Information access and inquiry

NWSJEMS

TECHNICAL REPORT No. 4

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CSIRO

GOVERNMENT OF
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Department of
Environment

NORTH WEST SHELF
JOINT ENVIRONMENTAL
MANAGEMENT STUDY

Final report

North West Shelf Joint Environmental Management Study Final Report.

List of technical reports

NWSJEMS Technical Report No. 1
Review of research and data relevant to marine environmental management of Australia's North West Shelf.
A. Heyward, A. Revill and C. Sherwood

NWSJEMS Technical Report No. 2
Bibliography of research and data relevant to marine environmental management of Australia's North West Shelf.
P. Jernakoff, L. Scott, A. Heyward, A. Revill and C. Sherwood

NWSJEMS Technical Report No. 3
Summary of international conventions, Commonwealth and State legislation and other instruments affecting marine resource allocation, use, conservation and environmental protection on the North West Shelf of Australia.
D. Gordon

NWSJEMS Technical Report No. 4
Information access and inquiry.
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NWSJEMS Technical Report No. 5
Data warehouse and metadata holdings relevant to Australia's North West Shelf.
P. Brodie, M. Fuller, T. Rees and L. Wilkes

NWSJEMS Technical Report No. 6
Modelling circulation and connectivity on Australia's North West Shelf.
S. Condie, J. Andrewartha, J. Mansbridge and J. Waring

NWSJEMS Technical Report No. 7
Modelling suspended sediment transport on Australia's North West Shelf.
N. Margvelashvili, J. Andrewartha, S. Condie, M. Herzfeld, J. Parslow, P. Sakov and J. Waring

NWSJEMS Technical Report No. 8
Biogeochemical modelling on Australia's North West Shelf.
M. Herzfeld, J. Parslow, P. Sakov and J. Andrewartha

NWSJEMS Technical Report No. 9
Trophic webs and modelling of Australia's North West Shelf.
C. Bulman

NWSJEMS Technical Report No. 10
The spatial distribution of commercial fishery production on Australia's North West Shelf.
F. Althaus, K. Woolley, X. He, P. Stephenson and R. Little

NWSJEMS Technical Report No. 11
Benthic habitat dynamics and models on Australia's North West Shelf.
E. Fulton, B. Hatfield, F. Althaus and K. Sainsbury

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Ecosystem characterisation of Australia's North West Shelf.
V. Lyne, M. Fuller, P. Last, A. Butler, M. Martin and R. Scott

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Contaminants on Australia's North West Shelf: sources, impacts, pathways and effects.
C. Fandry, A. Revill, K. Wenziker, K. McAlpine, S. Apte, R. Masini and K. Hillman

NWSJEMS Technical Report No. 14
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R. Little, E. Fulton, R. Gray, D. Hayes, V. Lyne, R. Scott, K. Sainsbury and D. McDonald

NWSJEMS Technical Report No. 15
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E. Fulton, K. Sainsbury, D. Hayes, V. Lyne, R. Little, M. Fuller, S. Condie, R. Gray, R. Scott,
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NWSJEMS Technical Report No. 17
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– Visualisation software and user guide.
B. Hatfield, L. Thomas and R. Scott

NWSJEMS Technical Report No. 18
Background quality for coastal marine waters of the North West Shelf, Western Australia.
K. Wenziker, K. McAlpine, S. Apte, R.Masini

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ACRONYMS

ACOM	Australian Community Ocean Model
AFMA	Australian Fisheries Management Authority
AFZ	Australian Fishing Zone
AGSO	Australian Geological Survey Organisation now Geoscience Australia
AHC	Australian Heritage Commission
AIMS	Australian Institute of Marine Science
AMSA	Australian Maritime Safety Authority
ANCA	Australian Nature Conservation Agency
ANZECC	Australian and New Zealand Environment and Conservation Council
ANZLIC	Australian and New Zealand Land Information Council
APPEA	Australian Petroleum, Production and Exploration Association
AQIA	Australian Quarantine Inspection Service
ARMCANZ	Agricultural Resources Management council of Australia and New Zealand
ASIC	Australian Seafood Industry Council
ASDD	Australian Spatial Data Directory
CAAB	Codes for Australian Aquatic Biota
CAES	Catch and Effort Statistics
CALM	Department of Conservation and Land Management (WA Government)
CAMBA	China Australia Migratory Birds Agreement
CDF	Common data format
CITIES	Convention on International Trade in Endangered Species
CTD	conductivity-temperature-depth
CMAR	CSIRO Marine and Atmospheric Research
CMR	CSIRO Marine Research
COAG	Council of Australian Governments
ConnIe	Connectivity Interface
CPUE	Catch per unit effort
CSIRO	Commonwealth Science and Industrial Research Organisation
DCA	detrended correspondence analysis
DIC	Dissolved inorganic carbon
DISR	Department of Industry, Science and Resources (Commonwealth)
DEP	Department of Environmental Protection (WA Government)
DOM	Dissolved organic matter
DPIE	Department of Primary Industries and Energy
DRD	Department of Resources Development (WA Government)
EA	Environment Australia
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EPA	Environmental Protection Agency
EPP	Environmental Protection Policy
ENSO	El Nino Southern Oscillation
EQC	Environmental Quality Criteria (Western Australia)
EQO	Environmental Quality Objective (Western Australia)
ESD	Ecologically Sustainable Development
FRDC	Fisheries Research and Development Corporation
FRMA	Fish Resources Management Act
GA	Geoscience Australia formerly AGSO
GESAMP	Joint Group of Experts on Scientific Aspects of Environmental Protection
GIS	Geographic Information System
ICESD	Intergovernmental Committee on Ecologically Sustainable Development
ICS	International Chamber of Shipping
IOC	International Oceanographic Commission
IGAE	Intergovernmental Agreement on the Environment
ICOMOS	International Council for Monuments and Sites

IMO	International Maritime Organisation
IPCC	Intergovernmental Panel on Climate Change
IUNC	International Union for Conservation of Nature and Natural Resources
IWC	International Whaling Commission
JAMBA	Japan Australian Migratory Birds Agreement
LNG	Liquified natural gas
MarLIN	Marine Laboratories Information Network
MARPOL	International Convention for the Prevention of Pollution from Ships
MECO	Model of Estuaries and Coastal Oceans
MOU	Memorandum of Understanding
MPAs	Marine Protected Areas
MEMS	Marine Environmental Management Study
MSE	Management Strategy Evaluation
NCEP - NCAR	National Centre for Environmental Prediction – National Centre for Atmospheric Research
NEPC	National Environmental Protection Council
NEPM	National Environment Protection Measures
NGOs	Non government organisations
NRSMPA	National Representative System of Marine Protected Areas
NWQMS	National Water Quality Management Strategy
NWS	North West Shelf
NWSJEMS	North West Shelf Joint Environmental Management Study
NWSMEMS	North West Shelf Marine Environmental Management Study
ICIMF	Oil Company International Marine Forum
OCS	Offshore Constitutional Settlement
PFW	Produced formation water
P(SL)A	Petroleum (Submerged Lands) Act
PSU	Practical salinity units
SeaWiFS	Sea-viewing Wide Field-of-view Sensor
SOI	Southern Oscillation Index
SMCWS	Southern Metropolitan Coastal Waters Study (Western Australia)
TBT	Tributyl Tin
UNCED	United Nations Conference on Environment and Development
UNCLOS	United Nations Convention of the Law of the Sea
UNEP	United Nations Environment Program
UNESCO	United Nations Environment, Social and Cultural Organisation
UNFCCC	United Nations Framework Convention on Climate Change
WADEP	Western Australian Department of Environmental Protection
WADME	Western Australian Department of Minerals and Energy
WAEPA	Western Australian Environmental Protection Authority
WALIS	Western Australian Land Information System
WAPC	Western Australian Planning Commission
WHC	World Heritage Commission
WOD	World Ocean Database
www	world wide web

TECHNICAL SUMMARY

The North West Shelf Joint Environmental Management Study (NWSJEMS) planned for good information systems to support the science from the start.

A comprehensive review of data sets and other information relevant to the marine ecosystems, the geology, infrastructure and industries of the North West Shelf area had been completed (Heyward et al. 2006). The Data Management Project was established to source and prepare existing data sets for use, requiring the development and use of a range of tools: metadata systems, data visualisation and data delivery applications. These were made available to collaborators to allow easy access to data obtained and generated by the Study.

The CMAR *MarLIN* metadata system was used to document the data sets which were identified as potentially useful for the Study. The *Data Warehouse* is a spatially enabled relational database engineered as a repository for the wide range of data types used. The *Data Trawler* was built as a web interface for discovering and downloading data sets. These tools were built and available for use by collaborators in the first year of the Study. The user interfaces and technologies are described in this report.

Several visualisation tools for working with the inputs and results of the NWSJEMS research are also described here. The *NWS Technical User Interface* is mainly used by programmers working with model runs. *ViewNWS* is for the Management Strategy Evaluation displays. *ConnIe* was built to display modelled circulation patterns in the North West Shelf area.

Concepts developed for this NWSJEMS knowledge base have since fed into other ecosystem-based regional studies in Australian marine science. The uptake of these tools, conceived for the Study, has gone far beyond the region for which they were built.

1. INTRODUCTION

Established to allow an ecosystem-wide and multiple use perspective to the management of the NWSJEMS, the Study adopted a unique approach to managing the scientific data that underpin the Study outputs.

The data management task of the Study was treated as a research outcome in its own right and was expected to leave behind infrastructure that could be useful for in ongoing management of the region. During the study outputs were to be presented in a way to maximise access and usability. These objectives could only be achieved with the design and implementation of innovative tools, some with features which were not generally available at the time. An ideal way of locating and presenting data for the study of a complex marine environment such as the North West Shelf was through spatially enabled interfaces.

At the earliest stages of the NWSJEMS, a data management framework was planned. The sources of relevant research material in the study area were identified. Knowledge, documents and data were gathered systematically from individuals, academia, business and government. Data use agreements were negotiated and systems established for information access, sharing and re-use.

There was a clear need for a quick startup with data management. To be of use during the course of the Study, procedures and some tools were developed and available for use within the first year. The main elements of this framework were released for use by the latter half of 2001.

The objectives in developing the framework were to:

- identify sources of relevant data from the NWSJEMS area;

- seek and prioritise data gathered from these sources in a systematic way;

- establish and share information about the data holdings (metadata) within the Study and with the public;

- set up data use agreements and systems for appropriate access and sharing of data and information; and

- establish a spatially enabled marine data management system containing key environmental information.

The Data Management Project was concerned not only with development of tools with which to describe, publish, search and access relevant data sets, but also with the management of the content, or data sets used during the Study.

Several outputs of the Study and tools used throughout the research are described in this report. The three components of the framework available for use by study participants by August 2001 were: *MarLIN*, the CMAR metadata tool which described the data sets; the *Data Warehouse*, a data repository; and the *Data Trawler*, a web interface to search, preview and download the *Data Warehouse* data.

Also described below is the *Middleware* tool, an expert's data viewer for *MSE Technical Visualisation* used throughout the Study. Finally, there is a description of the main tool for viewing outputs of the Study, *ViewNWS*, the MSE user-friendly visualisation software.

The next document in this NWSJEMS Technical Report series *Data Warehouse and Metadata Holdings Relevant to Australia's North West Shelf* describes the content available for research and the outputs of the Study.

2. BACKGROUND

It was acknowledged at the outset that systematic management of all the information required for, and generated by, the Study was of prime importance. It was recognised that this would require close collaboration between the project team and the WA State agencies. A NWSJEMS Data Management Project team was established with members from both the Department of Environmental Protection and the CSIRO Marine and Atmospheric Research (CMAR) Data Centre. This team developed the NWSJEMS information strategies. They set up management procedures to deal with fundamental issues, particularly those relating to information access and ownership. They also designed and implemented the systems necessary to support the data management components of the study.

The then Department of Environmental Protection (DEP), other WA agencies and CMAR all had existing data management arrangements and requirements, and these were largely unchangeable. New systems developed for NWSJEMS were therefore to integrate with, and complement, the existing arrangements and requirements of each agency.

Within the then DEP, NWSJEMS was aligned with corporate activities of the Geographic Information System (GIS) branch. This GIS branch was primarily responsible for managing the Department's spatial data.

While GIS is a very convenient and commonly used tool for visualising spatial information, it was recognised that it had some important limitations in presenting information for ecosystem management decision making. In particular, GIS is limited in its ability to efficiently manage complex or distributed data sets and to represent spatial changes through time – both of which are important in ecosystem models and management strategy evaluation.

Because GIS technology was likely to continue to be a commonly used tool among stakeholders and regulators it was decided that the data management framework would need to couple GIS with relational database software and allow features to function over the world wide web (www). GIS systems have deficiencies in displaying the 'time' component of any marine spatial data sets – this would be overcome with custom-built visualisation tools. This would build on existing CMAR information systems that were based on world wide web technologies. The resulting framework would allow agencies and users to continue to use their chosen GIS for visualisation, while also using the enhanced data and visualisation management facilities available from other software.

So the data management framework developed for NWSJEMS was set up to identify and enable access to this information, and to allow its more efficient integration and analysis. The framework has been used to gather and/or make available data from many public and private sector sources, and to share data between the several research projects within the Study.

This framework was designed so that it can provide the infrastructure to support for ongoing management of data and information about the North West Shelf, and to show how these data might be available to stakeholders and decision makers.

2.1 Data sources and metadata

During the planning for NWSJEMS it was evident a significant impediment to taking an ecosystem-wide view of the region could be the difficulty of accessing and integrating information. There have been numerous studies and reports completed on various aspects of the North West Shelf ecosystem and the human uses of it. However, the resulting knowledge, data and reports were scattered among numerous private business entities (ranging in size from individual consultants to multinational corporations) and government agencies (straddling many research, regulation and policy agencies across the three tiers of government). The relevant information was in diverse forms, ranging from written reports with various levels of accessibility, through to databases employing multiple platforms and software tools. Some knowledge of the area remained 'in the heads' of people with various levels of expertise.

A comprehensive review of research and data, relevant to the environmental management of the North West Shelf, was undertaken in 1999 (Heyward et al. 2006). The bibliography included the published material, grey literature, maps and data products. The review established which of the data sources suited the needs of the various parts of the Study. Data rich and data poor subjects and areas were identified and the process of obtaining the data sets required for NWSJEMS was planned.

Important basic data sets were available from CMAR and Geoscience Australia (GA, formerly AGSO). Others were identified through the Australian Spatial Data Directory (ASDD), the Western Australian Land Information Service (WALIS) Interragator database and through contact with individual agencies or interviews with data managers from industries operating in the region, mainly oil, gas and mining companies. Frequently these data sets were made available without accompanying documentation. For data from third parties to be used for the study systematic descriptions of data were completed and the conditions associated with the use of the data determined.

Metadata is a fundamental tool in managing scientific data sets. Data is easier to find, to access and to use with a good metadata system. This 'data about data' comprises descriptive information, details about the data supplier, information on data versions and on data quality, storage, formats, currency and status details, access constraints and licensing conditions.

These comprehensive descriptions of data holdings were created or updated and loaded into Department of Environmental Protection and CMAR metadata databases. There is a means of publishing and of searching such geospatial data set descriptions throughout Australia: the Australian Spatial Data Directory (ASDD). All data sets identified for NWSJEMS, which had not previously been submitted to the national data directory, were provided to WALIS for inclusion on the WA node of the ASDD at http://www.walis.wa.gov.au/

The CMAR metadata tool *MarLIN* was used to describe and publish NWSJEMS data sets. *MarLIN*, described in section 3, is also a node of the ASDD; however NWSJEMS metadata records in *MarLIN* were not published again through the ASDD.

2.2   Data acquisition and data use agreements

Licence agreements were developed with the agencies and industry representatives contributing data sets to the Study. The type of agreement depended upon whether the data came from state or Federal government or from industry.

The use of all data obtained from WA Government agencies was negotiated under the WALIS data exchange agreement. This allows access to data for the cost of extraction for non-commercial use. Licence agreements with Commonwealth agencies varied on an agency by agency basis.

A master licence agreement for use of data from the oil and gas sector was initially negotiated with the Australian Petroleum Production and Exploration Association (APPEA), Apache Energy, and the Department of Environmental Protection on behalf of NWSJEMS. The aim of the agreement was to make the data as accessible as possible to JEMS collaborators, the Oil Spill Response Atlas and to WALIS.

2.3   Tools and interfaces

The tools required in the early stages of the Study were provided through the data management framework. Metadata systems were used to establish and share information about the data gathered for use in the various study projects.

An Oracle database, the *Data Warehouse*, was established as the repository for observational data sets and to reference GIS data and model outputs. To interface with the *Warehouse* a web-enabled Java application was built. With this tool, the *Data Trawler*, the user can discover, select and download data to a local computer. They select GIS, oceanographic and biological data of interest using categories, geographic and temporal criteria.
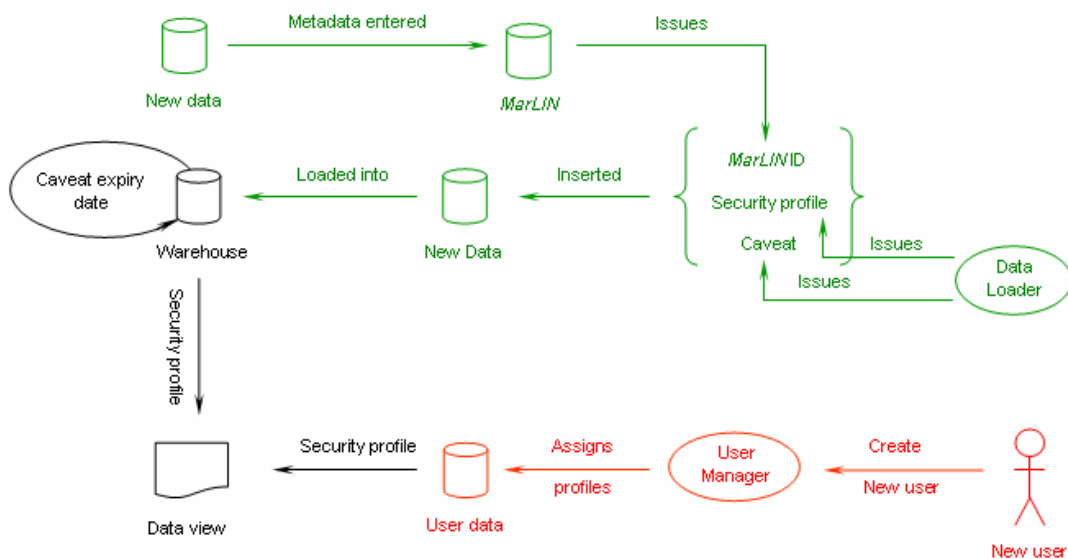
Figure 2.2.1: The Data Management Framework comprised data acquisition, documentation and preparation for data re-use with *MarLIN*, storage and management with the *Data Warehouse* and access through the explore, discover and retrieve functions of the *Data Trawler*.

As the study progressed other tools and dedicated interfaces were used or developed when required. The hydrodynamic models used for NWSJEMS outputs included the Australian Community Ocean Model (*ACOM*) and Northwest, based on the Model of Estuaries and Coastal Oceans (*MECO*). The simulation of human activity and the marine ecosystem in the study region was performed with *InVitro,* where the powerful features of *NWS Technical User Interface* were used for monitoring and visualising model inputs and outputs. The user interfaces for working with results of the study include *ConnIe* and *ViewNWS.*

The tools described in the sections that follow include *MarLIN*, the *Data Warehouse*, the *Data Trawler*, the *NWS Technical User Interface*, *ViewNWS* and *ConnIe*. The following topics, where relevant, are covered for each:

- discussion of the purpose of the application;

- access information and the web link;

- introduction to the interface or examples;

- notes on the technologies and architecture; and

- further technical information, which may be contained in an appendix.

3.   MARLIN AND METADATA

The *MarLIN* system comprises a metadata repository and web interface provided by CSIRO Marine and Atmospheric Research. This tool was used from the earliest stages of the study, supporting the discovery, appraisal, access, use and re-use of the data sets described therein.

MarLIN is publicly available at http://www.marine.csiro.au/marlin/

Structured descriptions of all data sets used in NWSJEMS feature here. Fields include data set title, abstract, geographic location, time period, subject category(s), search words, data quality, location and access constraints, documentation, contact details and other supporting information.

Figure 3.1: The *MarLIN* search interface.

The content conforms to the ANZLIC Version 2 Core metadata elements (Feb 2001) and ISO19115. There are extra Environment Australia (EA) fields. Other fields for use with CMAR data sets enhance the search functions of the tool. They include divisional activities, research projects, research platforms, voyages, defined regions, Codes for Australian Aquatic Biota (CAAB) species codes and descriptive subject categories based on the Aquatic Sciences and Fisheries Information System. The interface allows the user to search on permutations of these fields.

There is a link on many metadata records to a quick visualisation tool, *C-squares*. This will display the spatial extent of that data set.

