

# Learning About Nonpoint Source Pollution



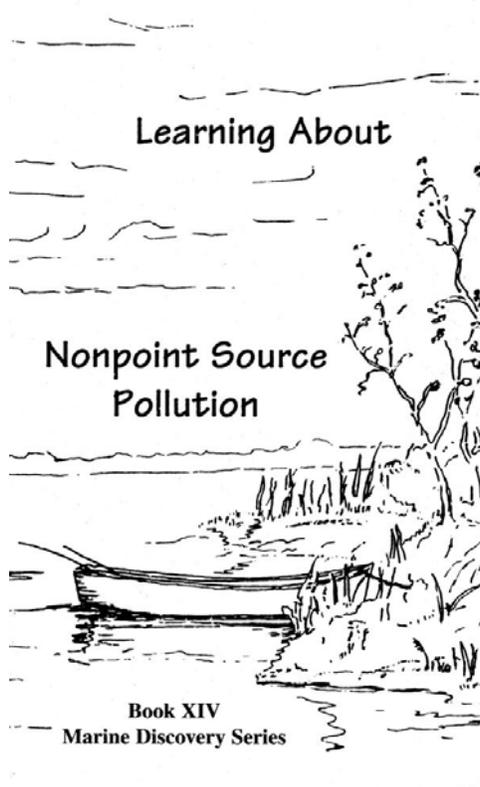
Learning About Nonpoint Source Pollution...

A Journey Through Coastal Waterways

Book XIV  
Marine Discovery Series  
Printed 1998



Mississippi Department of Marine  
Resources  
1141 Bayview Avenue, Suite 101  
Biloxi, Mississippi 39530



Written by  
Deborah L. Worrel

Edited and Co-Authored by  
J. Renee McDaniel

**Book XIV: MARINE DISCOVERY SERIES**

Arrangement and Design by  
Deborah L. Worrel—Mercy Cross High School

And  
Mike Walker—Department of Marine Resources Program Coordinator

Project Director Dr. Martha Watjus—Mercy Cross High School



*This publication was funded in part through a federal grant from the National Oceanic and Atmospheric Administration (NOAA), Office of Ocean and Coastal Resource Management under the Coastal Zone Management Act of 1972, as amended.*

## Acknowledgments

### Illustrators

Mrs. Ann Herring, Jun Kyung Cho, Melissa Smith—Mercy Cross High School Art Department

### Special Thanks to:

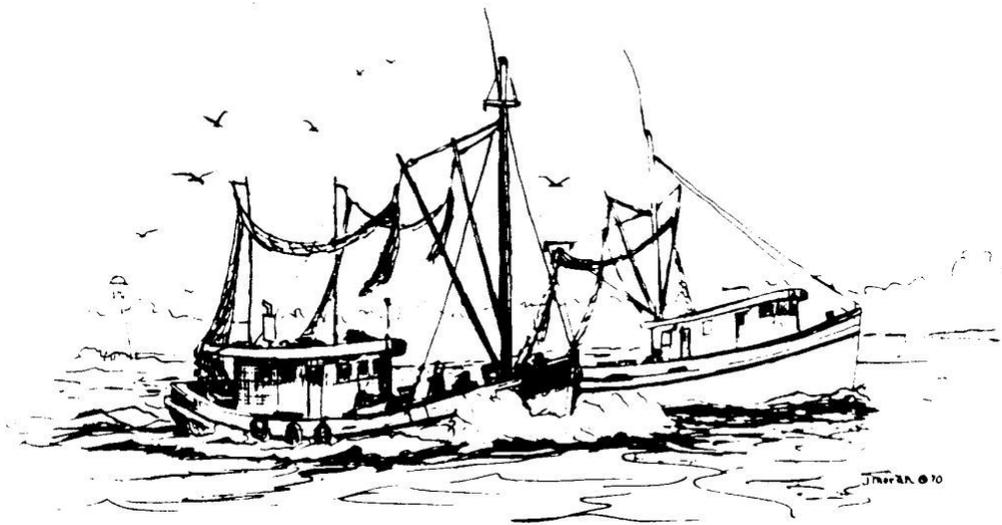
Mr. David E. Ford and Mr. Scott E. Ford for the generous use of their time and pleasure boat to view coastal waterways firsthand

Mr. Robert Stockton, Lifetouch Photography, for photographs of Nonpoint source pollution

The family and studio of Joe Moran, Artist and Historian for the permission and use of local sketches

Mrs. Della McCaughan, teacher and mentor, who helped us have the opportunity to write this book, supported our efforts, and encouraged our love and appreciation of the marine environment

Emily Collins & Kacie Palaez, Students of Mercy Cross High School and International Science Fair Researchers



## Preface

Imagine the sun glistening on the waters of the Mississippi Sound. A shrimp boat passes a group of ole-timers and children serenely casting nets and dangling fishing poles off the end of a pier. The shrimp boat passes silently, as its crew waves proudly as if to say that the day's catch was a success. This is the way that the people who live on and visit the Mississippi Gulf Coast want to remember its beauty. Its aesthetic beauty and bountiful seafood harvests have long provided a memorable lifestyle for its people.

Pollution in Mississippi's waterways affects this natural beauty, public health, and economic and recreational interests of inland and coastal waterways. Pollution that enters these waterways may be defined as point source or nonpoint source pollution. Point source is a type of pollution that can be identified from a specific source, such as from an industrial plant or wastewater facility. Nonpoint sources of pollution are not specific, in other words, their exact source is not known. They are, however, classified into five major pollutant source group categories: **Agriculture, Forestry, Urban Marinas and Recreational Boating, and Hydromodification.**

Nonpoint source pollution occurs as rainfall or snowmelt moves over or through the ground, picking up and carrying with it natural and human-made pollutants, then depositing them into lakes, rivers, wetlands, coastal waters, and even into our groundwater sources of drinking water. In most cases, the natural design of the land and its vegetation help reduce nonpoint source pollution. The porous soil and natural landscapes allow rainwater to filter slowly through the soil where it is physically filtered and biologically cleaned.

Today, nonpoint source pollution is our nation's largest source of water quality problems. At least 40% of rivers, lakes, and estuaries are not clean enough to provide quality drinking or recreational water use. Most coastal communities obtain their drinking water from underwater reservoirs at or near the water table. The education about nonpoint source pollution is important because even the seemingly negligible changes that affect our waters have impaired 60 – 70% of water bodies in Mississippi today.

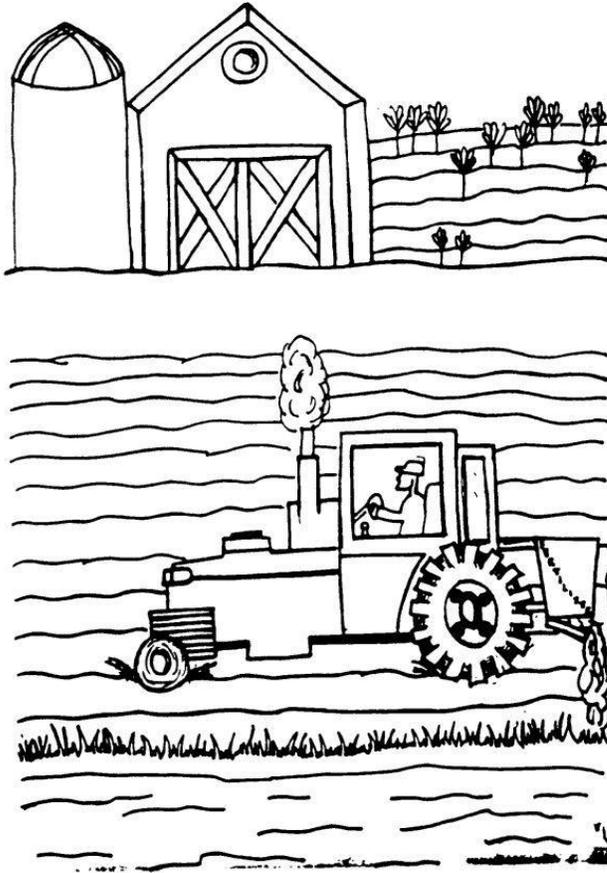
## I. Day One—River Systems

“Johnny, have you loaded the fishing gear onto the pontoon? We need to leave in ten minutes to reach MaMa Jo and PawPaw John’s camp by nightfall,” Jean said to her young children. Elizabeth is helping her father, David Anderson, prepare the boat to embark on the journey down the Biloxi River to the Coast.

Jean Anderson is the daughter of JoAnn and John Ross. The Ross family has a long history on the Gulf Coast. Their families have made their livings as shrimpers for many generations. As she grew up, Jean was active with her parents in and around the waters of the Mississippi Sound. She is now grown and married to David Anderson, living north of the Coast near the Biloxi River. Their plan is to travel to the Coast to visit their families and participate in the annual Blessing of the Fleet; a ceremony that began in the 1930’s to prepare the shrimpers for a safe and bountiful harvest and season. Their love of the water and homesite on the river has allowed them to make the journey to the Coast on their pontoon boat. The Ross family has a fishing camp near where the Biloxi River and Tchoutacabouffa rivers meet. The first night of the trip will be to meet JoAnn and John Ross at their camp. The children are intrigued by the trip, especially the idea of traveling by water. It will be a memorable and learning experience, both Mom and Dad will see to that.



Mesmerized by the water’s relaxing motion past the boat, Johnny realizes that an hour has already passed. He hears a distant sound and looks up to see a farmer harvesting his crop. As they neared the farmland, Mom quickly speaks up telling Johnny how lucky Mississippi is to have such a bountiful agricultural harvest.



