Database documentation for the Ministry of Fisheries Acoustic database

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Revision History

Version	Date	Change	Responsible
1.0	January 2006	First release	Gavin Macaulay
1.1	June 2006	Modifications from NIWA internal review	Gavin Macaulay

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1 Database Document Series

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

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

This document describes the **acoustic** database, and is part of the database documentation series produced by NIWA. It supersedes the previous documentation on the **acoustic** database [Macaulay 2000], and is intended as a guide for users and administrators of the **acoustic** database.

All documents in this series include a summary of 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 link together.

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

This document was produced using the LaTeX document preparation system. The constitutent files are stored in the CVS revision control system and the current version is 1.20.

2 Acoustic data collection

The **acoustic** database is designed for the storage of acoustic data. The data were collected using an echosounder either mounted on a vessel, towed by a vessel, or in a fixed location. The performance and characteristics of the echosounders used vary widely but generally involve sophisticated electronic equipment and associated software. A detailed description of how and why acoustic data are collected is available [MacLennan & Simmonds 1992]. The echosounders used to collect the acoustic data have changed considerably over the years, driven mainly by advances in electronic and computer technologies. However, the basic data have remained the same.

An echosounder periodically emits a pulse of sound (it 'pings') and then listens for echoes of this pulse. The range and amplitude of the echoes are measured and stored. Associated data such as the date, time, and vessel position are also stored.

The **acoustic** database contains data collected from acoustic surveys starting in 1984 through to the present day. Species on which acoustic data have been collected include hoki, hake, smooth and black oreos, orange roughy, and southern blue whiting. Areas from which these data have been collected include the Chatham Rise, the Campbell Plateau, the west coast of the South Island, Cook Strait and various inshore regions around New Zealand. The data are used primarily to estimate the biomass of

fish species for the Ministry of Fisheries.

Aside from the acoustic data, this database also stores various ancillary data that provide context to the acoustic data. This includes such data as vessel position, speed, and direction of travel. Details on the echosounder equipment and software settings are also stored, as are the results of any equipment calibrations.

3 Data Structures

3.1 Table relationships

The **acoustic** database comprises various related tables (see Figure 1 for an ERD of the entire database). The overall structure is centered on the *files* table (see Figure 2), with foreign key relationships to the tables associated with experiments (Figure 4), equipment (Figure 3), echo integration (Figure 5). In addition there are some temporary tables used to store information used during data loading, shown in Figure 6. All of the table attributes are shown in the ERDs.

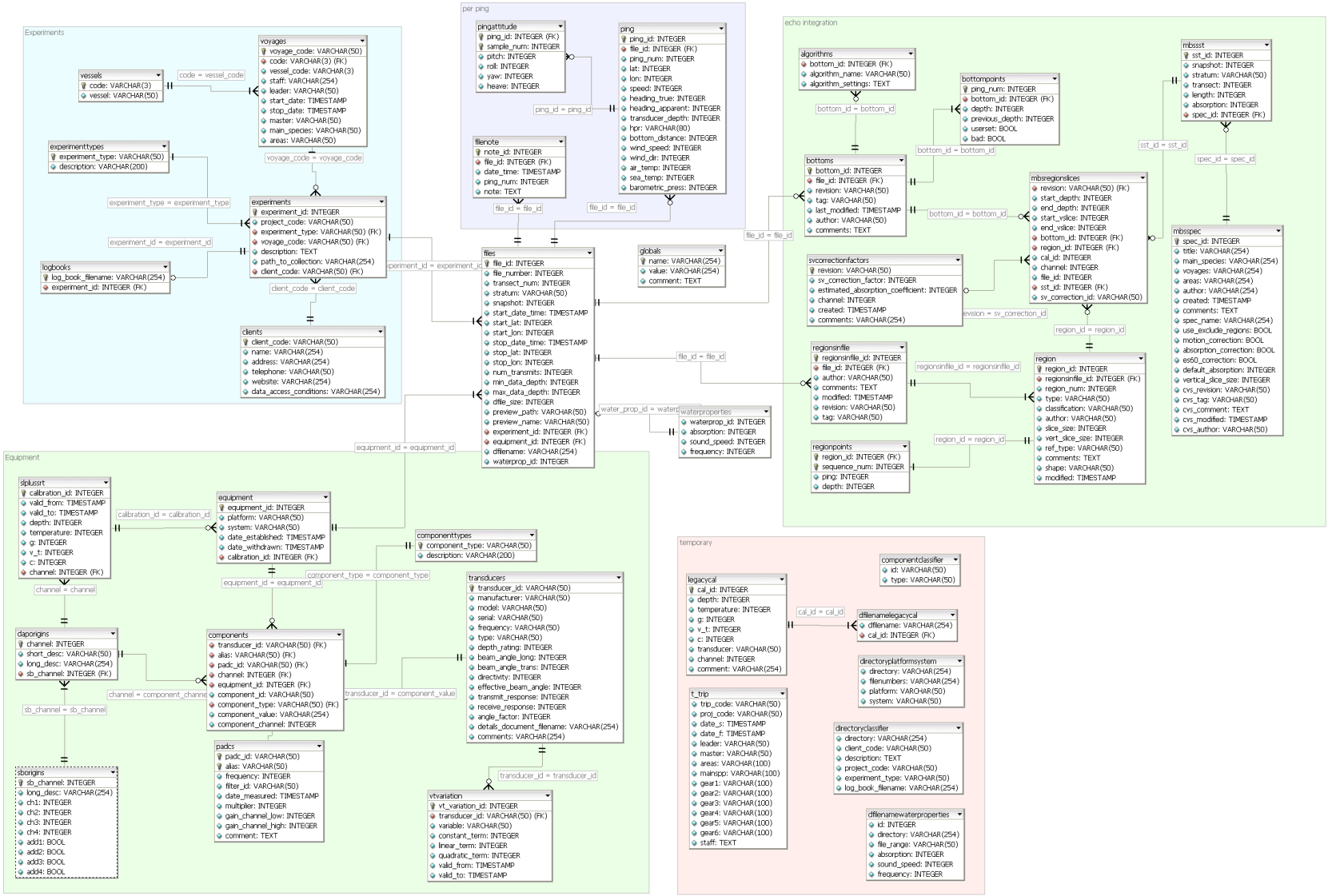

Figure 1: ERD for the entire database.

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.

The **acoustic** database is implemented as a relational database, and has one fundamental relationship that is repeated throughout the database — the one-to-many relationship. This is shown in the ERD by connecting a single line (indicating 'one') from the parent table to the child table with a crows foot (indicating 'many'). For example, consider the relationship between *experiments* and *files*. This means that any one record in *experiments* relates to or more records in *files*, and one record in *files* must relate to only one record in *experiments*. The child end is indicated by a 'crows-foot' symbol.

Note that the one-to-many relationships can be either mandatory or optional. The optional relationship, denoted in the ERD by the symbol 'o' at one or both ends of the relationship line, means that a record does not have to have any associated records. Conversely, the mandatory relationship denoted in the ERD by a bar symbol across the relationship line, means that a record has to have at least one associated record. For example, an experiment in *experiments* does not have to have a log book, but if it does, it can have many. Conversely a log book, in *logbooks* must relate to a record in *experiments*.

A key symbol to the left of the attribute name represents the primary key for the table.

Most of the tables in the **acoustic** database have some attributes, called foreign keys[1], which define the relationships between the tables in the **acoustic** database.

3.2 Database Design

The **acoustic** database was originally implemented as an object-oriented database using the ObjectStore product from eXcelon Corporation. However, for a number of reasons, the database has been moved to a relational model on the PostgreSQL database management system. Care has been taken to only use 'standard' database features to allow the database to be easily moved to other systems if required. In the process, the database structure was modified to incorporate a more complete set of the ancillary data that is necessary to interpret the raw acoustic data. This includes the results of calibration of the acoustic equipment, details on the acoustic equipment, water property information from survey areas, and details on the acoustic echo partitioning done as part of the production of biomass estimates from the acoustic data. The intention is to have a database that contains all the information required to correctly interpret the acoustic data without recourse to external sources of information.

The database uses several concepts to structure the acoustic data, and to provide intuitive access pathways for the database user. An experiment *uses* equipment, *collects* data, is *performed during* a certain time period and is *performed in* a certain

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

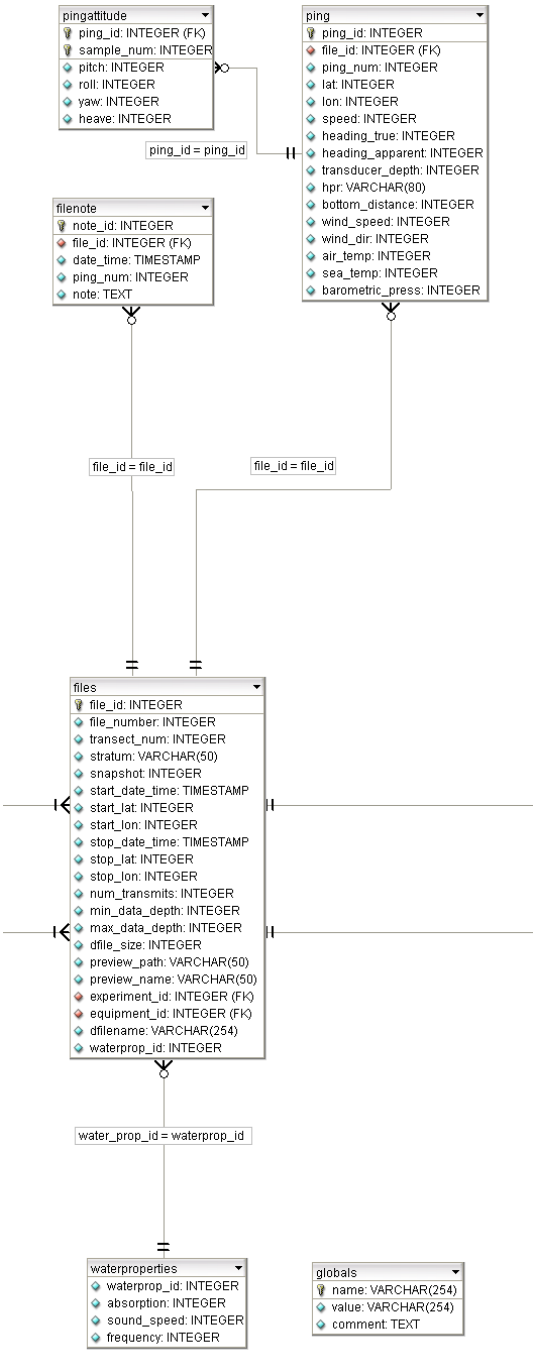

Figure 2: ERD for the files and related tables.

