BUILDING LAND IN COASTAL LOUISIANA:

Expert Recommendations for Operating a Successful Sediment Diversion that Balances Ecosystem and Community Needs

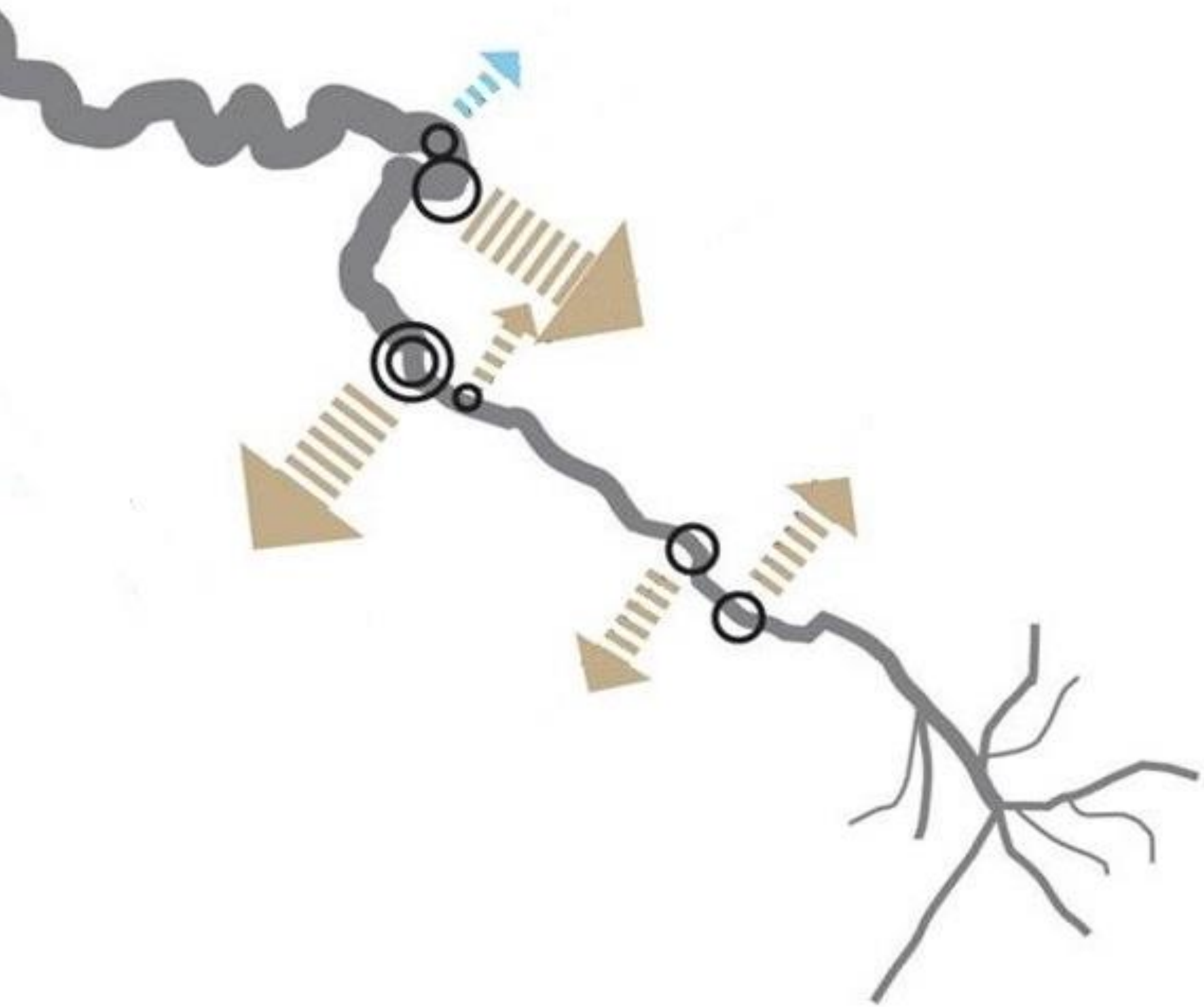
Photo source: Getty Images

OPERATION IN MODELING

Typical modeling operations are based solely on the flow of the Mississippi River, with a open/close threshold of 600,000 cfs.

STANDARDIZED AND SIMPLIFIED

- Provides consistency in analysis to optimize a single planning question (i.e., which location is best to capture sediment)
- Reduces computation time and costs
- Easier to determine cause and effect of predicted outcomes across multiple diversion locations, sizes and structure types
- Allows for easy comparison between multiple alternatives and over spatial and temporal scales



River Flow	Diversion Flow
>600,000 cfs	50,000 cfs
200,000 cfs to 600,000 cfs	8% of the river flow*
<200,000 cfs	0 cfs

21% Full Capacity
In first 20 years, a 50,000 cfs diversion is operated at full capacity 21% of the time.

73% Greater than 10,000 cfs
By operating at 8% of the river flow for maintenance, flows exceeded 10,000 cfs 73% of the time.

0.1% Closed
The diversion was completely shut off (flow = 0 cfs) for only 2 months in a 20-year period.

2012 COASTAL MASTER PLAN

*note: The 8% of river maintenance flow has been dropped for the 2017 CMP

MRHDM STUDY OPERATIONS

CONCERNS WITH CURRENT MODELING OPERATION STRATEGIES

- Can result in unrealistic operations
- Can overestimate effects to wetlands, vegetation, water levels, wildlife and fisheries, water quality and communities
- Likely to result in detrimental impacts to wetlands that are not fully accounted for in the modeling approach
- Does not optimize operations for land-building while considering other ecosystem needs as secondary goals or objectives

WORKING GROUP PURPOSE

The purpose of the Sediment Diversion Operations Expert Working Group (WG) is to explore, debate, discuss and document the complex environmental, social, economic and policy issues involved with the operation of a sediment diversion.

The WG does not attempt to define the details of the Operation Plan, but instead provide recommendations on strategies and options to explore and research, monitoring to be conducted, decision-making structures to be implemented and steps to engage stakeholders in the development of an Operation Plan.

CORE MEMBERS

James Cowan, Jr.

Fisheries

Louisiana State University

Rex Caffey

Natural Resource Economics & Policy

Louisiana State University

Dubravko Justic

Oceanography and Hydrology

Louisiana State University

Alex Kolker

Sedimentology

Louisiana University Marine Consortium and Tulane University

Shirley Laska

Social Sciences

University of New Orleans Lowlander Center

Alex McCorquodale

Hydrodynamics

University of New Orleans

Earl Melancon, Jr.

Oysters and Shellfish

Nicholls State University

Andy Nyman

Wildlife and Fisheries

Louisiana State University

Robert Twilley

Estuarine Ecology

Louisiana State University

John White

Biogeochemistry

Louisiana State University

James Wilkins

Natural Resource Law & Policy

Louisiana State University

Jenneke Visser

Vegetation

University of Louisiana at Lafayette

METHODOLOGY

Operations for Modeling is Not Operations for the Real World

CORE MEMBERS

The Working Group is comprised of 12 interdisciplinary core members with intimate knowledge of the Mississippi River Delta

GUEST EXPERTS

42 guest experts, selected by the core members, participated in meetings particular to their expertise.

MEETINGS

An all-day meeting was held every month for 8 months (from Sept 2015 through April 2016). Each meeting focused on a key topic of importance to operating a sediment diversion.

CASE STUDY

The Mid-Barataria Sediment Diversion was used as a case study since it was the first diversion to begin the engineering and design phase. We assumed that the diversion was going to be constructed.

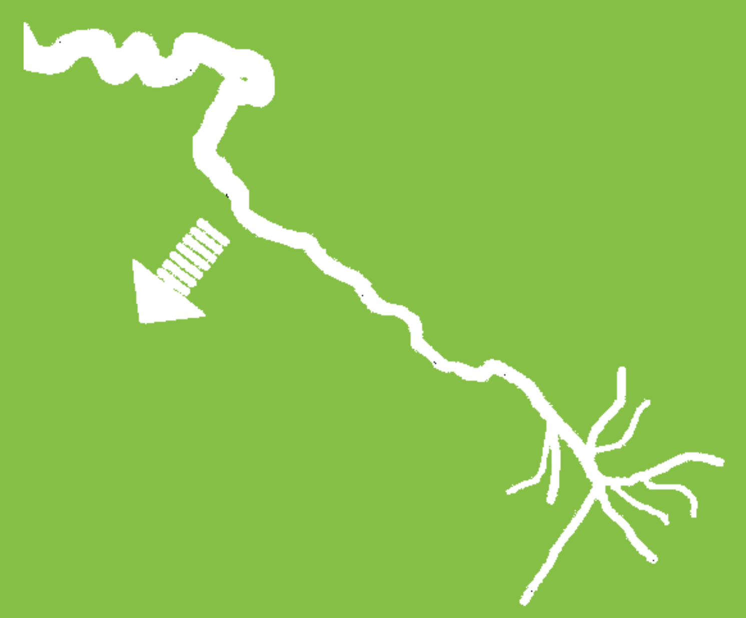
DELIVERABLES

A final recommendation report will be finalized and submitted to the CPRA and the USACE. In addition, a peer-review manuscript and public outreach materials are being developed

12

42

8



MEETINGS

September 2015 – April 2016

STATE OF THE KNOWLEDGE

What do we know about diversion outcomes?

What relationships do we understand?

What lessons have we learned from other examples?

DATA GAPS AND MONITORING

What do we not know?

How should we address key uncertainties?

What is needed to set up an effective adaptive management program?

09.16.15
RIVER HYDRODYNAMICS AND SEDIMENT

10.16.15
BASIN GEOLOGY AND LAND-BUILDING

11.20.15
WATER QUALITY

12.14.15
WETLAND HEALTH

01.13.16
FISH & WILDLIFE

02.17.16
COMMUNITIES & SOCIO-ECONOMICS

03.14.16
OPERATION STRATEGIES

04.13.16
GOVERNANCE, LEGAL & STAKEHOLDERS

OPTIMIZED BY PARAMETER

Considered each parameter as the only objective with no other constraints to determine the optimal operation strategy of a diversion to maximize that topic.

INTEGRATING STRATEGIES

After each topic (and their specific parameters) were discussed, the WG identified consistencies and conflicts in the various operations strategies.

RECOMMENDATIONS

Photo source: USFWS (first two), Audubon, Bill Stripling

GOALS AND OBJECTIVES

Building and sustaining land should always remain as the primary goal of operating a sediment diversion, although other primary or secondary goals or objectives should be developed.

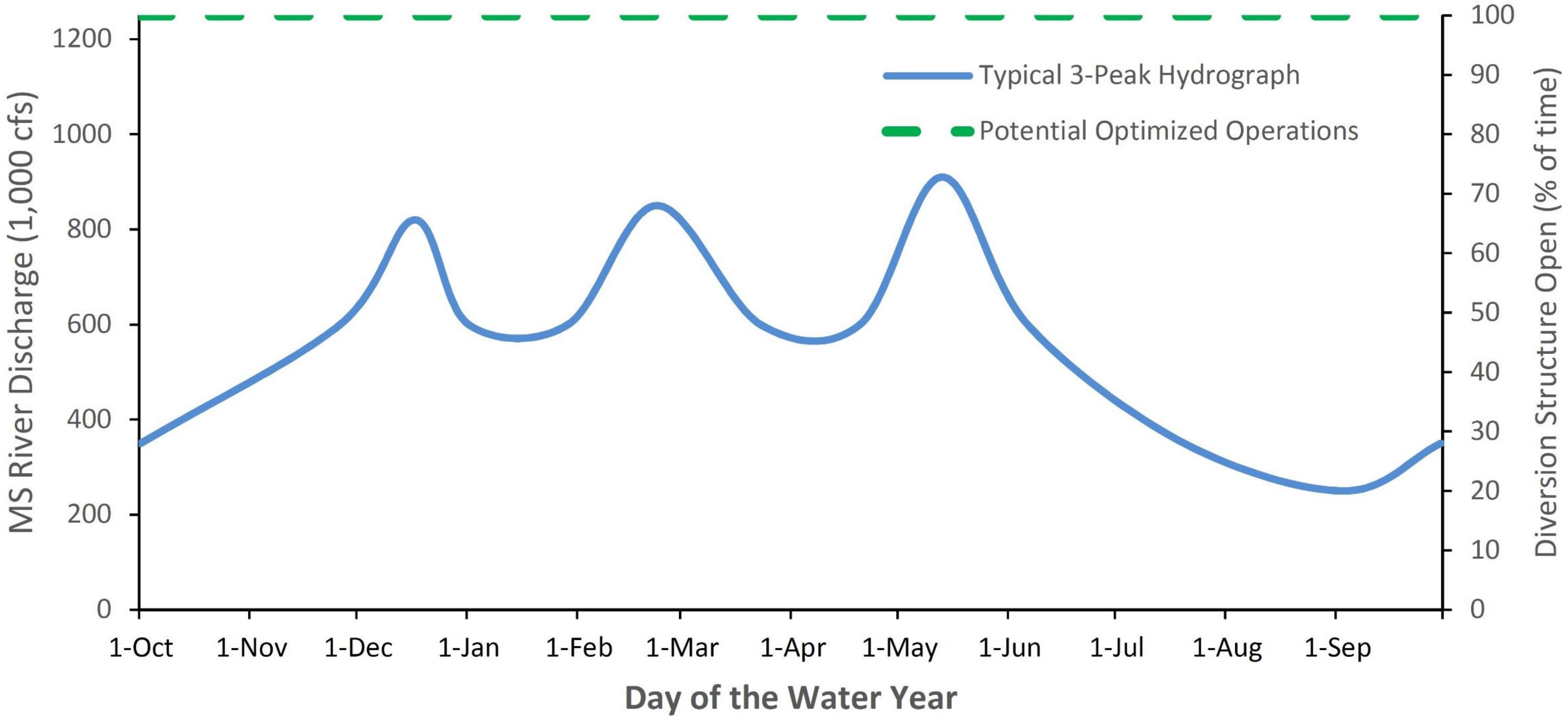


Science should heavily inform a framework for operations that ensure the goals and objectives of the project are being met.

