CHAPTER 4

SALTWATER NEKTON

Disclaimer

Methodologies for assessing ALUs have not been developed for Texas saltwater habitats—including Gulf waters, bays, estuaries, the Intracoastal Waterway, and tidal streams. Before conducting any biological monitoring activities on a saltwater body, it is imperative to coordinate this work with the TCEQ and the TPWD. As methodologies and metrics are established, this manual will be updated to reflect those changes.

Objective

A common goal in fish sampling is to collect a representative sample of the species present and their relative abundances. This chapter describes standard fish-collection techniques for saltwater bodies in Texas. Years of data collection and a large data set may be needed to develop a reliable estimate of relative abundance for marine and estuarine species. However, if all data from similar estuarine habitats are collected using comparable kinds of gear and techniques, the data will be valuable not only for the given study, but also to address the development of assessment methodologies for these saltwater bodies.

Any study employing saltwater fish collection must have clearly defined objectives. Careful consideration of the end uses of the data is essential. Choose specific methods, kinds of gear, and level of effort so that the study objectives can be met. Collections at each site in the study must be comparable. Consequently, collectors must ensure that the sampling procedures, level of effort expended, and types of habitat sampled are similar at each station and in succeeding sample events. At a minimum, collections that are intended to obtain fish-community data must include at least one active gear type, generally seines or trawls. Passive gear, such as gill nets or trap nets, must be used in conjunction with active gear.

Scientific Collection Permit

A Scientific Permit for Research is required to collect, salvage, band, or hold native Texas wildlife for scientific purposes. Scientific purposes include activities aimed at enhancing, protecting, conserving, or managing protected wildlife, or furthering scientific understanding of a resource or the environment. Refer to the TPWD website for application requirements and reporting forms: <www.tpwd.state.tx.us/business/permits/land/wildlife/research/>.

Notify each TPWD Law Enforcement Office in each region of your field activities by telephone at least 24 hours, but not more than 72 hours before collection if collection techniques or devices being used are ordinarily illegal (e.g., using gill nets or electroshocking devices to collect fish, or hunting or collecting along public roads and rights-of-way). A confirmed response from the local game warden is required before collection if the sampling activities being conducted involve methods of capture ordinarily classified as illegal. In addition, please be advised that collecting in a wildlife-management area is not authorized without prior written permission from the area manager.

For regional office location and telephone numbers, see <www.tpwd.state.tx.us/warden/office_locations> or call a Parks and Wildlife Communication Center: Austin—512-389-4848; Houston—281-842-8100.

Permit holders are required to carry this permit when conducting authorized activities. Sub-permittees may carry a copy in lieu of the original permit. It is also advisable to carry additional corroborative identification such as a driver's license. A permittee engaging unpermitted assistants must keep on file at his or her office and on his or her person in the field a signed and dated list of all unpermitted persons assisting in permitted activities. TCEQ regional office staff and central office SWQM and WQS staff are listed as sub-permittees on the permit currently held by the TCEQ SWQM team. Any TCEQ employee that needs to be added to this permit should contact the central-office SWQM team.

Records

In addition to sample labeling requirements as specified in this chapter, the following records must be maintained by the collector.

Field Logbook

For each sample event record the following information in a field logbook.

- date and time of sample collection
- name of water body
- location of sample site (Station ID)
- name of each collector
- collection methods and equipment
- number and type of samples collected
- number of sample containers
- preservative used
- time spent electrofishing
- number of seine hauls and length of each haul
- description of habitats sampled
- unusual site characteristics
- field measurements (flow, DO, pH, temperature, specific conductance)

Sample-Tracking Logbook

A sample-tracking logbook, containing the information described in Chapter 11 of this manual, must be maintained. The logbook documents when samples arrive at the laboratory or headquarters, when each sample enters each processing step, and who has custody or responsibility for it.

