CONCEPTUAL ECOSYSTEM MODEL

FIRE ISLAND INLET MONTAUK POINT
STORM DAMAGE REDUCTION STUDY

March 2006

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U.S. Army Corps of Engineers

WHAT IS A CONCEPTUAL MODEL?

- Pathway diagram that depicts relationships between initial source (driver) of environmental effect or change (stressor) and potential environmental components (endpoints) that may be affected

- Assessment tool used to delineate complete linkages or pathways between important drivers, stressors and endpoints that should be further investigated

Conceptual Model for Fire Island Inlet to Montauk Point (FIMP)

- The individual, habitat-based models are intended to describe the relationships among the natural biotic, abiotic (physical, geological and chemical), and anthropogenic components of the south shore ecosystem in sufficient detail to assess the ecological implications of management decisions associated with the plan.

- The FIMP Conceptual Model represents a tool to focus the Environmental Impact Assessment for the project on relevant pathways.

Phase 1 of FIMP Conceptual Model Development

- Foundation for the conceptual models
- Systematic identification, of all drivers, stressors and endpoints for all habitats and ecosystems within the FIMP Study Area
- Identification of idealized transect of habitats
- Development of habitat level stressor/effects matrices and preliminary Phase 1 conceptual models

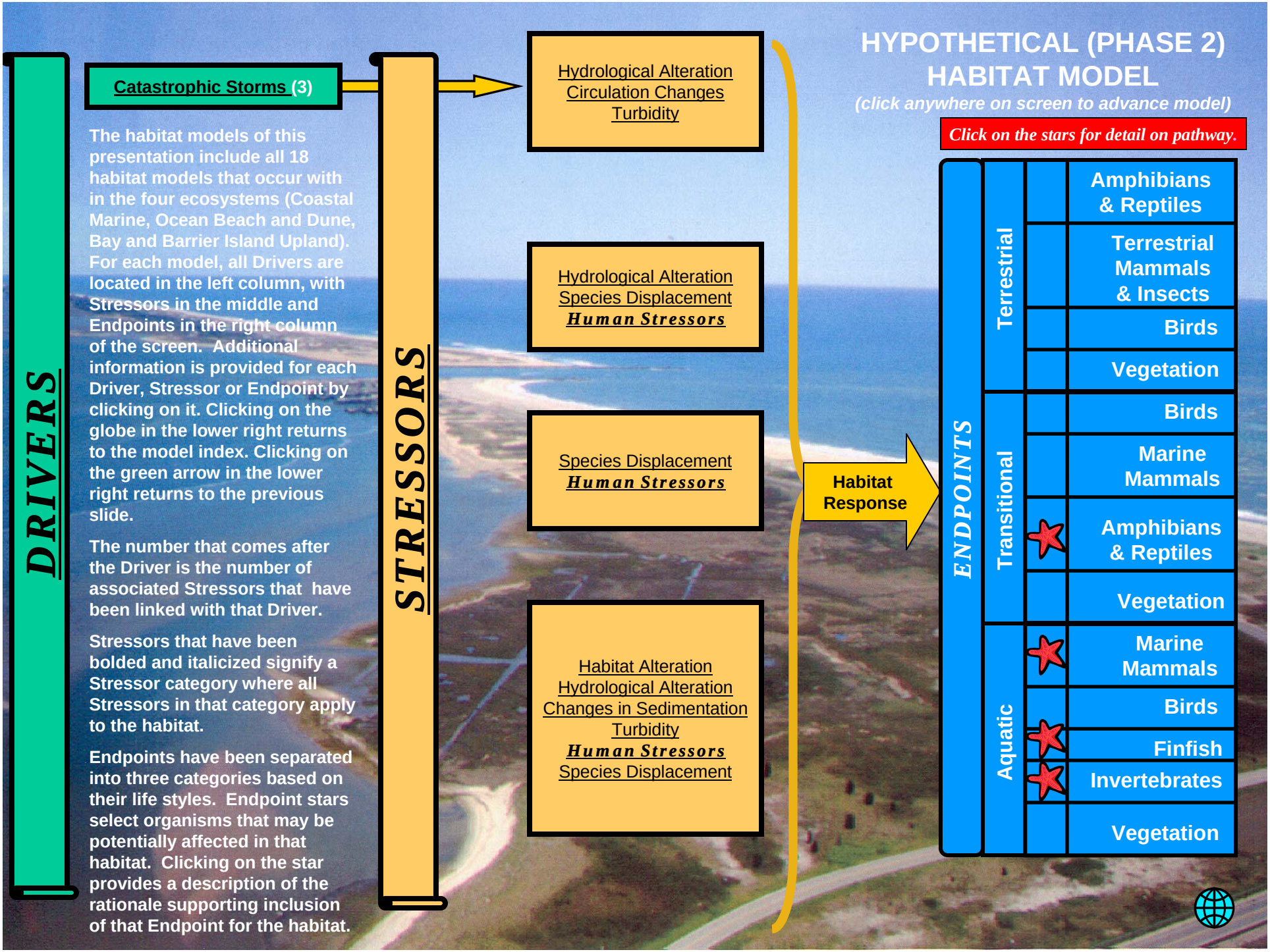
Phase 2 of FIMP Conceptual Model Development

- Refined the list of relevant Phase 1 ecosystems, habitats, drivers, stressors, and endpoints

- Habitat model development for 14 habitats in 4 ecosystems of the FIMP Study Area for a total of 18 models

- Models were more applicable to range of habitats and management options under consideration

Click for next slide showing hypothetical Phase 2 Model


HYPOTHETICAL (PHASE 2) HABITAT MODEL
(click anywhere on screen to advance model)
Click on the stars for detail on pathway.
DRIVERS
Catastrophic Storms (3)
STRESSORS
Hydrological Alteration
Circulation Changes
Turbidity
Hydrological Alteration
Species Displacement
Human Stressors
Species Displacement
Human Stressors
Habitat Alteration
Hydrological Alteration
Changes in Sedimentation
Turbidity
Human Stressors
Species Displacement
Habitat Response
ENDPOINTS
Terrestrial
Amphibians & Reptiles
Terrestrial Mammals & Insects
Birds
Vegetation
Transitional
Birds
Marine Mammals
Amphibians & Reptiles
Vegetation
Aquatic
Marine Mammals
Birds
Finfish
Invertebrates
Vegetation
The habitat models of this presentation include all 18 habitat models that occur with in the four ecosystems (Coastal Marine, Ocean Beach and Dune, Bay and Barrier Island Upland). For each model, all Drivers are located in the left column, with Stressors in the middle and Endpoints in the right column of the screen. Additional information is provided for each Driver, Stressor or Endpoint by clicking on it. Clicking on the globe in the lower right returns to the model index. Clicking on the green arrow in the lower right returns to the previous slide.
The number that comes after the Driver is the number of associated Stressors that have been linked with that Driver.
Stressors that have been bolded and italicized signify a Stressor category where all Stressors in that category apply to the habitat.
Endpoints have been separated into three categories based on their life styles. Endpoint stars select organisms that may be potentially affected in that habitat. Clicking on the star provides a description of the rationale supporting inclusion of that Endpoint for the habitat.

Phase 3 of FIMP Conceptual Model Development

- Habitat-based assessment model development for 13 storm damage reduction and restoration features associated with the FIMP Project
- Identification and characterization of idealized transects for the study area
- Considered development of additional habitat-specific models if needed
- Identification of relevant habitats and endpoints for each project feature or combination of features
- Complete pathway or linkage delineation for each project feature model that should be addressed in the EIS

Click for next slide showing hypothetical Phase 3 Model

HYPOTHETICAL (PHASE 3) STORM DAMAGE AND RESTORATION FEATURE ASSESSMENT MODEL

HABITATS

Marine Beaches (2)

The assessment models of this presentation incorporate the 13 storm damage reduction and restoration features. For the Phase 3 Models, all habitats are located in the left column, with Stressors in the middle and Endpoints in the right column of the screen. Clicking on the globe in the lower right returns to the appropriate model index.

The Phase 3 Models are designed in a similar format as the Phase 2 Models.

This presentation is not intended to be viewed as a slide show, but rather an interactive model that allows you walk through the model.

STRESSORS

Species Displacement
Human Stressors

Habitat Alteration
Hydrological Alteration
Turbidity
Human Stressors
Species Displacement

HABITAT RESPONSE

ENDPOINTS

		Marine Nearshore	Marine Intertidal	Marine Beach	Dunes & Swales
Aquatic	Vegetation	-	1(1)	-	-
	Invertebrates	3	1	-	-
	Finfish	3	3	-	-
	Birds	3	3	-	-
	Marine Mammals	-	2	-	-
Transitional	Vegetation	-	-	3(2)	3(2)
	Amphibians & Reptiles	-	-	-	-
	Marine Mammals	-	2(1)	-	-
	Birds	-	3	3(2)	

Organization of the Digital Model

The digital version of the FIMP Conceptual Model has been organized such that the following two slides provide indices to the 18 habitat, and 13 assessment models, respectively. Clicking on the name of any model will direct the viewer to that model. Clicking on any component of the model being viewed, will direct the viewer to additional information on that model component.

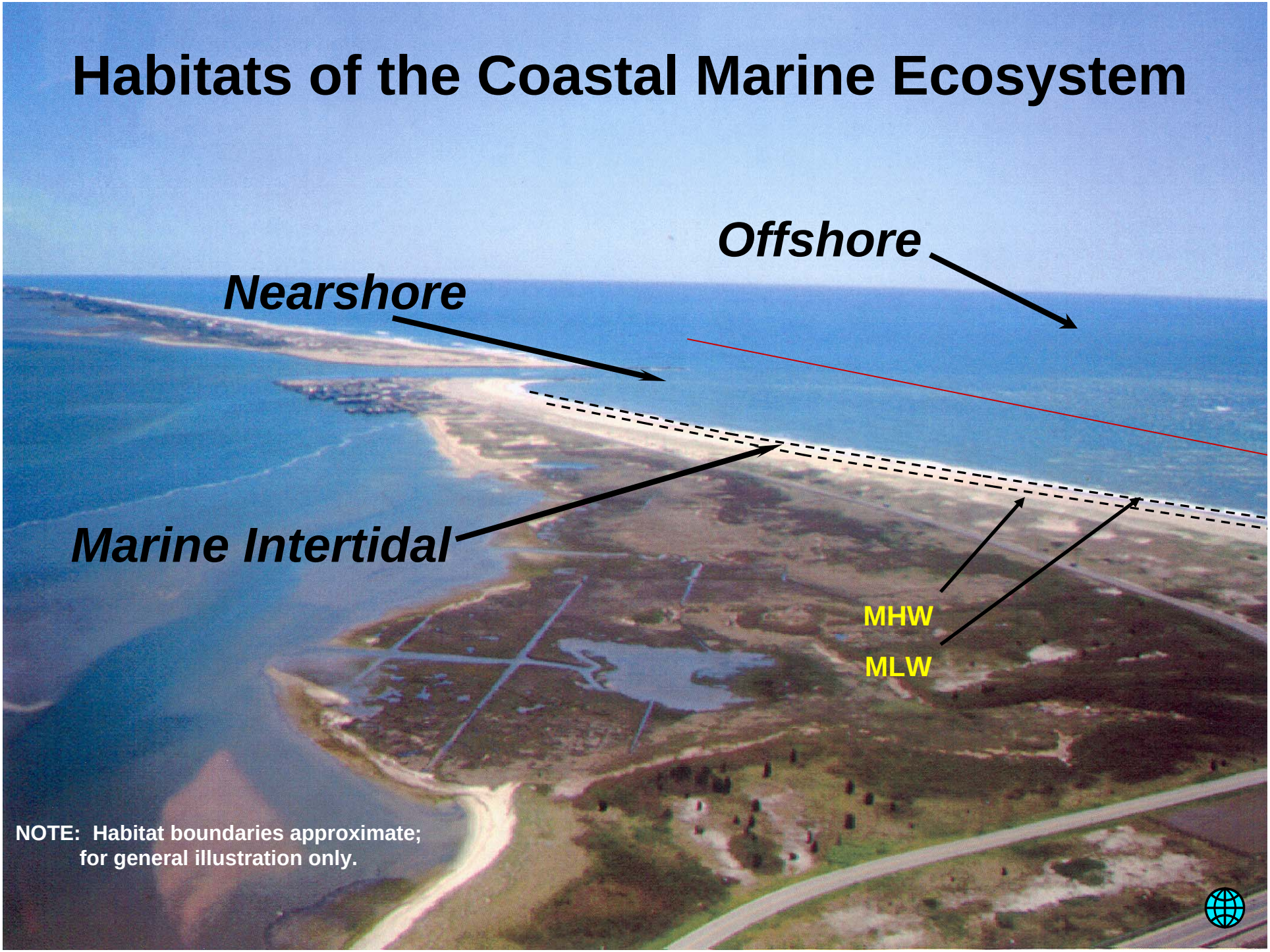
PHASE 2 HABITAT MODEL INDEX

- Image of the Coastal Marine Ecosystem (1)
  - Habitats of the Coastal Marine Ecosystem
    - Offshore Habitat
    - Nearshore Habitat
    - Marine Intertidal Habitat
    - Ecosystem Model
- Image of the Ocean Beach and Dune Ecosystem (1)
  - Habitats of the Ocean Beach and Dune Ecosystem
    - Marine Beach Habitat
    - Dunes and Swales Habitat
    - Ecosystem Model
- Images of the Bay Ecosystem (1) (2) (3)
  - Habitats of the Bay Ecosystem
    - Bay Intertidal Habitat
    - Sand Shoals and Mud Flats Habitat
    - Tidal Marsh Habitat
    - Bay Subtidal Habitat
    - SAV Habitat
    - Inlet Habitat
    - Ecosystem Model
- Images of the Barrier Island Ecosystem (1) (2)
  - Habitats of the Barrier Island Ecosystem
    - Terrestrial Upland Habitat
    - Bayside Beach Habitat
    - Maritime Forest Habitat
    - Ecosystem Model

PHASE 3 STORM DAMAGE AND RESTORATION FEATURES MODEL INDEX

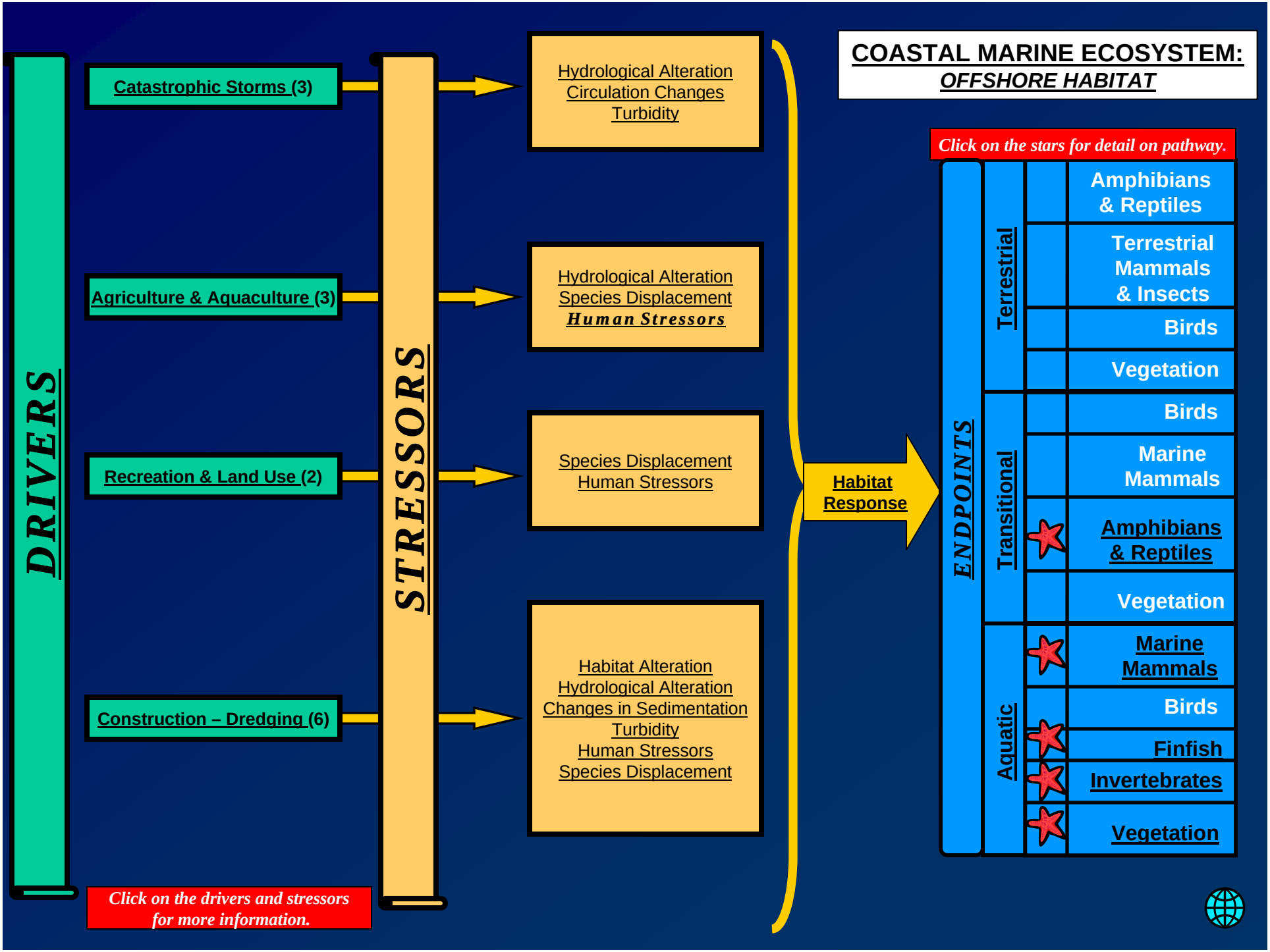
- Groin Alteration
- Groin Construction
- Beach Nourishment/Renourishment
- Dune Modification
- Dredging
- Bulkhead/Seawall
- Inlet Sand Bypass
- Structure Elevation and Relocation: Development
- Structure Elevation and Relocation: Construction-Soft
- Mainland Restoration
- Upland Restoration
- Bayside Shoreline
- Tidal Marsh Restoration
- SAV Restoration
- Assessment Model Development

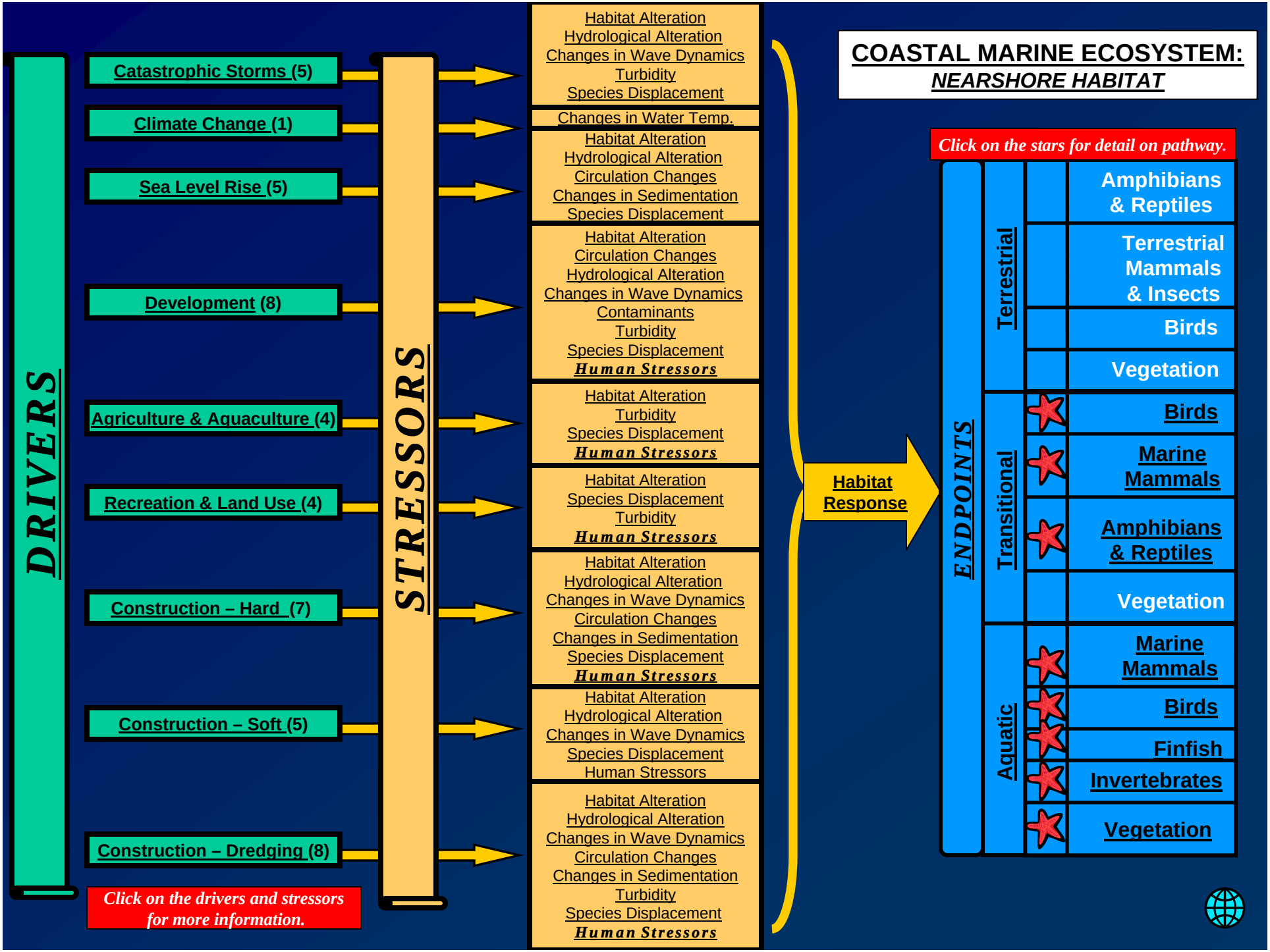
Habitats of the Coastal Marine Ecosystem

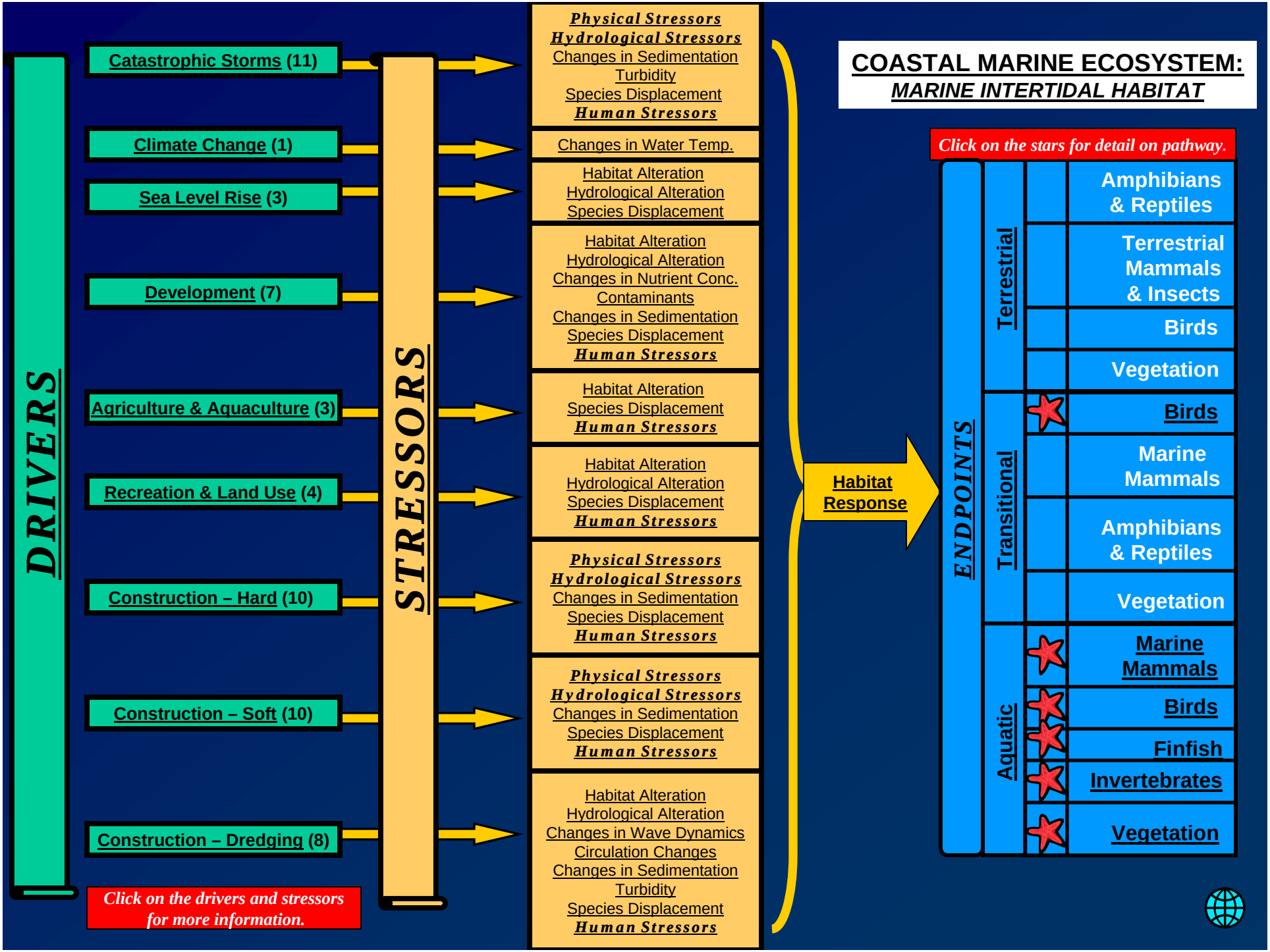


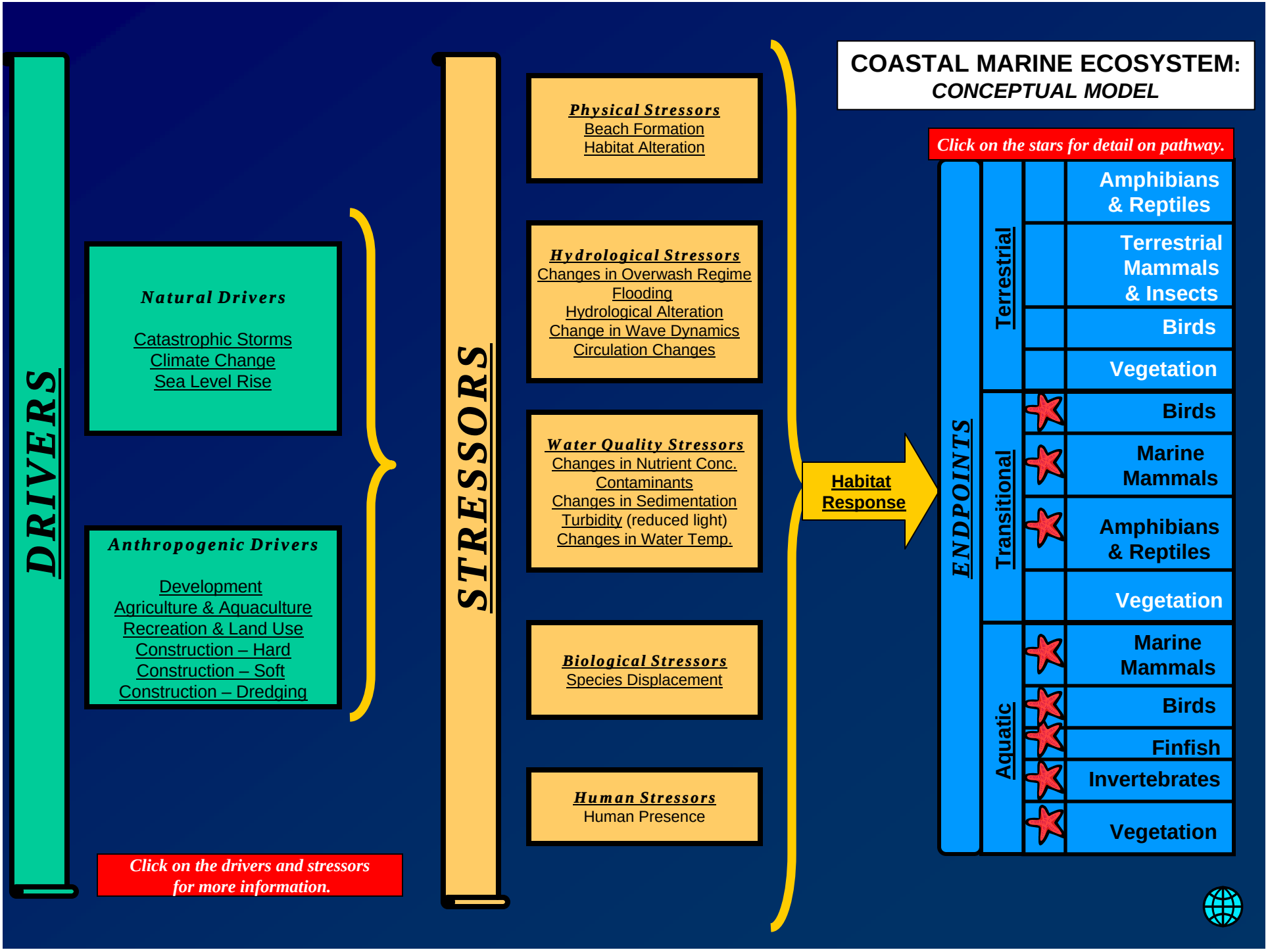
Habitats of the Coastal Marine Ecosystem

- **Offshore**
  - **Subtidal marine habitat ranging in depth from 10 to 30 meters; includes pelagic and benthic zones.**
- **Nearshore**
  - **MLW to depth of 10 meters; includes pelagic and benthic components.**
- **Marine Intertidal**
  - **Extends from the boundary of the Marine Nearshore at MLW, to MHW; sandy substrate.**

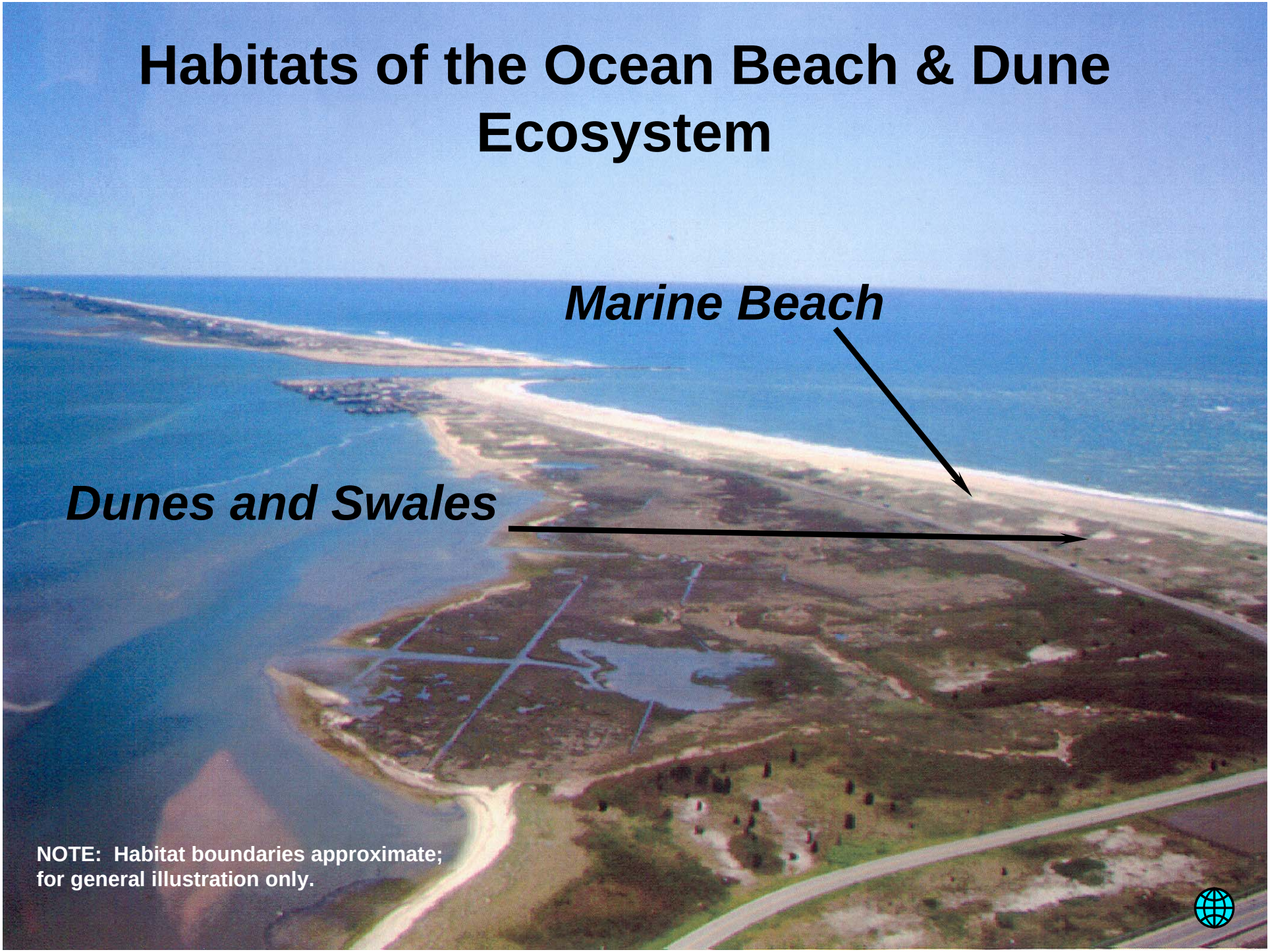

COASTAL MARINE ECOSYSTEM:
OFFSHORE HABITAT
DRIVERS
Catastrophic Storms (3)
Agriculture & Aquaculture (3)
Recreation & Land Use (2)
Construction – Dredging (6)
STRESSORS
Hydrological Alteration
Circulation Changes
Turbidity
Hydrological Alteration
Species Displacement
Human Stressors
Species Displacement
Human Stressors
Habitat Alteration
Hydrological Alteration
Changes in Sedimentation
Turbidity
Human Stressors
Species Displacement
Habitat Response
Click on the stars for detail on pathway.
ENDPOINTS
Terrestrial
Amphibians & Reptiles
Terrestrial Mammals & Insects
Birds
Vegetation
Transitional
Birds
Marine Mammals
Amphibians & Reptiles
Vegetation
Aquatic
Marine Mammals
Birds
Finfish
Invertebrates
Vegetation
Click on the drivers and stressors for more information.


