Database documentation for the fish communities database:

fish_comm

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Contents

List of Figures

Revision History

Version	Change	Date	Whom Responsible
1.0	Initial documentation	June 2009	David Fisher
2.0	Postgres version	Dec 2015	D Fisher, F Wei

1 Database documentation 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 for Primary Industries (MPI) formerly the Ministry of Fisheries.

This MPI data set, incorporates historic research data, data collected by MAF Fisheries prior to the split in 1995 of Policy to the Ministry of Fisheries and research to NIWA, and data collected by NIWA and other agencies for the Ministry of Fisheries and subsequently for MPI.

This document provides an introduction to the fish communities database **fish_comm**, and is a part of the database documentation series produced by NIWA.

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 how all the tables fit in together, and their relationships to other databases.

The fish communities database was developed under a project funded by the Foundation for Research, Science and Technology (FRST). Subsequently funding was received from the Ministry of Fisheries to produce this database documentation and add additional trawl trips to the database in 2009.
Based on the initial funding NIWA staff have access to the tables in this database containing data sourced from the research trawl database without the requirement that the work be for an MFish project or that permission for data access is required from MFish. The standard MFish requirements for permission to access data apply to the tables containing data extracted from the observer database(s). Namely that the data are required to fulfil an MFish contract and that unless fishing locations have been truncated to a precision of not more than on tenth of a degree then MFish permission must be obtained for access to these data.

This document is intended as a guide for users and administrators of the **fish_comm** database.
This database has been implemented as a schema within the Postgres database called **fish**.

2 Fish communities database

Fishes are the most abundant and diverse group of vertebrate animals and are a major component of marine ecosystems. Interactions between fish species, and between fishes and other marine animals and plants, are therefore important in defining the structure diversity, and stability of ecosystems and for managing them effectively. Determination of fish distribution and community structure are important first steps to improving our understanding and knowledge of marine ecosystems.

In 1997, a research programme was begun to determine if fish assemblages in the New Zealand region could be classified into clearly identifiable communities based on their associations with each other and with environmental features. The main source of data was the then Ministry of Fisheries, research trawl database.

2.1 Data sources

2.1.1 Trawl survey data

The **trawl** database is the major fisheries research database. It results from data collected by research trawl surveys on research vessels and chartered commercial fishing vessels.

Trawl surveys are a major tool used by research scientists for stock assessment. They are used to estimate basic parameters of commercial fish populations, including biomass, sex ratio, and the proportion of sexually mature fish, and the distribution of ages and lengths in the population. These parameters may be used in estimating mortality and growth rates.

Typically trawl surveys are carried out by fishing random locations or sometimes at positions on a regularly spaced grid. The whole catch for each trawl is sorted by individual species, and individual species weights and a total weight are calculated.

Trawl survey data were first computerised in the late 1970s and a relational database was created in 1989 (Mackay 1993). Selected surveys dating back to 1960 were later added to the **trawl** database.

For the initial fish community structure analysis, data was selected from the trawl database.
Only successful, research, random, bottom trawl records of fishes and squids were selected. All "foul" shots were excluded as the net may have been ripped, or some species of fish may have escaped on hauling. Only bottom trawl tows were selected because other trawl types are likely to have different species composition. Hence initially tables t_station and t_catch in this fish_comm database contained only bottom trawl data, but other methods were added later.

2.1.2 Observer data

The Scientific Observer Programme (SOP) was set up in 1986 to send observers, contracted to the then MAF Fisheries, to monitor the catches of commercial trawlers. The observer programme now re-branded as Observer Services has been expanded to include other fisheries and continues to collect data from commercial fishing vessels. The **obs** database contains data recoded by observers in their Observer Trawl Catch Effort Logbook. Observers on each vessel are responsible for completing this logbook. Each logbook documents details for every trawl shot by the vessel such as position, time, the composition and weight of each catch.

Note that since the tables containing observer data were created in the fish_comm database the observer data is no longer being loaded to the **obs** database which has been replaced by the database called **cod**.

2.2 Trip, cruise, or voyage?

Over the years, trawl surveys have been labelled many things. In the last few years research surveys

have been called “trips”, “cruises” or “voyages”, but all represent the same thing. As a consequence, while the fish_comm database labels all trawl surveys and associated tables with the word “trip”, the words “cruise” or “voyage” can just as easily be substituted.

2.3 Data validation and grooming

While the fish_comm database enforces data validation and integrity rules with the use of referential constraints and range checks, the data go though a rigorous data validation and error checking process before being entered.

Much of the checking of data in the fish_comm database was carried out as part of loading these data to the trawl database. This process includes instructions for data recording[1], simple data validation using the **checkq**[2] validation program language, followed by loading of data into a loading database, and more stringent error checking with Empress C routines[3]. Note that all trawl survey data collected from RV Tangaroa and more recently RV Kaharoa have been collected using an on-line data acquisition system that collects, checks, and loads data directly into a loading database.

Data have been incorporated into the fish_comm database in several iterations.

1. The original dataset relating to the research trawl trips between 1961 and 1997 described in Anderson *etal* (1998), and identified in the database by data_id = ‘OR’.
2. The new data loaded incorporating 1997 to 1999 data, identified in the database by data_id = ‘NW’.
3. Data loaded for the OBIS project, identified in the database by data_id = ‘OB’ about 2005.
4. Data loaded in 2009 funded by MFish, which includes recent trips loaded to the research trawl database comprising trips between 2005 and 2008 inclusive, plus 24 historic trips loaded to trawl since the previous addition. These historic trips range from 1980 to 1991. These data are coded in the database as data_id = ‘08’.

Data in the fish_comm database have undergone additional data validation and error checking.
Different datasets had different selection criteria and received different levels of data grooming.
For the original dataset (OR), the checks included checking and validating species identifications and outliers. This involved the production of geographical and depth distribution maps as published in Anderson etal (1998). Distribution maps were produced for 270 species or species groups (236 species, 26 species groups, 8 families) that occurred in more than 20 tows.

Initial distribution maps and depth plots showed occasional outliers for which location or depth had obviously been recorded incorrectly. These errors were corrected where possible. If the correct position and matching depth could not be determined, the record was deleted.

Another possible source of error arose where the net, the fish holding bins, or the conveyors were not completely cleared of fish from a particular tow. Such fish may have been occasionally recorded in the

[1]Currently located at ..\trawl_instructions\trawl_instr.doc
[2]See local Unix manual page on **checkq**
[3] Marine Research Computing: Trawl survey data entry. *User Note 10.*

catch from the next tow. Outliers which appeared to have resulted from incorrect tow allocation were omitted.

In summary, the criteria to remove the outliers were as follows:
One or more specimens of the species were recorded in the previous tow in a more common depth range.
All depth outliers came from the same voyage as a result of the species being given the wrong code.
Verified data entry errors (i.e. the original data forms were located and the data had been incorrectly entered onto the database).
Verified recorder errors (i.e. the original data recorder can verify incorrect code or identification was used).
The depth and position were inconsistent.
The tow position was incorrectly recorded.

The new data (as of 1999) with data_id = 'NW' was added to fish_comm to complete additional work on juvenile distributions and included prawn trawls and non-random trawls. The new data added to fish_comm has not had the extensive outlier checks done on the original data.

The second Altas Bagley etal (2000) utilised data from the obs database and included midwater trawls. Because of possible confusion over trawl gear identification (with 99 gear codes existing for midwater and bottom trawls), only those tows that were at least 20 m off the bottom at the start and finish of the tow, and for which the headline height was at least 20 m were included in the midwater trawl dataset, Bagley etal (2000).

The data loaded for the OBIS (Ocean Biogeographic Information System) project with data_id = 'OB' in 2005 had different objectives to the original fish_comm data. These data include foul tows, commercial tows, midwater tows, cod pots etc. Basically any shot catching a fish by any method. 480 plots were produced and error checked for outliers etc. Only species identified to species level were selected for the OBIS work.

For the data added in 2009 with data_id = '08' dataset stations were selected where gear performance was 1 or 2 or null, and gear method was one of Bottom trawl (code 01), High opening bottom trawl (code 03) or Multiple trawl nets eg twin or triple rigged (code 12). Species that occurred more than 20 times were plotted using an S-function for the species codes that have a 'description' in rdb:species master table of F*, 'MO', or 'MS' (ie for species in the categories of Fish, Mollusc Octopus or Mollusc Squid). Other species are included in the data added to the t_catch table but were not checked. For these data with data_id = '08' the process included producing individual plots of species distribution each of which included a plot of depth distribution. These plots were only for the additional data added for data_id = '08'.

The distribution plots by area and depth were compared with the original atlas, Anderson *etal* (1998) and earlier drafts with expert comments for each species. The erroneous points that were found, were identified, analyzed, and changed or deleted. Position errors were corrected in the trawl database and the corrected data re-extracted. Species or species groups that were either not present in the original atlas or where catches showed as outliers were checked by experts, namely Peter McMillan, who consulted staff on the relevant trips where appropriate. Three missing gear_meth codes were populated

in fish_comm, and species were updated in fish_comm where the expert taxonomist or science staff on the trip recommended. Ten species records were deleted that were deemed to be errors. The corrected data was inserted into the tables t_station and t_catch. A view was created as v_distribution_08 that displays these data for plotting if required.

For all of the datasets in the fish_comm database an average depth was calculated for each tow.
The value for this field was calculated in the following order according to available data:
Average of minimum depth and maximum depth,
Average of bottom gear start and bottom gear finish,
Average of gear start and gear finish,
Average of bottom vessel start and bottom vessel finish,
Just the bottom gear start value,
Gear start value,
Minimum gear start (only used once for original data) and gear finish (only used once for original data).

Due to the elapsed time, approximately 10 years, that has passed since this database was created and the initial data grooming was done, it has not been possible to clearly document all the data grooming carried out. Various documents have been located and sections deemed relevant included in this document.

Primary keys, foreign keys and unique indexes have been added to tables within this database where the data allowed as part of the process of documenting this database in 2009. Some tables contain duplicate values that prevent normal primary key constraints on a small number of tables, and these duplicates have been allowed to remain as the tables involved are historic records used for completed projects, and that these tables are unlikely to be added to.

Several time series of data were produced for various analyses:
Chatham Rise which included deep water (crdw) and middle depth (crmd) series, plus
East Coast South Island (ecsi), and Hauraki Gulf (hagu).

Sediment types for the Chatham Rise were determined by digitising the New Zealand Oceanographic Institute's (NZOI) Bounty oceanic chart west of 179° W, and by compiling a chart from raw sediment data east of 179° W. Sediment categories included the two general codes mud and sand which could be broken down further west of 179° W into 2 types of mud (terrigenous and planktonic carbonate) and 4 types of sand, medium to fine terrigenous, authigenic and planktonic carbonate and coarse benthic carbonate. Trawl stations were assigned a sediment type using the Empress PIP (point in polygon) function for both the start and finish positions and either mud or sand for the start position.
This process appears to have been done for the crmd_station table, (but not the crdw_table).

Sediment types for the east coast South island were determined by digitising the New Zealand Oceanographic Institute's coastal chart series for Pegasus, Ellesmere, Banks and Oamaru. Sediment categories included the three general codes gravel, mud and sand. Trawl stations were assigned a sediment type using the Empress PIP (point in polygon) function for the start, finish and a combination of the start and finish positions.

A similar process was carried out for the hagu_station table.

ECSI Data sources

Station and catch data prior to 1998 were sourced from the fish communities' database (fish_comm), originally derived from the MFish trawl database and after 1998 from the MFish trawl database. Length data to calculate the catch rates of key species by cohort or for juvenile and adult fish used the MFish trawl database. Error checking included checking for outliers, consistency of recording species codes, and species and depth distributions (see Anderson etal 1998).

Only trawl stations suitable for biomass estimation i.e. excluding foul stations were included.

An identification index reflecting how well species were identified was updated for each of the winter and summer time series separately. Benthic fauna and prawn codes were deleted from the catch table, which contains only fish or molluscs of type octopus or squid.

Catch rates for each species were calculated using the catch weight, distance towed and area swept by the trawl doors. Distance towed was the distance travelled across the seabed as determined by GPS and area swept the distance between the trawl doors using SCANMAR doorspread sensors. SCANMAR doorspread measurements were not available in the earlier years and averaged doorspread measurements from these earlier trips were used to provide updated doorspread distances for these surveys**.** The assumption that fish distribution did not extend above the headline height of the net (about 4 to 5 m), that all fish in the path of the doors were caught and the herding effect of the doors, sweeps and bridles was constant was made.

Catch rates by size for key species on the Kaharoa ECSI surveys using > 750 tonnes estimated biomass and present in more than 30% of the tows for each survey were considered. Of the 10 species meeting these criteria, catch rates were calculated for 4 species from the winter series and 10 species from the summer series. Reasons for not including the other 6 species catch rates by size for the winter series were that length data was not recorded on every tow. The length weight for the survey was used when ever possible to calculate catch rates by size class.

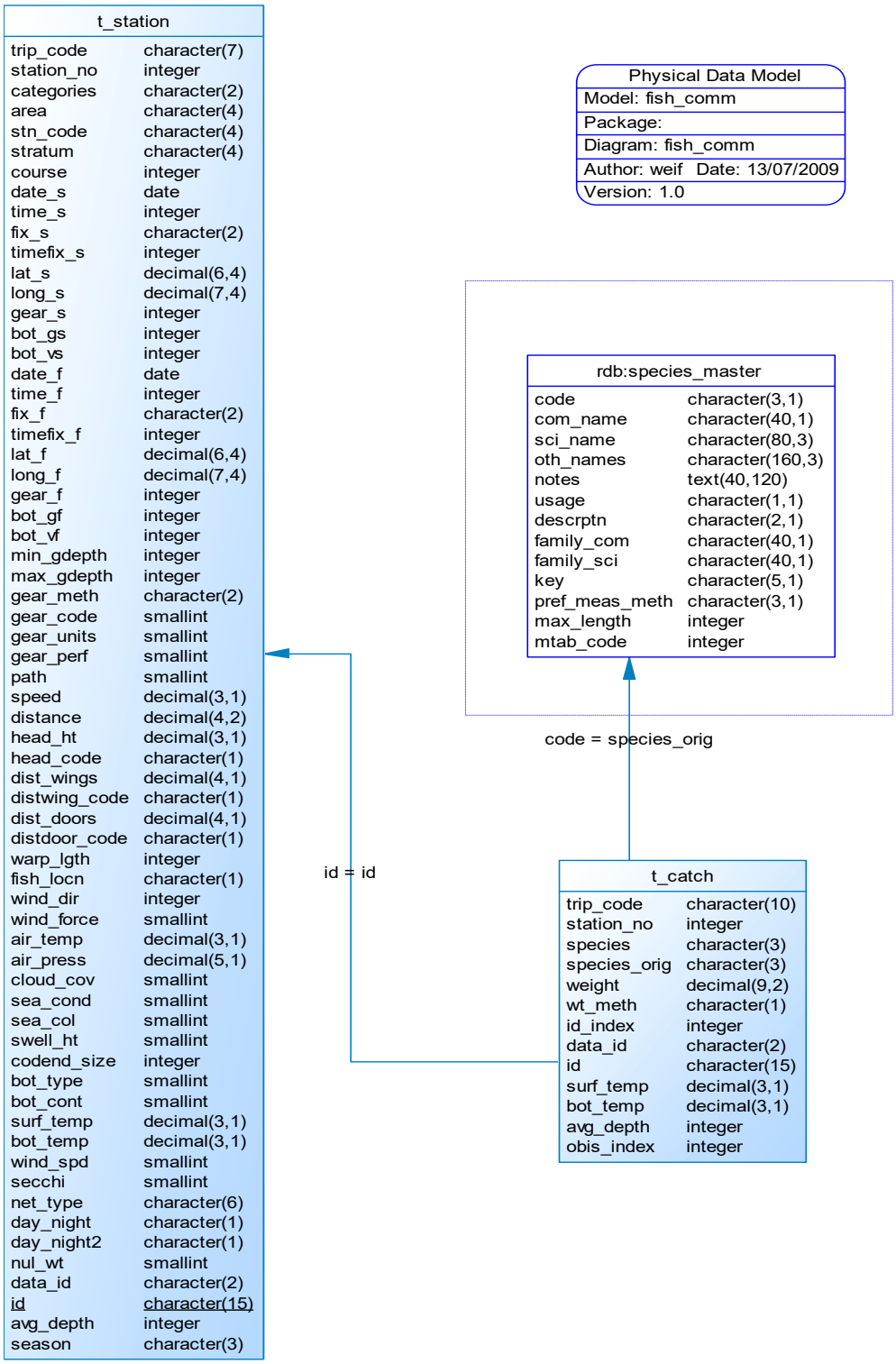

Figure 1: Entity Relationship Diagram (ERD) showing the 2 main tables.

