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Volume 4
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COLLECTION FORUM

The Journal of The Society for the Preservation of Natural History Collections

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Front cover — the cover of this issue is a reproduction of a "Bear Clan Blanket Design" by Simon Brascoupé. See page 23.

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Opinion

Lest We Forget

The Society for the Preservation of Natural History Collections was created in order to develop a communication network between and among persons working with, responsible for, or just concerned about natural history collections. Members of the Society work with large and small collections and are employed in large and small institutions. They work in many different natural history fields but a few have realized that knowledge developed in one field, discipline or science can be applied in others. The Society is a member-driven group of professionals, that is, our members develop ideas about what is important for our Society to do. For example, we should survey the software and computer programs that collection staff use.

But how does SPNHC actually work? Our bylaws tell us how to do things and who does what. Our officers and Standing Committees keep the Society going from day to day and month to month. For example, the Membership Committee searches out new members, handles membership applications, re-evaluates membership forms, and recommends changes in membership dues. The Sessional Committees are established and disbanded by the President of the Society. For example, I, as President from June 86 – June 88, established several sessional committees, among them the Conservation and Computer-use committees. It will be up to our new President, Cesar Romero-Sierra, to establish his sessional committees which he believes will provide fruitful results for our members.

Our Bylaws guide the Society but the Councillors (President-elect, Secretary, Treasurer, Past-president, and six Members-at-large) manage and direct it. Each councillor has one vote at council meetings.

The Annual Meeting and Workshops is an annual event which takes place somewhere in North America. It is an event where members can meet one another and develop invisible colleges. There, individuals can show their peers and colleagues what they are doing about collection management, conservation, preservation, etc. Members of our committees can meet and discuss their differences; members can attend workshops, and learn modern techniques.

The Society's publications keep the membership informed; the journal of the Society is *Collection Forum* which is published in spring and fall. The Society's Newsletter is published in summer and winter.

Daniel J. Faber

Research

Application of an Inventory of a Museum Collection

F. Rafi

Zoology Division
National Museum of Natural Sciences
Ottawa, Ontario K1P 6P4

Rafi, F. 1988. Application of an inventory of a museum collection. *Collection Forum* 4(1): 3–5

Abstract

Researchers remain largely uninformed of the nature and contents of museum collections. Curators and collections managers should take an active role in communicating the value of their collection to specialists. A relatively low-cost approach is the preparation of an inventory, itemizing unidentified taxa by geographic location. Such a system provides easy access to the collection for specialists who wish to study the material.

INTRODUCTION

Museums are resource centres where specialists can get required information and raw materials. It is therefore essential that the collections should be readily available. There is a need to establish in the scientific community a sense of the value of collections management. A computer-based inventory of unidentified specimens can help, by playing a significant role in satisfying the information requirements of staff and by making the collections more accessible to research workers, which could result in a closer bond between museums and other research institutions. On local, national and international levels more informed communication between specialists and museum professionals should result in improving the standards of collections management.

Museums have an obligation not only to manage and care for their collections but also to provide access to them. However, most museums have limited internal resources to identify the objects in their collections. In any museum, large or small, curators can play a role in communicating the contents of their collection to specialists.

Researchers remain largely uninformed of the nature and content of collections housed in museums. In order to communicate this information effectively, a museum must have detailed and accurate information about the specimens in its collection. To help overcome this problem the Crustacean Section of the Zoology Division, National Museum of Natural Sciences, has developed a computer-based inventory system which can be used to inform systematists of the potential value of the collection and to enable curators to identify those taxa which are either quantitatively or qualitatively under-represented.

DEVELOPMENT

The availability of a microcomputer capable of holding basic inventory information made the establishment of crustacean inventory programme possible. Use of the computer for this purpose is an economical and efficient way of using limited staff resources to their best advantage. Individuals in the section realized that rapid access to collection data could be provided to specialists if an inventory was developed and computerised.

The crustacean inventory which was started in 1986 covers 3 categories of specimens: type, identified, and unidentified material.

The first step in this system was to select data fields that were useful for inventory purposes. The field selected should form a fairly limited set that serves to identify the object within the collection. Each of our inventory records contains 3 to 5 categories, comprising: accession number; location; collector's name; species' name; and, catalogue number. Naturally, the amount of information to be included depends on the type of inventory required.

The following provides a sample of the set of data fields used in three different inventory projects:

Type Specimens (See Fig 1), included the following:
- species name (binomial or trinomial), author and date, type designation, and catalogue number.

