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Developing Methods For Establishing Coastal Nutrient Criteria

May 20, 2008

TX
LA
MS
AL
FL
GULF OF
MEXICO
ALLIANCE

Gulf of Mexico

- 9th Largest Water Body in the World with an Annual Economy of $3 trillion.
- 60% of US drains thru 33 major River Systems into the Gulf (MS River 90% of the Gulf's Fresh Water 420 Billion gal/day).
- Supplies much of the Nations Atmospheric Moisture
- Most Productive Fishery in the World
  - 69% of domestic shrimp,
  - 70 % of domestic oysters
    - More Fish, Shrimp & Shellfish than Mid-Atlantic, Chesapeake Bay and New England combined.
- Energy
  - 43% of U.S. Dry Natural Gas
  - 50% of U.S. Liquid Natural Gas
  - 44% of U.S. Crude Oil

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The Gulf States Governors Formally Announced the Alliance and Released Their Action Plan on March 28th at the "State of the Gulf Summit"

2006

Governor Bob Riley, Alabama

Governor Jeb Bush, Florida

Governor Kathleen Blanco, Louisiana

Governor Haley Barbour, Mississippi

Governor Rick Perry, Texas

The Gulf of Mexico Alliance

March 28, 2006

The 2005 hurricane season shattered records and consumed as 27 named storms and 13 hurricanes impacted America's coastal areas from Key West, Florida to Corpus Christi, Texas. Each one of the five Gulf States – Florida, Alabama, Mississippi, Louisiana and Texas were impacted by the devastating and destructive forces of the storms.

With each passing storm we were reminded how vulnerable the Gulf Coast and its citizens, industry and natural resources are to hurricanes. And each storm demonstrated how closely linked our quality of life is to the health of our coasts. These events brought worldwide attention to the Gulf of Mexico region and underscored the economic impact the coast has on the rest of the nation. Ultimately, last year's hurricane season demonstrated the need for a strong alliance between the Gulf States to strengthen our response to common challenges.

As a result of a shared vision for a healthy and resilient Gulf of Mexico coast, the Gulf States, together with our federal partners, formalized the Gulf of Mexico Alliance. The first action taken by our new partnership is the development of the Governors' Action Plan for Healthy and Resilient Coasts. This far-reaching Action Plan, supported in President George W. Bush's U.S. Ocean Action Plan, December 2004, challenges the Gulf of Mexico Alliance to make tangible progress over the next 36 months on several critical issues, including water quality, wetland and coastal conservation, environmental education, characterization of Gulf habitats and reductions in nutrient inputs, all of which will supplement ongoing recovery efforts across the Gulf region.

The Governors' Action Plan is intended to be a dynamic starting point for effective regional collaboration. As we move forward, we encourage and expect additional collaboration and contributions from other interested partners or organizations. Through our initial teamwork, the Governors' Action Plan will begin to set the stage for a long-term regional partnership that can address an expanded suite of issues, culminating in an improved Gulf of Mexico ecosystem and sustained economy. In addition, the Plan proposes several actions to be implemented in conjunction with the six Mexican Gulf States allowing for the Alliance to serve as a forum for effective bi-national partnership.

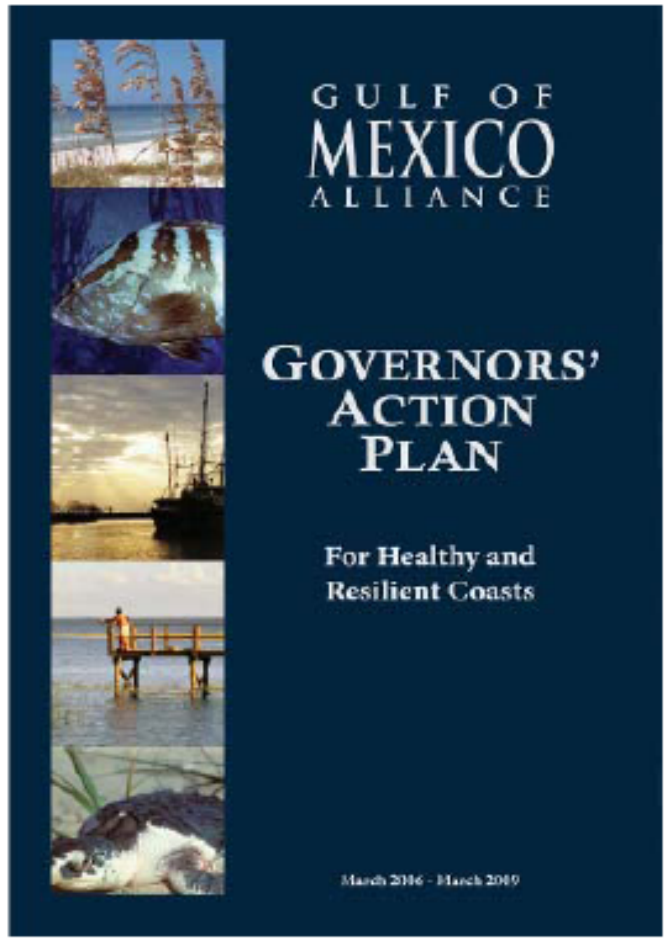
By working together on targeted resource management issues, we can increase governmental effectiveness, better prepare for future natural emergencies and support an improved quality of life. Together, our accomplishments as an Alliance will serve as a lasting legacy for all Gulf State coastal residents and visitors alike.

Sincerely,

Bob Riley — Governor of Alabama
Jeb Bush — Governor of Florida
Kathleen Blanco — Governor of Louisiana
Haley Barbour — Governor of Mississippi
Rick Perry — Governor of Texas

Governors' Action Plan

- Intentionally focused (versus comprehensive)
  - 5 Priority Issues
  - 11 specific actions
- Short-term "on the ground" successes
  - 36-month outcomes
- For each action, an "Action Blueprint" with major steps
- Two projects in Mexico
- *Approved and signed by all 5 Gulf State Governors and CEQ*



THE ALLIANCE IS A PARTNERSHIP OF THE STATES OF ALABAMA, FLORIDA, LOUISIANA, MISSISSIPPI, AND TEXAS.

GULF OF MEXICO ALLIANCE

SUPPORTING FEDERAL AGENCIES: COUNCIL ON ENVIRONMENTAL QUALITY • NATIONAL AERONAUTICS AND SPACE ADMINISTRATION • NATIONAL SCIENCE FOUNDATION • U.S. ARMY CORPS OF ENGINEERS • U.S. DEPARTMENT OF AGRICULTURE: *Natural Resources Conservation; Forest Service* • U.S. DEPARTMENT OF COMMERCE: *National Oceanic and Atmospheric Administration* • U.S. DEPARTMENT OF DEFENSE: *U.S. Navy* • U.S. DEPARTMENT OF ENERGY • U.S. DEPARTMENT OF THE INTERIOR: *Minerals Management Service; National Park Service; U.S. Fish and Wildlife Service; U.S. Geological Survey* • U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES: *Food and Drug Administration* • U.S. DEPARTMENT OF STATE • U.S. DEPARTMENT OF TRANSPORTATION • U.S. ENVIRONMENTAL PROTECTION AGENCY

- **GOMA directed by Alliance Management Team (AMT) composed of a governor's appointee from each of five Gulf states**
- **Substantial support by 14-agency Federal Working Group, chaired by EPA, NOAA and—a new chair—DOI. Chairs work closely with Alliance Management Team.**

How we got where we are

- All states facing deadlines for establishing nutrient criteria
- Gulf states prefer coastal nutrient criteria that protect the resource use and are based on biological effects.

How we got where we are

- GOMA helping develop standardized methods for states to use in establishing coastal nutrient criteria
- Seek methods that create criteria that are:
  - Biological effects-based
  - Scientifically sound
  - Legally defensible