3 Data structures

3.1 Table relationships

This database contains several tables. The ERD for **fish_comm** (Figure 1) shows the logical structure of the database and its main entities (each entity is implemented as a database *table*) and relationships between these tables and tables in other databases. All of the table's attributes are shown in the ERD. The underlined attributes represent the table's primary key[4]. This schema is valid regardless of the database system chosen, and it can remain correct even if the Database Management System (DBMS) is changed.

Each table represents an object, event, or concept in the real world that has been selected to be represented in the database. Each *attribute* of a table is a defining property or quality of the table.

Section 5 shows a listing of all the **fish_comm** tables as implemented by the Postgres DBMS. As can be seen in the listing of the tables, each table has a primary key on it. Primary keys are generally listed using the format:

Indices: index_name PRIMARY KEY, btree (*attribute* [, *attributes*])

where the attribute(s) make up the primary key and the index name is the primary key name. This prevents records with duplicate key values from being inserted into the table, e.g., a trip with an existing trip code.
Note that the typographical convention for the above format is that the square brackets [ ] may contain more than one item or none at all.

Some tables may also have a constraint of a unique index on them. Unique indexes are generally listed using the format:

Indices: index_name UNIQUE, btree (*attribute* [, *attributes*])

The highest level of a trawl survey is a research trip, which has many stations. Details for each station are held in the table *t_station* (Table 1). Each station is uniquely identified by the combination of trip code, and station number stored as the attribute *trip_code* and *station_no*. The attribute id also identifies each station and is formed by concatenating the trip_code with a '-' and then the station_no.

The fundamental relationship between tables that is repeated throughout the database is the *one-to-many* relationship[5]. This is shown in the ERD by connecting a single line (indicating 'many') from the child table (e.g., *t_catch*) to the parent table (e.g., *t_station*) with an arrow-head (indicating 'one') pointing to the parent. The ERD's in this document show attributes within the tables with generic data-types.

Every relationship has a mandatory or optional aspect to it. That is, if a relationship is mandatory, then

[4] A primary key is an attribute or a combination of attributes that contains an unique value to identify that record.
[5] A one-to-many relationship is where one record in a table (the *parent*) relates to one or many records in another table (the *child*).

it has to occur and least once, while an optional relationship might not occur at all. For all relationships in this database the parent table is mandatory and child the child table is optional, hence the arrow-head represents a mandatory parent.

For example, in Figure 1, consider that relationship between the table *t_station* and its child table *t_catch*. Not every station will produce a catch of fish so the station record can have zero or many catches, while for every catch there must be a matching station record.

The table *t_catch* contains the foreign key *id*, which enforces the link to the table *t_station*. Foreign key constraints do not allow *orphans* to exist in any table, i.e., where a child record exists without a related parent record. Without the foreign key constraint this may happen when: a parent record is deleted; the parent record is altered so that the relationship is lost; or a child record is entered without a parent record. Foreign key constraints are shown in the table listings by the following format:

```
Referential:  constraint name (attribute) INSERT
                  parent table (attribute)

Indices:      FOREIGN KEY (2, 15) BTREE fk_name ON (attribute)
```

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

```
Foreign-key constraints:
    "fk_t_catch_t_station" FOREIGN KEY (id) REFERENCES t_station(id)
     ON UPDATE CASCADE ON DELETE CASCADE
```

This means that the value of the attribute *id* in a *t_catch* record must already exist in the parent table *t_station* or the record will be rejected and an error message will be displayed.

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:

```
Indexes:    index_name btree (attribute[, attribute])
```

Note that indices may be simple, pointing to one attribute or composite pointing to more than one attribute.

Generally, a station is the location at which the trawl gear was towed. Details for the station, such as start and finish location, time, depth, gear performance and environment parameters are stored in the table *t_station* (Table 1). Many of the attributes in this table represent codes to explain how other attributes were derived and what methods were used. Many of these codes in the t_station table link to tables in the **rdb** database, that provide an explanation for the code used, but these are not enforced as foreign keys or referential constraints in this fish_comm database.

Each station in a trawl survey may produce a catch of several species of fish. A catch from any one station is broken down into the different species, with each species being an individual record in the table *t_catch* (Table 2). Each record contains the species code, catch weight and some attributes copied

from the station table. This table contains two species code attributes: species and species_orig. Where grooming of the species code has occurred this table records the groomed value in the species attribute and the original code in species_orig. In most cases (over 98%) these two species code attributes contain the same code. The attribute *species* is a code that is a foreign key to tables in the **rdb** database, (Figure 1) that documents the codes used.
I.e., the following foreign key constraint in the table *t_catch*:

```
Foreign-key constraints:
    "fk_t_catch_species_master" FOREIGN KEY (species) REFERENCES
     species_master(code)
```

This means that the value of the attribute species must already exist in the rdb database table species_master.

One view extends from these tables. This view is a 'window' into the records of the tables t_station and t_catch for a particular subset of records and attributes only. The view v_distribution_08 accesses distribution data (latitude, longitude and depth) for each species for where the data_id = '08'. Note that this view represents subsets of the t_station and t_catch tables and is not an entity in its own right. Therefore, it is not shown on an ERD.

The different time series of data namely crdw, crmd, ecsi and hagu all have corresponding pairs of station and catch tables that have additional attributes added such as those for bottom sediment type eg *sedi_s*, in crmd, hagu and ecsi datasets. All the station data in these 4 station tables is contained in the master station table t_station. There are also a pair of station and catch tables for observer data namely: observermw_station and observermw_catch. These tables can be joined using the attributes tripnumber and townumber.

There are additional tables containing 'distribution' data ie tables numbered 7 to 17. These tables contain position attributes (lat_s, long_s), and depth attributes plus station identifiers, and species code.

The following ERD diagrams show all the tables for these various time series of data.
Relationships that are not enforced by foreign keys in the database are shown in the ERD's as dotted lines.

