

# Implications of altered freshwater flows on estuarine fish and shellfish: a case study of the Lower Suwannee River

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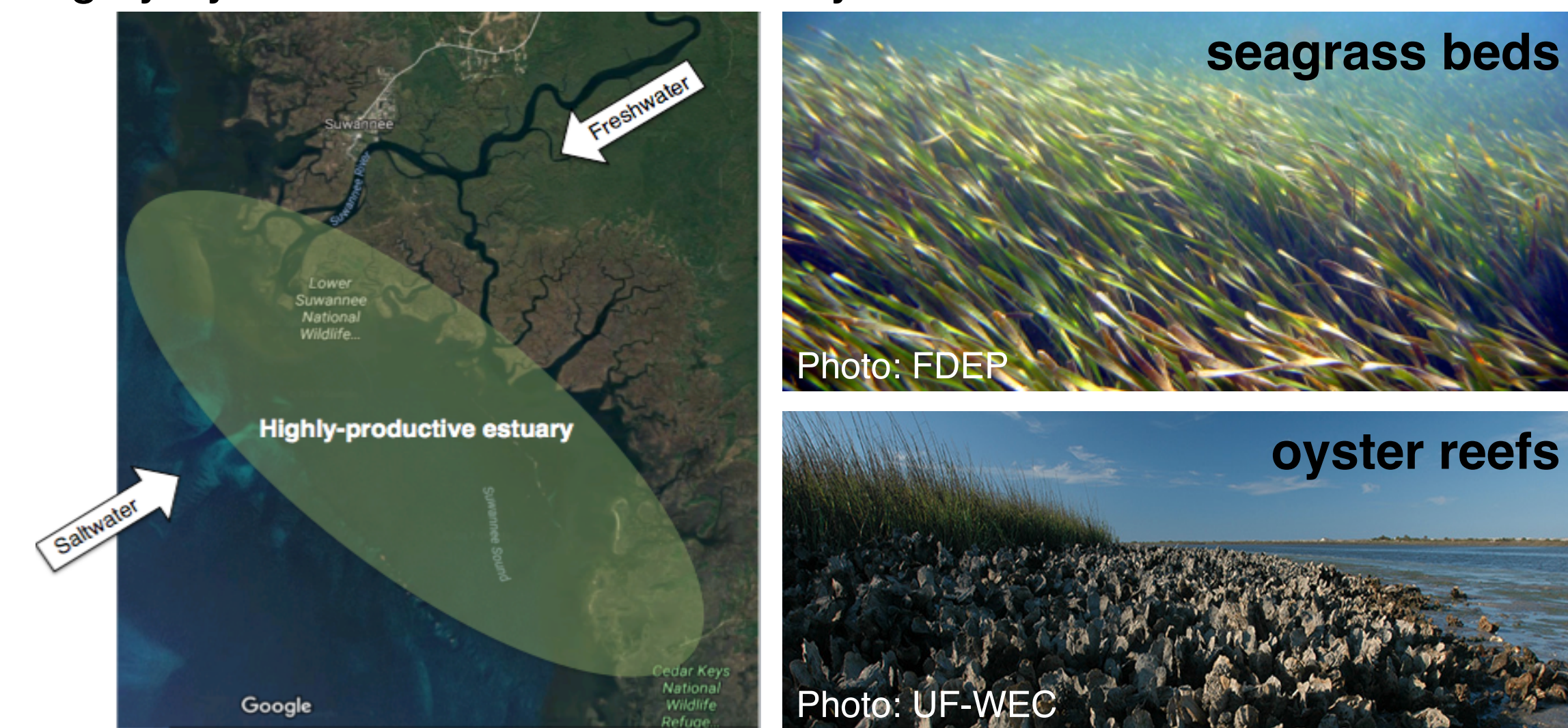
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## SUMMARY

Mounting anthropogenic pressures on inland water supplies threaten to starve downstream estuaries of their freshwater, which is further exacerbated by sea level rise. If rising seas are unmatched by increasing freshwater flows, estuaries will disappear from the coast. The ecosystem services provided by estuaries must not be overlooked when deciding how to manage freshwater flows and withdrawals. Stakeholder involvement strategies such as participatory research and stakeholder analysis can be employed to better inform management strategies. Existing legal and regulatory frameworks created to achieve equitable allocation of freshwater resources for human demand and environmental function have not seriously addressed water allocation between competing public interests. However, Ensuring that minimum flow and level standards account for issues like increasing sea level rise, and that water management authorities can effectively enforce these protections, will be critical to the impact on estuarine fish and shellfish.

