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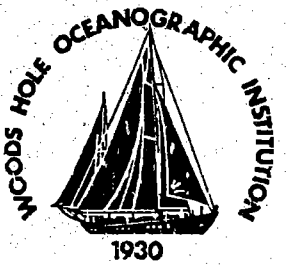

SOUND Database of Marine Animal Vocalizations Structure and Operations

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William A. Watkins, Kurt Fristrup, Mary Ann Daher,
and Terrance Howald

August 1992

Technical Report

Funding was provided by the Office of Naval Research through the Ocean Acoustics Program (code 11250A) under Contract No. N00014-88-K-0273 and No. N00014-91-J-1445 with supplemental support by CRINCON/DARPA and NRL (code 211).

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Approved for Distribution:

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ABSTRACT

The SOUND database system for marine animal vocalizations has been updated to include changes in the structure and operations that have evolved with use. These include more convenient operations, greater flexibility in analysis routines, and a revised database structure. The formats for data sorting and indexing, database structure, and analysis routines have developed into a convenient research tool. This report is a revision of the earlier operating manual for the SOUND databases (Watkins, Fristrup, and Daher 1991).

The interactive databases that comprise the SOUND system provide comprehensive means for quantitative analyses and statistical comparisons of marine animal vocalizations. These SOUND databases encompass (1) descriptive text databases cataloging the WHOI collection of underwater sound recordings of marine animals, (2) sets of files of digital sound sequences, (3) text databases organizing the digital sound cuts, and (4) software for analysis, display, playback, and export of selected sound files. The text databases index and sort the information about the sounds, and the digital sound cut files are accessed directly from the text record. From the text database, the sound cut data may be analyzed on screen, listened to, and compared or exported as desired.

The objective of this work has been the development of a basic set of tools for the study of marine animal sounds. The text databases for cataloging the recordings provide convenient sorting and selection of sounds of interest. Then, as specific sequences are digitized from these recordings, they become part of another database system that manages these acoustic data. Once a digital sound is part of the organized database, several tools are available for interactive spectrographic display, sound playback, statistical feature extraction, and export to other application programs.

KEY WORDS -- Sound database, Marine animals, Underwater sounds, Animal vocalizations.

SOUND Database

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SOUND Database

OBJECTIVES

This 1992 manual revises the description of the SOUND database system, and incorporates current formats for data sorting and indexing, for database structure, and for conducting data searches. Details of the operation of database associated programming are given for retrieval of selected digital sound files and for interactive display of text data along with waveform, FFT spectra, and RID spectral decomposition analyses. Other operations include concurrent playback of sound files and export of data for other uses.

The Marine Animal SOUND Database system (Watkins, Fristrup, and Daher 1991) provides convenient access and rapid analysis and display of acoustic data in the WHOI collection of recordings from marine species. The organization of the database structures follows that developed for convenient indexing and retrieval of data in our CETACEA database of literature references (Watkins, Daher, and Haley 1990). In addition, acoustic sequences from the various animal repertoires were digitized to provide a representative selection of sounds associated with the behaviors of the different animal species and sounds from a number of other non-biological sources. These digital sound files were organized and accessed directly from within the text databases.

The objective of this program has been the development of basic tools for the study of marine animal sounds, for accessing, analyzing, and comparing the acoustic patterns. This has included work on characterization of sound features for statistical comparison, and automatic recognition and diagnosis of marine animal vocalizations.

The SOUND databases have fulfilled these objectives of providing convenient means of relating the sounds to text data, sorting and retrieving them, allowing immediate analysis and playback of sequences of these sounds. This has opened the way for comprehensive, quantitative analyses and statistical comparisons of marine animal sounds.

ACKNOWLEDGEMENTS

The Marine Animal SOUND Database program is a joint effort by all who use these databases in their research, including William Schevill, Peter Tyack, Laela Sayigh, and Cheri Recchia. This effort is shared also by previous members of our bioacoustics program, including Nancy Haley, Karen Moore, and James Bird. The data collection at sea had expert contribution from all of those associated with the vessels and aircraft used for observations of marine animals over more than four decades. The organization and interpretation of the acoustic data encoded now by the SOUND databases are a result of the collective ideas and experiences of this entire group. The authors' contributions have emphasized basic structural organization (Watkins), innovative computer tools for augmenting the database functions (Fristrup), careful oversight of acoustic and annotation records (Daher), and analysis and software innovations (Howald). The central core of this program is the long standing collection of marine animal sound recordings -- tributes to the researchers that have made these important contributions for over 45 years.