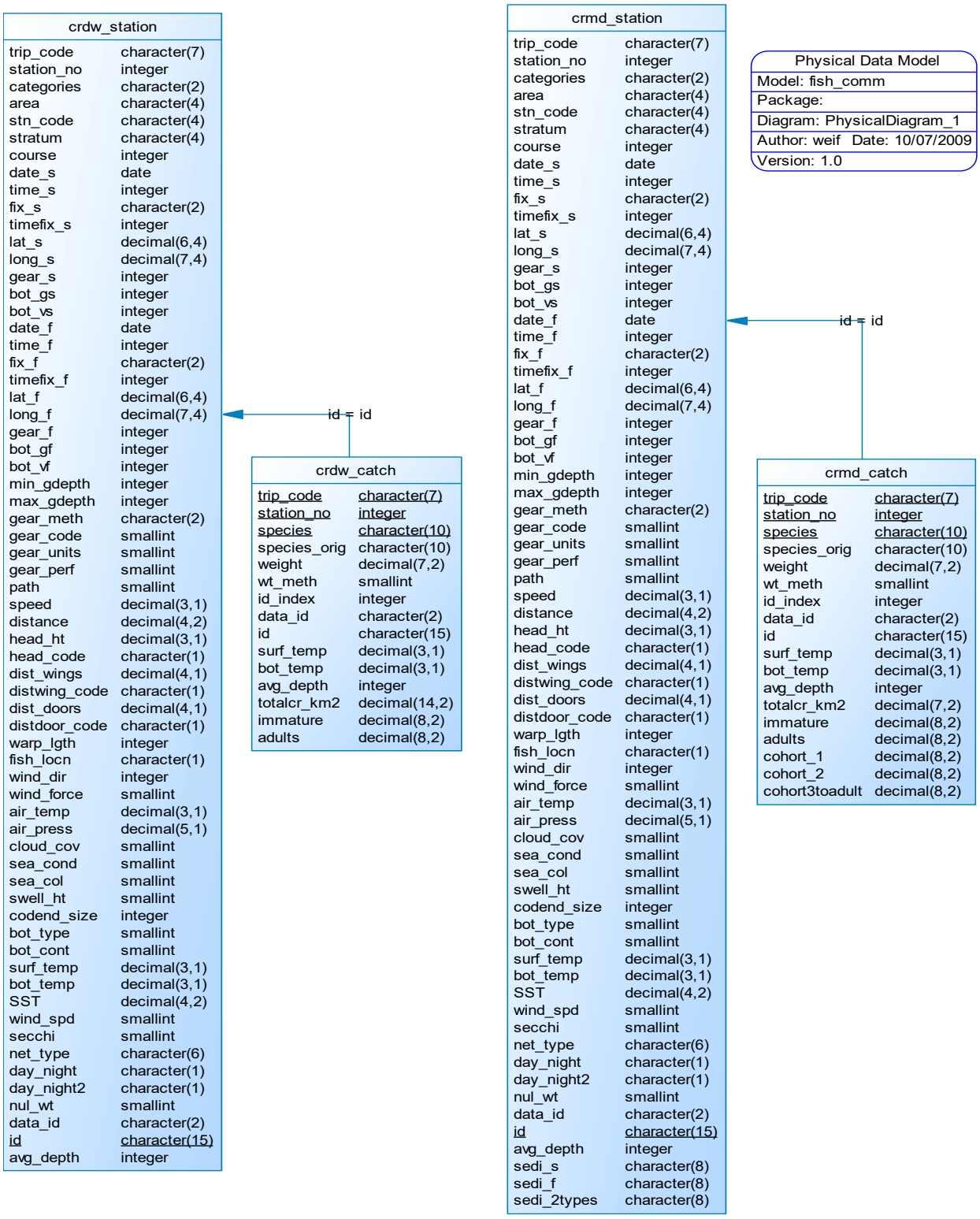

Figure 2: ERD showing the Chatham Rise time series tables

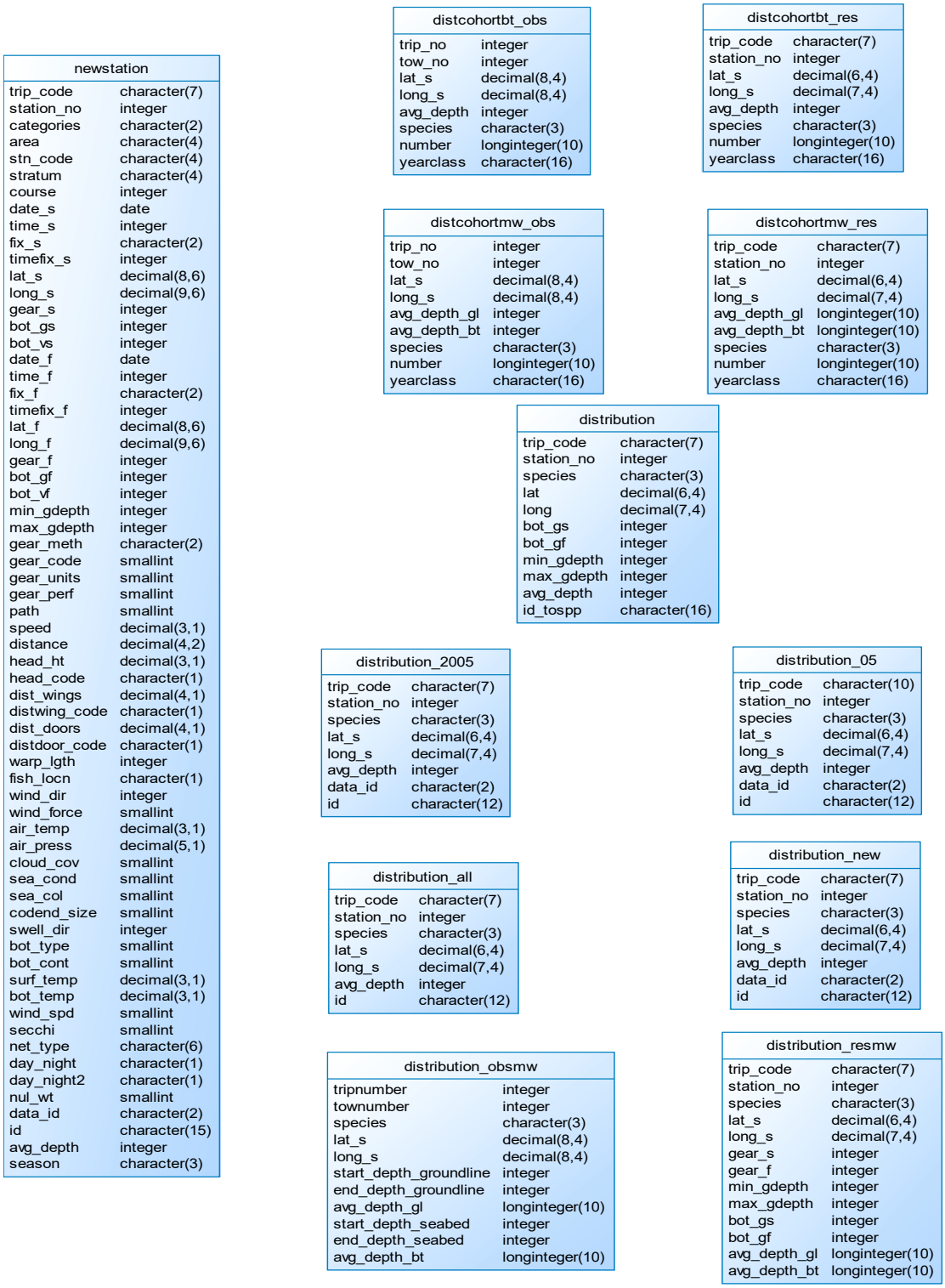

Figure 3: Diagram showing tables including the distribution tables

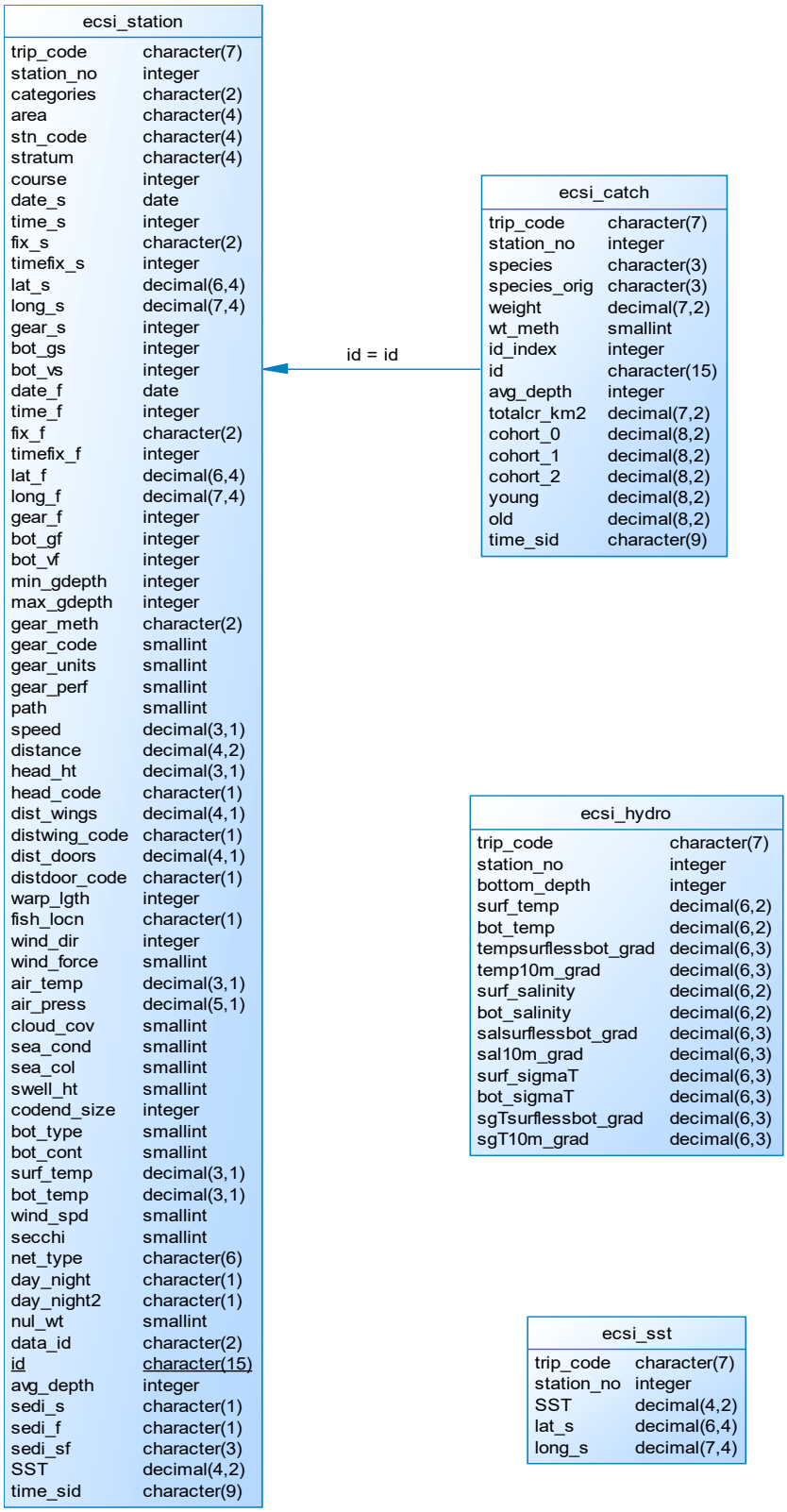

Figure 4: ERD showing the east coast south island time series tables

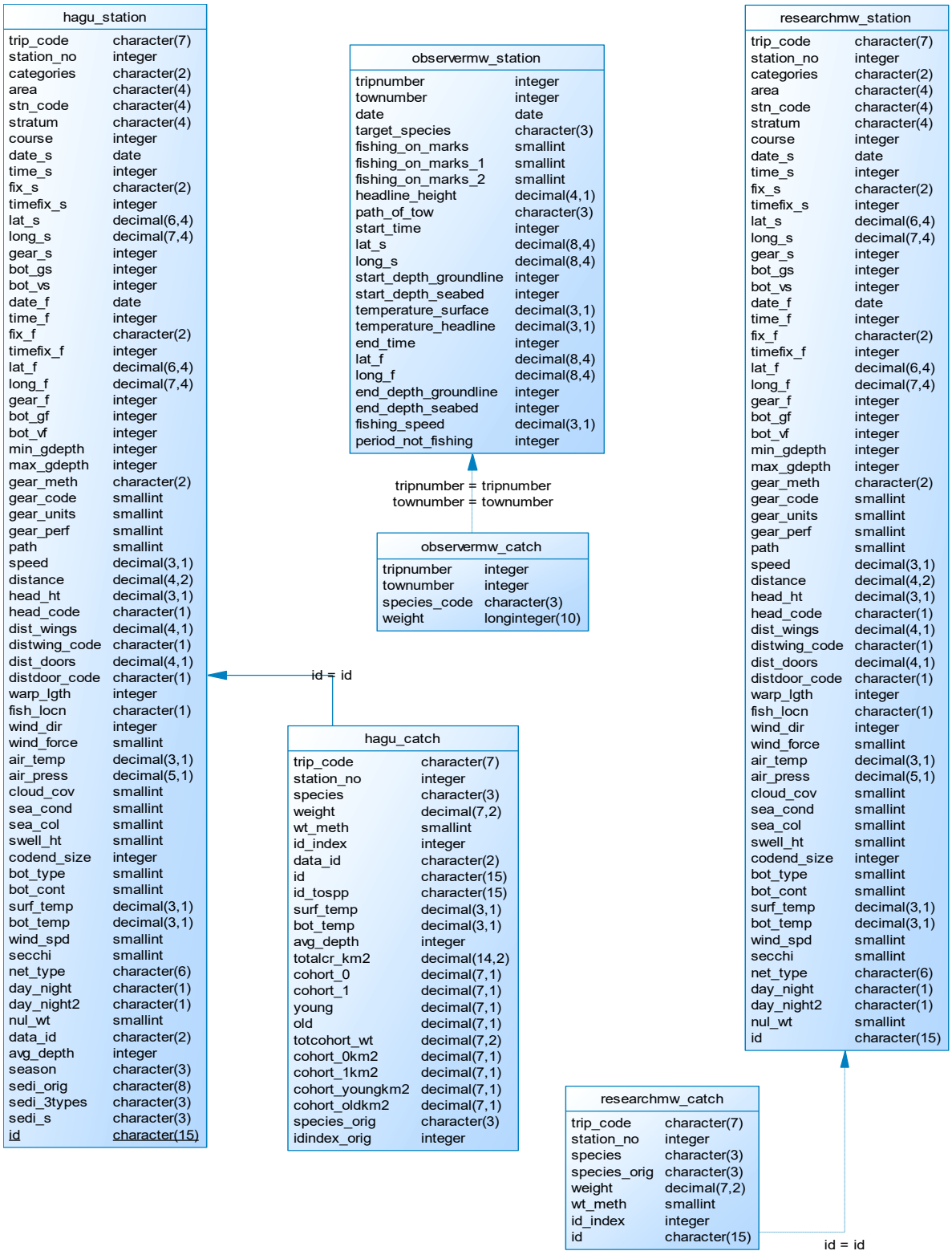

Figure 5: ERD showing Hauraki Gulf and mid-water time series tables

4 Table summaries

The following is a listing and brief outline of the tables and 1 view contained in **fish_comm** database:

1. t_station : contains all station data from research tows (from the trawl database).
2. t_catch : contains catch data from research tows (from the trawl database).
3. crdw_station : contains Chatham Rise deepwater time series station data
4. crdw_catch : contains Chatham Rise deepwater time series catch data
5. crmd_station : contains Chatham Rise middle depth time series station data
6. crmd_catch : contains Chatham Rise middle depth time series catch data
7. distcohortbt_obs : locality by year class for observer bottom trawl data
8. distcohortbt_res : locality by year class for research (trawl database) bottom trawl data
9. distcohortmw_obs: locality by year class for observer mid water trawl data
10. distcohortmw_res : locality by year class for research (trawl database) mid water trawl data
11. distribution : Original (OR) distribution data used for Anderson etal(1998)
12. distribution_05 : Distribution data including data added for OBIS ~ 2005 (379897 records) includes some species not in table distribution_2005
13. distribution_2005 : Distribution data including data added for OBIS ~ 2005 (378666 records).
14. distribution_all : contains position and depth data by species from research for 'NW' and 'OR' data with additional species compared with table distribution (338692 records).
15. distribution_new: Position and depth data for species, for new (NW) data.
16. distribution_obsmw : Distribution data from observer mid water trawls used for Bagley etal (2000)
17. distribution_resmw : Distribution data from research (trawl database) mid water trawls used for Bagley etal (2000)
18. ecsi_station : contains East Coast South Island time series station data
19. ecsi_catch : contains East Coast South Island time series catch data
20. ecsi_hydro : Oceanographic data collected on James Cook surveys 1980 – 1983.
21. ecsi_sst : Sea surface temperature from East Coast south island
22. hagu_station : contains Hauraki Gulf time series station data
23. hagu_catch : contains Hauraki Gulf time series catch data
24. newstation : contains station data for data_id = ‘OB’, 9713 total records including 1196 records not in t_station
25. observermw_station : Observer mid water station used in Bagley etal(2000)
26. observermw_catch : Observer mid water catch used in Bagley etal(2000)
27. researchmw_station : Research from trawl database for mid water station data used in Bagley etal(2000)
28. researchmw_catch : Research from trawl database for mid water catch used in Bagley etal(2000)
29. v_distribution_08 : View showing position and depth data for each species for where the data_id = ‘08’

5 fish_comm tables

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

5.1 Table 1: t_station

Comment: Data on location, gear used and environment at each station for all bottom trawl data.

Column	Type	Null?	Description
trip_code	character varying(7)	No	Trip code, comprised of a 3 char vessel code, 2 digit year and 2 digit trip number.
station_no	integer	No	Station number - unique within a trip.
categories	character varying(2)		2 separate user-defined categories, definitions should be in trawl:t_trip_comm.
area	character varying(4)		Code describing area, refer rdb.area_codes.
stn_code	character varying(4)		Code for a permanent station occupied repeatedly.
stratum	character varying(4)		Stratum number if trip is a stratified survey, else a transect code.
course	integer		Course of vessel during the shot (course-made-good).
date_s	date		Starting date of the shot.
time_s	integer		Starting time (24hr,NZST) of the shot (hhmm format).
fix_s	character varying(2)		Method of fixing position at start of tow, refer rdb.t_fix_meth_codes.
timefix_s	integer		Time (in minutes) elapsed since last position fix at the start of tow.
lat_s	numeric(6,4)		Latitude of vessel at start of tow in decimal degrees (DD.dddd format).
long_s	numeric(7,4)		Longitude of vessel at start of tow

		in decimal degrees east of Greenwich (DD.dddd format).
gear_s	integer	Depth of lowest part of gear (ground rope) at start of tow (m).
bot_gs	integer	Depth of sea bottom at gear position at start of tow (m).
bot_vs	integer	Depth of sea bottom at vessel position at start of tow (m).
date_f	date	Finishing date of the shot.
time_f	integer	Finishing time (24hr, NZST) of shot (hhmm format).
fix_f	character varying(2)	Method of fixing position at start of tow, refer rdb.t_fix_meth_codes.
timefix_f	integer	Time (in minutes) elapsed since last position fix at end of the tow.
lat_f	numeric(6,4)	Latitude of vessel at end of tow in decimal degrees (DD.dddd format).
long_f	numeric(7,4)	Longitude of vessel at end of tow in decimal degrees east of Greenwich (DD.dddd format).
gear_f	integer	Depth of lowest part of gear (groundrope) at end of tow (m).
bot_gf	integer	Depth of sea bottom at gear position at end of tow (m).
bot_vf	integer	Depth of sea bottom at vessel position at end of tow (m).
min_gdepth	integer	Minimum depth of lowest part of gear (ground rope) during tow (m).
max_gdepth	integer	Maximum depth of lowest part of gear (ground rope) during tow (m).
gear_meth	character varying(2)	Gear method code, descriptions in rdb.meth_codes.
gear_code	smallint	Code for set of gear used, details in trawl.t_trip record.
gear_units	smallint	Number of units of gear used in the tow.

gear_perf	smallint	Code for performance of gear during the tow.
path	smallint	Code describing configuration of path of shot.
speed	numeric(3,1)	Average speed through water during shot (knots).
distance	numeric(4,2)	Distance of gear over bottom (nautical miles).
head_ht	numeric(3,1)	Average headline height (m).
head_code	character varying(1)	Code showing how headline height was determined, refer to rdb.t_headline_codes.
dist_wings	numeric(4,1)	Average distance between wings (m).
distwing_code	character varying(1)	Code to indicate how distance between wings was determined for this tow, refer rdb.t_wing_dist_codes.
dist_doors	numeric(4,1)	Average distance between doors of gear (m).
distdoor_code	character varying(1)	Code to indicate how the distance between the doors was determined for this tow, refer rdb.t_door_dist_codes.
warp_lgth	integer	Length of warp during the tow (m).
fish_locn	character varying(1)	Code to indicate the location of the fish at the net mouth during shot as observed on net sonde, refer rdb.t_fish_obs_codes.
wind_dir	integer	Wind direction (degrees true), 999=No wind.
wind_force	smallint	Wind force on Beaufort scale.
air_temp	numeric(3,1)	Air temperature (degrees C).
air_press	numeric(5,1)	Air pressure (millibars).
cloud_cov	smallint	Code describing cloud cover during tow, in eighths cover.
sea_cond	smallint	Codes describing condition of the sea, refer to the Appendix.

sea_col	smallint	Code describing colour of sea, refer to the Appendix.
swell_ht	smallint	Code describing height of swell, refer to the Appendix.
codend_size	integer	Size of the codend mesh in mm.
bot_type	smallint	Code describing sea bottom type, refer to the Appendix.
bot_cont	smallint	Code describing sea bottom contour, refer to the Appendix.
surf_temp	numeric(3,1)	Surface temperature (degrees C).
bot_temp	numeric(3,1)	Temperature at bottom (degrees C).
wind_spd	smallint	Wind speed from anemometer (m/s) (1knot=0.51m/s).
secchi	smallint	Depth at which Secchi disc becomes invisible (m).
net_type	character varying(6)	The type of trawl net used, nwing refers to trawls with no lower wings, fwing refers to trawls with lower wings.
day_night	character varying(1)	Uses the categories D for daylight and N for night where the start and finish times are used to determine day or night.
day_night2	character varying(1)	Uses the categories D for daylight and N for night and assumes 0.5 hr of twilight before sunrise and after sunset. Generally a better reflection of actual daylight hours.
nul_wt	smallint	Indicates where there is a station where catch weights are missing.
data_id	character varying(2)	This refers to the original data in the first atlas (OR), the new (NW) data loaded (ie 1997 to 1999 or 2000 data), data loaded for the OBIS project (OB) subsequent to the NW data.

id	character varying(15)	No	A specific code for a trawl shot, made from the trip code and station number e.g. tan9301-100, used to join to t_catch.
avg_depth	integer		Average depth, calculated from other depth fields.
season	character varying(3)		Season. smr = summer, win = winter.
startp	geometry		Position of vessel at start of the station as gis point type.
endp	geometry		Position of vessel at end of the station as gis point type.
track	geometry		Track line of vessel from start position to end position of station as gis line type.

```
Indexes:
   "pk_t_station" PRIMARY KEY, btree (id)
   "ui_t_station" UNIQUE, btree (trip_code, station_no)
   "nx_t_station_endp" gist (endp)
   "nx_t_station_startp" gist (startp)
   "nx_t_station_track" gist (track)
Check constraints:
   "enforce_dims_endp" CHECK (ndims(endp) = 2)
   "enforce_dims_startp" CHECK (ndims(startp) = 2)
   "enforce_dims_track" CHECK (ndims(track) = 2)
   "enforce_geotype_endp" CHECK (geometrytype(endp) = 'POINT'::text
                                 OR endp IS NULL)
   "enforce_geotype_startp" CHECK (geometrytype(startp) = 'POINT'::text
                                   OR startp IS NULL)
   "enforce_geotype_track" CHECK (geometrytype(track) = 'LINESTRING'::text
                                 OR track IS NULL)
   "enforce_srid_endp" CHECK (srid(endp) = 4326)
   "enforce_srid_startp" CHECK (srid(startp) = 4326)
   "enforce_srid_track" CHECK (srid(track) = 4326)
```

5.2 Table 2: t_catch

Comment: Information (weight, number caught etc) on all species caught at each station from the research trawl database.