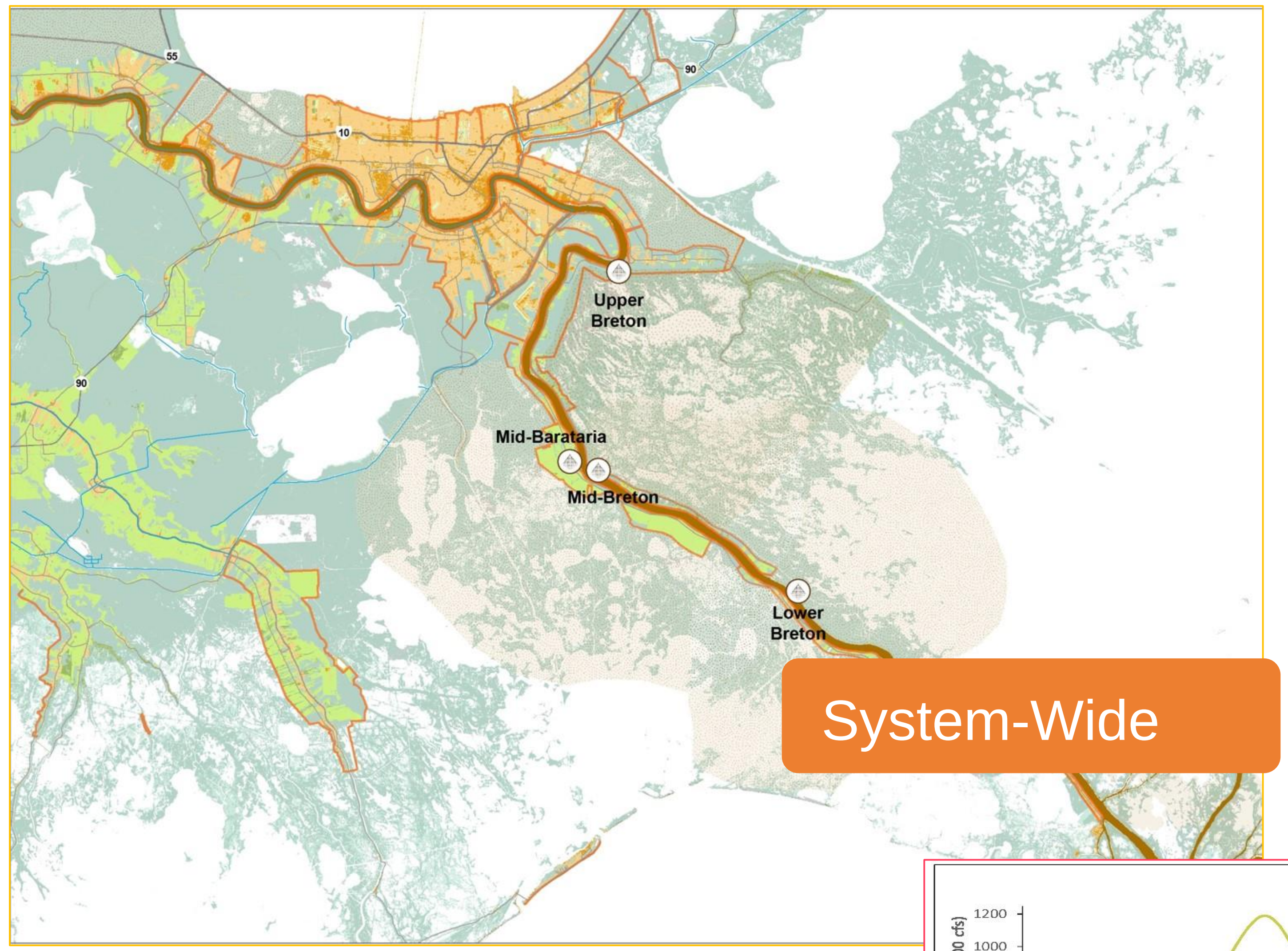
Negotiations should not occur over how to operate the diversion, instead on how to manage and deal with any predicted and unforeseen impacts.

Photo source: MRD, James Callahan, Audubon, NWF

BUILDING AND SUSTAINING LAND

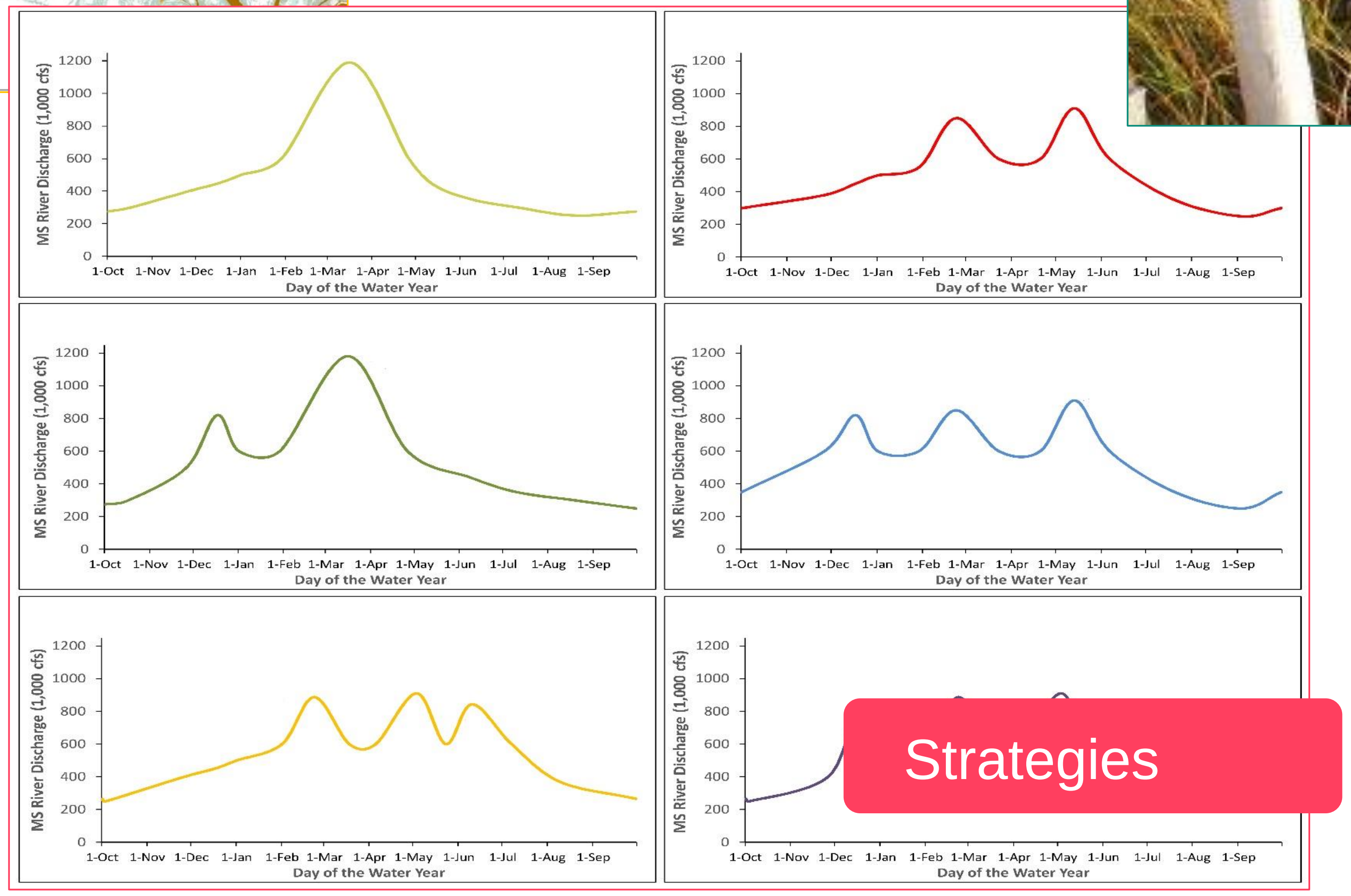


OPERATIONS PLANS



Indicators and Outcomes

Operation plans may initially be designed for each individual diversion, but should quickly move towards basin- and system-wide operation plans that include individual project and collective goals and objectives as well as basin-wide outcomes and indicators of success. Operation plans should take into account all diversions and flood control structures.



Expectation Management

Plans include overall strategies based on typical hydrographs supplemented annually based on predicted river and basin conditions, outcome of previous year's operations and other conditions.