Plowing, planting, and harvesting of crops may leave the land exposed, allowing heavy runoff concentrated with many pollutants.

“Our state is blessed with rich soil, abundant water, and skilled farmers who produce food for its people. Mississippi’s number one business is agriculture. But agricultural pollutants make up the leading source to estuaries and nearshore waters.” Johnny quickly questions how nonpoint source pollution may contribute to water quality. Some of his questions are answered when Jean replies with, “Let me tell you a story that might help you understand. Imagine the journey of a single raindrop from the moment it falls to the earth. We can trace its path as it meanders through a small stream and is joined with other droplets of water. These droplets of water have washed over surfaces of land, through streets, parking lots, farm fields and construction sites, picking up and carrying with them natural and man-made pollutants. Eventually, depending on the land itself and the source of pollutant, the water droplets merge with many others, and continue a journey as the flow into rivers, bays, estuaries, and

the Mississippi Sound.” Johnny nods, “So water from even here will reach the Coast? How do the raindrops and the farmland reach each other?”

“On farmland, weeds are treated with herbicide chemicals applied to kill and control them. Insects that eat the leaves are treated with insecticides. The crops themselves are treated with chemicals to prepare them for harvesting. Animals graze on these farmlands. The animals themselves produce wastes that contain pathogens (bacteria and viruses). The land itself is drastically changed. The plowing, planting, and harvesting methods often leave the land exposed. During a heavy rainfall, runoff water is not able to percolate into the soil. The result is heavy runoff concentrated with eroded soil and many pollutants,” Jean answered her son’s curious look.

Agricultural activities that cause nonpoint source pollution include animal facilities, grazing, plowing, chemical treatments, fertilizing, irrigating, planting, and harvesting. Pollutants from these activities include sediment, nutrients, pathogens, and chemicals from fertilizers, pesticides, and herbicides. When the land is naturally landscaped, water gradually percolates through the soil and is chemically and biologically

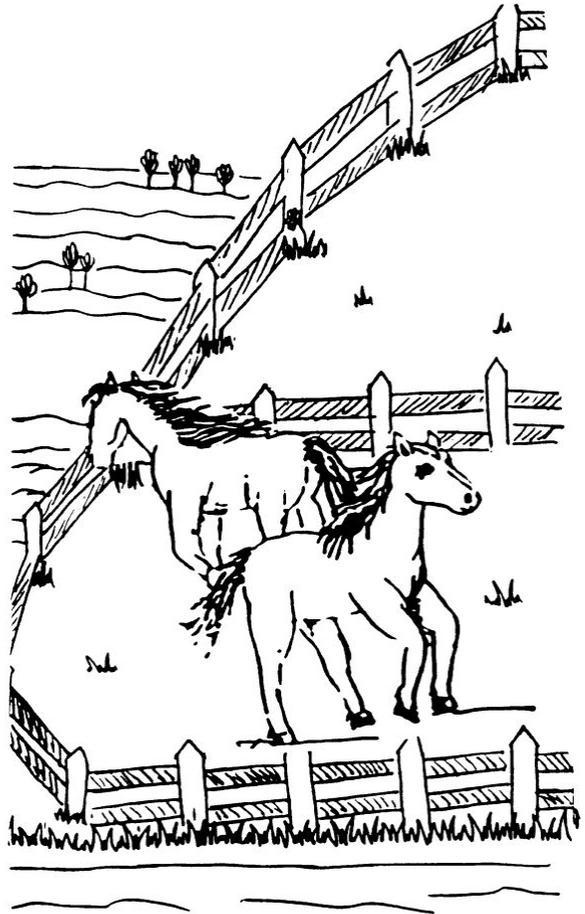
cleaned and filtered. It then will gradually enter nearby waters and seep into the natural ground water supply, at or near the water table. A bare farm field allows rapid erosion. The runoff contains sediment, wastes, and chemicals. These substances cloud the waters, reduce available sunlight to marine and plant life, damage food supplies and spawning grounds, even clog the gills of fish. Pathogens that wash into water supplies contaminate ground water and habitats. Our coastal waters have been greatly affected where the shellfish beds have become closed to harvesting due to levels of animal waste contaminants.

Mom appears disturbed when Elizabeth interrupts her thoughts and asks, "Mom, what can be done to prevent this pollution?" Dad intervenes, "It is called Agricultural Management Practices." He points out several examples.

"Farmers know techniques of soil and water conservation practices. Farmers use methods such as terracing, crop rotation, and contour planting to replenish nutrients and prevent erosion. Terracing is where farmers plant with the contour of the land, especially where there is a slope. Then water will not flow as quickly if the area is leveled. Crop rotation occurs where farmers alternate crop planting so that nutrients are replenished into the soil. Even off-season plants are grown so that the soil is never bare." He pointed out a field that was recently harvested. "That farmer has left the bottoms of the stems so that water will be trapped and not erode quickly. Also, livestock should graze away from streams and waterways. Animal wastes can be treated or made part of compost for fertilizer in regulated rates.

Chemicals should be applied only as needed and in amounts limited only to what is actually required. Excessive irrigation increases erosion and even concentrates the chemical supplies that wash into nearby waters. Some agricultural land includes a level where water is trapped and stored, such as in a retention or detention pond. Later, that water can be used for irrigation. Irrigation can be regulated to be more efficient.

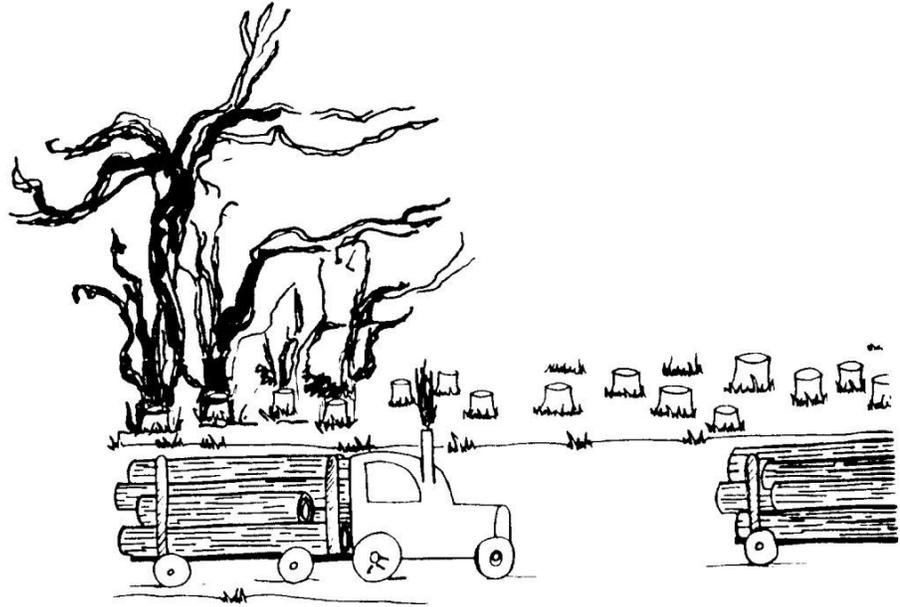
Remember that water that runs off of this farmland carries with it chemicals and other pollutants that eventually travel all the way to the Coast, joining other bodies of water and affecting plant and animal life along the way. Techniques that farmers use to



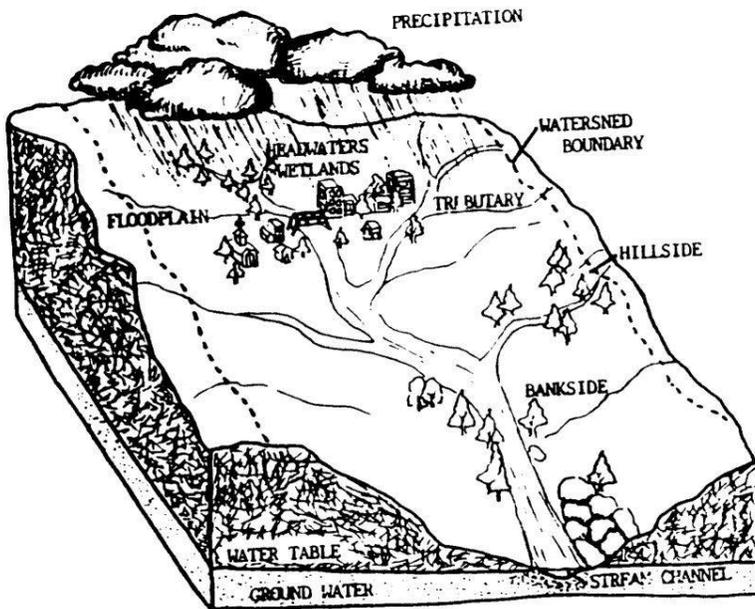
Grazing livestock create wastes that may wash directly into nearby waters.

manage agricultural practices are important to all of us, not only for our food supply, but for our waterways and the life within them.”

Billowing smoke interrupts Elizabeth’s daydreaming. She had been watching the large white clouds pass by when a large dark cloud came into view. Her eyes follow the dark cloud to its source—a field being cleared of timber. Large trucks are moving the freshly cut trees, as workers stack timber and burn excess limbs and trunks of cut trees. Elizabeth stares at the acres of land that were once covered with trees as her mother notices her curiosity.



Undisturbed forestlands generally provide high quality watersheds suitable for municipal drinking water supplies, fisheries, and other valuable recreational uses. Pollution associated with forestry includes removal of streamside vegetation, road construction, and harvesting timber.



