# TEXAS PLASTIC POLLUTION SYMPOSIUM

## Tuesday, October 30, 2018

**Del Mar Center for Economic Development**
**3209 Staples St., Corpus Christi, Texas**

# Welcome!

The University of Texas Marine Science Institute, Mission-Aransas National Estuarine Research Reserve, Texas Parks and Wildlife Department, Coastal Bend Chapter- Surfrider Foundation, and Texas Sea Grant are proud to host the first Texas Plastic Pollution Research Symposium. We have a great program of talks and posters this year from presenters all around the state of Texas.

The symposium has longer than normal breaks so that you may enjoy the poster session. Lunch will be catered by the Ocean Friendly Restaurant, Shoreline Sandwich Company courtesy of Texas Sea Grant. There will be a fifteen minute break to collect your lunch, which will be followed by a movie presentation at 12:15 p.m. of "Straws" by Texas Sea Grant.

Once again, thank you for participating and we hope you enjoy the meeting.

*Texas Plastic Pollution Research Symposium Planning Committee*
Jace Tunnell, Adriana Leiva, Neil McQueen, Katie Swanson, and Kelly Dunning

*A special thank you goes to volunteers and moderators:*
Kristin Evans
Pamela Plotkin
Nicole Poulson
Lindsay Scheef
Amanda Taylor
Jenny Vander Pluym

**Follow the meeting on social media with #TxPPS2018**

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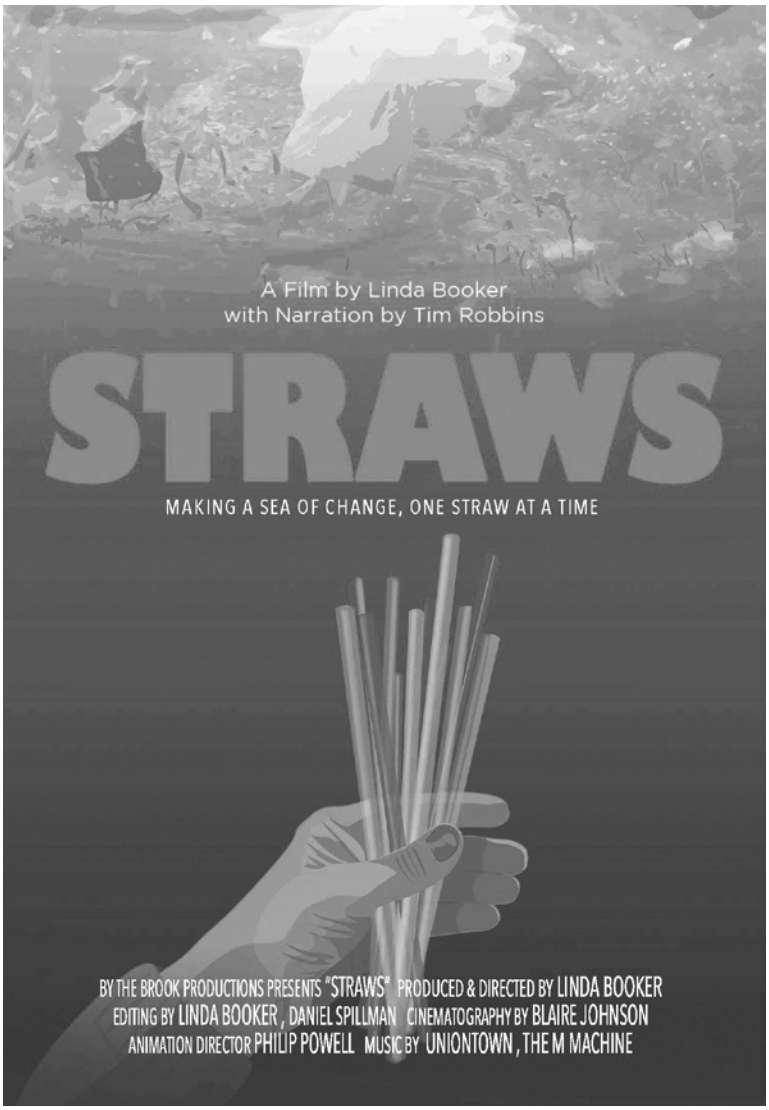


## A DOCUMENTARY FILM BY LINDA BOOKER

Every day in the USA, half a billion non-recyclable plastic straws are used once and tossed, ending up in landfills, littering streets and reaching beaches. Actor and Director Tim Robbins narrates a colorful history of man's origins and obsession with using straws and marine researchers, citizen activists and business owners discuss how they're making a sea of change...one plastic straw at a time.

RT 33 MIN. / © 2017 By The Brook Productions
**www.strawsfilm.com / @strawsfilm / #strawsfilm**
contact: strawsfilm@gmail.com

**STRAWS available at VideoProject.com** for Educational Use and Community Screenings. Email: **support@videoproject.com**

TAKE ACTION at www.plasticpollutioncoaliton.org - or - text straws to 52886
**DONATE to the STRAWS IMPACT CAMPAIGN through The Fund for Sustainable Tomorrows**
**http://thefundforsustainabletomorrows.org**

# Schedule

8:00 AM - **Registration,** Del Mar Center for Economic Development, Corpus Christi, Texas

8:45 AM - **Welcome and Opening Remarks,** Jace Tunnell, Director, Mission-Aransas National Estuarine Research Reserve at The University of Texas Marine Science Institute

## Impacts to Fish and Wildlife

9:00 AM - **Blueback Herring in the Hudson River Intentionally Try Not to Consume Microplastics... but are Microplastics Too Abundant to be Avoided?**
Gray Ryan*, M. Todd Walter and Lisa Watkins

9:15 AM - **A Comparison of Microplastic Ingestion Between Freshwater Sunfish and Marine Pinfish**
Colleen A. Peters, Peyton A. Thomas, Kaitlyn B. Rieper and Susan P. Bratton*

9:30 AM - **Life on a Nurdle: the Microbial Response to Plastic and Bioplastic in the Upper Laguna Madre, TX**
Lee J. Pinnell* and Jeffrey W. Turner