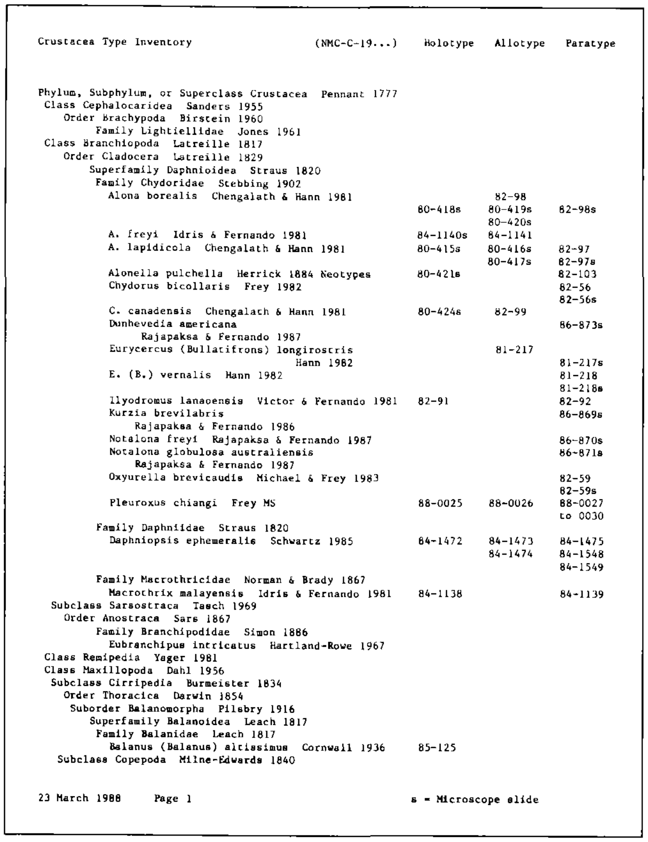
Identified Specimens (See Fig 2), included the following:
- species name (binomial or trinomial), author and date, and whether catalogued.

Unidentified Specimens (See Fig 3), included the following:
- geographical location (province or state), collector's name, accession number, and station number.

Requests from researchers have placed an ever increasing burden on the Crustacean section for accurate and up-to-date information regarding its holdings. These demands, along with the proven success of published records of inventory projects (Neufeld 1983; Sarasan and Neuner 1983) and the section's inventories of type material and identified specimens, encouraged us to attempt an item-by-item inventory of unidentified specimens.

METHOD

Specimens collected during a field trip are brought back to the Museum for processing. A unique (accession) number is assigned to each expedition's collection. After accessioning, the collection is sorted into various taxa. The resulting specimen lots, usually consisting of several species, are treated as individual records. At the time of collection, field sheets (See Fig. 4) are completed for each station lot by the collector.