Laboratory Bench Sheets

Laboratory bench sheets must be maintained where specimen identification and enumeration occur. These bench sheets document the raw counts of individuals for each taxon and notes relevant to their identification and enumeration. Examples appear in Appendix H.

Sample Collection

The method used to collect nekton samples will depend on the type of habitat. Collections of saltwater fish will generally be conducted in one of three major habitat types—tidal streams, open bay, or Gulf waters. Each requires a slightly different approach. The coastal bays and nearshore Gulf waters are sampled extensively by the TPWD Coastal Fisheries Division to understand status and trends of selected finfish and shellfish species, within the realm of fisheries management. Any fish collections in these areas must follow TPWD methods (TPWD 2002) unless there is a compelling reason to do otherwise. Fish collections in tidal streams must follow the methods outlined in this manual. Because of the limited guidance available for assessing fish data from tidal streams for regulatory purposes, it is important to consult with the TCEQ WQSG staff before sampling.

The concept of critical and index periods used for freshwater streams may not directly apply to bays, estuaries, and tidal streams. The same is true for level of effort in using collection gear. Thus any assessment must be planned in coordination with TPWD and TCEQ personnel to ensure that the timing and level of effort are appropriate for the type of assessment.

The field equipment and materials necessary to collect fish are listed in Appendix A. Forms needed for biological assessments appear in Appendix C. Electronic copies of all the tables in the appendixes are available at <www.tceq.texas.gov/goto/biopacket>. Definitions of technical terms are in the glossary (Appendix E).

Collection Procedures

Because the objective of the nekton sample is to obtain information on the composition and integrity of the nekton community, collectors must net, identify, and enumerate all organisms possible or selectivity (bias) may occur (Murphy and Willis 1996). The amount of effort must be recorded. Catch per unit effort is used as a way of measuring and comparing fish data when the same methods and gear types are employed. Do not combine fish from different kinds of gear.

Fish Collection in Tidal Streams and Bayous

In general, one must use smaller gear in a tidal stream compared to what is used in open bays or Gulf waters—for example, a 10 ft trawl in tidal streams instead of the 20 ft trawl used in open bays and 100 ft gill nets instead of 600 ft gill nets. A 15 ft straight seine is used in tidal streams, rather than the larger bag or beach seines used in more open habitats. In bayous where the salinity may be low, such as in the upper coast, it may also be possible to use electrofishing techniques.

Trawl

Trawling is an active fish-capture method because it uses moving gear (a towed net) to collect organisms in open water. Trawls sample a discrete area or volume over a specified time, thus making quantitative sampling possible. This method captures pelagic (water-column) and bottom-dwelling organisms. As the net (trawl) is dragged along the bottom, fish enter it and are captured. They collect in the end of the net (cod end), which is tied shut. After retrieval of the net from the water, the cod end is untied to easily remove the fish for identification. Otter trawls use heavy wooden "doors" or "otter boards" to spread the mouth of the net open and keep the net on the bottom by applying lateral pressure on it as it is towed forward. It may not be possible to use a trawl in environments with abundant rock or woody debris on the bottom.

In tidal streams, use a 10 ft otter trawl.

Appropriate methods for deploying and collecting biological specimens with trawls are outlined in Murphy and Willis (1996).

Usually four replicates, composited, are required for a complete trawl sample. All stations must receive a similar level of effort.

Do not trawl in marked navigation channels.

Attach a tail buoy to the end of the trawl when collecting bay trawl samples to ensure its retrievability.

Seine

Seining is an active fish-capture method used near shore to capture mainly smaller fish and juveniles. Seines can be hard to use in stands of emergent vegetation or areas with a lot of woody debris, stumps, or cypress knees.

Seines must be inspected for any holes and repaired or replaced before each use.