Column	Type	Null?	Description
trip_code	character varying(10)	No	Trip code as in station table.
station_no	integer	No	Station number - unique within a trip.
species	character(3)	No	Species code, refer to rdb.curr_spp.
species_orig	character varying(3)		The original species code from the research database, refer rdb.curr_spp.
weight	numeric(9,2)		Weight of the species caught at that station (kg).
wt_meth	character varying(1)		Code of method used to determine weight of catch, refer rdb.t_wgt_meth_codes.
id_index	integer		Reliability of identification for a species where: 1 = reliably identified to species over time, 2 = a species code that may represent 2 species, 3 = identification to genus, 9 = index not assigned - less than 20 occurrences.
data_id	character varying(2)		This refers to the original data in the first atlas (OR), the new (NW) data loaded (ie 1997 to 1999 or 2000 data), data loaded for the OBIS project (OB) subsequent to the NW data, (08) for data loaded in 2008-2009.
id	character varying(15)		A specific code for a trawl shot, made from the trip code and station number e.g. tan9301-100, used to join to t_station.
surf_temp	numeric(3,1)		Surface temperature for a station (from the station table).
bot_temp	numeric(3,1)		Bottom temperature for a station (from the station table).
avg_depth	integer		Average depth, calculated as for avg_depth in t_station.

```
obis_index      integer


Foreign-key constraints:
   "fk_t_catch_species_master" FOREIGN KEY (species)
    REFERENCES rdb.species_master(code)
   "fk_t_catch_species_master_2" FOREIGN KEY (species_orig)
    REFERENCES rdb.species_master(code)
   "fk_t_catch_t_station" FOREIGN KEY (id)
    REFERENCES fish_comm.t_station(id) ON UPDATE CASCADE ON DELETE CASCADE
```

5.3 Table 3: crdw_station

Comment: Chatham Rise deepwater time series station data.

Column	Type	Null?	Description
trip_code	character varying(7)	No	Trip code, comprised of a 3 char vessel code, 2 digit year and 2 digit trip number.
station_no	integer	No	Station number - unique within a trip.
categories	character varying(2)		2 separate user-defined categories, definitions should be in trawl:t_trip_comm.
area	character varying(4)		Code describing area, refer rdb.area_codes.
stn_code	character varying(4)		Code for a permanent station occupied repeatedly.
stratum	character varying(4)		Stratum number if trip is a stratified survey, else a transect code.
course	integer		Course of vessel during the shot (course-made-good).
date_s	date		Starting date of the shot.
time_s	integer		Starting time (24hr,NZST) of the shot (hhmm format).
fix_s	character varying(2)		Method of fixing position at start of tow, refer rdb.t_fix_meth_codes.
timefix_s	integer		Time (in minutes) elapsed since last position fix at the start of tow
lat_s	numeric(6,4)		Latitude of vessel at start of tow in decimal degrees (DD.dddd format).
long_s	numeric(7,4)		Longitude of vessel at start of tow in decimal degrees east of Greenwich (DD.dddd format).
gear_s	integer		Depth of lowest part of gear (ground rope) at start of tow (m).
bot_gs	integer		Depth of sea bottom at gear position at start of tow (m).

bot_vs	integer	Depth of sea bottom at vessel position at start of tow (m).
date_f	date	Finishing date of the shot.
time_f	integer	Finishing time (24hr, NZST) of shot (hhmm format).
fix_f	character varying(2)	Method of fixing position at start of tow, refer rdb.t_fix_meth_codes.
timefix_f	integer	Time (in minutes) elapsed since last position fix at end of the tow.
lat_f	numeric(6,4)	Latitude of vessel at end of tow in decimal degrees (DD.dddd format).
long_f	numeric(7,4)	Longitude of vessel at end of tow in decimal degrees east of Greenwich (DD.dddd format).
gear_f	integer	Depth of lowest part of gear (groundrope) at end of tow (m).
bot_gf	integer	Depth of sea bottom at gear position at end of tow (m).
bot_vf	integer	Depth of sea bottom at vessel position at end of tow (m).
min_gdepth	integer	Minimum depth of lowest part of gear (ground rope) during tow (m).
max_gdepth	integer	Maximum depth of lowest part of gear (ground rope) during tow (m).
gear_meth	character varying(2)	Gear method code, descriptions in rdb.meth_codes.
gear_code	smallint	Code for set of gear used, details in trawl:t_trip record.
gear_units	smallint	Number of units of gear used in the tow.
gear_perf	smallint	Code for performance of gear during the tow.
path	smallint	Code describing configuration of path of shot.
speed	numeric(3,1)	Average speed through water during shot (knots).

distance	numeric(4,2)	Distance of gear over bottom (nautical miles).
head_ht	numeric(3,1)	Average headline height (m).
head_code	character varying(1)	Code showing how headline height was determined, refer to rdb.t_headline_codes.
dist_wings	numeric(4,1)	Average distance between wings (m).
distwing_code	character varying(1)	Code to indicate how distance between wings was determined for this tow, refer rdb.t_wing_dist_codes.
dist_doors	numeric(4,1)	Average distance between doors of gear (m).
distdoor_code	character varying(1)	Code to indicate how the distance between the doors was determined for this tow, refer rdb.t_door_dist_codes.
warp_lgth	integer	Length of warp during the tow (m).
fish_locn	character varying(1)	Code to indicate the location of the fish at the net mouth during shot as observed on net sonde, refer rdb.t_fish_obs_codes.
wind_dir	integer	Wind direction (degrees true), 999=No wind.
wind_force	smallint	Wind force on Beaufort scale.
air_temp	numeric(3,1)	Air temperature (degrees C).
air_press	numeric(5,1)	Air pressure (millibars).
cloud_cov	smallint	Code describing cloud cover during tow, in eighths cover.
sea_cond	smallint	Codes describing condition of the sea, refer to the Appendix.
sea_col	smallint	Code describing colour of sea, refer to the Appendix.
swell_ht	smallint	Code describing height of swell, refer to the Appendix.
codend_size	integer	Size of the codend mesh in mm.
bot_type	smallint	Code describing sea bottom type,

			refer to the Appendix.
bot_cont	smallint		Code describing sea bottom contour, refer to the Appendix.
surf_temp	numeric(3,1)		Surface temperature (degrees C).
bot_temp	numeric(3,1)		Temperature at bottom (degrees C).
sst	numeric(4,2)		Sea Surface Temperature derived from SST maps.
wind_spd	smallint		Wind speed from anemometer (m/s) (1knot=0.51m/s).
secchi	smallint		Depth at which Secchi disc becomes invisible (m).
net_type	character varying(6)		The type of trawl net used, nwing refers to trawls with no lower wings, fwing refers to trawls with lower wings.
day_night	character varying(1)		Uses the categories D for daylight and N for night where the start and finish times are used to determine day or night.
day_night2	character varying(1)		Uses the categories D for daylight and N for night and assumes 0.5 hr of twilight before sunrise and after sunset. Generally a better reflection of actual daylight hours.
nul_wt	smallint		Indicates where there is a station where catch weights are missing.
data_id	character varying(2)		This refers to the original data in the first atlas (OR), the new (NW) data loaded (ie 1997 to 1999 or 2000 data), data loaded for the OBIS project (OB) subsequent to the NW data.
id	character varying(15)	No	A specific code for a trawl shot, made from the trip code and station number e.g. tan9301-100, used to join to the catch table.
avg_depth	integer		Average depth, calculated from other depth fields.
startp	geometry		Position of vessel at start of the station as gis point type.

endp	geometry	Position of vessel at end of the station as gis point type.
track	geometry	Track line of vessel from start position to end position of station as gis line type.

```
Indexes:
   "pk_crdw_station" PRIMARY KEY, btree (id)
   "ui_crdw_station" UNIQUE, btree (trip_code, station_no)
   "nx_crdw_station_endp" gist (endp)
   "nx_crdw_station_startp" gist (startp)
   "nx_crdw_station_track" gist (track)
Check constraints:
   "enforce_dims_endp" CHECK (ndims(endp) = 2)
   "enforce_dims_startp" CHECK (ndims(startp) = 2)
   "enforce_dims_track" CHECK (ndims(track) = 2)
   "enforce_geotype_endp" CHECK (geometrytype(endp) = 'POINT'::text
    OR endp IS NULL)
   "enforce_geotype_startp" CHECK (geometrytype(startp) = 'POINT'::text
    OR startp IS NULL)
   "enforce_geotype_track" CHECK (geometrytype(track) = 'LINESTRING'::text
    OR track IS NULL)
   "enforce_srid_endp" CHECK (srid(endp) = 4326)
   "enforce_srid_startp" CHECK (srid(startp) = 4326)
   "enforce_srid_track" CHECK (srid(track) = 4326)
```

5.4 Table 4: crdw_catch

Comment: Chatham Rise deepwater time series catch data.

Column	Type	Null?	Description
trip_code	character varying(7)	No	Trip code as in station table.
station_no	integer	No	Station number - unique within a trip.
species	character(3)	No	Species code, refer to rdb.curr_spp.
species_orig	character(3)		The original species code from the research database, refer rdb.curr_spp.
weight	numeric(7,2)		Weight of the species caught at that station (kg).
wt_meth	smallint		Code of method used to determine weight of catch, refer rdb.t_wgt_meth_codes.
id_index	integer		Reliability of identification for a species where: 1 = reliably identified to species over time, 2 = a species code that may represent 2 species, 3 = identification to genus, 9 = index not assigned - less than 20 occurrences.
data_id	character varying(2)		This refers to the original data in the first atlas (OR), the new (NW) data loaded (ie 1997 to 1999 or 2000 data), data loaded for the OBIS project (OB) subsequent to the NW data, (08) for data loaded in 2008-2009.
id	character varying(15)		A specific code for a trawl shot, made from the trip code and station number e.g. tan9301-100, used to join to the station table.
surf_temp	numeric(3,1)		Surface temperature for a station (from the station table).
bot_temp	numeric(3,1)		Bottom temperature for a station (from the station table).
avg_depth	integer		Average depth, calculated as for avg_depth in t_station.

totalcr_km2	numeric(14,2)	Total catch rate per square km.
immature	numeric(8,2)	Catch rate of immature fish. see Hurst etal(2000).
adults	numeric(8,2)	Catch rate of mature fish. see Hurst etal(2000).

Indexes:
"pk_crdw_catch" PRIMARY KEY, btree (trip_code, station_no, species)

Foreign-key constraints:
"fk_crdw_catch_species_master" FOREIGN KEY (species)
REFERENCES rdb.species_master(code) ON UPDATE CASCADE ON DELETE CASCADE
"fk_crdw_catch_species_master_2" FOREIGN KEY (species_orig)
REFERENCES rdb.species_master(code) ON UPDATE CASCADE ON DELETE CASCADE
"fk_crdw_catch_station" FOREIGN KEY (id)
REFERENCES fish_comm.crdw_station(id) ON UPDATE CASCADE ON DELETE CASCADE

5.5 Table 5: crmd_station

Comment: Chatham Rise middle depth time series station data.

Column	Type	Null?	Description
trip_code	character varying(7)	No	Trip code, comprised of a 3 char vessel code, 2 digit year and 2 digit trip number.
station_no	integer	No	Station number - unique within a trip.
categories	character varying(2)		2 separate user-defined categories, definitions should be in trawl:t_trip_comm.
area	character varying(4)		Code describing area, refer rdb.area_codes.
stn_code	character varying(4)		Code for a permanent station occupied repeatedly.
stratum	character varying(4)		Stratum number if trip is a stratified survey, else a transect code.
course	integer		Course of vessel during the shot (course-made-good).
date_s	date		Starting date of the shot.
time_s	integer		Starting time (24hr,NZST) of the shot (hhmm format).
fix_s	character varying(2)		Method of fixing position at start of tow, refer rdb.t_fix_meth_codes.
timefix_s	integer		Time (in minutes) elapsed since last position fix at the start of tow.
lat_s	numeric(6,4)		Latitude of vessel at start of tow in decimal degrees (DD.dddd format).
long_s	numeric(7,4)		Longitude of vessel at start of tow in decimal degrees east of Greenwich (DD.dddd format).
gear_s	integer		Depth of lowest part of gear (ground rope) at start of tow (m).
bot_gs	integer		Depth of sea bottom at gear position at start of tow (m).

bot_vs	integer	Depth of sea bottom at vessel position at start of tow (m).
date_f	date	Finishing date of the shot.
time_f	integer	Finishing time (24hr, NZST) of shot (hhmm format).
fix_f	character varying(2)	Method of fixing position at start of tow, refer rdb.t_fix_meth_codes.
timefix_f	integer	Time (in minutes) elapsed since last position fix at end of the tow.
lat_f	numeric(6,4)	Latitude of vessel at end of tow in decimal degrees (DD.dddd format).
long_f	numeric(7,4)	Longitude of vessel at end of tow in decimal degrees east of Greenwich (DD.dddd format).
gear_f	integer	Depth of lowest part of gear (groundrope) at end of tow (m).
bot_gf	integer	Depth of sea bottom at gear position at end of tow (m).
bot_vf	integer	Depth of sea bottom at vessel position at end of tow (m).
min_gdepth	integer	Minimum depth of lowest part of gear (ground rope) during tow (m).
max_gdepth	integer	Maximum depth of lowest part of gear (ground rope) during tow (m).
gear_meth	character varying(2)	Gear method code, descriptions in rdb.meth_codes.
gear_code	smallint	Code for set of gear used, details in trawl:t_trip record.
gear_units	smallint	Number of units of gear used in the tow.
gear_perf	smallint	Code for performance of gear during the tow.
path	smallint	Code describing configuration of path of shot.
speed	numeric(3,1)	Average speed through water during shot (knots).

distance	numeric(4,2)	Distance of gear over bottom (nautical miles).
head_ht	numeric(3,1)	Average headline height (m).
head_code	character varying(1)	Code showing how headline height was determined, refer to rdb.t_headline_codes.
dist_wings	numeric(4,1)	Average distance between wings (m).
distwing_code	character varying(1)	Code to indicate how distance between wings was determined for this tow, refer rdb.t_wing_dist_codes.
dist_doors	numeric(4,1)	Average distance between doors of gear (m).
distdoor_code	character varying(1)	Code to indicate how the distance between the doors was determined for this tow, refer rdb.t_door_dist_codes.
warp_lgth	integer	Length of warp during the tow (m).
fish_locn	character varying(1)	Code to indicate the location of the fish at the net mouth during shot as observed on net sonde, refer rdb.t_fish_obs_codes.
wind_dir	integer	Wind direction (degrees true), 999=No wind.
wind_force	smallint	Wind force on Beaufort scale.
air_temp	numeric(3,1)	Air temperature (degrees C).
air_press	numeric(5,1)	Air pressure (millibars).
cloud_cov	smallint	Code describing cloud cover during tow, in eighths cover.
sea_cond	smallint	Codes describing condition of the sea, refer to the Appendix.
sea_col	smallint	Code describing colour of sea, refer to the Appendix.
swell_ht	smallint	Code describing height of swell, refer to the Appendix.
codend_size	integer	Size of the codend mesh in mm.
bot_type	smallint	Code describing sea bottom type,

			refer to the Appendix.
bot_cont	smallint		Code describing sea bottom contour, refer to the Appendix.
surf_temp	numeric(3,1)		Surface temperature (degrees C).
bot_temp	numeric(3,1)		Temperature at bottom (degrees C).
sst	numeric(4,2)		Sea Surface Temperature derived from SST maps.
wind_spd	smallint		Wind speed from anemometer (m/s) (1knot=0.51m/s).
secchi	smallint		Depth at which Secchi disc becomes invisible (m).
net_type	character varying(6)		The type of trawl net used, nwing refers to trawls with no lower wings, fwing refers to trawls with lower wings.
day_night	character varying(1)		Uses the categories D for daylight and N for night where the start and finish times are used to determine day or night.
day_night2	character varying(1)		Uses the categories D for daylight and N for night and assumes 0.5 hr of twilight before sunrise and after sunset. Generally a better reflection of actual daylight hours.
nul_wt	smallint		Indicates where there is a station where catch weights are missing.
data_id	character varying(2)		This refers to the original data in the first atlas (OR), the new (NW) data loaded (ie 1997 to 1999 or 2000 data), data loaded for the OBIS project (OB) subsequent to the NW data.
id	character varying(15)	No	A specific code for a trawl shot, made from the trip code and station number e.g. tan9301-100, used to join to the catch table.
avg_depth	integer		Average depth, calculated from other depth fields.
sedi_s	character varying(8)		Bottom sediment type at the start position of the tow, from the NZOI

		sediment charts, refer to the Appendix for codes.
sedi_f	character varying(8)	Bottom sediment type at the end position of the tow, from the NZOI sediment chart(s), refer to the Appendix for codes.
sedi_2types	character varying(8)	Bottom sediment type from the start position of the tow, from the NZOI sediment charts, either 'sand' or 'mud'.
startp	geometry	Position of vessel at start of the station as gis point type.
endp	geometry	Position of vessel at end of the station as gis point type.
track	geometry	Track line of vessel from start position to end position of station as gis line type.

```
Indexes:
   "pk_crmd_station" PRIMARY KEY, btree (id)
   "ui_crmd_station" UNIQUE, btree (trip_code, station_no)
   "nx_crmd_station_endp" gist (endp)
   "nx_crmd_station_startp" gist (startp)
   "nx_crmd_station_track" gist (track)
Check constraints:
   "enforce_dims_endp" CHECK (ndims(endp) = 2)
   "enforce_dims_startp" CHECK (ndims(startp) = 2)
   "enforce_dims_track" CHECK (ndims(track) = 2)
   "enforce_geotype_endp" CHECK (geometrytype(endp) = 'POINT'::text
    OR endp IS NULL)
   "enforce_geotype_startp" CHECK (geometrytype(startp) = 'POINT'::text
    OR startp IS NULL)
   "enforce_geotype_track" CHECK (geometrytype(track) = 'LINESTRING'::text
    OR track IS NULL)
   "enforce_srid_endp" CHECK (srid(endp) = 4326)
   "enforce_srid_startp" CHECK (srid(startp) = 4326)
   "enforce_srid_track" CHECK (srid(track) = 4326)
```

5.6 Table 6: crmd_catch

Comment: Chatham Rise middle depth time series catch data.

