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Ifremer

Ec(h)obase a relational database for fisheries acoustic surveys

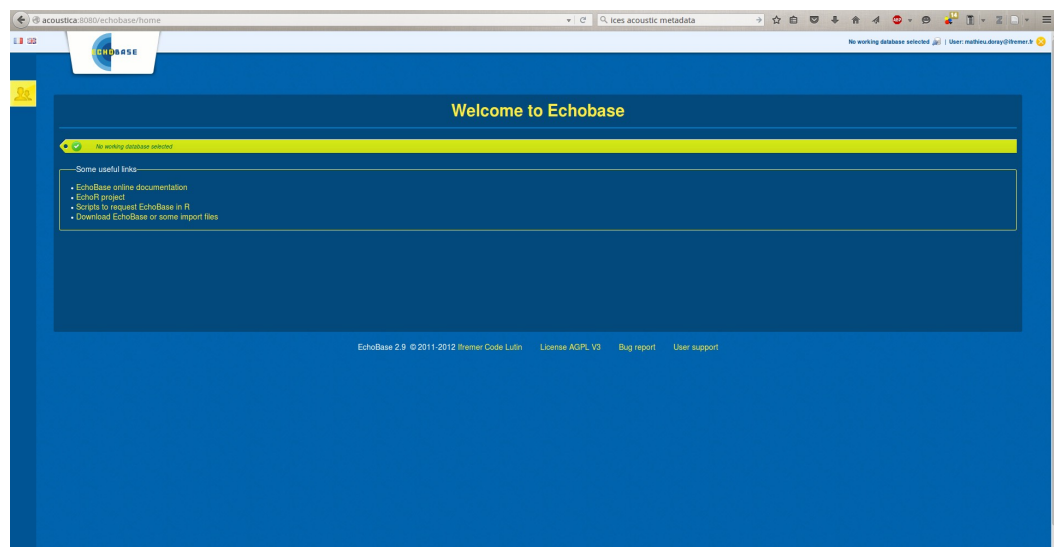


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1. Abstract

The French Institute for the Exploitation of the Sea (Ifremer) has designed an open software suite for storing fisheries acoustic data and computing acoustic indicators for survey-based ecosystem monitoring. It comprises a PostgreSQL database designed to store acoustic, navigation and fishing data from ecosystemic surveys (EchoBase) and a suite of R codes (EchoR) for computing fish population indicators based on Echobase data. This site describes the Echobase database. If you are interested in EchoR, please visit the [Ifremer forge](#).

EchoBase is built upon an open source PostgreSQL database, ensuring large storage capacities and easy integration into Geographical Information Systems or dynamic websites. It has been designed to store data collected during both acoustic and bottom trawl based ecosystemic cruises. The EchoBase data model is based on the ICES WGFASST Topic Group on metadata standards recommendations¹. It comprised a main « cruise metadata branch » on which are plugged acoustic and fishing (« Operation ») data. Biomass estimation results can also be stored in the database at both the acoustic cell (small scale results) and voyage (large scale results) levels. The database also allows for the storage of length-weight and Target Strength-length reference relationships, as well as map data at the voyage level.

EchoBase features a Java web-browser interface for selecting working databases, managing users, importing, editing and querying data. One can also display maps of parameters stored in Echobase in an online Geographic Information System based on QGIS server. Echobase can be easily connected to LibreOffice base, the R statistical software or Geographic Information System for querying and displaying data. Portable H2 databases can be extracted from the server-based EchoBase instance and stored on a local harddrive.

2. Overview

The French Institute for the Exploitation of the Sea (Ifremer) has designed an open software suite for storing fisheries acoustic data and computing acoustic indicators for survey-based ecosystem monitoring. It comprises a PostgreSQL database designed to store acoustic, navigation and fishing data from ecosystemic surveys (EchoBase) and a suite of R codes (EchoR) for computing fish population indicators based on Echobase data. This site describes the Echobase database. If you are interested in EchoR, please visit the [Ifremer forge](#).

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EchoBase features a Java web-browser interface for selecting working databases, managing users, importing, editing and querying data. One can also display maps of parameters stored in Echobase in an online Geographic Information System based based on QGIS server. Echobase can be easily connected to LibreOffice base, the R statistical software or Geographic Information System for querying and displaying data. Portable H2 databases can be extracted from the server-based EchoBase instance and stored on a local harddrive. The integration of Echobase in the Ifremer acoustic survey workflow is presented in Figure 1.