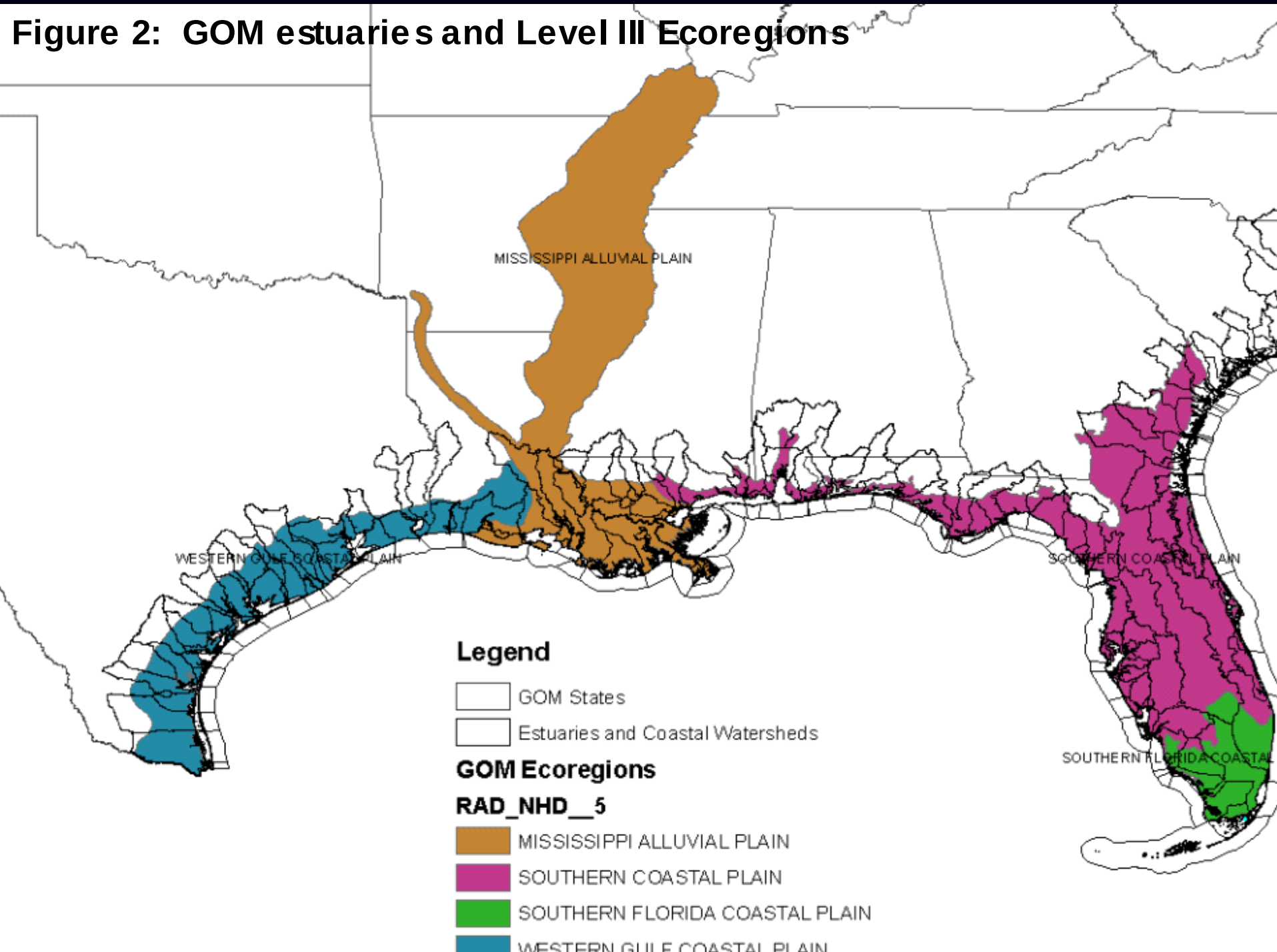
Where we are

- Existing efforts have been tailored to system being studied and do not provide a “tool” or “tool set” that can easily be applied to a different system.
- GOMA approach is to first develop a broadly-useable tool, then optimize for specific types of systems.

Where we are

- The variety of systems contained in the Gulf of Mexico provides an opportunity to develop a common sampling/study design that can be reliably applied at any location within the Gulf of Mexico (similar to the oceanographic 'bounding-box' approach.)

Figure 2: GOM estuaries and Level III Ecoregions



Approach:

- Identify the four-to-five "most-different" types of coastal systems in the Gulf, based upon basic system functions such as the physical-chemical regimes and nutrient pathways.

Approach:

- Devise a conceptual model that includes relationships between the nutrient pathways and the biological endpoints as the nutrients move through the system. This conceptual model must identify the 'critical points' where undesirable ecosystem effects can result.