Support for the Marine Animal SOUND Databases has been primarily from the Ocean Acoustics Program (code 11250A) of the Office of Naval Research with Contracts and Research Grants (most recent N00014-91-J-1445) and supplementary support through NRL (code 211, Stennis Center, MI) and DARPA/ORINCON (San Diego, CA). The program of bioacoustic studies that provided much of the previous work resulting in our acoustic recordings of marine life was supported for a considerable period by the Oceanic Biology Program of ONR. A wide range of other research programs and private support over this long period also have contributed to our work at sea and in the laboratory, providing understanding of the acoustic behavior of these marine species.

INTRODUCTION

Database Organization --

This revision reflects changes to the SOUND database structure, organization, and associated analyses that have evolved since the original documentation (Watkins, Fristrup, and Daher 1991). These systems are in daily use, and the current arrangement is a result of its practical application for analysis and comparison of animal sounds.

The SOUND database system has a similar organization to that developed for the CETACEA databases described by Watkins, Bird, Moore, and Tyack (1988) with modified format revisions detailed by Watkins, Daher, and Haley (1990). Both SOUND and CETACEA databases use the same text systems for cataloging subjects, dates, geographic locations, and pertinent descriptive data. These notations are directly related to more than 150 species categories (Species List and List of Common Names for Marine Animals are appended). The acoustic data are referenced to text information about the species and the recording situation.

The data about the sound recordings cataloged in the SOUND databases are indexed and sorted by the database management program to provide convenient, rapid mechanisms for selecting sound recordings or digitized data of interest. The SOUND databases are presently installed on PC and AT compatible computers running Microsoft DOS, and the current organization for the system is based on INMAGIC 7.2 database software (INMAGIC INC., Cambridge, MA).

The text information for the SOUND databases are indexed in 31 fields (including date, location, recording data, sound class, species, number of animals, author, etc. -- see pages 19-22), and it allows independent sorting and retrieval of data in each field and unlimited subfields. The databases are searched by any combination of indexed or unindexed alphanumerical notations, by any combination of terms or partial phrases or stems of these notations. Searches may be complex and mixed with Boolean search statements. The data record for the desired sound file is selected by the text databases. The related digitized sound file may be immediately retrieved, analyzed, displayed, and played back, without leaving the text database. The databases continue to enlarge as the numbers of recordings increase, and as sound analyses have become more detailed. The databases (recordings, sound cuts, and literature) organize more than ten thousand records.

SOUND Database

Marine Animal Recordings --

The library of sound recordings that provide the basis for the Marine Animal SOUND Databases were made during studies on acoustic behavior of marine species. This bioacoustic work was started in 1947 by William E. Schevill, and a continuous program of study of marine animal acoustic behaviors has been maintained at WHOI since that time. The initial set of tape recordings organized by the SOUND database included approximately 2000 magnetic tapes. These sounds on the tapes represented approximately 70 species of marine mammals, as well as fishes, crustaceans, and selected ambient noises.

The collection of marine animal sounds continues to enlarge as recordings are added from our own experiments at sea (two Arctic and four Caribbean cruises in 1989-1991), in addition to recordings by others. This library of recordings includes a variety of magnetic tapes, reel-to-reel with different widths and reel dimensions, VCR tapes, cassettes, phonograph records, computer digital media and optical disks. The combined SOUND databases now have more than 6000 entries.

The animal sounds in the recording collection and its database system incorporate a number of the historically important scientific contributions in bioacoustics, such as the first science recordings from marine mammals at sea by William Schevill (beluga, Delphinapterus leucas) and the early sound records of echolocating bats (Eptesicus and Plecotus) and oil birds (Steatornis caripensis) by Donald Griffin.

These original underwater bioacoustic studies were underway before tape recorders were readily available, so that recordings were made on a variety of different types of equipment. For example, the earliest records of the acoustic behavior of beluga were made on a "Gray Audograph" dictating machine, and signals were recorded on waxed paper disks. These sounds were then reproduced on transcription phonograph records. Copies of these recordings made on magnetic tape are retained in the collection.

The sound spectra recorded by the different recording media vary with each system that was used, from bandwidths of only a few kHz to 200 kHz or more. Recordings were made with single channel systems and with arrays of four or more hydrophones, using sensor depths varying from near surface to bottom mounted units. Recording equipment has varied considerably over the years, including standard audio systems, professional standards IRIG systems, and special purpose recorders. Most systems used "Direct" recording because of the wide bandwidths or high frequencies required to reproduce the natural animal sounds.