The technology used in *MarLIN* is based on the mid-nineties EA Environmental Data Directory (EDD or "Green Pages") software. Currently *MarLIN* requests are redirected from the CSIRO Marine Divisional Apache Web Server to an Oracle Internet Application Server. Here html pages are created by Oracle PLSQL procedures 'on the fly' from the contents of the database. The MarLIN Oracle 10g database comprises several tables in which up to 90 fields can be recorded for a data set.

The *NWSJEMS Technical Report No. 5* collates summaries of these *MarLIN* NWSJEMS records.

3.1   GIS metadata system and metadata publishing

Development of the marine-oriented Geographic Information System (GIS) was an early component in the data management framework. The various data sets were converted into a standard data format and standard coordinate system ready for spatial analysis.

The *GIS Data Management System,* initially used in the Data Management Project, published metadata nationally through the ASDD. The system is described fully in Chapter 4 of the *North West Shelf Joint Environmental Management Study Interim Report June 2002*.

4. DATA WAREHOUSE

The *Data Warehouse* database was designed for a range of scientific data sets. They include oceanographic conductivity, temperature and depth (ctd) and hydrology survey data; moored current meter time series data; biological catch data with associated image information and GIS content. Such a variety of data sets is rarely integrated into a single data store.

4.1 Schema

The *Data Warehouse* is the Oracle 10g data repository. The schema for the database is represented in Data Definition Language (DDL) where four files separately define comments, sequences, constraints and tables (Appendix B). The full schema contains some 72 tables. The comprehensive Entity Relationship Diagram (ERD) as well as in cluster diagrams of particular data types are included in Appendix A. Figure 4.1.1 below, shows an overview of the repository.
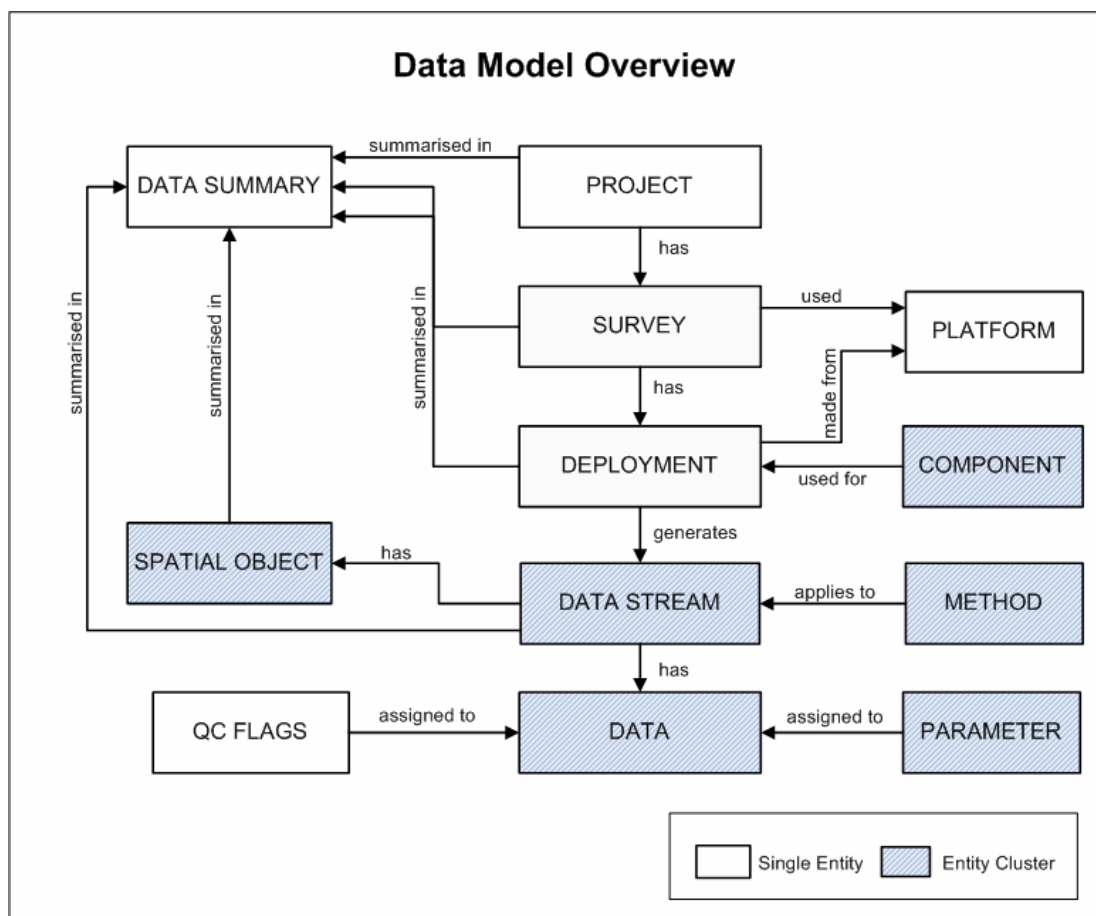
Figure 4.1.1: Overview of the *Data Warehouse* schema.

The *Data Warehouse* also contains application-specific tables for the *Data Trawler*. Some of these serve to improve the search performance of the interface, others manage users and connections to the application. Another table configures the presentation of pages in the *Data Trawler* interface as show in the category tree in Appendix D.

4.2 Security

Many data sets in the *Data Warehouse* are available to the public. However, with such a repository all data are not automatically available to any user. Before data is loaded into the database a security code is applied which will determined who will have access to that data in the *Data Warehouse*. The main entry point for accessing the *Data Warehouse* is through the *Data Trawler*. This application ensures restricted data sets are available only to the approved users who log in to the application. Furthermore, it is necessary to clarify who can do what with the data. For this purpose the *Data Warehouse* contains a 'licence note' element with information indicating which permissions might be required before the data can be used.

4.3 Data loading and content

No data set reaches the *Data Warehouse* until it has a *MarLIN* record describing the data. The data must also have reached a known state of processing, and this quality control is flagged. There are various tools used for loading data sets into the *Data Warehouse*. The oceanographic conductivity, temperature and depth (ctd) data, hydrology, GIS, underway and moorings data have Java data loading interfaces. The biological catch data sets are more diverse and loading tools using Oracle and Perl are built as required.

The content of the *Data Warehouse* is described in *NWSJEMS Technical Report No. 5*.

5. DATA TRAWLER

The *Data Trawler* is a tool with the capability to discover, investigate and download the scientific data held in the *Data Warehouse* database. It is the key application created for the NWSJEMS data management framework. The classic online store model, well known by now to those who shop on the web, was extended in the design of the internet-enabled *Data Trawler*. This interface, deployed in 2001, has been a very successful tool for delivering marine data sets to users for several years.

5.1 User interface

The url for the *Data Trawler* is http://www.marine.csiro.au/warehouse/jsp/loginpage.jsp For this site *Internet Explorer* is recommended.

### 5.1.1 Left hand side bar and tab header

Each page of the *Data Trawler* contains a panel of links on the left (figure 5.1.1). These point to associated resources and essential information about the application; there is a help page and tutorial; the description of download file formats and data quality flags, the *MarLIN* metadata interface and finally, a link to the Codes for Australian Aquatic Biota (CAAB) taxon list which is used in association with the biological data sets.

About Data Trawler	http://www.marine.csiro.au/datacentre/about_trawler.htm
Data Trawler Help	http://www.marine.csiro.au/warehouse/training/html/page_00.htm
MarLIN metadata search	http://www.marine.csiro.au/marlin/search.html
CAAB taxon list (genus index)	http://aqua.hba.marine.csiro.au:7272/CAAB/search/caab_search.list_genera
Data Download format	http://www.marine.csiro.au/warehouse/javadoc/Download.pdf

Figure 5.1.1: Associated resources to use with the *Data Trawler*.

The pages have a tab layout where each tab groups the three functions of the application: the user can frame a search, consider a result set and 'fill the shopping basket' with data sets which are of interest and which can be downloaded to the user's computer. The interface is non linear in that the user can navigate between tabs at any point. The tab content depends upon the previous user activity.
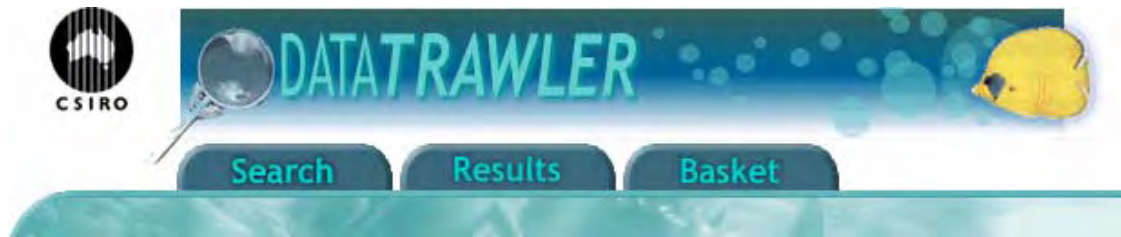
Figure 5.1.2: The tab header on each page of the Data Trawler allows the user to move between the primary functions of the application.

The user interface is designed to support the workflow steps as detailed below:

- A user logs in and a session is created;

- Search parameters are entered;

- A search is performed, returning a single result or multiple result sets;

- Preview information about a result set can be viewed;

- Any result set can be "kept" by placing them in a basket;

- Result sets can be removed from a basket;

- The spatial distribution of basket result sets can be viewed;

- The user can choose to build a download file for the data of one or more basket result sets;

- The image displayed in the Basket Map page can be saved using the browser's "Save Image As" functionality;

- A printable map of the image displayed in the Basket Map page can be viewed and printed;

- Many different searches can be performed in a session, the basket is used to keep the results of interest;

- If required, data sets are selected for download. This triggers a database query, the result set of which is zipped and written to disk on the server. The user receives an email with a link to the requested data;

- A user logs out and the session is completed.

5.1.2 Login

The *Data Trawler* interface initially presents the user with a login screen and the associated Data Use Agreement (see Appendix C). Users agree to these conditions by logging into the application. Those who wish to download data use their email address. Users registered with the *Data Trawler* are given an appropriate security code for selective access to data sets. Unregistered users gain access only to data that is in the public domain.
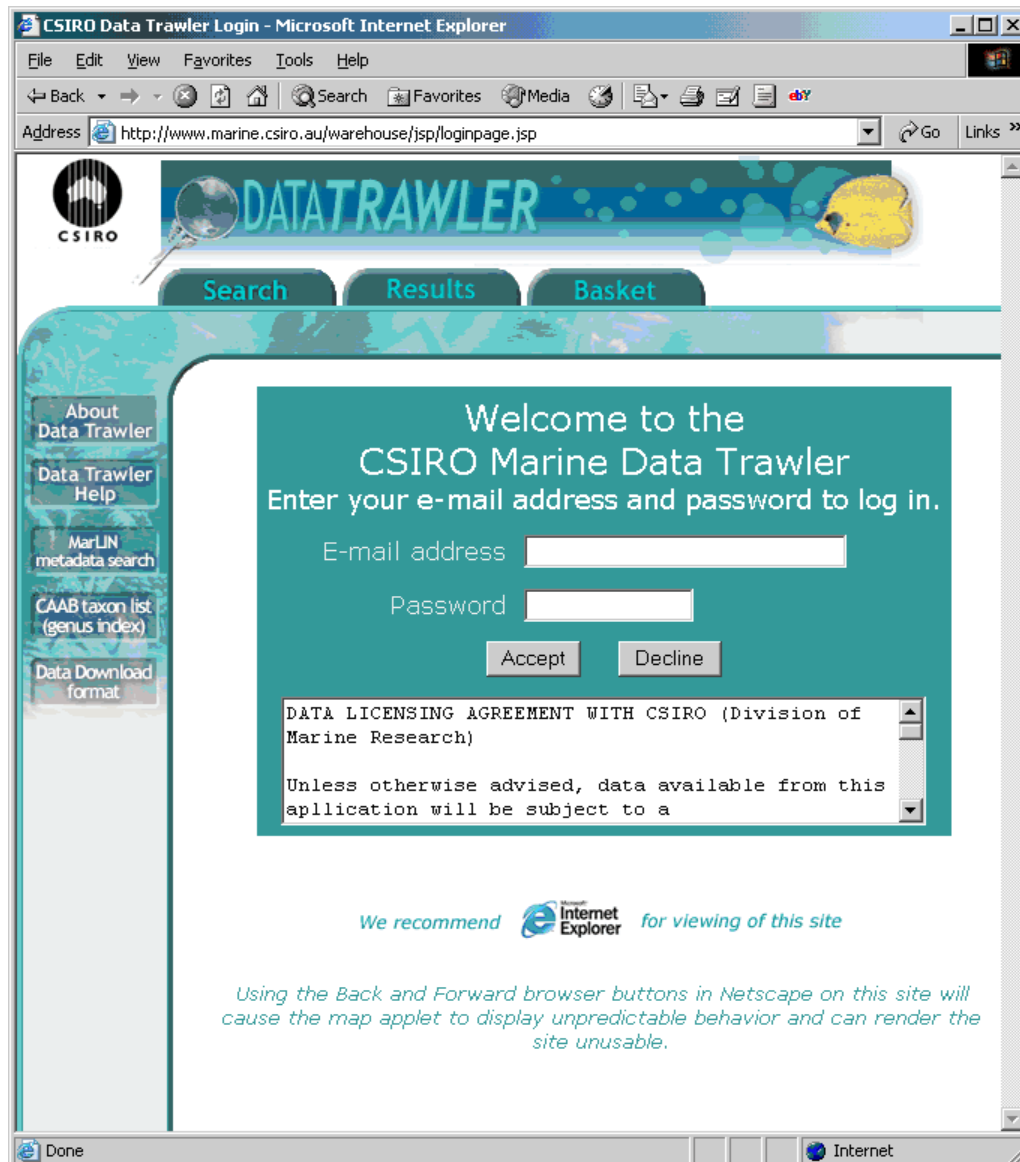

Figure 5.1.3: The login page.

The user accepts the terms of the Data Use Agreement and a subsequent page notifies the user of the login status: authorised or public. This is the entry point to the search page.

5.1.3 Search page

The search interface has provision for specifying space and time parameters along with selecting the data types or categories of interest. The buttons used for controlling the map area are defined in figure 5.1.4.

North, East, South and West fields at the bottom of the map allow a new map extent to be entered. After a new value is entered placing the cursor in one of the other fields will cause the map to redraw.

The categories showing on the search page (figure 5.1.5) are configured using a category tree (see Appendix D). Access to a data set is organised by category, class and source. The next step in the search depends upon the link chosen. It might be a list of data sub-groupings from which to select; a parameter page appropriate for the data selected; or a single item from the selected data group.

Buttons

Display initial map

Zoom in

Zoom out

Pan

Display previous map

Display next map

Search button

Figure 5.1.4: Control buttons on the search pages.
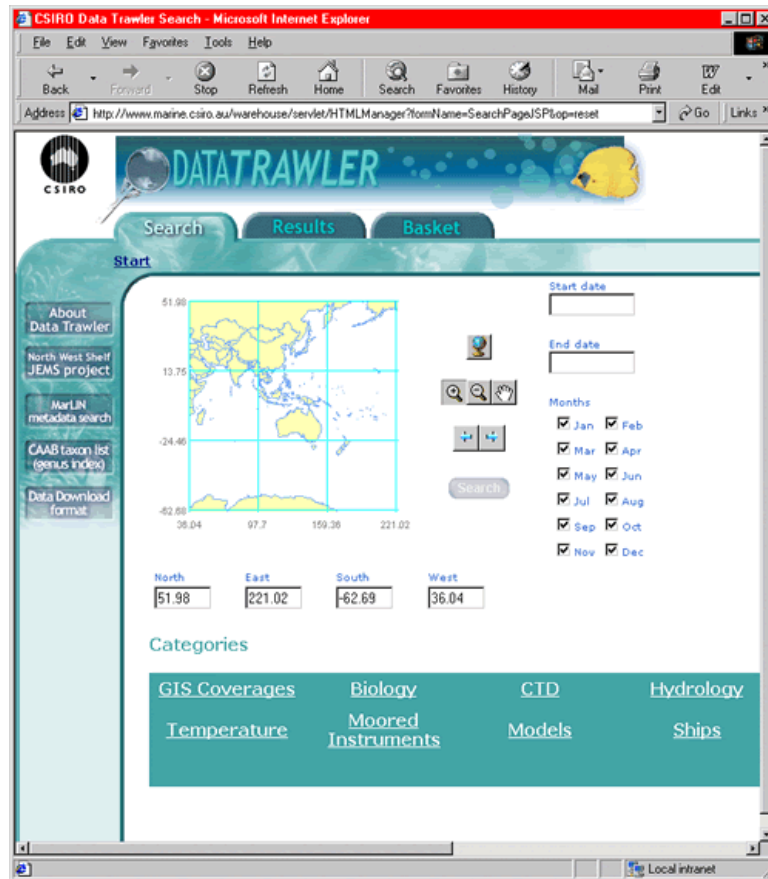
Figure 5.1.5: The search page.

5.1.4   Search results

The search results page displays a list of result sets for the current search. Result sets can be previewed from this page by selecting the 'View Summary' button. A map, graph, table or descriptive text is shown, depending upon the type of data contained in the result set. Selecting the plus button adds the result set to the basket.
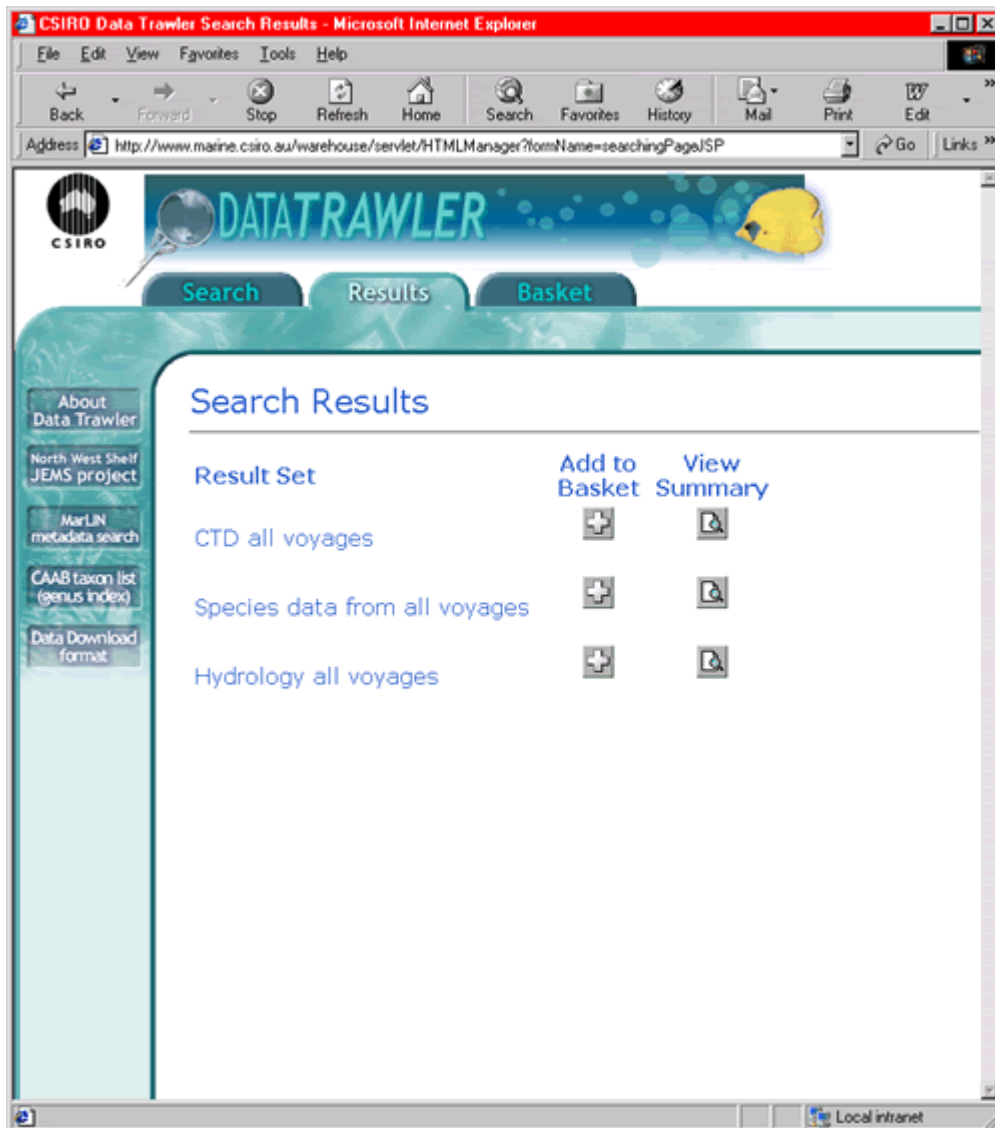
Figure 5.1.6: The search results page.