DRIVERS
Catastrophic Storms (5)
Climate Change (1)
Sea Level Rise (5)
Development (8)
Agriculture & Aquaculture (4)
Recreation & Land Use (4)
Construction – Hard (7)
Construction – Soft (5)
Construction – Dredging (8)
Click on the drivers and stressors for more information.
STRESSORS
Habitat Alteration
Hydrological Alteration
Changes in Wave Dynamics
Turbidity
Species Displacement
Changes in Water Temp.
Habitat Alteration
Hydrological Alteration
Circulation Changes
Changes in Sedimentation
Species Displacement
Habitat Alteration
Circulation Changes
Hydrological Alteration
Changes in Wave Dynamics
Contaminants
Turbidity
Species Displacement
Human Stressors
Habitat Alteration
Turbidity
Species Displacement
Human Stressors
Habitat Alteration
Species Displacement
Turbidity
Human Stressors
Habitat Alteration
Hydrological Alteration
Changes in Wave Dynamics
Circulation Changes
Changes in Sedimentation
Species Displacement
Human Stressors
Habitat Alteration
Hydrological Alteration
Changes in Wave Dynamics
Species Displacement
Human Stressors
Habitat Alteration
Hydrological Alteration
Changes in Wave Dynamics
Circulation Changes
Changes in Sedimentation
Turbidity
Species Displacement
Human Stressors
Habitat Response
COASTAL MARINE ECOSYSTEM:
NEARSHORE HABITAT
Click on the stars for detail on pathway.
ENDPOINTS
Terrestrial
Amphibians & Reptiles
Terrestrial Mammals & Insects
Birds
Vegetation
Transitional
Birds
Marine Mammals
Amphibians & Reptiles
Vegetation
Aquatic
Marine Mammals
Birds
Finfish
Invertebrates
Vegetation


DRIVERS
Catastrophic Storms (11)
Climate Change (1)
Sea Level Rise (3)
Development (7)
Agriculture & Aquaculture (3)
Recreation & Land Use (4)
Construction – Hard (10)
Construction – Soft (10)
Construction – Dredging (8)
Click on the drivers and stressors for more information.
STRESSORS
Physical Stressors
Hydrological Stressors
Changes in Sedimentation
Turbidity
Species Displacement
Human Stressors
Changes in Water Temp.
Habitat Alteration
Hydrological Alteration
Species Displacement
Habitat Alteration
Hydrological Alteration
Changes in Nutrient Conc.
Contaminants
Changes in Sedimentation
Species Displacement
Human Stressors
Habitat Alteration
Species Displacement
Human Stressors
Habitat Alteration
Hydrological Alteration
Species Displacement
Human Stressors
Physical Stressors
Hydrological Stressors
Changes in Sedimentation
Species Displacement
Human Stressors
Physical Stressors
Hydrological Stressors
Changes in Sedimentation
Species Displacement
Human Stressors
Habitat Alteration
Hydrological Alteration
Changes in Wave Dynamics
Circulation Changes
Changes in Sedimentation
Turbidity
Species Displacement
Human Stressors
Habitat Response
COASTAL MARINE ECOSYSTEM:
MARINE INTERTIDAL HABITAT
Click on the stars for detail on pathway.
ENDPOINTS
Terrestrial
Amphibians & Reptiles
Terrestrial Mammals & Insects
Birds
Vegetation
Transitional
Birds
Marine Mammals
Amphibians & Reptiles
Vegetation
Aquatic
Marine Mammals
Birds
Finfish
Invertebrates
Vegetation

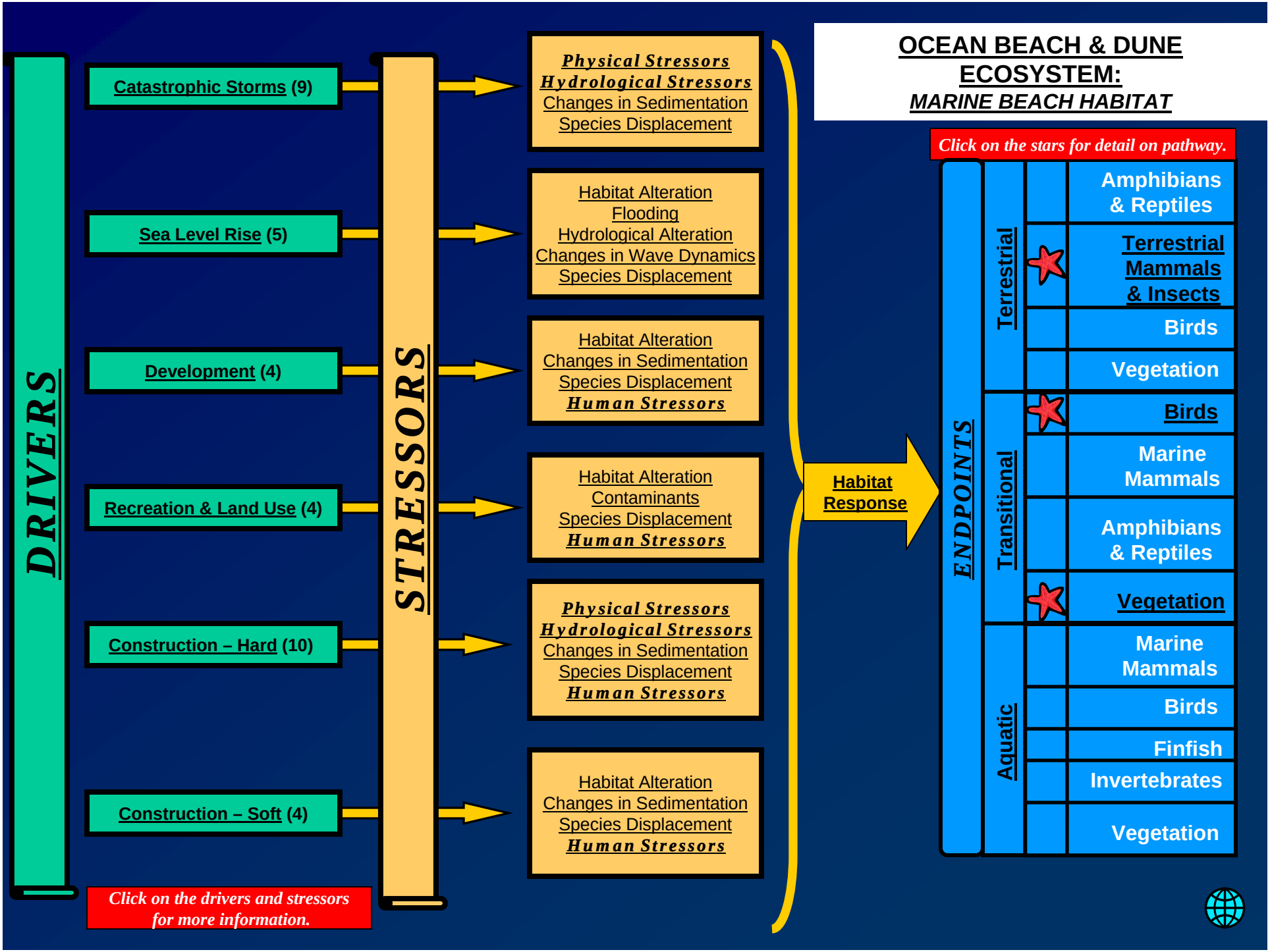

COASTAL MARINE ECOSYSTEM:
CONCEPTUAL MODEL
DRIVERS
Natural Drivers
Catastrophic Storms
Climate Change
Sea Level Rise
Anthropogenic Drivers
Development
Agriculture & Aquaculture
Recreation & Land Use
Construction – Hard
Construction – Soft
Construction – Dredging
Click on the drivers and stressors for more information.
STRESSORS
Physical Stressors
Beach Formation
Habitat Alteration
Hydrological Stressors
Changes in Overwash Regime
Flooding
Hydrological Alteration
Change in Wave Dynamics
Circulation Changes
Water Quality Stressors
Changes in Nutrient Conc.
Contaminants
Changes in Sedimentation
Turbidity (reduced light)
Changes in Water Temp.
Biological Stressors
Species Displacement
Human Stressors
Human Presence
Habitat Response
Click on the stars for detail on pathway.
ENDPOINTS
Terrestrial
Amphibians & Reptiles
Terrestrial Mammals & Insects
Birds
Vegetation
Transitional
Birds
Marine Mammals
Amphibians & Reptiles
Vegetation
Aquatic
Marine Mammals
Birds
Finfish
Invertebrates
Vegetation

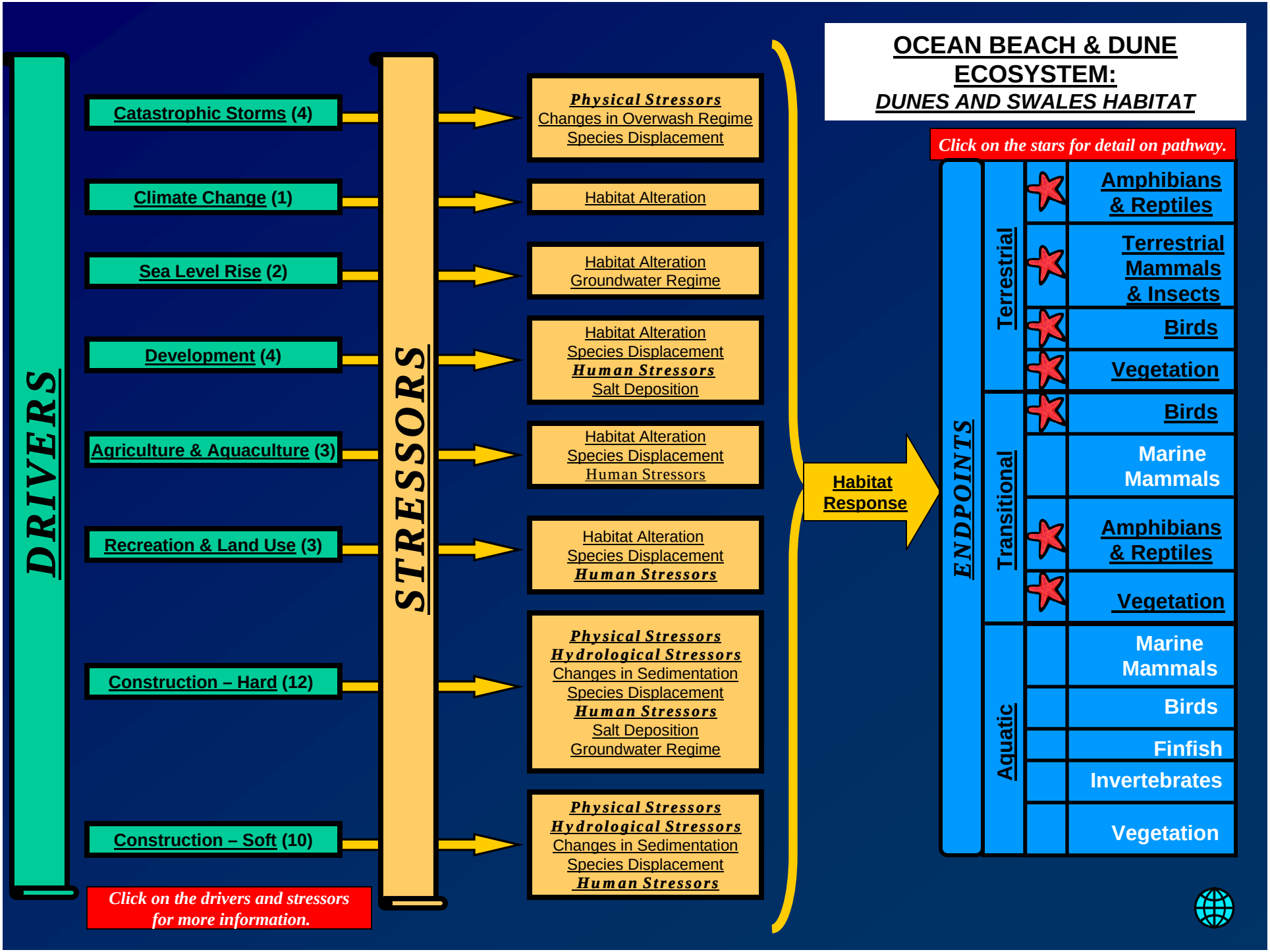
Habitats of the Ocean Beach & Dune Ecosystem

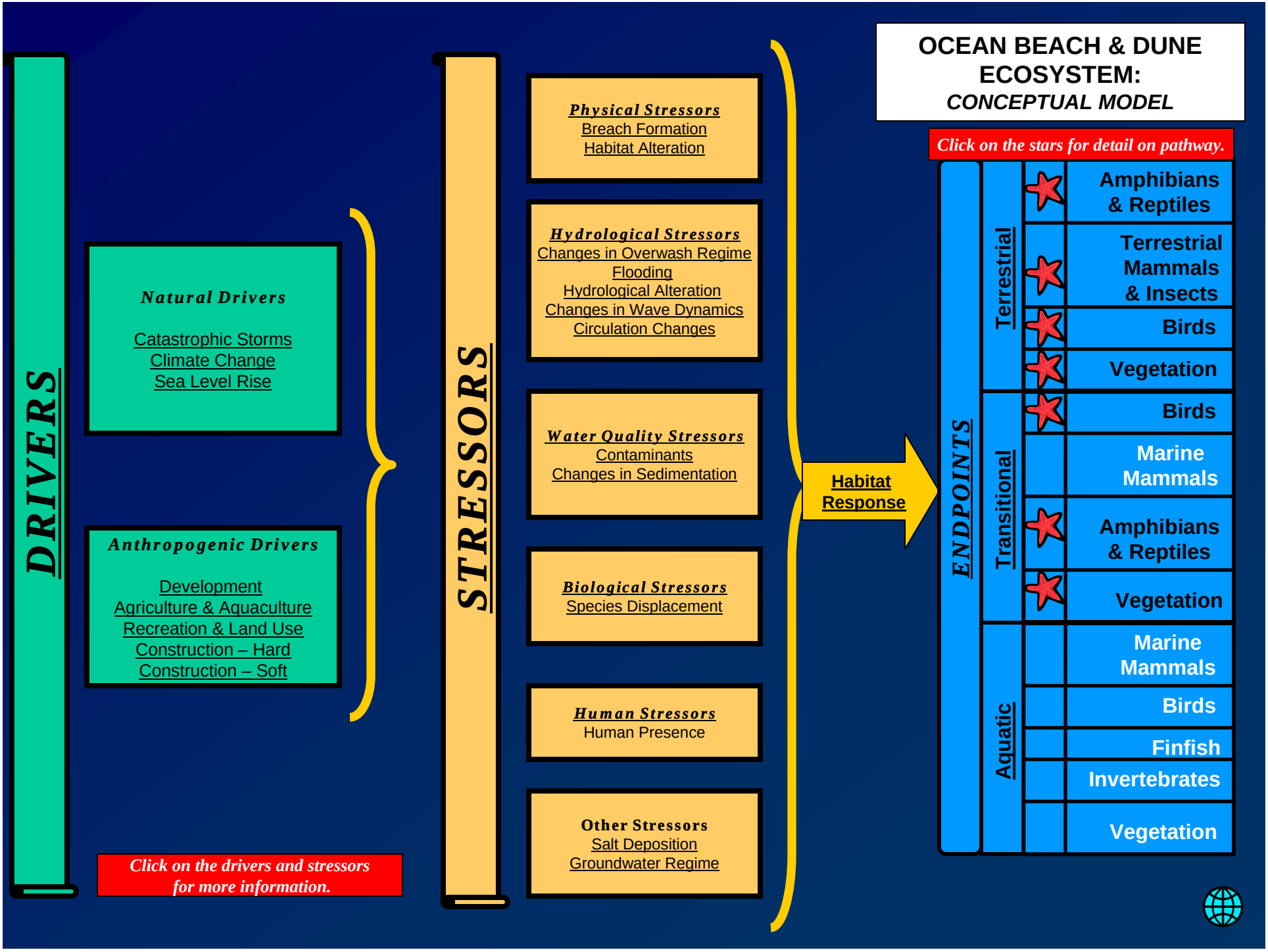


Habitats of the Ocean Beach & Dune Ecosystem

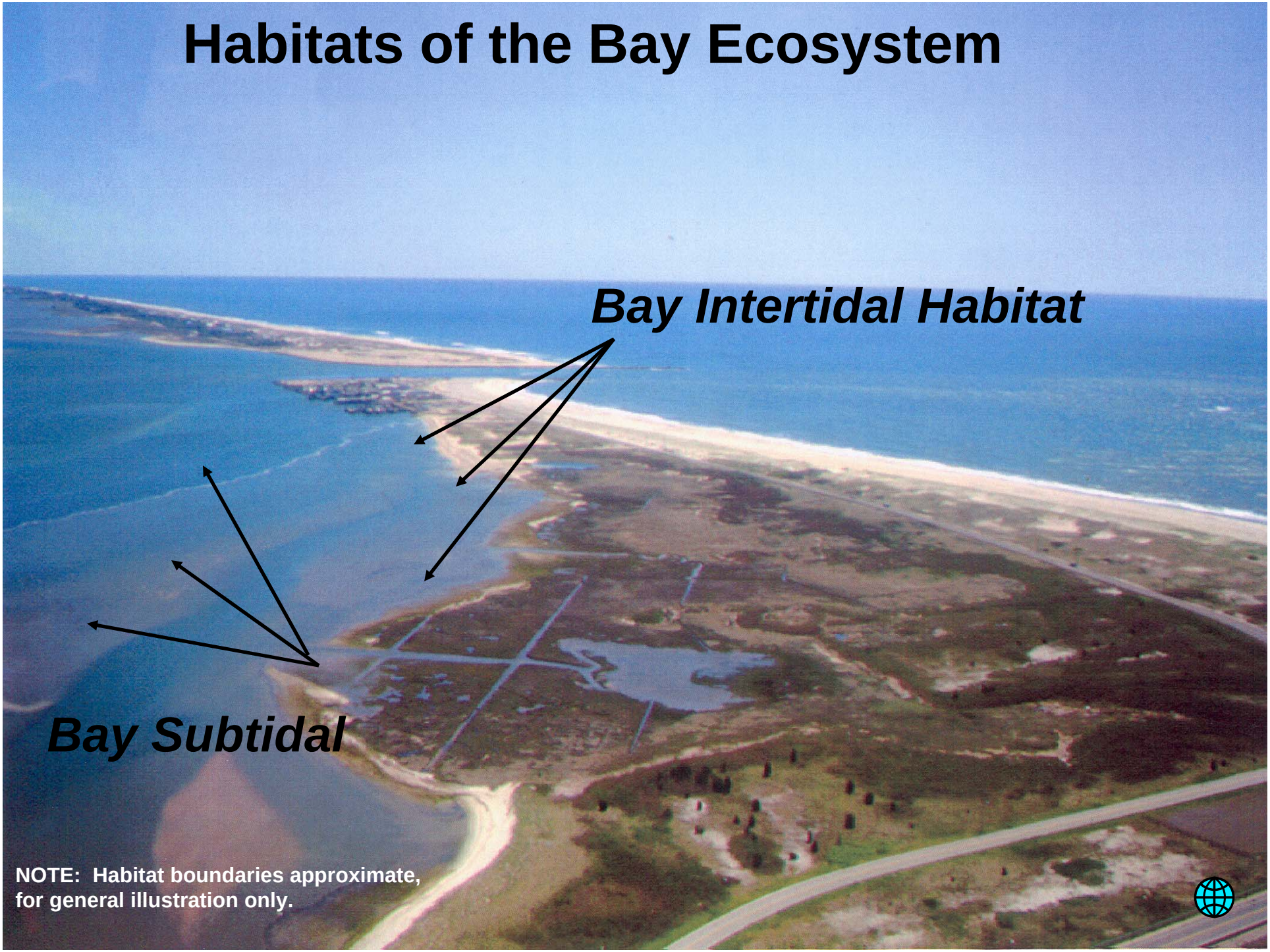
- **Marine Beach**
  - **Extends from the MHW line on the ocean side to the boundary of the primary Dune and Swale habitat with the Terrestrial Upland; sandy substrate.**
- **Dunes and Swales**
  - **Primary dune through most landward primary swale system.**


OCEAN BEACH & DUNE ECOSYSTEM:
MARINE BEACH HABITAT
DRIVERS
Catastrophic Storms (9)
Sea Level Rise (5)
Development (4)
Recreation & Land Use (4)
Construction – Hard (10)
Construction – Soft (4)
STRESSORS
Physical Stressors
Hydrological Stressors
Changes in Sedimentation
Species Displacement
Habitat Alteration
Flooding
Hydrological Alteration
Changes in Wave Dynamics
Species Displacement
Habitat Alteration
Changes in Sedimentation
Species Displacement
Human Stressors
Habitat Alteration
Contaminants
Species Displacement
Human Stressors
Physical Stressors
Hydrological Stressors
Changes in Sedimentation
Species Displacement
Human Stressors
Habitat Alteration
Changes in Sedimentation
Species Displacement
Human Stressors
Habitat Response
ENDPOINTS
Terrestrial
Amphibians & Reptiles
Terrestrial Mammals & Insects
Birds
Vegetation
Transitional
Birds
Marine Mammals
Amphibians & Reptiles
Vegetation
Aquatic
Marine Mammals
Birds
Finfish
Invertebrates
Vegetation
Click on the stars for detail on pathway.
Click on the drivers and stressors for more information.

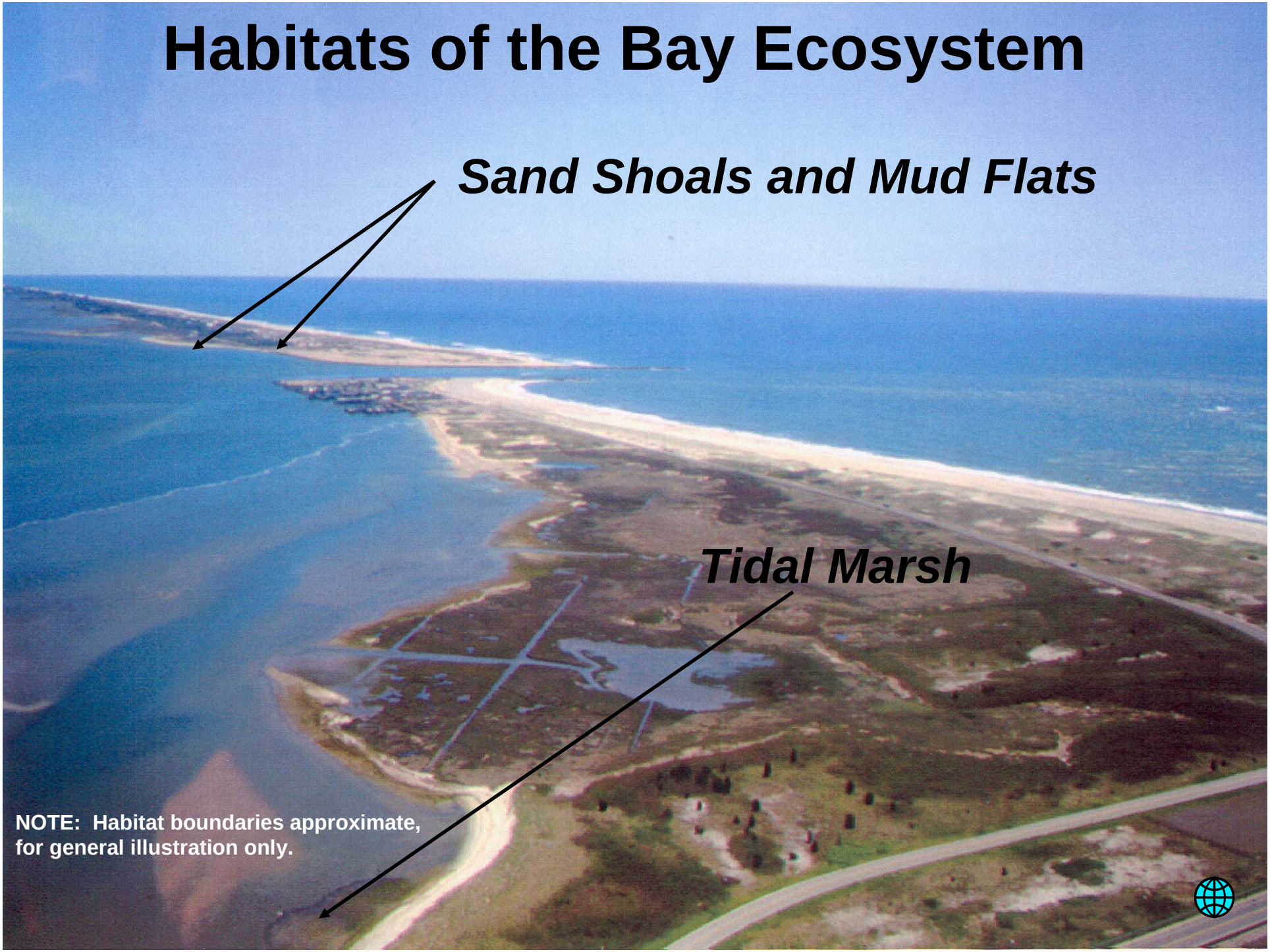

OCEAN BEACH & DUNE ECOSYSTEM:
DUNES AND SWALES HABITAT
Click on the stars for detail on pathway.
DRIVERS
Catastrophic Storms (4)
Climate Change (1)
Sea Level Rise (2)
Development (4)
Agriculture & Aquaculture (3)
Recreation & Land Use (3)
Construction – Hard (12)
Construction – Soft (10)
Click on the drivers and stressors for more information.
STRESSORS
Physical Stressors
Changes in Overwash Regime
Species Displacement
Habitat Alteration
Habitat Alteration
Groundwater Regime
Habitat Alteration
Species Displacement
Human Stressors
Salt Deposition
Habitat Alteration
Species Displacement
Human Stressors
Habitat Alteration
Species Displacement
Human Stressors
Physical Stressors
Hydrological Stressors
Changes in Sedimentation
Species Displacement
Human Stressors
Salt Deposition
Groundwater Regime
Physical Stressors
Hydrological Stressors
Changes in Sedimentation
Species Displacement
Human Stressors
Habitat Response
ENDPOINTS
Terrestrial
Amphibians & Reptiles
Terrestrial Mammals & Insects
Birds
Vegetation
Transitional
Birds
Marine Mammals
Amphibians & Reptiles
Vegetation
Aquatic
Marine Mammals
Birds
Finfish
Invertebrates
Vegetation


OCEAN BEACH & DUNE ECOSYSTEM:
CONCEPTUAL MODEL
Click on the stars for detail on pathway.
DRIVERS
Natural Drivers
Catastrophic Storms
Climate Change
Sea Level Rise
Anthropogenic Drivers
Development
Agriculture & Aquaculture
Recreation & Land Use
Construction – Hard
Construction – Soft
Click on the drivers and stressors for more information.
STRESSORS
Physical Stressors
Breach Formation
Habitat Alteration
Hydrological Stressors
Changes in Overwash Regime
Flooding
Hydrological Alteration
Changes in Wave Dynamics
Circulation Changes
Water Quality Stressors
Contaminants
Changes in Sedimentation
Biological Stressors
Species Displacement
Human Stressors
Human Presence
Other Stressors
Salt Deposition
Groundwater Regime
Habitat Response
ENDPOINTS
Terrestrial
Amphibians & Reptiles
Terrestrial Mammals & Insects
Birds
Vegetation
Transitional
Birds
Marine Mammals
Amphibians & Reptiles
Vegetation
Aquatic
Marine Mammals
Birds
Finfish
Invertebrates
Vegetation