Marine mammals have been emphasized in the studies of animal acoustic behavior, therefore, much of the recorded data has focused on the sounds of cetaceans, pinnipeds, and sirenians. Recordings in the collection include underwater sounds from more than 70 species of marine mammals. Geographic locations for these recordings are scattered worldwide, with observations in many locations often taken over much of the year. Because of the long sequence of studies and the wide range of acoustic work represented by these continuing programs, the recording collection is representative for many areas of the world.

Prior to 1970, the attribution for sounds heard underwater was not always immediately certain, but with experience, more of the repertoire of the different species became recognized. As a result, there has been a change in the nature of the recordings over time. The use of multiple hydrophone arrays has increasingly allowed identification of vocalizations and sequences of sounds from individuals. Sources for the recorded sounds have been positively identified by these means. Many of the recordings were made especially to trace the usage or development of particular sequences of vocal activity.

The more recently recorded sounds deal less with species or population differences, and more with sounds that illustrate specific behaviors. Later recordings, therefore, are more focused on specific scientific objectives (vocal identity, mimicry, shared signalling, ontogeny of learned signals), and they relate to certain species (sperm whales, finbacks, bowheads, bottlenose dolphins, etc.). For example, our 1954-1968 sperm whale recordings led to specific studies of their activities, which in turn opened the way to work focused on coda signals produced by these whales, and then to analyses of distinctions between codas from individuals and those shared by the members a particular population.

INTERRELATED DATABASES

The textual data on marine animals and their sounds are organized by a series of interrelated computer databases currently using PC and AT workstations. These separate, related databases for organization of marine animal vocal behavior include: (1) CETACEA, a comprehensive database of references to the literature on marine animal sounds, (2) SOUND, a database for the descriptive information about each of the sound recordings, (3) SOUNDC, a database for the detailed information and acoustic descriptors for each of the separate digital sound cuts, (4) SOUND2 (SOUND2C, and other series), auxiliary databases for specific research emphases using these same data protocols, and (5) a set of matching digital sound cut files (filename matching the text database record). The digitized sound cuts are stored as separate files on optical disk, and they can be accessed, analyzed (time series and a variety of spectrographic portrayals), displayed, and played back from within the text (SOUNDC) databases.

Structures for all of the databases follow similar patterns, use the same systems of annotation, and relate to the same lists of species, geographic codes, etc. Separate, indexed fields within each of the database records describe the recording situation, the equipment used, the geographic locations and recording dates, species (and individuals) that were present, behavioral notes, sound types, etc. Records with any of these data or any alphanumeric combination in any field may be rapidly searched and selected. Then, the matching digital sound file can be retrieved for analysis and display or accessed for other purposes. Auxiliary databases provide separate organization for particular research projects on animal sounds (dolphin mother-calf signature whistles, beluga vocal behavior, sperm whale coda patterns, etc.).

A display-edit-export function for the sound files accesses the digital files from within the text databases. This is a pop-up, TSR utility for retrieving the stored digital sound file, and analyzing and displaying waveforms and color spectrograms (a variety of FFT and RID analyses) from within the text database. Cursors provide measurement of signal time and frequency, and select portions for expansion or export.

A header with identifying information is prefixed to each digital sound file. The header duplicates a portion of the ASCII text from the related (SOUNDC) text database record. This text information is also related to the original database record of the library collection of recordings, SOUND, thereby allowing the sorting and retrieval of tape information from subsidiary databases, SOUNDC, SOUND2C, etc. The identified digital sound files are accessed from within these text databases, retrieved directly from storage, such as from optical disks.

Equipment --

Sounds from the marine animal recording collection are reproduced on a variety of reel-to-reel, VCR, and cassette equipment. As possible, frequency responses and dynamic ranges at least as good as for the original recordings are maintained, so as to provide equivalent spectra to those of the original recording systems.

Sounds are analyzed with a variety of equipment, including Kay DSP Sonagraph 5500 (Kay Elemetrics, Pinebrook, NJ), WHOI VOICE analyzer (Martin, Catipovic, Fristrup, and Tyack 1990), RSIG and CSIG routines from within the SOUND databases (Fristrup, Daher, Howald, and Watkins 1992), and other special purpose analyses adapted to specific requirements. Digital conversion for sound cuts is performed at more than twice the highest frequency of the sequences of interest. PC and AT work-stations (optimized 286, 386, and 486 computers) are used for database operations.

