OPEN ENVIRONMENTAL DATABASES FOR OPEN-SEA FISHERIES BIOLOGISTS

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SUMMARY

The present working document aims to list the main environmental databases (including in-situ observations, remote-sensing data and ocean models outputs), that are currently available on the Net and of interest in open-sea fisheries biology and ecology.

RESUME

Ce document a pour objet de lister les principales bases de données environnementales (concernant les données in-situ, satellitaires et les sorties de modèles océaniques), qui sont actuellement disponibles sur la toile et d'intérêt pour l'écologie halieutique se rapportant aux ressources thonières.

RESUMEN

El objetivo de este documento es presentar una relación de las principales bases de datos medioambientales (sobre datos in situ, vía satélite y valores de salida de los modelos oceánicos) que están disponibles actualmente en la red y que revisten interés para la ecología pesquera relacionada con los recursos atuneros.

KEYWORDS

In-situ observations, Remote sensing data collections, Ocean model outputs

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1. Introduction

A large body of literature has already depicted how much the spatial distribution and the population dynamics (e.g., recruitment, growth) of tuna and tuna-like species, as well as the catchability of most gears (e.g., purse seine, long-line, bait boat), are strongly affected by environmental changes (e.g., Lehodey, *et al.* 1997, Gaertner, *et al.* 1999, Marsac 1999, Humston, *et al.* 2000, Fromentin and Restrepo 2001, Maury, *et al.* 2001, Travassos 2001, Bigelow, *et al.* 2002, Ravier and Fromentin 2004, Royer, *et al.* 2004). Standard stock assessment procedures used in ICCAT (e.g., VPA or surplus models) do not usually take into account information on environmental variability and standardised CPUE are also rarely corrected for such sources of variations. Consequently, the perception of a stock and its management may be biased to a certain extent (although the effects may be counterintuitive, see ICCAT 2002). It is, therefore, of importance to investigate these potential relationships prior to stock assessment sessions, but environmental databases are often hardly accessible and/or validated to an unknown degree. In order to help tuna scientists in their investigations, the present working document aims to list the main environmental databases that are currently available on the Net and of interest for open-sea fisheries biologists, as this was asked by the 2003 SCRS meeting.

2. Environmental databases

2.1 In-situ data collections

- Bristish Oceanographic Data Center, BODC (http://www.bodc.ac.uk/). Include: NERC Metadata files, oceanographic data collections (e.g., CTD profiles), sea level data (from the WOCE programme), tide data and indices (e.g., waves index). This site also holds the European Directory of Marine Environmental Data (EDMED, http://www.bodc.ac.uk/ services/edmed/) which describes more than 2300 Datasets from over 500 Data Holding Centres across Europe. Binary format and HTML files.

- Climate Analysis Section, CAS (http://www.cgd.ucar.edu/cas/catalog/). This site, that is held by the National Center for Atmospheric Research (NCAR, US), provides links to the ECMWF and NCEP (see below) and a list of surface data (monthly data over 2°x2° or 5°x5° boxes of sea surface temperature and sea ice concentration), satellite data (see below) and climate indices, among which: the North Atlantic Oscillation index from Hurrell (1995), the North Pacific index from Trenberth and Hurrell (1994), the Southern Oscillation Index from Trenberth (1984) and several other El Niño indices from (Trenberth 1997). ASCII and HTML Files.

- Climate Diagnostics Center, CDC NOAA-CIRES (http://www.cdc.noaa.gov/). A key plateform to access to the extensive NOAA data bases and get links to various other key sites, such as COADS, ECMWF (see below) and the NCEP/NCAR reanalysis data web site (http://www.cdc.noaa.gov/cdc/data.ncep.reanalysis.html) that provides gridded daily and monthly data sets of a large variety of variables (temperature, pressure, winds, etc.) from 1948 to present. ASCII and HTML Files.

- Climate Prediction Center, CPC (http://www.cpc.ncep.noaa.gov/products/ monitoring_and_data/). Hold by the National Center for Environmental Prediction (NCEP, US). This web site collects and produces daily and monthly data, time series, and maps for various climate parameters, such as precipitation, temperature, snow cover, and degree days for the United States, Pacific Islands, and other parts of the world. The CPC also compiles data on historic and current atmospheric and oceanic conditions, El Niño Southern Oscillations (ENSO) and other climate patterns such as the North Atlantic and Pacific Decadal Oscillations, and stratospheric ozone and temperature. ASCII and HTML Files.

- Comprehensive Ocean-Atmosphere data set, COADS (http://www.cdc.noaa.gov/coads/). One the largest and most visited environmental data provider. Includes various statistics (such as the mean and median) for each of 22 observed and derived variables (e.g., sea surface temperature, air temperature, sea level, wind, cloudiness, relative humidity) over 2° latitude x 2° longitude boxes back to 1800 and 1°x1° boxes since 1960. Binary files.

- International Research Institute for Climate Prediction, IRI (http://ingrid.ldeo.columbia.edu/ docfind/databrief/cat-ocean.html). IRI proposes an oceanographic data library which includes oceanic station data from the arctic region, geochemical, isotopic, and radiochemical tracers data, monthly data sets from land-ocean models including snow cover and depth, sea ice, and sea surface temperature data

and LEVITUS, a regularly updated world ocean atlas (1°x1°) of objectively analyzed fields of major ocean parameters at the annual, seasonal, and monthly time scales. Binary files.

