

InvertNet

Advancing Digitization of Biological Collections



Carnegie Museum of Natural History
Section of Invertebrate Zoology

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Timeline

CMNH - 1898 to present

A component of Carnegie Museums of Pittsburgh (=Carnegie Institute)

Center for Biodiversity and Ecosystems

- CBE - 2011
- A new administrative organization 2011, with Center for Evolutionary Studies and Center for World Cultures

Section of Invertebrate Zoology

CMNH-IZ

- 1898 to present (current quarters 1906 to present)
- Research, Collections, Services, Information and Public Programs on Arthropoda
- Formerly the Section of Insects and Spiders

The Arthropod Collection Historical Activity

The Ancient Times (1890's to 1940)

Holland, Kahl, Avinoff,

The Middle Ages (1940 to 1980)

Wallace, Sweadner, Fox, Clench, Ekis

The Renaissance (1980 to present)

Young, Davidson, Rawlins, Androw, Fetzner et al.

The Future Kingdom (1913 to forever))

?? !!

Recent NSF-funded Renovation (1981, 1995, 2000, 2006)

NSF AWARD DEB-8108957 (1981-1985) Phase I. Compactorized storage system (pre-1981 acquisition). Focus on overall collection triage.

NSF AWARD DEB-9509570 (Oct 1995 to Sep 1999) Phase I. Further storage and major improvements (another large compactor). Focus on major collection storage improvements.

NSF AWARD DEB-9987522 (Oct 2000 to Mar 2003) Phase II. Conservation of specimens of exceptional value (especially types); sorting uncurated exotische by PI's and NSF-supported consulting specialists. Focus on Lepidoptera renovation and curation.

NSF AWARD DBI-0545426 (2006-2008) Phase III. Penultimate historical renovations, Rehousing Lepidoptera into retrofitted 19th Century cabinetry in "Holland Room." Storage/sorting large Siphonaptera collection.

Recent and Current Programs

- Research by staff and associates
- Biotic Inventory (Hispaniola and many US projects)
- Biodiversity Services Facility (BSF)
- Conservation-oriented / applied research

The Collection: Size and Taxonomic Scope and types

PINNED ARTHROPOD COLLECTION, CARNEGIE MUSEUM (2010)

| TAXON | TOTAL | Number of USNM Drawers (or equivalent space) | | | | Sorted | Not Sorted | % of Total |
|------------------------------|---------------|--|--------------------|---------------------|--------------|--------------|---------------|------------|
| | | Nearctic | Neotropical | Afrotropical | Other | | | |
| BIOTIC REGIONS | | | | | | | | |
| NON-LEPIDOPTERA | | | | | | | | |
| Coleoptera | 6,792 | 2,663 | 1,951 | 1,046 | 836 | 296 | 22.70% | |
| Hymenoptera | 1,030 | 491 | 289 | 77 | 97 | 76 | 3.50% | |
| Diptera | 1,854 | 690 | 683 | 176 | 209 | 96 | 6.20% | |
| Odonata | 411 | 173 | 151 | 32 | 29 | 26 | 1.40% | |
| Heteroptera | 480 | 220 | 147 | 49 | 32 | 32 | 1.60% | |
| Homoptera | 414 | 162 | 142 | 26 | 28 | 56 | 1.40% | |
| Other taxa | 721 | 166 | 162 | 78 | 53 | 262 | 2.40% | |
| Total Non-Lepidoptera | 11,702 | 4,565 | 3,525 | 1,484 | 1,284 | 844 | 39.20% | |
| % of total non-Lepidoptera | 39.00% | 30.10% | 12.70% | 11.00% | 7.20% | | | |
| LEPIDOPTERA | 18,180 | 5,745 | 5,863 | 2,471 | 2,895 | 1,206 | 60.80% | |
| % of total Lepidoptera | | 31.60% | 32.30% | 13.60% | 15.90% | 6.60% | | |
| TOTAL DRAWERS | 29,882 | 10,310 | 9,388 | 3,955 | 4,179 | 2,050 | | |
| % of all drawers | 100.00% | 34.50% | 31.40% | 13.20% | 14.00% | 6.90% | | |

Types: 4,143 primary types and 34,480 secondary types (estimated as 80% of actual types).