The mention of a “watershed” catches Johnny’s interest. David explains to his son that a watershed is a region of land and small waterways that feed into larger rivers and streams by direct runoff from the land, precipitation, wetlands, and percolation through the soil. In its naturally-landscaped state, the land and soil allow water to flow slowly, being absorbed by the soil. The water is slowly absorbed and “percolates” through the texture of the soil being biologically and physically filtered. The watershed nourishes the water

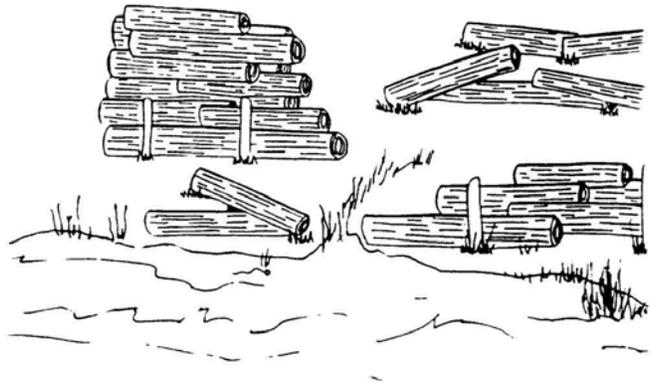
Schematic of a Watershed

table, which is a reservoir for much of our drinking water.

“Drinking water?” exclaims Johnny. The water table is the water level at or below the surface. Because water is held in place there, it becomes a natural reservoir and provides quality water supplies.

Pollutants resulting from forestry include sediment, chemical pollutants, excess nutrients and excess organic materials. Removing streamside vegetation not only destabilizes the streambank, but also actually elevates the temperature of water by reducing shade along the water’s edge. These changes can harm marine life by limiting food, shade and shelter. Poor forestry management results in a large impact on sensitive nearby ecosystems.

Elizabeth again remarks, “What can be done to stop pollution from forestry?” Dad replies, “Management plans that identify the area to be harvested and describe measures to design roadways to regenerate the forest are important. Some of the factors that are considered in these preharvest plans include surveying the site to be harvested for specific ecological landscape, design roadways to utilize natural land contours, carefully identify the timing to avoid rainy seasons and migrating and spawning seasons, stabilize the stream banks with vegetation, and regenerate the forest area by replanting seed or seedlings.”

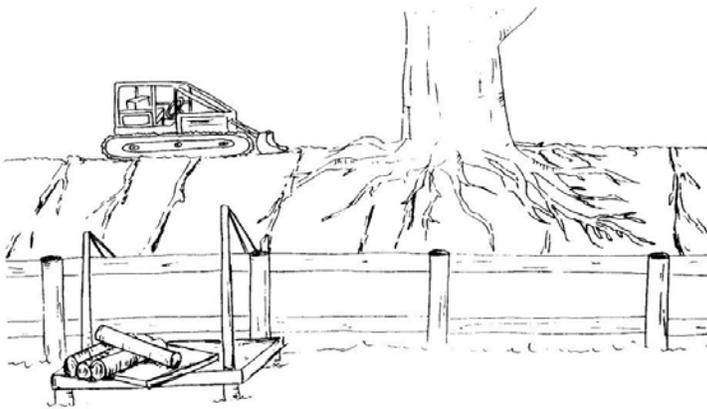


As the day draws to a close, the sun sets over the river’s bank. Johnny and Elizabeth’s excitement grows as they round the bend and see MaMa Jo and PawPaw John’s fishing camp ahead. PawPaw can be seen out on his pier waiting patiently for their arrival. As the Anderson’s pontoon boat glides peacefully up to the pier, the first day ends.



## II. Day Two—Rivers to Bayous and Bays

Before the break of dawn, PawPaw wakes Johnny and Elizabeth for an early morning fishing trip. Back on the pontoon boat, they begin a trip into the mouth of the Tchoutacabouffa River. Soon after they round the first bend, they spot a large construction site where a riverside subdivision is being built. Johnny quickly remarks on the large area of land being cleared and homesites being prepared for rows of homes already under construction. “What beautiful homes,” remarks Elizabeth. Paw Paw remarks on the beauty of the river’s banks. “I can remember when these rivers were untouched. Their natural beauty provided many people with clean water, fishing, and recreation.” Johnny notices a pipe that now drains directly into the river. “Dad and Mom talked to us about pollution from agriculture and forestry. Does that happen here?” he

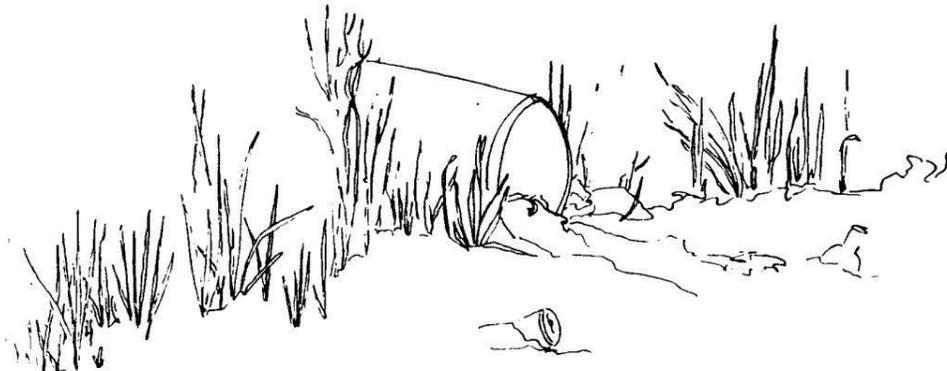


The construction of this riverside subdivision has created exposed soil and increased erosion into the river.

asked. Paw Paw reminded us that again the natural landscape and contour of the land has been changed. “The natural ground soil is porous and allows seepage of the water throughout the soil. Construction and development replace the soil’s natural surface with concrete driveways, impervious roads, and underground septic systems,” explained Paw Paw.

From the questioning look on Johnny and Elizabeth’s faces, Paw Paw continues. “Of

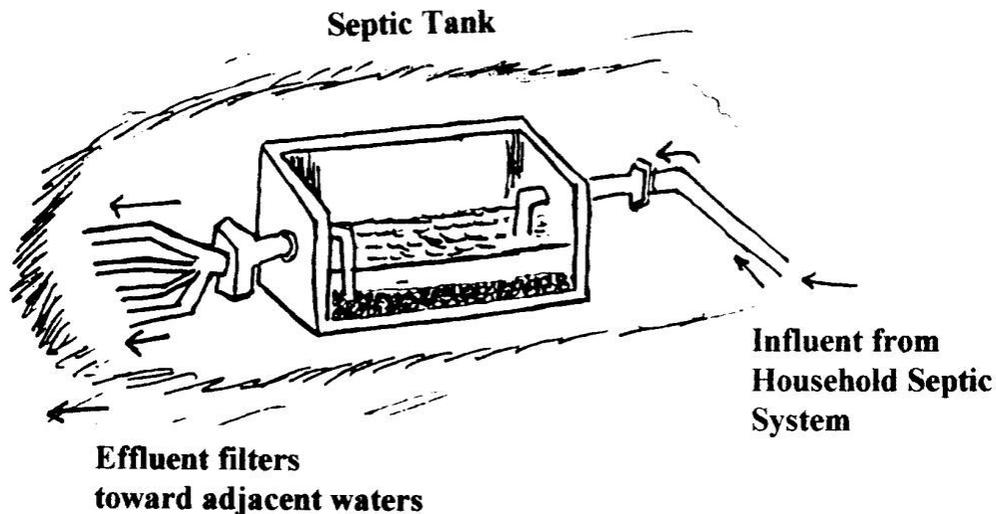
all the contributors of nonpoint source pollution, improperly treated sewage from failing individual septic systems has been identified as the dominant source of nonpoint source pollution in coastal Mississippi.” The most common type of septic systems is the underground septic tank and underground absorption field. It is a maintenance system that relies on native soils for treatment and disposal of the septic tank effluent. It requires proper soil type and texture and is often not effective in low-lying coastal land. “The pipe you see draining into the river may be street runoff or it may be septic tank effluent.”



A septic tank receives all of the water and wastes that drain from a house. Solid wastes will settle to the bottom of the tank and begin a process of decomposition. Liquid wastes remain at the surface and will eventually flow through pipes and tubes located in a leach field. This area is behind the septic tank and allows the liquid to filter through layers of pipes. Without this leach field where gradual percolation exists, wastewater will supersaturate the ground and possibly flow directly off into nearby streams and the water table. If the septic tank is poorly designed and the soil and site are unsuitable, the septic tank will fail. Proper soil type and textures are able to treat organic and inorganic matter and pathogens by biological and chemical processes. Through these processes, the water produced is acceptable for discharge into the ground water supply or adjacent waters.

Paw Paw continues, “Water contaminated by improperly treated wastewater threatens public health, degrades the environment, and contains harmful bacteria and viruses. These pathogenic substances can affect our oyster beds in the bays and Mississippi Sound and eliminate the availability of their harvest for many years. The oyster beds in our state already close periodically due to pathogens and these closing have a devastating effect on the livelihood of many people.”

Elizabeth quickly counters with her question, “What can be done to stop this type of pollution?” Septic tank placement is important. The soil must be suitable for slow percolation and filtering, away from tree roots and nearby waters. The septic tank usage should be limited so that overflow does not occur, contaminating nearby lakes, streams, estuaries, and ground water.



