Database documentation: **rlcs**

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1   Database Document Series

The National Institute of Water and Atmospheric Research (NIWA) currently carries out the role of Data Manager and Custodian for the fisheries research data owned by the Ministry of Fisheries.

The Ministry of Fisheries data set incorporates historic research data, data collected more recently by MAF Fisheries prior to the split in 1995 of Policy to the Ministry of Fisheries and research to NIWA, and currently data collected by NIWA and other agencies for the Ministry of Fisheries.

This document is a brief introduction to the rock lobster catch sampling database **rlcs**, and is a part of the database documentation series produced by NIWA. It supercedes the previous documentation by Mackay (1992)[1] and Mackay & Tyson (1998)[2] on this database.

Up to September 1992 this database was the MAF Fisheries catch sampling database **csdb** and included both the rock lobster catch sampling data and the market sampling data. At that date, in order to simplify matters, the market sampling data was moved to the **market** database. In 1994, **csdb** was renamed the **rlcs** database and now contains only rock lobster catch sampling data.

All documents in this series include an introduction to the database design, a description of the main data structures accompanied by an Entity Relationship Diagram (ERD), and a listing of all the main tables. The ERD graphically shows the relationships between the tables in **rlcs**, and the relationships between these tables and other databases.

This document is intended as a guide for users and administrators of the **rlcs** database.

Access to this database and data is restricted to specific Nominated Personnel as specified in the current Schedule 6 of the Data Management contract between the Ministry of Fisheries and NIWA. Any requests for data should in the first instance be directed to the Ministry of Fisheries.

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[1] MACKAY, K. 1992: MAF Fisheries database documentation: 1: csdb. *MAF Fisheries Internal Report No. 197*. 22p.

[2] MACKAY, K. & TYSON, P. J. 1998. Database documentation: rlcs. *NIWA Internal Report No. 33*. 45p.

2   Rock lobster Sampling Programs

2.1   Nomenclature

Term applied in text	*Usage*
red rock lobster CRA	} *Jasus edwardsii*
packhorse rock lobster PHC	} *Jasus verreauxi* (also known as the green rock lobster)
rock lobster	Generic term for either species (also known as spiny lobster).
crayfish	Rock lobster (used in table name t_crayfish)

2.2   Sources of data

The **rlcs** database predominantly contains catch sampling data related to rock lobster catch samples, for both rock lobster species. Additionally, there are morphological measurement data (including some market sampling data) within **rlcs**. It has been created in response to a need to maintain a time series on biological and CPUE data independent from the industry daily landing logs.

The basis for these data is a sample. A sample is defined as one fishing day per vessel and information relating to the day's fishing is recorded on a cover sheet.

A unique sample number, up to 10 characters long, identifies each sample: the first character denotes a geographic area; the next two characters are a sequential sample number for a calendar year, the next two characters are the year. The last five are available for identifying the data source: data collected by Rock Lobster Industry Council (RLIC) or by NIWA. The use of five characters to identify data source has been used for samples since 1 January 1998. The characters "NIWA" indicates the sample was collected by NIWA stock monitoring staff, and "RLIC" indicates RLIC staff collected the sample.

Prior to 1 January 1998, the first character of the sample number had been based on the FMA (Fisheries Management Area) codes in use when the pilot catch sampling program began in 1987. As these FMA codes subsequently changed, and as more codes were added to cover special cases, this first character identifying the area soon became irrelevant.

Guidelines for interpreting the first character of the sample number are shown in the table below:

1987 - 31 December 1997		Effective 01 January 1998	
1	Central Region	1	CRA1 – Northland
2	Auckland Region	2	CRA2 - Bay of Plenty
3	Southern Region	3	CRA3 – Gisborne
4	Challenger/Fiordland	4	CRA4 - Hawkes Bay/Wellington
5	Research samples	5	CRA5 - Canterbury/Marlborough
6	Stewart Island	6	CRA6 – Chatham Islands
7	Chatham Islands	7	CRA7 – Otago
8	NZFIB CRA3 contract samples	8	CRA8 – Southern
9	Stewart Island NZFIB samples	9	CRA9 - Westland/Taranaki
A	Chatham Islands - A. Rodger	10	CRA10- Kermadec
B	Chatham Islands - R. Anderson		
N	CRA1 Northland		

For example, there were three codes to identify Chatham Island samples depending on the type of sample and who collected them. Samples beginning with the character "A" or "B" were market samples of an entire landed catch from individual vessels collected by workers contracted to NIWA. A prefix of "7" indicates NIWA staff collected the data as part of a catch or tagging sample.

Prior to August 1993, all catch sampling in the CRA3 red rock lobster management area had the sample number prefix as "1" (Central Region). However, from August 1993, NIWA (formerly MAF Fisheries) was contracted by NZFIB to collect a specific number of samples within CRA3. To keep the NZFIB data easily identifiable from the rest of the Central Region data, which also included the Napier area, they were given a prefix of "8".

Some samples collected by industry in the Northland area in the latter part of 1997 were given a prefix of "N", as their sample numbers were duplicates of NIWA's sample numbers.

Because of the changes with the sample number prefix, the table below should be used as a guide for pre-1998 data and selection of the required data based on the attribute *area* in the table *t_sample*.

As of 1 January 1998, the first character now represents the CRA management area. These changes are shown in the table below. The attribute *area*, from *t_sample*, can still be used to select a particular statistical area within a CRA management area.

Two sets of information can be gained from a sample.

The first is data on the pot lift, which is the unit effort for the rock lobster industry. Data are recorded on the Pot Catch Form and include the number of lobsters caught (both dead and alive)

pot type, depth, soak time, bait and an escape gap code. The latter was used to identify pots with closed escape gaps during a red rock lobster tagging program. This was done under special permit during a closed season.

The second is biological data for individual rock lobsters recorded on the Length Frequency Form. It includes sex, carapace length, and tail width (across the spines on the second abdominal segment), tail length, weight, injuries, moult and run states, and the red rock lobsters status as to whether it was landed to a Licensed Fish Receiver (LFR).

Two catch sampling programs have been run. There is the primary program for the red rock lobster, and an exploration program for packhorse rock lobster

While the red and packhorse rock lobster catch sampling programs each catch both rock lobster species as a bycatch of each other's target fishery, only the packhorse rock lobster are measured in the packhorse rock lobster program. Both species are measured in the more extensive red rock lobster catch sampling program.

2.3   Data validation
This process includes instructions for data recording, simple data validation using the **checkq**[3] validation program language, PERL and C programming language scripts, followed by inserting data into a database. See Appendix 1 for a more detailed description of the processes involved.

While the **rlcs** database enforces data validation and integrity with use of referential constraints and range checks, the data go through a rigorous data validation and error checking process before being entered. The various codes used in this database are documented in Appendix 2.

3   Data Structures
3.1   Table Relationships
This database encompasses several tables. The ERD for **rlcs** (Figure 1) shows the physical data model structure[4] of the database and it's entities (each entity is implemented as a database *table*) and relationships between these tables. Each table represents an object, event, or concept in the real world that has been represented in the database. Each *attribute* of a table is a defining property or quality of the table.

All of the table's attributes are shown in the ERD. The underlined attributes represent the table's primary key[5]. This schema is valid regardless of the database system chosen, and it can remain correct even if the Database Management System (DBMS) is changed. Most of the tables in the **rlcs** database also contain special attributes, called foreign keys[6].

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[3] See local Unix manual page on **checkq**

[4] Also known as database *schema*

[5] A primary key is an attribute or a combination of attributes that contains an unique value to identify that record.

[6] A foreign key is any attribute, or a combination of attributes, in a table that is a primary key of another table. Tables are linked together through foreign keys.

Physical Data Model

Project : rlcs		
Model : Rock lobster catch sampling database		
Author : dba	Version 2.0	8/20/98

t_sample

sample_no	character(10,1)
date_s	date(10)
species	character(3,1)
CFA	character(3,1)
area	integer
vessel_no	longinteger
calipers	decimal(3,2)
recorder	character(12,1)
sampler	character(12,1)
wind1_dir	character(3,1)
beau1_scale	smallint
wind2_dir	character(3,1)
beau2_scale	smallint
swell1_dir	character(3,1)
swell1_code	smallint
swell2_dir	character(3,1)
swell2_code	smallint
method	character(1,1)
GPS	character(1,1)
vessel	character(18,1)
skipper	character(20,1)
divers	character(29,1)
remarks	character(35,1)
season	smallint
keepers	integer
kg_est	integer
kg_act	decimal(4,1)
sample_type	character(2,1)

sample_no = sample_no

sample_no = sample_no

t_effort

sample_no	character(10,1)
season	smallint
effort_no	integer
num_of_effort	integer
pot_type	character(2,1)
es_gaps	smallint
depth	integer
soak	integer
bait	integer
caught	integer
octopus	integer
no_legal	integer
legal_wt	decimal(7,4)
no_berried	integer
caught_sp2	integer
latitude	decimal(5,1)
longitude	decimal(6,1)
EorW	character(1,1)
sample_type	character(2,1)

t_bait_codes

bait_code	integer
description	character(60,1)