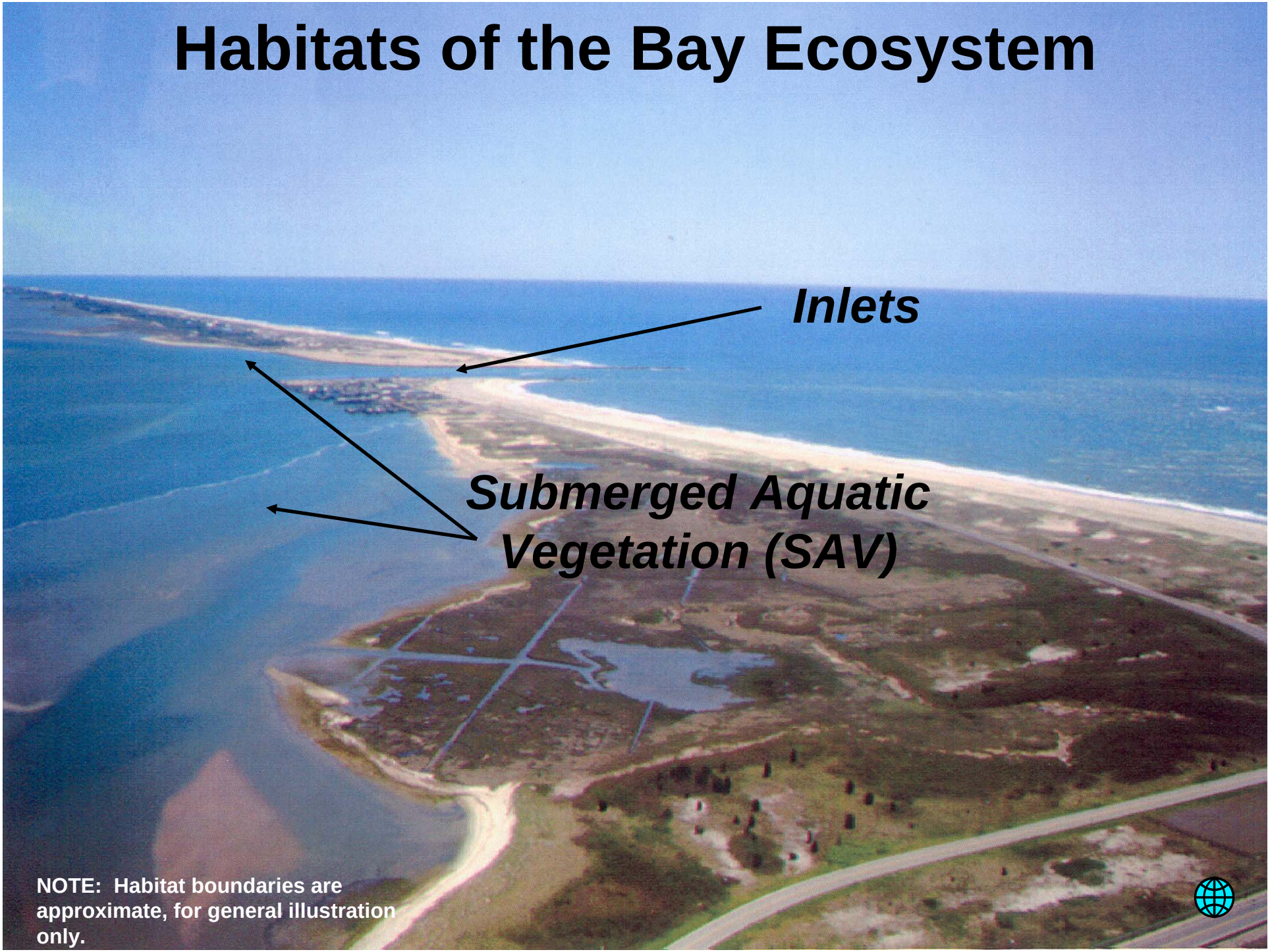
Habitats of the Bay Ecosystem



Habitats of the Bay Ecosystem



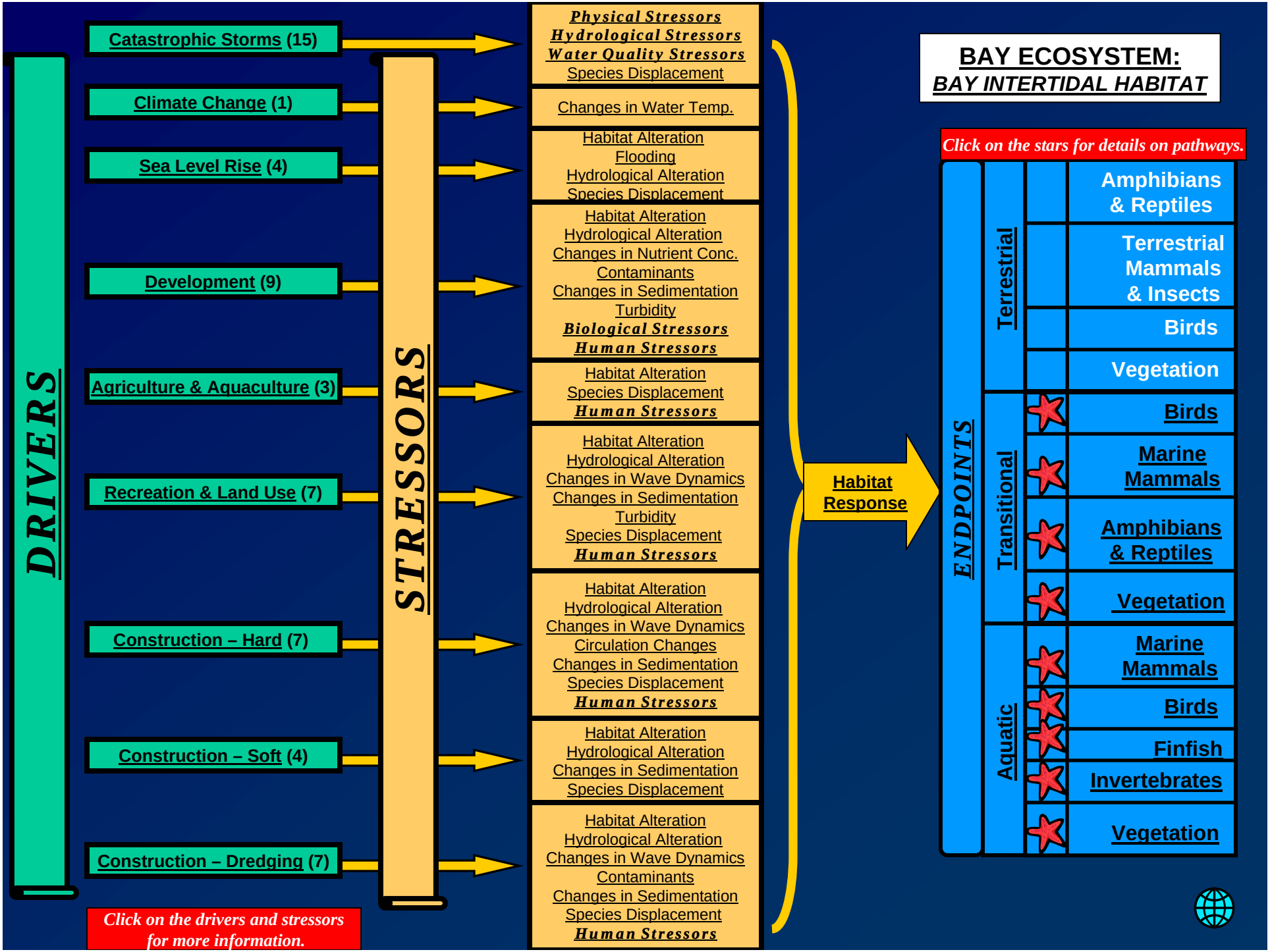
Habitats of the Bay Ecosystem

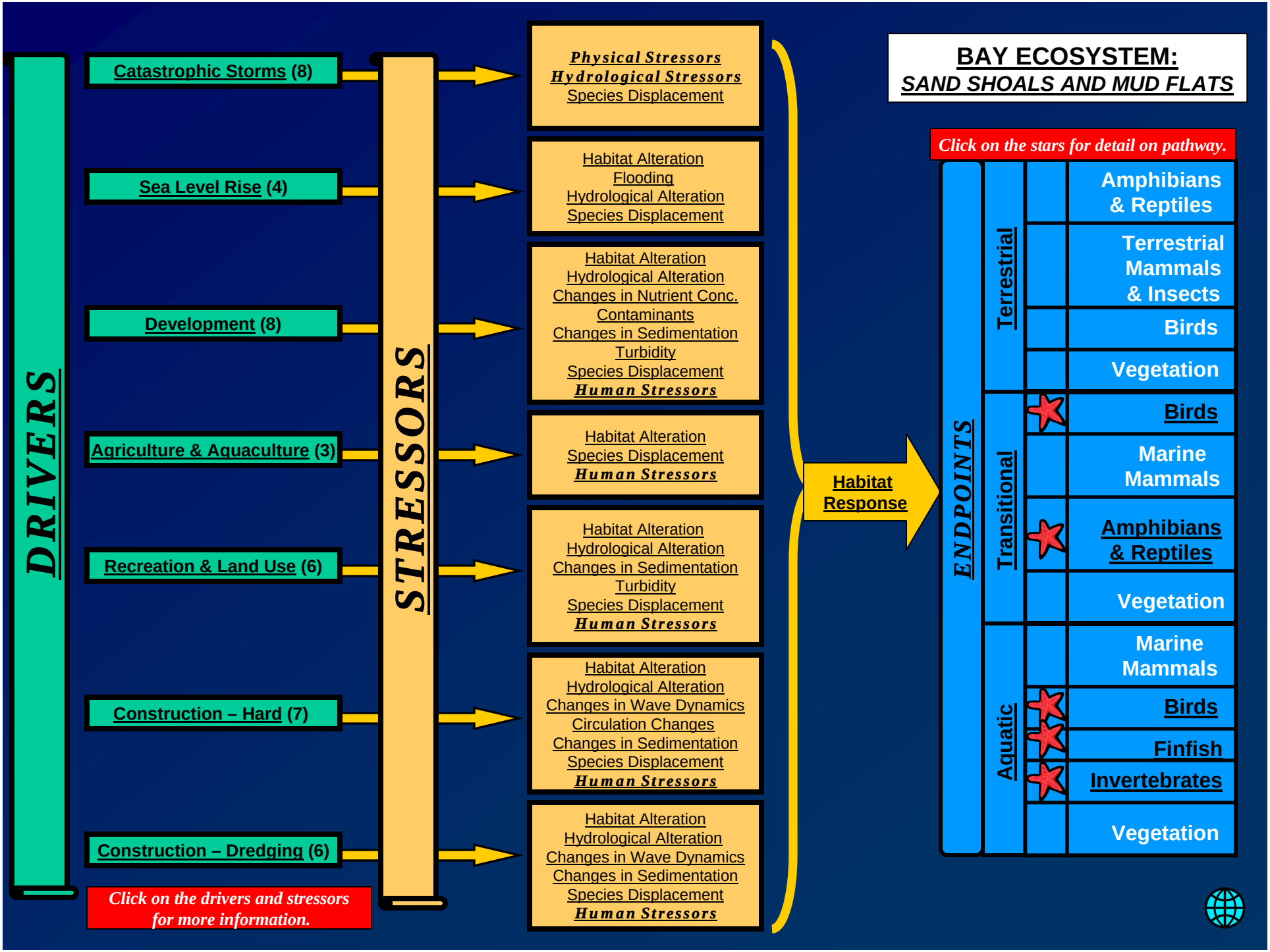


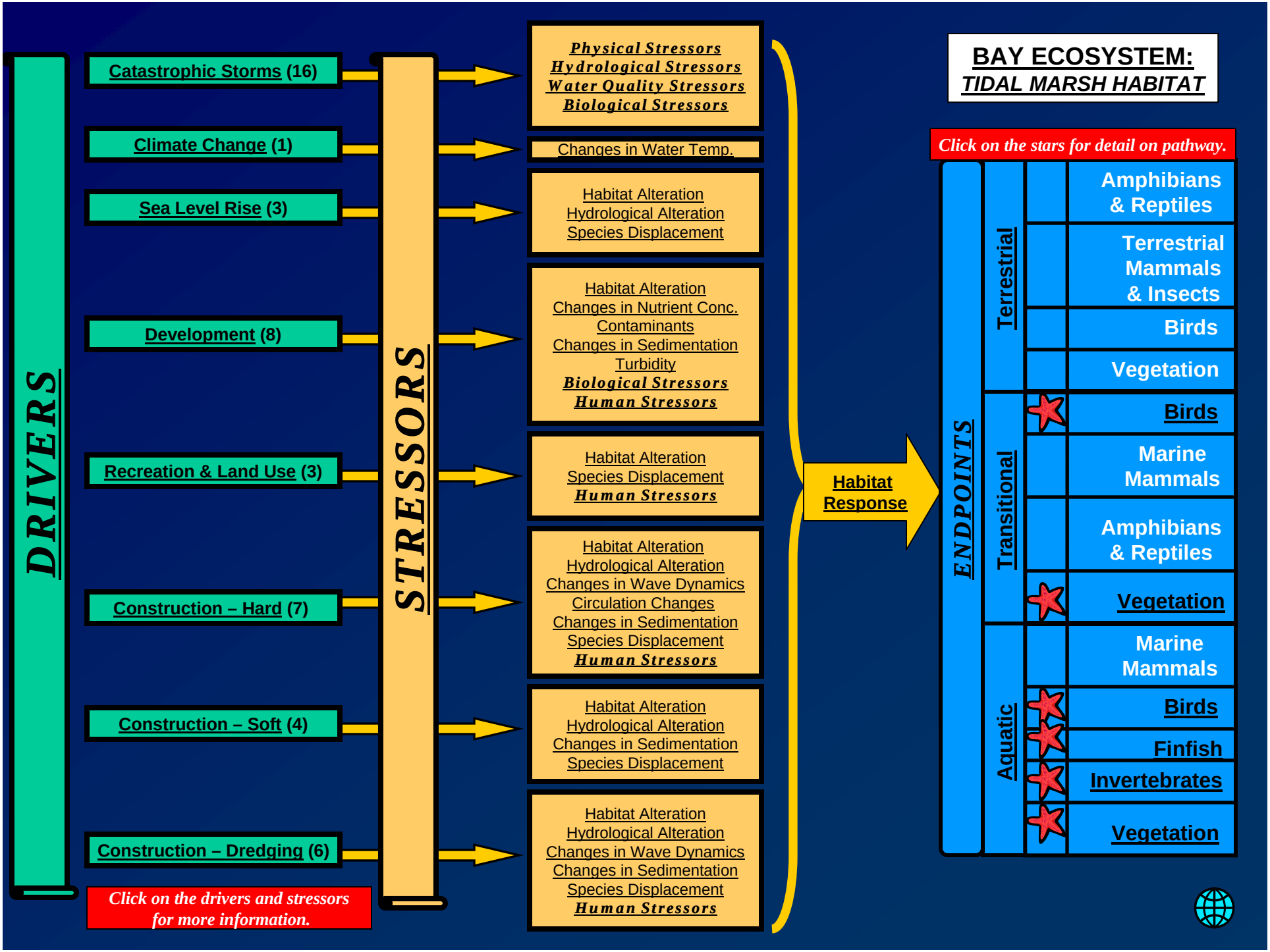
NOTE: Habitat boundaries are approximate, for general illustration only.

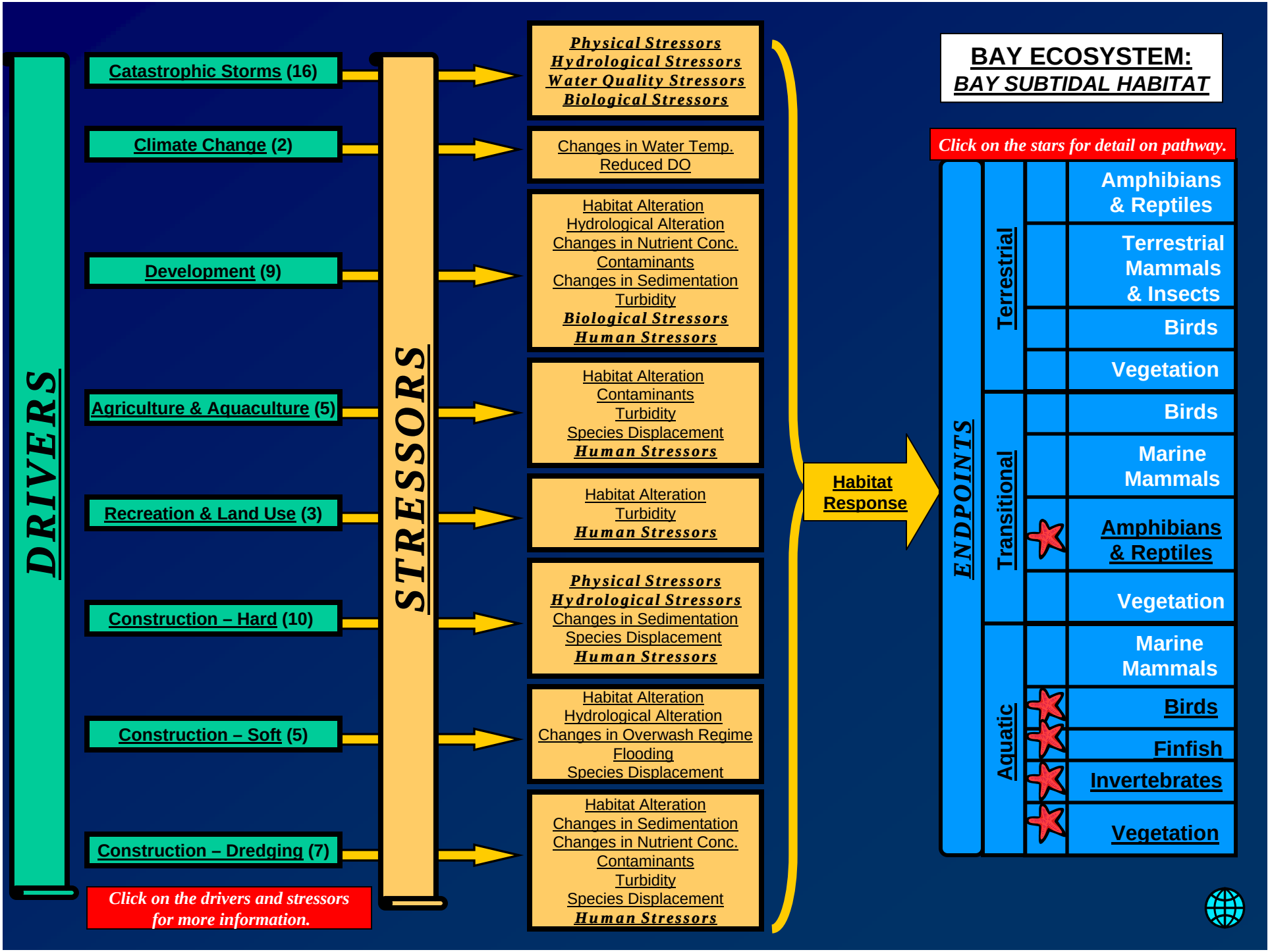
Habitats of the Bay Ecosystem

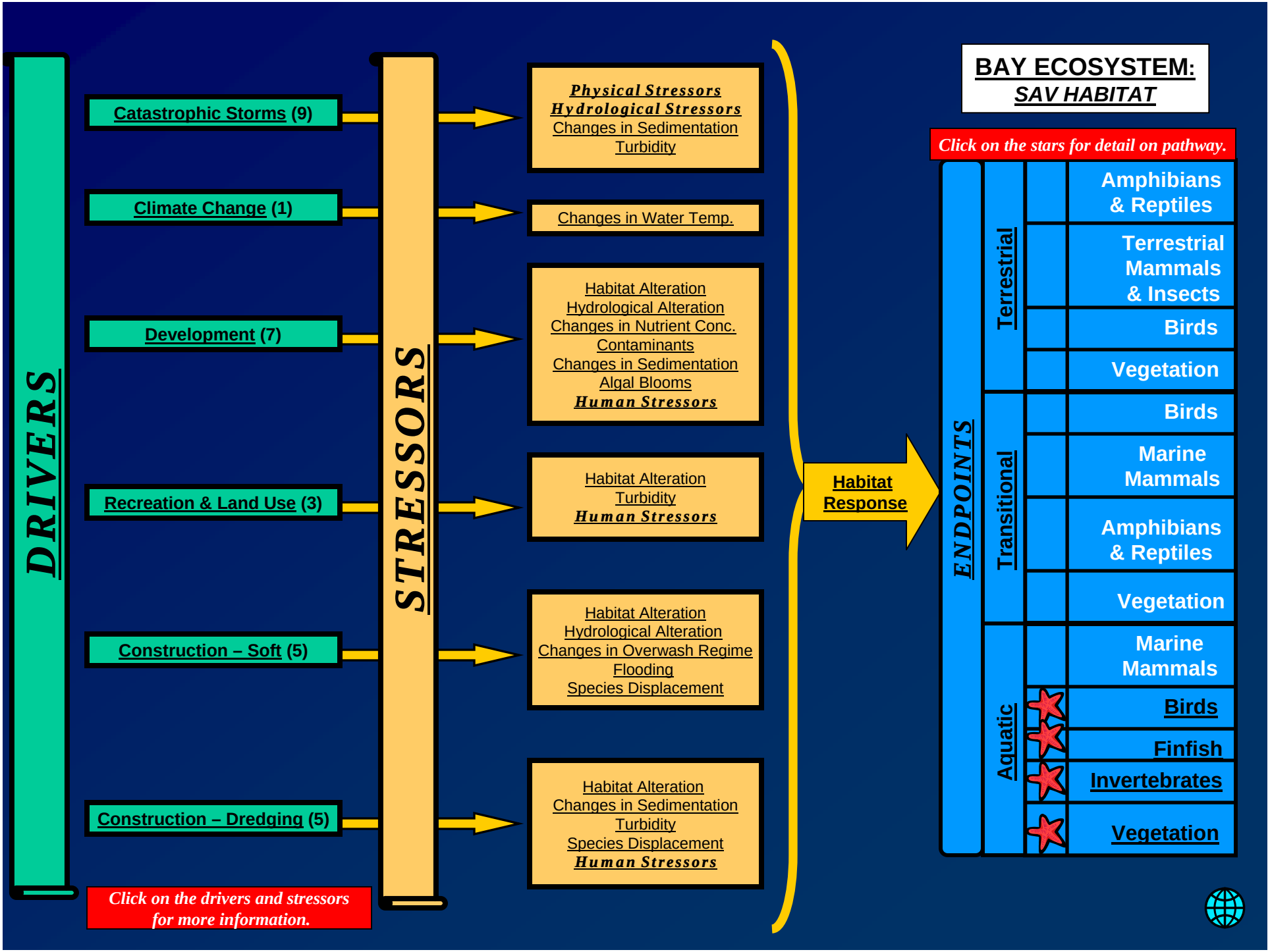
- **Bay Intertidal Habitat**
  - Extends from the terrestrial upland boundary with MHW, or landward limit of high marsh vegetation of the barrier island Terrestrial Upland habitat, to MLW. May include other habitats such as Tidal Marsh, Shoals, and/or Mud Flat.
- **Sand Shoals and Mud Flats**
  - Found within the intertidal zone and exposed at low tide; specific habitat type is defined by the substrate type.
- **Tidal Marsh**
  - Bayside vegetation communities dominated and defined by salt-tolerant species; occurs from the landward limit of the high marsh vegetation, sometimes also AHW or slightly landward to the seaward limit of the intertidal marsh vegetation.
- **Bay Subtidal**
  - Bayside aquatic areas below the MLW.
- **Submerged Aquatic Vegetation (SAV)**
  - Bayside vegetation communities found within the subtidal zone.
- **Inlets**
  - Areas of water interchange between backbay and ocean zones (e.g., Fire Island Inlet, Moriches Inlet, and Shinnecock Inlet).

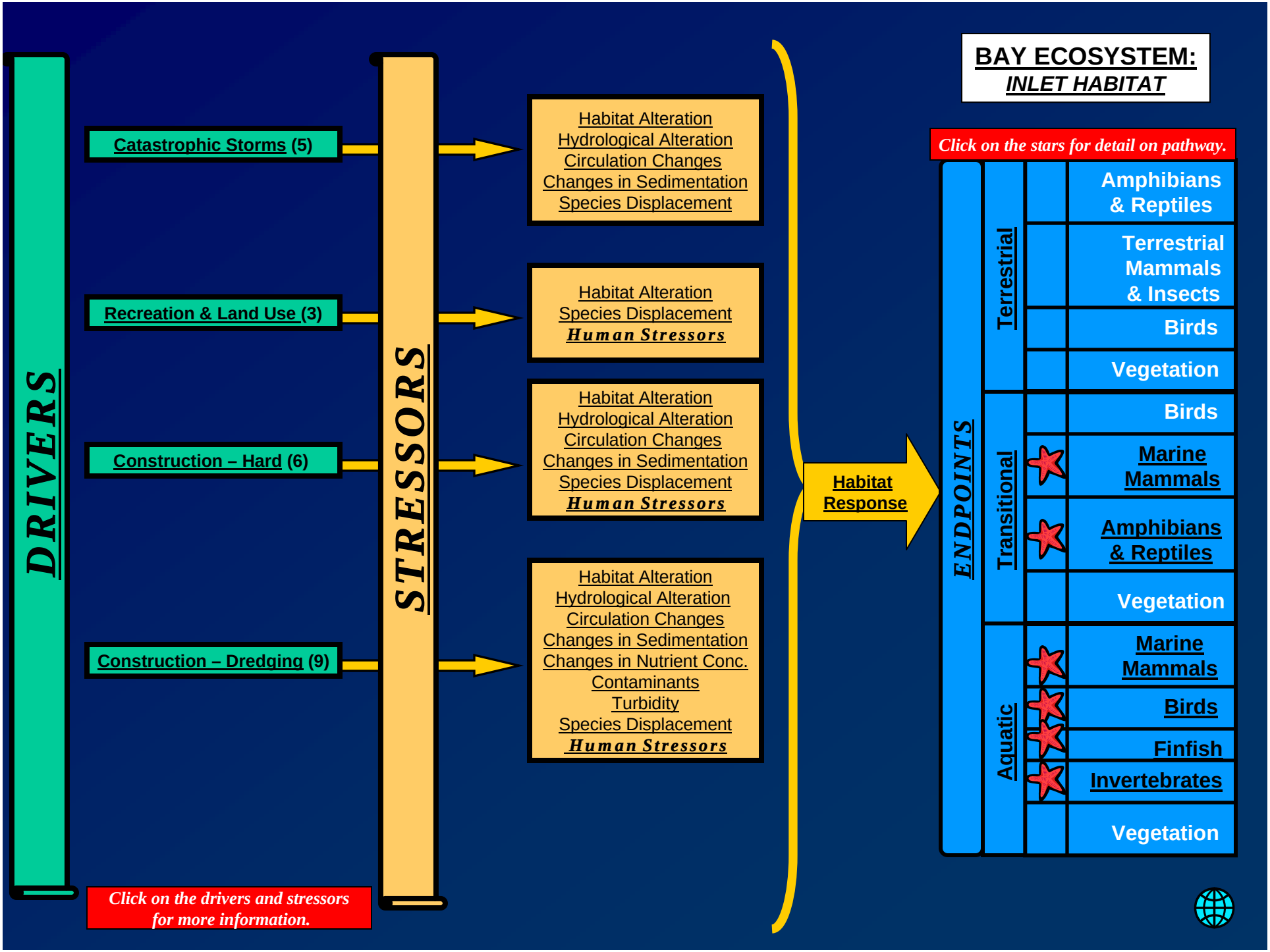

DRIVERS
Catastrophic Storms (15)
Climate Change (1)
Sea Level Rise (4)
Development (9)
Agriculture & Aquaculture (3)
Recreation & Land Use (7)
Construction – Hard (7)
Construction – Soft (4)
Construction – Dredging (7)
Click on the drivers and stressors for more information.
STRESSORS
Physical Stressors
Hydrological Stressors
Water Quality Stressors
Species Displacement
Changes in Water Temp.
Habitat Alteration
Flooding
Hydrological Alteration
Species Displacement
Habitat Alteration
Hydrological Alteration
Changes in Nutrient Conc.
Contaminants
Changes in Sedimentation
Turbidity
Biological Stressors
Human Stressors
Habitat Alteration
Species Displacement
Human Stressors
Habitat Alteration
Hydrological Alteration
Changes in Wave Dynamics
Changes in Sedimentation
Turbidity
Species Displacement
Human Stressors
Habitat Alteration
Hydrological Alteration
Changes in Wave Dynamics
Circulation Changes
Changes in Sedimentation
Species Displacement
Human Stressors
Habitat Alteration
Hydrological Alteration
Changes in Sedimentation
Species Displacement
Habitat Alteration
Hydrological Alteration
Changes in Wave Dynamics
Contaminants
Changes in Sedimentation
Species Displacement
Human Stressors
Habitat Response
BAY ECOSYSTEM:
BAY INTERTIDAL HABITAT
Click on the stars for details on pathways.
ENDPOINTS
Terrestrial
Amphibians & Reptiles
Terrestrial Mammals & Insects
Birds
Vegetation
Transitional
Birds
Marine Mammals
Amphibians & Reptiles
Vegetation
Aquatic
Marine Mammals
Birds
Finfish
Invertebrates
Vegetation

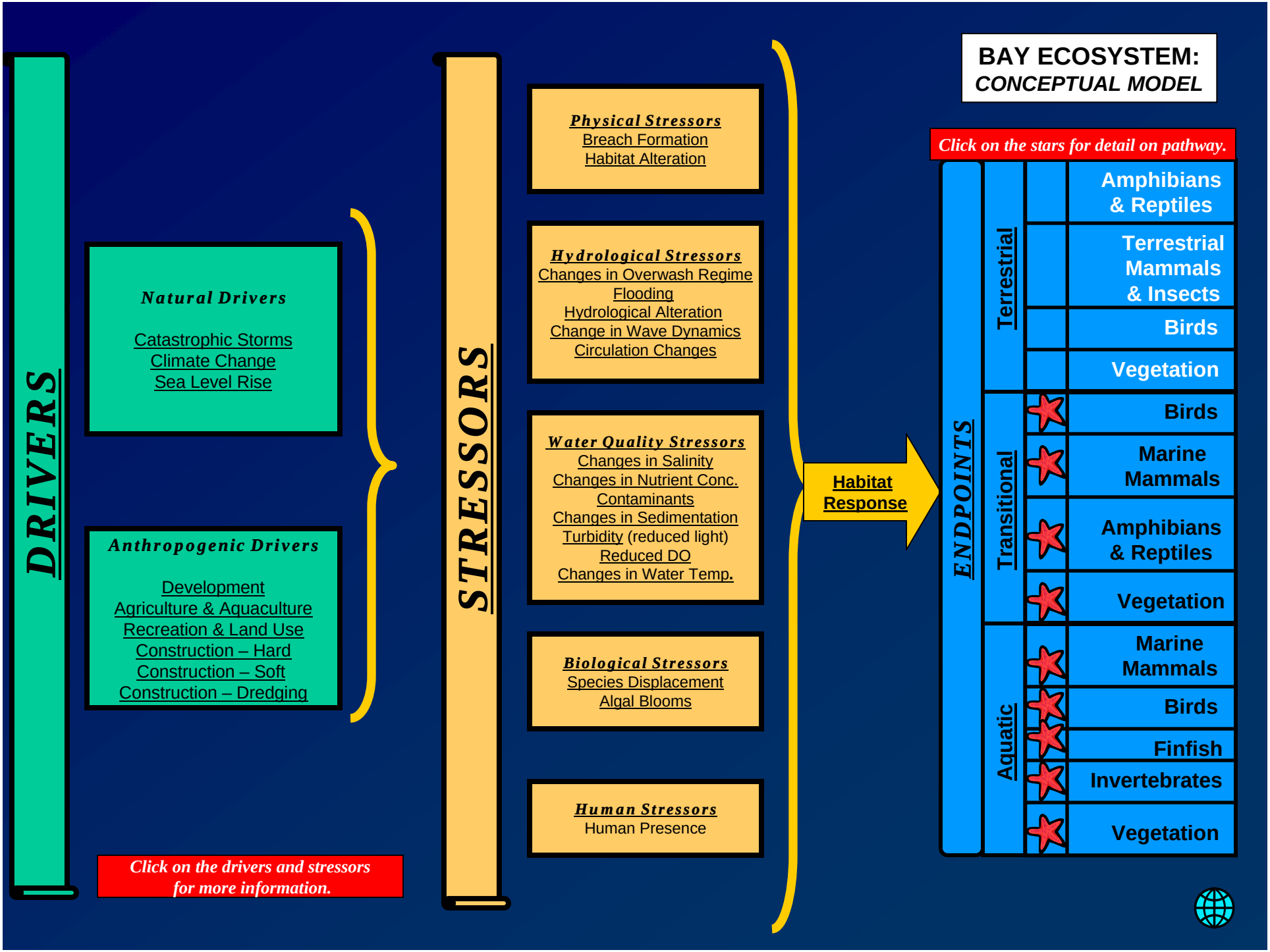

BAY ECOSYSTEM:
SAND SHOALS AND MUD FLATS
DRIVERS
Catastrophic Storms (8)
Sea Level Rise (4)
Development (8)
Agriculture & Aquaculture (3)
Recreation & Land Use (6)
Construction – Hard (7)
Construction – Dredging (6)
Click on the drivers and stressors for more information.
STRESSORS
Physical Stressors
Hydrological Stressors
Species Displacement
Habitat Alteration
Flooding
Hydrological Alteration
Species Displacement
Habitat Alteration
Hydrological Alteration
Changes in Nutrient Conc.
Contaminants
Changes in Sedimentation
Turbidity
Species Displacement
Human Stressors
Habitat Alteration
Species Displacement
Human Stressors
Habitat Alteration
Hydrological Alteration
Changes in Sedimentation
Turbidity
Species Displacement
Human Stressors
Habitat Alteration
Hydrological Alteration
Changes in Wave Dynamics
Circulation Changes
Changes in Sedimentation
Species Displacement
Human Stressors
Habitat Alteration
Hydrological Alteration
Changes in Wave Dynamics
Changes in Sedimentation
Species Displacement
Human Stressors
Habitat Response
Click on the stars for detail on pathway.
ENDPOINTS
Terrestrial
Amphibians & Reptiles
Terrestrial Mammals & Insects
Birds
Vegetation
Transitional
Birds
Marine Mammals
Amphibians & Reptiles
Vegetation
Aquatic
Marine Mammals
Birds
Finfish
Invertebrates
Vegetation


DRIVERS
Catastrophic Storms (16)
Climate Change (1)
Sea Level Rise (3)
Development (8)
Recreation & Land Use (3)
Construction – Hard (7)
Construction – Soft (4)
Construction – Dredging (6)
Click on the drivers and stressors for more information.
STRESSORS
Physical Stressors
Hydrological Stressors
Water Quality Stressors
Biological Stressors
Changes in Water Temp.
Habitat Alteration
Hydrological Alteration
Species Displacement
Habitat Alteration
Changes in Nutrient Conc.
Contaminants
Changes in Sedimentation
Turbidity
Biological Stressors
Human Stressors
Habitat Alteration
Species Displacement
Human Stressors
Habitat Alteration
Hydrological Alteration
Changes in Wave Dynamics
Circulation Changes
Changes in Sedimentation
Species Displacement
Human Stressors
Habitat Alteration
Hydrological Alteration
Changes in Sedimentation
Species Displacement
Habitat Alteration
Hydrological Alteration
Changes in Wave Dynamics
Changes in Sedimentation
Species Displacement
Human Stressors
Habitat Response
BAY ECOSYSTEM:
TIDAL MARSH HABITAT
Click on the stars for detail on pathway.
ENDPOINTS
Terrestrial
Amphibians & Reptiles
Terrestrial Mammals & Insects
Birds
Vegetation
Transitional
Birds
Marine Mammals
Amphibians & Reptiles
Vegetation
Aquatic
Marine Mammals
Birds
Finfish
Invertebrates
Vegetation

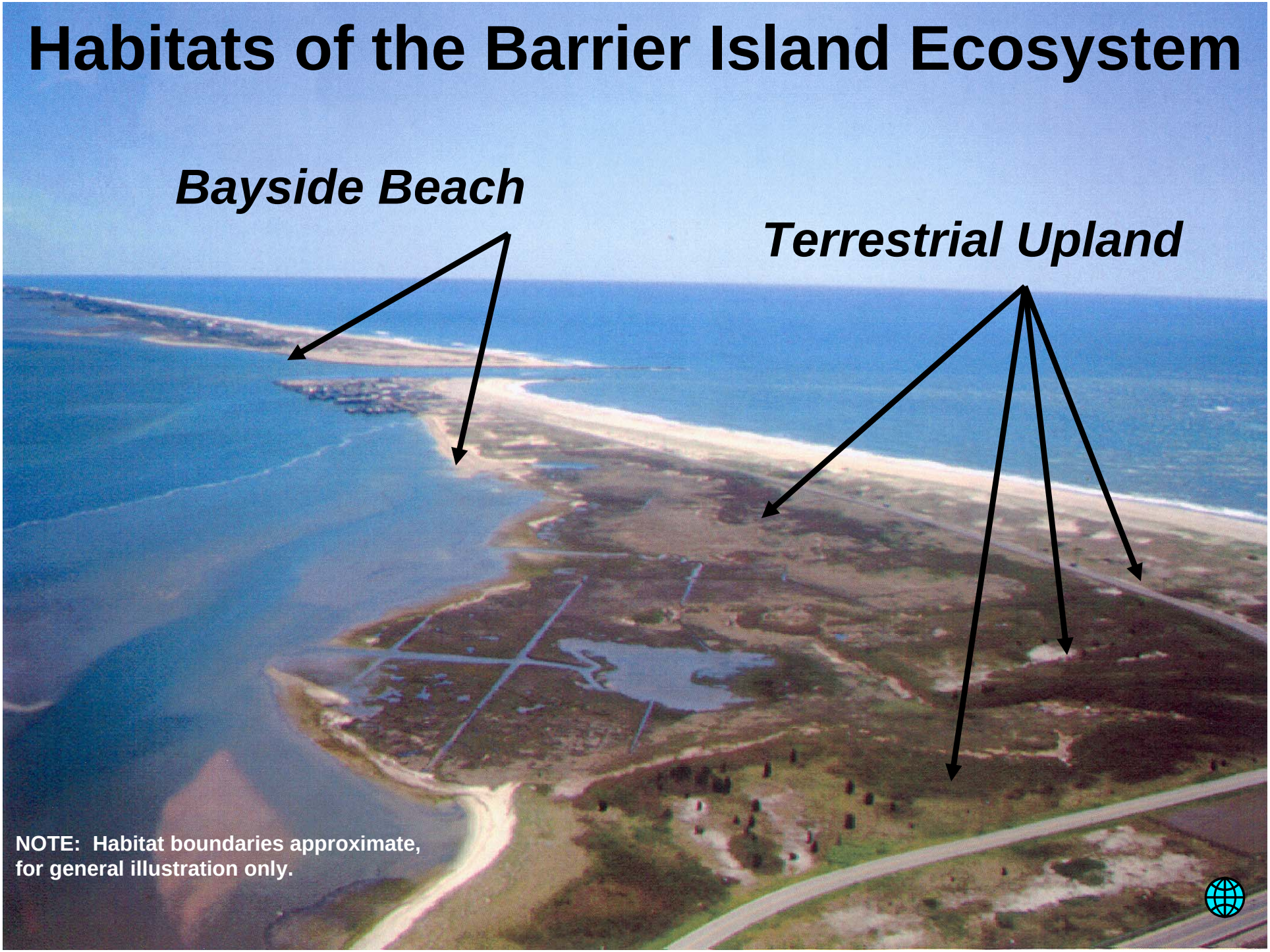

DRIVERS
Catastrophic Storms (16)
Climate Change (2)
Development (9)
Agriculture & Aquaculture (5)
Recreation & Land Use (3)
Construction – Hard (10)
Construction – Soft (5)
Construction – Dredging (7)
Click on the drivers and stressors for more information.
STRESSORS
Physical Stressors
Hydrological Stressors
Water Quality Stressors
Biological Stressors
Changes in Water Temp.
Reduced DO
Habitat Alteration
Hydrological Alteration
Changes in Nutrient Conc.
Contaminants
Changes in Sedimentation
Turbidity
Biological Stressors
Human Stressors
Habitat Alteration
Contaminants
Turbidity
Species Displacement
Human Stressors
Habitat Alteration
Turbidity
Human Stressors
Physical Stressors
Hydrological Stressors
Changes in Sedimentation
Species Displacement
Human Stressors
Habitat Alteration
Hydrological Alteration
Changes in Overwash Regime
Flooding
Species Displacement
Habitat Alteration
Changes in Sedimentation
Changes in Nutrient Conc.
Contaminants
Turbidity
Species Displacement
Human Stressors
Habitat Response
BAY ECOSYSTEM:
BAY SUBTIDAL HABITAT
Click on the stars for detail on pathway.
ENDPOINTS
Terrestrial
Amphibians & Reptiles
Terrestrial Mammals & Insects
Birds
Vegetation
Transitional
Birds
Marine Mammals
Amphibians & Reptiles
Vegetation
Aquatic
Marine Mammals
Birds
Finfish
Invertebrates
Vegetation


DRIVERS
Catastrophic Storms (9)
Climate Change (1)
Development (7)
Recreation & Land Use (3)
Construction – Soft (5)
Construction – Dredging (5)
Click on the drivers and stressors for more information.
STRESSORS
Physical Stressors
Hydrological Stressors
Changes in Sedimentation
Turbidity
Changes in Water Temp.
Habitat Alteration
Hydrological Alteration
Changes in Nutrient Conc.
Contaminants
Changes in Sedimentation
Algal Blooms
Human Stressors
Habitat Alteration
Turbidity
Human Stressors
Habitat Alteration
Hydrological Alteration
Changes in Overwash Regime
Flooding
Species Displacement
Habitat Alteration
Changes in Sedimentation
Turbidity
Species Displacement
Human Stressors
Habitat Response
BAY ECOSYSTEM:
SAV HABITAT
Click on the stars for detail on pathway.
ENDPOINTS
Terrestrial
Amphibians & Reptiles
Terrestrial Mammals & Insects
Birds
Vegetation
Transitional
Birds
Marine Mammals
Amphibians & Reptiles
Vegetation
Aquatic
Marine Mammals
Birds
Finfish
Invertebrates
Vegetation


BAY ECOSYSTEM:
INLET HABITAT
DRIVERS
STRESSORS
Catastrophic Storms (5)
Recreation & Land Use (3)
Construction – Hard (6)
Construction – Dredging (9)
Habitat Alteration
Hydrological Alteration
Circulation Changes
Changes in Sedimentation
Species Displacement
Habitat Alteration
Species Displacement
Human Stressors
Habitat Alteration
Hydrological Alteration
Circulation Changes
Changes in Sedimentation
Species Displacement
Human Stressors
Habitat Alteration
Hydrological Alteration
Circulation Changes
Changes in Sedimentation
Changes in Nutrient Conc.
Contaminants
Turbidity
Species Displacement
Human Stressors
Habitat Response
Click on the stars for detail on pathway.
ENDPOINTS
Terrestrial
Amphibians & Reptiles
Terrestrial Mammals & Insects
Birds
Vegetation
Transitional
Birds
Marine Mammals
Amphibians & Reptiles
Vegetation
Aquatic
Marine Mammals
Birds
Finfish
Invertebrates
Vegetation
Click on the drivers and stressors for more information.