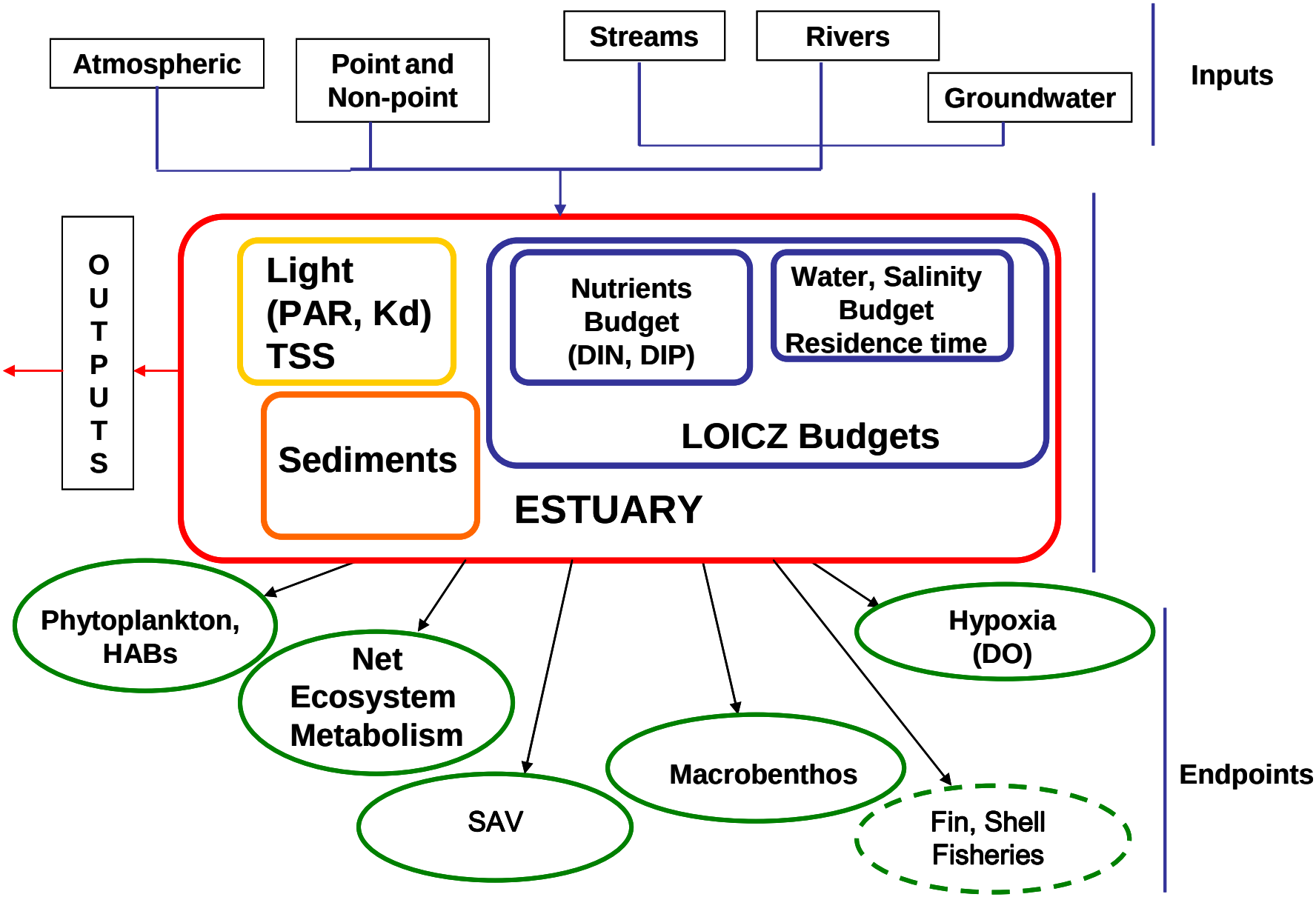


Figure 1: Overview

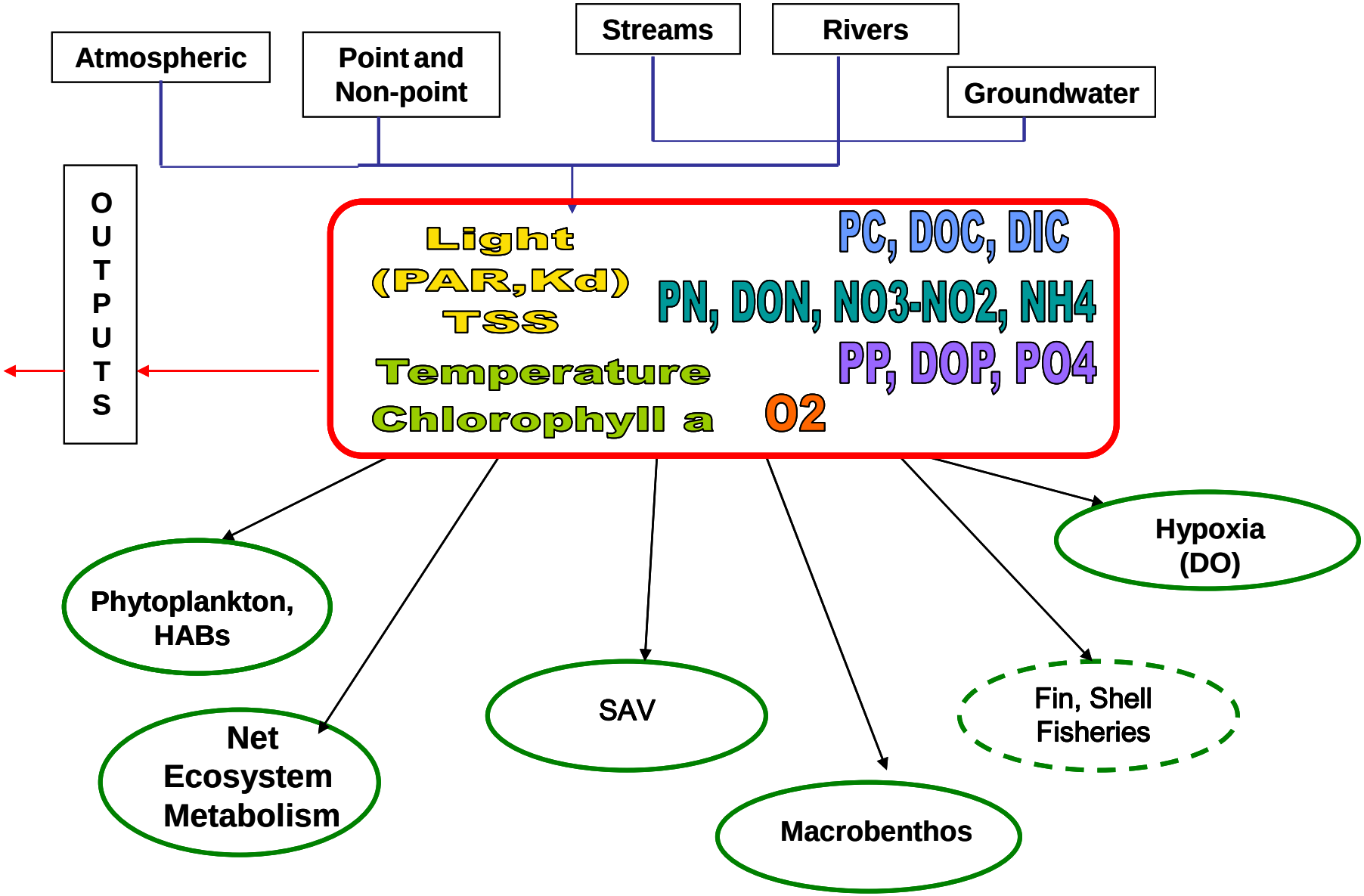


Figure 2: Pathway measurements

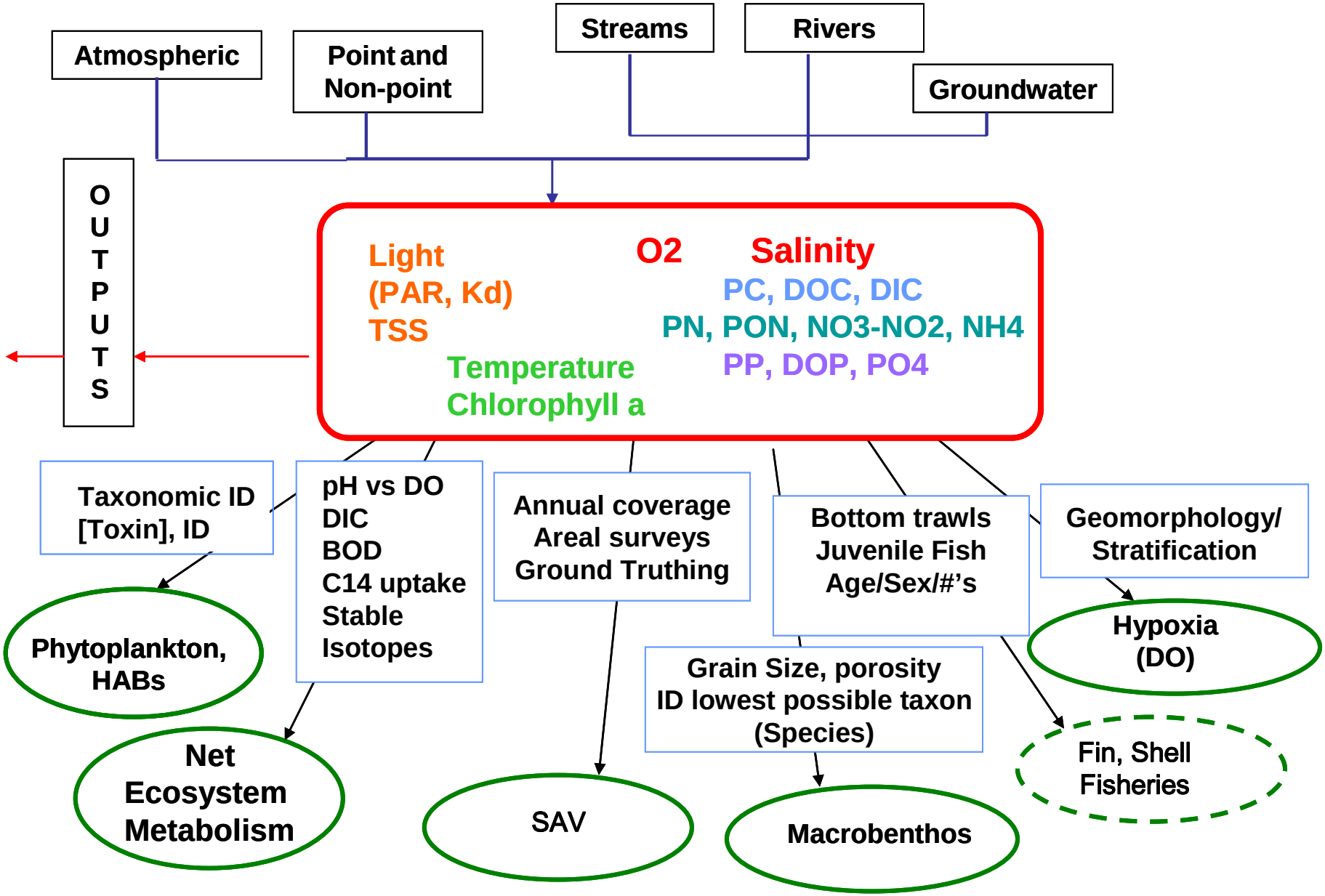


Figure 2: Endpoint Measurements

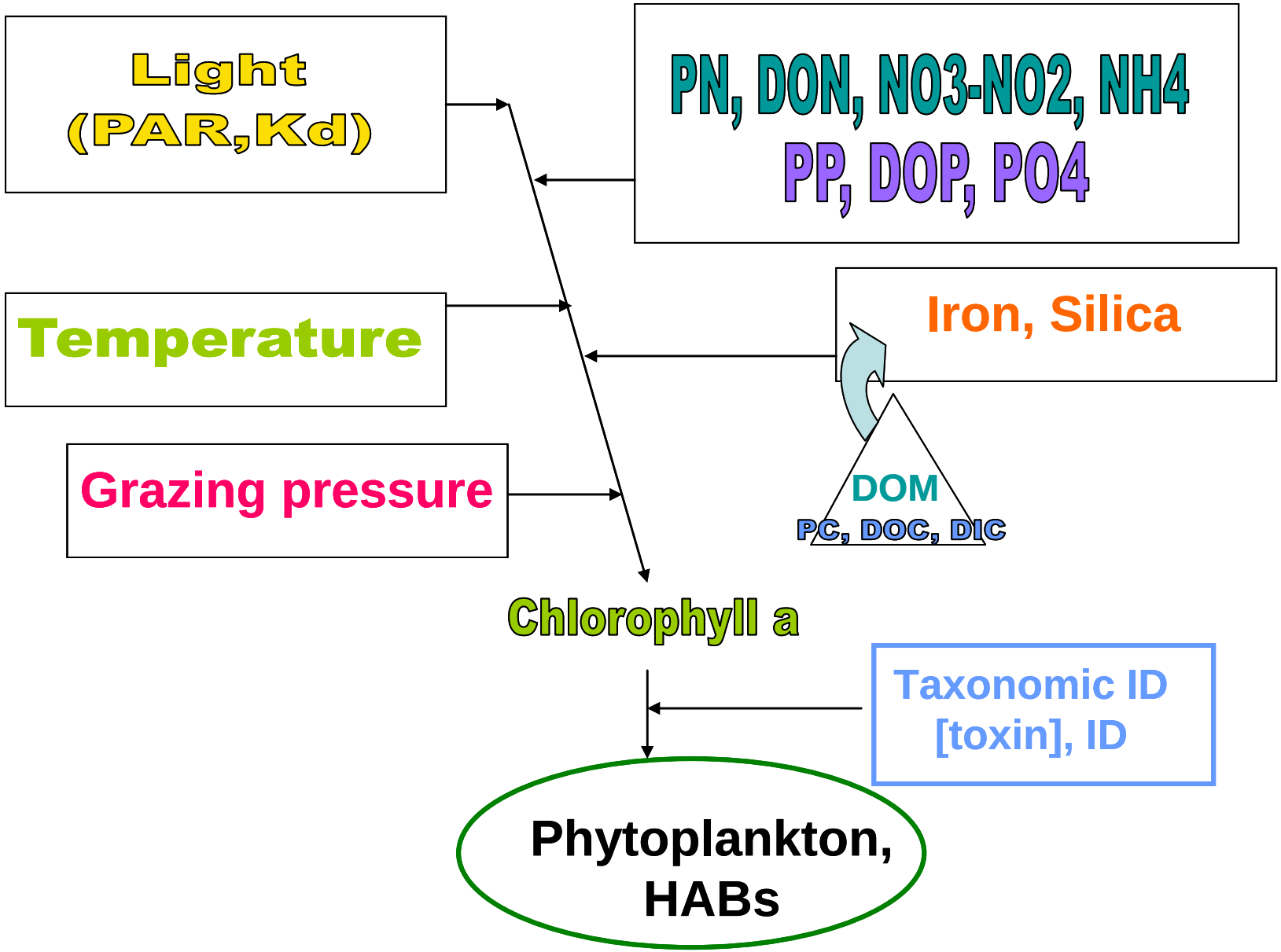