The digital sound cut files are stored (archival) on optical disks (Maxtor OC-800), and large capacity hard disk drives are used for temporary deposit of sound files during database manipulations.

CETACEA --

The comprehensive, background database of references to the literature, CETACEA, emphasizes information on marine animal sounds. The data in about 4500 records (to date) are indexed and sorted by 300 subjects, 150 species categories, and a variety of other indexed notations

including dates, locations, sound spectral characteristics, environmental observations, etc. A unique feature of these database structures is the direct connection between species and all other indices, including subjects, locations, observation dates, notes, etc. In addition, codes have been adapted for ease in identifying and linking data in various fields. Searching the database is rapid, using a wide variety of simple and complex Boolean strategies. The CETACEA database and its operations have been described in two reports (Watkins, Bird, Moore, and Tyack 1988; and Watkins, Daher, and Haley 1990).

The CETACEA database and the related SOUND databases use an adaptation of INMAGIC software (INMAGIC Inc., Cambridge, MA) for the text data indexing, sorting, and searching routines. For each database, the programs operate with three interactive files: structure, index, and data records. They all share the direct linkage of species with other indices.

SOUND --

The databases for the marine animal collections of analog acoustic recordings organize the descriptive information about each of the sound records and sequences of sound. The SOUND databases (including auxiliary databases such as SOUND2, etc.) index and sort the data for more than 6000 recordings to date. These databases continue to grow as the collections increase in size and complexity. Separate databases are established for particular research needs (for example, one database is currently used for separate organization of the collection of VCR and cassette recordings of dolphins, and other related databases are for specific data on digitized cuts of signature sounds, etc.). Unique retrieval numbers for each record also provide the date and sequence of recording (for example, 83093 indicates the 93rd recording cataloged for the year 1983), and these retrieval codes are used in indexing and shelving of the library collections. Data about the recordings are sorted by 150 species, 30 indexed subjects that are also directly connected to species, in addition to a variety of other information, including recording locations, dates and times, identities of individuals, number of animals, sound levels, and sound types.

SOUNDC --

The digital cuts of marine animal sounds are organized by specific text databases, such as SOUNDC (sound cut). These text databases for the sound cuts have similar structure and design to the other SOUND databases, and they are used in the same ways to index and sort the data appropriate to the individual sound sequence on the digital file. The sound cut databases relate specifically to the sequences of sounds taken from the different recordings in the library collection. Unique retrieval numbers for each digital sound cut file identify the original recording as well as the sequence of digital cuts made from that original (for example, 83093034 identifies the 93rd recording catalogued for 1983 listed as tape number 83093, and this cut is sound cut number 34 from that recording). Added details indexed in the sound cut databases (such as SOUNDC) include particulars about that sound sequence, including reference to library tape cue, channel numbers analyzed, duration and sampling rate for the digital file, sound comparison characters, etc. These data are sorted by 150 species, 30 indexed subjects that are directly connected to species, such as recording location, dates, number of animals, sound types, etc.

A specific digital sound cut file selected by searching the SOUNDC databases is retrieved as desired. Then, using the pop-up display utility, RSIG, without leaving the database, the sound cut may be analyzed, displayed on screen, and played back by loudspeaker. At a keystroke, the text data for the cut is back on screen or another type of analysis is underway to provide further detail about the sound cut.

Digital Sound Files --

Digital sound cuts are stored as independent files, identified by filenames that match text database record numbers. The first 512 bytes of each file include the indexing information as a header for that sound cut file. The related text SOUNDC database provides the flexible search, selection, and retrieval capabilities for accessing these files from within the database. Sound sequences are selected and digitized as separate sound cut files for a variety of purposes, including that of illustration of a particular type of sound, detailing the repertoire of individual species, analyzing sounds related to certain

behaviors, comparing sequences of signals from different species, separating distinctive calls from different populations, or demonstrating variation with season and activity, etc.

ANALYSIS AND DISPLAY

The digital sound cut files identified by searching the SOUNDC database may be selected for later analysis, or as noted above, they may be immediately analyzed, displayed, and played back without leaving the SOUNDC text database. Immediate access to the digital acoustic data is provided by a pop-up utility, RSIG. RSIG retrieves the digital file identified by the current search results from SOUNDC, and the digital file is analyzed with both waveform and spectrogram displayed simultaneously on screen, with concurrent audio playback. The analyzed signals may be edited, re-analyzed, and expanded as desired. Or, the text search results may be re-examined and other signals rapidly retrieved for analysis and display. These digital sound files may also be reformatted and exported by RSIG as needed.

