For many persons, a trip to the beach is a wonderful and fun-filled form of recreation. Whether you are going sea bathing, fishing, or camping, coastal communities are frequently visited for their breathtaking scenery, comfortable breeze and general enjoyment and relaxation.

Coastal communities are also special places that many persons and families call home and are also a source of income for many fisher folk, marine industries and businesses. However, these communities are also vulnerable to coastal hazards such as coastal erosion and rising sea levels.

Preparation and mitigation, therefore, are key elements in disaster risk reduction for everyone but particularly for persons living, working by, or visiting coastal areas. Naturally, coastal hazards are of particular interest to the Office of Disaster Preparedness and Management (ODPM), which by its very mandate utilises an All of Society approach towards preventing and mitigating the impacts of coastal hazards.

One such coastal hazard that everyone should prepare for is a tsunami. Although Trinidad and Tobago has not experienced a tsunami in recent times, it is critical for all persons to know the risks they pose and how to be prepared in the event one is encountered. A tsunami is a series of gigantic waves caused by earthquakes, underwater slump (landslides) or undersea volcanic eruptions (NOAA). This deadly hazard can cause extensive deaths, injuries, damage and destruction to buildings and infrastructure that are as far as five kilometres inland from the coast, depending on the terrain and the strength of the Tsunami.

Because of the devastating effects that tsunamis can have on coastal communities, the ODPM formed strategic collaborations with local, regional and international agencies and undertook a pilot project to prepare the Carenage Community for the impact of a tsunami. This successful project titled “Strengthening Capacities of Early Warning and Response to Tsunamis and Other Coastal Hazards in the Caribbean”, also established Carenage as the first UNESCO/IOC/CTIC certified Tsunami Ready community in Trinidad and Tobago.

The project involved various elements but arguably the highpoint was the engagement of the community in a tsunami drill. The drill commenced on the morning of Wednesday 5th February 2020, when the various national first response and support agencies simulated a tsunami warning issued for Trinidad and Tobago and other Caribbean islands.

The tsunami resulted from an 8.4 magnitude earthquake that occurred in the Northern Atlantic Basin. The residents and students, along with many excited volunteers from the very young to the mature, responded to the sounds of sirens that were heard across the community, warning of the ensuing danger. The rush to safety was swift as participants followed the evacuation signs placed in low lying vulnerable areas.
such as the Carenage Fish Market and the Chaguaramas Boardwalk, as well as along Abbe Poujade and School Streets.

These signs led persons to the Carenage Recreation Grounds, which was used as the assembly point for the exercise and ultimately where persons were accounted for.

Critical to the success of the tsunami drill was the valuable input of the principals, staff, parents and pupils of the Carenage Girls and Boys RC Schools and the Martha’s Pre-School. Also of immense importance was the involvement of the residents of the Carenage Community.

The Carenage community was selected for the pilot project because of its vulnerabilities such as its low lying topography, a dense population, as well as being the site for a number of national security agencies, maritime industries, businesses, sea bathing and other recreational activities along its coastline.

Some of the other significant achievements that this project accomplished was the development of National Standard Operating Procedures (SOPs) for Tsunamis. These SOPs were developed following a National Tsunami Response Workshop hosted by the ODPM in collaboration with the Caribbean Disaster Emergency Management Agency (CDEMA). Additionally, a National Tsunami Technical Workshop, facilitated by IH Cantabria of Spain and hosted by the ODPM, was a strategic initiative that was used to increase tsunami awareness and preparedness across Trinidad and Tobago.
Following this Technical Workshop, the consultants conducted a verification visit to validate existing evacuation routes from the data previously collected. As a result of this visit, the development of inundation and evacuation maps for the Carenage community were confirmed along with the evacuation routes.

Additionally, a Geographic Information System (GIS) Tsunami Evacuation Map was developed and this stands as a model that can be used to develop similar maps for other vulnerable communities across the country.

