



allen★**press**
PUBLISHING SERVICES

Second Survey of Fish Collections in the United States and Canada

Author(s): Stuart G. Poss and Bruce B. Collette

Source: *Copeia*, Vol. 1995, No. 1 (Feb. 15, 1995), pp. 48-70

Published by: American Society of Ichthyologists and Herpetologists (ASIH)

Stable URL: <http://www.jstor.org/stable/1446799>

Accessed: 04-05-2016 13:10 UTC

Your use of the JSTOR archive indicates your acceptance of the Terms & Conditions of Use, available at

<http://about.jstor.org/terms>

JSTOR is a not-for-profit service that helps scholars, researchers, and students discover, use, and build upon a wide range of content in a trusted digital archive. We use information technology and tools to increase productivity and facilitate new forms of scholarship. For more information about JSTOR, please contact support@jstor.org.



American Society of Ichthyologists and Herpetologists (ASIH), Allen Press are collaborating with JSTOR to digitize, preserve and extend access to *Copeia*

Second Survey of Fish Collections in the United States and Canada

STUART G. POSS AND BRUCE B. COLLETTE

A second survey of fish collections in the United States and Canada conducted by the American Society of Ichthyologists and Herpetologists reveals holdings of about 63.7 million specimens in the 118 collections responding to the survey. Subsequent to the first survey (Collette and Lachner, 1976), there have been significant differences in growth rates among collections and a notable increase in the computerization of collections-related information. The quality of curation has measurably improved. Special collections, most notably larval collections, have greatly increased in size. Three-fourths of the collections now report that they can be used to document environmental changes, with holdings of extinct and endangered species and hybrids increased among collections. There has been a marked decline in personnel associated with collections.

Continued loss of trained curatorial personnel will likely adversely impact the long-term maintenance of existing archival collections. A reduction in the number of scientists engaged in collections-based research and education will probably impede efforts to study and preserve biodiversity. Results of both surveys emphasize the importance of maintaining accurate information about collections. Further joint data sharing among collections personnel may be effective in meeting challenges faced by managers and users of collections.

LONG-TERM support and maintenance of research collections are among the most critical issues facing systematic biology. Since the first survey of ichthyological collections was conducted by the American Society of Ichthyologists and Herpetologists (ASIH; Collette and Lachner, 1976), their scientific importance and the rationale for their continued support have not diminished. Periodic reevaluation of the status of North American collections is necessary to measure progress and to address new issues relevant to the long-term care and use of these collections. To help satisfy these needs, a second survey by ASIH was undertaken. This paper focuses on comparisons with the first survey. With similar efforts in Europe (Kottelat, et al., 1993), and significant progress toward the computerization of collections worldwide (e.g., Humphries, 1992; Matsuura and Arai, 1992), it may be possible to have estimates of world holdings in the near future.

METHODS

An open meeting of the ASIH Ichthyological Collections Committee was held at the 1989 annual meetings in San Francisco, California, to discuss the need, form, and content of a second survey. A consensus was reached that the second survey should, to the maximum extent possible, provide data comparable to those of the first survey, as well as evaluate the collec-

tions, using the same criteria. Additional questions, particularly those dealing with computerization, were formulated quantitatively, where practical, to facilitate comparisons. No effort was made to evaluate collections of fossil fishes, because these are being treated separately by the Society of Vertebrate Paleontologists.

Advice of a professional questionnaire design expert was sought to maximize response to the survey. Following the expert's recommendations, the questionnaire, in large part identical to that published in the results of the first survey, was distributed at the 1990 annual meetings in Charleston, South Carolina. Additional questionnaires were sent subsequently by mail to all respondents to the previous survey. Few questionnaires were received in response to the original Sept. 1990 cutoff date. The period for receipt of questionnaires was then extended to obtain information from all known North American collections. Follow-up letters, telephone calls, faxes, e-mail messages, and requests were sent repeatedly to nonrespondents. The second survey took somewhat longer to complete than the first, which was first distributed in the fall of 1973.

