# ANNEX E - SOCIAL AND ECONOMICAL SCIENCE INDICATORS

***Introduction***

Coral reef scientists and coastal resource managers are coming to the realization that coastal resources can no longer be effectively managed if biophysical scientific monitoring is the only focus. As the recent IUCN report (Jackson *et al* 2014) found, there were key drivers of coral reef ecosystem change that have direct human dimensions linkages including; population, tourism development, overfishing, coastal pollution to name a few. It is important that systematic monitoring of social science indicators be implemented in conjunction with biophysical monitoring. In doing so may enhance the ability to make connections and inferences between observed changes the coral reef ecosystem quality and human and social parameters.

From as far back as 2000, GCRMN recognized the need for collecting socioeconomic data in coral reef and coastal areas. The development of the Socioeconomic Manual for Coral Reef Management (Bunce et al 2000) was intended to improve the understanding of the social and economic conditions, contexts and motivations associated with the use of coral reef ecosystems. In addition to this manual, regional guidelines were developed including one for the Caribbean titled; Socioeconomic Monitoring Guidelines for Coastal Managers in the Caribbean (SocMon Caribbean). These two publications should serve as key resource documents when implementing the recommended monitoring of the socioeconomic indicators discussed below. These publications were intended to parallel the biophysical manual (English et al 1997) and therefore this renewed commitment by the Caribbean GCRMN participants aims to foster integrated coral reef monitoring, both the biophysical and humans that impact the coral reefs.

***Recommended Socioeconomic Indicators for Monitoring***

We recommend that the socio economic parameters described below to be collected in the first instance for each site willing to be part of the network, as Tier 1 or **basic Socioeconomic Monitoring**. This level of monitoring is required. In addition to the required (tier 1) monitoring, we highly recommend the implementation of more in-depth socioeconomic assessments/monitoring exercises once funding and capacity are available. This may include community level surveys, facilitated stakeholder discussions, other key informant interviews, group interactive methods and visualization techniques as part of the data collection process. Where possible, data collection should be linked to management goals and objectives and to decision-making questions of the respective agencies and stakeholders. This would represent what we are calling "Tier 2" or **Advanced Socioeconomic Monitoring**

Guidance for the collection of these streams of data can be found in the Socioeconomic Monitoring Guidelines for Coastal Managers in the Caribbean (http://www.socmon.org/download.ashx?docid=58172 ). In addition the main "Socioeconomic Manual for Coral Reef Management" manuals provide more detailed nformation on field methods see link here: (http://www.socmon.org/download.ashx?docid=58170 ). If participants need to conduct more in depth socioeconomic monitoring (for example site level household surveys) the GCRMN SocMon Team is willing to provide guidance and assistance. Opportunities for collaboration should be explored.

*Note: Other protocols are suitable as long as they provide the expected data, particularly when a socioeconomic monitoring is already in place on the site.*

The socioeconomic variables presented below are grouped into major categories, related to major industries: Tourism, Fisheries, Agriculture, Other Industries, as well as Land Use and Demographic characteristics. Those parameters represent key drivers of coral reef ecosystem impacts. In addition there are recommendations on conducting an analysis of governance indicators that can also have an impact on coral reef health and demersal reef fisheries. Each indicator is described in a template which could be incorporated into a database format for data entry.

These data, described as secondary data collection (see page 17 Caribbean SocMon Guidelines) should be primarily collected from information that exists or has already been collected, analysed and published in various forms through various sources such as government agencies and institutions, national and local government offices, NGOs, Universities, websites etc. Much of this information can be accessed from public records and industry profiles. In some cases some of this information may have to be obtained through direct contact with key informants. In some cases GIS representation of the data is the most appropriate way to display the information. Where possible, spatial representation of the key drivers mentioned below should be attempted.n the Caribbean, CERMES investigated the development of a practical method for integrating of SocMon and participatory GIS – "SocMon Spatial". One of the main aims of SocMon Spatial is to offer alternative visualization of socio-economic data that may be more useful for decision-making (Wood 2013).

***Socio Economic Parameters***

| **Driver/Industry** | **Tourism** |
|---|---|
| Variable Description | Tourism Arrivals |
| Rationale | Coral reef locations/countries are often highly dependent on coastal tourism for their economies. The collection of annual statistics on visitor arrivals and other variables can provide an indication of volume of tourists per given period. This gross numbers of persons who can be identified to be engaged in coastal tourism can also be used as a proxy for pressure on coastal ecosystems including coral reefs. Examining annual trends of tourist arrivals can also be linked to the rate of tourism related infrastructure development occurring in specific locations thus leading to additional environmental pressure. |
| Data Collection Methods/Sources | 1) National tourism statistics, government and tourism agencies. Caribbean Tourism Organisation (CTO) country profiles can be obtained from CTO and World Tourism Organisation (WTO) web resources. Where possible find data that disaggregates or highlights tourists who indicated the primary purpose of the vacation is beach/coastal<br><br>2) Annual hotel occupancy statistics and cruise ship arrival statistics<br><br>*when possible, obtain these statistics for tourism entities that may be located close to the GCRMN sites/location. For example – number of hotel rooms in a 5 mile radius of the site or in the upper watershed |
| Reporting Format/Units | 1) Visitor Arrivals (stop over and cruise passengers)<br><br>2) Number of ship arrivals and capacity of vessels (or estimated annual volume of passengers) + number of hotel clients? |
| Periodicity | If possible obtain annual statistics for national arrival numbers<br><br>Every 4 years or timed to coincide with GCRMN Report preparation |