Another key accomplishment was the ability of various national agencies to work in a coordinated manner among themselves and the local community. Some of these agencies that partnered with the ODPM included the Trinidad and Tobago Defence Force, Trinidad and Tobago Fire Service, Trinidad and Tobago Police Service, the Diego Martin Regional Corporation, Trinidad and Tobago Red Cross Society, and the Civilian Conservation Corps.

Undoubtedly, the most valuable achievement arising out of the project is the improved resilience of the Carenage Community to a tsunami. Residents not only showed excitement but energetic participation and an eagerness to contribute to their community’s resilience. This pilot project is a step in the right direction to strengthening resilience and increasing tsunami awareness for persons, families and businesses in other coastal communities.

The ODPM is proud to have partnered with the many stakeholders who participated in this strategic pilot project that in the long term would assist in making more communities better prepared for tsunamis. Building disaster resilience cannot be done overnight nor by one agency alone, but together we can all contribute to building Trinidad and Tobago’s resilience to disasters one community at a time.
Modernizing the Fisheries Management Legislative Framework in Trinidad and Tobago

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The Fisheries Management Bill was introduced in Parliament in June 2020 after almost three decades of development. This Bill is intended to revolutionize and modernize fisheries management in Trinidad and Tobago by creating a robust legal basis for regulation of the fishing industry and management of the common property fisheries resources that belong to the people of the country.

Consistent with international best practices in fisheries management and embodied in the Bill’s principles for decision-making is a participatory approach. As such, the Bill makes provision for stakeholder involvement in the governance and decision-making process and for collaboration of government agencies with responsibilities impacting fisheries, such as trade, health, customs, finance, national security, maritime services, foreign affairs and the environment, with the Fisheries Division. Long-term sustainability of fisheries resources, and the ecosystem and precautionary approaches to fisheries management are also embodied in the Bill’s principles for decision-making.

In addition to these overarching principles the Bill facilitates: (a) protection of current fish trade markets and penetration of potential markets; (b) fulfillment of the country’s international coastal, flag, port and market State obligations; (c) security of access by nationals to fisheries resources in areas beyond national jurisdiction; (d) strengthened control of fisheries crimes including illegal, unreported and unregulated fishing; and (e) strengthened control of crimes associated with fishing.

The Bill expands the scope of the regulatory framework to include all fishing (artisanal, non-artisanal, commercial, recreational, national and foreign) and fishing-related activities (e.g. landing, processing, transshipment, in transit movement, trade) within the waters under national jurisdiction (Archipelagic Waters, Territorial Sea and Exclusive Economic Zone) and by national fishing vessels in areas beyond national jurisdiction; mindful that the current Fisheries Act of 1916 regulates only fishing by the national fleet up to the Territorial Sea, while the Archipelagic Waters and Exclusive Economic Zone Act regulates foreign fishing in the full extent of Trinidad and Tobago’s jurisdiction.

Some key measures of the Bill provide for:
1. an administrative framework for harmonization of the fisheries management programs in Trinidad and in Tobago and establishment of fisheries inspectorates in both islands;
2. development and implementation of fisheries management plans;
3. establishment of a Fisheries Management Fund to be managed by a Fisheries Financial Board;
4. mandatory registration of fishers and fish workers;
5. mandatory record-keeping by the Fisheries Division (e.g. records of fishing vessels and fish vendors);

Consultations with State Agencies (June 2018)
6. institution of a system of regulated access to the fisheries resources to be implemented through a range of authorizations, licences and permits with requisite fees; this is a distinct change from the existing practice of open access to the fisheries resources;

7. enhanced fisheries monitoring, control, surveillance and enforcement systems including extensive duties and powers of authorized officers and observers, logbook and vessel monitoring systems, increase in the type and form of admissible evidence, a penalty system to deter non-compliance with penalties in addition to fines and imprisonment, e.g. forfeiture, banning order;

8. expanded regulation-making powers of the Minister taking into consideration the changing national, regional and international circumstances and obligations.