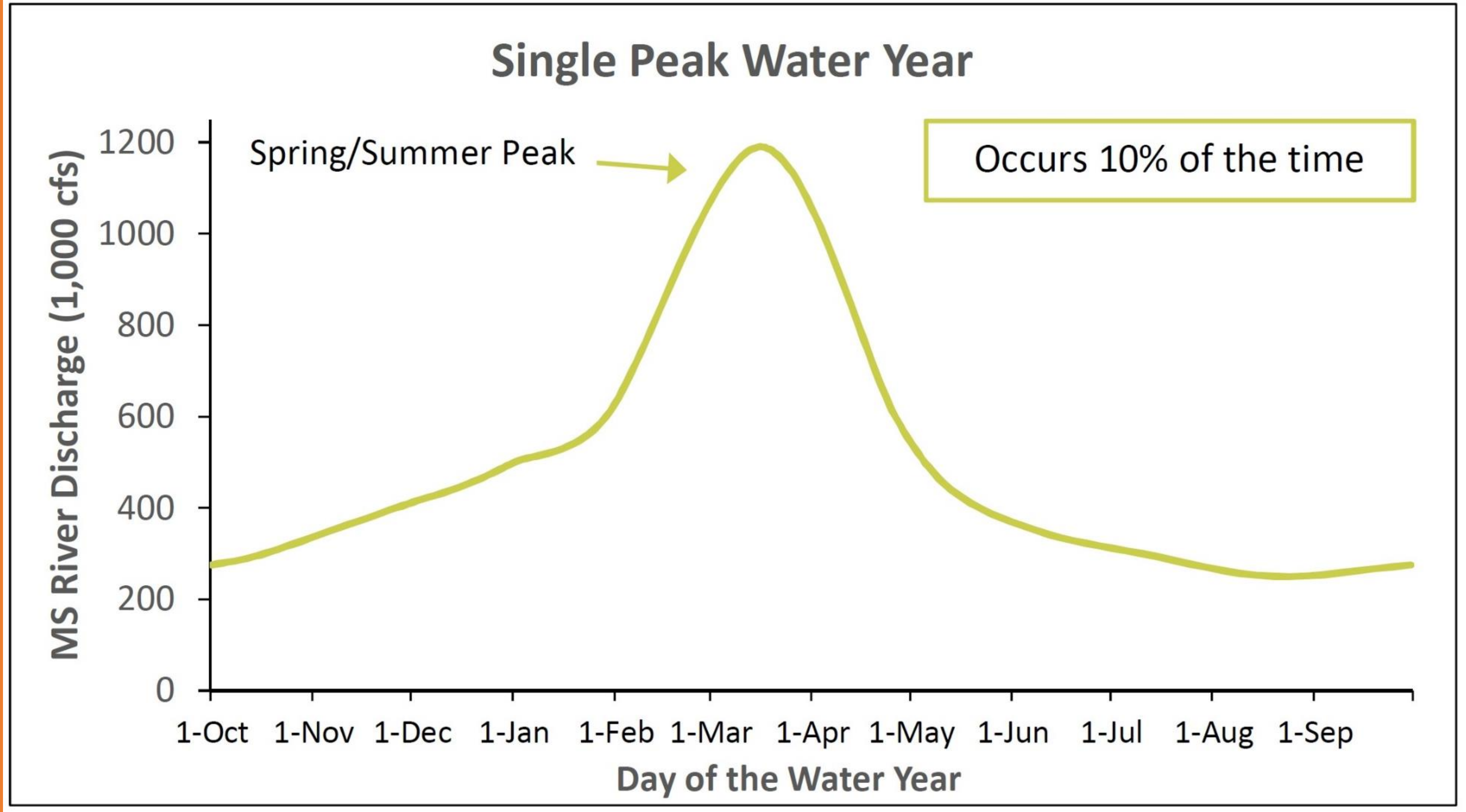
Learning as Primary Management Function

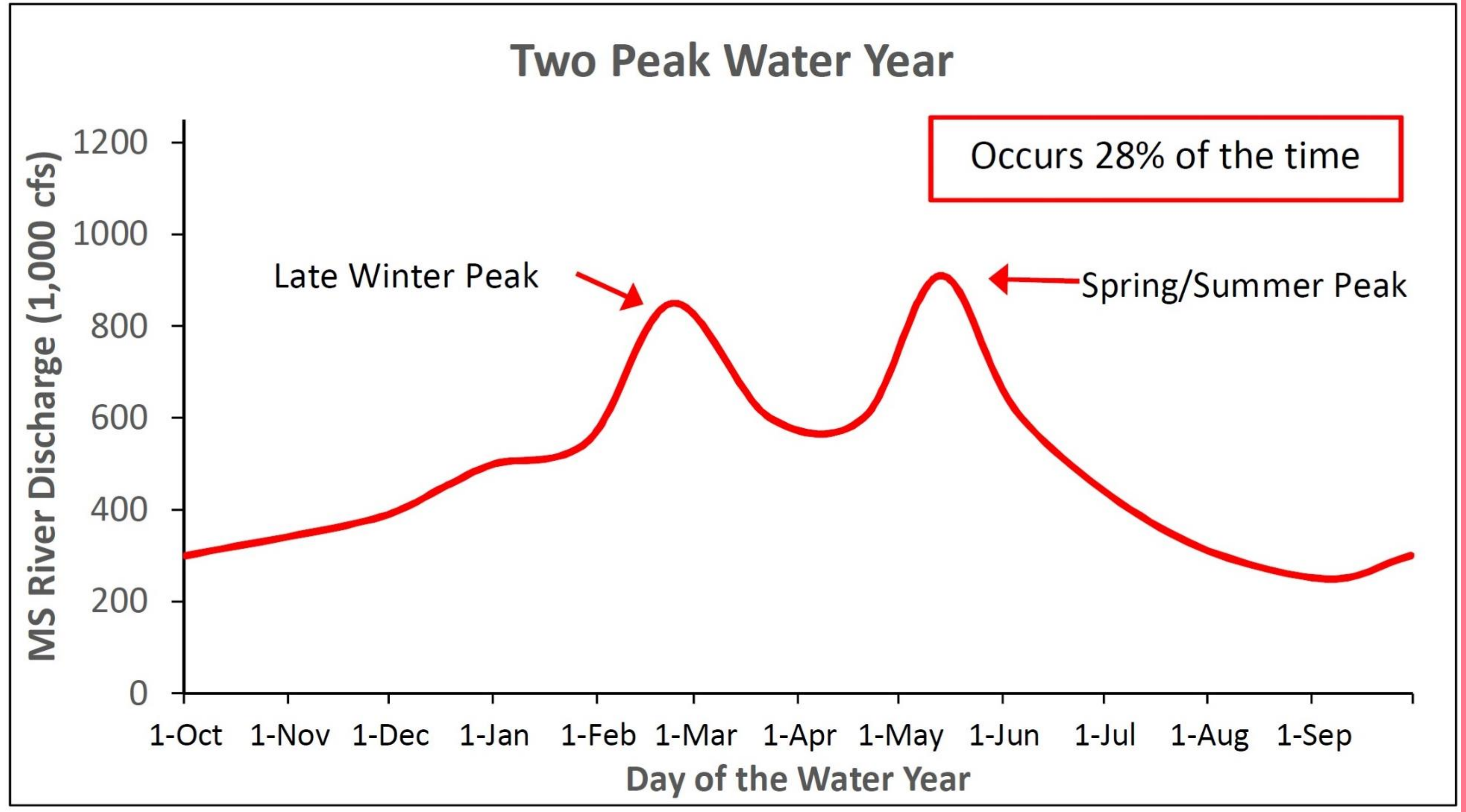
The plan should outline a robust monitoring plan, including baseline data, to support an adaptive management process with defined feedback loops and timelines, including a system-wide assessment at least every 5 years.

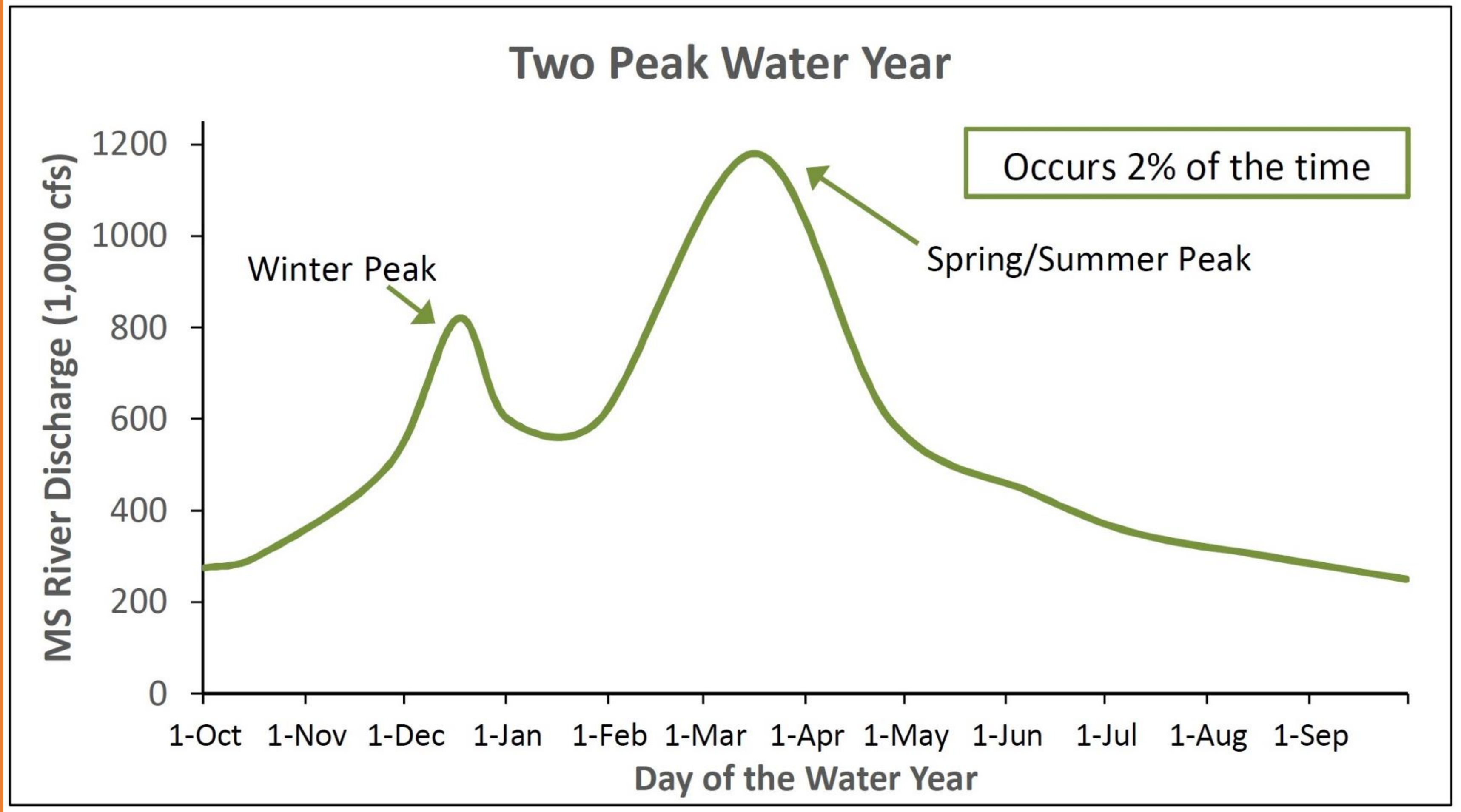
Decision-Making Structure

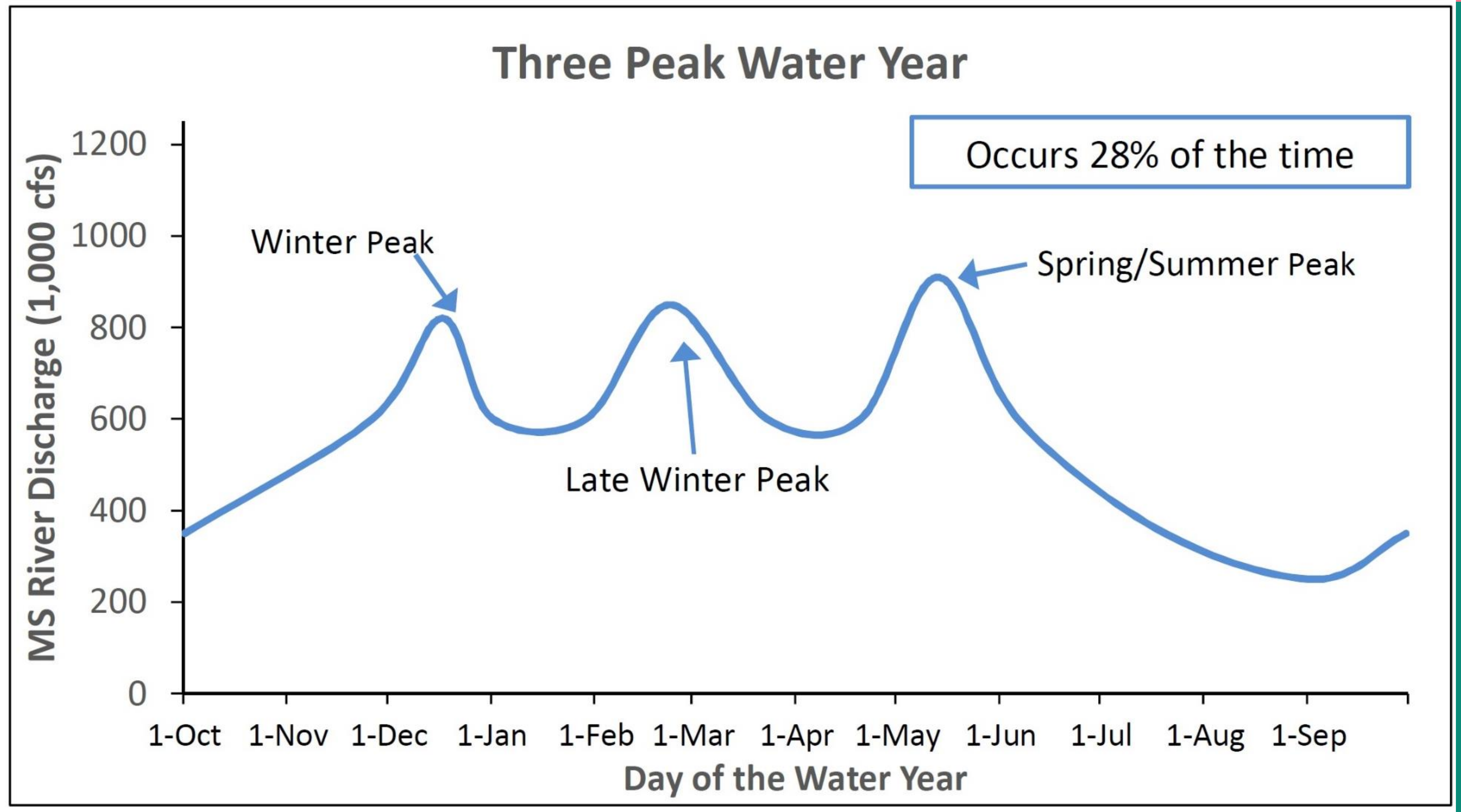
The plan should outline a clear decision-making process and structure with roles and responsibilities for agencies, local governments, researchers and stakeholders.