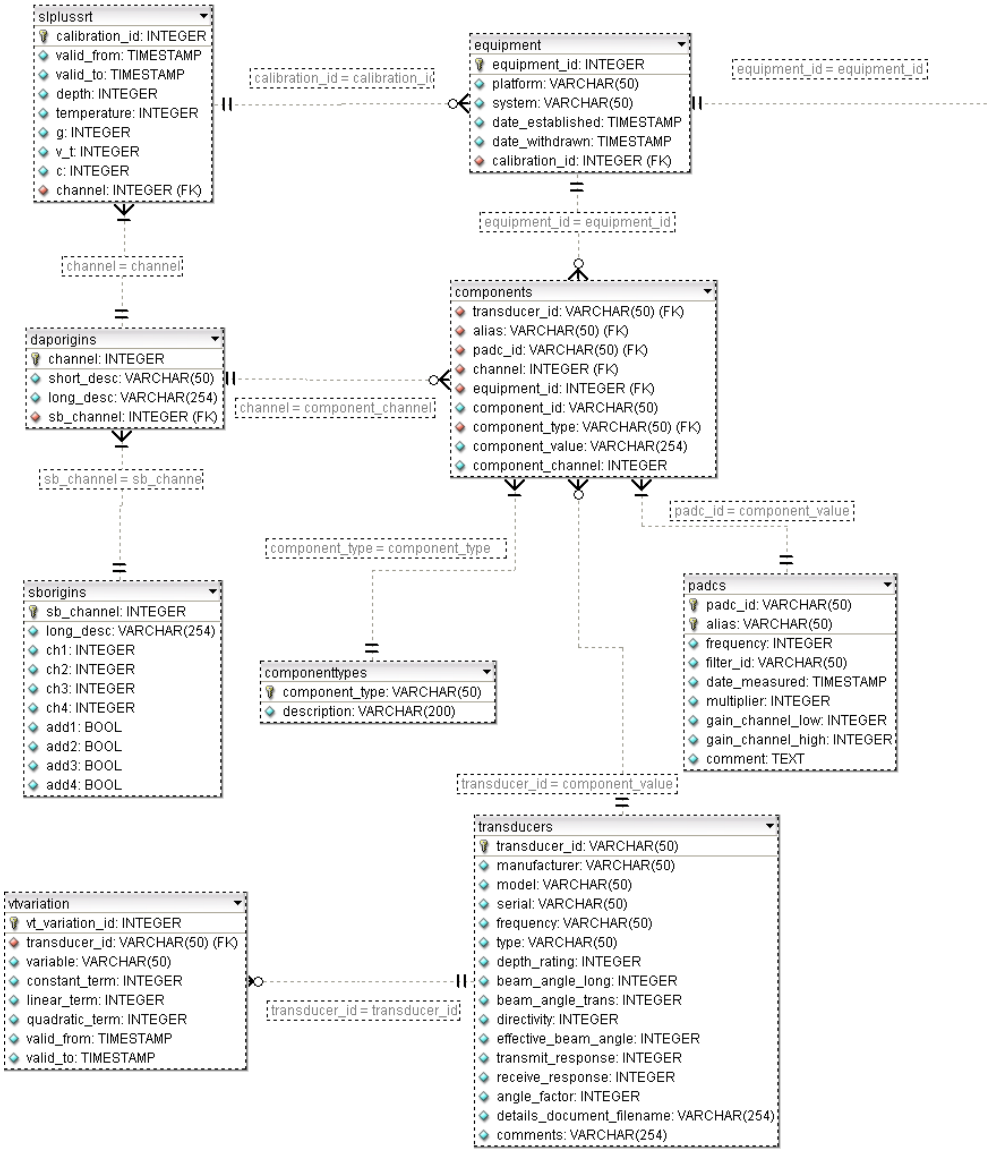

Figure 3: ERD for the tables associated with the echosounder equipment.

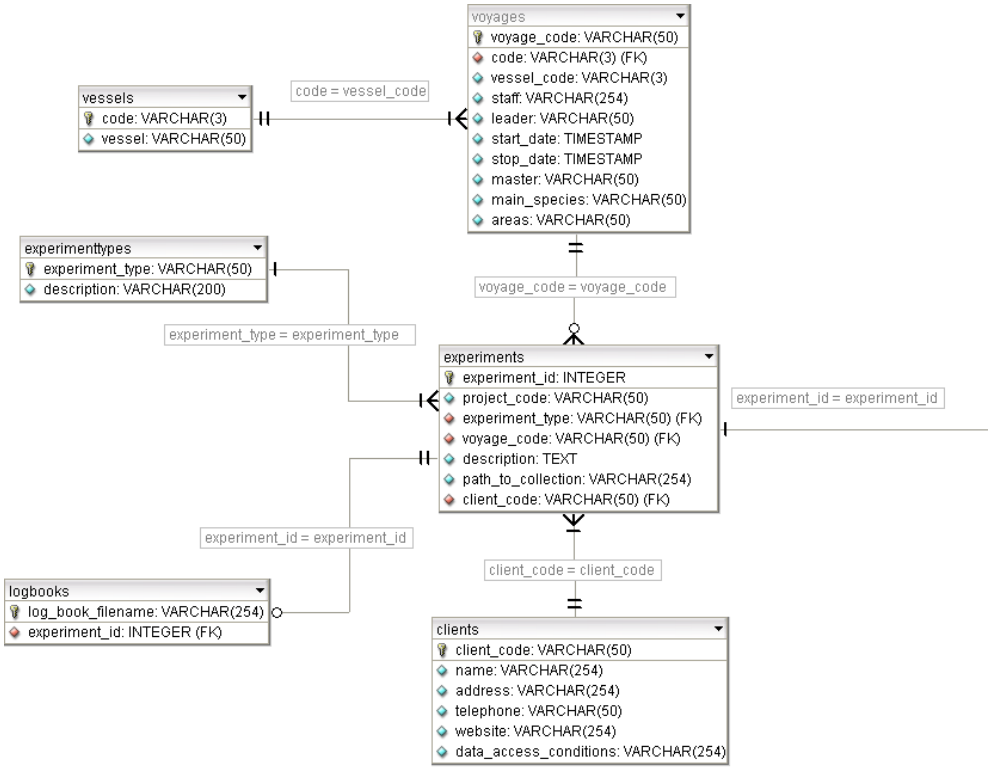

Figure 4: ERD for the tables associated with an experiment.

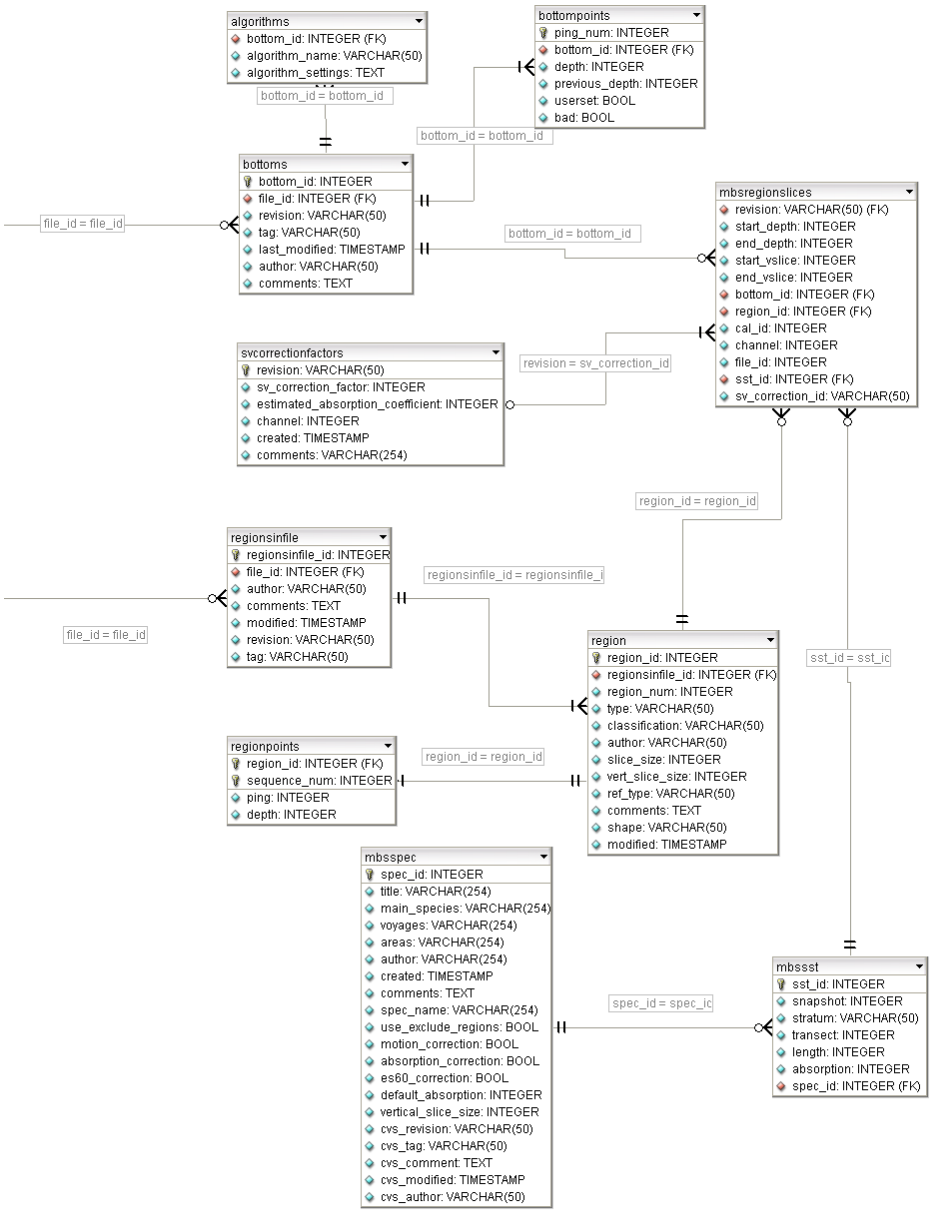

Figure 5: ERD for the tables associated with echo integration analysis of the acoustic data.