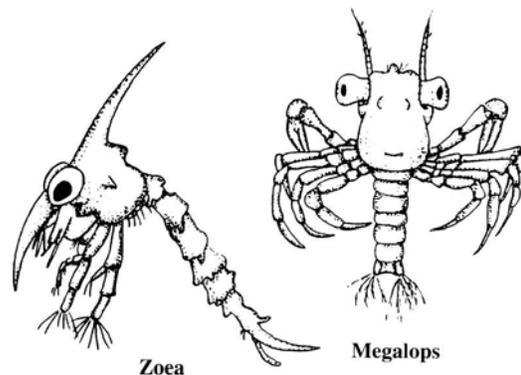
This limited usage is accomplished by using water efficiently. The system should be inspected and emptied every three to five years. It is very important that household cleaners, grease, oil, food, and paper products are not placed into the septic system. Chemicals will corrode pipes and interfere with the chemical and biological breakdown within the system. Large objects may clog the system and increase chances of overflow. Substances that are not biodegradable, or naturally breakdown through the septic process, will also clog and cause overflow of the septic system. This overflow, in a soil texture

already not well suited for water percolation, allows the untreated wastewater to flow directly into adjacent waters.

Paw Paw realizes that they need to return to the fishing camp. The sun now glistens on the water's surface. The early morning sun promises a good day. The boat glides up to the pier where Jean and David await the arrival of their children. Joann and John Ross will join them for their trip to the Mississippi Gulf Coast to PawPaw's shrimp boat that will be decorated and prepared for the Blessing of the Fleet. MaMa Jo and Jean have packed a huge basket of breakfast biscuits and sandwiches for later in the day. The second day of their trip now continues.

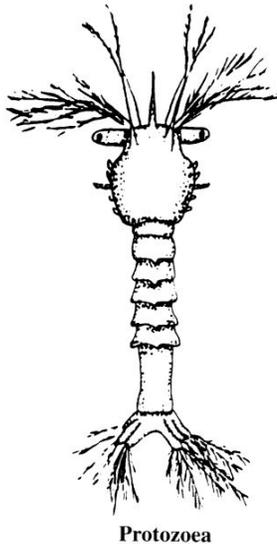
The pontoon boat slowly leaves the narrow river waters and turns to enter a larger body of water. David Anderson remarks that they have just exited the Biloxi River. Looking across the marshy wetlands he point to another river, the Tchoutacabouffa, which also drains into this region. "We are now in a body of water called Big Lake, a large, brackish body of water which these rivers and smaller tributaries empty into." The pontoon is steered toward the channel heading toward an industrial canal. Johnny notices that the tugboat is heading toward another narrow, but straight body of water. "Is that a river, too?" asks Johnny. David answers his son, "No, that is an industrial canal. It is man-made. It was dredged and straightened so that large boats could navigate into and through it toward industries along the canal. That process is called Hydromodification." "Hydromodification," mimics Johnny, "is that good or bad?" Paw Paw answers this one. "Many of these projects are designed to provide boat traffic with better routes and industries with access to water. Many streams are straightened to control flooding. But sometimes the result is severe erosion and excess sediment. Habitat loss and poor water quality, as well as increased pollution, and decrease of fish and aquatic wildlife also may occur as a result of dredging for channelization. In some cases, an entire ecosystem is devastated. Hydromodification may also result in nonpoint source pollution. In a largely populated area such as the coast, we may see other examples of this man-made change."

As they make their way through the water toward the east, paw Paw sees a perfect example just ahead. "Let's make our way toward that bayou, David," instructs Paw Paw. Easing the boat toward a narrow opening, Paw Paw continues. "At one time there was a bridge crossing over the mouth of this bayou. The bayou must have a continuous, natural flow with the tides. Water must be able to enter and exit this bayou. When the bridge was built, the ground was built up for better stability for the bridge. But at the same time, the mouth of the river was narrowed at least 30 to 50 feet on each side. This has definitely changed the natural flow of water in and out of this bayou. This also is hydromodification because the natural direction and flow of the bayou has been changed." Elizabeth immediately asks, "Where

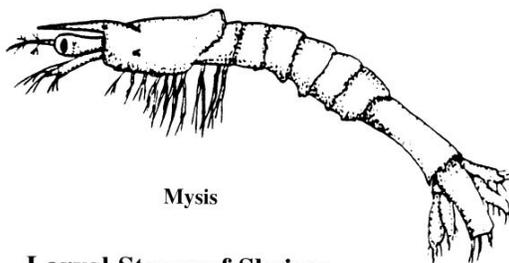


**Blue Crab  
(larval stages)**

does this bayou water go?” Paw Paw’s wisdom begins. “A bayou is an estuary. It is an inland body of water with a free connection to a larger body of water. Natural tidal flow enters and exits this estuary. The water is brackish, a mixture of salt and fresh water. Bayous and all estuaries provide our coastline with natural nursery grounds for our seafood and several young stages of marine animal life cycles. The larval stages of our shrimp, crabs, and many fish, and our oysters, depend on the tidal flow in order to reach the estuaries. The habitat here provides them with protection from predators and good food supply. They feed and grow here. Imagine what would happen to the seafood supply if these estuaries were destroyed by pollution. The life cycle of these marine organisms would be endangered. If they could not enter a safe, nurturing area, they often would become food for larger fish and the harvesting that I depend on for shrimp, crabs, and oysters would be endangered. Sometimes months after they enter these estuaries, the young organisms have grown to a suitable size to make their way out of the estuaries and back into open and saltier deep waters. They are able to move on their own by now, but with the aid of the direction of the water’s current.”



Protozoa



Mysis

### Larval Stages of Shrimp

pollution. Every little bit makes a difference.” He pauses and later remarks, “You can see that within a community, and in on a body of water alone, several factors can contribute to nonpoint source pollution. We have seen hydromodification, or man-made altering of a natural flow, and a result of urban nonpoint source pollution. Urban nonpoint source pollution results where populated areas alter the natural flow, natural landscape, or add

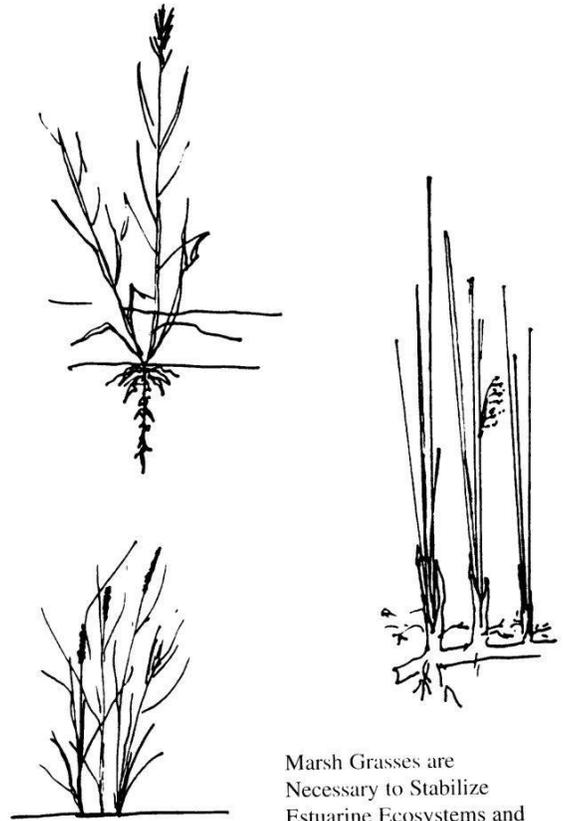
Suddenly the overcast skies threaten rain. Sprinkles of rain are felt and Paw Paw suggests that we stop nearby for a quick lunch. Johnny looks across the bayou watching a bulldozer working at a landfill. Paw Paw shakes his head. “As you can see, this landfill has drastically narrowed the bayou at this point. Unknown materials used in landfills, such as old tires, metal scraps, concrete, and even some toxic chemicals, have been pushed into the edge of the bayou and covered with soil. The natural plant life on the edge of the bayou has disappeared. This narrow region changes the bayou’s flow also. The material that is underneath this soil could be disposed of in much better ways. Some material like concrete, large pieces of metal, and tires could be recycled and used again. Not knowing what is below that soil creates great concern. Sometimes substances become toxic or poisonous to the organisms in the water. Communities have to educate people about what is happening here. Everybody plays a part in nonpoint source

pollutants to waterways. The substances that wash into the waterways are not easily defined by the source and content.”

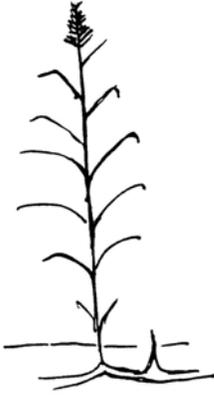
Just ahead is an overpass and solid ground suggesting a covered area where the family could picnic along the bayou’s edge. David carefully eases the pontoon boat near the solid area. MaMa Jo and Jean prepare the lunch in picnic style. Suddenly, the rains come. The afternoon thunderstorm may last only a few minutes, but the family is safely covered and enjoying a brief stop and lunch.

MaMa Jo is immediately disturbed by the flow of the rainwater through the overflow opening in the overpass above their picnic area. Openings in the concrete bridge wash large volumes of water into the bayou. “Here is another example of nonpoint source pollution,” she quickly instructs. Urban areas are of great concern to the environment where pollution is concerned. Looking past the highway overpass, she points out that beyond this bayou are businesses, homes, shopping centers, and schools. She looks around with suspense. “There it is,” she points. “That large pipe is a drainage pipe from a street. This area has a watershed, too. There are many streets in this area that drain their runoff through these pipes and many empty into this bayou from that pipe alone.”