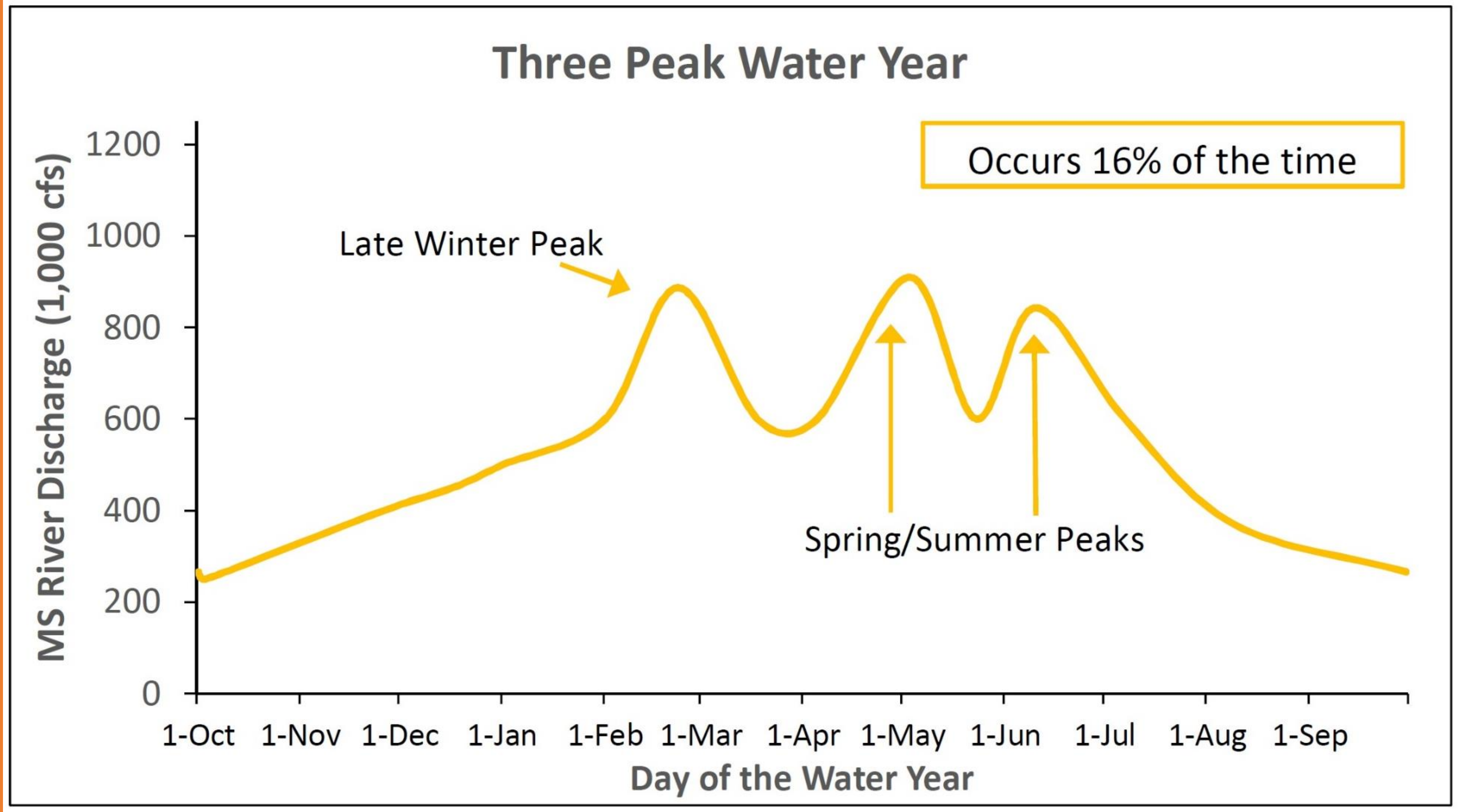
HYDROGRAPH TYPOLOGIES

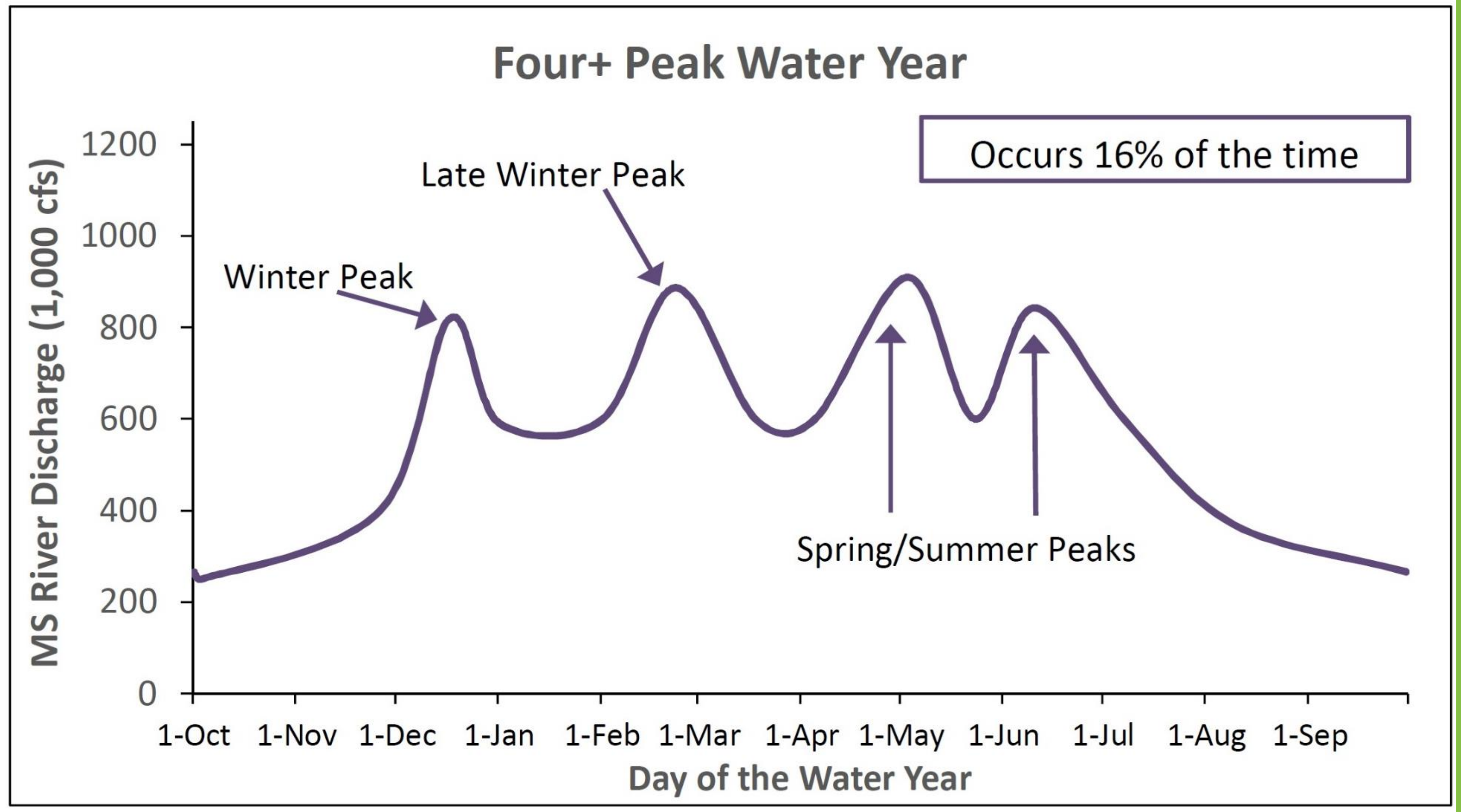












Strategy Development

Hydrograph typologies can be used to define different operation strategies for a single or multiple diversions for any given typical flow of the river. These strategies can be incorporated into the modeling efforts.

Balance Outcomes

Hydrograph typologies can better balance the primary goal to build/sustain land with other ecosystem needs by focusing on the most efficient peaks and operation times in any given year.

Expectation Management

Hydrograph typologies are a communication tool that provide stakeholders and decision-makers with a clearer picture of operations in any given year.

PULSED OPERATIONS

Based on the Water Year

Mimic the natural flood cycles of the Mississippi River which occurs from late winter to early summer, but can extend from early winter to late summer. As much as possible, management should allow the ecosystem, vegetation and species to self-organize based on these more historically-based and natural seasonal conditions.

What’s a Water Year?
A Water Year is defined as October 1 for any given year to September 30 of the following year and is designed to incorporate snow fall and snow melt into predictions of water storage and movement, including river flows and flood events.

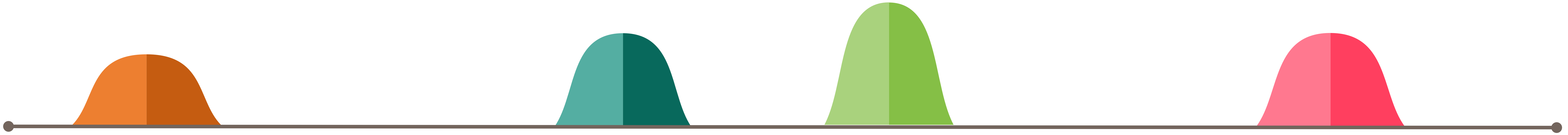


Photo source: National Geographic

INITIAL OPERATIONS

Year 0 to Year 10

Initial Operation Plans

Operation strategies will change over time as the basin matures and the ecosystem adjusts to the new normal condition. Initial operation plans should include more monitoring and flexibility to modify operations as the conditions in the basin will be changing rapidly. Updates to the plan may occur more frequently based on an integrated and near real-time operations-monitoring feedback loop.

DISTRIBUTARY CHANNEL NETWORK

An estimated 5-10 years is needed to develop a distributary channel network that can move 75,000 cfs through the basin without causing backwater flooding. Operations should ramp up to 75,000 cfs over time to facilitate the development of the network.

WATER LEVELS

The diversion channel will be flowing into already fragmented, degraded wetlands. In some of these areas, water levels are already high at certain times. Research is needed on how long it will take water levels to even out and ensure the diversion is not inducing additional flood risk on adjacent communities.

EROSION

The outfall of the diversion consists of weak, highly erodible marshes. The jet plume that enters the basin will cause some scour in the channel and immediate outfall area. Efforts should be made to anticipate this erosion and limit it to areas of the developing channel network.

VEGETATION

Wetland loss could also occur from preexisting vegetation loss due to flood stress or the initial shock of changing conditions, especially during the growing season. Initial operations should focus on operating during the dormant season to reduce loss and allow vegetation to adapt to new conditions.

FISH & WILDLIFE

Similar to vegetation, fish and wildlife species can suffer from an initial shock of changing conditions. Initial operations should occur gradually to ensure fish and wildlife species, as well as the habitats they depend on, can self-organize around the new normal conditions.

WINTER OPERATIONS

November through February

SEDIMENT LOADS

First peak of the Water Year carriers the greatest concentration of sand, silt and clay. Highest suspended sediment loads occur from November to February.

FISH & WILDLIFE

Reduce or eliminate impacts to most commercial and recreational fish and wildlife species, especially during initial operations. Closing the diversion in March can facilitate the larval recruitment of blue crab and shrimp into Barataria Basin.

WATER LEVELS

The Gulf of Mexico stage is lowest in the winter, which helps to move water out of the basin and reduce the risk of elevated water levels for extended periods of time.

COLD FRONTS

Silts and clays initially deposited on bay and canal bottoms can be resuspended and deposited on the marsh surface by cold front passages prior to consolidation.

NUTRIENT UPTAKE

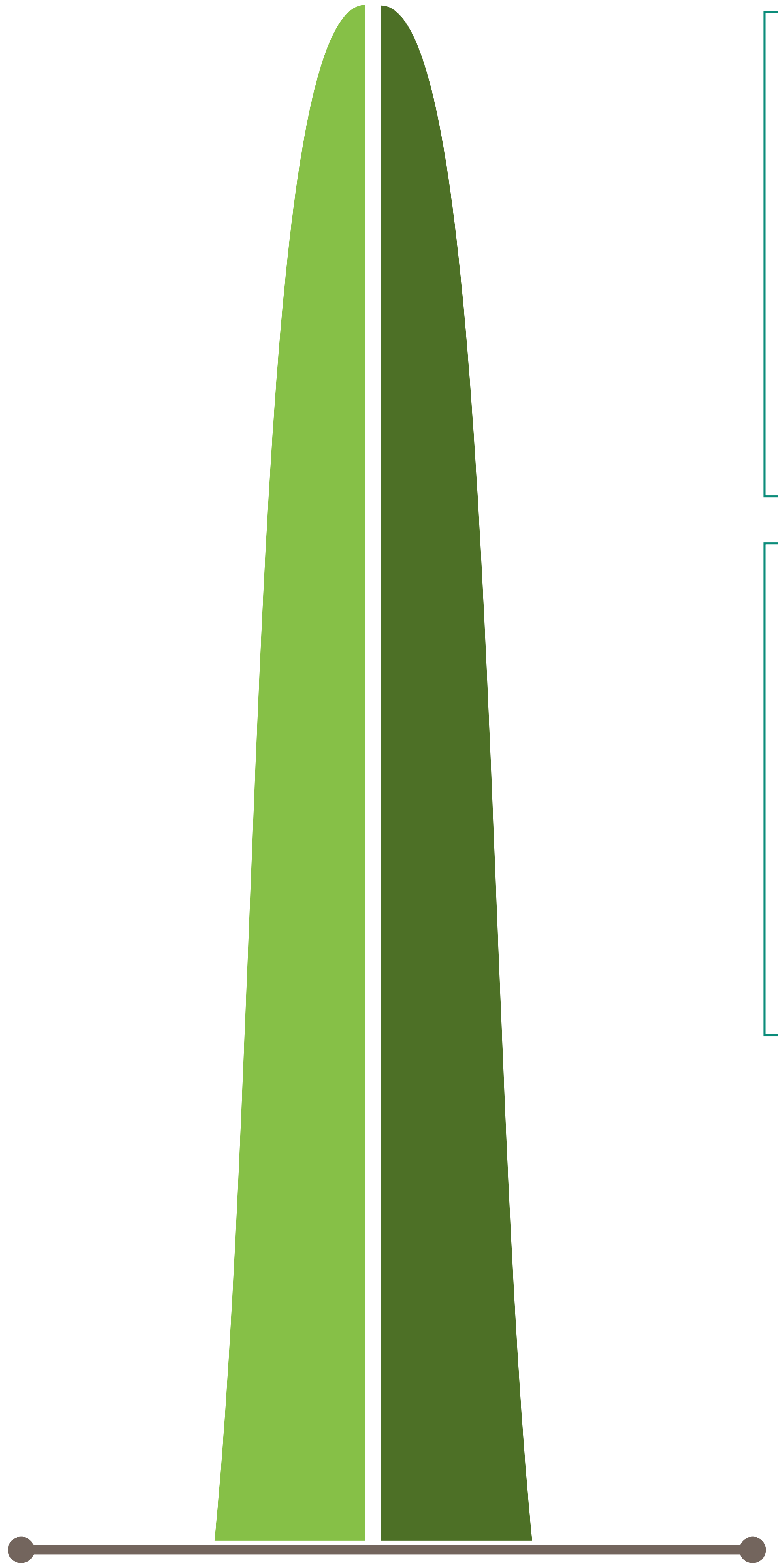
Cold fronts can also push nutrient-laden water onto the marsh surface and increase the denitrification potential of the basin during these months.

VEGETATION

Operation during the non-growing season will reduce vegetation stress and loss and allow prolonged and continuous flooding while plants are dormant.

HOW COMMON ARE WINTER PEAKS?