5.1.5 Basket

When a user has added a result set to the basket, that tab displays the contents. The basket may include several selections from searches performed during the *Data Trawler* session. Result sets can be viewed or removed from the basket. They are selected for display in the Basket Map page from here using the 'ViewMap' button.
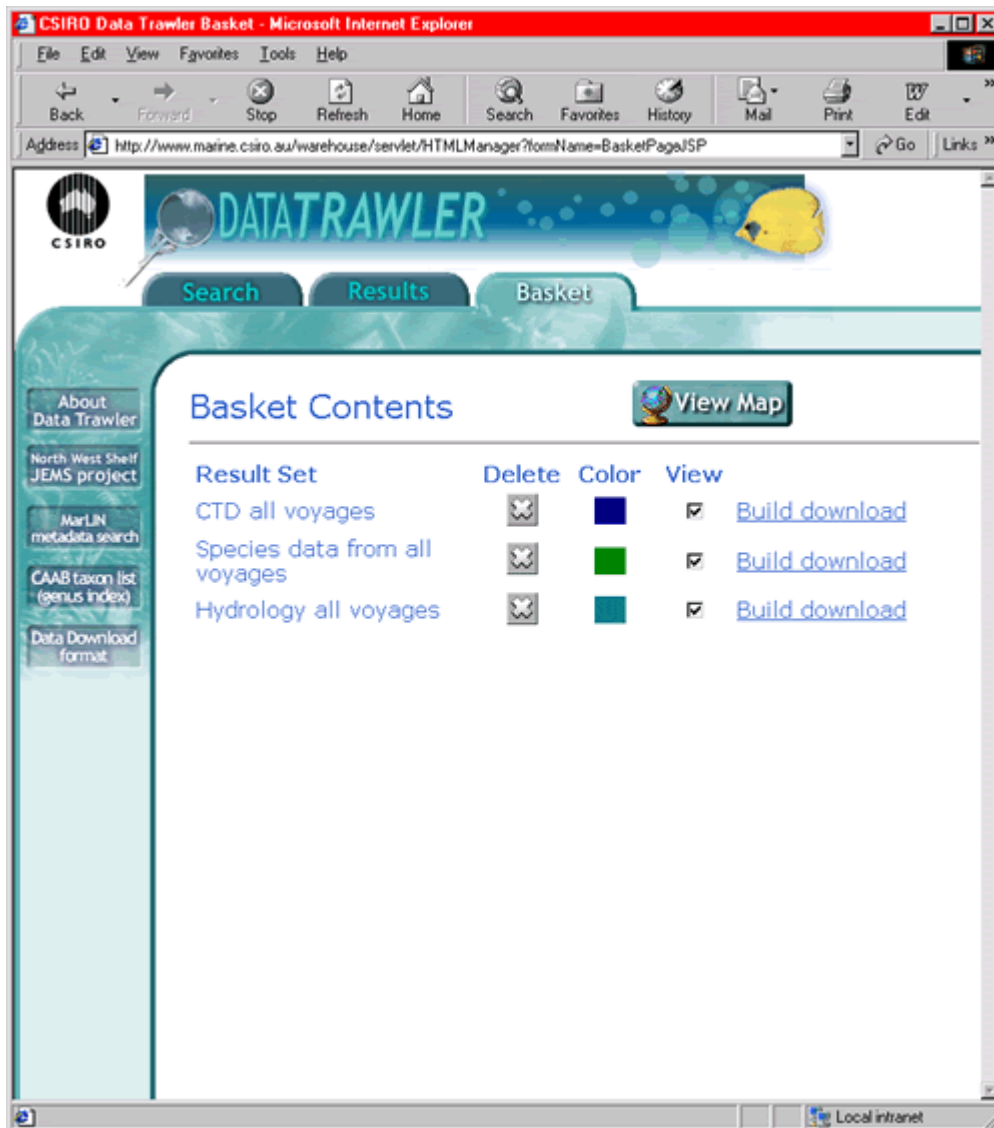
Figure 5.1.7: The basket page shows result sets of interest to the user.

5.1.6   Basket map

The basket result sets selected for viewing are displayed on a map in this page. Each result set is assigned a colour and point based data is rendered as a set of points, vector based data as a set of vectors and area based data is rendered as an outline showing the data's extents. A larger scale printable map can be produced from this screen.
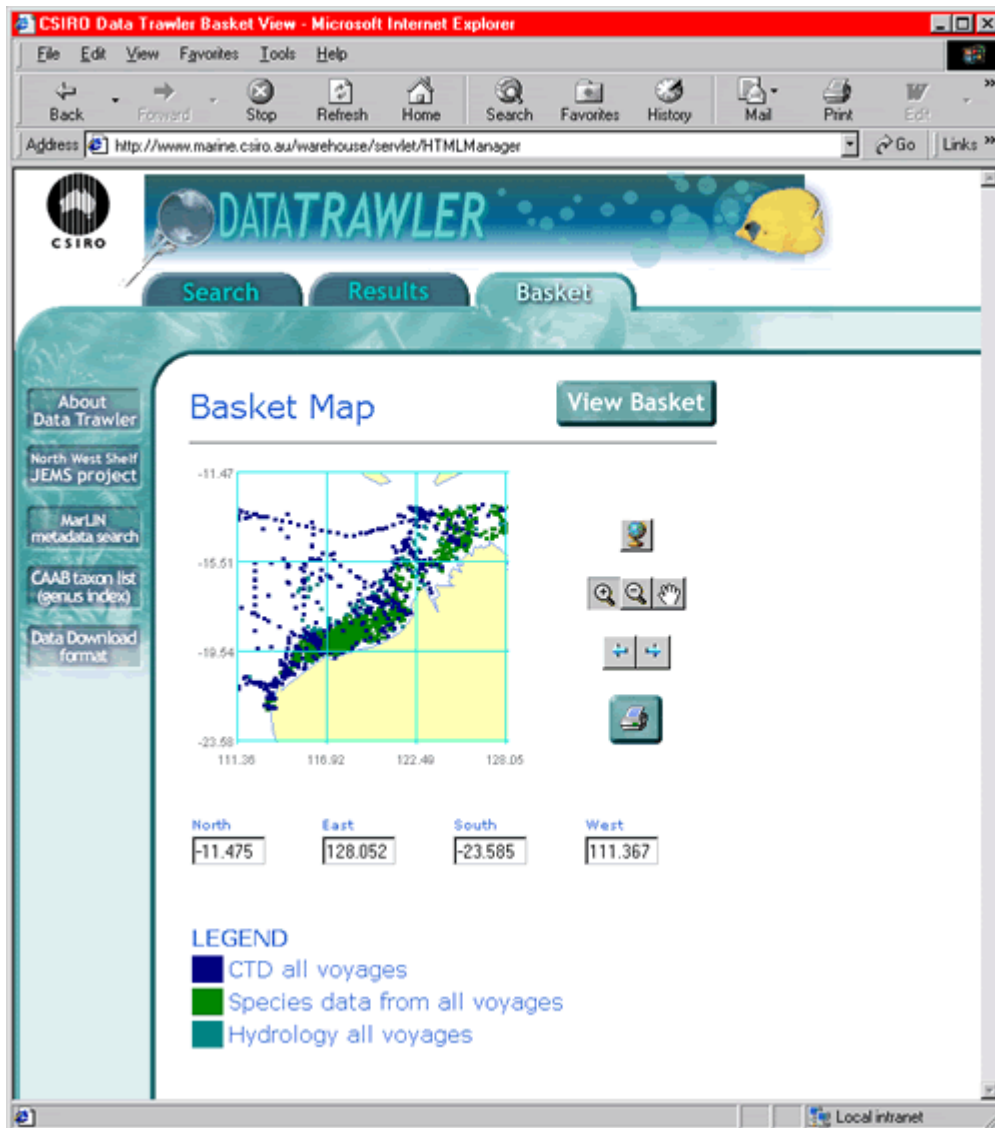
Figure 5.1.8: The basket map is the result of the 'view' option of the basket page.

5.1.7 Data download

When a data set in the Basket page has been selected for download the user is asked to confirm the request. A new search of the *Warehouse* is then started and the result set is zipped and written to disk on the server. The user is notified by email when this is done. A link to the requested data is included in the email as shown in figure 5.1.9. The data set is then saved to the hard drive on the user's computer. The formats of the data which have been downloaded are documented in the Download file, a pdf document, the link to which is on the left panel of each page of the *Data Trawler* –

http://www.marine.csiro.au/warehouse/javadoc/Download.pdf
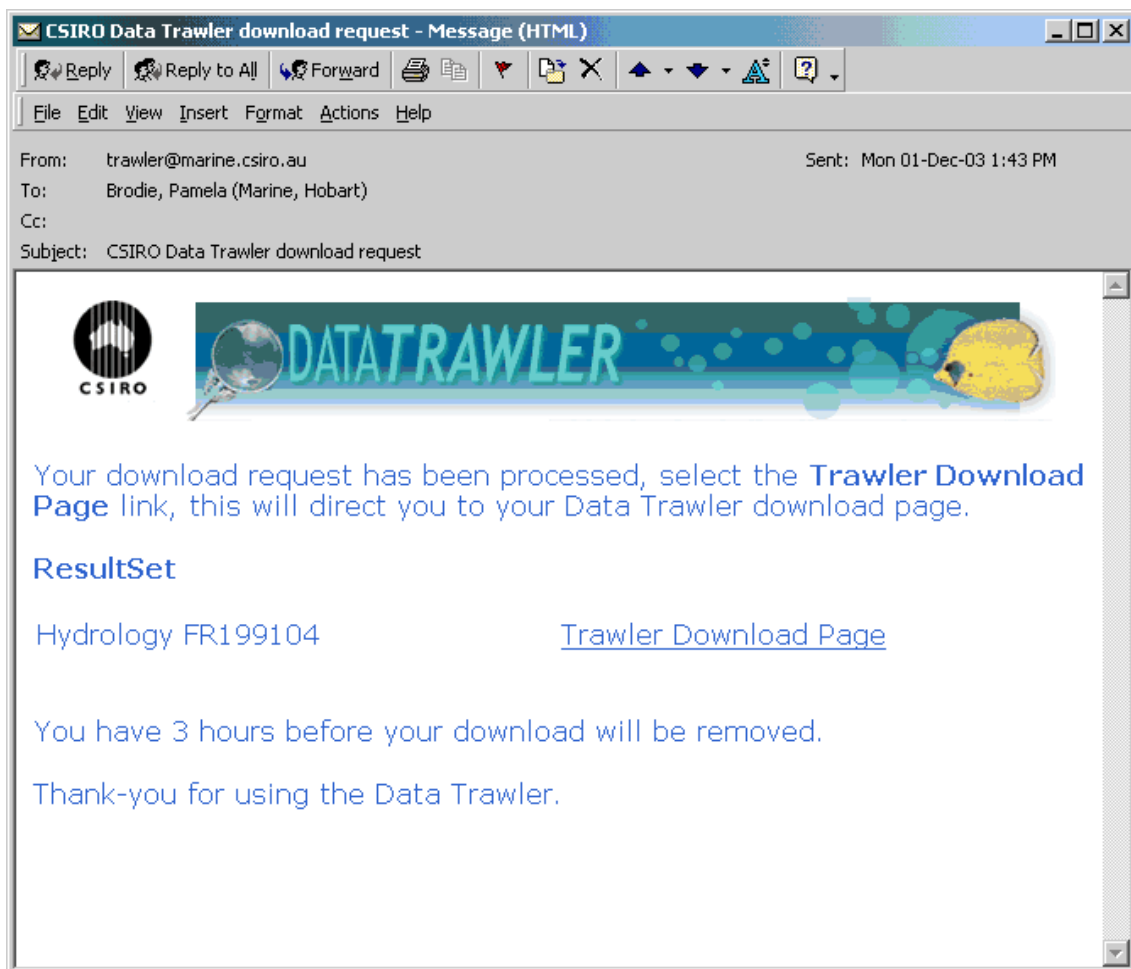
Figure 5.1.9: The email sent to notify a user their data set is available for download.

5.2   Technologies

The *Data Trawler* Java2 application runs on a Windows 2000 server using Apache Tomcat. It is based on the 3-tier architecture of a presentation layer, a business logic layer and the data access layer. The presentation layer displays web pages created with Java Server Pages (JSP) software. These pages contain search parameters for the application, the results of a search, the 'basket' or data sets the user earmarks as of interest and status messages for the user. The business logic, to mesh presentation and data access layers, is implemented using Java Beans.

The user cannot directly access data stored in the *Data Warehouse* scientific data repository. The data access layer classes provide the necessary services for this. These use both Java Database Connectivity (JDBC) technology for the application to connect to the database, and data servers utilising Remote Method Invocation (RMI) to build result sets.

The search and result visualisation interfaces of the presentation layer use the MapInfo Corporation product MapXtreme for Java to generate maps. The JavaMail API manages email notification of users when the selected data sets are ready to download. The Log4j, the Apache package for runtime logging, was used throughout the application.
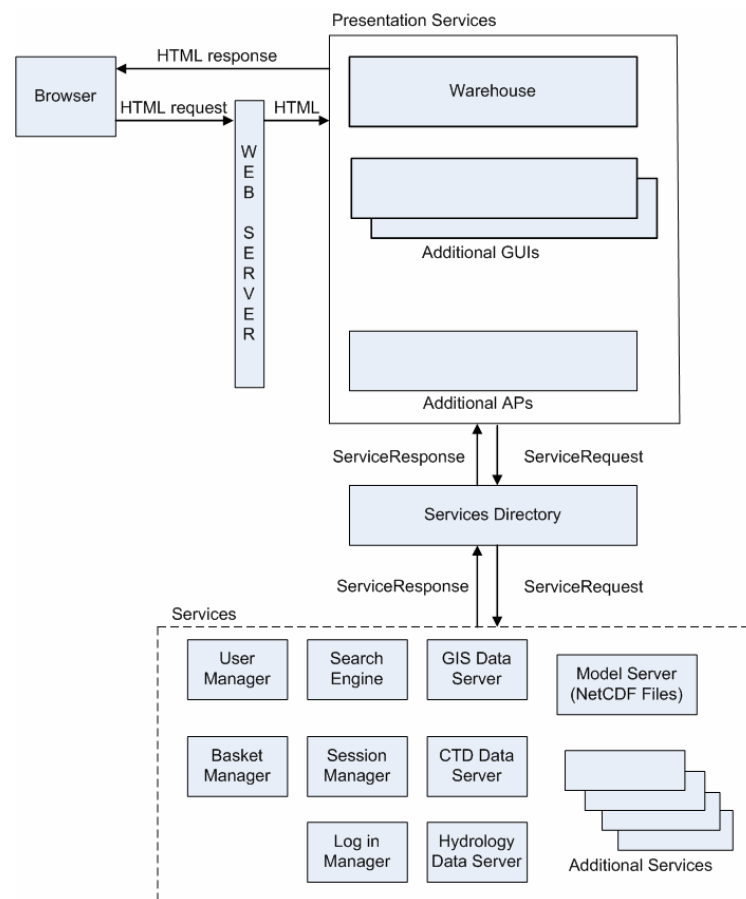
Figure 5.2.1: *Data Trawler* architecture.

5.3   Installation

The following components are required for the *Data Trawler* application;

- JDK 1.3, JavaMail and the Java Activation Framework
  (http://www.javasoft.com/)
- MapXtreme for Java 3.1
- Oracle 8i 8.1.7
- Tomcat 3.2 and Log4j (http://www.apache.org/)

The application requires the services.xml and portal_logger.conf files to startup cleanly. These files need to be located in the jre\lib\ext directory.

Table 5.3.1: Web Server Directory Structure.

Directory	Description
tomcat\webapps\warehouse	Application root directory
tomcat\webapps\warehouse\applets	Applet root directory – the map is the only applet in the application. This directory structure is required to allow the map applet to operate with Java's security constraints.
tomcat\webapps\warehouse\applets\classes	The class files for the map applet, subdirectory structure reflects class package for the map applet.
tomcat\webapps\warehouse\applets\conf	Not currently used. Its purpose is to allow uploading of any configuration details the applet may require.
tomcat\webapps\warehouse\applets\images	Map control images.
tomcat\webapps\warehouse\applets\images\maps	Images generated by the map applet. Used to support the history (back and forward arrows) caching of maps viewed by a user.
tomcat\webapps\warehouse\downloads	Contains user generated downloads.
tomcat\webapps\warehouse\downloads\coverages	Contains zipped GIS coverage files exposed through the application.
tomcat\webapps\warehouse\downloads\netCDF	Contains zipped netCDF files exposed through the application.
tomcat\webapps\warehouse\images\	User interface images.
tomcat\webapps\warehouse\images\applet	Images for map applet user feedback, i.e. "Sending image please wait".
tomcat\webapps\warehouse\images\graphs	Graph images generated by a user viewing a preview page for a result set that uses graphs.
tomcat\webapps\warehouse\images\if	Additional user interface images.
tomcat\webapps\warehouse\jsp	Application JSPs.
tomcat\webapps\warehouse\training	Root directory for the application help.
tomcat\webapps\warehouse\WEB-INF	Standard WEB-INF directory structure for a Tomcat application.

6.   NWS TECHNICAL USER INTERFACE

The data rich screens of the *NWS Technical User Interface* mainly serve for analysis of raw inputs into *InVitro*, the spatially explicit agent-based biophysical simulation model at the core of this Study. For details on *InVitro* see *NWSJEMS Technical Report No. 14*. The secondary use of the interface is for fine-scale investigation of MSE indicators.

A configurable control for each session allows the creation of multiple concurrent interactive windows. These screens have pan, zoom and layer features familiar to users of GIS systems with the advantage of also including a temporal perspective when required. Data layers can feed geographical screens, time series and other property plots, tabulations of data, 2D and 3D histograms. *NWS Technical Interface* supplies extensive data manipulation and analysis options, parsing functions, as well as editing, output, animation and printing utilities. For details of these specialist functions see Hatfield et al. (2006).

6.1   User interface screens

The toolbar at the top of each screen controls geographic functions as in figure 6.1.1. The left hand layer panel of each screen shows the available data sets. These buttons include a thumbnail image of the display element.

Buttons

Info	print clicked location to stdout
Zoom in	select and drag a bounding box
Zoom out	from the clicked point
Move	to drag of pan within the graphics area

Figure 6.1.1: The geographic toolbar button functions.

Several types of screen are used in this application and some are shown in figure 6.1.2. Two geographical 'geowin' displays are at the top. The first screen displays a contaminant plume, the second, a current vector field.

A screen containing a data table is in the centre of the figure. Here the attributes of a spatial data set or time series can be closely monitored with dynamic calculation of contained values.

The final two images represent a time series geographic window and a time series plot, 'tsgeo' and 'tswin' respectively. The former is controlled with a slide as the user selects the required time on the active layer. The plot shows data points linked by the colour-coded lines, in this instance indicating the data associated with catch trend for effort over time.
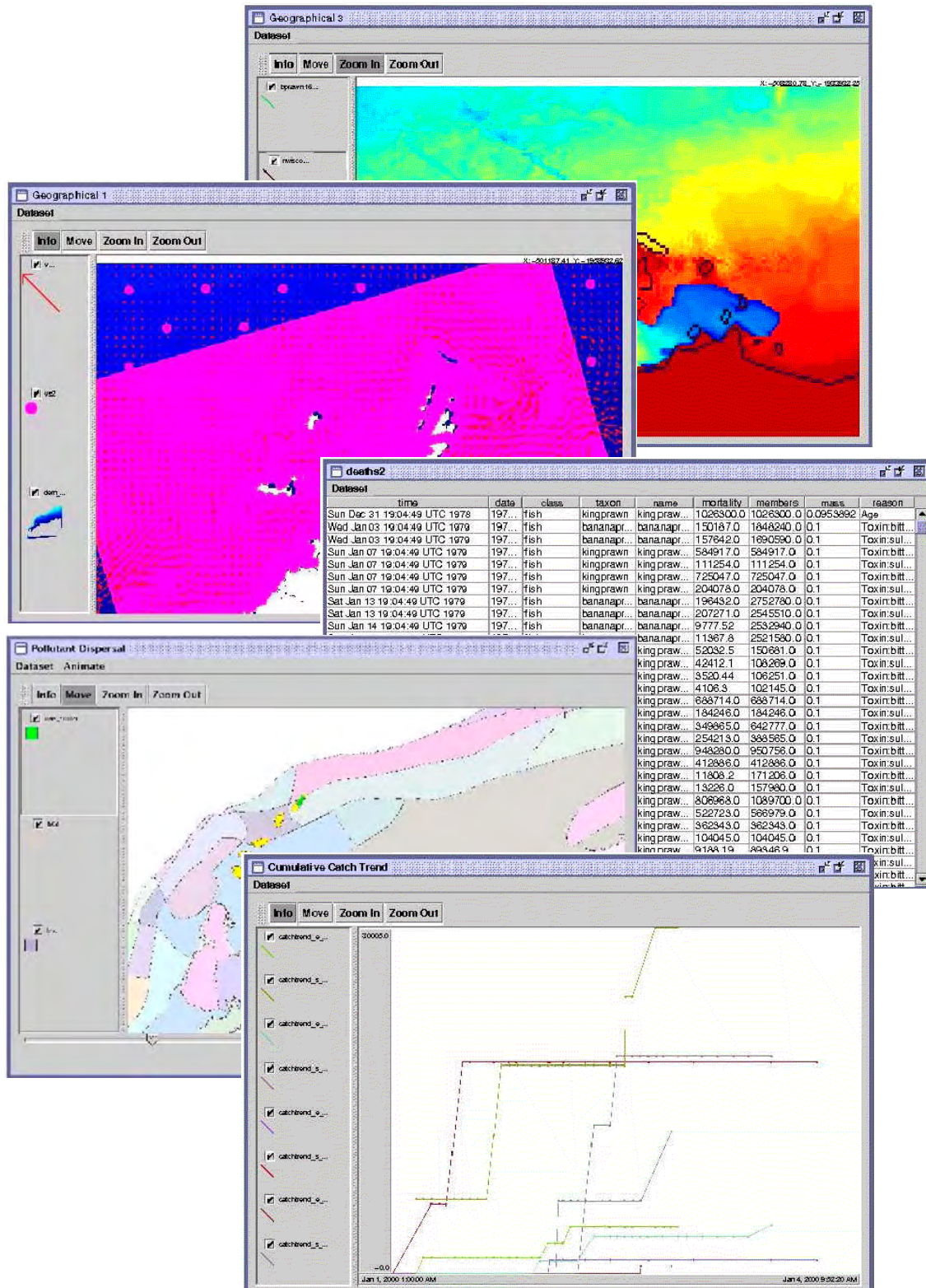
Figure 6.1.2: Sample data screens from the *NWS Technical Interface*. From top, two geographical spatial displays, tabulation of a chosen data set, and two time series screens, one a spatial display with a slide control to scroll through time, below the property plots.