Though primarily focusing on fisheries management the provisions of the Bill also support and strengthen national initiatives towards integrated coastal zone management. In addition to the measures above, the Bill addresses matters related to prevention and elimination of over fishing; waste minimization - including pollution from fishing vessels; biodiversity protection (including protection of fish habitat); use of scientific information and traditional and local knowledge in decision-making; sharing of data and information; fisheries scientific research and fish bioprospecting; climate change adaptation and mitigation and disaster risk management in fisheries; protected, threatened or endangered species; establishment of marine protected areas; and designation of landing sites and associated maintenance and inspection of such sites.

Given the magnitude of the administrative, social and economic changes required for effective implementation of the Bill once it becomes law and the associated industry trade-offs (See Box 1.), the restructuring of the fisheries administrations in both islands and implementation of a change management-stakeholder awareness programme are critical elements in moving forward.

The Bill was forwarded to a Joint Select Committee for review and reporting back to Parliament by 31 August 2020. Subsequently, Parliament was dissolved on 3 July in advance of national general elections on 10 August 2020.

COSTS
- financial costs (application fees, certification, outfitting compliant gear, support to observers, penalties);
- requirement for registration, recording and associated certification;
- regulated access to fisheries resources;
- increased and more stringent administrative procedures and monitoring;
- requirement to use specific designated landing sites or identified ports;
- requirement to provide fisheries data; and
- organizational strengthening to effectively participate in decision-making.

BENEFITS
- social and economic benefits as a consequence of well-managed fisheries;
- legitimate and equitable access to fisheries resources;
- improved safety at sea and search and rescue;
- secured international trade markets;
- well-equipped and managed fishing facilities;
- a formal role in fisheries management decision-making;
- protection from theft or interference of fishing gear/equipment and fish contained in such gear;
- confidentiality of economically sensitive and personal information;
- comparative advantage of those who demonstrate historical compliance.
The Gulf of Paria (GOP) historically has been used for upstream oil and gas activities, fishing, recreation as well as a main transportation trade route. It is the receiving environment for marine and land-based discharges from agricultural, commercial, industrial and domestic sources. The water quality of the GOP is strongly influenced by the nutrient inputs from the Orinoco and Amazon Rivers, which contribute to its high fisheries productivity. Several communities along the southwestern coastline depend on the GOP for their livelihoods from socio-economic activities such as fishing, crab-catching and oyster-catching.

During the recent years, there has been an increase in the frequency of oil spill incidences in the GOP that may have originated from onshore and/or offshore oil and gas activities. There have been many concerns raised by the public on the direct effects of oil spills on the receiving physical, biological and socio-economic environment as well as the use of dispersants to treat oil in the marine environment along the southwestern coastline of the GOP.

Based on the expressed public concerns, the Environmental Management Authority (EMA) procured the services of CSA Ocean Sciences Incorporated (CSA) in partnership with international experts, Harwell, Gentile and Associates (HGA), a United States-based consulting firm with extensive experience and expertise in Ecological Risk Assessments (ERAs) to conduct a Baseline ERA Study along the south west peninsula of Trinidad. This study was conducted in accordance with the 1998 Guidelines for Ecological Risk Assessment (U.S. Environmental Protection Agency [USEPA], 1998) which describe an ERA as ‘the process that evaluates the likelihood that adverse ecological effects may occur or are occurring as a result of exposure to one or more stressors.

The study commenced in April 2018 with the aim of identifying the risks posed by chemical contaminants to ecological receptors within the defined study area and to provide recommendations for the remedial action(s) for each ecological risk deemed to be significant or unacceptable. The study area extended from the High Water Mark from Pointe-a-Pierre to Icacos along the southwestern coast of Trinidad to a 5.56-km (3-nautical mile) offshore area in the GOP as depicted in Figure 1 below.

Figure 1. Study area for the Baseline Ecological Risk Assessment for the South West Peninsula of Trinidad, Pointe-a-Pierre to Icacos.
This two-phased project consisted of Phase I which included a literature review to design and scope the project, while Phase II entailed the conduct of seasonal environmental baseline surveys, a Conceptual Ecosystem Model (CEM) Workshop and a Baseline ERA Study.