From 56 Years of Mississippi River Flows



OVER 600,000 CFS

82%	**41%**	**14%**
1+ WINTER PEAK	**2+ WINTER PEAKS**	**3+ WINTER PEAKS**

BETWEEN 500,000 AND 600,000 CFS

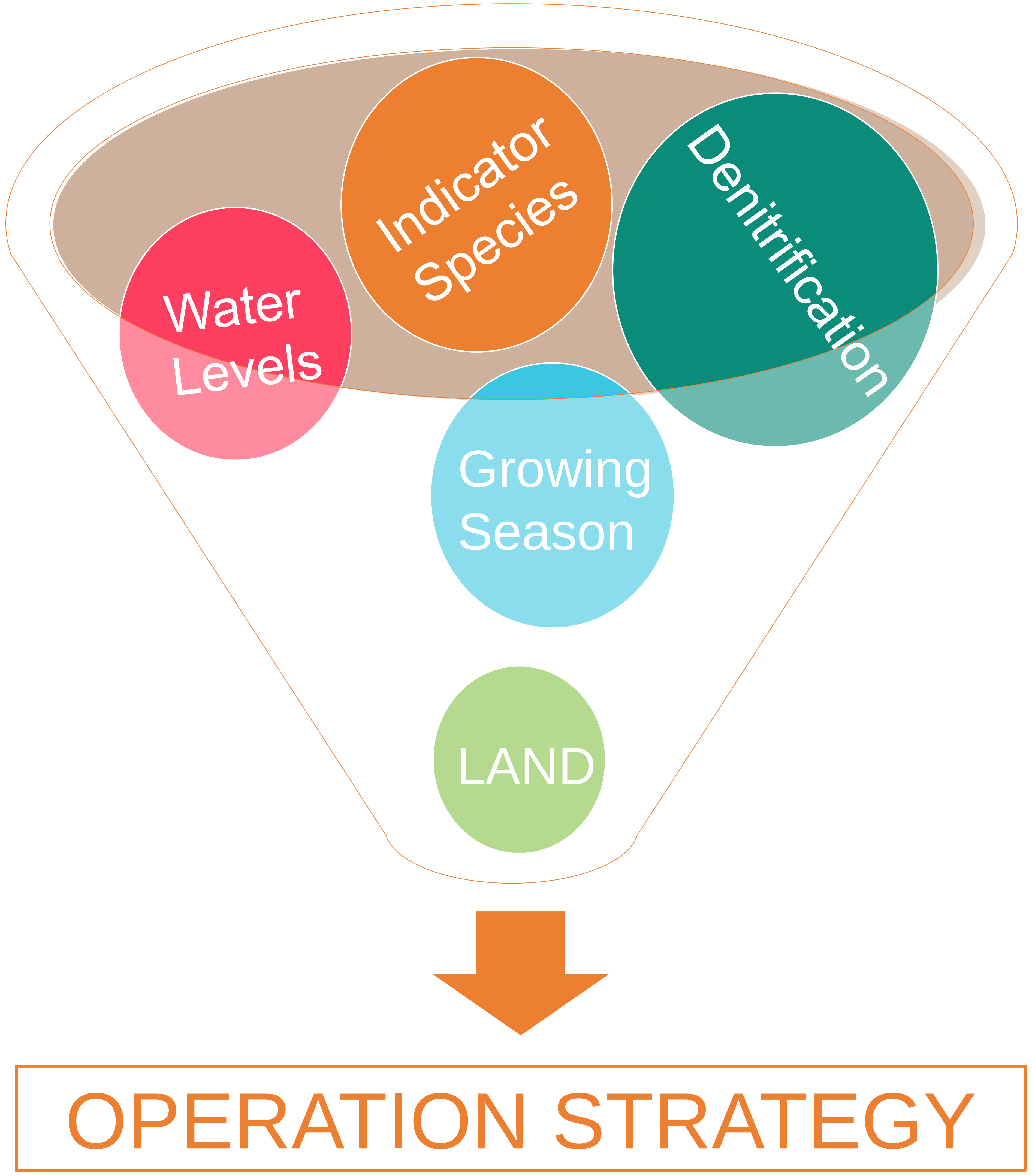
100%	**79%**	**61%**
1+ WINTER PEAK	**2+ WINTER PEAKS**	**3+ WINTER PEAKS**

LENGTH OF PEAKS

Between 500,000 cfs and 600,000 cfs, peaks are typically short lived (less than one week)

SPRING & SUMMER OPERATIONS

Taking Full Advantages of the Highest Peaks during the Water Year



Operations during spring and summer are more complex and require a more intricate and balance operation strategy:

Provide adequate dry period for vegetation (species specific), especially at the start of growing season.

Optimize denitrification – rates are highest during the warmer months and concentrations in the river are at a peak.

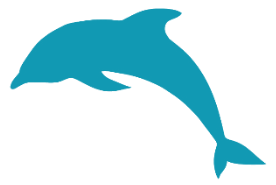
Minimize negative net effects on the community of indicator species. Include predictions of effect, research and monitoring to quantify effect, mitigation options and communicate any potential anticipated effects (or actual effects) to the public.

Alligators, once established, nest from mid-May to September and can be impacted by prolonged elevated water levels.

Blue crab spawn in May and from August to September

Brown shrimp juvenile recruit into the basin in April and May

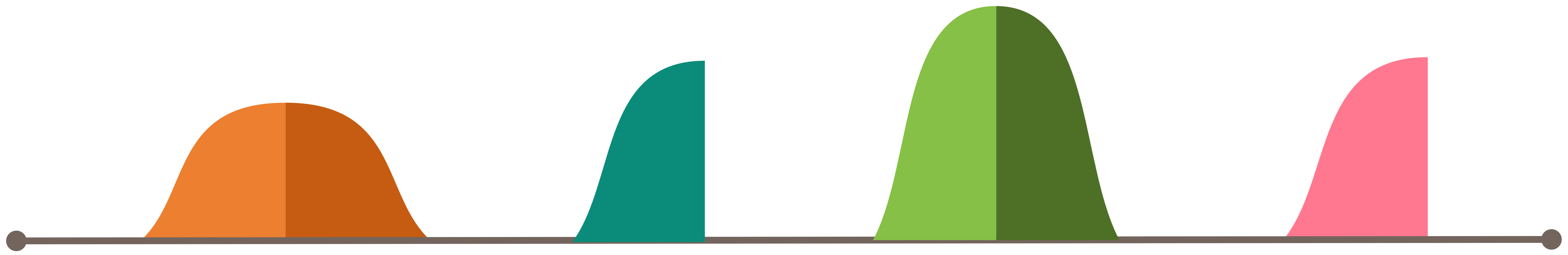
Oyster spawning and establishment occurs in spring/ summer



Birthing season for bottlenose dolphins

TIMING OF OPERATIONS

What Scientists Refer to as the River's Hysteresis



Operating on the rising limb would result in:

56%
of the water diverted

72%
of the sediment diverted

compared to operating on both the rising and falling limbs of the flood peak.

WHAT DOES HYSTERESIS MEAN?

For the Mississippi River, hysteresis means that the flow and sediment load in the river is not only dependent on what is happening at the present time, but also what has happened in the past. For instance, the river can have the exact same flow rate (say 550,000 cfs) but carry vastly different amounts of sediment depending if the river is rising or falling.

Another potential benefit of closing on the falling limb would be to **increase sediment transport capacity** in the river, thereby reducing the potential for shoaling.

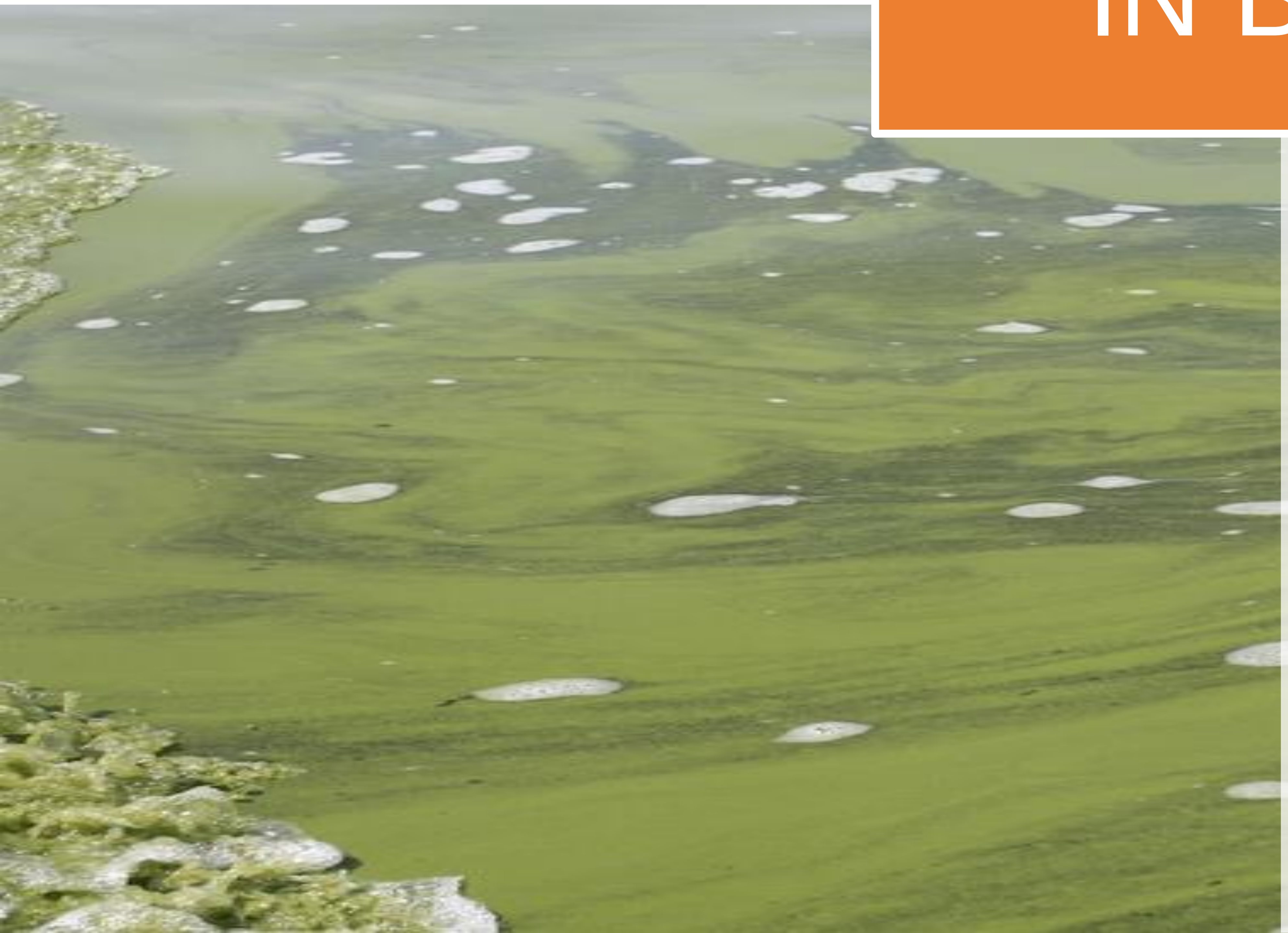
Habitat Types

Freshwater habitat may establish in the immediate outfall area over time, however the WG recommends maintaining as much intermediate and brackish marsh as possible to prevent loss of freshwater from salinity spikes and more resilience to future sea level rise.

IN BARATARIA BASIN

Sediment Retention

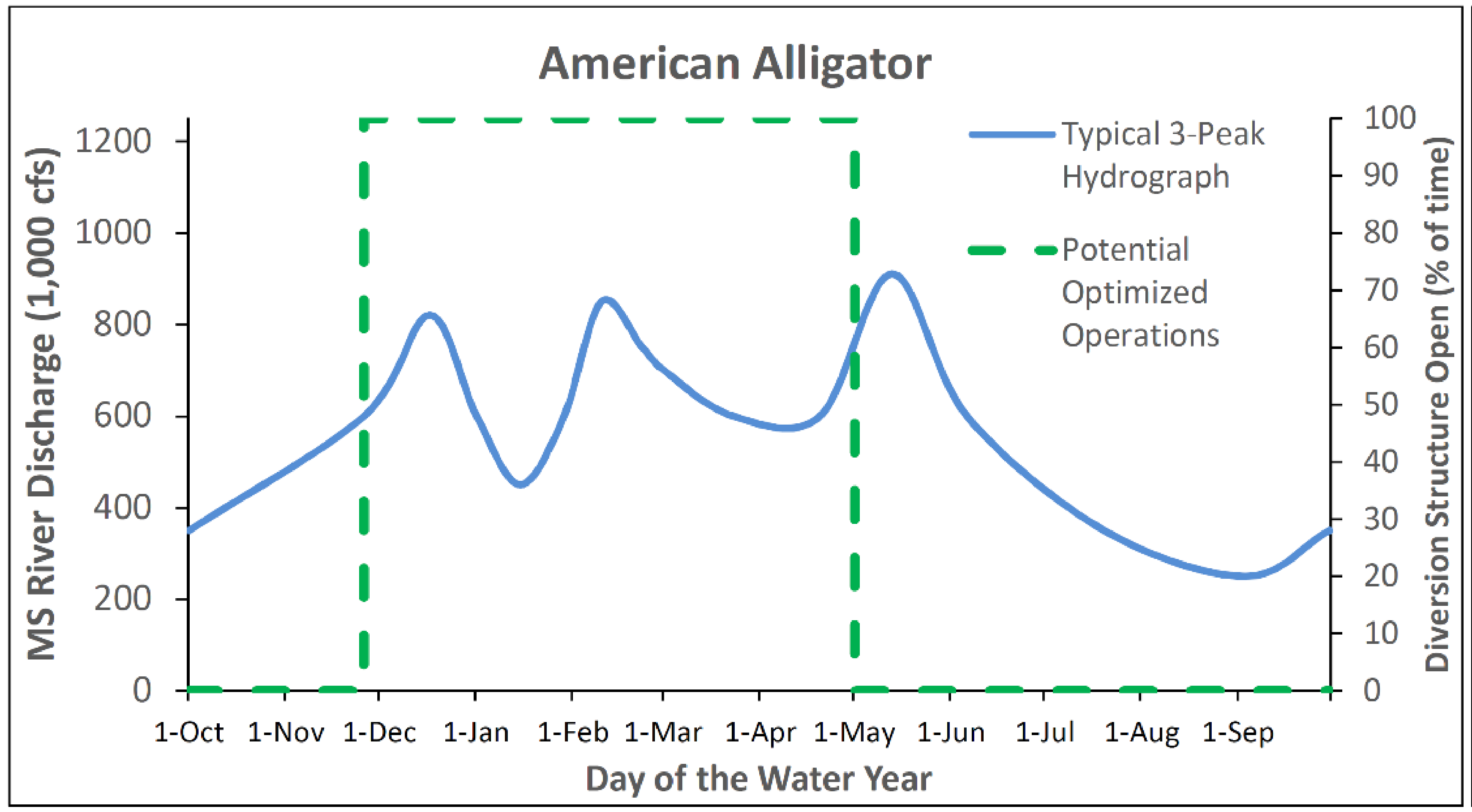
A sediment retention area and goal should be established for each diversion. For Mid-Barataria Sediment Diversion, the WG recommends a retention area that extends to the barrier islands and a retention rate of at least 75% of sediment. Management actions, such as sediment retention and enhancement devices (SREDs), should be considered if we are not meeting the retention goal.