6.2 Technologies

The *NWS Technical User Interface,* also known as *Middleware* is a Java2 Model Document Interface (MDI) application running mainly on well resourced Unix platforms. A flexible and powerful technical visualisation tool, it is used to work with the agent-based model data sets. The Data Set Transfer Protocol (DSTP) server uses a file-based catalogue to publish and query remote and distributed data sets.

7.   ViewNWS

ViewNWS is a user interface and data set which was designed for the presentation of environmental, social and economic data, the very factors that depict the state of an ecosystem as it evolves in response to natural forcing and human use. There are several *ViewNWS* Management Strategy Evaluation (MSE) displays which include maps, digital images and time series data. The user can choose whether the tool will use observational records from the real ecosystem or, alternatively, a computer-generated representation, or model of the ecosystem.

ViewNWS is flexible in displaying a wide range of data. It could be used in other regional management situations with such display requirements. The application was specified to be readily configurable for other regions, indeed for a variety of terrestrial, coastal and marine regional ecosystems.

Maps and images can be overlayed for comparative purposes. The spatial characteristics of the ecosystem at particular times can be visualised, and further, overlays can be updated through time to produce animations. A complete view is thus developed of the dynamics of the real and modelled systems under various management or monitoring strategies, model specifications and human use or environmental change scenarios. This is the tool to use when comparing chosen combinations of strategy, specification and scenario.

7.1   User interface for NWSJEMS MSE data

This application is provided as an integrated software and data package on CD.

7.1.1   Data display tools

An initial splash screen is displayed while the software loads. The main interface then presents the user with a toolbar and a map area. Typically one might start with a spatial data display: a vector map or satellite image can be chosen using the toolbar. When the background has been selected the user then select further map layers using a file dialog. By clicking on the map area, time series or depth series plots of the relevant data type can be displayed.
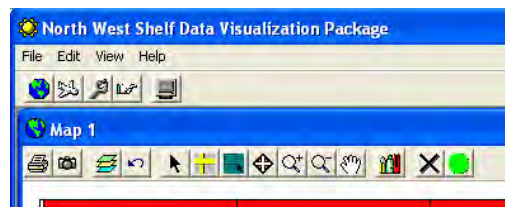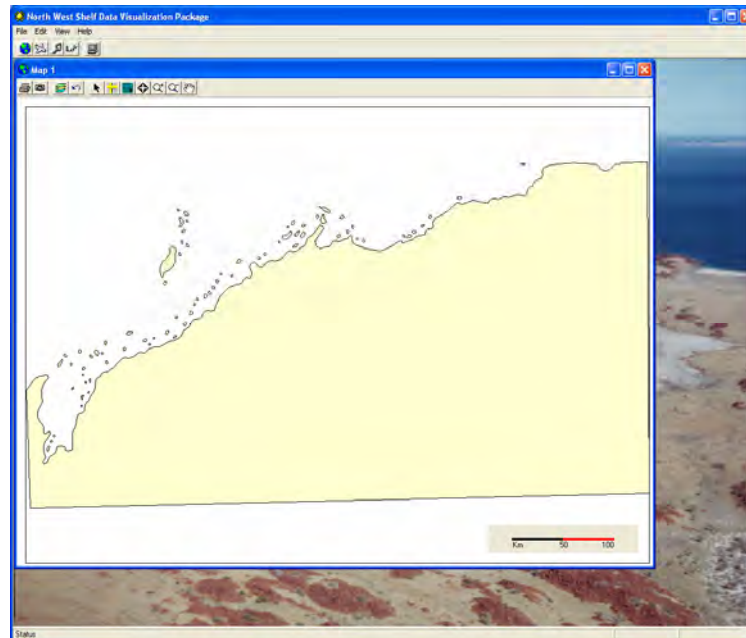

Figure 7.1.1: *ViewNWS* toolbar.

7.1.2   Spatial displays

The legend and symbols settings used on the map can be changed with a legend dialog
invoked by double clicking on the map legend at the bottom of the screen.

Figure 7.1.2: *ViewNWS* initial startup screen, a spatial display of ESRI shape files. The user
can select whether lat/long or model coordinates are used.

7.1.3   MSE screen

To explore the outcomes of various modelling scenarios, the user would choose the
"MSE" button on the toolbar. This will launch the *Management Strategy Evaluation*
screen where indicator results from a number of *strategies*, *specifications* and *scenarios*
can be chosen.
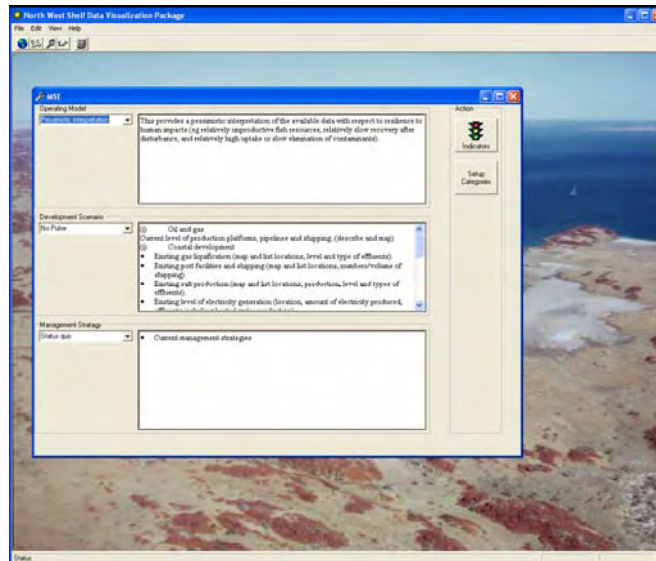
Figure 7.1.3: The Management Strategy Evaluation screen allows the user to select from the 3 by 3 by 3 matrix (operating model, development scenario and management strategy).

7.1.4   Indicators screens

Once a *strategy-specification-scenario* combination has been chosen, the *Indicators* screen will be launched. It displays the environmental, economic and social indicators that have been agreed for the project. The user can choose to display all of the indicators at once or a predefined subset (such as "Protected Species"). These predefined subsets can be altered by the *Change Categories* screen which is accessed through the *MSE* screen. The categories information will be stored in the categories descriptor table.
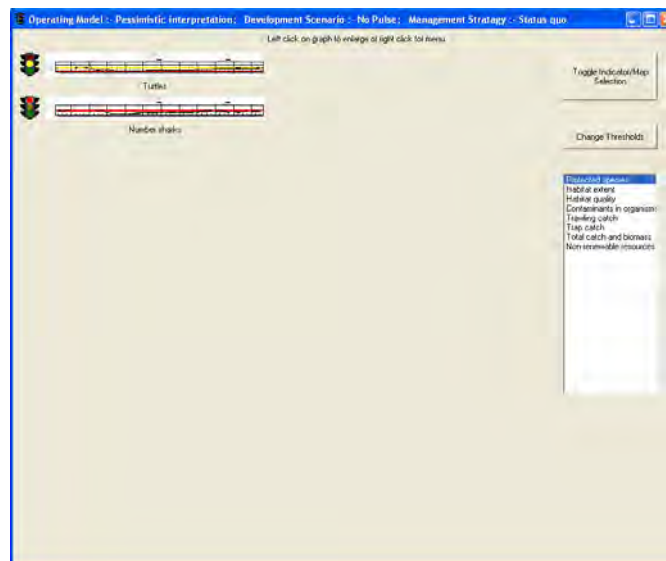
Figure 7.1.4: The *Indicators* screen shows the collected indicators for a give MSE combination. The side bar allow for pre-defined groupings of indicators to be selected.

In order to highlight specific problem areas, the indicators are flagged using a "traffic light" system to grade environmental indicators against specific targets:

- green means the indicator is within the target;

- yellow signifies that the indicator should be examined more closely; and

- red means that the target indicator has not been reached.
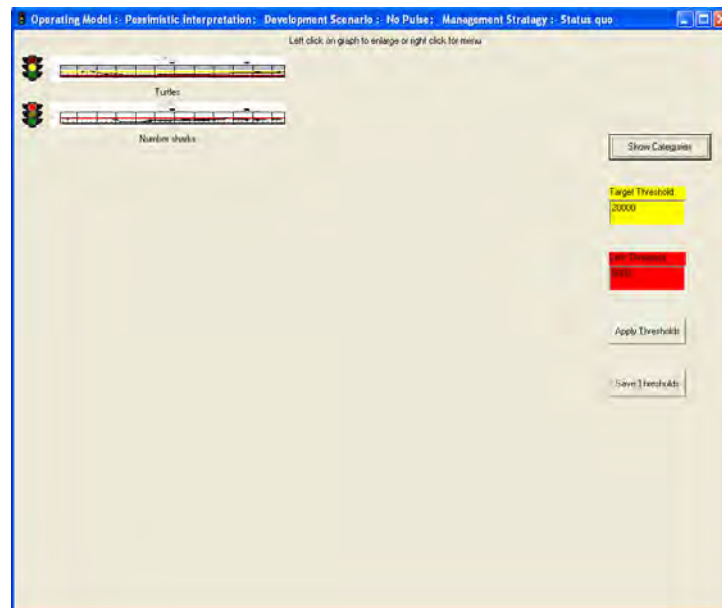
Figure 7.1.5: Each indicator can be selected and the chart enlarged. The upper and lower thresholds can be changed by typing in values into the corresponding boxes on the right and applying them.

The user can change specified targets with the slide controls on the *Indicators* screen as shown in figure 7.1.5.

The *Indicators* screen also contains a compressed summary of the performance of the indicator through time. By clicking on the small chart, a full screen version is launched. This is particularly effective if the user has multiple monitors.

The *Indicators* screen is used to access two other forms of indicator status display:

1. The first, the spatial display (figure 7.1.6), is selected by clicking on a map icon next to the appropriate indicator. This displays a map of the data shaded in the appropriate traffic light colours. This enables the user to quickly identify problem areas.

2. The second display is accessed from the *Indicators* screen (figure 7.1.7) by clicking on the appropriate traffic light icon. It brings up the *All Scenarios* screen which shows how any given indicator performs across the 3 by 3 by 3 matrix.
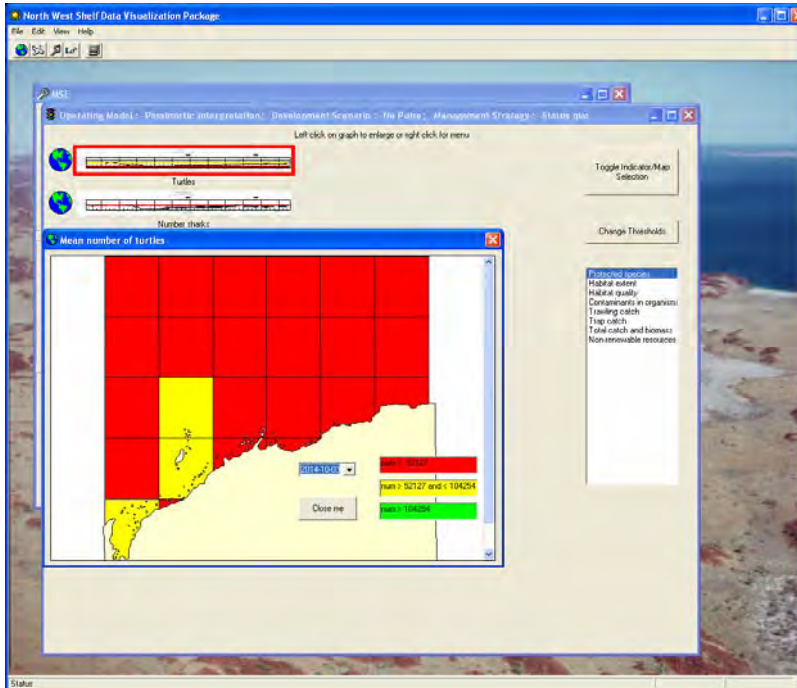
Figure 7.1.6: Traffic light spatial display of an individual indicator is selected using the map toggle switch on the *Indicators* screen. Clicking on a region will bring up the time history for that region.
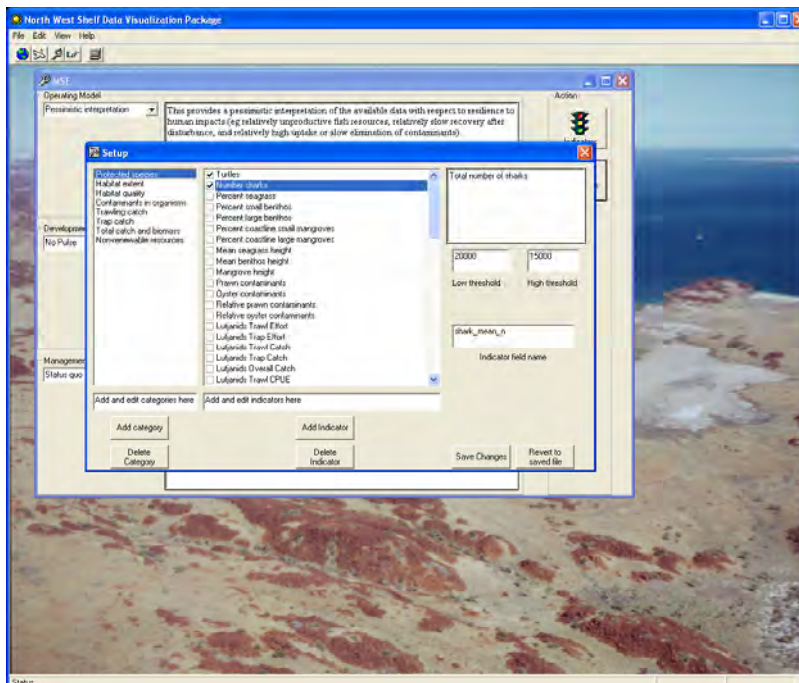
Figure 7.1.7: Setup screen for indicators and categories.

7.2   ViewNWS data structures

The main directory contains the *ViewNWS* executable and the data directory. Sub-directories for each strategy-specification-scenario combination include all data on relevant indicators, images and maps for that combination.
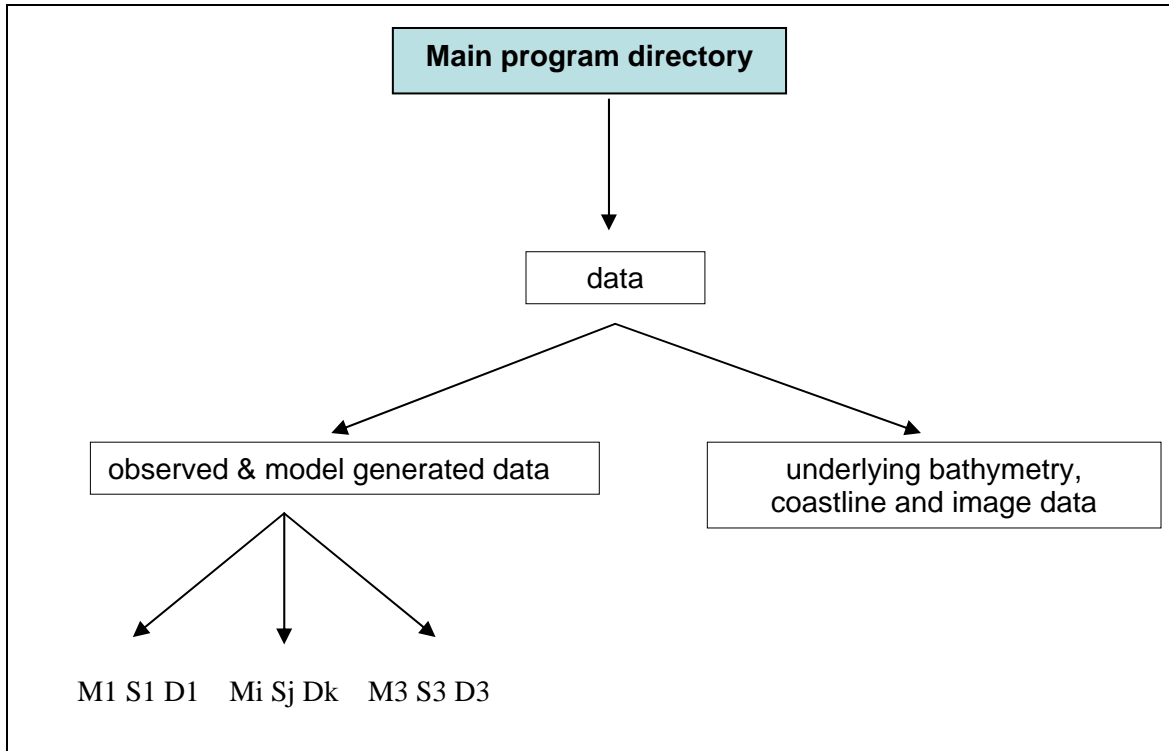
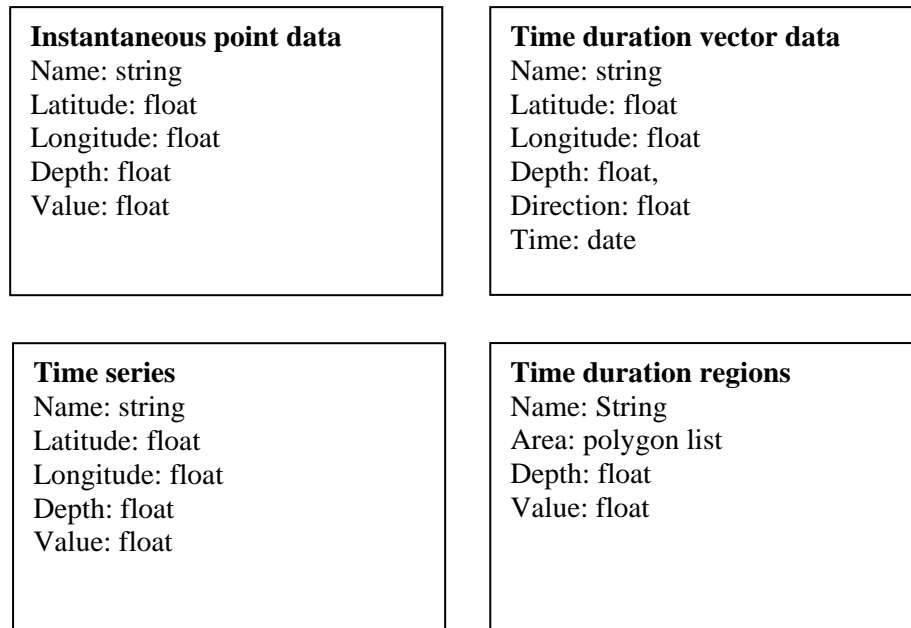

Figure 7.2.1: *ViewNWS* data input structure.

In the data input structure of figure 7.2.1, Mi, Sj and Dk represent "management" *strategy* i "model" or "real system" *specification* j and "development" *scenario* k respectively. The letters i, j and k are integers valued between 1 and 3. They represent each possible combination of data.