| **Driver/Industry** | **Tourism** |
|---|---|
| Variable Description | Tourism Recreation |
| Rationale | The collection of information on various types of recreational activities that may occur on or near a particular reef location will give a more specific information on reef related pressure. This can provide answers to questions on who is doing what, where and with what frequency. The activities/entities that would fall under this category include dive shops snorkel tours, kayaking, glass bottom boats and other watersports reef related activities dependent on healthy coral reefs (for example a stable back reef environment). |
| Data Collection Methods/Sources | 1) Tourism Board, published lists of registered companies, chambers of commerce, web searches, tourism brochures.<br><br>2) In person visual census and field data collection. For the purpose of enumerating the number of relevant establishments/operators. If possible in person data collection can include information requests from these establishments. Suggested questionnaire formats could be provided. Information on annual/seasonal numbers of visitors, number of trips per week/month and locations most frequently accessed would be useful to collect.<br><br>3) Develop a sampling protocol for observing and counting the number of reef related activities occurring in a given location (randomize, stratify if necessary – eg 8 random visits over the course of one year) |
| Reporting Format/Units | 1 Type of entity – No. “X type” shops<br><br>2 Quantity of operators - No. Snorkeler Boats/Dive Boats<br><br>3 Where the activity occurs – General areas, GPS coordinates if necessary<br><br>4 Frequency, Number trips/tours per day (will require proper sampling protocol for visual census) |
| Periodicity | Every 2 years |

| **Driver/Industry** | **Tourism** |
|---|---|
| Variable Description | Tourism Infrastructure |
| Rationale | Coral reef locations/countries are often highly dependent on coastal tourism for their economies. The collection of statistics on the number, size and location of tourism establishments (hotels and coastal attractions) can provide an indication of potential impacts to the coast from coastal development. These types of infrastructure can be linked to water and energy demand, coastal pollution and general indicators of carrying capacity. The information can therefore be used as a proxy for pressure on coastal ecosystems including coral reefs. This information can also be used to track impacts from infrastructure development occurring in specific for example increased sedimentation from damage from hotel construction, seagrass removal for swimming area and beach creation as well as dredging for port maintenance – cruise and cargo shipping. |
| Data Collection Methods/Sources | 1) Tourism Board, published lists of registered companies, chambers of commerce, web searches, planning agencies – maps and GIS information<br><br>2) Port Authority, cruise ship schedules (number per year, capacity), web sites of major cruise lines |
| Reporting Format/Units | 1 Number and size of hotels per unit area (room numbers)<br><br>2 Number and types of large coastal attractions (water parks, aquaria, dolphinaria etc)<br><br>3 Number and size of cruise shipping piers<br><br>4 Number of ship calls per annum |
| Periodicity | Every 4 years (or timed for the production of the GCRMN report). Baseline information should be collected initially |

| **Driver/Industry** | **Fishing** |
|---|---|
| Variable Description | Fishing Infrastructure |
| Rationale | This information is useful for making a link to the level of fishing activity from specific landing sites (fishing beaches). Fishing pressure is directly linked to (in water) abundance and biomass. Information on the location of fishing beaches, other features such as sanitation, storage facilities, waste management etc. is also useful. |
| Data Collection Methods/Sources | 1 National fishing statistics, fisheries agencies, MPAs/NGOs that interact directly with fishers at/near the GCRMN site.<br><br>2 National export statistics (if any), Ministry of Fisheries/Trade etc – for example Lobster and Conch are typically key species for export.<br><br>3 In person visual census (at landing sites that may have an impact on the GCRMN site of interest). Field sampling to count and enumerate number of landing sites, number of vessels, estimates of fishers etc. |
| Reporting Format/Units | Number of beaches/landing sites<br><br>Number of fishing vessels – type and size of boats and type of gear |
| Periodicity | Every 4 years – completed in time for GCRMN Report (collect initial data in the first year – baseline) |

| **Driver/Industry** | **Fishing** |
|---|---|
| Variable Description | Fishing Pressure |
| Rationale | This information is useful for making the link to the level of fishing activity by fishers who operate from specific landing sites (fishing beaches). Fishing pressure is directly linked to (in water) abundance and biomass. Information on the amount and type of catch that is targeted can be correlated with the abundance and biomass data collected at the GCRMN site of relevance. Thus confirming presence/absence of key biological indicator species. |
| Data Collection Methods/Sources | 1 National statistics from fisheries agencies, number of registered fishers, reports of creel surveys (if conducted by agency), MPA/NGOs who interact with fishers at the location of interest (at/near GCRMN site)<br><br>2 Information on large exporters (conch, lobster, reef fish) – national statistics may not be directly related to GCRMN site but provides a picture of overall demand for key reef species.<br><br>3 Field data collection, in-person visual census or interviews (creel survey approaches) |
| Reporting Format/Units | Number of Fishers who operate from a particular site<br><br>Estimated catch – Kgs/lbs of fish caught (per trip/month) |
| Periodicity | Every 4 years – completed in time for GCRMN Report (do in first year – baseline |

