A guide to the reef monitoring database

V.J. Baker and G.J. Coleman

Long-term Monitoring of the Great Barrier Reef

Standard Operational Procedure Number 5

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1. Marine ecology - Queensland - Great Barrier Reef. 2.
Coral reef ecology - Queensland - Great Barrier Reef -
Databases. 3. Crown-of-thorns starfish - Queensland -
Great Barrier Reef - Databases. 4. Coral reef ecology -
Databases. 5. Crown-of-thorns starfish - Databases. I.
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PREFACE

This report is intended to serve as a guide to several large data groups, collectively referred to as the Reef Monitoring Database, which are maintained at the Australian Institute of Marine Science (AIMS). This document describes the various types of data contained in the database as well as the research programs and techniques that produced them. This database was previously known as 'The Reef Ecology Database' (Baker et.al. 1991).

The Reef Monitoring Database is available for use by scientists on application to the Director.

Throughout this report, the Australian Institute of Marine Science will be referred to as AIMS and the Great Barrier Reef Marine Park Authority will be referred to as GBRMPA.

The data described here reflect a strong collaboration between AIMS, GBRMPA and more recently the CRC: Reef Research Centre.

INTRODUCTION

The Reef Monitoring Database contains research data from 1982 to present. In that time 452 reefs, covering the full length of the Great Barrier Reef (GBR) have been visited for different purposes and many surveyed repetitively using the same methods. As such, the records contained in the database provide a considerable amount of information both on temporal and spatial scales on the state of the GBR.

In 1993, AIMS expanded its research activities and a permanent research station was established in Western Australia (WA). As some of the research activities parallel those carried out on the GBR, relevant data from twenty-seven Western Australian reefs are archived in this database.

Initially data were derived mainly from ecological surveys of the crown-of-thorns starfish, *Acanthaster planci* (COTS) and associated benthic communities on the GBR. In 1992, the Broadscale Monitoring program was expanded to form the Long-term Monitoring Program. Within this program surveys have been conducted in four main areas, broadscale surveys for crown-of-thorns starfish, visual census of fish, video surveys of benthic communities and water quality surveys. Water quality surveys were discontinued in the 1996/97 field season.

The data are stored in the ORACLE® Relational Database Management System on a SUN system. As of June 1998, AIMS runs Version 7.3.2.1.0 of the database server, Version 3.2.2.0.1 of the SQL*Plus™ query language and Version 2.3.2.0.0 of the PL/SQL™ programming language.

For consistency, a **data set** is defined here as a single ORACLE table and a **data group** is defined as a group of related data sets. Data from one or more research programs may be included in a data set/group, if the data are of similar structure. The structure of the database is shown in Figure 1.

At present the Reef Monitoring Database consists of four data groups:

1. The Geographic Data Group
2. The Reef Monitoring Data Group
3. The Feeding Preference Data Group
4. The Crown-of-thorns Bibliographic Data Group

DATA MANAGEMENT

The database manager is responsible for coordination of all data entry, verification and the transfer of data into the ORACLE database tables. Access to the database is granted to users on a select only basis. Access can be achieved directly using SQL, SQL*Plus™ and PL/SQL™ or using ODBC to link the data from the ORACLE tables to PC based applications such as Microsoft Access® and Microsoft Excel®.

Data entry

Procedures have been set in place to handle data both in the field and in the laboratory. These procedures vary slightly depending on the type of survey. To minimise errors and the occurrence of missing data, field data sheets have been designed for each data type, if appropriate, and data entry programs have been developed using Microsoft Access®. Data are usually entered in the field. For each sample, data are divided into two tables. The first table contains details of the sample, including the sample type, locality and ambient conditions. The second is a table appropriate for the type of data collected.

Video data are recorded in the field using a Blaupunkt Hi-8 video camera on Sony P5-90HMPX professional video tapes. A video data sheet containing details of the transect is filmed at the beginning of each transect for correct identification and tapes are labelled with the name of the reef and the date. Tapes are analysed in the laboratory using the AIMS Video Transect Analysis System (AVTAS) (Bainbridge 1995) which incorporates a Microsoft Access® database.

The data from the analysis of water samples was handled in various ways but has now ceased. Sample details were entered in the field using a Microsoft Access® data entry program. Nutrient data from the autoanalyser was generated in digital ascii format and required no further processing before being loaded into the relevant ORACLE tables. The initial results of salinity, suspended solids and chlorophyll analyses were entered into data sheets then keyed into a spread sheet. Salinity values were calculated from this raw data using a BASIC Program. Chlorophyll and phaeophytin raw data was loaded into a Microsoft® Excel spreadsheet to calculate the final values. Suspended solids values were calculated once the raw data had been loaded into ORACLE using a PL/SQL™ program which also removed anomalous data.

Data checking

Data are checked at three stages:

1. Initial screening of data is carried out via the data entry programs. This includes checking of ranges and the validity of codes.

2. In the laboratory data are printed and checked by two people, one reading from the original data sheet and the second checking this against the print out. Data are then edited. Ascii files are generated and given to the database manager.

3. Once data have been loaded into the final ORACLE tables, programs are run to ensure that data entered correspond to the rest of the data in the database.

Data are transferred by the database manager to the SUN using an ethernet file service connection (Digital PCSA) and loaded into the relevant ORACLE tables using an upload program written in Access.

In some cases further processing of data is required. Manta tow data are summarised by calculating median values for cover category data using a PL/SQL™ program. Similarly, video data are summarised as percent cover using a PL/SQL™ program.

Figure 1. Structure of the Reef Ecology Database.

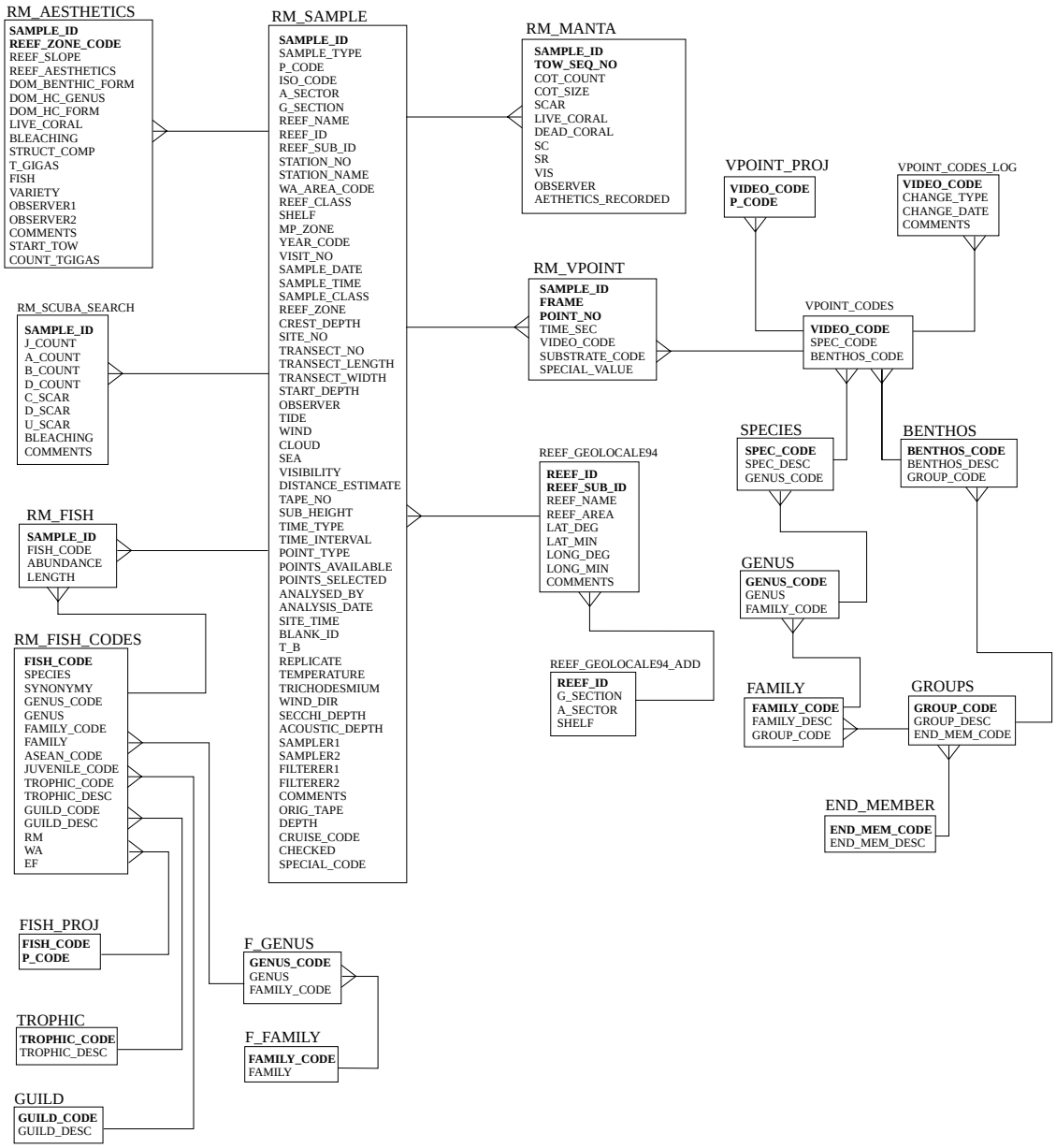
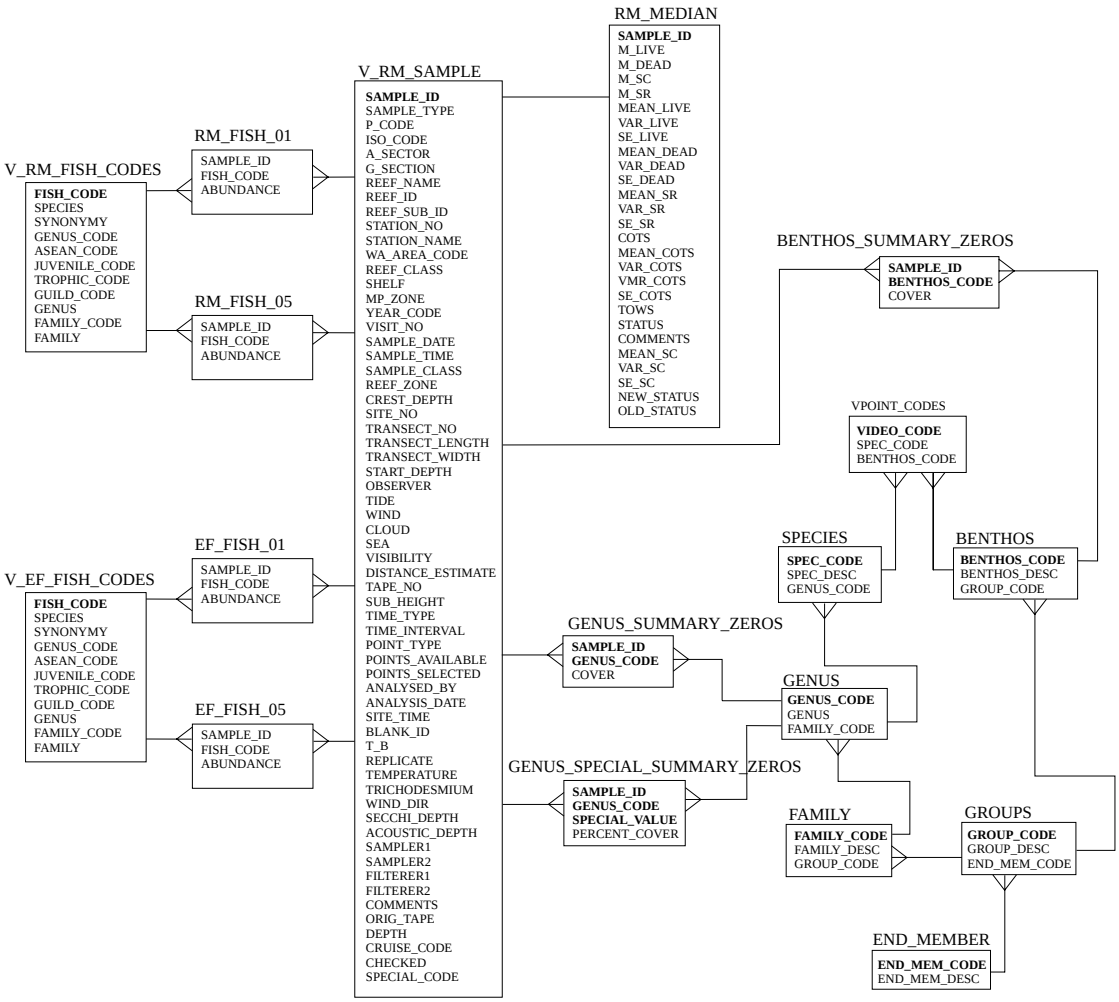


Figure 2. Structure of the Summary tables



Please note: Before doing any average operations on either the fish or benthic tables, sum the data to the taxanomic or lifeform level required.

THE ACTIVE DATABASE

The active database is that part which is used for current projects. Most of the active database was redesigned in 1997/98 as is described below.

1. Database structure

Figure 1 shows an Entity Relationship diagram representing the active database. The square boxes represent tables (entities) and the lines between them represent relationships between those entities. The fields (attributes) of each table are listed inside the box. All the relationships shown on the diagram are one-to-many relationships, ie one record on the one side of the relationship will relate to one or more records on the many side of the relationship. An arrow represents the many side of the relationship. For example one record in the RM_SAMPLE table will relate to many records in the RM_MANTA table.

The tables shown on this diagram are the core tables needed to store the information from the project. There are other tables (SUMMARY TABLES) discussed later which are derived from the information stored in these core tables. These tables store no new information and exist only for ease of output. This method of creating summary tables has been kept to a minimum because it promotes redundancy, which can lead to inconsistencies. Procedures have been put in place to prevent these inconsistencies. The database contains some historic data, which we do not update any more, and are not shown here but are discussed later. Views are not shown on the diagram.

The table RM_SAMPLE contains some redundant information. This is stored for historic reasons but it is not used for output. When the database manager is satisfied that it contains no useful information it will be deleted.

Appendix 1 gives a description of all the tables and every field in those tables.