There are 27 sub-directories of data associated with these permutations: ASCII data files are associated with each data subdirectory (Mi Sj Dk) and all images and GIS files appropriate to the combination are located there

7.2.1   Map data

The ESRI shape file format, well known to GIS users, is used for the spatial data in this application. These files can also be temporally specific, as layers display change over time.

Data structures for shape files are outlined in figure 7.2.2.

Instantaneous point data	Time duration vector data
Name: string	Name: string
Latitude: float	Latitude: float
Longitude: float	Longitude: float
Depth: float	Depth: float,
Value: float	Direction: float
	Time: date

Time series	Time duration regions
Name: string	Name: String
Latitude: float	Area: polygon list
Longitude: float	Depth: float
Depth: float	Value: float
Value: float	

Figure 7.2.2: Shape file data structure.

Note that spatial displays can include any generic ESRI shape file or BIL image file. For this reason the spatial extent and scale of maps is not limited.

7.2.2   Output

The interface performs the main function of the application. However there is provision to print or save the graphics to the clipboard and to file with bmp, gif or emf formats. As the program does not itself generate data no export of data to the database is required.

Images are exportable either via the clipboard, or in bitmap or JPEG formats.

7.3   Technologies

ViewNWS is coded in Visual Basic Version 6. It is distributed on CD as an executable package for use on computers operating Windows 2000 or XP. The map displays on the interface are rendered with embedded MapObjects ActiveX components. Extensive use is made of Gigasoft ProEssentials ActiveX charting components to display data.

Spatial data inputs comprise ArcView shape files and the *ViewNWS* non-spatial data reside in sub-directories for each strategy-specification-scenario combination.

7.3.1   Installation

The software is provided on a CD and uses a self-install package including a setup program and CAB files for the executable and the data. Relevant individual files are provided in a separate directory structure to facilitate the re-composition of the installer for future updates. The data used by the application is distributed on a separate DVD.

7.3.2   Documentation

A user's manual, which outlines the purpose and operation of the program, is available in hard copy: *Management Strategy Evaluations for Multiple Use Management of Australia's North West Shelf – visualisation software and user guide. NWSJEMS Technical Report No.17*. This manual is also accessible through the interface using the "help" option on the main screen menu. Context sensitive help is also provided in the form of floating cursor messages. These 'tool tips' can be seen when the user pauses over a particular button or menu, as in standard Windows. The documentation also includes a programmer's manual (Hatfield et al. 2006) outlining the forms, classes, modules, subroutines and functions used in the program.

7.3.3   Platform and performance

ViewNWS was tested on Windows XP. However it is expected the software will run on any Windows platform, above and including Windows 98.

The main performance bottleneck in a program like *ViewNWS* is usually the amount of time it takes a computer to display data on the screen as a map or image. The program should be run on a moderately specified PC, for example a 1.5 GHz Pentium 4 or Athlon processor with 512 MB of RAM. This should accommodate rendering of the largest images (several gigabytes) within a reasonable time, say 30 seconds. Ordinary maps and images (tens of megabytes) will be rendered within 5 to 10 seconds.

8.   OTHER TOOLS

8.1   Connle

ConnIe has been described as the NWSJEMS Connectivity Interface, a dynamic web display of modelled circulation patterns in the North West Shelf area. It was developed as a tool for environmental scientists and managers to investigate the patterns of spatial connectivity on Australia's North West Shelf (NWS) and was made available in 2002. Specifically, it provides the user with an estimate of the probability that any two regions are connected by modelled ocean circulation over a specified dispersion period. These connectivity statistics were computed from the paths of neutrally buoyant particles computed from the "Northwest" circulation model (based on MECO), run over the period from 1994 to 1999.
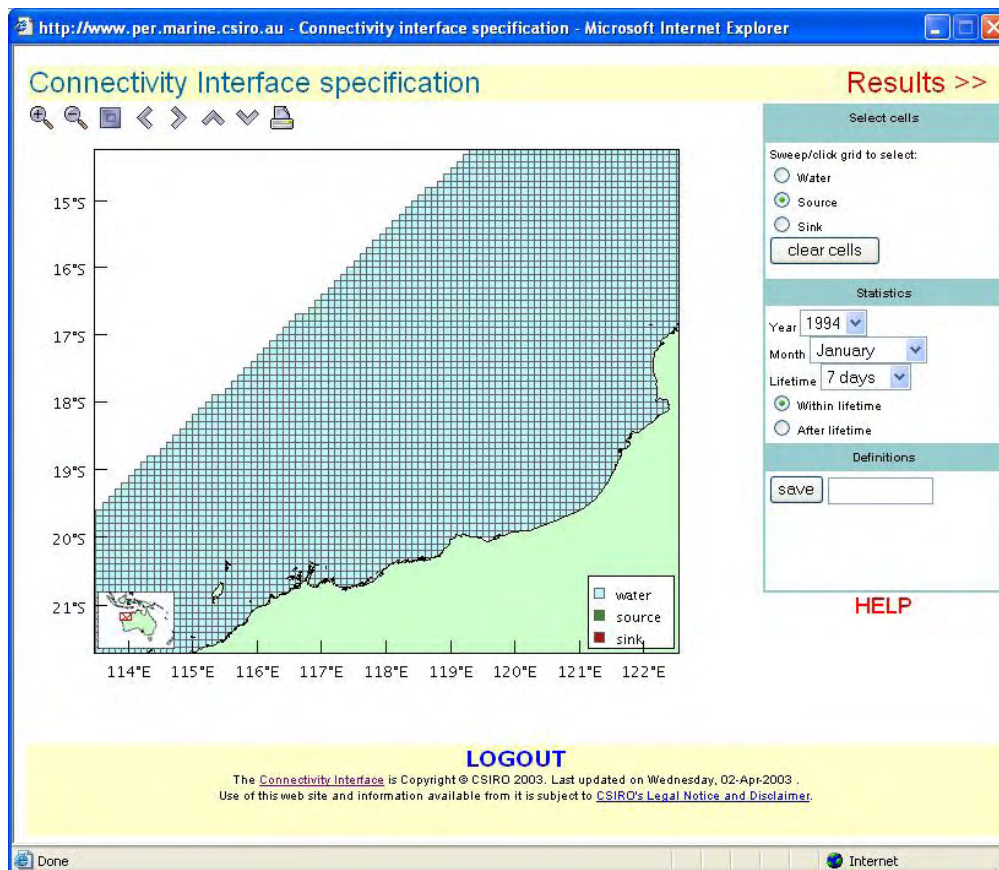
Figure 8.1.1: The *Connle* interface spatial display.

The url for *ConnIe* is: http://www.per.marine.csiro.au/connie/index.html

The circulation model used a rotated latitude-longitude grid, with a horizontal resolution of approximately 10 km and a vertical resolution expanding from 3 m near the surface to a maximum of 200 m at depths below 1000 m. The model was forced by

wind fields from the NCEP-NCAR reanalysis, while temperature and salinity fields around the lateral boundaries were interpolated from a global circulation model known as the Australian Community Ocean Model (ACOM). Sea levels on the boundaries were also taken from the global model output, with the addition of a tidal component derived from a combination of coastal sea level data and output from a global tidal model.

ConnIe is used in areas such as larval dispersion and recruitment studies, and the development of scenarios and risk assessments for contaminant dispersion.

A more recent version of the interface, built for a wider geographical area, is known as *Aus-ConnIe* (Condie et al. 2005).

8.1.1   The ConnIe interface

The user registers for this interface at the *ConnIe* web site and is supplied with an 'account' which enables login to the application. There is provision for individual settings from a user's session to be saved.

The workflow for a *ConnIe* session, as indicated in the 'quick guide' on the web site, is outlined below. The user selects:

- a region of interest on the map of the NWS (with resolution of 0.1°);

- whether the selected region represents a source region from which particles disperse (probability of going to other areas) or a sink region into which particles arrive (probability of coming from other areas);

- the years and months on which the connectivity statistics will be based;

- the dispersion period (7, 14, or 21 days for monthly or 28, 56, or 84 for quarterly); and

- whether the connectivity probabilities are based only on the particle distribution at the end of the dispersion period (*after lifetime*), or on all the particle distributions that occur over the dispersion period (*within lifetime*).

Outputs are in the form of maps of the NWS showing the probability distribution for the user specified source or sink at a resolution of 0.1°.

8.1.2   Technologies

The *ConnIe* Java2 software employs similar technologies to the *Data Trawler*. It uses an Apache web server, Tomcat, for displaying Servlets and JSP, and an Oracle data store. The CMAR CMRlib Java package is used for manipulating and displaying the scientific data.

8.2   Other utilities

There are NWSJEMS data sets which are viewed using other utilities than those described herein, notably ERMapper and ESRI software. A NetCDF file viewer can be useful and DiGIR might also be used for NetCDF files.

9. CONCLUDING REMARKS

The development of data management strategies for the NWSJEMS began at the inception of the Study. An ecosystem-wide approach was adopted for work on this complex geographical region. The resources required for research of such scope were extensive. From the wide-ranging data collection phase to the final model runs, there were diverse datasets to source and manage.

There was an early effort in the Data Management Project to determine the tools and standards which were to be developed and used in the course of the Project. Tools which would acquire, track and access these resources were successfully developed in a multi-agency environment.

No part of this process was charted. Although the value of data has long been acknowledged in science this frequently meant that the datasets would be sequestered by individual scientists for their own use.

Publications were the means of documenting the methods and results of research while datasets were rarely published. However, large scale collaborative science efforts, particularly in the study of ocean and climate, were coming on line at the end of the 20th century. A new and more formal approach to the supporting information systems was evolving.

For NWSJEMS fast and effective data exchange and access was facilitated using database technologies. Spatial functionality was provided in web-based and other graphical user interfaces. At the time, many of these features were rarely implemented beyond demonstration datasets. These tools integrated the various kinds of data used in the Study in new ways.

The advances made with developing the NWSJEMS knowledge base have fed into subsequent projects in Australian marine science and beyond. There has been uptake of many tools and concepts developed for this Study, of value not only for ecosystem-based regional studies but also for the management of national datasets.

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Rees, A.J.J., K. Finney, June 2000. Biological Data and Metadata Initiatives as CSIRO Marine Research, Australia. *Oceanography*, Vol. 13, No.3, 60-65.

Rees, A.J.J., M.M. Ryba, November 1998, *MarLIN – a metadata base for research data holdings at CSIRO Marine*, paper presented at Australasian Marine and Coastal Data Management Conference, Hobart.

http://www.marine.csiro.au/datacentre/ext_docs/marlinpaper.htm

Other urls used in this report

The WA node of ASDD
http://www.walis.wa.gov.au/

MarLIN
http://www.marine.csiro.au/marlin/

Data Trawler
http://www.marine.csiro.au/warehouse/jsp/loginpage.jsp

Data Trawler Information Page
http://www.marine.csiro.au/datacentre/about_trawler.htm

Data Trawler Tutorial
http://www.marine.csiro.au/warehouse/training/html/page_00.htm

Taxonomic information for *Data Warehouse* records: CAAB - Codes for Australian
Aquatic Biota
http://aqua.hba.marine.csiro.au:7272/CAAB/search/caab_search.list_genera
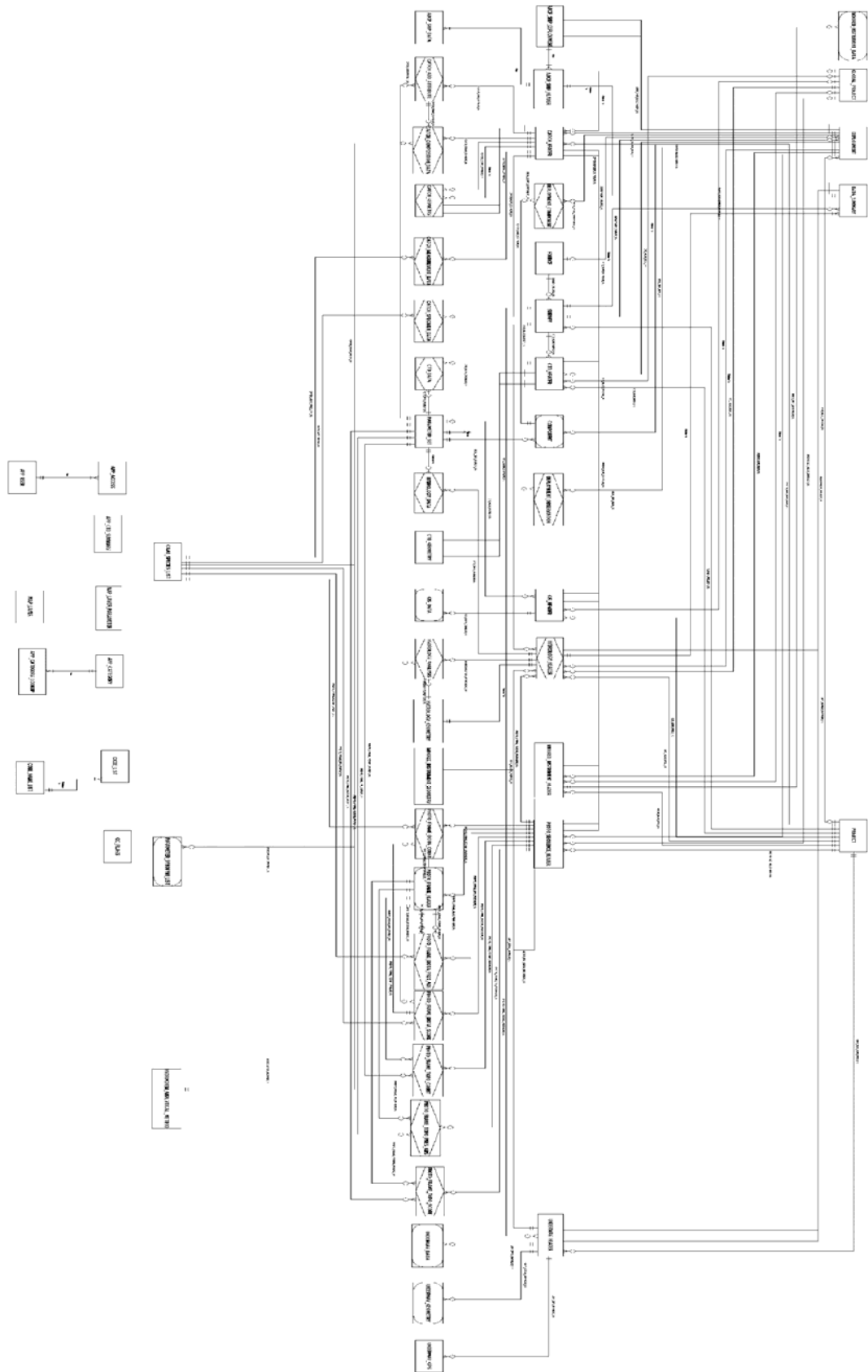
Data Trawler data set descriptions
http://www.marine.csiro.au/warehouse/javadoc/Download.pdf

Data Trawler technical resources
http://www.javasoft.com/
http://www.apache.org/

ConnIe
http://www.per.marine.csiro.au/connie/index.html

APPENDIX A: THE SCHEMA OF THE DATA WAREHOUSE

The *Data Warehouse* Entity Relationship Diagrams (ERD) are best viewed in clusters of tables which are functionally related. There is first a diagram of the full set of tables and relationships. The subsequent ERDs respectively represent catch, oceanographic conductivity, temperature and depth (ctd), GIS, hydrology and mooring data types.

CATCH CLUSTER - ATTRIBUTE DIAGRAM (DEVEL) 1-6-01

SURVEY
SURVEY_NAME
SOURCE_ID [FK]
SURVEY_TYPE
MARLIN_SURVEY_ID
PROJECT_ID [FK]
START_TIME
END_TIME
START_LAT
START_LON
END_LAT
END_LON
START_LOCATION
END_LOCATION
COMMENTS

SOURCE
SOURCE ID
SOURCE_NAME
SOURCE_TYPE

DEPLOYMENT_COMPONENT [At]
DEPLOYMENT_ID [FK]
COMPONENT_ID [FK]
COMPONENT_NO

GC_FLAGS
GC FLAG
DATA_STATE
OPERATION
ERROR_TYPE

SURVEY_SOURCE_EX

DEPLOYMENT_SOURCE_FK

DEPLOYMENT_SURVEY_FK

DEPL_COMP_DEPLOYMENT_FK

DATA_SUMMARY
DATA ID
DATA_STREAM_TYPE
SURVEY_NAME
DEPLOYMENT_ID
PROJECT_ID
START_TIME
END_TIME
MIN_DEPTH
MAX_DEPTH
MIN_LAT
MAX_LAT
MIN_LON
MAX_LON
DESCRIPTION

DEPLOYMENT
DEPLOYMENT ID
DEPLOYMENT_TYPE
SOURCE_ID [FK]
PROJECT_ID [FK]
SURVEY_NAME [FK]
START_TIME
END_TIME
OPERATION_NO
MAX_DEPTH
STATION_NO
START_LAT
START_LON
END_LAT
END_LON
LOCATION_SELECTION
DESCRIPTION
COMMENTS

DEPL_COMP_COMPONENT_FK

DEPLOYMENT_OBSERVATION [At]
DEPLOYMENT_ID [FK]
PARAMETER_CODE [FK]
VALUE
QC_FLAG

DEPL_OBS_DEPL_FK

DEPLOYMENT_PROJECT_FK

CATCH_HEADER_DEPL_FK

COMPONENT [At]
COMPONENT ID
SUB_COMPONENT_OF
COMMISSION_DATE
DECOMMISSION_DATE
MANUFACTURER
MODEL_NO
SERIAL_NO
PARAMETER_CODE
CSIRO_TRAWL_GEAR_CODE
NAME
DESCRIPTION

GLOBAL_PROJECT
GLOBAL_PROJECT_ID
GLOBAL_PROJECT_NAME
DESCRIPTION

CATCH_HEADER_DATASUM_FK

PROJECT
PROJECT ID
PROJECT_NAME
PROJECT_DESCRIPTION

CATCH_HEADER_PROJ_FK

CATCH_HEADER
DATA_ID [FK]
DEPLOYMENT_ID [FK][AK1]
COMPONENT_ID [AK1]
SURVEY_NAME
START_TIME
END_TIME
UTC_OFFSET
START_LAT
START_LON
END_LAT
END_LON
START_DEPTH
END_DEPTH
MIN_DEPTH
MAX_DEPTH
TOTAL_CATCH_WT
FRACTION_SAMPLED
SAMPLED_CATCH_WT
SUBSAMPLED_CATCH_WT
DISCARDED_CATCH_WT
ADD_ATTRIBUTE_FLAG
COMMENTS
PROJECT_ID [FK]
GLOBAL_PROJECT_ID
MARLIN_ID
SECURITY_CODE
RELEASE_DATE
LICENCE_NOTE
CATCH_METHOD
CATCH_EFFORT
COMPONENT_NO

Relates To

DEPL_OBS_PARSET_FK

Relates To

CATCH GEOMETRY [At]
DATA_ID [FK]
MI_PRINX
GEOLOC
SECURITY_CODE
LICENCE_NOTE

CATCH_MEAS_CATHEAD_FK

CATCH_SPEC_CATHEAD_FK

CATCH_ADD_CATHEAD_FK

CATCH_ADD_ATTRIBUTE [At]
DATA_ID [FK]
PARAMETER_CODE [FK]
VALUE

CATCH_ADD_PARSET_FK

PARAMETER_SET
PARAMETER_CODE
PARAMETER_UNITS
PARAMETER_LABEL
COMMON_NAME
DESCRIPTION
MINIMUM_VALUE
MAXIMUM_VALUE
VALUE_TYPE

Relates To

CATCH_MEASUREMENT DATA [At]
DATA_ID [FK]
CAAB_SPECIES_CODE [FK]
SEX_CODE
MEDIAN_LENGTH
INTERVAL_WIDTH
SPECIMEN_COUNT
COUNT_QC_FLAG
LENGTH_METHOD_CODE
COMMENTS
ORIGINAL_SPECIES_CODE

CATCH_COMP_CATHEAD_FK

CATCH_SPECIMEN_DATA [At]
DATA_ID [FK]
CAAB_SPECIES_CODE [FK]
SPECIMEN_NUMBER
QUANTITY_MEASURED_CODE
SEX_CODE
LENGTH
LENGTH_METHOD_CODE
LENGTH_QC_FLAG
WEIGHT
WEIGHT_METHOD_CODE
WEIGHT_QC_FLAG
MATURATION_STAGE_CODE
MAT_STAGE_QC_FLAG
GONAD_WEIGHT
GONAD_WT_QC_FLAG
STOMACH_FULLNESS_CODE
STOMACH_FULL_QC_FLAG
COMMENTS
ORIGINAL_SPECIES_CODE

CATCH_MEAS_SPECLIST_FK

CATCH_SPEC_SPLIST_FK

CATCH_COMP_SPLIST_FK

CATCH COMPOSITION DATA [At]
DATA_ID [FK]
CAAB_SPECIES_CODE [FK]
QUANTITY_MEASURED_CODE
SPECIES_ID_QC_FLAG
CATCH_COUNT
CATCH_COUNT_QC_FLAG
CATCH_WEIGHT
CATCH_WEIGHT_QC_FLAG
SPECIMEN_DATA_FLAG
COMMENTS
ORIGINAL_SPECIES_CODE