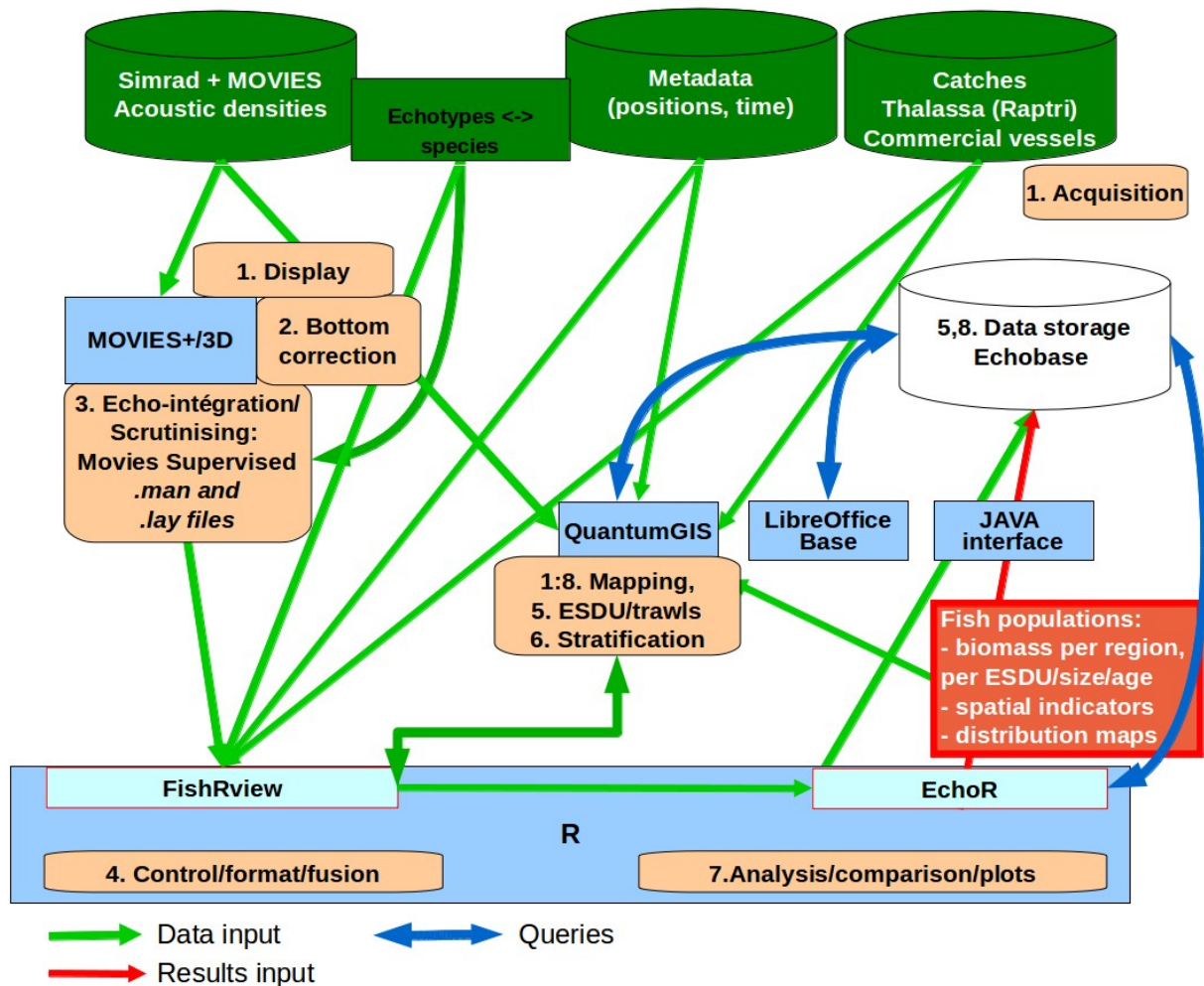


Figure 1. Integration of Echobase in the Ifremer acoustic survey workflow

3. Database structure

The EchoBase data model is based on the ICES WGFASST Topic Group on active acoustic metadata standards recommendations (ICES 2013). The ICES acoustic metadata format having no formal hierarchical structure, hierarchical relationships have added between its component to build the relational database Echobase.

Echobase comprises a main « cruise metadata branch » on which are plugged acoustic and fishing (« Operation ») data. Biomass estimation results can also be stored in the database at both the acoustic cell (small scale results) and voyage (large scale results) levels. The database also allows for the storage of length-weight and Target Strength-length reference relationships, as well as map data at the voyage level. Echobase time and date are in ISO formats.

3.1. Cruise metadata

The cruise metadata branch is based on the ICES (2013) standards (Figure 2).