bait_code = bait

t_crayfish

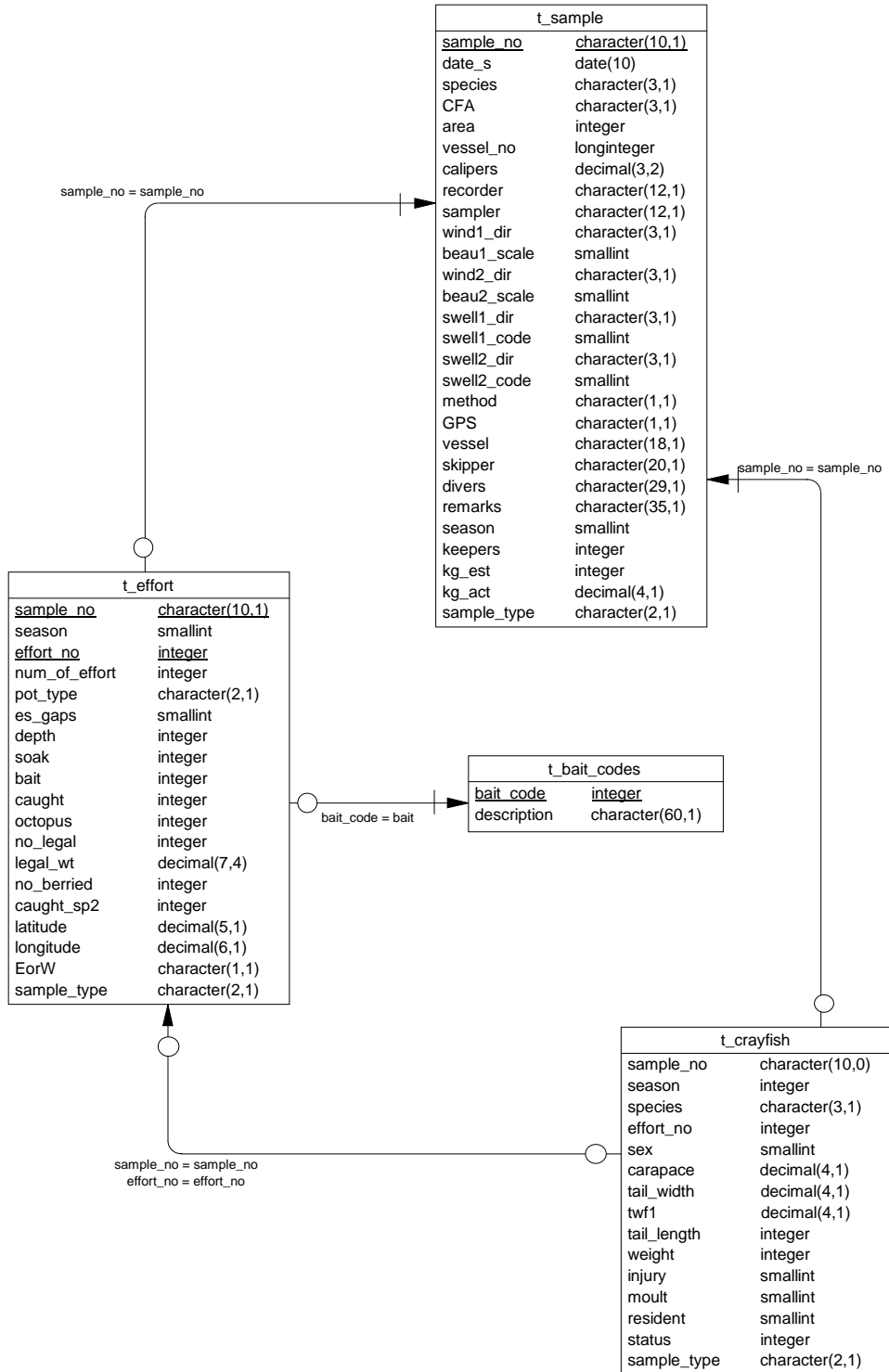| sample_no	character(10,0)
season	integer
species	character(3,1)
effort_no	integer
sex	smallint
carapace	decimal(4,1)
tail_width	decimal(4,1)
twf1	decimal(4,1)
tail_length	integer
weight	integer
injury	smallint
moult	smallint
resident	smallint
status	integer
sample_type	character(2,1)

sample_no = sample_no
effort_no = effort_no

Figure 1: Entity Relationship Diagram (ERD) for the **rlcs** database

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Section 5 shows a listing of all the **rlcs** tables as implemented by the Empress DBMS. As can be seen in the listing of the tables, a table's primary key has an unique index on it. Primary keys are generally listed using the format:

```
Indices:    UNIQUE index_name ON (attribute [, attributes])
```

where the attribute(s) make up the primary key (the key attributes) and the index name is the primary key name. Note that the typographical convention for the above format is that square brackets [] may contain more than one item or none at all. A unique index prevents records with duplicate key values from being inserted into the table; e.g., a sample with an existing sample number. Note that the table *t_crayfish* has no primary key.

The **rlcs** database is implemented as a relational database. That is, each table is a special case of the mathematical construct known as a *relation* and hence elementary relation theory is used to deal with the data within tables and the relationships between them. All relationships in **rlcs** are of the type *one-to-many*[7]. This is shown in the ERD by connecting a single line (indicating 'many') from the child table; e.g., *t_effort*, to the parent table; e.g., *t_sample*, with an arrowhead (indicating 'one') pointing to the parent. For example, consider the relationship between the tables' *t_sample* (the parent table) and *t_effort* (the child table). Any one trip in *t_sample* can have one or more stations in *t_effort*, but any one station can only be a part of one trip. Note that the word 'many' applies to the possible number of records another is associated with. For a given instance, there might be zero, one, two, or more associated records, but if it is ever possible to have more than one, we use the word 'many' to describe the association.

Note that the one-to-many relationships can be either mandatory or optional. The optional relationship, denoted in the ERD by the symbol "O" at one or both ends of the relationship line, means that a record does not have to have any associated records. Conversely, the mandatory relationship denoted in the

ERD by a bar symbol across the relationship line, means that a record has to have at least one associated record. For example, if we consider again the one-to-many relationship between the tables *t_sample* and *t_effort*, which has a mandatory 'one' and an optional 'many'. This means that one sample record can have zero or more (many) unit efforts; e.g., pot lift, recorded in the effort tables, but one unit effort in the effort table must have one, and only one, associated record in the sample table.

These relationships are enforced in the database by the use of referential constraints[8]. Constraints do not allow *orphans* to exist in any table; i.e., where a child record exists without a related parent record. This may happen when:
  i.   a parent record is deleted;
  ii. the parent record is altered so the relationship is lost;

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[7] A one-to-many relationship is where one record (the *parent*) in a table relates to one or many records (the *child*) in another table; e.g., one survey in *t_sample* can have many stations in *t_effort* but any one station can only come from one survey.
[8] Also known as integrity checks.

iii.   or a child record is entered without a parent record.

All constraints in **marlin** prevent the latter from occurring. Constraints are shown in the table listings by the following format:

```
Referential:     constraint_name (attribute[, attribute])  INSERT
                                                            DELETE
                 Parent_table (attribute[, attribute])
```

where a constraint can either be INSERT (prevents (iii) and (ii) from occurring) or DELETE (prevents (i) or (ii) from occurring). For example, consider the following constraint found in the table *data_sets*:

For example, consider the following constraint found in the table *t_effort*:

```
Referential:     cra pots loaded after cover (sample_no) INSERT t_sample
                 (sample_no)
```

This means that the value of the attribute *sample_no* in the current record must already exist in the parent table *t_sample* or the record will be rejected and the following error message will be displayed:

```
*** User Error: insert constraint 'pot catch loaded after cover' violation
```

All tables in this database are indexed. That is, attributes that are most likely to be used as a searching key have like values linked together to speed up searches. These indices are listed using the following format:

```
Indices:   NORMAL (2, 15) index_name ON (attribute [, attributes])
```

Note that indices may be simple, pointing to one attribute, or composite pointing to more than one attribute. The numbers "…(2, 15)…" in the syntax are Empress DBMS default values relating to the amount of space allocated to index storage.

3.2   Database Design

3.2.1   Rock lobster Sampling Base Tables
Conceptually, any rock lobster sampling program will involve at most 3 tables: a sample (*t_sample*, Table 1), which may or may not record effort data (*t_effort*, Table 2), and generates data on individual rock lobster (*t_crayfish*, Table 3). The attribute *sample_type* is included in each of these three tables to record which sampling program each record. At a physical implementation level, a fourth table, *t_bait_codes* (Table 4), is added to store all valid bait codes.

The ERD for these four base tables is shown in Figure 1.

Each type of sampling program can be accessed through views that filter the records for specific sample types and show attributes that are only relevant to that program.

Note that *t_sample* is only in a first normal form because the vessel name attribute *vessel* is not fully functionally dependent on the primary key *sample_no*. It is fully functionally dependent on *vessel_no* and should be in a vessel table with *vessel_no* as it's primary key. However, in some instances only the vessel name is available or multiple vessels might be involved in a sample. It has therefore been decided to leave this table in a first normal form, realising that such a form can lead to update, insertion, and deletion anomalies. Regular data audits have been implemented to compensate for this.

3.2.2   Red Rock Lobster Catch Sampling Program

The ERD for this program is shown in Figure 2. The top-level view is v_*lob_sample* (View 1). This holds records for every catch sample taken, with each record denoted by the primary key *sample_no*. Other attributes in this table describe the who/what/where of the sample and the prevailing weather. The actual landed weight, if available, and the numbers of red rock lobsters landed to a LFR are also recorded. The number of red rock lobsters landed, as stored in the attribute *keepers*, can be obtained from the sum of all red rock lobsters with *status* equal to '1' in view *v_cra_lf* only when the whole catch has been measured. As this is not always possible, a separate tally is kept to include those *keepers* from pots not measured.

From the 1993/94 fishing season, closed fishing seasons were introduced in some areas as part of a regional fisheries management plan. While normal fishing operations were banned for certain months of the year, catch sampling was permitted. The attribute *season* allows samples to be identified as being from an open or closed season. Note that *season* is an attribute common to v_*lob_sample*, v_*cra_catch* and v_*cra_lf*. In a third normal form database, this attribute should only be in v_*lob_sample*, as season is functionally dependent on only on *sample_no*. However, *season* was added to v_*cra_catch* and v_*cra_lf* to allow views of solely closed season data to be constructed on them.

The standard unit of effort is one pot lift and the effort details for CRA program are stored in the view v_*cra_catch* (View 2). For every catch sample, each pot lifted onboard is allocated a sequential pot (or set) number denoted by the attribute *pot_no*. When combined with the attribute *sample_no* this provides the primary key for *v_cra_catch*. For this catch sampling program, all rock lobsters caught in each pot are recorded in the attribute *caught*. If both red and packhorse rock lobsters are caught in one pot, *caught* represents the total of both species, and the attribute *species* is set to "RLM". These effort tables all contain the attribute *bait*, which is a foreign key to link them to the table *t_bait_codes*. This table contains all bait codes used and their definitions.

An effort is made to measure all rock lobsters caught. These measurements result in records in the view v_*cra_lf* (View 3). Every rock lobster in any given pot is measured; however, not all pots lifted may be measured. The view v_*cra_lf* contains, as attributes, the primary keys for *v_cra_catch*, which enables each rock lobster that has been measured to be linked back to the pot from which it was caught. However, v_*cra_lf* does not have a unique primary key, as it is possible that any one pot may contain several rock lobsters with identical measurements.