CAAB_SPECIES_LIST
SPECIES_CODE
SCIENTIFIC_NAME
COMMON_NAME

CTD CLUSTER - ATRIBUTE DIAGRAM (DEVEL) 1-6-01

SURVEY
- SURVEY_NAME
- SOURCE_ID [FK]
- SURVEY_TYPE
- MARLIN_SURVEY_ID
- PROJECT_ID [FK]
- START_TIME
- END_TIME
- START_LAT
- START_LON
- END_LAT
- END_LON
- START_LOCATION
- END_LOCATION
- COMMENTS

SOURCE
- SOURCE_ID
- SOURCE_NAME
- SOURCE_TYPE

SURVEY_SOURCE_FK

DEPLOYMENT_SURVEY_FK

DEPLOYMENT_SOURCE_FK

DATA_SUMMARY
- DATA_ID
- DATA_STREAM_TYPE
- SURVEY_NAME
- DEPLOYMENT_ID
- PROJECT_ID
- START_TIME
- END_TIME
- MIN_DEPTH
- MAX_DEPTH
- MIN_LAT
- MAX_LAT
- MIN_LON
- MAX_LON
- DESCRIPTION

SURVEY_PROJECT_FK

PROJECT
- PROJECT_ID
- PROJECT_NAME
- PROJECT_DESCRIPTION

CTD_GEOMETRY
- DATA_ID [FK]
- MI_PRINX
- GEOLOC
- SECURITY_CODE
- LICENCE_NOTE

CTD_HEAD_DATASUM_FK

CTD_HEAD_DATASUM_FK

DEPLOYMENT
- DEPLOYMENT_ID
- DEPLOYMENT_TYPE
- SOURCE_ID [FK]
- PROJECT_ID [FK]
- SURVEY_NAME [FK]
- START_TIME
- END_TIME
- OPERATION_NO
- MAX_DEPTH
- STATION_NO
- START_LAT
- START_LON
- END_LAT
- END_LON
- LOCATION_SELECTION
- DESCRIPTION
- COMMENTS

CTD_HEAD_PROJ_FK

CTD_GEOM_CTDHEAD_FK

CTD_HEADER
- DATA_ID [FK]
- DEPLOYMENT_ID [FK] [AK1]
- CAST_NO [AK1]
- SURVEY_NAME [FK] [AK1]
- START_TIME
- END_TIME
- MIN_DEPTH
- MAX_DEPTH
- BOTTOM_DEPTH
- BOTTOM_TIME
- BOTTOM_LAT
- BOTTOM_LON
- END_LAT
- END_LON
- START_LAT
- START_LON
- PROJECT_ID [FK]
- GLOBAL_PROJECT_ID
- MARLIN_ID
- SECURITY_CODE
- RELEASE_DATE
- LICENCE_NOTE

CTD_HEAD_DEPL_FK

DEPL_COMP_DEPLOYMENT_FK

GLOBAL_PROJECT
- GLOBAL_PROJECT_ID
- GLOBAL_PROJECT_NAME
- DESCRIPTION

CTD_DATA_CTDHEAD_FK

CTD_DATA [At]
- DATA_ID [FK]
- PRESSURE
- PARAMETER_CODE [FK]
- VALUE
- QC_FLAG

DEPLOYMENT COMPONENT [At]
- DEPLOYMENT_ID [FK]
- COMPONENT_ID [FK]
- COMPONENT_NO

CTD_DATA_PARSET_FK

DEPL_COMP_COMPONENT_FK

PARAMETER_SET
- PARAMETER_CODE
- PARAMETER_UNITS
- PARAMETER_LABEL
- COMMON_NAME
- DESCRIPTION
- MINIMUM_VALUE
- MAXIMUM_VALUE
- VALUE_TYPE

COMPONENT [At]
- COMPONENT_ID
- SUB_COMPONENT_OF
- COMMISSION_DATE
- DECOMMISSION_DATE
- MANUFACTURER
- MODEL_NO
- SERIAL_NO
- PARAMETER_CODE
- CSIRO_TRAWL_GEAR_CODE
- NAME
- DESCRIPTION

QC_FLAGS
- QC_FLAG
- DATA_STATE
- OPERATION
- ERROR_TYPE

PAR_SYN_LIST_PARSET_FK

PARAMETER_SYNONYM_LIST [At]
- PARAMETER_CODE [FK]
- PARAMETER_SYNONYM

GIS CLUSTER - ATTRIBUTE DIAGRAM (DEVEL) 30-5-01

HYDROLOGY CLUSTER - ATTRIBUTE DIAGRAM (DEVEL) 7-6-01

SURVEY
SURVEY_NAME
SOURCE_ID [FK]
SURVEY_TYPE
MARLIN_SURVEY_ID
PROJECT_ID [FK]
START_TIME
END_TIME
START_LAT
START_LON
END_LAT
END_LON
START_LOCATION
END_LOCATION
COMMENTS

SOURCE
SOURCE_ID
SOURCE_NAME
SOURCE_TYPE

PROJECT
PROJECT_ID
PROJECT_NAME
PROJECT_DESCRIPTION

DATA_SUMMARY
DATA_ID
DATA_STREAM_TYPE
SURVEY_NAME
DEPLOYMENT_ID
PROJECT_ID
START_TIME
END_TIME
MIN_DEPTH
MAX_DEPTH
MIN_LAT
MAX_LAT
MIN_LON
MAX_LON
DESCRIPTION

DEPLOYMENT
DEPLOYMENT_ID
DEPLOYMENT_TYPE
SOURCE_ID [FK]
PROJECT_ID [FK]
SURVEY_NAME [FK]
START_TIME
END_TIME
OPERATION_NO
MAX_DEPTH
STATION_NO
START_LAT
START_LON
END_LAT
END_LON
LOCATION_SELECTION
DESCRIPTION
COMMENTS

GLOBAL_PROJECT
GLOBAL_PROJECT_ID
GLOBAL_PROJECT_NAME
DESCRIPTION

HYDROLOGY_HEADER [Aa]
DATA_ID [FK]
DEPLOYMENT_ID [FK]
SURVEY_NAME [FK][AK1]
CAST_NO [AK1]
START_TIME
END_TIME
MIN_DEPTH
MAX_DEPTH
BOTTOM_DEPTH
BOTTOM_TIME
BOTTOM_LAT
BOTTOM_LON
END_LAT
END_LON
START_LAT
START_LON
PROJECT_ID [FK]
GLOBAL_PROJECT_ID
MARLIN_ID
SECURITY_CODE
RELEASE_DATE
LICENCE_NOTE

DEPLOYMENT_COMPONENT [Aa]
DEPLOYMENT_ID [FK]
COMPONENT_ID [FK]
COMPONENT_NO

HYDROLOGY_GEOMETRY
DATA_ID
MI_PRINX
GEOLOC
SECURITY_CODE
LICENCE_NOTE

COMPONENT [At]
COMPONENT_ID
SUB_COMPONENT_OF
COMMISSION_DATE
DECOMMISSION_DATE
MANUFACTURER
MODEL_NO
SERIAL_NO
PARAMETER_CODE
CSIRO_TRAWL_GEAR_CODE
NAME
DESCRIPTION

HYDROLOGY_ANALYSIS [Aa]
DATA_ID [FK]
ANALYTE_CODE
METHOD_CODE [FK]
APPLICATION_DATE [FK]

HYDROCHEM_ANALYTICAL_METHOD
METHOD_CODE
APPLICATION_DATE
DESCRIPTION
REFERENCE

PARAMETER_SET
PARAMETER_CODE
PARAMETER_UNITS
PARAMETER_LABEL
COMMON_NAME
DESCRIPTION
MINIMUM_VALUE
MAXIMUM_VALUE
VALUE_TYPE

HYDROLOGY_DATA [Aa]
DATA_ID [FK]
PRESSURE
BOTTLE_NUMBER
PARAMETER_CODE
VALUE
QC_FLAG

QC_FLAGS
QC_FLAG
DATA_STATE
OPERATION
ERROR_TYPE

DEPLOYMENT_SURVEY_FK
SURVEY_SOURCE_FK
DEPLOYMENT_SOURCE_FK
SURVEY_PROJECT_FK
DEPLOYMENT_PROJECT_FK
HYD_HEAD_SURVEY_FK
HYD_HEAD_PROJ_FK
HYD_HEAD_DEPL_FK
DEPL_SUS_DEPL_FK
DEPL_COMP_DEPLOYMENT_FK
DEPL_COMP_COMPONENT_FK
HYDROANALYSIS_HYDROHEAD_FK
HYDROANALYSIS_METHOD_FK
HYD_DATA_HYDHEAD_FK
Relates To

MOORED INSTRUMENT CLUSTER - ATTRIBUTE DIAGRAM (DEVEL) 30-5-01

DEPLOYMENT
DEPLOYMENT ID
DEPLOYMENT_TYPE
SOURCE_ID [FK]
PROJECT_ID [FK]
SURVEY_NAME [FK]
START_TIME
END_TIME
OPERATION_NO
MAX_DEPTH
STATION_NO
START_LAT
START_LON
END_LAT
END_LON
LOCATION_SELECTION
DESCRIPTION
COMMENTS

DEPLOYMENT_SOURCE_FK

SURVEY_SOURCE_FK

SOURCE
SOURCE ID
SOURCE_NAME
SOURCE_TYPE

SURVEY
SURVEY_NAME
SOURCE_ID [FK]
SURVEY_TYPE
MARLIN_SURVEY_ID
PROJECT_ID [FK]
START_TIME
END_TIME
START_LAT
START_LON
END_LAT
END_LON
START_LOCATION
END_LOCATION
COMMENTS

QC_FLAGS
QC_FLAG
DATA_STATE
OPERATION
ERROR_TYPE

DEPLOYMENT_SURVEY_FK

SURVEY_PROJECT_FK

MOOR_HEAD_DEPL_FK

PROJECT
PROJECT_ID
PROJECT_NAME
PROJECT_DESCRIPTION

MOOR_HEAD_PROJ_FK

GLOBAL_PROJECT
GLOBAL_PROJECT_ID
GLOBAL_PROJECT_NAME
DESCRIPTION

DEPL_COMP_DEPLOYMENT_FK

MOORED_INSTRUMENT_HEADER
DATA ID [FK]
DEPLOYMENT_ID [FK]
METER_TYPE
NOMINAL_METER_DEPTH
START_TIME
END_TIME
START_LAT
START_LON
MAGNETIC_DECLINATION
SAMPLE_INTERVAL
FILTER_ID
DATA_PROCESSOR
COMMENTS
PROJECT_ID [FK]
GLOBAL_PROJECT_ID
MARLIN_ID
SECURITY_CODE
RELEASE_DATE
LICENCE_NOTE
SURVEY_NAME

Relates to

MOORED INSTRUMENT GEOMETRY
DATA_ID [FK]
MI_PRINX
GEOLOC
SECURITY_CODE
LICENCE_NOTE

MOOR_INST_GEOM_MOORHEAD_FK

MOOR_INST_MOORHEAD_FK

MOORED_INSTRUMENT_DATA [At]
DATA_ID [FK]
TIME
TIME_QC_FLAG
EAST_COMPONENT
EAST_COMPONENT_QC_FLAG
NORTH_COMPONENT
NORTH_COMPONENT_QC_FLAG
PRESSURE
PRESSURE_QC_FLAG
TEMPERATURE
TEMPERATURE_QC_FLAG
SALINITY
SALINITY_QC_FLAG

DEPLOYMENT_COMPONENT [At]
DEPLOYMENT_ID [FK]
COMPONENT_ID [FK]
COMPONENT_NO

MOOR_HEAD_DATASUM_FK

DATA_SUMMARY
DATA_ID
DATA_STREAM_TYPE
SURVEY_NAME
DEPLOYMENT_ID
PROJECT_ID
START_TIME
END_TIME
MIN_DEPTH
MAX_DEPTH
MIN_LAT
MAX_LAT
MIN_LON
MAX_LON
DESCRIPTION

DEPL_COMP_COMPONENT_FK

COMPONENT [At]
COMPONENT_ID
SUB_COMPONENT_OF
COMMISSION_DATE
DECOMMISSION_DATE
MANUFACTURER
MODEL_NO
SERIAL_NO
PARAMETER_CODE
CSIRO_TRAWL_GEAR_CODE
NAME
DESCRIPTION

Relates to

PARAMETER_SET
PARAMETER_CODE
PARAMETER_UNITS
PARAMETER_LABEL
COMMON_NAME
DESCRIPTION
MINIMUM_VALUE
MAXIMUM_VALUE
VALUE_TYPE

APPENDIX B: THE DATA WAREHOUSE DEFINITIONS

Data Warehouse schema the Data Definition Language (DDL) scripts can be used to create the sequences, tables and constraints of the Warehouse. They are available through a link on the *MarLIN* metadata record for the *Data Warehouse* –

http://www.marine.csiro.au/marq/edd_search.Browse_Citation?txtSession=6390

A fourth script is included, WHComments, which forms the basis of the Data Dictionary: the set of data element definitions. This documents the content of the repository such as the units of a value and the parameters which can be assigned values. Elements parameter_set and code_list are important for data loading as they ensure the database content is controlled.

APPENDIX C: THE LICENSING AGREEMENT

By login to the *Data Trawler* the user agrees to the following regarding data sets obtained using this tool.

DATA LICENSING AGREEMENT WITH CSIRO (Division of Marine & Atmospheric Research)

Unless otherwise advised, data available from this application will be subject to a CSIRO Marine & Atmospheric Research Data License. Some data in the warehouse is owned by organizations other than CSIRO and in these cases the License conditions associated with these data are bundled with the data at the time of download.

CSIRO, through its Division of Marine & Atmospheric Research (and only that Division) agrees to make data available to you, the user ("the Licensee") under License on the following terms and conditions which constitute a legally binding agreement.

1. The Licensee shall use the data product at their own risk and agrees that CSIRO Marine & Atmospheric Research shall not be liable for any loss or damage or consequential loss or damage whatsoever arising from the direct or indirect use of the data product.

CSIRO Marine & Atmospheric Research does not make any warranty to the receiving party as to the condition, quality or fitness of the data product for the receiving party's requirements and the receiving party agrees that they are entirely responsible for ensuring that the data product supplied is suitable for the receiving party's purposes. This clause does not exclude or limit the application of warranties where to do so would contravene the law of the relevant jurisdiction or cause any part of this clause to be void.

2. The Licensee acknowledges that copyright in all or any part of the "data product" is and remains the property of the CSIRO Marine & Atmospheric Research.

3. Data products supplied by CSIRO to the Licensee may only be used by the Licensee for non-commercial purposes in the course of its ordinary business. Neither the supplied data product, nor enhanced products generated from the supplied data product are to be provided or sold to other persons without the prior written consent of CSIRO (which consent may include a proviso that CSIRO's contribution to the data sets is acknowledged). Non-commercial means that the Licensee will not:

(a) make the data product available to a third party by sale or otherwise

(b) sell products derived from or incorporating the data product originally provided

(c) use the data product to cause substantial distortion to normal competitive arrangements; or

(d) use the data product to derive income or gain a financial return.

4. If the Licensee adapts and/or combines the data product provided by CSIRO with other data held by the Licensee, the Licensee shall prior to making that material available to a third person,

ensure that an acknowledgement of CSIRO's contributions to the data sets is made as follows: "Base Data/Data provided by CSIRO and reproduced with the permission of CSIRO."

5. The Licensee covenants that it will acknowledge CSIRO Marine & Atmospheric Research as being the source provider of the "data product" in any publications, scientific papers or reports produced as a result of, or in relation to, the Licensee's use of the data.

6. Should any of these conditions be breached by the Licensee, CSIRO Marine & Atmospheric Research, may by written notice, require the Licensee to rectify such breach. If the Licensee fails to do so in the time specified in the notice, the disclosing party may terminate this agreement immediately. Upon termination the licensee shall cease using the data product in any form whether modified or merged with other material and destroy all transferred data product or return it to the disclosing party at the disclosing party's discretion. The Licensee acknowledges that if the terms of this Agreement are breached that damages may be an insufficient remedy for the disclosing party and may seek injunctive or other relief in a court.

7. The Licensee agrees to provide CSIRO Marine & Atmospheric Research with written notification of any errors found in the "data product" and if these errors are considerable and have subsequently been corrected, a digital copy of the corrected "data product" will be provided to CSIRO Marine & Atmospheric Research.

APPENDIX D: DATA TRAWLER CATEGORY TREE CONTENTS

Table1: The *Data Trawler* search pages are configurable, built with information in the *Data Warehouse* table APP_CATEGORY.

CATEGORY_NAME	CATEGORY_ID	PARENT_ID
GIS Coverages	15	
Administrative Boundaries	1	15
Fish License Areas	7	1
Land Tenure	8	1
Proposed Zones	9	1
Petroleum Tenure	10	1
Maritime Boundaries	23	1
Topography	2	15
Habitats	3	15
Benthic Habitats	11	3
Coastal Habitats	21	3
Human Use	4	15
Coastal Zones	12	4
Study Areas	33	4
Infrastructure	5	15
Pipes	13	5
Wells	14	5
Transport	22	5
Geology	6	15
Bathymetry	0	15
Biology	16	
Benthos	17	16
Species	18	16
CTD	19	
Hydrology	20	
Temperature	24	
Moored Instruments	25	
Models	26	
NWS Region Hydrodynamic model	27	26
Pilbara Coast Hydrodynamic model	28	26
Dampier Archipelago Hydrodynamic	29	26
NWSJEMS Wave Model Data	31	26
JEMS CARS Model Data	32	26
Ships	30	

APPENDIX E: TRAWLER DATA DOWNLOAD DOCUMENT

DOWNLOAD

FILE

DESCRIPTIONS

DOCUMENT

REVISED 25/10/05

DOWNLOAD OVERVIEW

When voyages are selected that the user is not authorised to receive, the data for these voyages will not appear in the result set and will not be contained in any resulting download files.

The format of all date/time fields in download files is dd/MM/YYYY HH24:mi.

Most of the download files are in csv format. They can be opened in any text editor. Users importing data into MS-Excel should ensure that they have their Regional Settings Properties for Short Date Style set to d/MM/yy. Excel users should also note that MS-Excel may only load the first rows of any largedownload file.

CTD DOWNLOAD FILES

CTD data is delivered to the user in a zip file. The data is comma delimited with the following file format. Those fields which are shaded in the following table are only downloaded if they were selected as part of the original search parameters.

Times are in UTC for all Franklin voyages and Southern Surveyor voyages after 1996. Times for other voyages are not reliable.

CTD Download File Format Description

Field Name	Type	Units	Range	Codes	Description
SURVEY_NAME	VARCHAR(12)				name given to vessel based survey expedition
STATION_NO	NUMBER(6)				oceanographic station number
START_TIME	DATE				start time of dip
END_TIME	DATE				end time of dip
MIN_DEPTH	NUMBER(5:1)	metres			minimum depth
MAX_DEPTH	NUMBER(5:1)	metres			maximum depth
BOTTOM_DEPTH	NUMBER(5:1)	metres			water depth at start of dip
BOTTOM_TIME	DATE				time of maximum depth of dip
BOTTOM_LAT	NUMBER(7:5)	degrees	0 – 90		latitude at time of maximum ctd depth
BOTTOM_LON	NUMBER(8:5)	degrees	0 – 360		longitude at time of maximum ctd depth
END_LAT	NUMBER(7:5)	degrees	0 – 90		latitude at end of dip
END_LON	NUMBER(8:5)	degrees	0 – 360		longitude at end of dip

Field Name	Type	Units	Range	Codes	Description
START_LAT	NUMBER(7:5)	degrees	0 – 90		latitude at start of dip
START_LON	NUMBER(8:5)	degrees	0 – 360		longitude at start of dip
PROJECT_NAME	VARCHAR(300)				name assigned to project
MARLIN_ID	NUMBER(7)				ID of the MarLIN record which describes this ctd
PRESSURE	NUMBER(5)	decibars	0 – 10000		pressure value
TEMPERATURE_VALUE	NUMBER(16:6)	deg C	-3 – 35		temperature value
TEMPERATURE_QC_FLAG	NUMBER(3)		0 – 255	QC_FLAGS	quality flag for temperature value
SALINITY_VALUE	NUMBER(16:6)	psu	0 – 38.5		salinity value
SALINITY_QC_FLAG	NUMBER(3)		0 – 255	QC_FLAGS	quality flag for salinity value
OXYGEN_VALUE	NUMBER(16:6)	micromole/litre	0 – 600		oxygen value
OXYGEN_QC_FLAG	NUMBER(3)		0 – 255	QC_FLAGS	quality flag for oxygen value
FLUORESCENCE_VALUE	NUMBER(16:6)	arbitrary units			fluorescence value
FLUORESCENCE_QC_FLAG	NUMBER(3)		0 – 255	QC_FLAGS	quality flag for fluorescence value
OBS_VALUE	NUMBER(16:6)	volts	0 – 10		obs value
OBS_QC_FLAG	NUMBER(3)		0 – 255	QC_FLAGS	quality flag for obs value
PAR_VALUE	NUMBER(16:6)	UE/m**2/sec			par value
PAR_QC_FLAG	NUMBER(3)		0 – 255	QC_FLAGS	quality flag for par value
PH_VALUE	NUMBER(16:6)	ph	0 – 10		ph value
PH_QC_FLAG	NUMBER(3)		0 – 255	QC_FLAGS	quality flag for ph value
TURBIDITY_VALUE	NUMBER(16:6)	%	0 – 100		turbidity value
TURBIDITY_QC_FLAG	NUMBER(3)		0 – 255	QC_FLAGS	quality flag for turbidity value
POSITION_QC_FLAG	NUMBER(3)		0 – 255	QC_FLAGS	quality flag for positions
TIME_QC_FLAG	NUMBER(3)		0 – 255	QC_FLAGS	quality flag for times

CTD Temperature Notes

For CTD temperature values up to the end of 1989 the temperature scale is t68 (IPTS-68). From 01-JAN-1990 onwards the temperature scale is t90 (ITS-90). The conversion between the two temperature scales in the 'Oceanographic' range is:
t68 = 1.00024 X t90 or
t90 = 0.99976 X t68
All CTD temperature values in the warehouse are in the t90 scale.