2. Views

Some “views “have been developed which output the data in a format regularly required by the program. A view is essentially a stored query, so that every time the view is

accessed the query is executed. The data comes from the core tables. The following views are defined:

v_rm_sample

To be used instead of RM_SAMPLE. Reef information comes from reef_geolocale94 and reef_geolocale94_add and ignores the reef information in RM_SAMPLE.

v_all_vpoint_codes

For every VPOINT code, this view shows all BENTHOS, SPECIES, GENUS, FAMILY, GROUP and END-MEMBER information.

v_standard_vpoint_codes

For every VPOINT code in the standard list used by the Reef Monitoring project, this view shows all BENTHOS, SPECIES, GENUS, FAMILY, GROUP and END-MEMBER information.

v_advanced_vpoint_codes

For every VPOINT code in the advanced list used by the Reef Monitoring project, this view shows all BENTHOS, SPECIES, GENUS, FAMILY, GROUP and END-MEMBER information.

v_training_vpoint_codes

For every VPOINT code in the training list used by the Reef Monitoring project, this view shows all BENTHOS, SPECIES, GENUS, FAMILY, GROUP and END-MEMBER information.

v_os_training_vpoint_codes

For every VPOINT code in the list used for over-seas training, this view shows all BENTHOS, SPECIES, GENUS, FAMILY, GROUP and END-MEMBER information.

v_wa_vpoint_codes

For every VPOINT code used by the AIMS staff is Western Australia, this view shows all BENTHOS, SPECIES, GENUS, FAMILY, GROUP and END-MEMBER information.

v_rm_fish_codes

For every fish code used by the AIMS Reef Monitoring project, this view shows all SPECIES, GENUS and FAMILY information.

v_ef_fish_codes

For every fish code used by the Effect of Line Fishing project, this view shows all SPECIES, GENUS and FAMILY information.

v_wa_fish_codes

For every fish code used by the AIMS staff is Western Australia, this view shows all SPECIES, GENUS and FAMILY information.

v_reefs

Combines information from reef_geolocale94 and reef_geolocale94_add to produce all the information for a reef in one view.

3. Summary tables

While views are a good way to present the data in a format pleasing to the user, sometimes the user requires information which is hard to extract with a query. In these cases summary tables have been created. As stated before, summary tables are dangerous because they promote redundancy so their use has been limited as much as possible. Each summary table is created by a stored procedure which is run by the upload program. This ensures that the summary tables will always reflect the core tables so long as input is always done via the upload program.

Following are the summary tables stored in the database. All the tables and all their fields are described in Appendix 1.

RM_MEDIAN

stored procedure sp_median

VPOINT_SUMMARY, GENUS_SUMMARY_ZEROS, GENUS_SPECIAL_SUMMARY_ZEROS, BENTHOS_SUMMARY_ZEROS, BENTHOS_SPECIAL_SUMMARY_ZEROS

stored procedure sp_coral_summary

RM_FISH01, RM_FISH05, EF_FISH01, EF_FISH05

stored procedure sp_fish_zeros

These Summary tables and their relationships are shown in figure 2.

THE ENTIRE DATABASE DESCRIPTION

The following sections describe the data contained in each data group and how they originated. The structures of the ORACLE tables in which these data reside are listed in Appendix 1.

1. The geographical data group

An essential component of conducting surveys on the GBR is the correct identification of reefs. The standard adopted for this database is the Great Barrier Reef Gazetteer: a listing of individual reefs of the GBR, each with its unique identification code. This listing was produced for GBRMPA by the Geography Department of James Cook University and has been adopted for identification of reefs in GBRMPA zoning plans (GBRMPA; 1985,1987a,b,1992). The identification code (REEF_ID) consists of 5 digits. The first two digits represent the degree of latitude. This is followed by 3 digits which locate reefs sequentially west to east in 30 minute strips within a degree block. Where a reef consists of more than 1 reefal structure, sections of the reef are denoted by an additional alphabetical code, the REEF_SUB_ID. The listing also includes the size, location and geomorphological classification of reefs. The latter is discussed in more detail in Hopley (1983). The data are in the ORACLE table REEF_GEOLOCALE94. Some of the reefs which are surveyed by the monitoring program have been determined by the monitoring program to consist of more than one reefal structure but were not subdivided by the original data obtained from GBRMPA. In these cases the reefs have been given REEF_SUB_ID's S1, S2, S3 etc. REEF_GEOLOCALE94_ADD contains extra information pertaining to a reef not supplied by GBRMPA.

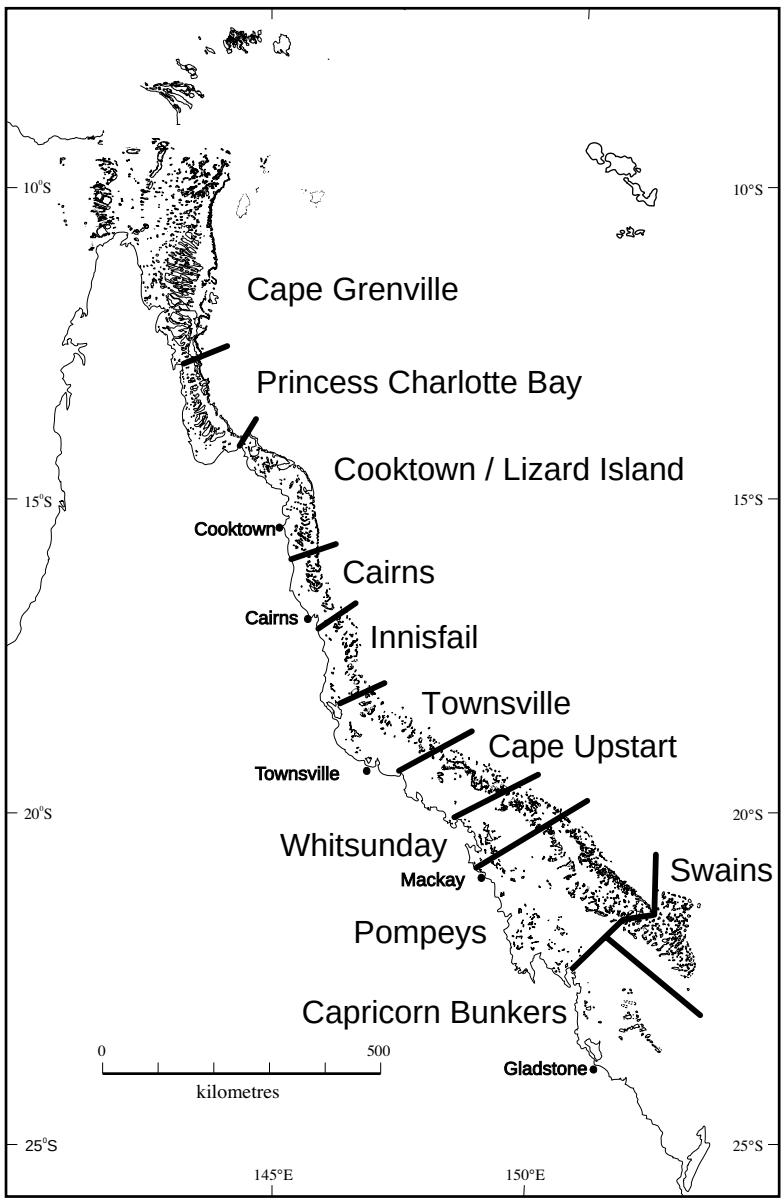
Western Australia does not have a comparable system of reef identification codes. Reefs are identified by name only. Navigational charts are used for this purpose. Coding of WA reefs is currently under review.

While the Great Barrier Reef Marine Park is divided into 4 sections for zoning purposes, it was necessary to subdivide the GBR into smaller units for logistic reasons. Thus the reef was divided into 11 regions referred to as **sectors** to avoid confusion with the GBRMPA **sections**. These sectors are not subsets of the GBRMPA sections and in some cases overlap section boundaries. A map of sector locations is given in Figure 2 and full

descriptions of the sector boundaries are given in Appendix 2. The description of sector boundaries can also be found in the ORACLE Table RM_SECTOR.

The positions of all study sites used in the Long-term Monitoring Program and in WA have been fixed using the Global Positioning System (GPS). Sites used for fish and benthic and water quality surveys can be found in the table RM_WAYPOINTS.

Figure 3. AIMS Sectors.



2. The reef monitoring data group

Data from 8 research programs have been incorporated into the Reef Monitoring Data Group as the programs share common objectives and methodologies. Data tables may contain data from several research programs. Data from each program can be identified by a program code (P_CODE) which occurs in the table containing sample details (RM_SAMPLE).

While the methods of data collection have been standardised as much as possible, different types and amounts of data have been collected within each program. For example, transect length and the number of life form categories has varied between research programs which have used the line intercept transect technique (Loya 1972; DeVantier et al. 1985). Similarly, the number of variables recorded during manta tow surveys has varied within and between programs. A series of Standard Operational Procedure manuals have been produced, which describe the current methods used (Bass & Miller 1995; Halford & Thompson 1996; Devlin & Lourey 1996; Christie et al. 1996).

2.1 The coral recovery program

Background

These data were derived from postdoctoral research carried out by Dr. P. Moran, which sought to investigate the recolonization and development of coral communities after disturbance from COTS. Many of these reefs experienced outbreaks of starfish during the mid 1960s and early 1970s and sites were chosen close to areas surveyed by Mr. R. Pearson during the mid to late 1970s (Pearson 1974, 1981).

As part of this research, control sites were established on Wheeler and Davies Reefs which were not recorded to have been affected by outbreaks during the mid 1970s. As the surveys at John Brewer Reef were conducted just prior to a second outbreak of COTS, three additional surveys were carried out at the study sites on this reef to gain data on early stages of coral recovery. Some of the sites at Feather and Ellison Reefs were also resurveyed to investigate the effects of cyclone damage on the coral communities of these reefs. Sites on Bowden and Helix Reefs were established before and during an outbreak of COTS respectively, in order to enhance the information collected from the other reefs.

Hard corals were identified to species, except for Bowden, Helix, Feather (2nd survey) and Ellison (2nd survey) where, due to time constraints, corals were identified to genera. Non hard coral entities were identified using lifeform categories.

Program Code:	CRS (hard corals identified to species) CRG (hard corals identified to genera)
Survey Period:	October 1982 - June 1987
Survey Methodology:	Line intercept transect Hard coral species categories - 228 Hard coral genera categories - 53 Life form categories - 12 Sites per reef - 2 to 4 Depth contours - generally 5 (0,3,6,9,12m) Transect length - 50m (divided into 5 x 10m)
No. of Reefs Surveyed:	9
Data Tables:	RM_SAMPLE RM_TRANSECT RM_VPOINT_CODES
Program Status:	Data collection complete

2.2 The CCEP coral monitoring program

Background

This program was designed to develop appropriate methodologies to provide baseline data on benthic reef communities representing a cross section of the central GBR extending into the Coral Sea. It was considered that ‘research enabling description of the current state of the ecosystem, as a baseline to monitor man-induced or natural changes through time, should be considered of importance’ (DeVantier et al. 1985; Reichelt et al. 1986).

The technical reports from this program were titled ‘Studies in the assessment of coral reef ecosystems. A series of studies to describe the patterns of major components of the Great Barrier Reef over ecologically significant spatial and temporal scales.’

The program was largely supported through funds from the Commonwealth Community Employment Program.

Program Code:	CM
Survey Period:	March 1984 - February 1985
Survey Methodology:	Line intercept transect Life form categories - 32 Sites per reef - generally 3 (front,back,flat) Depth contours - generally 5 (0,5,10,15,20m) Transect length - generally 100m
No. of Reefs Surveyed:	12
Data Tables:	RM_SAMPLE RM_TRANSECT RM_VPOINT_CODES
Program Status:	Data collection complete

2.3 The Crown-of-thorns study 1985

Background

This research program was developed to assess the activity and effects of Crown-of-thorns-Starfish (COTS) on the GBR since the early 1980’s. Surveys were undertaken to provide information, which would facilitate analyses of starfish, distribution and effect over both spatial and temporal scales.

In determining which reefs would be surveyed, it was considered important to build on information already available through previous surveys and incidental reports of COTS

sightings. The main source of information on previous reports of COTS was a database maintained by GBRMPA.

Stratified random sampling of reefs throughout the length of the GBR was undertaken and reefs to be surveyed were grouped within 11 sectors. Where possible, equal numbers of inner-shelf, mid-shelf and outer-shelf reefs were surveyed in each sector.

The technical reports from this study were subtitled ‘An assessment of the distribution and effects of *Acanthaster planci* (L.) on the Great Barrier Reef. An inter-disciplinary study to assess the level of risk of the crown-of-thorns starfish to the integrity of the ecosystem of the Great Barrier Reef’.

The study was largely supported through funds from the Commonwealth Community Employment Program.

Program Code: CT

Survey Period: March 1985 - January 1986

Survey Methodology: Line intercept transect
- Life form categories - 21
- Sites per reef - generally 2 (front,back)
- Depth contours - generally 3 (3,6,12m)
- Transect length - generally 100m

Manta tow
- Tow duration - consecutive 2 minute tows
- Location - reef perimeter
- Variables - number of COTS
  - live coral cover
  - dead coral cover

No. of Reefs Surveyed: Line intercept transect - 86
Manta tow - 228

Data Tables:	RM_SAMPLE
	RM_TRANSECT
	RM_MANTA
	RM_VPOINT_CODES
Program Status:	Data collection complete

2.4 The broadscale survey program

Background

This program continues the broadscale surveys initiated by the Crown-of-thorns Study 1985 and forms part of The Crown-of-thorns Study, a multidisciplinary study which was coordinated by AIMS and funded by GBRMPA (Zann & Moran 1988).

It has two main objectives:

1. To assess and summarise the broadscale distribution and effects of COTS since the early 1980's.

2. To develop a scientific understanding of the broad spatial and temporal dynamics of COTS and its hard coral prey.

By continuing to use established and effective monitoring techniques, this research project provides data, which are compatible with and greatly expands the time frame of the existing database. In addition, the monitoring strategy is flexible enough to be able to respond to current needs in identifying outbreaking reefs.

Initially, the reefs surveyed in this project were chosen from those surveyed during the Crown-of-thorns Study 1985. In July 1987 it was decided to discontinue Line intercept transect surveys and concentrate on manta tow surveys in order to increase the number of new reefs surveyed each year. The criteria now used for selection of reefs to be surveyed are discussed by Moran et al. (1991).