Physical Data Model		
Project : rlcs		
Model : Rock lobster catch sampling views		
Author : dba	Version 2.0	2/1/01

v_lob_sample

sample_no	character(10,1)
date_s	date(10)
species	character(3,1)
area	integer
vessel_no	longinteger
calipers	decimal(3,2)
recorder	character(12,1)
sampler	character(12,1)
wind1_dir	character(3,1)
beau1_scale	smallint
wind2_dir	character(3,1)
beau2_scale	smallint
swell1_dir	character(3,1)
swell1_code	smallint
swell2_dir	character(3,1)
swell2_code	smallint
method	character(1,1)
GPS	character(1,1)
vessel	character(18,1)
skipper	character(20,1)
divers	character(29,1)
remarks	character(35,1)
season	smallint
keepers	integer
kg_est	integer
kg_act	decimal(4,1)
sample_type	character(3,1)

sample_no = sample_no

v_cra_catch

sample_no	character(10,1)
season	smallint
pot_no	integer
pot_type	character(2,1)
es_gaps	smallint
depth	integer
soak	integer
bait	integer
caught	integer
octopus	integer
no_legal	integer
legal_wt	decimal(7,4)
no_berried	integer
sample_type	character(2,1)

v_cra_lf

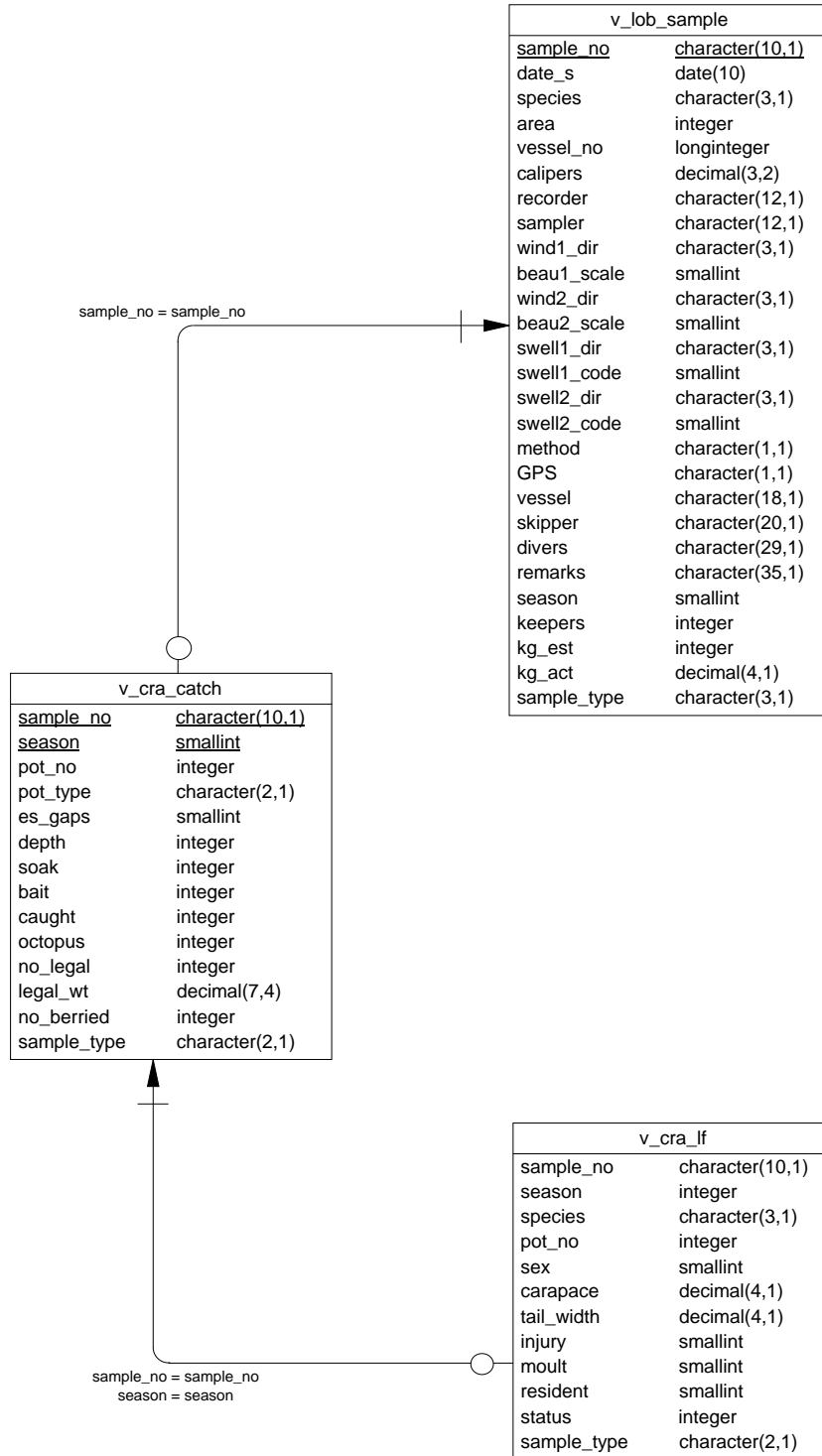| sample_no	character(10,1)
season	integer
species	character(3,1)
pot_no	integer
sex	smallint
carapace	decimal(4,1)
tail_width	decimal(4,1)
injury	smallint
moult	smallint
resident	smallint
status	integer
sample_type	character(2,1)

sample_no = sample_no
season = season

Figure 2: ERD of the views for the red rock lobster catch sampling program**.**

3.2.3 Red Rock Lobster Market/Morphology Sampling

Since 1994 there has also been samples to exclusively collect morphology data including weight, tail width, and carapace length from individual red rock lobsters. Examples of this type of data are length and weight data collected either onboard a vessel or in a packing shed (as market samples). The ERD for this program is shown in Figure 3. Details for each morphometric/market sample are in the view *v_morp_sample* (View 4). Each sample should be from one fisher's catch for one day of fishing. However, during market sampling, this has not always been possible, as catches may have been mixed while in the shed's holding tanks.

The morphometric data for individual red rock lobsters are recorded in the view v_*cra_wt* (View 5).

Physical Data Model		
Project : rlcs		
Model : Rock lobster shed morphology sampling views		
Author : dba	Version 2.0	2/1/01

v_morp_sample	
sample_no	character(10,1)
date_s	date(10)
species	character(3,1)
area	integer
vessel_no	longinteger
calipers	decimal(3,2)
method	character(1,1)
GPS	character(1,1)
vessel	character(18,1)
skipper	character(20,1)
divers	character(29,1)
remarks	character(35,1)
season	smallint
kg_act	decimal(4,1)
sample_type	character(2,1)

sample_no = sample_no

v_cra_wt	
sample_no	character(10,1)
season	integer
species	character(3,1)
sex	smallint
carapace	decimal(4,1)
tail_width	decimal(4,1)
injury	smallint
status	integer
weight	integer
sample_type	character(2,1)

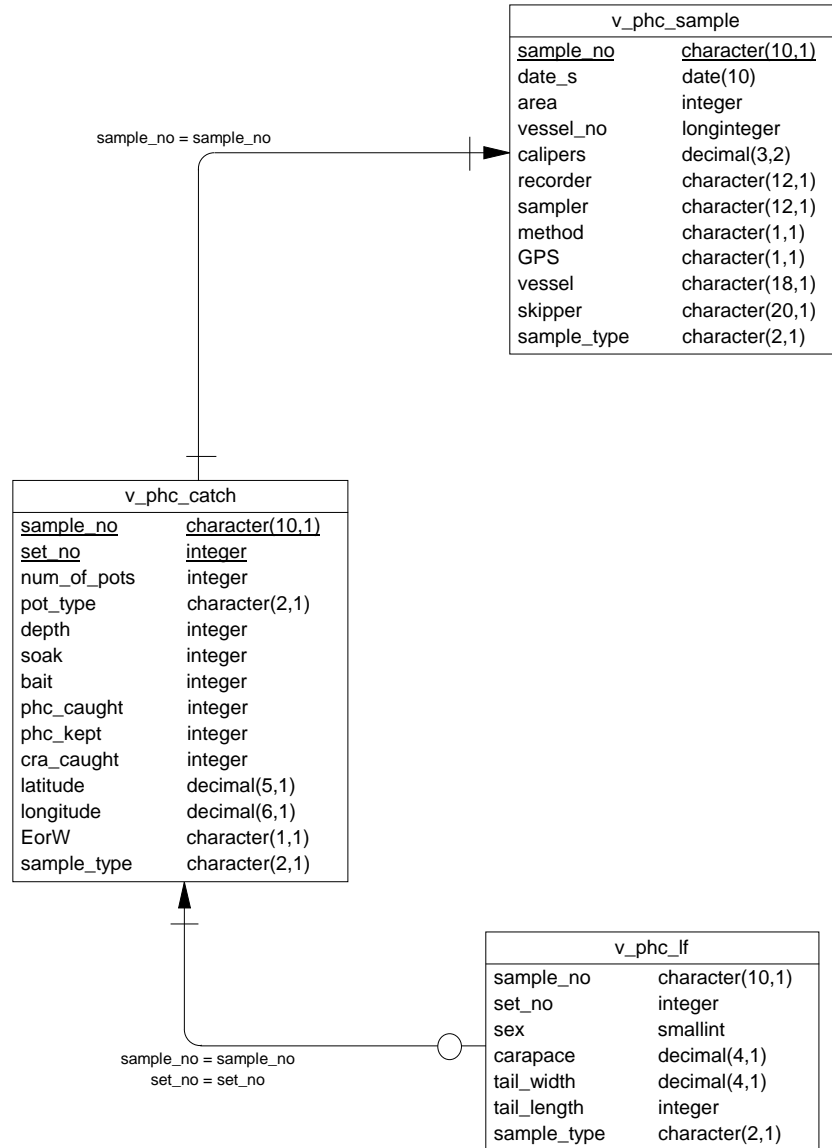**Figure 3:** ERD for the views of the market/morphology sampling program.

Figure 4: ERD of the views of the packhorse rock lobster catch sampling program.

3.2.4 Packhorse Rock Lobster Catch Sampling Program

During 1991/92, a special permit was granted to a commercial fisher to run a exploratory survey for packhorse rock lobsters. Observers in conjunction with this survey carried out a catch sampling program. The ERD for this program is shown in Figure 4.

The top-level view is v_*phc_sample* (View 6). This holds records for every catch sample taken, with each record denoted by the primary key *sample_no*.

Individual pot lift details were recorded for the first few samples of the packhorse rock lobster exploratory survey, but in subsequent samples the unit of effort was changed to a set of pot lifts, with 5-20 pot lifts per set. These effort data are stored in the view v_*phc_catch* (View 7) with the attribute *set_no* assigned sequentially to each set lifted and the attribute *num_of_pots* detailing the number of pots lifted per set. Where a record concerns a single pot lift the *num_of_pots* will be set to 1. For every catch sample, each pot (or set) lifted on board is allocated a sequential pot (or set) number denoted by the attribute *set_no*. When combined with the attribute *sample_no* this provides the primary key for v_phc_catch. The numbers of packhorse and red rock lobsters caught in each pot/set are stored in the attributes *phc_caught* and *cra_caught* respectively. These effort tables all contain the attribute *bait*, which is a foreign key to link them to the table *t_bait_codes*. This table contains all bait codes used and their definitions.

An effort is made to measure all packhorse rock lobsters caught. These measurements result in records in the table v_*phc_lf* (View 8). Every packhorse rock lobster in any given pot is measured; however, not all pots lifted may be measured.

The view v_*phc_lf* contains, as attributes, the primary keys for *v_phc_catch* so that each packhorse rock lobster measured can be linked back to the pot/set in which it was caught. However, v_*phc_lf* does not have a unique primary key, as it is possible that any one pot/set may contain several packhorse rock lobsters with identical measurements.

3.2.5   Minimum Legal Size (MLS) Investigation Sampling

There are two views, v_*mls_sample* (View 9) and v_*mls_data* (View 10), pertaining to historical (circa 1986) red rock lobster minimum legal size (MLS) investigation sampling. Details for each MLS sample are in v_mls_sample. The morphometric data for individual red rock lobsters are recorded in v_*mls_data*.