“Emptying into the bayou from these overhead openings are large volumes of nonpoint source pollution, created by street and storm runoff. Imagine where all that water comes from. As rain falls on that concrete, it cannot be absorbed, but it rapidly is transported toward those drainage openings carrying with it water from the highway mixed with gasoline, antifreeze and oil from automobiles, litter, sediment, and animal wastes from the roadside. The volume of water beats heavily on the sensitive marshland below. It is obvious to us that the grasses that line this bayou are in danger. They will not be able to withstand the heavy beatings of water too many times. These pollutants will not only change the structure of the bayou, but the water will become filled with these pollutants.”



Marsh Grasses are Necessary to Stabilize Estuarine Ecosystems and Form a Natural Buffer Zone for Pollutants



MaMa Jo continues, “From that drainage pipe also empties water containing nonpoint source pollutants. That water is coming from a watershed region surrounding this area where businesses, homes, shopping centers, and even schools drain their water into this pipe and eventually into this bayou. That water not only contains substances from the highway above, but detergents, fertilizers and chemicals from lawns and households, and especially substances which people deliberately release into the street drains near their homes. The land that was once porous and helped drain this region is now often covered by urban development. That means that concrete driveways and roadways, and asphalt parking lots have made the area impervious to water. This water can only flow directly off, carrying with it all the sediment, litter, and automobile and animal wastes directly to the adjacent water, and in this case, this bayou. Again, everyone plays a part in nonpoint source pollution. Every little bit counts.”

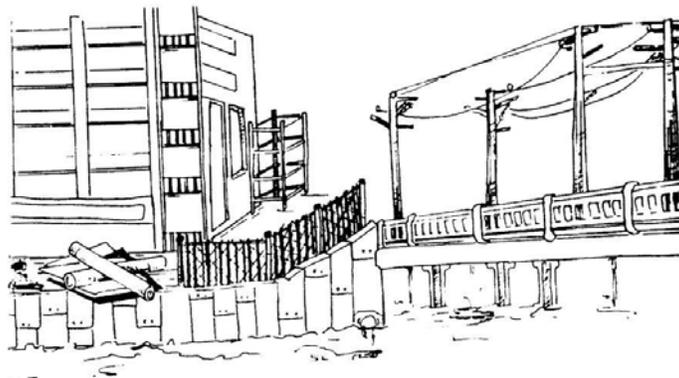
It is obvious that Johnny and Elizabeth are saddened by the information they are hearing. They are overwhelmed by the effect of nonpoint source pollution. Johnny asks, “If it is nonpoint source pollution, and no one knows where it comes from, how can we stop it?” David intervenes. “Everyone has to do their part. The biggest problem is what people put down their drains in their homes and along their streets. Grease, oils, detergents, paints, and toxic chemicals cannot be placed in drains. Automobiles should be properly maintained. All fluids such as oil and antifreeze must be disposed of at proper locations. Cities often have designated areas and businesses that specialize in proper disposal of these substances. Lawns should be fertilized and chemically treated with care. Excess fertilizer appears in runoff waters all the time. Proper amounts and types of fertilizers and lawn treatments should be carefully chosen. Even leaves and grass clippings need to be removed from storm drainage so that the drains do not become overloaded and clogged. Imagine the volume of pollution carried by these pipes into this bayou. Then imagine how great it would be if everyone did their part in eliminating all of these pollutants.”

As the rain begins to subside, Johnny takes a deep breath. “I know that you and MaMa Jo have lived here all your life. Has pollution caused a lot of change?” Paw Paw reassures him, “Well, many things have changed. Our coastline has grown with industries, shopping, homes, and roadways. But it is still a beautiful Gulf Coast. Everyone can keep it that way so that when you are our age you can still bring your grandchildren down here to enjoy its beauty.”

The sun begins to peek through the clouds. Everyone helps clean up the lunch site and bring the supplies back to the boat. The late lunch has revived their excitement and all are ready to get underway. When the boat is packed, David maneuvers the pontoon out of the bayou as they all glance back. The afternoon rain shower gives a fresh look to the bayou. A mullet jumps near the boat and an egret wanders along the shoreline looking for food. This is a true reminder of what the bayou and all estuaries should be. It is as if everyone was thinking the same thing as they pull away from the mouth of the bayou.

Johnny remarks, "Paw Paw, I want to work with you this summer on your shrimp boat. I would like to work with you to harvest shrimp just like you, MaMa Jo, and my mom have."

The pontoon reaches the Back Bay of Biloxi. Construction is obvious in many locations. Part of urban development in this region is the construction and growth of the casino industry. Along the water's edge is a casino construction site. Jean has kept up with the growth of the casino industry, constantly reading about changes occurring in the cities. She remarks, "Many government regulations are placed on the casinos which are being brought in here. They have allowed great growth and economic influx to the Coast. But their construction results in the same types of nonpoint source pollution that we have seen along our way. Removal of the natural landscaping leaves bare soil and increases erosion. Sediment and wastes become part of the drainage systems. Large trucks and machinery produce engine wastes, chemical wastes, and debris that wash into the adjacent waters. But the economic growth cannot destroy our natural wetlands." Elizabeth asks, "What do they do to stop their pollution?" Well, says Jean, "They must do much of what we have already talked about. They must be careful of what is placed into their water systems. They must replace the landscape which they remove and prevent erosion. Our casinos must be built along a shore, anchored in water. This means that many will also affect coastal wetlands and marshes. These marshes are protected and replenished.



Casino construction is "dock-side."  
Construction must adhere to strict laws  
governing the surrounding wetlands.

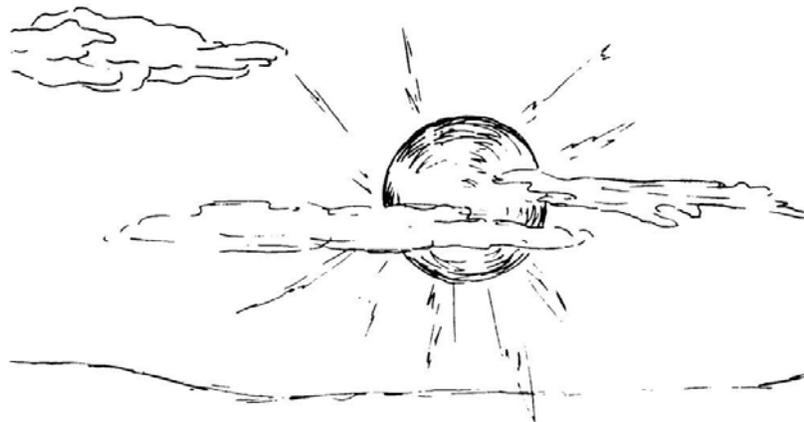
Many casinos bring new ideas of preventing runoff. Some casinos use a concrete grid system instead of full concrete parking lots. This allows water to be held in place and slowly absorbed into the ground for filtering. Some areas of construction include a retention basin. This looks like a pond where water from parking lots and runoff is directed and held in place. This process allows oil and sediment products to settle. Many times plants are placed in these ponds that naturally feed on pollutants. Given time these plants help eliminate, or at least lessen, the amount of pollutants. Many large businesses,

subdivisions, and even casinos have their own “package” type sewage treatment plants. Because of the large numbers of people they serve and the large volumes of wastewater, they chemically treat their wastewater within a sewage treatment facility. This takes some of the burden off the city itself and helps maintain safer water supply, better water quality, less runoff, and less damage to the underground water reservoirs.” Casinos are included in the urban nonpoint pollution category since they are found in populated urban areas.

JoAnn and John Ross glance at each other, smiling. Jean has gained a true appreciation of the region where she grew up. Knowing about the environment and how changes affect the ecosystems within it is a big part to stopping the problem. Regulations exist to help prevent the pollution from occurring. Careful monitoring of these processes helps ensure the protection of the waterways and adjacent wetlands.

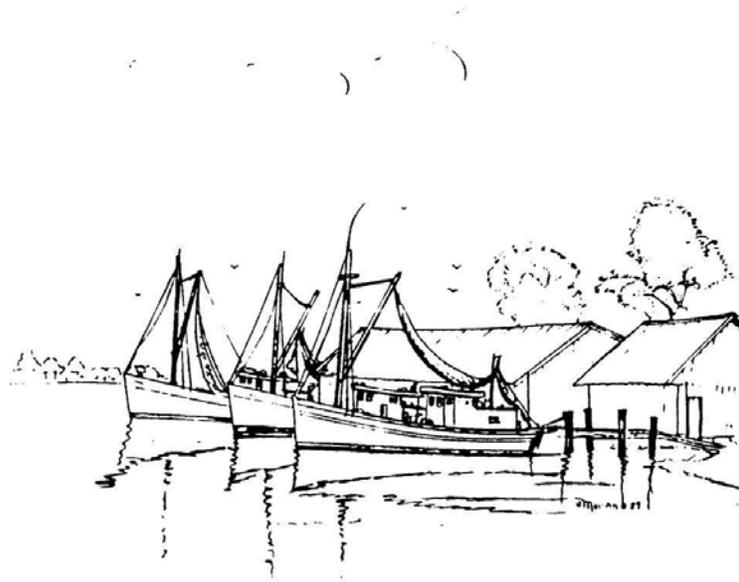
Just past the last bend in the bay, Paw Paw looks ahead at the marina where his shrimp boat is kept. Along Back Bay are several marinas which house and store shrimp boats and pleasure boats. Johnny and Elizabeth grow in excitement to see many people already working on their own boats. Many are decorating and cleaning their boats, preparing them for the next day’s festivities. Easing up to the pier, David is able to dock and tie the pontoon boats up next to the shrimp boat. Paw Paw soon steps onto the pier, on his way to check on his boat. The shrimp boat is large enough for the entire family to spend the night. The day has been a long, but enjoyable learning experience. It will surely be an early evening for Johnny and Elizabeth.

