EcoBase: a repository solution to gather and communicate information from EwE models

Mathieu Colléter, Audrey Valls, Jérôme Guitton, Morissette Lyne, Francisco Arreguín- Sánchez, Villy Christensen, Didier D. Gascuel, Daniel Pauly

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Director's Foreword

It is now clear that research addressed at a large scale can allow for new insights on complex phenomena taking place in the global ocean. Ecological studies are more and more based on data-driven methodologies that rely on pre-existing datasets. However, open-access, digital and cross-disciplinary datasets are still uncommon for ecology. In the face of the global overexploitation of marine resources and rapid degradation of ecosystem integrity, new research tools are required to tackle these issues and enable new powerful, interdisciplinary research capabilities. We have, in fisheries research generally, and at the Fisheries Centre in particular, broad experience with fisheries data collection, and analysis of food web aspects of ecosystem dynamics.

With this report titled *EcoBase: a repository solution to gather and communicate information from EwE models*, Colléter and colleagues have made a big effort at collecting information from all existing ecosystem models worldwide, built using the Ecopath with Ecosim (EwE) approach. EwE is the world's most widely used ecological modeling approach, and its development is led by Fisheries Centre researchers, including, Villy Christensen, Daniel Pauly and Carl Walters. A new accomplishment is now achieved with the EcoBase project initiated by the Ecopath Research and Development Consortium (ERDC) and carried out by the authors of this report. The ERDC was initiated at the Fisheries Centre in October 2011, and formally established in Edinburgh, Scotland, in May 2012. It contributes to creating synergies and partnerships between scientists in aquatic ecology, and promotes the EwE modeling approach.

The main goals of EcoBase are to (i) gather published EwE models; (ii) communicate on EwE modeling research; (iii) facilitate meta-analyses based on EwE models. EcoBase is meant to be a comprehensive, open-access, digital repository where EwE models are made discoverable, accessible and reusable by the scientific community. The structure, capabilities and current state of the EcoBase models repository are described in further details in this report. This represents new opportunities for research and trans-disciplinary analyses, including, trophic functioning, fisheries impact or economic aspects, for which I commend the authors.

U. R. Sumaila,

Director,

Fisheries Centre, UBC.

EcoBase: a repository solution to gather and communicate information from EwE models[1]

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Introduction

Data sharing in ecology

The Life Sciences have reached a new era, that of the "Big New Biology" (Thessen and Patterson 2011). Ecology is following the same pathway, and has turned into a data-intensive science (Kelling *et al.* 2009; Michener and Jones 2012). Ecological studies are more and more based on data-driven methodologies, relying on pre-existing large datasets and allowing for new insights on complex or underlying phenomena at global scales (Christensen *et al.* 2009). We are facing environmental degradation world-wide, and research has to be conducted at a large or global scale to tackle these issues. However, open-access, digital and cross-disciplinary datasets are still lacking for ecology to actually join the other historical "Big" sciences, such as astronomy (Thessen and Patterson 2011). The main reason for this relates to sociological and technological challenges with data sharing (Reichman *et al.* 2011; Thessen and Patterson 2011; Hampton *et al.* 2013).

Even if it is now clear that "large integrated datasets can potentially provide a much deeper understanding of both nature and society and open up many new avenues of research" (Science Staff 2011), data sharing too often remains individual scientists' responsibility. In fact, sharing data is not a tradition in ecology (Pauly 1995; Reichman *et al.* 2011), yet it is a required principle for independent verification, as well as reuse (Vision 2010). Most of the time, biological data are not being collected with reuse in mind and are then published in a narrative or summarized style in scientific articles (Vision 2010; Thessen and Patterson 2011). The actual data are meant to be provided in online supplements or upon individual requests sent to the authors, but these options have been demonstrated unreliable (Vision 2010). Thus, several authors acknowledged that new practices are needed to make data sharing fully part of the culture in Life Sciences (Vision 2010; Reichman *et al.* 2011; Thessen and Patterson 2011; Dalgleish *et al.* 2012; Hampton *et al.* 2013). The two critical stages at which practices have to be improved to allow for data sharing are the very first one, the collection of the data, and the very last one, the publication of the data. Another challenge is the simple loss of data (e.g., hard-copies, computer files in outmoded format), which can be met – at least in part – by extensive data sharing (Zeller *et al.* 2005).

The open-access principle of sharing information online for free has been increasingly applied to publications but much less to data, due to issues of recognition, technical support and sense of data ownership (Vision 2010; Thessen and Patterson 2011). Nevertheless, authors demonstrated that published papers making available their data are cited more frequently (Piwowar *et al.* 2007), and incentives for digitization of non-digital materials through the use of metadata and repositories have been growing (Thessen and Patterson 2011). A popular example in aquatic ecology is the FishBase database (www.fishbase.org). As stated by Thessen and Patterson (2011), repositories that "provide standardization, atomization and quality control services facilitate the [discovery, storage and] reuse of data and will play a stronger role in data-intensive science". Since May 2007, the INSPIRE Directive established an Infrastructure for Spatial Information in the European Community to support environmental policies. The Directive notably requires that common Implementing Rules are adopted to ensure discoverability, compatibility and usability principles for spatial data to be shared among the Member States of the European Union (inspire.jrc.ec.europa.eu/index.cfm).

1 Cite as: Colléter, M., Valls, A., Guitton, J., Morissette, L., Arreguín-Sánchez, F., Christensen, V., Gascuel, D. and Pauly, D. (2013) EcoBase: a repository solution to gather and communicate information from EwE models. Fisheries Centre Research Report 21(1). Fisheries Centre, University of British Columbia, Canada (ISSN 1198-6727).

Ecopath with Ecosim (EwE)[2] models, a data source on marine ecosystems

Facing the challenges described above, the Ecopath Research and Development Consortium (ERDC) initiated the project of an Ecopath with Ecosim (EwE) models repository, which led to EcoBase, which we developed with the intention of making published models discoverable, accessible and reusable to the scientific community. The main goals of EcoBase are to (i) gather published EwE models; (ii) communicate on EwE modeling research; (iii) facilitate meta-analyses based on EwE models.

EwE is based on ECOPATH, a trophic web model initially developed by Dr. Jeffrey Polovina in the early 1980s. In ECOPATH, the modeled ecosystem was partitioned into groups of similar species and estimates of biomass, diet, production and food consumption were provided (Polovina 1984). The original version has then been developed further, notably by Drs. Daniel Pauly, Villy Christensen and Carl Walters from the UBC Fisheries Centre, and several versions have successively been proposed over the past 30 years. The latest released version of EwE (version 6.3, released on November 25, 2012) consists of a suite of three main routines: (i) Ecopath, a static, mass-balanced snapshot of the ecosystem food-web; (ii) Ecosim, a time-dynamic simulation module for exploring fisheries management or climate change scenarii; (iii) Ecospace, a spatial and temporal dynamic module primarily designed for exploring impact and placement of marine protected areas (Christensen and Pauly 1992; Walters *et al.* 1999; Pauly *et al.* 2000; Christensen and Walters 2004; Walters and Christensen 2007; Walters *et al.* 2008; Walters *et al.* 2010). In addition, a suite of modules or plug-ins have also been developed and added to the EwE package, such as EcoTroph, which is a representation of the biomass distribution across trophic levels in the ecosystem (Gascuel 2005; Gascuel *et al.* 2008; Gascuel and Pauly 2009; Gascuel *et al.* 2009; Gascuel *et al.* 2011). Details on the core principles and equations of EwE can be found in the references cited above as well as in the EwE6 user guide available online (Christensen *et al.* 2008). Since October 2011, the ERDC has been in charge of the research, development and sustainability of the EwE approach and software.

The EwE software is user-friendly, free (under the terms of the GNU General Public License) and downloadable online (www.ecopath.org). EwE can be seen as a tool-box offering a wide range of different tools and thus allowing analyses of various ecological phenomena. These are certainly the main reasons why it has been applied to hundreds of (aquatic) ecosystems worldwide. Several meta-analyses based on EwE models have been published (Table 1).

Some of these models focused on specific ecological questions, such as ecosystems flow characteristics (Christensen and Pauly 1993), ecosystem maturity (Christensen 1995), relations between stability and complexity (Pérez-España and Arreguín-Sánchez 1999) or stability and maturity (Pérez-España and Arreguín-Sánchez 2001), fish biomass predictions (Christensen *et al.* 2003b), ecosystem impacts of MSY policies from single-species assessment (Walters *et al.* 2005), the concept of alternative attractors (Feng *et al.* 2006) or the keystone species concept (Libralato *et al.* 2006), trophic flow kinetics (Gascuel *et al.* 2008), ecosystem effects of fishing on primary production and transfer efficiency (Libralato *et al.* 2008) or of selected marine protected areas (Le Quesne *et al.* 2008), top-down and bottom-up dynamics (Arreguín-Sánchez 2011), or metabolic scaling regularity (Salcido-Guevara *et al.* 2012). Others focused on ecosystems of particular interest, such as the South China Sea (Pauly and Christensen 1993; Christensen *et al.* 2003a), the Gulf of Mexico (Pauly *et al.* 1999; Vidal-Hernandez and Pauly 2004), the Gulf of California (Lluch-Cota *et al.* 2010) or the Mediterranean Sea (Coll and Libralato 2012). Finally, few meta-analyses were dedicated to a particular species or taxon, like jellyfish (Pauly *et al.* 2009) or squids (Coll *et al.* 2012). However, these meta-analyses were based on different individual datasets. To our knowledge, no comprehensive, open-access, digital collection of EwE models published worldwide has been made, and that is what EcoBase is meant to be.

EcoBase, an information repository

The EcoBase project seeks to gather information obtained from all the ecosystem models built using the EwE approach, which have been published worldwide in scientific journals, technical reports or theses. All models have already been referenced, but not all of them have been made available in EcoBase yet. We hope that the capabilities and perspectives of the EcoBase project described in this report will encourage more modelers to make their models fully available. EcoBase is not, strictly speaking, a database but an information repository, the distinction between the two being important, but generally overlooked (Thessen and Patterson 2011). Indeed, EwE models integrate several types of data: descriptive data on species abundance, diet composition and catch; computed data on species production, consumption and ecotrophic efficiency as well as ecosystem properties; and simulation data on species biomass trends after applying alternate scenarios. These data are required to build a model and run scenarios, and they are often only partly provided by the authors in the corresponding publications. There are also many cases where

2 Strictly speaking, ECOPATH models correspond to models developed before the Ecosim implementation, and EwE models to models developed with Ecopath with Ecosim. We retroactively renamed all models as EwE models, even if EcoBase does not account for Ecosim data yet.

details on the data and parameters used to build the model are provided in supplementary materials, which are not always easily accessible.

Besides, each EwE model is also associated with a particular ecosystem with specific characteristics (e.g. location, area), as well as a corresponding publication (identified by its authors, year, reference type, etc.). The former information represents critical metadata when one wants to conduct a meta-analysis. However, detailed information on the modeled ecosystems is not systematically provided by the modelers. In EcoBase, we built a framework where all critical metadata may be stored, in a standardized and granular fashion, so that they can be reused as criteria based on which models can be selected for future meta-analyses. Thus, we hope that EcoBase would also serve authors as a template of the required information which should be provided when publishing a model. In the long term, EcoBase is meant to be used by ecosystem modelers worldwide as a platform where to (i) look for published EwE models; (ii) select and access models of interest to one's research work; (iii) download other's models as well as upload one's own models. Overall, EcoBase will provide an online repository where to make your own model discoverable, accessible and reusable to the scientific community, as soon as it is published. We believe EcoBase may thus contribute to create synergies and partnership between scientists in aquatic ecology.

Table 1. List of published meta-analyses based on EwE models

Reference	Research question/topic	Location	Number of models
Christensen and Pauly 1993	Ecosystems flow characteristics	-	41
Christensen 1995	Ecosystem maturity	-	41
Perez-España and Arreguín-Sánchez 1999	Relation between complexity and stability	-	4
Perez-España and Arreguín-Sánchez 2001	Relation between maturity and stability	-	14
Christensen *et al.* 2003a	Fish biomass predictions	North Atlantic	23
Christensen *et al.* 2003b	Fish biomass predictions	South China Sea	16
Walters *et al.* 2005	Ecosystem impacts of MSY policies from single-species assessment	-	11
Feng *et al.* 2006	Concept of alternative attractors	-	36
Libralato *et al.* 2006	Keysotne species concept	-	33
Gascuel *et al.* 2008	Trophic flow kinetics	-	55
Libralato *et al.* 2008	Ecosystem effects of fishing on primary production and transfer efficiency	-	91
Le Quesne *et al.* 2008	Ecosystem effects of marine protected areas	-	5
Pauly *et al.* 2009	Role of jellyfish in ecosystems	-	23
Lluch-Cota et al. 2010		Gulf of California	12
Arreguín-Sánchez 2011	Top-down and bottom-up dynamics	-	13
Coll and Libralato 2012		Mediterranean Sea	40
Coll *et al.* 2012	Role of squid in ecosystems	-	75
Salcido-Guevara *et al.* 2012	Metabolic scaling regularity	-	98

EcoBase description

History

Sharing data among EwE developers has been a persistent dream, and a models depository was implemented on the ecopath website (www.ecopath.org). However, only a small fraction of the published models were included on the web-page, and the structure was not in place for extensive data sharing. That is the reason why the idea of creating a new models repository has been growing since the creation of the Ecopath Research and Development Consortium (ERDC). The EcoBase project itself started with the PhD project of Mathieu Colléter, which consists in a meta-analysis of EwE models focusing on the trophic functioning of aquatic ecosystems. An oral presentation was made during the last Ecopath Consortium meeting (Colléter *et al.* 2012). Colléter and colleagues first gathered EwE models from two existing databases:

- Dr. Lyne Morissette developed Excel sheets for 178 EwE models, and listed the total number of EwE models developed to date (393 models (Morissette 2007)). She collected some metadata (publication year, reference, ecosystem type, area, modeled period, Ecosim model developed), as well as detailed data on each of the 178 EwE models (main inputs and outputs);
- Drs. Luís Antonio Salcido-Guevara and Francisco Arreguín-Sánchez developed an Access database, called ECOMOD, accounting for 153 models. This database was initiated during the INCOFISH project (INCOFISH 2006), and expanded later on as part of Dr. Salcido-Guevara PhD project (Salcido-Guevara 2006). The database integrated several metadata (publication info, geographic location, country, FAO area, LME, ecosystem type, etc.), functional groups, and all input and output data (basic parameterization and network analysis). All models were updated to EwE version 5.1 and verified in respect to associated publications.

The first step was then to compare and merge both sets of EwE models into one single database supported by PostgreSQL to create a data server. Making the same data available all over the world from a single database is the first step for information sharing. The main challenge was to define a database structure accounting for all compatibility and identification issues. Notably, we double-checked for duplicates and made sure that versions of similar EwE models inherited from both collections were actually identical. Indeed, some models had been modified to be balanced if they were not, whereas others were still not balanced. However, most of the time, all the modifications had been recorded and the collections proved to be very valuable materials. The two existing databases both integrated the great collection of documentation and files listed in the ecopath website. After matching, we obtained a list of about 200 unique models. Then, a third contribution was added to EcoBase: Dr. Villy Christensen and his team had gathered a collection of 233 EwE models, with their associated publications. Some metadata about the person through whom the model was given and the few modifications made had also been recorded. This collection was compared and merged as well to the previous list. We obtained an additional list of 132 unique additional models after comparison. Several authors have also sent their models directly for incorporation in the repository. Finally, since the inherited collections were not up-to-date with the most recent EwE models published, Audrey Valls and Mathieu Colléter conducted a literature review and ended up with a list of 99 recent (or previously missing) models, to be added to the list. Thus, we ended up with a list of 425 unique models and 494 models in total (including duplicates). A list of the EwE models registered and referenced in EcoBase is provided in Appendix 1 (with details on the model location, period, country, author, facilitator and reference, and indexes by author and country).

Software and access

Several database management systems were available to develop our information repository. We chose to use the PostgreSQL software. PostgreSQL is a professional relational database management system. It is a free software, and sources are available (www.postgresql.org). All its technical capabilities make it a robust and widely used management system. It notably has graphical interfaces to manage tables, libraries for various programming languages, and drivers for the Microsoft Open Database Connectivity (ODBC) application programming interface (API) enabling connections with several softwares. The database server is currently hosted on a development server at Agrocampus Ouest (Rennes, France) and accessible everywhere in the world (with access authorization).

Currently, access to the repository is possible through various interfaces such as: pgAdmin “the most popular and feature rich Open Source administration and development platform for PostgreSQL, the most advanced Open Source database in the world” (www.pgadmin.org), any Internet server, or Microsoft Access (office.microsoft.com/en-ca/access) through ODBC connections. All the different ways to access the repository are currently restricted with user logins and passwords, managed by the database administrators (DBAs). Full access to the repository is restricted to expert users (EUs) only. However, a large number of web services may become accessible to general users (GUs) (see section 2).

Structure of the repository

General structure

EcoBase comprises numerous tables encompassing all Ecopath data and various metadata. The architecture of the repository relies on one main table called 'models_list'. This table is used to declare all encoded models by assigning a unique number to each one, declared as a primary key: the 'model_number' variable. A primary key is a special relational database table column (or combination of columns) designated to uniquely identify all table records. It must contain a unique value for each row of data and no null values. The 'model_number' primary key enables a complete identification of each single model and linkages to other tables comprising the other data. Along with 'models_list', four other tables ('references_tables, 'models_details', 'fishery_fleets and 'import_like_groups') are used to declare the four other primary keys needed to create the linked tables (Figure 1). All five tables enable the creation of a series of tables used to store all the other data. We differentiated three categories of data stored in EcoBase.

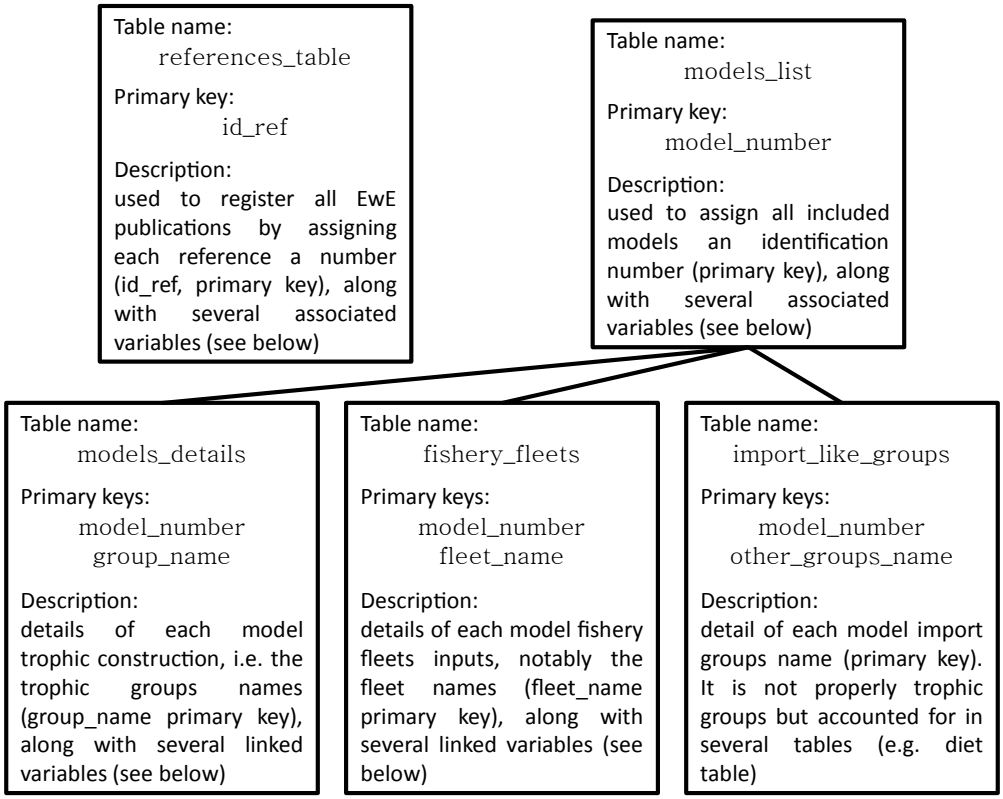

Figure 1. Basic diagram of the five main tables of the PostgreSQL EcoBase repository (name of the tables, associated primary keys and a short description).