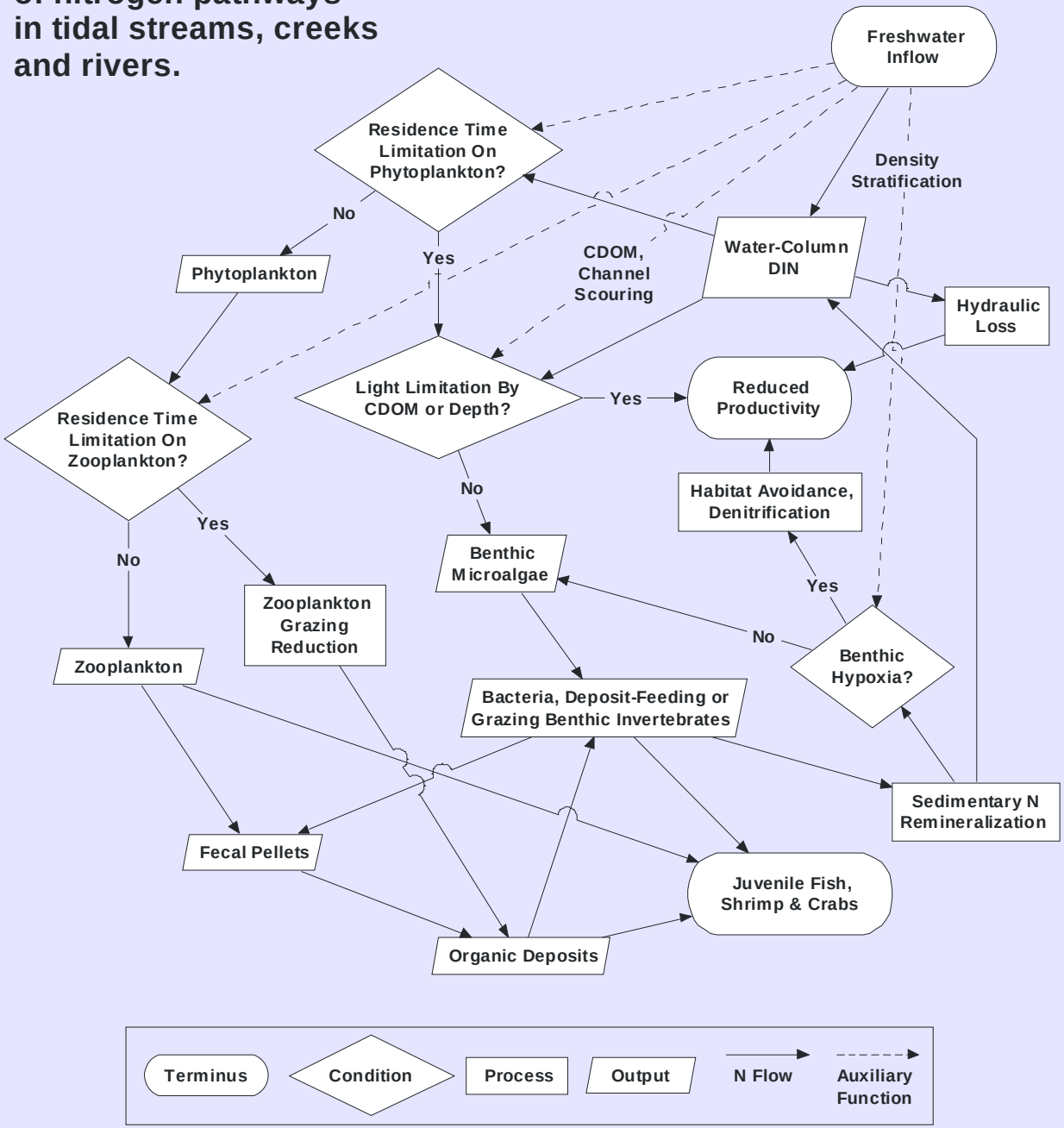
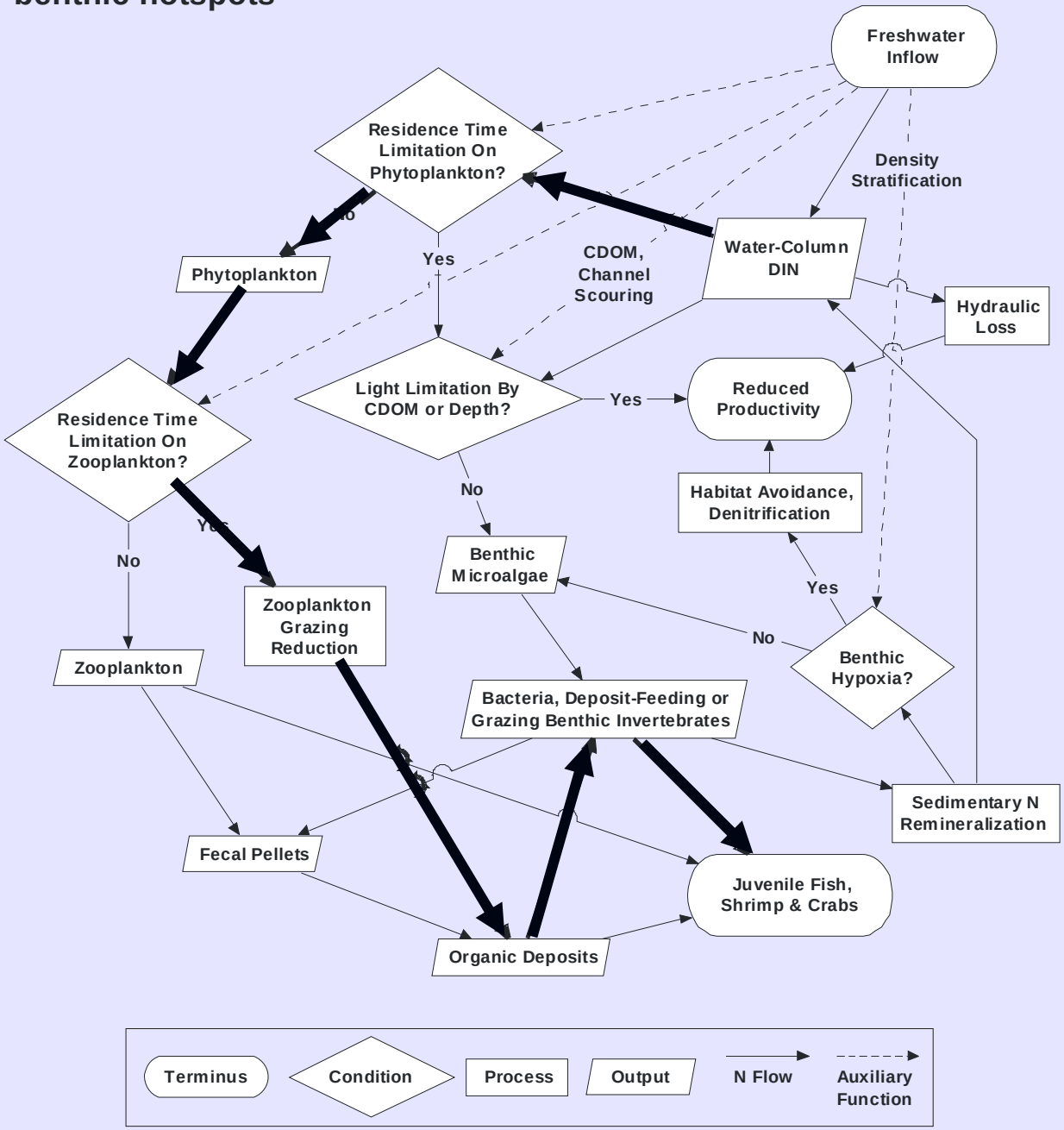


Figure 3: Endpoint relationship to pathway measurements

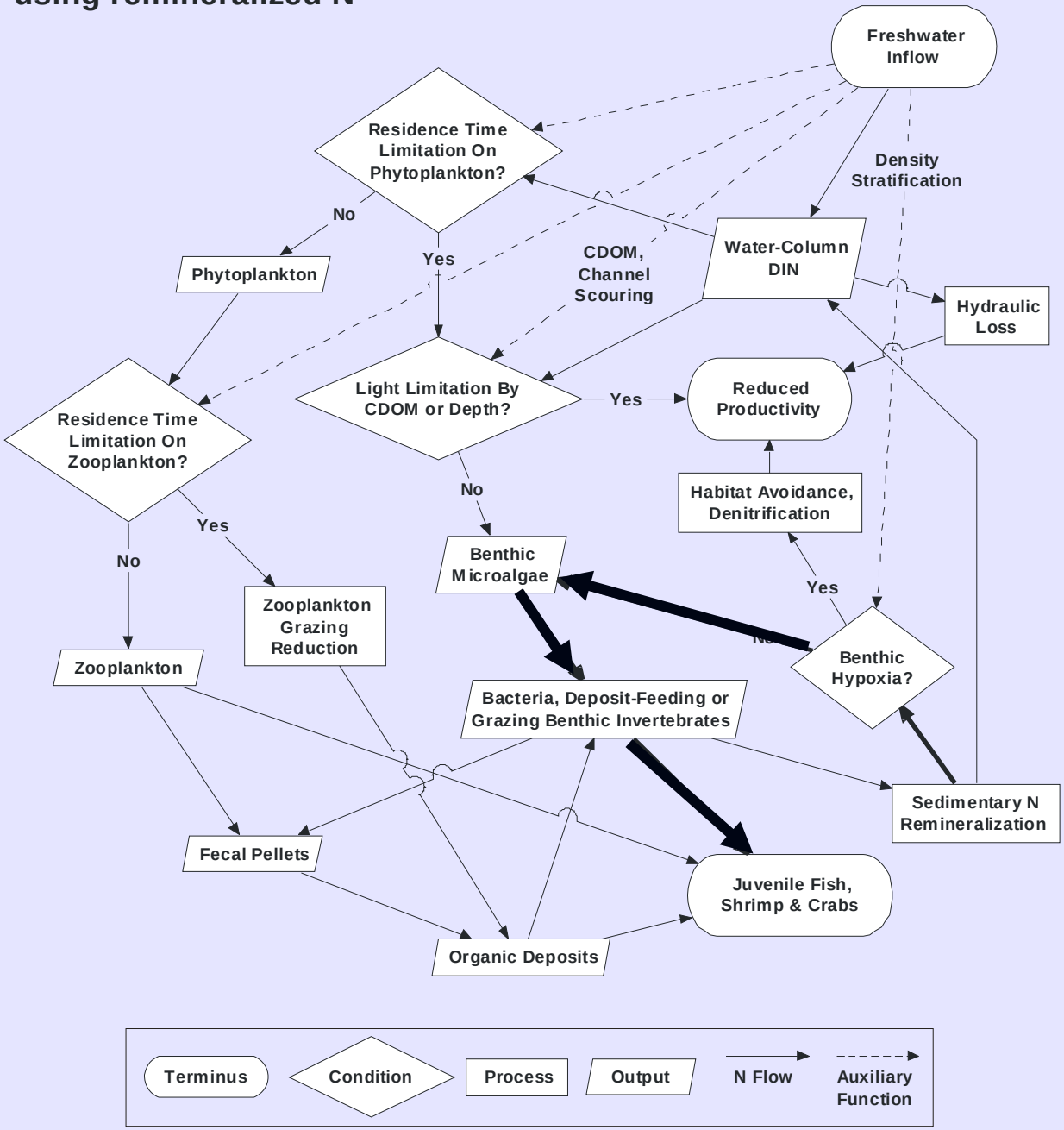
Conceptual model of nitrogen pathways in tidal streams, creeks and rivers.