In tidal streams, use a 15 ft straight seine. In some cases, the banks of a stream drop off too steeply to use a 15 ft straight seine. One alternative is for one worker to hold a 30 ft seine from the bow of a boat with another worker standing near shore holding the other end of the seine. The boat is then maneuvered to pull the seine along shore and back to shore while the worker on shore holds the other end of the seine steady. Choose a section of shoreline to seine that will allow the net to be pulled for approximately 8 m at a time. Shoreline is considered to be the edge of the emergent vegetation if vegetation extends out from shore. One end of the seine is positioned near the shore. The other end of the seine is positioned perpendicularly offshore. With the net fully extended, both persons pull the net parallel to shore with the person onshore slightly behind the person offshore. At 8 m, the person at the shore remains stationary. The person offshore proceeds to shore with the seine extended. Both persons pull the seine onto shore. Be sure the lead line remains on the bottom until the seine is pulled out of the water.

Count and record all organisms collected by the seine or put them in a container with a label and fixative. Often the organisms are so small and numerous that it is preferable to bring the entire catch back to the laboratory for identification and enumeration.

Repeat this process until six or more replicates are collected.

Boat-Mounted Electrofisher

Electrofishing uses electricity to temporarily stun fish so they may be collected with a dip net. This method is typically used by moving the boat slowly along the shore.

Safety

Safety is extremely important. Use only commercially produced electrofishing equipment. At least three people are required when electrofishing out of a boat. All persons on the boat must wear rubber, nonconductive gloves and knee boots or waders. Keep the gloves dry. Everyone in the boat must wear a personal flotation device.

Collecting

Electrofishing is only effective for collecting nekton in areas where the salinity is low, such as in the upper end of tidal streams or bayous. The duration of sampling is 900 seconds of actual shock time.

Frequency and voltage are set to maximize output for the water conditions. Once the controls are adjusted, the samplers reset the timer. Electricity is discontinuously applied. Catches usually can be increased in areas of submerged cover by moving in with the power on but the circuit off and then energizing electrodes for an element of surprise. All habitat and cover types must be electrofished. Record the distance and the actual shocking time. A slow, deliberate style of capture is safer than fish chasing, and also yields more representative samples.

If conductivities are elevated, observe manufacturer recommendations about equipment limitations. Electrofisher capabilities vary by manufacturer and model. Each model is effective under certain ranges of specific conductance. Check manufacturer specifications for optimal operating procedures and consult with the manufacturer if the unit is consistently operated at higher conductivities. Electrofishing gear does exist for use in higher salinity waters (Smith-Root 2003)—for example, the Smith-Root 7.5 GPP Electrofisher, 10–11,000 µS/cm, and the Smith-Root 9.0 GPP Electrofisher, 100–25,000 µS/cm; however, there are not enough data to determine their effectiveness. See Chapter 3 for detailed information about boat-mounted electrofishing.

Gill Netting

Gill netting is a passive fish-capture method since the gear is stationary and fish become entangled in the gear while it is deployed, usually for several hours or overnight. Experimental gill nets contain panels of different mesh sizes, which are able to capture different sizes of fish.

Weights attached to each end of the net and lead weights at the bottom of the net (lead line) keep the net near the bottom of the water column, while floats and flotation material in the top line of the net keep the net stretched open and suspended in the water column or near the surface (depending on the water depth where the net is set). These nets target pelagic species as they move upstream and downstream or along the shore. See Figure 4.1.