Column	Type	Null?	Description
trip_code	character varying(7)	No	Trip code as in station table.
station_no	integer	No	Station number - unique within a trip.
species	character(3)	No	Species code, refer to rdb.curr_spp.
species_orig	character(3)		The original species code from the research database, refer rdb.curr_spp.
weight	numeric(7,2)		Weight of the species caught at that station (kg).
wt_meth	smallint		Code of method used to determine weight of catch, refer rdb.t_wgt_meth_codes.
id_index	integer		Reliability of identification for a species where: 1 = reliably identified to species over time, 2 = a species code that may represent 2 species, 3 = identification to genus.
data_id	character varying(2)		This refers to the original data in the first atlas (OR), the new (NW) data loaded (ie 1997 to 1999 or 2000 data), data loaded for the OBIS project (OB) subsequent to the NW data, (08) for data loaded in 2008-2009.
id	character varying(15)		A specific code for a trawl shot, made from the trip code and station number e.g. tan9301-100, used to join to the station table.
surf_temp	numeric(3,1)		Surface temperature for a station (from the station table).
bot_temp	numeric(3,1)		Bottom temperature for a station (from the station table).
avg_depth	integer		Average depth, calculated as for avg_depth in t_station.
totalcr_km2	numeric(7,2)		Total catch rate per square km.

immature	numeric(8,2)	Catch rate of immature fish. See Hurst etal(2000).
adults	numeric(8,2)	Catch rate of mature fish. See Hurst etal(2000).
cohort_1	numeric(8,2)	Catch weight for cohort 1+.
cohort_2	numeric(8,2)	Catch weight for cohort 2+.
cohort3toadult	numeric(8,2)	Catch weight for cohort 3+ to adult.

Indexes:
"pk_crmd_catch" PRIMARY KEY, btree (trip_code, station_no, species)

Foreign-key constraints:
"fk_crmd_catch_ref_station" FOREIGN KEY (id)
REFERENCES fish_comm.crmd_station(id) ON UPDATE CASCADE ON DELETE CASCADE
"fk_crmd_catch_species_master_2" FOREIGN KEY (species_orig)
REFERENCES rdb.species_master(code) ON UPDATE CASCADE ON DELETE CASCADE

5.7 Table 7: distcohortbt_obs

Comment: Locality by year class for observer bottom trawl data.

Column	Type	Null?	Description
trip_no	integer	No	Unique sequential number for each observer trip.
tow_no	integer	No	Sequential identifier for each tow.
lat_s	numeric(8,4)		Latitude for the start of the tow, in decimal degrees (DD.dddd) format.
long_s	numeric(8,4)		Longitude for the start of the tow, in decimal degrees (DDD.dddd) format east of Greenwich.
avg_depth	integer		Average depth, calculated from other depth fields.
species	character(3)	No	Species code, refer to rdb.curr_spp.
number	integer		Number.
yearclass	character varying(16)		Year class cohort.

Foreign-key constraints:

```
   "fk_distcohortbt_obs_species_master" FOREIGN KEY (species)
    REFERENCES rdb.species_master(code) ON UPDATE CASCADE ON DELETE CASCADE
```

5.8 Table 8: distcohortbt_res

Comment: Locality by year class for research (trawl db) bottom trawl data.

Column	Type	Null?	Description
trip_code	character varying(7)	No	Trip code, comprised of a 3 char vessel code, 2 digit year and 2 digit trip number.
station_no	integer	No	Station number - unique within a trip.
lat_s	numeric(6,4)		Latitude for the start of the tow, in decimal degrees (DD.dddd) format.
long_s	numeric(7,4)		Longitude for the start of the tow, in decimal degrees (DDD.dddd) format east of Greenwich.
avg_depth	integer		Average depth, calculated from other depth fields.
species	character(3)	No	Species code, refer to rdb.curr_spp.
number	integer		Number.
yearclass	character varying(16)		Year class cohort.

Foreign-key constraints:
"fk_distcohortbt_res_species_master" FOREIGN KEY (species)
REFERENCES rdb.species_master(code) ON UPDATE CASCADE ON DELETE CASCADE

5.9 Table 9: distcohortmw_obs

Comment: Locality by year class for observer mid water trawl data.

Column	Type	Null?	Description
trip_no	integer	No	Unique sequential number for each observer trip.
tow_no	integer	No	Sequential identifier for each tow.
lat_s	numeric(8,4)		Latitude for the start of the tow, in decimal degrees (DD.dddd) format.
long_s	numeric(8,4)		Longitude for the start of the tow, in decimal degrees (DDD.dddd) format east of Greenwich.
avg_depth_gl	integer		Average depth of groundline, calculated from other depth fields.
avg_depth_bt	integer		Average depth of seabed, calculated from other depth fields.
species	character(3)	No	Species code, refer to rdb.curr_spp.
number	integer		Number.
yearclass	character varying(16)		Year class cohort.

Foreign-key constraints:
"fk_distcohortmw_obs_species_master" FOREIGN KEY (species)
REFERENCES rdb.species_master(code) ON UPDATE CASCADE ON DELETE CASCADE

5.10 Table 10: distcohortmw_res

Comment: Locality by year class for research (trawl db) mid water trawl data.

Column	Type	Null?	Description
trip_code	character varying(7)	No	Trip code, comprised of a 3 char vessel code, 2 digit year and 2 digit trip number.
station_no	integer	No	Station number - unique within a trip.
lat_s	numeric(6,4)		Latitude for the start of the tow, in decimal degrees (DD.dddd) format.
long_s	numeric(7,4)		Longitude for the start of the tow, in decimal degrees (DDD.dddd) format east of Greenwich.
avg_depth_gl	integer		Average depth of groundline, calculated from other depth fields.
avg_depth_bt	integer		Average depth of seabed, calculated from other depth fields.
species	character(3)	No	Species code, refer to rdb.curr_spp.
number	integer		Number.
yearclass	character varying(16)		Year class cohort.

Foreign-key constraints:

```
   "fk_distcohortmw_res_species_master" FOREIGN KEY (species)
    REFERENCES rdb.species_master(code) ON UPDATE CASCADE ON DELETE CASCADE
```

5.11 Table 11: distribution

Comment: Original (OR) distribution data used for Anderson etal(1998).

Column	Type	Null?	Description
trip_code	character varying(7)	No	Trip code, comprised of a 3 char vessel code, 2 digit year and 2 digit trip number.
station_no	integer	No	Station number - unique within a trip.
species	character(3)	No	Species code, refer to rdb.curr_spp.
lat	numeric(6,4)		Latitude of vessel at start of tow in decimal degrees (DD.dddd format).
long	numeric(7,4)		Longitude of vessel at start of tow in decimal degrees east of Greenwich (DD.dddd format).
bot_gs	integer		Depth of sea bottom at gear position at start of tow (m).
bot_gf	integer		Depth of sea bottom at gear position at end of tow (m).
min_gdepth	integer		Minimum depth of lowest part of gear (ground rope) during tow (m).
max_gdepth	integer		Maximum depth of lowest part of gear (ground rope) during tow (m).
avg_depth	integer		Average depth, calculated as for avg_depth in t_station.
id_tospp	character varying(16)		A specific code for a record, made from the trip code, station number and species_orig e.g. tan9301-22-SKI.

5.12 Table 12: distribution_05

Comment: Distribution data including data added for OBIS ~ 2005 (379897 records), includes some species not in table distribution_2005.

Column	Type	Null?	Description
trip_code	character varying(7)	No	Trip code, comprised of a 3 char vessel code, 2 digit year and 2 digit trip number.
station_no	integer	No	Station number - unique within a trip.
species	character varying(3)	No	Species code, refer to rdb.curr_spp.
lat_s	numeric(6,4)		Latitude for the start of the tow, in decimal degrees (DD.dddd) format.
long_s	numeric(7,4)		Longitude for the start of the tow, in decimal degrees (DDD.dddd) format east of Greenwich.
avg_depth	integer		Average depth, calculated from other depth fields.
data_id	character varying(2)		This refers to the original data in the first atlas (OR), the new (NW) data loaded (ie 1997 to 1999 or 2000 data), data loaded for the OBIS project (OB) subsequent to the NW data.
id	character varying(12)		A specific code for a trawl shot, made from the trip code and station number e.g. tan9301-100.

5.13 Table 13: distribution_2005

Comment: Distribution data including data added for OBIS ~ 2005 (378666 records).

Column	Type	Null?	Description
trip_code	character varying(7)	No	Trip code, comprised of a 3 char vessel code, 2 digit year and 2 digit trip number.
station_no	integer	No	Station number - unique within a trip.
species	character varying(3)	No	Species code, refer to rdb.curr_spp.
lat_s	numeric(6,4)		Latitude for the start of the tow, in decimal degrees (DD.dddd) format.
long_s	numeric(7,4)		Longitude for the start of the tow, in decimal degrees (DDD.dddd) format east of Greenwich.
avg_depth	integer		Average depth, calculated from other depth fields.
data_id	character varying(2)		This refers to the original data in the first atlas (OR), the new (NW) data loaded (ie 1997 to 1999 or 2000 data), data loaded for the OBIS project (OB) subsequent to the NW data.
id	character varying(12)		A specific code for a trawl shot, made from the trip code and station number e.g. tan9301-100.

5.14 Table 14: distribution_all

Comment: Distribution data from research including 'NW' and 'OR' data with additional species compared with table distribution.

Column	Type	Null?	Description
trip_code	character varying(7)	No	Trip code, comprised of a 3 char vessel code, 2 digit year and 2 digit trip number.
station_no	integer	No	Station number - unique within a trip.
species	character(3)	No	Species code, refer to rdb.curr_spp.
lat_s	numeric(6,4)		Latitude for the start of the tow, in decimal degrees (DD.dddd) format.
long_s	numeric(7,4)		Longitude for the start of the tow, in decimal degrees (DDD.dddd) format east of Greenwich.
avg_depth	integer		Average depth, calculated from other depth fields.
id	character varying(12)		A specific code for a trawl shot, made from the trip code and station number e.g. tan9301-100.

5.15 Table 15: distribution_new

Comment: Position and depth data for species, for new (NW) data.

Column	Type	Null?	Description
trip_code	character varying(7)	No	Trip code, comprised of a 3 char vessel code, 2 digit year and 2 digit trip number.
station_no	integer	No	Station number - unique within a trip.
species	character varying(3)	No	Species code, refer to rdb.curr_spp.
lat_s	numeric(6,4)		Latitude for the start of the tow, in decimal degrees (DD.dddd) format.
long_s	numeric(7,4)		Longitude for the start of the tow, in decimal degrees (DDD.dddd) format east of Greenwich.
avg_depth	integer		Average depth, calculated from other depth fields.
data_id	character varying(2)		This data identifier refers to the new (NW) data loaded (ie 1997 to 1999 or 2000 data).
id	character varying(12)		A specific code for a trawl shot, made from the trip code and station number e.g. tan9301-100.

5.16 Table 16: distribution_obsmw

Comment: Distribution data from observer mid water trawls used for Bagley etal(2000).

Column	Type	Null?	Description
tripnumber	integer		Trip number as unique number for each observer trip.
townumber	integer		Tow number or station number as sequential identifier for each tow.
species	character varying(3)		Species code, refer to rdb.curr_spp.
lat_s	numeric(8,4)		Latitude for the start of the tow, in decimal degrees (DD.dddd) format.
long_s	numeric(8,4)		Longitude for the start of the tow, in decimal degrees (DDD.dddd) format east of Greenwich.
start_depth_groundline	integer		Depth to groundline at the start of tow (m).
end_depth_groundline	integer		Depth to groundline at the end of tow (m).
avg_depth_gl	integer		Average depth of groundline, calculated from start_depth_groundline + end_depth_groundline / 2.
start_depth_seabed	integer		Depth to seabed at the start of tow (m).
end_depth_seabed	integer		Depth to seabed at the end of tow (m).
avg_depth_bt	integer		Average depth of seabed, calculated from start_depth_seabed + end_depth_seabed / 2.

5.17 Table 17: distribution_resmw

Comment: Distribution data from research (trawl db) mid water trawls used for Bagley etal(2000).

Column	Type	Null?	Description
trip_code	character varying(7)	No	Trip code, comprised of a 3 char vessel code, 2 digit year and 2 digit trip number.
station_no	integer	No	Station number - unique within a trip.
species	character varying(3)	No	Species code, refer to rdb.curr_spp.
lat_s	numeric(6,4)		Latitude for the start of the tow, in decimal degrees (DD.dddd) format.
long_s	numeric(7,4)		Longitude for the start of the tow, in decimal degrees (DDD.dddd) format east of Greenwich.
gear_s	integer		Depth of lowest part of gear (ground rope) at start of tow (m).
gear_f	integer		Depth of lowest part of gear (groundrope) at end of tow (m).
min_gdepth	integer		Minimum depth of lowest part of gear (ground rope) during tow (m).
max_gdepth	integer		Maximum depth of lowest part of gear (ground rope) during tow (m).
bot_gs	integer		Depth of sea bottom at gear position at start of tow (m).
bot_gf	integer		Depth of sea bottom at gear position at end of tow (m).
avg_depth_gl	integer		Average depth of groundline, calculated from other depth fields.
avg_depth_bt	integer		Average depth of seabed, calculated from other depth fields.

5.18 Table 18: ecsi_station

Comment: East Coast South Island time series station data.