Model metadata

A first objective of our approach was to store metadata on EwE models. These data are necessary for a complete identification of each model and to provide information not directly included in EwE data, such as the location of the ecosystem, the objectives and history of the model or its contributors. The definition of metadata was based on potential needs for conducting meta-analyses, and key points identified by merging the three existing databases of EwE models. All metadata were stored in five tables (Figure 2). We created three additional tables linked with 'models_list': 'models_history', 'models_info' and 'models_ref' (also linked with 'references_table'). Jointly, these tables enable a complete storage of all metadata and models quality criteria. A comprehensive list and detailed description of all the models' metadata fields is available in Appendix 2.

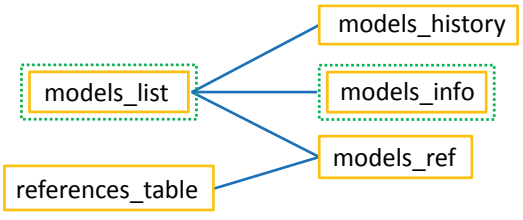

Figure 2. Relation diagram of the five metadata tables (orange solid contours indicate tables containing metadata, green dotted ones tables containing EwE inputs).

- 'models_list' enables the storage of several model parameters, such as the models name, author, units, the use of several routines or plug-ins (e.g. Ecosim, Ecospace, EcoTracer, EcoTroph), and other criteria of particular interest.

- 'models_history' includes information on the history of the model: through whom the model was obtained? ; is it balanced? ; is it referenced? ; has it been modified and by whom? Additionally, by merging several contributions, we included comments made at different stages by the different involved researchers.
- 'models_info' informs on the model itself and the modeled ecosystem. The table stores the model period, area, location, and geographic extent (see Appendix 3). We used Postgis extensions for Postgres which add spatial capabilities to the database. These libraries enable numerous spatial functions, like the computation of areas, distances, or intersections. The table also comprises several environmental variables, such as the ecosystem type or zone. We proposed a-priori classification of models by ecosystem types, and we distinguished 12 types: channel/strait, bay/fjord, coastal lagoon, coral reef, continental shelf (200m depth), ocean, river, estuary, reservoir, lake, beach, and terrestrial. We also defined three ecosystem zones: tropical, temperate and polar.
- 'models_ref' links the models to the associated references contained in 'references_table', and enables their classification by importance.

Model inputs

We also stored the descriptive data required to build EwE models, here called 'model inputs'. Several tables have been designed to store these data (Figure 3). The names of the tables and fields have been designed to enable an easy understanding, and to create a homogeneous database with condensed information. All tables rely on the 'models_list' table and the three main associated tables 'models_details', 'fishery_fleets' and 'import_like_groups'. This ensures referential integrity of EcoBase (e.g., if a model is suppressed from models_list, then all associated records are suppressed too). The repository has been designed to store all the input data coming from EwE version 6.3, also accounting for additional routines like the Taxonomy or Pedigree (Figure 4). An exhaustive list and detailed description of all models' inputs fields is available in Appendix 2.

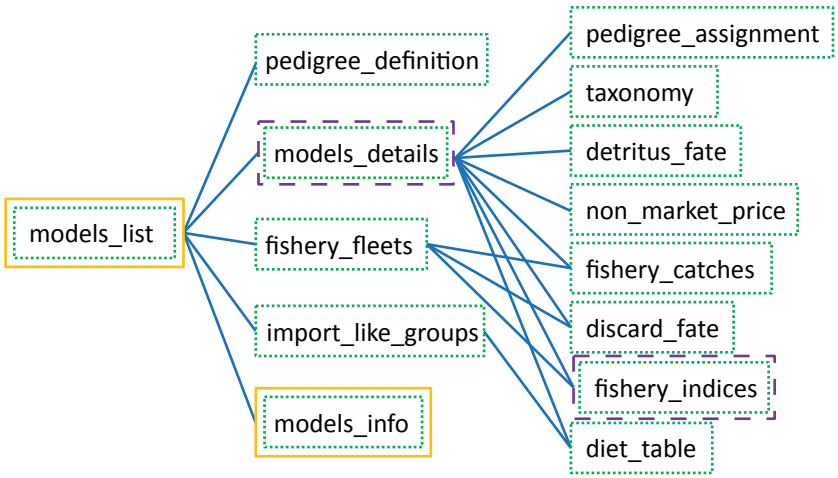

Figure 3. Relation diagram of the EwE input tables (orange solid contours indicate tables containing metadata, green dotted ones tables containing EwE inputs, and purple dashed ones tables containing EwE outputs).

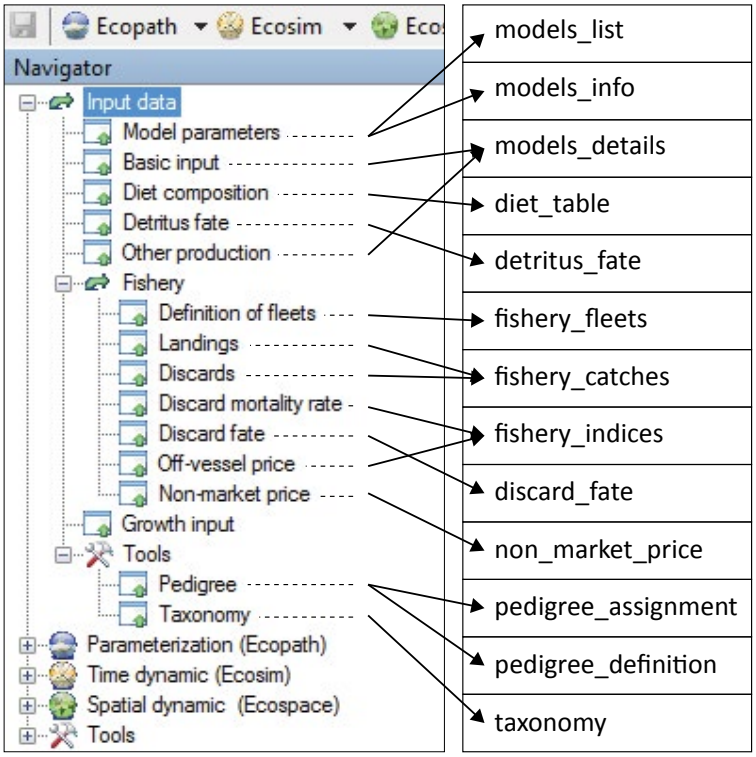

Figure 4. Snapshot of EwE software navigator for input data, and correspondence with EcoBase tables.

Model outputs (Ecopath)

For the purpose of our analyses, we decided to store as well in EcoBase the computed data obtained from EwE models (the Ecopath routine only), here called 'model outputs'. In fact, several outputs are needed to perform meta-analyses or run EwE plug-ins, such as EcoTroph. Again, several tables have been designed to store these data (Figure 5). As we did for the 'model inputs', the tables and fields names have been chosen to simplify the usage and structure of EcoBase. The referential integrity is guaranteed by relations between tables and the use of the four main tables: 'models_list', 'models_details', 'fishery_fleets' and 'import_like_groups'.

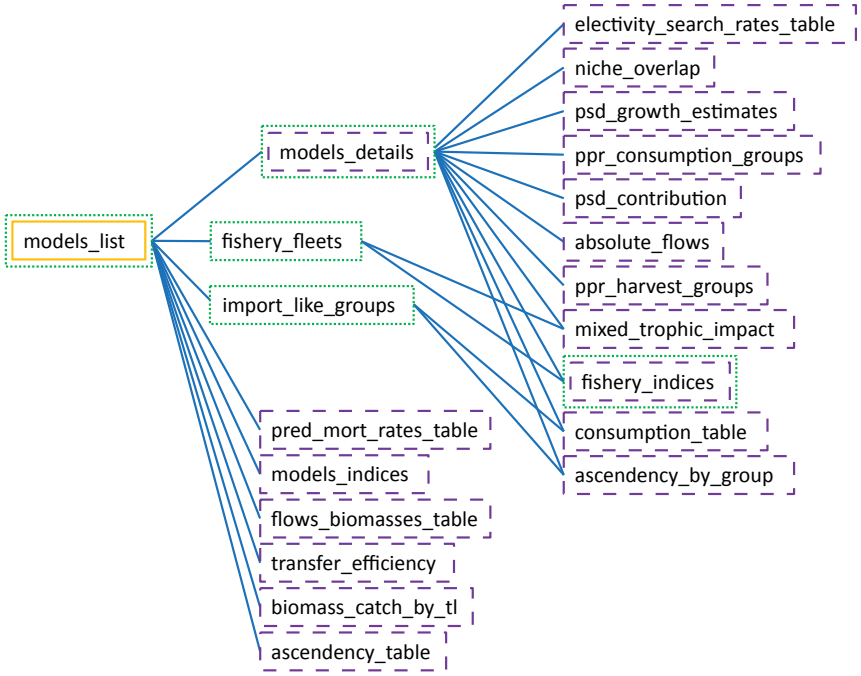

Figure 5. Relation diagram of the EwE input tables (orange solid contours indicate tables containing metadata, green dotted ones tables containing EwE inputs, and purple dashed ones tables containing EwE outputs).

The repository has been designed to store output data coming from EwE version 6.3 (Figures 6 and 7). We decided not to consider the Fishery Quantity and Value tables and the Relative Flows table as they are easily computable with included data. Details of the Cycle and Pathways module are not yet accounted for, due to the large amount of data this would have required, and neither are the Ecosim Network Analysis and Value Chain modules. The architecture of EcoBase can still evolve to include new data and fulfill new needs expressed by the EwE community. A complete list and full description of all the models' outputs fields is available in Appendix 2.

In conclusion, EcoBase has been designed to store almost all data coming from EwE version 6.3, also accounting for several relevant modules, such as the Taxonomy, Particle Size Distribution and Pedigree. Additional metadata may also be stored, such as the geographic coordinates (spatial extent of the model, see Appendix 3). Model quality criteria were also added for selection and meta-analyses. The entire structure of EcoBase can be summarized using a relations diagram (Figure 8). We strongly believe that the format we chose is suitable not only for our particular use, but also for a global use by any EwE modelers and fisheries scientists.

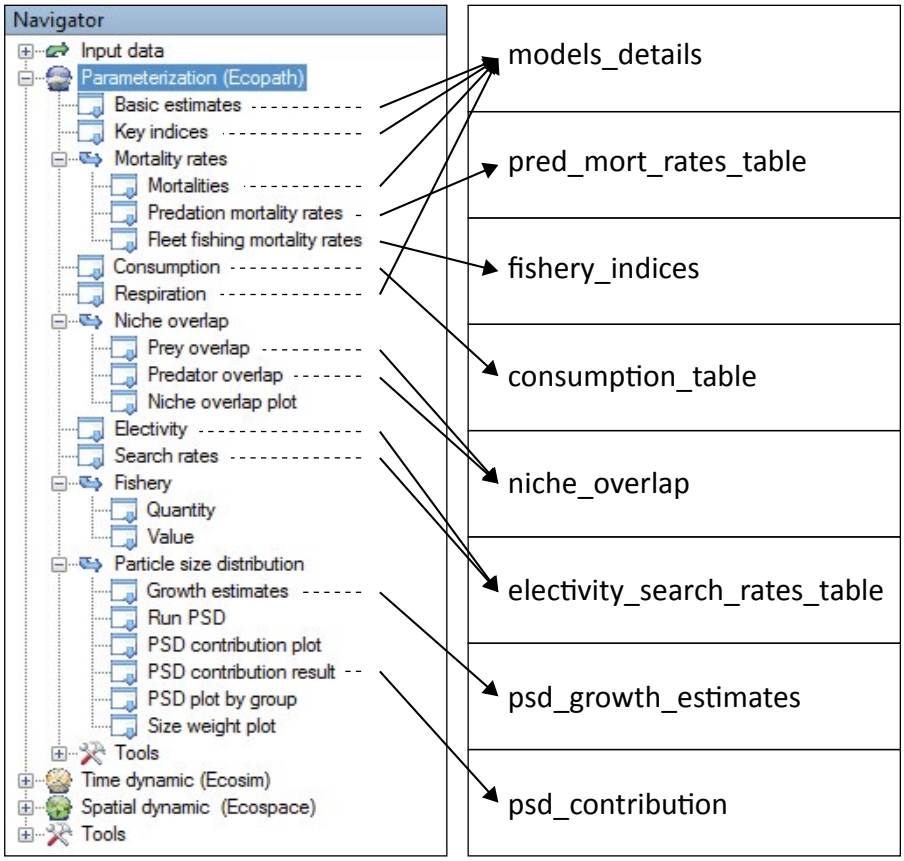

Figure 6. Snapshot of EwE software navigator for input data, and correspondence with EcoBase tables.

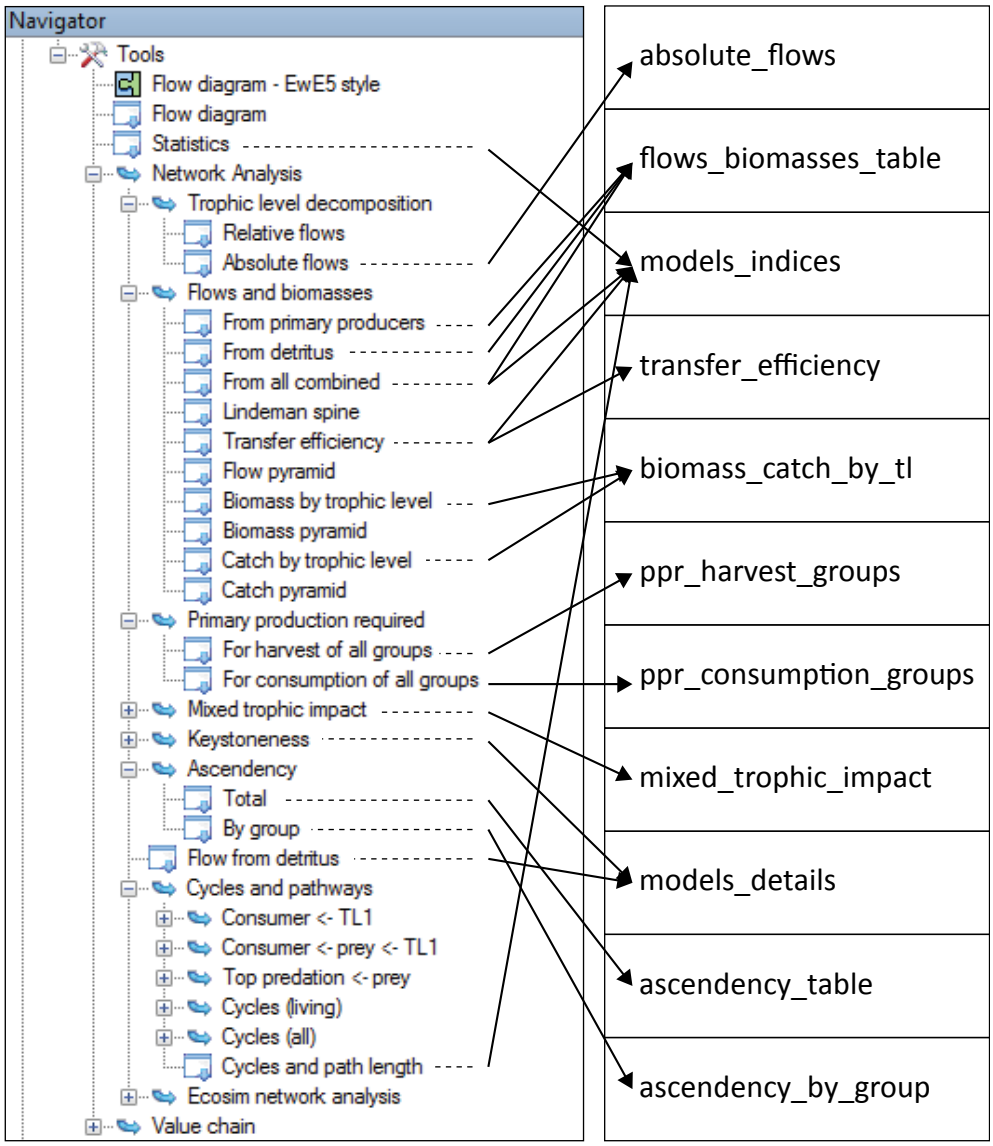

Figure 7. Snapshot of EwE software navigator for Network analysis output data, and correspondence with EcoBase tables.

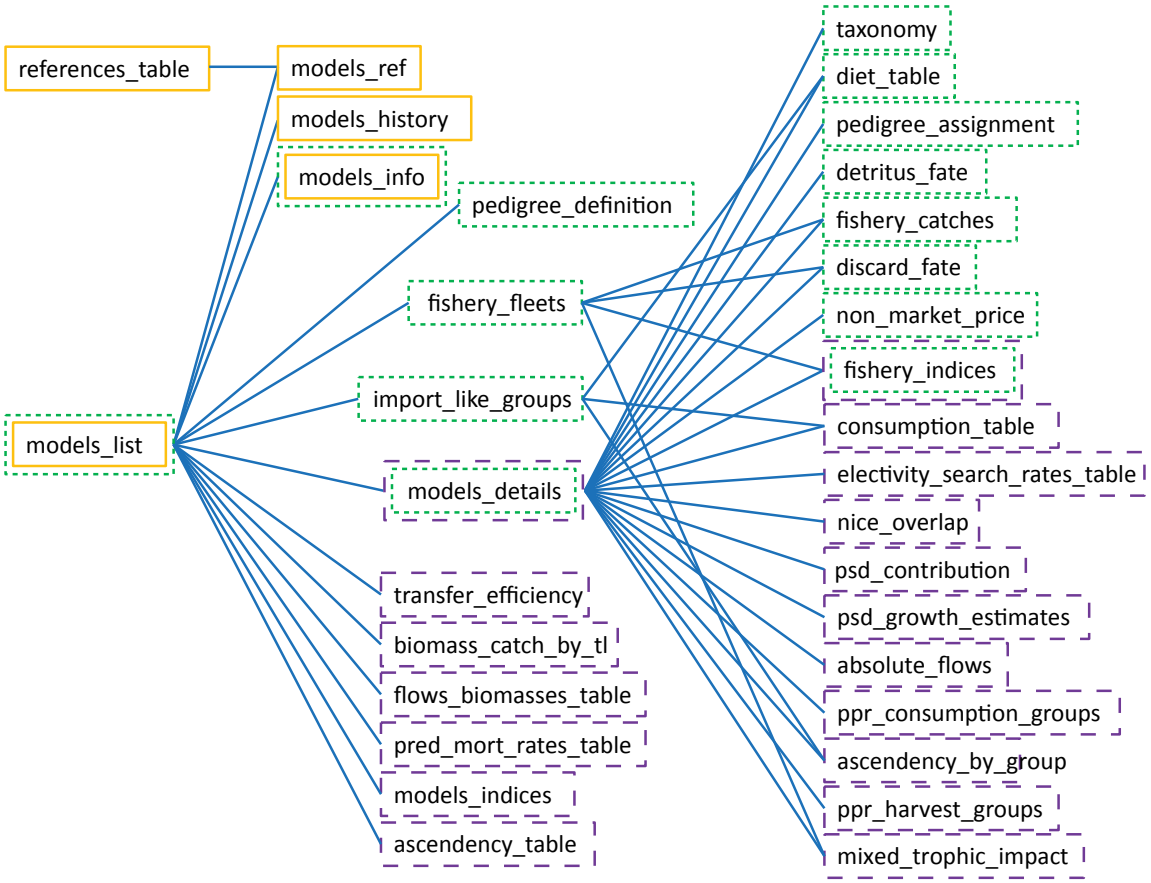

Figure 8. Diagram of tables relations (orange solid contours indicate tables containing metadata, green dotted ones tables containing EwE inputs, and purple dashed ones tables containing EwE outputs).