Geographical Coverage. Not dominated by **Nearctic material (only 34.5% of collection)**, although largest repository for entomological specimens from Pennsylvania and West Virginia.

The Collection: Loans

ENTOMOLOGICAL LOANS, CARNEGIE MUSEUM OF NATURAL HISTORY

| | Loans | Total Specimens | Student Loans | Specimens | Domestic Loans | Specimens | Foreign Loans | Specimens |
|------------------------|------------|-----------------|---------------|---------------|----------------|---------------|---------------|---------------|
| 2005 | 83 | 40,535 | 13 | 5,269 | 59 | 26,240 | 24 | 14,295 |
| 2006 | 55 | 20,624 | 9 | 2,681 | 30 | 8,618 | 25 | 12,216 |
| 2007 | 61 | 28,466 | 10 | 3,700 | 42 | 23,083 | 19 | 5,383 |
| 2008 | 21 | 14,879 | 5 | 1,934 | 16 | 14,365 | 5 | 514 |
| 2009 | 26 | 24,534 | 4 | 1,037 | 21 | 23,472 | 5 | 1062 |
| TOTAL 2005-2009 | 246 | 129,248 | 41 | 14,621 | 168 | 95,778 | 78 | 33,470 |

Percent of all loans (1913-2009) borrowed in last five years

| | | | | | | | |
|-----------------------|--------------|---------------|--|--------------|---------------|--------------|--------------|
| | 8.20% | 12.00% | | 8.00% | 13.70% | 8.60% | 8.80% |
| Total loans 1913-2009 | 3,004 | 1,080,254 | | 2,097 | 699,195 | 907 | 381,451 |
| Pre-1980 loans | 837 | 304,156 | | 696 | 221,812 | 141 | 82,344 |
| Total 1980-2009 | 2,167 | 776,098 | | 1,401 | 477,383 | 766 | 299,107 |

Percent of all loans (1913-2009) borrowed after first NSF renovation (1980)

| | | | | | | | |
|--|---------------|---------------|--|---------------|---------------|---------------|---------------|
| | 72.10% | 71.80% | | 66.80% | 68.30% | 84.50% | 78.40% |
|--|---------------|---------------|--|---------------|---------------|---------------|---------------|

Students: 16.7% of loans in last five years, and 11.3% of specimens borrowed
69.8% of loans to U.S. investigators with 30.2% to foreign borrowers.

The Collection: **Publications**

PUBLICATIONS CITING SPECIMENS IN CMNH COLLECTION (2005-2009)

| | Total | Average | 2005 | 2006 | 2007 | 2008 | 2009 |
|--------------------------------------|--------------|---------------|--------|--------|--------|--------|-------|
| Publications | 142 | 28.4 | 43 | 32 | 27 | 14 | 26 |
| Pages | 8,983 | 1,797 | 3,122 | 1,592 | 1,199 | 1,476 | 1,594 |
| Publications by students | 28 | 5.6 | 8 | 6 | 6 | 3 | 5 |
| % of all publications | | 19.70% | 18.60% | 18.70% | 22.20% | 21.40% | 19.2% |
| Pages in student publications | 1,714 | 343 | 801 | 298 | 220 | 141 | 254 |
| % of all pages | | 19.10% | 25.60% | 18.70% | 18.30% | 9.50% | 15.9% |

Note: Data include only publications known to Carnegie staff by July 2010; decreases reflect delay in receiving reprints

The Collection: Growth

GROWTH OF ENTOMOLOGICAL COLLECTIONS, CMNH (2005-2009)