The format of presentation largely parallels that of the first survey to facilitate comparison. Resultant data for the largest collections were indexed and ranked using scoring and weighting procedures described in the first survey. In the first survey questionnaire, the number of

species represented by primary and secondary types was requested. However, these values were reported as representing the number of primary and secondary types.

A conservative estimate of five specimens/lot was used to estimate the number of specimens in cases where the number of lots was provided, but the number of specimens was not given. A few collections that provided incomplete responses could not be ranked. Completed questionnaires received from both surveys are maintained as permanent records of the ASIH Ichthyological Collections Committee. Museums are referred to by institutional codes provided by Leviton et al. (1985). Exceptions include the University of Alabama (UAIC) and nine collections that changed their names. The UIMNH collection listed by Leviton et al. refers to the Illinois Natural History Survey (INHS) collection and is not a separate collection. Some newer collections and a few collections noted by Collette and Lachner (1976), but not listed by Leviton et al., are indicated by an asterisk; their institutional codes are provisional. Formal requests from several archives to change their institutional codes have been accommodated, and these changes are indicated in the list of collections (Appendix). These data, now in spreadsheet form, are also maintained as a permanent record of the ASIH Collections Committee.

RESULTS

Of 158 questionnaires distributed (ignoring duplicate and triplicate mailings), 118 collections responded to the survey. Of these, 18 report holdings of a million or more specimens (Table 1), double the number reporting more than a million specimens in the first survey. Collections that responded are listed in the Appendix, with collections believed to contain significant holdings that did not respond. Data for 11 collections are reported for the first time. Of the 118 respondents, seven federal collections are nonpermanent, and an additional 29 nonfederal collections regard themselves as temporary. One hundred seven collections responded to both surveys. Twenty-nine collections that responded to the first survey did not respond to the second survey. As indicated in the Appendix, 23 collections reporting for the first survey are now incorporated into other collections. Three collections reported that they had become inactive, with only selected holdings formally incorporated into another collection. Five collections reported that they now serve exclusively as teaching collections, where-

as another nine indicated that they are used for teaching 80–99% of the time. A fire destroyed one collection (NMFS Sandy Hook, SHML), and all previously listed materials were lost.

Collection size and growth.—The total holdings in North American collections are estimated to be approximately 63.7 million specimens, an increase of 27.8 million or 77% between surveys. Total lots of specimens number 3.8 million, an increase of 1.7 million lots or 81%. These and subsequent estimates represent approximate minimum figures given the significant number of smaller collections, which did not report their holdings. Collections with the largest holdings are presented in Figure 1. Of these holdings, 2.9 million lots (77%) are cataloged.

In terms of total number of specimens, collections that grew the most are the Los Angeles County Museum (LACM); Tulane University (TU); National Museum, Natural History, Washington, D.C. (USNM); and Northeast Louisiana University (NLU) (Fig. 2), in terms of lots, USNM. As a percentage of size measured in lots (from the first survey), greatest growth occurred at the Milwaukee Public Museum (MPM). Holdings of type specimens are considerable (Fig. 3). The greatest increases in type holdings have occurred at the USNM, the Bernice P. Bishop Museum (BPBM), and the American Museum of Natural History (AMNH).

Accessioning activity (Fig. 4) often fails to show a correspondence between amounts of materials accessioned and that subsequently reported as cataloged or placed in backlog. This suggests notable error in estimates, particularly for uncataloged material. Forty-seven million specimens have been cataloged for an average yearly rate of 1346 lots per year (based on a five-year average of 68 collections reporting cataloging activity). Cataloging rates reach over 7000 lots per year in the largest collection (Fig. 5).