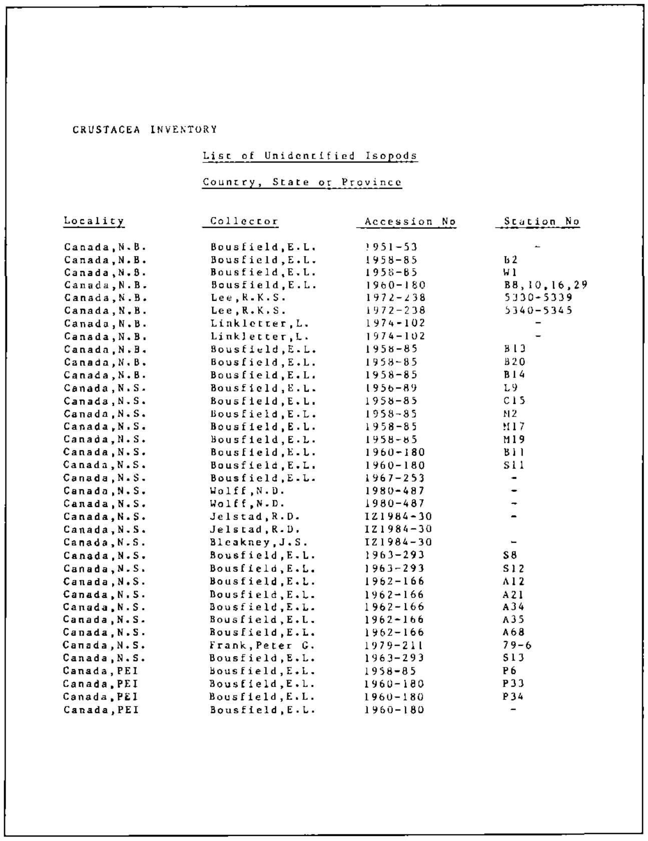


```
Crustacea Type Inventory                  (NMC-C-19...)   Holotype   Allotype   Paratype


Phylum, Subphylum, or Superclass Crustacea  Pennant 1777
 Class Cephalocaridea  Sanders 1955
    Order Brachypoda  Birstein 1960
         Family Lightiellidae  Jones 1961
 Class Branchiopoda  Latreille 1817
    Order Cladocera  Latreille 1829
        Superfamily Daphnioidea  Straus 1820
         Family Chydoridae  Stebbing 1902
           Alona borealis  Chengalath & Hann 1981                  82-98
                                                     80-418s    80-419s    82-98s
                                                                80-420s
           A. freyi  Idris & Fernando 1981           84-1140s   84-1141
           A. lapidicola  Chengalath & Hann 1981     80-415s    80-416s    82-97
                                                                80-417s    82-97s
           Alonella pulchella  Herrick 1884 Neotypes 80-421s               82-103
           Chydorus bicollaris  Frey 1982                                  82-56
                                                                           82-56s
           C. canadensis  Chengalath & Hann 1981     80-424s    82-99
           Dunhevedia americana                                            86-873s
                Rajapaksa & Fernando 1987
           Eurycercus (Bullatifrons) longirostris                81-217
                                      Hann 1982                            81-217s
           E. (B.) vernalis  Hann 1982                                     81-218
                                                                           81-218s
           Ilyodromus lanaoensis  Victor & Fernando 1981  82-91            82-92
           Kurzia brevilabris                                              86-869s
               Rajapaksa & Fernando 1986
           Notalona freyi  Rajapaksa & Fernando 1987                       86-870s
           Notalona globulosa australiensis                                86-871s
               Rajapaksa & Fernando 1987
           Oxyurella brevicaudis  Michael & Frey 1983                      82-59
                                                                           82-59s
           Pleuroxus chiangi  Frey MS                88-0025    88-0026    88-0027
                                                                           to 0030
         Family Daphniidae  Straus 1820
           Daphniopsis ephemeralis  Schwartz 1985    84-1472    84-1473    84-1475
                                                                84-1474    84-1548
                                                                           84-1549
         Family Macrothricidae  Norman & Brady 1867
           Macrothrix malayensis  Idris & Fernando 1981  84-1138           84-1139
  Subclass Sarsostraca  Tasch 1969
    Order Anostraca  Sars 1867
         Family Branchipodidae  Simon 1886
           Eubranchipus intricatus  Hartland-Rowe 1967
 Class Remipedia  Yager 1981
 Class Maxillopoda  Dahl 1956
  Subclass Cirripedia  Burmeister 1834
    Order Thoracica  Darwin 1854
     Suborder Balanomorpha  Pilsbry 1916
        Superfamily Balanoidea  Leach 1817
         Family Balanidae  Leach 1817
           Balanus (Balanus) altissimus  Cornwall 1936   85-125
   Subclass Copepoda  Milne-Edwards 1840


23 March 1988     Page 1                             s = Microscope slide
```

Figure 1 – Example of a page from the crustacean Type inventory.



```
CRUSTACEA INVENTORY

                       List of Unidentified Isopods

                       Country, State or Province

Locality          Collector          Accession No      Station No

Canada,N.B.       Bousfield,E.L.     1951-53              -
Canada,N.B.       Bousfield,E.L.     1958-85           B2
Canada,N.B.       Bousfield,E.L.     1958-85           W1
Canada,N.B.       Bousfield,E.L.     1960-180          B8,10,16,29
Canada,N.B.       Lee,R.K.S.         1972-238          5330-5339
Canada,N.B.       Lee,R.K.S.         1972-238          5340-5345
Canada,N.B.       Linkletter,L.      1974-102             -
Canada,N.B.       Linkletter,L.      1974-102             -
Canada,N.B.       Bousfield,E.L.     1958-85           B13
Canada,N.B.       Bousfield,E.L.     1958-85           B20
Canada,N.B.       Bousfield,E.L.     1958-85           B14
Canada,N.S.       Bousfield,E.L.     1956-89           L9
Canada,N.S.       Bousfield,E.L.     1958-85           C15
Canada,N.S.       Bousfield,E.L.     1958-85           M2
Canada,N.S.       Bousfield,E.L.     1958-85           M17
Canada,N.S.       Bousfield,E.L.     1958-85           M19
Canada,N.S.       Bousfield,E.L.     1960-180          B11
Canada,N.S.       Bousfield,E.L.     1960-180          S11
Canada,N.S.       Bousfield,E.L.     1967-253           -
Canada,N.S.       Wolff,N.D.         1980-487           -
Canada,N.S.       Wolff,N.D.         1980-487           -
Canada,N.S.       Jelstad,R.D.       IZ1984-30          -
Canada,N.S.       Jelstad,R.D.       IZ1984-30
Canada,N.S.       Bleakney,J.S.      IZ1984-30          -
Canada,N.S.       Bousfield,E.L.     1963-293          S8
Canada,N.S.       Bousfield,E.L.     1963-293          S12
Canada,N.S.       Bousfield,E.L.     1962-166          A12
Canada,N.S.       Bousfield,E.L.     1962-166          A21
Canada,N.S.       Bousfield,E.L.     1962-166          A34
Canada,N.S.       Bousfield,E.L.     1962-166          A35
Canada,N.S.       Bousfield,E.L.     1962-166          A68
Canada,N.S.       Frank,Peter G.     1979-211          79-6
Canada,N.S.       Bousfield,E.L.     1963-293          S13
Canada,PEI        Bousfield,E.L.     1958-85           P6
Canada,PEI        Bousfield,E.L.     1960-180          P33
Canada,PEI        Bousfield,E.L.     1960-180          P34
Canada,PEI        Bousfield,E.L.     1960-180           -
```