| Specimens Acquired | 2005 | 2006 | 2007 | 2008 | 2009 | Average |
|--|----------------|----------------|------------------|------------------|----------------|------------------|
| Non-Lepidoptera Specimens | | | | | | |
| Pinned and labeled | 55,697 | 48,568 | 42,174 | 41,000 | 16,420 | 52,752 |
| Not pinned or labeled, counted | 0 | 0 | 0 | 0 | 0 | 0 |
| Bulk samples, number estimated | 918,400 | 764,800 | 1,230,400 | 1,283,200 | 697,400 | 978,840 |
| Total Non-Lepidoptera | 974,097 | 813,368 | 1,272,574 | 1,324,200 | 713,820 | 1,019,612 |
| Lepidoptera Specimens | | | | | | |
| Pinned and labeled, spread or not | 11,111 | 16,576 | 5,723 | 2,216 | 4,154 | 7,956 |
| Not prepared, in papers | 0 | 0 | 0 | 0 | 466 | 93 |
| Total Lepidoptera | 11,111 | 16,576 | 5,723 | 2,216 | 4,620 | 8,049 |
| Unspread Lepidoptera received | 6,112 | 5,347 | 2,386 | 2,138 | 1,978 | 3,592 |
| Lepidoptera spread by staff | 12,345 | 15,488 | 16,649 | 17,542 | 20,173 | 16,439 |
| Specimens Prepared by Staff | 48,414 | 61,539 | 54,724 | 39,234 | 22,167 | 45,216 |
| Total Prepared Specimens Acquired | 66,808 | 65,144 | 47,897 | 43,216 | 20,574 | 48,728 |
| Total Unprepared Specimens Acquired | 918,400 | 764,800 | 1,230,400 | 1,283,200 | 697,866 | 978,933 |
| TOTAL SPECIMENS ACQUIRED | 985,208 | 829,944 | 1,278,297 | 1,326,416 | 718,440 | 1,027,661 |

Note: Data include only publications known to Carnegie staff by July 2010; decreases reflect delay in receiving reprints

The Collection

CMNH Strengths

- Lepidoptera (all families, all regions)
- Coleoptera (Carabidae, Cerambycidae)
- Siphonaptera (worldwide)
- Caribbean, Afrotropical, Neotropical (major holdings)
- Tipuloidea (worldwide)
- Crayfish (small but growing)
- Historical type holdings in many orders

The Collection

CMNH needs for Pre-digitization ID and curation

- Odonata (not ready for curation)
- Lepidoptera (not this grant)
- Trichoptera
- Neuroptera: Hemerobiidae
- Mecoptera: Panorpidae
- Coleoptera: Curculionoidea, Staphylinidae, Chrysomelidae, Elateridae, Tenebrionidae
- Hemiptera: Membracidae, Lygaeidae
- Hymenoptera: Sphecoidea, Formicidae, Ichneumonoidea
- Diptera: Muscoidea in part; Syrphidae in part
Lineages with experts collaborating on this grant

Digitization – Phase IV.

Digitization Funding – InvertNet 2011 only

1980's and early 1990's: Historical lethargy for inverts, falling far behind vertebrate and botanical databasing at CMNH.

Mid-1990's. Spreadsheet storage for data from ongoing surveys (Lotus, then Excel). Adopted **unique number labels** for specimen recognition, and **sampling station codes** facilitate capture of detailed occurrence data.

Late 1990's. Retrospective data capture extended to specimens in special groups, regions, or funded projects (spreadsheets)

Early 2000's. Fetzner devises custom MySQL database with diversity of tools for uploading, processing, and distributing data. Primary data entry is literal with tools to expand information in primary database into secondary database for web presentation, sharing, mapping, and other functions.

Digitization – Phase IV.

Mid-2000's. Fetzner devises database to cope with customer-related problems for sample screening and identification service developed by Rawlins and staff (the Biodiversity Services Facility or BSF).

Late 2000's. Data capture using Excel continues (nearly 1 million records) but core database not refined or developed (simple reality of large museum collections...no time, no money).

2011. Proposal by Fetzner and Rawlins to NEAFWA is funded to develop a tool for gathering and disseminating data on invertebrate species of special concern for conservation. Tool developed by Fetzner now in beta-testing.

SYSTEM

Network and Datacenter. CMP-IT is Information Technology Department at Carnegie Museums of Pittsburgh (=Carnegie Institute).

Backup via IBM robotic tape library.

Security. CMP-IT protocols to secure data, servers, and network with internal monitoring capabilities

Support. CMP-IT provides support services on a 24/7/365 basis (not really)

Public Outreach and Educational Opportunities

- Internships – High School and Undergraduate
- Graduate Student Involvement
- Volunteer Curatorial Assistants
- Insect Exhibits (current development)
- Invertebrate Museum Tours, Programs, and Events
- Invertebrate Zoo Development (NOW !!)