9:45 AM - **Occurrence of Microplastic in the Diet of Juvenile Fish in the Corpus Christi Bay and the Upper Laguna Madre**
Polly Hajovsky*, Michelle Bromschwig and Simon Geist

## Chemistry

10:00 AM - **Microplastics in the Mississippi River Watershed**
K.M. Martin, E.A. Hasenmueller, J.R. White, L.G. Chambers and J.L. Conkle*

10:15 AM - **Macro and Microplastics in Corpus Christi**
Jeremy L. Conkle*, Kieu Tran, Elijah Waddell, Camille Valenta and Katherine Martin

10:30 AM - **Chemical Mechanisms and Toxicological Effects of Microplastics in the Aqueous Environment**
Christie M. Sayes*

10:45 AM - **POSTER SESSION (15 MINUTES)**

## Policy & Urban Communities

11:00 AM - **Ongoing Environmental Litigation Against Formosa in Port Comfort**
David Bright

11:15 AM - **Stopping the Plastic Wave: Marine Plastic Pollution and International Law**
Elizabeth Nyman,* Amanda Fuentes-McPherson and Rachel Tiller

11:30 AM - **Greater Houston-Galveston Trash-Based Aquatic Action Plan: Project History and Current Status**
Amanda Hackney*, Cynthia Clevenger, Dr. Stephanie Glenn, Dr. Erin Kinney and Lisa Marshall

11:45 AM - **Love Laredo B.I.G. (Bag It Green) Campaign**
Melissa R. Cigarroa, Tricia Cortez* and Beatriz Vidales

12:00 PM - **LUNCH and the MOVIE "STRAWS"**
With introduction by Christine Figgener, Texas Sea Grant

# MONITORING

1:00 PM - **Monitoring for Microplastics in Texas Least Disturbed Streams**
Anne Rogers Harrison

1:15 PM - **Assessment of Microplastic Deposition in Different Depositional Environments of the San Antonio River Near Elmendorf, TX**
Keith Mecum*, J.K. Haschenburger and Doug Schnoebelen

1:30 PM - **Microplastic Pollution in Surface Waters of Urban Watersheds in Central Texas, USA: A Comparison Above and Below Treated Wastewater Effluents**
Jasmine K. Stovall and Susan P. Bratton*

1:45 PM - **Accumulation and Distribution of Marine Debris on Barrier Islands Across the Northern Gulf of Mexico**
Katie Swanson* and Caitlin Wessel

# SOLUTIONS

2:00 PM - **The Big Shell Beach Cleanup: A Look Back at 2 Decades of Data**
Aaron Baxter

2:15 PM - **The Galveston Bay Report Card**
T'Noya Thompson

2:30 PM - **A Gelatinous Solution to Plastic Pollution - GoJelly!**
Rachel Tiller

2:45 PM - **Surfrider Foundation's Ocean Friendly Restaurants Program**
Christie Irps* and Holly Thomas

3:00 PM - **POSTER SESSION (30 MINUTES)**

3:30 PM - **Plastic Pollution Prevention Partnership: An Oil Spill Response to Plastic Pollution**
Stennie Meadours

3:45 PM - **Good Intentions Aren't Enough to Reduce Fishing Line Litter: A Case of Effectively Reducing Threats to Marine Wildlife Along the Texas Coast**
Stennie Meadours* and Taylor Rhoades*

4:00 PM - **First Steps – An Aquarium Campaign to Reduce Plastic Pollution**
Leslie Peart

4:15 PM - **Texas General Land Office Derelict Vessel and Vessel Turn-In Program**
Frank McDaniel

4:30 PM - **Texas Abandoned Crab Trap Removal Program**
Zack Thomas*, Dakus Geeslin and Holly Grand

4:45 PM - **Texas Marine Debris Emergency Response Guide**
Amy Gohres

5:00 PM - **PROGAM END.**

# Poster Titles & Presenters

*The symposium is structured with longer than normal breaks to allow for poster presentations - so grab your cup of coffee and check out some cool science.*

**Love Laredo B.I.G. (Bag It Green) Campaign as a Model for Other Texas Cities to Attract Retailer Support**
Melissa R. Cigarroa*, Tricia Cortez*, Beatriz Vidales*

**Marine medaka (*Oryzias melastigma*) as a Model Organism to Assess the Risk of Microplastic Pollution**
Elizabeth DiBona*, Jeremy Conkle, Simon Geist, Jeff Turner, Frauke Seemann

**Pyr-GC/MS Analysis of Microplastics Extracted from the Stomach Content of Benthivore Fish from the Texas Gulf Coast**
Colleen A. Peters, Erik Hendrickson, Elizabeth C. Minor, Kathryn Schreiner, Julie Halbur, and Susan Bratton*

# Abstracts for Oral Presentations

## IMPACTS TO FISH AND WILDLIFE

### Blueback Herring in the Hudson River Intentionally Try Not to Consume Microplastics... but are Microplastics Too Abundant to be Avoided?

[1]Gray Ryan*, [2]M. Todd Walter and [2]Lisa Watkins; [1]Texas A&M University- Corpus Christi, [2]Cornell University

There is growing concern surrounding microplastics in the aquatic environment and their effect on the health of organisms, especially since there is evidence that a variety of aquatic animals consume them. This is of particular concern for organisms whose main food source is zooplankton, many of which fit into similar size categories as microplastics. However, our understanding of whether fish consumption of microplastic is intentional or not is limited. We also have a limited understanding of how intentional consumption of microplastics affects fitness. To answer these questions, the fitness and degree of selective feeding on various categories of microplastics were determined and compared for a sample of 108 fish collected from the Hudson River. Microplastics made up around 10% of the >335 micron portion of fish diets and around 20% of the same size category in the water sample from the Hudson. Our results revealed selective feeding on zooplankton and avoidance of all microplastic types and all microplastics colors, with the exception of tan. There was no correlation between degree of selectivity toward any particular food types and fitness.

