

Marine Mammal Health Relational Database Upgrade and Integration Utilizing "User-friendly" Software Systems

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ABSTRACT

A computerized relational database has been utilized by the Space and Naval Warfare (SPAWAR) Systems Center, San Diego (SSC San Diego), to track the health status and inventory of marine mammals for many years. While allowing for annexation of some inventory statistics, health assessments, retrospective studies, preventive maintenance, and research support on marine mammals, the program is being expanded to incorporate current technological capabilities and processing capacity. This system is currently being upgraded from a program in DOS format using Paradox 4.5 software, to a Windows environment, and will operate via a custom-designed program using MS[®] Access software. The upgrade will provide for both increases in processing speed, and options for further growth and development. The new program integrates all of the components of the existing system and will also include health history highlights, monthly kilocalorie intakes, specialized lab results, specimen bank inventories, and training and behavioral information. In addition, this program will provide the capability to include medical images [e.g., computed tomography (CT), magnetic resonance imaging (MRI), ultrasonography, radiography, and endoscopy], digital photos, and audio recordings. The much-improved database will not only benefit clinical, behavioral, and research efforts at SSC San Diego, but illustrates the process by which other marine mammal facilities, and the scientific community at large, may create or update their own databases, utilizing readily available, efficient, user-friendly applications.

SYSTEM REQUIREMENTS

IBM-compatible personal or multimedia computer, 486 or higher processor, Microsoft Windows[®] 95 operating system or later, or Windows NT[®] Workstation operating system, 32-MB RAM or higher.

SOFTWARE REQUIREMENTS

Microsoft Windows[®] 95, Microsoft[®] Office 97 Professional Edition (the database is developed and run from Access), and ProcommPlus[®] 32 (laboratory modem download program).

CONVERSION PROCESS

A data model, or Conceptual Design Model, mapping all of the proposed tables and links was designed using S-Designer 5.0 software. The Vet Lab Database was then built in Microsoft[®] Access using this data model. The actual data was imported from Paradox 4.5 into spreadsheet format where the old fields were analyzed for inconsistencies with the new standardized menu options. Any data not fitting the new requirements was converted manually, and all of the data was then imported into the MS[®] Access database.

The Navy has one of the most comprehensive collections of linear marine mammal data in the world. This data set incorporates information for over 300 animals, including *Delphinapterus leucas*, *Delphinus delphis*, *Grampus griseus*, *Halichoerus grypus*, *Pseudorca crassidens*, *Tursiops truncatus*, and *Zalophus californianus*. Over 1,000 samples are collected and processed during semi-annual, annual, pre-transport, follow-up health check, or other physical examinations throughout the year. Additionally, over 2,000 morphometrics and statistical health data are collected annually. As with any database, the most important function of ours is the ability to ask questions or query the data for specific sets of information. In addition to providing queries and scripts that generate reports for frequently established requests, this new customized application will allow the users to ask specific questions that can be readily answered by using the application system with the pre-defined tables. This allows the clinician to find out the answers to "what if" questions—which may be asked only once, and therefore are not necessary to save as a function of the application. Examples of specific questions that can be answered are: How many endoscopic ulcer images do we have? How much serum do we have in our freezer? From what animals (past/present)? What are the kidney morphometrics for mature male Tursiops? Many questions can be answered immediately. In addition, this data will allow us to compare relationships between information such as animal age, weight, and length to organ weights of individuals or specific groups within the population. Consistency of the information is essential. Custom choice pull-down menus for specific fields are being developed to ensure correct spelling and consistency.

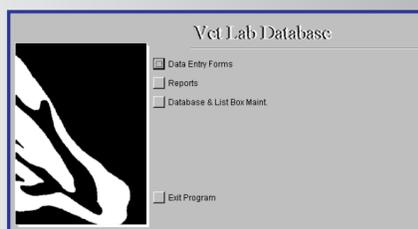


Figure 1. Main Switchboard. This switchboard provides access to three primary functions: data-entry forms, reports, and database maintenance for the custom menu lists. All data entry forms have these customized pull-down menus for consistency of data-entry.

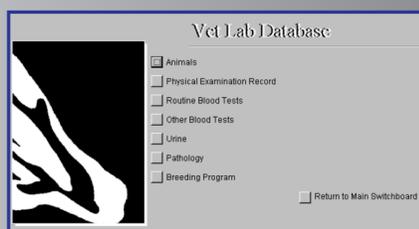


Figure 2. Data-Entry Forms switchboard. This is the main menu for all data entry pertaining to all collections of animals, both past and present. The "Animals" option allows viewing and data entry for one specific animal (Fig. 3a), including inventory statistics, transport and morphometric data, and individual observations. The "Physical Examination Record" option in Fig. 2 accesses all health examination data, including radiography, ultrasound, and endoscopies (Fig 4).

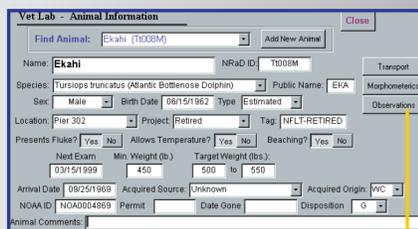


Figure 3a. Animal Information includes next physical exam date, custom morphometric target ranges, signalment and inventory information. This form links to Transports, Morphometrics, and Observations.



Figure 3b. Morphometrics Information allows for current weight/length/grirth data entry, or viewing of any previous entries. It expands further into Figure 3c. Body Condition for calories, blubber measurements, etc., or to Figure 3d. Detailed Morphometrics for comprehensive body measurements, down to the very last of the dorsal fin for our Cetaceans.