In July 1987, the number of variables recorded during manta tow surveys was increased to include soft coral cover, sand/rubble cover, estimates of COTS size and the abundance

of COTS feeding scars. In July 1989 estimation of soft coral cover was discontinued and an estimate of visibility included as recommended by Fernandes (1989). In October 1997 estimation of soft coral cover was re-introduced at the expense of sand/rubble cover.

Program Code: BS

Survey Period: April 1986 - March 1992

Survey Methodology: Line intercept transect (1986/87 only)
- Life form categories - 21
- Sites per reef - generally 1
- Depth contours - generally 3 (3,6,12m)
- Transect length - 100m

Manta tow
- Tow duration - consecutive 2 minute tows
- Location - reef perimeter
- Variables - number of COTS
  - COTS size
  - COTS feeding scar abundance
  - live coral cover
  - dead coral cover
  - soft coral cover
  - sand/rubble cover
  - visibility

No. of Reefs Surveyed:

1986/87	Line intercept transect	36
	Manta tow	111
1987/88	Manta tow	140
1988/89	Manta tow	133
1989/90	Manta tow	168
1990/91	Manta tow	121
1991/92	Manta tow	98

Data Tables: RM_SAMPLE
RM_TRANSECT

RM_MANTA
RM_VPOINT_CODES

Program Status: Replaced by the Long-Term Monitoring Program

2.5 The Long-term monitoring program

Background: Oliver et.al. (1995)

The primary objectives of the Long-Term Monitoring Program are to:

1. Monitor the status and trends in the distribution and abundance of reef biota and in water quality, on reefs in the GBR.
2. Provide environmental managers (and other decision makers) with information that is pertinent to managing the GBR according to the principals of Ecologically Sustainable Use.

Program Code: RM

Survey Period: March 1992 -present

Survey Methodology: Line intercept transect (1992/1993 only)
Sites per reef - 3
Transects per site - 5
Depth contours - 1 (6-9 metres)
Transect length - 50m

Video transect
Species categories - 290
Sites per reef - 3
Transects per site - 5
Depth contours - 1 (6-9 metres)
Transect length - 50m

Visual census (fish)
- Species categories - 204
- Sites per reef - 3
- Transects per site - 5
- Depth contours - 1 (6-9 metres)
- Transect length - 50m

Scuba Search
- Sites per reef - 3
- Transects per site - 5
- Depth contours - 1 (6-9 metres)
- Transect length - 50m
- Variables -
  - COTS Counts for Various Size Categories
  - Drupella Counts
  - Drupella and COTS scar counts
  - Percentage of Bleached Coral

Manta tow
- Tow duration - consecutive 2 minute tows
- Location - reef perimeter
- Variables - number of COTS
  - COTS size
  - COTS feeding scar abundance
  - live coral cover
  - dead coral cover
  - sand/rubble cover
  - visibility
  - soft coral cover

Water Sampling (1992-1996)
- Drops per station - 1-2
- Water column - top and bottom
- Variables - temperature
  - salinity
  - secchi depth
  - suspended solids

chlorophyll
phaeophytin
dissolved inorganic nitrogen
dissolved organic nitrogen
dissolved inorganic phosphorus
dissolved organic phosphorus
silica

No. of Reefs Surveyed: Fish, Video transect, Manta tow, Water quality - 52 reefs/year

Manta tow only - an additional 12 reefs/year
an additional 138 reefs surveyed 1/3yrs

Program Status: Ongoing

2.6 The juvenile Crown-of-thorns survey program

Background

Surveys for juvenile COTS were initiated to address the need to locate an extensive, high density population for field studies.

Program Code: JU

Survey Period: October - November 1989

Survey Methodology: SCUBA swim search
Search duration - 20 minutes
Sites per reef - 3 to 6
Depth contours - generally 4 (0,5,10,15m)

No. of Reefs Surveyed: 14

Program Status: Continued in Long-term Monitoring Project

Data Tables: RM_SAMPLE
RM_SCUBA_SEARCH

2.7 The grub reef starfish control program

Background

A COTS control program was conducted by GBRMPA at Grub Reef with the assistance of 15 Royal Australian Navy divers. A total of 3175 COTS were injected with a saturated solution of copper sulphate over a period of two weeks on 53 patch reefs. In order to evaluate the effectiveness of the control program three biological surveys were conducted by AIMS. The first was undertaken two weeks prior to the start of the program and further surveys were conducted one month and six months after the program had ended. Johnson et al. (1990) have discussed the results of these surveys.

This research formed part of the Crown-of-thorns Study coordinated by AIMS and funded by GBRMPA (Zann & Moran 1988).

Program Code: GR

Survey Periods: June 1986, August 1986, January 1987

Survey Methodology: Line intercept transect

- Life form categories - 8
- Sites - 27 (1 large and 26 small patch reefs
- Depth contours - 3 on large patch reef (3,6,12m), 1 on small patch reefs (0m)
- Transect length - 100m for large patch reef and generally 50m for small patch reefs

Manta tow

- Tow duration - consecutive 2 minute tows
- Location - main reef perimeter
- Variables - number of COTS
  - live coral cover
  - dead coral cover

SCUBA swim search

- Sites - 27 (1 large and 26 small patch reefs)

Depth contours - 3 (0,6 m)
Variables - as for manta tow

Program Status: Data collection complete

Data Tables: RM_SAMPLE
RM_SWIM
RM_MANTA

2.8 The effects of line fishing program

Background

This is part of an extensive program conducted by CRC Reef Research. The data held here represents only a small part of the entire program. Visual fish census are conducted in a similar way to the methods used by the Long-Term Monitoring Program. However, this program concentrates on fewer species than are covered by Long-Term Monitoring, with special interest in line fished and potential prey species. The reefs surveyed were a combination of green and blue reefs. A blue reef is a general use zone where fishing is allowed. A green reef is Marine National Park B zone where fishing is not allowed. At certain times during the project, green reefs were opened, blue reefs were closed and other blue reefs were deliberately fished heavily. The purpose of this study is to determine the effects of zoning changes on populations of fish species.

The GBR was divided into four ‘Clusters’ for the purpose of this project. These clusters are ‘LIZARD’, ‘TOWNSVILLE’, ‘BAX’ and ‘SWAINS’. Each cluster contains 6 survey reefs.

Program Code: EF

Survey Periods: September 1995 - Present

Survey Methodology: Visual Census (fish)
Species categories - 40
Sites per reef - 6 (3 front and 3 back)

Transects per site - 5
Depth contours - 1 (6-9 metres)
Transect length - 50m

Program Status: Ongoing

Data Tables: RM_SAMPLE
RM_FISH
EF_REEF_CLUSTERS
EF_REEF_TREATMENTS

3. The feeding preference data group

Background

The project from which these data were derived formed part of the research, which was conducted within the Crown-of-thorns Study. The objectives of the project were firstly, to obtain quantitative field data on the feeding preferences of COTS and secondly, to compile an extensive database on COTS in the field which would allow investigation of their feeding behaviour and general ecology.

A total of 28 variables were recorded for each of 5,749 COTS. Measurements were conducted on reefs, which exhibited different COTS population types. These reefs were located between Townsville and the Swain Reefs in the south. Several of these reefs were surveyed on a number of occasions whereas some were only visited once. Where possible surveys were also conducted during the night so that an investigation of nocturnal and diurnal feeding could be initiated.

Feeding preferences were measured in the field using nearest neighbour techniques. This involved recording those corals (maximum of 5) which were within a 50cm radius and closest to that which was being fed upon. No nearest neighbour measurements were taken if the COTS was not feeding or it was feeding on something other than hard coral (eg. soft coral). In some instances no neighbouring corals were identified as the coral which was being fed upon either was very large (eg. staghorn thicket) or was surrounded by sand or other non-coral substrata.

Survey Period: March 1986 - December 1987

Survey Methodology: SCUBA swim search
Variables - Appendix 1

No. of Reefs Surveyed: 15 (Table 9)

Program Status: Data collection complete

Data Tables: PREF_SAM
PREF_NEA
PREF_IND

Table 1. Reefs surveyed during the Feeding Preference Program.

John Brewer Reef	Little Broadhurst Reef	Reef No. 22110
Helix Reef	Bowden Reef	Sanctuary Reef
Centipede Reef	Stanley Reef	Reef No. 22112
Wheeler Reef	Holbourne Island	Reef No. 22118
Davies Reef	Gannet Cay	Reef No. 22144

4. The Crown-of-thorns bibliographic data group

This data group includes all citations given in the fourth edition of '*Acanthaster planci*: *an annotated bibliography'* (Moran et al. 1991). As such it expands the list given in the three previous editions (Moran & Davies 1986; Moran 1988; Moran & Davies 1989). This data group has **not** been updated since 1991.

Each citation has been classified by one or more annotations which helps to define the general content of the article and to assist in the retrieval of information. It should be noted that several new annotations have been included in the most recent edition to take into account articles that deal with new subjects. A key to the annotations is provided at the front of each edition of the bibliography.

Several of the references had no stated authorship. These references have been listed by institution (eg. Great Barrier Reef Marine Park Authority).

Citations for some published works have not been included since they were too general or did not provide any useful information. In contrast, certain unpublished documents have been included where the information they presented was thought to be important, but only if these articles were readily obtainable. Articles which are known to be published but could not be obtained are also listed but have not been given annotations and are identified with a code.

Data Table: COT_BIBLIO

REFERENCES

Bainbridge, S. (1995). *AVTAS User Manual.* Australian Institute of Marine Science, Townsville.

Baker, V.J., Moran, P.J., Mundy C.N., Reichelt, R.E. and Speare, P.J. (1991). *A Guide to the Reef Ecology Database 1. Description of Data.* The Crown-of-thorns Study, Australian Institute of Marine Science, Townsville.

Bass, D.K. and Miller, I.R. (1995). Crown-of-thorns starfish and coral surveys using the manta tow and scuba search techniques. *Long-term Monitoring of the Great Barrier Reef Standard Operational Procedure* No. 1.

Christie, C.A., Bass, D.K., Neale, S.J., Osborne K. and Oxley W.G. (1996). Surveys of sessile benthic communities using the video technique. *Long-term Monitoring of the Great Barrier Reef Standard Operational Procedure* No. 2.

DeVantier, L.M., Barnes, G.R., Daniel, P.A. and Johnson, D.B. (1985). *Studies in the Assessment of Coral Reef Ecosystems. 1. Assessment Protocol.* Australian Institute of Marine Science, Townsville. 23p.

Devlin, M.J. and Lourey, M.J. (2000). Water quality - field and analytical procedures. *Long-term Monitoring of the Great Barrier Reef. Standard Operational Procedure* Number 6.

Fernandes, L. (1989). *Biases Associated with the Use of the Manta Tow, a Rapid Surveillance Technique, with Particular Application to the Crown-of-thorns Starfish (Acanthaster planci).* M.Sc. Dissertation, James Cook University, Townsville.

Great Barrier Reef Marine Park Authority (1985). *Great Barrier Reef Marine Park Far Northern Section Zoning Plan.* Great Barrier Reef Marine Park Authority, Townsville.

Great Barrier Reef Marine Park Authority (1987a). *Great Barrier Reef Marine Park Central Section Zoning Information.* Great Barrier Reef Marine Park Authority, Townsville.

Great Barrier Reef Marine Park Authority (1987b). *Great Barrier Reef Marine Park Mackay/Capricorn Section Zoning Information.* Great Barrier Reef Marine Park Authority, Townsville.

Great Barrier Reef Marine Park Authority (1992). *Great Barrier Reef Marine Park Cairns Section and Cairns Marine Park Zoning Plans.* Great Barrier Reef Marine Park Authority, Townsville.

Halford, A.R. and Thompson, A. (1996). Visual census surveys of reef fish. *Long-term Monitoring of the Great Barrier Reef Standard Operational Procedure* Number 3.

Hopley, D. (1983). Morphological classifications of shelf reefs: a critique with special reference to the Great Barrier Reef. In: Barnes, D.J. (ed) *Perspectives on Coral Reefs.* Brian Clouston Publisher, Manuka, ACT; 180-199.

Johnson, D.B., Moran, P.J. and Driml, S. (1990). Evaluation of a crown-of-thorns starfish (Acanthaster planci) control program at Grub Reef (central Great Barrier Reef). *Coral Reefs* 9(3): 167-171.

Loya, L. (1972). Community structure and species diversity of hermatypic corals at Eilat, Red Sea. *Marine Biology* 29: 177-189.

Moran, P.J. (1988). *The AcanthasterPhenomenon.* Australian Institute of Marine Science Monograph Series 7, Townsville. 178pp.

Moran, P. and Davies, S. (1986). *Acanthaster planci: an Annotated Bibliography.* The Crown-of-thorns Study. Australian Institute of Marine Science, Townsville. November 1986, 43pp.

Moran, P. and Davies, S. (1989). *Acanthaster planci: an Annotated Bibliography.* Third Edition. The Crown-of-thorns Study. Australian Institute of Marine Science, Townsville. May 1989, 77pp.

Moran, P.J., Davies, S.M. and Baker, V.J. (1991). *Acanthaster Planci: an Annotated Bibliography. Fourth Edition.* The Crown-of-thorns Study. Australian Institute of Marine Science, Townsville. 1991, 95pp.

Moran, P.J., De'ath, G., Baker, V.J., Bass, D.K., Christie, C.A., Johnson, D.B., Miller, I.R., Miller-Smith, B.A., Mundy, C.N. and Thompson, A.A. (1991). *Broadscale Surveys of Crown-of-thorns Starfish and Corals Along the Great Barrier Reef: 1982-1990.* The Crown-of-thorns Study. Australian Institute of Marine Science, Townsville. 36pp.

Oliver, J. et. al. (eds.) (1995). *Long-term Monitoring of the Great Barrier Reef Status Report* Number 1.

Pearson, R.G. (1974). Recolonization by hermatypic corals of reefs damaged by Acanthaster. In: Cameron, A.M., et al., (eds). Proc. 2nd Int. Symp. Coral Reefs. 2, 207-215.

Pearson, R.G. (1981). Recovery and recolonization of coral reefs. *Marine Ecoogy. Progress Series* 4:105-122.

Reichelt, R.E., Loya, Y. and Bradbury, R.H. (1986). Patterns in the use of space by benthic communities on two coral reefs of the Great Barrier Reef. *Coral Reefs* 5:73-79.

