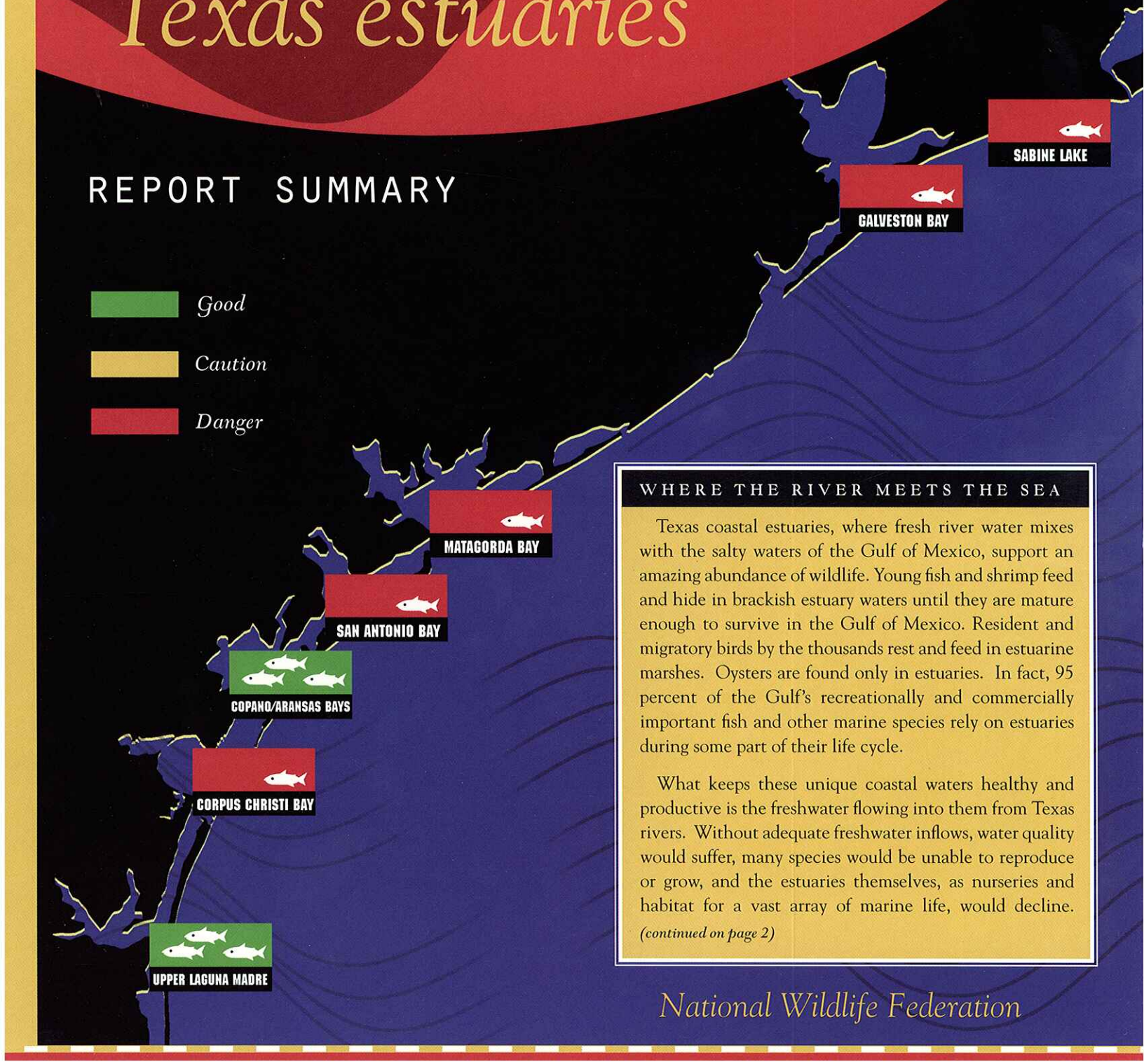
BAYS IN PERIL

A forecast for freshwater flows to Texas estuaries

REPORT SUMMARY



WHERE THE RIVER MEETS THE SEA

Texas coastal estuaries, where fresh river water mixes with the salty waters of the Gulf of Mexico, support an amazing abundance of wildlife. Young fish and shrimp feed and hide in brackish estuary waters until they are mature enough to survive in the Gulf of Mexico. Resident and migratory birds by the thousands rest and feed in estuarine marshes. Oysters are found only in estuaries. In fact, 95 percent of the Gulf's recreationally and commercially important fish and other marine species rely on estuaries during some part of their life cycle.

What keeps these unique coastal waters healthy and productive is the freshwater flowing into them from Texas rivers. Without adequate freshwater inflows, water quality would suffer, many species would be unable to reproduce or grow, and the estuaries themselves, as nurseries and habitat for a vast array of marine life, would decline.