The seasonal environmental baseline surveys were conducted in August 2018 (wet season) and May 2019 (dry season) which included collection of water, sediment and faunal samples at riverine, intertidal, nearshore and offshore locations within the study area. Data from these surveys were used to identify chemicals of potential concern which may pose a risk to the ecological resources of the GOP.

The CEM Workshop was hosted by CSA and HGA, the project consultants, and the EMA in January 2019 with expert participants from varying regulatory government agencies and non-governmental organisations with local knowledge on fisheries, water quality, coastal ecology, spill management and environmental management of the GOP. At this workshop, the Trinidad Gulf of Paria CEM was developed (See Figure 2 below).

Major stressors were qualitatively ranked with respect to ecological risks to inform the Screening Level ERA (SLERA). Oil spills were ranked as a high risk to the GOP, based on the increase in significant oil spills in recent history as they produce a suite of specific stressors that affect ecological components during the immediate, intermediate, and long-term period following the spill. Other stressors such as climate change, over-fishing and habitat alteration were also ranked as high, but were not considered under the scope of this study.

The Baseline Ecological Risk Assessment (BERA) Study modelled several potential scenarios for oil and chemical spills for products produced and shipped within the south west of the GOP. The risks from these potential spills were quantified in the BERA, and it was determined that risks from an oil spill would have the most potentially catastrophic ecological sequences particularly on coastal ecosystems such as mangroves ecosystems.

In June, 2020, CSA, HGA, and the EMA hosted a virtual presentation to brief stakeholders including government and non-government agencies on the findings of the Baseline ERA Study which include the following conclusions and recommendations of the ERA:

- The study area is a stressed environment with polluted rivers discharging into the GOP.
- Data from the baseline seasonal surveys were generally comparable to previous studies. However, elevated levels...
of Total Extractable Hydrocarbon (TEH) were found in sediment at several stations and in faunal samples while high concentrations of metals in the sediment were also found at some stations, but not at toxic effects levels. Copper and zinc concentrations were elevated in invertebrates. Further studies are required to investigate these concerns.

- Specific management strategies have been suggested to mitigate potential risks from hydrocarbon spills and their sources. Some of these include pre-deploy oil-containment systems (e.g., booms) around vulnerable ecological resources such as the Caroni Swamp and the Godineau Swamp, and the installation of automated oil-spill detection and containment systems to facilitate real time detection and early spill-response actions at high risk locations of previous oil spills.

Based on these conclusions, future studies are required to address these concerns. These include continuous monitoring of select GOP environmental resources including water, sediment and fauna to assess parameter concentrations, temporal changes and natural variability and an in-depth monitoring study of the riverine systems and potential point and non-point sources that discharge into the GOP.
The Coastal Protection Unit (CoPU) is one of the few government agencies tasked with managing the shoreline of Trinidad and Tobago. Established in 2014 within the Ministry of Works and Transport, the unit (CoPU) has been tasked with carrying out the mandate of protecting our coastlines through the execution of the Critical Coastal Protection Programme (CCPP). This programme aims to create a world class national coastal defence system to mitigate against shoreline erosion, coastal flooding and other health and environmental hazards through hard and soft coastal engineering techniques and management methodologies.

Prior to the establishment of the Comprehensive National Coastal Monitoring Programme (CNCMP), the CoPU carried out several feasibility studies and investigation that identified critical areas around the country that was in desperate need of stabilization works. Consequently, protection works were designed and implemented under the Critical Coastal Protection Programme (CCPP). Some of the completed works are highlighted further in this issue, while ongoing works will be in the next issue of ICZM NEWS.
Completed Projects – Capital Works

**Little Rockly Bay, Magdalena Grand Beach and Golf Resort, Tobago**

Manzanilla Beach Facility has in the past, been plagued by severe erosion due to the strong impact of the Atlantic waves on the sea wall. It has also suffered from coastal inundation and as a result had to be repaired. The CoPU in its mandate to provide short to medium term solutions to address coastal erosion and inundation, as well as develop long term solutions to address coastal erosion along Trinidad’s shoreline, constructed 252 linear meters of vinyl sheet pile seawall along the alignment of the original seawall of the beach facility; 252 linear meters of concrete capping; 252 linear meters of FRP safety railings and the reconstruction of the access ramp and stairs, and landscaping.