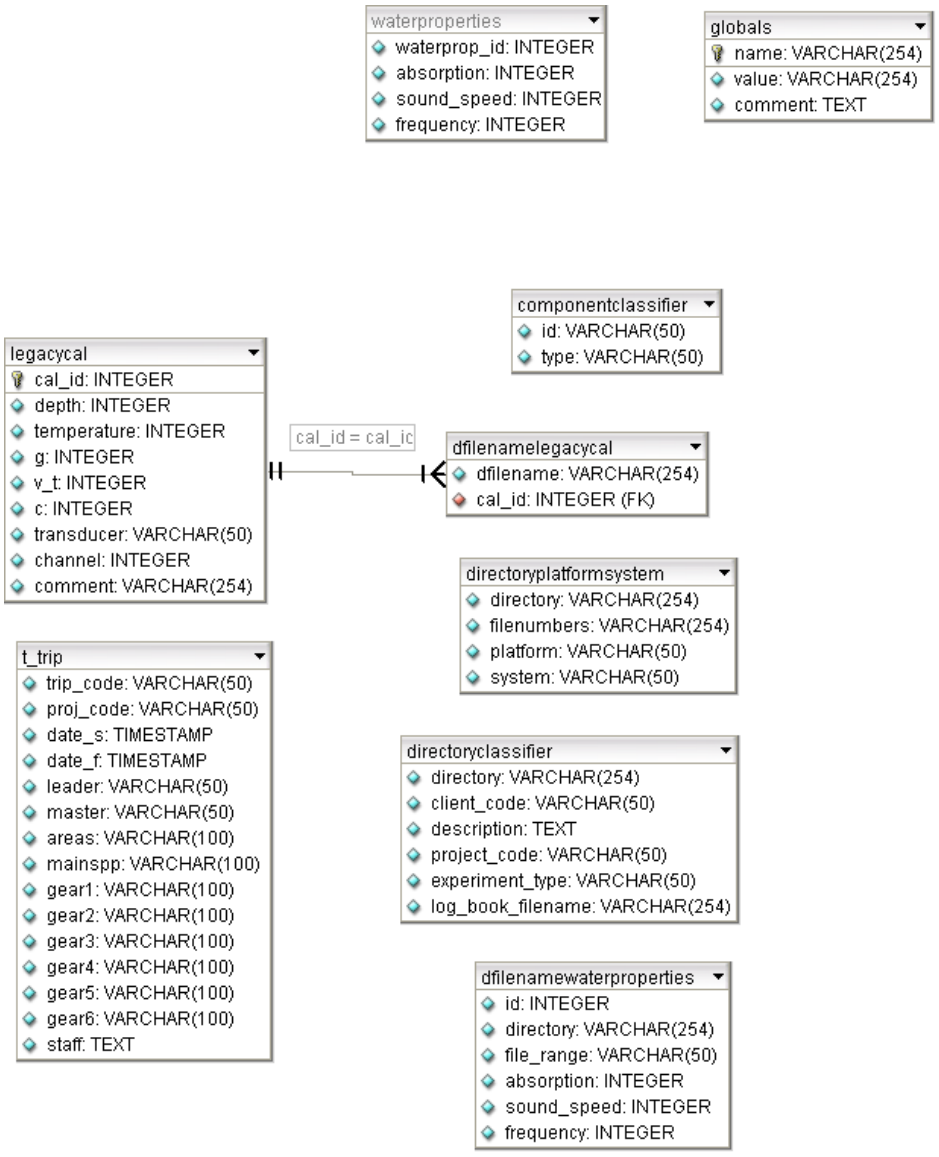

Figure 6: ERD for temporary tables used to provide information during data loading, as well as some tables that contain global information.

location. In the past, an experiment has been taken to be synonymous with a voyage of a vessel conducting a survey. However, surveys have extended over several voyages. Equally, several experiments have been carried out during a single voyage. Data collection has always been organised primarily around voyages and stored in the first instance as sets of directories and files in a voyage directory. This is a convenient organisation for voyage oriented processing tasks such as the production of biomass estimates; it is easy to understand and relates in a straightforward manner to other fisheries data (e.g. trawl data) which are also organised around voyages. The database structure has been designed to reflect this useful organisational structure, but to also allow access to the data in other ways that suit other analyses.

The concept of an experiment is represented in the database with an *experiment* table, and that of a file of acoustic data with a *file* table. There is a one-to-many relationship between the *experiment* and *file* tables. The equipment that was used to collect a file of acoustic data is represented with an *equipment* table, and a one-to-many relationship is maintained between the *experiment* table and the *file* table. All other tables in the database are directly or indirectly connected to these three tables.

Aside from the actual acoustic data collected for each ping of the echosounder, a set of ancillary data is also collected. These data are stored in the *ping* table, and include such data as the vessel and echosounder latitude and longitude, the sea and air temperature, etc. Periodically, the echosounder operator can enter electronic notes into the data collection system and these are stored in the *filenote* table. Both the *ping* and *filenote* tables have many-to-one relationships with the *file* table.

The components that make up an echosounder are represented in the *components* table, which covers both the physical equipment that constituted the echosounder and the software settings that define its behaviour. This information is represented as (parameter, value) pairs, with a classification applied to the parameter values to allow selection of different parts of the echosounder. There is a one-to-many relationship between the *equipment* and *components* table. The value for some of the parameters has special meaning and two auxiliary tables exist to provide further data. These are the *transducer* and *padcs* table. For example, if component_id is 'transducer_id', the corresponding component_value will exist in the *transducers* table as the transducer_id column.

Each acoustic data file that is collected can potentially have a calibration associated with it. These are usually obtained from experiments conducted with acoustic targets of known reflectively and are typically done before, during, and after a voyage of experiment. See [Coombs et al. 2003] for details on the procedures used. The resulting G, V_t, and C values are stored in the *slplussrt* table, and a one-to-many relationship is maintained between this table and the *equipment* table.

The raw acoustic data collected by an echosounder is voluminous, and is usually only of interest when viewed with a software programme designed for visualising and analysing such data. For these reasons, the actual acoustic echo data is not stored in the database, but as files external to the database management system. The DBMS stores all other data pertaining to the acoustic data.

3.3 Biomass estimation

Producing biomass estimates from acoustic survey data requires that echoes from fish close to the seabed be separated from echoes from the bottom, and that aggregations of fish be marked by a region, in which echo integration is done. The bottoms and regions produced during an analysis are stored in the database, along with information on how they are to be combined to produce the biomass estimates. The tables associated with this section of the database link to the rest of the database via the *files* table only.

3.4 Spatial attributes

The core database design does not include any spatial attributes, even though much of the data has a spatial component - latitude/longitude pairs are stored as plain floating point numbers. However, the PostGIS extensions available in the PostgreSQL database have been used to add a spatial element to the **acoustic** database, and hence to provide the means for spatially aware software packages to treat the acoustic data in a spatial manner. In particular, the *files* table has an extra column containing a linestring datatype that stores the start and finish position of the data in a file. An extra table (*files_transect_detailed*) has been created that contains the ping-by-ping position collected by acoustic echosounders in the form of a linestring. Another table (*files_transect_simplified*) contains a simplified, but still representative, version of this line obtained by using the Douglas-Peuker algorithm. Several views have been defined that combine these detailed and simplified tables and the data in the *files* table (note that all view names in the database start with v_). Details on the extra tables and views are contained in Section 5.

4 Table Summaries

The seven main tables contained in the **acoustic** database are:

experiments contains details on a set of data collected as part of a voyage, project, or experiment.

equipment contains details on the equipment used to collect a set of data.

files contains details on the acoustic echodata files, as well environmental data for the beginning and end of the transect.

ping contains environmental data for every ping.

components contains details on the equipment used to collect each acoustic data set.

slplussrt contains calibration factors to enable conversion of the acoustic data to physical units.

mbsspec contains details on the process in which the acoustic data was combined to form biomass estimates

5 acoustic Tables

5.1 algorithms

This table holds information on the algorithms used to obtain the bottom points.

Column	*Type*	*Modifiers*	*Description*
bottom_id	integer	not null default 0	Unique identifier to distinguish different algorithms
algorithm_name	character varying(50)	not null	The name of the algorithm as named by ESP2
algorithm_settings	text		The ESP2 settings for the algorithm.

Index: ”algorithms_pkey” primary key, btree (bottom_id, algorithm_name)

Foreign-key constraint: ”$1” FOREIGN KEY (bottom_id) REFERENCES bottoms(bottom_id) ON DELETE CASCADE DEFERRABLE

5.2 bottompoints

This table holds the bottom points for every bottom that has been defined on an echogram.