Zann, L.P. and Moran, P.J. (1988). A coordinated research program on the Acanthaster phenomenon in Australia. In Choat, J.H., et al. (eds), Proceedings of the Sixth International Coral Reef Symposium, 8-12 August 1988, Townsville, Australia, 2, 177-182.

APPENDIX I

Descriptions of the ORACLE tables that comprise the Reef Monitoring Database.

Each table is accompanied by a short description of the data it contains. Descriptions of summary tables include the names of the parent tables from which the summary tables were derived, the name of the program used to generate the summary and if applicable, any assumptions inherent in the summarised data and additional notes.

Columns within each table are described by listing the column name, data type, column length, and a short description of the data stored in the column. The data type can be one of the following:

Data Type	**Description**
VARCHAR2	Stores variable length character strings having a specified maximum length
NUMBER	Stores zero, positive and negative fixed and floating point numbers with precision *p* and scale *s*
DATE	Stores date and time information. Within this database the time component is not used.
LONGRAW	Stores raw binary data of variable length up to 2 gigabytes

For character columns, the length is the maximum number of characters that can be stored in the column. For number columns the following formats are used:

Length	**Description**
p,s	*p* (precision) is the total number of digits, including the decimal point and *s* (scale) is the number of digits to the right of the decimal point
p	a fixed point number of precision *p* and scale 0

The tables are listed by data group. Within the Reef Monitoring data group, tables are grouped as either data, reference or summary tables.

1. ACTIVE CORE TABLES

1.1 Geographic Tables

Table Name: REEF_GEOLOCALE94

Description: A listing of the *reefs* of the Great Barrier Reef (GBR). The position of the reef is taken at the *centre* of the reef or reefal structure. The columns REEF_ID, REEF_SUB_ID and REEF_NAME are used as the standard throughout the Reef Monitoring Database. This table comes directly from GBRMPA although we have changed it slightly to meet our needs. The REEF_SUB_ID has been changed from a one character field to a two character field. Any reefs with a two character REEF_SUB_ID has been sub-divided by us. Also there are WA and some International reefs added to the table but these are not properly formatted. And we do not have co-ordinates for them.

Column Name	Data Type	Length	Description
REEF_ID	NUMBER	5	Code which uniquely identifies each reef
REEF_SUB_ID	VARCHAR2	2	Code to identify distinct reefal structures
REEF_NAME	VARCHAR2	30	Name of the reef
REEF_AREA	NUMBER	8,2	Reef area (hectares)
LAT_DEG	NUMBER	2	Position of the reef (degrees of latitude)
LAT_MIN	NUMBER	5,2	Position of the reef (degrees of latitude)
LONG_DEG	NUMBER	3	Position of the reef (degrees of longitude)
LONG_MIN	NUMBER	5,2	Position of the reef (minutes of longitude)
COMMENTS	VARCHAR2	2000	To record any changes or anything strange about a record

Table Name: REEF_GEOLOCALE94_ADD

Description: Additional information about the *reefs* not supplied by GBRMPA. Note REEF_SUB_ID is not required because this information is all at an entire reef level.

Column Name	Data Type	Length	Description
REEF_ID	NUMBER	5	Code which uniquely identifies each reef
G_SECTION	VARCHAR2	3	Code for the GBRMPA Section
A_SECTOR	VARCHAR2	2	Code for the AIMS Sector
SHELF	VARCHAR2	1	Code for location across the continental shelf

Table Name: RM_SECTOR

Description: A listing of the boundaries of the Sectors used by AIMS for surveys of the GBR, Coral Sea and Western Australia (WA).

Column Name	Data Type	Length	Description
A_SECTOR	VARCHAR2	2	Code for the AIMS Sector
SECTOR_NAME	VARCHAR2	22	Name of the Sector
DESC1	VARCHAR2	80	Line 1 of boundary description
DESC2	VARCHAR2	80	Line 2 of boundary description
DESC3	VARCHAR2	80	Line 3 of boundary description
DESC4	VARCHAR2	80	Line 4 of boundary description
DESC5	VARCHAR2	80	Line 5 of boundary description
DESC6	VARCHAR2	80	Line 6 of boundary description
DESC7	VARCHAR2	80	Line 7 of boundary description
DESC8	VARCHAR2	80	Line 8 of boundary description
NS	NUMBER	2	Position of the Sector from north to south (GBR reefs only)
LOCATION	VARCHAR2	3	Broad geographic location

Table Name: RM_WAYPOINTS

Description: A listing of GPS coordinates for permanent *sites* used in WA, the Long-term Monitoring Program and the Queensland Department of Environment and Heritage (QDEH) reef monitoring program. This table is not currently in use and its integrity has not been checked recently.

Column Name	Data Type	Length	Description
P_CODE	VARCHAR2	5	Code for research program identification
REEF_NAME	VARCHAR2	29	Name of the reef
REEF_ID	NUMBER	5	Code which uniquely identifies each reef GBR reefs)
REEF_SUB_ID	VARCHAR2	4	Code to identify distinct reefal structures GBR reefs)
STATION_NO	NUMBER	3	Unique number assigned to the station
STATION_NAME	VARCHAR2	25	Name of the station
BIO_NO	NUMBER	3	Number assigned to this station by the AIMS Bio-oceanography group
CALM_SITE_NO	VARCHAR2	3	Site number used by WA Department of Conservation and Land Management
WA_AREA_CODE	VARCHAR2	5	Code to identify sub-reef areas (WA reefs)
REEF_ZONE	VARCHAR2	13	Position on the reef
SITE_NO	NUMBER	1	Site number
TRANSECT_NO	NUMBER	2	Transect number within the site (QDEH sites)
LAT_DEG	NUMBER	2	Position of the site (degrees of latitude)
LAT_MIN	NUMBER	6,3	Position of the site (minutes of latitude)
LAT_DIR	VARCHAR2	1	Direction of latitude
LONG_DEG	NUMBER	3	Position of the site (degrees of longitude)
LONG_MIN	NUMBER	6,3	Position of the site (minutes of longitude)
LONG_DIR	VARCHAR2	1	Direction of longitude

Table Name: EF_REEF_CLUSTERS

Description: A listing of the reefs used for the Effects of Line Fishing project and the clusters they have been divided into as well as their original Marine Park Zone.

Column Name	Data Type	Length	Description
P_CODE	VARCHAR2	5	Code for research program identification
REEF_ID	NUMBER	5	Code which uniquely identifies each reef
REEF_SUB_ID	VARCHAR2	2	Code to identify distinct reefal structures
REEF_CLUSTER	VARCHAR2	10	Cluster it is in
MP_ZONE	VARCHAR2	15	The zone (BLUE or GREEN) of the reef when the project began

Table Name: EF_REEF_TREATMENTS

Description: A listing of the *reefs* used for the Effects of Line Fishing and any treatment which has been applied to it for a particular visit.

Column Name	Data Type	Length	Description
REEF_ID	NUMBER	5	Code which uniquely identifies each reef
REEF_SUB_ID	VARCHAR2	2	Code to identify distinct reefal structures
VISIT_NO	NUMBER		The visit number for which the treatment is effective
TREATMENT	VARCHAR2	7	The treatment applied to the reef. OPEN - Reef was closed to fishing is now open HEAVY - Heavy fishing was encouraged here CLOSED - Reef was open to fishing is now closed

1.2 Data Tables

Table Name: RM_SAMPLE

Description: Master table which lists sampling details for records contained in all other tables in the data group. This table contains some redundant fields regarding reef information. These fields should be ignored but they will not be deleted until the DBA is satisfied that they are not needed.

Column Name	Data Type	Length	Description	
SAMPLE_ID	VARCHAR2	6	Unique sample identifier and link to other tables in the data group	
SAMPLE_TYPE	VARCHAR2	9	Survey method used	
P_CODE	VARCHAR2	5	Code for research program identification	
ISO_CODE	VARCHAR2	2	Country code defined by the International Standards Organisation	
A_SECTOR	VARCHAR2	2	Code for the AIMS Sector. This field should not be used, it should come from REEF_GEOLOCALE94_ADD	
G_SECTION	VARCHAR2	2	Code for the GBRMPA Section. This field should not be used, it should come from REEF_GEOLOCALE94_ADD	1
REEF_NAME	VARCHAR2	29	Name of the reef. This field should not be used, it should come from REEF_GEOLOCALE94	
REEF_ID	NUMBER	5	Code which uniquely identifies each reef and link to REEF_GEOLOCALE94	1
REEF_SUB_ID	VARCHAR2	4	Code to identify distinct reefal structures and link to REEF_GEOLOCALE94	1
STATION_NO	NUMBER	3	Unique number assigned to the station	2
STATION_NAME	VARCHAR2	25	Name of the station	2
WA_AREA_CODE	VARCHAR2	5	Code to identify sub-reef areas	3
REEF_CLASS	VARCHAR2	20	Geomorphological classification of reef	1
SHELF	VARCHAR2	1	Code for location across the continental shelf. This field should not be used, it should come from REEF_GEOLOCALE94_ADD	1
MP_ZONE	VARCHAR2	14	Code for the GBRMPA Marine Park Zoning classification	1
YEAR_CODE	VARCHAR2	6	Fiscal year data was recorded	
VISIT_NO	NUMBER	4,2	A number to group samples belonging to the same year's survey	
SAMPLE_DATE	DATE		Date information was recorded	
SAMPLE_TIME	VARCHAR2	4	Time sampling commenced (hhmm)	
SAMPLE_CLASS	VARCHAR2	1	Code for additional classification of the sample	
REEF_ZONE	VARCHAR2	13	Location on the reef	
CREST_DEPTH	NUMBER	2	Depth of transect below the reef crest (m)	4
SITE_NO	NUMBER	2	Site number	
TRANSECT_NO	NUMBER	1	Transect number within the site	

RM_SAMPLE (continued)

Column Name	Data Type	Length	Description	
TRANSECT_LENGTH	NUMBER	5	Length of the transect (cm)	
TRANSECT_WIDTH	NUMBER	4	Width of the transect (cm)	
START_DEPTH	NUMBER	2	Depth at start of the transect (m)	
OBSERVER	VARCHAR2	2	Initials of the person collecting data	
TIDE	VARCHAR2	1	Code for tide state	
WIND	VARCHAR2	1	Code for wind speed	
CLOUD	VARCHAR2	1	Code for cloud cover	
SEA	VARCHAR2	1	Code for sea state	
VISIBILITY	NUMBER	2	Visibility (m)	5
DISTANCE_ESTIMATE	NUMBER	3,1	Estimate of the width of the transect (m)	5
TAPE_NO	VARCHAR2	5	Video tape number	6
SUB_HEIGHT	NUMBER	4	Distance above the substrate of video camera (cm)	6
TIME_TYPE	VARCHAR2	1	Is the time interval fixed or random?	6
TIME_INTERVAL	NUMBER	5,2	Time between stops when analysing the video tape (seconds)	6
POINT_TYPE	VARCHAR2	1	Is the choice of points on the screen fixed or random?	6
POINTS_AVAILABLE	NUMBER	3	Number of points marked on the screen	6
POINTS_SELECTED	NUMBER	2	Number of points selected at each stop	6
ANALYSED_BY	VARCHAR2	5	Initials of person who analysed the video tape	6
ANALYSIS_DATE	DATE		Date video tape was analysed	6
SITE_TIME	NUMBER	1	Number of times that the site has been visited within a survey trip	2
BLANK_ID	VARCHAR2	5	SAMPLE_ID given to the blank related to the sample	2
T_B	VARCHAR2	1	Code for the location in the water column	2
REPLICATE	NUMBER	1	Replicate number	2
TEMPERATURE	NUMBER	5,2	Temperature of the water sample (^{o}C)	2
TRICHODESMIUM	VARCHAR2	1	Is Trichodesmium present?	2
WIND_DIR	NUMBER	5,1	Wind direction (degrees)	2
SECCHI_DEPTH	NUMBER	5,2	Depth at which the secchi disk is no longer visible (m)	2
ACOUSTIC_DEPTH	NUMBER	3	Depth of the water at the station (m)	2
SAMPLER1	VARCHAR2	2	Initials of the person taking the sample	2
SAMPLER2	VARCHAR2	2	Initials of the person taking the sample	2
FILTERER1	VARCHAR2	2	Initials of the person filtering the sample	2
FILTERER2	VARCHAR2	2	Initials of the person filtering the sample	2
COMMENTS	VARCHAR2	150	Additional comments	
ORIG_TAPE	VARCHAR2	5	Original tape for a duplicate video sample	6
DEPTH	NUMBER	5	Depth (m)	
CRUISE_CODE	VARCHAR2	5	A unique identifier for each Cruise	

1. GBR reefs only
2. Water quality surveys only
3. WA reefs only
4. Line intercept transect surveys only
5. Fish visual census surveys only
6. Video surveys only

Table Name: RM_AESTHETICS

Description: Data on the general condition of the reef collated from observations made during manta tow surveys. Each reef is divided into four zones for this purpose.

Column Name	Data Type	Length	Description
SAMPLE_ID	VARCHAR2	5	Unique sample identifier and link to the corresponding MANTA sample in RM_SAMPLE
REEF_ZONE_CODE	VARCHAR2	1	Code for zone of the reef
REEF_SLOPE	VARCHAR2	1	Code for the angle of the reef slope
REEF_AESTHETICS	VARCHAR2	1	Code for the general appeal of the reef
DOM_BENTHIC_FORM	VARCHAR2	1	Code for the dominant benthic life form
DOM_HC_GENUS	VARCHAR2	1	Code for the dominant hard coral genus
DOM_HC_FORM	VARCHAR2	1	Code for the dominant hard coral life form
LIVE_CORAL	VARCHAR2	1	Percent cover code for live coral
BLEACHING	VARCHAR2	1	Percent cover code for coral bleaching
STRUCT_COMP	VARCHAR2	1	Code for the degree of structural complexity of the reef slope
T_GIGAS	VARCHAR2	1	Code for the abundance of *T. gigas*
FISH	VARCHAR2	1	Code for the abundance of fish
VARIETY	VARCHAR2	1	Variety or complexity of the benthic cover (no longer used)
OBSERVER1	VARCHAR2	2	Initials of person making the observation
OBSERVER2	VARCHAR2	2	Initials of person making the observation (if more than one person surveyed the specified section of the reef)
START_TOW	NUMBER	3	The first tow number (link to RM_MANTA) which comprises this zone. (only recorded since 2/1998)
COUNT_TGIGAS	INTEGER		Replaces T_GIGAS as of 2/1998. Stores estimated count rather than a code representing a range
COMMENTS	VARCHAR2	110	Additional comments

Table Name: RM_FISH

Description: Fish visual census data

Column Name	Data Type	Length	Description
SAMPLE_ID	VARCHAR2	6	Unique sample identifier and link to RM_SAMPLE
FISH_CODE	VARCHAR2	8	Fish species code and link to RM_FISH_CODES
ABUNDANCE	NUMBER	4	Absolute abundance of the fish species
LENGTH	NUMBER	3	Visual estimate of fish length (cm) [1]

[1] Effects of Fishing Project only

Table Name: GT_BOLTS

Description: Contains information on the bolts left on the video transect for Ground truthing purposes.