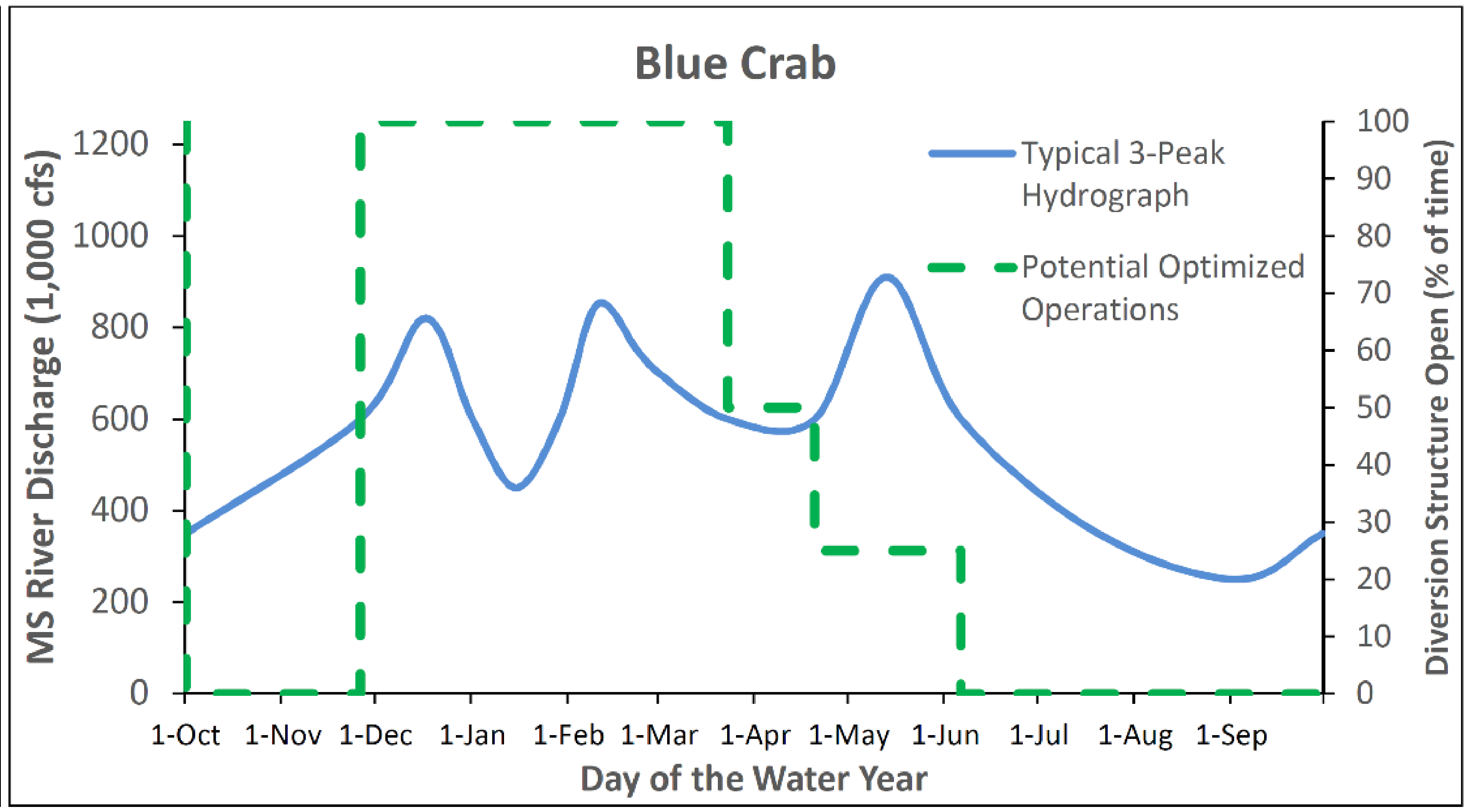


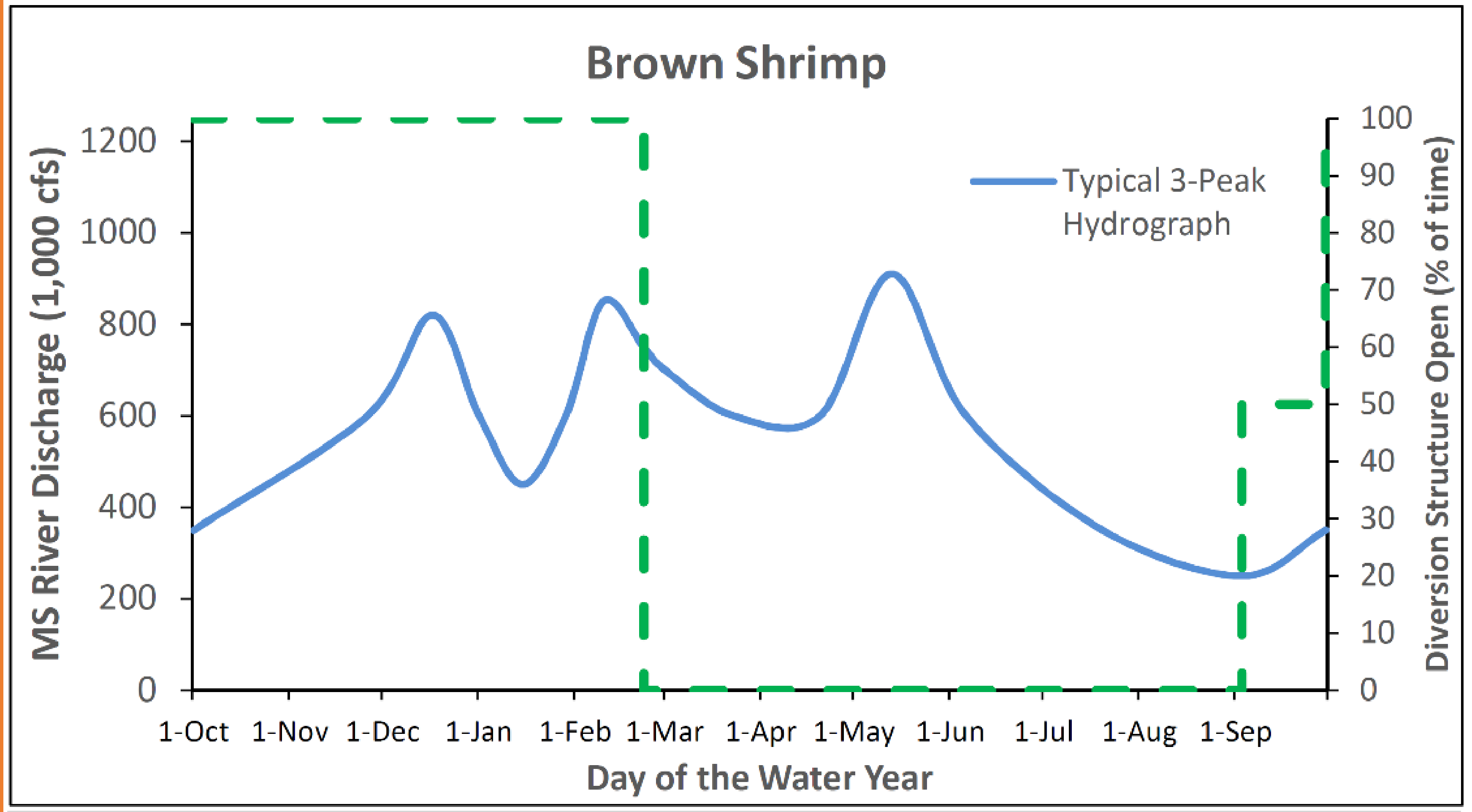
Water Quality

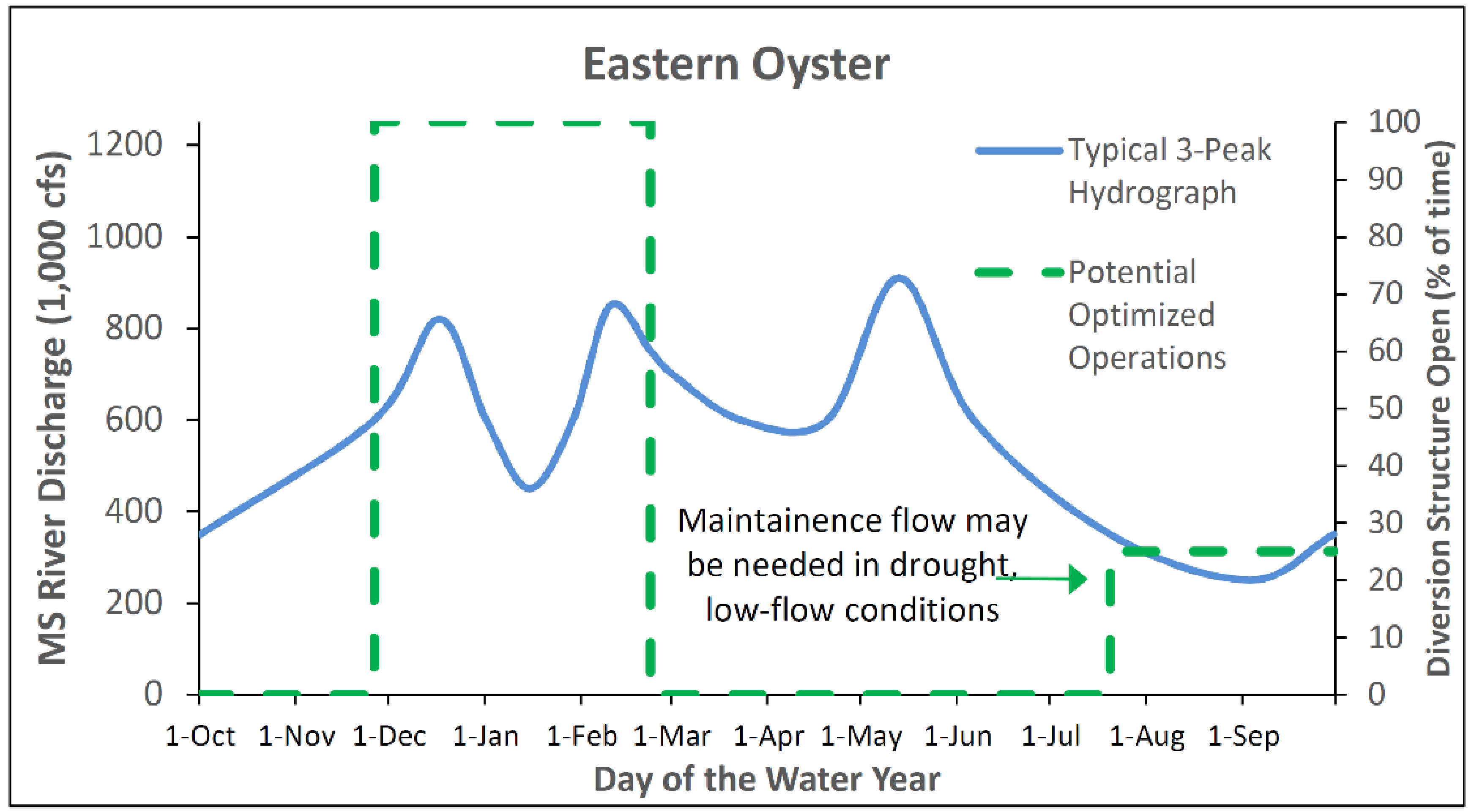
Salinity, temperature, nutrients and suspended sediment are all key variables to a healthy ecosystem. How quickly water is moving through the basin, and how much stagnant water is present, can greatly affect these variables. Understand and monitoring residence times is a key input to operation strategies.