EcoBase capabilities

Overview

After presenting the repository software and structure, we introduce in this section the possible usages of EcoBase and detail functionalities associated to the different users categories: the general users, and the developers including the database administrators (DBAs) and the expert users. The PostgreSQL Relational Database Management System (RDBMS) and the structure we developed enable powerful capabilities to share services linked with the database content. As for the database administrators, the EcoBase RDBMS and structure present interesting capabilities such as: a control of the access, centralized modifications, and a unique information source. Database administrators as well as expert users can directly use the database to manage structure and access, or perform analyses. Such powerful capabilities cannot logically be given to everybody. General users need more elaborated and controlled pathways to access data, via web services (Figure 9). Once users' needs are expressed, we have to deal with three main issues: (i) how to organize the database feeding; (ii) how to disseminate the data; (iii) which services to set up.

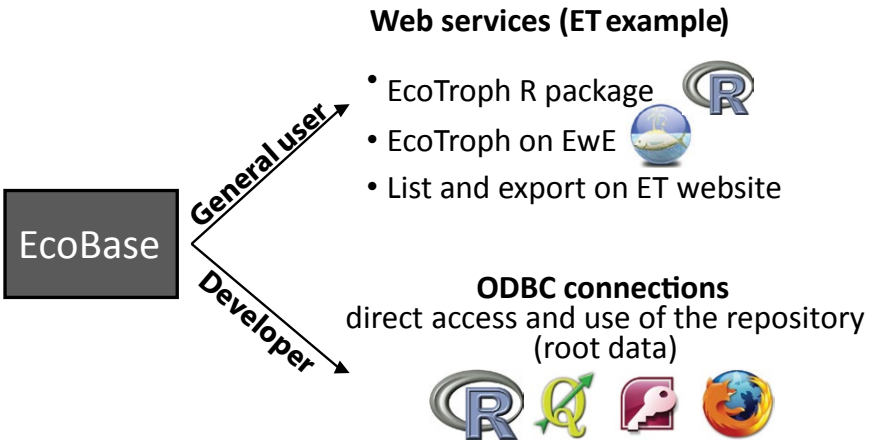

Figure 9. PostgreSQL formats user's functionalities.

For general users

A great number of web services responding to the general users' expectations are possible using EwE models data loaded in EcoBase and metadata added for each model. Examples detailed below focus on web services already developed and related to the EcoTroph approach, which give an interesting overview of the potential capabilities of EcoBase.

- EcoTroph R package: An EcoTroph R package has been developed enabling an independent use of the EcoTroph model (Colléter *et al.* 2013). This package contains EcoTroph functions but also a 'read.ecopath.model' function. This function enables the loading of data needed for EcoTroph analyses from each model in EcoBase with a granted access. EcoTroph users are given the possibility to analyze any Ecopath model available in the EcoBase models repository.
- EwE EcoTroph plug-in: A new functionality of the EwE EcoTroph plug-in is a linkage with EcoBase. EcoTroph inputs can be loaded in three different ways: from the model loaded in EwE, from an external .xml file, or from EcoBase via a web service which lists each model in EcoBase with a granted access and downloads the selected one (Figure 10).

A list of available EwE models stored in the repository and a short description of each of them is displayed on the EcoTroph website (sirs.agrocampus-ouest.fr/EcoTroph/). Users have the possibility to select a model, obtain additional information and see a map of the spatial extent of the model (see Appendix 3). Data needed for EcoTroph are also downloadable from this interface for each model in EcoBase with a granted access (Figure 11). The web service is yet limited (search by name or on a map if the geographic extent of the model is known), but advanced search capabilities could be easily developed using the models metadata.

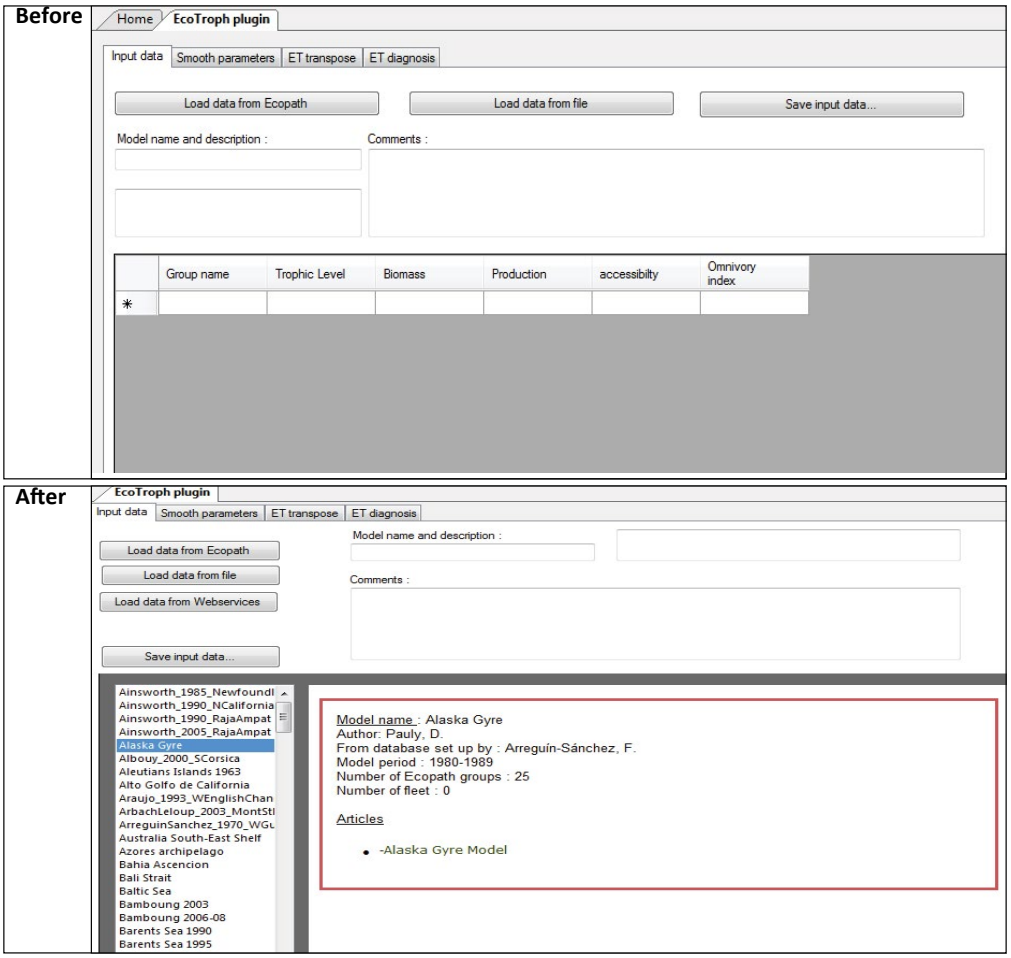

Figure 10. Snapshot of the EwE EcoTroph plug-in before and after the implementation of the EcoBase web service.

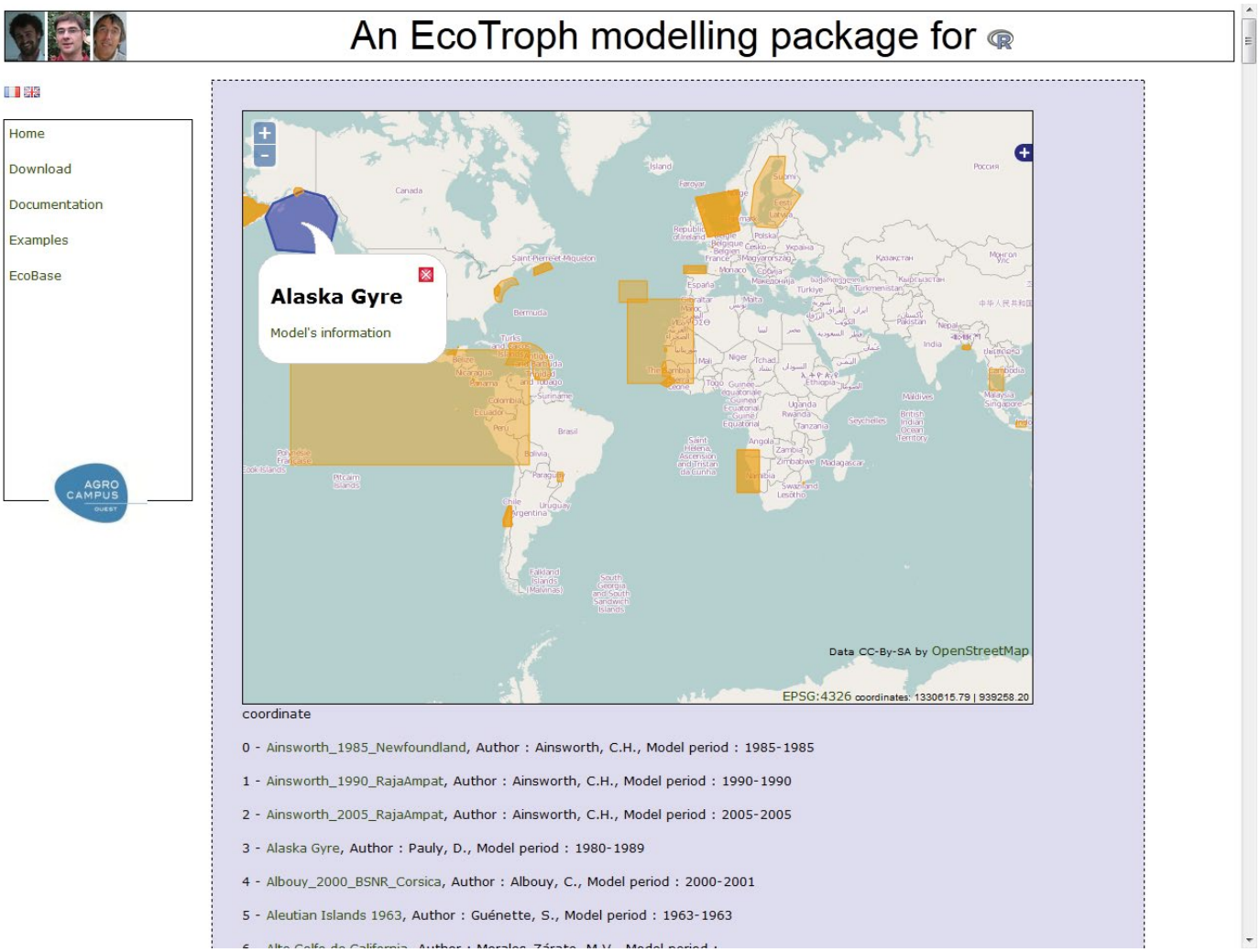

Figure 11. Snapshot of the EwE models list available on the ET website.

For developers only

EcoBase presents great capabilities for developers (including database administrators and expert users). First, a full control of the access to root data (tables and structure) is possible through security features of PostgreSQL (controlled by login, password, IP). Expert users who want to connect directly to the database need a user login and a password controlled by database administrators. There is also the possibility to manage different rights to users (data consulting only, data editing, etc.). Expert users can access to the complete database through the use of ODBC connections or the web interface, with clearly defined access rights allocated by database administrators. This opens new capabilities for expert users, notably statistical analyses using R and the package RODBC (cran.r-project.org/web/packages/RODBC/index.html) (or Rpgsql for Linux users), or spatial outputs using GIS tools. The great amount of data and the easy access through R is an open gate to large and reproducible analyses. However, these expert users' capabilities do not constitute the standard way to use the database, since it is often the less controlled and more CPU time-consuming. Thus, the number of expert users should be limited to ensure that standard services will always be available for general users.

In conclusion, EcoBase constitutes a unique source of information where modifications and usages are centralized and manageable. Access is possible all over the world, freely and easily. The repository can be managed by several database administrators at different places, and enables the set-up of a developers' community. Data access is fully controlled by database administrators through the use of clearly defined rights to the associated expert users, and web services for general users. A great number of web services answering general users' expectations are possible using EwE models data loaded in EcoBase and metadata added for each model. Provided examples concentrate on EcoTroph use, but give an interesting overview of capabilities. Direct interactions with the EwE software are possible, as external uses to provide additional information.

EcoBase: current state and future developments

Current state of EcoBase

As presented in the sections above, the core structure of EcoBase is in place but not all the fields have been encoded yet. Thus, in its current state, the models repository is not completed. The first phase of encoding focused on metadata. An exhaustive inventory of all published EwE models was completed and a final list of models in EcoBase was established. For all listed models, available information on metadata was then collected from the original publications describing the models and encoding of all fields consisting in metadata was completed. However, few actual data has been encoded in EcoBase yet. 494 EwE models are currently referenced in the EcoBase repository of which 425 are unique (see Appendix 1). Table 2 shows a detailed assessment of the current data availability, by table and for all referenced models. Data used by the EcoTroph routines have been encoded by Mathieu Colléter, as part of his PhD project, for models included in the Morissette and Arreguín-Sánchez databases. The completion of encoding will constitute the second phase of the project. EcoBase structure enables encoding of all input or output data from any referenced Ecopath models. EcoBase originally focused on the Ecopath routine of EwE models, so that no Ecosim time series or Ecospace maps can be stored in the database in its current state. Also, EwE scenarios are a type of data highly dependent on the context in which they were generated, putting restrictions on their potential reuse.

Table 2. Data availability for all referenced models in EcoBase (May 2013)

Table	Data type	Data availability
absolute_flows	Output	Empty
ascendency_by_group	Output	Column 'Throughput' available for models initially assembled by L. Morissette and F. Arreguín-Sánchez
ascendency_table	Output	Empty
biomass_catch_by_tl	Output	Empty
consumption_table	Output	Empty
detritus_fate	Input	Available for one model (test)
diet_table	Input	Available for one model (test)
discard_fate	Input	Available for one model (test)
electivity_search_rates_table	Output	Empty
fishery_catches	Input	Available for models assembled by L. Morissette and F. Arreguín-Sánchez
fishery_fleets	Input	Available for models assembled by L. Morissette and F. Arreguín-Sánchez
fishery_indices	Input / Output	Available for one model (test)
flows_biomasses_table	Output	Empty
mixed_trophic_impact	Output	Empty
models_details	Input / Output	Available for models assembled by L. Morissette and F Arreguín-Sánchez
models_history	Metadata	Available for all models
models_indices	Output	Available for models assembled by L. Morissette and F. Arreguín-Sánchez
models_info	Metadata / Input	Available for all models
models_list	Metadata / Input	Available for all models
models_ref	Metadata	Available for all models
niche_overlap	Output	Empty
non_market_price	Input	Available for one model (test)
other_groups	Input	Available for models assembled by L. Morissette and F. Arreguín-Sánchez
pedigree_assignment	Input	Empty
pedigree_definition	Input	Empty
ppr_consumption_groups	Output	Empty
ppr_harvest_groups	Output	Empty
pred_mort_rates_table	Output	Empty
psd_contribution	Output	Empty
psd_growth_estimates	Output	Empty
references_table	Metadata	Available for all recorded references
taxonomy	Input	Empty
transfer_efficiency	Output	Empty

Future improvements of EcoBase

EcoBase is an on-going project and many features are still to be improved to make it a more powerful and efficient tool. Table 3 shows a report card of EcoBase, which summarizes the key features already implemented, or still to be implemented, and estimates the degree of completion of each feature. Future improvements should notably focus on data encoding, linkages between EcoBase and the EwE software and database access policy. Also, users should not be allowed to encode outputs which are not consistent with the inputs. Maintenance of EcoBase in the long-term is probably the most critical aspect to ensure a long life span of the repository, facing issues such as migration to new technologies or updating.

Table 3. Report card of EcoBase

Feature	Grade	Comment
1. Structure	A	Structure is in place for storing metadata and Ecopath inputs/outputs data. Note: no Ecosim or Ecospace data considered yet.
2. Metadata	A	Metadata encoding is completed and metadata are accessible and usable. Remaining missing metadata was not provided in the references.
3. Data	D	Data encoding is not completed and data are not accessible or usable. Requires completion of items 4 and 5.
4. Links with the EwE software	C	No link between EcoBase and the EwE software is currently available, but feasible to develop such linkages. Several options are under consideration.
5. Open-access	C	Several options are under consideration. Requires a consensus within the ERDC.
6. Website and web services	B	Website partially completed: some functionalities already implemented such as models browser; some still missing such as fill-in forms for adding models.
7. Short-term maintenance	A	Mathieu Colléter and Jérôme Guitton are in charge of the maintenance in the short term.
8. Long-term maintenance	D	Modalities of the maintenance in the long-term still have to be defined.

Projects possibly involving EcoBase

As mentioned in the introduction, only a few meta-analyses based on a large collection of EwE models have been published. EcoBase creates new opportunities for various types of meta-analyses, involving larger datasets, at broader scales. The repository notably provides standardized and atomized metadata, which may be used as selection criteria. By applying a scoring method on these criteria, a list of models of potential interest may be obtained. The pool of selected models may then be reused to conduct meta-analyses. Also, the ODBC connections and web services enable direct links between EcoBase and popular statistical softwares such as R (www.r-project.org/), which allows for statistical analyses to be easily and quickly run. Besides, new mapping tools for EwE models are available in EcoBase and may be used to get new insights on EwE-based research worldwide (see Appendix 3). Table 4 shows a list of researchers who are members of on-going projects using EcoBase, or who have expressed strong interest in using the models repository. The list is not meant to be exhaustive and should grow as EcoBase is enhanced.

Table 4. List of on-going and potential projects involving EcoBase

Researcher	Interest	Project status
Mathieu Colléter (UBC/Agrocampus Ouest)	Trophic functioning meta-analysis (TE, Kinetic) and EcoTroph use	On-going PhD thesis
Audrey Valls (UBC, Nereus Program)	Index of Keystoneness; Diet composition	On-going PhD thesis
Sylvie Guénette (EcOceans)	Trophic role of small pelagics	Interests expressed
James Watson (Nereus Program)	Particle size distributions	Interests expressed
Deng Palomares (UBC, FishBase)	Links EcoBase-FishBase	Interests expressed
Jérôme Guitton (Agrocampus Ouest)	Links EcoBase-EwE	Starting project
Jérémy Lobry (IRSTEA)	Meta-analysis of EwE models of estuaries	Interests expressed
Jean Guillard, Orlanne Anneville and Jérémy Lobry (INRA/IRSTEA)	Meta-analysis of EwE models of lakes (Alpes)	Interests expressed (PhD thesis)
James Simons (CCS-TAMU-CC) Francisco Arreguín-Sánchez (IPN-CICIMAR)	Linking EcoBase with the Gulf of Mexico trophic database	Interests expressed (GoMexSI project)
Luis Salcido-Guevara (IPN-CICIMAR)	Supply-demand balance of trophic networks	On-going research
Francisco Arreguín-Sánchez (IPN-CICIMAR)	Ecosystem functional indicators	On-going research
Monica Ruiz-Barreiro (IPN-CICIMAR)	Exergy: application to management and conservation	Interests expressed (PhD thesis)

Links with the Ecopath Research and Development Consortium

Building a models repository was an initiative of the Ecopath Research and Development Consortium (ERDC), and EcoBase is an outcome of this initiative. The EcoBase project was instigated with two main phases in mind. Phase 1 consisted in establishing an up-to-date and comprehensive list of published Ecopath models and making the models discoverable through an online repository. Phase 1 notably involved: (i) merging three pre-existing lists of Ecopath models, gathered by Francisco Arreguín-Sánchez, Lyne Morissette and Villy Christensen; (ii) selecting published Ecopath models only and identifying their associated references (citations); (iii) collecting metadata about the published Ecopath models, when provided in the associated references (see Appendix 1). Phase 1 has been done as part of Mathieu Colléter and Audrey Valls' PhD theses and is now completed. We believe it will be valuable to anyone willing to conduct meta-analyses of Ecopath models.