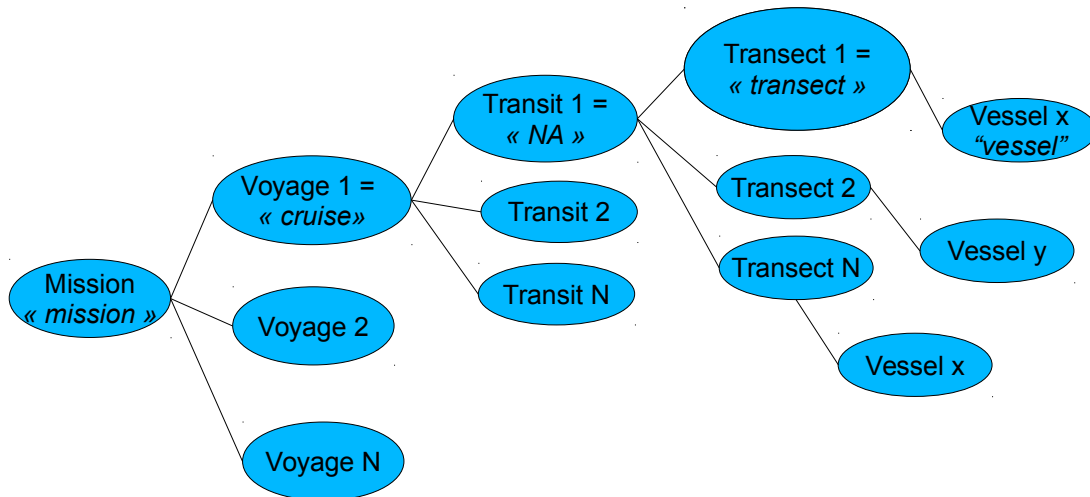


Figure 2. Echobase cruise metadata branch. ICES acoustic metadata names corresponding to Echobase names are in italic.

3.1.1. Mission

The “mission” category describes “metadata that gives a high level description of the overarching initiative (e.g. mission, project, ocean observing system) under which the acoustic data were collected” (ICES 2013). Missions attributes include most of the ICES (2013) mission category attributes (Table 1).

Echobase column name	Definition	Data type	Units	source	ICES standard name
MissionID		S		Manual	mission_id
PrincipallInvestigator		S		Manual	principal_investigator
References		S		Manual	
MissionName		S		Manual	mission_name
MissionAbstract	Free text description of the mission, its purpose, scientific objectives and area of o	S		Manual	mission_abstract
Project	The scientific project that produced the data	S		Manual	
Platform	Platform type – e.g. research vessel, mooring, AUV	S		Manual	mission_platform
Institution	Name of the institute, facility or company where the original data was produced	S		Manual	institution
Keywords	A comma separated list of key words and phrases. GCMD vocabulary	S		Manual	
References	Published or web-based references that describe the data or the methods used to prod	S		Manual	
DataCentre	Data centre in charge of the data management or party who distributed the resource	S		Manual	data_centre
DataCentreEmail	Data Centre contact e-mail address	S		Manual	data_centre_email
AuthorEmail	NetCDF file author contact e-mail address	S		Manual	
Author	Name of the person responsible for the creation of the dataset	S		Manual	creator
PrincipallInvestigatorEmail	Principal Investigator e-mail address	S		Manual	principal_investigator_email
OrganisationReferences	References that describe the data provider organisation, the place to find all informati separated with a semicolon “;”.	S		Manual	
DistributionStatement	Statement describing data distribution policy: Re-packagers of this data should include a statement that information about data qual	S		Manual	
OrganisationLevelAcknowledgement	Acknowledgments relevant to institution-level including funding sources, key contribu	S		Manual	
Source	The method of production of the original data. (e.g. “echosounder”)	S		Manual	
					mission_start_date
					mission_end_date
					contributor
					mission_comments

Table 1. Mission category attributes description. A missing “Echobase column name” means that the ICES attribute does not exist in Echobase.

3.1.2. Voyage

The “voyage” category corresponds to the “cruise” category in the ICES (2013) terminology. It describes the cruise from which the acoustic data were acquired. Its attributes include most of those of the ICES (2013) voyage category (Table 2).

Echobase column name	Definition	Data Type	Units	Default	ICES standard name
VoyageName	Voyage id where one exist, common mainly on research vessels.	S			cruise_name
	Formal name of voyage as recorded by voyage documentation or institutional data centre	S			
VoyageStartDate	Start date of voyage in ISO 8601 format	S			cruise_start_date
VoyageEndDate	End date of voyage in ISO 8601 format	S			cruise_end_date
StartPort	Name of port from where voyage starts	S			cruise_start_port
EndPort	Name of port where voyage finishes	S			cruise_end_port
AreaOfOperation	List main areas of operation	FK			cruise_area_description
VoyageDescription	Free text field to describe voyage. May include list objectives of voyage. For example scientific survey, commercial fishing, resupply or combinations of these.	S			cruise_description
Datum	Projection datum for bounding box positions. Most commonly the global datum WGS84, but other localised datum may be encountered in some circumstances.	S		WGS84	cruise_projection
MissionID	Unique mission ID	FK			cruise_id
					cruise_northlimit
					cruise_eastlimit
					cruise_southlimit
					cruise_westlimit
					cruise_uplimit
					cruise_downlimit
	The units of unlabelled numeric values of cruise_northlimit, cruise_eastlimit, cruise_southlimit, cruise_westlimit. Units specified as appropriate to the projection, e.g. geographic coordinates specify 'signed decimal degrees', UTM specify 'm'.	S			cruise_units
	The units applying to unlabelled numeric values of cruise_uplimit, cruise_downlimit. Typically would be 'm'.	S			cruise_zunits
	Name of port from where cruise starts. Recommend use of BODC port gazetteer: http://seadatanet.maris2.nl/v_bodc_vocab/search.asp?name=(C381)%20Ports+Gazetteer&l=C381	S			cruise_start_BODC_code
	See cruise_end_BODC_code				cruise_end_BODC_code
	Free text field for relevant information that might not be captured by the defined attributes				cruise_comments