## ESTUARINE LIFEBLOOD: FRESHWATER FLOWS

**Estuaries: where rivers meet the sea.** These interfacial zones are highly dynamic and characterized by diverse habitats:



**Linkages between freshwater flow and estuarine fish and shellfish.** Estuarine and estuarine-dependent fisheries rely on freshwater inputs to:

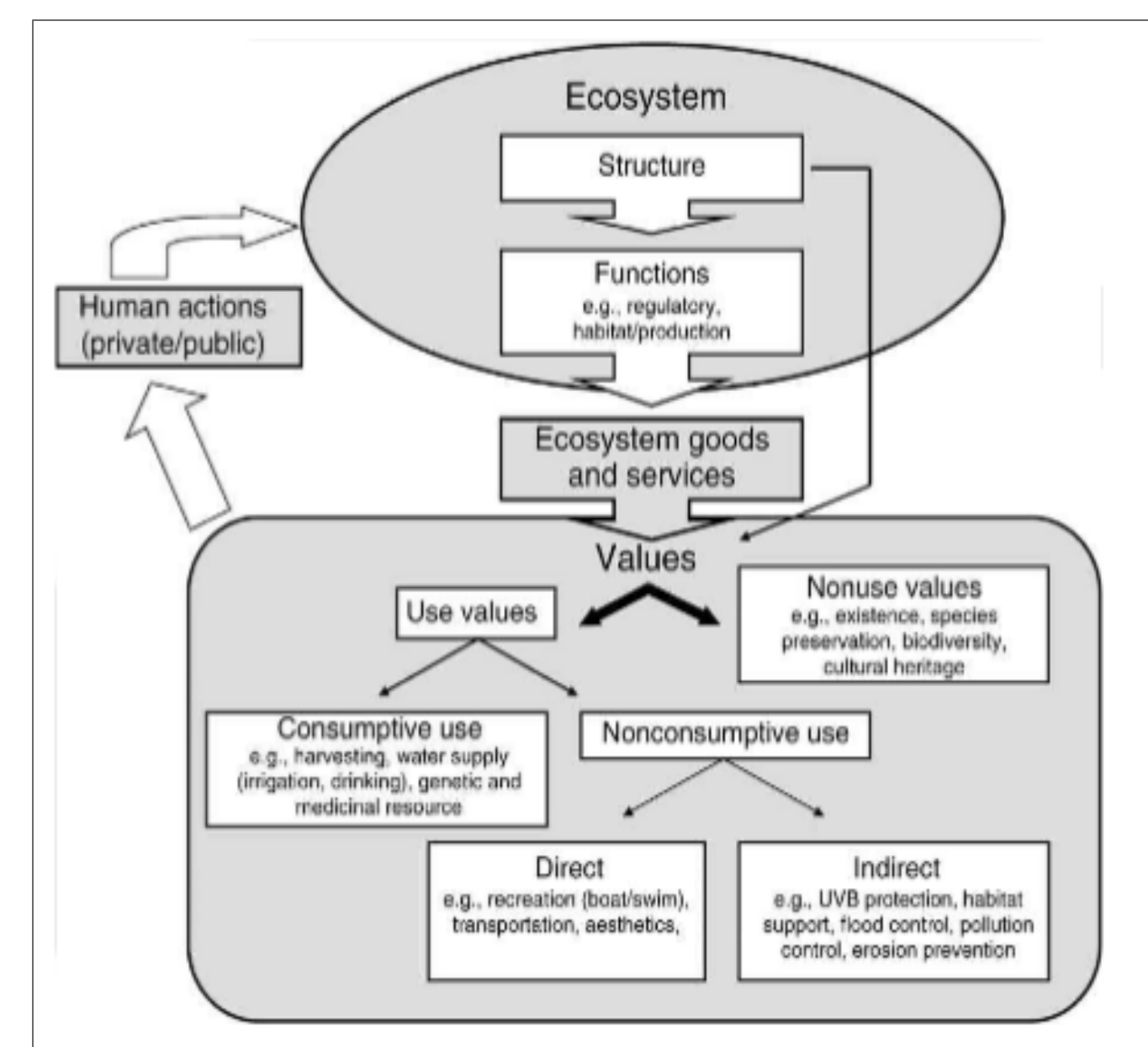
- Form brackish environments (required by oysters and hard clams harvested/farmed in FL);
- Deliver nutrient and organic matter pulses that enhance rates of primary and secondary productivity;
- Connect estuaries to their fringing wetlands, which provide structurally complex refugia for juvenile species;
- Drive variability in water quality, thereby altering habitat quality = wide array of ecological niches;
- Trigger migration patterns (e.g., for spawning purposes, larval migration) through thermal and chemical cues;
- Create turbid conditions that provide refugia for juveniles.