The sun is setting on the horizon. JoAnn and John Ross catch sight of the sunset from the shrimp boat’s bow, while David and Jean look ahead, absorbing its beauty. Elizabeth and Johnny notice what has caught their parents’ and grandparents’ attention and realize how much beauty exists along this coastline. The sky’s natural red, orange, and violet colors cast a beautiful glow along the water’s surface. Peeking across the horizon is a rainbow. “What a beautiful way to end this day,” declares MaMa Jo.



### III. Day Three—The Mississippi Sound and Open Waters

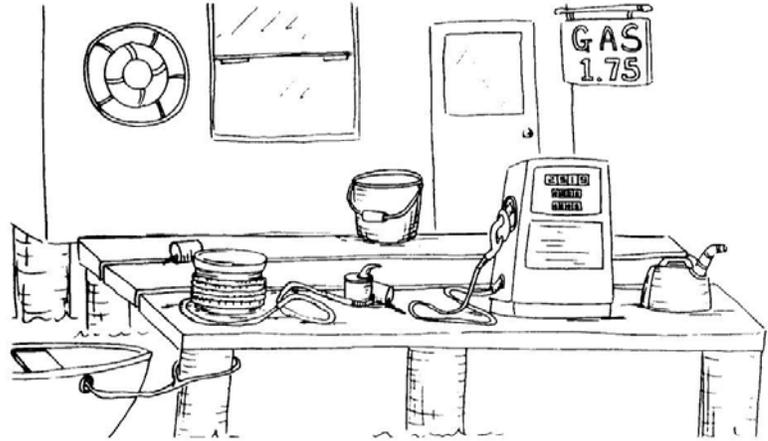
Early Sunday morning, MaMa Jo and Paw Paw John wake. Paw Paw says that there is much to do. Everyone will help. The shrimp boat must be cleaned and prepared for the Blessing of the Fleet. The engines must be checked and the shrimp boat will be moved out of the Back Bay into the Mississippi Sound, a relatively short journey from this marina. But most important of all to Johnny and Elizabeth, many decorations are ready to place all around the boat to enhance the festive mood of the occasion. These decorations will be the final touches just before the boat is moved. Meanwhile, Johnny and Elizabeth become restless.



Elizabeth and Johnny plead with their father to walk around the marina harbor to catch a glimpse of the already decorated boats. He agrees and they embark on a brief walk. The harbor and marina surrounding is active. Many boat owners wave and wish them a good day. Families are joined together working on boats, loading supplies for the day. The weather is beautiful and gives hope and excitement to the success of the day's activities.

Walking through the harbor, Johnny and Elizabeth both have intense looks on their faces. Elizabeth sees a rainbow of color shimmering on the water's surface near a boat. Nearby, a boat owner is filling his boat at the gas pumps. A passenger in a passing boat throws a plastic bag overboard without even looking back. David notices their concern. "Yes, children, nonpoint source pollution is here, too. As we pass through the harbor, we cannot determine the exact source of all the pollutants. Pollutants include fuel, oil, paints and chemicals, litter, cleaners being used on the boats, and even animal wastes. That rainbow of color on top of the water is spilled fuel and is a great hazard to this ecosystem. Boat owners have a great responsibility to protect these waters." He points out that near the harbor's main pier are the gas tanks and pumpout stations. These are two important areas of the harbor. Care must be taken to not allow fuel or discharge to empty into the water.

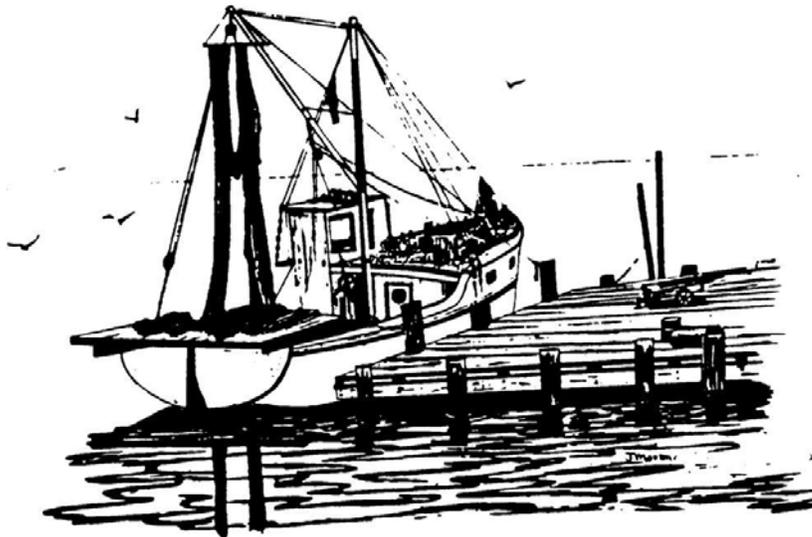
Johnny calls to David and Elizabeth as he runs ahead to the end of the pier. Johnny points to an old shrimp boat that must have been run aground some time ago. It is now leaning to one side, discolored and rusting from neglect. Johnny sees another shimmering rainbow on the water's surface, an area where diesel fuel still leaks slowly from the engine of this abandoned boat.



A marina provides boats with pumpout stations and receptacles for wastes. Boaters must take care when fueling and maintaining their boats.

Johnny then turns to see a boat hoisted for repairs. Along the water's edge, workers scrape and sand the hull of the boat, removing barnacles and old paint. Wave motion and wind sweeps debris and dust particles into the adjacent water. Chemical solvents and paint was overboard from the deck as runoff into the nearby bay.

Elizabeth is amazed by another nearby docked boat. "Look at that boat, Dad, it looks like a house on water." "That is exactly what it is, Elizabeth," says Dad. It is a houseboat, with all the comforts and facilities of home. Large numbers of houseboats line our rivers and waterways. They are often used as fishing camps and summer houses for families. But boats that have bathrooms must remove the raw sewage through pumpout stations, not empty them directly into the water. Harbors and marinas provide facilities for boat owners to remove their trash, waste, and properly care for their boats. There are regulations against houseboats and pleasure boats emptying raw sewage directly into the water.



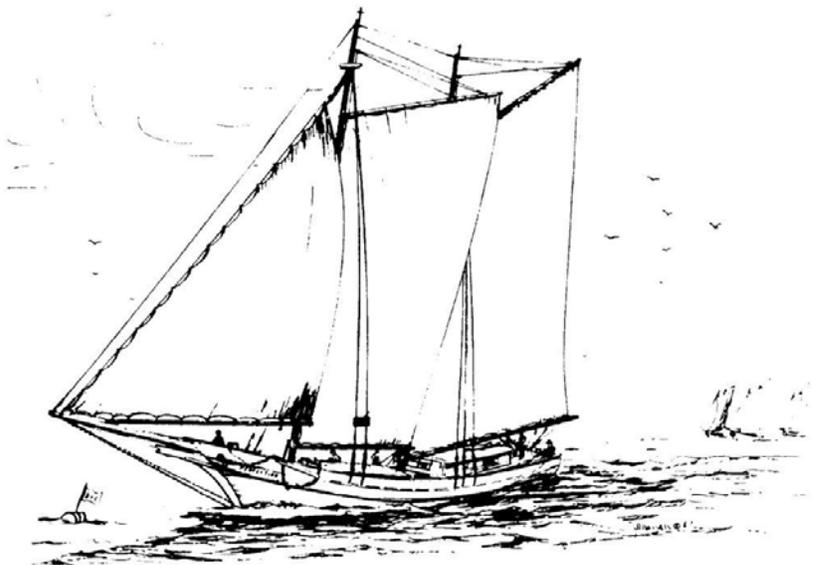
Elizabeth repeats, "What can be done to stop this type of pollution?" Communities carefully plan harbors and marinas so that facilities are available to boaters in areas that do not disrupt the natural shoreline and habitats. Boaters must take care in

fueling, maintenance, and repair of their boats. If possible, they should repair and clean their boat away from the water and use nontoxic cleaning supplies. This will prevent debris from entering the water and keep boats running smoothly. They should also use facilities provided for waste disposal and sewage removal so there is “zero discharge” of sewage and waste.

David repeats, “With owning a boat comes responsibility. Boat owners must do their part in care of the environment, too.” Marinas and recreational boating is one of the main categories of nonpoint source pollution. If monitored, recreational boating can remain a healthy, fun-filled experience. With proper planning, clean boats and marinas, and clean boating habits benefit the boating community and the coastal aquatic life.

When David, Johnny, and Elizabeth return to the shrimp boat, everyone pitches in to prepare the boat. Then, at last, the final touches. MaMa Jo and Paw Paw have saved the beautiful streamers for Johnny and Elizabeth. Elizabeth carefully rolls long sections of the colorful decorations back and forth to carefully planned points on the shrimp boat. Large cardboard replicas of shrimp and crabs are placed on the bow as finishing touches. To Johnny and Elizabeth, the shrimp boat is beautiful and ready for the Blessing.