The ERD for this program is shown in Figure 5.
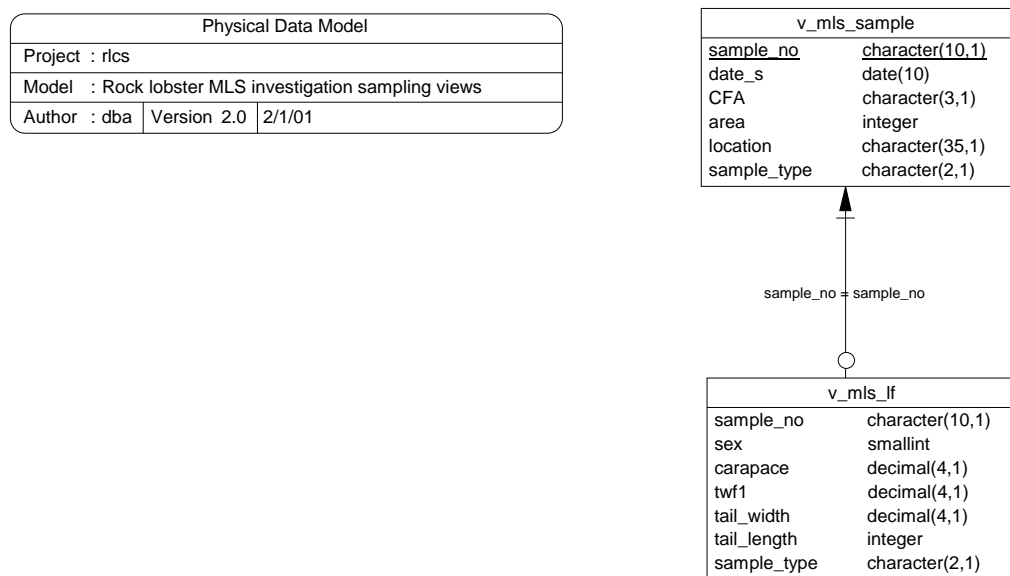
Figure 5: ERD of the views of the MLS Investigation sampling program**.**

3.2.6 Red Rock Lobster Tagging Sampling

This database can be linked to the tagging database **tag** via the table *t_releases* (attribute *trip_code*) in **tag**[9] and the view *v_tag_sample* (View 11) (attribute *sample_no*) in **rlcs**. If the pot number has been recorded on the tagging form, then joining can also be done on *station_code* and *pot_no* in the respective databases. This would only be useful for getting general information on the day's fishing, or information relating to a pot.

The ERD for this program is shown in Figure 6.
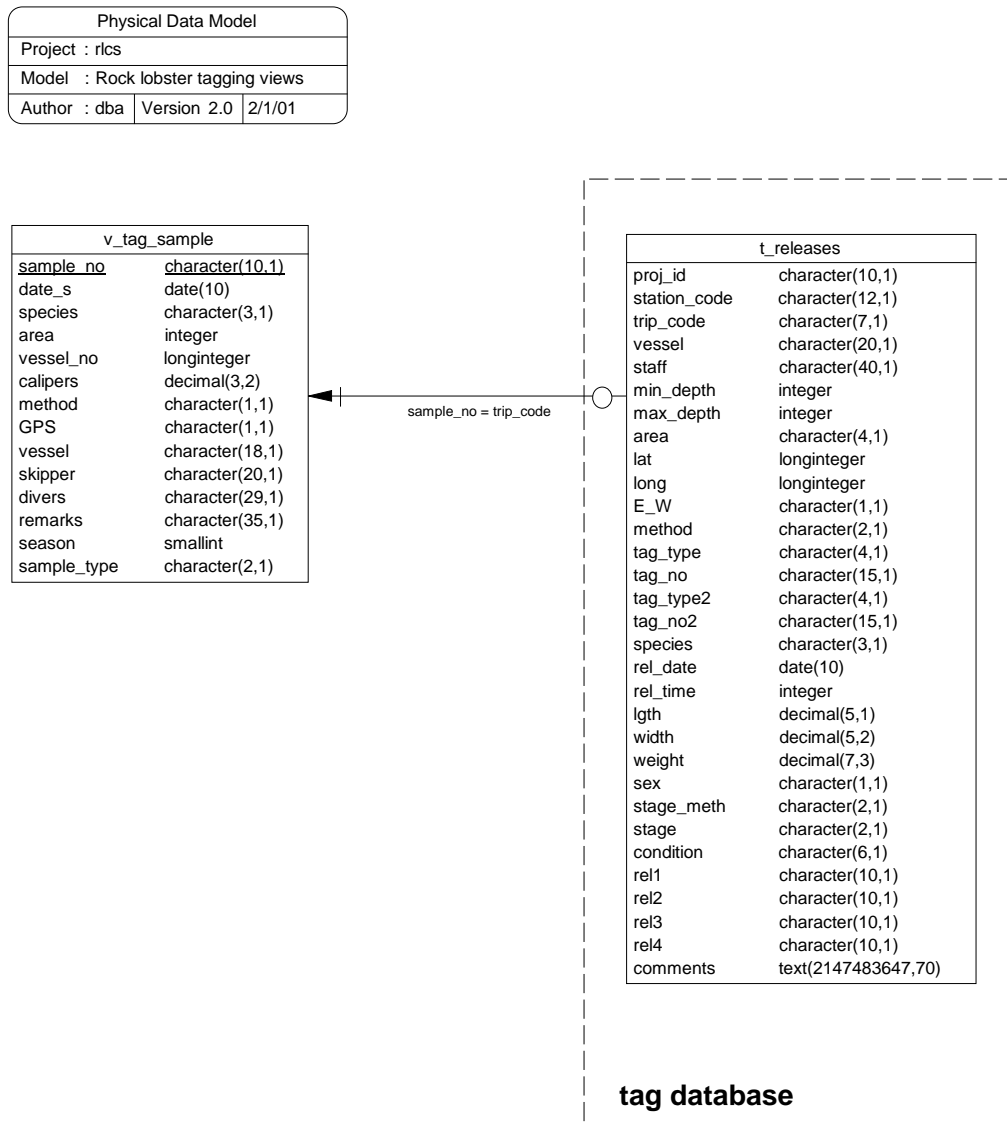
Figure 6: ERD of the rock lobster tagging program.

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[9] See WOOD, B. 1993: Marine Research database documentation. 10. Tag. *MAF Fisheries Greta Point Internal Report No. 216.* 13p.

4   Table Summaries

The following is a listing and brief outline of the tables contained in **rlcs**.

All sampling programs use the following base tables:

1. **t_sample :** contains details of all samples undertaken including details such as vessel registration number, date, skipper, sampler's names, weather conditions, season, landed weight if available, and the number of lobsters landed to a Licensed Fish Receiver (LFR).
2. **t_effort :** contains details for each unit effort (either a pot or a set of pots) used for catch sampling.
3. **t_crayfish :** contains details for individual rock lobsters.
4. **t_bait_codes :** contains a list of all bait codes and their meanings.

From these tables are a number of views.

- The red rock lobster catch sampling program uses the following views:

5. **v_lob_sample :** contains details of each sample undertaken including details such as vessel registration number, date, skipper, sampler's names, weather conditions, season, landed weight if available, and the number of red rock lobsters landed to a Licensed Fish Receiver (LFR).
6. **v_cra_catch :** contains details for each pot lifted during the sample. It includes the pot type, soak time, bait, depth set, number of live and dead lobsters caught, and codes for escape gaps and season. The latter two identify any samples, which were carried out under conditions atypical of a catch sample.
7. **v_cra_lf :** contains measurements for individual red rock lobsters which are linked to a pot in *t_cra_catch*. It also contains measurements for any packhorse rock lobsters caught during the red rock lobster catch sampling.

- The red rock lobster market sampling and morphometric sampling programs uses the following views:

8. **v_morp_sample :** contains details of each sample undertaken including details such as vessel registration number, date, skipper, and sampler's names.
9. **v_cra_wt :** contains red rock lobster morphometric data only, i.e., no effort (pot) information. Measurements may include carapace length, tail width, and/or weight.

- The packhorse rock lobster catch sampling program uses the following views:
9. **v_phc_sample :** contains details of each packhorse rock lobster sample undertaken including details such as vessel registration number, date, skipper, sampler's names, and weather conditions.

10. **v_phc_catch :** contains details for each unit effort during the sample including the number of packhorse rock lobsters caught, number of red rock lobsters caught, pot type, soak, bait used,depth and position of each unit effort. A unit effort is usually one pot lift but may be a set of many pot lifts.
11. **v_phc_lf :** contains measurements for individual packhorse rock lobsters.

- The red rock lobster Minimum Legal Size tail width feasibility study uses the following views:

12. **v_mls_sample :** contains details of each sample taken during this program.
13. **v_mls_data :** contains measurements for individual red rock lobsters.

- The red rock lobster tagging program uses the following view:

14. **v_tag_sample :** contains details of each tag sample undertaken. Tagged individual rock lobster details are stored in the *t_releases* table in the **tag** database.

5 rlcs Tables

The following listings of the tables in the **rlcs** database, including attribute names, data types (and any range restrictions), and comments.

5.1 Table 1: t_sample

Comment: This table contains the details of individual red rock lobster samples for a variety of sampling programs, including re rock lobster catch sampling, market sampling, tagging, MLS, packhorse rock lobster exploratory, and morphometric sampling.

Attributes	Data Type	Null?	Comment
sample_no	character(10,1)	No	Unique sample no: 3 character sample no., 2 digit year, 5 char data source (since 1 Jan 98).
date_s	date(4)		Date sampled.
species	character(3,1)	No	3 char species code. Only three valid codes: Red Rock Lobster CRA, Packhorse rock lobster PHC and mixed RLM.
	smatch 'CRA|PHC|RLM'		
CFA	character(3,1)		Controlled Fishing Areas. Only used during MLS samples (see t_mls_sample).
area	integer		Rock lobster statistical areas 901–943, followed by subarea used by fishers in Voluntary Logbook Program. Note area 900 is used where STATISTICAL area is undetermined, e.g., factory samples for length/weight data.
	range 900 i 943 i		
vessel_no	longinteger		Registration number of the vessel from which sampling was carried out on.
calipers	decimal(2,1)		Distance (decimal mm) that has been added to every tail width for the sample.
recorder	character(12,1)		Name of the recorder.
sampler	character(12,1)		Name of the sampler.
wind1_dir	character(3,1)		Prevalent wind direction during the soak time of the pots.
	match '[NSEW]{[NSEW]}{[NESW]}'		
	match 'VAR'		

Attributes	Data Type	Null?	Comment
beau1_scale	shortinteger range 0 i 12 i		Average Beaufort scale wind strength during the soak time of the pots.
wind2_dir	character(3,1) match '[NSEW]{[NSEW]}{[NESW]}' match 'VAR'		Direction to which the prevailing wind changed to during the soak time of the pot.
beau2_scale	shortinteger range 0 i 12 i		Beaufort scale which the prevailing wind changed to (if it changed).
swell1_dir	character(3,1) match '[NSEW]{[NSEW]}{[NESW]}'		Direction of the prevailing swell over the soak time of the pots.
swell1_code	shortinteger range 1 i 3 i		1 digit code for swell height: 1=<2m; 2=2-4m; 3=>4m
swell2_dir	character(3,1) match '[NSEW]{[NSEW]}{[NESW]}'		Direction to which the prevailing swell has changed to during the soak time of the pots.
swell2_code	shortinteger range 1 i 3 i		1 digit code for swell height: 1=<2m; 2=2-4m; 3=>4m
method	character(1,1) match '[12]'		1 char fishing method code: 1=potting; 2=diving
GPS	character(1,1) match '[01]'		1 char GPS code: 0=no GPS or present but not used; 1=GPS used
vessel	character(18,1)		Vessel name.
skipper	character(20,1)		Skipper's name.
divers	character(29,1)		Divers names.
remarks	character(35,1)		Comments about the sample.
season	smallint range 0 i 1 i		1 digit code to say whether the sample took place during an open or closed season: 1=open season; 0=closed season
keepers	integer		Actual number of rock lobsters landed to an LFR.
kg_est	integer		Estimate landed catch weight (kg).