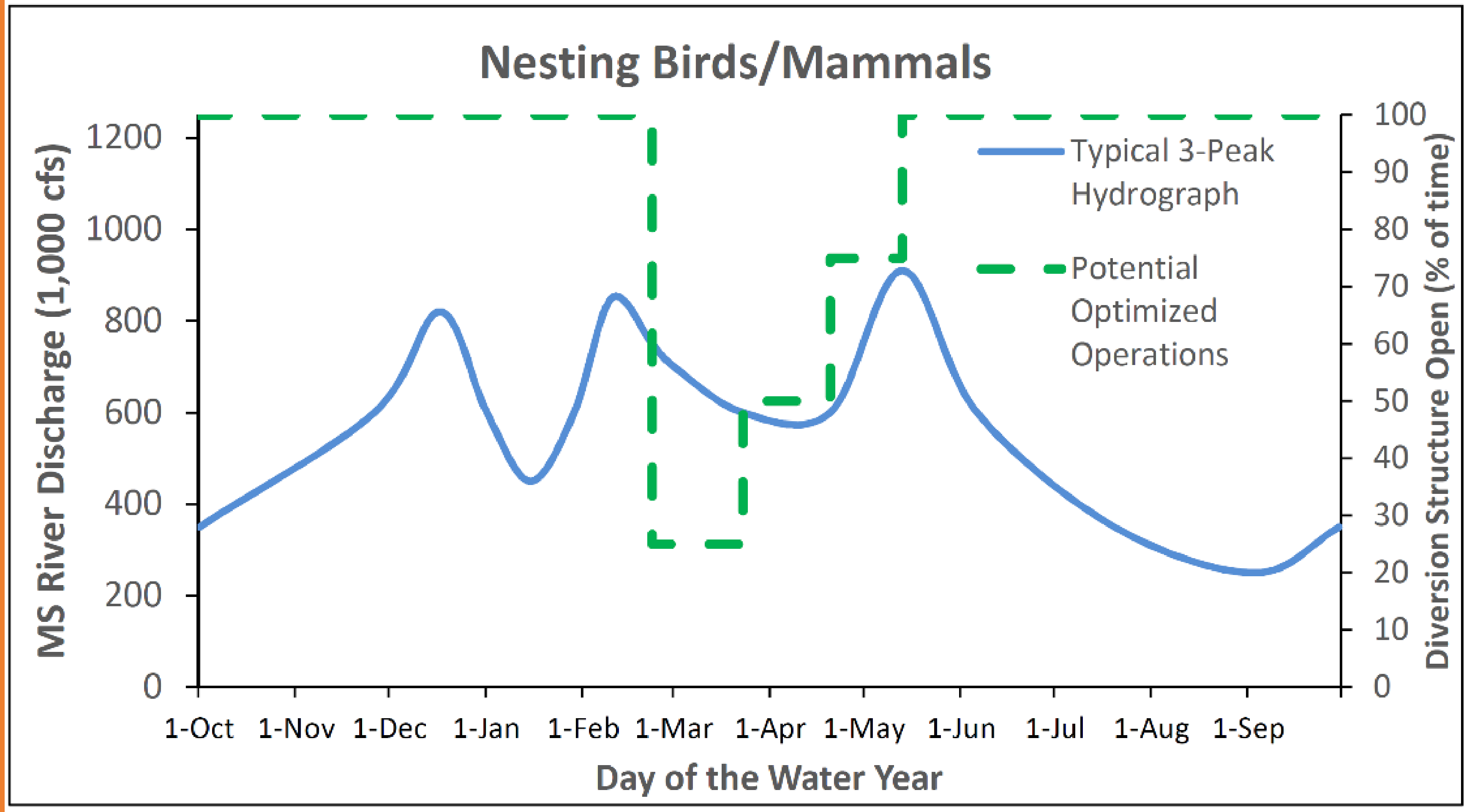
FISH AND WILDLIFE

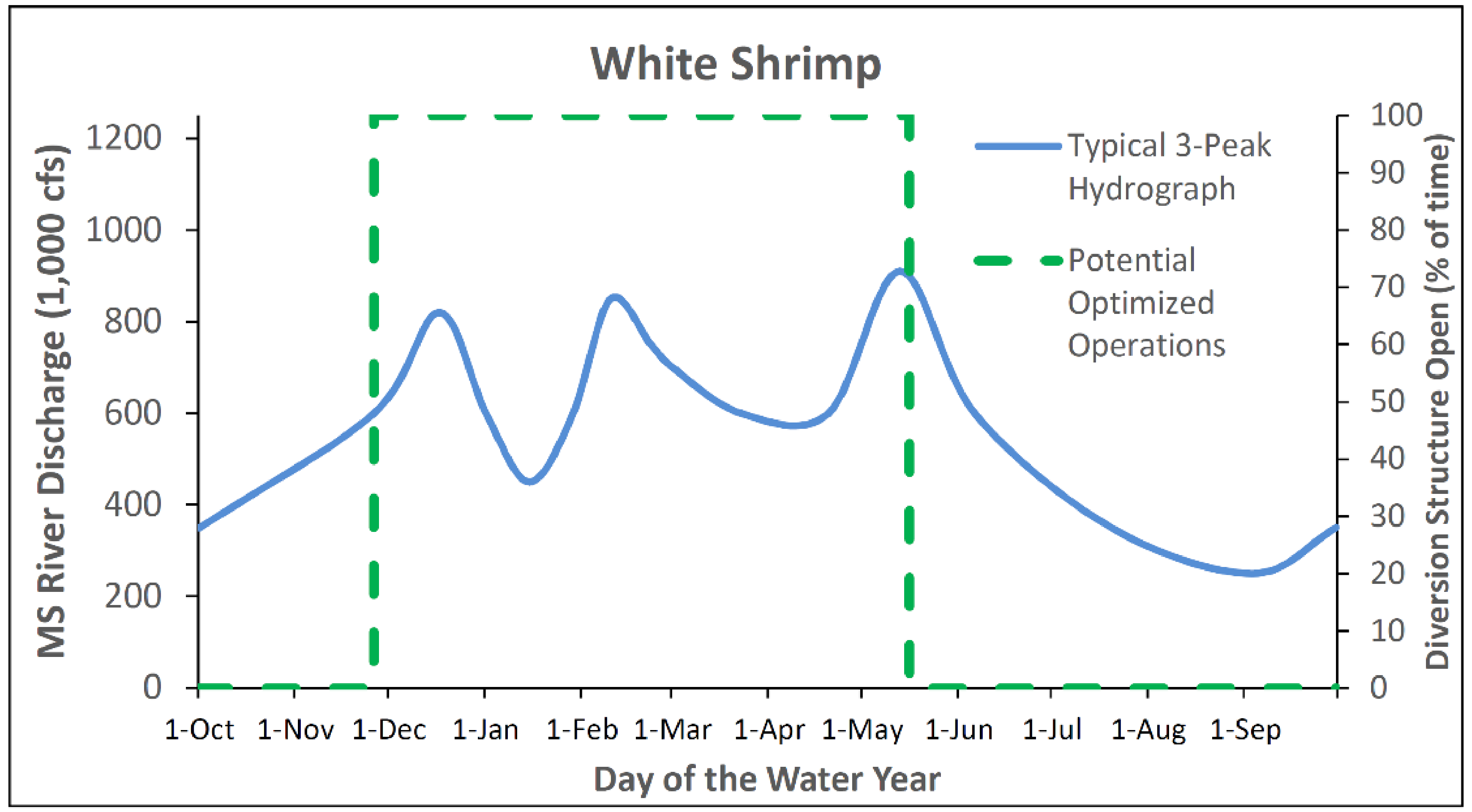












Productivity

Overall productivity of the entire trophic system increases with the input of nutrients, however there are changes in diversity and composition of species.

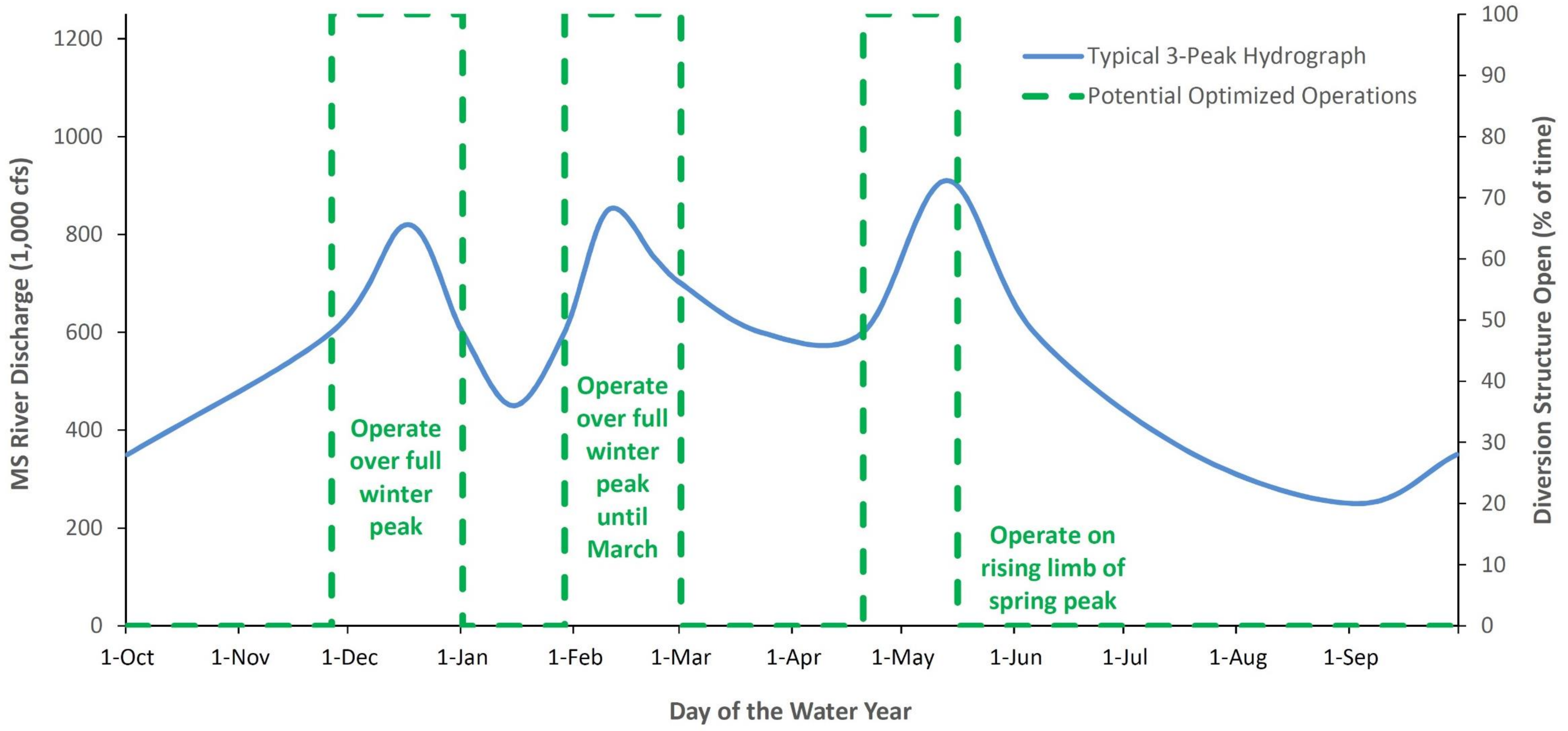
Operations should focus on community structure and productivity rather than individual species.

Expectation Management

Understanding the positive and negative affects of a sediment diversion on indicator species is key for transparency and expectation management. Indicator species should include those of commercial and recreational value, as well as species of intrinsic value to the food web or ecosystem.

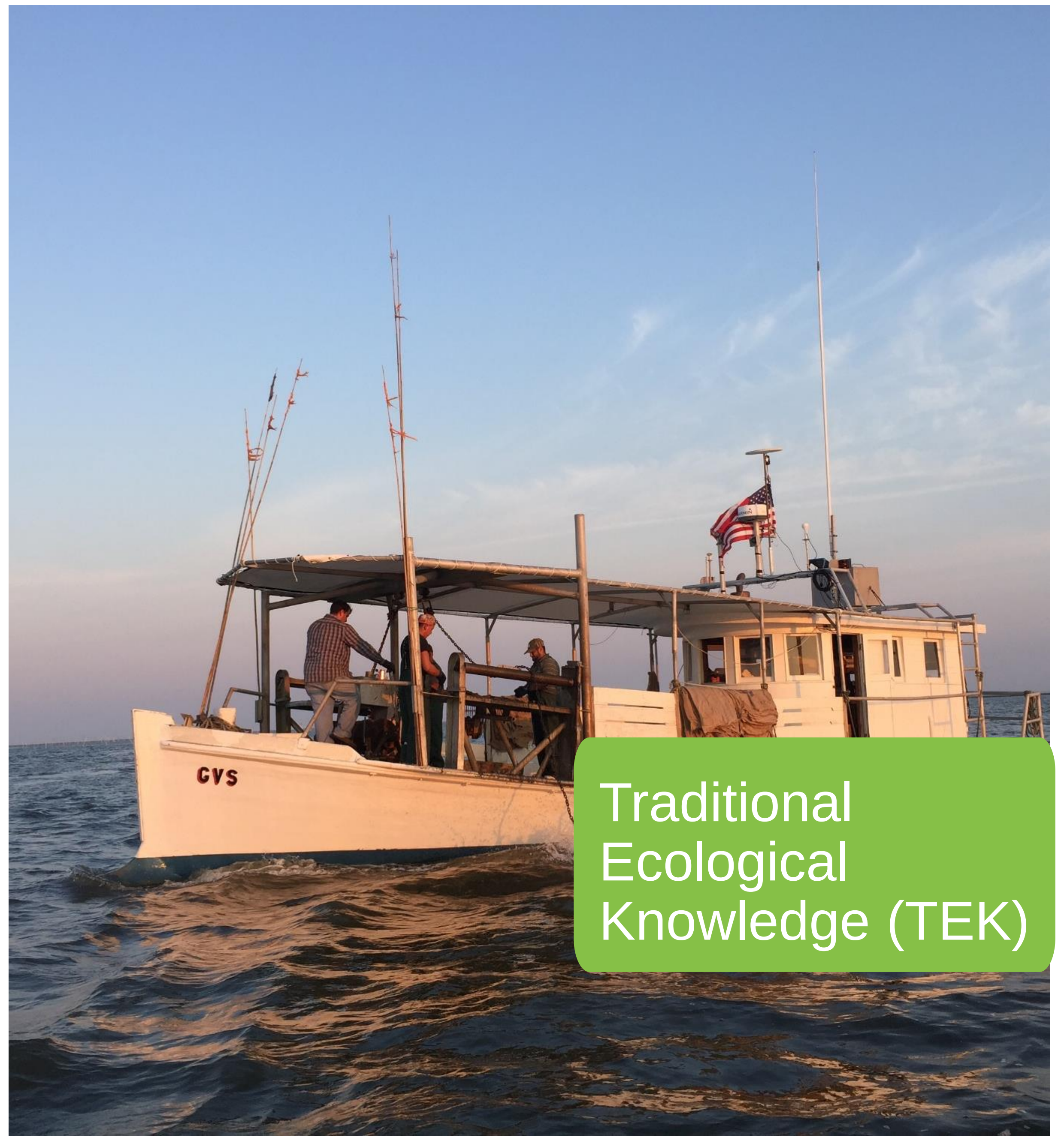
Operation Plans can start to see **commonalities** and **disparities** in species needs with the overall primary goal of land building/sustaining. Although Operation Plans should not be developed to meet any species specific needs, understanding the discrepancies of these operations will provide important information for the modeling, research and monitoring of potential adverse impacts and can inform discussions with stakeholders who may be affected by these outcomes.

