

Workshop on Standards for Archiving Samples from the Census of Marine Life
Draft summary of recommendations
Prepared by Gary Rosenberg

Introduction

Two dozen researchers met at the Academy of Natural Sciences in Philadelphia, September 5-7, 2003 to discuss standards for archiving samples from the Census of Marine Life. Specialists representing a variety of taxa were present as were scientists from a number of Census field projects. This summary was prepared for the CoML Scientific Steering Committee meeting of October 25, 2003.

Purposes of archiving

It is important that materials resulting from the Census of Marine Life be archived by means that maximize their usefulness to society. Archived samples serve a number of purposes: ensuring reproducibility of results and ability to test hypotheses; providing baseline data for studying change over time; allowing study by new and different methods; and providing materials for education and exhibition about the Census and its scientific results.

Repositories

Each CoML project must have a plan to ensure its samples are archived in a publicly accessible repository. This may be

- a) a single repository for all taxa (e.g. CeDaMar and Senckenberg),
- b) repository by country or region of origin (e.g., NAGISA),
- c) repository by taxon (CoML will maintain list of institutions and expertise),
- d) repository by method of preservation, e.g., frozen tissue, cell culture, microscope slides (CoML maintain list of repositories).

The institution that accepts the samples will be paid for the cost of incorporating those samples it deems to be of research value; the project may maintain intellectual rights for a predetermined period of years. Costs should be based on uniform estimates by taxon and method of preservation.

To qualify as a repository, an institution should make sample data available to OBIS, and make a long term commitment to availability of specimens.

Projects are responsible for appropriate permits for sampling and import/export of samples; and for complying with archiving and data standards.

CoML should have guidelines for deeds of transfer for collections to repositories.

Taxa

CoML should provide guidance on collecting, photographing and preserving taxa. In general large-bodied and hard-bodied taxa can be collected and preserved by non-specialists with appropriate training. CoML projects should include technicians trained in handling diverse taxonomic groups. Some taxa, however, can only be effectively handled by specialist; CoML projects should make provisions to include such specialists as needed.

For many taxa, photographs of live animals are valuable for taxonomic purposes, records morphology, color and pattern not readily determined from preserved material. Photographs must be taken of particular parts and in particular orientations to be taxonomically useful. In addition, photographs can document behavior, serve as vouchers, especially when specimens are not captured or are consumed by analysis, and in identification of other samples.

Methods

Samples should in generally be preserved by more than one method; one optimal for morphological study of the taxon, the other optimal for genetic study. Particularly for genetic studies, tissues from targeted organs should be preserved if size of specimen permits.

Dry specimens: Dead collected material of hard bodied taxa such as corals, mollusks and bryozoans can often be identified to species level, or to genus level with diatoms and foramiferans. Dead collected material of most other taxa is not usually retained.

Ethanol preservation: used for general anatomy and short gene sequences for many taxa. Fluids from specimen dilute the ethanol which needs to reach a final concentration of 70% or above. Concentrations of 95% or above are preferred for DNA sequencing, but concentrations above 80% can harden tissue beyond usefulness for anatomy. With large specimens, injection of the ethanol and initial refrigeration increase effectiveness at stopping decay.

Buffered formalin: Formalin is used to fix fine anatomical detail for histological studies and to preserve gross morphology with some soft bodied taxa. Formalin typically prevents extraction of DNA, especially long sequences. Specimens are sometimes stored in Bouin's solution which contains formalin, but also contains picric acid, which is explosive when dry.

Gluteraldehyde: Better fixative than formalin in some situations, but can't be used for longterm storage.

Hydantoin: promising alternative to formalin or ethanol in some situations; needs further investigation.

Freezing (-80°C): Effective for DNA preservation; susceptible to power failures.

Liquid nitrogen: Best for DNA preservation, genomics, proteomics, cell culture; dangerous because of extreme temperatures.

Freeze-drying: Used for DNA preservation; cost-effectiveness relative to freezing should be investigated.

Other preparations, such as *Davidson's solution* or *RNA later*, might be appropriate for particular taxa and analyses.

Data

Census projects should follow existing standards for relational databases such as the Darwin Core and the OBIS schema, and make data available to OBIS via DiGIR. In addition, projects should track information that allows users to determine the usefulness of their samples for different kinds of analysis (e.g., details of collecting methods and protocols, preparation methods used in preserving samples and subsets thereof, and precision of measurements). As appropriate, database should be able to tie images to samples and stations.

Working Group

Workshop attendees representing particular taxa will prepare recommendations for their taxa, following a template to be distributed. Specialists will be recruited to treat taxa not represented at the workshop. The resulting compilation, incorporating some of the generalizations above, may be appropriate for submission to BioScience.

A working group should be established that will meet periodically to review standards and best practices for collection, preserving and archiving various taxa. The results of the workshop and the working groups should be maintained on a website for ready availability to Census projects and other interested parties.