Attributes	Data Type	Null?	Comment
kg_act	decimal(4,1)		Actual landed catch weight (kg).
sample_type	character(2,1)	No	Flag to denote which program(s) The sample is from: CS=catch sampling; TG=tagging only; CT=catch sampling and tagging; WS=market/morphometric sample; PH=packhorse exploratory; LS=MLS sampling.
	smatch 'CS|CT|LS|PH|TG|WS'		

Creator: dba
Indices: UNIQUE sample_pk ON (sample_no)
    NORMAL (2, 15) sample_sample_type_ndx ON (sample_type)
    NORMAL (2, 15) sample_area_ndx ON (area)

5.2   Table 2: t_effort

Comment: Details of each pot (or each set of pots) used in a catch sample, including pot size, materials used in pot construction, depth, soak time, and bait used.

Attributes	Data Type	Null?	Comment
sample_no	character(10,1)	No	Unique sample no: 3 character sample no., 2 digit year, 5 char data source (since 1 Jan 98).
season	smallint range 0 i 1 i		1 digit code to say whether the sample took place during an open or closed season: 1=open season; 0=closed season
effort_no	integer	No	A sequential number given to each effort (a pot or a set of pots) lifted during a sample.
num_of_effort	integer		Number of pots used in the set (effort).
pot_type	character(2,1) smatch '[A-Z0-9][0-9]'	No	2 char code for pot type: first denotes the materials used in construction; the second denotes mesh size. Refer to Rock Lobster Catch Sampling Manual or Appendix 2 of database documentation for codes.
es_gaps	smallint range 0 i 1 i		1 digit code for escape gaps in the pot: 0=escape gaps wired closed; 1=normal escape gaps.
depth	integer		Depth in metres that the pot/set.
soak	integer		Soak time (hours).
bait	integer		Code for bait used. Refer t_bait_codes
caught	integer		Number of live rock lobsters caught.
octopus	integer		1 digit code for octopus attacks on potted rock lobster: 0-8=no. of dead, limp lobsters, or empty shell as a result of octopus; 9=octopus only
no_legal	integer		Number of legal rock lobsters.
legal_wt	decimal(7,4)		Weight (kg) of legal rock lobsters.

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Attributes	Data Type	Null?	Comment
no_berried	integer		Number of berried female rock lobsters.
caught_sp2	integer		Number of non-target rock lobsters caught e.g., no. of CRA caught when target species is PHC.
latitude	decimal(5,1)		Latitude (degrees & decimal minutes) of the pot/set (DDMM.m).
	match '[3-6][0-9][0-5][0-9].[0-9]'		
longitude	decimal(6,1)		Longitude (degrees & decimal minutes) of the pot/set (DDDMM.m).
	match '1[7-8][0-9][0-5][0-9].[0-9]' = 18000.0		
EorW	character(1,1)		Meridian of pot/set: E=east; W=west
	match '[EW]'		
sample_type	character(2,1)	No	Flag to denote which program(s) The sample is from: CS=catch sampling; PH=packhorse exploratory.
	smatch 'CS|PH'		

Creator:	dba
Referential:	Invalid bait code (bait) INSERT t_bait_codes (bait_code) cra pots loaded after cover (sample_no) INSERT t_sample (sample_no)
Indices:	UNIQUE effort_pk ON (sample_no, pot_no) NORMAL (2, 15) effort_sample_type_ndx ON (sample_type)

5.3   Table 3: t_crayfish

Comment: Details of individual rock lobsters, such as sex, tail width, and weight.

Attributes	Data Type	Null?	Comment
sample_no	character(10,1)	No	Unique sample no: 3 character sample no., 2 digit year, 5 char data source (since 1 Jan 98).
season	smallint range 0 i 1 i		1 digit code to say whether the sample took place during an open or closed season: 1=open season; 0=closed season
species	character(3,1) smatch 'CRA|PHC'	No	3 char species code: CRA=red rock lobster; PHC=packhorse rock lobster.
effort_no	integer		A sequential number given to each effort (a pot or a set) lifted. Provides a link to t_effort.
sex	smallint range 0 i 7 i = 9		1 digit sex code: 1=male; 2-9=female of varying maturity; 0 = hermaphrodite. Refer to Rock Lobster Catch Sampling Manual or Appendix 2 of database documentation for codes.
carapace	decimal(4,1)		Carapace length (mm).
tail_width	decimal(4,1)		Width of tail (decimal mm) between the primary spines of the second abdominal segment.
twf1	decimal(4,1)		Width of tail (decimal mm) across the first calcified bar.
injury	smallint range 0 i 9 i		1 digit code of rock lobster injury: 0-8=number of missing appendages; 9=body or tail damage.
moult	smallint match '[015]'		1 digit code for moult stage: 1=hard shell; 0 = old shell;5 = soft shell.
resident	smallint range 0 i 1 i		1 digit code to denote if lobster is resident (=0), or run (=1).

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Attributes	Data Type	Null?	Comment
status	smallint		1 digit code for landing status: 0 = not kept; 1 = kept for landing.
	range 0 i 1 i		
sample_type	character(2,1)	No	Flag to denote which program(s) The sample is from: CS=catch sampling; WS=market/morphometric sampling; PH=packhorse exploratory; LS=MLS sampling.
	smatch 'CS|LS|PH|WS'		

Creator: dba
Referential: cra lfs loaded after cover (sample_no) INSERT
t_sample (sample_no)
Indices: NORMAL (2, 15) crayfish_species_ndx ON (species)
NORMAL (2, 15) crayfish_sample_no_ndx ON (sample_no)
NORMAL (2, 15) crayfish_sample_type_ndx ON (sample_type)
NORMAL (2, 15) crayfish_sex_ndx ON (sex)

5.4   Table 4: t_bait_codes

Comment: This table contains all valid bait codes.

Attributes	Data Type	Null?	Comment
bait_code	integer	No	3 digit numeric code for species and processed state of bait used.
description	character(60,1)	No	Description of the bait code.

Creator: sma
Indices: UNIQUE bait_codes_pk ON (bait_code)

6   rlcs Views

The following listings of the views in the **rlcs** database, including attribute names, data types (and any range restrictions), and comments.

6.1   View 1: v_lob_sample

Comment: Details of a red rock lobster catch sample. Refer t_sample for attribute comments.

View: select attr 'sample_no', attr 'date_s', attr 'species', attr 'area', attr 'vessel_no', attr 'calipers', attr 'recorder', attr 'sampler', attr 'wind1_dir', attr 'beau1_scale', attr 'wind2_dir', attr 'beau2_scale', attr 'swell1_dir', attr 'swell1_code', attr 'swell2_dir', attr 'swell2_code', attr 'method', attr 'GPS', attr 'vessel', attr 'skipper', attr 'divers', attr 'remarks', attr 'season', attr 'keepers', attr 'kg_est', attr 'kg_act', attr 'sample_type' from 't_sample' where ((attr 'sample_type' = 'CS' or attr 'sample_type' = 'CT'))

Attributes	Data Type	Null?
sample_no	character(10,1)	Not Null
date_s	date(4)	
species	character(3,1)	Not Null
area	integer	
vessel_no	longinteger	
calipers	decimal(3,2)	
recorder	character(12,1)	
sampler	character(12,1)	
wind1_dir	character(3,1)	
beau1_scale	smallint	
wind2_dir	character(3,1)	
beau2_scale	smallint	
swell1_dir	character(3,1)	
swell1_code	smallint	
swell2_dir	character(3,1)	
swell2_code	smallint	
method	character(1,1)	
GPS	character(1,1)	
vessel	character(18,1)	
skipper	character(20,1)	
divers	character(29,1)	
remarks	character(35,1)	
season	smallint	
keepers	integer	
kg_est	integer	
kg_act	decimal(4,1)	
sample_type	character(2,1)	Not Null

6.2   View 2: v_cra_catch

Comment: Details of each pot used during a red rock lobster catch sample.
Refer t_effort for attribute comments.

View: select attr 'sample_no', attr 'season', attr 'effort_no'
print 'pot_no', attr 'pot_type', attr 'es_gaps', attr
'depth', attr 'soak', attr 'bait', attr 'caught', attr
'octopus', attr 'no_legal', attr 'legal_wt', attr
'no_berried', attr 'sample_type' from 't_effort' where
(attr 'sample_type' = 'CS')

Attributes	Data Type	Null?
sample_no	character(10,1)	Not Null
season	smallint	
pot_no	integer	Not Null
pot_type	character(2,1)	Not Null
es_gaps	smallint	
depth	integer	
soak	integer	
bait	integer	
caught	integer	
octopus	integer	
no_legal	integer	
legal_wt	decimal(7,4)	
no_berried	integer	
sample_type	character(2,1)	Not Null

6.3   View 3: v_cra_lf

Comment: Details of individual rock lobsters measured during a red rock
lobster catch sample. Refer t_crayfish for attribute comments.

View: select attr 'sample_no', attr 'season', attr 'species',
attr 'effort_no' print 'pot_no', attr 'sex', attr
'carapace', attr 'tail_width', attr 'injury', attr 'moult',
attr 'resident', attr 'status', attr 'sample_type' from
't_crayfish' where (attr 'sample_type' = 'CS')

Attributes	Data Type	Null?
sample_no	character(10,1)	Not Null
season	smallint	
species	character(3,1)	Not Null
pot_no	integer	
sex	smallint	
carapace	decimal(4,1)	
tail_width	decimal(4,1)	
injury	smallint	
moult	smallint	
resident	smallint	
status	integer	
sample_type	character(2,1)	Not Null

6.4   View 4: **v_morp_sample**

Comment: Details of a market/morphometric sample. Refer t_sample for
attribute comments.