Phase 2 is meant to be taken over by the ERDC, under the coordination of the Models Repository Working Group. The ERDC was initiated in Vancouver, Canada, in October 2011, and formally established in Edinburgh, Scotland, in May 2012. It is "a global, cooperative network focused on the research, development and sustainability of the EwE approach and software, its information basis, and complementary activities and capabilities". Its objective is "to contribute to the sustainability of living resources and ecosystems by developing, applying, teaching, and promoting modeling and analytical tools, with a focus on the EwE modeling approach" (www.ecopath.org/consortium). Phase 2 will consist in making accessible to and reusable by the EwE community all the Ecopath models which are currently discoverable in EcoBase. We believe that open-access has to become the way of thinking in ecology and we built the EcoBase repository with this idea in mind. Thus, we hope that the ERDC will encourage the EwE community to take that route as well.

Conclusions

This report constituted for us a great opportunity to present the on-going EcoBase project. The EcoBase models repository is meant to make published EwE models discoverable, accessible and reusable, and thus to enhance the promotion of EwE-based approaches and meta-analyses in marine ecosystem modeling. It has been designed to meet global scientific challenges, such as data sharing, gathering and dissemination. We merged three existing EwE models databases into a new models repository enabling more powerful capabilities. The architecture of EcoBase is meant to correspond to the EwE software structure (version 6.3) and collect all the data required for conducting meta-analyses and ensuring models identification. We integrated a large amount of metadata on the models origin, structure, and history, as well as the modeled ecosystems traits. Moreover, the PostgreSQL format enables new capabilities for data sharing and access control. The structure of the repository is flexible, and the database administrators have a full control on users' access. Thus, different user profiles are configurable through the use of web services. We have already developed interesting examples of web services linked with the EcoTroph approach, and there are possibilities for more if new users are willing to develop their own tools in the future.

This report represents the completion of the phase 1 of the EcoBase project. We developed the models repository as part of the ERDC initiative to move forward in EwE modeling. We hope EcoBase will offer new functionalities to the EwE community and bring new perspectives within the ERDC. The phase 2 of the EcoBase project is meant to be taken over by the members of the Models Repository Working Group, under the coordination of the ERDC. We would like to encourage them to develop new linkages between EwE and EcoBase, which could help encoding all missing data in EcoBase as well as developing new web services for EwE modelers. We envision the EcoBase project as a new opportunity for strengthening the EwE community via a shared online tool, and offering new capabilities for EwE research and communication.

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Appendix 1. List of EwE models registered and referenced in EcoBase (list of the models, the associated references and indexes by author and by country)

Appendix Table A1. List of the EwE models

Number	Location	Period	Country	Author	Facilitator	References
7	Azores archipelago	1997-1997	Portugal	Guénette, S.	Morissette, L.	8
12	Bay of Bengal	1984-1986	Bangladesh	Mustafa, M.G.	Morissette, L.	12
13	Bay of Biscay	1970-1970	France	Ainsworth, C.H.	Morissette, L.	13
14	Bay of Biscay	1998-1998	France	Ainsworth, C.H.	Morissette, L.	13
22	Cantabrian Sea	1994-1994	Spain	Sánchez, F.	Morissette, L.	23
24	Carribean Islands	1986-1986	Not affiliated	Melgo, J.L.	Morissette, L.	24
25	Celestun lagoon	1986-1986	Mexico	Vega-Cendejas, M.E.	Morissette, L.	25
27	Celestun lagoon	1986-1986	Mexico	Vega-Cendejas, M.E.	Morissette, L.	25
28	Atlantic Ocean, central	1950-1950	Not affiliated	Vasconcellos, M.	Morissette, L.	27
29	Atlantic Ocean, central	1998-1999	Not affiliated	Vasconcellos, M.	Morissette, L.	27
30	Central Chile	1992-1992	Chile	Neira, S.	Morissette, L.	28
33	Pacific Ocean, central	1990-1998	Not affiliated	Cox, S.P.	Morissette, L.	31
34	Chesapeake Bay	1950-1950	United States of America	Christensen, V.	Morissette, L.	32,479
35	Chesapeake Bay	2002-2002	United States of America	Christensen, V.	Morissette, L.	32
36	Mexican Caribbean	1990-1990	Mexico	Alvarez-Hernández, J.H.	Morissette, L.	33
40	Nova-Scotia, Eastern	1980-1985	Canada	Bundy, A.	Morissette, L.	34,35
41	Nova-Scotia, Eastern	1995-2000	Canada	Bundy, A.	Morissette, L.	35,34
42	Pacific Ocean, Eastern tropical	1993-1997	Not affiliated	Olson, R.J.	Morissette, L.	36,37,459
43	English Channel	1973-1973	U.K. of Great Britain and Northern Ireland	Stanford, R.	Morissette, L.	38
44	English Channel	1995-1995	U.K. of Great Britain and Northern Ireland	Stanford, R.	Morissette, L.	38
46	Faroe Islands	1997-1997	Faroe Islands	Zeller, D.	Morissette, L.	435,41,40
48	Floreana Island	2000-2001	Ecuador	Okey, T.A.	Morissette, L.	43
49	Gambia, continental shelf	1986-1986	Gambia	Mendy, A.N.	Morissette, L.	44
50	Gambia, continental shelf	1992-1992	Gambia	Mendy, A.N.	Morissette, L.	45
51	Gambia, continental shelf	1995-1995	Gambia	Mendy, A.N.	Morissette, L.	45
52	Gironde estuary	1991-1998	France	Lobry, J.	Morissette, L.	478,46
53	Gulf Dulce	1993-1994	Costa Rica	Wolff, M.	Morissette, L.	47
54	GBR, Northern	1993-1994	Australia	Gribble, N.A.	Morissette, L.	49,48
55	Large area off Guinea	1985-1985	Guinea	Guénette, S.	Morissette, L.	50
56	Large area off Guinea	1998-1998	Guinea	Guénette, S.	Morissette, L.	50
57	Guinea-Bissau continental shelf	1990-1992	Guinea-Bissau	Amorim, P.	Morissette, L.	51
58	Gulf of Mexico	1980-1989	Mexico	Browder, J.A.	Morissette, L.	52
60	Gulf of Thailand	1997-1997	Thailand	Vibunpant, S.	Morissette, L.	54,56,55
66	Icelandic marine ecosystem (ICES area Va)	1997-1997	Iceland	Mendy, A.N.	Morissette, L.	60
67	Icelandic shelf	1997-1997	Iceland	Mendy, A.N.	Morissette, L.	61
68	Icelandic shelf	1997-1997	Iceland	Samb, B.	Morissette, L.	62
71	Lagoon Chiku	1997-1997	China	Lin, H.-J.	Morissette, L.	65
72	Lagoon of Venice	1994-1994	Italy	Carrer, S.	Morissette, L.	66
73	Manila, Laguna de Bay	1950-1950	Philippines	Delos Reyes, M.R.	Morissette, L.	67,68
74	Manila, Laguna de Bay	1980-1980	Philippines	Delos Reyes, M.R.	Morissette, L.	67,68

Appendix Table A1. Continued

Number	Location	Period	Country	Author	Facilitator	References
76	Lake Awassa	2003-2004	Ethiopia	Fetahi, T.	Morissette, L.	452,69
81	Lake Malawi	1977-1996	Malawi	Nsiku, E.	Morissette, L.	74
86	Lake Victoria	1985-1986	Kenya	Moreau, J.	Morissette, L.	78
92	Loyalty Islands, Uvea Atoll	1991-1992	New Caledonia	Bozec, Y.M.	Morissette, L.	81
93	Veracruz, Mandinga lagoon	1982-1983	Mexico	De La Cruz-Aguero, G.	Morissette, L.	82
95	Canary Islands, Maspalomas lagoon	1993-1994	Spain	Moreno, T.	Morissette, L.	84
96	Mauritania EEZ	1987-1987	Mauritania	Ould Taleb Ould Sidi, M.M.	Morissette, L.	85
97	Mauritania EEZ	1998-1998	Mauritania	Ould Taleb Ould Sidi, M.M.	Morissette, L.	85
98	Bank Arguin	1988-1998	Mauritania	Ould Taleb Ould Sidi, M.M.	Morissette, L.	86
99	Middle Atlantic Bight	1995-1998	United States of America	Okey, T.A.	Morissette, L.	87
103	Moorea, Fringing reef of Tiahura	1971-1989	French Polynesia	Arias-González, J.E.	Morissette, L.	89
104	Atlantic coast of Morocco	1985-1986	Morocco	Stanford, R.	Morissette, L.	90
105	Newfoundland	1900-1905	Canada	Pitcher, T.J.	Morissette, L.	95
106	Newfoundland	1985-1987	Canada	Bundy, A.	Morissette, L.	92,93
107	Newfoundland	1985-1987	Canada	Heymans, S.J.J.	Morissette, L.	94,91
108	Newfoundland	1995-1997	Canada	Heymans, S.J.J.	Morissette, L.	91,94
110	Newfoundland	1994-1995	Canada	Pitcher, T.J.	Morissette, L.	91
111	Atlantic Ocean, central	1950-1950	Not affiliated	Vasconcellos, M.	Morissette, L.	27
112	Atlantic Ocean, central	1997-1998	Not affiliated	Vasconcellos, M.	Morissette, L.	27
113	Caete estuary	1970-1990	Brazil	Wolff, M.	Morissette, L.	96
114	North Sea	1970-1970	Not affiliated	Beattie, A.	Morissette, L.	97
115	Benguela, Northern	1956-1956	Namibia	Heymans, S.J.J.	Morissette, L.	101,100
116	Gulf of St Lawrence, Northern	1985-1987	Canada	Morissette, L.	Morissette, L.	103
117	Gulf of St Lawrence, Northern	1994-1996	Canada	Savenkoff, C.	Morissette, L.	104
118	Africa, Northwestern	1987-1987	Not affiliated	Morissette, L.	Morissette, L.	105
119	Orbetello lagoon	1996-1996	Italy	Brando, V.E.	Morissette, L.	106
120	Venice, Pallude della Rosa	1994-1994	Italy	Carrer, S.	Morissette, L.	107
124	Peruvian upwelling ecosystem	1973-1979	Peru	Jarre-Teichmann, A.	Morissette, L.	108
125	Ria Formosa reservoir	1996-1997	Portugal	Gamito, S.	Morissette, L.	109
126	British Columbia, Rivers Inlet	1951-1955	Canada	Watkinson, S.	Morissette, L.	110
127	British Columbia, Rivers Inlet	1991-1995	Canada	Watkinson, S.	Morissette, L.	110
129	San Miguel Bay	1992-1994	Philippines	Bundy, A.	Morissette, L.	112
130	Leyte, San Pedro Bay	1994-1995	Philippines	Campos, W.L.	Morissette, L.	113
131	Gulf of Mexico, Terminos lagoon		Mexico	Rivera-Arriaga, E.	Morissette, L.	114
132	Normandy, Seine estuary	1995-1995	France	Rybarczyk, H.	Morissette, L.	115
133	Senegambian continental shelf	1990-1990	Senegal,Gambia	Samb, B.	Morissette, L.	116,117
134	Pacific Ocean, central	1990-1998	Not affiliated	Kitchell, J.F.	Morissette, L.	118
135	Shelf and slope waters off Sierra Leone	1964-1964	Sierra Leone	Heymans, S.J.J.	Morissette, L.	119
136	Shelf and slope waters off Sierra Leone	1978-1978	Sierra Leone	Heymans, S.J.J.	Morissette, L.	119
137	Shelf and slope waters off Sierra Leone	1990-1990	Sierra Leone	Heymans, S.J.J.	Morissette, L.	119
140	Brazil Bight, Southern	1998-1999	Brazil	Gasalla, M.A.	Morissette, L.	121
141	Brazil Bight, Southern	1998-1999	Brazil	Gasalla, M.A.	Morissette, L.	121
143	South Orkneys, South Georgia	1990-2000	Antarctica	Bredesen, E.L.	Morissette, L.	122

Appendix Table A1. Continued

Number	Location	Period	Country	Author	Facilitator	References
144	Brazil, Southern	1950-1994	Brazil	Vasconcellos, M.	Morissette, L.	123
145	Gulf of St Lawrence, Southern	1985-1987	Canada	Savenkoff, C.	Morissette, L.	124
146	Gulf of St Lawrence, Southern	1994-1996	Canada	Savenkoff, C.	Morissette, L.	124
147	Southwest Coast of India	1994-1996	India	Vivekanandan, E.	Morissette, L.	125
149	Gulf of Mexico, Seagrass in St Marks	1994-1994	United States of America	Christian, R.R.	Morissette, L.	127
151	Subantarctic plateau of New Zealand		New Zealand	Bradford-Grieve, J.M.	Morissette, L.	129
154	Gulf of Mexico, Tampamachoco lagoon		Mexico	Rosado-Solórzano, R.	Morissette, L.	133
155	Terengganu coast	1984-1985	Malaysia	Liew, H.C.	Morissette, L.	134
157	Thames, Sonning	1966-1972	U.K. of Great Britain and Northern Ireland	Mathews, C.P.	Morissette, L.	136
158	Tongoy Bay	1978-1989	Chile	Wolff, M.	Morissette, L.	137
163	Gulf of Salamanca	1997-1997	Colombia	Duarte, L.O.	Morissette, L.	142,141
168	Greenland, Western	1997-1997	Greenland	Pedersen, S.A.	Morissette, L.	145
169	Peninsula Malaysia, Western	1987-1991	Malaysia	Man, A.	Morissette, L.	146
173	Florida shelf, Western	2000-2000	United States of America	Okey, T.A.	Morissette, L.	148
174	West Greenland shrimp grounds	1991-1992	Greenland	Pedersen, S.A.	Morissette, L.	149
175	Bering Sea, Western	1981-1990	Russian Federation	Aydin, K.Y.	Morissette, L.	150
176	English Channel, Western	1994-1994	France,U.K. of Great Britain and Northern Ireland	Araújo, J.N.	Morissette, L.	151,152
179	Sine Saloum estuary, Bolong de Bamboung	2003-2003	Senegal	Colléter, M.	Colléter, M.	155
180	Sine Saloum estuary, Bolong de Bamboung	2006-2008	Senegal	Colléter, M.	Colléter, M.	155
181	Gulf of Alaska	1980-1989	Canada	Pauly, D.	Arreguín-Sánchez, F.	156
182	Bering Sea, Eastern	1955-1960	Not affiliated	Trites, A.W.	Arreguín-Sánchez, F.	15
183	Bering Sea, Eastern	1979-1985	Not affiliated	Trites, A.W.	Arreguín-Sánchez, F.	15
184	Weddel Sea, Eastern	1983-1993	Antarctica	Jarre-Teichmann, A.	Arreguín-Sánchez, F.	7
185	GBR, Northern	1993-1994	Australia	Gribble, N.A.	Arreguín-Sánchez, F.	48,49
186	GBR, Central		Australia	Tudman, P.D.	Arreguín-Sánchez, F.	157
187	GBR, Northern	1993-1994	Australia	Gribble, N.A.	Arreguín-Sánchez, F.	49,48
188	Baltic Sea	1974-1974	Sweden	Harvey, C.J.	Arreguín-Sánchez, F.	11
189	Caete estuary	1970-1990	Brazil	Wolff, M.	Arreguín-Sánchez, F.	96
190	State of Sao Paulo, Broa reservoir		Brazil	Angelini, R.	Arreguín-Sánchez, F.	158
191	Brazil Bight, Southern	1998-1999	Brazil	Gasalla, M.A.	Arreguín-Sánchez, F.	121
192	Brunei Darussalam	1989-1990	Brunei Darussalam	Silvestre, G.	Arreguín-Sánchez, F.;Morissette, L.	17
193	Lake Tanganyika	1980-1983	Burundi	Moreau, J.	Arreguín-Sánchez, F.	77
194	British Columbia, Northern	1750-1750	Canada	Ainsworth, C.H.	Arreguín-Sánchez, F.	159
195	British Columbia, Northern	1900-1900	Canada	Ainsworth, C.H.	Arreguín-Sánchez, F.	159
196	British Columbia, Northern	1950-1950	Canada	Ainsworth, C.H.	Arreguín-Sánchez, F.	159
197	British Columbia, Northern	2000-2000	Canada	Ainsworth, C.H.	Arreguín-Sánchez, F.	159
198	British Columbia, Rivers Inlet	1951-1955	Canada	Watkinson, S.	Arreguín-Sánchez, F.	110
199	British Columbia, Rivers Inlet	1991-1995	Canada	Watkinson, S.	Arreguín-Sánchez, F.	110
200	Lake Ontario	1991-1991	Canada	Halfon, E.	Arreguín-Sánchez, F.	76
201	Newfoundland	1450-1450	Canada	Pitcher, T.J.	Arreguín-Sánchez, F.	95
202	Newfoundland	1900-1905	Canada	Pitcher, T.J.	Arreguín-Sánchez, F.	95
203	Newfoundland	1985-1987	Canada	Pitcher, T.J.	Arreguín-Sánchez, F.	91
204	Newfoundland	1995-1997	Canada	Pitcher, T.J.	Arreguín-Sánchez, F.	91