Figure 2 – Example of a page from the crustacean inventory of identified specimens.

These data are transferred to labels, and become the raw data used to create inventory records.

The basic inventory was taken directly from the specimen lots in the collection, manually entered to data sheets and subsequently, entered into the computer. Data are first entered into temporary files, which can be checked on the screen for errors. Any discrepancies can then be noted as needing further scrutiny. Once the data have been checked, they can be transferred to a permanent file. Checking for accuracy is essential to enable later information retrieval.

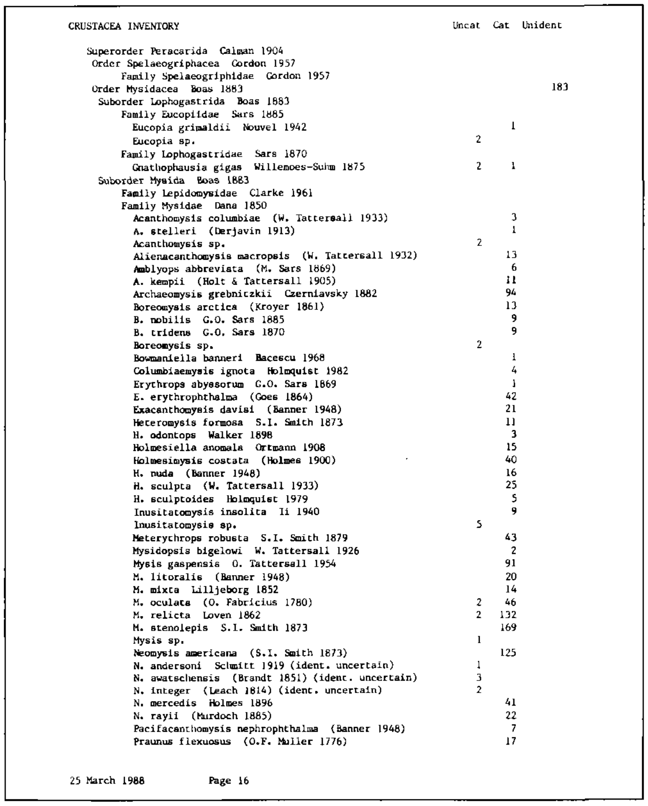
USES OF THE SYSTEM

There are many possible uses for museum inventories, such as auditing, managing and disseminating information. Audit programmes demonstrate accountability to external authorities. To support collection management, accurate answers on e.g., how many specimens lots from a particular locality there are, can easily be provided. With the aid of an inventory the dissemination of information to systematists about the scope of the unidentified material is much less of a problem.

Organizations that might be interested in making use of the system are many and varied. They comprise:

— museums;
— universities;
— government institutions; and,
— private industries.

Contact and liaison with a very large number of institutions and specialists will also be a vital part of the job.

