

THE INTERNATIONAL GROWTH OF ENVIRONMENTAL SPECIMEN BANKING AS A TOOL FOR MONITORING AND RESEARCH

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Abstract

Formal environmental specimen banking began in the early 1970s in several countries. These banks have increased in importance in the last decade with the realization of the value of such well documented collections in investigating the temporal trends in newly recognized emerging contaminants, documenting response of natural ecosystems to controls that have been placed on the emissions on the classic contaminants of interest (i.e., PCBs, chlorinated pesticides, etc.), and the discovery that such resources can also be of importance in research on other issues related to environmental degradation (i.e., animal and human health). New environmental specimen banks (ESBs) are being constructed world-wide or are in stages of planning. The designs of these ESBs and their associated programs are making extensive use of the past experiences of the existing established banks in various countries.

Introduction

Formal environmental specimen banking is the systematic long-term preservation of well-documented representative environmental specimens that are used for deferred (i.e., retrospective) analysis and evaluation. Such banking efforts have been undertaken on a national scale beginning in the 1970s by several countries, including Germany, USA, Canada, and Sweden, and more recently Japan.¹ Specimens that have been formally banked for environmental studies include human tissues and fluids, animal tissues, plant materials, sediments, soils, and ice cores. For the majority of environmental specimen banking programs, cryogenic storage has been the preferred manner of preservation. Peer-reviewed literature presenting research that makes use of banked specimens for time trend studies are appearing more frequently. This is probably due to the relatively long-time series of specimens now available for many banking programs (30 years or more in some cases), the realization of “newly discovered” chemical contaminants in the environment and the need to determine time trends for these materials, an increasing interest in climate change and its potential role in changing historical patterns of contaminant transport and cycling through the ecosystem, and the initiation of new specimen banking programs over the last decade.

Materials and Methods

Using the definition of environmental specimen banking as presented above, a review of existing facilities and programs has identified 16 operational environmental specimen banks (ESBs), world-wide (Table 1). Also, new ESBs and associated specimen banking programs are being established in three additional countries: the National Environmental Specimen Bank, Incheon, Korea;

Environmental Specimen Bank, ORQUE, Pau, France; and at the Tromsø University Museum and Norwegian Polar Institute, Tromsø, Norway.

Table 1: Environmental Specimen Banks (ESBs) as of 2007

Name of Bank	Location	Application
Environmental Specimen Bank	Schmallenberg, Germany	National
ESB for Human Organ Specimens	Muenster, Germany	National
Tissue and Data Bank for Greenland	Roskilde, Denmark	Regional
ESB Swedish Museum of Natural History	Stockholm, Sweden	National
Paljakka ESB	Muhos, Finland	Regional/Forestry
Mediterranean Marine Mammal Tissue Bank	Padua, Italy	Regional
The Antarctic ESB	Genoa, Italy	Regional
Barcelona BMA Environmental Tissue Bank	Barcelona, Spain	Regional
Biological Resource Bank	Pretoria, South Africa	Regional
ESB for Global Monitoring (<i>es</i> -Bank)	Matsuyama, Japan	Regional/Global
Time Capsule for Environment and Endangered Wildlife	Tsukuba, Japan	National
Canadian Wildlife Service Specimen Bank	Ottawa, Canada	National
National Biomonitoring Specimen Bank	Gaithersburg, MD, USA	National
Marine Environmental Specimen Bank	Charleston, SC, USA	National
CASPIR	Lawrenceville, GA, USA	National
Alaska Frozen Tissue Collection	Fairbanks, AK, USA	Regional

Results and Discussion

Not all ESBs are “national” banks. Many are regional in scope, i.e., regional within a nation such as the Alaska Frozen Tissue Collection at the Museum of the North in Fairbanks, Alaska, multi-national regional such as the Mediterranean Marine Mammal Tissue Bank, or essentially global such as the *es*-Bank in Japan.

The reasons for establishing ESBs vary. In some cases, ESBs have been established to evaluate the results of governmental policies and regulations.^{2,3} In other cases, use of ESBs to evaluate changes in health of animal populations is the determining factor.^{4,5} Other reasons include establishing a resource to be used as an ecological research tool.^{6,7,8} Whatever the reasons, formal ESBs have certain things in common, such as well developed design concepts with substantial thought given to protocols for specimen collection, handling, and archival, emphasis on maintaining specimen integrity (which includes minimizing the possibility of specimen change during long-term archival and maintaining accurate datasets associated with that specimen), and a substantial investment in facility and personnel resources to ensure high quality research materials for future researchers. The value of this investment is being recognized more and more. This is resulting in new ESBs being established in more countries based on the experiences of the existing established banks. It is also recognized that environmental

problems, including those involving animal and human health, go beyond national borders. International monitoring and research efforts will include environmental specimen banking as an important tool in attacking these problems.

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