### A Comparison of Microplastic Ingestion Between Freshwater Sunfish and Marine Pinfish

Colleen A. Peters, Peyton A. Thomas, Kaitlyn B. Rieper and Susan P. Bratton*; Livingston Ripley Waterfowl Conservancy, Baylor University

This study compared the frequency of microplastic ingestion by freshwater sunfish (*Lepomis macrochirus* and *Lepomis metalotis*) and their marine ecological analogs, pinfish (Lagodon rhomboids). Overall, 885 fish, inclusive of 436 sunfish and 449 pinfish were examined and 45% percent of sunfish and 46.5% of pinfish had ingested anthropogenic materials (p=0.876). Sunfish averaged 0.81 particles per fish, which did not significantly differ from pinfish (0.96 particles) (p=0.311). In addition to the ingestion of microplastics, sunfish stomach content contained 26 categories of prey, out of which, microplastics significantly associated with eggs (p=0.000), vegetation ( p=0.025), earthworms (p=0.000), and mollusks (p=0.030). Pinfish stomach content contained eleven categories of prey, in addition to microplastic, however, pinfish ingestion of microplastic only associated with the ingestion of wood (p=0.028) and fish (p=0.008). Additionally, Agglomerative clustering via Wards method, utilizing Whittakers Index as the distance measure, demonstrated that sunfish ingestion of microplastic most closely related to the ingestion of vegetation, wood, and sand, while the ingestion of microplastic by pinfish most closely related to the ingestion of vegetation and shrimp. Despite the variations in habitat (freshwater vs. marine) and ingested prey groups, overall, sunfish and pinfish display similar frequencies of microplastic ingestion and average number of particles per fish. The results suggest that similarities between species, such as methods of prey capture (i.e. suction feeding) and dietary guild (i.e. benthivore diet with herbivory) are the most important factors influencing microplastic ingestion.

## Life on a Nurdle: the Microbial Response to Plastic and Bioplastic in the Upper Laguna Madre, TX

Lee J. Pinnell* and Jeffrey W. Turner; Texas A&M University - Corpus Christi

Plastic is abundant in marine environments, accounting for up to 95% of all debris in coastal areas, yet little is known about the microbial assemblages or individuals that colonize this substrate. Moreover, the contribution of microbe-plastic interactions to biogeochemical processes is virtually unknown. This study reports the shotgun metagenomic sequencing of biofilms associated with plastic and bioplastic [polyethylene terephthalate (PET) and polyhydroxyalkanoate (PHA), respectively] microcosms staged at the water-sediment interface of the Upper Laguna Madre, TX. Community composition analysis revealed that sulfate-reducing bacteria (SRB) dominated bioplastic biofilms whereas plastic biofilms were indistinguishable in comparison to a ceramic biofilm control. Analysis of bioplastic enzyme pools revealed the enrichment of depolymerases, esterases, adenylyl sulfate reductases (aprAB), and dissimilatory sulfite reductases (dsrAB). Phylogenetic analysis of a highly enriched polyhydroxybutyrate (PHB) depolymerase indicated that it was genetically diverse, suggesting the presence of a mixed microbial assemblage. Biodegradation rates of each plastic type were calculated by comparing the pre- and post-exposure mass and scanning electron microscopy (SEM) was used to visualize both the microorganisms forming biofilms, and any signs of degradation. Results show that after 424 days' exposure PHA samples decreased by over 1500mg, representing a drop of approximately 51% from the pre-exposure mass. In contrast, the mass of PET did not change. Visual analysis with SEM demonstrates that while biofilms form on both plastic types, there is a disparity in biodegradation. Overall findings indicate that the introduction of plastic did not alter the microbial community. By contrast, the introduction of bioplastic promoted a rapid and significant shift in microbial diversity and enzyme pools.

## Occurrence of Microplastic in the Diet of Juvenile Fish in the Corpus Christi Bay and the Upper Laguna Madre

Polly Hajovsky*, Michelle Bromschwig and Simon Geist; Texas A&M University-Corpus Christi

Microplastic pollution and the negative consequences of microplastics entering the food web has come into the focus of research in recent years. However, a baseline study of microplastic pollution in the water column, ingestion by early juvenile fish and effect on nutritional condition is lacking in the South Texas Bays. Here we show baseline information on microplastic pollution in Corpus Christi Bay and the Upper Laguna Madre, which are important nursery areas for such as redfish (Sciaenops ocellatus), spotted seatrout (Cynoscion nebulosus), Atlantic croaker (Micropogonias undulatus) and anchovies (Anchoa spp). We then examined the diet of selected species representing two different foraging types, bottom feeder or filter feeder. The hypothesis tested was, water column filter feeders (e.g. Anchoa spp.) will have higher amounts of plastic in their digestive tract than bottom feeders (e.g. M. undulatus). Preliminary results show that out of 175 fish, ~80% had one or more suspected microplastic in their digestive tract, with bottom feeders being the most affected species (Kruskal–Wallis test, $p = 0.017$). Blue and black colored fibers were the most abundant with ~45% blue and ~36% black. Water treatment plants are the prime suspect to be the source as it is assumed that most of these fibers stem from shedding of clothes and enter the bay. As a next step, the type of plastics found in the digestive tracts will be determined by a micro Fourier Transform Infra-Red system.

# CHEMISTRY OF PLASTIC POLLUTION

## Microplastics in the Mississippi River Watershed

K.M. Martin, E.A. Hasenmueller, J.R. White, L.G. Chambers and J.L. Conkle*; Texas A&M University-Corpus Christi

Rivers are likely one of the greatest sources of plastic debris to the ocean, yet studies are just starting to quantify their contributions. The Mississippi River and its watershed encompass ~40% of U.S. land area and are home to >90 million people. Because of this large area and the plastic consumption potential of its population, the Mississippi River is likely one of the largest contributors of plastic debris to the global ocean. This research provides baseline information on the quantity and characteristics (size, shape, resin type) of microplastics within the main stem and tributaries (Missouri, Illinois, and Ohio Rivers) of the Mississippi River near major cities such as St. Louis and New Orleans. Processing is ongoing, but so far ~10,000 suspected microplastics have been identified in the samples sorted. Using µ-FTIR analysis, we have determined that 13% of suspected microplastics are fully synthetic polymers. This equates to 11.1 ± 3.4 microplastics per liter of river water, with ~97% being fibers. When these concentrations are scaled up to the volume of the Mississippi River, this equates to annual microplastic discharges into the Gulf of Mexico in the quadrillions (1,000,000,000,000,000).