Column	Type	Null?	Description
trip_code	character varying(7)	No	Trip code, comprised of a 3 char vessel code, 2 digit year and 2 digit trip number.
station_no	integer	No	Station number - unique within a trip.
categories	character varying(2)		2 separate user-defined categories, definitions should be in trawl:t_trip_comm.
area	character varying(4)		Code describing area, refer rdb.area_codes.
stn_code	character varying(4)		Code for a permanent station occupied repeatedly.
stratum	character varying(4)		Stratum number if trip is a stratified survey, else a transect code.
course	integer		Course of vessel during the shot (course-made-good).
date_s	date		Starting date of the shot.
time_s	integer		Starting time (24hr,NZST) of the shot (hhmm format).
fix_s	character varying(2)		Method of fixing position at start of tow, refer rdb.t_fix_meth_codes.
timefix_s	integer		Time (in minutes) elapsed since last position fix at the start of tow.
lat_s	numeric(6,4)		Latitude of vessel at start of tow in decimal degrees (DD.dddd format).
long_s	numeric(7,4)		Longitude of vessel at start of tow in decimal degrees east of Greenwich (DD.dddd format).
gear_s	integer		Depth of lowest part of gear (ground rope) at start of tow (m).
bot_gs	integer		Depth of sea bottom at gear position at start of tow (m).

bot_vs	integer	Depth of sea bottom at vessel position at start of tow (m).
date_f	date	Finishing date of the shot.
time_f	integer	Finishing time (24hr, NZST) of shot (hhmm format).
fix_f	character varying(2)	Method of fixing position at start of tow, refer rdb.t_fix_meth_codes.
timefix_f	integer	Time (in minutes) elapsed since last position fix at end of the tow.
lat_f	numeric(6,4)	Latitude of vessel at end of tow in decimal degrees (DD.dddd format).
long_f	numeric(7,4)	Longitude of vessel at end of tow in decimal degrees east of Greenwich (DD.dddd format).
gear_f	integer	Depth of lowest part of gear (groundrope) at end of tow (m).
bot_gf	integer	Depth of sea bottom at gear position at end of tow (m).
bot_vf	integer	Depth of sea bottom at vessel position at end of tow (m).
min_gdepth	integer	Minimum depth of lowest part of gear (ground rope) during tow (m).
max_gdepth	integer	Maximum depth of lowest part of gear (ground rope) during tow (m).
gear_meth	character varying(2)	Gear method code, descriptions in rdb.meth_codes.
gear_code	smallint	Code for set of gear used, details in trawl:t_trip record.
gear_units	smallint	Number of units of gear used in the tow.
gear_perf	smallint	Code for performance of gear during the tow.
path	smallint	Code describing configuration of path of shot.
speed	numeric(3,1)	Average speed through water during shot (knots).

distance	numeric(4,2)	Distance of gear over bottom (nautical miles).
head_ht	numeric(3,1)	Average headline height (m).
head_code	character varying(1)	Code showing how headline height was determined, refer to rdb.t_headline_codes.
dist_wings	numeric(4,1)	Average distance between wings (m).
distwing_code	character varying(1)	Code to indicate how distance between wings was determined for this tow, refer rdb.t_wing_dist_codes.
dist_doors	numeric(4,1)	Average distance between doors of gear (m).
distdoor_code	character varying(1)	Code to indicate how the distance between the doors was determined for this tow, refer rdb.t_door_dist_codes.
warp_lgth	integer	Length of warp during the tow (m).
fish_locn	character varying(1)	Code to indicate the location of the fish at the net mouth during shot as observed on net sonde, refer rdb.t_fish_obs_codes.
wind_dir	integer	Wind direction (degrees true), 999=No wind.
wind_force	smallint	Wind force on Beaufort scale.
air_temp	numeric(3,1)	Air temperature (degrees C).
air_press	numeric(5,1)	Air pressure (millibars).
cloud_cov	smallint	Code describing cloud cover during tow, in eighths cover.
sea_cond	smallint	Codes describing condition of the sea, refer to the Appendix.
sea_col	smallint	Code describing colour of sea, refer to the Appendix.
swell_ht	smallint	Code describing height of swell, refer to the Appendix.
codend_size	integer	Size of the codend mesh in mm.
bot_type	smallint	Code describing sea bottom type,

			refer to the Appendix.
bot_cont	smallint		Code describing sea bottom contour, refer to the Appendix.
surf_temp	numeric(3,1)		Surface temperature (degrees C).
bot_temp	numeric(3,1)		Temperature at bottom (degrees C).
wind_spd	smallint		Wind speed from anemometer (m/s) (1knot=0.51m/s).
secchi	smallint		Depth at which Secchi disc becomes invisible (m).
net_type	character varying(6)		The type of trawl net used, nwing refers to trawls with no lower wings, fwing refers to trawls with lower wings.
day_night	character varying(1)		Uses the categories D for daylight and N for night where the start and finish times are used to determine day or night.
day_night2	character varying(1)		Uses the categories D for daylight and N for night and assumes 0.5 hr of twilight before sunrise and after sunset. Generally a better reflection of actual daylight hours.
nul_wt	smallint		Indicates where there is a station where catch weights are missing.
data_id	character varying(2)		This refers to the original data in the first atlas (OR), the new (NW) data loaded (ie 1997 to 1999 or 2000 data), data loaded for the OBIS project (OB) subsequent to the NW data.
id	character varying(15)	No	A specific code for a trawl shot, made from the trip code and station number e.g. tan9301-100, used to join to the catch table.
avg_depth	integer		Average depth, calculated from other depth fields.
sedi_s	character varying(1)		Bottom sediment type at the start position of the tow, from the NZOI sediment chart(s). M = Mud, S = Sand, G = Gravel.

sedi_f	character varying(1)	Bottom sediment type at the end position of the tow, from the NZOI sediment chart(s). M = Mud, S = Sand, G = Gravel.
sedi_sf	character varying(3)	Bottom sediment type at the start and finish positions of the tow (sedi_s & sedi_f concatenated), from the NZOI sediment charts. eg SG means that there was Sand at the start position and Gravel at the finish position.
sst	numeric(4,2)	Sea Surface Temperature derived from SST maps.
time_sid	character varying(9)	Time series identifier. Not populated.
startp	geometry	Position of vessel at start of the station as gis point type.
endp	geometry	Position of vessel at end of the station as gis point type.
track	geometry	Track line of vessel from start position to end position of station as gis line type.

```
Indexes:
   "pk_ecsi_station" PRIMARY KEY, btree (id)
   "ui_ecsi_station" UNIQUE, btree (trip_code, station_no)
   "nx_ecsi_station_endp" gist (endp)
   "nx_ecsi_station_startp" gist (startp)
   "nx_ecsi_station_track" gist (track)
Check constraints:
   "enforce_dims_endp" CHECK (ndims(endp) = 2)
   "enforce_dims_startp" CHECK (ndims(startp) = 2)
   "enforce_dims_track" CHECK (ndims(track) = 2)
   "enforce_geotype_endp" CHECK (geometrytype(endp) = 'POINT'::text
    OR endp IS NULL)
   "enforce_geotype_startp" CHECK (geometrytype(startp) = 'POINT'::text
    OR startp IS NULL)
   "enforce_geotype_track" CHECK (geometrytype(track) = 'LINESTRING'::text
    OR track IS NULL)
   "enforce_srid_endp" CHECK (srid(endp) = 4326)
   "enforce_srid_startp" CHECK (srid(startp) = 4326)
   "enforce_srid_track" CHECK (srid(track) = 4326)
```

5.19 Table 19: ecsi_catch

Comment: contains East Coast South Island time series catch data.

Column	Type	Null?	Description
trip_code	character varying(7)	No	Trip code as in station table.
station_no	integer	No	Station number - unique within a trip.
species	character(3)	No	Species code, refer to rdb.curr_spp.
species_orig	character varying(3)		The original species code from the research database, refer rdb.curr_spp.
weight	numeric(7,2)		Weight of the species caught at that station (kg).
wt_meth	smallint		Code of method used to determine weight of catch, refer rdb.t_wgt_meth_codes.
id_index	integer		Reliability of identification for a species where: 1 = reliably identified to species over time, 2 = a species code that may represent 2 species, 3 = identification to genus.
id	character varying(15)		A specific code for a trawl shot, made from the trip code and station number e.g. tan9301-100, used to join to the station table.
avg_depth	integer		Average depth, calculated from other depth fields.
totalcr_km2	numeric(7,2)		Total catch per square km, a scaled catch rate by distance trawled and doorspread.
cohort_0	numeric(8,2)		Calculated scaled catch rate for cohort 0+.
cohort_1	numeric(8,2)		Calculated scaled catch rate for cohort 1+.
cohort_2	numeric(8,2)		Calculated scaled catch rate for cohort 2+.
young	numeric(8,2)		Calculated scaled catch rate for young fish.

old1	numeric(8,2)	Calculated scaled catch rate for old fish.
time_sid	character varying(9)	Time series identifier. jco_ts = James Cook time series, kah_win = Kaharoa winter, kah_sum = Kaharoa summer, wjs_ts = WJ Scott time series.

Foreign-key constraints:
"fk_ecsi_catch_ecsi_station" FOREIGN KEY (id)
REFERENCES fish_comm.ecsi_station(id)

5.20 Table 20: ecsi_hydro

Comment: Oceanographic data collected on James Cook surveys 1980 - 1983.

Column	Type	Null?	Description
trip_code	character varying(7)		Trip code, comprised of a 3 char vessel code, 2 digit year and 2 digit trip number.
station_no	integer		Station number - unique within a trip.
bottom_depth	integer		Depth of the seabed (m).
surf_temp	numeric(6,2)		Sea surface temperature (degrees C).
bot_temp	numeric(6,2)		Water temperature at the seabed (degrees C).
tempsurflessbot_grad	numeric(6,3)		Temperate gradient between surface and bottom.
temp10m_grad	numeric(6,3)		
surf_salinity	numeric(6,2)		Salinity at the sea surface.
bot_salinity	numeric(6,2)		Salinity at the seabed.
salsurflessbot_grad	numeric(6,3)		Salinity gradient between sea surface and bottom.
sal10m_grad	numeric(6,3)		Salinity at 10m depth gradient.
surf_sigmat	numeric(6,3)		Specific gravity anomaly at sea surface.
bot_sigmat	numeric(6,3)		Specific gravity anomaly at the seabed.
sgtsurflessbot_grad	numeric(6,3)		
sgt10m_grad	numeric(6,3)		

5.21 Table 21: ecsi_sst

Comment: Sea surface temperature from East Coast South Island.

Column	Type	Null?	Description
trip_code	character varying(7)		Trip code, comprised of a 3 char vessel code, 2 digit year and 2 digit trip number.
station_no	integer		Station number - unique within a trip.
sst	numeric(4,2)		Derived Sea Surface Temperature from SST maps.
lat_s	numeric(6,4)		Latitude for the start of the tow, in decimal degrees (DD.dddd) format.
long_s	numeric(7,4)		Longitude for the start of the tow, in decimal degrees (DDD.dddd) format east of Greenwich.

5.22 Table 22: hagu_station

Comment: Hauraki Gulf time series station data.

Column	Type	Null?	Description
trip_code	character varying(7)	No	Trip code, comprised of a 3 char vessel code, 2 digit year and 2 digit trip number.
station_no	integer	No	Station number - unique within a trip.
categories	character varying(2)		2 separate user-defined categories, definitions should be in trawl:t_trip_comm.
area	character varying(4)		Code describing area, refer rdb.area_codes.
stn_code	character varying(4)		Code for a permanent station occupied repeatedly.
stratum	character varying(4)		Stratum number if trip is a stratified survey, else a transect code.
course	integer		Course of vessel during the shot (course-made-good).
date_s	date		Starting date of the shot.
time_s	integer		Starting time (24hr,NZST) of the shot (hhmm format).
fix_s	character varying(2)		Method of fixing position at start of tow, refer rdb.t_fix_meth_codes.
timefix_s	integer		Time (in minutes) elapsed since last position fix at the start of tow.
lat_s	numeric(6,4)		Latitude of vessel at start of tow in decimal degrees (DD.dddd format).
long_s	numeric(7,4)		Longitude of vessel at start of tow in decimal degrees east of Greenwich (DD.dddd format).
gear_s	integer		Depth of lowest part of gear (ground rope) at start of tow (m).
bot_gs	integer		Depth of sea bottom at gear position at start of tow (m).

bot_vs	integer	Depth of sea bottom at vessel position at start of tow (m).
date_f	date	Finishing date of the shot.
time_f	integer	Finishing time (24hr, NZST) of shot (hhmm format).
fix_f	character varying(2)	Method of fixing position at start of tow, refer rdb.t_fix_meth_codes.
timefix_f	integer	Time (in minutes) elapsed since last position fix at end of the tow.
lat_f	numeric(6,4)	Latitude of vessel at end of tow in decimal degrees (DD.dddd format).
long_f	numeric(7,4)	Longitude of vessel at end of tow in decimal degrees east of Greenwich (DD.dddd format).
gear_f	integer	Depth of lowest part of gear (groundrope) at end of tow (m).
bot_gf	integer	Depth of sea bottom at gear position at end of tow (m).
bot_vf	integer	Depth of sea bottom at vessel position at end of tow (m).
min_gdepth	integer	Minimum depth of lowest part of gear (ground rope) during tow (m).
max_gdepth	integer	Maximum depth of lowest part of gear (ground rope) during tow (m).
gear_meth	character varying(2)	Gear method code, descriptions in rdb.meth_codes.
gear_code	smallint	Code for set of gear used, details in trawl:t_trip record.
gear_units	smallint	Number of units of gear used in the tow.
gear_perf	smallint	Code for performance of gear during the tow.
path	smallint	Code describing configuration of path of shot.
speed	numeric(3,1)	Average speed through water during shot (knots).

distance	numeric(4,2)	Distance of gear over bottom (nautical miles).
head_ht	numeric(3,1)	Average headline height (m).
head_code	character varying(1)	Code showing how headline height was determined, refer to rdb.t_headline_codes.
dist_wings	numeric(4,1)	Average distance between wings (m).
distwing_code	character varying(1)	Code to indicate how distance between wings was determined for this tow, refer rdb.t_wing_dist_codes.
dist_doors	numeric(4,1)	Average distance between doors of gear (m).
distdoor_code	character varying(1)	Code to indicate how the distance between the doors was determined for this tow, refer rdb.t_door_dist_codes.
warp_lgth	integer	Length of warp during the tow (m).
fish_locn	character varying(1)	Code to indicate the location of the fish at the net mouth during shot as observed on net sonde, refer rdb.t_fish_obs_codes.
wind_dir	integer	Wind direction (degrees true), 999=No wind.
wind_force	smallint	Wind force on Beaufort scale.
air_temp	numeric(3,1)	Air temperature (degrees C).
air_press	numeric(5,1)	Air pressure (millibars).
cloud_cov	smallint	Code describing cloud cover during tow, in eighths cover.
sea_cond	smallint	Codes describing condition of the sea, refer to the Appendix.
sea_col	smallint	Code describing colour of sea, refer to the Appendix.
swell_ht	smallint	Code describing height of swell, refer to the Appendix.
codend_size	integer	Size of the codend mesh in mm.
bot_type	smallint	Code describing sea bottom type,

		refer to the Appendix.
bot_cont	smallint	Code describing sea bottom contour, refer to the Appendix.
surf_temp	numeric(3,1)	Surface temperature (degrees C).
bot_temp	numeric(3,1)	Temperature at bottom (degrees C).
wind_spd	smallint	Wind speed from anemometer (m/s) (1knot=0.51m/s).
secchi	smallint	Depth at which Secchi disc becomes invisible (m).
net_type	character varying(6)	The type of trawl net used, nwing refers to trawls with no lower wings, fwing refers to trawls with lower wings.
day_night	character varying(1)	Uses the categories D for daylight and N for night where the start and finish times are used to determine day or night.
day_night2	character varying(1)	Uses the categories D for daylight and N for night and assumes 0.5 hr of twilight before sunrise and after sunset. Generally a better reflection of actual daylight hours.
nul_wt	smallint	Indicates where there is a station where catch weights are missing.
data_id	character varying(2)	This refers to the original data in the first atlas (OR), the new (NW) data loaded (ie 1997 to 1999 or 2000 data), data loaded for the OBIS project (OB) subsequent to the NW data.
avg_depth	integer	Average depth, calculated from other depth fields.
season	character varying(3)	Season. Values SPR, SUM, AUT, WIN.
sedi_orig	character varying(8)	Original bottom sediment codes, based on the NZOI sediment charts. The numbers refer to polygon identifiers.
sedi_3types	character varying(3)	The bottom sediment type, coded to 3 types: M = Mud, S = Sand, G = Gravel.
sedi_s	character varying(3)	Bottom sediment type at the start

			position of the tow, from the NZOI sediment charts.
id	character varying(15)	No	A specific code for a trawl shot, made from the trip code and station number e.g. tan9301-100, used to join to the catch table.
startp	geometry		Position of vessel at start of the station as gis point type.
endp	geometry		Position of vessel at end of the station as gis point type.
track	geometry		Track line of vessel from start position to end position of station as gis line type.

```
Indexes:
   "pk_hagu_station" PRIMARY KEY, btree (id)
   "ui_hagu_station" UNIQUE, btree (trip_code, station_no)
   "nx_hagu_station_endp" gist (endp)
   "nx_hagu_station_startp" gist (startp)
   "nx_hagu_station_track" gist (track)
Check constraints:
   "enforce_dims_endp" CHECK (ndims(endp) = 2)
   "enforce_dims_startp" CHECK (ndims(startp) = 2)
   "enforce_dims_track" CHECK (ndims(track) = 2)
   "enforce_geotype_endp" CHECK (geometrytype(endp) = 'POINT'::text
    OR endp IS NULL)
   "enforce_geotype_startp" CHECK (geometrytype(startp) = 'POINT'::text
    OR startp IS NULL)
   "enforce_geotype_track" CHECK (geometrytype(track) = 'LINESTRING'::text
    OR track IS NULL)
   "enforce_srid_endp" CHECK (srid(endp) = 4326)
   "enforce_srid_startp" CHECK (srid(startp) = 4326)
   "enforce_srid_track" CHECK (srid(track) = 4326)
```

5.23 Table 23: hagu_catch

Comment: Hauraki Gulf time series catch data.