Alternatively, a stand alone analysis program, CSIG (with functions similar to RSIG), may be used directly, without interaction with the database, to analyze, display, and playback the digital sound files.

All of the SOUND databases, file handling routines, and signal analysis and display programs are related. They utilize common identifiers, data structures, field labels, search and sorting strategies, and display parameters. In addition to the primary databases and their analysis systems, other auxiliary databases are also maintained, such as SOUND2 and SOUND3C which organize data for different species and particular bioacoustic projects and analyses.

INMAGIC PROGRAM

The SOUND databases are currently used with an adaptation of INMAGIC database software (version 7.2, INMAGIC Inc., Cambridge, MA) for text databases. This is a

flexible text database system that has proven to be relatively simple and easily searched, while retaining the needed complexity of association within indexed data. A unique feature of the data association for these databases is the direct link between species and other indexed subjects. The combination of the coding system and the database software allows every component or alphanumeric entry in the record to be available for searching by a wide variety of simple and complex Boolean strategies.

The INMAGIC text database system includes the following features: (1) permits records of any length, (2) relates 75 or more fields, (3) provides for unlimited numbers of defined subfields, (4) indexes and sorts fields and subfields, (5) indexes as each data record is entered, (6) allows independent sorting and retrieval of data in subfields as well as fields, (7) supports search strategies developed with Boolean operators (and, or, not) and nested arguments, (8) uses searches with qualifiers (greater than, less than, equal to, from/to), (9) provides for convenient right-hand truncation in search statements, (10) saves and combines search results, (11) allows use with user-defined formats for display or re-ordering of data, (12) prints any number of selected records in any of these formats, (13) lists any indexed terms or fields and subfields with their frequency of occurrence, (14) permits the use of extended characters in records, (15) provides for development of flexible on-line thesaurus of terms, search operators, and definitions for help in searching the records, (16) permits rapid copying of data records, and (17) allows importation of ASCII records created elsewhere. Records in the CETACEA database, for example, are indexed by more than 300 subjects, 150 species categories, and a variety of other notations including dates, locations, sound features, environmental observations, etc. With approximately 5000 records in the CETACEA database, searching and retrieval of data records or combinations of records are rapid, usually less than a second.

The databases may be searched by any combination of indexed or unindexed alphanumeric notations. Detailed searches may be made using specific indexed fields, such as genus/species (searchable by order/suborder and family as well). Searching may use any combination of terms and text words or even stems of words or partial phrases and parts of any alphanumeric entry. In addition, codes have been adapted for ease in identifying and searching species, subjects, geographic areas, etc. The alphanumeric coding of marine animal species allows indexing, sorting, and

retrieval of most subject fields, geographic locations, dates, and events in direct relationship to specific species. Detailed searches may be made using genus/species, record number, identification, age, gender, observation date, geographic locations (including area names and latitude and longitude), author of recording, sound type, etc.

Detailed descriptions of search operations and potential combinations of search statements appropriate to these databases are reviewed in more detail in the previous SOUND database report (Watkins, Fristrup, and Daher 1991) and in the CETACEA database reports (Watkins, Bird, Moore, and Tyack 1988, Watkins, Daher, and Haley 1990). See the INMAGIC Manual (INMAGIC INC., Cambridge, MA 02140-1338).

Search features include simple and complex BOOLEAN relations (such as, equals, less/greater than, less than or equals, starts with, contains stem, from...to, etc.). Codes assigned to species and subject categories provide direct associations of most indexed fields. This allows generalized searches or increasingly specific searches by truncation of the codes (refer to Organization to Species List, p. 41).

The design of the database takes advantage of INMAGIC's system for right-hand truncation, so that the placement of codes at the end of fields allows searches by codes or elements of codes, as well as by the other record data. Although a bit slower, searches are also possible using any alphanumeric combination contained in any record, whether in indexed or unindexed fields.

ORGANIZATION OF DATABASE RECORDS

Database records are organized for convenience in entering the data, for relative ease of utilization of the information in records, and for reorganization of the data for display.

The organizational detail is indicated by the list of field names in the database structure and descriptions of these fields (next sections). In brief, the records are organized as follows:

-- Each record is given a unique retrieval number (RECNO). This number gives the year of recording, the recording series, and the sequence of digital analysis. In addition, it serves as a pointer for identification of the recording in the library collection.