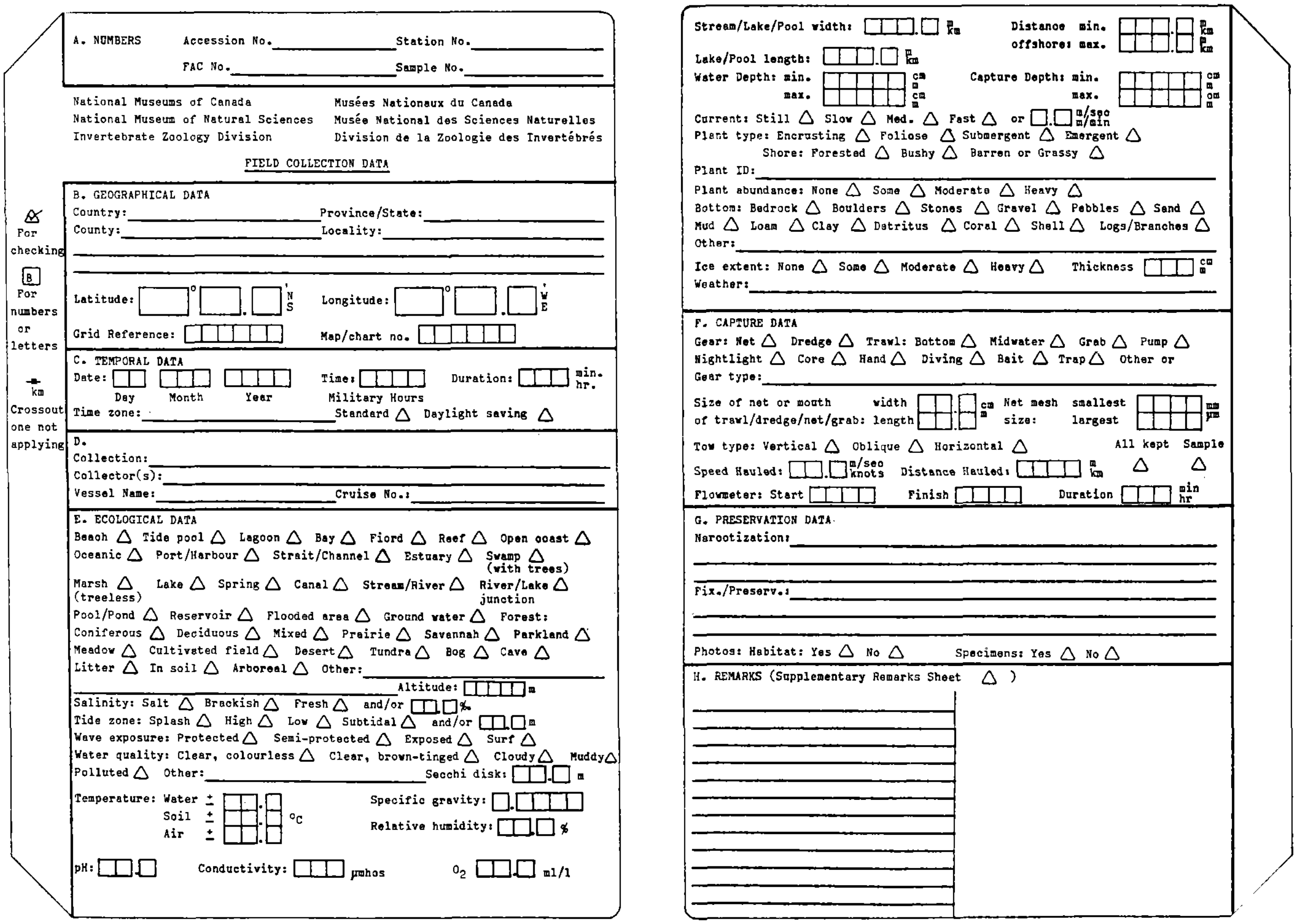


```
CRUSTACEA INVENTORY                                              Uncat  Cat  Unident

  Superorder Peracarida  Calman 1904
   Order Spelaeogriphacea  Gordon 1957
        Family Spelaeogriphidae  Gordon 1957
   Order Mysidacea  Boas 1883                                                 183
    Suborder Lophogastrida  Boas 1883
        Family Eucopiidae  Sars 1885
          Eucopia grimaldii  Nouvel 1942                                 1
          Eucopia sp.                                              2
        Family Lophogastridae  Sars 1870
          Gnathophausia gigas  Willemoes-Suhm 1875                 2     1
    Suborder Mysida  Boas 1883
        Family Lepidomysidae  Clarke 1961
        Family Mysidae  Dana 1850
          Acanthomysis columbiae  (W. Tattersall 1933)                   3
          A. stelleri  (Derjavin 1913)                                   1
          Acanthomysis sp.                                         2
          Alienacanthomysis macropsis  (W. Tattersall 1932)             13
          Amblyops abbreviata  (M. Sars 1869)                            6
          A. kempii  (Holt & Tattersall 1905)                           11
          Archaeomysis grebnitzkii  Czerniavsky 1882                    94
          Boreomysis arctica  (Kroyer 1861)                             13
          B. nobilis  G.O. Sars 1885                                     9
          B. tridens  G.O. Sars 1870                                     9
          Boreomysis sp.                                           2
          Bowmaniella banneri  Bacescu 1968                              1
          Columbiaemysis ignota  Holmquist 1982                          4
          Erythrops abyssorum  G.O. Sars 1869                            1
          E. erythrophthalma  (Goes 1864)                               42
          Exacanthomysis davisi  (Banner 1948)                          21
          Heteromysis formosa  S.I. Smith 1873                          11
          H. odontops  Walker 1898                                       3
          Holmesiella anomala  Ortmann 1908                             15
          Holmesimysis costata  (Holmes 1900)                           40
          H. nuda  (Banner 1948)                                        16
          H. sculpta  (W. Tattersall 1933)                              25
          H. sculptoides  Holmquist 1979                                 5
          Inusitatomysis insolita  Ii 1940                               9
          Inusitatomysis sp.                                       5
          Meterythrops robusta  S.I. Smith 1879                         43
          Mysidopsis bigelowi  W. Tattersall 1926                        2
          Mysis gaspensis  O. Tattersall 1954                           91
          M. litoralis  (Banner 1948)                                   20
          M. mixta  Lilljeborg 1852                                     14
          M. oculata  (O. Fabricius 1780)                          2    46
          M. relicta  Loven 1862                                   2   132
          M. stenolepis  S.I. Smith 1873                               169
          Mysis sp.                                                1
          Neomysis americana  (S.I. Smith 1873)                        125
          N. andersoni  Schmitt 1919 (ident. uncertain)            1
          N. awatschensis  (Brandt 1851) (ident. uncertain)        3
          N. integer  (Leach 1814) (ident. uncertain)              2
          N. mercedis  Holmes 1896                                      41
          N. rayii  (Murdoch 1885)                                      22
          Pacifacanthomysis nephrophthalma  (Banner 1948)                7
          Praunus flexuosus  (O.F. Muller 1776)                         17


25 March 1988         Page 16
```