## ECOSYSTEM SERVICES FROM ESTUARIES

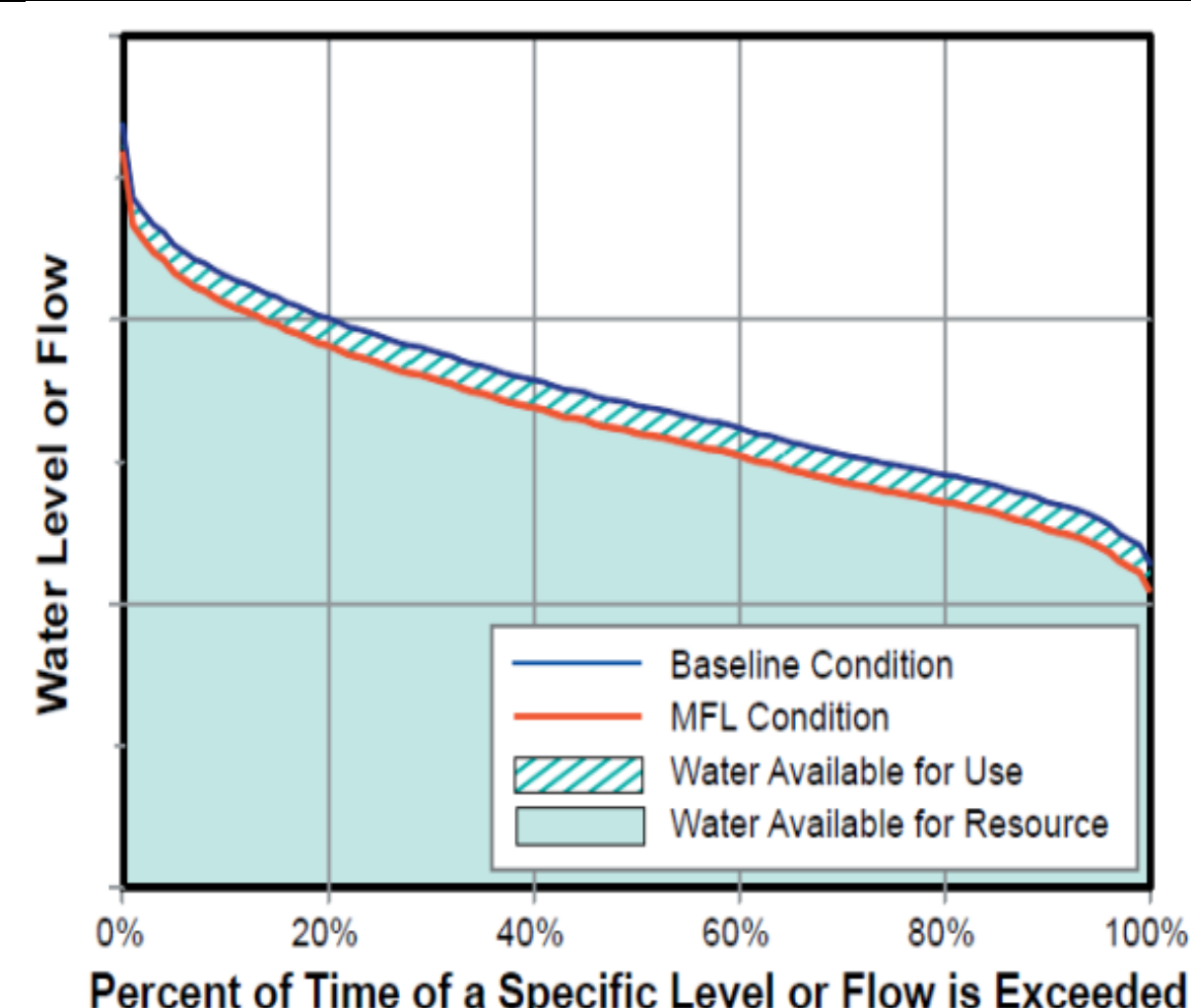
**Ecosystem services:** “direct or indirect contributions that ecosystems make to the well-being of human populations”