Column	*Type*	*Modifiers*	*Description*
bottom_id	integer	not null default 0	Unique identifiier for the bottom point
ping_num	integer	not null default 0	The ping number that this bottom point applies to
depth	integer	default 0	The depth of the bottom point in samples
previous_depth	integer	default 0	The depth of the previous bottom point in samples for ping ping_num
userset	boolean	default false	Is the bottom point set by the user?
bad	boolean	default false	Is the transmit marked as bad?

Index: ”bottompoints_pkey” primary key, btree (bottom_id, ping_num)

Foreign-key constraint: ”$1” FOREIGN KEY (bottom_id) REFERENCES bot-

toms(bottom_id) ON DELETE CASCADE DEFERRABLE

5.3 bottoms

This table holds information on a bottom that has been defined on an echogram. The actual bottom points are stored in the *bottompoints* table.

Column	*Type*	*Modifiers*	*Description*
file_id	integer	default 0	Unique identifier for the file that this bottom applies to
revision	character varying(50)		The CVS revision number for the bottom
tag	character varying(50)		The CVS tag created when committing the version
bottom_id	integer	not null default 0	Unique identifier for this bottom
last_modified	timestamp without time zone		The time in UTC when this bottom was modifier
author	character varying(50)		The initials of the person who last modified this bottom
comments	text		Any comments entered by the person who last modified this bottom

Index: ”bottoms_pkey” primary key, btree (bottom_id)

Foreign-key constraint ”$1” FOREIGN KEY (file_id) REFERENCES files(file_id) ON DELETE CASCADE DEFERRABLE

5.4 clients

This is a reference table that holds information on organisations that have commissioned the collection of acoustic data.

Column	*Type*	*Modifiers*	*Description*
client_code	character varying(50)	not null	Unique identifier for the client
name	character varying(255)		The name of the client
address	character varying(255)		The postal address of the client
telephone	character varying(50)		The telephone number of the client
website	character varying(255)		The website address of the client
data_access_conditions	character varying(255)		Any conditions on the use of the data collected on behalf of the client

Index: "clients_pkey" primary key, btree (client_code)

5.5 componentclassifier

This is a temporary table that provides classifications for components. It is used when populating the *components* table and provides the value for the component_type column.

Column	*Type*	*Modifiers*	*Description*
id	character varying(50)		Identifier for the component
type	character varying(50)		The classification for the component

5.6 components

This table holds the components that make up a piece of equipment. This includes both physical pieces of equipment, as well as software settings that define the operation of the equipment. It is defined in a sufficiently general manner so that it can contain a variety of information, and can adapt as data from new equipment is added to the database.

Column	*Type*	*Modifiers*	*Description*
equipment_id	integer	not null default 0	The equipment identifier that this component is part of
component_id	character varying(50)		The name of the component
component_type	character varying(50)		The type of the component
component_value	character varying(255)		The value of the component
component_channel	integer	default 0	The channel number for the component

Foreign-key constraints:

- ”$2” FOREIGN KEY (equipment_id) REFERENCES equipment(equipment_id) ON DELETE CASCADE DEFERRABLE
- ”$1” FOREIGN KEY (component_type) REFERENCES componenttypes(component_type) DEFERRABLE

5.7 componenttypes

This is a reference table that provides short descriptions for the component_type column found in the *components* table.

Column	*Type*	*Modifiers*	*Description*
component_type	character varying(50)	not null	Unique identifier for the component type
description	character varying(200)		A short description of the component type

Index: ”componenttypes_pkey” primary key, btree (component_type)

5.8 daporigins

This is a reference table that provides descriptions of the channel numbers found in the Crest formatted raw data files.

Column	*Type*	*Modifiers*	*Description*
channel	integer	not null default 0	The channel number
short_desc	character varying(50)		A short description of the channel
long_desc	character varying(255)		A longer description of the channel
sb_channel	integer	default 0	If not null, gives the pseudo channel number for the appropriate splitbeam channel (see table sborigins)

Index: ”daporigins_pkey” primary key, btree (channel)

Foreign-key constraint: ”$1” FOREIGN KEY (sb_channel) REFERENCES sborigins(sb_channel) DEFERRABLE

5.9 dfilenamelegacycal

This is a temporary table that contains equipment calibration values for particular acoustic data files. It is referred to when inserting or updating rows into the *files* table.

Column	*Type*	*Modifiers*
dfilename	character varying(255)	not null
cal_id	integer	default 0

Index: ”dfilenamelegacycal_pkey” primary key, btree (dfilename)

Foreign-key constraint: ”$1” FOREIGN KEY (cal_id) REFERENCES legacycal(cal_id) ON DELETE CASCADE DEFERRABLE

5.10 dfilenamewaterproperties

This is a temporary table that contains water property information for particular acoustic data files. It is referred to when inserting or updating rows

into the *files* table

Column	*Type*	*Modifiers*	*Description*
id	integer	not null default 0	
directory	character varying(255)		
file_range	character varying(50)		in format 100-103,45,50-60, etc
absorption	double precision	default 0	dB/m
sound_speed	double precision	default 0	m/s
frequency	double precision	default 0	Hz

Index: ”dfilenamewaterproperties_pkey” primary key, btree (id)

5.11 directoryclassifier

This is a temporary table that provides ancillary information on a directory of data during the loading process. A directory of data is closely linked to a row in the *experiments* table and this table provides much of the information that ends up in the *experiments* table.

Column	*Type*	*Modifiers*
directory	character varying(255)	not null
client_code	character varying(50)	
description	text	
project_code	character varying(50)	
experiment_type	character varying(50)	
log_book_filename	character varying(255)	

Index: ”directoryclassifier_pkey” primary key, btree (directory)

5.12 directoryplatformsystem

This is a temporary table that is used when inserting rows into the *equipment* table.

Column	*Type*	*Modifiers*	*Description*
directory	character varying(255)		The data directory
filenumbers	character varying(255)		A list of file number ranges e.g., 200-345,357,340-350
platform	character varying(50)		A short description of the platform (e.g. hull, tb2, frame)
system	character varying(50)		The name of the system (e.g., CREST, EK60, ES60, CRFREDA, etc)

5.13 equipment

This table contains information on the piece of equipment used to collect an acoustic data file.

Column	*Type*	*Modifiers*	*Description*
equipment_id	integer	not null default 0	Unique identifier for the piece of equipment
platform	character varying(50)		The equipment platform (e.g. hull, tb2, frame).
system	character varying(50)		The type of system (e.g. CREST, ES60, EK60, DATASONICS)
date_established	timestamp without time zone		The date when the equipment was first used (UTC)
date_withdrawn	timestamp without time zone		The date when the equipment was last used (UTC)
calibration_id	integer	default 0	The identifier for the calibration that applies to this piece of equipment

Index: ”equipment_pkey” primary key, btree (equipment_id)

Foreign-key constraint: ”$1” FOREIGN KEY (calibration_id) REFERENCES slplussrt(calibration_id) DEFERRABLE

5.14 experiments

This table contains information on the experiment for which acoustic data files were collected.

Column	*Type*	*Modifiers*	*Description*
experiment_id	integer	not null default 0	Unique identifier for this experiment
project_code	character varying(50)		The project codes that this experiment was conducted under. Multiple projects separated by commas
experiment_type	character varying(50)		The type of experiment
voyage_code	character varying(50)		The voyage code for the voyage that this experiment was part of (if there was a voyage)
description	text		A short description of the experiment
path_to_collection	character varying(255)		The directory path to where the acoustic data files are stored
client_code	character varying(50)		The code for the client that funded this experiment

Index: ”experiments_pkey” primary key, btree (experiment_id)
Foreign-key constraints:

- ”$2” FOREIGN KEY (experiment_type) REFERENCES experimenttypes(experiment_type) DEFERRABLE
- ”$1” FOREIGN KEY (client_code) REFERENCES clients(client_code) DEFERRABLE

5.15 experimenttypes

This is a reference table that contains descriptions on the various experiment types found in the *experiment* table.

Column	*Type*	*Modifiers*	*Description*
experiment_type	character varying(50)	not null	Unique identifier for this experiment type
description	character varying(200)		A short description of the experiment type

Index: ”experimenttypes_pkey” primary key, btree (experiment_type)

5.16 filenote

This table contains notes the the acoustic system operator enters from time to time when collecting data.

Column	*Type*	*Modifiers*	*Description*
note_id	integer	not null default 0	Unique identifier for the file note
file_id	integer	not null default 0	The file identifier that this file note applies to
date_time	timestamp without time zone		The date and time that this note was created (UTC)
ping_num	integer	default 0	The ping number that this note applies to
note	text		The note as typed in by the user

Index: ”filenote_pkey” primary key, btree (note_id)
Foreign-key constraint: ”$1” FOREIGN KEY (file_id) REFERENCES files(file_id) ON DELETE CASCADE DEFERRABLE

5.17 files

This table contains information on each acoustic data file that has been collected, as well as links to the equipment and experiments that collected the data.

Column	*Type*	*Modifiers*	*Description*
file_id	integer	not null default 0	Unique identifier for the file
file_number	integer	default 0	The number of the file.
transect_num	integer	default 1	The transect number label for the file
stratum	character varying(50)		The stratum label for the file
snapshot	integer	default 0	The snapshot label for the file
start_date_time	timestamp without time zone		The start date/time for the file (UTC)
start_lat	double precision	default 0	The start latitude for the file (decimal degrees, positive is the northern hemisphere)

start_lon	double precision	default 0	The start longitude for the file (decimal degrees, 0 to 360 degrees, 0 is Greenwich, increasing in an eastward direction)
stop_date_time	timestamp without time zone		The stop date/time for the file (UTC)
stop_lat	double precision	default 0	The stop latitude for the file (decimal degrees, positive is the northern hemisphere)
stop_lon	double precision	default 0	The stop longitude for the file (decimal degrees, 0 to 360 degrees, 0 is Greenwich, increasing in an eastward direction)
num_transmits	integer	default 0	The number of transmits in this file
min_data_depth	real	default 0	The minimum range of acoustic data in this file (metres)
max_data_depth	real	default 0	The maximum range of acoustic data in this file (metres)
dfile_size	bigint	default 0	The size of this file in bytes
preview_path	character varying(50)		The file path to the preview image
preview_name	character varying(50)		The filename of the preview image for this file
experiment_id	integer		The identifier for the experiment that this file was part of
equipment_id	integer	default 0	The identifier for the equipment that was used to collect this file
dfilename	character varying(255)		The filename of the acoustic data file, relative to the value of the datalocation row in the globals table
waterprop_id	integer		The identifier for the water properties for the water where this file was collected

Index: ”files_pkey” primary key, btree (file_id)
Foreign-key constraints:

- ”$3” FOREIGN KEY (waterprop_id) REFERENCES waterproperties(waterprop_id) DEFERRABLE
- ”$2” FOREIGN KEY (experiment_id) REFERENCES experiments(experiment_id) ON DELETE CASCADE DEFERRABLE

- ”$1” FOREIGN KEY (equipment_id) REFERENCES equipment(equipment_id) ON DELETE CASCADE DEFERRABLE

5.18 files_transect_detailed

This table contains ping-by-ping position data for each transect.