Figure 3 – Example of a page from the crustacean inventory of unidentified specimens.



A. NUMBERS Accession No.________ Station No.________
FAC No.________ Sample No.________

National Museums of Canada — Musées Nationaux du Canada
National Museum of Natural Sciences — Musée National des Sciences Naturelles
Invertebrate Zoology Division — Division de la Zoologie des Invertébrés

FIELD COLLECTION DATA

For checking
For numbers or letters
km Crossout one not applying

B. GEOGRAPHICAL DATA
Country:________ Province/State:________
County:________ Locality:________
Latitude: ☐°☐.☐' N S Longitude: ☐°☐.☐' W E
Grid Reference: ☐☐☐☐☐☐ Map/chart no. ☐☐☐☐☐☐

C. TEMPORAL DATA
Date: ☐☐ Day ☐☐☐ Month ☐☐☐☐ Year Time: ☐☐☐☐ Military Hours Duration: ☐☐☐ min. hr.
Time zone:________ Standard △ Daylight saving △

D.
Collection:________
Collector(s):________
Vessel Name:________ Cruise No.:________

E. ECOLOGICAL DATA
Beach △ Tide pool △ Lagoon △ Bay △ Fiord △ Reef △ Open coast △
Oceanic △ Port/Harbour △ Strait/Channel △ Estuary △ Swamp (with trees) △
Marsh (treeless) △ Lake △ Spring △ Canal △ Stream/River △ River/Lake junction △
Pool/Pond △ Reservoir △ Flooded area △ Ground water △ Forest:
Coniferous △ Deciduous △ Mixed △ Prairie △ Savannah △ Parkland △
Meadow △ Cultivated field △ Desert △ Tundra △ Bog △ Cave △
Litter △ In soil △ Arboreal △ Other:________
Altitude: ☐☐☐☐☐ m
Salinity: Salt △ Brackish △ Fresh △ and/or ☐☐.☐‰
Tide zone: Splash △ High △ Low △ Subtidal △ and/or ☐☐.☐ m
Wave exposure: Protected △ Semi-protected △ Exposed △ Surf △
Water quality: Clear, colourless △ Clear, brown-tinged △ Cloudy △ Muddy △
Polluted △ Other:________ Secchi disk: ☐☐.☐ m
Temperature: Water ± ☐☐.☐ °C
Soil ± ☐☐.☐
Air ± ☐☐.☐
Specific gravity: ☐.☐☐☐☐
Relative humidity: ☐☐.☐ %
pH: ☐☐.☐ Conductivity: ☐☐☐ µmhos O_2 ☐☐.☐ ml/l

Stream/Lake/Pool width: ☐☐☐.☐ m km Distance offshore: min. ☐☐☐.☐ m km max. ☐☐☐.☐ m km
Lake/Pool length: ☐☐☐.☐ m km
Water Depth: min. ☐☐☐☐☐ cm m max. ☐☐☐☐☐ cm m Capture Depth: min. ☐☐☐☐☐ cm m max. ☐☐☐☐☐ cm m
Current: Still △ Slow △ Med. △ Fast △ or ☐.☐ m/sec m/min
Plant type: Encrusting △ Foliose △ Submergent △ Emergent △
Shore: Forested △ Bushy △ Barren or Grassy △
Plant ID:________
Plant abundance: None △ Some △ Moderate △ Heavy △
Bottom: Bedrock △ Boulders △ Stones △ Gravel △ Pebbles △ Sand △
Mud △ Loam △ Clay △ Detritus △ Coral △ Shell △ Logs/Branches △
Other:________
Ice extent: None △ Some △ Moderate △ Heavy △ Thickness ☐☐☐ cm m
Weather:________