-- Separate fields give the recording cue for specific sounds, number and sequence of channels, equipment, author, sampling rate, duration of the sound sequence, etc.

-- Separate fields also are used for entering a variety of data about the animals and the particular vocal sequence, such as activity, animal identity, age, interaction, sound class and type.

-- Genus/species names and alphanumeric codes are entered for all species recorded -- order/suborder, family, genus, and species are indicated by each code.

-- Codes for genus/species are appended to data in many other fields for direct association with location, observation date and time, sound type, etc.

-- Location for the recording is given by name, by geographic code, as well as by latitude and longitude.

-- Notes, and annotations may be included, and are related to species.

-- Data on the recording situation are also entered, such as hydrophone depths, recording conditions, received signal levels, and sound type.

Most fields in the SOUND database records are indexed and may be searched separately or in combination to provide rapid selection of these records. Notes and similar fields are not indexed, but these too may be searched (more slowly) for any words, phrases, or alphanumeric notation.

The List of Species is provided at the end of this report to assist in identification of interrelated codes and to aid in database searches. In addition, a List of Common Names for Marine Animals provides reference to some of the more frequently used vernacular names for these species.

STRUCTURE FOR SOUND DATABASES
Revised July 1992

INMAGIC Program Format
(Index: T = term, Y = both term and key-word, N = no index)
See INMAGIC Manuel for Sort and Emphasis codes.

LABEL	NAME	INDEX	SORT	EMPHASIS
RN	RECNO	T	3	1
CU	CUE	T	3	1
NC	NOCHAN	T	3	1
SR	SAMRATE	T	1	1
CS	CUTSIZE	T	1	1
PL	PLAYBAK	Y	7	1
SC	SIGCLAS	Y	5	1
ID	IDENT	Y	7	1
AG	AGE	Y	7	1
IA	INTERAC	Y	7	1
GS	GENSP	Y	5	1
GA	GEOA	Y	5	1
OD	OBSDATE	Y	4	1
NT	NOTE	N		
DA	DATE	T	4	1
IP	IDPRES	Y	7	1
AP	AGEPRES	Y	7	1
BH	BEHAV	Y	5	1
OS	OTHERSP	Y	5	1
NA	NOANIM	T	3	1
GB	GEOB	Y	5	1
GC	GEOC	Y	7	1
OT	OBSTIME	Y	7	1
SH	SHIP	Y	5	1
AU	AUTHOR	Y	5	1
LO	LOCATE	Y	5	1
HY	HYDEPTH	T	3	1
RC	RCOND	Y	5	1
RG	RGEAR	Y	5	1
SL	SIGLEVL	Y	7	1
ST	SIGTYPE	Y	5	1

Abbreviated List of Fields --

SOUND Databases
(July 1992)

RN	Retrieval number of record year/tape#/cut#)
CU	Cue or time on tape, buffer (B) size, sec in buffer
NC	Number channels recorded, digitized, chan/side ID
SR	Sample rate (convert Kay input freq. to sample rate)
CS	Cut size -- digital cut in sec (2 or 3 dec. places)
PL	Playback equip., filter setting low (L) high (H) kHz
SC	Signal class - Signature, Mimic..., qual 1-5, Overlap
ID	ID of individual vocalizing, species code
AG	Age, sex (M/F) prefix, birth year, ID, species code
IA	Interaction (MC = male-calf, etc.), ID
GS	Genus/Species animals producing sounds, species code
GA	Geographic location A = ASFIS code, species code
OD	Observation date of original recording, species code
NT	Note = Species code, observation or recording details
DA	Date of this record entry (latest modification)
IP	Identification conspecifics present, species code
AP	Age consp. present: sex-pref., birth yr., ID, sp. code
BH	Behavior of the animals, species code
OS	Other species present, species codes
NA	Number of animals vocalizing, species code
GB	Geographic location B = name of area, species code
--/2	Location of birth/capture area, species code, (ID)
GC	Geographic location C = lat. & long., species code
OT	Observation time of original recording, species code
SH	Ship/cruise, aquarium, or recording platform
AU	Author, originator of the recording
LO	Location of original recording
HY	Hydrophone depth in m
RC	Recording conditions, weather, salinity, etc.
RG	Recording gear, equipment
SL	Signal level (dB received or source), species code
ST	Signal type codes, species code
--/2	Signal type names (coda, slow clicks), species code