- **Economic provisions:** \$230B USD globally; on the Gulf Coast of Florida; commercial fish are worth \$5.5B USD in sales, \$3B in income, and 100k jobs annually; oysters have \$5M total landed value annually; recreational fishing is worth \$5.65B USD in sales, 54k jobs, and 16 million trips annually
- **Contributions for food security and sustenance:** 80 Mt food per year globally
- **Property destruction prevention; shore stabilization:** oysters can reduce wave height by up to 90% and wave energy by up to 99%; valued at \$1.5M USD per hectare in property protected
- **Cultural significance:** spiritual, aesthetic, and inspirational values; individual and community identification with fishing and the coast; historical ties

75-90% of fish rely on estuaries for spawning, habitat, feeding, protection, etc.



## WATER MANAGEMENT POLICY



- Florida manages its water resources with the Florida Department of Environmental Protection who oversees water resources at the state-wide level and five regional Water Management Districts (WMDs) that implement many core aspects of the regulatory framework, including water use via consumptive use permits and environmental protection standards such as minimum flows and levels (MFLs) of water bodies. The jurisdiction of these regulatory and planning agencies were created based on **watersheds rather than political boundaries**.
- WMDs are responsible for establishing MFLs for all waters within their watersheds. MFLs are “the limit at which further withdrawals would be significantly harmful to the water resources or ecology of the area.”
- By having MFLs, **WMDs are required to “consider . . . the protection of nonconsumptive uses,” such as estuary function**, and can protect those uses at their discretion.

## LOWER SUWANNEE RIVER CASE STUDY



Map of the Suwannee River (1977, Nat. Geo.)



**Preventing the Tri-State Water Wars:** For decades, AL, GA, & FL have **battled over freshwater withdrawals** from the ACF River Basin, with no real solution. Conflict of this proportion in the Suwannee could be catastrophic for the ecology of the Big Bend and livelihoods of local fisherman and residents.