Table 2. Voyage category attributes description. A missing “Echobase column name” means that the ICES attribute does not exist in Echobase.

3.1.3. Transit

The “transit” category was present in an earlier version of the ICES (2013) standards. It has been removed from the actual standards, but kept in Echobase. The “transit” describes the part (or leg) of the cruise during which the data were recorded. Its attributes are described in Table 3.

Echobase column name	Definition	Data Type	Units	Default	ICES standard name
TransitName	Unique identifier for transect	S			
TransitDescription	Description of transect, its purpose and main activity				
RelatedActivity	Describe related activities that may occur on the transit				
TransitStartTime	Start time of transect in ISO 8601 format	S			
TransitEndTime	End time of transect in ISO 8601 format	S			
TransitStartLocality	Name of recognisable locality in the general area of start of transit	S			
TransitEndLocality	Name of recognisable locality in the general area of the end of transit	S			

Table 3. Transit category attributes description.

3.1.4. Transect

The “transect” category describes transect data, normally applied to acoustic data from a moving platform ICES (2013). The transect category attributes are described in Table 4.

Echobase column name	Definition	Data type	Units	Default	ICES standard name
Title	Short description of the dataset	S			transect_id
Abstract	A paragraph describing the dataset: type of data contained in the dataset, how the data was created, the creator of the dataset, the mission for which the data was created, the geospatial coverage of the data, the temporal coverage of the data. Manually generated attribute.	S			transect_description
History	Provides an audit trail for modifications to the original data. It should contain a separate line for each modification, with each line beginning with a timestamp and including user name, modification name and modification arguments. Manually generated attribute.	S			
Comment	Miscellaneous information about the data or methods used to produce it. Any free-format text is appropriate. Manually generated attribute.	S			
Metadata	URL to the metadata record corresponding to the netCDF File. Manually generated attribute.	S			
Citation	The citation to be used in publications using the dataset should follow the format: "ProjectName. [year-of-data-download], [Title], [Data access URL], accessed [date-of-access]". Manually generated attribute.	S			
Licence	Describe the restrictions to data access and distribution.	S		EU Data Collection Framework data	
VesselName	Name of the ship	S			
VoyageID	Voyage id where one exist, common mainly on research vessels. Manually generated attribute.	S			
DateCreated	The date on which the data was created. Date format is ISO 8601, for example 2010-12-15T14:30:00Z with the Z indicating time is UTC. Will vary with each data file, possibly automatically generated.	S			
GeospatialLonMin	Westernmost longitude of bounding box. Will vary with each data file, possibly automatically generated.	D	degrees_east		transect_westlimit
GeospatialLonMax	Easternmost longitude of bounding box. Will vary with each data file, possibly automatically generated.	D	degrees_east		transect_eastlimit
GeospatialLatMin	Southernmost latitude of bounding box. Will vary with each data file, possibly automatically generated.	D	degrees_north		transect_southlimit
GeospatialLatMax	Northernmost latitude of bounding box. Will vary with each data file, possibly automatically generated.	D	degrees_north		transect_northlimit
Datum	Projection datum for bounding box positions. Most commonly the global datum WGS84, but other localised datum may be encountered in some circumstances.	S		WGS84	
Linestring	OGC:SFS/WKT compliant LINESTRING geometry representing each transect. A LineString consists of a sequence of two or more vertices, along with all points along the linearly-interpolated curves (line segments) between each pair of consecutive vertices	S			
GeospatialVerticalMin	Minimum depth of measurements. Will vary with each data file, possibly automatically generated.	D	m		transect_downlimit
GeospatialVerticalMax	Maximum depth of measurements. Will vary with each data file, possibly automatically generated.	D	m		transect_uplimit
GeospatialVerticalPositive	Direction in with geospatial vertical increases, "up" or "down"	S		down	
TimeCoverageStart	Start date of the data in UTC Date format is ISO 8601, for example 2010-12-15T14:30:00Z with the Z indicating time is UTC. Will vary with each data file, possibly automatically generated.	S			transect_start_time
TimeCoverageEnd	Final date of the data in UTC Date format is ISO 8601, for example 2010-12-15T14:30:00Z with the Z indicating time is UTC. Will vary with each data file, possibly automatically generated.	S			transect_end_time
BinUnitsPingAxis	Units on the ping-axis by which processed data has been binned. Must be either Time, Distance or number of pings. Will vary with each data file, possibly automatically generated.	S		1 nautical mile	
BinSizePingAxis	Size of bin dimension on the ping-axis according to bin units. Will vary with each data file, possibly automatically generated.	D			
BinSizeRangeAxis	Size of bin dimension on the range-axis. Will vary with each data file, possibly automatically generated.	D	m		
Stratum	Sampling stratum	S			
	Describe related activities that may occur on the transit				transect_related_activity
	The units of unlabelled numeric values of transect_northlimit, transect_eastlimit, transect_southlimit, transect_westlimit. Units specified as appropriate to the projection, e.g. geographic coordinates specify 'signed decimal degrees', UTM specify 'm'.				transect_units
					transect_comments