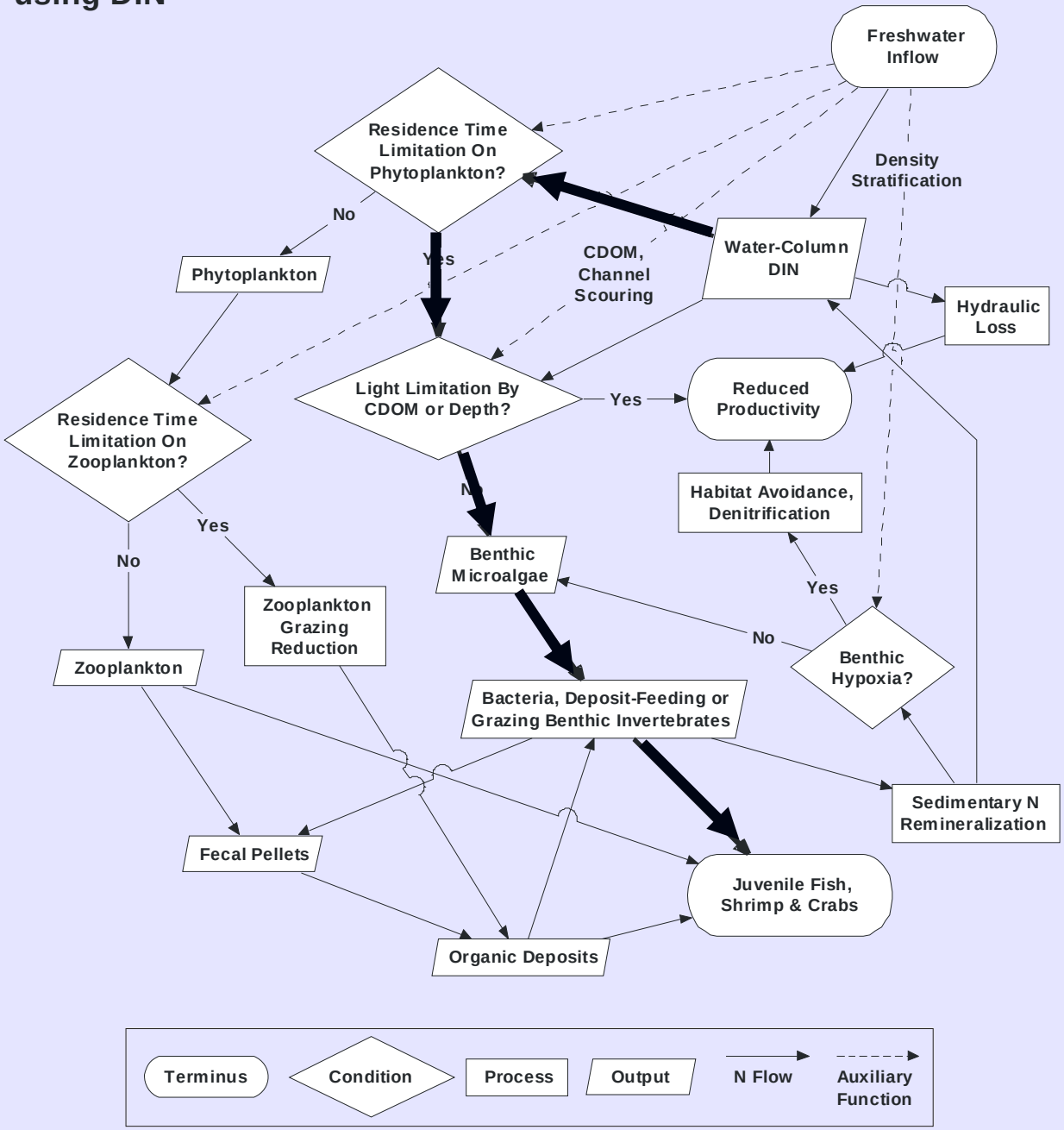
Phytoplankton-derived benthic hotspots



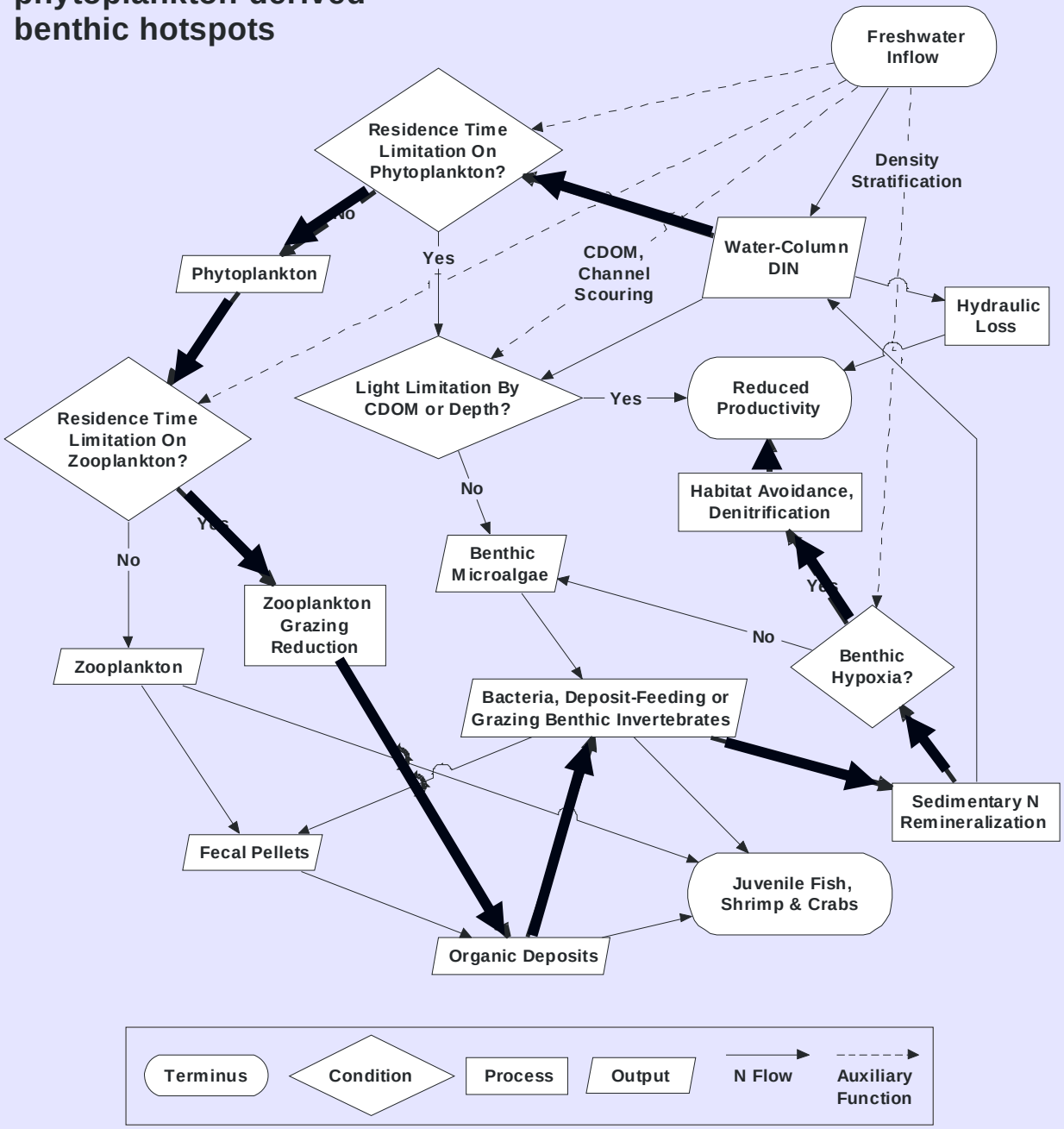
Benthic microalgae using remineralized N