Column	Type	Null?	Description
trip_code	character varying(7)	No	Trip code as in station table.
station_no	integer	No	Station number - unique within a trip.
species	character(3)	No	Species code, refer to rdb.curr_spp.
weight	numeric(7,2)		Weight of the species caught at that station (kg).
wt_meth	smallint		Code of method used to determine weight of catch, refer rdb.t_wgt_meth_codes.
id_index	integer		Reliability of identification for a species where: 1 = reliably identified to species over time, 2 = a species code that may represent 2 species, 3 = identification to genus, 9 = index not assigned - less than 20 occurrences.
data_id	character varying(2)		This refers to the original data in the first atlas (OR), the new (NW) data loaded (ie 1997 to 1999 or 2000 data), data loaded for the OBIS project (OB) subsequent to the NW data, and data loaded in 2009 (08).
id	character varying(15)	No	A specific code for a trawl shot, made from the trip code and station number e.g. tan9301-100, used to join to the station table.
id_tospp	character varying(15)		Catch id code, made from the trip code, station number and species e.g. tan9301-100-JGU.
surf_temp	numeric(3,1)		Surface temperature (degrees C).
bot_temp	numeric(3,1)		Temperature at bottom (degrees C).
avg_depth	integer		Average depth, calculated from other depth fields.
totalcr_km2	numeric(14,2)		Total catch rate per square km.
cohort_0	numeric(7,1)		Catch weight for cohort 0+.

cohort_1	numeric(7,1)	Catch weight for cohort 1+.
young	numeric(7,1)	Catch weight for young fish.
old1	numeric(7,1)	Catch weight for old fish.
totcohort_wt	numeric(7,2)	
cohort_0km2	numeric(7,1)	Catch weight in kg per square km for cohort 0+.
cohort_1km2	numeric(7,1)	Catch weight in kg per square km for cohort 1+.
cohort_youngkm2	numeric(7,1)	Catch weight in kg per square km for cohort young.
cohort_oldkm2	numeric(7,1)	Catch weight in kg per square km for cohort old.
species_orig	character varying(3)	The original species code from the research database, refer rdb.curr_spp.
idindex_orig	integer	Reliability of identification for a species where: 1 = reliably identified to species over time, 2 = a species code that may represent 2 species, 3 = identification to genus, 9 = index not assigned - less than 20 occurrences. The new data NW have not had an index assigned as the data has not been checked for outliers.

Foreign-key constraints:
"fk_hagu_catch_station" FOREIGN KEY (id)
REFERENCES fish_comm.hagu_station(id)

5.24 Table 24: newstation

Comment: Data from trawl station table where data_id = OB including 1196 records not in t_station.

Column	Type	Null?	Description
trip_code	character varying(7)	No	Trip code, comprised of a 3 char vessel code, 2 digit year and 2 digit trip number.
station_no	integer	No	Station number - unique within a trip.
categories	character varying(2)		2 separate user-defined categories, definitions should be in trawl:t_trip_comm.
area	character varying(4)		Code describing area, refer rdb.area_codes.
stn_code	character varying(4)		Code for a permanent station occupied repeatedly.
stratum	character varying(4)		Stratum number if trip is a stratified survey, else a transect code.
course	integer		Course of vessel during the shot (course-made-good).
date_s	date		Starting date of the shot.
time_s	integer		Starting time (24hr,NZST) of the shot (hhmm format).
fix_s	character varying(2)		Method of fixing position at start of tow, refer rdb.t_fix_meth_codes.
timefix_s	integer		Time (in minutes) elapsed since last position fix at the start of tow.
lat_s	numeric(8,6)		Latitude of vessel at start of tow in decimal degrees (DD.dddd format).
long_s	numeric(9,6)		Longitude of vessel at start of tow in decimal degrees east of Greenwich (DD.dddd format).
gear_s	integer		Depth of lowest part of gear (ground rope) at start of tow (m).
bot_gs	integer		Depth of sea bottom at gear position at start of tow (m).

bot_vs	integer	Depth of sea bottom at vessel position at start of tow (m).
date_f	date	Finishing date of the shot.
time_f	integer	Finishing time (24hr, NZST) of shot (hhmm format).
fix_f	character varying(2)	Method of fixing position at start of tow, refer rdb.t_fix_meth_codes.
timefix_f	integer	Time (in minutes) elapsed since last position fix at end of the tow.
lat_f	numeric(8,6)	Latitude of vessel at end of tow in decimal degrees (DD.dddd format).
long_f	numeric(9,6)	Longitude of vessel at end of tow in decimal degrees east of Greenwich (DD.dddd format).
gear_f	integer	Depth of lowest part of gear (groundrope) at end of tow (m).
bot_gf	integer	Depth of sea bottom at gear position at end of tow (m).
bot_vf	integer	Depth of sea bottom at vessel position at end of tow (m).
min_gdepth	integer	Minimum depth of lowest part of gear (ground rope) during tow (m).
max_gdepth	integer	Maximum depth of lowest part of gear (ground rope) during tow (m).
gear_meth	character varying(2)	Gear method code, descriptions in rdb.meth_codes.
gear_code	smallint	Code for set of gear used, details in trawl:t_trip record.
gear_units	smallint	Number of units of gear used in the tow.
gear_perf	smallint	Code for performance of gear during the tow.
path	smallint	Code describing configuration of path of shot.
speed	numeric(3,1)	Average speed through water during shot (knots).

distance	numeric(4,2)	Distance of gear over bottom (nautical miles).
head_ht	numeric(3,1)	Average headline height (m).
head_code	character varying(1)	Code showing how headline height was determined, refer to rdb.t_headline_codes.
dist_wings	numeric(4,1)	Average distance between wings (m).
distwing_code	character varying(1)	Code to indicate how distance between wings was determined for this tow, refer rdb.t_wing_dist_codes.
dist_doors	numeric(4,1)	Average distance between doors of gear (m).
distdoor_code	character varying(1)	Code to indicate how the distance between the doors was determined for this tow, refer rdb.t_door_dist_codes.
warp_lgth	integer	Length of warp during the tow (m).
fish_locn	character varying(1)	Code to indicate the location of the fish at the net mouth during shot as observed on net sonde, refer rdb.t_fish_obs_codes.
wind_dir	integer	Wind direction (degrees true), 999=No wind.
wind_force	smallint	Wind force on Beaufort scale.
air_temp	numeric(3,1)	Air temperature (degrees C).
air_press	numeric(5,1)	Air pressure (millibars).
cloud_cov	smallint	Code describing cloud cover during tow, in eighths cover.
sea_cond	smallint	Codes describing condition of the sea, refer to the Appendix.
sea_col	smallint	Code describing colour of sea, refer to the Appendix.
codend_size	smallint	Size of the codend mesh in mm.
swell_dir	integer	Direction of the swell (degrees true).

bot_type	smallint	Code describing sea bottom type, refer to the Appendix.
bot_cont	smallint	Code describing sea bottom contour, refer to the Appendix.
surf_temp	numeric(3,1)	Surface temperature (degrees C).
bot_temp	numeric(3,1)	Temperature at bottom (degrees C).
wind_spd	smallint	Wind speed from anemometer (m/s) (1knot=0.51m/s).
secchi	smallint	Depth at which Secchi disc becomes invisible (m).
net_type	character varying(6)	The type of trawl net used, nwing refers to trawls with no lower wings, fwing refers to trawls with lower wings.
day_night	character varying(1)	Uses the categories D for daylight and N for night where the start and finish times are used to determine day or night.
day_night2	character varying(1)	Uses the categories D for daylight and N for night and assumes 0.5 hr of twilight before sunrise and after sunset. Generally a better reflection of actual daylight hours.
nul_wt	smallint	Indicates where there is a station where catch weights are missing.
data_id	character varying(2)	This refers to the original data in the first atlas (OR), the new (NW) data loaded (ie 1997 to 1999 or 2000 data), data loaded for the OBIS project (OB) subsequent to the NW data.
id	character varying(15)	A specific code for a trawl shot, made from the trip code and station number e.g. tan9301-100, used to join to t_catch.
avg_depth	integer	Average depth, calculated from other depth fields.
season	character varying(3)	Season. smr = summer, win = winter. Not populated.
startp	geometry	Position of vessel at start of the

```
                                        station as gis point type.

endp            geometry                Position of vessel at end of the
                                        station as gis point type.

track           geometry                Track line of vessel from start
                                        position to end position of station
                                        as gis line type.


Indexes:
    "nx_newstation_endp" gist (endp)
    "nx_newstation_startp" gist (startp)
    "nx_newstation_track" gist (track)
Check constraints:
    "enforce_dims_endp" CHECK (ndims(endp) = 2)
    "enforce_dims_startp" CHECK (ndims(startp) = 2)
    "enforce_dims_track" CHECK (ndims(track) = 2)
    "enforce_geotype_endp" CHECK (geometrytype(endp) = 'POINT'::text
     OR endp IS NULL)
    "enforce_geotype_startp" CHECK (geometrytype(startp) = 'POINT'::text
     OR startp IS NULL)
    "enforce_geotype_track" CHECK (geometrytype(track) = 'LINESTRING'::text
     OR track IS NULL)
    "enforce_srid_endp" CHECK (srid(endp) = 4326)
    "enforce_srid_startp" CHECK (srid(startp) = 4326)
    "enforce_srid_track" CHECK (srid(track) = 4326)
```

5.25 Table 25: observermw_station

Comment: Observer mid water station data from obs database.

Column	Type	Null?	Description
tripnumber	integer	No	Trip number as unique number for each observer trip.
townumber	integer	No	Tow number or station number as sequential identifier for each tow.
date	date		Date at start of the tow.
target_species	character varying(3)		3 character code for the target species.
fishing_on_marks	smallint		fishing_on_marks code, see observer logbook instructions.
fishing_on_marks_1	smallint		The first digit of fishing_on_marks, the code indicates whether the vessel was actively targeting fish sign: 0=No, 1=Yes.
fishing_on_marks_2	smallint		The second digit of fishing_on_marks, the code indicates who shot the net.
headline_height	numeric(4,1)		Vertical opening distance of net (m).
path_of_tow	character varying(3)		Configuration of tow (see logbook instructions), eg straight line etc.
start_time	integer		Start time of the tow, NZST (24 hour clock).
lat_s	numeric(8,4)		Latitude for the start of the tow, in decimal degrees (DD.dddd) format.
long_s	numeric(8,4)		Longitude for the start of the tow, in decimal degrees (DDD.dddd) format east of Greenwich.
start_depth_groundline	integer		Depth to groundline at the start of tow (m).
start_depth_seabed	integer		Depth to seabed at the start of tow (m).
temperature_surface	numeric(3,1)		Sea surface temperature (decimal degrees C).
temperature_headline	numeric(3,1)		Sea temperature at the net headline (decimal degrees C).

end_time	integer	End time of the tow, NZST (24 hour clock).
lat_f	numeric(8,4)	Latitude for the end of the tow, in decimal degrees (DD.dddd) format.
long_f	numeric(8,4)	Longitude for the end of the tow, in decimal degrees (DDD.dddd) format east of Greenwich.
end_depth_groundline	integer	Depth to groundline at the end of tow (m).
end_depth_seabed	integer	Depth to seabed at the end of tow (m).
fishing_speed	numeric(3,1)	Fishing speed in knots.
period_not_fishing	integer	Duration between start and end time when the net is not fishing (hr and min).
startp	geometry	Position of vessel at start of the station as gis point type.
endp	geometry	Position of vessel at end of the station as gis point type.
track	geometry	Track line of vessel from start position to end position of station as gis line type.

```
Indexes:
   "nx_observermw_station_endp" gist (endp)
   "nx_observermw_station_startp" gist (startp)
   "nx_observermw_station_track" gist (track)
Check constraints:
   "enforce_dims_endp" CHECK (ndims(endp) = 2)
   "enforce_dims_startp" CHECK (ndims(startp) = 2)
   "enforce_dims_track" CHECK (ndims(track) = 2)
   "enforce_geotype_endp" CHECK (geometrytype(endp) = 'POINT'::text OR endp IS
                                 NULL)
   "enforce_geotype_startp" CHECK (geometrytype(startp) = 'POINT'::text OR
                                 startp IS NULL)
   "enforce_geotype_track" CHECK (geometrytype(track) = 'LINESTRING'::text OR
                                 track IS NULL)
   "enforce_srid_endp" CHECK (srid(endp) = 4326)
   "enforce_srid_startp" CHECK (srid(startp) = 4326)
   "enforce_srid_track" CHECK (srid(track) = 4326)
```

5.26 Table 26: observermw_catch

Comment: Observer mid water catch data.

Column	Type	Null?	Description
tripnumber	integer		Unique sequential number for each observer trip.
townumber	integer		Sequential identifier for each tow.
species_code	character(3)		3-char code for a species of fish caught.
weight	integer		Greenweight of species caught (kg).

5.27 Table 27: researchmw_station

Comment: Research station data from the trawl database for mid water tows used in Bagley etal(2000).