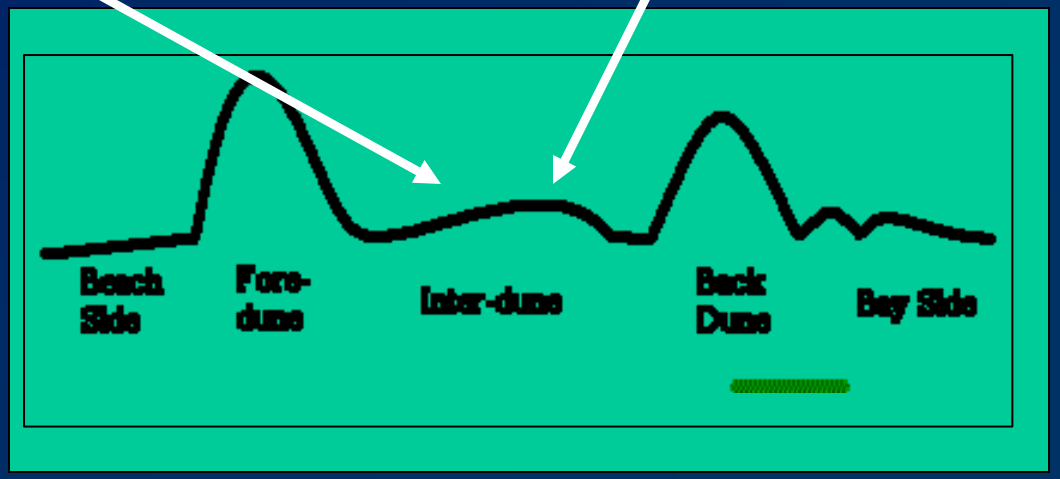

BAY ECOSYSTEM:
CONCEPTUAL MODEL
DRIVERS
Natural Drivers
Catastrophic Storms
Climate Change
Sea Level Rise
Anthropogenic Drivers
Development
Agriculture & Aquaculture
Recreation & Land Use
Construction – Hard
Construction – Soft
Construction – Dredging
Click on the drivers and stressors for more information.
STRESSORS
Physical Stressors
Breach Formation
Habitat Alteration
Hydrological Stressors
Changes in Overwash Regime
Flooding
Hydrological Alteration
Change in Wave Dynamics
Circulation Changes
Water Quality Stressors
Changes in Salinity
Changes in Nutrient Conc.
Contaminants
Changes in Sedimentation
Turbidity (reduced light)
Reduced DO
Changes in Water Temp.
Biological Stressors
Species Displacement
Algal Blooms
Human Stressors
Human Presence
Habitat Response
Click on the stars for detail on pathway.
ENDPOINTS
Terrestrial
Amphibians & Reptiles
Terrestrial Mammals & Insects
Birds
Vegetation
Transitional
Birds
Marine Mammals
Amphibians & Reptiles
Vegetation
Aquatic
Marine Mammals
Birds
Finfish
Invertebrates
Vegetation

Habitats of the Barrier Island Ecosystem



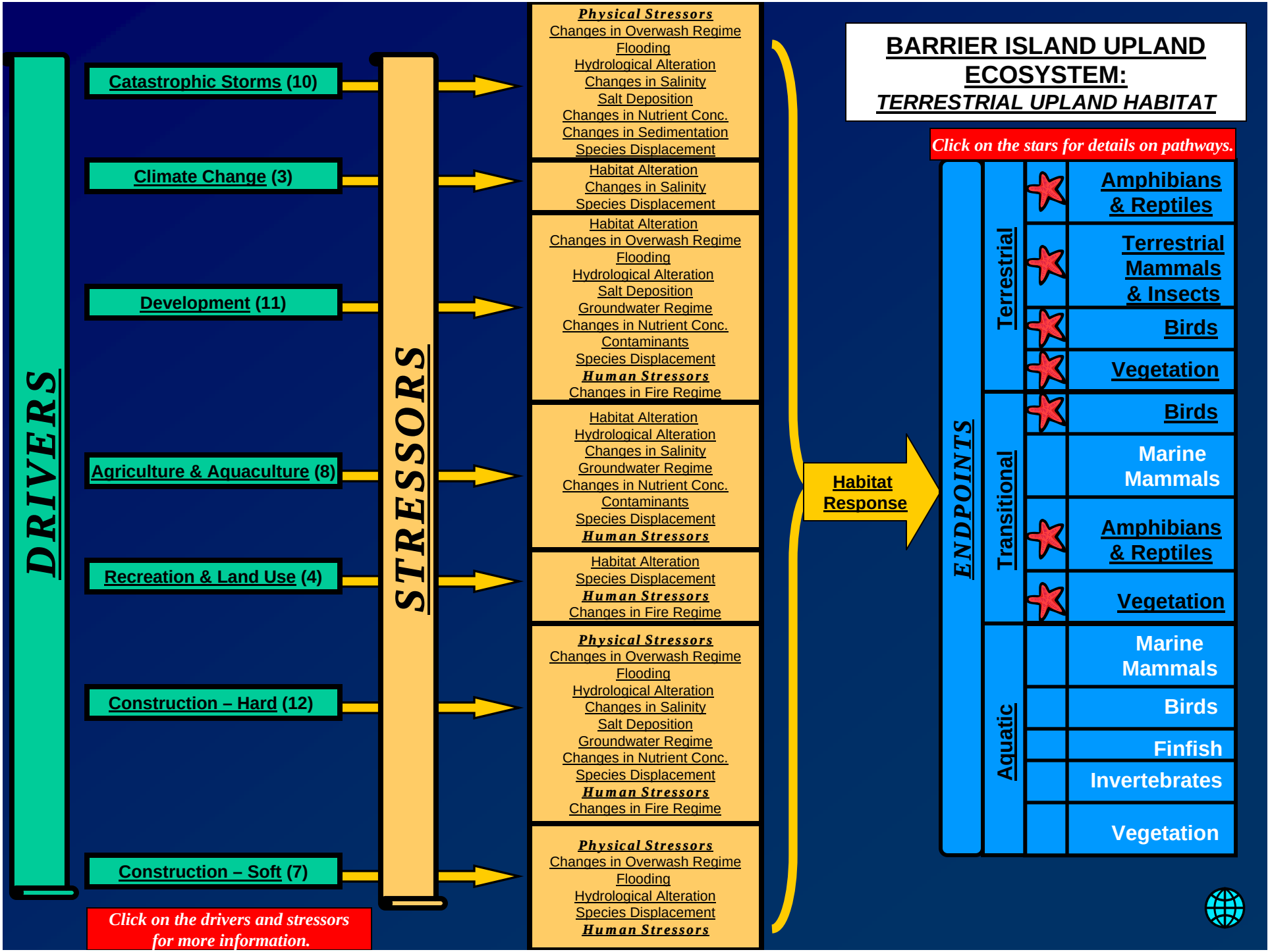
Habitats of the Barrier Island Ecosystem

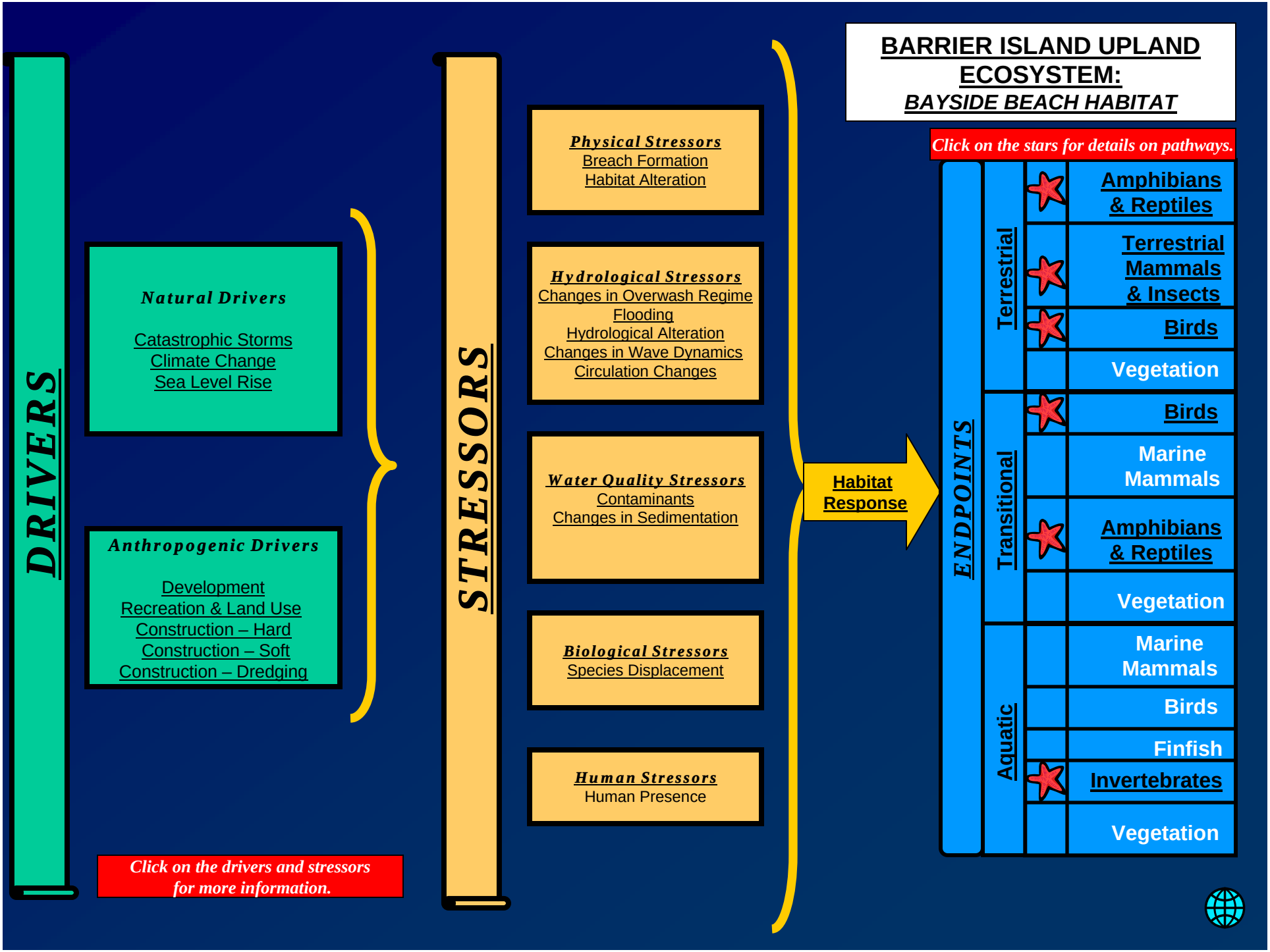
Maritime Forest

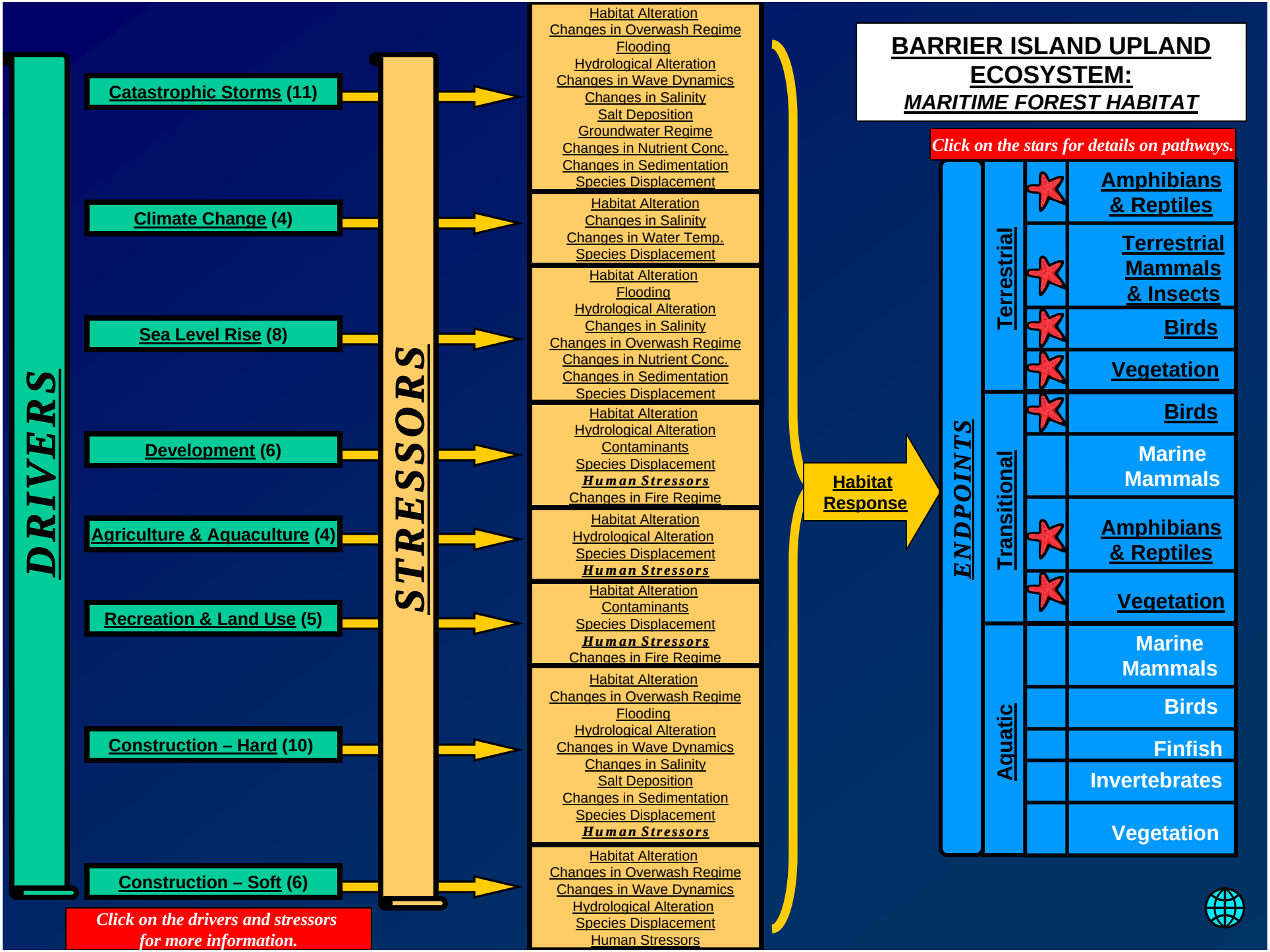


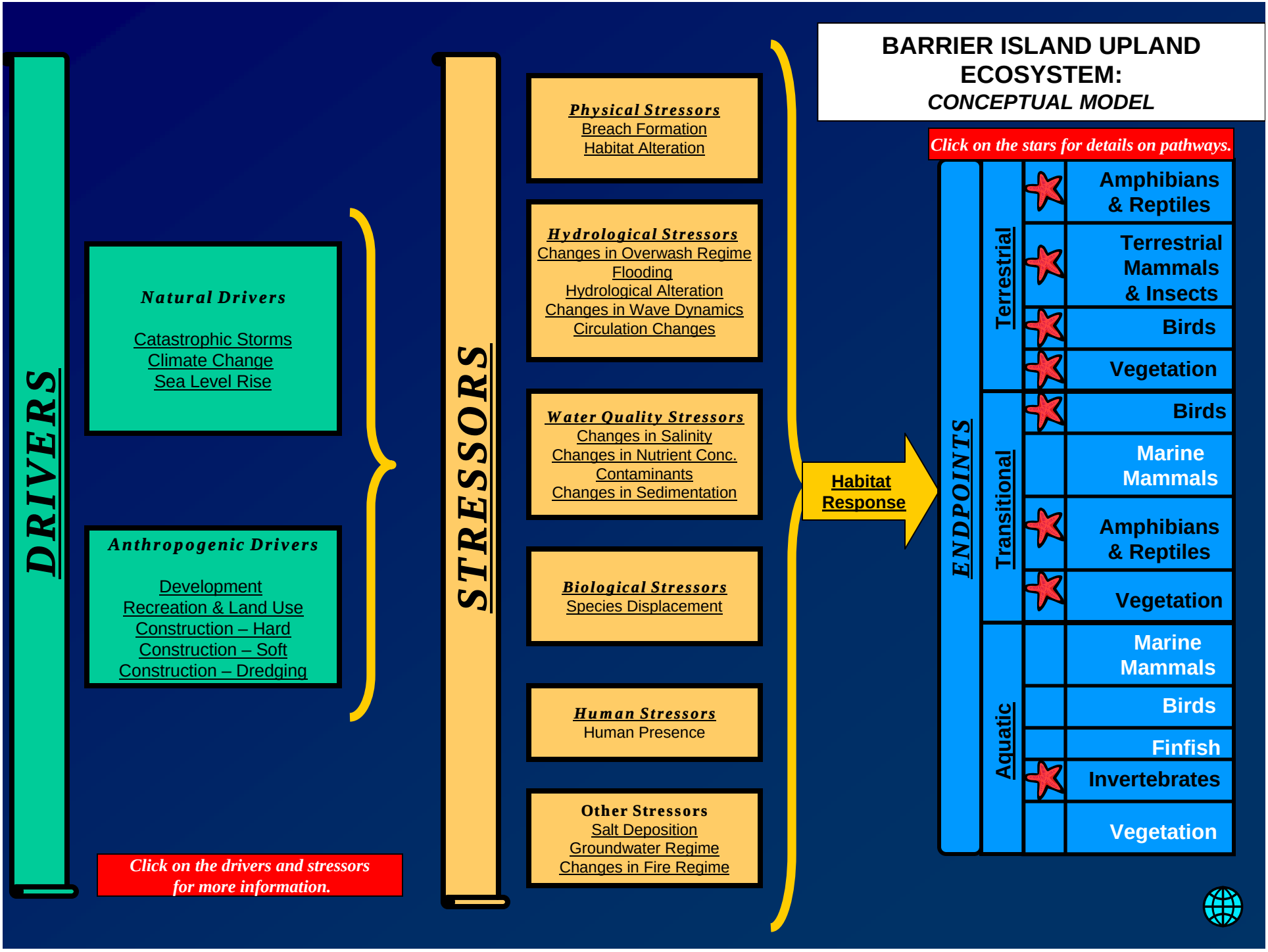
Habitats of the Barrier Island Upland Ecosystem

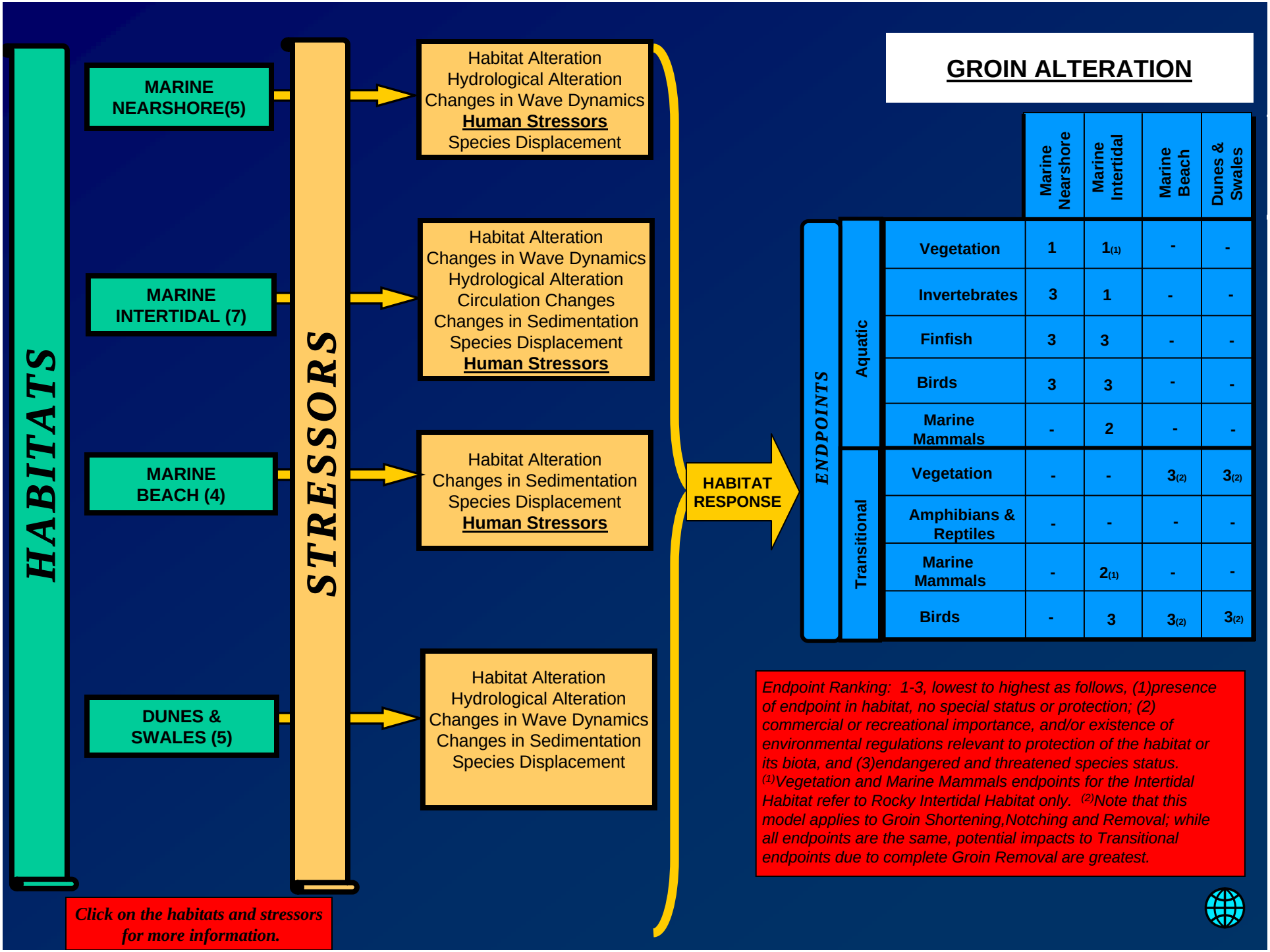
- **Terrestrial Upland**
  - Extends from the landward boundary of the primary dunes and swales on the ocean side, to the MHW boundary of the Bay Intertidal habitat on the bay side of the island; contains all upland habitats excluding the Maritime Forest; scrub/shrub are also included in this habitat, along with Bayside Beach areas.
- **Bayside Beach**
  - Area between MHW to seaward limit of vegetation or upland boundary.
- **Maritime Forest**
  - Forested area on the barrier island defined by assemblages of salt tolerant tree, shrub and herbaceous vegetation, high salinity and salt spray adapted soils; referred to as the Sunken Forest.


DRIVERS
Catastrophic Storms (10)
Climate Change (3)
Development (11)
Agriculture & Aquaculture (8)
Recreation & Land Use (4)
Construction – Hard (12)
Construction – Soft (7)
Click on the drivers and stressors for more information.
STRESSORS
Physical Stressors
Changes in Overwash Regime
Flooding
Hydrological Alteration
Changes in Salinity
Salt Deposition
Changes in Nutrient Conc.
Changes in Sedimentation
Species Displacement
Habitat Alteration
Changes in Salinity
Species Displacement
Habitat Alteration
Changes in Overwash Regime
Flooding
Hydrological Alteration
Salt Deposition
Groundwater Regime
Changes in Nutrient Conc.
Contaminants
Species Displacement
Human Stressors
Changes in Fire Regime
Habitat Alteration
Hydrological Alteration
Changes in Salinity
Groundwater Regime
Changes in Nutrient Conc.
Contaminants
Species Displacement
Human Stressors
Habitat Alteration
Species Displacement
Human Stressors
Changes in Fire Regime
Physical Stressors
Changes in Overwash Regime
Flooding
Hydrological Alteration
Changes in Salinity
Salt Deposition
Groundwater Regime
Changes in Nutrient Conc.
Species Displacement
Human Stressors
Changes in Fire Regime
Physical Stressors
Changes in Overwash Regime
Flooding
Hydrological Alteration
Species Displacement
Human Stressors
Habitat Response
BARRIER ISLAND UPLAND ECOSYSTEM:
TERRESTRIAL UPLAND HABITAT
Click on the stars for details on pathways.
ENDPOINTS
Terrestrial
Amphibians & Reptiles
Terrestrial Mammals & Insects
Birds
Vegetation
Transitional
Birds
Marine Mammals
Amphibians & Reptiles
Vegetation
Aquatic
Marine Mammals
Birds
Finfish
Invertebrates
Vegetation


BARRIER ISLAND UPLAND ECOSYSTEM:
BAYSIDE BEACH HABITAT
Click on the stars for details on pathways.
DRIVERS
Natural Drivers
Catastrophic Storms
Climate Change
Sea Level Rise
Anthropogenic Drivers
Development
Recreation & Land Use
Construction – Hard
Construction – Soft
Construction – Dredging
Click on the drivers and stressors for more information.
STRESSORS
Physical Stressors
Breach Formation
Habitat Alteration
Hydrological Stressors
Changes in Overwash Regime
Flooding
Hydrological Alteration
Changes in Wave Dynamics
Circulation Changes
Water Quality Stressors
Contaminants
Changes in Sedimentation
Biological Stressors
Species Displacement
Human Stressors
Human Presence
Habitat Response
ENDPOINTS
Terrestrial
Amphibians & Reptiles
Terrestrial Mammals & Insects
Birds
Vegetation
Transitional
Birds
Marine Mammals
Amphibians & Reptiles
Vegetation
Aquatic
Marine Mammals
Birds
Finfish
Invertebrates
Vegetation


DRIVERS
Catastrophic Storms (11)
Climate Change (4)
Sea Level Rise (8)
Development (6)
Agriculture & Aquaculture (4)
Recreation & Land Use (5)
Construction – Hard (10)
Construction – Soft (6)
STRESSORS
Habitat Alteration
Changes in Overwash Regime
Flooding
Hydrological Alteration
Changes in Wave Dynamics
Changes in Salinity
Salt Deposition
Groundwater Regime
Changes in Nutrient Conc.
Changes in Sedimentation
Species Displacement
Habitat Alteration
Changes in Salinity
Changes in Water Temp.
Species Displacement
Habitat Alteration
Flooding
Hydrological Alteration
Changes in Salinity
Changes in Overwash Regime
Changes in Nutrient Conc.
Changes in Sedimentation
Species Displacement
Habitat Alteration
Hydrological Alteration
Contaminants
Species Displacement
Human Stressors
Changes in Fire Regime
Habitat Alteration
Hydrological Alteration
Species Displacement
Human Stressors
Habitat Alteration
Contaminants
Species Displacement
Human Stressors
Changes in Fire Regime
Habitat Alteration
Changes in Overwash Regime
Flooding
Hydrological Alteration
Changes in Wave Dynamics
Changes in Salinity
Salt Deposition
Changes in Sedimentation
Species Displacement
Human Stressors
Habitat Alteration
Changes in Overwash Regime
Changes in Wave Dynamics
Hydrological Alteration
Species Displacement
Human Stressors
Habitat Response
BARRIER ISLAND UPLAND ECOSYSTEM:
MARITIME FOREST HABITAT
Click on the stars for details on pathways.
ENDPOINTS
Terrestrial
Amphibians & Reptiles
Terrestrial Mammals & Insects
Birds
Vegetation
Transitional
Birds
Marine Mammals
Amphibians & Reptiles
Vegetation
Aquatic
Marine Mammals
Birds
Finfish
Invertebrates
Vegetation
Click on the drivers and stressors for more information.