View: select attr 'sample_no', attr 'date_s', attr 'species',
attr 'area', attr 'vessel_no', attr 'calipers', attr
'method', attr 'GPS', attr 'vessel', attr 'skipper', attr
'divers', attr 'remarks', attr 'season', attr 'kg_act',
attr 'sample_type' from 't_sample' where (attr
'sample_type' = 'WS')

Attributes	Data Type	Null?
sample_no	character(10,1)	Not Null
date_s	date(4)	
species	character(3,1)	Not Null
area	integer	
vessel_no	longinteger	
calipers	decimal(3,2)	
method	character(1,1)	
GPS	character(1,1)	
vessel	character(18,1)	
skipper	character(20,1)	
divers	character(29,1)	
remarks	character(35,1)	
season	smallint	
kg_act	decimal(4,1)	
sample_type	character(2,1)	Not Null

6.5   View 5: **v_cra_wt**

Comment: Details of individual red rock lobsters measured during a
market/morphometric sample. Refer t_crayfish for attribute
comments.

View: select attr 'sample_no', attr 'season', attr 'species',
attr 'sex', attr 'carapace', attr 'tail_width', attr
'injury', attr 'status', attr 'weight', attr 'sample_type'
from 't_crayfish' where (attr 'sample_type' = 'WS')

Attributes	Data Type	Null?
sample_no	character(10,1)	Not Null
season	integer	
species	character(3,1)	Not Null
sex	smallint	
carapace	decimal(4,1)	
tail_width	decimal(4,1)	
injury	smallint	
status	integer	
weight	integer	
sample_type	character(2,1)	Not Null

6.6   View 6: **v_phc_sample**

Comment: Details of a packhorse rock lobster exploratory catch sample.
Refer t_sample for attribute comments.

View: select attr 'sample_no', attr 'date_s', attr 'area', attr
'vessel_no', attr 'calipers', attr 'recorder', attr
'sampler', attr 'method', attr 'GPS', attr 'vessel', attr
'skipper', attr 'sample_type' from 't_sample' where (attr
'sample_type' = 'PH')

Attributes	Data Type	Null?
sample_no	character(10,1)	Not Null
date_s	date(4)	
area	integer	
vessel_no	longinteger	
calipers	decimal(3,2)	
recorder	character(12,1)	
sampler	character(12,1)	
method	character(1,1)	
GPS	character(1,1)	
vessel	character(18,1)	
skipper	character(20,1)	
sample_type	character(2,1)	Not Null

6.7   View 7: v_phc_catch

Comment: Details of each pot/set used during a packhorse rock lobster
exploratory catch sample. Refer t_effort for attribute comments.

View: select attr 'sample_no', attr 'effort_no' print 'set_no',
attr 'num_of_effort' print 'num_of_pots', attr 'pot_type',
attr 'depth', attr 'soak', attr 'bait', attr 'caught' print
'phc_caught', attr 'no_legal' print 'phc_kept', attr
'caught_sp2' print 'cra_caught', attr 'latitude', attr
'longitude', attr 'EorW', attr 'sample_type' from
't_effort' where (attr 'sample_type' = 'PH')

Attributes	Data Type	Null?
sample_no	character(10,1)	Not Null
set_no	integer	Not Null
num_of_pots	integer	
pot_type	character(2,1)	Not Null
depth	integer	
soak	integer	
bait	integer	
phc_caught	integer	
phc_kept	integer	
cra_caught	integer	
latitude	decimal(5,1)	
longitude	decimal(6,1)	
EorW	character(1,1)	
sample_type	character(2,1)	Not Null

6.8   View 8: v_phc_lf

Comment: Details of individual packhorse rock lobsters measured during a
packhorse rock lobster exploratory catch sample. Refer t_crayfish
for attribute comments.

View: select attr 'sample_no', attr 'effort_no' print 'set_no',
attr 'sex', attr 'carapace', attr 'tail_width', attr
'tail_length', attr 'sample_type' from 't_crayfish' where
(attr 'sample_type' = 'PH')

Attributes	Data Type	Null?
sample_no	character(10,1)	Not Null
set_no	integer	
sex	smallint	
carapace	decimal(4,1)	
tail_width	decimal(4,1)	
tail_length	integer	
sample_type	character(2,1)	Not Null

6.9   View 9: v_mls_sample

Comment: Details of a red rock lobster Minimum Legal size (MLS)
                investigation sample. Refer to t_sample for attribute comments.

View: select attr 'sample_no', attr 'date_s', attr 'CFA', attr
                'area', attr 'remarks' print 'location', attr 'sample_type'
                from 't_sample' where (attr 'sample_type' = 'LS').

Attributes	Data Type	Null?
sample_no	character(10,1)	Not Null
date_s	date(4)	
CFA	character(3,1)	
area	integer	
location	character(35,1)	
sample_type	character(2,1)	Not Null

6.10   View 10: v_mls_lf

Comment: Details of individual red rock lobsters measured during a MLS
                investigation sample. Refer t_crayfish for attribute comments.

View: select attr 'sample_no', attr 'sex', attr 'carapace', attr
                'twf1', attr 'tail_width', attr 'tail_length', attr
                'sample_type' from 't_crayfish' where (attr 'sample_type' =
                'LS')

Attributes	Data Type	Null?
sample_no	character(10,1)	Not Null
sex	smallint	
carapace	decimal(4,1)	
twf1	decimal(4,1)	
tail_width	decimal(4,1)	
tail_length	integer	
sample_type	character(2,1)	Not Null

6.11   View 11: **v_tag_sample**

Comment: Details of a tag sample. Refer t_sample for attribute comments.

View: select attr 'sample_no', attr 'date_s', attr 'species',
                 attr 'area', attr 'vessel_no', attr 'calipers', attr
                 'method', attr 'GPS', attr 'vessel', attr 'skipper', attr
                 'divers', attr 'remarks', attr 'season', attr 'sample_type'
                 from 't_sample' where ((attr 'sample_type' = 'TG' or attr
                 'sample_type' = 'CT'))

Attributes	Data Type	Null?
sample_no	character(10,1)	Not Null
date_s	date(4)	
species	character(3,1)	Not Null
area	integer	
vessel_no	longinteger	
calipers	decimal(3,2)	
method	character(1,1)	
GPS	character(1,1)	
vessel	character(18,1)	
skipper	character(20,1)	
divers	character(29,1)	
remarks	character(35,1)	
season	smallint	
sample_type	character(2,1)	Not Null

6 rlcs Business Rules

6.1 Introduction to business rules

The following are a list of business rules applying to the **rlcs** database. A business rule is a written statement specifying what the information system (i.e., any system that is designed to handle market sampling data) must do or how it must be structured.

There are three recognised types of business rules:

Fact   Certainty or an existence in the information system.
Formula   Calculation employed in the information system.
Validation   Constraint on a value in the information system.

Fact rules are shown on the ERD by the cardinality (e.g., one-to-many) of table relationships. Formula and Validation rules are implemented by referential constraints, range checks, and algorithms both in the database and during validation.

Validation rules may be part of the preloading checks on the data as opposed to constraints or checks imposed by the database. These rules sometimes state that a value <u>should</u> be within a certain range. All such rules containing the word 'should' are conducted by preloading software. The use of the word 'should' in relation to these validation checks means that a warning message is generated when a value falls outside this range and the data are then checked further in relation to this value.

6.2   Summary of rules

Sample details (t_sample)

sample_no   Sample number must be a unique. Sample numbers are in the following format: 3-digit incremental sample number; 2-digit year; and up to 5-character data source code.

date_s   Must be a valid date.

species   Must be either equal to "CRA", "PHC", or "RLM".

area   Must be a valid rock lobster statistical area code as listed in the *area_codes* table in the **rdb** table.

vessel_no   Must be a number between 1 and 99999.

calipers   Must be a number that equals 0.0, or should be within the reasonable range of 1.5 – 4.0

wind1_dir}   Must be equal to "VAR", or one of the 16 valid wind direction based
wind2_dir}   on the characters "N", "S", "E", and "W".
swell1_dir}
swell2_dir}

beau1_scale}   Must be a valid beaufort scale code as listed in Appendix 2.
beau2_scale}

swell1_code}   Must be a valid swell height code as listed in Appendix 2.
swell2_code}

method   Must be either a 1 or 2.

GPS   Must be either a 0 or 1.

season   Must be either a 0 or 1.

keepers   Must be an integer greater or equal to 0..

kg_est}   Must be an integer 0 or greater and should be within the reasonable
kg_act}   range of 0 - 2000

sample_type   Must be a valid sample type code as listed in the *t_sample_type* table.

Pot details (t_effort)

sample_ no   Must be a valid sample number as listed in the *t_sample* table.

season   Must be either a 0 or 1.

effort_no   Must be an integer greater than zero and should be within the reasonable range of 1 - 250.

num_of effort   Must be an integer greater than zero and should be within the reasonable range of 1 to 25.

pot_type   Must be a valid pot type code as listed in Appendix 2.

es_gaps   Must be either a 0 or 1.

depth   Must be an integer and should be within the reasonable range of 1- 400.

soak   Must be: an integer within the range 1 - 24; or an integer divisible by 24 up to 960; or equal to 999.

bait   Must be a valid bait code listed in the *t_bait_codes* table and listed in Appendix 2.

caught   Must be an integer equal or greater than zero and should be within the reasonable range of 0 - 500

octopus   Must be an integer within the range 0 - 9.

no_legal   Must be an integer equal or greater than zero and should be within the reasonable range of 0 - 150

legal_wt   Must be a number equal or greater than zero and should be within the reasonable range of 0 - 70

no_berried   Must be an integer equal or greater than zero and should be within the reasonable range of 0 - 50

caught_sp2   Must be an integer equal or greater than zero and should be within a reasonable range of 0 - 12

latitude   Must be a valid latitude and should be within the reasonable range of 25 S – 55 S

longitude   Must be a valid longitude and should be within the reasonable range of.165 E – 175 W

EorW   Longitude east or west must be equal to either "E" or "W".

sample_type   Must be a valid data sample type code as listed in the *t_sample_type* table.

Lobster details (t_crayfish)

sample_no   Must be a valid sample number as listed in the *t_sample* table.

season   Must be either a 0 or 1.

species   Must be either equal to "CRA" or "PHC".

effort_no   Must be an integer greater than zero.

Multiple column checks on sample number and effort number:
If effort number exists, the combination of sample number and effort number must exist in the *t_effort* table.

sex   Must be a valid sex code as listed in Appendix 2.

carapace   Must be a integer greater than zero.

Multiple column checks on carapace, sex and species:
Carapace length for each sex of the crayfish species should be within the reasonable range as listed below:

Species	Sex	Carapace length
CRA	Male	35 - 235
CRA	Female	30 - 195
PHC	Male	80 - 245
PHC	Female	85 - 225

tail_width   Must be a integer greater than zero.