Column Name	Data Type	Length	Description
SAMPLE_ID	VARCHAR2	5	Unique sample identifier and link to RM_SAMPLE
COLOUR	VARCHAR2	10	The colour of the bolt should be unique for each sample
FRAME	VARCHAR2	11	The frame on the tape where the bolt was seen
SORT_ORDER	NUMBER	38	The order that the data was originally entered. Should correspond to the order that the bolts appear on the transect.
COMMENTS	VARCHAR2	200	Any comments relating to the bolt
IGNORE	NUMBER	38	1 if there is something wrong with this bolt otherwise NULL. If 1 then there should be a comment to explain why.

Table Name: GT_ID

Description: Contains data identifying what the bolts on the transect are pointing to.

Column Name	Data Type	Length	Description
SAMPLE_ID	VARCHAR2	5	Unique sample identifier and link to RM_SAMPLE
COLOUR	VARCHAR2	10	The colour of the bolt
ID_TYPE	VARCHAR2	2	V - identified on video. U- identified under water.
OBSERVER	VARCHAR2	2	The initials of the person making the Identification
SAMPLE_DATE	DATE		The date the identification was made
SPEC_CODE	VARCHAR2	7	The species identified
BENTHOS_CODE	VARCHAR2	3	The lifeform identified (may be null if it is implied by the species)

Table Name: RM_SCUBA_SEARCH

Description: SCUBA swim data from surveys for COTS, *Drupella* and coral bleaching.

Column Name	Data Type	Length	Description
SAMPLE_ID	VARCHAR2	5	Unique sample identifier and link to RM_SAMPLE
J_COUNT	NUMBER	3	Number of COTS in size class J (<=4cm)
A_COUNT	NUMBER	3	Number of COTS in size class A (>4-15cm)
B_COUNT	NUMBER	3	Number of COTS in size class B (>15cm)
D_COUNT	NUMBER	3	Number of *Drupella*
C_SCAR	NUMBER	3	Number of COTS feeding scars (all size classes)
D_SCAR	NUMBER	3	Number of *Drupella* feeding scars
U_SCAR	NUMBER	3	Number of scars of unknown origin
BLEACHING	VARCHAR2	2	Percent cover code for coral bleaching

Table Name: RM_MANTA

Description: Manta tow data.

Column Name	Data Type	Length	Description
SAMPLE_ID	VARCHAR2	6	Unique sample identifier and link to RM_SAMPLE
COT_COUNT	NUMBER	3	Number of COTS counted for the tow
COT_SIZE	VARCHAR2	1	Code for the average size category of COTS observed during the tow
SCAR	VARCHAR2	1	Code for the abundance of feeding scars for the tow
LIVE_CORAL	VARCHAR2	2	Percent cover code for live coral
DEAD_CORAL	VARCHAR2	2	Percent cover code for dead coral
SC	VARCHAR2	2	Percent cover code for soft coral (no longer recorded)
SR	VARCHAR2	2	Percent cover code for sand and rubble
VIS	VARCHAR2	1	Code for visibility during the tow
TOW_SEQ_NO	NUMBER	3	Sequential tow number recorded clockwise around the reef perimeter
OBSERVER	VARCHAR2	2	Initials of the person collecting the data

Table Name: RM_VPOINT

Description: Video point data.

Column Name	Data Type	Length	Description
SAMPLE_ID	VARCHAR2	5	Unique sample identifier and link to RM_SAMPLE
FRAME	VARCHAR2	11	Frame number from the video tape
TIME_SEC	NUMBER	7,2	Time from the start of the transect (seconds)
POINT_NO	NUMBER	2	The point number on the screen
VIDEO_CODE	NUMBER	3	Code for the combination of species and benthic lifeform and link to VPOINT_CODES
SUBSTRATE_CODE	VARCHAR2	3	Code for the substrate

1.3 REFERENCE TABLES

Table Name: RM_DATABASE_CODES

Description: Full listing of codes used in the Reef Monitoring Database

Column Name	Data Type	Length	Description
TABLE_NAME	VARCHAR2	21	ORACLE Table name
COLUMN_NAME	VARCHAR2	16	Column name
CODE	VARCHAR2	13	Code used in the column
DESCRIPTION	VARCHAR2	75	Full description of code

Table Name: FISH_CODES

Description: This table describes the codes used in the table RM_FISH. All fish are identified to species level, where possible. This table is used as a look-up table to enable fish to be grouped at other levels and to allow comparison of Long-term Monitoring data with data from other research groups.

Column Name	Data Type	Length	Description
FISH_CODE	VARCHAR2	8	Code for the fish species and link to the table RM_FISH
SPECIES	VARCHAR2	33	Full name of species
SYNONYMY	VARCHAR2	33	Other species names for the species
GENUS_CODE	VARCHAR2	3	Code for the genus
ASEAN_CODE	VARCHAR2	8	Code for the fish species used by the ASEAN Coastal Living Resources Project
JUVENILE_CODE	NUMBER	4	Code used by Dr. Peter Doherty for juveniles of the species
TROPHIC_CODE	VARCHAR2	2	Code for the trophic group
GUILD_CODE	VARCHAR2	2	Code for the guild

Table Name: F_GENUS

Description: This table lists all the genus for fish.

Column Name	Data Type	Length	Description
GENUS_CODE	VARCHAR2	3	Code for the genus
GENUS	VARCHAR2	19	Full name of genus
FAMILY_CODE	VARCHAR2	4	Code for the family

Table Name: F_FAMILY

Description: This table lists all the families for fish.

Column Name	Data Type	Length	Description
FAMILY_CODE	VARCHAR2	4	Code for the family
FAMILY	VARCHAR2	15	Full name of the family

Table Name: TROPHIC

Description: This table lists all the trophics for fish.

Column Name	Data Type	Length	Description
TROPHIC_CODE	VARCHAR2	2	Code for the trophic group
TROPHIC_DESC	VARCHAR2	20	Full description of the trophic group

Table Name: GUILD

Description: This table lists all the guilds for fish.

Column Name	Data Type	Length	Description
GUILD_CODE	VARCHAR2	2	Code for the guild
GUILD_DESC	VARCHAR2	20	Full description of the guild

Table Name: FISH_PROJ

Description: This table determines which fish codes are used by which projects.

Column Name	Data Type	Length	Description
FISH_CODE	VARCHAR2	8	Code for the fish
P_CODE	VARCHAR2	2	Project which uses this code

Table Name: VPOINT_CODES

Description: This table describes codes used in the tables RM_VPOINT and RM_TRANSECT. VIDEO_CODE is a unique code for the combination of species and benthic life form. As all benthos is identified to species level where possible, abiotic features are also given a species code. This table is used as a look-up table to enable benthos to be grouped at other levels.

Column Name	Data Type	Length	Description
VIDEO_CODE	NUMBER	3	Code for the combination of species and benthic lifeform and link to RM_VPOINT
SPEC_CODE	VARCHAR2	7	Code for the species and link to SPECIES
BENTHOS_CODE	VARCHAR2	3	Code for the benthic life form category and link to BENTHOS

Table Name: VPOINT_PROJ

Description: This table is used to determine which VPOINT_CODEs are used by different projects. Note a video_code can be used by many projects and a project may use many video_codes.

Column Name	Data Type	Length	Description
VIDEO_CODE	NUMBER	3	Code for the combination of species and benthic lifeform and link to RM_VPOINT_CODES
P_CODE	VARCHAR2	2	Code for the project which uses this video_code

Table Name: SPECIES

Description: This table lists all the species of Coral.

Column Name	Data Type	Length	Description
SPEC_CODE	VARCHAR2	7	Code for the species and link to
SPEC_DESC	VARCHAR2	32	Full name of the species
GENUS_CODE	VARCHAR2	3	Code for the genus (if a coral) and link to GENUS

Table Name: GENUS

Description: This table lists all the Genus of Coral.

Column Name	Data Type	Length	Description
GENUS_CODE	VARCHAR2	3	Code for the genus (if a coral)
GENUS	VARCHAR2	18	Full name of the genus (if a coral)
FAMILY_CODE	VARCHAR2	3	Code for the family (if a coral) and link to Family

Table Name: FAMILY

Description: This table lists all the families of Coral.

Column Name	Data Type	Length	Description
FAMILY_CODE	VARCHAR2	3	Code for the family (if a coral)
FAMILY	VARCHAR2	16	Full name of the family (if a coral)
GROUP_CODE	VARCHAR2	2	Code for the broad functional group and link to groups

Table Name: VPOINT_CODES_LOG

Description: This table describes changes to the VPOINT_CODES and related tables. This only reflects changes made since 1998.

Column Name	Data Type	Length	Description
VIDEO_CODE	NUMBER	3	Code for the combination of species and benthic lifeform and link to RM_VPOINT
P_CODE	VARCHAR2	5	The Project which is using this code
CHANGE_DATE	DATE		The date the CODE was added or deleted from the project's list of codes
CHANGE_TYPE	VARCHAR2	12	One of A (Added) or D (Deleted)
COMMENTS	VARCHAR2	200	Any comments about what change was made, why etc.

Table Name: BENTHOS

Description: This table lists all the Benthic Life-Forms of Coral.

Column Name	Data Type	Length	Description
BENTHOS	VARCHAR2	3	Code for the benthic life form category and link to RM_TRANSECT
BENTHOS_DESC	VARCHAR2	23	Full name of the benthic life form category
GROUP_CODE	VARCHAR2	2	Code for the broad functional group and link to groups

Table Name: GROUPS

Description: This table lists all the Groups of Coral.

Column Name	Data Type	Length	Description
GROUP_CODE	VARCHAR2	2	Code for the broad functional group
GROUP_DESC	VARCHAR2	15	Full name of the functional group
END_MEM_CODE	VARCHAR2	3	Code for the end member category and link to END_MEMBERS

Table Name: END_MEMBERS

Description: This table lists all the End-member categories for Benthic groups.

Column Name	Data Type	Length	Description
END_MEM_CODE	VARCHAR2	3	Code for the end member category
END_MEM_DESC	VARCHAR2	25	Full name of the end member category

2. ACTIVE SUMMARY TABLES

Table Name: RM_MEDIAN

Description: Mean and median coral cover categories, crown-of-thorns starfish abundance and status of reefs surveyed by manta tow.

Parent Table: RM_MANTA

Program: sp_median (source summary.sql)

Column Name	Data Type	Length	Description	
SAMPLE_ID	VARCHAR2	5	Unique sample identifier and link to RM_SAMPLE	
M_LIVE	VARCHAR2	5	Median percent cover code for live coral	
M_DEAD	VARCHAR2	5	Median percent cover code for dead coral	
M_SC	VARCHAR2	5	Median percent cover code for soft coral	
M_SR	VARCHAR2	5	Median percent cover code for sand and rubble	
MEAN_LIVE	NUMBER	7,3	Mean percent cover for live coral based on the midpoint of the percent cover codes	1
VAR_LIVE	NUMBER	8,3	Variance of the percent cover for live coral based on the midpoint of the percent cover codes	1
SE_LIVE	NUMBER	8,3	Standard error of the percent cover for live coral based on the midpoint of the percent cover codes	1
MEAN_DEAD	NUMBER	7,3	Mean percent cover for dead coral based on the midpoint of the percent cover codes	1
VAR_DEAD	NUMBER	8,3	Variance of the percent cover for dead coral based on the midpoint of the percent cover codes	1
SE_DEAD	NUMBER	8,3	Standard error of the percent cover for dead coral based on the midpoint of the percent cover codes	1
MEAN_SR	NUMBER	7,3	Mean percent cover for sand and rubble based on the midpoint of the percent cover codes	1
VAR_SR	NUMBER	8,3	Variance of the percent cover for sand and rubble based on the midpoint of the percent cover codes	1
SE_SR	NUMBER	8,3	Standard error of the percent cover for sand and rubble based on the midpoint of the percent cover codes	1

RM_MEDIAN (continued)

Column Name	Data Type	Length	Description
SAMPLE_ID	VARCHAR2	5	Unique sample identifier and link to RM_SAMPLE
COTS	NUMBER	4	Total number of COTS observed
MEAN_COTS	NUMBER	6,3	Mean number of COTS/tow
VAR_COTS	NUMBER	8,3	Variance of the number of COTS/tow
VMR_COTS	NUMBER	8,3	Variance to mean ratio for the number of COTS/tow
SE_COTS	NUMBER	8,3	Standard error of the mean number of COTS/tow
TOWS	NUMBER	3	Total number of tows for the reef
STATUS	VARCHAR2	2	Code for the status of the reef in terms of COTS damage
COMMENTS	VARCHAR2	150	Additional information used in determining the status of a reef

1 Midpoint values used in calculation of mean, variance and standard error of coral cover

% Cover Code	% Cover Range	% Cover Midpoint
0	0	0
1	>0-10	5
1L	>0-5	2.5
1U	>5-10	7.5
2	>10-30	20
2L	>10-20	15
2U	>20-30	25
3	>30-50	40
3L	>30-40	35
3U	>40-50	45
4	>50-75	62.5
4L	>50-62.5	56.25
4U	>62.5-75	68.75
5	>75-100	85.0 *
5L	>75-87.5	81.25
5U	>87.5-100	93.75

* Adjusted down on advice from statistician

Table Name: BENTHOS_SUMMARY_ZEROS

Description: Percent cover calculated on the basis of the benthic life form code. Does include zero values.

Parent Tables: RM_VPOINT, VPOINT_CODES

Program: SP_CORAL_SUMMARY (Source Summary.sql)

Column Name	Data Type	Length	Description
SAMPLE_ID	VARCHAR2	5	Unique sample identifier and link to RM_SAMPLE
BENTHOS	VARCHAR2	3	Code for the benthic life form category
COVER	NUMBER	5,2	Percent cover

Table Name: GENUS_SPECIAL_SUMMARY_ZEROS

Description: Percent cover calculated on the basis of the genus code and special value (Bleaching). Does include zero values.