## Macro and Microplastics in Corpus Christi

Jeremy L. Conkle*, Kieu Tran, Elijah Waddell, Camille Valenta and Katherine Martin; Texas A&M University-Corpus Christi

Corpus Christi is a destination city for Texans, attracting new residents with abundant job prospects and tourists with scenic natural beauty. However, this growth has also impacted the natural resources that partly drive our economy. If you spend any time near the water in Corpus Christi you will notice abundant litter on the bay and coastal shorelines. This study sought to quantify the amounts of macro (cups, bags, wrappers, etc.) and microplastics entering and accumulating in Corpus Christi Bay. To do this, stormwater, wastewater effluent, and bay sediment were sampled. With stormwater discharge, debris capture was unsuccessful due to poor timing, unpredictable rains, strong winds, choppy water, and spring tides. Only limited data was collected. Preliminary results for microplastics in wastewater indicate that millions of microplastic fibers and particles are discharged daily from the three Corpus Christi wastewater treatment plants, which ranges from billions to 10s of billions annually. For sediment sampling, preliminary results indicate that there are between 160-450 microplastics $Kg^{-1}$ of sediment in the top 20 cm of Corpus Christi Bay sediment. These values for wastewater and sediment align with studies conducted globally. While still preliminary, these results demonstrate that in addition to stormwater debris, microplastics are a significant contaminant of our surface waters. Although, their impacts require more investigation. Broadly speaking, local efforts must determine the underlying causes of plastic debris and then address them, improve waste infrastructure, increase litter capturing infrastructure and grow community buy-in to reduce litter in our environment.

## Chemical Mechanisms and Toxicological Effects of Microplastics in the Aqueous Environment

Christie M. Sayes; Department of Environmental Science- Baylor University

Particle-particle interactions are central to the understanding of a wide spectrum of environmental, chemical, biological, and physical phenomena. Studies reported in the literature are mostly limited to single-particle species. The influence of microplastic surface properties on particle transformation or vice

versa is largely missing. Microplastic particles have been shown to readily enter into different compartments of the environment. The presence of these anthropogenic particles in the aquatic environment has been hypothesized to induce long-lasting adverse effects on human and environmental health. Thus, there is a need to investigate the chemistry and toxicology related to microplastics. In this study, we defined microplastics as polymer-based particles ranging in size from 5 to 500 µm and studied the particle transformation under environmentally-relevant conditions. The behavior of microplastics within the aqueous environment depends heavily on the surrounding matrix: particles aggregate in the presence of natural organic matter, degrade in the presence of ultraviolet light and high salinity, and remain largely unchanged in pH fluctuations. We compared the particle transformation properties of three different polymeric species (Polyacryonitrile (PAN), polyethylene terephthalate (PET), and polystyrene (PS)) and observed the particle-particle interactions between silver sulfide particles with each polymeric species. Results show that UV light exposures, incubation with NOM, and increases in salinity resulted in the addition of silver in the para position of PS, nitrogen of PAN, and oxygen of PET. Nitrile, ester, and aromatic functional groups were monitored for shifts or disappearances of vibration in the FTIR analyses. Lastly, the toxicity of microplastic particles observed in algal cells was significantly higher when exposed to silver-plastic particle mixtures as opposed to either silver or plastic particle exposures alone. The goal of this research is to gain critical information on the chemical transformations and toxicological effects of microplastic mixtures in an effort to enhance strategies in achieving water sustainability in Texas.

# POLICY & URBAN COMMUNITIES

### Ongoing Environmental Litigation Against Formosa in Port Comfort

David Bright; Sico, Hoelscher & Harris- Corpus Christi, Texas

This presentation concerns ongoing environmental litigation against Formosa Plastics arising out of their activities in the Port Comfort, Texas Plant. Formosa's manufacturing plant has caused large amounts of plastic pellets to be released onto the land and waterways near Formosa's plant.

Formosa has a 2,500 acre plant in Point Comfort. The plant discharges its stormwater into Cox's Creek and its wastewater into Lavaca Bay. For many years, Formosa has been illegally discharging plastics, including pellets and PVC powder, into these waterways. The EPA noted illegally discharged pellets in 2010. Former employees indicate that plastic pellets were being discharged as early as 2002.

Plaintiffs San Antonio Bay Estuarine Waterkeeper and S. Diane Wilson filed suit against Formosa Plastics Corp., Texas, Formosa Plastics Corp., U.S.A., and Formosa Plastics Corp., America in United States District Court for the Southern District of Texas, Victoria Division on July 31, 2017. That suit is in proceeding at this time. The lawsuit seeks penalties against Formosa running starting from January 31, 2016.

### Stopping the Plastic Wave: Marine Plastic Pollution and International Law

[1]Elizabeth Nyman*, [2]Amanda Fuentes-McPherson and [3]Rachel Tiller; [1]Department of Liberal Studies, Texas A&M University at Galveston, [2]Department of Marine Science, Texas A&M University at Galveston. [3]Center for Clean Ocean Research, SINTEF Ocean

There has been an alarming increase in plastic pollution in the world's oceans, highlighted by greater understanding of the numerous floating garbage patches, as well as an increase in our understanding of

the threat this pollution poses to marine life. This has led to a number of successful campaigns to raise awareness and to stem the tide of particular kinds of plastics pollution through the introduction of bans – cosmetic microplastics, single use shopping bags, and plastic straws, to name a few. Yet plastics pollution continues to be a problem despite these efforts. In this paper, we discuss the efforts to slow marine plastic pollution and how the current international legal regime against marine pollution fails to address this major issue. We also highlight some potential solutions that could be provided under international law to help stop this plastic wave, should the international community choose to address the problem in this manner.