The main objective of the project was to provide stability along the length of the coastline of the Manzanilla Beach Facility which was destabilized by the effects of coastal erosion and wave overtopping of the original seawall. Since the project was completed in 2015, the beach facility has benefited from an increased ability to withstand erosion. The works has ensured the sustainable use of the beach facility, coastal community space, and tourism related economic activities, tourism infrastructure, public communication lines, public utilities and other assets are the key benefits of the project.

**Manzanilla Beach Facility Stabilization Works, East Trinidad**

The Magdalena Grand Beach & Golf Resort (MGBGR) is located on the South East coast of Tobago, within the Little Rockly Bay. The MGBGR is an oceanfront luxury resort built in 2001 and active operation since. The resort sits on approximately 23 acres of land leased from the Tobago Plantations Estate. The MGBGR has a shoreline length of roughly 550m with a North beach, centre headland and South beach. Retreat of shoreline due to erosion activity over the years and continuously aggressive wave environment makes it difficult to have comfortable and safe bathing for beachgoers.

The Government of the Republic of Trinidad and Tobago through the Coastal Protection Unit (CoPU), Ministry of Works and Transport intends to arrest the problems associated with coastal erosion along the Little Rock Bay shoreline, Tobago. The project extends within the North Beach area of the shoreline. The scope of works for this project included the construction of a breakwater system, comprising off four (4) emergent breakwaters and (3) armour stone sills. Construction began in October 2019 and has been completed as of February 2020. It is expected that frequency and severity of erosion will reduced and therefore offer suitable protection for the MGBGR thus increasing its amenity value.
North Cocos Bay Shoreline Stabilization Works, East Trinidad

North Cocos Bay is located on the East coast. The main objective for this project was to alleviate coastal erosion and coastal flooding along this stretch of coastline given the vulnerability to these events caused by the low relief, relatively unstable geology, and direct exposure to the Atlantic Ocean and North East Trade Winds, influence of deep water oceanic currents and localised rip currents and squalls. The scope of works for the North Cocos Bay Project is the construction of a 100 linear meters of seawall with toe protection is being undertaken. Berthing and landing facilities including the construction of a slipway, a landing shed together with paving and drainage works are also being done. The installation of 100 meters of vinyl sheet pile coastal protection works; the construction of a slipway and the provision of launching/berthing facilities were completed.

The key benefits of this project are to support to the fishing industry and overall national food security by provision of the only fish landing site on the east coast and erosion protection of the facility. This project was completed in 2015. The capital works is complete and the area is to this day, still showing signs of benefiting from the coastal protection works.

Shore of Peace Cliff Stabilization Works Projects, South West Trinidad

The Shore of Peace Cliff Stabilization Works Project was completed in 2015. The site is an important religious site situated adjacent to the mouth of the Godineau River. The Shore of Peace Cliff Stabilization Works project was developed to address the erosion of sandstone cliffs that exist at the backshore zone of the Shore of Peace Cremation Facility. Erosional activity resulted from undercutting due to wave action on the base of the cliff. Although located on the western coast in what one might consider a more sheltered area, the erosion still proved to be extensive enough to spark stabilization works.

The scope of works for this project includes the construction of 530 linear metres of combined concrete seawall and rubble mound revetment at the cliff’s base and 530 linear metres of safety railing at the cliff's edge. Since completion, the implemented works has provided increased safety features for users of the cremation site; reduced overall erosion rates on the south west peninsula; reduced the destruction of property of religious and cultural significance that will result from continued coastal erosion prevention.
Quinam Coastal Protection Works, South Trinidad

Historically, the Manzanilla-Mayaro Road has been susceptible to flooding at tidal wave situations, i.e. during spring tidal conditions, in combination with surges and waves, leaving the road exposed to erosion at certain locations. The road is the main thoroughfare which links residence from the South-east to the North-east villages and coastline. Continued erosion along this stretch of coastline has increased the vulnerability of the Manzanilla-Mayaro Road, in areas where there are currently no interventions.