DIVERSION STRATEGY - EXAMPLE



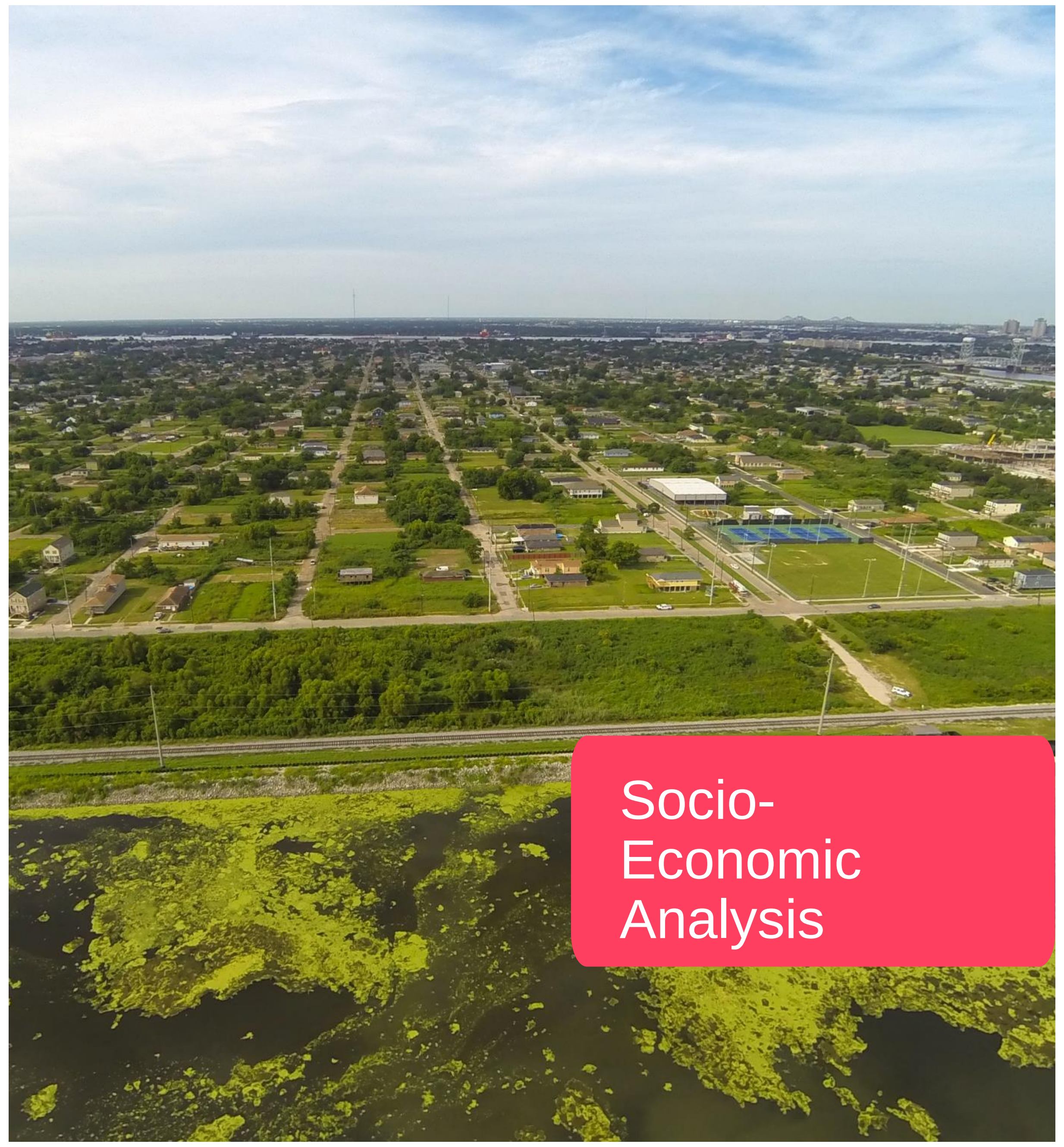
SOCIO-ECONOMICS

What does all of this mean to those who live, work and play on the coast?



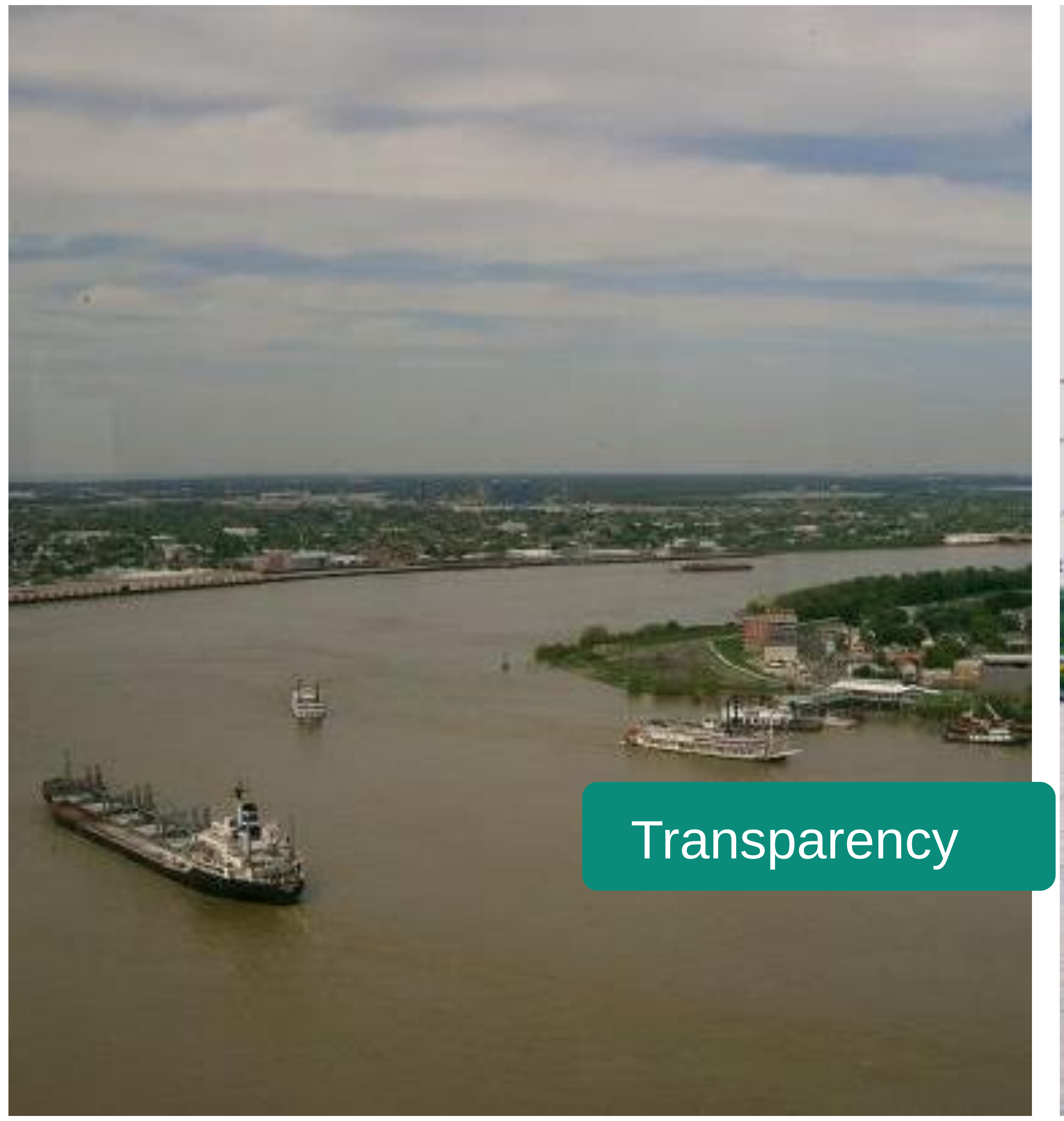
Years of Experience

So many of south Louisiana residents have decades of daily knowledge of the coast. They can recant stories of land loss, understand water movement, and can describe the life histories and habitat use of fish and wildlife species. Incorporating TEK into our modeling and monitoring efforts to develop and inform operation plans is critical.



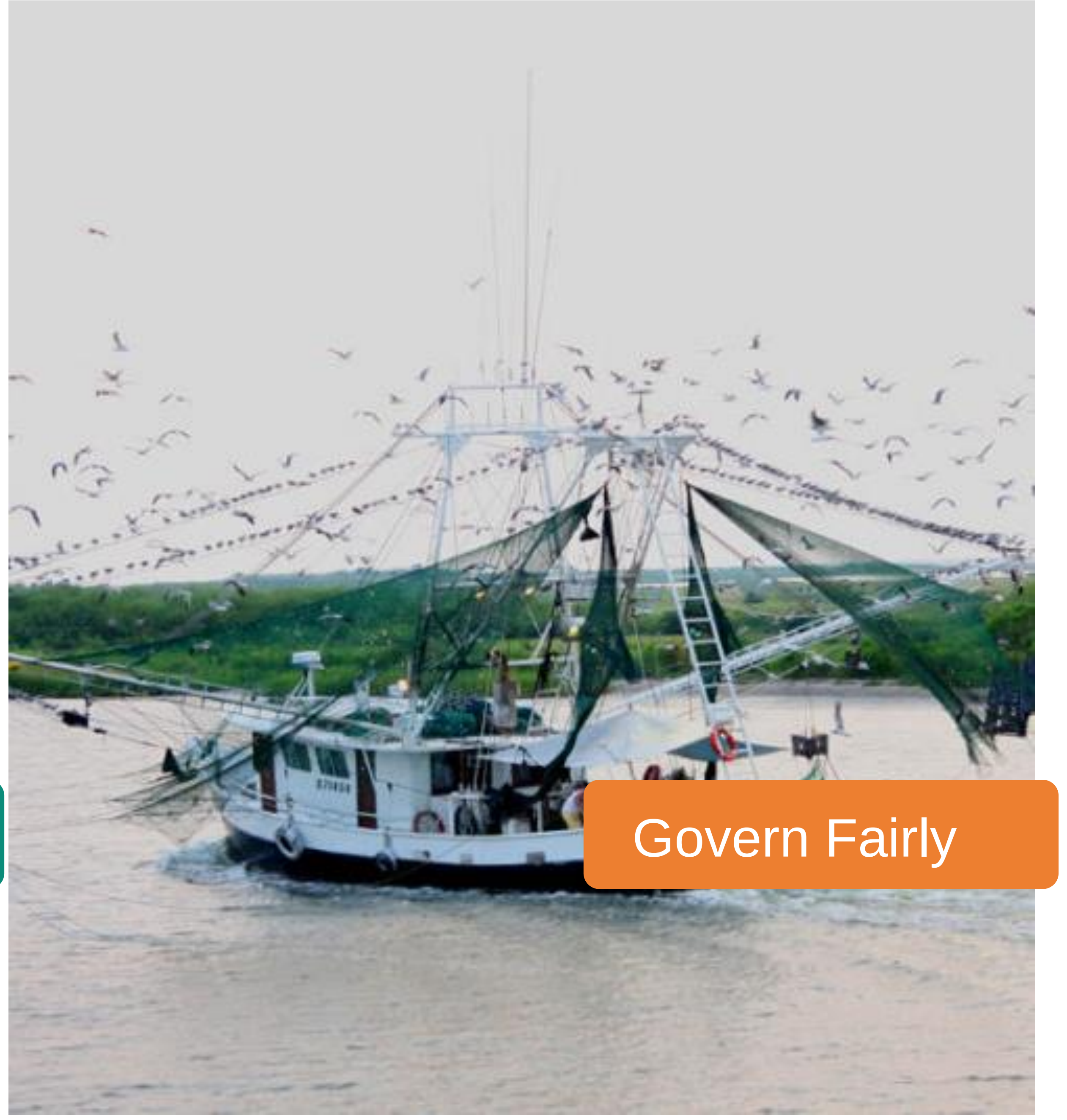
Accelerate Studies

Evaluate socio-economic affects on clearly defined spatial and temporal scales, including both short term and long term effects (both positive and negative), and develops tools for transitions in coordination with stakeholders.



Dialogue with Affected Parties

Identification of affected parties, transparency of potential affects, two-way sharing of information and a genuine attempt to mitigate socioeconomic impacts without compromising the effectiveness of the diversion are crucial.



Set Examples Today

Use existing diversion structures (Caernarvon and Davis Pond) to demonstrate a new behavior in diversion management, building transparency, trust and inclusiveness into the decision-making structure.

RECOMMENDATION REPORT

What Else is Included:

Photo source: NWF, Tim Carruthers, Loomis


QUESTIONS?
THANK YOU!