## Greater Houston-Galveston Trash-Based Aquatic Action Plan: Project History and Current Status

[1]Amanda Hackney*, [2]Cynthia Clevenger, [3]Dr. Stephanie Glenn, [3]Dr. Erin Kinney and [2]Lisa Marshall; [1]Black Cat GIS and Biological Services, [2]Galveston Bay Estuary Program, [3]Houston Advanced Research Center

Beginning in late 2016, we began organizing partners to create a Houston-Galveston Regional Litter and Marine Debris Prevention Action Plan. Marine debris is a chronic condition in the Galveston Bay area that worsens with every major rainfall and corresponding flooding event. During extreme weather, trash from local communities "escapes" into streets, bayous and creeks that all divert floodwaters into Galveston Bay. During Hurricane Harvey, existing debris (including vast amounts of plastic float-able trash) clogged flood control structures and further exacerbated flood water issues. This project was created to develop regional initiatives to research, track and quantify litter; explore policy and funding strategies; create partnership opportunities; coordinate communication approaches; and plan future emergency response and preparedness. In May 2017, the first Trash Summit was organized to begin developing a regional Action Plan for litter and marine debris prevention. The Summit was a critical first step in coordinating litter and trash efforts regionally. Our second meeting was conducted in October 2017, post-Harvey. Post hurricane debris management and "daily" debris control were major topics of concern. Our latest meeting (May 2018) refined action goals and continued forward with the creation of working groups to address specific issues. Currently, we have over 18 partner organizations participating in planning meetings. The document is not intended to be regulatory or specifically binding on actions or timeframes. By researching and targeting efforts on direct sources of marine debris, we will decrease the average trash load of area waterways, thereby increasing water quality in terms of pollution.

## Love Laredo B.I.G. (Bag It Green) Campaign

[1]Melissa R. Cigarroa, [1]Tricia Cortez* and [2]Beatriz Vidales; [1]Rio Grande International Study Center, [2]Love Laredo B.I.G.

In the wake of the June 22, 2018 Texas Supreme Court ruling that struck down the Laredo plastic bag ordinance, what can Texas cities do now to reduce their consumption of single-use plastic bags?

In Laredo, a passionate group of concerned citizens, local retailers, civic organizations, schools, and city officials gave launched the Love Laredo B.I.G. (Bag It Green!) campaign as a way to counter this recent setback.

The Love Laredo B.I.G. (Bag It Green!) is focused on two target audiences:

1) Retailers
2) Shopping public.

This campaign aims to keep Laredo clean and plastic bag free, by:

- Applying pressure on retailers;

- Rewarding businesses that take the pledge through social media promotion;
- Launching multiple PSAs, billboards and El Metro transit bus signs;
- Getting school campuses involved in a pro-active way.

We've assembled a week-long plastic bag curriculum that is TEKS-aligned, which has now been adopted by all Laredo Catholic schools and all Harmony Science campuses in Laredo. We want Laredo youth to help take the lead in getting retailers to choose wisely for our future world and community.

Prior to adopting its ordinance (passed in 2014, took effect in 2015), Laredo consumed nearly 120 million single-use plastic bags each year. They were omnipresent throughout the city and in our creeks and waterways. We can't go back to that era. In this decades-long battle, were are currently in a one-step-backward phase but believe that if more cities can adopt a Love Laredo B.I.G. style campaign, we can make inroads and enter a new two-steps-forward phase. We need your help.

# MONITORING

### Monitoring for Microplastics in Texas Least Disturbed Streams

Anne Rogers Harrison; Texas Parks and Wildlife Department - Water Quality Program

In the summer of 2017, the Water Quality Program of the Texas Parks and Wildlife Department (TPWD) sampled for microplastics in fifteen fresh water bodies throughout the state as part of a global microplastics sampling initiative through the non-profit organization, Adventure Scientists, based in Bozeman, MT. The water bodies selected for sampling were part of the Texas Least Disturbed Streams Study under the direction of the Texas Commission for Environmental Quality. Least disturbed streams in this context are those with 1) little or no urban development in the watershed; 2) no major point sources of pollution; 3) no atypical sources of non-point pollution; and 4) no channelization or major physical habitat modifications. TPWD is a collaborative partner in the multi-year study and incorporated microplastics sampling as a pilot study to assess the efficacy of the sampling protocols as well as to determine whether streams with minimal human disturbance show signs of microplastic contamination. Although densities were low, microplastics were confirmed in eight of the fourteen 1-liter samples analyzed (one sample was not able to be analyzed). This presentation will highlight the results of this study, potential implications to least disturbed streams from microplastic contamination and possible future steps for microplastics sampling in Texas Freshwater systems.

### Assessment of Microplastic Deposition in Different Depositional Environments of the San Antonio River Near Elmendorf, TX

Keith Mecum*, J.K. Haschenburger and Doug Schnoebelen; UTSA, USGS

Small plastics, better known as microplastics (< 5 mm), have demonstrated risk to freshwater and marine organisms. Unfortunately, little is known about microplastic retention in the freshwater environment. Specifically, knowledge of how microplastic deposition is distinct to depositional environments within the riparian environment is lacking. To help fill this gap, this research aims to answer two questions. First, what is the relation between the deposition of microplastics and particle size distribution of sediment? Second, how do microplastic concentrations differ between bed, bank and near bank floodplain depositional zones? To answer the research questions a total of 64 sediment samples were taken from the bed, bank, and floodplain of the San Antonio River near Elmendorf, TX. Standard sieve and hydrometer analyses are being conducted to determine sediment size distributions. Extraction of

microplastics will be conducted using a lithium metatungstate (LMT) density extraction. Microplastics will then be identified using an Olympus SZX9 stereomicroscope at a maximum magnification of 57X. Linear regression and analysis of variance will be conducted in JMP statistical software to answer the research questions. Preliminary observations of sediment size distribution and methodologic complications with microplastic assessment will also be discussed. The outcome of this research will ultimately improve the understanding of microplastic pollution in the fluvial environment.