Column	Type	Null?	Description
trip_code	character varying(7)	No	Trip code, comprised of a 3 char vessel code, 2 digit year and 2 digit trip number.
station_no	integer	No	Station number - unique within a trip.
categories	character varying(2)		2 separate user-defined categories, definitions should be in trawl:t_trip_comm.
area	character varying(4)		Code describing area, refer rdb.area_codes.
stn_code	character varying(4)		Code for a permanent station occupied repeatedly.
stratum	character varying(4)		Stratum number if trip is a stratified survey, else a transect code.
course	integer		Course of vessel during the shot (course-made-good).
date_s	date		Starting date of the shot.
time_s	integer		Starting time (24hr,NZST) of the shot (hhmm format).
fix_s	character varying(2)		Method of fixing position at start of tow, refer rdb.t_fix_meth_codes.
timefix_s	integer		Time (in minutes) elapsed since last position fix at the start of tow.
lat_s	numeric(6,4)		Latitude of vessel at start of tow in decimal degrees (DD.dddd format).
long_s	numeric(7,4)		Longitude of vessel at start of tow in decimal degrees east of Greenwich (DD.dddd format).
gear_s	integer		Depth of lowest part of gear (ground rope) at start of tow (m).
bot_gs	integer		Depth of sea bottom at gear position at start of tow (m).

bot_vs	integer	Depth of sea bottom at vessel position at start of tow (m).
date_f	date	Finishing date of the shot.
time_f	integer	Finishing time (24hr, NZST) of shot (hhmm format).
fix_f	character varying(2)	Method of fixing position at start of tow, refer rdb.t_fix_meth_codes.
timefix_f	integer	Time (in minutes) elapsed since last position fix at end of the tow.
lat_f	numeric(6,4)	Latitude of vessel at end of tow in decimal degrees (DD.dddd format).
long_f	numeric(7,4)	Longitude of vessel at end of tow in decimal degrees east of Greenwich (DD.dddd format).
gear_f	integer	Depth of lowest part of gear (groundrope) at end of tow (m).
bot_gf	integer	Depth of sea bottom at gear position at end of tow (m).
bot_vf	integer	Depth of sea bottom at vessel position at end of tow (m).
min_gdepth	integer	Minimum depth of lowest part of gear (ground rope) during tow (m).
max_gdepth	integer	Maximum depth of lowest part of gear (ground rope) during tow (m).
gear_meth	character varying(2)	Gear method code, descriptions in rdb.meth_codes.
gear_code	smallint	Code for set of gear used, details in trawl:t_trip record.
gear_units	smallint	Number of units of gear used in the tow.
gear_perf	smallint	Code for performance of gear during the tow.
path	smallint	Code describing configuration of path of shot.
speed	numeric(3,1)	Average speed through water during shot (knots).

distance	numeric(4,2)	Distance of gear over bottom (nautical miles).
head_ht	numeric(3,1)	Average headline height (m).
head_code	character varying(1)	Code showing how headline height was determined, refer to rdb.t_headline_codes.
dist_wings	numeric(4,1)	Average distance between wings (m).
distwing_code	character varying(1)	Code to indicate how distance between wings was determined for this tow, refer rdb.t_wing_dist_codes.
dist_doors	numeric(4,1)	Average distance between doors of gear (m).
distdoor_code	character varying(1)	Code to indicate how the distance between the doors was determined for this tow, refer rdb.t_door_dist_codes.
warp_lgth	integer	Length of warp during the tow (m).
fish_locn	character varying(1)	Code to indicate the location of the fish at the net mouth during shot as observed on net sonde, refer rdb.t_fish_obs_codes.
wind_dir	integer	Wind direction (degrees true), 999=No wind.
wind_force	smallint	Wind force on Beaufort scale.
air_temp	numeric(3,1)	Air temperature (degrees C).
air_press	numeric(5,1)	Air pressure (millibars).
cloud_cov	smallint	Code describing cloud cover during tow, in eighths cover.
sea_cond	smallint	Codes describing condition of the sea, refer to the Appendix.
sea_col	smallint	Code describing colour of sea, refer to the Appendix.
swell_ht	smallint	Code describing height of swell, refer to the Appendix.
codend_size	integer	Size of the codend mesh in mm.

bot_type	smallint	Code describing sea bottom type, refer to the Appendix.
bot_cont	smallint	Code describing sea bottom contour, refer to the Appendix.
surf_temp	numeric(3,1)	Surface temperature (degrees C).
bot_temp	numeric(3,1)	Temperature at bottom (degrees C).
wind_spd	smallint	Wind speed from anemometer (m/s) (1knot=0.51m/s).
secchi	smallint	Depth at which Secchi disc becomes invisible (m).
net_type	character varying(6)	The type of trawl net used, nwing refers to trawls with no lower wings, fwing refers to trawls with lower wings.
day_night	character varying(1)	Uses the categories D for daylight and N for night where the start and finish times are used to determine day or night.
day_night2	character varying(1)	Uses the categories D for daylight and N for night and assumes 0.5 hr of twilight before sunrise and after sunset. Generally a better reflection of actual daylight hours.
nul_wt	smallint	Indicates where there is a station where catch weights are missing.
id	character varying(15)	A specific code for a trawl shot, made from the trip code and station number e.g. tan9301-100, used to join to the catch table.
startp	geometry	Position of vessel at start of the station as gis point type.
endp	geometry	Position of vessel at end of the station as gis point type.
track	geometry	Track line of vessel from start position to end position of station as gis line type.

Indexes:
"nx_researchmw_station_endp" gist (endp)
"nx_researchmw_station_startp" gist (startp)

```
    "nx_researchmw_station_track" gist (track)
Check constraints:
    "enforce_dims_endp" CHECK (ndims(endp) = 2)
    "enforce_dims_startp" CHECK (ndims(startp) = 2)
    "enforce_dims_track" CHECK (ndims(track) = 2)
    "enforce_geotype_endp" CHECK (geometrytype(endp) = 'POINT'::text
     OR endp IS NULL)
    "enforce_geotype_startp" CHECK (geometrytype(startp) = 'POINT'::text
     OR startp IS NULL)
    "enforce_geotype_track" CHECK (geometrytype(track) = 'LINESTRING'::text
     OR track IS NULL)
    "enforce_srid_endp" CHECK (srid(endp) = 4326)
    "enforce_srid_startp" CHECK (srid(startp) = 4326)
    "enforce_srid_track" CHECK (srid(track) = 4326)
```

5.28 Table 28: researchmw_catch

Comment: Research catch data from the trawl database for mid water tows used in Bagley etal(2000).

Column	Type	Null?	Description
trip_code	character varying(7)	No	Trip code as in station table.
station_no	integer	No	Station number - unique within a trip.
species	character(3)	No	Species code, refer to rdb.curr_spp.
species_orig	character varying(3)		The original species code from the research database, refer rdb.curr_spp.
weight	numeric(7,2)		Weight of the species caught at that station (kg).
wt_meth	smallint		Code of method used to determine weight of catch, refer rdb.t_wgt_meth_codes.
id_index	integer		Reliability of identification for a species.
id	character varying(15)		A specific code for a trawl shot, made from the trip code and station number e.g. tan9301-100, used to join to the station table.

5.29 View 1: v_distribution_08

Comment: View showing position and depth data for each species for where the data_id = 08.

Attributes	Data type	Null?
trip_code	character(7,1)	No
station_no	integer	No
species	character(3,1)	No
lat_s	decimal(6,4)	
long_s	decimal(7,4)	
avg_depth	integer	
data_id	character(2,1)	
id	character(15,1)	

View definition:

```
 SELECT s.trip_code, s.station_no, c.species, s.lat_s, s.long_s, s.avg_depth,
s.data_id, s.id
   FROM t_station s, t_catch c
  WHERE s.id::text = c.id::text AND s.data_id::text = '08'::text;
```

See Tables t_station and t_catch for attribute comments for v_distribution_08.

6 fish_comm business rules

6.1 Introduction to business rules

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

There are three recognized 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 should 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

Trawl survey station details (t_station)

trip_code	Must be a valid trip code in the following format: 3 character vessel code (see the *t_vessels* table in the **rdb** database for available codes); followed by 2 digit year (e.g., 99 = 1999, 00 = 2000); followed by a 2 digit sequential trip number for each vessel each year.
station_no	Must be a unique number within a single trip.
area	Area code must be a valid code as listed in the *area_codes* table in the **rdb** database.
course	Course should be within the range of 0 – 359 degrees.
date_s	The date at the start of a station must be a legitimate date. **Multiple column checks on start date:** The start date must not be greater than the finish date.
time_s	Start time of the station must be a valid 24-hour time and should fall within the range of 0 – 2359 hours. (Values to 2400 accepted).
fix_s } **fix_f }**	The method of position fix code must be valid code as listed in the *t_fix_meth_codes* table in the **rdb** database.
lat_s	Must be a valid latitude
long_s	Must be a valid longitude.
bot_gs	Depth of sea bottom must not be less than depth of gear
date_f	The date at the finish of a station must be a legitimate date. **Multiple column checks on finish date:** The finish date must not be less than the start date.
time_f	Finish time of the station must be a valid 24-hour time and should fall within the range of 0 – 2359. (Values to 2400 accepted). **Multiple columns checks on date and time**: The start date and time must not be later than the finish date time and should be within a reasonable time period.
lat_f	Must be a valid latitude

long_f	Must be a valid longitude. **Multiple columns checks on position:** The finish position should be within a reasonable distance from the start position for the gear type used.
bot_gf	Depth of sea bottom must not be less than depth of gear
min_gdepth	Minimum gear depth must be less than or equal to the depth of gear at the start and finish of the station.
max_gdepth	Maximum gear depth must be greater than or equal to the minimum gear depth and the depth of gear at the start and finish of the station
gear_meth	Gear method code must be a valid code as listed in the *meth_codes* table in the **rdb** database.
gear_code	Should be within the range 1 – 6.
gear_perf	The gear performance code must be valid code as listed in Appendix 1.
path	The path code must be valid code as listed in Appendix 1.
speed	The vessel's recorded speed during the station should be within the range 0 – 5 knots and be reasonable for the gear method.
distance	The distance travelled during the station should be reasonable for the gear method. **Multiple columns check on: distance; start and finish positions; and speed and start/finish times:** The distance travelled during a station as calculated by (1) the difference between start and finish positions; (2) speed * elapsed time; and (3) recorded distance should be in approximate agreement.
head_code	Headline height code must be a valid code as listed in the *t_headline_codes* table in the **rdb** database.
distwing_code	Distance between trawl wings code must be a valid code as listed in the *t_wing_dist_codes* table in the **rdb** database.
distdoor_code	Distance between trawl doors code must be a valid code as listed in the *t_door_dist_codes* table in the **rdb** database.
fish_locn	Must be a valid code as listed in the *t_fish_obs_codes* table in the **rdb** database.

wind_dir	Wind direction must fall within the range of 0-359, 999.
wind_force	Wind force must fall within the range of 0 – 12.
air_temp	Air temperature should fall within the reasonable range of 5 – 30.
air_press	Air pressure should fall within the reasonable range of 960 to 1040.
cloud_cov	Cloud cover must fall within the range of 0-8.
sea_cond	The sea condition code must be valid code as listed in Appendix 1.
sea_col	The sea colour code must be valid code as listed in Appendix 1.
swell_ht	The swell height code must be valid code as listed in Appendix 1.
swell_dir	Wind direction must fall within the range of 0-359, 999.
bot_type	The bottom type code must be valid code as listed in Appendix 1.
bot_cont	The bottom contour code must be valid code as listed in Appendix 1.
surf_temp	Sea surface temperature should fall within the reasonable range of 5 – 28.
bot_temp	Sea bottom temperature should fall within the reasonable range of 3 – 25.
wind_spd	Wind speed should fall within the reasonable range of 0 - 30.
secchi	Secchi disc distance should fall within the reasonable range of 0 – 40.
id	Must be a comprised of trip_code concatenated with '-' concatenated with station_no

Trawl survey catch details (t_catch)

trip_code	Must be equal to a trip code as listed in the *t_station* table.
station_no	Must be a unique number within a single trip. **Multiple columns check on trip code and station number:** The combination of trip code and station number must exist in the *t_station* table.
species	Should be a valid species code as listed in the *curr_spp* table in the **rdb** database.
species_orig	Must be a valid species code as listed in the *species_master* table in the **rdb** database, and preferably in the view *curr_spp*.
weight	Must be a valid number greater then 0
wt_meth	Must be a valid code as listed in the *t_wgt_meth_codes* table in the **rdb** database.
id_index	Must be an integr and should be in the range 0-9.
data_id	Must be a 2 character code and should be one of (OR, NW, OB, 08).
id	Must be a comprised of trip_code concatenated with '-' concatenated with station_no, and must exist in table t_station.

The other station and catch tables, namely for crdw, crmd, ecsi and hagu time series, should conform to the same business rules as the t_station and t_catch tables as above.

The attributes or columns in the various distribution tables mostly share the same attributes with the t_station and t_catch tables as above so the same business rules apply to the respective attributes.

Observer station record (observermw_station)

tripnumber	Must be an integer and should be a legitimate trip number in the **obs** or **cod** database.
townumber	Must be a unique integer within all station records, for a given trip number.
date	The date of the station must be a legitimate date. The station start date should be sequential between stations, for a given trip.
target_species	Must be a valid species code as listed in the *curr_spp* table in the **rdb** database.
fishing_on_marks	Must be an integer.
headline_height	The headline height should fall within the reasonable range of 20 – 120 m.
path_of_tow	Consists of three parts: tow type, tow configuration and number of turns. The tow type code and configuration must be valid codes as listed in Appendix 1.
lat_s	Must be a valid latitude should fall within the range of -32 to -54.
long_s	Must be a valid longitude and should fall within the range of 164 to 190 degrees East of Greenwich.
start_depth_groundline	Net depth at start, should fall within the reasonable range of 20 – 1500 m.
start_depth_seabed	Depth of seabed at start, should fall within the range of 20 – 2000 m.
temperature_surface	Sea surface temperature should be in the range 7.0 to 24.0 degrees Celsius.
temperature_headline	Sea temperature at the net should be in the range 4.0 to 15.5 degrees Celsius.
lat_f	Latitude at finish, must be a valid latitude and should fall within the range of -32 to -54 degrees.
long_f	Longitude at finish, must be a valid longitude and should fall within the reasonable range of 164 to 190 degrees East of Greenwich .
	Multiple column checks on station start and finish positions: The start and finish positions should be within a defined maximum distance.

The validation parameter for the distance between positions is set at 25 nautical miles. The time elapsed between the start and the finish of the station is taken into account on validation. The distance between stations must be within a distance that could be covered by the vessel in the elapsed time period between stations. The validation parameter is set at 15 knots for this check.

end_depth_groundline Net depth at finish, should fall within the reasonable range of 20 – 1500 meters.

end_depth_seabed Bottom depth at finish, should fall within the range of 20 – 2000 m.

fishing_speed Speed should fall within the reasonable range of 1.0 – 6.0 knots.

period_not_fishing Must be an integer.

Observer catch record (observermw_catch)

Multiple column checks on trip and station number:
The combination of tripnumber and townumber must exist in the *observermw_ station* table.

species_code Should be a valid species code as listed in the *species_master* table in the **rdb** database, preferably in the view *curr_spp*.

weight Must be a number greater than zero.

7 Acknowledgements

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Appendix 1 – Reference Code Tables

Gear performance code

1.	Excellent
2.	Satisfactory, catch unlikely to be reduced by performance
3.	Unsatisfactory, catch probably reduced by malfunction or damage
4.	Unsatisfactory, catch reduced by malfunction or damage

Path code

1.	Horizontal straight line
2.	Vertical straight line
3.	Closed circle or loop
4.	Closed triangle or square
5.	Zigzag
6.	U-bend
7.	Contour at constant depth
8.	Retrack on straight line

Sea condition code

0	Calm, glassy	0m
1	Calm	0 – 0.1m
2	Smooth	0.1 – 0.5m
3	Slight	0.5 – 1m
4	Moderate	1 – 2.5m
5	Rough	2.5 – 4m
6	Very rough	4 – 6m
7	High	6 - 10m
8	Very high	10 – 15m
9	Huge	over 15m

Sea colour code

01	Deep blue
02	Blue
03	Light blue
04	Greeny blue
05	Bluey green
06	Deep green
07	Green
08	Yellow green

Swell height code

1	Low	0 – 2m
2	Moderate	2 – 4m
3	Heavy	over 4m

Bottom contour code

0	Unknown
1	Smooth/flat
2	Undulating
3	Hillocky
4	Rugged
5	Very rugged

Bottom type code

0	Unknown
1	Mud or ooze
2	Mud with some sand
3	Sand
4	Sand/gravel and shells
5	Shells (broken)
6	Gravel
7	Rock
8	Coral
9	Stone
10	Live shell beds
11	Mud with broken shells
12	Sponge beds

data_id

OR	Original data in the first atlas
NW	New data for years 1997 to 1999 or 2000
OB	Data loaded for the OBIS project subsequent to the 'NW' data
08	Data up to 2008 loaded in 2009, includes historic trawl surveys from 1980 to 1991

sedi_s and **sedi_f** from table crmd_station

crmt	chatham rise mud terrigenous
crmpc	chatham rise mud planktonic carbonate
crcsbc	chatham rise sand coarse benthic carbonate
crst	chatham rise sand terrigenous
crsau	chatham rise sand authigenic
crspc	chatham rise sand planktonic carbonate
crmud	chatham rise mud
crsand	chatham rise sand

Any stations east of 179 West has only mud or sand categories ie. crmud or crsand.

Codes for observer tables

Tow type codes

1 Bottom throughout tow.
2 Midwater at relatively constant depth.
3 Midwater in a broad range of depths.
4 Mixed bottom & midwater.

Tow configuration codes

A Straight line
B ”U”
C Zigzag
D Closed pattern (circle, loop etc)
E Constant depth contour
F Pinnacle fishing