Parent Tables: RM_VPOINT, VPOINT_CODES

Program: SP_CORAL_SUMMARY (Source Summary.sql)

Column Name	Data Type	Length	Description
SAMPLE_ID	VARCHAR2	5	Unique sample identifier and link to RM_SAMPLE
GENUS_CODE	VARCHAR2	3	Code for the genus
SPECIAL_VALUE	VARCHAR2	5	Special value (Bleaching)
COVER	NUMBER	5,2	Percent cover

Table Name: **GENUS_SUMMARY_ZEROS**

Description: Percent cover calculated on the basis of the genus code. Includes zero values.

Parent Tables: RM_VPOINT, VPOINT_CODES

Program: SP_CORAL_SUMMARY (Source Summary.sql)

Column Name	Data Type	Length	Description
SAMPLE_ID	VARCHAR2	5	Unique sample identifier and link to RM_SAMPLE
GENUS_CODE	VARCHAR2	3	Code for the genus
PERCENT_COVER	NUMBER	5,2	Percent cover

Table Name: **RM_FISH01**

Description: Fish visual census data for Pomacentridae for the Monitoring project. Includes zero entries for any fish which is part of the RM project and is not seen.

Program: sp_fish_zeros (source summary.sql)

Column Name	Data Type	Length	Description
SAMPLE_ID	VARCHAR2	6	Unique sample identifier and link to RM_SAMPLE
FISH_CODE	VARCHAR2	8	Fish species code and link to RM_FISH_CODES
ABUNDANCE	NUMBER	4	Absolute abundance of the fish species

Table Name: RM_FISH05

Description: Fish visual census data for non-Pomacentridae for the Monitoring project. Includes zero entries for any fish which is part of the RM project and is not seen.

Program: sp_fish_zeros (source summary.sql)

Column Name	Data Type	Length	Description
SAMPLE_ID	VARCHAR2	6	Unique sample identifier and link to RM_SAMPLE
FISH_CODE	VARCHAR2	8	Fish species code and link to RM_FISH_CODES
ABUNDANCE	NUMBER	4	Absolute abundance of the fish species

Table Name: EF_FISH01

Description: Fish visual census data for Pomacentridae for the effects of fishing project. Includes zero entries for any fish which is part of the EF project and is not seen.

Program: sp_fish_zeros (source summary.sql)

Column Name	Data Type	Length	Description
SAMPLE_ID	VARCHAR2	6	Unique sample identifier and link to RM_SAMPLE
FISH_CODE	VARCHAR2	8	Fish species code and link to RM_FISH_CODES
ABUNDANCE	NUMBER	4	Absolute abundance of the fish species

Table Name: EF_FISH05

Description: Fish visual census data for non-Pomacentridae for the effects of fishing project. Includes zero entries for any fish which is part of the EF project and is not seen.

Program: sp_fish_zeros (source summary.sql)

Column Name	Data Type	Length	Description
SAMPLE_ID	VARCHAR2	6	Unique sample identifier and link to RM_SAMPLE
FISH_CODE	VARCHAR2	8	Fish species code and link to RM_FISH_CODES
ABUNDANCE	NUMBER	4	Absolute abundance of the fish species
LENGTH	NUMBER	3	Visual estimate of fish length (cm)

3. NON-ACTIVE TABLES

3.2 Data Tables

Table Name: RM_MANTA_TRAIN

Description: Additional information related to manta tow training. Training is carried out with two observers, one towed behind the other. This table is not currently in use and its integrity has not been checked recently.

Column Name	Data Type	Length	Description
SAMPLE_ID	VARCHAR2	6	Unique sample identifier and link between RM_SAMPLE and RM_MANTA
GROUP_NO	NUMBER	1	Code to separate groups of people being trained
TRAIN_SITE_NO	NUMBER	2	Training site number
TRIAL_NO	NUMBER	1	Trial number within a site
RUN_NO	NUMBER	1	Run number within a trial
DRIVER	VARCHAR2	2	Initials of the person driving the boat
OBSERVER	VARCHAR2	2	Initials of the person collecting the data
OBSERVER_NO	NUMBER	1	Code for the position of the observer

Table Name: RM_SWIM

Description: SCUBA swim survey data from the Grub Reef starfish control program. This table is not currently in use and its integrity has not been checked recently.

Column Name	Data Type	Length	Description
SAMPLE_ID	VARCHAR2	5	Unique sample identifier and link to RM_SAMPLE
BOMMIE	NUMBER	2	Patch reef identifier
LOCATION	VARCHAR2	4	Location on patch reef
COT_COUNT	NUMBER	3	Number of COTS observed
LIVE_CORAL	NUMBER	1	Percent cover code for live coral
DEAD_CORAL	NUMBER	1	Percent cover code for dead coral

Table Name: RM_TRANSECT

Description: Line intercept transect data.

Column Name	Data Type	Length	Description
SAMPLE_ID	VARCHAR2	6	Unique sample identifier and link to RM_SAMPLE
BENTHOS	VARCHAR2	6	Code for the benthic life form and link to RM_VPOINT_CODES
SPEC_CODE	VARCHAR2	7	Code for the species and link to RM_VPOINT_CODES
TRANSITION	NUMBER	5	Intercept along the transect tape (cm)
OBSERVER	VARCHAR2	2	Initials of the person collecting the data
LENGTH	NUMBER	5	Length of life form category (cm)

Data from water samples

Table Name: RM_WATER_CHLOROPHYLL

Description: Chlorophyll *a* and phaeophytin data. This table is not currently in use and its integrity has not been checked recently.

Column Name	Data Type	Length	Description	
SAMPLE_ID	VARCHAR2	5	Unique sample identifier and link to RM_SAMPLE	
DUPLICATE	VARCHAR2	1	Repeat sample analysis code	
ANALYSIS_DATE	DATE		Date sample was analysed	
ANALYSED_BY	VARCHAR2	3	Initials of the person who analysed the sample	
BLANK_SF	NUMBER	3	Blank scale factor (1 or 100)	1
BLANK_FACTOR	NUMBER	5,2	Blank door factor (31.6,3.16,10,1)	1
BLANK_F0	NUMBER	5,3	Blank fluorescence reading before acidification	1
BLANK_F1	NUMBER	5,3	Blank fluorescence reading after acidification	1
SAMPLE_SF	NUMBER	3	Sample scale factor (1 or 100)	1
SAMPLE_FACTOR	NUMBER	5,2	Sample door factor (31.6,3.16,10,1)	1
VOLUME	NUMBER	4,2	Volume of acetone used in analysis (ml)	
CALIBRATION	VARCHAR2	4	Calibration value for fluorometer	
SAMPLE_F0	NUMBER	5,3	Sample fluorescence reading before acidification	
SAMPLE_F1	NUMBER	5,3	Sample fluorescence reading after acidification	
SAMPLE_ CORRECT_F0	NUMBER	5,3	Sample reading corrected for fluorometer calibration (before acidification)	
SAMPLE_ CORRECT_F1	NUMBER	5,3	Sample reading corrected for fluorometer calibration (after acidification)	
CHLOROPHYLL_A	NUMBER	8,3	Concentration of chlorophyll *a* (µg/l)	
PHAEOPHYTIN	NUMBER	8,3	Concentration of phaeophytin (µg/l)	
ORIG_ CHLOROPHYLL_A	NUMBER	8,3	Inconsistent value for CHLOROPHYLL_A removed from data	
ORIG_ PHAEOPHYTIN	NUMBER	8,3	Inconsistent value for PHAEOPHYTIN removed from data	
COMMENTS	VARCHAR2	50	Additional comments	

1 No longer required as new analytical equipment is now used

Table Name: RM_WATER_DINUTRIENTS

Description: Dissolved inorganic nutrient data. This table is not currently in use and its integrity has not been checked recently.

Column Name	Data Type	Length	Description
SAMPLE_ID	VARCHAR2	5	Unique sample identifier and link to RM_SAMPLE
DUPLICATE	VARCHAR2	1	Repeat sample analysis code
$DIPO_4$	NUMBER	5,2	Concentration of phosphate (PO_4^{3-}) (µM)
$DINH_4$	NUMBER	5,2	Concentration of ammonia (NH_4^+) (µM)
$DINO_2\_NO_3$	NUMBER	5,2	Concentration of nitrite plus nitrate (NO_2^- + NO_3^-) (µM)
$DINO_2$	NUMBER	5,2	Concentration of nitrite (NO_2^-) (µM)
ORIG_$DIPO_4$	NUMBER	5,2	Inconsistent value for $DIPO_4$ removed from data
ORIG_$DINH_4$	NUMBER	5,2	Inconsistent value for $DINH_4$ removed from data
ORIG_$DINO_2_NO_3$	NUMBER	5,2	Inconsistent value for $DINO_2\_NO_3$ removed from data
ORIG_$DINO_2$	NUMBER	5,2	Inconsistent value for $DINO_2$ removed from data
COMMENTS	VARCHAR2	50	Additional comments

Table Name: RM_WATER_PARTICULATE_N

Description: Particulate nitrogen data. This table is not currently in use and its integrity has not been checked recently.

Column Name	Data Type	Length	Description
SAMPLE_ID	VARCHAR2	5	Unique sample identifier and link to RM_SAMPLE
DUPLICATE	VARCHAR2	1	Repeat sample analysis code
PN	NUMBER	(5,2)	Concentration of particulate nitrogen (µmolN/l)
COMMENTS	VARCHAR2	50	Additional comments

Table Name: RM_WATER_PARTICULATE_P

Description: Particulate phosporus data. This table is not currently in use and its integrity has not been checked recently.

Column Name	Data Type	Length	Description
SAMPLE_ID	VARCHAR2	5	Unique sample identifier and link to RM_SAMPLE
DUPLICATE	VARCHAR2	1	Repeat sample analysis code
PP	NUMBER	(5,2)	Concentration of particulate phosphate (µmolP/l)
COMMENTS	VARCHAR2	50	Additional comments

Table Name: RM_WATER_SALINITY

Description: Salinity data. This table is not currently in use and its integrity has not been checked recently.

Column Name	Data Type	Length	Description
SAMPLE_ID	VARCHAR2	5	Unique sample identifier and link to RM_SAMPLE
DUPLICATE	VARCHAR2	1	Duplicate sample analysis code
ANALYSIS_DATE	DATE		Date sample was analysed
SSSW	VARCHAR2	3	Salinity sub standard
NEW_COND	NUMBER	7,5	New conductivity for sub standard
OLD_COND	NUMBER	7,5	Old conductivity for sub standard
STANDARD	NUMBER	4	Value obtained for seawater standard
COND_RATIO	NUMBER	7,5	Conductivity value for sample
ANALYSED_BY	VARCHAR2	3	Initials of the person who analysed the sample
SALINITY	NUMBER	7,4	Salinity (ppt)
ORIG_SAL	NUMBER	7,4	Inconsistent value for SALINITY removed from data
COMMENTS	VARCHAR2	50	Additional comments

Table Name: RM_WATER_SI

Description: Silica data. This table is not currently in use and its integrity has not been checked recently.

Column Name	Data Type	Length	Description
SAMPLE_ID	VARCHAR2	5	Unique sample identifier and link to RM_SAMPLE
DUPLICATE	VARCHAR2	1	Repeat sample analysis code
SI	NUMBER	6,2	Concentration of silica as SiO_2 (µM)
ORIG_SI	NUMBER	6,2	Inconsistent value for SI removed from data
COMMENTS	VARCHAR2	50	Additional comments

Table Name: RM_WATER_SS

Description: Suspended solids data. This table is not currently in use and its integrity has not been checked recently.

Program: CALC_SS.SQL

Column Name	Data Type	Length	Description
SAMPLE_ID	VARCHAR2	5	Unique sample identifier and link to RM_SAMPLE
DUPLICATE	VARCHAR2	1	Repeat sample analysis code
VOLUME	NUMBER	4	Volume of sample analysed (ml)
INIT_WEIGHT_DATE	DATE		Date filter papers were initially weighed
FINAL_WEIGHT_DATE	DATE		Date filter paper plus sample was weighed
INIT_BLANK_WEIGHT	NUMBER	7,5	Initial weight of filter paper blank (mg)
FINAL_BLANK_WEIGHT	NUMBER	7,5	Final weight of filter paper blank (mg)
INIT_SAMP_WEIGHT	NUMBER	7,5	Initial weight of sample filter paper (mg)
FINAL_SAMP_WEIGHT	NUMBER	7,5	Weight of filter paper plus sample (mg)
SS	NUMBER	8,5	Concentration of suspended solids (mg/l)
ORIG_SS	NUMBER	8,5	Inconsistent value for SS removed from data
COMMENTS	VARCHAR2	50	Additional comments relating to calculation of the suspended solids concentration

Table Name: RM_WATER_TDNUTRIENTS

Description: Total dissolved nutrient data. This table is not currently in use and its integrity has not been checked recently.

Column Name	Data Type	Length	Description
SAMPLE_ID	VARCHAR2	5	Unique sample identifier and link to RM_SAMPLE
DUPLICATE	VARCHAR2	1	Repeat sample analysis code
$TDPO_4$	NUMBER	5,2	Concentration of phosphate (PO_4^{3-}) (µM)
$TDNH_4$	NUMBER	5,2	Concentration of ammonia (NH_4^+) (µM)
$TDNO_2\_NO_3$	NUMBER	5,2	Concentration of nitrite plus nitrate ($NO_2^- + NO_3^-$) (µM)
TDN	NUMBER	5,2	Total concentration of nitrogen (µM)
$ORIG\_TDPO_4$	NUMBER	5,2	Inconsistent value for $TDPO_4$ removed from data
$ORIG\_TDNH_4$	NUMBER	5,2	Inconsistent value for $TDNH_4$ removed from data
$ORIG\_TDNO_2\_NO_3$	NUMBER	5,2	Inconsistent value for $TDNO_2\_NO_3$ removed from data
ORIG_TDN	NUMBER	5,2	Inconsistent value for TDN removed from data
COMMENTS	VARCHAR2	50	Additional comments

Table Name: RM_WATER_PARAMETERS

Description: All data from water samples with calculated values for concentration of organic nutrients. This table is not currently in use and its integrity has not been checked recently.