Table 4. Transect category attributes description. A missing “Echobase column name” means that the ICES attribute does not exist in Echobase.

3.1.5. Vessel

Each transect is linked to a “vessel” item (“ship” in ICES (2013) terminology), that describes the platform used to collect the data. The vessel category attributes are described in Table 5. Note that no “Mooring” category is available in Echobase now, as this category was added to the ICES (2013) standard after the design of the database.

Echobase column name	Definition	Data type	Units	ICES standard name
VesselName	Name of the ship	S		ship_name
VesselType	Describe type of vessel that is hosting the acoustic instrumentation (e.g. research, commercial fishing, merchant)	S		ship_type
VesselCode		S		ship_code
Callsign	Ship's callsign	S		ship_callsign
AltCallsign	Alternative callsign if the ship has more than one.	S		ship_alt_callsign
IMO	Ship's International Maritime Organisation ship identification number.	S		ship_imo
Operator	Name of organisation or company which operates the ship	S		ship_operator
VesselLength		N	m	ship_length
VesselTonnage		N	tonnes	ship_tonnage
VesselEnginePower		N	kW	ship_engine_power
VesselNoiseDesign		S		ship_noise_design
Acknowledgement	Any users (including re-packagers) of this data are required to clearly acknowledge the source of the material in this format. E.g. vessel of opportunity - acknowledge contribution by vessel and company.	S		ship_acknowledgement A
	The width of the ship at its widest point	N	m	ship_breadth
	Free text field for relevant information that might not be captured by the defined attributes	S		ship_comments

Table 5. Vessel category attributes description. A missing “Echobase column name” means that the ICES attribute does not exist in Echobase.

3.2. Acoustic data

The acoustic data branch of the database model is based on the ICES (2013) standards (Figure 3).

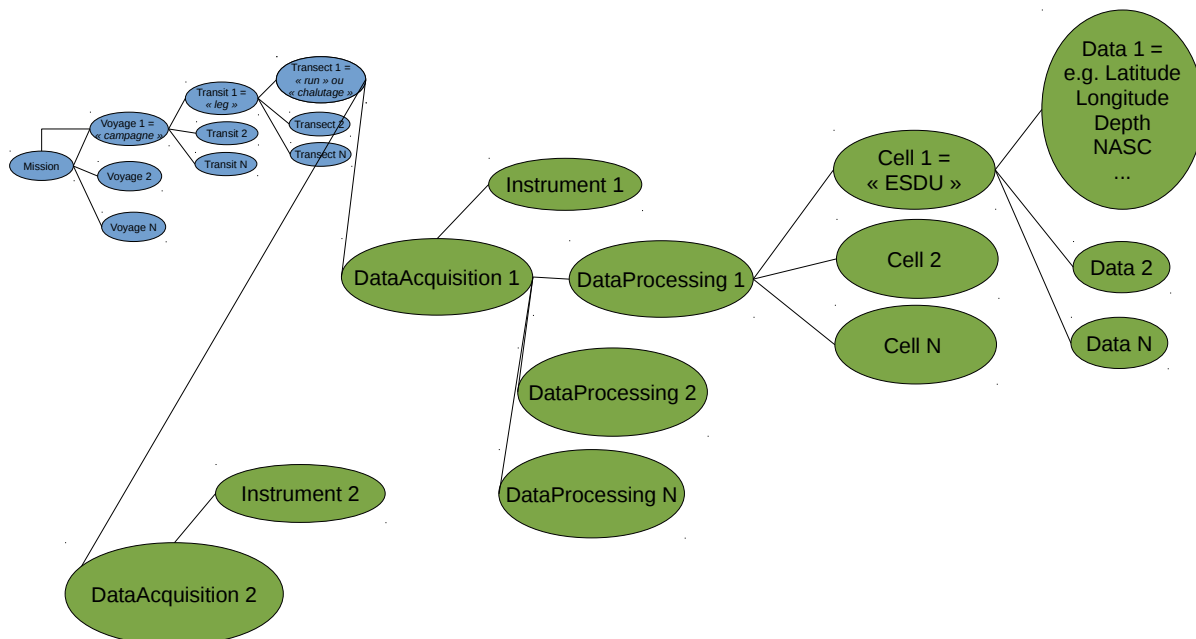


Figure 3. Echobase acoustic data branch.