Multiple column checks on tail width, sex and species:
Tail width for each sex of the crayfish species should be within the reasonable range as listed below:

Species	Sex	Tail width
CRA	Male	22 - 130
CRA	Female	60 - 125
PHC	Male	44 - 105
PHC	Female	65 - 135

twf1   Must be a integer greater than zero and should be within the reasonable range 30 - 100

injury   Must be a valid injury code as listed in Appendix 2.

moult   Must be equal to 0, 1 or 5.

resident   Must be either a 0 or 1.

status   Must be either a 0 or 1.

sample_type Must be a valid sample type code as listed in the *t_sample_type* table.

Bait details (t_bait_codes)

bait_code   Must contain an unique code.

description Must contain a value.

Sex details (t_sex_codes)

sex   Must be a number between zero and nine.

descrptn   Must contain a value.

Sample type details (t_sample_types)

sample_type Must contain an unique code.

description Must contain a value.

Lobster vessel details (t_lob_vessel)

vessel_no   Must be a number between 1 and 99999

status   Must be a "C", "P" or "N"

7   Acknowledgments

The authors would like to thank Dave Banks for his review and editorial comment for this document.

Appendix 1 - Data entry, error checking, and loading

This section outlines the flow of paper-recorded data for rock lobster data from field collection through to its availability to researchers for stock assessment analyses, and defines the separate tasks that are required to do this.

In this example, samplers working on a vessel or in processing facilities on shore collect data. These data are recorded on waterproof forms. Each sample is unique and is given a sample number that can be linked to every pot lifted and every rock lobster measured.

At the completion of each sample, the recorder ensures that all pages have a sample number, are numbered sequentially, are in order and have all the required data fields completed. The data are then forwarded to a project team member who checks the above, checks all data are legible, registers receipt of the data and forwards them to key punching.

There are 5 steps in the data flow from its collection to availability for analysis:

1   Data collection

- Data are collected[10] on the following forms (Appendix 3):
- Cover Sheet: **RTAG22/RLCS22**
- Length Frequency Form: Typically **RLCS35** for catch sampling.
- Pot Catch Form: **RLCS21**
- Tagging and Release Form: **RTAG42** - can by used if tagging is done in conjunction with catch sampling, although typically **RTAG42** and **RLCS35** will be used separately in a sample.
- Examples of other forms occasionally used are also included in Appendix 3.

2.   Pre-key punching, checking and collating

Paper forms from each sample are visually checked for obvious errors or omissions, corrected, and collated together with paper forms from other samples from the same fishing area, allocated a file name; e.g., cs***97, where cs = catch sampling, *** = unique sample no, and 97 = year.

3.   Key punching data entry

At this point trained data entry operators keypunch the collated forms to a fixed-field ASCII file format on computer by keyboard entry. NIWA uses the KEYS data emulator package.

All data entry is verified, that is, each page of data is key punched twice and the two results are crosschecked electronically for mismatches. Any data entry operator errors are corrected at this

---

[10] See the Rock Lobster Catch Sampling Manual for more details.

point. This is an important step, as data entry errors can constitute a major source of all data errors.

The digitised data files are transferred back to the client, along with the original raw data files. Data are now ready for error checking and validation routines.

If the client requires unvalidated data, a disk copy of the digitised data will be returned to the client, along with a hard copy print out together with the original raw data.

If validation is required then the data go through the next step.

4.   Data error checking (manual and computer) and validation ("grooming")

Here we define "grooming" as:

The process by which digitised data files are checked for validation errors (is value A within valid range?), data integrity (given that value A is valid, and value B is valid, does B make sense given A?), and the file structure is manipulated in preparation for insertion into the database.

The individual data files are now put through a number of computer error checking (validation) routines that look for inconsistencies within the sample and check ranges of data within set limits. Errors are corrected. This part of the process also accommodates real changes in data; e.g., a new bait or pot type, and a split in fishing area for the one sample. Changes can be made to the validation routines if required, and to the definitions in the database. Data are then run through these checking routines until all detected errors have been eliminated and changes updated. These "groomed" data files are then deemed to be of a sufficient standard to load into the **rlcs** database. The groomed data file is given a **.dat** suffix; e.g., cs12397.dat.

5.   Groomed data loaded to database. Available for analysis

The groomed data are now loaded into the database. At this point the data become available for analyses.

The **.dat** file, along with the digitised data file and the paper raw data are all then archived for safekeeping.

Appendix 2 - Reference Code Tables

WEATHER OVER PERIOD OF POT SET

NB: This is not always possible to record when soak time has been in excess of 48 hours

WIND

Beaufort scale	Descriptive Term	Mean wind speed in knots
0	Calm	< 1
1	Light air	1 - 3
2	Light breëze	4 - 6
3	Gentle breeze	7 - 10
4	Moderate breeze	11 - 16
5	Fresh breeze	17 - 21
6	Strong breeze	22 - 27
7	Near gale	28 - 33
8	Gale	34 - 40
9	Strong gale	41 - 47
10	Storm	48 - 55

SEA STATE

Average height from trough to crest (meters)

Swell Code	Descriptive Term	Wave Height
1	Low swell	0 - 2
2	Moderate swell	2 - 4
3	Heavy swell	over 4

Remember to complete both fields of wind and sea state, even if there has been no change in conditions.

BAIT CODES

Common name	Scientific name	Processed	Whole	Combined
Ling	*Genypterus blacodes*	101	301	501
Blue-nose	*Hyperglyphe antarctica*	102	302	502
Barracouta	*Thyrsites atun*	103	303	503
Hapuku	*Polyprion oxygeneios*	104	304	504
Trevally	*Caranx georgianus*	105	305	505
Jack mackerels	*Trachurus spp.*	106	306	506
Stargazers	*F:Uranoscopidae*	107	307	507
Red gurnard	*Cheilidonichthys kumu*	108	308	508
Kahawai	*Arripis trutta*	109	309	509
Marblefish	*Aplodactylus arctidens*	110	310	510
Hoki	*Macruronus novaezelandiae*	111	311	511
Frost fish	*Lepidopus caudatus*	112	312	512
Copper moki	*Latridopsis forsteri*	113	313	513
Blue moki	*Latridopsis ciliaris*	115	315	515
Blue cod	*Parapercis colias*	116	316	516
Red cod	*Pseudophycus bachus*	117	317	517
Gemfish	*Rexia solandri*	118	318	518
Deepsea cardinalfish	*Epigonus telescopus*	119	319	519
White warehou	*Seriolella caerulea*	120	320	520
Tarakihi	*Nemadactylus macropterus*	121	321	521
Greenbone/Butterfish	*Odax pullus*	122	322	522
Trumpeter	*Latris lineata*	123	323	523
Silver warehou	*Seriolella punctata*	124	324	524
Common warehou	*Seriolella brama*	125	325	525
Wrasse(Parrot Fish)	*F:Labridae*	126	326	526
Kingfish(Yellowtail)	*Seriola grandis*	127	327	527
Leatherjacket (Cream fish)	*Parika scaber*	128	328	528
Sea perch (Jock Stewart)	*Helicolenus percoides*	129	329	529
Snapper	*Chrysophrys auratus*	130	330	530
Porae	*Nemadactylus douglasi*	131	331	531
Orange roughy	*Hoplosteyhus atlanticus*	132	332	532
Soles	*F: pleuronectidae*	133	333	533
Flounders	*F: Bothidae & Pleuronectidae*	134	334	534
Rock cod	*Lotella rhacinus*	135	335	535
Alfonsino	*Beryx splendens*	136	336	536
Rattail	*Coelorinchus spp.*	137	337	537
Squid	*Nototodarus spp.*	138	338	538
Ribaldo	*Mora moro*	139	339	549
Moonfish	*Lampris guttatis*	140	340	540
Spotted gurnard	*Pterygotrigla picta*	141	341	541
Ruby fish	*Plagiogeneion rubiginosus*	142	342	542
Mixed species		100	300	500

POT TYPE

Shape Frame Mesh	Largest Dimension (meters)	Mesh Size (mm)								
		10-19	20-29	30-34	35-39	40-44	45-49	50-54	55-59	60-69
Rectangular Steel Frame Net Fibre	< 1.2	A7	A9	A1	A2	A3	A4	A5	A6	A8
	1.2-1.5	B7	B9	B1	B2	B3	B4	B5	B6	B8
	> 1.5	C7	C9	C1	C2	C3	C4	C5	C6	C8
Rectangular Steel Frame Plastic	< 1.2	D7	D9	D1	D2	D3	D4	D5	D6	D8
	1.2-1.5	E7	E9	E1	E2	E3	E4	E5	E6	E8
	> 1.5	G7	G9	G1	G2	G3	G4	G5	G6	G8
Rectangular Steel Frame Steel	< 1.2	H7	H9	H1	H2	H3	H4	H5	H6	H8
	1.2-1.5	I7	I9	I1	I2	I3	I4	I5	I6	I8
	> 1.5	K7	K9	K1	K2	K3	K4	K5	K6	K8
Rectangular HRC Folded Frame	< 1.2	L7	L9	L1	L2	L3	L4	L5	L6	L8
	1.2-1.5	M7	M9	M1	M2	M3	M4	M5	M6	M8
	> 1.5	O7	O9	O1	O2	O3	O4	O5	O6	O8
Rectangular Wood Frame Plastic	< 1.2	R7	R9	R1	R2	R3	R4	R5	R6	R8
	1.2-1.5									
	> 1.5									
Rectangular Wood Frame Net Fibre	< 1.2	S7	S9	S1	S2	S3	S4	S5	S6	S8
	1.2-1.5									
	1.5									
Beehive, cane or supplejack	< 1.2	T7	T9	T1	T2	T3	T4	T5	T6	T8
	> 4	V7	V9	V1	V2	V3	V4	V5	V6	V8
Beehive Wire	< 1.2	W7	W9	W1	W2	W3	W4	W5	W6	W8
	> 4	X7	X9	X1	X2	X3	X4	X5	X6	X8
Cylinder Steel Plastic	< 1.2	Z7	Z9	Z1	Z2	Z3	Z4	Z5	Z6	Z8
	1.2-1.5	57	59	51	52	53	54	55	56	58
	> 1.5	47	49	41	42	43	44	45	46	48
Round Steel Plastic	< 1.2	67	69	61	62	63	64	65	66	68
	1.2-1.5									
	> 1.5									
Truncated Pyramid Steel/Plastic Wood/Fibre	< 1.2	37	39	31	32	33	34	35	36	38
	> 1.2	97	99	91	92	93	94	95	96	98
Cod Pot Steel Net Fibre	7I·5	77	79	71	72	73	74	75	76	78
	< 1.5	27	29	21	22	23	24	25	26	76
Circular HRC Folded Frame	< 1.2	87	89	81	82	83	84	85	86	88
Round Plastic Plastic	< 1.2	P7	P9	P1	P2	P3	P4	P5	P6	P8

NB: Always code for the smallest mesh.

HRC pots with fibre mesh, are coded as HRC's with appropriate mesh size.