(continued on page 2)

National Wildlife Federation

BAYS IN PERIL

THREATS FROM UPSTREAM

Despite their importance, Texas estuaries face an uncertain future because they are last in line, both physically and legally, to get a share of our publicly owned rivers. More and more water is being withdrawn from our rivers upstream to meet inland water demands. Since estuaries have no legal claim on the rivers' flows, larger upstream withdrawals mean less water for the coast. In some river basins, the state has issued permits to *take out* more water than will actually be *in* the river during drier years, meaning freshwater inflows to the coast could essentially cease at times. Fortunately, much of the water now authorized for withdrawal is not actually being withdrawn each year. But that will change as Texas' population grows and current permit holders increasingly sell whatever water they're not using. With increased demand for a limited resource, full use of these existing water permits is coming closer and closer.

To compound matters, cities, businesses and other permit holders are finding new ways to *re-use* wastewater—for landscape irrigation, for example, or industrial cooling systems—rather than discharge it back into the river. While reuse can be an efficient water use, it also reduces the 'return flows' that are all that keep some rivers flowing during drier times. The challenge is to find the right balance in meeting human water needs and protecting our rivers and bays.

WHAT'S AHEAD FOR FRESHWATER INFLOWS?

In this report, the National Wildlife Federation takes a first-ever look at what would happen to the inflows to Texas' seven major estuaries if existing water permits were fully used and wastewater reuse increased. We projected what freshwater inflows would be for each estuary if holders of *all* existing permits withdrew their *full authorized amount* of water and if the amount of wastewater that was reused rather than discharged back into the river increased to roughly 50 percent.

While this 'future use' scenario may seem somewhat hypothetical, we believe these conditions are likely to be seen in the not-too-distant future if Texas does not change how it manages water. In addition, our analysis considers only impacts from current water permits and does not attempt to account for new water-use permits that are likely to be issued.

To quantify expected inflows, we used computer models developed for the Texas Commission on Environmental Quality. These models predict what inflows to each estuary would have been under 'naturalized conditions,' i.e., if there were no dams or pipelines or other human-induced alterations in the river's flow pattern, and if there were a repeat of past rainfall patterns. We also used the models to predict what freshwater inflows to each estuary would be with the same rainfall but with the 'future use' (full permit use/50 percent reuse) scenario.

Having determined the freshwater inflows each bay would receive under 'naturalized conditions' and under our 'future use' scenario, we then looked at how the future-use inflows stack up against what each estuary system needs to stay healthy.

FRESHWATER: HOW MUCH IS ENOUGH?

To determine how much freshwater a given estuary needs, we used two inflow criteria we developed from state studies. The first addresses what each estuary needs during low-rainfall periods. These 'drought tolerance levels' are the inflows needed to keep salinity conditions within reasonable tolerance ranges for key species. The second criterion addresses the important 'freshwater pulses' of high inflows that naturally occur in the spring and early summer of most years. These 'freshwater pulses' support strong levels of reproduction and growth.

Even if humans were not using any water, the estuaries would not always receive enough freshwater inflows to satisfy these two criteria. Rainfall varies from year to year and the fish and wildlife that depend on estuaries are adapted to these naturally varying conditions. The challenge is to avoid patterns of water use (and reuse) that push inflows below one or both criteria so often that fish and wildlife can no longer cope.

As a starting point for our comparisons, we looked at how often the inflows predicted under 'naturalized conditions' fell below each of the two inflow criteria over roughly a 50-year period. The frequency of periods of 'below-criteria' inflows under 'naturalized conditions' became a baseline for each estuary, because it reflects *natural* variations in inflows.

We then looked at how often the inflows predicted under the 'future use' scenario (full permit use/50 percent reuse) for the same time period would fall below the inflow criteria. Finally, we compared the results by calculating, as a percentage, how much more often inflows predicted under the 'future use' scenario fell below one or both criteria when compared to the baseline. For example, if our results showed that the number of times the freshwater pulse target was not met increased from two years under 'naturalized conditions' to four years under the 'future use' scenario, we indicated a 100 percent increase in 'years with low freshwater pulses.' We calculated percentage changes for each criterion for each estuary.