Column	*Type*	*Modifiers*	*Description*
file_id	integer	not null	Unique identifier for the file
transect_geom	geometry		The PostGIS linestring that contains the detailed transect path

Indexes:

- ”files_transect_detailed_pkey” primary key, btree (file_id) ”files_transect_detailed_spatial” gist (transect_geom)
- ”files_transect_detailed_spatial” gist (transect_geom)

Check constraints:

- ”$3” CHECK (geometrytype(transect_geom) = ’LINESTRING’::text OR transect_geom IS NULL)
- ”$2” CHECK (srid(transect_geom) = 4326)

Foreign-key constraint: ”$1” FOREIGN KEY (file_id) REFERENCES files(file_id) ON DELETE CASCADE DEFERRABLE

5.19 files_transect_simplified

This table contains position data for each transect that has been derived from the data in *files_transect_detailed* by use of the Douglas-Peuker line simplification algorithm.

Column	*Type*	*Modifiers*	*Description*
file_id	integer	not null	Unique identifier for the file
transect_geom	geometry		The PostGIS linestring that contains the simplified transect path

Indexes:

- ”files_transect_simplified_pkey” primary key, btree (file_id) ”files_transect_simplified_spatial” gist (transect_geom)
- ”files_transect_simplified_spatial” gist (transect_geom)

Check constraints:

- ”$3” CHECK (geometrytype(transect_geom) = ’LINESTRING’::text OR transect_geom IS NULL)
- ”$2” CHECK (srid(transect_geom) = 4326)

Foreign-key constraint: ”$1” FOREIGN KEY (file_id) REFERENCES files(file_id) ON DELETE CASCADE DEFERRABLE

5.20 globals

This is a reference table that contains directory paths for files that are stored externally.

Column	*Type*	*Modifiers*	*Description*
name	character varying(255)	not null	The global variable name
value	character varying(255)		The global variable value
comment	text		A comment to provide context to the global variable

Index: ”globals_pkey” primary key, btree (name)

5.21 legacycal

This is a temporary table that is used when inserting or updating rows to the *files* and *slplussrt* tables.

Column	*Type*	*Modifiers*
cal_id	integer	not null default 0
depth	real	
temperature	real	
g	double precision	
v_t	double precision	
c	double precision	
transducer	character varying(50)	
channel	integer	default 0
comment	character varying(255)	

Index: ”legacycal_pkey” primary key, btree (cal_id)

5.22 logbooks

This table contains links to electronic copies of the acoustic transect logbooks.

Column	*Type*	*Modifiers*	*Description*
experiment_id	integer	default 0	The experiment for which this log book was created
log_book_filename	character varying(255)		The filename of this logbook. The full pathname is obtained by preprending the value of the acousticlogbooklocation value in the globals table

Foreign-key constraint: ”$1” FOREIGN KEY (experiment_id) REFERENCES experiments(experiment_id) ON DELETE CASCADE DEFERRABLE

5.23 mbsregionslices

This table contains information on which parts of integration regions are used in an acoustic analysis run.

Column	*Type*	*Modifiers*	*Description*
start_depth	real	default 0	The start depth in metres of this region slice
end_depth	real	default 0	The end depth in metres of this region slice
start_vslice	integer	default 0	The start vertical slice for this region slice
end_vslice	integer	default 0	The end vertical slice for this region slice
bottom_id	integer	default 0	The identifier for the bottom that this region slice applies to
region_id	integer	default 0	The identifier for the region that this region slice applies to
cal_id	integer	default 0	The identifier of the calibration to apply to the file that this region slice is part of
channel	integer	default 0	The channel number that this region slice applies to
file_id	integer	default 0	The identifier of the file that this region slice applies to
sst_id	integer	default 0	The identifier of the sst that this region slice applies to

sv_correction_id	character varying(50)		The identifier of the sv correction factor that was applied to the file that this region slice is part of

Foreign-key constraints:

- "$3" FOREIGN KEY (sv_correction_id) REFERENCES svcorrectionfactors(revision) ON DELETE CASCADE DEFERRABLE
- "$2" FOREIGN KEY (sst_id) REFERENCES mbssst(sst_id) ON DELETE CASCADE DEFERRABLE
- "$1" FOREIGN KEY (file_id) REFERENCES files(file_id) DEFERRABLE

5.24 mbsspec

This table contains information on an acoustic analysis run.

Column	*Type*	*Modifiers*	*Description*
spec_id	integer	not null default 0	Unique identifier for this mbs specification
title	character varying(255)		The title for the mbs specification
main_species	character varying(255)		The mains species that this msb specification was created for
voyages	character varying(255)		The voyages that this mbs specification applies to. This is manually entered
areas	character varying(255)		The areas that this mbs specification applies to. This is manually entered
author	character varying(255)		The name of the person who created this mbs specification
created	timestamp without time zone		The time/date that this mbs specification was created (UTC)
comments	text		Comments entered when the mbs specification was created
spec_name	character varying(255)		The CVS name for the mbs specification. Created by esp2
use_exclude_regions	boolean		Whether to use regions flagged as exclude in the mbs processing

motion_correction	boolean		Whether to correct for motion of the transducer in the mbs processing
absorption_correction	boolean		Whether to correct for a different acoustic absorption in the mbs processing
es60_correction	boolean		Whether to correct for the systematic triangle wave error in Simrad ES60 data in the mbs processing
default_absorption	real	default 0	The value of acoustic absorption to use as a default
vertical_slice_size	integer	default 0	The default vertical slice size for the region slices
cvs_revision	character varying(50)		The CVS revision text generated when esp2 committed this version of the mbs specification
cvs_tag	character varying(50)		The CVS tag text generated when esp2 committed this version of the mbs specification
cvs_comment	text		The CVS comment entered by the user when esp2 committed this version of the mbs specification
cvs_modified	timestamp without time zone		The time at which this version of the mbs specification was modified (UTC)
cvs_author	character varying(50)		The person who committed this version of the mbs specification

Index: ”mbsspec_pkey” primary key, btree (spec_id)

5.25 mbssst

This table contains information on the snapshot, stratum, and transect names used to label the echo integration data from a single acoustic data file.

Column	*Type*	*Modifiers*	*Description*
sst_id	integer	not null default 0	Unique identifier for this sst (snapshot, stratum, transect)
snapshot	integer	default 0	The snapshot number for this sst
stratum	character varying(50)		The stratum label for this sst

transect	integer	default 0	The transect number for this sst
length	real	default 0	The length in nautical miles of this sst if one wishes to override the automatic calculation of the transect length
absorption	real	default 0	The acoustic absorption to use for files that are part of thi sst
spec_id	integer	default 0	The identifier of the mbs specification that this sst is part of

Index: ”mbssst_pkey” primary key, btree (sst_id)
Foreign-key constraint: ”$1” FOREIGN KEY (spec_id)
REFERENCES mbsspec(spec_id) ON DELETE CASCADE DEFERRABLE

5.26 padcs

This is a reference table that contains calibration information on the amplifiers in the echosounder.

Column	*Type*	*Modifiers*	*Description*
padc_id	character varying(50)	not null	Indetifier for this padc calibration
alias	character varying(50)		An alternative identifier for the padc_id.
frequency	double precision		The frequency that this calibration was conducted at (Hz)
filter_id	character varying(50)		The identifier of the DSP filter that was used during the calibration
date_measured	timestamp without time zone		The date during which the calibration was performed (UTC)
multiplier	integer		The between channel multiplier
gain_channel_low	double precision		The gain of the low gain channel
gain_channel_high	double precision		The gain of the high gain channel
comment	text		A comment on the calibration

5.27 ping

This table contains environmental information associated with a ping.

Column	*Type*	*Modifiers*	*Description*
ping_id	bigint	not null default 0	Unique identifier for the ping
file_id	integer	not null default 0	The identifier of the file that this ping is part of
ping_num	integer	not null default 0	The ping number
lat	double precision	default 0	The latitude of the equipment or ship when this ping was sent (decimal degrees, positive is the northern hemisphere)
lon	double precision	default 0	decimal degrees
speed	real	default 0	The speed of the vessel when this ping was sent (knots)
heading_true	real	default 0	The heading of the vessel when this ping was sent (degrees)
heading_apparent	real	default 0	The direction of motion of the vessel when this ping was sent (degrees)
transducer_depth	real	default 0	The depth of the transducer when this ping was sent (metres)
hpr	character varying(80)		The raw NMEA string from the Simrad HPR system when this ping was sent
bottom_distance	real	default 0	The distance between the trasducer and the seabed derived from this ping (metres)
wind_speed	real	default 0	The speed of the wind when this ping was sent (knots)
wind_dir	real	default 0	The true wind direction when this ping was sent (degrees)
air_temp	real	default 0	The air temperature when this ping was sent (degrees Celcius)
sea_temp	real	default 0	The surface water temperature when this ping was sent (degrees Celcius)
barometric_press	real	default 0	The barometric pressure when this ping was sent (bar)

Index: ”ping_pkey” primary key, btree (ping_id)
Foreign-key constraint: ”$1” FOREIGN KEY (file_id) REFERENCES files(file_id) ON DELETE CASCADE DEFERRABLE

5.28 pingattitude

This table contains transducer attitude information for a given ping.