HYRDOLOGY DOWNLOAD FILES

Hydrology data is delivered to the user in a zip file. The data is comma delimited with the following file format. Those fields which are shaded in blue in the following table are only downloaded if they were selected as part of the original search parameters or if 'All parameters' is selected. Those fields shaded in green are only downloaded when 'All parameters' is selected in the data search.

Times are in UTC for all Franklin voyages and Southern Surveyor voyages after 1996. Times for other voyages are not reliable.

For Coastal Stations the START_TIME and END_TIME may be the same. From November 2004 START_TIME is in UTC, before November 2004 all times are unreliable.

For voyage data where CTD operations match Hydrology stations, CTD times and positions are used and qc flags are applied.

All hydrology temperatures can be assumed to be t90.

HYDROLOGY DOWNLOAD FILE FORMAT DESCRIPTION

Field Name	Type	Units	Range	Codes	Description
SURVEY_NAME	VARCHAR(12)				name given to vessel based survey expedition
STATION_NO	NUMBER(6)				hydrology station number
START_TIME	DATE				start time of dip
END_TIME	DATE				end time of dip
MIN_DEPTH	NUMBER(5:1)	metres			minimum depth
MAX_DEPTH	NUMBER(5:1)	metres			maximum depth
BOTTOM_DEPTH	NUMBER(5:1)	metres			water depth at start of dip
BOTTOM_TIME	DATE				time of maximum depth of dip
BOTTOM_LAT	NUMBER(7:5)	degrees	0 – 90		latitude at time of maximum ctd depth
BOTTOM_LON	NUMBER(8:5)	degrees	0 – 360		longitude at time of maximum ctd depth
END_LAT	NUMBER(7:5)	degrees	0 – 90		latitude at end of dip
END_LON	NUMBER(8:5)	degrees	0 – 360		longitude at end of dip
START_LAT	NUMBER(7:5)	degrees	0 – 90		latitude at start of dip
START_LON	NUMBER(8:5)	degrees	0 – 360		longitude at end of dip
PROJECT_NAME	VARCHAR(300)				name assigned to project

Field Name	Type	Units	Range	Codes	Description
MARLIN_ID	NUMBER(7)				ID of the MarLIN record which describes this hydrology data set
BOTTLE_NUMBER	NUMBER(6)				number given to bottle on rosette
PRESSURE	NUMBER(5)	decibars	0 – 10000		for ctd casts depths are in decibars, for wire casts depths are in metres
ROSETTE_POSITION	NUMBER(16:6)		1 – 24		position of bottle in rosette
ROSETTE_POSITION_QC_FLAG	NUMBER(3)		0 – 255	QC_FLAGS	quality flag for rosette position
NITRATE_VALUE	NUMBER(16:6)	micromole/litre	0 – 50		nitrate value-all negative values have been set to zero, and flagged to below detection limits using qc flag '63' (good data which has been manually adjusted and the flag is user defined)
NITRATE_QC_FLAG	NUMBER(3)		0 – 255	QC_FLAGS	quality flag for nitrate value
NITRITE_VALUE	NUMBER(16:6)	micromole/litre	0 – 5		nitrite value-all negative values have been set to zero, and flagged to below detection limits using qc flag '63' (good data which has been manually adjusted and the flag is user defined)
NITRITE_QC_FLAG	NUMBER(3)		0 – 255	QC_FLAGS	quality flag for nitrite value
OXYGEN_VALUE	NUMBER(16:6)	micromole/litre	0 – 600		oxygen value
OXYGEN_QC_FLAG	NUMBER(3)		0 – 255	QC_FLAGS	quality flag for oxygen value
PHOSPHATE_VALUE	NUMBER(16:6)	micromole/litre	0 – 3		phosphate value-all negative values have been set to zero, and flagged to below detection limits using qc flag '63' (good data which has been manually adjusted and the flag is user defined)
PHOSPHATE_QC_FLAG	NUMBER(3)		0 – 255	QC_FLAGS	quality flag for phosphate value
SALINITY_VALUE	NUMBER(16:6)	psu	0 – 38.5		salinity value
SALINITY_QC_FLAG	NUMBER(3)		0 – 255	QC_FLAGS	quality flag for salinity value
SILICATE_VALUE	NUMBER(16:6)	micromole/litre	0 – 220		silicate value-all negative values have been set to zero, and flagged to below detection limits using qc flag '63' (good data which has been manually adjusted and the flag is user defined)
SILICATE_QC_FLAG	NUMBER(3)		0 – 255	QC_FLAGS	quality flag for silicate value

Field Name	Type	Units	Range	Codes	Description
TEMPERATURE_VALUE	NUMBER(16:6)	deg C	-3 – 35		temperature value-assumed to be t90
TEMPERATURE_QC_FLAG	NUMBER(3)		0 – 255	QC_FLAGS	quality flag for temperature value
AMMONIA_VALUE	NUMBER(16:6)	micromole/litre	0 – 2.5		ammonia value-all negative values have been set to zero, and flagged to below detection limits using qc flag '63' (good data which has been manually adjusted and the flag is user defined)
AMMONIA_QC_FLAG	NUMBER(3)		0 – 255	QC_FLAGS	quality flag for ammonia value
POSITION_QC_FLAG	NUMBER(3)		0 – 255	QC_FLAGS	quality flag for positions
TIME_QC_FLAG	NUMBER(3)		0 – 255	QC_FLAGS	quality flag for times

CURRENT METER DOWNLOAD FILES

Current meter data is delivered to the user in a zip file. The data is comma delimited with the following file format. Those fields which are shaded in the following table are only downloaded if they were selected as part of the original search parameters.

CURRENT METER DOWNLOAD FILE FIELDS

Field Name	Type	Units	Range	Codes	Description
SURVEY_NAME	VARCHAR(12)				name given to groupings of moored instrument deployments (e.g. in some cases the name of the experiment)
STATION_NO	NUMBER(6)				oceanographic station number
START_TIME	DATE				time the meter entered the water
END_TIME	DATE				time the meter exited the water
NOMINAL_METER_DEPTH	NUMBER(5)	metres			how far under water the meter was supposed to be
METER_TYPE	VARCHAR(20)			METER_TYPE	allows differentiation between different moored instrument data sets
START_LAT	NUMBER(7:5)	degrees	0 – 90		start latitude
START_LON	NUMBER(8:5)	degrees	0 – 180		start longitude
FILTER_ID	VARCHAR(15)				name of the filter used to produce this data from the raw format
PROJECT_NAME	VARCHAR(300)				name assigned to project
MARLIN_ID	NUMBER(7)				ID of the MarLIN record which describes this moored instrument data set
MODEL_NO	VARCHAR(16)				model number of moored instrument
TIME_SECONDS	NUMBER	seconds			in seconds since 1 January on the year of start_time
TIME	DATE				nominal time to which this record relates (UTC)
TIME_QC_FLAG	NUMBER(3)		0 – 255	QC_FLAGS	quality flag associated with this item for historical records simply indicates whether data has been filtered

Field Name	Type	Units	Range	Codes	Description
EAST_COMPONENT	NUMBER(5:2)	cm/sec	-300 – 200		velocity component of the current parallel to the equator
EAST_COMPONENT_QC_FLAG	NUMBER(3)		0 – 255	QC_FLAGS	quality flag associated with this item for historical records simply indicates whether data has been filtered
NORTH_COMPONENT	NUMBER(5:2)	cm/sec	-300 – 200		velocity component of the current perpendicular to the equator
NORTH_COMPONENT_QC_FLAG	NUMBER(3)		0 – 255	QC_FLAGS	quality flag associated with this item for historical records simply indicates whether data has been filtered
PRESSURE	NUMBER(5:2)	decibars	0 – 10000		calibrated pressure meter reading
PRESSURE_QC_FLAG	NUMBER(3)		0 – 255	QC_FLAGS	quality flag associated with this item for historical records simply indicates whether data has been filtered
TEMPERATURE_VALUE	NUMBER(5:2)	deg C	-3 – 35		calibrated temperature gauge reading
TEMPERATURE_QC_FLAG	NUMBER(3)		0 – 255	QC_FLAGS	quality flag associated with this item for historical records simply indicates whether data has been filtered
SALINITY_VALUE	NUMBER(4:2)	psu	0 – 38.5		derived quantity based on temperature depth and conductivity
SALINITY_QC_FLAG	NUMBER(3)		0 – 255	QC_FLAGS	quality flag associated with this item for historical records simply indicates whether data has been filtered

GIS DOWNLOAD FILES

GIS data is delivered to the user in a zip file with the following files zipped files being delivered depending on whether the data is in ArcView or MapInfo format.

GIS ZIP FILE FORMAT

GIS Type	File Extension	File Description
ArcView	.shp	
	.shx	
	.dbf	
	.sbn	
	.sbx	
	.doc	License Agreement Document if applicable
MapInfo	.id	
	.dat	
	.map	
	.tab	
	.doc	License Agreement Document if applicable

BIOLOGY DOWNLOAD FILES

Biology data is delivered to the user in a zip file containing four files. Each data file is comma delimited and the files have the following formats.

Times are in UTC for Southern Surveyor voyages after 1996, times for other voyages are not reliable.

CATCH HEADER DOWNLOAD FILE FORMAT

Field	Type	Units	Range	Codes	Description
SURVEY_NAME	VARCHAR(12)				name given to vessel based survey expedition
PROJECT_NAME	NUMBER(6)				name assigned to project
MARLIN_ID	NUMBER(7)				ID of the MarLIN record which describes this catch data set
OPERATION_NO	NUMBER(4)				fisheries operation number
OPERATION_Start_Time	DATE				time instrument deployed in water
OPERATION_End_Time	DATE				time instrument out of water
OPERATION_Start_Lat	NUMBER(7:5)	degrees	0 – 90		latitude at start of deployment
OPERATION_Start_Lon	NUMBER(8:5)	degrees	0 – 180		longitude at start of deployment
OPERATION_End_Lat	NUMBER(7:5)	degrees	0 – 90		latitude at end of deployment
OPERATION_End_Lon	NUMBER(8:5)	degrees	0 – 180		longitude at end of deployment
DEPLOYMENT_TYPE	VARCHAR(16)			DEPLOYMENT_TYPE	type of this deployment (trawl sled etc)
OPERATION_MAX_DEPTH	NUMBER(5:1)	metres			maximum depth of deployment
DEPLOYMENT_DESCRIPTION	VARCHAR(80)				description (name) given to the deployment/operation
Location_Selection	VARCHAR(16)			Location_SelectION	code of deployment location selection method
COMPONENT_Name	VARCHAR(80)				common name of equipment or instrument.
Component_No	NUMBER(2)				sequence number assigned to gear component
CATCH_Start_Time	DATE				start date/time of catch (UTC)
CATCH_End_Time	DATE				end date/time of catch (UTC)
UTC_Offset	NUMBER(3:1)	hours			offset in hours to UTC required to give local time

Field	Type	Units	Range	Codes	Description
CATCH_Start_Lat	NUMBER(7:5)	degrees	0 – 90		catch start latitude (decimal degrees)
CATCH_Start_Lon	NUMBER(8:5)	degrees	0 – 180		catch start longitude (decimal degrees)
CATCH_End_Lat	NUMBER(7:5)	degrees	0 – 90		catch end latitude (decimal degrees)
CATCH_End_Lon	NUMBER(8:5)	degrees	0 – 180		catch end longitude (decimal degrees)
CATCH_Start_Depth	NUMBER(5)	metres			catch start depth in m if available
CATCH_End_Depth	NUMBER(5)	metres			catch end depth in m if available
CATCH_Min_Depth	NUMBER(5)	metres			catch minimum depth
CATCH_Max_Depth	NUMBER(5)	metres			catch maximum depth
Total_Catch_Wt	NUMBER(7:3)	kg			weight of total catch
Fraction_Sampled	NUMBER(4:1)		0 – 100		fraction of catch sampled
Discarded_Catch_Wt	NUMBER(7:3)	kg			weight of discarded catch fraction
SAMPLED_CATCH_WT	NUMBER(7:3)	kg			weight of sampled catch fraction
Comments	VARCHAR(255)				field for comments regarding catch

CATCH COMPOSITION DOWNLOAD FILE FORMAT

Field	Type	Units	Range	Codes	Description
Survey_Name	VARCHAR(12)				name given to vessel based survey expedition
Operation_No	NUMBER(4)				fisheries operation number
COMPONENT_Name	VARCHAR(80)				common name of equipment or instrument.
Component_No	NUMBER(2)				sequence number assigned to gear component
CATCH_Start_Time	DATE				start date/time of catch (UTC)
CATCH_End_Time	DATE				end date/time of catch (UTC)
UTC_Offset	NUMBER(3:1)	hours			offset in hours to UTC required to give local time
CATCH_Start_Lat	NUMBER(7:5)	degrees	0 – 90		catch start latitude (decimal degrees)
CATCH_Start_Lon	NUMBER(8:5)	degrees	0 – 180		catch start longitude (decimal degrees)
CATCH_End_Lat	NUMBER(7:5)	degrees	0 – 90		catch end latitude (decimal degrees)
CATCH_End_Lon	NUMBER(8:5)	degrees	0 – 180		catch end longitude (decimal degrees)
CATCH_MIN_DEPTH	NUMBER(5)	metres			catch minimum depth in metres
CATCH_MAX_DEPTH	NUMBER(5)	metres			catch maximum depth in metres
CAAB_Species_Code	NUMBER(8)				numeric version of current CAAB code for the species e.g. 37004001 for CAAB species 37 004 001
Scientific_Name	VARCHAR(255)				latest scientific name for the species
Original_Species_Code	VARCHAR(8)				species codes which appeared in the original data
Species_Id_QC_Flag	NUMBER(3)		0 – 255	QC_FLAGS	quality flag associated with species identification
Catch_Count	NUMBER(5)				count of individuals of this species in sample
Catch_Count_QC_flag	NUMBER(3)		0 – 255	QC_FLAGS	quality flag associated with catch count
Catch_Weight	NUMBER(7:3)				weight of this species in sample
Catch_Weight_QC_Flag	NUMBER(3)		0 – 255	QC_FLAGS	quality flag associated with catch weight
Quantity_Measured_Code	VARCHAR(16)			QUANTITY_MEASURED _CODE	how measured quantity was determined
Specimen_Data_Flag	VARCHAR(1)				indicates that biological sample or measurement exists for specimen/s from this species and catch
Comments	VARCHAR(255)				field for comments

CATCH MEASUREMENT DOWNLOAD FILE FORMAT

Field	Type	Units	Range	Codes	Description
Survey_Name	VARCHAR(12)				name given to vessel based survey expedition
Operation_No	NUMBER(4)				fisheries operation number
COMPONENT_Name	VARCHAR(80)				common name of equipment or instrument.
Component_No	NUMBER(2)				sequence number assigned to gear component
CATCH_Start_Time	DATE				start date/time of catch (UTC)
CATCH_End_Time	DATE				end date/time of catch (UTC)
UTC_Offset	NUMBER(3:1)	hours			offset in hours to UTC required to give local time
CATCH_Start_Lat	NUMBER(7:5)	degrees	0 – 90		catch start latitude (decimal degrees)
CATCH_Start_Lon	NUMBER(8:5)	degrees	0 – 180		catch start longitude (decimal degrees)
CATCH_End_Lat	NUMBER(7:5)	degrees	0 – 90		catch end latitude (decimal degrees)
CATCH_End_Lon	NUMBER(8:5)	degrees	0 – 180		catch end longitude (decimal degrees)
CAAB_Species_Code	NUMBER(8)				numeric version of current CAAB code for the species e.g. 37004001 for CAAB species 37 004001
Scientific_Name	VARCHAR(255)				latest scientific name for the species
Original_Species_Code	VARCHAR(8)				species codes which appeared in the original data
Sex_Code	VARCHAR(10)			SEX_CODE	indicates sex of individual
Median_Length	NUMBER(7:2)	cm			mid-point of the length class for which the count applies
InterVal_Width	NUMBER(3:1)	cm			total width of the length class for which the count applies
Specimen_Count	NUMBER(5)				number of individuals of this species in specified length class of specified sex
Length_Method_Code	VARCHAR(2)			LENGTH_METHOD_CODE	indicates measurement method e.g. fork length total length etc
Count_QC_Flag	NUMBER(3)		0 – 255	QC_FLAGS	quality flag associated with this data item

CATCH SPECIMEN DOWNLOAD FILE FORMAT

Field	Type	Units	Range	Codes	Description
Survey_Name	VARCHAR(12)				name given to vessel based survey expedition
Operation_No	NUMBER(4)				fisheries operation number
COMPONENT_Name	VARCHAR(80)				common name of equipment or instrument.
Component_No	NUMBER(2)				sequence number assigned to gear component
CATCH_Start_Time	DATE				start date/time of catch (UTC)
CATCH_End_Time	DATE				end date/time of catch (UTC)
UTC_Offset	NUMBER(3:1)	hours			offset in hours to UTC required to give local time
CATCH_Start_Lat	NUMBER(7:5)	degrees	0 – 90		catch start latitude (decimal degrees)
CATCH_Start_Lon	NUMBER(8:5)	degrees	0 – 180		catch start longitude (decimal degrees)
CATCH_End_Lat	NUMBER(7:5)	degrees	0 – 90		catch end latitude (decimal degrees)
CATCH_End_Lon	NUMBER(8:5)	degrees	0 – 180		catch end longitude (decimal degrees)
Caab_Species_Code	NUMBER(8)				numeric version of current CAAB code for the species e.g. 37004001 for CAAB species 37 004001
Scientific_name	VARCHAR(255)				latest scientific name for the species
Original_Species_Code	VARCHAR(8)				species codes which appeared in the original data
Specimen_Number	NUMBER(3)				sequential number of individual being measured
Sex_Code	VARCHAR(10)			SEX_CODE	indicates sex of individual
Length	NUMBER(7)	cm			length of the specimen
Length_Method_Code	VARCHAR(2)			LENGTH_METHOD_ CODE	indicates measurement method e.g. fork length total length etc
Length_QC_Flag	NUMBER(3)		0 – 255	QC_FLAGS	quality flag associated with catch lengths
WEIGHT_METHOD_CODE	VARCHAR(2)			WEIGHT_METHOD_ CODE	indicates measurement method e.g. whole fish part only etc
WEIGHT_QC_FLAG	NUMBER(3)		0 – 255	QC_FLAGS	quality flag associated with catch weights

Field	Type	Units	Range	Codes	Description
Maturation_Stage_Code	VARCHAR(6)			**currently being defined	
Mat_Stage_QC_Flag	NUMBER(8)		0 – 255	QC_FLAGS	quality flag
Gonad_Weight	NUMBER(8)	g			weight of the gonads of specimen
Gonad_Wt_QC_Flag	NUMBER(3)		0 – 255	QC_FLAGS	quality flag associated with gonad weights
Stomach_Fullness_Code	VARCHAR(6)			STOMACH_FULLNESS_CODE	indicates stomach fullness of the specimen
Stomach_Fullnes_QC_Flag	NUMBER(3)		0 – 255	QC_FLAGS	quality flag associated with stomach fullness
Comments	VARCHAR(2)				field for comments

NETCDF DOWNLOAD FILES

NetCDF data as described on the application interface is delivered to the user archived in a zip file.

NETCDF DESCRIPTION

NetCDF is a binary file format for storing data.

NetCDF data is:

- *Self-Describing*. A netCDF file includes information about the data it contains.