Appendix Table A1. Continued

Number	Location	Period	Country	Author	Facilitator	References
205	Gulf of St Lawrence, Northern	1985-1987	Canada	Morissette, L.	Arreguín-Sánchez, F.	103
206	Canary Islands, Maspalomas lagoon	1993-1994	Spain	Moreno, T.	Arreguín-Sánchez, F.	84
207	Central Chile	1992-1992	Chile	Neira, S.	Arreguín-Sánchez, F.	28
208	Central Chile	1998-1998	Chile	Neira, S.	Arreguín-Sánchez, F.	28
209	Tongoy Bay	1978-1989	Chile	Wolff, M.	Arreguín-Sánchez, F.	137
210	Bohai Sea	1982-1983	China	Tong, L.	Arreguín-Sánchez, F.	16
211	Gulf of Salamanca	1997-1997	Colombia	Duarte, L.O.	Arreguín-Sánchez, F.	142,141
212	Gulf of Nicoya		Costa Rica	Wolff, M.	Arreguín-Sánchez, F.	53
213	Gulf Dulce	1993-1994	Costa Rica	Wolff, M.	Arreguín-Sánchez, F.	47
214	Thames, Sonning	1966-1972	U.K. of Great Britain and Northern Ireland	Mathews, C.P.	Arreguín-Sánchez, F.	136
215	Lake Awassa	2003-2004	Ethiopia	Fetahi, T.	Arreguín-Sánchez, F.	452,69
216	Bay of Somme	1998-1998	France	Rybarczyk, H.	Arreguín-Sánchez, F.	14
217	Etang de Thau	1980-1989	France	Palomares, M.L.D.	Arreguín-Sánchez, F.	39
218	Gironde estuary	1991-1998	France	Lobry, J.	Arreguín-Sánchez, F.	46,478
219	Massif Central, Lake Aydat	1990-1992	France	Reyes-Marchant, P.	Arreguín-Sánchez, F.	42
220	Normandy, Seine estuary	1995-1995	France	Rybarczyk, H.	Arreguín-Sánchez, F.	115
221	Garonne river, Toulouse	1990-1991	France	Palomares, M.L.D.	Arreguín-Sánchez, F.	160
222	Moorea, Barrier reef of Tiahura	1971-1989	French Polynesia	Arias-González, J.E.	Arreguín-Sánchez, F.	89
223	Moorea, Fringing reef of Tiahura	1971-1989	French Polynesia	Arias-González, J.E.	Arreguín-Sánchez, F.	89
224	Sakumo lagoon	1971-1971	Ghana	Pauly, D.	Arreguín-Sánchez, F.	111
225	West Greenland shrimp grounds	1991-1992	Greenland	Pedersen, S.A.	Arreguín-Sánchez, F.	149
226	Icelandic marine ecosystem (ICES area Va)	1997-1997	Iceland	Mendy, A.N.	Arreguín-Sánchez, F.	61
227	Icelandic shelf	1950-1950	Iceland	Buchary, E.A.	Arreguín-Sánchez, F.	59
228	Icelandic shelf	1997-1997	Iceland	Samb, B.	Arreguín-Sánchez, F.	62
229	Lake Veli	1980-1980	India	Aravindan, C.M.	Arreguín-Sánchez, F.	143
230	Lake Kinneret	1980-1989	Israel	Walline, P.D.	Arreguín-Sánchez, F.	73
231	Lagoon of Venice	1994-1994	Italy	Carrer, S.	Arreguín-Sánchez, F.	66
232	Orbetello lagoon	1996-1996	Italy	Brando, V.E.	Arreguín-Sánchez, F.	106
233	Lake Turkana	1973-1973	Kenya	Kolding, J.	Arreguín-Sánchez, F.	138
234	Lake Turkana	1987-1987	Kenya	Kolding, J.	Arreguín-Sánchez, F.	138
235	Lake Victoria	1971-1972	Kenya	Moreau, J.	Arreguín-Sánchez, F.	79
236	Lake Malawi	1979-1981	Malawi	Degnbol, P.	Arreguín-Sánchez, F.	75
237	Terengganu coast	1984-1985	Malaysia	Liew, H.C.	Arreguín-Sánchez, F.	134
238	Gulf of California, La Paz Bay	1992-1998	Mexico	Arreguín-Sánchez, F.	Arreguín-Sánchez, F.	161
239	Gulf of California, Central	1978-1979	Mexico	Arreguín-Sánchez, F.	Arreguín-Sánchez, F.	30,29
240	Gulf of Mexico, Sonda de Campeche	1988-1994	Mexico	Manickchand-Heileman, S.	Arreguín-Sánchez, F.	21,120
241	Huizache-Caimanero lagoon	1984-1986	Mexico	Zetina-Rejón, M.J.	Arreguín-Sánchez, F.	58
242	Alto Golfo de California		Mexico	Morales-Zárate, M.V.	Arreguín-Sánchez, F.	6
243	Gulf of Mexico, Terminos lagoon		Mexico	Manickchand-Heileman, S.	Arreguín-Sánchez, F.	135
244	Veracruz, Mandinga lagoon	1982-1983	Mexico	De La Cruz-Aguero, G.	Arreguín-Sánchez, F.	82
245	Gulf of Mexico, Tampamachoco lagoon		Mexico	Rosado-Solórzano, R.	Arreguín-Sánchez, F.	133
246	Celestun lagoon		Mexico	Chávez, E.A.	Arreguín-Sánchez, F.	26
247	Celestun lagoon	1986-1986	Mexico	Vega-Cendejas, M.E.	Arreguín-Sánchez, F.	25

Appendix Table A1. Continued

Number	Location	Period	Country	Author	Facilitator	References
248	Maputo Bay	1972-1985	Mozambique	De Paula E Silva, R.	Arreguín-Sánchez, F.	83
249	Loyalty Islands, Uvea Atoll	1991-1992	New Caledonia	Bozec, Y.M.	Arreguín-Sánchez, F.	81
250	Subantartic Plateau New Zealand		New Zealand	Bradford-Grieve, J.M.	Arreguín-Sánchez, F.	129
251	North Sea	1981-1981	Not affiliated	Christensen, V.	Arreguín-Sánchez, F.	98
252	Aleutian Islands	1963-1963	United States of America	Guénette, S.	Arreguín-Sánchez, F.;Morissette, L.	5,4
253	Pacific Ocean, central	1990-1998	Not affiliated	Cox, S.P.	Arreguín-Sánchez, F.	31
254	Pacific Ocean, central	1990-1998	Not affiliated	Kitchell, J.F.	Arreguín-Sánchez, F.	118
255	Manila, Laguna de Bay	1820-1820	Philippines	Delos Reyes, M.R.	Arreguín-Sánchez, F.	68,67
256	Manila, Laguna de Bay	1920-1920	Philippines	Delos Reyes, M.R.	Arreguín-Sánchez, F.	68,67
257	Manila, Laguna de Bay	1950-1950	Philippines	Delos Reyes, M.R.	Arreguín-Sánchez, F.	67,68
258	Manila, Laguna de Bay	1968-1968	Philippines	Delos Reyes, M.R.	Arreguín-Sánchez, F.	68,67
259	Manila, Laguna de Bay	1980-1980	Philippines	Delos Reyes, M.R.	Arreguín-Sánchez, F.	67,68
260	Manila, Laguna de Bay	1990-1990	Philippines	Delos Reyes, M.R.	Arreguín-Sánchez, F.	67,68
261	Santiago Island, Bolinao coral reef	1990-1990	Philippines	Aliño, P.M.	Arreguín-Sánchez, F.	162
262	South Orkneys, South Georgia	1990-2000	Antarctica	Bredesen, E.L.	Arreguín-Sánchez, F.	122
263	Benguela, Northern		Namibia	Heymans, S.J.J.	Arreguín-Sánchez, F.	102
264	Cantabrian Sea	1994-1994	Spain	Sánchez, F.	Arreguín-Sánchez, F.	23
265	Parakrama Samudra reservoir	1970-1980	Sri Lanka	Moreau, J.	Arreguín-Sánchez, F.	126
266	Kuosheng Bay	1998-2001	China	Lin, H.-J.	Arreguín-Sánchez, F.	64
267	Lagoon Chiku	1997-1997	China	Lin, H.-J.	Arreguín-Sánchez, F.	65
268	Gulf of Paria		Trinidad and Tobago,Venezuela	Manickchand-Heileman, S.	Arreguín-Sánchez, F.	163
269	Looe Key	1980-1989	United States of America	McCormick Venier, J.	Arreguín-Sánchez, F.	80
270	Lake George	1970-1979	Uganda	Moreau, J.	Arreguín-Sánchez, F.	71
271	English Channel	1973-1973	U.K. of Great Britain and Northern Ireland	Stanford, R.	Arreguín-Sánchez, F.	38
272	English Channel	1995-1995	U.K. of Great Britain and Northern Ireland	Stanford, R.	Arreguín-Sánchez, F.	38
273	Monterey Bay	1989-1991	United States of America	Olivieri, R.A.	Arreguín-Sánchez, F.	88
274	Gulf of Mexico, Seagrass in St Marks	1994-1994	United States of America	Christian, R.R.	Arreguín-Sánchez, F.	127
275	Florida shelf, Western	2000-2000	United States of America	Okey, T.A.	Arreguín-Sánchez, F.	148
276	Bering Sea, Eastern	1979-1985	United States of America	Aydin, K.Y.	Arreguín-Sánchez, F.	150
277	Bering Sea, Western	1981-1990	Russian Federation	Aydin, K.Y.	Arreguín-Sánchez, F.	150
279	Prince William Sound	1994-1996	United States of America	Okey, T.A.	Arreguín-Sánchez, F.;Morissette, L.	1,2
280	Prince William Sound	1980-1989	United States of America	Dalsgaard, J.	Arreguín-Sánchez, F.	3
282	Venezuela shelf	1988-1988	Venezuela	Mendoza, J.J.	Arreguín-Sánchez, F.	144
283	Lake Chad	1970-1972	Chad	Palomares, M.L.D.	Arreguín-Sánchez, F.	70
284	Lake Kariba	1980-1980	Zimbabwe	Machena, C.	Arreguín-Sánchez, F.	72
285	San Miguel Bay	1992-1994	Philippines	Bundy, A.	Arreguín-Sánchez, F.	112
286	Ria Formosa reservoir	1996-1997	Portugal	Gamito, S.	Arreguín-Sánchez, F.	109
287	Mexican Caribbean	1990-1990	Mexico	Alvarez-Hernández, J.H.	Arreguín-Sánchez, F.	33
288	Celestun lagoon	1992-1994	Mexico	Vega-Cendejas, M.E.	Arreguín-Sánchez, F.	25
289	Gulf of Mexico, Terminos lagoon		Mexico	Rivera-Arriaga, E.	Arreguín-Sánchez, F.	114
290	Bahia La Ascencion	1989-1995	Mexico	Vidal, L.	Arreguín-Sánchez, F.	9
291	Campeche Sound	1988-1994	Mexico	Zetina-Rejón, M.J.	Arreguín-Sánchez, F.	19,20,21,22

Appendix Table A1. Continued

Number	Location	Period	Country	Author	Facilitator	References
292	Brazil, Southern	1950-1994	Brazil	Vasconcellos, M.	Arreguín-Sánchez, F.	123
293	North Sea	1881-1890	Not affiliated	Mackinson, S.	Arreguín-Sánchez, F.	99
294	Barents Sea	1990-1990	Russian Federation	Blanchard, J.L.	Arreguín-Sánchez, F.	57
295	Barents Sea	1995-1995	Russian Federation	Blanchard, J.L.	Arreguín-Sánchez, F.	57
296	West Scotland	2000-2004	U.K. of Great Britain and Northern Ireland	Haggan, N.	Arreguín-Sánchez, F.	164
297	English Channel, Western	1994-1994	France,U.K. of Great Britain and Northern Ireland	Araújo, J.N.	Arreguín-Sánchez, F.	151,152
298	Paraná River Floodplain	1992-1995	Brazil	Angelini, R.	Arreguín-Sánchez, F.	140
299	Venice, Pallude della Rosa	1994-1994	Italy	Carrer, S.	Arreguín-Sánchez, F.	107
300	Bay of Bengal	1984-1986	Bangladesh	Mustafa, M.G.	Arreguín-Sánchez, F.	12
301	Southwest coast of India	1994-1996	India	Vivekanandan, E.	Arreguín-Sánchez, F.	125
302	North Coast of Central Java	1979-1979	Indonesia	Nurhakim, S.	Arreguín-Sánchez, F.	165
303	Peninsula Malaysia, Western	1987-1991	Malaysia	Man, A.	Arreguín-Sánchez, F.	146
304	Sarawak, Western	1972-1972	Malaysia	Garces, L.R.	Arreguín-Sánchez, F.	147
305	Sabah, Western	1972-1972	Malaysia	Garces, L.R.	Arreguín-Sánchez, F.	147
306	Leyte, San Pedro Bay	1994-1995	Philippines	Campos, W.L.	Arreguín-Sánchez, F.	113
307	Jalisco and Colima	1995-1996	Mexico	Galván-Piña, V.H.	Arreguín-Sánchez, F.	63
308	Lake Kinneret	1980-1989	Israel	Walline, P.D.	Arreguín-Sánchez, F.	73
309	Lake Tanganyika	1974-1976	Burundi	Moreau, J.	Arreguín-Sánchez, F.	77
310	Lake Tanganyika	1980-1983	Burundi	Moreau, J.	Arreguín-Sánchez, F.	77
311	Peruvian upwelling ecosystem	1953-1959	Peru	Jarre-Teichmann, A.	Arreguín-Sánchez, F.	108
312	Peruvian upwelling ecosystem	1960-1969	Peru	Jarre-Teichmann, A.	Arreguín-Sánchez, F.	108
314	Gulf of Mexico	1980-1989	Mexico	Browder, J.A.	Arreguín-Sánchez, F.	52
315	Lake George	1970-1979	Uganda	Moreau, J.	Arreguín-Sánchez, F.	71
316	Lake Kariba	1980-1980	Zimbabwe	Machena, C.	Arreguín-Sánchez, F.	72
317	Gulf of Mexico, Southwestern	1970-1979	Mexico	Arreguín-Sánchez, F.	Arreguín-Sánchez, F.	153
318	Gulf of Mexico, Tamiahua	1980-1989	Mexico	Abarca-Arenas, L.G.	Arreguín-Sánchez, F.	130
320	Gulf of Mexico, Yucatan	1987-1987	Mexico	Arreguín-Sánchez, F.	Arreguín-Sánchez, F.	154
321	Lake Victoria	1971-1972	Kenya	Moreau, J.	Arreguín-Sánchez, F.	79
322	Lake Victoria	1985-1986	Kenya	Moreau, J.	Arreguín-Sánchez, F.	79
323	Campeche Bank	1985-1990	Mexico	Vega-Cendejas, M.E.	Arreguín-Sánchez, F.	18
324	British Virgin Islands	1960-1999	British Virgin Islands	Opitz, S.	Arreguín-Sánchez, F.	139
325	Gulf of California, Southern	1994-1997	Mexico	Salcido-Guavara, L.A.	Arreguín-Sánchez, F.	166
327	Brazil, Southern	1950-1994	Brazil	Vasconcellos, M.	Arreguín-Sánchez, F.	123
328	Strait of Georgia	1950-1950	Canada	Martell, S.J.D.	Arreguín-Sánchez, F.	128
329	Bali Strait	1990-1999	Indonesia	Buchary, E.A.	Arreguín-Sánchez, F.	10
330	Lake Malawi	1977-1996	Malawi	Nsiku, E.	Arreguín-Sánchez, F.	74
331	Lake Victoria	1985-1986	Kenya	Moreau, J.	Arreguín-Sánchez, F.	78
332	Barents Sea	1990-1990	Russian Federation	Blanchard, J.L.	Arreguín-Sánchez, F.	57
333	Barents Sea	1995-1995	Russian Federation	Blanchard, J.L.	Arreguín-Sánchez, F.	57
335	Bay of Biscay	1994-2005	France	Lassalle, G.	Lassalle, G.	171,170
400	Raja Ampat	1990-1990	Indonesia	Ainsworth, C.H.	Christensen, V.	301,300
401	Raja Ampat	2005-2005	Indonesia	Ainsworth, C.H.	Christensen, V.	509,301,300
402	Bonifacio Strait Natural Reserve, Corsica	2000-2001	France	Albouy, C.	Albouy, C.	304

Appendix Table A1. Continued

Number	Location	Period	Country	Author	Facilitator	References
403	Western English Channel	1993-1995	France,U.K. of Great Britain and Northern Ireland	Araújo, J.N.	Christensen, V.	151
404	Celestun lagoon		Mexico	Arreguín-Sánchez, F.	Christensen, V.	153
405	Australian North West Shelf	1986-1991	Australia	Bulman, C.	Christensen, V.	308
406	East Bass Strait	1994-1994	Australia	Bulman, C.	Christensen, V.	310
407	Tasmanian Seamounts Marine Reserve	1992-1996	Australia	Bulman, C.	Christensen, V.	309
408	China Sea, Beibu Gulf	1997-1999	China,Viet Nam	Chen, Z.	Christensen, V.	439,313
409	China Sea, Beibu Gulf	1997-1999	China,Viet Nam	Chen, Z.	Christensen, V.	439,312
410	N South China Sea	1970-1970	China,Viet Nam	Cheung, W.W.L.	Christensen, V.	314
411	Falkland Islands (Islas Malvinas)	1990-1990	Falkland Islands (Malvinas)	Cheung, W.W.L.	Christensen, V.	315
412	Gulf of Thailand	1963-1963	Thailand	Christensen, V.	Christensen, V.	56
413	North Sea		Not affiliated	Christensen, V.	Christensen, V.	317
414	West coast of Peninsular Malaysia	1970-1970	Malaysia	Christensen, V.	Christensen, V.	318
415	SW coast of Vietnam	1993-1995	Viet Nam	Christensen, V.	Christensen, V.	318
417	Baja California Sur	1970-1970	Mexico	Cisneros-Montemayor, A.M.	Christensen, V.	320,441
418	Catalan Sea, Southern	1994-1994	Spain	Coll, M.	Christensen, V.	321
419	Northern and Central Adriatic Sea	1990-1990	Italy,Slovenia,Croatia	Coll, M.	Christensen, V.	322
420	Catalan Sea, Southern	1978-1980	Spain	Coll, M.	Christensen, V.	323
421	NC Adriatic Sea	1975-1975	Italy,Slovenia,Croatia	Coll, M.	Christensen, V.	324,453
422	Antarctic Peninsula		Antarctica	Cornejo-Donoso, J.	Christensen, V.	325
423	La Guajira, N Colombian coast	1995-2000	Colombia	Criales-Hernández, M.I.	Christensen, V.	521,443,326
424	Black Sea	1960-1960	Not affiliated	Daskalov, G.M.	Christensen, V.	327
425	Gulf of California, La Paz Bay + La Ventana Bay	1990-2001	Mexico	Díaz-Uribe, J.G.	Christensen, V.	329
426	Norwegian and Barents Sea	1997-1997	Norway,Russian Federation	Dommasnes, A.	Christensen, V.	330
427	Antarctic Peninsula		Antarctica	Erfan, A.	Christensen, V.	331
428	Central North Pacific		Not affiliated	Essington, T.E.	Christensen, V.	332
429	Sorfjord and Ullsfjord, Troms County	1993-1996	Norway	Falk-Petersen, J.	Christensen, V.	333
430	East Brazil Large Marine Ecosystem	1970-1970	Brazil	Freire, K.M.	Christensen, V.	336
431	Port Phillip Bay	1994-1995	Australia	Fulton, E.	Christensen, V.	337,520
433	Black Sea	1955-1965	Not affiliated	Gucu, A.	Christensen, V.	341
434	Black Sea	1980-1980	Not affiliated	Gucu, A.	Christensen, V.	341
435	Black Sea	1990-1990	Not affiliated	Gucu, A.	Christensen, V.	341
436	WC Tropical Pacific Ocean	1990-2001	Not affiliated	Godinot, O.	Christensen, V.	339
437	Lingayen Gulf, NW Philippine coast		Philippines	Guarin, F.Y.	Christensen, V.	376,340
438	SE Alaska	1963-1963	United States of America	Guénette, S.	Christensen, V.	4
439	Peruvian coast		Peru	Guénette, S.	Christensen, V.	343
440	Guinean coast	2004-2004	Guinea	Guénette, S.	Christensen, V.	338
441	Sri Lanka coast	2000-2000	Sri Lanka	Haputhantri, S.	Christensen, V.	344
442	WC Aleutian Islands	1963-1963	United States of America	Heymans, S.J.J.	Christensen, V.	346
443	Rockall Trough and its seamounts, Scotland	1974-1974	U.K. of Great Britain and Northern Ireland	Heymans, S.J.J.	Christensen, V.	465,347
444	Gulf of Maine and Georges Banks	1977-1986	United States of America	Heymans, S.J.J.	Christensen, V.	345
445	East China Sea	1997-2000	China,Japan	Jiang, H.	Christensen, V.	348
446	Hudson Bay	1970-1970	Canada	Hoover, C.	Christensen, V.	351,350,462
447	Antarctica		Antarctica	Hoover, C.	Christensen, V.	349