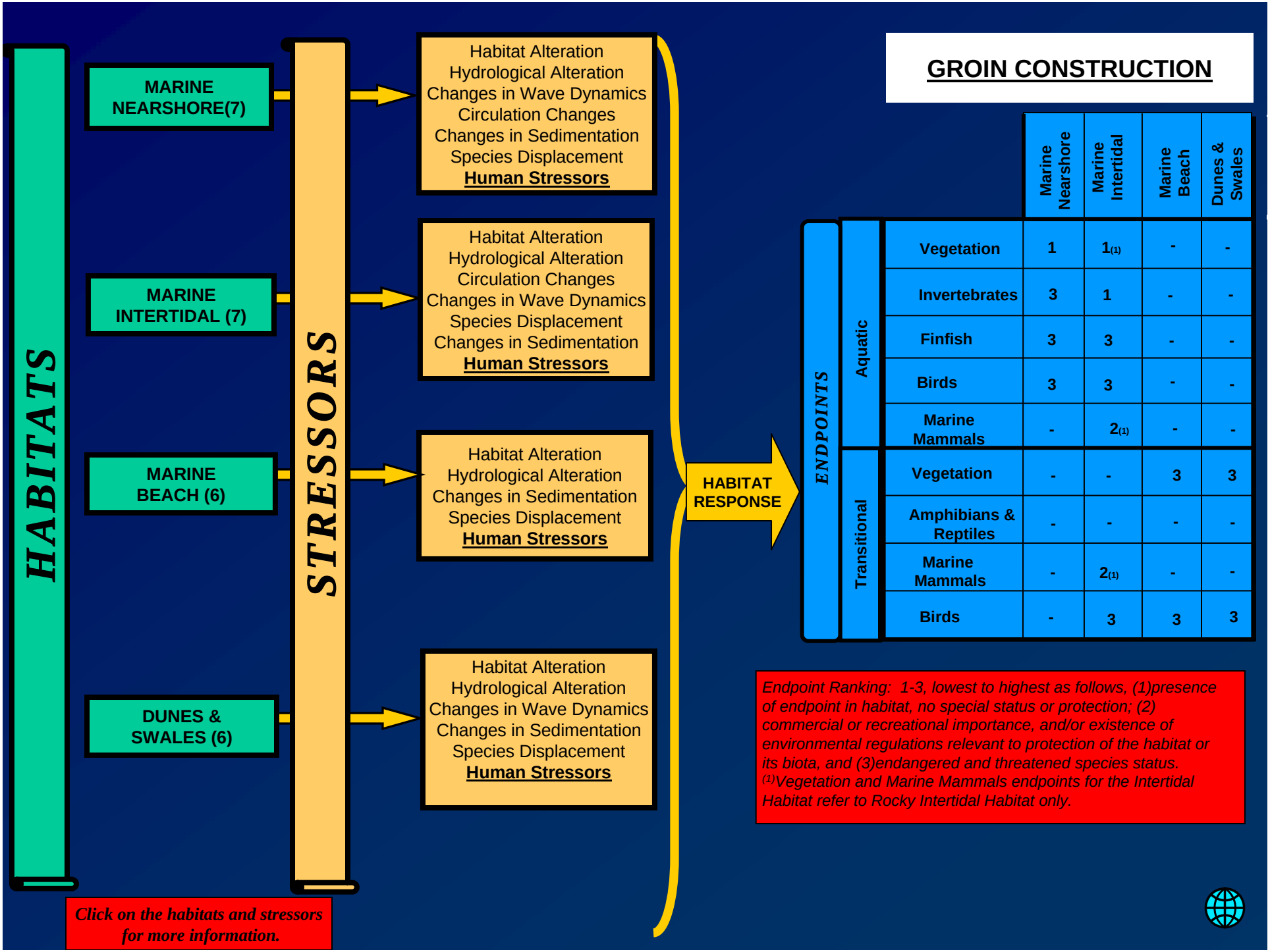

BARRIER ISLAND UPLAND ECOSYSTEM:
CONCEPTUAL MODEL
DRIVERS
Natural Drivers
Catastrophic Storms
Climate Change
Sea Level Rise
Anthropogenic Drivers
Development
Recreation & Land Use
Construction – Hard
Construction – Soft
Construction – Dredging
Click on the drivers and stressors for more information.
STRESSORS
Physical Stressors
Breach Formation
Habitat Alteration
Hydrological Stressors
Changes in Overwash Regime
Flooding
Hydrological Alteration
Changes in Wave Dynamics
Circulation Changes
Water Quality Stressors
Changes in Salinity
Changes in Nutrient Conc.
Contaminants
Changes in Sedimentation
Biological Stressors
Species Displacement
Human Stressors
Human Presence
Other Stressors
Salt Deposition
Groundwater Regime
Changes in Fire Regime
Habitat Response
Click on the stars for details on pathways.
ENDPOINTS
Terrestrial
Amphibians & Reptiles
Terrestrial Mammals & Insects
Birds
Vegetation
Transitional
Birds
Marine Mammals
Amphibians & Reptiles
Vegetation
Aquatic
Marine Mammals
Birds
Finfish
Invertebrates
Vegetation



GROIN ALTERATION

ENDPOINTS		Marine Nearshore	Marine Intertidal	Marine Beach	Dunes & Swales
Aquatic	Vegetation	1	1(1)	-	-
	Invertebrates	3	1	-	-
	Finfish	3	3	-	-
	Birds	3	3	-	-
	Marine Mammals	-	2	-	-
Transitional	Vegetation	-	-	3(2)	3(2)
	Amphibians & Reptiles	-	-	-	-
	Marine Mammals	-	2(1)	-	-
	Birds	-	3	3(2)	3(2)

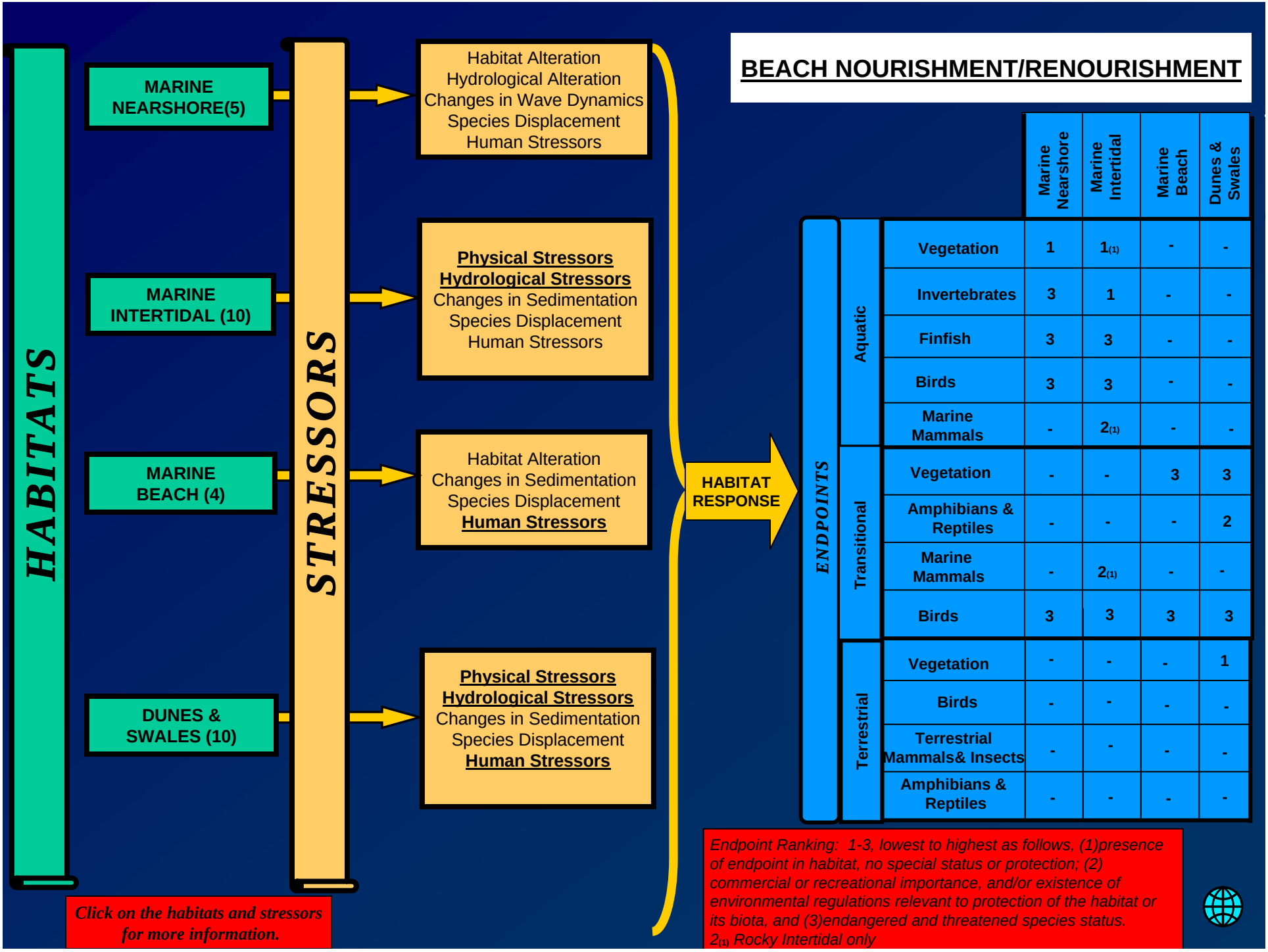
Endpoint Ranking: 1-3, lowest to highest as follows, (1)presence of endpoint in habitat, no special status or protection; (2) commercial or recreational importance, and/or existence of environmental regulations relevant to protection of the habitat or its biota, and (3)endangered and threatened species status. (1)Vegetation and Marine Mammals endpoints for the Intertidal Habitat refer to Rocky Intertidal Habitat only. (2)Note that this model applies to Groin Shortening,Notching and Removal; while all endpoints are the same, potential impacts to Transitional endpoints due to complete Groin Removal are greatest.



GROIN CONSTRUCTION

ENDPOINTS		Marine Nearshore	Marine Intertidal	Marine Beach	Dunes & Swales
Aquatic	Vegetation	1	1(1)	-	-
	Invertebrates	3	1	-	-
	Finfish	3	3	-	-
	Birds	3	3	-	-
	Marine Mammals	-	2(1)	-	-
Transitional	Vegetation	-	-	3	3
	Amphibians & Reptiles	-	-	-	-
	Marine Mammals	-	2(1)	-	-
	Birds	-	3	3	3

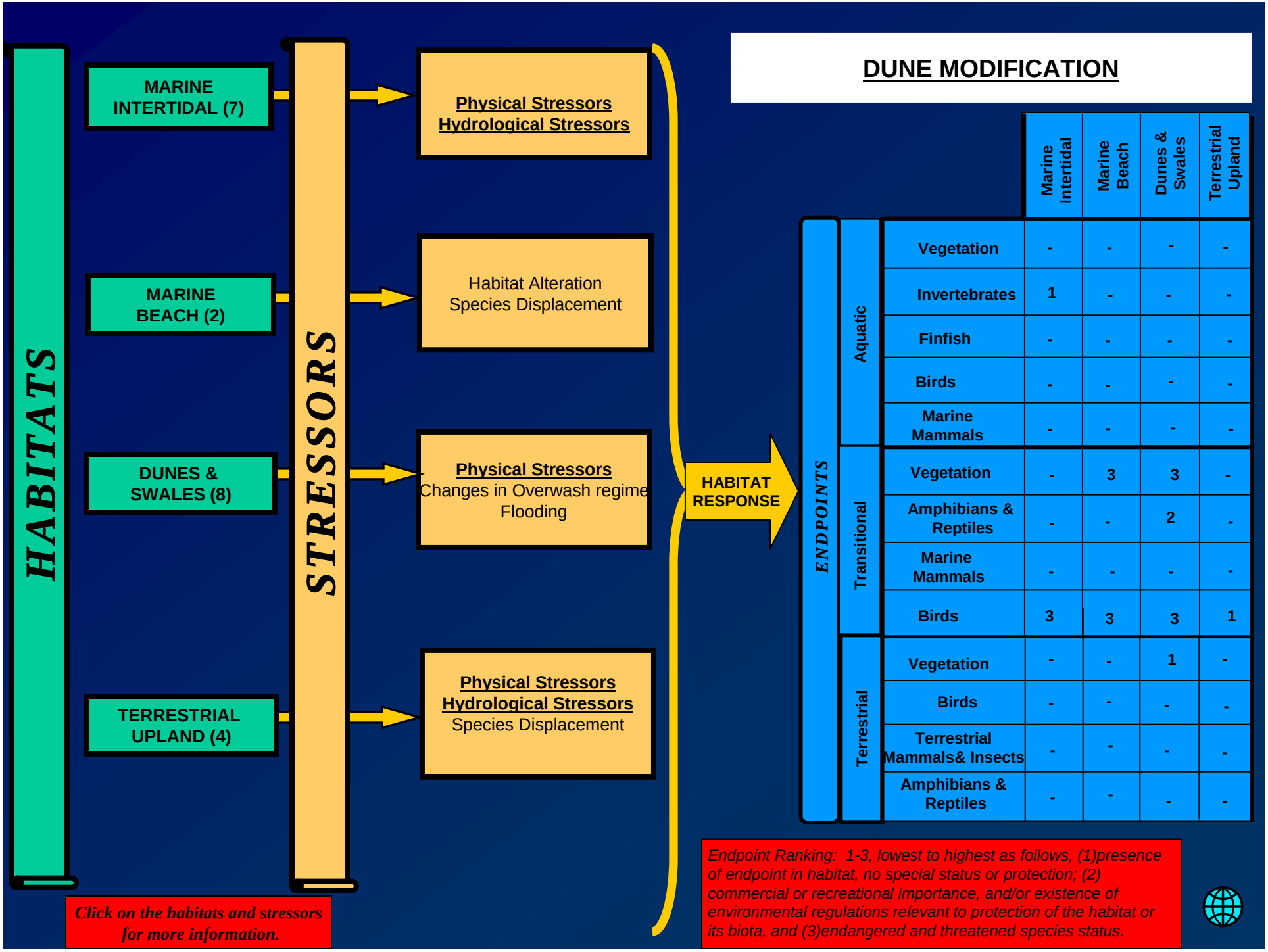
Endpoint Ranking: 1-3, lowest to highest as follows, (1)presence of endpoint in habitat, no special status or protection; (2) commercial or recreational importance, and/or existence of environmental regulations relevant to protection of the habitat or its biota, and (3)endangered and threatened species status.
(1)Vegetation and Marine Mammals endpoints for the Intertidal Habitat refer to Rocky Intertidal Habitat only.



BEACH NOURISHMENT/RENOURISHMENT

ENDPOINTS			Marine Nearshore	Marine Intertidal	Marine Beach	Dunes & Swales
Aquatic		Vegetation	1	1(1)	-	-
		Invertebrates	3	1	-	-
		Finfish	3	3	-	-
		Birds	3	3	-	-
		Marine Mammals	-	2(1)	-	-
Transitional		Vegetation	-	-	3	3
		Amphibians & Reptiles	-	-	-	2
		Marine Mammals	-	2(1)	-	-
		Birds	3	3	3	3
Terrestrial		Vegetation	-	-	-	1
		Birds	-	-	-	-
		Terrestrial Mammals& Insects	-	-	-	-
		Amphibians & Reptiles	-	-	-	-

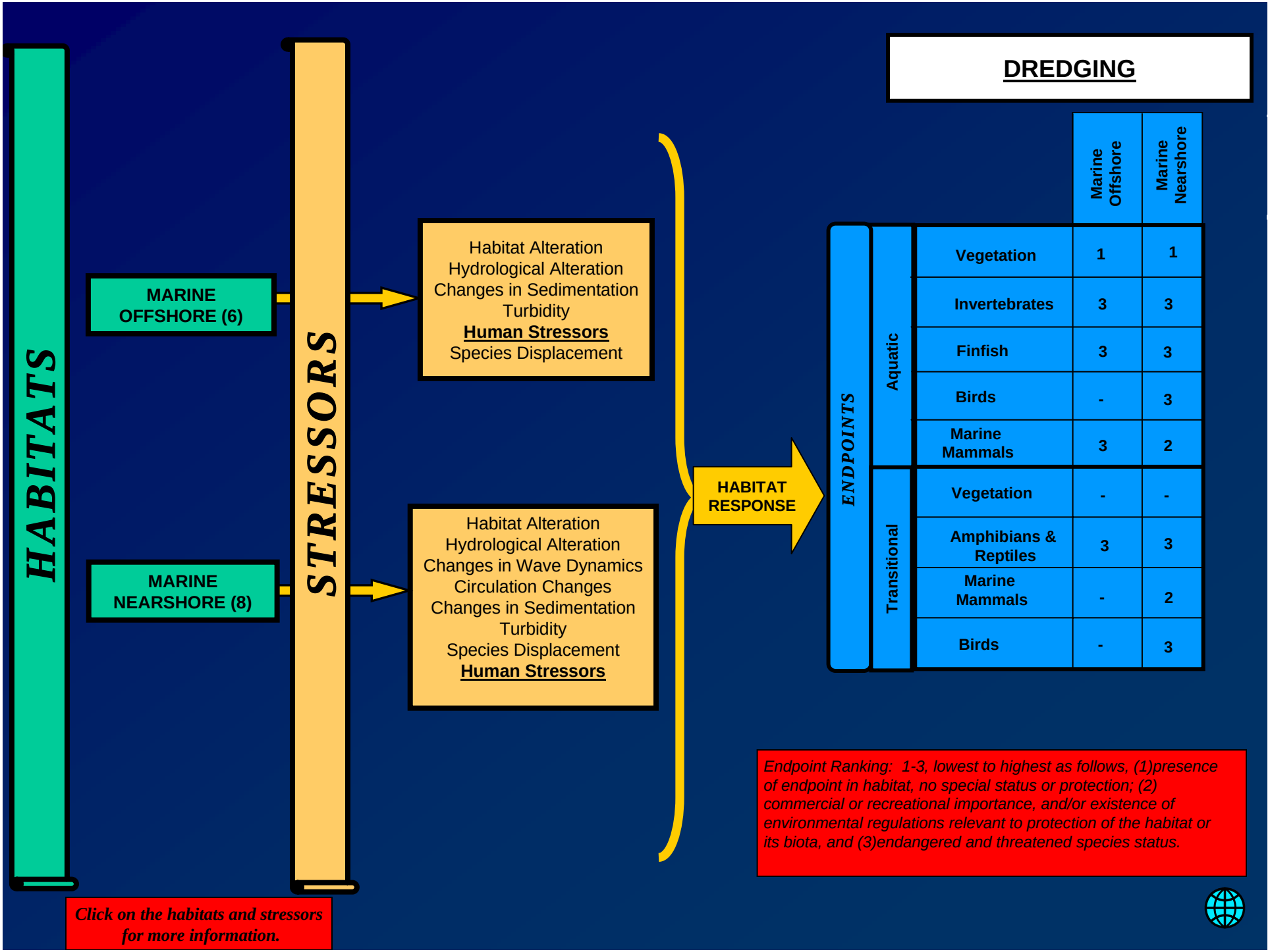
Endpoint Ranking: 1-3, lowest to highest as follows, (1)presence of endpoint in habitat, no special status or protection; (2) commercial or recreational importance, and/or existence of environmental regulations relevant to protection of the habitat or its biota, and (3)endangered and threatened species status.
2(1) Rocky Intertidal only

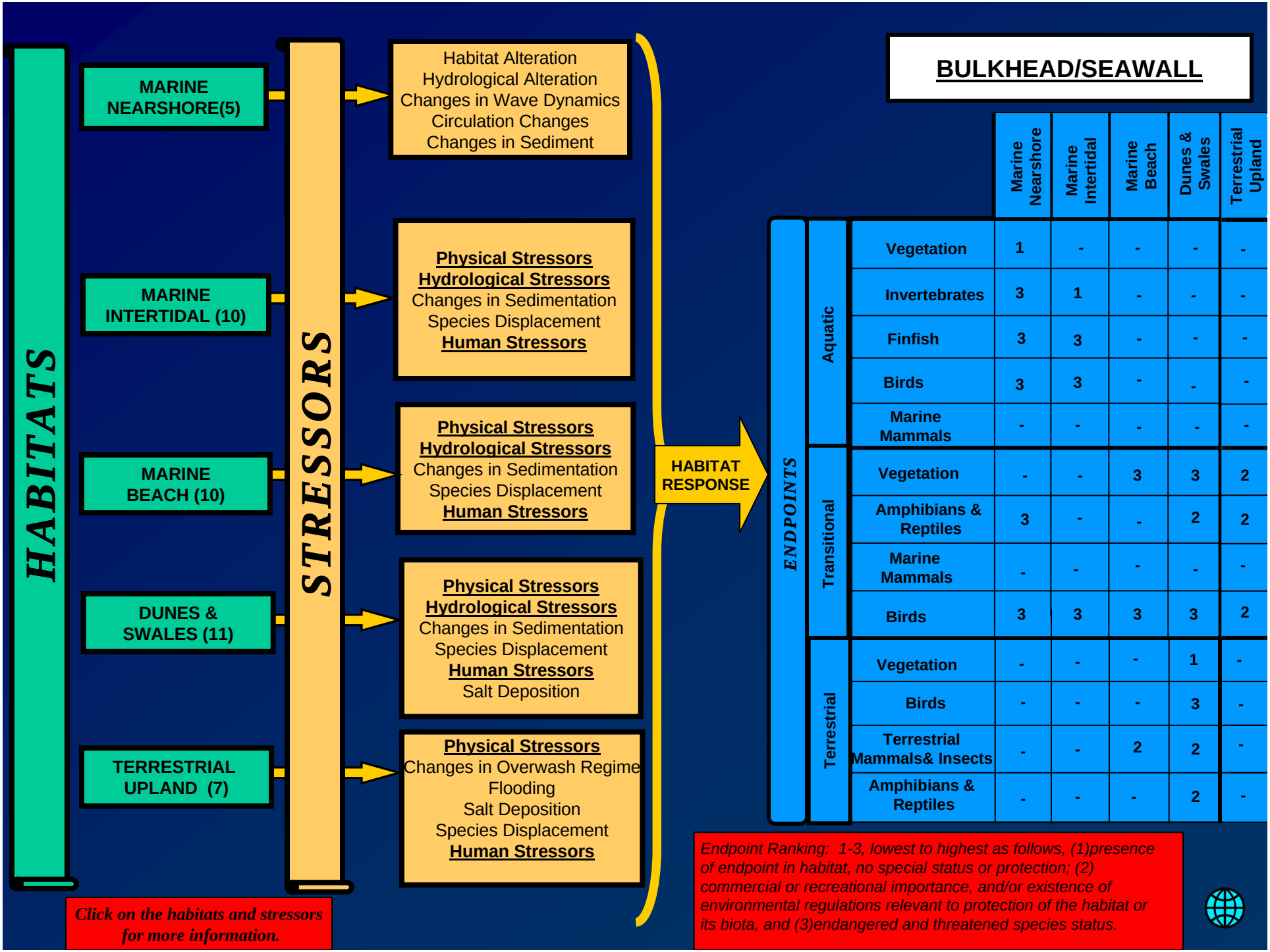


DUNE MODIFICATION

			Marine Intertidal	Marine Beach	Dunes & Swales	Terrestrial Upland
ENDPOINTS	Aquatic	Vegetation	-	-	-	-
		Invertebrates	1	-	-	-
		Finfish	-	-	-	-
		Birds	-	-	-	-
		Marine Mammals	-	-	-	-
	Transitional	Vegetation	-	3	3	-
		Amphibians & Reptiles	-	-	2	-
		Marine Mammals	-	-	-	-
		Birds	3	3	3	1
	Terrestrial	Vegetation	-	-	1	-
		Birds	-	-	-	-
		Terrestrial Mammals& Insects	-	-	-	-
		Amphibians & Reptiles	-	-	-	-

Endpoint Ranking: 1-3, lowest to highest as follows, (1)presence of endpoint in habitat, no special status or protection; (2) commercial or recreational importance, and/or existence of environmental regulations relevant to protection of the habitat or its biota, and (3)endangered and threatened species status.

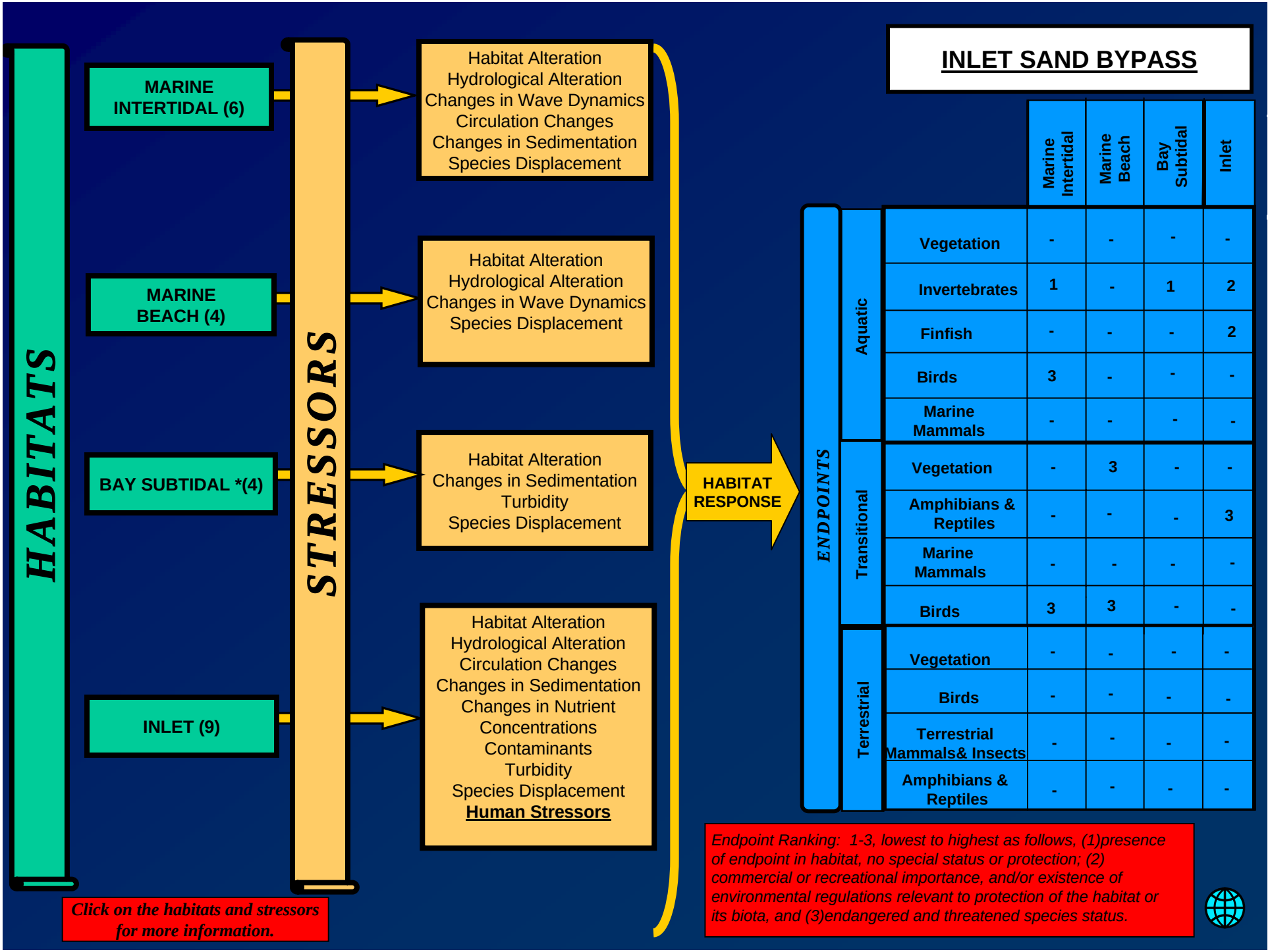

HABITATS
STRESSORS
MARINE OFFSHORE (6)
MARINE NEARSHORE (8)
Habitat Alteration
Hydrological Alteration
Changes in Sedimentation
Turbidity
Human Stressors
Species Displacement
Habitat Alteration
Hydrological Alteration
Changes in Wave Dynamics
Circulation Changes
Changes in Sedimentation
Turbidity
Species Displacement
Human Stressors
HABITAT RESPONSE
DREDGING
ENDPOINTS
Aquatic
Transitional
Marine Offshore
Marine Nearshore
Vegetation 1 1
Invertebrates 3 3
Finfish 3 3
Birds - 3
Marine Mammals 3 2
Vegetation - -
Amphibians & Reptiles 3 3
Marine Mammals - 2
Birds - 3
Endpoint Ranking: 1-3, lowest to highest as follows, (1)presence of endpoint in habitat, no special status or protection; (2) commercial or recreational importance, and/or existence of environmental regulations relevant to protection of the habitat or its biota, and (3)endangered and threatened species status.
Click on the habitats and stressors for more information.



BULKHEAD/SEAWALL

		Marine Nearshore	Marine Intertidal	Marine Beach	Dunes & Swales	Terrestrial Upland
Aquatic	Vegetation	1	-	-	-	-
	Invertebrates	3	1	-	-	-
	Finfish	3	3	-	-	-
	Birds	3	3	-	-	-
	Marine Mammals	-	-	-	-	-
Transitional	Vegetation	-	-	3	3	2
	Amphibians & Reptiles	3	-	-	2	2
	Marine Mammals	-	-	-	-	-
	Birds	3	3	3	3	2
Terrestrial	Vegetation	-	-	-	1	-
	Birds	-	-	-	3	-
	Terrestrial Mammals& Insects	-	-	2	2	-
	Amphibians & Reptiles	-	-	-	2	-

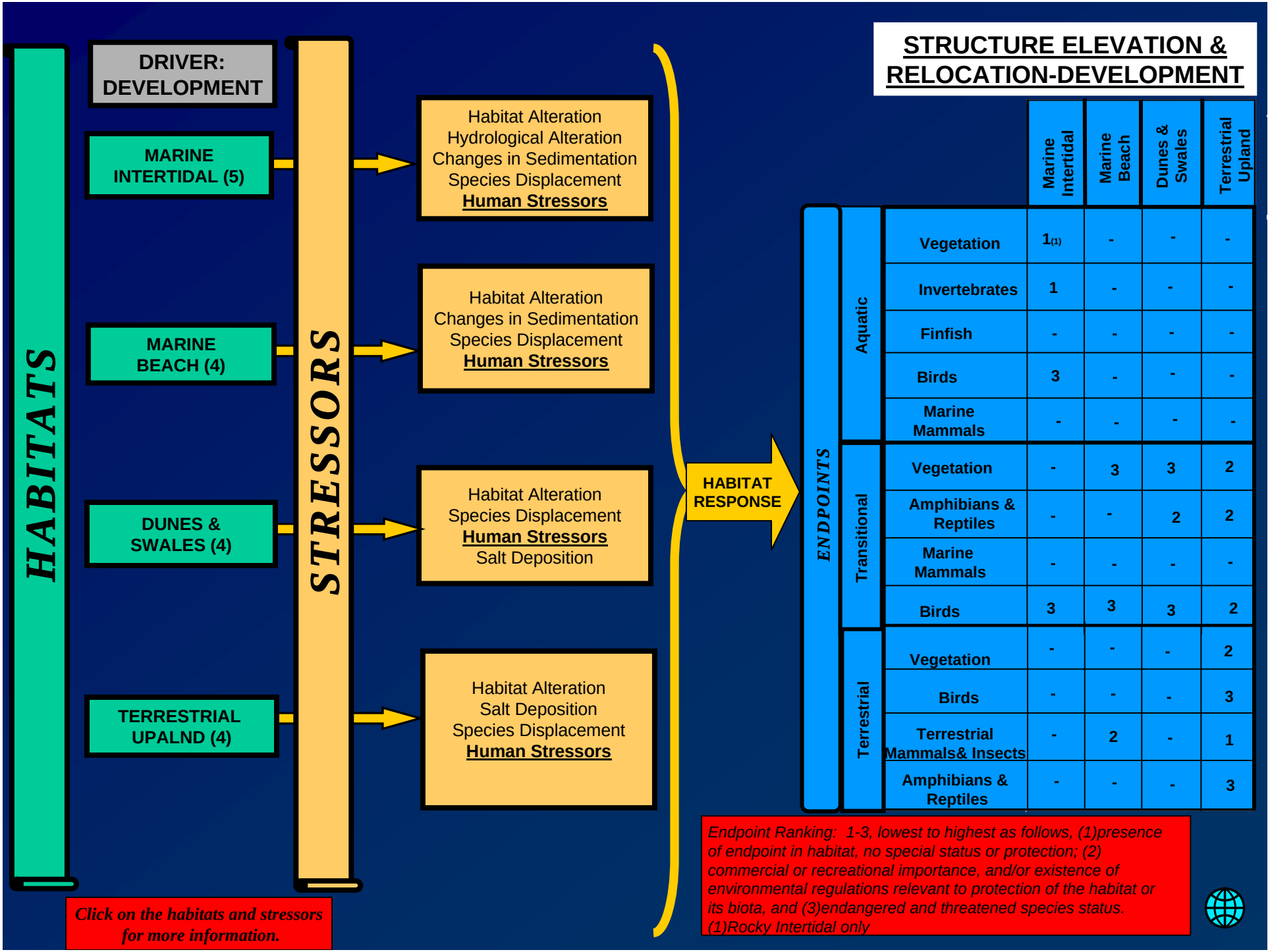
Endpoint Ranking: 1-3, lowest to highest as follows, (1)presence of endpoint in habitat, no special status or protection; (2) commercial or recreational importance, and/or existence of environmental regulations relevant to protection of the habitat or its biota, and (3)endangered and threatened species status.



INLET SAND BYPASS

ENDPOINTS		Marine Intertidal	Marine Beach	Bay Subtidal	Inlet
Aquatic	Vegetation	-	-	-	-
	Invertebrates	1	-	1	2
	Finfish	-	-	-	2
	Birds	3	-	-	-
	Marine Mammals	-	-	-	-
Transitional	Vegetation	-	3	-	-
	Amphibians & Reptiles	-	-	-	3
	Marine Mammals	-	-	-	-
	Birds	3	3	-	-
Terrestrial	Vegetation	-	-	-	-
	Birds	-	-	-	-
	Terrestrial Mammals& Insects	-	-	-	-
	Amphibians & Reptiles	-	-	-	-

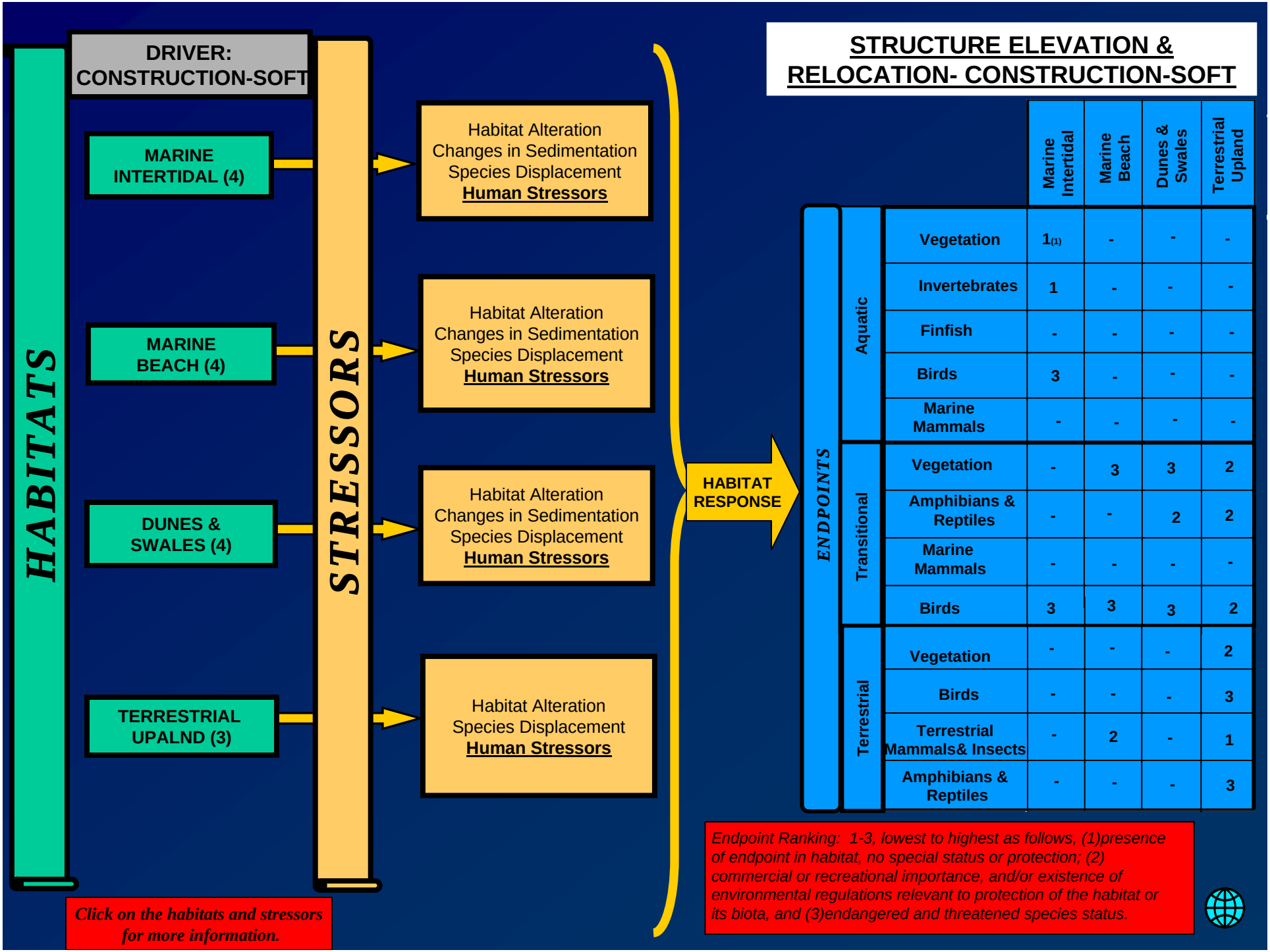
Endpoint Ranking: 1-3, lowest to highest as follows, (1)presence of endpoint in habitat, no special status or protection; (2) commercial or recreational importance, and/or existence of environmental regulations relevant to protection of the habitat or its biota, and (3)endangered and threatened species status.