Column	*Type*	*Modifiers*	*Description*
ping_id	bigint	not null default 0	The ping identifier that this set of ping attitude data applies to
sample_num	integer	not null default 0	The sample number that this set of ping attitude data applies to
pitch	real	default 0	The transducer pitch (degrees, positive is bow up)
roll	real	default 0	The transducer roll (degrees, positive is to starboard)
yaw	real	default 0	The transducer yaw (degrees, positive is to starboard)
heave	real	default 0	The transducer heave (metres relative to some datam)

Index: ”pingattitude_pkey” primary key, btree (ping_id, sample_num)
Foreign-key constraint: ”$1” FOREIGN KEY (ping_id) REFERENCES ping(ping_id) ON DELETE CASCADE DEFERRABLE

5.29 region

This table contains information about a region.

Column	*Type*	*Modifiers*	*Description*
regionsinfile_id	integer	default 0	Indentifier for the regions in file row that this region is part of
region_num	integer	default 0	The region number for this region
type	character varying(50)		Type of region (bottom/surface/standalone)
classification	character varying(50)		Region classification (user supplied)
author	character varying(50)		Person who originally created this region
slice_size	real	default 0	The horizontal slice size for this region (m)

vert_slice_size	integer	default 0	The vertical slice size for this region (pings)
ref_type	character varying(50)		Whether the slices in this region are referrenced to the surface or the bottom
comments	text		Comments entered by the person who created this region
shape	character varying(50)		The shape of this region (rectangular or polygon)
region_id	integer	not null default 0	Unique identifier for this region
modified	timestamp without time zone		The time/date when this region was modified (UTC)

Index: ”region_pkey” primary key, btree (region_id)

Foreign-key constraint: ”$1” FOREIGN KEY (regionsinfile_id) REFERENCES regionsinfile(regionsinfile_id) ON DELETE CASCADE DEFERRABLE

5.30 regionpoints

This table contains the vertices that define a region.

Column	*Type*	*Modifiers*	*Description*
region_id	integer	not null default 0	Identifier of the region that this point is part of
ping	integer	default 0	Ping number of this point
depth	double precision	default 0	Depth (m) of this point
sequence_num	integer	not null default 0	The sequence number of this point. Records the sequence of points required to construct the region

Indexes: ”regionpoints_pkey” primary key, btree (region_id, sequence_num)

Foreign-key constraint: ”$1” FOREIGN KEY (region_id) REFERENCES region(region_id) ON DELETE CASCADE DEFERRABLE

5.31 regionsinfile

This table contains information about the regions that have been defined for a specific acoustic data file.

Column	*Type*	*Modifiers*	*Description*
file_id	integer	default 0	Identifier for the file that the region in file row applies to
author	character varying(50)		Name of person who originally created this regionsinfile row
comments	text		Comments entered when this regionsinfile row was created
regionsinfile_id	integer	not null default 0	Unique identifier for this row
modified	timestamp without time zone		Date/time when this regionsinfile row was last modified (UTC)
revision	character varying(50)		CVS revision created when this regionsinfile row was last saved
tag	character varying(50)		CVS tag created when this regionsinfile row was last saved

Index: ”regionsinfile_pkey” primary key, btree (regionsinfile_id)
Foreign-key constraint: ”$1” FOREIGN KEY (file_id) REFERENCES files(file_id) ON DELETE CASCADE DEFERRABLE

5.32 sborigins

This is a reference table that contains information on how single channels of a splitbeam echsounder system are to be combined to produce a combined single-beam data.

Column	*Type*	*Modifiers*	*Description*
long_desc	character varying(255)		A long description about this channel
sb_channel	integer	not null default 0	Unique identifier for this pseudo splitbeam channel
ch1	integer	default 0	The channel number for channel 1 of this splitbeam system
ch2	integer	default 0	The channel number for channel 2 of this splitbeam system
ch3	integer	default 0	The channel number for channel 3 of this splitbeam system

ch4	integer	default 0	The channel number for channel 4 of this splitbeam system
add1	boolean		Whether to add or subtract this channel when created the summed splitbeam channel
add2	boolean		Whether to add or subtract this channel when created the summed splitbeam channel
add3	boolean		Whether to add or subtract this channel when created the summed splitbeam channel
add4	boolean		Whether to add or subtract this channel when created the summed splitbeam channel

Index: ”sborigins_pkey” primary key, btree (sb_channel)

5.33 slplussrt

This is a table that contains details on a calibration of a specific piece of echosounding equipment.

Column	*Type*	*Modifiers*	*Description*
calibration_id	integer	not null default 0	Unique identifier for this calibration
valid_from	timestamp without time zone		Date and time from which this calibration is valid (UTC)
valid_to	timestamp without time zone		Date and time to which this calibration is valid (UTC)
depth	real	default 0	depth (m) at which V_T is valid
temperature	real	default 0	temperature (degrees C) at which V_T is valid
g	double precision	default 0	receiver gain
v_t	double precision	default 0	voltage at transducer terminals for a target of unit backscattering cross-section ($1m^2$) at given temperature
c	double precision	default 0	overall calibration constant
channel	integer	default 0	The Crest channel number that this calibration applies to

Index: ”slplussrt_pkey” primary key, btree (calibration_id)

Foreign-key constraint: ”$1” FOREIGN KEY (channel) REFERENCES daporigins(channel) DEFERRABLE

5.34 svcorrectionfactors

This is a reference table that contains a echo integration correction factor.

Column	*Type*	*Modifiers*	*Description*
revision	character varying(50)	not null	Unique identifier for this sv correction factor
sv_correction_factor	double precision	default 0	sv correction factor
estimated_absorption_coefficient	double precision	default 0	The absorption to use for this sv correction factor (dB/km)
channel	integer	default 0	The channel that this sv correction factor applies to
created	timestamp without time zone		The time/date that this sv correction factor was created (UTC)
comments	character varying(255)		User entered comments about the sv correction factor

Index: ”svcorrectionfactors_pkey” primary key, btree (revision)

5.35 t_trip

This is a temporary table that contains information on a voyage. It is derived from a table of the same name in the Marine Research Trawl database. It is used when populating the *voyages* table.

Column	*Type*	*Modifiers*
trip_code	character varying(50)	not null
proj_code	character varying(50)	
date_s	timestamp without time zone	
date_f	timestamp without time zone	
leader	character varying(50)	
master	character varying(50)	
areas	character varying(100)	
mainspp	character varying(100)	
gear1	character varying(100)	
gear2	character varying(100)	
gear3	character varying(100)	

gear4	character varying(100)
gear5	character varying(100)
gear6	character varying(100)
staff	text

Index: ”t_trip_pkey” primary key, btree (trip_code)

5.36 transducers

This is a reference table that contains information on acoustic transducers.

Column	*Type*	*Modifiers*	*Description*
transducer_id	character varying(50)	not null	Unique transducer identifier
manufacturer	character varying(50)		The manufacturer of the transducer
model	character varying(50)		The model name of the transducer
serial	character varying(50)		The serial name of the transducer
frequency	character varying(50)		The frequency that the transducer details are applicable to (kHz)
type	character varying(50)		The transducer configuration (dual, single, or split)
depth_rating	real	default 0	The manufacturer supplies maximum operational depth for the transducer (m)
beam_angle_long	double precision	default 0	The alongships 3dB beam angle (degrees)
beam_angle_trans	double precision	default 0	The athwartships 3dB beam angle (degrees)
directivity	double precision	default 0	The transducer directivity
effective_beam_angle	double precision	default 0	The effective beam angle (steradians)
transmit_response	double precision	default 0	The transmit repsonse (kPa/V at 1 m)
receive_response	double precision	default 0	The receive response (V/kPa)
angle_factor	double precision	default 0	The conversion factor between splitbeam electrical phase angle and physical echo arrival angle

details_document_filename	character varying(255)	The filename of the document that contains manufacturer supplied details on the transducer. The transducerdetailslocation row in the globals table gives the pathname to go with thei filename
comments	character varying(255)	Any miscellaneous comments about this transducer

Index: ”transducers_pkey” primary key, btree (transducer_id)

5.37 v_files

This view contains all of the columns in the *files* table, as well as some derived columns that are of interest.

Column	*Type*
oid	integer
file_id	integer
voyage_code	character varying(50)
file_number	integer
transect_num	integer
stratum	character varying(50)
snapshot	integer
start_date_time	timestamp without time zone
start_lat	double precision
start_lon	double precision
stop_date_time	timestamp without time zone
stop_lat	double precision
stop_lon	double precision
num_transmits	integer
min_data_depth	real
max_data_depth	real
dfile_size	bigint
preview_path	character varying(50)
preview_name	character varying(50)
experiment_id	integer
equipment_id	integer
dfilename	character varying(255)
waterprop_id	integer
log_book_filename	character varying(255)
start_year	double precision

start_month	double precision
start_day	double precision
start_hour	double precision
start_minute	double precision
start_second	double precision
stop_year	double precision
stop_month	double precision
stop_day	double precision
stop_hour	double precision
stop_minute	double precision
stop_second	double precision
transect_geom	geometry

View definition: SELECT files.file_id AS oid, files.file_id, experiments.voyage_code, files.file_number, files.transect_num, files.stratum, files.snapshot, files.start_date_time, files.start_lat, files.start_lon, files.stop_date_time, files.stop_lat, files.stop_lon, files.num_transmits, files.min_data_depth, files.max_data_depth, files.dfile_size, files.preview_path, files.preview_name, files.experiment_id, files.equipment_id, files.dfilename, files.waterprop_id, logbooks.log_book_filename, date_part('year'::text, files.start_date_time) AS start_year, date_part('month'::text, files.start_date_time) AS start_month, date_part('day'::text, files.start_date_time) AS start_day, date_part('hour'::text, files.start_date_time) AS start_hour, date_part('minute'::text, files.start_date_time) AS start_minute, date_part('second'::text, files.start_date_time) AS start_second, date_part('year'::text, files.stop_date_time) AS stop_year, date_part('month'::text, files.stop_date_time) AS stop_month, date_part('day'::text, files.stop_date_time) AS stop_day, date_part('hour'::text, files.stop_date_time) AS stop_hour, date_part('minute'::text, files.stop_date_time) AS stop_minute, date_part('second'::text, files.stop_date_time) AS stop_second, files.transect_geom FROM files, experiments, logbooks WHERE experiments.experiment_id = files.experiment_id AND experiments.experiment_id = logbooks.experiment_id;

5.38 v_files_detailed

This view contains all of the columns in the *v_files* view, but with the full detailed transect path instead of the path defined by the start and stop positions in the transect.