The project has been broken up into two phases: South Cocos Bay and Cocos Bay. The main functional objective is the protection of the road infrastructure while the socio-environmental objectives are to limit changes in the geomorphological processes from erosion to beach accretion along the project area, and to facilitate sustainable public access and use of the project area. A rock revetment system is proposed along this section of the coast and will tie into the works proposed in the vicinity of the Nariva River mouth. At South Cocos Bay, the scope of works includes the construction of a 66 m Fiberglass Reinforced Polymer (FRP); the construction of a 735 m Rubble Mound Revetment with a walkway, beach access points and the construction of Drainage and Ancillary Works.

At Cocos Bay the scope of works includes the construction of 500m of rock revetment and ancillary works.

Cocos Bay Shoreline Stabilization Works

The Cocos Bay coastline has been recorded as experiencing erosion at an average rate of 2.7 meters per year. The ongoing erosion and periodic flooding has impacted several public assets, of which the most critical is the Manzanilla-Mayaro Road.
The Integrated Coastal Zone Management (ICZM) Policy Framework provides a comprehensive and integrated foundation for the management of our coastal and marine environment.

Two key objectives of the Policy Framework are to maintain the diversity, health and productivity of coastal and marine processes and ecosystems and to promote and enhance pollution control and waste management activities.

ICZM aims to incorporate contemporary principles of planning and resource management over various disciplines in efforts to keep the marine environment interconnected and bridge the gap between science and policy.

Through the ICZM’s policy strategy to implement a comprehensive national water quality monitoring programme, benthos can be used for environmental assessment as they are key environmental indicators of water quality. Benthos can also contribute to the identification and protection of unique and sensitive habitats in the coastal zone.

Marine benthos is the community of organisms that inhabit the ocean floor. This zone expands from nearshore to deep sea encompassing the sediment surface and subsurface layers.

Benthos are commonly found attached to rocks and vegetation, or on or burrowed in the sediment at the bottom of the ocean. To the naked eye, this zone may appear sparse; however, it is filled with countless macro and microscopic organisms such as polychaetes, large crustaceans, sponges, corals and amoeba.

Benthos are used as environmental indicators when evaluating the overall health of aquatic ecosystems, and in water quality management. These communities are sensitive to sudden changes in the environment therefore they can be used as a gauge in determining trends in ecological communities. They also play a vital role as a food source in ecosystems.

Benthos can be characterized based on size into three categories: macro, meio and microbenthos. Macrobenthos are typically larger than one millimetre such as polychaetes, echinoderms and crustaceans. Meiobenthos are typically between 0.1-1 millimetre such as copepods, turbellarians and nematodes. Microbenthos are smaller than 0.1 millimetre such as amoeba, diatoms and flagellates.

The sensitivity of several benthic species to changes in water quality due to pollution, and to other environmental shocks directly reflects characteristics of the community. These are observed through species abundance, richness, diversity and evenness indices as well as overall community composition. For example, a benthic sample consisting mainly of pollution tolerant species such as polychaetes with a low diversity and abundance index generally indicates poor water quality.
Furthermore, benthic assessments can be used to differentiate between naturally occurring changes and changes due to anthropogenic influences. Benthos are considered as one of the most important components of aquatic ecosystems as they function in nutrient cycling, and contribute to the removal of contaminants from the water column. As such, understanding their role should be equally appealing to scientists, environmental managers and policy makers as well as the general public. Thus, continuous analysis of the benthic community can be utilized in policy-making.

The relationship between science and policy-making is complex and involves both disciplines establishing common ground; thus, creating a continuous flow of interactions which allows for both scientists and policymakers to simultaneously share information in efforts to manage the marine environment. Without scientific information, such as that provided through the monitoring of marine benthos, policy-makers have no rationale to implement and monitor regulatory changes to protect and maintain the marine environment.

Fireworms are abundant on reefs, rocky areas, seagrass beds and muddy bottoms.