## Microplastic Pollution in Surface Waters of Urban Watersheds in Central Texas, USA: A Comparison Above and Below Treated Wastewater Effluents

Jasmine K. Stovall and Susan P. Bratton*; Baylor University Department of Environmental Science

Microplastics are polymer-based particles ranging in size from 50 µm to 5 mm. The behavior of microplastics within freshwater systems remains largely unknown. The purposes of this study are to assess and compare microplastic pollution levels in spring-fed and runoff-fed freshwater systems in small, urban watersheds above and below local point-source wastewater effluents, to investigate patterns in microplastic spatial distribution and to evaluate the influence that seasonality, land use and associated human activities may have on microplastic frequency and form. A total of 779 surface water samples of 800 mL each, inclusive of five study locales and five microhabitats per locale, were collected and filtered through a 53-µm mesh. Samples were visually analyzed for the presence of microplastics via microscopy, and were characterized by size, color (i.e. Munsell color system) and form. In total, 1,198 microplastics were found, inclusive of fibers (95.0%) and fragments (5.0%). Approximately 57% of all samples were contaminated with microplastics, on average, ranging from 33.3%-80% per study locale. Overall, significant differences between sample site and sampling interval suggest that seasonality and land use influence microplastic frequency within a system, while spatial locale influences particle color and form.

## Accumulation and Distribution of Marine Debris on Barrier Islands Across the Northern Gulf of Mexico

[1]Katie Swanson* and [2]Caitlin Wessel; [1]Mission-Aransas National Estuarine Research Reserve at University of Texas Marine Science Institute, [2]National Oceanic Atmospheric Administration

Marine debris is an economic, environmental, human health and aesthetic problem posing a complex challenge to communities around the globe. Coastal communities specifically are among the most seriously impacted with increased expenses for beach cleaning, public health and waste disposal issues, as well as a loss of income from decreased tourism. To better document this problem we monitored the occurrence and accumulation rate of marine debris at 12 sites located on barrier islands from North Padre Island, TX to Santa Rosa, FL. Surveys were conducted using the NOAA Marine Debris Shoreline Survey Guide and consisted of 100m-long transects along the shoreline extending from the water edge to the upland shoreline limit. All debris larger than 2.5 cm, including cigarette butts, was collected and sorted by material type and placed into predetermined categories. Each category was counted and measured for dry mass. With this information we are investigating three specific questions: (1) what are the major types and possible sources (land or ocean based) of shoreline debris; (2) does the rate of debris deposition onto the shoreline show seasonal oscillations; and (3) how does debris deposition change from east to west in the nGoM? Over the two-year study period several trends emerged. Accumulation rates and patterns suggest the debris washed onto nGOM shorelines from the ocean containing a combination of ocean and land-based sources. A significant increase in the amount of debris collected on the shoreline during tourist/boating season (May to September). In addition, we observed a drastic increase in the amount of trash at the western nGoM sites, with accumulation rates more than 10x greater in Texas. This difference in accumulation rates between study sites is likely attributable to currents in the nGoM.

# SOLUTIONS

### The Big Shell Beach Cleanup: A Look Back at 2 Decades of Data

Aaron Baxter; Friends of Padre

In 1995, Capt. Billy Sandifer started The Big Shell Beach Cleanup as a grassroots effort to clean the area of the Padre Island National Seashore known as Big Shell. To access this section of beach requires the use of 4-wheel drive vehicles, as soft sand and high tides often make for hazardous driving conditions. The cleanup occurs on the last Saturday of February, due to the beginning of sea turtle nesting season, which also presents weather associated challenges. The convergence of major currents along this section of coast gives the area its name, as sandy substrate gives way to large shell hash brought ashore by these currents. This same convergence is responsible for the large amounts of debris deposited in this area, as trash originating in several countries makes its way onto shore. In 2008, Capt. Sandifer founded Friends of Padre, Inc. to ensure that the Big Shell Beach Cleanup continued into the future. Over the course of two decades, the Big Shell Beach Cleanup has steadily grown in numbers of volunteers, miles cleaned, and tonnage removed from the beach. The debris removed comes in a variety of forms, but the vast majority consists of rigid plastics. In the past, recycling of these plastics posed several logistical challenges. Recently, the Big Shell Beach Cleanup has incorporated a plastic recycling component into the cleanup and looks to continue this into the future. To date, 8,000 volunteers have removed over 1,200 tons of trash from this remote stretch on Padre Island.

### The Galveston Bay Report Card

T'Noya Thompson; Galveston Bay Foundation

The Galveston Bay Watershed is home to more than 10 million residents, with almost 5 million living in the Houston metropolitan region alone. These residents comprise a diverse population and represent an eclectic mix of cultures, ethnicities, and socioeconomic groups. As urbanization and population growth continue to put pressure on the natural resources of our watershed, local stakeholders and communities must develop novel and collaborative strategies to protect the natural resources that are so integral to the region’s ecology and economy. The Galveston Bay Report Card (GBRC) is a citizen-driven, scientific analysis of the overall health of Galveston Bay, Texas’ largest estuary. The GBRC has six categories and 22 indicators that make up the overall grade of a ""C"" for 2018. Under ""Pollution Events and Sources"", also with a category grade of ""C"", litter and trash is an indicator that the GBRC monitors. With a grade of ""I"" for insufficient data, plans and strategies have been implemented to address this issue, specifically focusing on plastic pollution prevention this year. Researching the best ways to educate and inspire communities that contribute to the watershed, is crucial to conserving this natural resource.

### A Gelatinous Solution to Plastic Pollution - GoJelly!

Rachel Tiller; SINTEF Ocean

The GoJelly project (2018-2021), funded by EU Horizon2020, is working to develop a solution for two environmental challenges today - jellyfish blooms and microplastic pollution. To do this, the project works on developing a bio-filter from mucus produced by jellyfish under stress. This filter has been shown to absorb nanoparticles, including micro- and nano plastics as well as metals. This filter will then be used in water treatment plants at the final steps of the treatment process. To ensure this work, the project has five different case areas around Europe where jellyfish is a challenge. In these areas, we are working with commercial fishers to develop harvesting methods that best preserves the jellyfish and ensures mucus harvest most efficiently. In addition, in each area, the different jellyfish are being

processed for not only mucus use but also for using other parts of the resource for use if the production of fertilizers, cosmetics and food to name a few, ensuring a circular bioeconomy that also is a partial solution to plastic pollution.