STRUCTURE ELEVATION & RELOCATION-DEVELOPMENT

ENDPOINTS			Marine Intertidal	Marine Beach	Dunes & Swales	Terrestrial Upland
Aquatic		Vegetation	1(1)	-	-	-
		Invertebrates	1	-	-	-
		Finfish	-	-	-	-
		Birds	3	-	-	-
		Marine Mammals	-	-	-	-
Transitional		Vegetation	-	3	3	2
		Amphibians & Reptiles	-	-	2	2
		Marine Mammals	-	-	-	-
		Birds	3	3	3	2
Terrestrial		Vegetation	-	-	-	2
		Birds	-	-	-	3
		Terrestrial Mammals& Insects	-	2	-	1
		Amphibians & Reptiles	-	-	-	3

Endpoint Ranking: 1-3, lowest to highest as follows, (1)presence of endpoint in habitat, no special status or protection; (2) commercial or recreational importance, and/or existence of environmental regulations relevant to protection of the habitat or its biota, and (3)endangered and threatened species status.
(1)Rocky Intertidal only

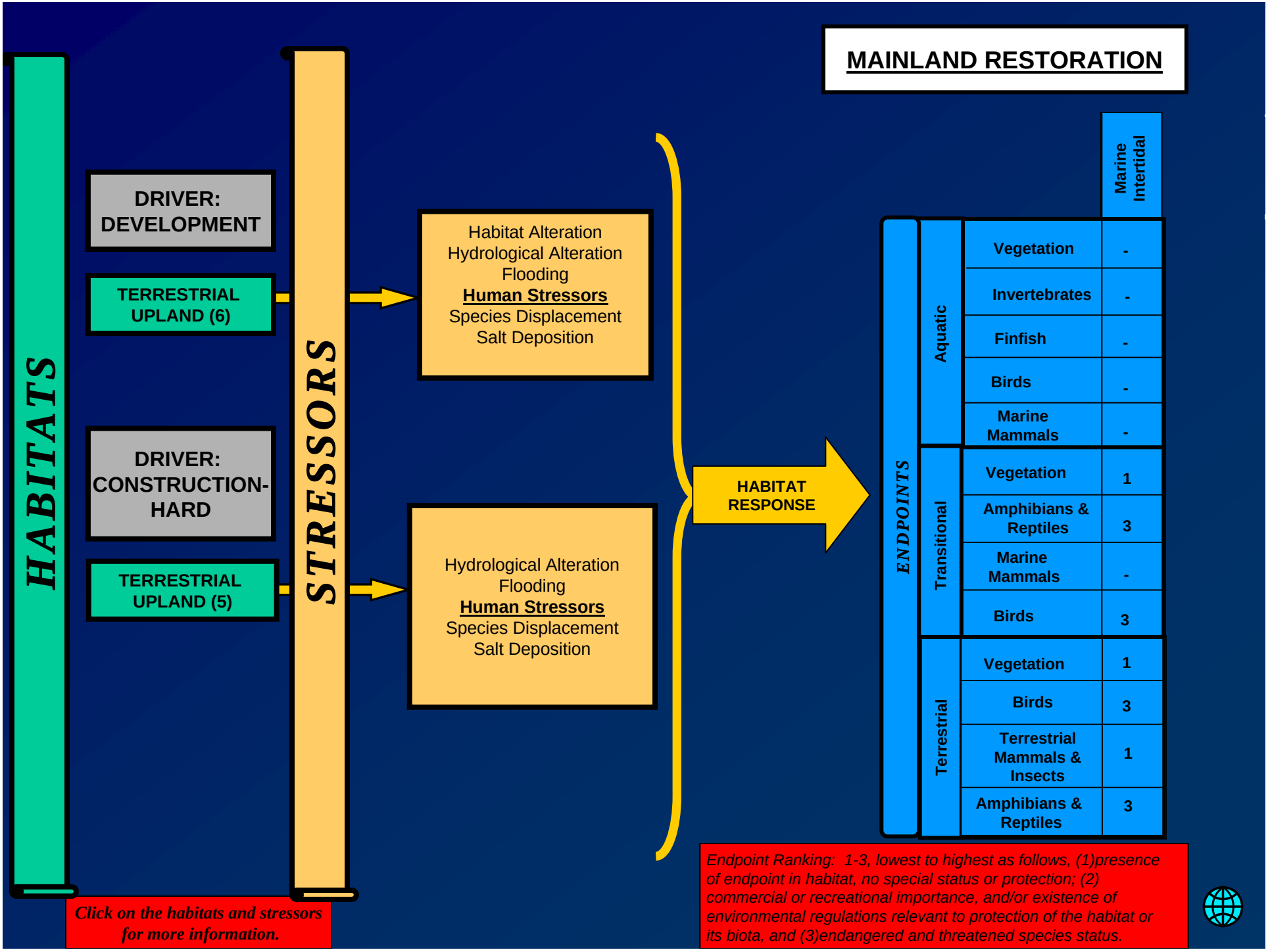


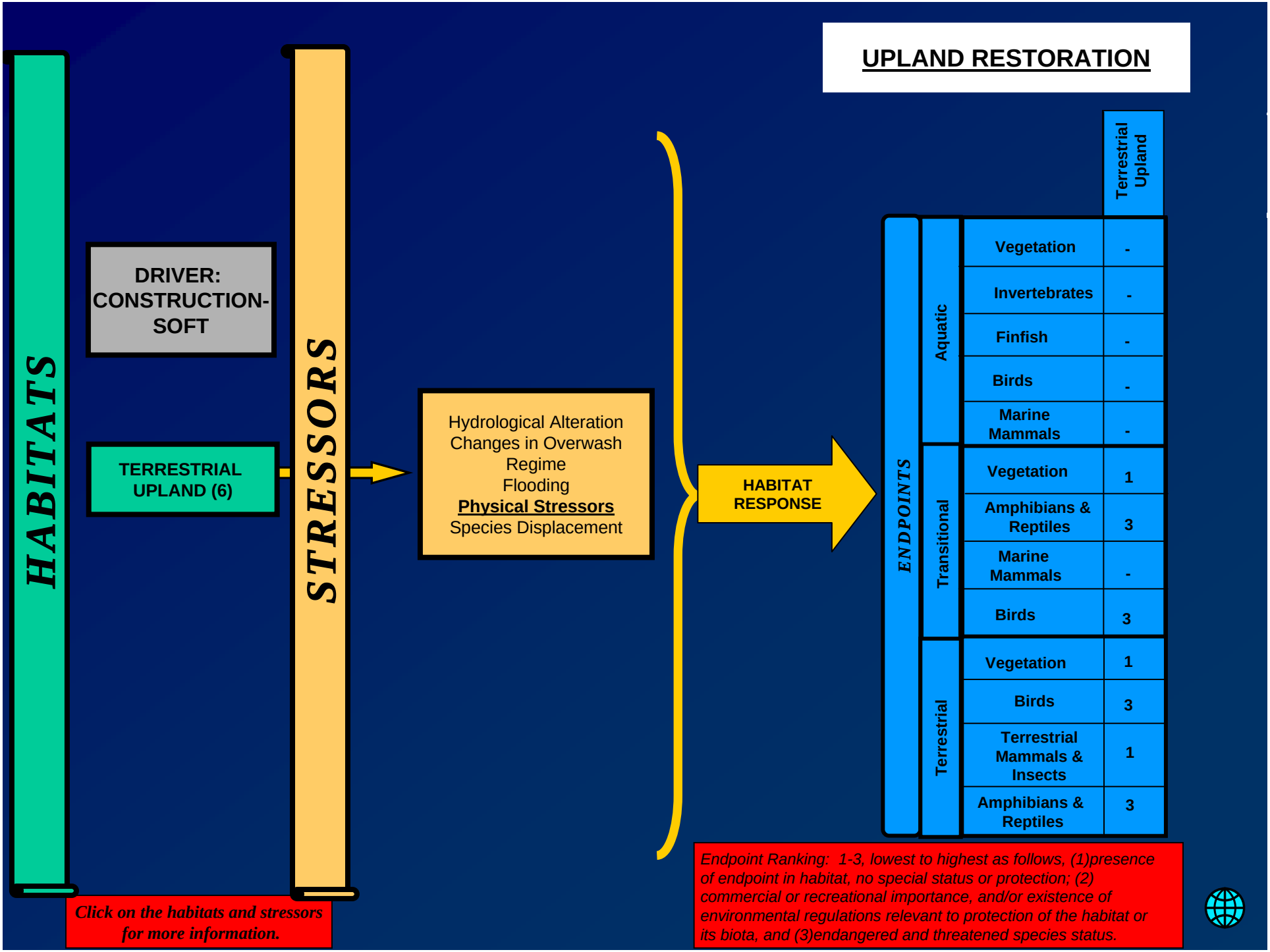
STRUCTURE ELEVATION & RELOCATION- CONSTRUCTION-SOFT

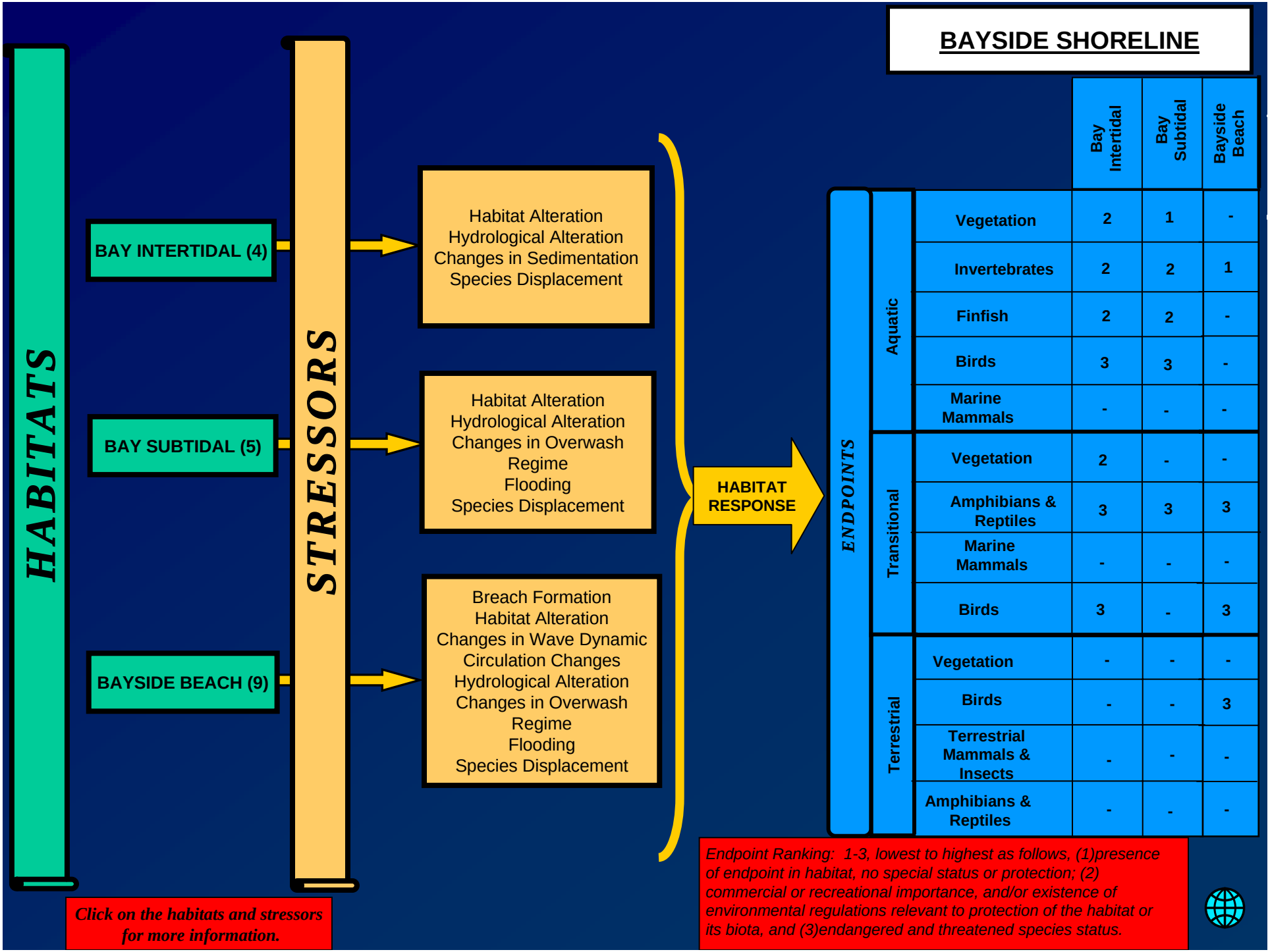
ENDPOINTS		Marine Intertidal	Marine Beach	Dunes & Swales	Terrestrial Upland
Aquatic	Vegetation	1(1)	-	-	-
	Invertebrates	1	-	-	-
	Finfish	-	-	-	-
	Birds	3	-	-	-
	Marine Mammals	-	-	-	-
Transitional	Vegetation	-	3	3	2
	Amphibians & Reptiles	-	-	2	2
	Marine Mammals	-	-	-	-
	Birds	3	3	3	2
Terrestrial	Vegetation	-	-	-	2
	Birds	-	-	-	3
	Terrestrial Mammals& Insects	-	2	-	1
	Amphibians & Reptiles	-	-	-	3

Endpoint Ranking: 1-3, lowest to highest as follows, (1)presence of endpoint in habitat, no special status or protection; (2) commercial or recreational importance, and/or existence of environmental regulations relevant to protection of the habitat or its biota, and (3)endangered and threatened species status.

MAINLAND RESTORATION

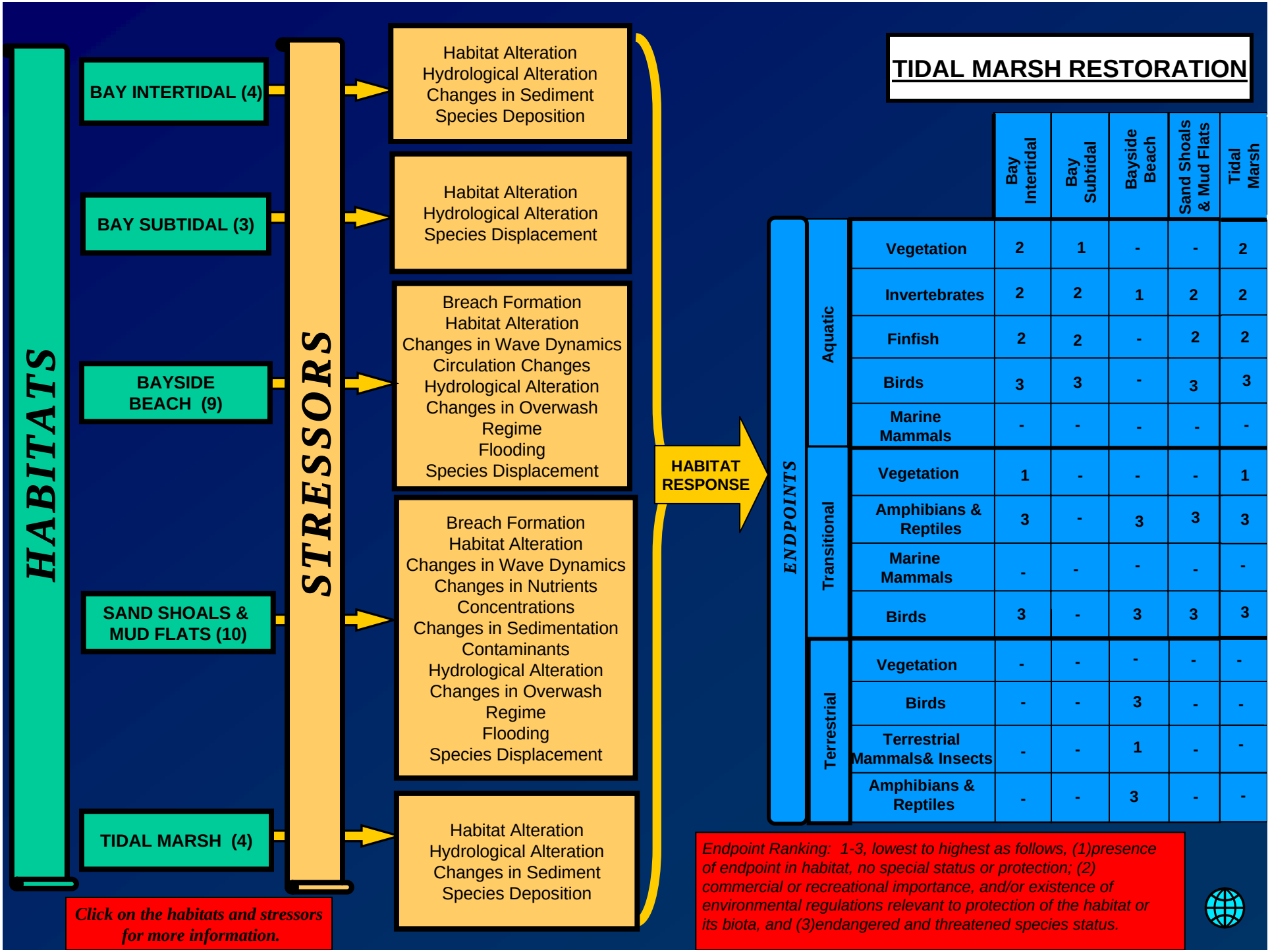



UPLAND RESTORATION
HABITATS
STRESSORS
DRIVER: CONSTRUCTION-SOFT
TERRESTRIAL UPLAND (6)
Hydrological Alteration
Changes in Overwash Regime
Flooding
Physical Stressors
Species Displacement
HABITAT RESPONSE
ENDPOINTS
Terrestrial Upland
Aquatic
Vegetation -
Invertebrates -
Finfish -
Birds -
Marine Mammals -
Transitional
Vegetation 1
Amphibians & Reptiles 3
Marine Mammals -
Birds 3
Terrestrial
Vegetation 1
Birds 3
Terrestrial Mammals & Insects 1
Amphibians & Reptiles 3
Click on the habitats and stressors for more information.
Endpoint Ranking: 1-3, lowest to highest as follows, (1)presence of endpoint in habitat, no special status or protection; (2) commercial or recreational importance, and/or existence of environmental regulations relevant to protection of the habitat or its biota, and (3)endangered and threatened species status.



		Bay Intertidal	Bay Subtidal	Bayside Beach
Aquatic	Vegetation	2	1	-
	Invertebrates	2	2	1
	Finfish	2	2	-
	Birds	3	3	-
	Marine Mammals	-	-	-
Transitional	Vegetation	2	-	-
	Amphibians & Reptiles	3	3	3
	Marine Mammals	-	-	-
	Birds	3	-	3
Terrestrial	Vegetation	-	-	-
	Birds	-	-	3
	Terrestrial Mammals & Insects	-	-	-
	Amphibians & Reptiles	-	-	-

Endpoint Ranking: 1-3, lowest to highest as follows, (1)presence of endpoint in habitat, no special status or protection; (2) commercial or recreational importance, and/or existence of environmental regulations relevant to protection of the habitat or its biota, and (3)endangered and threatened species status.

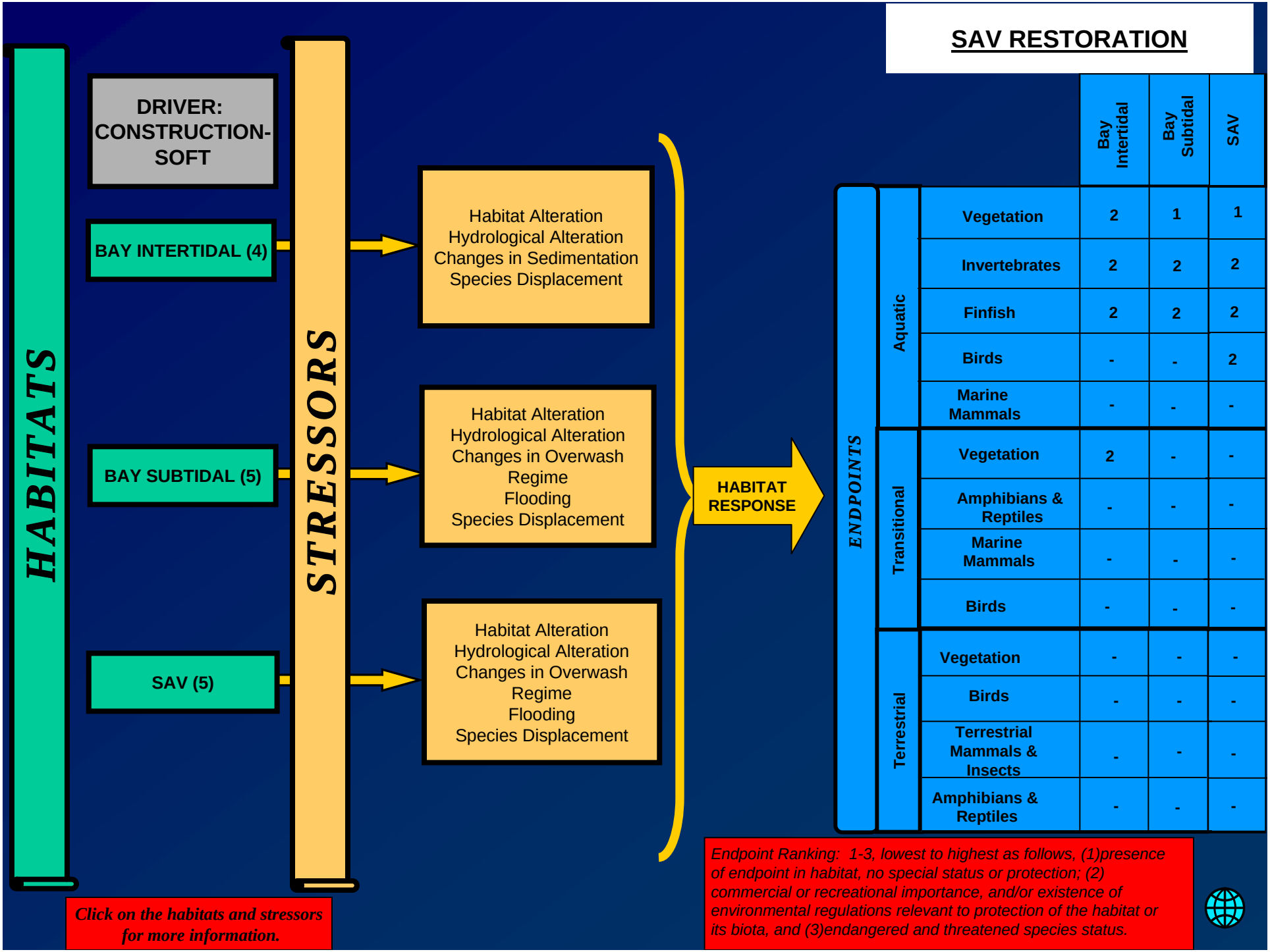


TIDAL MARSH RESTORATION

		Bay Intertidal	Bay Subtidal	Bayside Beach	Sand Shoals & Mud Flats	Tidal Marsh
Aquatic	Vegetation	2	1	-	-	2
	Invertebrates	2	2	1	2	2
	Finfish	2	2	-	2	2
	Birds	3	3	-	3	3
	Marine Mammals	-	-	-	-	-
Transitional	Vegetation	1	-	-	-	1
	Amphibians & Reptiles	3	-	3	3	3
	Marine Mammals	-	-	-	-	-
	Birds	3	-	3	3	3
Terrestrial	Vegetation	-	-	-	-	-
	Birds	-	-	3	-	-
	Terrestrial Mammals& Insects	-	-	1	-	-
	Amphibians & Reptiles	-	-	3	-	-

Endpoint Ranking: 1-3, lowest to highest as follows, (1)presence of endpoint in habitat, no special status or protection; (2) commercial or recreational importance, and/or existence of environmental regulations relevant to protection of the habitat or its biota, and (3)endangered and threatened species status.

SAV RESTORATION



		Bay Intertidal	Bay Subtidal	SAV
Aquatic	Vegetation	2	1	1
	Invertebrates	2	2	2
	Finfish	2	2	2
	Birds	-	-	2
	Marine Mammals	-	-	-
Transitional	Vegetation	2	-	-
	Amphibians & Reptiles	-	-	-
	Marine Mammals	-	-	-
	Birds	-	-	-
Terrestrial	Vegetation	-	-	-
	Birds	-	-	-
	Terrestrial Mammals & Insects	-	-	-
	Amphibians & Reptiles	-	-	-

Click on the habitats and stressors for more information.

Endpoint Ranking: 1-3, lowest to highest as follows, (1)presence of endpoint in habitat, no special status or protection; (2) commercial or recreational importance, and/or existence of environmental regulations relevant to protection of the habitat or its biota, and (3)endangered and threatened species status.

Assessment Model Development

Project specific assessment models are developed from combinations of relevant habitat and feature based models using the following approach:

Step 1

- Select appropriate project/restoration model

- The most representative model will ensure that the appropriate endpoints are assessed, and that relevant drivers and stressors have also been considered.

Click for next slide

Assessment Model Development

Step 2

- Incorporate site-specific habitat components (eg., drivers, stressors and endpoints)

- Each habitat has associated endpoints identified that must be considered

Click for next slide

Assessment Model Development

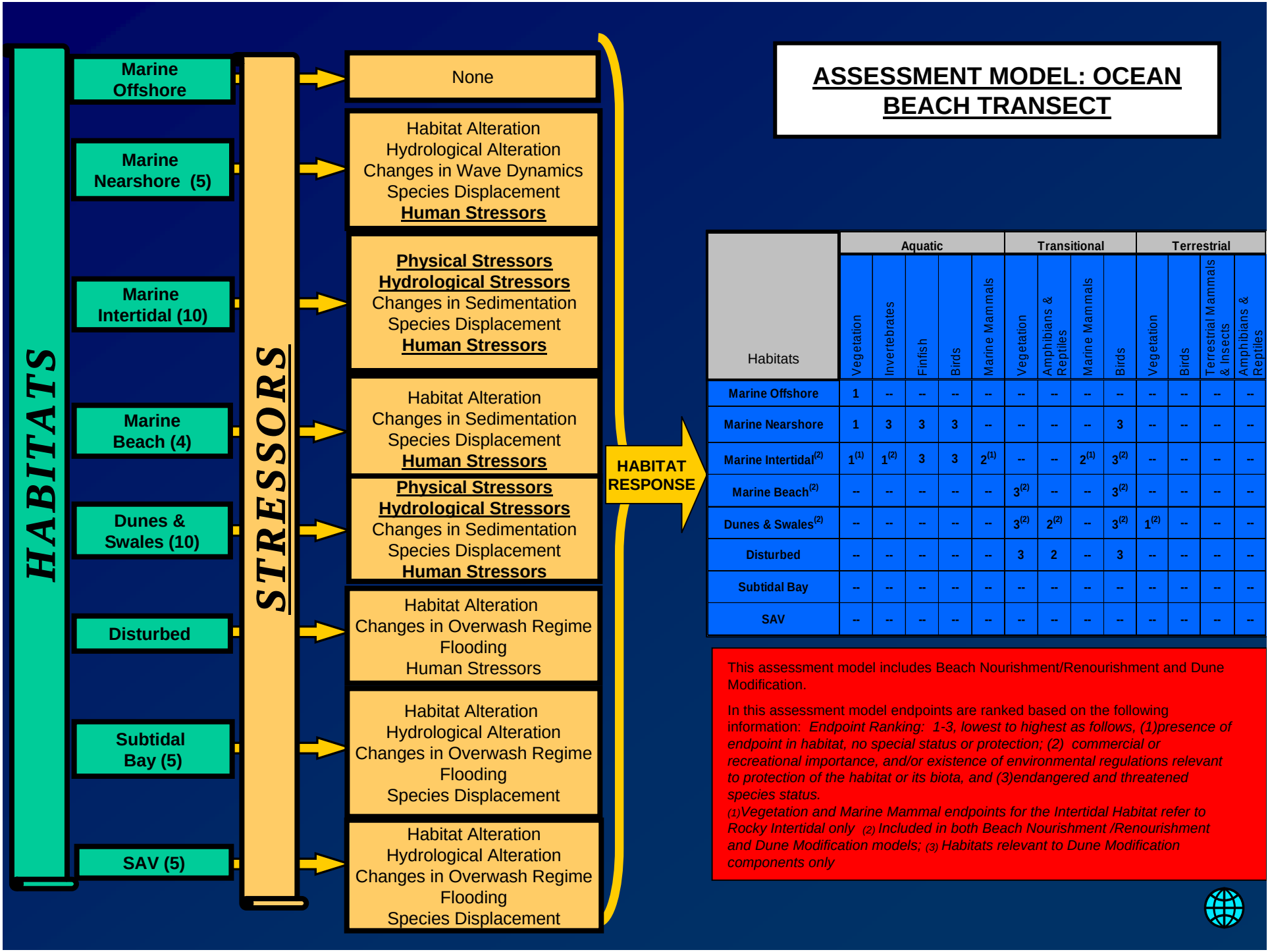
Step 3

- Identify relevant site-specific complete pathways to be analyzed in the EIS

- A complete pathway must include the following four elements to be carried into the EIS:
  - -driver
  - -stressor
  - -contact mechanism
  - -endpoint

Refer to Section 6.0 of the Phase 3 Conceptual Model for detailed approach to Assessment Model Development

Click for next slide for example of hypothetical assessment model



ASSESSMENT MODEL: OCEAN BEACH TRANSECT

Habitats	Aquatic					Transitional				Terrestrial			
	Vegetation	Invertebrates	Finfish	Birds	Marine Mammals	Vegetation	Amphibians & Reptiles	Marine Mammals	Birds	Vegetation	Birds	Terrestrial Mammals & Insects	Amphibians & Reptiles
Marine Offshore	1	--	--	--	--	--	--	--	--	--	--	--	--
Marine Nearshore	1	3	3	3	--	--	--	--	3	--	--	--	--
Marine Intertidal[2]	1[1]	1[2]	3	3	2[1]	--	--	2[1]	3[2]	--	--	--	--
Marine Beach[2]	--	--	--	--	--	3[2]	--	--	3[2]	--	--	--	--
Dunes & Swales[2]	--	--	--	--	--	3[2]	2[2]	--	3[2]	1[2]	--	--	--
Disturbed	--	--	--	--	--	3	2	--	3	--	--	--	--
Subtidal Bay	--	--	--	--	--	--	--	--	--	--	--	--	--
SAV	--	--	--	--	--	--	--	--	--	--	--	--	--

This assessment model includes Beach Nourishment/Renourishment and Dune Modification.

In this assessment model endpoints are ranked based on the following information: *Endpoint Ranking: 1-3, lowest to highest as follows, (1)presence of endpoint in habitat, no special status or protection; (2) commercial or recreational importance, and/or existence of environmental regulations relevant to protection of the habitat or its biota, and (3)endangered and threatened species status.*

(1)Vegetation and Marine Mammal endpoints for the Intertidal Habitat refer to Rocky Intertidal only (2) Included in both Beach Nourishment /Renourishment and Dune Modification models; (3) Habitats relevant to Dune Modification components only

Groin Alteration

- Groin Alteration includes groin removal, notching and shortening. Groin removal restores the component of the sediment budget involving longshore transport of sediment that was interrupted by placement of the groin. In so doing it allows for natural restoration of downdrift habitats, but this restoration is variable and accomplished at the expense of updrift habitats providing the source of sediment. The effects of groin notching or shortening are similar to removal in that these activities restore some of the longshore sediment transport.

Groin Construction

- Groin Construction protects beaches from erosion by interrupting longshore transport of sediment. While the beach on the updrift side of the groin is stabilized, in some cases the downdrift side can be starved for sediment and may erode over time. By interrupting longshore sediment transport, Groin Construction will affect natural development of the barrier island profile.

Beach Nourishment/Renourishment

- Beach nourishment generally involves the initial placement of sand removed from borrow areas to an eroding beach; renourishment is the ongoing placement of sand removed from offshore borrow areas to maintain beach design geometry. Beach Nourishment/Renourishment is applicable to oceanfront shorelines in areas that are subject to minor to moderate erosion, inundation and wave attack. Beach Nourishment/Renourishment by definition is not intended for any bayside areas in the FIMP Study Area.

Dune Modification

- Dune Modification can be considered a feature of Beach Nourishment/Renourishment since it is usually performed in conjunction with recontouring of the adjacent beach area. Dune Modification includes but is not limited to, raising or lowering the height of the dune, changing the slope of the dune, increasing the width of the dune, expanding the linear extent of the dune, connecting fragmented dunes and increasing vegetative cover.

Dredging

- Dredging for the purpose of sand mining in the marine nearshore, or more typically, offshore area can be a component of Beach Nourishment/Renourishment. As such, it should be considered in the assessment of potential project features. Dredging involves significant short-term disturbance to the substrate and water column in the areas where sediment is removed.