| **Driver/Industry** | **Agriculture (Large Scale)** |
|---|---|
| Variable Description | Logging/Coffee/Sugar Cane/Livestock/Other Agriculture* [Templates can be made for each of these industries where applicable] |
| Rationale | Watershed degradation leads increased coastal pollutions. This variable seeks to identify some large industries that can have point (and non-point) source coastal pollution impacts (sediment, nutrients, coliforms) that in turn affect coral health. Information on the scale location and level of activity can provide data that links coastal water quality characteristics with upstream activities. This data is only relevant for GCRMN sites if it can be reasonably shown that the particular industry/activity may have an impact on the site of interest. |
| Data Collection Methods/Sources | 1 Land management agencies, local planning bodies, GIS imagery and maps. This category should rely heavily on spatial imagery/mapping tools and databases. More than one industry could be represented spatially to show diversity of possible pollution inputs and to major receiving water bodies.<br><br>2 Industry information such as production figures and annual reports from each major sector. Web site, ministries responsible for industry (eg Agriculture, Forestry)<br><br>3 In person field visit to conduct rapid watershed/coastline ground truthing exercise. Provides a profile of the various point source pollution sources that may impact GCRMN biological site. Recommend collecting photographic information. |
| Reporting Format/Units | Some form of spatial representation – $km^2$, hectares – A map with areas of interest identified, perhaps in relation to (distance from) GRCMN biological site.<br><br>List of potential types of waste streams e.g. dunder (sugar/rum), manure, coffee pulp, offal (abattoir)<br><br>Gross Production figures –tonnes coffee/sugar per annum, lumber($m^3$ per annum) |
| Periodicity | Every 5 years (timed with the production of GCRMN report), should be done initially to provide baseline information |

| **Driver/Industry** | **Other Point Sources Pollution Activities** |
|---|---|
| Variable Description | Quarry/Mine/Oil/Other Minerals/Power Plant/Transshipment Port/Dry Dock/Sewage Treatment Plant/Other* [Templates can be made for each of these industries where applicable] |
| Rationale | Like agriculture this category highlights other major industrial activities. Particularly those that may be operating in the coast and in proximity to the GCRMN Biological monitoring site. This will assist in the identification of large industries that may have point (and non-point) source coastal pollution impacts (sediment, nutrients, water temperature, hydrocarbon and other chemical pollutants) that in turn affect coral health. Information on the scale location and level of activity can provide data that links coastal water quality characteristics with upstream activities. This data is only relevant for GCRMN sites if it can be reasonable shown that the particular industry/activity may have an impact on the site of interest. |
| Data Collection Methods/Sources | 1 Secondary (pre-existing) sources of information, Land management agencies,). Government ministries with the relevant portfolios (eg mining, petroleum, energy), industry websites and other public records.<br><br>2 Primary data collection, in person field census, rapid enumeration of the types and numbers of activities in the areas close to the GCRMN site of interest. (photographic records recommended) |
| Reporting Format/Units | GIS spatial representation most appropriate, perhaps embedded with meta data on other characteristics such as gross annual production figures, annual output. If possible waste streams should be identified (photos) - not necessarily quantified. |
| Periodicity | Every 4 years (timed with the production of GCRMN report), should be done initially to provide baseline information |

| **Driver/Industry** | **Land Use and Demographics** |
|---|---|
| Variable Description | Population |
| Rationale | Number of residents in coastal area (enumeration district, watershed) Urban pressure on receiving water bodies and coastal areas. Presence of municipal sources of waste such as sewage treatment facilities and landfills/garbage dumps should be noted. This information should be collected by other agencies. It is not intended that the GRCMN participant will initiate this type of study. If the data does not exist then its absence should be noted. (governance gap) |
| Data Collection Methods/Sources | Land use and planning agencies, web based searches |
| Reporting Format/Units | GIS and spatial representation, enumeration districts, counties, municipalities. Location of sewage treatment facilities, major drainage ditches/gullies |
| Periodicity | Every 4 years (timed with the production of GCRMN report), should be done initially to provide baseline information |

**Other Governance Indicators**

Instructions for collecting governance indicators are provided in the Caribbean SocMon Manual (page 18 and 45). The collection of the industry data presented above will provide opportunities for collection of some of this information. For example, if there is the presence or absence of appropriate management bodies, the level of enforcement of the rules and regulations (resource management/pollution control). Collection of this type of information will require a combination of secondary (desktop analysis) and key informant interviews.

Key features of interest for collecting information is the presence, absence and level of effectiveness of the following categories as applied to relevant agencies and institutions that impact on coral reef ecosystems and their associated resources. These include; Management Body, Management Plan, Legislation, Management resources, Enforcement, Public Education; Legal/Judicial processes

**References**

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