3.2.1. Data acquisition

The data acquisition category describes the acoustic data acquisition process. Its attributes are based on the ICES (2013) standard (Table 6).

Echobase column name	Description	Type	Units	Default	ICES standard name
TransceiverAcquisitionAbsorption	Absorption value in dB/m	D	dB/m		
TransceiverAcquisitionAbsorptionDescription	Describe (i) equation used to calculate absorption, (ii) source of input data into absorption calculation (e.g. model, XBT, CTD), (iii) arithmetic or geometric mean of depth-absorption profile or nominal value applied to entire data set, e.g. (i) Equation: Francois and garrison 1982, (ii) WOCE98 model, (iii) nominal value for entire data set.	S		(i) Equation: Francois and garrison 1982, (ii) CTD, (iii) nominal value for entire data set	
TransducerAcquisitionBeamAngleAftwardship	Aftwardship beam angle – need to establish convention (major/minor, Longitudinal etc	D	degrees		
TransducerAcquisitionBeamAngleAlongship	Alongship beam angle – need to establish convention (major/minor, Longitudinal etc	D	degrees		
TransducerAcquisitionPsi	Transducer equivalent beam angle	D	dB		
TransceiverAcquisitionPower	Transceiver power	I	Watts		
TransectAcousticInstrumentID	Unique transect/instrument ID	S			
DataAcquisitionID	unique data acquisition ID	ID			
AcquisitionSoftwareVersion	Version of software that controls echosounder and its data logging	S		one value for ER60 and one value for ME70	data_acquisition_software_version
LoggedDataFormat	Format(s) in which logged data is stored	S		.hac and .raw formats	
LoggedDataDatatype	Datatype of logged data. For example 'raw' digitisation samples or S _v (volume backscatter)	S		'raw' digitisation samples	
TransceiverAcquisitionPulseLength	Transceiver pulse length	D	Milliseconds		
TransceiverAcquisitionGain	Transceiver gain value. Units may be in dB for some systems (e.g. Simrad) but on other instruments may be dimensionless numeric values	D	dB		
TransceiverAcquisitionSacorrection	Sa correction value (Simrad transceivers)	D	dB		
PingDutyCycle	Free text field to describe ping duty cycle. For a vessel system this may be continuous pinging at a certain rate. For a mooring this may describe the duty cycle. For example 10 minutes pinging at 1 ping per second, followed by 50 minute sleep mode.	S		ffremers standard ping duty cycle	data_acquisition_ping_duty_cycle
EchosounderSoundSpeed	Sound speed used by echosounder. Should be global across all frequencies	S	ms ⁻¹	Variable	
SoundSpeedCalculations	Describe (i) equation used to calculate sound speed, (ii) source of input data into sound speed calculation (e.g. model, XBT, CTD), (iii) arithmetic or geometric mean of depth-sound speed profile or nominal value applied to entire data set, e.g. (i) Equation: Mackenzie (1980), (ii) WOCE98 model, (iii) nominal value for entire data set.	S		(i) Equation: Mackenzie (1980), (ii) CTD, (iii) nominal value for entire data set (i) Equation: Mackenzie (1980), (ii) Hull-mounted thermosalinometer, (iii) surface absorption value recomputed every 30s and applied to the entire data set	
					data_acquisition_software_name
					data_acquisition_stored_data_format
					data_acquisition_comments

Table 6. Data acquisition category attributes description. A missing “Echobase column name” means that the ICES attribute does not exist in Echobase.

3.2.2. Acoustic instrument

Each data acquisition item is linked to an “acoustic instrument”. The Echobase acoustic instrument category corresponds to the ICES (2013) “instrument” category. No ICES (2013) “Ancillary instrumentation” category is available in Echobase.

Its attributes are presented in Table 7. Some attributes included in the ICES (2013) “instrument” category are in Echobase in the “data acquisition” category (Table 6).