### Surfrider Foundation's Ocean Friendly Restaurants Program

Christie Irps* and Holly Thomas; Surfrider Foundation - Texas Coastal Bend Chapter

Plastic pollution is suffocating our oceans and the many animals that call them home. Researchers estimate there are now over 5.25 trillion pieces of plastic in the ocean with the number continuing to grow every day. This pollution is impacting our marine ecosystems, wildlife such as seabirds, dolphins, fish, and turtles, and plastic fragments are even displacing plankton at the base of the food chain.

So what's the best way to combat this global epidemic facing our ocean? It's simple: we need to stop the problem at its source! The Surfrider Foundation's new Ocean Friendly Restaurants program does just that. One restaurant, one customer at a time, it increases awareness, drives change in behavior and ultimately creates scalable impact to reduce our plastic footprint.

### Plastic Pollution Prevention Partnership: An Oil Spill Response to Plastic Pollution

Stennie Meadours; Texas Master Naturalists - Galveston Bay Area Chapter and Plastic Pollution Prevention Partnership

On Galveston Island in December 2014, 124 juvenile brown pelicans were found sick, injured, entangled, and distressed as a direct result of plastic pollution and discarded monofilament line. These 124 pelicans were successfully rehabilitated and released by the Wildlife Center of Texas, countless others did not survive their injuries. Similarly a juvenile American Oystercatcher was found unable to fly in Galveston Bay and was taken to a wildlife rehabber. The bird died the next day. The determined cause of death was ingestion of monofilament. In another situation, well meaning beach goers chased windblown trash into a colony of beach nesting birds, dramatically disturbing incubation, and increasing the chance of predation.

The incidents above were the catalyst for a Galveston Bay Area stake holders meeting in 2014. The Plastic Pollution Partnership (P3P) emerged in 2015. The P3P organized as an "Incident Command System" to assess plastic litter accumulations and conduct plastic cleanups along public shorelines in Galveston/Harris Counties. P3P is not incorporated, partners contribute staff and resources that fall within their respective mission statements, as is done for oil spills. Galveston Bay Area Chapter – Texas Master Naturalist volunteers coordinate P3P activities, assess sites for cleanup, administer Facebook page, and coordinate cleanups. .

This presentation will focus on how the P3P functions, cleanup data, P3P "off spring" efforts, unintended consequences, and non-partner entities that have participated and cooperated in P3P efforts.

### Good Intentions Aren't Enough to Reduce Fishing Line Litter: A Case of Effectively Reducing Threats to Marine Wildlife Along the Texas Coast

[1]Stennie Meadours* and [2]Taylor Rhoades*; [1]Texas Master Naturalists - Galveston Bay Area Chapter, [2]Houston Zoo

As environmental threats continue to grow and put increasing pressure on both human and wildlife populations, researchers have been seeking out innovative approaches to lessen the impact of human-borne threats such as plastic pollution. Within the realm of social and environmental science, it is understood that just as people are often the source of environmental problems, they are equally the

potential solution. Community based social marketing (CBSM) creates the right conditions and incentives to allow for a change in human behavior to be both accomplished and sustained.

In this presentation, we will demonstrate how organizations can collaborate in a unique, dynamic partnership to enhance the viability of a long-term, sustainable wildlife saving effort. We will explore the steps of developing and implementing a community based social marketing campaign and present examples of its value with respect to uncovering real and perceived barriers and benefits for adopting a new, wildlife-friendly behavior. This methodology is currently being used to address severe fishing line littering on Texas City Dike, a popular 5-mile long fishing site. By demonstrating each step of the CBSM process within the Plastic Pollution Prevention Partnership's fishing line recycling campaign, this presentation will showcase how this methodology ultimately results in a better research experience and creates a solid foundation for campaign implementation.

### First Steps – An Aquarium Campaign to Reduce Plastic Pollution

Leslie Peart; Texas State Aquarium

The Aquarium Conservation Partnership's First Step campaign is the 2018 iteration of the In Our Hands initiative. This campaign is centered around one key action: an online pledge to skip single-use plastic straws. Member aquariums will use their owned digital channels (primarily email and social media) to encourage their supporters to first take the pledge, then engage in other ways to get involved and spread the word. Email and social messaging will center on the core message that committing to skip single-use plastic straws is a small step people can take in addressing the larger plastic pollution problem. In addition to the pledge, Aquarium Conservation Partnership members will encourage people to ask their favorite restaurants to join the movement, sign up for a 7-day plastic-free texting challenge, invite their friends to take the pledge, and call on their community and elected officials to support policies that reduce plastic pollution.

### Texas General Land Office Derelict Vessel and Vessel Turn-In Program

Frank McDaniel; Texas General Land Office- Oil Spill Prevention and Response Division

While most vessel owners dispose of their vessels properly, the trend of increasing coastal population and development has resulted in a gradual increase in the numbers of abandoned vessels coast-wide. In 2005, the 79th Texas Legislature passed House Bill (H.B.) 2096 relating to the removal and disposal of certain vessels and structures in coastal waters, and the bill was signed into law by Governor Perry and took effect on September 1, 2005. The bill amends several sections of the Oil Spill Prevention and Response Act of 1991 (OSPRA), Chapter 40 of the Natural Resources Code and expands the authority of the Texas Land Commissioner to remove and dispose of any vessel or structure that has been abandoned in Texas coastal waters and is in a wrecked, derelict or substantially dismantled condition, after a finding that the structure or vessel has been involved in an actual or threatened unauthorized discharge of oil; is a threat to public health, safety, or welfare; a threat to the environment; or a navigation hazard. Prior to H.B. 2096, no significant deterrent or enforcement mechanism for removal and disposal of wrecked, derelict or substantially dismantled vessels or structures existed and authority under § 40.108 applied only to vessels involved in an actual or threatened unauthorized discharge of oil. The Vessel Turn-In Program (VTIP) was introduced in 2014. With the removal of more than 7,995 linear vessel feet, VTIP has resulted in a cost savings of almost $2 million for state and local governments.