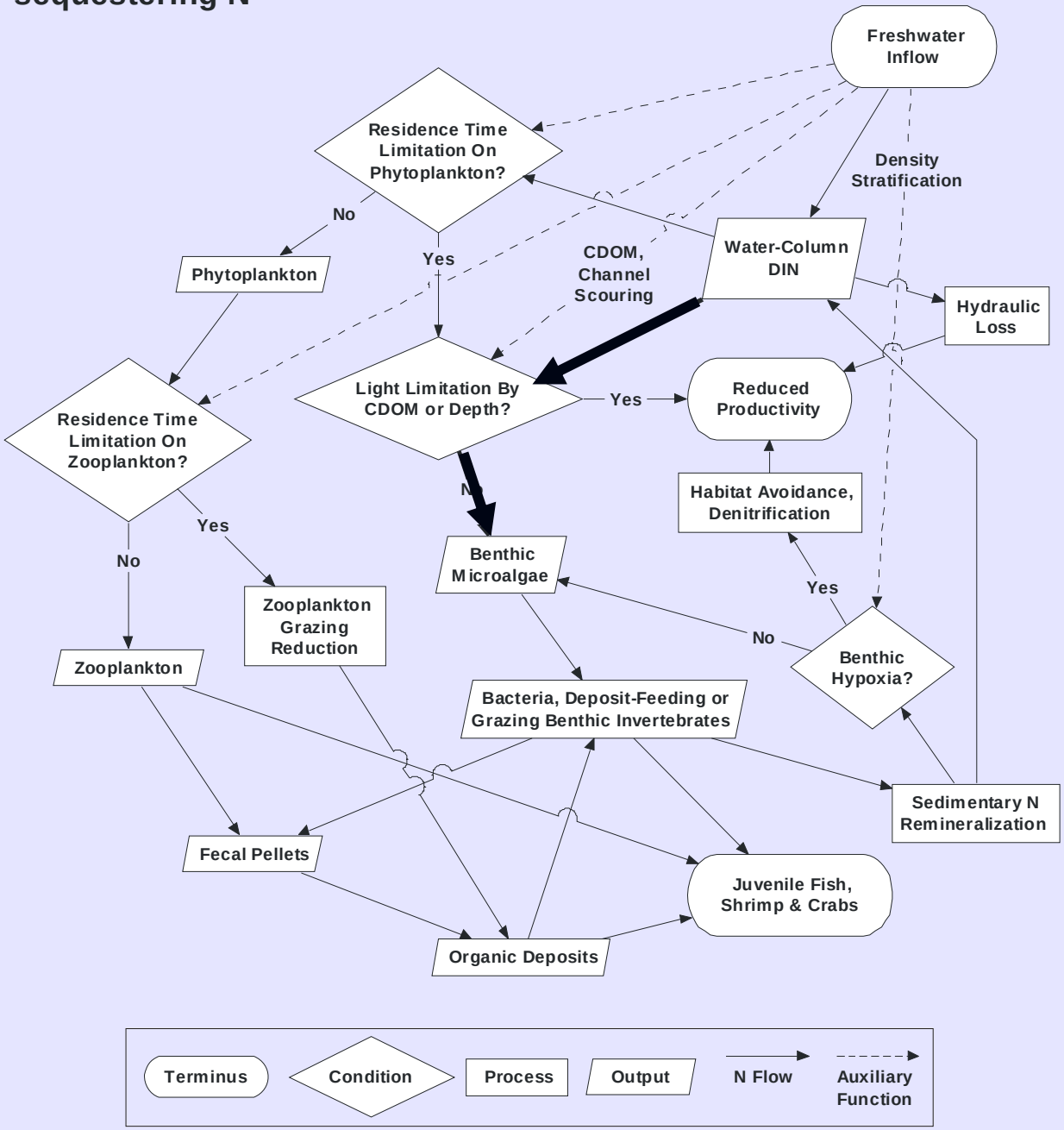
Up-estuary benthic microalgae using DIN



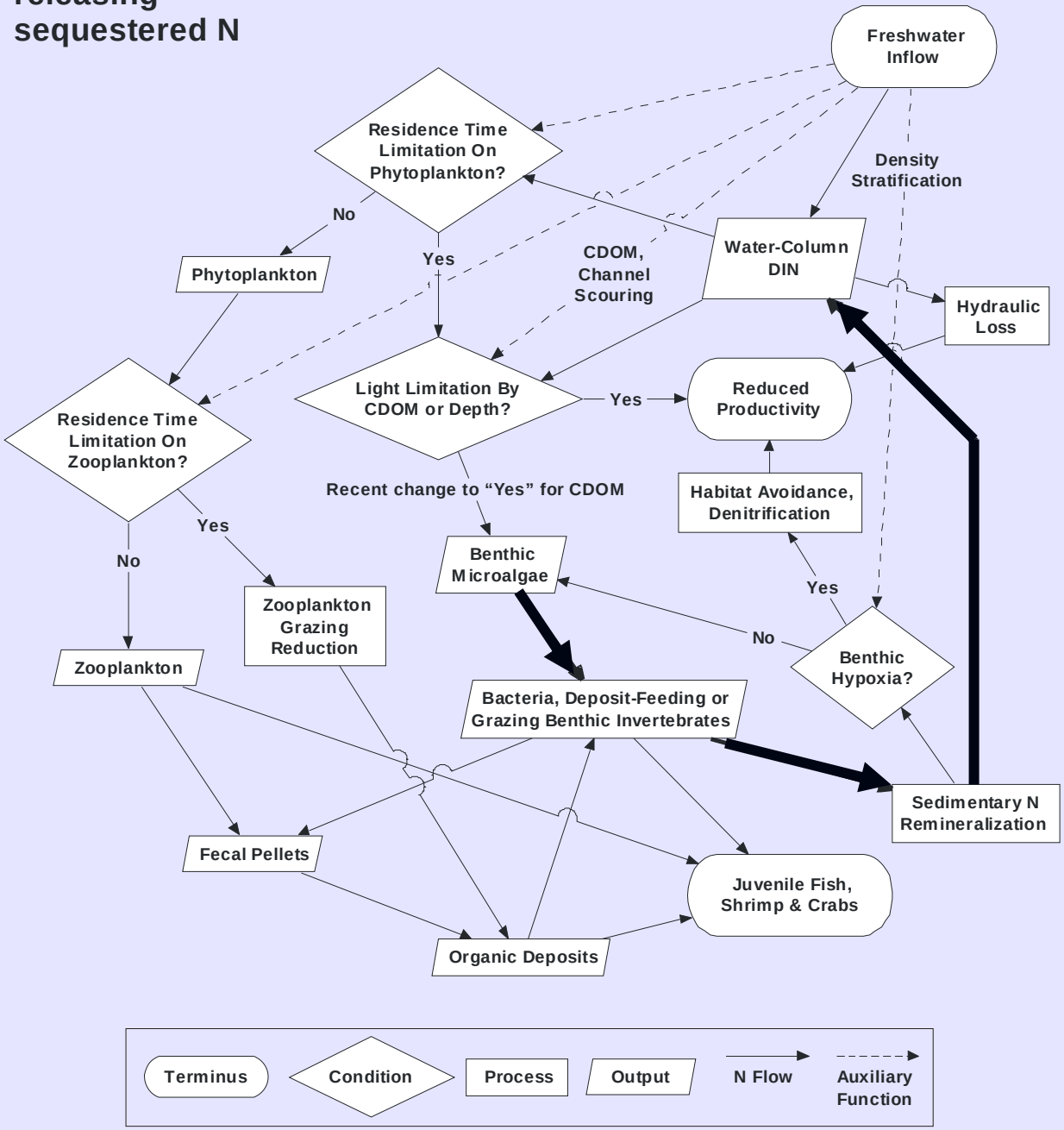
Overloaded phytoplankton-derived benthic hotspots



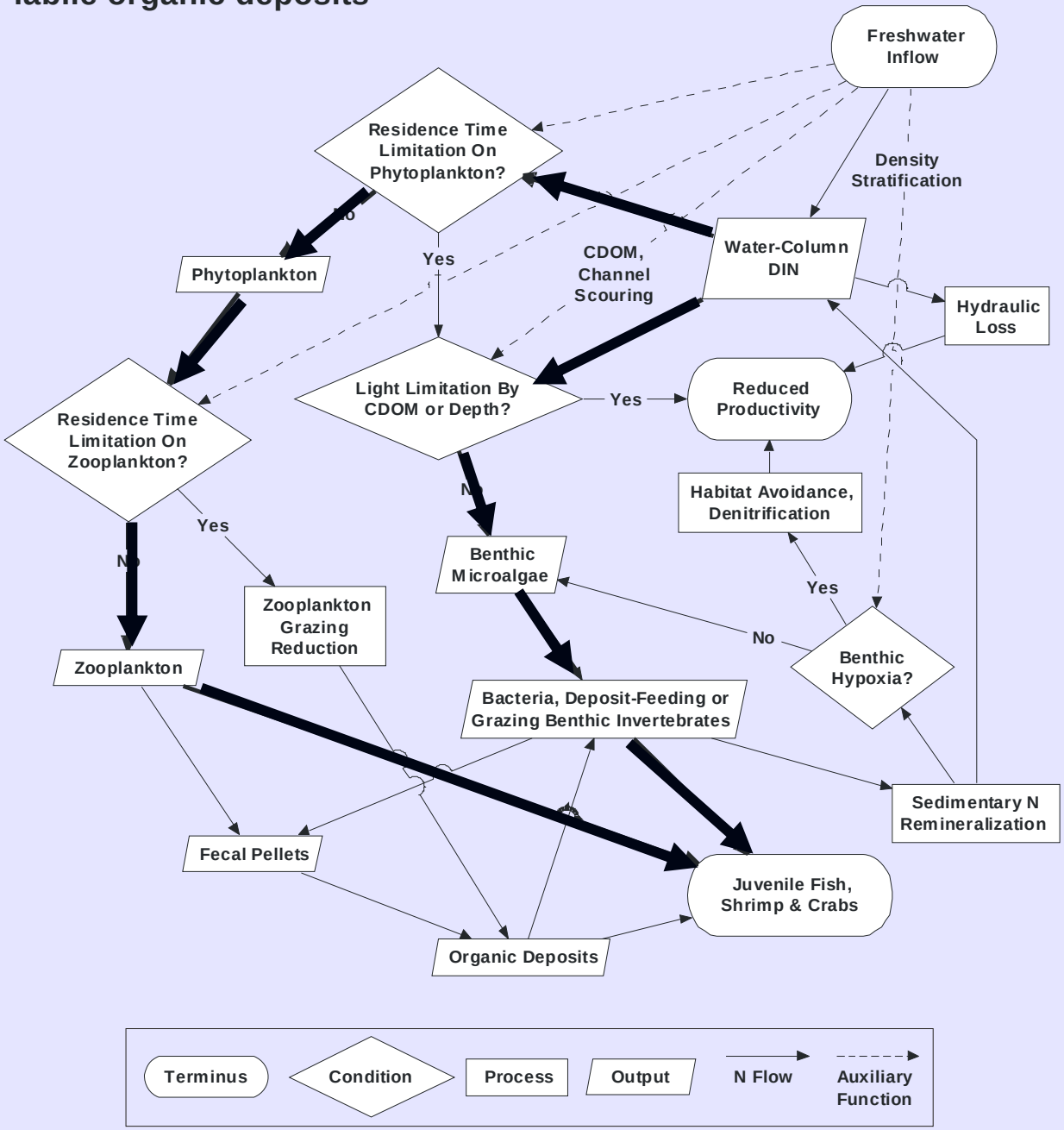
Benthic microalgae sequestering N



Benthic microalgae releasing sequestered N



Locations without labile organic deposits



Approach:

