Alignment of Coastal Development with Vibrant, Sustainable Marine Ecosystems

Robert W. Dickey, Director
University of Texas at Austin Marine Science Institute
Port Aransas, TX

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(Title Slide) I would like to thank everyone in attendance today for your interest and time taken to hear about the NAML network of marine science institutions and the work we do. My name is Robert Dickey and I am the director of the University of Texas Marine Science Institute located in Port Aransas, Texas.

Coastal counties of the United States constitute less than 10 percent of the total land area, yet are home to nearly 50 percent of the U.S. population. This demographic of about 150 million people, and the social & economic infrastructure supporting it, is growing much faster than inland counties - Nationally, coastline counties grew an average of 5.6 percent since 2010, while inland counties gained 4 percent. This trend tracks with decades of development along U.S. coastlines.

There is mounting concern about how and where infrastructure development is occurring, and the implications of this growth for the integrity, productivity and sustainability of marine ecosystems and natural resources. NAML institutions contribute to informed decision-making to help align coastal socioeconomic and development aspirations with functional, dynamic, and sustainable marine ecosystems ….. Those very ecosystems that also contribute services through: commercial and recreational fisheries; boating; tourism; storm surge protection; and much broader tangible and intangible benefits to human health, safety, and quality of life.

With that overview, I would like to present an example of service NAML institutions provide to my region. (Slide of TX Coastal Bend) Some of you may be aware that big changes have been proposed to industrial and maritime infrastructure along the Texas coastline. Specifically, the Port City of Corpus Christi and the Ship Channel that connects the Gulf

of Mexico to the Inner Harbor of Corpus Christi Bay. (Slide of CC Bay Close Up)

The Texas Coastal Bend has seen unprecedented growth in the last five years with large business investments exceeding 40 billion dollars. The Port of Corpus Christi on the western shore of Corpus Christi Bay and industrial development on northern shore is the most significant driver of this rapid growth. Corpus Christi is the leading port in the nation for exporting crude oil and aspires to increase exports to maintain that leadership. The Port is limited by ship channel depth to fully load vessels; and growth of the industrial complex on the north shore is limited by the availability of potable freshwater in drought prone South Texas.

To address constraints on industry development the Port Authority proposes the construction of a seawater desalination plant on Harbor Island. To address constraints on crude oil exports the Port sought and received Congressional support in 2017 to deepen the 29-mile ship channel to a depth of 54 feet to accommodate loading and transit of large crude carriers. This is where NAML comes in – both of these industrial projects are near two NAML institutions. (Slide of CCSC Close Up)

The proposed desalination plant calls for taking in 150 million gallons of offshore seawater per day to be processed by Reverse Osmosis to potable water; and to discharge 96 million gallons of salt brine per day into the ship channel. Harbor Island, located on the ship channel, is within the city limits of Port Aransas and borders some of the state's most productive bays and estuaries. The Corpus Christi ship channel connects these estuaries and bay systems to the Gulf of Mexico. The life cycles of many species, such as shrimp, crab and finfish, are dependent upon this connection. Juveniles of these species live and mature in the estuary or "nurseries", then migrate through the channel to the Gulf to become reproductive adults, releasing their eggs that hatch and become planktonic larvae in the open ocean. These larvae must return to the estuaries to complete their life cycles. The larvae are weak swimmers and too small to migrate back into the estuaries under their own power, so they are dependent on hydrodynamics and environmental signals, such as reduced salinity from the estuary, to ride tidal and

meteorologically driven currents back into the estuaries. Astronomical tides and meteorologically driven currents play the major role in water exchanges between the open Gulf and inshore bays and estuaries, which take about one year to fully exchange.

The Corpus Christi ship channel is by far the larger of only two waterways connecting the estuaries and Bay system to the open Gulf of Mexico. The proposed salt brine discharge has raised stakeholder concerns about potentially detrimental effects of hypersalinity and elevated metal concentrations on marine life in the channel and adjacent estuaries. Regional labs in the NAML network provide important local expertise for stakeholders to look at issues just like this. We worked with several partners, including the Port Authority, to develop a hydrodynamic model of the Corpus Christi Bay system to determine whether the proposed discharge of desalination brine into the ship channel could be harmful to marine life and ecosystem structure and function. The model tested the Port's assumption that a brine discharge diffuser would produce a 1% increase in salinity relative to ambient conditions at 400 feet from the discharge location, as detailed in the permit application.

The model was applied to a two-year period, which covers two complete exchanges of water between the open Gulf of Mexico and inshore estuaries and bays, and it includes both a rainy year and a drought year. The report concluded that the Harbor Island discharge location at the modeled depth of 54 feet, with an effective diffuser, appears to be suitable; that the brine discharge as proposed would not lead to a cumulative increase in ambient salinity over time and would not cause the formation of a high-salinity layer of water along the channel bottom.

However, circumstances have changed and recently, an amendment was filed to further deepen and widen the eastern most section of the ship channel, including Harbor Island, to a depth of 80 feet to accommodate Very Large Crude Carriers (VLCC or SuperTankers). This new plan raises additional socioeconomic and environmental issues. Associated permit applications were also filed to construct a crude oil pipeline through Redfish Bay State Scientific Area, install petroleum storage

facilities and construct two supertanker loading terminals on Harbor Island.

As circumstances continue to evolve, NAML institutions will work with all stakeholders to provide the coastal intelligence needed for informed decision making. Among the tasks that we are engaged or preparing for includes:

- Hydrologic modeling of brine discharge at greater channel depth;
- Forecasting the impact of greater channel depth on storm surge from tropical storms and hurricanes;
- Modeling the influence of greater channel depth on marine life migrating to the gulf and larvae recruitment into the estuaries;
- Human health and safety risk assessments of the proximity of Port Aransas to petrochemical infrastructure; and
- Human health and environmental risk assessments for inshore versus offshore oil spill scenarios.

In a call for public comment the Corps of Engineer's initial determination of substantial adverse impacts on essential fish habitat or federally managed fisheries in the Gulf of Mexico is a good beginning. It is also encouraging that the Corps committed to consultations with U.S. Fish and Wildlife and/or National Marine Fisheries Service to assess the effects on endangered species. However, these assessments should be extended to larval, juvenile and adult stages of invertebrate and vertebrate marine species that make up the breadth and depth of the marine food web sustained by the channel. In turn, that web sustains environmental health and the economic well-being of Port Aransas and the surrounding municipalities.

Considerations of coastal development in Texas and elsewhere require case-based and place-based approaches, and partnerships, for analyzing the social, economic and environmental balancing act required for major developments such as those proposed for the Port of Corpus Christi. These types of developments present remarkable economic opportunities for societal advancement, yet they also raise important questions about the continued viability of coastal ecosystems and the many tangible and intangible services that they provide.

It is in this context that we use the term **Coastal intelligence** to reference actionable knowledge. The current and available research, monitoring and historical data to help inform our understanding, use and stewardship of the natural environment. **Coastal intelligence** enables citizens, business, industry and government to make knowledgeable choices that support and enhance healthy, resilient communities and marine ecosystems along our shorelines. NAML institutions are well placed to provide that knowledge and guidance.