## Texas Abandoned Crab Trap Removal Program

Zack Thomas*, Dakus Geeslin and Holly Grand; Texas Parks and Wildlife Department

Lost or abandoned, fishing gear represents around 10% of marine debris, and while there is always some fishing gear that is inevitably lost in any fishery, an effective clean-up program should include a systematic process to locate and regularly remove nets, traps, and other fishing gear as efficiently as possible. In Texas, abandoned or lost crab traps have been identified as a significant source of mortality for a variety of recreationally and commercially important non-target species. Additionally, these traps can have negative impacts on habitat, create navigation hazards, and become a source of visual pollution. The Texas Abandoned Crab Trap Removal Program was created in 2001 with the passing of Senate Bill 1410 during the 77th Texas Legislative session giving the Texas Parks and Wildlife Department (TPWD) the authority to create a community-based program to systematically remove abandoned or lost crab traps during a 10-day crabbing seasonal closure. Consequently, in February 2002, TPWD planned and facilitated the first ever Texas Abandoned Crab Trap Removal Program clean-up along the Gulf Coast in Texas. Since that time, countless numbers of Texans have spent time on the water searching the bays for abandoned crab traps that have been left to foul shrimpers' nets, snag anglers' lines, "ghost fish," and create unpleasant views. To date, over 3,000 volunteers have removed over 35,000 crab traps using over 1,000 vessels coast-wide. This presentation will showcase program overviews, program highlights, measures of success, and lessons learned since its inception.

## Texas Marine Debris Emergency Response Guide

Amy Gohres; Genwest Systems for NOAA Marine Debris Program

Through a highly collaborative process, NOAA's marine debris program is developing marine debris emergency response guides for coastal states. The Texas Marine Debris Emergency Response Guide is nearing publication and will serve as a complete reference for marine debris response after disasters - with an emphasis on incidents affecting the 18 counties within the Texas coastal zone. The document outlines existing response structures at the local, state, and federal levels to facilitate a coordinated, well-managed, and immediate response. The guide also includes an overview of permitting and compliance requirements that must be met before waterway debris removal work begins.

# Abstracts for Poster Presentations

### Marine medaka (*Oryzias melastigma*) as a model organism to assess the risk of microplastic pollution

Elizabeth DiBona*, Jeremy Conkle, Simon Geist, Jeff Turner, Frauke Seemann; Texas A&M University Corpus Christi, College of Science and Engineering

Due to public awareness of plastic pollution, there is current need for microplastics research. Besides spherical shaped plastic particles, fibers have been shown to be the particle type mainly ingested by aquatic animals. Knowledge on how different shapes and types of microplastic pollutants affect fish health is scarce. The current study proposes the investigation of polyethylene terephthalate (PET) fibers impacts on marine fish development and immune competence. The marine medaka (*Oryzias melastigma*) is used as a model to assess how pristine and UV weathered PET fibers may interfere with the fish intestinal integrity. Two different life stages, larval (mouth-opening, 6 dph) and adult (6 months), will be exposed to 5 environmentally relevant PET fiber concentrations through the feed for 21-days, mimicking a chronic exposure scenario as it occurs in bays at the coast of Texas. A seven-day depuration will be included to evaluate the organisms' potential for recovery. Markers for reproduction (offspring hatching, fecundity, fertility, gonad histology, gonad-somatic index, expression of key reproductive genes), nutrition status (growth index, hepato-somatic index, condition factor, activity of digestion and metabolic enzymes), intestine integrity (gut histology, gut microbiota, molecular expression of inflammation marker) and immune competence (bacterial host resistance challenge, phagocytic activity of leukocytes) will be measured to provide a holistic picture of fish fitness. This project will yield necessary knowledge to assess the risk of microplastic exposure in the coastal waters of Texas for commercially important fish populations and determine a group of potential early warning markers in response to microplastic pollution.

### Pyr-GC/MS Analysis of Microplastics Extracted from the Stomach Content of Benthivore Fish from the Texas Gulf Coast

Colleen A. Peters, Erik Hendrickson, Elizabeth C. Minor, Kathryn Schreiner, Julie Halbur, and Susan Bratton*; Livingston Ripley Waterfowl Conservancy, Baylor University, University of Minnesota Duluth

Fish ingestion of microplastic has been widely documented within freshwater, marine, and estuarine species. While numerous studies have quantified and characterized microplastic particles, analytical methods for polymer identification are limited. This study investigated the applicability of pyr-GC/MS for polymer identification of microplastics extracted from the stomach content of marine fish from the Texas Gulf Coast. A total of 43 microplastic particles were analyzed, inclusive of 30 fibers, 3 fragments, and 10 microbeads. Polyvinyl chloride (PVC) and polyethylene terephthalate (PET) were the most commonly identified polymers (44.1%), followed by nylon (9.3%), silicone (2.3%), and epoxy resin (2.3%). Approximately 42% of samples could not be classified into a specific polymer class, due to a limited formation of pyrolytic products, low product abundance, or a lack of comparative standards, and were subsequently categorized as "Unknown". Diethyl phthalate, a known plasticizer, was found in 16.3% of the total sample, including PVC (14.3%), silicone (14.3%), nylon (14.3%), and sample unknowns (57.2%). Furthermore, approximately half of the sample "Unknowns" resulted in a similar pyrogram and are hypothesized to be related to petroleum waste, coal tar, or creosote. Overall, the results of this study indicate that the Texas Gulf Coast experiences microplastic contamination, as well as industrial pollution, and that these materials are consumed by local fish. Although pyr-GC/MS was successfully used for polymer identification, its capability was inhibited by particle size and a lack of comparative standards, two factors which attributed to the classification of sample unknowns.