- Based on the conceptual model, devise a 1-yr ‘core’ study design intended to provide information at multiple levels:

Approach:

- ***System-Specific Interim Products***
  - **1) 3D or 4D hydrodynamic model**
  - **2) WQ box models of gross nutrient flux and transport with higher resolution WQ box or 3D models at "critical points".**

Approach:

- ***System-Specific Final Products***
  - **1) Within a system, study design will research best ecological endpoints, best methods to measure indicators of those endpoints, and best methods to measure phys-chem parameters.**

Approach:

- ***System-Specific Final Products***
  - **2) Establish cause-effect linkages between nutrients and ecological endpoints, providing a basis for establishing nutrient criteria.**

Approach:

- ***Between-System Products***
  - 1) Comparison of effectiveness of ecological endpoints across system types as detectors of nutrient impairment
  - 2) Comparison of model performance in different system types

Approach:

- ***Between-System Products***
  - 3) Comparison of performance of physical-chemical and biological measurement methods (e.g, precision, accuracy) under different conditions.

Approach:

- ***Between-System Products***
  - **4) Identification of the minimum set of physical, chemical and biological measurements that, collected in any system, will provide sufficient information to allow legally-defensible nutrient criteria to be established.**

Approach:

Available resources for pilots include:

- **A) NASA satellite imagery support for model validation and spatial and temporal interpolation of chlorophyll, color, turbidity, etc. (w/ground truthing and calibration).**
- **B) USGS support for quantifying nutrient fluxes into systems**

Approach:

Available resources for pilots include:

- **C) University support for determining productivity:respiration ratios (through isotopic measurements) to examine basic system function and level of nutrient "stress".**

Approach:

- Trial the core study design in one of the chosen systems.
  - Select a system already having as much as possible of the monitoring and information (models, etc.) called for by the study design. Fund the gaps.
- Improve the core design as appropriate

Approach:

- Use the modified core study design in the remaining ‘most-different” types of estuary or coastal systems.
  - Again, choose those systems already having as much of the monitoring and information called for as possible. Fund the gaps.

Approach:

- Compare the results among the systems studied to identify the simplest, least expensive study that should work anywhere within the Gulf (and perhaps beyond)…the oceanographic bounding-box approach.

Bounding Box approach

Hypersaline lagoons

Tropical mangroves

Low-salinity marsh estuary

Etc.

Approach:

- Subsequently, optimize the methods for use with specific types of systems. This should result in <u>simpler, less expensive methods</u> <u>that retain the legal defensibility of the full study</u>.

Approach:

- This approach requires comparable data.
- GOMA has launched Gulf-wide methods-standardization efforts that include analytical and field round robins to provide data comparability.

Please Help Us:

PATHWAYS

ENDPOINTS

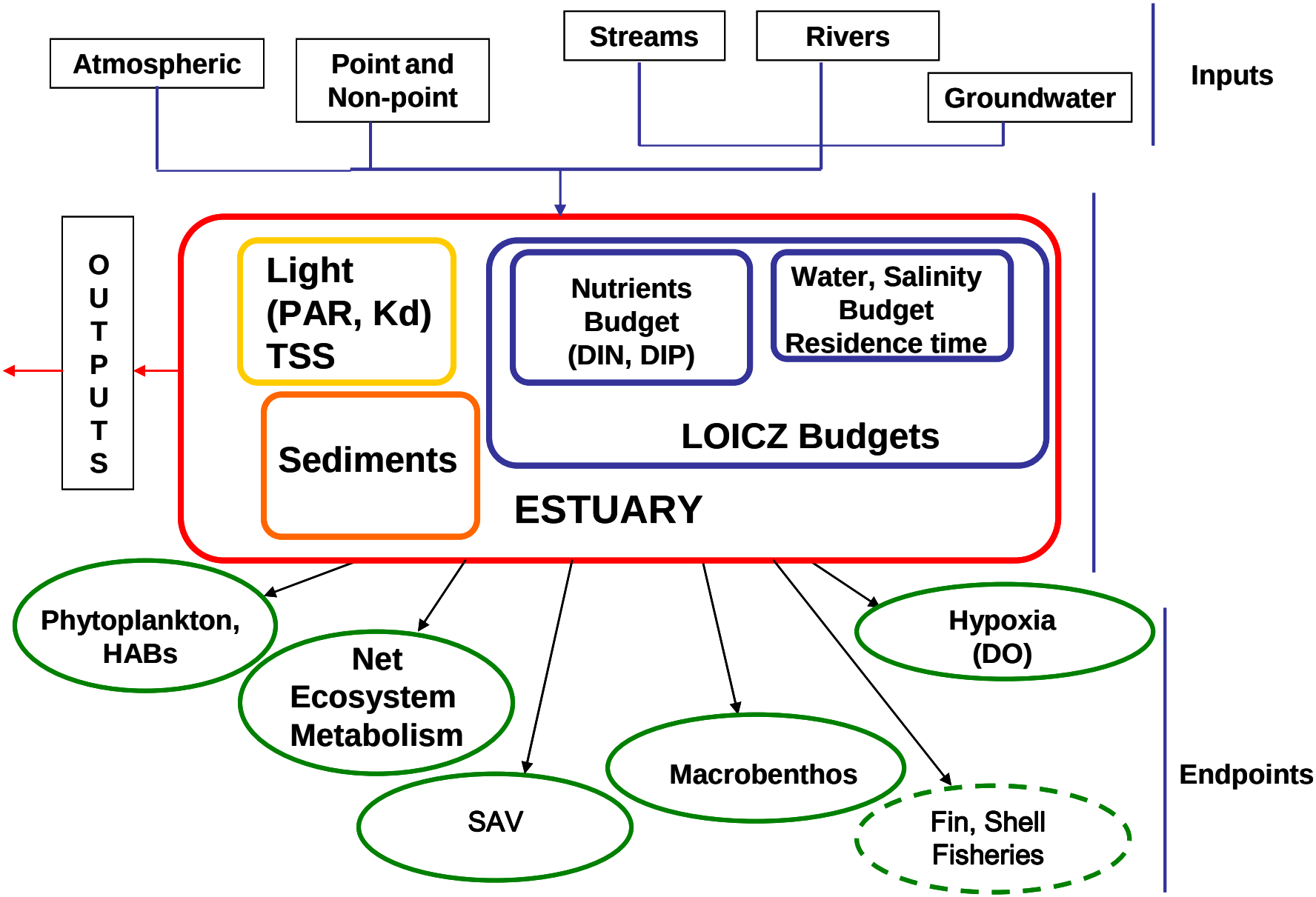


Figure 1: Overview

Please Tell Us:

PATHWAYS:

- Have all appropriate pathways been identified? Are there compelling reasons to eliminate of add additional pathways? Is/are there a preferred pathway(s) that can capture nutrient-estuary relations most efficiently from a management perspective?