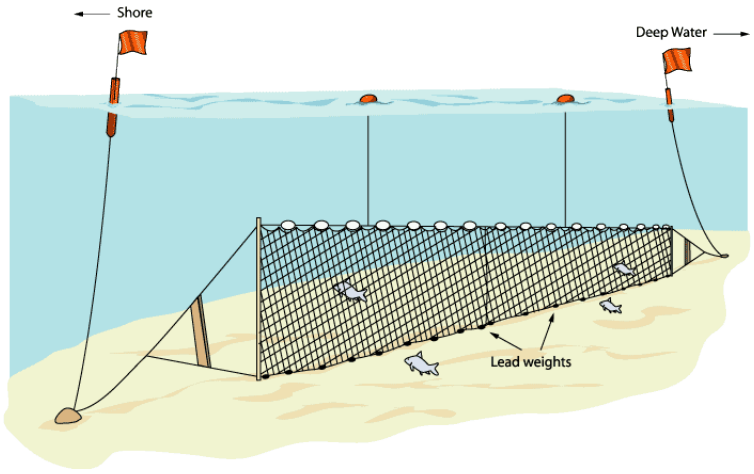

Figure 4.1. A bottom gill net. (Michigan Sea Grant.)

Use experimental gill nets and set them one hour before to four hours after sunset. The first gill-net pickup is to begin no sooner than sunrise, and within the first hour after sunrise. Start time is when the nets are fully deployed and end time is when pickup begins.

Appropriate methods for deploying gill nets and collecting the fish are outlined in Murphy and Willis (1996).

Save all edible dead organisms and make them available to local charities, or other needy organizations or individuals, if possible. Retain written records and receipts.

Sample Preservation and Processing

Field Processing

Maintain the fish in some type of holding bucket or tank with adequate aeration until ready to process.

Do not combine data from electrofishing and seining into one sample. The catch from each method constitutes a separate sample. Use a separate biological reporting form for each collection method.

Other than voucher specimens, easily identified fish may be counted in the field after all collection activity at a sampling location has been completed. **Do not** release any fish caught using either method until all sampling is completed!

Retain two individuals of each species collected for positive identification in the laboratory. Do not retain any fish greater than 0.3 m in total length. These specimens are photo-vouchered. Retain all but the most easily identifiable fish for laboratory identification. See Chapter 3 for detailed information on retaining voucher specimens and photographing fish as vouchers.

Field Preservation

The standard preservative consists of 10 percent formalin—one part full-strength formalin and nine parts water. Place specimens in this fixative while still alive, as those that die before preservation normally do not retain distinctive markings. To allow proper preservation, do not crowd fishes into bottles.

Slit larger specimens on the right side of the abdominal cavity to allow proper preservation. Avoid contact with formalin.

Safety

Avoid breathing formalin fumes! Formalin is corrosive to the eyes, skin, and respiratory tract. Wear safety glasses and latex gloves when working with this suspected carcinogen. Always work in a well-ventilated area or under a hood when preparing formalin solutions.

Alcohol is highly flammable; take care in storage and handling.

Check the material-safety data sheets for alcohol and formalin for proper handling requirements.

Labeling a Field Sample

Label each field container with an internal label that includes the following information. Use pencil or waterproof ink on paper with a high rag content for each label. Chapter 11 outlines the details of the container label requirements.

- station number and location description
- date and time of collection
- collection method (for example, trawl, gill net, or seine)
- preservative used
- name of each collector
- container replicate number if needed (for example, *1 of 2* or *2 of 2*)

Laboratory Processing

Identification of Fish-Assemblage Samples

The identification of fish-assemblage samples to the species level requires taxonomic training and a familiarity with appropriate keys and literature. The validity of identifications affects the quality of community analyses and, frequently, the ALU designated for a stream. Consequently, species must be identified by staffers with appropriate taxonomic training.

Appropriate equipment must be available for laboratory determinations of biological specimens, including a dissecting microscope, an assortment of probes, dividers, a ruler, forceps, and taxonomic references.

The primary reference for identifying Texas saltwater fishes is Hoese and Moore (1998) with complementary sources as necessary. Many estuarine and freshwater fishes, often collected in tidal streams, can be identified using Hubbs et al. (1991). Chapter 11 contains complete required and recommended references for identifying saltwater fish.

Sample-Tracking Log

Upon return to the laboratory, assign a unique sample tracking number to each jar containing the fish specimens according to the sequence in the fish-sample-tracking logbook. For example, an

instance of numbering may look like *F 040 13*, where F refers to 'fish,' *040* refers to sample number 40, and *13* refers to the year 2013.