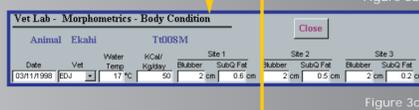


Figure 3c. Observations are detailed written notes relating to animal health. This table also includes a function to incorporate the current entry into Health History Highlights, which is a summary of the animal's entire health history, divided up by individual diagnoses.

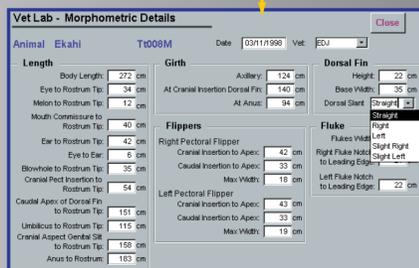


Figure 3d. Detailed Morphometrics for comprehensive body measurements, down to the very last of the dorsal fin for our Cetaceans.

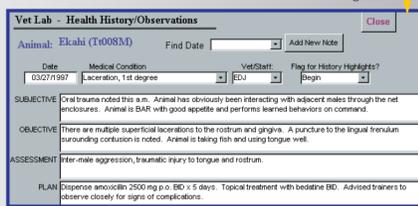


Figure 3e. Observations are detailed written notes relating to animal health. This table also includes a function to incorporate the current entry into Health History Highlights, which is a summary of the animal's entire health history, divided up by individual diagnoses.

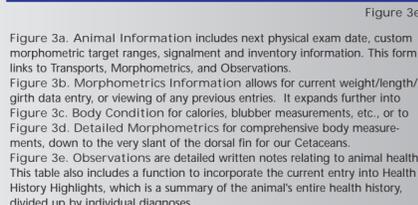


Figure 3f. Observations are detailed written notes relating to animal health. This table also includes a function to incorporate the current entry into Health History Highlights, which is a summary of the animal's entire health history, divided up by individual diagnoses.



Figure 3g. Detailed Morphometrics for comprehensive body measurements, down to the very last of the dorsal fin for our Cetaceans.

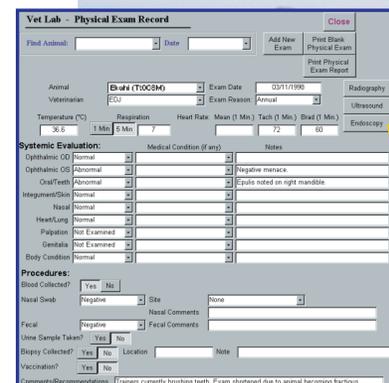


Figure 4a. Physical Exam Record. Custom pull-down menus detailing each body area allow for ease of entering data. There are fields for detailed notes regarding specific body area findings, or for more generalized notes, as well as for results of clinical samples collected during the exam. This form links to Figure 4b Radiography, Figure 4c Ultrasound, and Figure 4d Endoscopy.

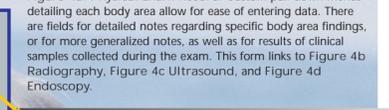


Figure 4b. Radiography Information form showing fields for Date, Animal, and Notes.

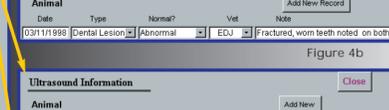


Figure 4c. Ultrasound Information form showing fields for Date, Animal, and Body Area.



Figure 4d. Endoscopy Information form showing fields for Date, Animal, and Body Area.

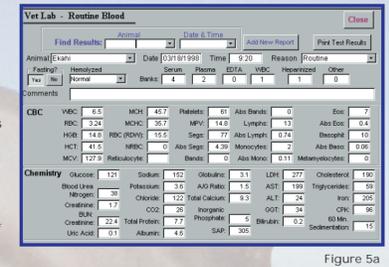


Figure 5a. Routine blood tests (chemistry panel, iron, CPK total, CBC) are downloaded directly from a commercial clinical laboratory via a modern program (ProcommPlus[®] 32), and converted into database format via a customized program designed utilizing Visual C++ 5.0 and ODBC API software. The results are then easily imported directly into the Routine Blood table (Fig. 5a), eliminating data entry. Here we also record the number of blood samples that were archived and any comments regarding the blood collection (i.e., hemolysis, etc.). In addition, there is a table for "hand-entry" of any non-routine blood tests, such as serum electrophoresis, serology, etc. (not shown). Any non-blood results are accessed from the Data Entry Switchboard (Fig. 2) via the Pathology tables. One of these, the Bacteriology table is shown in Fig. 5b, and includes a pull-down menu for isolate.



Figure 5b. Bacteriology table is shown in Fig. 5b, and includes a pull-down menu for isolate. The data-entry form is linked (button not shown) to the Antibiotic Sensitivities table (Fig. 5c), which has customized fields and menus for each antibiotic.

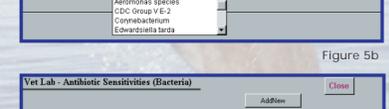


Figure 5c. Antibiotic Sensitivities (Bacteria) form showing a table for recording antibiotic sensitivity results for various bacterial isolates.



Figure 6a. Accessible from the Main Switchboard (Fig. 1), the Database & List Box Maintenance Switchboard (not shown) permits customizing of all pull-down menus, allowing for changes, additions, etc. This expands further into the Pathology List Maintenance Switchboard (Fig. 6a), which accesses all of the pathology custom pull-down menus, as in the Bacteria List (Fig. 6b).

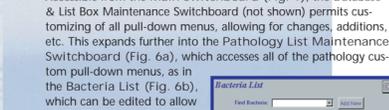


Figure 6b. Bacteria List form showing a list of bacterial isolates with fields for Name, Source, and Date.



Figure 6c. Pathology List Maintenance Switchboard (Fig. 6a), which accesses all of the pathology custom pull-down menus, as in the Bacteria List (Fig. 6b).

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