F. CAPTURE DATA
Gear: Net △ Dredge △ Trawl: Bottom △ Midwater △ Grab △ Pump △
Nightlight △ Core △ Hand △ Diving △ Bait △ Trap △ Other or
Gear type:________
Size of net or mouth of trawl/dredge/net/grab: width ☐☐.☐ length ☐☐.☐ cm m Net mesh size: smallest ☐☐☐☐ largest ☐☐☐☐ mm µm
Tow type: Vertical △ Oblique △ Horizontal △ All kept △ Sample △
Speed Hauled: ☐☐.☐ m/sec knots Distance Hauled: ☐☐☐☐ m km
Flowmeter: Start ☐☐☐☐ Finish ☐☐☐☐ Duration ☐☐☐ min hr

G. PRESERVATION DATA
Narcotization:________
Fix./Preserv.:________
Photos: Habitat: Yes △ No △ Specimens: Yes △ No △

H. REMARKS (Supplementary Remarks Sheet △)

Figure 4 – Field collection data sheet for the Invertebrate Zoology Division. Left – Front side. Right – Back side.

Communication to interested specialists could be the greatest advantage of the inventory. This can be done by:
- — publishing a list of unidentified material;
- — communicating through various museum associations' newsletters; and,
- — responding to direct requests.

DISCUSSION

This low-cost approach can be a powerful tool in assisting curators to identify those areas which are quantitatively or qualitatively under-represented in their collections. Where such gaps in collections are found, an overall inventory, which not only identified specimens but also their locations, would permit some rationalization of the collection and indicate priorities for future research. For specialists, such an inventory would offer a device to indicate the holdings of major collections.

No claims are being made for the "best method" or any original ideas. We have simply developed an inventory system which is low-cost, safe and effective. While a significant number of museums have inventory programmes they do not itemize their individual lots, but simply identify the size of the collection.

We see the need to establish an accurate computer-based inventory of all the Crustacea in our collection as an essential prelude to its management and to allow access for potential users. Our main object is to inventory the unidentified collection within a reasonable period and to communicate what has been compiled, so that others may benefit from our experiences.

ACKNOWLEDGEMENT

I appreciate the willing help of volunteers in compiling the inventory data and thank Ms. Judith Price for providing the inventory sheets for identified and type specimens. Thanks are also due to Mrs. Diana R. Laubitz for reviewing and commenting upon the manuscript.

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Sarasan, L. and A.M. Neuner 1983. Museum Collections and Computers, Report of an ASC Survey. Lawrence, Kansas: Association of Systematic Collections. viii, 292p. ISBN 0-94292-03-07.

Preservation of Sitka Spruce for Museum Display

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Abstract

A preservation formula has been developed for Sitka spruce that proved effective for the retention of needles, while causing some discolouration. The treatment consisted of immersing the branches in a mixture of chemicals for a period of up to two weeks. They were subsequently rinsed in water and glycerin for another two weeks and finally air dried. These procedural steps are similar to those we previously reported, but the treatment formula differs substantially.

INTRODUCTION

We described a general method for preserving the structure and chlorophyll pigment of botanical specimens (Romero-Sierra and Webb 1986a). The chemical composition of the preservative formula was based on the results of our experiments with a broad variety and large number of botanical specimens. We later used this formula to treat new species with varying degrees of success. Also, we reported on the preservation of Douglas fir branches (Romera-Sierra and Webb 1986b).

We discovered that neither our general formula nor our formulae for Douglas fir yielded satisfactory results for Sitka spruce. This paper reports on our experiments to determine the effective formulation for Sitka spruce.

MATERIALS AND METHODS

The procedure consisted of three basic steps, namely, 1) immersion in a bath of a preservative solution, 2) rinsing in clear water, and 3) subsequent immersion in a second bath of a holding solution. The temperature of the solutions was maintained between 15° and 21°C.

Clear glass jars of 600 ml capacity and with plastic lids were filled either with one of the various preservative solutions or with the holding solution. Small twigs of Sitka spruce were used to test the efficacy of the various formulae in these containers. We considered the results satisfactory or successful only when both needles and colour were retained for a month following treatment. Furthermore, two containers measuring 1 m^2 at the base and with 120 litres capacity coated and sealed with resin from the inside were used to process larger branches to corroborate the positive results obtained previously with a twig in a glass jar.