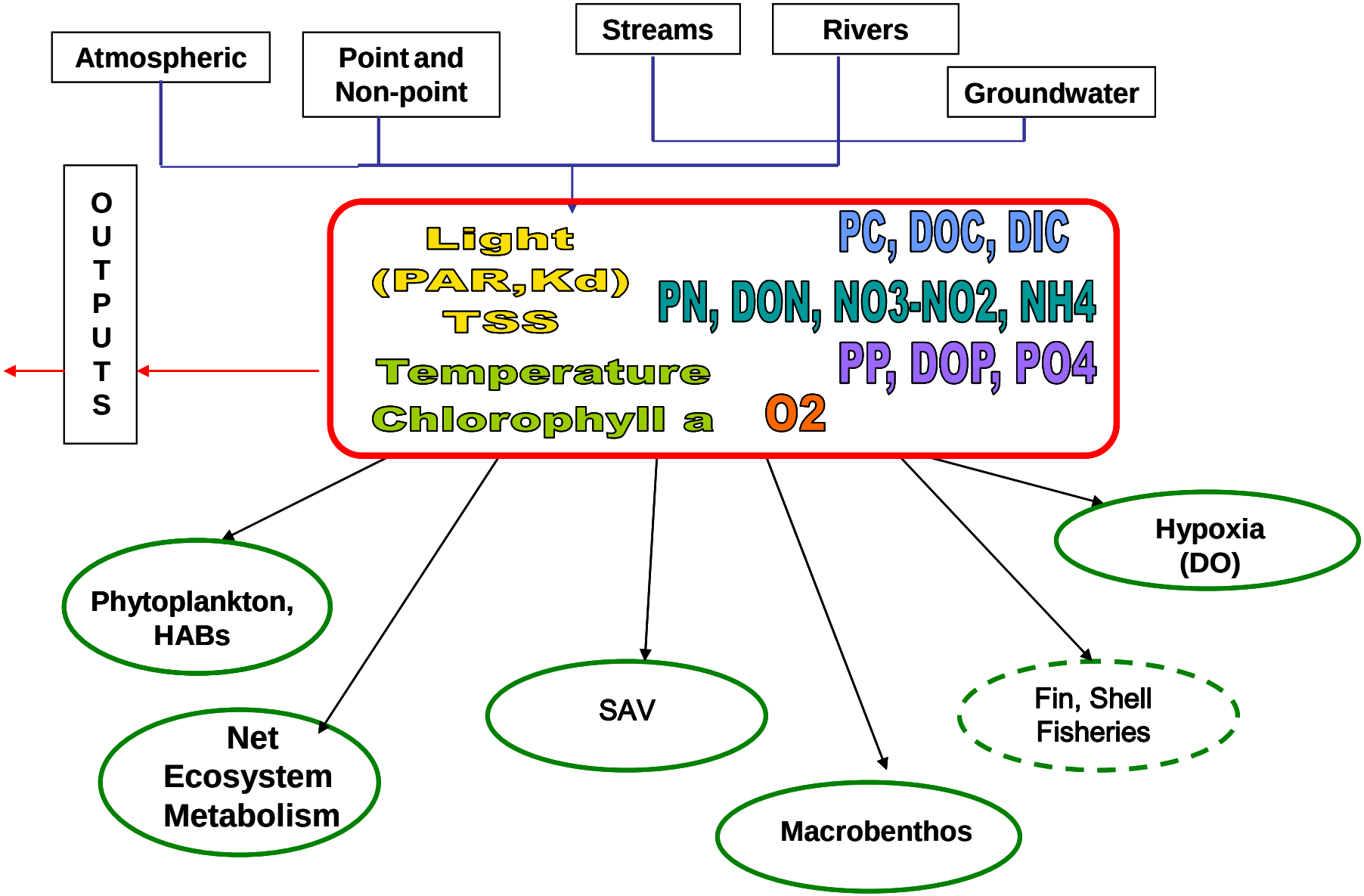


Figure 2: Pathway measurements

Please Help Us:

ENDPOINTS:

- Have all appropriate ecological endpoints been identified? Are there compelling reasons to eliminate or add additional endpoints? Is/are there a preferred endpoint(s) [with rationale for selecting]?

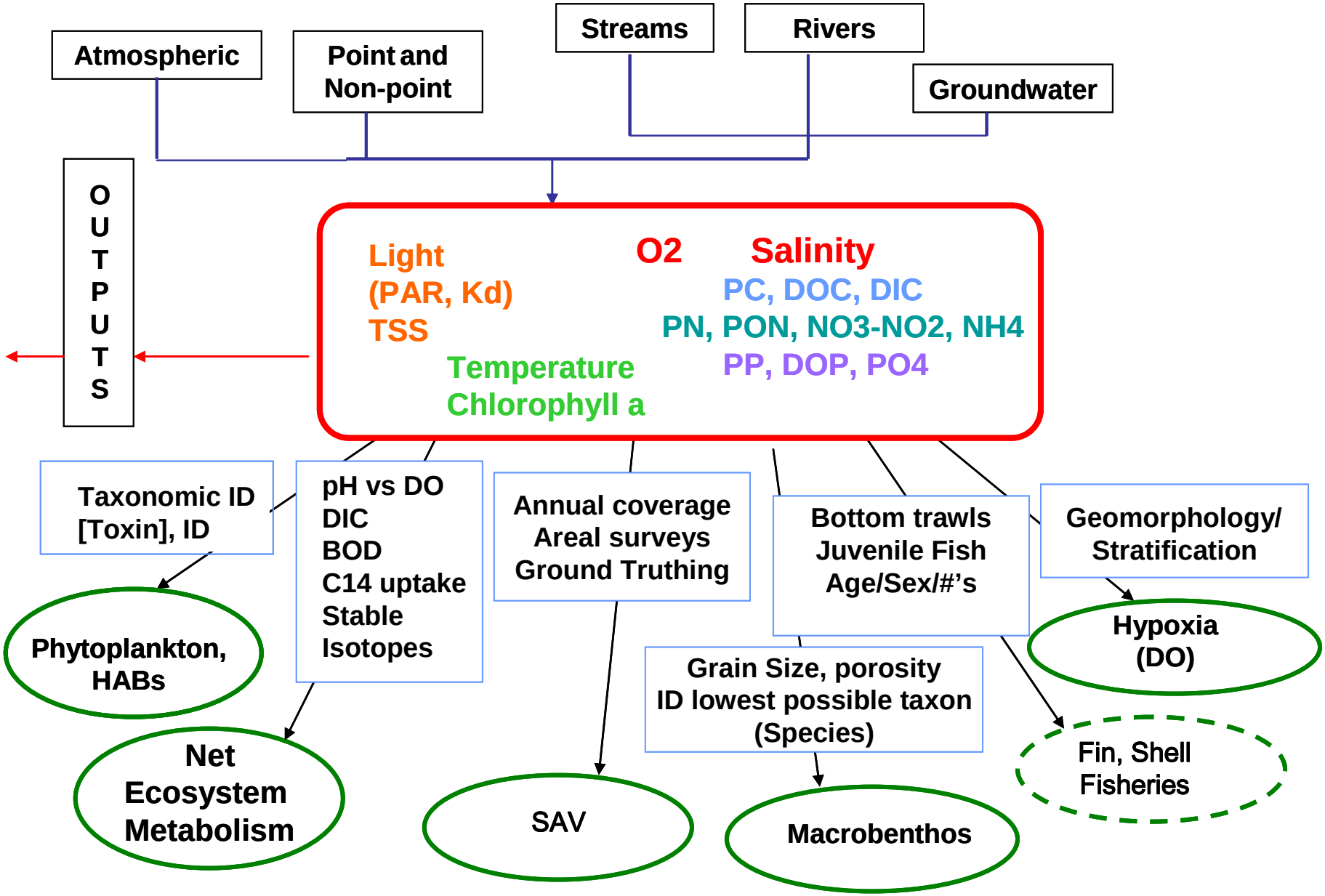


Figure 2: Endpoint Measurements

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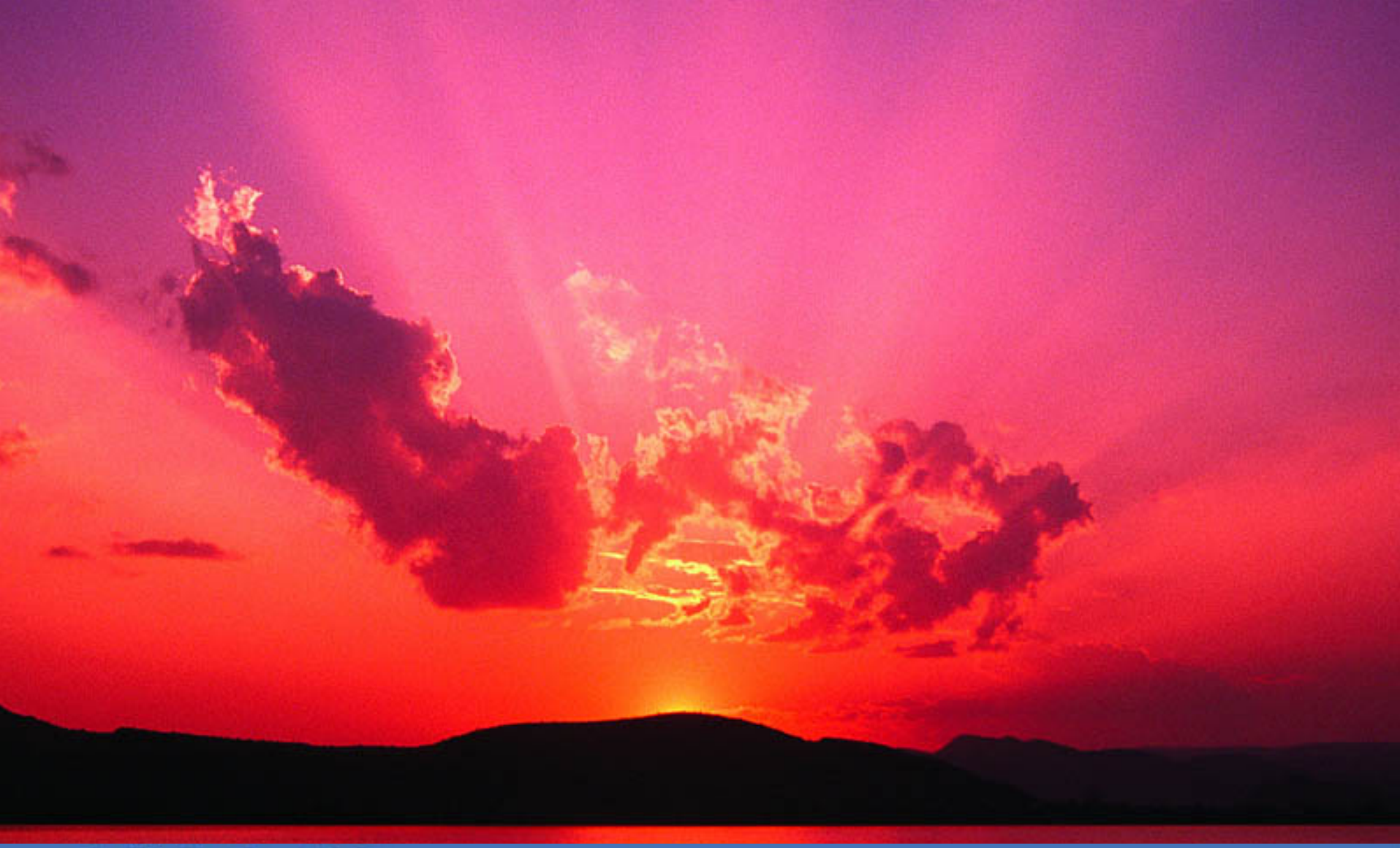

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US OAP Gulf of Mexico Regional Partnership

Alliance Working Website