- *Architecture-independent*. A netCDF file is represented in a form that can be accessed by computers with different ways of storing integers, characters, and floating-point numbers.

- *Direct-access*. A small subset of a large data set may be accessed efficiently, without first reading through all the preceding data.

- *Appendable*. Data can be appended to a netCDF data set along one dimension without copying the data set or redefining its structure. The structure of a netCDF data set can be changed, though this sometimes causes the data set to be copied.

- *Sharable*. One writer and multiple readers may simultaneously access the same netCDF file.

Further information on netCDF may be obtained at
http://www.unidata.ucar.edu/software/netcdf/index.html

LISTING OF CODES

Code Name	Code Value	Description
METER_TYPE	Current Meter	current meter deployed
METER_TYPE	Tide Gauge	tide gauge deployed
QUANTITY_MEASURED_CODE	Measured	catch totally measured
QUANTITY_MEASURED_CODE	Raised	catch species were weighed but sub-sample measured
QUANTITY_MEASURED_CODE	Estimated	catch species quantity was estimated
QUANTITY_MEASURED_CODE	Guessed	catch species quantity was guessed
DEPLOYMENT_TYPE	CTD Cast	deployment of CTD gear
DEPLOYMENT_TYPE	Current Meter	deployment of current meter
DEPLOYMENT_TYPE	Tide Gauge	deployment of tide gauge
DEPLOYMENT_TYPE	Underway System	deployment of underway system
DEPLOYMENT_TYPE	Catch	Catch
DEPLOYMENT_TYPE	Video	Video
DEPLOYMENT_TYPE	Acoustics	Acoustics
DEPLOYMENT_TYPE	Sediment Grab	Sediment grab
DEPLOYMENT_TYPE	Hydrology Cast	Hydrology Cast
DEPLOYMENT_TYPE	Catch Failed	Catch Failed
LENGTH_METHOD_CODE	Standard Length	Standard length (SL)
LENGTH_METHOD_CODE	Total Length	Total length (TL)
LENGTH_METHOD_CODE	Caudal Fork	Caudal fork (CF)
LENGTH_METHOD_CODE	Carpace Length	Carpace length (CL)
LENGTH_METHOD_CODE	Disk Width	Disk width (DW)
LENGTH_METHOD_CODE	Mantle Length	Mantle length (ML)
LENGTH_METHOD_CODE	Overall Length	Overall Length (OL)
LENGTH_METHOD_CODE	Other	Other type of length measurement
WEIGHT_CODE	Total Weight	Total weight
WEIGHT_CODE	Truncated Weight	Truncated weight (without head)
WEIGHT_CODE	Gutted Weight	Gutted weight
WEIGHT_CODE	Frozen Weight	Frozen weight
WEIGHT_CODE	Dried Weight	Dried weight
LOCATION_SELECTION	Survey Location	Survey location
LOCATION_SELECTION	Aimed At Target	Aimed at target
LOCATION_SELECTION	Random Location	Random location
LOCATION_SELECTION	Other	Other selection method
SEX_CODE	Male	Male
SEX_CODE	Female	Female
SEX_CODE	Juvenile	Juvenile - immature individual
SEX_CODE	Indeterminate	Impossible to determine
STOMACH_FULLNESS_CODE	0	Empty stomach
STOMACH_FULLNESS_CODE	1	Quarter full
STOMACH_FULLNESS_CODE	2	Half full
STOMACH_FULLNESS_CODE	3	3/4 full
STOMACH_FULLNESS_CODE	4	Full stomach
STOMACH_FULLNESS_CODE	E	Everted, fullness unknown

LISTING OF QUALITY CONTROL FLAGS

QC Flag	Data State	Operation	Error Type
0	Good	None	No error – data is good
1	Good	None	Hardware error
2	Good	None	Software error
3	Good	None	Operator error
4	Good	None	Error flagged by hardware
5	Good	None	Error flagged by processor
6	Good	None	Analytical error
7	Good	None	Recording anomaly
8	Good	None	Data stream corrupted
9	Good	None	Data out of range
10	Good	None	Anomalous spike
11	Good	None	Preliminary processing (calibration) only
12	Good	None	Unprocessed (uncalibrated) or processing error
13	Good	None	No data – data missing for unknown reason
14	Good	None	Timing error
15	Good	None	User defined – user must fully describe
16	Good	Interpolated	No error – data is good
17	Good	Interpolated	Hardware error
18	Good	Interpolated	Software error
19	Good	Interpolated	Operator error
20	Good	Interpolated	Error flagged by hardware
21	Good	Interpolated	Error flagged by processor
22	Good	Interpolated	Analytical error
23	Good	Interpolated	Recording anomaly
24	Good	Interpolated	Data stream corrupted
25	Good	Interpolated	Data out of range
26	Good	Interpolated	Anomalous spike
27	Good	Interpolated	Preliminary processing (calibration) only
28	Good	Interpolated	Unprocessed (uncalibrated) or processing error
29	Good	Interpolated	No data – data missing for unknown reason
30	Good	Interpolated	Timing error
31	Good	Interpolated	User defined – user must fully describe
32	Good	Filtered	No error – data is good
33	Good	Filtered	Hardware error
34	Good	Filtered	Software error
35	Good	Filtered	Operator error
36	Good	Filtered	Error flagged by hardware
37	Good	Filtered	Error flagged by processor
38	Good	Filtered	Analytical error
39	Good	Filtered	Recording anomaly
40	Good	Filtered	Data stream corrupted
41	Good	Filtered	Data out of range
42	Good	Filtered	Anomalous spike
43	Good	Filtered	Preliminary processing (calibration) only

QC Flag	Data State	Operation	Error Type
44	Good	Filtered	Unprocessed (uncalibrated) or processing error
45	Good	Filtered	No data – data missing for unknown reason
46	Good	Filtered	Timing error
47	Good	Filtered	User defined – user must fully describe
48	Good	Manually adjusted	No error – data is good
49	Good	Manually adjusted	Hardware error
50	Good	Manually adjusted	Software error
51	Good	Manually adjusted	Operator error
52	Good	Manually adjusted	Error flagged by hardware
53	Good	Manually adjusted	Error flagged by processor
54	Good	Manually adjusted	Analytical error
55	Good	Manually adjusted	Recording anomaly
56	Good	Manually adjusted	Data stream corrupted
57	Good	Manually adjusted	Data out of range
58	Good	Manually adjusted	Anomalous spike
59	Good	Manually adjusted	Preliminary processing (calibration) only
60	Good	Manually adjusted	Unprocessed (uncalibrated) or processing error
61	Good	Manually adjusted	No data – data missing for unknown reason
62	Good	Manually adjusted	Timing error
63	Good	Manually adjusted	User defined – user must fully describe
64	Suspect	None	No error – data is good
65	Suspect	None	Hardware error
66	Suspect	None	Software error
67	Suspect	None	Operator error
68	Suspect	None	Error flagged by hardware
69	Suspect	None	Error flagged by processor
70	Suspect	None	Analytical error
71	Suspect	None	Recording anomaly
72	Suspect	None	Data stream corrupted
73	Suspect	None	Data out of range
74	Suspect	None	Anomalous spike
75	Suspect	None	Preliminary processing (calibration) only
76	Suspect	None	Unprocessed (uncalibrated) or processing error
77	Suspect	None	No data – data missing for unknown reason
78	Suspect	None	Timing error
79	Suspect	None	User defined – user must fully describe
80	Suspect	Interpolated	No error – data is good
81	Suspect	Interpolated	Hardware error
82	Suspect	Interpolated	Software error
83	Suspect	Interpolated	Operator error
84	Suspect	Interpolated	Error flagged by hardware
85	Suspect	Interpolated	Error flagged by processor
86	Suspect	Interpolated	Analytical error
87	Suspect	Interpolated	Recording anomaly
88	Suspect	Interpolated	Data stream corrupted
89	Suspect	Interpolated	Data out of range

QC Flag	Data State	Operation	Error Type
90	Suspect	Interpolated	Anomalous spike
91	Suspect	Interpolated	Preliminary processing (calibration) only
92	Suspect	Interpolated	Unprocessed (uncalibrated) or processing error
93	Suspect	Interpolated	No data – data missing for unknown reason
94	Suspect	Interpolated	Timing error
95	Suspect	Interpolated	User defined – user must fully describe
96	Suspect	Filtered	No error – data is good
97	Suspect	Filtered	Hardware error
98	Suspect	Filtered	Software error
99	Suspect	Filtered	Operator error
100	Suspect	Filtered	Error flagged by hardware
101	Suspect	Filtered	Error flagged by processor
102	Suspect	Filtered	Analytical error
103	Suspect	Filtered	Recording anomaly
104	Suspect	Filtered	Data stream corrupted
105	Suspect	Filtered	Data out of range
106	Suspect	Filtered	Anomalous spike
107	Suspect	Filtered	Preliminary processing (calibration) only
108	Suspect	Filtered	Unprocessed (uncalibrated) or processing error
109	Suspect	Filtered	No data – data missing for unknown reason
110	Suspect	Filtered	Timing error
111	Suspect	Filtered	User defined – user must fully describe
112	Suspect	Manually adjusted	No error – data is good
113	Suspect	Manually adjusted	Hardware error
114	Suspect	Manually adjusted	Software error
115	Suspect	Manually adjusted	Operator error
116	Suspect	Manually adjusted	Error flagged by hardware
117	Suspect	Manually adjusted	Error flagged by processor
118	Suspect	Manually adjusted	Analytical error
119	Suspect	Manually adjusted	Recording anomaly
120	Suspect	Manually adjusted	Data stream corrupted
121	Suspect	Manually adjusted	Data out of range
122	Suspect	Manually adjusted	Anomalous spike
123	Suspect	Manually adjusted	Preliminary processing (calibration) only
124	Suspect	Manually adjusted	Unprocessed (uncalibrated) or processing error
125	Suspect	Manually adjusted	No data – data missing for unknown reason
126	Suspect	Manually adjusted	Timing error
127	Suspect	Manually adjusted	User defined – user must fully describe
128	Bad	None	No error – data is good
129	Bad	None	Hardware error
130	Bad	None	Software error
131	Bad	None	Operator error
132	Bad	None	Error flagged by hardware
133	Bad	None	Error flagged by processor
134	Bad	None	Analytical error

QC Flag	Data State	Operation	Error Type
135	Bad	None	Recording anomaly
136	Bad	None	Data stream corrupted
137	Bad	None	Data out of range
138	Bad	None	Anomalous spike
139	Bad	None	Preliminary processing (calibration) only
140	Bad	None	Unprocessed (uncalibrated) or processing error
141	Bad	None	No data – data missing for unknown reason
142	Bad	None	Timing error
143	Bad	None	User defined – user must fully describe
144	Bad	Interpolated	No error – data is good
145	Bad	Interpolated	Hardware error
146	Bad	Interpolated	Software error
147	Bad	Interpolated	Operator error
148	Bad	Interpolated	Error flagged by hardware
149	Bad	Interpolated	Error flagged by processor
150	Bad	Interpolated	Analytical error
151	Bad	Interpolated	Recording anomaly
152	Bad	Interpolated	Data stream corrupted
153	Bad	Interpolated	Data out of range
154	Bad	Interpolated	Anomalous spike
155	Bad	Interpolated	Preliminary processing (calibration) only
156	Bad	Interpolated	Unprocessed (uncalibrated) or processing error
157	Bad	Interpolated	No data – data missing for unknown reason
158	Bad	Interpolated	Timing error
159	Bad	Interpolated	User defined – user must fully describe
160	Bad	Filtered	No error – data is good
161	Bad	Filtered	Hardware error
162	Bad	Filtered	Software error
163	Bad	Filtered	Operator error
164	Bad	Filtered	Error flagged by hardware
165	Bad	Filtered	Error flagged by processor
166	Bad	Filtered	Analytical error
167	Bad	Filtered	Recording anomaly
168	Bad	Filtered	Data stream corrupted
169	Bad	Filtered	Data out of range
170	Bad	Filtered	Anomalous spike
171	Bad	Filtered	Preliminary processing (calibration) only
172	Bad	Filtered	Unprocessed (uncalibrated) or processing error
173	Bad	Filtered	No data – data missing for unknown reason
174	Bad	Filtered	Timing error
175	Bad	Filtered	User defined – user must fully describe
176	Bad	Manually adjusted	No error – data is good
177	Bad	Manually adjusted	Hardware error
178	Bad	Manually adjusted	Software error
179	Bad	Manually adjusted	Operator error

QC Flag	Data State	Operation	Error Type
180	Bad	Manually adjusted	Error flagged by hardware
181	Bad	Manually adjusted	Error flagged by processor
182	Bad	Manually adjusted	Analytical error
183	Bad	Manually adjusted	Recording anomaly
184	Bad	Manually adjusted	Data stream corrupted
185	Bad	Manually adjusted	Data out of range
186	Bad	Manually adjusted	Anomalous spike
187	Bad	Manually adjusted	Preliminary processing (calibration) only
188	Bad	Manually adjusted	Unprocessed (uncalibrated) or processing error
189	Bad	Manually adjusted	No data – data missing for unknown reason
190	Bad	Manually adjusted	Timing error
191	Bad	Manually adjusted	User defined – user must fully describe
192	No QC	None	No error – data is good
193	No QC	None	Hardware error
194	No QC	None	Software error
195	No QC	None	Operator error
196	No QC	None	Error flagged by hardware
197	No QC	None	Error flagged by processor
198	No QC	None	Analytical error
199	No QC	None	Recording anomaly
200	No QC	None	Data stream corrupted
201	No QC	None	Data out of range
202	No QC	None	Anomalous spike
203	No QC	None	Preliminary processing (calibration) only
204	No QC	None	Unprocessed (uncalibrated) or processing error
205	No QC	None	No data – data missing for unknown reason
206	No QC	None	Timing error
207	No QC	None	User defined – user must fully describe
208	No QC	Interpolated	No error – data is good
209	No QC	Interpolated	Hardware error
210	No QC	Interpolated	Software error
211	No QC	Interpolated	Operator error
212	No QC	Interpolated	Error flagged by hardware
213	No QC	Interpolated	Error flagged by processor
214	No QC	Interpolated	Analytical error
215	No QC	Interpolated	Recording anomaly
216	No QC	Interpolated	Data stream corrupted
217	No QC	Interpolated	Data out of range
218	No QC	Interpolated	Anomalous spike
219	No QC	Interpolated	Preliminary processing (calibration) only
220	No QC	Interpolated	Unprocessed (uncalibrated) or processing error
221	No QC	Interpolated	No data – data missing for unknown reason
222	No QC	Interpolated	Timing error
223	No QC	Interpolated	User defined – user must fully describe
224	No QC	Filtered	No error – data is good

QC Flag	Data State	Operation	Error Type
225	No QC	Filtered	Hardware error
226	No QC	Filtered	Software error
227	No QC	Filtered	Operator error
228	No QC	Filtered	Error flagged by hardware
229	No QC	Filtered	Error flagged by processor
230	No QC	Filtered	Analytical error
231	No QC	Filtered	Recording anomaly
232	No QC	Filtered	Data stream corrupted
233	No QC	Filtered	Data out of range
234	No QC	Filtered	Anomalous spike
235	No QC	Filtered	Preliminary processing (calibration) only
236	No QC	Filtered	Unprocessed (uncalibrated) or processing error
237	No QC	Filtered	No data – data missing for unknown reason
238	No QC	Filtered	Timing error
239	No QC	Filtered	User defined – user must fully describe
240	No QC	Manually adjusted	No error – data is good
241	No QC	Manually adjusted	Hardware error
242	No QC	Manually adjusted	Software error
243	No QC	Manually adjusted	Operator error
244	No QC	Manually adjusted	Error flagged by hardware
245	No QC	Manually adjusted	Error flagged by processor
246	No QC	Manually adjusted	Analytical error
247	No QC	Manually adjusted	Recording anomaly
248	No QC	Manually adjusted	Data stream corrupted
249	No QC	Manually adjusted	Data out of range
250	No QC	Manually adjusted	Anomalous spike
251	No QC	Manually adjusted	Preliminary processing (calibration) only
252	No QC	Manually adjusted	Unprocessed (uncalibrated) or processing error
253	No QC	Manually adjusted	No data – data missing for unknown reason
254	No QC	Manually adjusted	Timing error
255	No QC	Manually adjusted	User defined – user must fully describe

LISTING OF SOURCES

A field within the download data files for all data types except GIS data is the 'Survey_Name'. For an explanation of Survey Names see the table below.

For data which has been sourced from a ship the format for the corresponding survey name is up to twelve characters. The first (up to six) characters represent the ship's name, followed by the year of the voyage, then the number of the voyage that year (e.g. FR199806 is the survey name for the sixth Franklin voyage undertaken in 1998). Therefore in the table below 'XXXXXX' represents the year and voyage number.

Survey Name	Source Name	Source Type
ABXXXXXX	Jacqueline D	Ship
ALBAXXXXXX	Alba	Ship
BACAXXXXXX	Bacaevo	Ship
BERGXXXXXX	Berg-1	Ship
COURXXXXXX	Courageous	Ship
CS-BAR-ALL	Barrow Island	Coastal Station
DES92-4	Derwent Estuary	Locality
DMXXXXXX	Diamantina	Ship
EQUAXXXXXX	Equator	Ship
FRXXXXXX	Franklin	Ship
KAMEXXXXXX	Kamensky	Ship
KORIXXXXXX	Korifei	Ship
LIRAXXXXXX	Lira	Ship
M-ACE83-CH	ACE Cape Howe Moorings (1983)	Mooring
M-ACE83-MI	ACE Maria Island Mooring (1983)	Mooring
M-ACE83-NE	ACE Newcastle Moorings (1983)	Mooring
M-ACE83-SP	ACE Stanwell Park Moorings (1983)	Mooring
M-ACE83-SSI	ACE South Solitary Island Mooring (1983)	Mooring
M-ARA-GOC87	Gulf of Carpentaria Moorings (1987)	Mooring
M-BASS-UN91	Bass Strait Moorings - UNSW (1991)	Mooring
M-DEV91	Devonport Moorings (1992)	Mooring
M-EH89	Evans Head Upwelling Moorings (1989)	Mooring
M-EZ88	Tasmania: Storm Bay Moorings (1988)	Mooring
M-GBR-CS85	AIMS Coral Sea Moorings (1985)	Mooring
M-HALMA93	Halmahera Sea Moorings (1993)	Mooring
M-HEARD90	Heard Island Moorings (1990)	Mooring
M-ICM694	ICM6/Ningaloo Reef Moorings (1994)	Mooring
M-LHR89	Tasman Sea Moorings (1989)	Mooring
M-LUCIE86-AS	LUCIE: alongshore Moorings (1986/7)	Mooring
M-LUCIE86-CM	LUCIE: Cape Mentelle Moorings (1987)	Mooring
M-LUCIE86-DO	LUCIE: Dongara Moorings (1986/7)	Mooring
M-MAKA93	Makassar Strait Moorings (1993)	Mooring
M-MALUKU93	Maluku Strait Moorings (1993)	Mooring
M-MERTZ98	Mertz Polynya Moorings (1998)	Mooring
M-NWS95	North West Shelf Moorings (all years)	Mooring
M-PCM3-91-2	Tasman Sea/PCM3 Moorings (1991)	Mooring
M-SA89	South Australian Upwelling M'gs (1989)	Mooring
M-SAFDE95	Southern Ocean Moorings (1995)	Mooring
M-SAZ97-8	Southern Ocean Moorings (1997-99)	Mooring
M-SEF96	SEF-Gabo Reef Moorings (1996)	Mooring
M-SO91-93	Southern Ocean Moorings (1991-93)	Mooring

Survey Name	Source Name	Source Type
M-TASE88	Tasmania: East Coast Moorings (1988)	Mooring
M-TASW88	Tasmania: West Coast Moorings (1988)	Mooring
M-TIMORS88	Timor Sea Moorings (1988)	Mooring
M-TOGA90	TOGA Moorings (1990)	Mooring
M-TROP97	TROPICS 97 - Sepik River Moorings (1997)	Mooring
M-WAB95	West Australian Basin Moorings (1995)	Mooring
MY-TICXXXXXX	Mys Tichy	Ship
P-DERXXXXXX	Pr. Deruygin	Ship
P-MERXXXXXX	Pulk. Meridian	Ship
POEXXXXXX	Pride of Eden	Ship
POSEXXXXXX	Poseidon	Ship
PROMXXXXXX	Prometey	Ship
RACHXXXXXX	Rachel	Ship
RADUXXXXXX	Raduga	Ship
SESKXXXXXX	Seskar	Ship
SHANXXXXXX	Shantar	Ship
SOXXXXXX	Soela	Ship
SPXXXXXX	Sprightly	Ship
SRTMXXXXXX	SRTM 8-449	Ship
SSXXXXXX	Southern Surveyor	Ship
SUTCXXXXXX	Sutchan	Ship
TICHXXXXXX	Tichookeanscy	Ship

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