Record the number and related information in the sample-tracking logbook, including:

- sample tracking number
- date and time of collection
- station number and location description
- name of each collector
- collection method (for example, trawl, gill net, seine)
- preservative used
- number of containers in sample

Laboratory Sample Preservation

Specimens remain in 10 percent formalin solution for at least one week and then soak in water for three days with a change of water each day. Transfer the specimens to 45 percent isopropyl alcohol or 70 percent ethanol before examination.

If the intent is to archive specimens in a museum, the preservative must match the individual museum's requirement, normally non-denatured ethyl alcohol. When samples are rinsed and transferred from formalin to alcohol, examine each internal label and ensure that it remains legible. Labels are often destroyed during rinsing. Procedures for disposing of formalin must follow your organization's chemical disposal plan. Detailed information on storing specimens is outlined in Fink et al. (1979).

Sample Sorting and Identification

When sorting and identification begins, handle collections individually with each staff person working up one sample at a time. For QA purposes, maintain a record of who identified specimens from each sample.

Place samples in a sorting tray, grouped by species. Keep specimens moist to prevent deterioration or desiccation. *Do not* combine samples collected using different methods. Once sorted and identified, place each species into a separate jar by type of gear with appropriate labels that include the following:

- station number and location description
- state
- county
- river basin
- name of each collector
- collection method (for example, trawl, gill net, seine)
- species name (not common name)

- number of specimens in container
- range of total lengths
- preservative used
- number of containers in sample

Label those that are not identifiable with a similar label noting either "no species name" or "possibly"—for example, "possibly *Opisthonema oglinum*."

Affix a label with the sample tracking number and container replicate number to the outside of the container. Make sure the container is dry, and wrap it with clear tape to ensure the label will not come off. Do not affix the label to the container lid.

Laboratory Bench Sheets

Prepare a laboratory bench sheet listing the species, number of specimens, disease presence, and sample identifiers. Sample identifiers must include information from the collecting label, such as location, date, and collector. Once species enumerations are completed, double check the bench sheet against the sample bottles to ensure the counts are correct. Examples of laboratory bench sheets appear in Appendix H.

Quality-Control Checks

A minimum of five percent of all identifications are subject to a blind recheck by another biological expert. Selection of samples for rechecking must be random. A record of rechecks must be kept for QC purposes. If identifications by a particular individual have an error rate of more than 10 percent, reidentify all specimens. Laboratories must be aware of the potential for systematic or consistent errors in identification of a particular family, genus, or species.

Voucher Specimens

Retain at least one representative of each fish taxon collected as a voucher specimen for at least five years or until the conclusion of all applicable regulatory decisions (whichever is longer) to allow verification of identification if necessary. Voucher specimens serve as long-term physical proof that confirm the names applied to organisms stored in SWQMIS. Voucher specimens ensure the credibility of TCEQ bioassessment data by documenting the identity of the organisms and making them available for review by the general scientific community.

Consider the following when storing voucher specimens.

- long-term maintenance of wet (alcohol-preserved) and mounted specimens
- adequate quantity and quality of space to store specimens
- an effective mechanism for locating and retrieving specimens upon request
- personnel experience in fish taxonomy

The organization maintaining voucher specimens must have a history that demonstrates the ability to preserve the specimens into the future (USGS 2000). This could include

in-house provisions for sample maintenance or archiving in a university or museum natural-history collection.

Field Notes

Field notes must describe the collection methods employed, equipment used, areas sampled, the way equipment was used, time spent sampling, a description of all sampled habitats, and any unusual site characteristics.

Data Evaluation

There are no currently accepted criteria for analyzing saltwater fish data. Consult personnel of the TCEQ WQSG, the SWQM team, or the TPWD for guidance in interpreting fish data collected from saltwater bodies.