Echobase column name	Description	Type	Default	ICES standard name
DataProcessingID	Unique Data processing ID	S		
ProcessingTemplate	Source template upon which all processing was based (if applicable)	S		
ProcessingDescription	Free text field where processing details can be outlined. References to external documents which give a full account of processing may be appropriate	S		
SounderConstant		D	NA	
DigitThreshold		I	-100	
EIThresholdLow		I		
EIThresholdHigh		I		
AcousticDensityUnit		S	sA	
Notes		S		
TransceiverProcessingGain	Transceiver gain value. Units may be in dB for some systems (e.g. Simrad) but on other instruments may be dimensionless numeric values	D		data_processing_transceiver_gain
DataAcquisitionID	Unique Data acquisition ID	S		
ProcessingSoftwareVersion	Name and version of software that was used to process raw acoustic data	S		data_processing_software_version
TransceiverProcessingSacorrection	Sa correction value (Simrad transceivers)	D		data_processing_sacorrection
TransceiverProcessingAbsorption	Absorption value in dB/m			data_processing_absorption
TransceiverProcessingAbsorptionDescription	Describe (i) equation used to calculate absorption, (ii) source of input data into absorption calculation (e.g. model, XBT, CTD), (iii) arithmetic or geometric mean of depth-absorption profile or nominal value applied to entire data set. e.g. (i) Equation: Francois and garrison 1982, (ii) WOCE98 model, (iii) nominal value for entire data set.		(i) Equation: Francois and garrison 1982, (ii) CTD, (iii) nominal value for entire data set	data_processing_absorption_description
TransducerProcessingPsi	Transducer equivalent beam angle	D		data_processing_transducer_psi
TransducerProcessingBeamAngleAthwartship	Athwartship beam angle – need to establish convention (major/minor, Longitudinal etc	D		
TransducerProcessingBeamAngleAlongship	Alongship beam angle – need to establish convention (major/minor, Longitudinal etc	D		
EchosounderSoundSpeed	Sound speed used by echosounder. Should be global across all frequencies	S	Variable	data_processing_soundspeed
SoundSpeedCalculations	Describe (i) equation used to calculate sound speed, (ii) source of input data into sound speed calculation (e.g. model, XBT, CTD), (iii) arithmetic or geometric mean of depth-sound speed profile or nominal value applied to entire data set. e.g. (i) Equation: Mackenzie (1980), (ii) WOCE98 model, (iii) nominal value for entire data set.	S	For ER60 : (i) Equation: Mackenzie (1980), (ii) CTD, (iii) nominal value for entire data set For ME70 : (i) Equation: Mackenzie (1980), (ii) Hull-mounted thermosalinometer, (iii) surface absorption value recomputed every 30s and applied to the entire data set	data_processing_soundspeed_description
	Name of software that was used to process raw acoustic data	S		data_processing_software_name
	Unique identifier for each data channel	S		data_processing_channel_id
	Bandwidth associated with processed data	N		data_processing_bandwidth
	Transmit frequency associated with processed data	N		data_processing_frequency
	Nominal transceiver power	N		data_processing_transceiver_power
	Transmit pulse length	N		data_processing_transmit_pulse_length
	Units for the data_processing_transceiver_gain attribute. Units may be in dB for some systems (e.g. Simrad) but on other instruments may be dimensionless numeric values	S		data_processing_transceiver_gain_units
	Free text field for relevant information that might not be captured by the defined attributes	S		data_processing_comments

Table 7. Acoustic instrument category attributes description. A missing “Echobase column name” means that the ICES attribute does not exist in Echobase.

3.2.3. Calibration

The calibration category describes the acoustic instrument calibration process. One or several data calibration items can be linked to each instrument. The calibration attributes are based on the ICES (2013) standard (Table 8).

Echobase column name	Description	Type	Units	ICES standard name
AcousticInstrumentID	For each transceiver/transducer combination, the <id> in the variable name will be replaced by an integer number, commencing at 1 for the lowest frequency incrementing by 1 for each higher frequency.	S		
CalibrationDate	Date of calibration from which calibration results have been applied to the data	S		calibration_date
CalibrationAcquisitionMethod	Describe the method used to acquire calibration data	S		calibration_acquisition_method
CalibrationProcessingMethod	Describe method of processing that was used to generate calibration offsets.	S		calibration_processing_method
CalibrationAccuracyEstimate	Estimate of calibration accuracy either in dB or a percentage	S		calibration_accuracy_estimate
CalibrationReport	URL or reference to location of calibration report	S		calibration_report
	Free text field to for relevant information that might not be captured by the defined attributes	S		calibration_comments

Table 8. Calibration category attributes description. A missing “Echobase column name” means that the ICES attribute does not exist in Echobase.

3.2.4. Data processing

The data processing category describes the acoustic data processing process. One or several data processing items can be linked to each data acquisition item. The data processing attributes are based on the ICES (2013) standard (Table 9).