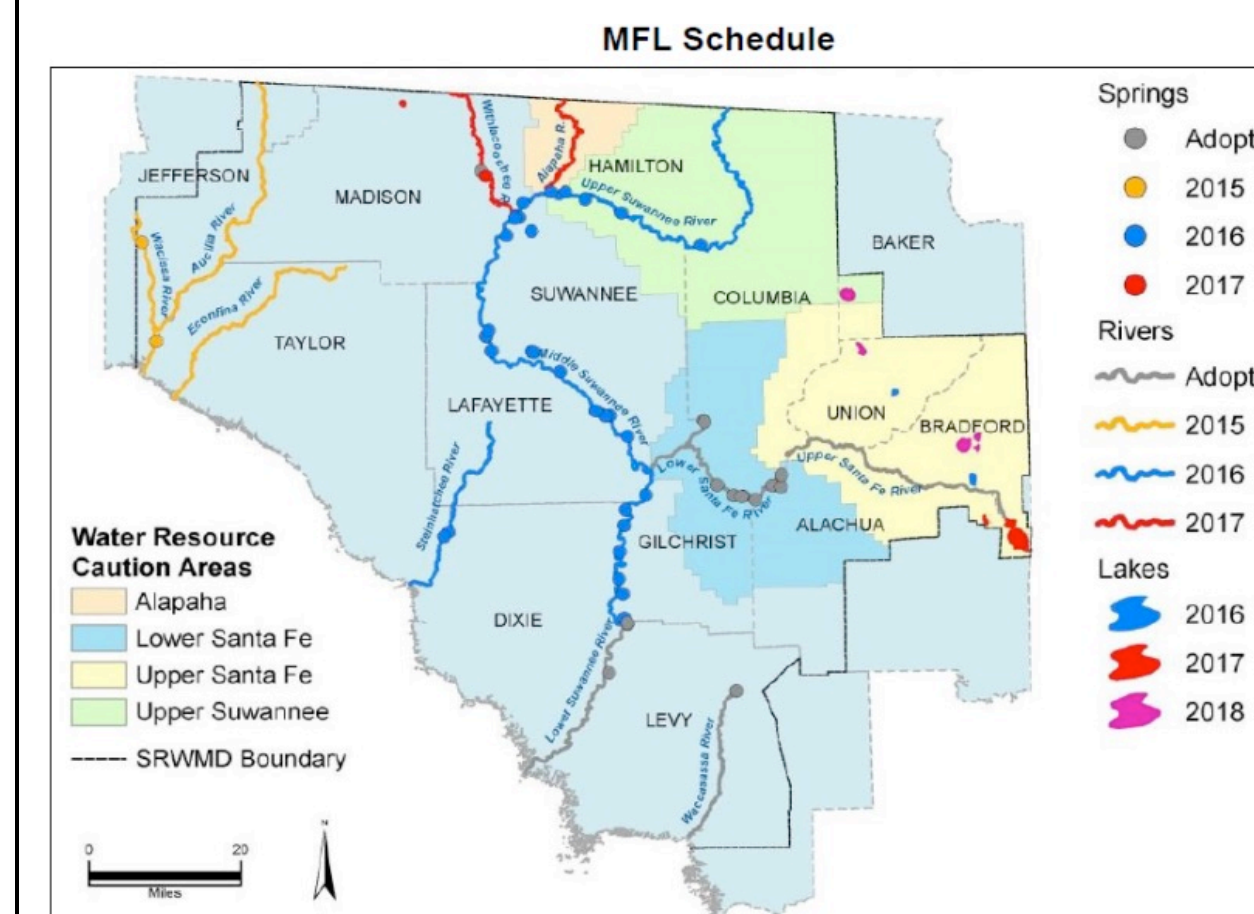


**Stakeholders in the Suwannee River Basin:**

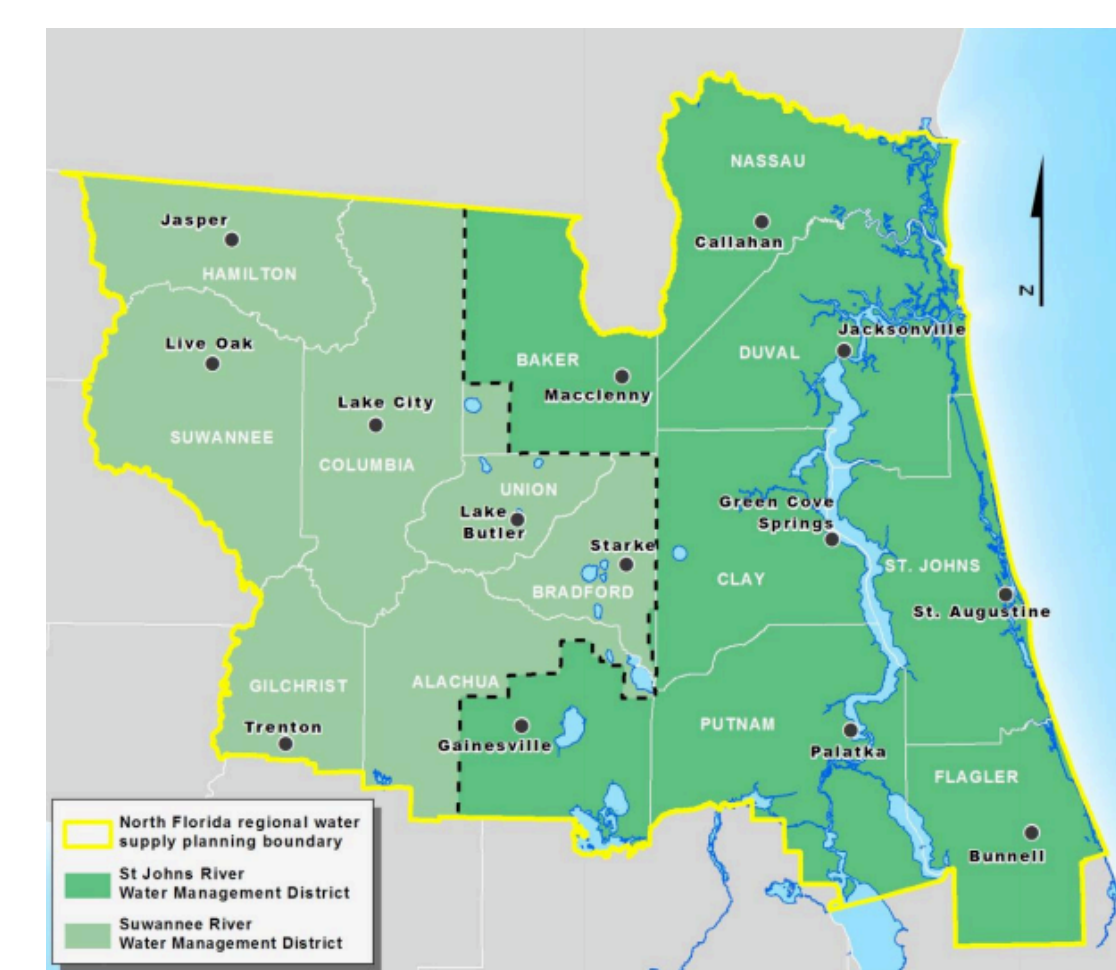
- **Fisherman** and their organizations, as well as the **broadier coastal community**, those who buy, sell, and transport fish, and **environmental groups**.
- **Farmers**, their special interest groups and community, and those who buy, sell, and transport ag. products.
- **Public supply** stakeholders include **municipalities, citizens** who benefit from the use of the water.

**Water management policy in the Lower Suwannee:**

- The Lower Suwannee was among the first waterbodies in the SRWMD to receive an MFL (2005). Predictions regarding sea level rise and impacts from water withdrawals = **needed updates to MFLs**.
- **Monitoring of consumptive use permits** is an integral component to ensure that water is properly distributed for human and environmental needs.
- **Interagency agreements** may become more necessary for long-term management as sustainable water supplies reach their carrying capacity for populations and ecosystems.



Schedule for adoption of MFLs of priority listed water bodies (SRWMD)



The North Florida Regional Water Supply Planning Partnership

## CONCLUSIONS & RECOMMENDATIONS

- Support long-term monitoring of water quality, fishery populations, and habitat quality in the Suwannee River Estuary
- Priority list of waterbodies, i.e. those imperiled by reduced flows, developed and updated annually
- Methods, flows or levels updated and peer-reviewed to incorporate accelerating sea level rise models.
- Workshops held for public input, to include aquaculture interests to address impact of lost offshore oyster reef habitat.
- Recovery or prevention strategies developed for waterbodies that do not meet minimum flows and levels.
- Water management district adopts/updates minimum flows and levels by accounting for cross-boundary water withdrawal impacts.
- Necessary recovery strategies included in North Florida Regional Water Supply Plan Partnership, which could include novel water use constraints beyond minimum flows and levels.