Column	*Type*
oid	integer
file_id	integer
voyage_code	character varying(50)
file_number	integer
transect_num	integer
stratum	character varying(50)

snapshot	integer
start_date_time	timestamp without time zone
start_lat	double precision
start_lon	double precision
stop_date_time	timestamp without time zone
stop_lat	double precision
stop_lon	double precision
num_transmits	integer
min_data_depth	real
max_data_depth	real
dfile_size	bigint
preview_path	character varying(50)
preview_name	character varying(50)
experiment_id	integer
equipment_id	integer
dfilename	character varying(255)
waterprop_id	integer
log_book_filename	character varying(255)
start_year	double precision
start_month	double precision
start_day	double precision
start_hour	double precision
start_minute	double precision
start_second	double precision
stop_year	double precision
stop_month	double precision
stop_day	double precision
stop_hour	double precision
stop_minute	double precision
stop_second	double precision
transect_geom	geometry

View definition: SELECT files.file_id AS oid, files.file_id, experiments.voyage_code, files.file_number, files.transect_num, files.stratum, files.snapshot, files.start_date_time, files.start_lat, files.start_lon, files.stop_date_time, files.stop_lat, files.stop_lon, files.num_transmits, files.min_data_depth, files.max_data_depth, files.dfile_size, files.preview_path, files.preview_name, files.experiment_id, files.equipment_id, files.dfilename, files.waterprop_id, logbooks.log_book_filename, date_part('year'::text, files.start_date_time) AS start_year, date_part('month'::text, files.start_date_time) AS start_month, date_part('day'::text, files.start_date_time) AS start_day, date_part('hour'::text, files.start_date_time) AS start_hour, date_part('minute'::text, files.start_date_time) AS start_minute, date_part('second'::text, files.start_date_time) AS start_second, date_part('year'::text, files.stop_date_time) AS stop_year, date_part('month'::text, files.stop_date_time) AS stop_month, date_part('day'::text, files.stop_date_time) AS

stop_day, date_part('hour'::text, files.stop_date_time) AS stop_hour, date_part('minute'::text, files.stop_date_time) AS stop_minute, date_part('second'::text, files.stop_date_time) AS stop_second, files_transect_detailed.transect_geom FROM files, files_transect_detailed, experiments, logbooks WHERE files.file_id = files_transect_detailed.file_id AND experiments.experiment_id = files.experiment_id AND experiments.experiment_id = logbooks.experiment_id;

5.39 v_files_endpoint

This view contains all of the columns in the *v_files* view, but with the transect end point instead of the path defined by the start and stop positions in the transect.

Column	*Type*
oid	integer
file_id	integer
voyage_code	character varying(50)
endpoint	geometry
file_number	integer
transect_num	integer
stratum	character varying(50)
snapshot	integer
start_date_time	timestamp without time zone
start_lat	double precision
start_lon	double precision
stop_date_time	timestamp without time zone
stop_lat	double precision
stop_lon	double precision
num_transmits	integer
min_data_depth	real
max_data_depth	real
dfile_size	bigint
preview_path	character varying(50)
preview_name	character varying(50)
experiment_id	integer
equipment_id	integer
dfilename	character varying(255)
waterprop_id	integer
log_book_filename	character varying(255)
start_year	double precision
start_month	double precision
start_day	double precision
start_hour	double precision
start_minute	double precision

start_second	double precision
stop_year	double precision
stop_month	double precision
stop_day	double precision
stop_hour	double precision
stop_minute	double precision
stop_second	double precision

View definition: SELECT files.file_id AS oid, files.file_id, experiments.voyage_code, endpoint(files.transect_geom) AS endpoint, files.file_number, files.transect_num, files.stratum, files.snapshot, files.start_date_time, files.start_lat, files.start_lon, files.stop_date_time, files.stop_lat, files.stop_lon, files.num_transmits, files.min_data_depth, files.max_data_depth, files.dfile_size, files.preview_path, files.preview_name, files.experiment_id, files.equipment_id, files.dfilename, files.waterprop_id, logbooks.log_book_filename, date_part('year'::text, files.start_date_time) AS start_year, date_part('month'::text, files.start_date_time) AS start_month, date_part('day'::text, files.start_date_time) AS start_day, date_part('hour'::text, files.start_date_time) AS start_hour, date_part('minute'::text, files.start_date_time) AS start_minute, date_part('second'::text, files.start_date_time) AS start_second, date_part('year'::text, files.stop_date_time) AS stop_year, date_part('month'::text, files.stop_date_time) AS stop_month, date_part('day'::text, files.stop_date_time) AS stop_day, date_part('hour'::text, files.stop_date_time) AS stop_hour, date_part('minute'::text, files.stop_date_time) AS stop_minute, date_part('second'::text, files.stop_date_time) AS stop_second FROM files, experiments, logbooks WHERE experiments.experiment_id = files.experiment_id AND experiments.experiment_id = logbooks.experiment_id;

5.40 v_files_simplified

This view contains all of the columns in the *v_files* view, but with the simplified transect path instead of the path defined by the start and stop positions in the transect.

Column	*Type*
oid	integer
file_id	integer
voyage_code	character varying(50)
file_number	integer
transect_num	integer
stratum	character varying(50)
snapshot	integer
start_date_time	timestamp without time zone
start_lat	double precision
start_lon	double precision
stop_date_time	timestamp without time zone
stop_lat	double precision

stop_lon	double precision
num_transmits	integer
min_data_depth	real
max_data_depth	real
dfile_size	bigint
preview_path	character varying(50)
preview_name	character varying(50)
experiment_id	integer
equipment_id	integer
dfilename	character varying(255)
waterprop_id	integer
log_book_filename	character varying(255)
start_year	double precision
start_month	double precision
start_day	double precision
start_hour	double precision
start_minute	double precision
start_second	double precision
stop_year	double precision
stop_month	double precision
stop_day	double precision
stop_hour	double precision
stop_minute	double precision
stop_second	double precision
transect_geom	geometry

View definition: SELECT files.file_id AS oid, files.file_id, experiments.voyage_code, files.file_number, files.transect_num, files.stratum, files.snapshot, files.start_date_time, files.start_lat, files.start_lon, files.stop_date_time, files.stop_lat, files.stop_lon, files.num_transmits, files.min_data_depth, files.max_data_depth, files.dfile_size, files.preview_path, files.preview_name, files.experiment_id, files.equipment_id, files.dfilename, files.waterprop_id, logbooks.log_book_filename, date_part('year'::text, files.start_date_time) AS start_year, date_part('month'::text, files.start_date_time) AS start_month, date_part('day'::text, files.start_date_time) AS start_day, date_part('hour'::text, files.start_date_time) AS start_hour, date_part('minute'::text, files.start_date_time) AS start_minute, date_part('second'::text, files.start_date_time) AS start_second, date_part('year'::text, files.stop_date_time) AS stop_year, date_part('month'::text, files.stop_date_time) AS stop_month, date_part('day'::text, files.stop_date_time) AS stop_day, date_part('hour'::text, files.stop_date_time) AS stop_hour, date_part('minute'::text, files.stop_date_time) AS stop_minute, date_part('second'::text, files.stop_date_time) AS stop_second, files_transect_simplified.transect_geom FROM files, files_transect_simplified, experiments, logbooks WHERE files.file_id = files_transect_simplified.file_id AND experiments.experiment_id = files.experiment_id AND experiments.experiment_id = logbooks.experiment_id;

5.41 v_files_startpoint

This view contains all of the columns in the *v_files* view, but with the transect start point instead of the path defined by the start and stop positions in the transect.