Echobase column name	Description	Type	Default	ICES standard name
DataProcessingID	Unique Data processing ID	S		
ProcessingTemplate	Source template upon which all processing was based (if applicable)	S		
ProcessingDescription	Free text field where processing details can be outlined. References to external documents which give a full account of processing may be appropriate	S		
SounderConstant		D	NA	
DigitThreshold		I	-100	
EIThresholdLow		I		
EIThresholdHigh		I		
AcousticDensityUnit		S	sA	
Notes		S		
TransceiverProcessingGain	Transceiver gain value. Units may be in dB for some systems (e.g. Simrad) but on other instruments may be dimensionless numeric values	D		data_processing_transceiver_gain
DataAcquisitionID	Unique Data acquisition ID	S		
ProcessingSoftwareVersion	Name and version of software that was used to process raw acoustic data	S		data_processing_software_version
TransceiverProcessingSacorrection	Sa correction value (Simrad transceivers)	D		data_processing_Sacorrection
TransceiverProcessingAbsorption	Absorption value in dB/m			data_processing_absorption
TransceiverProcessingAbsorptionDescription	Describe (i) equation used to calculate absorption, (ii) source of input data into absorption calculation (e.g. model, XBT, CTD), (iii) arithmetic or geometric mean of depth-absorption profile or nominal value applied to entire data set. e.g. (i) Equation: Francois and garrison 1982, (ii) WOCE98 model, (iii) nominal value for entire data set.		(i) Equation: Francois and garrison 1982, (ii) CTD, (iii) nominal value for entire data set	data_processing_absorption_description
TransducerProcessingPsi	Transducer equivalent beam angle	D		data_processing_transducer_psi
TransducerProcessingBeamAngleAthwartship	Athwartship beam angle – need to establish convention (major/minor, Longitudinal etc	D		
TransducerProcessingBeamAngleAlongship	Alongship beam angle – need to establish convention (major/minor, Longitudinal etc	D		
EchosounderSoundSpeed	Sound speed used by echosounder. Should be global across all frequencies	S	Variable	data_processing_soundspeed
SoundSpeedCalculations	Describe (i) equation used to calculate sound speed, (ii) source of input data into sound speed calculation (e.g. model, XBT, CTD), (iii) arithmetic or geometric mean of depth-sound speed profile or nominal value applied to entire data set. e.g. (i) Equation: Mackenzie (1980), (ii) WOCE98 model, (iii) nominal value for entire data set.	S	For ER60 : (i) Equation: Mackenzie (1980), (ii) CTD, (iii) nominal value for entire data set For ME70 : (i) Equation: Mackenzie (1980), (ii) Hull-mounted thermosalinometer, (iii) surface absorption value recomputed every 30s and applied to the entire data set	data_processing_soundspeed_description
	Name of software that was used to process raw acoustic data	S		data_processing_software_name
	Unique identifier for each data channel	S		data_processing_channel_id
	Bandwidth associated with processed data	N		data_processing_bandwidth
	Transmit frequency associated with processed data	N		data_processing_frequency
	Nominal transceiver power	N		data_processing_transceiver_power
	Transmit pulse length	N		data_processing_transmit_pulse_length
	Units for the data_processing_transceiver_gain attribute. Units may be in dB for some systems (e.g. Simrad) but on other instruments may be dimensionless numeric values	S		data_processing_transceiver_gain_units
	Free text field for relevant information that might not be captured by the defined attributes	S		data_processing_comments

Table 9. Data processing category attributes description. A missing “Echobase column name” means that the ICES attribute does not exist in Echobase.

3.2.5. Cells

In Echobase, a cell is a spatial entity in which data have been collected or to which analysis results are associated. Common cell types include: echo-integration cell, acoustic Elementary Sampling Distance Unit (ESDU), post-stratification region etc... The cell attributes are described in Table 10.

Echobase column name	Description	Type
CellName	Unique depth stratum ID	S
CellID	Unique cell ID for region	S
CellType	Type of cell (ESDU, elementary, region...)	S

Table 10. Cell category attributes description.

3.2.6. Data

In Echobase, data items are linked to cells. A data describe the spatial and temporal extent of the cells (e.g. longitude and latitude of the cell vertices, date/time). Data attributes are presented in Table 11.

Echobase column name	Description	Type	Units
CellID	Cell unique ID	S	
DataID	Data unique ID	S	
DataMetadataID	Link to metadata describing the data value	S	
DataValue		N	
DataQualityFlagValues	Quality	FK	

Table 11. Data category attributes description.

3.2.7. Results

In Echobase, results items are linked to cells. Results actually stored in Echobase include:

- "AcousticDensity": acoustic densities derived from echo-integration per depth layer
- "Biomass": fish biomass derived from acoustic and catch data
- "Abundance": fish abundance derived from acoustic and fishing data
- "MeanLength": mean fish length"

Results attributes are presented in Table 12.

Echobase column name	Description	Type	Units
CategoryID	Result category	S	
DataValue	Data value	S	
ResultID	unique ID of data classified into echotypes	ID	
ResultMetadataID	Type of result (NASC, biomass...)	ID	

Table 12: Result category attributes description.