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Number	Location	Period	Country	Author	Facilitator	References
448	Irish Sea	1973-1973	Ireland,U.K. of Great Britain and Northern Ireland	Lees, K.	Christensen, V.	354
449	Mont St Michel Bay	2003-2003	France	Arbach Leloup, F.	Christensen, V.	355
450	Gulf of California, Northern	1990-2000	Mexico	Lercari, D.	Christensen, V.	356
451	East China Sea	2000-2000	China,Republic of Korea,Japan	Li, Y.	Christensen, V.	357
452	Miramare Natural Marine Reserve, Gulf of Trieste, Adriatic Sea	2000-2003	Italy	Libralato, S.	Christensen, V.	358
453	Tapong Bay, SW Taiwan	1999-2001	China	Lin, H.-J.	Christensen, V.	359
454	Nanwan Bay, Kenting National Park, S Taiwan	2001-2003	China	Liu, P.-J.	Christensen, V.	360
455	Aranci Bay, NE Sardinian coast	2004-2007	Italy	Díaz-López, B.	Christensen, V.	328
457	North Sea	1991-1991	Not affiliated	Mackinson, S.	Christensen, V.	362
458	Strait of Georgia		Canada	Mackinson, S.	Christensen, V.	361
459	Lesser Antilles Pelagic Ecosystem	2001-2005	Not affiliated	Mohammed, E.	Christensen, V.	364
460	Grenada and the Grenadines	1999-1999	Grenada	Mohammed, E.	Christensen, V.	363
461	West coast of Scotland	2000-2004	U.K. of Great Britain and Northern Ireland	Morissette, L.	Christensen, V.	367
462	Gulf of St Lawrence, Northern	1995-1995	Canada	Morissette, L.	Christensen, V.	366
463	Gulf of St Lawrence, Northern	1985-1987	Canada	Morissette, L.	Christensen, V.	365,366
464	Baltic Sea, Schlei Fjord		Germany	Nauen, C.	Christensen, V.	368,319
465	Albatross Bay, Gulf of Carpentaria	1986-1992	Australia	Okey, T.A.	Christensen, V.	370
466	Gulf of Carpentaria	1990-1990	Australia	Okey, T.A.	Christensen, V.	371
467	South Atlantic Bight	1995-1998	United States of America	Okey, T.A.	Christensen, V.	372
468	Black Sea		Not affiliated	Orek, H.	Christensen, V.	373
469	South China Sea	1980-1980	Not affiliated	Pauly, D.	Christensen, V.	376
470	Southern BC Shelf		Canada	Pauly, D.	Christensen, V.	375
471	Mejillones Peninsula, Antofagasta	1999-2002	Chile	Pavés, H.J.	Christensen, V.	377
472	Te Tapuwae o Rongokako Marine Reserve	2000-2003	New Zealand	Pinkerton, M.	Christensen, V.	378
473	Bay of Calvi		France	Pinnegar, J.K.	Christensen, V.	379
474	NE Ionian Sea	1964-1964	Greece	Piroddi, C.	Christensen, V.	380
475	NE Ionian Sea	2007-2007	Greece	Piroddi, C.	Christensen, V.	381
476	French Frigate Shoals, NW Hawaiian Archipelago		United States of America	Polovina, J.J.	Christensen, V.	382
477	Strait of Georgia	1950-1950	Canada	Preikshot, D.B.	Christensen, V.	383
478	BC Shelf	1950-1950	Canada	Preikshot, D.B.	Christensen, V.	383
479	NE Pacific Ocean	1950-1950	Canada,United States of America	Preikshot, D.B.	Christensen, V.	383
480	Kerguelen Islands	1987-1988	French Southern and Antarctic Territories	Pruvost, P.	Christensen, V.	384
481	Sao Sebastiao Channel		Brazil	Rocha, G.R.	Christensen, V.	385
482	C Gulf of California	1980-1980	Mexico	Rosas-Luis, R.	Christensen, V.	386
483	C Gulf of California	2002-2002	Mexico	Rosas-Luis, R.	Christensen, V.	386
484	Oregon Coast, inner shelf	2000-2002	United States of America	Ruzicka, J.J.	Christensen, V.	387
485	S Benguela	1978-1978	South Africa	Shannon, L.	Christensen, V.	522,390,389
486	Cape Verde Archipelago	1981-1985	Cape Verde	Stobberup, K.A.	Christensen, V.	391
487	Northern Humboldt Current Ecosystem	1995-1996	Peru	Tam, J.	Christensen, V.	392
488	Northern Humboldt Current Ecosystem	1997-1998	Peru	Tam, J.	Christensen, V.	392
489	Sechura Bay	1996-1996	Peru	Taylor, M.H.	Christensen, V.	393
490	Independence Bay	1996-1996	Peru	Taylor, M.H.	Christensen, V.	394
491	Gulf of Riga	1990-1990	Lithuania	Tomczak, M.T.	Christensen, V.	396

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Number	Location	Period	Country	Author	Facilitator	References
492	Lithuanian Coast	1990-1990	Lithuania	Tomczak, M.T.	Christensen, V.	396
493	Parnu Bay	1990-1990	Estonia	Tomczak, M.T.	Christensen, V.	396
494	Puck Bay	1990-1990	Poland	Tomczak, M.T.	Christensen, V.	396
495	N Aegean Sea	2003-2006	Greece,Turkey	Tsagarakis, K.	Christensen, V.	397
496	Eritrean Red Sea coast	1998-1998	Eritrea	Tsehaye, I.	Christensen, V.	398
497	Port-Cros Archipelago	1998-2008	France	Valls, A.	Christensen, V.	399
498	S Brazilian Shelf		Brazil	Velasco, G.	Christensen, V.	402,400,401
499	Kaloko-Honokohau, Honolulu	2005-2005	United States of America	Wabnitz, C.C.	Christensen, V.	403,516
500	N Benguela	1600-1600	Angola	Watermeyer, K.	Christensen, V.	406
501	N Benguela	1900-1900	Angola	Watermeyer, K.	Christensen, V.	406
502	N Benguela	1967-1967	Angola	Watermeyer, K.	Christensen, V.	406
503	N Benguela	1990-1990	Angola	Watermeyer, K.	Christensen, V.	406
504	S Benguela	1600-1600	Namibia,South Africa	Watermeyer, K.	Christensen, V.	407
505	S Benguela	1900-1900	Namibia,South Africa	Watermeyer, K.	Christensen, V.	407
506	S Benguela	1960-1960	Namibia,South Africa	Watermeyer, K.	Christensen, V.	407
507	Gulf of Maine	1980-1980	United States of America	Zhang, Y.	Christensen, V.	409
508	Gulf of Maine	1990-1990	United States of America	Zhang, Y.	Christensen, V.	409
509	Congo	2005-2007	Democratic Republic of the Congo	Bongu, M.M.	Christensen, V.	307
510	Sao Tome and Principe	1999-2006	Sao Tome and Principe	Castro, A.	Christensen, V.	311
511	Benin	2005-2005	Benin	Fiogbe, E.D.	Christensen, V.	335
512	Sierra Leone	2006-2007	Sierra Leone	Kargbo, V.H.	Christensen, V.	352
513	Liberia	1995-2007	Liberia	Kay, D.W.	Christensen, V.	353
514	Gabon	2005-2005	Gabon	Ogandagas, C.	Christensen, V.	369
515	Ghana	2005-2008	Ghana	Osei, S.V.	Christensen, V.	374
516	Togo	1990-2009	Togo	Sedzro, K.M.	Christensen, V.	388
517	Nigeria	1995-2007	Nigeria	Williams, A.B.	Christensen, V.	408
518	Grand Banks of Newfoundland	1985-1985	Canada	Ainsworth, C.H.	Christensen, V.	303
519	Northern Californian Current		United States of America	Walters, C.J.	Christensen, V.	405
520	Gulf of Mexico		Mexico,United States of America	Walters, C.J.	Christensen, V.	404,405
521	Northern Californian Current		United States of America	Field, J.C.	Christensen, V.	302,334
522	Catalan Sea	2009-2009	Spain	Tecchio, S.	Christensen, V.	395
523	Angola	1986-1986	Angola	Angelini, R.	Only publication	424
524	Parangipettai, southeast coast of India	2004-2005	India	Antony, P.J.	Only publication	425
525	NAFO Division 4X (western Scotian Shelf + Bay of Fundy)	1970-1970	Canada	Araújo, J.N.	Only publication	427,437
526	Western English Channel	1973-1973	France,U.K. of Great Britain and Northern Ireland	Araújo, J.N.	Only publication	428
527	Bay of Fundy	1995-2000	Canada	Araújo, J.N.	Only publication	426
528	NAFO Division 4X (western Scotian Shelf + Bay of Fundy)	1995-2000	Canada	Araújo, J.N.	Only publication	426
529	Western Scotian Shelf	1995-2000	Canada	Araújo, J.N.	Only publication	426
530	Alacranes Reef, Campeche Bank		Mexico	Arias-González, J.E.	Only publication	430
531	Boca Paila, N Sian Ka'an Biosphere Reserve		Mexico	Arias-González, J.E.	Only publication	429
532	Mahahual		Mexico	Arias-González, J.E.	Only publication	429
533	Tampalam, S Sian Ka'an Biosphere Reserve		Mexico	Arias-González, J.E.	Only publication	429

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Number	Location	Period	Country	Author	Facilitator	References
534	Gulf of Alaska		United States of America	Aydin, K.Y.	Only publication	431,455,456
535	Gulf of Lions	2000-2009	France	Bănaru, D.	Only publication	432
536	Northern Adriatic Sea	1996-1998	Italy,Slovenia,Croatia	Barausse, A.	Only publication	433
537	Santa Pola Bay	2001-2007	Spain	Bayle-Sempere, J.T.	Only publication	434
538	Java Sea	1974-1979	Indonesia	Buchary, E.A.	Only publication	436
539	Sea of Okhotsk	1980-1980	Russian Federation,Japan	Chaikina, N.	Only publication	438
540	East China Sea	2000-2000	China	Cheng, J.	Only publication	440
541	South Catalan Sea, Balearic Sea	1978-1978	Spain	Coll, M.	Only publication	442
542	Breton Sound Estuary	1986-1990	United States of America	de Mutsert, K.	Only publication	444,445
543	Northern and Central Gulf of California	1980-1980	Mexico	Díaz-Uribe, J.G.	Only publication	446
544	Lake Victoria	1977-1977	United Republic of Tanzania	Downing, A.S.	Only publication	447
545	Lake Victoria	1987-1987	United Republic of Tanzania	Downing, A.S.	Only publication	447
546	Lake Victoria	2005-2005	United Republic of Tanzania	Downing, A.S.	Only publication	447
547	Pearl River Estuary	1981-1981	China	Duan, L.J.	Only publication	449
548	Pearl River Delta	1997-1999	China	Duan, L.J.	Only publication	448
549	Pearl River Estuary	1998-1998	China	Duan, L.J.	Only publication	449
550	West coast of Vancouver Island		Canada	Espinosa-Romero, M.J.	Only publication	450
551	Kelavarapalli reservoir, Hosur Taluk		India	Feroz Khan, M.	Only publication	451
552	Delaware Bay	1966-1966	United States of America	Frisk, M.G.	Only publication	454
553	Eastern Great Australian Bight	1991-1991	Australia	Goldsworthy, S.D.	Only publication	457
554	Eastern Tuna and Billfish Fishery	2004-2007	Australia	Griffiths, S.P.	Only publication	458,459
555	Namyang reservoir	2007-2007	Republic of Korea	Han, J.-H.	Only publication	460
556	Puget Sound Central Basin	2000-2000	United States of America	Harvey, C.J.	Only publication	461
557	Antarctic Peninsula	1978-1978	Antarctica	Hoover, C.	Only publication	463
558	Lake Toya	1992-2004	Japan	Hossain, M.M.	Only publication	464
559	Lake Gehu	1986-1989	China	Jia, P.	Only publication	466
560	East China Sea	1997-2000	China,Republic of Korea,Japan	Jiang, H.	Only publication	348,468
561	SE Australian continental shelf	1915-1915	Australia	Klaer, N.L.	Only publication	469
562	SE Australian continental shelf	1961-1961	Australia	Klaer, N.L.	Only publication	469
563	Lake Huron	1981-1981	Canada,United States of America	Langseth, B.J.	Only publication	470
564	Lake Michigan	1987-1987	Canada,United States of America	Langseth, B.J.	Only publication	470
565	Bay of Biscay	1994-2005	France,Spain	Lassalle, G.	Only publication	170,171
566	Eastern Bering Sea	1979-1985	United States of America	Lee, S.I.	Only publication	473
567	Arachania, sandy beach		Uruguay	Lercari, D.	Only publication	474
568	Barra del Chuy, sandy beach		Uruguay	Lercari, D.	Only publication	474
569	Strait of Georgia	2005-2005	Canada	Li, L.	Only publication	476
570	Northern Central Adriatic Sea	1990-1990	Italy,Slovenia,Croatia	Libralato, S.	Only publication	358
571	Miramare Natural Marine Reserve, Gulf of Trieste	2000-2003	Italy	Libralato, S.	Only publication	358
572	Lake Qiandaohu	2004-2004	China	Liu, Q.-G.	Only publication	477
573	Laguna de Rocha	2003-2006	Uruguay	Milessi, A.C.	Only publication	480
574	Arabian Sea	1999-2001	India	Mohamed, K.S.	Only publication	481
575	Lancaster Sound region	1980-1980	Canada	Mohammed, E.	Only publication	483
576	Bahia Tortugas, Baja California	2006-2008	Mexico	Morales-Zárate, M.V.	Only publication	484

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Number	Location	Period	Country	Author	Facilitator	References
577	Lake Victoria		Kenya	Moreau, J.	Only publication	78
578	Greek Ionian Sea	1998-2006	Greece	Moutopoulos, D.K.	Only publication	486
579	Southeastern Brazilian Bight	2001-2001	Brazil	Nascimento, M.C.	Only publication	487
580	Southern Humboldt upwelling system off central Chile	1970-1970	Chile	Neira, S.	Only publication	488
581	Baltic Sea		Not affiliated	Niiranen, S.	Only publication	489
582	Great South Bay, Long Island	1880-1880	United States of America	Nuttall, M.A.	Only publication	490
583	Great South Bay, Long Island	1930-1930	United States of America	Nuttall, M.A.	Only publication	490
584	Great South Bay, Long Island	1980-1980	United States of America	Nuttall, M.A.	Only publication	490
585	Great South Bay, Long Island	2000-2000	United States of America	Nuttall, M.A.	Only publication	490
586	Barren Ground habitat, Mejillones Peninsula	2004-2007	Chile	Ortiz, M.	Only publication	492
587	Lessonia trabeculata habitat, Mejillones Peninsula	2004-2007	Chile	Ortiz, M.	Only publication	492
588	Macrocystis integrifolia habitat, Mejillones Peninsula	2004-2007	Chile	Ortiz, M.	Only publication	492
590	La Rinconada Marine Reserve, Antofagasta Bay		Chile	Ortiz, M.	Only publication	493
591	Puerto Aldea, southern Tongoy Bay		Chile	Ortiz, M.	Only publication	496,495
592	Mud habitat, Puerto Aldea, southern Tongoy Bay		Chile	Ortiz, M.	Only publication	491,495
593	Sand habitat, Puerto Aldea, southern Tongoy Bay		Chile	Ortiz, M.	Only publication	495,496
594	Sand-gravel habitat, Puerto Aldea, southern Tongoy Bay		Chile	Ortiz, M.	Only publication	495,496
595	Seagrass habitat, Puerto Aldea, southern Tongoy Bay		Chile	Ortiz, M.	Only publication	495,496
596	Wyra reservoir	1995-1996	India	Panikkar, P.	Only publication	497
597	Wyra reservoir	2002-2003	India	Panikkar, P.	Only publication	497
598	Eutrophic area, south arm of Mondego Estuary	1991-1997	Portugal	Patricio, J.	Only publication	498
599	Intermediate area, south arm of Mondego Estuary	1991-1997	Portugal	Patricio, J.	Only publication	498
600	Meadows area, south arm of Mondego Estuary	1991-1997	Portugal	Patricio, J.	Only publication	498
601	Gulf of Mexico		Mexico,United States of America,Cuba	Pauly, D.	Only publication	499
602	Sørfjord	1993-1996	Norway	Pedersen, T.	Only publication	500
603	Discovery Bay	1999-2001	Jamaica	Persad, G.	Only publication	501
604	Mekong Delta	2002-2004	Viet Nam	Phong, L.T.	Only publication	502
605	Bolivar Channel, Galapagos	2004-2008	Ecuador	Ruiz, D.J.	Only publication	518,503
606	Northern California Current	2003-2007	United States of America	Ruzicka, J.J.	Only publication	504
607	Gwaii Haanas National Marine Conservation Area, Queen Charlotte Islands		Canada	Salomon, A.K.	Only publication	505
608	Baltic Proper, Baltic Sea	1974-1974	Not affiliated	Tomczak, M.T.	Only publication	506
609	Lake Ayamé	1995-1996	Côte d'Ivoire	Traore, A.	Only publication	507
610	Bay of Bengal	1991-2007	Bangladesh	Ullah, M.H.	Only publication	508
611	Ebrie lagoon	1980-1981	Côte d'Ivoire	Villanueva, M.C.S.	Only publication	511,514
612	Sine Saloum Estuary	1991-1992	Senegal	Villanueva, M.C.S.	Only publication	511,512
613	Bagré reservoir	1997-1998	Burkina Faso	Villanueva, M.C.S.	Only publication	513
614	Gambie Estuary	2000-2002	Gambia	Villanueva, M.C.S.	Only publication	511
615	Lake Nokoue	2000-2001	Benin	Villanueva, M.C.S.	Only publication	511,514
616	Lake Kivu	2002-2003	Democratic Republic of the Congo,Rwanda	Villanueva, M.C.S.	Only publication	515
617	Northern Hangzhou Bay	2006-2007	China	Xu, S.	Only publication	519
618	La Rinconada Marine Reserve SS1, Antofagasta Bay	2005-2007	Chile	Ortiz, M.	Only publication	494

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Number	Location	Period	Country	Author	Facilitator	References
619	La Rinconada Marine Reserve SS2, Antofagasta Bay	2005-2007	Chile	Ortiz, M.	Only publication	494
620	N South China Sea	2000-2000	China,Viet Nam	Cheung, W.W.L.	Only publication	314
622	S Gulf of St Lawrence	1995-1995	Canada	Morissette, L.	Only publication	366
623	S Gulf of St Lawrence	1985-1985	Canada	Morissette, L.	Only publication	366
624	Sao Sebastiao Inner Shelf		Brazil	Rocha, G.R.	Only publication	385
625	Independence Bay	1998-1998	Peru	Taylor, M.H.	Only publication	394
626	Curonian Lagoon, Baltic Sea	1990-1990	Lithuania	Tomczak, M.T.	Only publication	396
628	North Sea	1973-1973	Not affiliated	Mackinson, S.	Only publication	362
629	Pearl River Estuary	1981-1981	China	Wang, Y.	Only publication	449,517
630	Arabian Sea, SW India	1999-2001	India	Mohamed, K.S.	Only publication	481,482
631	Gulf of Mexico		Mexico,United States of America,Cuba	Vidal, L.	Only publication	510,499
725	Guinea continental shelf	2004-2004	Guinea	Gascuel, D.	Gascuel, D.	523
726	Guinea continental shelf	1985-1985	Guinea	Gascuel, D.	Gascuel, D.	523

Appendix Table A2. List of the associated references.