The Sitka spruce specimens were collected and shipped from British Columbia to Kingston. The preserving formula was a mixture of distilled water and chemicals that fixed and preserved the structure and pigments of the specimens. The duration of immersion in this mixture was generally two weeks. The holding formula was a solution of equal volumes of glycerol and water that influenced the water affinity of the specimens and caused them to retain their flexibility. Two weeks was normally required for this step, although specimens were left for extended periods of time until needed. As a final step the specimen was air dried for a few days, the length of time depending on the relative humidity in the room.

Some chemical ingredients, namely, formalin, glycerol and carboxylic acid, were tested in varying concentrations with unsatisfactory results until cupric chloride was introduced in the preserving formula. In the laboratory we adhere to regulatory safety precautions when handling formalin, ethylene, glycol, formic and propionic acids, cupric sulphate, cupric chloride and ethyl alcohol. The preserving bath was kept under a fumehood as was any uncapped volatile chemicals. The vat's lid which reduced the escape of fumes and prolonged the usefulness of the mixture was left on at all times for safety of handling and inspection.

Rinsing in water after treatment removed chemicals that emitted toxic substances into the finished products. Furthermore, it ensured that the water–glycerin bath remained clean. Once the branches were taken out of the holding solution, they were air dried until there was no trace of fumes. Tests conducted to assess the flammability of treated specimens showed it to be lower than in untreated specimens that had been left to dry naturally.

RESULTS AND DISCUSSION

In repeated trials we observed that an increase of formalin was beneficial and that the ideal concentration of glycerol was 10%. We also found that an increase of carboxylic acid in the formula was beneficial for the prevention of shedding needles.

The best results were obtained with the preserving formula presented in Table 1. Without cupric chloride the formula caused the branches to turn dark brown. In our unsuccessful trials using our previous formulae, as well as several formulae reported by other authors (Fessenden 1951, 1955; Lutz 1969), the needles became detached from the branches during the immersion in the preservative fluid. Examining these branches with the aid of a magnifying lens, we observed that the capping junctions of the branch to the needles were dilated and thus not holding the needles. By contrast, the junctions of specimens treated with the Sitka spruce formula were observed to grip the needles tightly.

Table 1. Preservation formula for Sitka spruce.

Distilled water (ml)	500
Formalin (ml)	150
Ethyl alcohol (ml)	150
Glycerol (ml)	100
Formic acid (ml)	50
Propionic acid (ml)	50
Citric acid (g)	20
Cupric chloride (g)	30
Cupric sulphate (g)	20
Sodium sulphite (g)	7

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It appeared that the beneficial effect of this formula was due to the proper concentration of the fluid chemicals used, in particular the carboxylic acids, which caused the junctions to tighten, and the formalin, which reinforced tissue preservation.

Cupric chloride proved mildly beneficial to retain structure. The principal benefit of this chemical is apparently due to its mordating and modifying effects. It rendered the formula a vibrant green and counteracted the browning effect of the other chemicals on the chlorophyll.

As mentioned above, the duration of immersion of Sitka spruce specimens in the preserving solution was generally two weeks, however, if the mixture had previously been used heavily for treatment of a large amount of specimens, or if it was old, immersion required up to four weeks. Rinsing in water and immersion in the holding solution after treatment in the preserving solution (50/50 glycerol and water) were identical to the steps in the process followed for Douglas fir (Romero and Webb 1986b), except the rinsing time was longer for Sitka spruce. Older branches preserved less satisfactorily than younger branches. Similarly, sections of a branch were affected differently by the treatment, ie., older sections benefitted much less than younger sections.

In our work on botanical preservation we viewed with concern the inconsistency in results of identical treatments of Sitka spruce specimens. The formula most successful for Sitka spruce (Table 1) did not always produce satisfactory results, indicating that factors which we did not take into account were operant.

Four major factors probably influenced the results, i.e., 1) the regions where specimens were collected (the higher the latitude of origin, the poorer the outcome of treatment); 2) the month in which specimens were collected (September was generally best); 3) the conditions of maintenance of specimens between collection and treatment (regarding humidity and temperature); and 4) the time lapse between collection and treatment of the specimen (the shorter the better). Although these factors appeared to play a particularly large role in the successful preservation of Sitka spruce, the above mentioned factors (2, 3 and 4) are not surprising *per se*, because they are common to other kinds of vegetation that we have handled in the past. Factor (1) was based on the simple information received from the collecting and shipping team as well as the results subsequently obtained during the preservative treatment.

Many factors other than geographic location of the region of origin may influence the success of the preservation, e.g., the particular soil or the age of the plant. Further experimentation is required to identify which intrinsic factors related to its region of growth influence the preservation of a specimen. Such information is expected to assist in improving the present formula and provide for more consistent results. Work is presently underway to test the effects of preserved specimens and in particular the preservation formula on nearby untreated objects in displays.

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