The pontoon boat is properly tied up and everyone is ready for the day’s festivities. PawPaw realizes that Johnny and Elizabeth have never been to the annual Blessing of the Fleet. He briefs them on the history, “Each year since 1930, Biloxi has celebrated her heritage with a Seafood festival, traditional Mass, and Blessing of the Fleet. It is a time to honor the coastal fishermen who still work these waters. It is a time of



hope, looking forward to a safe and bountiful season. It also allows us old-timers to recall the past that provided our families with the history and lifestyle we all remember. This year, this first weekend in May, marks the Blessing of the Fleet. The Seafood Festival takes place all weekend, a Shrimp King and Queen are chosen, and a traditional Mass is held before the vessels are blessed.”

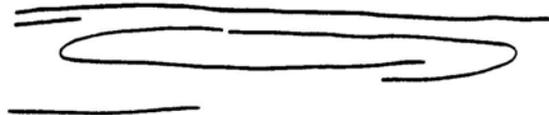
Following the Mass, Paw Paw prepares his boat and moves ahead. Rounding the channel, they enter the Mississippi Sound. Paw Paw has spent much time in these waters during his lifetime of shrimping. He remarks to the children, “This is the Mississippi Sound. It is about 80 miles long and about 10 miles wide. On its north side is the

mainland and on its south is a narrow chain of barrier islands. Three main rivers, the Alabama, Pearl and Pascagoula Rivers nourish the Mississippi Sound. The fresh water from these rivers contributes to the brackish environment here. The Mississippi Sound is part of a region called the Fertile Fisheries Crescent. It refers to the fact that this ecosystem supports and nourishes the breeding and growth stages of our fisheries industry. As you can see, it is a part of an entire natural ecosystem, fed and nourished by other bodies of water. Remember how important it is to care for all of it. Even areas north of us, from agriculture and forestry, city streets and urban construction, homes and wastewater, boats and marinas, each part is influenced by the other. We all play a part.”

As Paw Paw slowly proceeds to their place in line, they pass many other shrimp boats, decorated, and filled with family members and friends. Their families wave, too, as they pass on their way to their place in line. MaMa Jo looks back to see the lead boat where the Bishop stands. “That boat is a replica of the original schooners. Schooners were the work boats and forerunners of our modern day shrimp boats.”



As Paw Paw finds his place, there is a short pause. A helicopter overhead drops a wreath into the water at exactly noon. This is a strong symbol of the past in memory of those fishermen who have passed away. At that signal, the parade of boats begins to proceed toward the lead boat where the Bishop stands blessing each and every boat as it passes. MaMa Jo and Paw Paw wipe away small tears as they feel the emotion of the celebration. They know that their livelihood is here in these waters. It is their hope, as they watch their children and grandchildren stand in awe of the beauty of the ceremony, that this lifestyle will continue for many generations to come. Paw Paw says to his family “Many things have changed here on the Coast. But the history is important to us all. Everyone must do their part to keep our waters safe and clean.



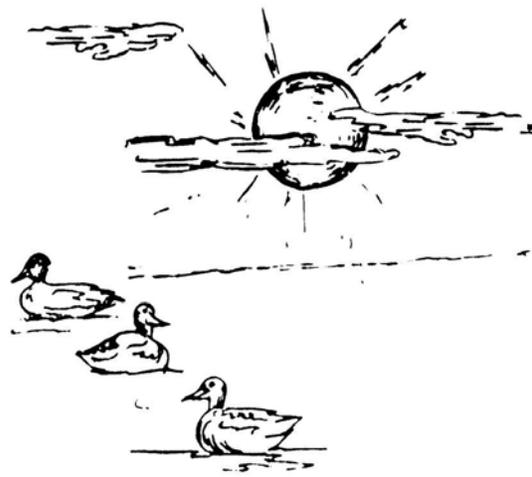


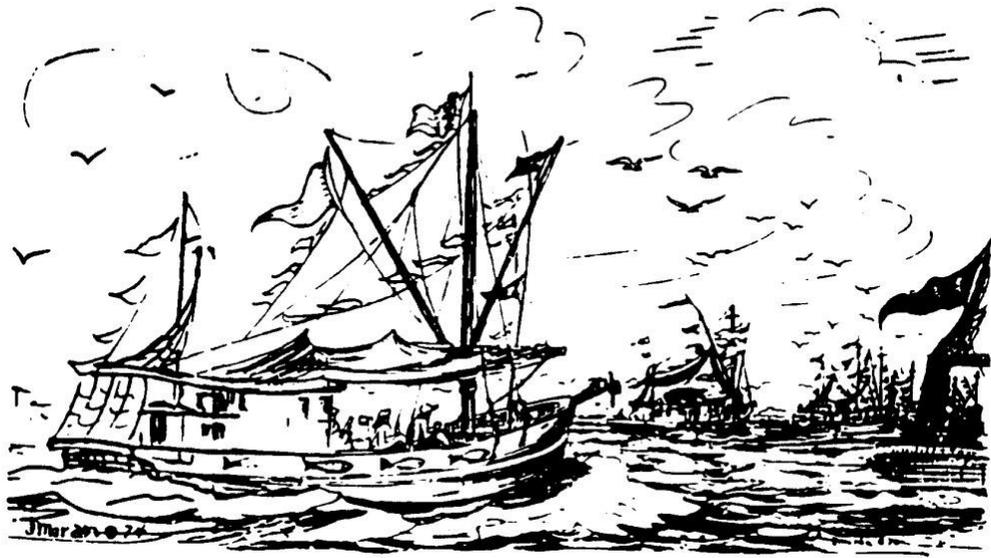
Our coastal waters are filled with life. The environment must remain a safe, protected habitat for our marine life. With care and proper planning, the habitats can remain clean, stable, and free of pollution. That way, Johnny and Elizabeth and their children will see the beauty of these coastal waters with their own grandchildren.”

Once his own boat is blessed, Paw Paw steers the shrimp boat out toward a small island, Deer Island. Paw Paw, MaMa Jo, Jean, David, Elizabeth, and Johnny all sit back and watch as other boats are blessed. The tradition continues. As time passes, the family relaxes and talks, enjoying each other’s company and the calming effect of the tides. Johnny and Elizabeth spend some of the afternoon fishing and walking along the island’s shoreline.

Johnny and Elizabeth know it is almost the end of their perfect weekend trip to the Coast. But they realize how much they have learned. Johnny pleads with Jean and David that he will be able to return for the summer to help Paw Paw work on the shrimp boat during the shrimping season. And Elizabeth quickly states, “I can’t wait to get back to school!” Johnny looks in complete surprise as she continues. “I can’t wait because I am going to tell my teacher, Mrs. Swamp, everything I have learned. Then we can start an environmental club. Our school can take part in programs that help teach people about pollution. You keep saying that everyone has to do their part. If all the kids help, then they can tell their parents, and we will all be working together.”

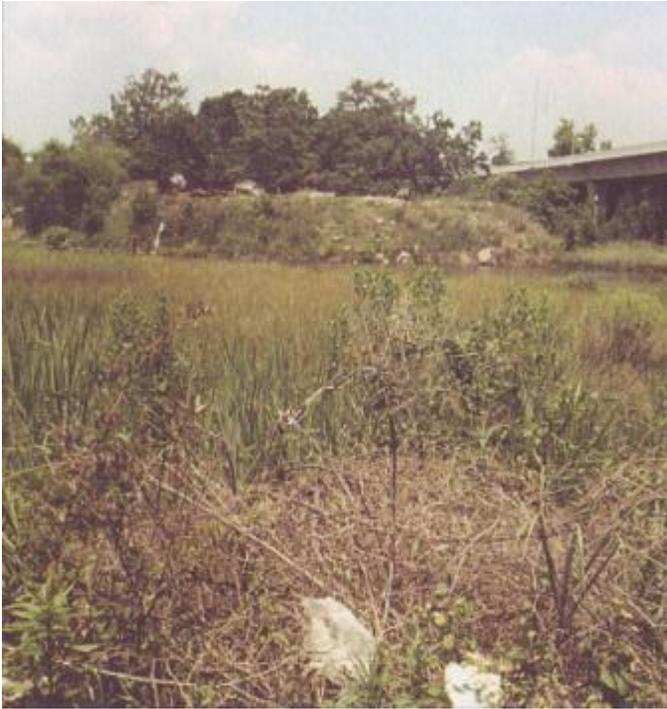
Paw Paw smiles. “I am very proud of both of you,” he proclaims. “You have learned much about the Coast, its people, our waters, and the life within it. Knowing about nonpoint source pollution is the first step to correcting it. The effects of nonpoint source pollution on these waters could be devastating to the future of the Coast, the hopeful dreams of its people, and their descendants who will follow.”