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Angola	501, 503, 500, 502, 523
Antarctica	557, 184, 262, 422, 427, 143, 447
Australia	407, 553, 561, 554, 185, 431, 187, 562, 465, 406, 466, 186, 54, 405
Bangladesh	12, 300, 610
Benin	511, 615
Brazil	579, 481, 144, 189, 498, 113, 140, 292, 327, 191, 430, 624, 190, 298, 141
British Virgin Islands	324
Brunei Darussalam	192
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Chad	283
Chile	618, 209, 587, 207, 593, 586, 619, 588, 208, 30, 594, 590, 595, 580, 158, 592, 591, 471
China	540, 267, 408, 629, 548, 445, 210, 454, 549, 620, 560, 266, 409, 453, 617, 547, 572, 559, 451, 410, 71
Colombia	211, 163, 423
Costa Rica	53, 212, 213
Côte d'Ivoire	611, 609
Croatia	419, 570, 536, 421
Cuba	631, 601
Democratic Republic of the Congo	616, 509
Ecuador	48, 605
Eritrea	496
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Ethiopia	215, 76
Falkland Islands (Malvinas)	411
Faroe Islands	46
France	52, 449, 14, 535, 402, 217, 219, 218, 216, 132, 526, 13, 497, 297, 220, 565, 627, 335, 221, 473, 176, 403
French Polynesia	103, 223, 222
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Gambia	133, 49, 614, 50, 51
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Ghana	515, 224
Greece	495, 578, 475, 474
Greenland	174, 168, 225
Grenada	460
Guinea	56, 55, 726, 440, 725
Guinea-Bissau	57
Iceland	228, 67, 226, 66, 227, 68
India	301, 551, 574, 524, 229, 596, 147, 597, 630
Indonesia	538, 400, 329, 401, 302
Ireland	448
Israel	308, 230
Italy	72, 231, 120, 455, 452, 571, 570, 536, 119, 421, 299, 232, 419
Jamaica	603
Japan	539, 558, 451, 445, 560
Kenya	234, 233, 235, 321, 331, 322, 577, 86
Liberia	513
Lithuania	492, 491, 626
Malawi	236, 330, 81
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Mauritania	97, 98, 96
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New Caledonia	249, 92
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Norway	602, 429, 426
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Peru	311, 439, 312, 488, 490, 487, 489, 625, 124

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Philippines	437, 73, 258, 259, 255, 256, 130, 260, 74, 285, 129, 306, 261, 257
Poland	494
Portugal	599, 598, 7, 125, 600, 286
Republic of Korea	555, 451, 560
Russian Federation	277, 332, 333, 295, 539, 175, 426, 294
Rwanda	616
Sao Tome and Principe	510
Senegal	180, 133, 612, 179
Sierra Leone	512, 137, 135, 136
Slovenia	570, 536, 419, 421
South Africa	504, 505, 506, 485
Spain	522, 541, 95, 420, 264, 565, 22, 418, 206, 537
Sri Lanka	441, 265
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United States of America	521, 276, 606, 582, 542, 149, 273, 507, 520, 508, 484, 269, 601, 34, 99, 173, 552, 444, 35, 274, 585, 534, 584, 631, 566, 467, 438, 476, 275, 442, 252, 279, 479, 556, 563, 564, 519, 499, 280, 583
Uruguay	567, 568, 573
Venezuela	268, 282
Viet Nam	620, 604, 409, 415, 410, 408
Zimbabwe	284, 316

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Abarca-Arenas, L.G.	318
Ainsworth, C.H.	196,401,195,400,13,518,194,197,14
Albouy, C.	402
Aliño, P.M.	261
Alvarez-Hernández, J.H.	36,287
Amorim, P.	57
Angelini, R.	190,523,298
Antony, P.J.	524
Araújo, J.N.	528,403,525,529,297,627,526,176,527
Aravindan, C.M.	229
Arbach Leloup, F.	449
Arias-González, J.E.	530,531,532,533,103,222,223
Arreguín-Sánchez, F.	238,404,239,320,317
Aydin, K.Y.	276,534,277,175
Bănaru, D.	535
Barausse, A.	536
Bayle-Sempere, J.T.	537
Beattie, A.	114
Blanchard, J.L.	333,294,332,295
Bongu, M.M.	509
Bozec, Y.M.	249,92
Bradford-Grieve, J.M.	250,151
Brando, V.E.	232,119
Bredesen, E.L.	143,262
Browder, J.A.	314,58
Buchary, E.A.	227,538,329
Bulman, C.	407,406,405
Bundy, A.	40,41,285,106,129
Campos, W.L.	306,130
Carrer, S.	72,120,231,299
Castro, A.	510
Chaikina, N.	539
Chávez, E.A.	246
Cheng, J.	540
Chen, Z.	409,408
Cheung, W.W.L.	620,410,411
Christensen, V.	412,413,414,415,35,34,621,251
Christian, R.R.	274,149
Cisneros-Montemayor, A.M.	417
Colléter, M.	180,179
Coll, M.	419,420,421,541,418
Cornejo-Donoso, J.	422
Cox, S.P.	33,253
Criales-Hernández, M.I.	423
Dalsgaard, J.	280
Daskalov, G.M.	424
Degnbol, P.	236
De La Cruz-Aguero, G.	93,244
Delos Reyes, M.R.	260,256,258,259,73,257,74,255
de Mutsert, K.	542
De Paula E Silva, R.	248
Díaz-López, B.	455
Díaz-Uribe, J.G.	543,425
Dommasnes, A.	426
Downing, A.S.	545,544,546
Duan, L.J.	547,548,549
Duarte, L.O.	163,211
Erfan, A.	427
Espinosa-Romero, M.J.	550
Essington, T.E.	428
Falk-Petersen, J.	429
Feroz Khan, M.	551
Fetahi, T.	215,76
Field, J.C.	521
Fiogbe, E.D.	511
Freire, K.M.	430
Frisk, M.G.	552
Fulton, E.	431
Galván-Piña, V.H.	307
Gamito, S.	286,125

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Author	Reference number
Garces, L.R.	305,304
Gasalla, M.A.	191,141,140
Gascuel, D.	726,725
Godinot, O.	436
Goldsworthy, S.D.	553
Gribble, N.A.	54,185,187
Griffiths, S.P.	554
Guarin, F.Y.	437
Gucu, A.	435,433,434
Guénette, S.	440,252,56,7,55,438,439
Haggan, N.	296
Halfon, E.	200
Han, J.-H.	555
Haputhantri, S.	441
Harvey, C.J.	188,556
Heymans, S.J.J.	137,444,443,442,115,107,136,108,263,135
Hoover, C.	446,557,447
Hossain, M.M.	558
Jarre-Teichmann, A.	312,124,184,311
Jiang, H.	560,445
Jia, P.	559
Kargbo, V.H.	512
Kay, D.W.	513
Kitchell, J.F.	254,134
Klaer, N.L.	562,561
Kolding, J.	234,233
Langseth, B.J.	563,564
Lassalle, G.	565,335
Lee, S.I.	566
Lees, K.	448
Lercari, D.	450,568,567
Libralato, S.	571,570,452
Liew, H.C.	237,155
Li, L.	569
Lin, H.-J.	266,71,453,267
Liu, P.-J.	454
Liu, Q.-G.	572
Li, Y.	451
Lobry, J.	52,218
Machena, C.	284,316
Mackinson, S.	457,293,628,458
Man, A.	303,169
Manickchand-Heileman, S.	240,268,243
Martell, S.J.D.	328
Mathews, C.P.	214,157
McCormick Venier, J.	269
Melgo, J.L.	24
Mendoza, J.J.	282
Mendy, A.N.	49,50,226,67,51,66
Milessi, A.C.	573
Mohamed, K.S.	574,630
Mohammed, E.	575,459,460
Morales-Zárate, M.V.	242,576
Moreau, J.	270,310,577,265,322,321,309,86,193,315,331,235
Moreno, T.	95,206
Morissette, L.	116,623,622,461,118,205,462,463
Moutopoulos, D.K.	578
Mustafa, M.G.	12,300
Nascimento, M.C.	579
Nauen, C.	464
Neira, S.	208,580,30,207
Niiranen, S.	581
Nsiku, E.	330,81
Nurhakim, S.	302
Nuttall, M.A.	582,584,583,585
Ogandagas, C.	514
Okey, T.A.	48,99,173,279,466,467,465,275
Olivieri, R.A.	273
Olson, R.J.	42
Opitz, S.	324

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Author	Reference number
Orek, H.	468
Ortiz, M.	587,595,594,593,592,591,590,588,586,618,619
Osei, S.V.	515
Ould Taleb Ould Sidi, M.M.	97,96,98
Palomares, M.L.D.	217,283,221
Panikkar, P.	596,597
Patricio, J.	599,598,600
Pauly, D.	181,469,470,601,224
Pavés, H.J.	471
Pedersen, S.A.	168,225,174
Pedersen, T.	602
Persad, G.	603
Phong, L.T.	604
Pinkerton, M.	472
Pinnegar, J.K.	473
Piroddi, C.	475,474
Pitcher, T.J.	204,202,203,110,201,105
Polovina, J.J.	476
Preikshot, D.B.	479,478,477
Pruvost, P.	480
Reyes-Marchant, P.	219
Rivera-Arriaga, E.	131,289
Rocha, G.R.	481,624
Rosado-Solórzano, R.	245,154
Rosas-Luis, R.	482,483
Ruiz, D.J.	605
Ruzicka, J.J.	606,484
Rybarczyk, H.	220,132,216
Salcido-Guavara, L.A.	325
Salomon, A.K.	607
Samb, B.	228,68,133
Sánchez, F.	264,22
Savenkoff, C.	145,146,117
Sedzro, K.M.	516
Shannon, L.	485
Silvestre, G.	192
Stanford, R.	44,104,271,272,43
Stobberup, K.A.	486
Tam, J.	487,488
Taylor, M.H.	490,489,625
Tecchio, S.	522
Tomczak, M.T.	491,494,492,626,493,608
Tong, L.	210
Traore, A.	609
Trites, A.W.	183,182
Tsagarakis, K.	495
Tsehaye, I.	496
Tudman, P.D.	186
Ullah, M.H.	610
Valls, A.	497
Vasconcellos, M.	292,112,144,111,28,327,29
Vega-Cendejas, M.E.	323,27,247,288,25
Velasco, G.	498
Vibunpant, S.	60
Vidal, L.	631,290
Villanueva, M.C.S.	612,614,613,611,616,615
Vivekanandan, E.	301,147
Wabnitz, C.C.	499
Walline, P.D.	308,230
Walters, C.J.	520,519
Wang, Y.	629
Watermeyer, K.	506,504,503,502,501,500,505
Watkinson, S.	198,199,126,127
Williams, A.B.	517
Wolff, M.	212,209,189,53,158,113,213
Xu, S.	617
Zeller, D.	46
Zetina-Rejón, M.J.	291,241
Zhang, Y.	508,507

Appendix 2. EcoBase nomenclature: list of fields by table (variables in bold type correspond to tables' primary keys, and data sources are given for metadata tables).

Appendix Table A5. Details of the 'absolute_flows' table

Variable	Type	Definition
model_number	Bigint	Number of the model in the DB (models_list)
group_name	character varying(255)	Name of the trophic group (models_details)
tl_classes	character varying(255)	Trophic level class (I, II, III…)
abs_fl_value	double precision	Absolute flows by trophic level value

Appendix Table A6. Details of the 'ascendency_by_group' table

Variable	Type	Definition
model_number	bigint	Number of the model in the DB (models_list)
group_name	character varying(250)	Name of the trophic group (models_details)
ascendency	double precision	Ascendency by group value
overhead	double precision	Overhead by group value
information	double precision	Information by group value
throughput	double precision	Throughput by group value

Appendix Table A7. Details of the 'ascendency_table' table

Variable	Type	Definition
model_number	bigint	Number of the model in the DB (models_list)
line_classes	character varying(255)	Total ascendency source (Import, Internal flow…)
column_classes	character varying(255)	Total ascendency class (Ascendency (flowbits), Overhead (flowbits))
asc_tab_value	double precision	Total ascendency value

Appendix Table A8. Details of the 'biomass_catch_by_tl' table

Variable	Type	Definition
model_number	bigint	Number of the model in the DB (models_list)
tl_classes	character varying(255)	Trophic level class (I, II, III…)
biomass_classes	character varying(255)	Biomass/Catch class (Living, Detritus, Total, Non-hidden)
biomass_value	double precision	Biomass by trophic level value
catch_value	double precision	Catch by trophic level value

Appendix Table A9. Details of the 'consumption_table' table

Variable	Type	Definition
model_number	bigint	Number of the model in the DB (models_list)
prey_group_name	character varying(255)	Name of the prey group (models_details + other_groups)
predator_group_name	character varying(255)	Name of the predator group (models_details)
consumption_value	double precision	Consumption value

Appendix Table A10. Details of the 'detritus_fate' table

Variable	Type	Definition
model_number	bigint	Number of the model in the DB (models_list)
group_name	character varying(255)	Name of the source trophic group (models_details)
detritus_group_name	character varying(255)	Name of the fate Detritus group (models_details)
det_fate_value	double precision	Detritus fate value

Appendix Table A11. Details of the 'diet_table' table

Variable	Type	Definition
model_number	bigint	Number of the model in the DB (models_list)
prey_group_name	character varying(255)	Name of the prey group (models_details + other_groups)
predator_group_name	character varying(255)	Name of the predator group (models_details)
diet_value	double precision	Diet table value

Appendix Table A12. Details of the 'discard_fate' table

Variable	Type	Definition
model_number	bigint	Number of the model in the DB (models_list)
fleet_name	character varying(255)	Name of the fleet (fishery_fleets)
detritus_group_name	character varying(255)	Name of the fate Detritus group (models_details)
discard_fate_value	double precision	Discard fate value

Appendix Table A13. Details of the 'electivity_search_rates_table' table

Variable	Type	Definition
model_number	bigint	Number of the model in the DB (models_list)
prey_group_name	character varying(255)	Name of the prey group (models_details)
predator_group_name	character varying(255)	Name of the predator group (models_details)
electivity_value	double precision	Electivity value
search_rates_value	double precision	Search rate value

Appendix Table A14. Details of the 'fishery catches' table

Variable	Type	Definition
model_number	bigint	Number of the model in the DB (models_list)
fleet_name	character varying(255)	Name of the fleet (fishery_fleets)
group_name	character varying(255)	Name of the trophic group (models_details)
catch_type	character varying(255)	Type of catch (landings or discards)
catch_value	double precision	Catch value

Appendix Table A15. Details of the 'fishery_fleets' table

Variable	Type	Definition
model_number	bigint	Number of the model in the DB (models_list)
fleet_name	character varying(255)	Name of the fleet (fishery_fleets)
fixed_cost	double precision	Fixed cost value (in %)
effort_related_cost	double precision	Effort related cost value (in %)
sailing_related_cost	double precision	Sailing related cost value (in %)
profit	double precision	Profit value (in %)
total_value	double precision	Total value (in %)

Appendix Table A16. Details of the 'fishery_indices' table

Variable	Type	Definition
model_number	bigint	Number of the model in the DB (models_list)
fleet_name	character varying(255)	Name of the fleet (fishery_fleets)
group_name	character varying(255)	Name of the trophic group (models_details)
discard_mort_rate	double precision	Discard mortality rate value
off_vessel_price	double precision	Off-vessel price value
fleet_fishing_mort_rate	double precision	Fleet fishing mortality rate value

Appendix Table A17. Details of the 'flows_biomasses_table' table

Variable	Type	Definition
model_number	bigint	Number of the model in the DB (models_list)
tl_classes	character varying(255)	Trophic level class (I, II, III…)
fl_classes	character varying(255)	Flows and biomasses class (Import, Consumption by predators...)
from_pp_value	double precision	Flows and biomasses from primary producers value
from_det_value	double precision	Flows and biomasses from detritus value
from_all_comb_value	double precision	Flows and biomasses from all combined value

Appendix Table A18. Details of the 'mixed_trophic_impact' table

Variable	Type	Definition
model_number	bigint	Number of the model in the DB (models_list)
impacting_group_name	character varying(255)	Impacting group name (models_details + fishery_fleets)
impacted_group_name	character varying(255)	Impacted group name (models_details + fishery_fleets)
mti_value	double precision	Mixed trophic impact value

Appendix Table A19. Details of the 'models_details' table

Variable	Type	Definition
model_number	bigint	Number of the model in the DB (models_list)
group_name	character varying(255)	Name of the trophic group
tl	double precision	Trophic level
habitat_area	double precision	Habitat area (fraction)
biomass_habitat_area	double precision	Biomass in habitat area
b_hab_area_input	boolean	Biomass in habitat area input? (TRUE/FALSE)
biomass	double precision	Biomass
pb	double precision	Production on biomass ratio
pb_input	boolean	Production on biomass ratio input? (TRUE/FALSE)
qb	double precision	Consumption on biomass ratio
qb_input	boolean	Consumption on biomass ratio input? (TRUE/FALSE)
ee	double precision	Ecotrophic efficiency
ee_input	boolean	Ecotrophic efficiency input? (TRUE/FALSE)
other_mortality_input_value	double precision	Other mortality (input value)
pq	double precision	Production on consumption ratio
pq_input	boolean	Production on consumption ratio input? (TRUE/FALSE)
uq	double precision	Unassimilated consumption on consumption ratio
detritus_import	double precision	Detritus import
consumer	boolean	Consumer group? (TRUE/FALSE)
producer	boolean	Producer group? (TRUE/FALSE)
detritus	boolean	Detritus group? (TRUE/FALSE)
part_prod_from_pp	double precision	Part of production from primary producer
multi_stanza_group_name	character varying(255)	Multi-stanza group name
stanza_age	double precision	Stanza age (in months)
immigration	double precision	Immigration (input value)
emigration	double precision	Emigration (input value)
emigration_rate	double precision	Emigration rate (input value)
biom_acc	double precision	Biomass accumulation
biom_acc_input	boolean	Biomass accumulation input? (TRUE/FALSE)
biom_acc_rate	double precision	Biomass accumulation rate
biom_acc_rate_input	boolean	Biomass accumulation rate input? (TRUE/FALSE)
a_in_lw	double precision	Parameter 'a' value in length-weight relation
b_in_lw	double precision	Parameter 'b' value in length-weight relation
l_at_infinity	double precision	Length at infinity
w_at_infinity	double precision	Weight at infinity
k_in_vbgf	double precision	Parameter 'K' value in Von Bertalanffy growth function
t0_in_vbgf	double precision	Parameter 't_0' value in Von Bertalanffy growth function
age_first_capture	double precision	Age of first capture
max_age	double precision	Maximum age
net_migration	double precision	Net migration
flow_to_det	double precision	Flow to detritus
net_efficiency	double precision	Net efficiency
oi	double precision	Omnivory index
fishing_mort_rate	double precision	Fishing mortality rate
pred_mort_rate	double precision	Predation mortality rate
net_migration_rate	double precision	Net migration rate
other_mort_rate	double precision	Other mortality rate
respiration	double precision	Respiration
assimilation	double precision	Assimilation
ks_index_1	double precision	Keystone index
ks_index_2	double precision	Keystone index #2
rel_tot_impact	double precision	Relative total impact
flow_from_det	double precision	Flow from detritus

Appendix Table A20. Details of the 'models_history' table

Variable	Type	Definition	Source
model_number	bigint	Number of the model in the DB (models_list)	database
available	boolean	Is the model recorded in the DB? (TRUE/FALSE)	database
referenced	boolean	Is the reference recorded in the DB? (TRUE/FALSE)	database
asked	boolean	If not available, did we ask for the model? (TRUE/FALSE)	database
facilitator	character varying(500)	Person through whom the model was given	database
facilitator_contact	character varying(500)	E-mail address of the facilitator	database
balanced	boolean	Is the Ecopath model balanced? (TRUE/FALSE)	database
modified	boolean	Has the model been modified? (TRUE/FALSE)	database
modifier	character varying(500)	If modified=TRUE, person who modified the model	database
modifier_contact	character varying(500)	E-mail address of the modifier	database
match_paper_b	boolean	Do model biomass values correspond to reference values? (TRUE/FALSE)	model/paper
difference_b	character varying(250)	If not, importance of the difference (low,medium,high)	model/paper
match_paper_dc	boolean	Do model diet values correspond to reference values? (TRUE/FALSE)	model/paper
difference_dc	character varying(250)	If not, importance of the difference (low,medium,high)	model/paper
match_paper_ee	boolean	Do model EE values correspond to reference values? (TRUE/FALSE)	model/paper
difference_ee	character varying(250)	If not, importance of the difference (low,medium,high)	model/paper
match_paper_pb	boolean	Do model P/B values correspond to reference values? (TRUE/FALSE)	model/paper
difference_pb	character varying(250)	If not, importance of the difference (low,medium,high)	model/paper
match_paper_qb	boolean	Do model Q/B values correspond to reference values? (TRUE/FALSE)	model/paper
difference_qb	character varying(250)	If not, importance of the difference (low,medium,high)	model/paper
match_paper_y	boolean	Do model catch values correspond to reference values? (TRUE/FALSE)	model/paper
difference_y	character varying(250)	If not, importance of the difference (low,medium,high)	model/paper
ewe_version_database	character varying(255)	Version of EwE in which the model has been stored in the DB	model/paper
ewe_version_original	character varying(255)	Version of EwE in which the model has been built by its author, as cited in the paper	paper
villy_remarks	text	Any remark from Villy Christensen on the model	database
paco_model_remarks	text	Any remark from Francisco Arreguín-Sánchez when opening and processing the model (balance procedure, problems, comparison with reference)	database
paco_remarks	text	Any additional remark from Francisco Arreguín-Sánchez on the model	database
mathieu_problem	text	Summary remarks from Mathieu Colléter when merging all databases	database
mathieu_usable	boolean	Is the model usable for Mathieu Colléter meta-analysis purposes? (personal use)	database