Column	*Type*
oid	integer
file_id	integer
voyage_code	character varying(50)
startpoint	geometry
file_number	integer
transect_num	integer
stratum	character varying(50)
snapshot	integer
start_date_time	timestamp without time zone
start_lat	double precision
start_lon	double precision
stop_date_time	timestamp without time zone
stop_lat	double precision
stop_lon	double precision
num_transmits	integer
min_data_depth	real
max_data_depth	real
dfile_size	bigint
preview_path	character varying(50)
preview_name	character varying(50)
experiment_id	integer
equipment_id	integer
dfilename	character varying(255)
waterprop_id	integer
log_book_filename	character varying(255)
start_year	double precision
start_month	double precision
start_day	double precision
start_hour	double precision
start_minute	double precision
start_second	double precision
stop_year	double precision
stop_month	double precision
stop_day	double precision
stop_hour	double precision
stop_minute	double precision
stop_second	double precision

View definition: SELECT files.file_id AS oid, files.file_id, experiments.voyage_code, startpoint(files.transect_geom) AS startpoint, files.file_number, files.transect_num, files.stratum, files.snapshot, files.start_date_time, files.start_lat, files.start_lon, files.stop_date_time, files.stop_lat, files.stop_lon, files.num_transmits, files.min_data_depth, files.max_data_depth, files.dfile_size, files.preview_path, files.preview_name, files.experiment_id, files.equipment_id, files.dfilename, files.waterprop_id, logbooks.log_book_filename, date_part('year'::text, files.start_date_time) AS start_year, date_part('month'::text, files.start_date_time) AS start_month, date_part('day'::text, files.start_date_time) AS start_day, date_part('hour'::text, files.start_date_time) AS start_hour, date_part('minute'::text, files.start_date_time) AS start_minute, date_part('second'::text, files.start_date_time) AS start_second, date_part('year'::text, files.stop_date_time) AS stop_year, date_part('month'::text, files.stop_date_time) AS stop_month, date_part('day'::text, files.stop_date_time) AS stop_day, date_part('hour'::text, files.stop_date_time) AS stop_hour, date_part('minute'::text, files.stop_date_time) AS stop_minute, date_part('second'::text, files.stop_date_time) AS stop_second FROM files, experiments, logbooks WHERE experiments.experiment_id = files.experiment_id AND experiments.experiment_id = logbooks.experiment_id;

5.42 vessels

This is a reference table that contains the name and abbreviation for vessels used to collect acoustic data.

Column	*Type*	*Modifiers*	*Description*
vessel	character varying(50)	not null	The name of the vessel
code	character varying(3)	not null	The vessel code

Index: "vessels_pkey" primary key, btree (code)

5.43 voyages

This is a table that contains information on voyages.

Column	*Type*	*Modifiers*	*Description*
voyage_code	character varying(50)	not null	Unique identifier for the voyage
vessel_code	character varying(3)		Vessel code for the vessel used in this voyage
staff	character varying(255)		Names of scientific staff who where on this vessel
leader	character varying(50)		Name of the voyage leader. Not included in the staff field
start_date	timestamp without time zone		The start date of the voyage
stop_date	timestamp without time zone		The stop date of the voyage
master	character varying(50)		The name of the captain
main_species	character varying(50)		A list of the main fish species that this voyage was interested in
areas	character varying(50)		A list of the areas that this voyage covered

Index: ”voyages_pkey” primary key, btree (voyage_code)

Foreign-key constraint: ”$1” FOREIGN KEY (vessel_code) REFERENCES vessels(code) DEFERRABLE

5.44 vtvariation

This is a reference table that provides relationships between transducer calibration and temperature and depth.

Column	*Type*	*Modifiers*	*Description*
vt_variation_id	integer	not null default 0	Unique identifier for this vt variation row
transducer_id	character varying(50)		The transducer that this vt variation applies to
variable	character varying(50)		The name of the independent variable (temperature/depth)

constant_term	double precision	default 0	The constant term in the quadratic relationship
linear_term	double precision	default 0	The linear term in the quadratic relationship
quadratic_term	double precision	default 0	The quadratic term in the quadratic relationship
valid_from	timestamp without time zone		The date/time that this vt variation is valid from
valid_to	timestamp without time zone		The date/time that this vt variation is valid to

Index: ”vtvariation_pkey” primary key, btree (vt_variation_id)

Foreign-key constraint: ”$1” FOREIGN KEY (transducer_id) REFERENCES transducers(transducer_id) ON DELETE CASCADE DEFERRABLE

5.45 waterproperties

This is a table that provides water property information for given acoustic data files. This information used to more accurately intrepret the acoustic data files.

Column	*Type*	*Modifiers*	*Description*
waterprop_id	integer	not null default 0	Unique identifier for this water property
absorption	double precision	default 0	Sound absorption in dB/m
sound_speed	double precision	default 0	Sound speed in m/s
frequency	double precision	default 0	Acoustic frequency in Hz

Index: ”waterproperties_pkey” primary key, btree (waterprop_id)

6 acoustic business rules

6.1 Introduction

The philosophy behind the acoustic database is that it will, as far as possible, contain raw, unprocessed data. As a consequence, minimal validation is carried out on the actual acoustic data (range/amplitude pairs). The nature of echosounder systems is that the raw acoustic data are an accurate and precise record of the acoustic amplitude at a given location at a given time and any processing, filtering or corrections should be applied during the analysis and use of the data. However, the associated data are subject to a number of validation rules, and are described in the following sections.

6.2 Summary of rules

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

There are three recognised types of business rules:

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

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

General rules

Some general rules are applied to all tables that contain latitude, longitude, date and time fields. In the sections that follow, only rules in addition to those below are listed.

1. All latitude values must be between -90.0 and 90.0 or be null.
2. All longitude values must be between -180 and 180 or be null.
3. All date/time fields must contain a valid date and time or be null.

6.2.1 bottompoints table

ping_num	Must be greater than or equal to 0.
depth	Must be greater than or equal to 0.
previous_depth	Must be greater than or equal to 0.

6.2.2 equipment table

date_withdrawn	Must be after date_established.

6.2.3 filenote table

ping_num	Must be greater than or equal to 0.

6.2.4 files table

num_transmits	Must be greater than or equal to 0.
min_data_depth	Must be greater than or equal to 0.
max_data_depth	Must be greater than or equal to max_data_depth.
dfile_size	Must be greater than or equal to 0.
stop_date_time	Must be after start_date_time.

6.2.5 mbsregionslices table

start_depth	Must be greater than or equal to 0.
end_depth	Must be greater than or equal to start_depth.
start_vslice	Must be greater than or equal to 0.
end_vslice	Must be greater than or equal to end_vslice.

6.2.6 mbsspec table

vertical_slice_size	Must be greater than or equal to 0.

6.2.7 mbssst table

length	Must be greater than or equal to 0.
absorption	Must be greater than or equal to 0.

6.2.8 padcs table

frequency	Must be greater than or equal to 0.

6.2.9 ping table

ping_num	Must be greater than or equal to 0.
speed	Must be greater than or equal to 0 or null.
heading_true	Must be within 0 to 360 inclusive or null.
heading_apparent	Must be within 0 to 360 inclusive or null.
transducer_depth	Must be greater than -5 m or null.
bottom_distance	Must be greater than 0 or null.
wind_speed	Must be greater than 0 or null.
wind_dir	Must be within 0 to 360 inclusive or null.

6.2.10 pingattitude table

sample_num	Must be greater than or equal to 0.

6.2.11 region table

slice_size	Must be greater than or equal to 0.
vert_slice_size	Must be greater than or equal to 0.
shape	Must be `Rectange` or `Polygon`.

6.2.12 regionpoints table

ping	Must be greater than or equal to 0.
depth	Must be greater than or equal to 0.
sequence_num	Must be greater than or equal to 0.

6.2.13 slplussrt table

depth	Must be greater than or equal to 0.
g	Must be greater than or equal to 0.
v_t	Must be greater than or equal to 0.
c	Must be greater than or equal to 0.
valid_to	Must be after valid_from.

6.2.14 svcorrectionfactors table

sv_correction_factor	Must be greater than or equal to 0.

6.2.15 transducers table

depth_rating	Must be greater than or equal to 0 or null.
beam_angle_long	Must be greater than or equal to 0 or null.
beam_angle_trans	Must be greater than or equal to 0 or null.
directivity	Must be greater than or equal to 0 or null.
effective_beam_angle	Must be greater than or equal to 0 or null.
transmit_response	Must be greater than or equal to 0 or null.
receive_response	Must be greater than or equal to 0 or null.
angle_factor	Must be greater than or equal to 0 or null.

6.2.16 voyage table

stop_date	Must be after start_date.

6.2.17 vtvariation table

valid_to	Must be after valid_from.

6.2.18 waterproperties table

absorption	Must be greater than or equal to 0.
sound_speed	Must be greater than or equal to 0.
frequency	Must be greater than or equal to 0.

7 Data formats

The acoustic data is stored in binary formatted files external to the DBMS. The files are in the format produced by the CREST echosounder system - see [Coombs et al. 2003] for a discussion of this echosounder.

The acoustic data is stored in the files in a 'message' format that consists of a header that defines the type of data that follows in the body part of the message. Multiple messages are stored in one file.

7.1 Header format

The message format files consist of 16 bit integers grouped into messages. Each message begins with a 12 byte (6 x 16 bit unsigned integers) header, defined as follows:

Bytes	Name	Description
0-1	type	defines the type of the data associated with this header
2-3	seqno	sets the sequence number of this message. Typically starts at 1 at the beginning of the file and increments or stays the same for successive messages.
4-5	spare	a spare field, currently only used with towbody telemetry data
6-7	origin	the origin of this message
8-9	target	the intended destination of this message
10-11	length	the length of the body part of this message in bytes

The next message header begins 'length' bytes past the end of the current message header. This repeats until the end of the file. The format of the message body is determined by the value in the 'type' field of the header.

7.2 Header type 32

The vast majority of the data collected is processed acoustic data and has always been stored in a 'bundled' format. The header 'type' value that indicates 'bundled' format is 32.

Acoustic data is collected via an analog-to-digital converter and the term used for the value obtained from the a/d converter is 'sample'. When acoustic data is collected a threshold is applied and samples below the threshold are set to zero. The

bundled data format just records the non-zero samples. A series of samples that do not contain a zero valued sample is called an 'echo'. Hence, the bundled data format stores samples in groups of echoes thus:

bytes	description
0-1	number of echoes in this message body
2-3	sample number of first sample in echo
4-5	number of samples in echo
6-7	real part of sample
8-9	imag part of sample
10-11	real part of sample
12-13	imag part of sample
14-15	...
16-17	...
...	sample number of first sample in next echo
...	number of samples in echo
...	real part of sample
...	imag part of sample
...	...

References

[Coombs et al. 2003] Coombs, R.F.; Macaulay, G.J.; Knol, W.; Porritt, G. (2003). Configurations and calibrations of 38 kHz fishery acoustic survey systems, 1991-2000. New Zealand Fisheries Assessment Report 2003/49. 24 p.

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