Program: UPDATE_RM_WATER_PARAMETERS.SQL

Column Name	Data Type	Length	Description
SAMPLE_ID	VARCHAR2	5	Unique sample identifier and link to RM_SAMPLE
DUPLICATE	VARCHAR2	1	Repeat sample analysis code
ACTUAL_DEPTH	NUMBER	3	Depth at which the sample was taken (m)
SS	NUMBER	8,5	Concentration of suspended solids (mg/l)
CHLOROPHYLL_A	NUMBER	8,3	Concentration of chlorophyll *a* (µg/l)
PHAEOPHYTIN	NUMBER	8,3	Concentration of phaeophytin (µg/l)
SALINITY	NUMBER	7,4	Salinity (ppt)
SI	NUMBER	6,2	Concentration of silica as SiO_2 (µM)
$TDPO_4$	NUMBER	5,2	Total concentration of dissolved phosphate (PO_4^{3-}) (µM)
$TDNH_4$	NUMBER	5,2	Total concentration of dissolved ammonia (NH_4^+) (µM)
$TDNO_2\_NO_3$	NUMBER	5,2	Total concentration of dissolved nitrite plus nitrate ($NO_2^- + NO_3^-$) (µM)
TDN	NUMBER	5,2	Total concentration of dissolved nitrogen (µM)
$DIPO_4$	NUMBER	5,2	Concentration of dissolved inorganic phosphate (PO_4^{3-}) (µM)
$DINH_4$	NUMBER	5,2	Concentration of dissolved inorganic ammonia (NH_4^+) (µM)
$DINO_2\_NO_3$	NUMBER	5,2	Concentration of dissolved inorganic nitrite plus nitrate ($NO_2^- + NO_3^-$) (µM)
$DINO_2$	NUMBER	5,2	Concentration of dissolved inorganic nitrite (NO_2^-) (µM)
$DINO_3$	NUMBER	5,2	Concentration of dissolved inorganic nitrate (NO_3^-) (µM)
TDIN	NUMBER	5,2	Total concentration of dissolved inorganic nitrogen (µM)
DON	NUMBER	5,2	Concentration of dissolved organic nitrogen (µM)
DOP	NUMBER	5,2	Concentration of dissolved organic phosphate (µM)
PN	NUMBER	5,2	Concentration of particulate nitrogen (µmolN/l)
PP	NUMBER	5,2	Concentration of particulate phosphate (µmolP/l)

Data from sediment samples

Table Name: RM_SED_DETAILS_FC

Description: Additional information relating to the setup and use of the flux chambers. This table is not currently in use and its integrity has not been checked recently.

Column Name	Data Type	Length	Description
SAMPLE_ID	VARCHAR2	5	Unique sample identifier and link to RM_SAMPLE
REPLICATE	NUMBER	1	Replicate number
TIME_START	VARCHAR2	4	Time the experiment started (hhmm)
VOL_CHAMBER	NUMBER	4	Volume of water in the chamber (ml)
L_D	VARCHAR2	1	Was the flux chamber light or dark?

Table Name: RM_SED_DINUTRIENTS_FC

Description: Dissolved inorganic nutrient data from the flux chamber. This table is not currently in use and its integrity has not been checked recently.

Column Name	Data Type	Length	Description
SAMPLE_ID	VARCHAR2	5	Unique sample identifier and link to
			RM_SAMPLE
REPLICATE	NUMBER	1	Replicate number
TIME_MIN	NUMBER	3	Time from start of the experiment (minutes)
$DIPO_4$	NUMBER	5,2	Concentration of phosphate (PO_4^{3-}) (µM)
$DINH_4$	NUMBER	5,2	Concentration of ammonia (NH_4^+) (µM)
$DINO_2$_NO_3	NUMBER	5,2	Concentration of nitrite plus nitrate (NO_2^- + NO_2^-) (µM)
$DINO_2$	NUMBER	5,2	Concentration of nitrite (NO_2^-) (µM)
COMMENTS	VARCHAR2	50	Additional comments

Table Name: RM_SED_NPOC_FC

Description: Non-purgable organic carbon data from flux chambers. This table is not currently in use and its integrity has not been checked recently.

Column Name	Data Type	Length	Description
SAMPLE_ID	VARCHAR2	5	Unique sample identifier and link to RM_SAMPLE
REPLICATE	NUMBER	1	Replicate number
TIME_MIN	NUMBER	3	Time from start of the experiment (minutes)
BLANK1	NUMBER	6,3	?
BLANK2	NUMBER	6,3	?
STANDARD	NUMBER	6,3	?
INIT_SAMP	NUMBER	6,3	?
NPOC	NUMBER	6,3	Concentration of non-purgable organic carbon (mg/l)
COMMENTS	VARCHAR2	50	Additional comments

Table Name: RM_SED_SI_FC

Description: Silica data from the flux chamber. This table is not currently in use and its integrity has not been checked recently.

Column Name	Data Type	Length	Description
SAMPLE_ID	VARCHAR2	5	Unique sample identifier and link to RM_SAMPLE
REPLICATE	NUMBER	1	Replicate number
TIME_MIN	NUMBER	3	Time from start of the experiment (minutes)
SI	NUMBER	5,2	Concentration of silica as SiO_2 (µM)
COMMENTS	VARCHAR2	50	Additional comments

Table Name: RM_SED_TDNUTRIENTS_FC

Description: Total dissolved nutrient data from the flux chamber. This table is not currently in use and its integrity has not been checked recently.

Column Name	Data Type	Length	Description
SAMPLE_ID	VARCHAR2	5	Unique sample identifier and link to RM_SAMPLE
REPLICATE	NUMBER	1	Replicate number
TIME_MIN	NUMBER	3	Time from start of the experiment (minutes)
$TDPO_4$	NUMBER	5,2	Concentration of phosphate (PO_4^{3-}) (µM)
$TDNH_4$	NUMBER	5,2	Concentration of ammonia (NH_4^+) (µM)
$TDNO_2\_NO_3$	NUMBER	5,2	Concentration of nitrite plus nitrate ($NO_2^- + NO^{3-}$) (µM)
TDN	NUMBER	5,2	Total concentration of nitrogen (µM)
COMMENTS	VARCHAR2	50	Additional comments

Table Name: RM_SED_PARAMETERS_FC

Description: All data from sediment samples from the flux chamber. This table is not currently in use and its integrity has not been checked recently.

Program: UPDATE_RM_SED_PARAMETERS_FC.SQL

Column Name	Data Type	Length	Description
SAMPLE_ID	VARCHAR2	5	Unique sample identifier and link to RM_SAMPLE
REPLICATE	NUMBER	1	Replicate number
TIME_START	VARCHAR2	4	Time the experiment started (hhmm)
VOL_CHAMBER	NUMBER	4	Volume of water in the chamber (ml)
L_D	VARCHAR2	1	Was the flux chamber light or dark?
TIME_MIN	NUMBER	3	Time from start of the experiment (minutes)
SI	NUMBER	5,2	Concentration of dissolved silica as SiO_2 (µM)
TDPO4	NUMBER	5,2	Total concentration of dissolved phosphate (PO_4^{3-}) (µM)
TDNH4	NUMBER	5,2	Total concentration of dissolved ammonia (NH_4^+) (µM)
TDNO2_NO3	NUMBER	5,2	Total concentration of dissolved nitrite plus nitrate ($NO_2^- + NO_3^-$) (µM)
TDN	NUMBER	5,2	Total concentration of dissolved nitrogen (µM)
DIPO4	NUMBER	5,2	Concentration of dissolved inorganic phosphate (PO_4^{3-}) (µM)

RM_SED_PARAMETERS_F (continued)

Column Name	Data Type	Length	Description
DINH4	NUMBER	5,2	Concentration of dissolved inorganic ammonia (NH_4^+) (µM)
DINO2_NO3	NUMBER	5,2	Concentration of dissolved inorganic nitrite plus nitrate (NO_2^- + NO_3^-) (µM)
DINO2	NUMBER	5,2	Concentration of dissolved inorganic nitrite (NO_2^-) (µM)
DINO3	NUMBER	5,2	Concentration of dissolved inorganic nitrate (NO_3^-) (µM)
TDIN	NUMBER	5,2	Total concentration of dissolved nitrogen (µM)
DON	NUMBER	5,2	Concentration of dissolved organic nitrogen (µM)
DOP	NUMBER	5,2	Concentration of dissolved organic phosphate (µM)
NPOC	NUMBER	6,3	Concentration of non-purgable organic carbon (mg/l)

Table Name: RM_SED_DINUTRIENTS_PW

Description: Dissolved inorganic nutrient data from pore water. This table is not currently in use and its integrity has not been checked recently.

Column Name	Data Type	Length	Description
SAMPLE_ID	VARCHAR2	5	Unique sample identifier and link to RM_SAMPLE
REPLICATE	NUMBER	1	Replicate number
DEPTH_CODE	VARCHAR2	1	Code for the distance from the top of the core (cm)
DIPO4	NUMBER	6,2	Concentration of phosphate (PO_4^{3-}) (µM)
DINH4	NUMBER	6,2	Concentration of ammonia (NH_4^+) (µM)
DINO2_NO3	NUMBER	6,2	Concentration of nitrite plus nitrate (NO_2^- + NO_3^-) (µM)
DINO2	NUMBER	6,2	Concentration of nitrite NO_2^- (µM)
COMMENTS	VARCHAR2	50	Additional comments

Table Name: RM_SED_NPOC_PW

Description: Non-purgable organic carbon data from pore water. This table is not currently in use and its integrity has not been checked recently.

Column Name	Data Type	Length	Description
SAMPLE_ID	VARCHAR2	5	Unique sample identifier and link to RM_SAMPLE
REPLICATE	NUMBER	1	Replicate number
DEPTH_CODE	VARCHAR2	1	Code for the distance from the top of the core (cm)
BLANK1	NUMBER	6,3	?
BLANK2	NUMBER	6,3	?
STANDARD	NUMBER	6,3	?
INIT_SAMP	NUMBER	6,3	?
NPOC	NUMBER	6,3	Concentration of non-purgable organic carbon (mg/l)
COMMENTS	VARCHAR2	50	Additional comments

Table Name: RM_SED_TDNUTRIENTS_PW

Description: Total dissolved nutrient data from pore water. This table is not currently in use and its integrity has not been checked recently.

Column Name	Data Type	Length	Description
SAMPLE_ID	VARCHAR2	5	Unique sample identifier and link to RM_SAMPLE
REPLICATE	NUMBER	1	Replicate number
DEPTH_CODE	VARCHAR2	1	Code for the distance from the top of the core (cm)
TDPO4	NUMBER	6,2	Concentration of phosphate (PO_4^{3-}) (µM)
TDNH4	NUMBER	6,2	Concentration of ammonia (NH_4^{+}) (µM)
TDNO2_NO3	NUMBER	6,2	Concentration of nitrite plus nitrate ($NO_2^{-} + NO_3^{-}$) (µM)
TDN	NUMBER	6,2	Total concentration of nitrogen (µM)
COMMENTS	VARCHAR2	50	Additional comments

Table Name: RM_SED_CHN_BULK

Description: Total nitrogen and total carbon from bulk sediments. This table is not currently in use and its integrity has not been checked recently.

Column Name	Data Type	Length	Description
SAMPLE_ID	VARCHAR2	5	Unique sample identifier and link to RM_SAMPLE
REPLICATE	NUMBER	1	Replicate number
DEPTH_CODE	VARCHAR2	1	Code for the distance from the top of the core (cm)
TOTN	NUMBER	6,3	Total concentration of nitrogen (% dry weight)
TOTC	NUMBER	6,3	Total concentration of carbon (% dry weight)
COMMENTS	VARCHAR2	50	Additional comments

Table Name: RM_SED_TOC_BULK

Description: Total organic carbon from bulk sediment samples. This table is not currently in use and its integrity has not been checked recently.

Column Name	Data Type	Length	Description
SAMPLE_ID	VARCHAR2	5	Unique sample identifier and link to RM_SAMPLE
REPLICATE	NUMBER	1	Replicate number
DEPTH_CODE	VARCHAR2	1	Code for the distance from the top of the core (cm)
MEAN_TOC	NUMBER	5,2	Mean concentration of total organic carbon (ppm)
SD_TOC	NUMBER	5,2	Standard deviation of the concentration of total organic carbon (ppm)
VAR_TOC	NUMBER	5,2	Variance of the concentration of total organic carbon (ppm)
PER_TOC	NUMBER	5,2	Total organic carbon (% dry weight)
SD_PER_TOC	NUMBER	5,2	Standard deviation of the total organic carbon (% dry weight)
COMMENTS	VARCHAR2	50	Additional comments

Table Name: RM_SED_TP_BULK

Description: Total Phosphorus from bulk sediment samples. This table is not currently in use and its integrity has not been checked recently.

Column Name	Data Type	Length	Description
SAMPLE_ID	VARCHAR2	5	Unique sample identifier and link to RM_SAMPLE
REPLICATE	NUMBER	1	Replicate number
DEPTH_CODE	VARCHAR2	1	Code for the distance from the top of the core (cm)
TOTP	NUMBER	5,1	Total concentration of phosphorus (µg/g)
PER_TOTP	NUMBER	5,3	Total concentration of phosphorus (% dry weight)
COMMENTS	VARCHAR2	50	Additional comments

Table Name: RM_SED_PARAMETERS_BULKPW

Description: All data from sediment samples from bulk and pore water samples. This table is not currently in use and its integrity has not been checked recently.