- Joint Environmental Data Analysis Center, JEDAC (http://jedac.ucsd.edu). This site, hosted at The Scripps Institution of Oceanography, holds monthly gridded fields of temperature at depths (standard levels from 0 to 400 m), mixed layer depth and heat storage, for the period 1955-2003. All available *in situ* observations are processed in a 2° latitude x 5° longitude grid, using an optimal interpolation procedure that is described in the site. Worldwide coverage. Compressed ASCII files

2.2 Remote-sensing databases

- Advanced Very High Resolution Radiometers, AVHRR, (http://podaac.jpl.nasa.gov/sst/). The NOAA/ NASA AVHRR Oceans Pathfinder sea surface temperature data are derived from AVHRR on board six polar orbiting satellites. Databases provide daily, weekly and monthly averages for both the ascending pass (daytime) and descending pass (nighttime) on a 4 km, 9 km, 18 km, 54 km and 0.5 degree resolution since 1985. Data available in HDF (a self-describing, platform independent format).

- AVISO (http://www.jason.oceanobs.com/html/presentation/welcome_uk.html) distributes Topex-Poseidon and ERS altimetric data worldwide since 1992 and Jason-1 and Envisat since 2002. This site is dedicated to gridded or along track altimetry data (sea level anomalies), absolute dynamic topography, wind/wave data and geophysical data over a 1/3 degree resolution. Both delayed time and near-real time data can be available. NetCDF Format.

- French ERS Processing and Archiving Facility, CERSAT (http://www.ifremer.fr/cersat /en/index.htm). This site ensures the off-line processing of ERS-1 and ERS-2 altimeter, scatterometer and microwave sounder data from various satellites. Databases can provide swath (band of the satellite track), collocated and gridded data of daily, weekly and monthly averages over several spatial resolutions (up to 2 km) since 1991 or 1996. Includes also buoy networks data and surveys of regional seas, such as the Bay of Biscay sea. Available variables are: sea wind, sea ice, sea level and waves. HDF Format.

- National Geophysical Data Center, NGDC (http://www.ngdc.noaa.gov/mgg/). NGDC, which is one of three NOAA National Data Centers, compiles and distributes extensive databases in both coastal and open ocean areas. Key data types include bathymetry, 2 and 5 minutes gridded relief, trackline geophysics (gravity, magnetics, seismic reflection), sediment thickness, data from ocean drilling and seafloor sediment and rock samples, digital coastlines, and data from the Great Lakes. Format binary.

- Ocean Color data from various sensors, namely CZCS, OCTS, SeaWifs and MODIS-Aqua (http://daac.gsfc.nasa.gov/oceancolor/panorama.shtml). This site provides satellite measurements of global and regional ocean color data from the NASA's Mission To Planet Earth programme (MTPE). The concentration and predominant identity of substances and particles in the euphotic (lighted) zone of the upper ocean influences the apparent color of the ocean, which can range from deep blue to varying shades of green and ruddy brown. Living phytoplankton, inorganic sediments, particulate and dissolved organic matter all contribute to the color of the ocean. CZCS was launched in October 1978 and operated until June 1986. The Japanese OCTS has been active from November 1996 to June 1997, prior to the SeaWifs mission which started in August 1997. MODIS-Aqua has been providing data since January 2003, with a higher resolution than previous satellites. There are two main types of data: the Global Area Coverage (GAC), that consists of radiance data for all scanned bands, subsampled at 4-km resolution; and the Local Area Coverage (LAC) includes high resolution data of 1 km for areas of special interest. Data available in HDF (a self-describing, platform independent format). Format HDF.

2.3 Models outputs

- European Centre for Medium-Range Weather Forecasting ECMWF (http://www.ecmwf.int/). ECMWF provides real-time data from a large variety of ocean models (partly from international programmes, such TOGA and DEMETER or ERA) and holds a data archives section, including full resolution, surface and pressure level data. format NetCDF.

- MERCATOR (www.mercator-ocean.fr) is an operational oceanography project founded in 2002. This site provides images and outputs numerical files (retrospective, real time and forecasts) of global

models assimilating both satellite and *in-situ* data over the North Atlantic and Mediterranean Sea. Two System Prototypes are already available: PSY1 (start 2001) implements a near-real-time model of the Northern and Tropical Atlantic regions with a 1/3° resolution and PSY2 (start 2003) near-real-time at a higher resolution (1/15°) for the North Atlantic and Mediterranean regions assimilating altimeter and *in situ* data. Several key variables are available in 2D and 3D, e.g., sea temperature, salinity, current speed, diffusion, depth and height of the upper mixing layer, wind stress, etc. Format NetCDF.

3. Conclusion

This list already provides a significant number of websites holding marine environmental data sets of interest for fisheries biologists, but more can be found (e.g., environmental data from drifters, such as the European GyroScope project at http://www.ifremer.fr/lpo/gyroscope/ or the Global Drifter Center, http://www.aoml.noaa.gov/phod/dac/gdc.html). However, our aim was not to provide an exhaustive list of websites, but to list the most significant ones among those known by the authors.

Most of the data bases are access free, but some are restricted over a given period or to research activity (in that case, a preliminary request must be provided). Nonetheless, a few data collections are with charge. Most often, the data sets appear of high quality as they mainly come from international programmes or national agencies. However, the quality control procedure is rarely described. A secondary difficulty relates to the format of these databases. Most of them can be easily and directly downloaded, but format vary among sites and some imply particular software. The variety of units used for some parameters (especially for nutrients) is also another source of worrying. More important is the difficulty to find the appropriate website corresponding to a given request, as several important providers can be reached through various paths that do not always lead to the same window (and consequently to the same data bases).

Finally, the web provides an impressive source of data about the marine environment, but it can be time consuming to find and get access to this information, especially when the request is rather specific (e.g., high resolution gridded data of a regional sea). Therefore, it would be of great help if ICCAT secretariat could host (and update) an existing environmental database (such as GAO, see Marsac 2005), that would be validated and easily accessible to all tuna scientists.

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