Bulkhead/Seawall

- A bulkhead is a steep or vertical structure supporting a natural or artificial embankment. Bulkheads can be made of timber, concrete, masonry, steel or timber sheet piling, etc., and may be used for toe protection in combination with revetment (rock). In bank and shore protection, a bulkhead is an armor on a slope steep that retains the bank against sliding or erosion. Bulkheads are normally constructed with a vertical face, maximizing wave reflection. Scour can be controlled by providing an environmentally sound engineering design that includes toe protection to the base of the constructed wall.

Inlet Sand Bypass

- Inlet Sand Bypassing is the hydraulic or mechanical movement of sand, from an area of accretion to a downdrift area of erosion, across a barrier to natural sand transport such as large scale harbor or jetty structure. The hydraulic movement may include natural movement as well as movement caused by man. Inlet Sand Bypassing includes sand placement and sand removal, as well as all other associated project needs.

Structural Elevation and Removal: Development and Construction-Soft

- The Reformulation Study includes the identification and evaluation of "nonstructural" methods of storm damage reduction. Nonstructural features are intended to reduce damages to existing buildings and infrastructure and future development without significantly interfering or altering the physical coastal processes of flooding or erosion. These nonstructural activities can occur on the barrier island or mainland. For example, flood-prone buildings can be raised, retrofitted, or relocated.

Mainland Restoration

- Mainland Restoration can involve the removal of structures and restoration of natural areas on the mainland. Associated features such as Plantings and Invasive Species Control could also be involved.

Upland Restoration

- Features that include habitat restoration or enhancement in upland areas are referred to as Upland Restoration. Upland Restoration includes any work on upland portions of barrier islands and adjacent bay islands such as restoration by vegetation planting, alteration of elevation, habitat use changes, or as a result of structural removal. In areas where restoration may replace poor quality or developed areas, ecological benefits will accrue to endpoints associated with the newly formed habitats.

Bayside Shoreline

- Bayside Shoreline Processes establish habitats that are essential to the overall system functioning. Bayside beaches, tidal flats, tidal marshes, and in-shore SAV beds provide fish and wildlife nursery, spawning, and feeding habitat. These habitats support diverse populations of fish and wildlife and support most life stages of fish, crabs, and other invertebrates that are essential components of the food web. These habitats also support migratory and resident shorebirds and wading birds, diamond-backed terrapins, horseshoe crabs, hard and soft shell clams, prey fish. Marshes also contribute to water quality, by providing filtration services, absorbing nutrients and capturing pollutants from the uplands.

Tidal Marsh Restoration

- Tidal Marsh Restoration is the intentional alteration of a site to establish the approximate biological, geological, and physical conditions that existed in the predisturbance indigenous Tidal Marsh habitat. Restoration can involve returning a nontidal area to tidal flushing, planting of high wildlife value vegetation, and modification of other aspects of the site. Modifications such as contouring or vegetation planting can increase the diversity of the habitat and hence, the ecological functions it can provide. Tidal Marsh Restoration is associated with Plantings and Invasive Species Control, Bayside Shoreline and Island Restoration.

SAV Restoration

- SAV Restoration is the process of seeding, plugging, or transplanting Submerged Aquatic Vegetation in order to restore SAV beds to a predisturbance condition. Construction-Soft is the driver associated with this restoration feature.

Vegetation Endpoints of the Offshore Habitat

- **Phytoplankton**

Invertebrate Endpoints of the Offshore Habitat

- ***Benthic:***
  - **Polychaetes, Amphipods, Sand Dollar, Sea Star, *Yoldia* sp., Horseshoe Crabs**
- ***Epibenthic:***
  - **Shrimp**
- ***Pelagic:***
  - **Jellyfish, Zooplankton**
- ***Commercially & Recreationally Important Species:***
  - **Clams, Lobster, Squid, Surf Clam, Scallop, Ocean Quahog, Crabs**

Finfish Endpoints of the Offshore Habitat

- **Pelagic**:
  - **Hake, Scup, Bluefish, Butterfish, Striped Bass, Herring, Mackerel**
- **Benthic:**
  - **Sandlance, Winter, Summer and Windowpane Flounders, Monkfish**
  - **Skates**

Note: All species are commercially and recreationally important.

Marine Mammal Endpoints of the Offshore Habitat

- Endangered Atlantic Right & Pygmy Sperm Whales

Amphibian & Reptile Endpoints of the Offshore Habitat

- ***Endangered Sea Turtles:***
  - **Kemps-Ridley**
  - **Hawksbill**
  - **Green**
  - **Leatherback**
- ***Threatened Sea Turtles:***
  - **Loggerhead**

Vegetation Endpoints of the Nearshore Habitat

- Phytoplankton

Bird Endpoints of the Nearshore Habitat

- Piscivorous Cormorant, Osprey*, Common & Least Terns*, Roseate Terns*, Mergansers
- Commercially & Recreationally Important Sea Ducks
- Other waterfowl such as Loons

* Endangered and Threatened species

Invertebrate Endpoints of the Nearshore Habitat

- ***Benthic:***
  - **Polychaetes, Amphipods, Sea Star, *Yoldia* sp.,**
- ***Epibenthic:***
  - **Shrimp**
- ***Pelagic:***
  - **Jellyfish, Zooplankton**
- ***Commercially & Recreationally Important Species:***
  - **Clams, Lobster, Squid, Surf Clam, Ocean Quahog**

Finfish Endpoints of the Nearshore Habitat

- ***Pelagic:***
  - **Silversides, Anchovies, Bluefish, Striped Bass, Mackerel, Herring**
- ***Benthic:***
  - **Winter and Summer Flounders**

Note: All species are commercially and recreationally important.

Amphibian & Reptile Endpoints of the Nearshore Habitat

- Endangered Kemps-Ridley & Hawksbill, and threatened Loggerhead sea turtles.

Marine Mammal Endpoints of the Nearshore Habitat

- Harbor and Gray Seals

Bird Endpoints of the Marine Intertidal Habitat

- ***Shorebirds:***
  - **Sandpipers and Piping Plover*, Gulls**
- ***Sea Birds:***
  - **Osprey*, Common & Least Terns***

***** **Endangered species**

Marine Mammals Endpoints of the Marine Intertidal Habitat

- **Harbor and Gray Seals**

* **Relevant to rocky substrate only**

Vegetation Endpoints of the Marine Intertidal Habitat

- Macroalgae*
- Phytoplankton

*Relevant to rocky substrate only.

Invertebrate Endpoints of the Marine Intertidal Habitat

- Amphipods and Isopods
- Polychaetes (e.g. *Scolelepis sp.*)
- Bivalves (e.g. *Donax sp.*)
- Mole Crab
- Attached forms (eg/. barnacles, mussels, limpets, chitons*)
- Hermit crab*, snails

* Relevant to rocky substrate only

Finfish Endpoints of the Marine Intertidal Habitat

- Silversides
- Kingfish
- Bluefish
- Anchovy

Vegetation Endpoints of the Marine Beach Habitat

- Sea Beach Amaranth*
- Miscellaneous Annuals
- Sea Beach Knotweed

*Threatened species

Bird Endpoints of the Marine Beach Habitat

- Least & Common Terns* and Piping Plover*
- Shorebirds
- Snowy Owl

*Endangered species

Terrestrial Mammal & Insect Endpoints of the Marine Beach Habitat

- ***Mammals:***
  - **Red Fox**
- ***Insects:***
  - **Northeast Tiger Beetle**

Note: The Northeast Tiger Beetle is extirpated and considered a locally important species.

Transitional Vegetation Endpoints of the Dunes & Swales Habitat

- Beach Grass
- Shrubs
- Panic Grass
- *Salicornia*
- Sea Beach Amaranth*
- Herbaceous Perennials

*Threatened species

Amphibian & Reptile Endpoints of the Dunes & Swales Habitat

- Frogs
- Diamondback Terrapin

Note: The Diamondback Terrapin is not an Endangered or Threatened species, but has local importance.

Transitional Bird Endpoints of the Dunes and Swales Habitat

- Piping Plover*
- Resident species of Horned Lark, Snow Bunting
- Snowy and Short-eared* Owls

*Endangered species

Terrestrial Mammal & Insect Endpoints of the Dunes & Swales Habitat

- ***Mammals:***
  - **Deer**
  - **Red Fox**
  - **Raccoon**
- ***Insects:***
  - **Ticks**
  - **Northeast Tiger Beetle**

Note: The Northeast Tiger Beetle is extirpated and considered a locally important species.

Terrestrial Vegetation Endpoints of the Dunes & Swales Habitat

- *Salicornia sp.*
- Sea Beach Amaranth*
- Herbaceous Perennials
- Beach Grass
- Shrubs
- Panic Grass

*Threatened species

Terrestrial Bird Endpoints of the Dunes & Swales Habitat

- Piping Plover*
- Short-eared Owl* & Snowy Owl
- Resident species Horned Lark & Snow Bunting

*Endangered species

Vegetation Endpoints of the Bay Intertidal Habitat

- Macroalgae
- Intertidal & High Marsh Species
- *Phragmites*

Invertebrate Endpoints of the Bay Intertidal Habitat

- ***Benthic:***
  - **Softshell Clam*, Blue and Ribbed Mussels*, Amphipods, Isopods, Zooplankton, Sea Star, Eastern Mudsnail, crabs such as Blue Crab*, Horseshoe Crab, Say Mud Crab, Hermit Crab, and Green Crab *Epibenthic:***
  - **Barnacle**

****Commercially & Recreationally Important Species***

Finfish Endpoints of the Bay Intertidal Habitat

- ***Forage/Bait Species***
  - **Silversides, Killfish, Cunner**
- ***Commercially & Recreationally Important Species:***
  - **Tautog, Weakfish, Bluefish, Black Sea Bass, Striped Bass, Herrings, Blackfish**

Bird Endpoints of the Bay Intertidal Habitat

- **Piping Plover* & Least Tern***
- ***Shorebirds, Wading & Migratory Species:***
  - **Cormorant**
  - **Gulls**
  - **Sharp-tail & Sea-side Sparrows**
  - **Oystercatcher**

***Endangered species**

Marine Mammal Endpoints of the Bay Intertidal Habitat

- Harbor Seal

Terrestrial Mammal & Insect Endpoints of the Bay Intertidal Habitat

- Mosquitoes

Amphibian & Reptile Endpoints of the Bay Intertidal Habitat

- **Diamondback Terrapin**

Note: **The Diamondback Terrapin is not an Endangered or Threatened species, but has local importance.**

Vegetation Endpoints of the Bay Subtidal Habitat

- ***Macroalgae:***
  - ***Cladophora*, *Ulva*, Phytoplanton (e.g. brown tide)**
- ***Submerged Aquatic Vegetation:***
  - **Eelgrass, Widgeon Grass**
- ***Phytoplankton***

Invertebrate Endpoints of the Bay Subtidal Habitat

- ***Benthic:***
  - **Polychaetes, Hard Clam*, Blue Crab*, Scallop*, Horseshoe Crab, Amphipods, Sea Star, Eastern Mudsnail, Say Mud Crab, Hermit Crab, Green Crab, Other Crabs, Zooplankton, Comb Jell**
- ***Epibenthic:***
  - **Shrimp**
- ***Pelagic:***
  - **Jellyfish, Comb Jelly**

Commercially & Recreationally Important Species

Finfish Endpoints of the Bay Subtidal Habitat

- ***Forage/Bait Species:***
  - **Cunner, Killfish, Silversides, Northern Puffer, Pipefish, Sticklebacks**
- ***Commercially & Recreationally Important Species:***
  - **Winter Flounder, American Eel, Blackfish**

Bird Endpoints of the Bay Subtidal Habitat

- ***Commercially & Recreationally Important Species:***
  - **Black Duck**
- **Gulls**
- **Common* & Least* Tern and Black Skimmer**
- **Cormorant**
- **Loons**

***Endangered species**

Amphibian & Reptile Endpoints of the Bay Subtidal Habitat

- **Diamondback Terrapin**

  Note: The Diamondback Terrapin is not an Endangered or Threatened species, but has local importance.

Invertebrate Endpoints of the Sand Shoals and Mud Flats Habitat

- ***Benthic:***
  - **Horseshoe Crab, Fiddler Crab**
- ***Commercially & Recreationally Important Species:***
  - **Blue & Ribbed Mussels, Softshell Clam**

Finfish Endpoints of the Sand Shoals and Mud Flats Habitat

- Forage/Bait Species (e.g. Killifish & Silverside)
- Juvenile Fish (eg, Winter & Summer Flounder & Bluefish)

Bird Endpoints of the Sand Shoals and Mud Flats Habitat

- Shorebirds
- Egrets
- Herons
- Seabirds
- Oystercatcher
- Migratory & Resident Species
- Piping Plover* and Least & Common Terns*

*Endangered species

Amphibian & Reptile Endpoints of the Sand Shoals and Mud Flats Habitat

- **Diamondback Terrapin**

Note: **The Diamondback Terrapin is not an Endangered or Threatened species, but has local importance.**

Vegetation Endpoints of the Sand Shoals and Mud Flats Habitat

- Cyanobacteria

Vegetation Endpoints of the Tidal Marsh Habitat

- Intertidal & High Marsh Species
- *Salicornia*
- *Phragmites*

Invertebrate Endpoints of the Tidal Marsh Habitat

- ***Benthic:***
  - **Amphipods, Isopods, Blue & Ribbed Mussels*, Sea Star, Eastern Mudsnail, Crabs such as Horseshoe Crab, Say Mud Crab, Hermit Crab, and Green Crab**
- ***Epibenthic:***
  - **Barnacle**
- ***Pelagic:***
  - **Jellyfish**

Commercially & Recreationally Important Species

Finfish Endpoints of the Tidal Marsh Habitat

- ***Forage/Bait Species:***
  - **Silversides, Killfish, Cunner**
- ***Commercially & Recreationally Important Species:***
  - **Tautog, Weakfish, Bluefish, Black Sea Bass, Striped Bass, Herrings**

Bird Endpoints of the Tidal Marsh Habitat

- Osprey*
- Egrets
- Herons
- Sharp-Tail and Sea-side Sparrows
- Oystercatcher
- Rails

*Endangered species

Vegetation Endpoints of the SAV Habitat

- **Macroalgae**
- ***Submerged Aquatic Vegetation:***
  - **Eelgrass, Widgeon Grass**

Invertebrate Endpoints of the SAV Habitat

- ***Benthic:***
  - **Polychaetes, Amphipods, Sea Star, Eastern Mudsnail, Isopods, Blue and Ribbed Mussels*, Softshell and Hard Clam, Scallop and crabs such as Blue Crab*, Horseshoe Crab Say Mud Crab, Hermit Crab, Green Crab, Other Crabs,**
- ***Epibenthic:***
  - **Shrimp, Barnacle**
- ***Pelagic:***
  - **Jellyfish, Comb Jelly**

Commercially & Recreationally Important Species

Finfish Endpoints of the SAV Habitat

- ***Forage/Bait Species:***
  - **Cunner, Killfish, Silversides, Northern Puffer, Pipefish, Sticklebacks**
- ***Commercially & Recreationally Important Species:***
  - **Tautog, Weakfish, Bluefish, Black Sea Bass, Striped Bass, Herrings, Winter Flounder, American Eel, Blackfish**

Bird Endpoints of the SAV Habitat

- ***Commercially & Recreationally Important:***

  Brant, Black Duck

- **Great Blue Heron**

Amphibian & Reptile Endpoints of the SAV Habitat

- Endangered Sea Turtles

Invertebrate Endpoints of the Inlet Habitat

- ***Benthic:***
  - **Polychaetes, Amphipods, Sea Star, Surf Clam*, Softshell Clam*, Ocean Quahog*, Blue and Ribbed Mussels*, Lobster*, *Yoldia*, Eastern Mudsnail, Isopods, Zooplankton and crabs such as blue Crab*, Horseshoe Crab, Say Mud Crab, Hermit Crab, and Green Crab*Epibenthic:***
  - **Shrimp, Barnacle**
- ***Pelagic:***
  - **Jellyfish, Squid***

Commercially & Recreationally Important Species

Finfish Endpoints for the Inlet Habitat

- ***Pelagic:***
  - **Hake, Skates**
- ***Benthic:***
  - **Sandlance, Windowpane**
- ***Forage/Bait:***
  - **Silversides, Killfish, Cunner, Anchovies, Northern Puffer, Pipefish, Sticklebacks**
- ***Commercially & Recreationally Important Species:***
  - **Winter & Summer Flounders, Scup, Tautog, Butterfish, Bluefish, Herrings, Striped Bass, Weakfish, Black Sea Bass, American Eel**

Bird Endpoints of the Inlet Habitat

- ***Seabirds:***
  - **Cormorant Loons, Grebes**
- ***Commercially & Recreationally Important Species:***
  - **Scaup & Black Ducks**

Marine Mammal Endpoints of the Inlet Habitat

- Harbor and Gray Seals

Amphibian & Reptile Endpoints of the Inlet Habitat

- ***Endangered and Threatened Sea Turtles:***
  - **Kemps-Ridley**
  - **Loggerhead**
  - **Hawksbill**

Vegetation Endpoint of the Terrestrial Upland Habitat

- Short Prostrate Pine species
- Pitch Pine
- Red Maple Swamp Forest
- Maritime Oak/Holly Forest
- Disturbed “vegetated” land (non-indigenous species)
- Pine Barren Community

Amphibian & Reptile Endpoints of the Terrestrial Upland Habitat

- Frogs
- Diamondback Terrapin*
- *Turtles:*
  - Mud
  - Box
  - Spotted

*Note: The Diamondback Terrapin is not an Endangered or Threatened species, but is locally important.

Bird Endpoints of the Terrestrial Upland Habitat

- ***Raptors:***
  - **Owls, Hawks* and Osprey***
- **Migratory Neotropical Species**
- **Resident & Migratory Passerine Species**
- **Piping Plover* and Least & Common Terns***

***Endangered species.**

Bird Endpoints of the Bayside Beach Habitat

- ***Raptors:***
  - **Owls, Hawks* and Osprey***
- **Migratory Neotropical Species**
- **Resident & Migratory Passerine Species**
- **Piping Plover* and Least & Common Terns***

***Endangered species**

Invertebrate Endpoints of the Bayside Beach Habitat

- ***Benthic Invertebrates***
- ***Wrack Invertebrates:***
  - **Amphipods, Isopods**

Amphibian & Reptile Endpoints of the Bayside Beach Habitat

- Frogs
- Diamondback Terrapin
- *Turtles:*
  - Mud
  - Box
  - Spotted

*Note: The Diamondback Terrapin is not an Endangered and Threatened species, but is locally important.

Terrestrial Mammal & Insect Endpoints of the Bayside Beach Habitat

- ***Mammals:***
  - **Deer, Red Fox, Raccoon, White-footed Mouse, Voles, Moles**
- ***Insects:***
  - **Bees, Mosquitoes, Ticks, Greenhead Fly, Wrack Insects**

Terrestrial Mammal & Insect Endpoints of the Terrestrial Upland Habitat

- ***Mammals:***
  - **Deer, Red Fox, Raccoon, White-footed Mouse, Voles, Moles**
- ***Insects:***
  - **Bees, Mosquitoes, Ticks, Greenhead Fly, Wrack Insects**

Vegetation Endpoints of the Maritime Forest Habitat

- ***Sunken Forest Species:***
  - **Trees, Shrubs, Herbaceous Perennials**
- **Cherries**
- **Vines**

Amphibian & Reptile Endpoints of the Maritime Forest Habitat

- Tiger Salamander
- Mud, Box and Spotted Turtles
- Eastern Hognose Snake

Finfish Endpoints of the Maritime Forest Habitat

Anadromous species:

- **Salmonids, Herrings, Eels**

Stocked Trout:

- **Rainbow, Brook**

All are *commercially & recreationally important species

Bird Endpoints of the Maritime Forest Habitat

- Warbler
- Migratory Species

Terrestrial Mammal & Insect Endpoints of the Maritime Forest Habitat

- ***Mammals:***
  - **Deer**
- ***Insects:***
  - **Ticks**
  - **Mosquitoes**

Catastrophic Storms

- Storms that can dramatically and catastrophically change the ecosystem or shoreline structures; storms can be either Nor-Easters or hurricanes.

Climate Change

- This driver includes changes from natural causes only and is not used in the context of a stressor or habitat response. It includes all manifestations of climatic change, from global warming to changes in precipitation, or other effects.

Sea Level Rise

- Increase in sea level over the next 50 years due to environmental changes such as global warming and other geologic events.

Development

- Includes development of buildings, marinas, roads; resultant alteration of run-off and nutrient loading (including all non-point source pollution). Solid waste and impervious surfaces increase with development. Development includes primary structures only (e.g., houses, roads, etc.) not accessory structures (e.g., bulkheads etc.) that are addressed under Construction drivers.

Agriculture / Aquaculture

- Harvesting or other forms of resource consumption (including commercial harvesting) of marine and terrestrial species that may result in habitat alteration (e.g., commercial clam dredging).

Recreation & Land Use

- Human land use associated with recreation not covered under development, includes camping, boating, vehicular activity, human presence and disturbance of natural habitats and species, fishing and camping. All associated visitor impacts such as the introduction of nuisance and/or non-native species, are also included.

Construction-Hard

- One of three separate construction drivers that all include some type of engineered device or land alteration. The three types of construction are ***Hard***, Soft, and Dredging. Construction-Hard includes: seawalls, bulkheads, groins, jetties and other types of permanent shoreline alteration.

Construction-Soft

- One of three separate construction drivers that all include some type of engineered device or land alteration. The three types of construction are Hard, ***Soft***, and Dredging. Construction-Soft includes: beach replenishment, dune enhancement, various restoration measures such as plantings, structural removal and habitat creation, restoration plantings and other types of permanent and temporary shoreline alteration.

Construction-Dredging

- One of three separate construction drivers that all include some type of engineered device or land alteration. The three types of construction are Hard, Soft, and ***Dredging***. Construction-Dredging includes: actual dredging operation of removal of offshore and nearshore sediment and sand. This does not include the placement of sand or machinery impacts.

Physical Stressors

- This category includes all relevant stressors that could impart a physical change to the habitat or ecosystem.

Breach Formation

- This refers to the condition where severe overwashing erodes a new inlet permitting exchange of ocean and bay waters under normal tidal conditions. Overwashing can lead to breach formation, but they are distinct events.

Habitat Alteration

- Loss, fragmentation, or conversion of habitat from one type to another through natural or anthropogenic drivers. This includes shoreline change, accretion, and erosion from sedimentation.

Hydrological Stressors

- These stressors act through any change in hydrology of Ocean, Bay, and/or associated water bodies. Since water can be a medium in sedimentation patterns, all Hydrological Stressors may include changes in sedimentation patterns.

Changes in Overwash Regime

- This is a change in the temporal, spatial or severity of the temporary overtopping of the barrier island by tides and/or waves during a storm.

Flooding

- This is an inundation event where ocean or bay waters rise to a level above mean high tide. Flooding relates only to the inundation due to catastrophic storms and sea level rise.

Hydrological Alteration

- Change in the frequency, duration, and severity of the pattern and availability of Ocean, Bay, and/or associated water bodies. This does not include a sole inundation or drought event.

Changes in Wave Dynamics

- Long-term change in the frequency, duration, direction and/or intensity of ocean and bay waves. Changes in Wave Dynamics includes the “scour” effect.

Circulation Changes

- Any change in movement patterns of Ocean, Bay, and/or associated water bodies from the water along shore and the flushing dynamics of bays and their habitats.

Water Quality Stressors

- These stressors result in a change to any aspect of the chemical or nutrient quality of Ocean, Bay, and/or associated water bodies.

Changes in Salinity

- Bay, tidal, or coastal pond systems where salinity changes might affect the survival and reproduction of plants and animals with specific salinity tolerance ranges.

Changes in Nutrient Concentrations

- Any alteration in nutrient levels or distribution in Ocean, Bay, and/or associated water bodies relative to typical regional conditions, particularly with respect to aquatic and marine plant communities. Eutrophication is an extreme case of changes in nutrient concentrations.

Contaminants

- Alteration of nature and/or extent of concentrations of toxic substances in the aquatic or marine environment relative to typical regional conditions. Examples of toxic substances include metals, organics, or pesticides. Acidificaiton effects of acid rain on small ponds is also included in this stressor.

Changes in Sedimentation

- Frequency, distribution pattern and amount of sediment loads, suspended sediments and sediment transport. This stressor is included in the Water Quality category because increased suspended sediments cause negative effects on water quality through turbidity and sediment-associated contamination. It also addresses stressors such as erosion and accretion.

Turbidity

- Continuous or long term condition of reduced water clarity caused by either the growth of phytoplankton or the presence of suspended sediments in the water column (e.g., bays and marinas with constant, heavy boat traffic).

Reduced Dissolved Oxygen (DO)

- Condition of reduction of optimal ambient levels of dissolved oxygen necessary to sustain aquatic and marine life, to a level that may impair communities' ability to reproduce and sustain itself.

Changes in Water Temperature

- General increase or decrease in air temperature resulting from global climate change or other extreme climatic variability that results in a long term extreme change in the temperature of Ocean, Bay, and/or associated water bodies.

Biological Stressors

- **Stress associated with a change in biological components of the system.**

Species Displacement

- Replacement of any existing native floral or faunal species with establishment of another species resultant of either natural or anthropogenic activities. This can include the introduction of nuisance or non-native species.

Harmful Algal Blooms

- Applies to both toxic microscopic algae and benthic or planktonic macroalgae which can proliferate in response to anthropogenic nutrient enrichment. HAB may lead to major ecological impacts such as the displacement of indigenous species, habitat alteration, or oxygen depletion. Stressor does not include growth of phytoplankton that might create turbidity.

Human Stressors

- **Stress associated with specific human activities; includes only one stressor, *Human Presence*:**

  Direct and indirect impacts as a result of human disturbance to the natural plant and animal communities and their associated habitats (eg., generation of solid waste, noise, over-exploitation of resources, or pollution, and air quality degradation). Human Presence is considered to be less severe than related Anthropogenic Drivers listed, and focuses on stress as a result of regular daily use of a habitat.

Salt Deposition

- Aerial deposition of sea salt from spray on beach, dune, and maritime vegetation communities.

Groundwater Regime

- Alteration of either groundwater inputs to fresh or saltwater areas, depth to groundwater for plant growth, or other stress relating to the availability of groundwater.

Changes in Fire Regime

- Change in the frequency and/or severity of fires in a system. Many organisms are adapted to a specific fire regime, and cannot survive when this regime is altered.

Driver

- A driver is any natural or human activity that can lead to or result in an environmental stressor.

Stressor

- Any physical, chemical, and/or biological change experienced by an ecosystem that can induce an environmental response.

Coastal Marine Offshore

- Subtidal marine habitat ranging in depth from 10 to 30 meters; includes pelagic and benthic zones.

Coastal Marine Nearshore

- Mean low water (MLW) to a water depth of 10 meters; includes pelagic and benthic zones.

Coastal Marine Intertidal

- Extends from the boundary of the Marine Nearshore at mean low water (MLW) to mean high water (MHW) with a sandy substrate.

Marine Beach

- Extends from the mean high water (MHW) line on the ocean side, to the boundary of the primary Dune and Swale habitat with the Terrestrial Upland; sandy substrate.

Dunes and Swales

- Primary dune through most landward primary swale system.

Bay Intertidal Habitat

- Extends from the Terrestrial Upland boundary with mean high water (MHW), or landward limit of high marsh vegetation of the barrier island Terrestrial Upland habitat, to mean low water (MLW). May include other habitats such as Tidal Marsh, Shoals, and/or Mud Flat.

Sand Shoals & Mud Flats

- Found within the Intertidal Zone and exposed at low tide; specific habitat type is defined by the substrate.

Tidal Marsh

- Bayside vegetation communities dominated and defined by salt-tolerant species. Occurs from the landward limit of the high marsh vegetation, sometimes also mean high water (MHW) or slightly landward to the seaward limit of the intertidal marsh vegetation.

Bay Subtidal

- Bayside aquatic areas below mean low water (MLW).

Submerged Aquatic Vegetation (SAV)

- **Bayside vegetation communities found within the subtidal zone.**

Inlets

- Areas of water interchange between backbay and ocean zones (e.g., Fire Island Inlet, Moriches Inlet, and Shinnecock Inlet).

Terrestrial Upland

- Extends from the landward boundary of the primary dunes and swales on the ocean side, to the mean high water (MHW) boundary of the Bay Intertidal habitat on the bay side of the island. Contains all upland habitats excluding the maritime forest; scrub/shrub cover types are also included in this habitat, along with Bayside Beach areas.

Bayside Beach

- Area between mean high water (MHW) to seaward limit of vegetation or “upland” boundary.

Maritime Forest

- Unique forested area on the barrier island referred to as the Sunken Forest defined by salt tolerant vegetation, high salinity and salt spray adapted soils and vegetation assemblages such as trees, shrubs, and herbaceous species.

Habitat Response

- Changes to habitat components such as community composition, species interactions, biodiversity, and/or physical, chemical and biological attributes of an area due to environmental impact.

Aquatic Endpoints

- The endpoint category that includes Vegetation, Invertebrates, Finfish, Birds and Marine Mammals that utilize the marine environment for all or a portion of their lives.

Transitional Endpoints

- The endpoint category that includes Vegetation, Amphibians & Reptiles, and Birds that require both aquatic and terrestrial habitats for portions of their life cycles, or to satisfy needs of reproduction, feeding or nesting.

Terrestrial Endpoints

- The endpoint category that includes Vegetation, Birds, Terrestrial Mammals & Insects, and Amphibians & Reptiles that rely solely on terrestrial habitats.

Ecological Endpoint

- A valued environmental attribute that has particular ecological importance (e.g., keystone species, threatened & endangered species), and/or societal relevance and value (e.g., commercially important species).

Transitional Amphibians & Reptiles of the Coastal Marine Offshore Habitat

- The most important pathway for this endpoint is Construction-Dredging and associated stressors. The potential for entrainment or capture and injury of endangered and threatened sea turtles that occur in the Offshore Habitat is of greatest concern. Dredging operations are required to use devices to minimize impacts.

Aquatic Marine Mammals of the Coastal Marine Offshore Habitat

- The most important pathway for this endpoint is Construction-Dredging and associated stressors. The potential entrainment or capture and injury of endangered and threatened marine mammals that occur in the Offshore Habitat is of greatest concern. Dredging operations have seasonal restrictions and are required to use devices to minimize impacts.

Aquatic Finfish of the Coastal Marine Offshore Habitat

- The primary endpoints of concern are bottom finfish. Catastrophic Storms and Construction-Dredging can disturb the substrate and injure bottom finfish, especially mature individuals of reproductive age.

Aquatic Invertebrates of the Coastal Marine Offshore Habitat

- Any driver or stressor that affects the substrate in the Offshore habitat may affect immobile invertebrates. Stressors such as Species Displacement, Human Presence, and Habitat Alteration may all directly affect Aquatic Invertebrate Endpoints.

Transitional Birds of the Coastal Marine Nearshore Habitat

- Habitat Alteration and Species Displacement are the two primary stressors, being induced by all nine drivers. Since the Nearshore habitat is most important to piscivorous birds, impacts to fish and benthos indirectly affect these endpoints also.

Transitional Marine Mammals of the Coastal Marine Nearshore Habitat

- Since Seals are known to utilize the eastern portion of the study area periodically; any stressors that alter the habitat may affect Transitional Marine Mammals.

Transitional Amphibians & Reptiles of the Coastal Marine Nearshore Habitat

- Habitat Alteration and Species Displacement are the two primary stressors, being induced by all nine drivers. Alterations of the Nearshore habitat will result in displacement, sometimes temporary, of Amphibian and Reptile endpoints.

Aquatic Marine Mammals of the Coastal Marine Nearshore Habitat

- The most important pathway for this endpoint is associated with Construction-Dredging and associated stressors. Of greatest concern is the potential entrainment or capture and injury of endangered and threatened marine mammals that may occur in the Nearshore habitat. Dredging operations have seasonal restrictions and are required to use devices to minimize impacts.

Aquatic Birds of the Coastal Marine Nearshore Habitat

- Habitat Alteration and Species Displacement are the two primary stressors, being induced by all nine drivers. Since the Nearshore Habitat is most important to piscivorous birds, impacts to fish and benthos indirectly affect these endpoints also.

Aquatic Finfish of the Coastal Marine Nearshore Habitat

- Habitat Alteration and Species Displacement are the two primary stressors, being induced by all nine drivers. Nearshore Finfish are an important resource to other trophic levels. Hence, impacts to this habitat may be localized, but may affect piscivorous birds that feed here.

Aquatic Invertebrates of the Coastal Marine Nearshore Habitat

- The pathway of greatest concern for this endpoint includes Construction drivers and associated stressors. Any disturbance to substrate in the Nearshore Habitat will impact Invertebrates.

Transitional Birds of the Coastal Marine Intertidal Habitat

- All nine drivers can induce stressors, with Habitat Alteration being the stressor of greatest concern. Birds use this habitat for forage. Endangered and threatened birds use this area for habitat.

Aquatic Birds of the Coastal Marine Intertidal Habitat

- All nine drivers can induce stressors, with Habitat Alteration being the stressor of greatest concern. Birds use this habitat for forage. Endangered and threatened birds use this area for habitat.

Aquatic Finfish of the Coastal Marine Intertidal Habitat

- **Habitat Alteration as a result of any of the nine drivers can locally affect the habitat and temporarily exclude finfish species in the pelagic zone.**

Aquatic Invertebrates of the Coastal Marine Intertidal Habitat

- **Habitat Alteration of the substrate as a result of any of the nine drivers can locally affect the habitat and temporarily eliminate benthic invertebrates.**

Transitional Birds of the Conceptual Model for the Coastal Marine Ecosystem

- This endpoint is important to the Nearshore and Marine Intertidal Habitats. Habitat Alteration and Species Displacement are important stressors induced by all nine drivers. Since these habitats are important to piscivorous birds, impacts to fish and benthos indirectly affect birds also.

Transitional Marine Mammals of the Conceptual Model for the Coastal Marine Ecosystem

- This endpoint is only relevant in the Nearshore Habitat of the eastern portion of the study area. Since Seals are known to utilize this area periodically; any stressors that alter the habitat may affect Transitional Marine Mammals.