Program: UPDATE_RM_SED_PARAMETERS_BULKPW.SQL

Column Name	Data Type	Length	Description
SAMPLE_ID	VARCHAR2	5	Unique sample identifier and link to RM_SAMPLE
REPLICATE	VARCHAR2	1	Replicate number
DEPTH_CODE	VARCHAR2	1	Code for the distance from the top of the core (cm)
TOTN	NUMBER	6,3	Total concentration of nitrogen (µg/g ?)
TOTC	NUMBER	6,3	Total concentration of carbon (µg/g ?)
MEAN_TOC	NUMBER	5,2	Mean concentration of total organic carbon (ppm)
SD_TOC	NUMBER	5,2	Standard deviation of the concentration of total organic carbon (ppm)
VAR_TOC	NUMBER	5,2	Variance of the concentration of total organic carbon (ppm)
PER_TOC	NUMBER	5,2	Total organic carbon (% dry weight)
SD_PER_TOC	NUMBER	5,2	Standard deviation of the total organic carbon (% dry weight)
TOTP	NUMBER	5,1	Total concentration of phosphorus (µg/g)
PER_TOTP	NUMBER	5,3	Total concentration of phosphorus (% dry weight)
TDPO4	NUMBER	5,2	Total concentration of dissolved phosphate (PO_4^{3-}) (µM)
TDNH4	NUMBER	5,2	Total concentration of dissolved ammonia (NH_4^+) (µM)

Table Name: RM_SED_PARAMETERS_BULKPW (continued)

Column Name	Data Type	Length	Description
TDNO2_NO3	NUMBER	5,2	Total concentration of dissolved nitrite plus nitrate (NO_2^- +NO_3^-) (µM)
TDN	NUMBER	5,2	Total concentration of dissolved nitrogen (µM)
DIPO4	NUMBER	5,2	Concentration of dissolved inorganic phosphate (PO_4^{3-}) (µM)
DINH4	NUMBER	5,2	Concentration of dissolved inorganic ammonia (NH_4^+) (µM)
DINO2_NO3	NUMBER	5,2	Concentration of dissolved inorganic nitrite plus nitrate (NO_2^- + NO_3^-) (µM)
DINO2	NUMBER	5,2	Concentration of dissolved inorganic nitrite (NO_2^-) (µM)
DINO3	NUMBER	5,2	Concentration of dissolved inorganic nitrate (NO_3^-) (µM)
TDIN	NUMBER	5,2	Total concentration of dissolved nitrogen (µM)
DON	NUMBER	5,2	Concentration of dissolved organic nitrogen (µM)
DOP	NUMBER	5,2	Concentration of dissolved organic phosphate (µM)
NPOC	NUMBER	6,3	Concentration of non-purgable organic carbon (mg/l)

Table Name: RM_PCOVER_BENTHOS

Description: Percent cover calculated on the basis of the benthic life form code. Table no longer used or updated. Replaced by views v_benthos_summary and v_vpoint_summary.

Parent Tables: RM_VPOINT, RM_VPOINT_CODES

Program: RM_PCOVER.COM

Column Name	Data Type	Length	Description
SAMPLE_ID	VARCHAR2	5	Unique sample identifier and link to RM_SAMPLE
BENTHOS	VARCHAR2	3	Code for the benthic life form category
PCOVER	NUMBER	5,2	Percent cover

Table Name: **RM_PCOVER_END_MEM_CODE**

Description: Percent cover calculated on the basis of the end member code. Table no longer used or updated.

Parent Tables: RM_VPOINT, RM_VPOINT_CODES

Program: RM_PCOVER.COM

Column Name	Data Type	Length	Description
SAMPLE_ID RM_SAMPLE	VARCHAR2	5	Unique sample identifier and link to
END_MEM_CODE	VARCHAR2	3	Code for the end member category
PCOVER	NUMBER	5,2	Percent cover

Table Name: **RM_PCOVER_FAMILY_CODE**

Description: Percent cover calculated on the basis of the family code. Table no longer used or updated. Replaced by views v_genus_summary and v_vpoint_summary.

Parent Tables: RM_VPOINT, RM_VPOINT_CODES

Program: RM_PCOVER.COM

Column Name	Data Type	Length	Description
SAMPLE_ID	VARCHAR2	5	Unique sample identifier and link to RM_SAMPLE
FAMILY_CODE	VARCHAR2	3	Code for the family
PCOVER	NUMBER	5,2	Percent cover

Table Name: RM_PCOVER_GENUS_CODE

Description: Percent cover calculated on the basis of the genus code. Table no longer used or updated. Replaced by views v_genus_summary and v_vpoint_summary.

Parent Tables: RM_VPOINT, RM_VPOINT_CODES

Program: RM_PCOVER.COM

Column Name	Data Type	Length	Description
SAMPLE_ID	VARCHAR2	5	Unique sample identifier and link to RM_SAMPLE
GENUS_CODE	VARCHAR2	3	Code for the genus
PCOVER	NUMBER	5,2	Percent cover

Table Name: RM_PCOVER_GROUP_CODE

Description: Percent cover calculated on the basis of the functional group code. Table no longer used or updated. Replaced by views v_benthos_summary and v_vpoint_summary.

Parent Tables: RM_VPOINT, RM_VPOINT_CODES

Program: RM_PCOVER.COM

Column Name	Data Type	Length	Description
SAMPLE_ID	VARCHAR2	5	Unique sample identifier and link to RM_SAMPLE
GROUP_CODE	VARCHAR2	2	Code for the functional group
PCOVER	NUMBER	5,2	Percent cover

Table Name: **RM_PCOVER_SPEC_CODE**

Description: Percent cover calculated on the basis of the species code. Table no longer used or updated.

Parent Tables: RM_VPOINT, RM_VPOINT_CODES

Program: RM_PCOVER.COM

Column Name	Data Type	Length	Description
SAMPLE_ID	VARCHAR2	5	Unique sample identifier and link to RM_SAMPLE
SPEC_CODE	VARCHAR2	7	Code for the species
PCOVER	NUMBER	5,2	Percent cover

Table Name: **RM_PCOVER_SUBSTRATE_CODE**

Description: Percent cover calculated on the basis of the substrate code. Table no longer used or updated.

Parent Tables: RM_VPOINT

Program: RM_PCOVER.COM

Column Name	Data Type	Length	Description
SAMPLE_ID	VARCHAR2	5	Unique sample identifier and link to RM_SAMPLE
SUBSTRATE_CODE	VARCHAR2	7	Code for the substrate
PCOVER	NUMBER	5,2	Percent cover

Table Name: RM_PCOVER_VIDEO_CODE

Description: Percent cover calculated on the basis of video code. Table no longer used or updated.

Parent Tables: RM_VPOINT, RM_VPOINT_CODES

Program: RM_PCOVER.COM

Column Name	Data Type	Length	Description
SAMPLE_ID	VARCHAR2	5	Unique sample identifier and link to RM_SAMPLE
VIDEO_CODE	NUMBER	3	Code for the combination of species and benthic lifeform
PCOVER	NUMBER	5,2	Percent cover

3.3 THE FEEDING PREFERENCE DATA GROUP

Table Name: PREF_SAM

Description: Master table which lists sampling details for records contained in the tables PREF_IND and PREF_NEA. Table no longer used or updated.

Column Name	Data Type	Length	Description
SAMPLE_ID	NUMBER	2	Unique sample identifier and link to the other tables in the data group
IND_NOS	VARCHAR2	9	The range of individual COTS identifiers for each sample period
REEF_NAME	VARCHAR2	15	Name of the reef
REEF_ID	NUMBER	5	Code which uniquely identifies each reef
SAMPLE_DATE	DATE		Date information was recorded
TIME	VARCHAR2	1	Code for time of day
SEA	VARCHAR2	1	Code for sea state
WIND	VARCHAR2	1	Code for wind speed
CLOUD	VARCHAR2	1	Code for cloud cover
SITE	VARCHAR2	9	Site on the reef
LOCATION	VARCHAR2	2	Location on reef

Table Name: PREF_IND

Description: Details of the individual starfish observed. Table no longer used or updated.

Column Name	Data Type	Length	Description
SAMPLE_ID	NUMBER	2	Sample identifier and link to PREF_SAM
INDIV_NO	NUMBER	4	Unique COTS identifier
DEPTH	NUMBER	2	Depth at which COTS was observed (m)
HABITAT	VARCHAR2	2	Code for the habitat where was COTS found?
OUTBREAK	VARCHAR2	1	Is the reef outbreaking?
DISTRIB	VARCHAR2	1	Code for the distribution of COTS
DENSITY	VARCHAR2	1	Code for the density of COTS
CRYPTIC	VARCHAR2	1	Were the COTS cryptic?
DIAMETER	NUMBER	2	Diameter of COTS (cm)
CONDITION	VARCHAR2	1	Code for the condition of COTS
DAMAGE	VARCHAR2	1	Was the COTS damaged?
ACTIVITY	VARCHAR2	1	Code for the activity of COTS
SUBSTRATE	VARCHAR2	3	Substrate the COTS was found on
C_GENUS	VARCHAR2	15	Coral genus (if substrate is coral)
C_FORM	VARCHAR2	2	Coral form
C_DIAMETER	NUMBER	4	Coral diameter (cm)
C_COVER	NUMBER	1	Live coral cover code

Table Name: PREF_NEA

Description: Details of the five closest corals to the coral being fed on, occurring within 50cm radius and greater than 3cm in diameter. Table no longer used or updated.

Column Name	Data Type	Length	Description
SAMPLE_ID	NUMBER	2	Sample identifier and link to PREF_SAM
INDIV_NO	NUMBER	4	Unique starfish identifier
GENUS	VARCHAR2	17	Coral genus
FORM	VARCHAR2	3	Coral form
DISTANCE	NUMBER	3	Distance from the coral being fed on (cm)
DIAMETER	NUMBER	3	Coral diameter (cm)
COMMENTS	VARCHAR2	5	Additional comments

3.4 THE CROWN-OF-THORNS BIBLIOGRAPHIC DATA GROUP

Table Name: COT_BIBLIO

Description: A listing of the crown-of-thorns bibliography. Table no longer used or updated. A copy of this table was sent to Bob McDonald at the library to create a bibliography database.

Column Name	Data Type	Length	Description
AUTHOR1	VARCHAR2	76	Line 1 of author
AUTHOR2	VARCHAR2	76	Line 2 of author
TITLE1	VARCHAR2	76	Line 1 of title
TITLE2	VARCHAR2	76	Line 2 of title
TITLE3	VARCHAR2	76	Line 3 of title
TITLE4	VARCHAR2	76	Line 4 of title
TITLE5	VARCHAR2	76	Line 5 of title
REF1	VARCHAR2	76	Line 1 of reference
REF2	VARCHAR2	76	Line 2 of reference
REF3	VARCHAR2	76	Line 3 of reference
REF4	VARCHAR2	76	Line 4 of reference
REF5	VARCHAR2	76	Line 5 of reference
CLASS	VARCHAR2	76	Classification of the contents
YEAR	NUMBER	4	Year published
STATUS	VARCHAR2	1	Identifies publications known to have been published but not obtained
NEW	VARCHAR2	1	Added since the most recent edition

APPENDIX II

Descriptions of the boundaries of the AIMS sectors used in the Reef Monitoring Database. Sectors within the Great Barrier Reef are based on the 1:250,000 maps included in GBRMPA zoning plans (GBRMPA; 1985,1987a,b,1992) and are listed north to south. Sectors are grouped by broad geographic location.

The Great Barrier Reef

Cape Grenville (CG): *Northern boundary*: Latitude 10°41'S (the northern boundary of the Great Barrier Reef Marine Park). *Southern boundary*: A line from Cape Direction and between First Small Reef (124°2'S,143°48'E) and reef number 12-114 (12°45'S,143°49'E).

Princess Charlotte Bay (PC): *Northern boundary*: Southern boundary of the Cape Grenville sector. *Southern boundary*: A line from the NW tip of Cape Melville running west of Pipon Island (14°07'S,144°31'E) and between reef number 13-132 (13°58'S,144°37'E) and Eves Reef (13°57'S,144°34'E).

Cooktown/Lizard Island (CL): *Northern boundary*: Southern boundary of the Princess Charlotte Bay sector. *Southern boundary*: A line running from the mouth of the Bloomfield River, south of Endeavour Reef (15°47'S,145°35'E) passing between Lena (15°39'S,145°48'E) and Pearl (15°42'S,145°48'E) Reefs.

Cairns (CA): *Northern boundary*: Southern boundary of the Cooktown/Lizard Island sector. *Southern boundary:* A line passing south of Thetford (16°48'S,146°11'E) and Flynn (16°44'S,146°16'E) Reefs and north of Moore (16°52'S,146°14'E) and Milln (16°47'S,146°17'E) Reefs.

Innisfail (IN): *Northern boundary*: Southern boundary of the Cairns sector. *Southern boundary*: A line from the NW tip of Cape Sandwich passing between reef numbers 17-069 (17°59'S,146°46'E) and 18-016 (18°01'S,146°51'E).

Townsville (TO): *Northern boundary*: Southern boundary of the Innisfail sector. *Southern boundary*: A line from Cape Bowling Green passing north of Bowden Reef (19°02'S,147°56'E), south of reef number 18-101 (18°55'S,147°57'E) and between reef numbers 18-108 (18°50'S,148°06'E) and 18-110 (18°51'S,148°09'E).

Cape Upstart (CU): *Northern boundary*: Southern boundary of the Townsville sector. *Southern boundary:* A line through the northern tip of Gloucester Island (20°03'S,148°28'E) passing between reef numbers 19-111 (19°31'S,149°13'E) and 19-112 (19°32'S,149°14'E).

Whitsunday (WH): *Northern boundary*: Southern boundary of the Cape Upstart sector. *Southern boundary:* A line from Carpet Snake Island (20°49'S,148°50'E) passing south of Square Reef (20°04'S,149°49'E) and between Oom (19°50'S,150°11'E) and Wyatt Earp (19°52'S,150°13'E) Reefs.

Pompey Complex (PO): *Northern boundary*: Southern boundary of the Whitsunday sector. *Southern boundary:* A line from Island Head passing south of reef number 21-140 (21°29'S,151°17'E), intersecting a line passing south of reef number 21-138 (21°26'S,151°25'E), north of reef number 21-177 (21°20'S,151°42'E) and south of Riptide Cay (21°14.5'S,151°50.5'E), intersecting a line heading north passing midway between Riptide Cay (21°14.5'S,151°50.5'E) and Laver's Cay (21°13'S,152°01'E).

Swain (SW): *Northern boundary*: Southern boundary of the Pompey Complex sector. *Western boundary*: The Capricorn Channel.

Capricorn Bunker (CB): Within the boundaries of the Capricornia Marine Park in the Mackay/Capricorn Section of the Great Barrier Reef Marine Park.

Coral Sea

Coral Sea (CS): Flinders Reefs.

Western Australia

Dampier (DA): Dampier Archipelago.

Ningaloo (NI): Ningaloo Reef

Rowley Shoals (RS): Rowley Shoals (Mermaid Reef, Clerke Reef and Imperieuse Reef)

Scott Reef (SR): Scott Reef and Seringapatam Reef