For mesh < 5mm, code 0. E.g., A0, D0.

ROCK LOBSTER CATCH SAMPLING CODES

SAMPLE ☐☐☐☐☐

　　　Area Sequential Year

SPECIES ☐☐☐

CRA Spiny Rock Lobster
PHC Packhorse Lobster
RLM Mixed species

1 CRA1 - Northland
2 CRA2 - Bay of Plenty
3 CRA3 - Gisborne
4 CRA4 - Hawke's Bay
　　Wellington
5 CRA5 - Canterbury/
　　Marlborough

6 Chatham Islands
7 CRA7 - Otago
8 CRA8 - Southern
9 CRA9 - Westland
　　　　　　Taranaki
10 CRA10 - Kermadec

LOCATION ☐☐☐☐☐☐

Statistical area; Left
justified first three boxes.
Next three - sub area.

FORM ☐☐

	Carapace	Aux
28	to 0.1 mm	Whole weight, g
29	to 0.1 mm	blank
30	down to nearest mm	blank
31	down to nearest mm	Tail width, spine to spine, down to nearest mm
32	to 0.1mm	Tail width, spine to spine, to 0.1 mm
33	down to nearest mm	Whole weight, g
34	down to nearest mm	Tail width, spine to spine, to 0.1 mm
35	blank	Tail width, spine to spine, to 0.1 mm

Market sample or weight sample with no pot catch data
36　down to nearest mm Tail width, spine-spine, 0.1 mm; weight down to nearest gm
37　down to nearest mm Tail width, spine-spine, 0.1mm

Tagging forms
42　down to nearest mm Tail width, spine-spine, 0.1mm **plus tag & position**
43　**tag & position** for recaptures. (Used with Form 42 for morphometrics)

INJURY CODE

blank	not inspected
0	no injury
1-8	no. legs, antennae missing
8	> 8, and brutal damage
9	broken bar, 1st abd. segment

STATUS CODE

blank	not determined
0	not kept
1	kept for sale to a LFR

OCTOPUS

blank	not determined
0-8	no. dead, nearly dead, or limp lobster, or empty shell
9	octopus only

SOAK CODE

blank	not determined
24	overnight soak
48	2day soak

SEX CODE

blank	not determined
0	hermaphrodite or indeterminate
1	male
2	female, no setae
3	female, with setae
4	berried female
5	berried female, eyed eggs
6	spent female with infertile/unhatched eggs or cases visible
7	spent female and no infertile/unhatched eggs or cases
9	female, maturity not determined

Appendix 3 - Data Forms

COVER SHEET

STOCK MONITORING PROGRAMME
ROCK LOBSTER CATCH SAMPLING (1997 Edition)

NIWA

SHEET _1_ OF _ _ _ _

SAMPLE
| | | | | 9 |
1 2 3 4 5

Season
0=closed
1=open
148

DAY   MO
| | | | | | |
6 7   8 9

SPECIES
| | | |
10 11 12

CALIPER ADJ.
| | |
73 74

| R | T | A | G |
| R | L | C | S |
75 76 77 78

FORM
| 2 | 2 |
79 80

AREA
| | | | | | | |
16 17 18 19 20 21 22

CFV
| | | | | |
23 24 25 26 27

Method
| |
70
1=Potting
2=Diving

GPS
| |
71
0=No
1=Yes

Depth units
| |
72
1=feet
2=fathoms
3=metres

RECORDER ──────────────── SAMPLER
28   51

WIND
Direction | Beaufort scale | Speed (kts)
52   56
TO
Direction | Beaufort scale | Speed (kts)
57   61

SEA STATE
Direction | Swell code | Height (m)
62   65
TO
Direction | Swell code | Height (m)
66   69

LOCATION _

VESSEL
81   98

SKIPPER
99   118

DIVER(S)
119

LANDED CATCH
No. keepers
149
Est. weight (kg)
153
Actual Weight (kg)
157

POT TYPE _

_ _

BAIT _
39

REMARKS: (escape gaps?)

LENGTH FREQUENCY FORM (1994 Edition)

NIWA

STOCK MONITORING PROGRAMME
ROCK LOBSTER CATCH SAMPLING

SHEET .... OF ....

SAMPLE	DAY MO	SPECIES		FORM
9			R L C S	3
1 2 3 4 5	6 7 8 9	10 11 12	75 76 77 78	79 80

Pot#	Type	Sex	Carapace	Tail Width	Inj.	Status		Pot#	Type	Sex	Carapace	Tail Width	Inj.	Status
30 31 32	33 34	44	45 46 47 48	49 50 51 52	53	54	55	30 31 32	33 34	44	45 46 47 48	49 50 51 52	53	54	55

CALIPER ADJUSTMENT .... REMARKS:

POT CATCH FORM (1993 Edition)

STOCK MONITORING PROGRAMME
ROCK LOBSTER CATCH SAMPLING

NIWA

SHEET _____ OF _____

SAMPLE	DAY MO	SPECIES		FORM
[ ][ ][ ][9][ ]	[ ][ ][ ][ ]	[ ][ ][ ]	[R][L][C][S]	[2][1]
1 2 3 4 5	6 7 8 9	10 11 12	75 76 77 78	79 80

Depth	Pot#	Type	Catch	Bait	Soak	Depth	Pot#	Type	Catch	Bait	Soak
13 14 15	30 31 32	33 34	35 36 37	38 39 40	41 42 43	13 14 15	30 31 32	33 34	35 36 37	38 39 40	41 42 43
0	1		0			0	6		0		
0	2		0			0	7		0		
0	3		0			0	8		0		
0	4		0			0	9		0		
0	5		0			0	0		0		
0	6		0			0	1		0		
0	7		0			0	2		0		
0	8		0			0	3		0		
0	9		0			0	4		0		
0	0		0			0	5		0		
0	1		0			0	6		0		
0	2		0			0	7		0		
0	3		0			0	8		0		
0	4		0			0	9		0		
0	5		0			0	0		0		
0	6		0			0	1		0		
0	7		0			0	2		0		
0	8		0			0	3		0		
0	9		0			0	4		0		
0	0		0			0	5		0		
0	1		0			0	6		0		
0	2		0			0	7		0		
0	3		0			0	8		0		
0	4		0			0	9		0		
0	5		0			0	0		0		
0	6		0			0	1		0		
0	7		0			0	2		0		
0	8		0			0	3		0		
0	9		0			0	4		0		
0	0		0			0	5		0		
0	1		0			0	6		0		
0	2		0			0	7		0		
0	3		0			0	8		0		
0	4		0			0	9		0		
0	5		0			0	0		0		

DEPTH: Fathoms _____ Metres _____ Feet _____

LENGTH FREQUENCY FORM (1994 Edition)

NIWA

STOCK MONITORING PROGRAMME
ROCK LOBSTER CATCH SAMPLING

SHEET .... OF ....

SAMPLE	DAY MO	SPECIES	R L C S	FORM 3 6
	9			
1 2 3 4 5	6 7 8 9	10 11 12	75 76 77 78	79 80

* / No Pol Data

Pot#	Type	Sex	Carapace	Tail Width	Inj.	Status		Weight						
30 31 32	33 34	44	45 46 47 48	49 50 51 52	53	54	55	57 58 59						
			0	0						0	0			
			0	0						0	0			
			0	0						0	0			
			0	0						0	0			
			0	0						0	0			
			0	0						0	0			
			0	0						0	0			
			0	0						0	0			
			0	0						0	0			
			0	0						0	0			
			0	0						0	0			
			0	0						0	0			
			0	0						0	0			
			0	0						0	0			
			0	0						0	0			
			0	0						0	0			
			0	0						0	0			
			0	0						0	0			
			0	0						0	0			
			0	0						0	0			
			0	0						0	0			
			0	0						0	0			
			0	0						0	0			
			0	0						0	0			
			0	0						0	0			
			0	0						0	0			
			0	0						0	0			
			0	0						0	0			
			0	0						0	0			
			0	0						0	0			
			0	0						0	0			
			0	0						0	0			

CALIPER ADJUSTMENT ....   REMARKS:

49

LENGTH FREQUENCY FORM (1994 Edition)

STOCK MONITORING PROGRAMME
ROCK LOBSTER CATCH SAMPLING

NIWA

SHEET_____ OF _____

SAMPLE	DAY MO	SPECIES		FORM
[ ][ ][ ][9][ ]	[ ][ ][ ][ ]	[ ][ ][ ]	[R][L][C][S]	[3][7]
1 2 3 4 5	6 7 8 9	10 11 12	75 76 77 78	79 80

* / No Pot Data

Pot#	Type	Sex	Carapace	Tail Width	Inj.	Status		Pot#	Type	Sex	Carapace	Tail Width	Inj.	Status
30 31 32	33 34	44	45 46 47 48	49 50 51 52	53	54	55	30 31 32	33 34	44	45 46 47 48	49 50 51 52	53	54 55
			0	0							0	0		
			0	0							0	0		
			0	0							0	0		
			0	0							0	0		
			0	0							0	0		
			0	0							0	0		
			0	0							0	0		
			0	0							0	0		
			0	0							0	0		
			0	0							0	0		
			0	0							0	0		
			0	0							0	0		
			0	0							0	0		
			0	0							0	0		
			0	0							0	0		
			0	0							0	0		
			0	0							0	0		
			0	0							0	0		
			0	0							0	0		
			0	0							0	0		
			0	0							0	0		
			0	0							0	0		
			0	0							0	0		
			0	0							0	0		
			0	0							0	0		
			0	0							0	0		
			0	0							0	0		
			0	0							0	0		
			0	0							0	0		
			0	0							0	0		
			0	0							0	0		
			0	0							0	0		
			0	0							0	0		
			0	0							0	0		
			0	0							0	0		

CALIPER ADJUSTMENT _____   REMARKS:

TAGGING AND RELEASE FORM

STOCK MONITORING
ROCK LOBSTER TAGGING PROGRAMME (1996 Edition)

NIWA

SAMPLE: 9

DATE: DAY / MONTH

SPECIES

TAG PREFIX

SHEET .... of ....

Form 4,2

R T A G

0=No 1=Yes

Pot No.	Carapace	Sex	Tail width	Injury Old New	Status	Recap	Release	Tag #1	Tag #2	Release Position							Release depth
										Latitude DEG MIN		Longitude DEG MIN				EW	

Comments e.g. Position description and tag reference where no GPS available.

Caliper Adjustment: ....

Depth: Fathoms   Feet   Metres   GPS: Yes / No

RECAPTURE FORM
STOCK MONITORING
ROCK LOBSTER TAGGING PROGRAMME (1996 Edition)

SAMPLE: 9

DATE: DAY / MONTH

SPECIES

Tag prefix	Tag #1	Tag #2	Recapture Position					Recap. depth	Comments e.g. Position description and tag reference where no GPS available.
			DEG	MIN Latitude	DEG	MIN Longitude	E/W		

NIWA

SHEET .... of .... Form

R T A G   4 3