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Estuary System	Periods Below Drought Tolerance Levels			Years With Low Freshwater Pulses			Overall Ranking
	Naturalized Conditions	Future Use	Increase	Naturalized Conditions	Future Use	Increase	
Sabine Lake	2	10	400%	23	34	48%	Danger
Galveston Bay	0	5	>500%	10	16	60%	Danger
Matagorda Bay	3	20	567%	16	31	94%	Danger
San Antonio Bay	2	7	250%	19	24	26%	Danger
Copano/Aransas Bays	6	6	0%	21	21	0%	Good
Corpus Christi Bay	2	6	NA	13	35	169%	Danger
Upper Laguna Madre	3	3	0%	15	15	0%	Good

See glossary on back

OUR RANKING SYSTEM

An estuary can't stay healthy and productive if it experiences too many years without strong freshwater pulses or if it endures too many prolonged periods of inflows below drought tolerance levels. Because a large increase in the frequency of either of these conditions signals real problems, we used the higher of the two percentage-increase calculations to assign an overall ranking for the estuary. We assumed, however, that the estuaries can tolerate some increase in how often inflows would fall below the criteria. We considered an estuary's prospects 'good' if our assessment showed no more than a 33 percent (or 1/3) increase in periods with inflows below either criterion. We assigned a 'caution' ranking if the increase fell between 33 percent and 67 percent. A 'danger' ranking resulted only if the analysis predicted a 67 percent (or 2/3) or greater increase in periods with inflows below at least one of the criteria. More study is needed to determine if estuaries would be seriously harmed by smaller changes than those used as the basis of assessment here. Because each estuary has developed in response to unique patterns of inflow pulses and of low inflows, our analysis does not attempt to make comparisons between different estuaries.

WHAT WE FOUND

The results of our analysis are troubling, with five estuaries receiving a 'danger' ranking. During dry times, four of Texas' seven major estuaries would face serious problems under the 'future use' scenario, with sustained periods of very low flows happening much more frequently than under 'naturalized conditions.' During these low-flow periods, many species are on life-support and are just able to survive. If they are on life-support too often or for too long, they may be unable to recover quickly, or at all, when inflows increase with wetter times. The key spring and early summer inflow pulses needed to support strong productivity would not be impacted as heavily. Two of the seven major estuaries would face very large increases in the number of years with reduced spring and early summer inflow pulses.

Overall Ranking	Increase in Problem Conditions
Good	0% to 33%
Caution	above 33% but below 67%
Danger	67% or greater

BAYS IN PERIL

WHAT WE CAN DO ABOUT IT

Water is the lifeblood of our Texas landscape. Texas rivers provide water and habitat for fish and wildlife throughout the state and provide the freshwater that keeps coastal estuaries functioning and healthy. Unfortunately, we haven't done a very good job of protecting our rivers. Most water use permits were issued without any consideration of how much flow should be left in the river to protect water quality, fish and wildlife, and human recreational activities.

Even today, the state hasn't come to grips with how to protect river flows and freshwater inflows to the coast. The state and 16 regional water planning groups are developing plans to meet water demands for the next 50 years, but so far that process does not include freshwater inflows as a water demand to be met.

Water planning and management involve choices. For example, planners and managers can choose to improve water-use efficiency to support more people with the same amount of water and reduce the need for new reservoirs. Lawmakers can choose to formally set aside river flows that haven't yet been allocated to make sure those flows will remain available for fish and wildlife. We can develop voluntary methods to convert some existing unused permits from their original purpose to a new use for protecting river flows and freshwater inflows.

In short, we can avoid the severe damage to our estuaries that this analysis predicts. Texas can have water development policies that meet our increasing human demands for water while also protecting our natural heritage. The vast majority of Texans want strong protections for Texas rivers and estuaries. If we get that message to state and local leaders, we can pass on to future Texans the same beauty and bounty from Texas bays that we inherited.

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GLOSSARY OF KEY CONCEPTS

NATURALIZED CONDITIONS:
A computer model scenario showing freshwater inflow amounts that would have occurred during about a 50-year period if there had not been water withdrawals, dams, or other human alterations of inflow patterns. Used as a baseline for comparison.

FUTURE USE:
A computer model scenario showing freshwater inflow amounts during the same period as for naturalized conditions if all *existing* water withdrawal permits were fully used and levels of wastewater reuse were increased to about 50%.

PERIODS BELOW DROUGHT TOLERANCE LEVELS:
A determination of the number of periods of six consecutive months of very low freshwater inflows, within a March-October window. During such periods, inflows would not be adequate to keep salinity levels within state-determined salinity bounds for key species, resulting in stressful conditions and in reduced reproduction and survival.

YEARS WITH LOW FRESHWATER PULSES:
A determination of the number of years during which the important spring or early summer pulses of high freshwater inflows are below target levels. These pulses are needed to support strong reproduction and growth of key estuarine species.

For More Information

You can get the full Bays in Peril *report and learn more about the Texas Living Waters Project at www.texaswatermatters.org or www.nwf.org. To get involved in protecting our rivers and bays, contact the National Wildlife Federation at 1-800-919-9151 or mcmahon@nwf.org.*

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