**1. This is a stable bayou.**



**2. A grassy buffer zone on the water's edge of a bayou acts as a physical filter, trapping debris and preventing it from entering the bayou water.**



**3. An overpass above an estuary, a bayou, allows runoff from the highway to flow with great force into the region below.**



**4. The forceful beating of the highway overflow damages and often removes tender vegetation from the water's edge.**



**5. The removal of the tender vegetation enhances strong erosion and limits any percolation through the soil. Any and all pollutants wash directly into the water.**



**6. Large drainage pipes release water from a surrounding watershed. As you can see, many types of pollutants are found in this drain water.**



**7. The force of the water leaving the street drains damages the plant life and increases erosion.**



**8. The shimmering look of the water's surface is a mixture of insoluble gasoline, antifreeze, and other chemicals.**



**9. A landfill on a bayou's edge narrows the bayou itself and increases the chance of toxic substances seeping into the water. The grassy buffer zone of the bayou has been covered.**



**10. The mouth of the bayou has been narrowed by construction. The natural tidal flow of the bayou now has been altered. This is a form of Hydromodification.**



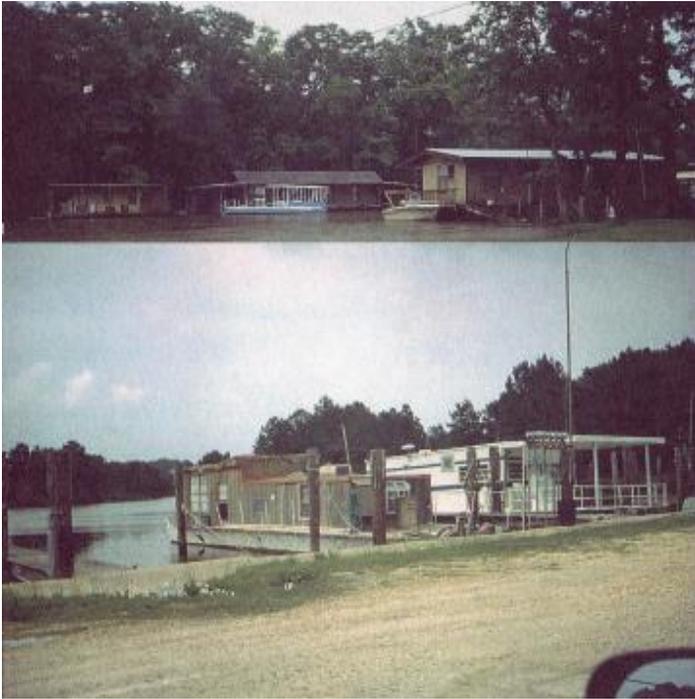
**11. A silt fence shown above is a method of trapping fine sediment and sand at a construction site, preventing erosion.**



**12. This is a grid pavement, a fairly new method of trapping water so that it may filter and percolate through soil, thus some pollutants are absorbed.**



**13. In urban areas, concrete roadways create impervious surfaces where chemicals, silt, sand and wastes wash directly off the roadway into drains, and then into waterways with no filtering.**



**14. Houseboats may be temporary pleasure crafts, summer camps, and even permanent homes. Household wastes are often emptied directly into rivers with no treatment.**



**15. Street curbs direct water resulting as runoff from lawns, rain, and animal wastes through a subdivision into underground water systems. Chemicals and wastes are contained in these waters.**



**16. An industrial canal as shown here is a man-made, long, narrow waterway that is built to allow vessels to maneuver directly to industrial sites.**



**17. Areas cleared of timber, as shown here, will remove stability from the land and reduce the filtering ability of the land, increasing erosion.**

## GLOSSARY

**adjacent** – not distant: nearby

**aesthetic** – relating to or dealing with beautiful

**biodegradable** – any pollutant that is subject to decay by organisms

**brackish** – somewhat salty

**channelization** – an area straightened by means of a channel

**compost** – a mixture that consists largely of decayed organic matter

**concrete grid pavement** – honey-comb shaped concrete that allows filtering of water used for parking areas

**constructed wetland** – natural or constructed shallow pond which temporarily holds and treats runoff

**contaminate** – to soil, stain, corrupt or infect by contact or association

**contour planting** – planting around hills rather than up and down hills

**destabilizes** – to make unstable

**devastating** – bringing to ruin or desolation by violent action

**discharge** – to let go: clear out

**dredged** – to deepen with a dredging machine

**economic** – relating to, or based on the production, distribution, and consumption of goods and services

**ecosystem** – all the living and non-living components of an environment

**effluent** – something that flows out

**estuaries** – a water passage where the tide meets a river current

**facility** – something that is built, installed, or established to serve a particular purpose

**Fertile Fisheries Crescent** – productive region of the northern Gulf of Mexico, ranging from Galveston, Texas to Apalachicola, Florida

**government regulations** – rules made by the ruling party

**habitat** – the physical area in which an organism lives

**herbicide** – used to kill or control weeds

**hydromodification** – the dredging and straightening of waterways to control flooding or to improve navigation

**impaired** – damaged or made worse

**impervious** – not allowing entrance

**inorganic matter** – matter that is derived from non-living things and does not contain carbon

**influx** – coming in

**insecticides** – chemicals used to destroy insects

**landfill** – system of burying trash and garbage between layers of earth

**marinas** – a dock or basin providing secure moorings for motor boats and yachts and often offering supplies, repair, and other facilities

**marine organisms** – organisms living in the sea

**merge** – to become combined into one

**monitored** – to be warned or instructed

**municipal** – having local self-government

**negligible** – so small or unimportant or of so little consequence as to warrant little or no attention

**nursery** – a place where young animals grow or are cared for

**organic matter** – matter that is derived from living things and contains carbon

**pathogen** – an organism that causes disease

**percolation** – to cause a liquid to pass through a permeable substance

**pontoon boat** – a flat-bottom boat

**porous** – possessing or full of holes

**raw sewage** – untreated human waste

**recreation** – refreshment of strength and spirit after work

**retention basin** – basins where water from parking lots is diverted into the basin so that soil and petroleum products can settle and plants can soak up pollutants

**reservoirs** – a place where something is kept in store

**seepage** – a quantity of fluid that has passed through fine pores

**septic tank** – a tank in which bacteria disintegrates the solid matter of continuously flowing sewage

**spawning** – the process by which aquatic animals lay eggs

**storm runoff** – the portion of the precipitation on the land that reaches streams

**terracing** – a raised embankment with the top leveled

**tributaries** – stream feeding a larger stream or a lake

**watershed** – a region of land which has a natural contour to drain small tributaries and natural erosion into larger bodies of water

**wastewater** – water that has been used: sewage

## FACT SHEET

- Nonpoint sources of pollution have no specific point of discharge.
- Wetlands receive significant amounts of NPS pollution because they are typically the lowest point on the landscape.
- Nonpoint sources of pollution contribute 65% of all contaminants in water.
- **Agriculture** is Mississippi's number one business.
- Nonpoint pollution from agriculture is the leading source of water quality impacts to rivers and lakes and the third largest source to estuaries.
- Pollutants carried in stormwater runoff from urban areas are the leading source of contaminants to estuaries and the third largest source to lakes.
- The most common NPS pollutions are soils and nutrients.
- The three leading sources of nonpoint water pollution are agriculture, urban runoff, and municipal point sources.
- Approximately **40%** of the surveyed lakes, rivers and estuaries are not clean enough to meet standards for swimming or fishing.
- The Clean Water Act Amendment was established in 1987—Section 319 is the Nonpoint Source Management Program that helps states identify affected waters and recommends the best management practices to prevent pollution to these waters.
- **180 Million** People visit coastal waters yearly.
- Impervious surfaces generate nine times more runoff than a wooded area the same size.
- Septic tanks should be inspected and emptied every three to five years.
- Undisturbed forested lands provide high quality watersheds.
- Urban development is a major contributor to the impairment of Mississippi's surface and ground waters.
- Failing septic systems are a dominant source of nonpoint source pollution on the Mississippi Coast.
- The Coastal Zone Management Act of 1972 established a program for states to develop programs to protect and manage coastal water resources.
- Slow-watering techniques, such as soaker hoses, reduce runoff and are 20% more effective than sprinklers.
- Two million gallons of drinking water can be contaminated by one quart of oil.
- More than 10,000 marinas dot North American coastlines and waterfront property.
- **MSD** – Marine sanitation device is a portable toilet used on boats.
- **VTS** – Vegetated treatment systems are used to remove suspended solids from NPS pollution before the runoff reaches natural wetlands.
- **95%** of the people in Mississippi use underground water for domestic supplies.  
40% of waterway pollution is caused by waste motor oil.

## QUESTIONS

1. Distinguish between point source and nonpoint source pollution.
2. List the five major categories of nonpoint source pollution. Give an example of each category.
3. Explain how the natural design of the land reduces the amount of runoff and, therefore, reduces the amount of pollution.
4. List five specific pollutants from agricultural activities.
5. Identify ways that agricultural management practices prevent runoff and pollution.
6. What is a “watershed?”
7. List four specific pollutants from forestry activities.
8. List several measures that can be used to reduce pollution from forestry practices.
9. What is the dominant source of nonpoint source pollution in coastal Mississippi?
10. Distinguish between influent and effluent waters.
11. What is the function of the leach field surrounding a household septic tank? What factors must be considered in providing an acceptable area for a septic tank leach field?
12. Name two examples of hydromodification described in these chapters.
13. Define brackish.
14. Why is an estuary considered a “nursery ground?”
15. Describe ways that a stream or bayou edge may become destabilized. How might these changes increase runoff and pollution?
16. How do businesses, homes, and even schools alter the porous nature of the soil?
17. List six types of pollutants that are contained in street runoff.
18. Identify the function of detention/retention ponds, silt fences, and grid pavement.
19. What is a “package” sewage plant?
20. What role does the Blessing of the Fleet play in the heritage and history of the Gulf Coast?
21. What is the “Fertile Fisheries Crescent?”
22. List several pollutants caused by recreational boating. Identify ways to prevent and manage these activities.
23. How does the water table in a watershed relate to drinking water for households?
24. How often must household septic tanks be emptied and inspected?
25. List the two main government regulations which directly identify coastal pollution management. Describe the specific function of each one.
26. Explain the reasons why the natural landscape of the ground allows “natural filtration.”
27. During filtration in the soil, explain the “percolation” of the waters.
28. Define “aesthetic.”
29. Why do the larvae of some coastal marine organisms enter the bayous and inland waters during their life cycle? What role does the estuary play in their life cycle?
30. List several pollutants that are considered “runoff” from a household lawn.