Transitional Amphibians & Reptiles of the Conceptual Model for the Coastal Marine Ecosystem

- Endpoints that use the Offshore and Nearshore habitats of the Marine Ecosystem are especially vulnerable to Construction-Dredging and associated stressors. The potential for entrainment or capture and injury of endangered and threatened sea turtles that occur in the these habitats is of greatest concern. Dredging operations are required to use devices to minimize impacts.

Aquatic Marine Mammals of the Conceptual Model for the Coastal Marine Ecosystem

- These endpoints that use the Offshore and Nearshore habitats of the Marine Ecosystem are especially vulnerable to Construction-Dredging and associated stressors. The potential for injury of endangered and threatened seals that occur in the these habitats is of greatest concern.

Aquatic Birds of the Conceptual Model for the Coastal Marine Ecosystem

- All nine drivers can induce stressors, with Habitat Alteration being the stressor of greatest concern. While Birds use all three habitats of the Marine Ecosystem, potential effects to the Marine Intertidal would be of greatest concern since it is the most heavily used habitat by all Aquatic Birds, including endangered and threatened species.

Aquatic Finfish of the Conceptual Model for the Coastal Marine Ecosystem

- Finfish use all three habitats of the Marine Ecosystem. Habitat Alteration and Species Displacement are the two primary stressors, being induced by all nine drivers. Alterations of the Nearshore habitat will result in displacement, sometimes temporary, of Finfish endpoints. Other endpoints (eg., birds) can be indirectly affected by changes in Finfish.

Aquatic Invertebrates of the Conceptual Model for the Coastal Marine Ecosystem

- Any driver or stressor that affects the substrate in the habitats of the Marine Ecosystem may affect immobile invertebrates. Stressors such as Species Displacement, Human Presence, and Habitat Alteration may all directly affect Aquatic Invertebrate Endpoints. Greater potential effects would occur in the Nearshore and Offshore habitats, where invertebrate densities are greater than in the Marine Intertidal habitat.

Terrestrial Mammals & Insects of the Ocean Beach & Dune Beach Habitat

- While this habitat is not very important to these endpoints, any driver or stressor that reduces the extent of the Beach may potentially affect mammals and insects that occur here. Construction-Hard is the driver inducing the greatest number of stressors. Stressors induced by Anthropogenic Drivers are the most common and potentially disturbing. The Northeast Tiger Beetle is extirpated but of local interest, and could be affected by changes to this habitat.

Transitional Birds of the Ocean Beach & Dune Beach Habitat

- **Construction-Hard is the driver inducing the greatest number of stressors. Stressors induced by Anthropogenic Drivers are the most common and potentially disturbing. Since this endpoint requires this habitat for a portion of its life to survive, the Beach is critical to threatened and/or endangered birds such as the Least and Common Terns and Piping Plover.**

Transitional Vegetation of the Ocean Beach & Dune Beach Habitat

- Any driver or stressor that reduces the extent of the Beach may potentially affect Transitional Vegetation. Since the Sea Beach Amaranth occurs in the Beach, potential effects to this habitat where the Amaranth occurs would be of concern.

Terrestrial Amphibians & Reptiles of the Ocean Beach Dunes & Swales Habitat

- Eight of the nine drivers are included in this model indicating a highly vulnerable habitat. Construction-Hard and –Soft are of greatest importance. The Diamondback Terrapin, a species of local importance uses this habitat and hence, could be affected locally.

Terrestrial Mammals & Insects of the Ocean Beach Dunes & Swales Habitat

- Eight of the nine drivers are included in this model indicating a highly vulnerable habitat. Construction-Hard and –Soft are of greatest importance. The Northeast Tiger Beetle is extirpated but of local interest, and could be affected by changes to this habitat.

Terrestrial Birds of the Ocean Beach Dunes & Swales Habitat

- Eight of the nine drivers are included in this model indicating a highly vulnerable habitat. Construction-Hard and –Soft are of greatest importance. The endangered Short-Eared Owl is known to use this habitat and could be locally affected if the habitat were disturbed.

Terrestrial Vegetation of the Ocean Beach Dunes & Swales Habitat

- Eight of the nine drivers are included in this model indicating a highly vulnerable habitat. Construction-Hard and –Soft, are of greatest importance. The threatened Sea Beach Amaranth occurs in this habitat and could be locally affected if the habitat were disturbed.

Transitional Birds of the Ocean Beach Dunes & Swales Habitat

- Eight of the nine drivers are included in this model indicating a highly vulnerable habitat. Construction-Hard and –Soft are of greatest importance. The endangered Piping Plover is known to use this habitat and could be locally affected if the habitat were disturbed.

Transitional Amphibians & Reptiles of the Ocean Beach Dunes & Swales Habitat

- Eight of the nine drivers are included in this model indicating a highly vulnerable habitat. Construction-Hard and –Soft are of greatest importance. The locally important Diamondback Terrapin that occurs in finite areas of the Dunes and Swales, would be affected if the habitat were disturbed.

Transitional Vegetation of the Ocean Beach Dunes & Swales Habitat

- **Eight of the nine drivers are included in this model indicating a highly vulnerable habitat. Construction-Hard and –Soft, are of greatest importance. Vegetation of the Dunes and Swales Habitat that requires periodic inundation, such as *Spartina patens,* could be affected by changes to the habitat.**

Terrestrial Amphibians & Reptiles of the Conceptual Model for the Ocean Beach & Dune Ecosystem

- Eight of the nine drivers are included in this model indicating a highly vulnerable habitat. Construction-Hard and –Soft are of greatest importance. The Diamondback Terrapin, a species of local importance uses the Dunes and Swales Habitat and hence, could be affected locally.

Terrestrial Mammals & Insects of the Conceptual Model for the Ocean Beach & Dune Ecosystem

- Eight of the nine drivers are included in this model indicating a highly vulnerable habitat. Construction-Hard and –Soft are of greatest importance. The Northeast Tiger Beetle is extirpated but of local interest, and could be affected by changes to either habitat in this ecosystem.

Terrestrial Birds of the Conceptual Model for the Ocean Beach & Dune Ecosystem

- Eight of the nine drivers are included in this model indicating a highly vulnerable habitat. Construction-Hard and –Soft are of greatest importance. The endangered Short-Eared Owl and Piping Plover are known to use this ecosystem and could be locally affected if the habitat were disturbed.

Terrestrial Vegetation of the Conceptual Model for the Ocean Beach & Dune Ecosystem

- Eight of the nine drivers are included in this model indicating a highly vulnerable habitat. Construction-Hard and –Soft, are of greatest importance. The threatened Sea Beach Amaranth occurs in both habitats of this ecosystem and could be locally affected if the ecosystem were disturbed.

Transitional Birds of the Conceptual Model for the Ocean Beach & Dune Ecosystem

- Eight of the nine drivers are included in this model indicating a highly vulnerable habitat. Construction-Hard and –Soft are of greatest importance. The endangered Piping Plover and Short-Eared Owl use this ecosystem and could be locally affected if the ecosystem were disturbed.

Transitional Amphibians & Reptiles of the Conceptual Model for the Ocean Beach & Dune Ecosystem

- Eight of the nine drivers are included in this model indicating a highly vulnerable habitat. Construction-Hard and –Soft are of greatest importance. The locally important Diamondback Terrapin that occurs in finite areas of the Dunes and Swales, would be affected if the habitat were disturbed. These endpoints are not a concern in the Beach habitat.

Transitional Vegetation of the Conceptual Model for the Ocean Beach & Dune Ecosystem

- Eight of the nine drivers are included in this model indicating a highly vulnerable habitat. Construction-Hard and –Soft, are of greatest importance. Vegetation of the Dunes and Swales Habitat such as *Spartina patens*, requiring periodic inundation, could be affected by changes to the habitat.

Transitional Birds of the Bay Intertidal Habitat

- All nine drivers can induce stressors in this habitat. Catastrophic Storms and Development are of greatest importance, inducing most stressors. Threatened and endangered Piping Plover and Least Tern use this habitat for forage, and hence, could be affected by disturbance.

Transitional Marine Mammals of the Bay Intertidal Habitat

- All nine drivers can induce stressors in this habitat. Catastrophic Storms and Development are of greatest importance, inducing most stressors. The Harbor Seal is the only Marine Mammal, and occurs in this habitat only sporadically.

Transitional Amphibians & Reptiles of the Bay Intertidal Habitat

- All nine drivers can induce stressors in this habitat. Catastrophic Storms and Development are of greatest importance, inducing most stressors. The Diamondback Terrapin is of local importance and passes through this habitat from time to time.

Transitional Vegetation of the Bay Intertidal Habitat

- All nine drivers can induce stressors in this habitat. Catastrophic Storms and Development are of greatest importance, inducing most stressors. Vegetation requiring periodic inundation could be affected by changes to this habitat.

Aquatic Marine Mammals of the Bay Intertidal Habitat

- All nine drivers can induce stressors in this habitat. Catastrophic Storms and Development are of greatest importance, inducing most stressors. The Harbor Seal is the only Marine Mammal and occurs in this habitat only sporadically.

Aquatic Birds of the Bay Intertidal Habitat

- All nine drivers can induce stressors in this habitat. Catastrophic Storms and Development are of greatest importance, inducing most stressors. Numerous birds including endangered Piping Plover and Least Tern, Shorebirds, and Wading and Migratory Species use this habitat for forage.

Aquatic Finfish of the Bay Intertidal Habitat

- All nine drivers can induce stressors in this habitat. Catastrophic Storms and Development are of greatest importance, inducing most stressors. A variety of forage fish, and commercially and recreationally important species such as the Striped Bass, Bluefish, and Weakfish use this habitat for a portion of their lives.

Aquatic Invertebrates of the Bay Intertidal Habitat

- All nine drivers can induce stressors in this habitat. Catastrophic Storms and Development are of greatest importance, inducing most stressors. This habitat is important to dense communities of infaunal benthic invertebrates, a variety of crabs and crustaceans along with commercially and recreationally important mollusks and crustaceans.

Aquatic Vegetation of the Bay Intertidal Habitat

- All nine drivers can induce stressors in this habitat. Catastrophic Storms and Development are of greatest importance, inducing most stressors. Bay Intertidal Vegetation includes Macroalgae, Intertidal and High Marsh Species that can be affected by changes to the habitat.

Transitional Birds of the Bay Sand Shoal and Mud Flat Habitat

- Events influencing bay hydrology affect this habitat. Catastrophic Storms, Development and Construction-Hard are the most important stressors, inducing changes to sediment dynamics of the bay. Impacts to this habitat can influence birds that forage or nest here including both Shore Birds and Seabirds.

Transitional Amphibians & Reptiles of the Bay Sand Shoal and Mud Flat Habitat

- Events influencing bay hydrology affect this habitat. Catastrophic Storms, Development and Construction-Hard are the most important stressors, inducing changes to sediment dynamics of the bay. The locally important Diamondback Terrapin is the only endpoint in this category that relies on Sand Shoals and Mud Flats habitat.

Aquatic Birds of the Bay Sand Shoal and Mud Flat Habitat

- Events influencing bay hydrology affect this habitat. Catastrophic Storms, Development and Construction-Hard are the most important stressors, inducing changes to sediment dynamics of the bay. Aquatic Birds such as Herons and Egrets that rely on this habitat for forage space can be affected by changes to it.

Aquatic Finfish of the Bay Sand Shoal and Mud Flat Habitat

- Events influencing bay hydrology affect this habitat. Catastrophic Storms, Development and Construction-Hard are the most important stressors, inducing changes to sediment dynamics of the bay. Killifish were the only endpoint identified that could persist in these areas.

Aquatic Invertebrates of the Bay Sand Shoal and Mud Flat Habitat

- Events influencing bay hydrology affect this habitat. Catastrophic Storms, Development and Construction-Hard are the most important stressors, inducing changes to sediment dynamics of the bay. The predominant endpoints in this habitat are the more mobile crabs, but commercially and recreationally important Blue Mussels may also use this habitat locally.

Aquatic Vegetation of the Bay Sand Shoal and Mud Flat Habitat

- Events influencing bay hydrology affect this habitat. Catastrophic Storms, Development and Construction-Hard are the most important stressors, inducing changes to sediment dynamics of the bay. Cyanobacteria is the only endpoint in this catgegory that colonizes this habitat.

Transitional Birds of the Bay Tidal Marsh Habitat

- Inclusion of eight of the nine drivers indicates this habitat is highly sensitive to project implementation. It has more relevant stressors (16) than any other habitat, and is highly vulnerable to Habitat Alteration. Any stressor that can alter hydrology can affect the extent and distribution of Tidal Marsh. Numerous piscivorous birds including Egrets, Herons and the endangered Osprey use this habitat.

Transitional Vegetation of the Bay Tidal Marsh Habitat

- **Inclusion of eight of the nine drivers indicates this habitat is highly sensitive to project implementation. It has more relevant stressors (16) than any other habitat, and is highly vulnerable to Habitat Alteration. Any stressor that can alter hydrology can affect the extent and distribution of Tidal Marsh. Vegetation requiring twice daily tidal flushing such as *Spartina patens* would be affected by changes to the Tidal Marsh.**

Aquatic Birds of the Bay Tidal Marsh Habitat

- Inclusion of eight of the nine drivers indicates this habitat is highly sensitive to project implementation. It has more relevant stressors (16) than any other habitat, and is highly vulnerable to Habitat Alteration. Any stressor that can alter hydrology can affect the extent and distribution of Tidal Marsh. Aquatic birds such as Waders (eg., Herons and Egrets) that rely on the Tidal Marsh for habitat would be affected if changes were induced.

Aquatic Finfish of the Bay Tidal Marsh Habitat

- Inclusion of eight of the nine drivers indicates this habitat is highly sensitive to project implementation. It has more relevant stressors (16) than any other habitat, and is highly vulnerable to Habitat Alteration. Any stressor that can alter hydrology can affect the extent and distribution of Tidal Marsh. Numerous bait fish (eg., Silversides, Killifish) and commercially and recreationally important Weakfish, Bluefish, Herring and Striped Bass are dependent on the Tidal Marsh for habitat.

Aquatic Invertebrates of the Bay Tidal Marsh Habitat

- Inclusion of eight of the nine drivers indicates this habitat is highly sensitive to project implementation. It has more relevant stressors (16) than any other habitat, and is highly vulnerable to Habitat Alteration. Any stressor that can alter hydrology can affect the extent and distribution of Tidal Marsh. The Tidal Marsh provides habitat to a variety of Crabs (eg., Horseshoe, Say Mud, Blue), Crustaceans (eg., amphipods, isopods) and invertebrates that would be affected by potential changes.

Aquatic Vegetation of the Bay Tidal Marsh Habitat

- Inclusion of eight of the nine drivers indicates this habitat is highly sensitive to project implementation. It has more relevant stressors (16) than any other habitat, and is highly vulnerable to Habitat Alteration. Any stressor that can alter hydrology can affect the extent and distribution of Tidal Marsh. Vegetation of the Tidal Marsh (eg., Intertidal and High Marsh Species) is typically dependent on the unique hydrology of this area which, if altered, would affect these highly adapted species.

Transitional Amphibians & Reptiles of the Bay Subtidal Habitat

- Eight drivers can induce stressors in this habitat; Catastrophic Storms have the potential to induce most stressors. Any changes to physical or hydrological features that alter distribution of submerged vegetation are considered important to the habitat. The locally important Diamondback Terrapin is the only relevant reptile for this habitat.

Aquatic Birds of the Bay Subtidal Habitat

- Eight drivers can induce stressors in this habitat; Catastrophic Storms have the potential to induce most stressors. Any changes to physical or hydrological features that alter distribution of submerged vegetation are considered important to the habitat. Numerous bird species including the Endangered Common and Least Terns and the Black Skimmer use this habitat for forage and hence, can be affected by changes to it.

Aquatic Finfish of the Bay Subtidal Habitat

- Eight drivers can induce stressors in this habitat; Catastrophic Storms have the potential to induce most stressors. Any changes to physical or hydrological features that alter distribution of submerged vegetation are considered important to the habitat. Forage and predatory finfish species use the Bay Subtidal for feeding, nursery and breeding area.

Aquatic Invertebrates of the Bay Subtidal Habitat

- Eight drivers can induce stressors in this habitat; Catastrophic Storms have the potential to induce most stressors. Any changes to physical or hydrological features that alter distribution of submerged vegetation are considered important to the habitat. Aquatic Invertebrates occur both on the surface of submerged vegetation and in the substrate and can be affected by potential changes to the habitat; examples include a variety of crustaceans, polychaetes, and pelagic zooplankton.

Aquatic Vegetation of the Bay Subtidal Habitat

- Eight drivers can induce stressors in this habitat; Catastrophic Storms have the potential to induce most stressors. Any changes to physical or hydrological features that alter distribution of submerged vegetation are considered important to the habitat. Vegetation (eg., Eelgrass, Widgeon Grass) is critical to habitat function since it provides food and habitat to all levels of the food web.

Aquatic Vegetation of the Bay
Submerged Aquatic Vegetation Habitat

- Six drivers can induce stressors in this habitat; Catastrophic Storms have the potential to induce most stressors. Any changes to physical or hydrological features that alter distribution of submerged vegetation are considered important to the habitat. The stressors that influence the abundance and distribution of forage can have a potential effect on birds that use the SAV for forage.

Aquatic Finfish of the Bay Submerged Aquatic Vegetation Habitat

- Six drivers can induce stressors in this habitat; Catastrophic Storms have the potential to induce most stressors. Any changes to physical or hydrological features that alter distribution of submerged vegetation are considered important to the habitat. Commercially and recreationally important finfish species, such as Tautog, Weakfish, Bluefish, Black Sea Bass, Striped Bass, Herring, Winter Flounder, and American Eel, use the Bay Subtidal for foraging on epiphytic invertebrates.

Aquatic Invertebrates of the Bay Submerged Aquatic Vegetation Habitat

- Six drivers can induce stressors in this habitat; Catastrophic Storms have the potential to induce most stressors. Any changes to physical or hydrological features that alter distribution of submerged vegetation are considered important to the habitat. Commercially important Blue and Ribbed Mussels and Blue Crabs can be affected because of the unique habitat that the SAV beds provide.

Aquatic Birds of the Bay Submerged Aquatic Vegetation Habitat

- Six drivers can induce stressors in this habitat; Catastrophic Storms have the potential to induce most stressors. Any changes to physical or hydrological features that alter distribution of submerged vegetation are considered important to the habitat. Stressors that influence the abundance and distribution of forage can potentially effect birds that use the SAV for forage.

Transitional Marine Mammals of the Bay Inlet Habitat

- The role of inlets in allowing passage and transport of Ocean and Bay water and associated biota makes potential impacts to this habitat particularly important. Most species response's would be to physical alterations of the habitat. Harbor and Gray Seals use Inlet habitats to move from the ocean to the bay zones.

Transitional Amphibians & Reptiles of the Bay Inlet Habitat

- The role of inlets in allowing passage and transport of Ocean and Bay waters and associated biota makes potential impacts to this habitat particularly important. Most species response's would be to physical alterations of the habitat. Endangered and threatened sea turtles may use Inlets from time to time to move from the ocean to the bay.

Aquatic Marine Mammals of the Bay Inlet Habitat

- The role of inlets in allowing passage and transport of Ocean and Bay waters and associated biota makes potential impacts to this habitat particularly important. Most species response's would be to physical alterations of the habitat. Harbor and Gray Seals use Inlet habitats to move from the ocean to the bay zones.

Aquatic Birds of the Bay Inlet Habitat

- The role of inlets in allowing passage and transport of Ocean and Bay waters and associated biota makes potential impacts to this habitat particularly important. Most species response's would be to physical alterations of the habitat or indirectly related to the density and variety of species in that habitat. Commercially important Scaup and Black Duck use Inlets for the variety of prey items available for forage in this habitat.

Aquatic Finfish of the Bay Inlet Habitat

- The role of inlets in allowing passage and transport of Ocean and Bay waters and associated biota makes potential impacts to this habitat particularly important. Most species response's would be to physical alterations of the habitat or indirectly related to the density and variety of species in that habitat. Inlet habitats provide services to commercially important Winter and Summer Flounder, Scup, Tautog, Butterfish, Bluefish, Herrings, Striped Bass, Weakfish, Black Sea Bass, and the American Eel.

Aquatic Invertebrates of the Bay Inlet Habitat

- The role of inlets in allowing passage and transport of Ocean and Bay waters and associated biota makes potential impacts to this habitat particularly important. Most species response's would be to physical alterations of the habitat or indirectly related to the density and variety of species in that habitat. Changes in sedimentation from any natural or anthropogenic drivers can bury or dislodge any commercially important species, such as Surf Clam, Softshell Clam, Blue and Ribbed Mussels, Ocean Quahog, Blue Crab and Lobster.

Transitional Vegetation of the Conceptual Model for the Bay Ecosystem

- The Tidal Marsh and Bay Intertidal habitats are the only two where Transitional Vegetation could be affected due to changes in habitat. Any stressor that can alter hydrology can affect the extent and distribution of Tidal Marsh. Changes in hydrology or sedimentation could alter vegetation distribution and community composition.

Transitional Amphibians & Reptiles of the Conceptual Model for the Bay Ecosystem

- The Bay Subtidal, Sand Shoals & Mud Flats and Inlet habitats are the only Bay habitats used by Amphibians and Reptiles. The locally important Diamondback Terrapin, and endangered and threatened sea turtles are the only Amphibians and Reptiles that would be affected by changes to this ecosystem.

Transitional Marine Mammals of the Conceptual Model for the Bay Ecosystem

- The Bay Intertidal and Inlet habitats are the only Bay habitats used by Marine Mammals. The Harbor Seal and Gray Seal are the only Mammals known to use these habitats from time to time that would be affected by changes to this ecosystem.

Transitional Birds of the Conceptual Model for the Bay Ecosystem

- This endpoint is important to the all of the habitats of the Bay Ecosystem. A variety of endangered bird species, shore birds, wading birds, sea birds, waterfowl and other migratory species use these habitats. Since these habitats are important to piscivorous birds, impacts to fish and benthos indirectly affect birds also.

Aquatic Vegetation of the Conceptual Model for the Bay Ecosystem

- All Bay habitats with the exception of Inlets include Aquatic Vegetation endpoints that could be affected by changes in the habitats. Changes in hydrology or sedimentation could alter vegetation distribution and community composition.

Aquatic Invertebrates of the Conceptual Model for the Bay Ecosystem

- This endpoint is important to the all of the habitats of the Bay Ecosystem. Invertebrates are particularly sensitive to Physical Stressors of Habitat Alteration and Water Quality Stressors of Sedimentation. Long term changes to the Bay Invertebrate community could also effect higher order biota (eg., carnivorous birds) who use the biota for forage.

Aquatic Finfish of the Conceptual Model for the Bay Ecosystem

- Aquatic Finfish occur in all Bay Ecosystem habitats. Habitat Alteration and Species Displacement are the two primary stressors, being induced by all nine drivers. Alterations of the Nearshore habitat will result in displacement, sometimes temporary, of Finfish endpoints. Other endpoints (eg., birds) can be indirectly affected by changes in Finfish distribution and community structure.

Aquatic Birds of the Conceptual Model for the Bay Ecosystem

- This endpoint is important to the all of the habitats of the Bay Ecosystem. A variety of endangered bird species, shore birds, wading birds, sea birds, waterfowl and other migratory species use these habitats. Since these habitats are important to piscivorous birds, impacts to fish and benthos indirectly affect birds also.

Aquatic Marine Mammals of the Conceptual Model for the Bay Ecosystem

- The Bay Intertidal and Inlet habitats are the only Bay habitats used by Marine Mammals. The Harbor Seal and Gray Seal are the only Mammals known to use these habitats from time to time that would be affected by changes to this ecosystem.

Terrestrial Vegetation of the Barrier Island Terrestrial Upland Habitat

- Seven of the nine drivers are included in this model indicating a highly vulnerable habitat. Construction-Hard, Development and Catastrophic Storms are of greatest importance. Since much of the habitat is defined by the presence of vegetation communities, any negative impact to this endpoint may be important since it has the potential to alter or eliminate the habitat itself.

Terrestrial Birds of the Barrier Island Terrestrial Upland Habitat

- Seven of the nine drivers are included in this model indicating a highly vulnerable habitat. Construction-Hard, Development and Catastophic Storms are of greatest importance. Threatened and endangered Osprey and Hawks utilize this habitat and could be negatively affected by changes.

Terrestrial Mammals & Insects of the Barrier Island Terrestrial Upland Habitat

- Seven of the nine drivers are included in this model indicating a highly vulnerable habitat. Construction-Hard, Development and Catastrophic Storms are of greatest importance. Any disturbance to the Terrestrial Upland habitat will displace Mammals and Insects that use these areas for habitat.

Terrestrial Amphibians & Reptiles of the Barrier Island Terrestrial Upland Habitat

- Seven of the nine drivers are included in this model indicating a highly vulnerable habitat. Construction-Hard, Development and Catastrophic Storms are of greatest importance. A variety of Amphibians and Reptiles including the endangered Mud Turtle may be affected locally by such stressors inducing habitat changes to the Terrestrial Upland.

Transitional Amphibians & Reptiles of the Barrier Island Terrestrial Upland Habitat

- Seven of the nine drivers are included in this model indicating a highly vulnerable habitat. Construction-Hard, Development and Catastrophic Storms are of greatest importance. A variety of Amphibians and Reptiles including the endangered Mud Turtle may be affected locally by such stressors inducing habitat changes to the Terrestrial Upland.

Transitional Vegetation of the Barrier Island Terrestrial Upland Habitat

- Seven of the nine drivers are included in this model indicating a highly vulnerable habitat. Construction-Hard, Development and Catastophic Storms are of greatest importance. Since much of the habitat is defined by the presence of vegetation communities, any negative impact to this endpoint may be important since it has the potential to alter or eliminate the habitat itself.

Transitional Birds of the Barrier Island Terrestrial Upland Habitat

- Seven of the nine drivers are included in this model indicating a highly vulnerable habitat. Construction-Hard, Development and Catastrophic Storms are of greatest importance. Threatened and endangered Osprey and Hawks utilize this habitat and could be negatively affected by changes.

Terrestrial Amphibians & Reptiles of the Barrier Island Bayside Beach Habitat

- Eight of the nine drivers are included in this model indicating a highly vulnerable habitat. Construction-Hard and Soft, Development and Catastrophic Storms are of greatest importance. A variety of Amphibians and Reptiles including the endangered Mud Turtle may be affected locally by such stressors inducing habitat changes to the Bayside Beach. The locally important Diamondback Terrapin is known to use this habitat to migrate from bay to upland dune habitats to lay eggs.

Terrestrial Mammals & Insects of the Barrier Island Bayside Beach Habitat

- Eight of the nine drivers are included in this model indicating a highly vulnerable habitat. Construction-Hard and Soft, Development and Catastrophic Storms are of greatest importance. Any disturbance to the Bayside Beach habitat will displace Mammals and Insects that use these areas for habitat.

Terrestrial Birds of the Barrier Island Bayside Beach Habitat

- Eight of the nine drivers are included in this model indicating a highly vulnerable habitat. Construction-Hard and Soft, Development and Catastrophic Storms are of greatest importance. Habitat responses can potentially affect a variety of bird species that utilize the Bayside Beach. Threatened and Endangered Hawks and Osprey, along with Piping Plover, Common Tern and Least Tern have been known to use this habitat.

Transitional Birds of the Barrier Island Bayside Beach Habitat

- Eight of the nine drivers are included in this model indicating a highly vulnerable habitat. Construction-Hard and Soft, Development and Catastrophic Storms are of greatest importance. Habitat responses can potentially affect a variety of bird species that utilize the Bayside Beach. Threatened and Endangered Hawks and Osprey, along with Piping Plover, Common Tern and Least Tern have been known to use this habitat.

Transitional Amphibians & Reptiles of the Barrier Island Bayside Beach Habitat

- Eight of the nine drivers are included in this model indicating a highly vulnerable habitat. Construction-Hard and Soft, Development and Catastrophic Storms are of greatest importance. A variety of Amphibians and Reptiles including the endangered Mud Turtle may be affected locally by such stressors inducing habitat changes to the Bayside Beach. The locally important Diamondback Terrapin is known to use this habitat to migrate from bay to upland dune habitats to lay eggs.

Aquatic Invertebrates of the Barrier Island Bayside Beach Habitat

- Eight of the nine drivers are included in this model indicating a highly vulnerable habitat. Construction-Hard and Soft, Development and Catastrophic Storms are of greatest importance. Habitat responses can locally affect Invertebrates that use the Bayside Beach for habitat.

Terrestrial Vegetation of the Barrier Island Maritime Forest Habitat

- Inclusion of all drivers, except Construction-Dredging, indicates this habitat is highly sensitive to project implementation. Any storm effects could result in changes to hydrology which could negatively impact the Maritime Forest because of its sensitivity to salinity regime. This sensitivity gives the greatest vulnerability to Habitat Alteration out of all other habitats.

Terrestrial Amphibians & Reptiles of the Barrier Island Maritime Forest Habitat

- Inclusion of all drivers, except Construction-Dredging, indicates this habitat is highly sensitive to project implementation. Any storm effects could result in changes to hydrology which could negatively impact the Maritime Forest because of its sensitivity to salinity regime. This unique habitat is home to the threatened and endangered species of Tiger Salamander, Mud, Eastern Box and Spotted Turtles, and the Eastern Hognose Snake.

Terrestrial Mammals & Insects of the Barrier Island Maritime Forest Habitat

- Inclusion of all drivers, except Construction-Dredging, indicates this habitat is highly sensitive to project implementation. Any storm effects could result in changes to hydrology which could negatively impact the Maritime Forest because of its sensitivity to salinity regime. Any physical changes to the Maritime Forest could also affect Terrestrial Mammals and Insects.

Terrestrial Birds of the Barrier Island Maritime Forest Habitat

- Inclusion of all drivers, except Construction-Dredging, indicates this habitat is highly sensitive to project implementation. Any storm effects could result in changes to hydrology which could negatively impact the structure of the Maritime Forest because of its sensitivity to salinity regime. A variety of birds including the Warbler and other Migratory Species could be affected by potential habitat changes.

Transitional Birds of the Barrier Island Maritime Forest Habitat

- Inclusion of all drivers, except Construction-Dredging, indicates this habitat is highly sensitive to project implementation. Any storm effects could result in changes to hydrology which could negatively impact the Maritime Forest because of its sensitivity to salinity regime. A variety of birds including the Warbler and other Migratory Species could be affected by potential habitat changes.

Transitional Amphibians & Reptiles of the Barrier Island Maritime Forest Habitat

- Inclusion of all drivers, except Construction-Dredging, indicates this habitat is highly sensitive to project implementation. Any storm effects could result in changes to hydrology which could negatively impact the Maritime Forest because of its sensitivity to the salinity regime. This unique habitat is home to the threatened and endangered species of Tiger Salamander, Mud, Eastern Box and Spotted Turtles, and the Eastern Hognose Snake.

Transitional Vegetation of the Barrier Island Maritime Forest Habitat

- Inclusion of all drivers, except Construction-Dredging, indicates this habitat is highly sensitive to project implementation. Any storm effects could result in changes to hydrology which could negatively impact the Maritime Forest and the native vegetation that is highly sensitive to salinity. This sensitivity renders this habitat the most sensitive to Habitat Alteration compared to all other habitats.

Terrestrial Amphibians & Reptiles of the Conceptual Model for the Barrier Island Ecosystem

- Most drivers are included in this ecosystem model indicating a highly vulnerable habitat. Amphibians and Reptiles are present in all four habitats including a variety of endangered turtles, the Tiger Salamander and the Eastern Hognose Snake. Any changes to the ecosystem could potentially affect these endpoints.

Terrestrial Mammals & Insects of the Conceptual Model for the Barrier Island Ecosystem

- Most drivers are included in this ecosystem model indicating a highly vulnerable system. Terrestrial Mammals and Insects are most relevant in the Terrestrial Upland and Maritime Forest. Any changes to these habitats could potentially affect these endpoints.

Terrestrial Birds of the Conceptual Model for the Barrier Island Ecosystem

- Most drivers are included in this ecosystem model indicating a highly vulnerable system. Birds are an important endpoint for all habitats of the ecosystem including the endangered Hawks, Osprey and Least and Common Terns. Any changes to these habitats could potentially affect these endpoints.

Terrestrial Vegetation of the Conceptual Model for the Barrier Island Ecosystem

- Most drivers are included in this ecosystem model indicating a highly vulnerable system. Terrestrial Vegetation is relevant to all habitats in the ecosystem and typically uniquely defines the habitat. Any changes to these habitats could potentially affect Terrestrial Vegetation and other endpoints dependent upon it.

Transitional Birds of the Conceptual Model for the Barrier Island Ecosystem

- Most drivers are included in this ecosystem model indicating a highly vulnerable system. Birds are an important endpoint for all habitats of the ecosystem including the endangered Hawks, Osprey and Least and Common Terns. Any changes to these habitats could potentially affect these endpoints.

Transitional Amphibians & Reptiles of the Conceptual Model for the Barrier Island Ecosystem

- Most drivers are included in this ecosystem model indicating a highly vulnerable habitat. Amphibians and Reptiles are present in all four habitats including a variety of endangered turtles, the Tiger Salamander and the Eastern Hognose Snake. Any changes to the ecosystem could potentially affect these endpoints.

Transitional Vegetation of the Conceptual Model for the Barrier Island Ecosystem

- Most drivers are included in this ecosystem model indicating a highly vulnerable system. Vegetation is relevant to all habitats in the ecosystem and typically uniquely defines the habitat. Any changes to these habitats could potentially affect Vegetation and other endpoints dependent upon it.

Aquatic Invertebrates of the Conceptual Model of the Barrier Island Ecosystem

- Eight of the nine drivers are included in this model indicating a highly vulnerable habitat. Only the Bayside Beach and Coastal Ponds are relevant to the model. Construction-Hard and Soft, Development and Catastrophic Storms are of greatest importance. Habitat responses can locally affect Invertebrates that use the Bayside Beach or Coastal Ponds for habitat.