Appendix Table A21. Details of the 'models_indices' table

Variable	Type	Definition
model_number	bigint	Number of the model in the DB (models_list)
sum_all_consumption	double precision	Sum of all consumption
sum_all_exports	double precision	Sum of all exports
sum_all_resp_flows	double precision	Sum of all respiratory flows
sum_all_flows_into_det	double precision	Sum of all flows into detritus
total_system_throughput	double precision	Total system throughput
sum_all_prod	double precision	Sum of all production
mean_tl_catch	double precision	Mean trophic level of the catch
gross_efficiency	double precision	Gross efficiency (catch/net p.p.)
input_total_net_pp	double precision	Input total net primary production
calculated_total_net_pp	double precision	Calculated total net primary production
unaccounted_pp	double precision	Unaccounted primary production
pp_resp_ratio	double precision	Total primary production/total respiration
net_system_prod	double precision	Net system production
pp_biomass_ratio	double precision	Total primary production/total biomass
biomass_throughput_ratio	double precision	Total biomass/total throughput
total_biomass_exclud_det	double precision	Total biomass (excluding detritus)
total_catch	double precision	Total catch
connectance_index	double precision	Connectance Index
system_omnivory_index	double precision	System Omnivory Index
total_market_value	double precision	Total market value
total_shadow_value	double precision	Total shadow value
total_value	double precision	Total value
total_fixed_cost	double precision	Total fixed cost
total_variable_cost	double precision	Total variable cost
total_cost	double precision	Total cost
profit	double precision	Profit
pedigree_index	double precision	Ecopath pedigree index
measure_fit_t	double precision	Measure of fit, t*
flows_biomasses_throughput_extracted_break_cycles	double precision	Flows and biomasses from all combined extracted to break cycles
flows_biomasses_throughput_input_tl_ii	double precision	Flows and biomasses from all combined: Input TL II+ (not in throughput)
prop_flow_origin_det	double precision	Proportion of total flow originating from detritus
te_from_pp	double precision	Transfer efficiency from primary producer (calculated as geometric mean for TL II-IV)
te_from_det	double precision	Transfer efficiency from detritus (calculated as geometric mean for TL II-IV)
te_total	double precision	Total transfer efficiency (calculated as geometric mean for TL II-IV)
throughput_cycled_exclud_det	double precision	Throughput cycled (excluding detritus)
pred_cycling_index	double precision	Predatory cycling index
throughput_cycled_includ_det	double precision	Throughput cycled (including detritus)
finn_cycling_index	double precision	Finn's cycling index
finn_mean_path_leng	double precision	Finn's mean path length
finn_straight_through_path_length_without_det	double precision	Finn's straight-through path length (without detritus)
finn_straight_through_path_length_with_det	double precision	Finn's straight-through path length (with detritus)

Appendix Table A22. Details of the 'models_info' table

Variable	Type	Definition	Source
model_number	bigint	Number of the model in the DB (models_list)	database
model_year_start	smallint	Start year of the modeled period	model input/paper
model_year_end	smallint	End year of the modeled period	model input/paper
sibling_model	boolean	Are there several historical versions of the model? (TRUE/FALSE)	database
sibling_code	character varying(255)	Model number(s) of sibling(s) (if several, noted as 195_196)	database
area	double precision	Modeled area (km2)	model input/paper
model_location	character varying(255)	Model location	model input/paper
country	character varying(255)	Country (if the model can be related to one (or several) country)	model input/paper
fao_area	character varying(255)	FAO area in which the model is included (if several, noted as 61_71)	database
lme	character varying(255)	Large Marine Ecosystem in which the model is included (if several, noted as 27_28)	database
coordinates_north	text	Northern coordinate (in decimal degrees)	model input
coordinates_south	text	Southern coordinate (in decimal degrees)	model input
coordinates_east	text	Eastern coordinate (in decimal degrees)	model input
coordinates_west	text	Western coordinate (in decimal degrees)	model input
geographic_extent	text	Spatial polygon of the model (in decimal degrees)	database
geom	geometry	Calculated geometric column (from geographic_extent) enabling mapping of the models	database
overlapping_model	boolean	Are there several spatial versions of the model? (TRUE/FALSE)	database
overlapping_code	character varying(255)	Model number(s) of overlapping model(s) (if several, noted as 195_196)	database
temperature_min	double precision	Minimum sea surface temperature (SST) of the ecosystem on the modeled time period	paper
temperature_max	double precision	Maximum SST of the ecosystem on the modeled time period	paper
temperature_mean	double precision	Mean SST of the ecosystem on the modeled time period	paper
depth_min	double precision	Minimum depth of the modeled ecosystem	paper
depth_max	double precision	Maximum depth of the modeled ecosystem	paper
depth_mean	double precision	Mean depth of the modeled ecosystem	paper
salinity_min	double precision	Minimum water salinity of the ecosystem on the modeled time period	paper
salinity_max	double precision	Maximum water salinity of the ecosystem on the modeled time period	paper
salinity_mean	double precision	Mean water salinity of the ecosystem on the modeled time period	paper
oxygen_min	double precision	Minimum water oxygen rate of the ecosystem on the modeled time period	paper
oxygen_max	double precision	Maximum water oxygen rate of the ecosystem on the modeled time period	paper
oxygen_mean	double precision	Mean water oxygen rate of the ecosystem on the modeled time period	paper
primary_production	double precision	Mean primary production of the ecosystem on the modeled time period	paper
sediment_structure	character varying(255)	Sediment structure of the ecosystem	paper
ecosystem_zone	character varying(255)	Model ecosystem zone (tropical, temperate or polar)	paper
ecosystem_type	character varying(255)	Model ecosystem type (channel/strait, bay/fjord, coastal lagoon, coral reef, continental shelf (< 200m depth), ocean, river, estuary, beach, reservoir, lake, terrestrial)	paper
mathieu_ecosyst_type	character varying(255)	Model ecosystem type (Mathieu Colléter's classification)	database
paco_ecosyst_type	text	Model ecosystem type (Paco Arreguín-Sánchez's classification)	database
paco_other_ecosyst_type	text	Model other ecosystem type (Paco Arreguín-Sánchez's classification)	database
paco_other_ecosyst_uses	boolean	Other modeled ecosystem uses? (Paco Arreguín-Sánchez's info, TRUE/FALSE)	database
paco_describe_uses	text	What for other use (Paco Arreguín-Sánchez's info)	database
whole_food_web	boolean	Is the entire food web accounted for in the model? (TRUE/FALSE)	paper
mpa	boolean	Is the modeled ecosystem under any protection? (TRUE/FALSE)	paper

Appendix Table A23. Details of the 'models_list' table

Variable	Type	Definition	Source
model_number	bigserial	Number of the model in the DB	database
model_name	character varying(255)	Name of the model	model input/database
description	text	Description of the model	model input
author	character varying(255)	1st author name	paper
author_contact	character varying(500)	1st author e-mail address	paper
relevant_decimal_digits	smallint	Number of relevant decimal digits	model input
group_digits	boolean	Group digits? (TRUE/FALSE)	model input
monetary_units	character varying(255)	Monetary unit of the model	model input/paper
currency_units	character varying(255)	Currency unit of the model	model input/paper
time_units	character varying(255)	Time unit of the model	model input/paper
include_psd_calculations	boolean	Includes particle size distribution (PSD) calculations? (TRUE/FALSE)	model input
ecospace	boolean	Is the Ecospace routine used? (TRUE/FALSE)	paper/model
ecosim	boolean	Is the Ecosim routine used? (TRUE/FALSE)	paper/model
ecopath	boolean	Is the Ecopath routine used? (TRUE/FALSE)	paper/model
ecotracer	boolean	Is the Ecotracer routine used? (TRUE/FALSE)	paper/model
ecotroph	boolean	Is the EcoTroph routine used? (TRUE/FALSE)	paper
keystone_analysis	boolean	Has a keystone analysis been done? (TRUE/FALSE)	paper/model
species_info	boolean	Is the list of species for each functional group available? (TRUE/FALSE)	paper
species_of_interest	boolean	Has the model been built to study a particular species/group? (TRUE/FALSE)	paper
stanza_groups	boolean	Are there any stanzas in the model? (TRUE/FALSE)	model input/paper
species_of_interest_name	character varying(255)	If species_of_interest=TRUE, name of species/group of particular interest	paper
number_groups	smallint	Number of functional groups included in the model	paper/model
fisheries	boolean	Was the model built to study fisheries? (TRUE/FALSE)	paper
aquaculture	boolean	Was the model built to study aquaculture? (TRUE/FALSE)	paper
environment_variability	boolean	Was the model built to study environmental variability? (TRUE/FALSE)	paper
ecosyst_functioning	boolean	Was the model built to study global ecosystem functioning? (TRUE/FALSE)	paper
pollution	boolean	Was the model built to study pollution? (TRUE/FALSE)	paper

Appendix Table A24. Details of the 'models_ref' table

Variable	Type	Definition
model_number	bigint	Number of the model in the DB (models_list)
id_ref	bigint	Number of the reference in the DB (references_table)
ref_importance	integer	Importance of the reference (if several: 1, 2...)

Appendix Table A25. Details of the 'niche_overlap' table

Variable	Type	Definition
model_number	bigint	Number of the model in the DB (models_list)
group_name	character varying(255)	Name of the trophic group (models_details)
column_group_name	character varying(255)	Name of the trophic group (models_details)
prey_overlap_value	double precision	Prey overlap value
pred_overlap_value	double precision	Predator overlap value

Appendix Table A26. Details of the 'non_market_price' table

Variable	Type	Definition
model_number	bigint	Number of the model in the DB (models_list)
group_name	character varying(255)	Name of the trophic group (models_details)
price_value	double precision	Non-market price value

Appendix Table A27. Details of the 'other_groups' table

Variable	Type	Definition
model_number	bigint	Number of the model in the DB (models_list)
other_groups_name	character varying(255)	Name of the other groups
other_groups_type	character varying(255)	Other groups type (notably import)

Appendix Table A28. Details of the 'pedigree_assignment' table

Variable	Type	Definition
model_number	bigint	Number of the model in the DB (models_list)
group_name	character varying(255)	Name of the trophic group (models_details)
variable	character varying(255)	Concerned variable
definition_name	character varying(255)	Pedigree classification name

Appendix Table A29. Details of the 'pedigree_definition' table

Variable	Type	Definition
model_number	bigint	Number of the model in the DB (models_list)
variable	character varying(255)	Name of the variable (Biomass in habitat area, P/B...)
definition_name	character varying(255)	Name of the Pedigree classification
index_value	double precision	Index value
conf_interv	double precision	Confidence interval (+/-%)

Appendix Table A30. Details of the 'ppr_consumption_groups' table

Variable	Type	Definition
model_number	bigint	Number of the model in the DB (models_list)
group_name	character varying(255)	Name of the trophic group (models_details)
paths_number	double precision	Number of paths
ppr_pp	double precision	Primary production required (PPR) from primary producers
ppr_det	double precision	PPR from detritus
ppr	double precision	Total PPR for consumption
consumption	double precision	Consumption
ppr_cons_ratio	double precision	PPR on consumption ratio
ppr_totpp_ratio	double precision	PPR on total primary production ratio
ppr_ubiomass_ratio	double precision	PPR on biomass unit ratio

Appendix Table A31. Details of the 'ppr_harvest_groups' table

Variable	Type	Definition
model_number	bigint	Number of the model in the DB (models_list)
group_name	character varying(255)	Name of the trophic group (models_details)
paths_number	double precision	Number of paths
ppr_pp	double precision	Primary production required (PPR) from primary producers
ppr_det	double precision	PPR from detritus
ppr	double precision	Total PPR for harvest
catch	double precision	Catch
ppr_catch_ratio	double precision	PPR on catch ratio
ppr_totpp_ratio	double precision	PPR on total primary production ratio
ppr_ucatch_ratio	double precision	PPR on catch unit ratio

Appendix Table A32. Details of the 'pred_mort_rates_table' table

Variable	Type	Definition
model_number	bigint	Number of the model in the DB (models_list)
prey_group_name	character varying(255)	Name of the prey group (models_details)
predator_group_name	character varying(255)	Name of the predator group (models_details)
pmr_value	double precision	Predation mortality rate value

Appendix Table A33. Details of the 'psd_contribution' table

Variable	Type	Definition
model_number	bigint	Number of the model in the DB (models_list)
group_name	character varying(255)	Name of the trophic group (models_details)
weight_class	character varying(255)	Name of the weight class
contrib_value	double precision	Contribution value

Appendix Table A34. Details of the 'psd_growth_estimates' table

Variable	Type	Definition
model_number	bigint	Number of the model in the DB (models_list)
group_name	character varying(255)	Name of the trophic group (models_details)
a_in_lw	double precision	Parameter 'a' value in length-weight relation
b_in_lw	double precision	Parameter 'b' value in length-weight relation
l_at_infinity	double precision	Length at infinity
w_at_infinity	double precision	Weight at infinity
k_in_vbgf	double precision	Parameter 'K' value in Von Bertalanffy growth function
t0_in_vbgf	double precision	Parameter 't_0' value in Von Bertalanffy growth function
age_first_capture	double precision	Age of first capture
max_age	double precision	Maximum age

Appendix Table A35. Details of the 'references_table' table

Variable	Type	Definition
id_ref	integer	Number of the reference in the DB
xml_ref	xml	Reference in xml format
pdf	boolean	Is the reference available online in pdf format? (TRUE/FALSE)
supplement	boolean	Does the reference contain supplementary materials? (TRUE/FALSE)

Appendix Table A36. Details of the 'taxonomy' table

Variable	Type	Definition
model_number	bigint	Number of the model in the DB (models_list)
group_name	character varying(255)	Name of the trophic group (models_details)
subgroup_name	character varying(255)	Name of the subgroup name, i.e. species name
prop_of_biomass	double precision	Proportion of biomass
genus	character varying(255)	Genus name
species	character varying(255)	Species name
family_name	character varying(255)	Family name
order_name	character varying(255)	Order name
class_name	character varying(255)	Class name
phylum_name	character varying(255)	Phylum name
organism	character varying(255)	Organism name
ecology	character varying(255)	Ecology
occurence_status	character varying(255)	Occurence status
prop_of_biomass2	double precision	Proportion of biomass
prop_of_catch	double precision	Proportion of catch
iucn_conserv_status	character varying(255)	IUCN conservation status
vuln_index	double precision	Vulnerability index
mean_length	double precision	Mean length
max_length	double precision	Maximum length
mean_weight	double precision	Mean weight
mean_life_span	double precision	Mean life span

Appendix Table A37. Details of the 'transfer_efficiency' table

Variable	Type	Definition
model_number	bigint	Number of the model in the DB (models_list)
transf_classes	character varying(255)	Transfer efficiency source class (Producer, Detritus, All flows)
tl_classes	character varying(255)	Trophic level class (I, II, III…)
te_tab_value	double precision	Transfer efficiency value

Appendix 3. Method for the geo-localization of EwE models

We decided to include a precise spatial polygon for each EwE model. This representation relies mainly on publications information, and has been developed for several uses. It relies on the specification of spatial coordinates in the 'geographic_extent' field of the 'models_info' table. This field is treated within the database to furnish a geographic object usable in GIS software. We use spatial capabilities of the Postgres/Postgis database object. The geometry type enables us to store more than only numeric or text objects, but also spatial ones. Import of the data can be made as text (it should be KML files) or as shapefiles. Spatial coordinates can correspond to a specific point or a polygon (2D), e.g. '-33,41,0 -33,35,0 -23,35,0 -23,41,0 -33,41,0' corresponding to a square covering the area modeled by Guénette and Morato (2001; see Figure A1).[1] Once data are loaded, several functions dedicated to this data type are usable: area, distance, projections, intersection, union calculations, and transformation as shape or kml.

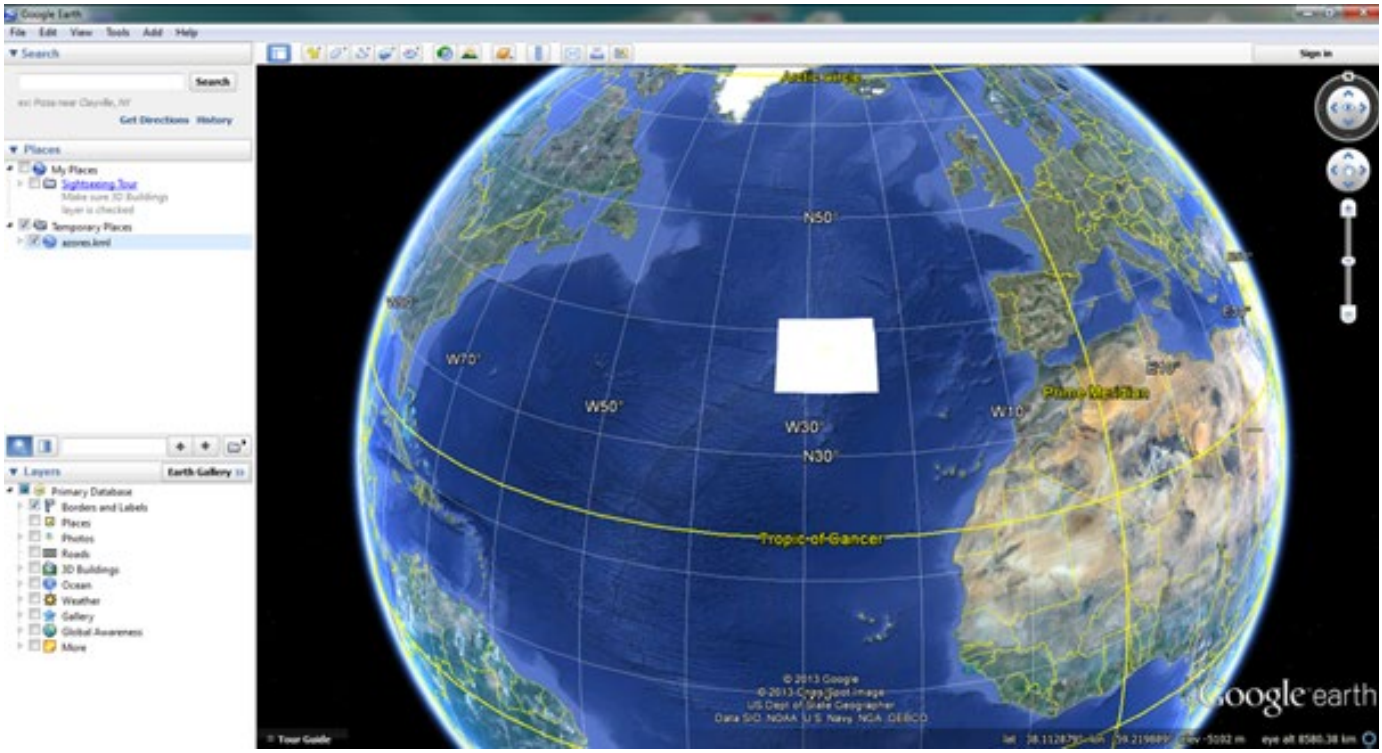

Figure A1. Google Earth representation of the spatial polygon allocated to Azores EwE model.

[1] Guénette S and Morato T (2001) The Azores Archipelago, 1997. pp. 241-270 In Zeller D, Watson R and Pauly D (eds.), Fisheries Impacts on North Atlantic Ecosystems: Models and Analyses. Fisheries Centre Research Reports 9 (4). The Fisheries Centre, University of British Columbia, Vancouver, Canada.