BARCODING MARINE LIFE
Recommendations to the CoML SSC
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Meeting Results

Participants agreed that adding DNA barcoding to CoML activities would enhance their impact significantly. Barcode data could be linked to data records in OBIS, which would increase the value of records generated by CoML field projects. Occurrences of species in other locations could then be compared genetically to earlier observations. Potential new species could also be compared with known species using standardized barcode data, thereby confirming or refuting differences. In these ways, barcode data could make CoML data records the basis for a more integrated, objective and repeatable analysis of marine biodiversity.

The participants agreed that setting the following goal for 2010 would be worthwhile:

Establish a "reference library" of DNA barcodes for as many of the 200,000 known marine species as possible. For each species, representative voucher specimens would be obtained from:

1. Existing collections and museum holdings. These specimens have the advantage of already being identified, for the most part. The disadvantage is that the DNA of many of these specimens is degraded, either because of original fixation in formalin and/or the aging process; and
2. Recent and future CoML expeditions. These specimens provide intact DNA as well as fresh tissue that can be preserved in cryogenic repositories. Using these specimens as barcode vouchers will require identification by taxonomic specialists in that group.

Participants discussed the challenges associated with reaching this goal, and they identified a number of action items that should be undertaken:

A. **Increase awareness of DNA Barcoding.** Develop an educational process on the potential value of DNA barcoding to CoML. This process should target the science community, collectors, end-users (e.g., government agencies, industry, conservation groups), CoML scientists and other scientists such as AToL. This process should also enhance collaboration among CoML scientists.

B. **Establish a data infrastructure for marine barcodes.** CBOL has established data standards for barcode records in GenBank, EMBL and DDBJ, with GPS locality data and linkages to databases of taxonomic names and on-line museum catalogs. CoML projects will need to encourage the managers of existing and new specimen collections to digitize their specimen records and put them online, so they can be linked to barcode records.

C. **Agree on the standard barcode region to be used in marine groups.** The mitochondrial COI region is being used for most animal groups but it does not work for some marine taxa. CBOL anticipates that there will be barcode regions other than COI and is creating a protocol for reviewing proposals to formally adopt others. CoML projects should learn more about this process and submit proposals for suitable barcode regions in groups where COI doesn't work.

D. **Consider costs and benefits.** Most CoML projects have not been designed and costed to include comprehensive programs of specimen curation and barcoding. They will need to

consider the costs and benefits of adding a barcoding component. Alternatively, they could seek partnerships with taxonomic research programs that would benefit from the specimens collected by CoML projects and would obtain barcode data that could be linked back into OBIS.

E. **Expand linkages between CoML field projects and specimen repositories.** CoML needs to develop and promote a tradition of specimen vouchering. Museums and other kinds of collections, especially those that are CBOL Member Organizations, should be approached about becoming repositories for new collections produced by CoML field projects.

F. **Create barcoding and curatorial protocols for use by CoML field projects.** As the culture of specimen vouchering grows and linkages to specimen repositories develop, CoML projects will need to adopt standard curatorial practices. CBOL and the museum community could produce and distribute updated protocols for specimen collection, processing and analysis. These protocols would ensure preservation of tissue and DNA for molecular analysis as well as smooth transfer of information about specimens. CBOL's DNA working group might also be helpful in compiling laboratory protocols and in making them available to CoML participants. Some protocols have already been developed and are posted on the BOLD website. Other protocols have been developed by individual programs, and they need to be assembled and updated.

G. **Conduct barcoding workshops** that would introduce barcoding to CoML projects and create working partnerships with barcoding labs; and

H. **Develop sequencing capacity in developing countries.** CoML projects in developing countries will have less access to sequencing facilities. There needs to be an outreach effort to these countries that will result in training and capacity-building related to DNA sequencing.

The workshop participants articulated the following Next Steps that should be proposed to CoML's Scientific Steering Committee:

1. Adopt CBOL's data standards, policies, and protocols;
2. Develop and agree upon standard formats for visualization of specimens and data;
3. Design strategies for archiving tissue and/or DNA extracts resulting from CoML field projects;
4. Establish partnerships with large museums that would be willing to act as repositories of barcode voucher specimens collected by CoML projects;
5. Establish partnerships with other relevant organizations (e.g., Ocean Genome Legacy) and institutions
6. Develop and distribute integrated "workbench software" to track specimens from collection, through barcoding, to species page production.
7. Identify barcoding "service centers" for each taxon or guild; consider distributed versus centralized barcoding facilities
8. Try to influence equipment manufacturers in ways helpful to barcoding
9. Better at-sea sequencing
10. Identify bottlenecks in CBOL protocol chain; address most serious bottleneck