Space requirements.—Reported space utilization increased, with at least 20,058 m² of floor space now devoted to ichthyological collections (Table 2). This is an increase of 333 m² or 1.7%. This small increase reflects the consolidation of collections, the increased use of compactors, and absence of information from nonreporting collections. Unfortunately, data on shelf space were too incompletely reported to permit assessment of the contribution of these factors individually. For the 62 collections responding to this item in both surveys, there has been an increase of 2210 m² or 14%. Of these, 21 report less space, for a total loss of 4614 m². Data for teaching

TABLE 1. MAJOR NORTH AMERICAN ICHTHYOLOGICAL RESOURCE CENTERS.^a

Institution	Index no.	Number of specimens	Nominal species with types
1. International centers			
USNM	34	5,000,000	7300
UMMZ	42	3,304,903	711
CAS	43	2,158,742	3200
AMNH	49	2,200,000	1000
ANSP	49	1,502,700	2350
MCZ	50	1,283,000	1305
FMNH	51	1,740,000	1415
LACM	52	7,000,000	530
Totals		24,189,345	17,811
2. National centers			
SIO	59	2,100,000	243
UF	63	1,299,950	200
ROM	63	939,000	108
NMC	66	1,005,683	60
TU	74	5,900,000	111
CU	74	1,600,000	125
BPBM	76	483,333	671
Totals		13,327,966	1518
3. Regional centers			
GCRL	77	360,030	141
OSM	79	1,179,429	25
NLU	81	2,680,000	17
UBC	83	850,000	43
UW	84	229,400	14
UAIC	84	848,000	58
KU	85	338,672	44
INHS	87	605,500	68
Totals		7,091,031	410
4. Important nonpermanent collections			
NMFS, La Jolla (larval)		6,000,000	0
NMFS, Sandy Hook (larval)		250,000	0
NMFS, AFSC (larval)		175,000	0
NMFS, Narragansett		100,000	0
Total		6,525,000	0
5. Other important collections			
UMML	93	550,000	100
YPM	94	41,554	189
TCWC	94	230,000	10
OS	95	444,000	45
MPM	101	1,500,000	2
TNHC	102	357,867	0
AUM	105	600,000	10
UGAMNH	105	215,000	1
PSU	105	450,000	0
SIUC	105	160,000	16
ARC	105	158,670	0

TABLE 1. CONTINUED.^a

Institution	Index no.	Number of specimens	Nominal species with types
LSUMZ	106	232,238	0
UAMZ	107	280,000	0
UT	107	202,000	30
JFBM	107	199,000	0
GMBL	107	275,000	1
UNC	117	353,000	0
NYSM	108	46,200	0
FSBC	108	110,000	0
OSUS	109	692,700	14
Other collections (71)		5,510,510	99
Totals		12,607,739	517
Grand totals		63,741,081	18,738

* Table 2 in Collette and Lachner (1976) reported numbers of Nominal Species with Types as "Types of Nominal Species". Types include both primary and secondary types.

collections are not well reported and are not included in these figures. Collections occupying the greatest space are indicated in Figure 6. There is considerable variation in space needs, with collections reporting the need for a sum of more than 6873 m² of additional space within the next 10 years.

Service functions.—Loan, accession, and exchange activity associated with research and visitor support form integral measures of the use and importance of collections (Table 3). Loan activity is substantial (Fig. 7). Some 99 collections report lending 67,598 specimens in 11,111 lots. This corresponds to a yearly average loan rate of 601 specimens in 98 lots or 6.1 specimens per loaned lot per year (based on a five-year average). About 97% of these loans were made by collections that hold more than 100,000 specimens.

Based on a five-year average, 84 collections reported a total of 1325 scientific research visitors per year, for an average of about 12 visitors per collection per year. Figure 8 shows collections with the greatest number of research visitors per year. Methods for recording visiting researchers do not appear to be uniformly maintained.

Based on a five-year average, a total of 17,822 specimens (3756 lots) is estimated as exchanged per year. Average annual exchange rates for institutions reporting significant activity are presented in Figure 9.

In terms of percentages of respondents, available facilities improved between surveys but not uniformly. Improvements are more difficult to

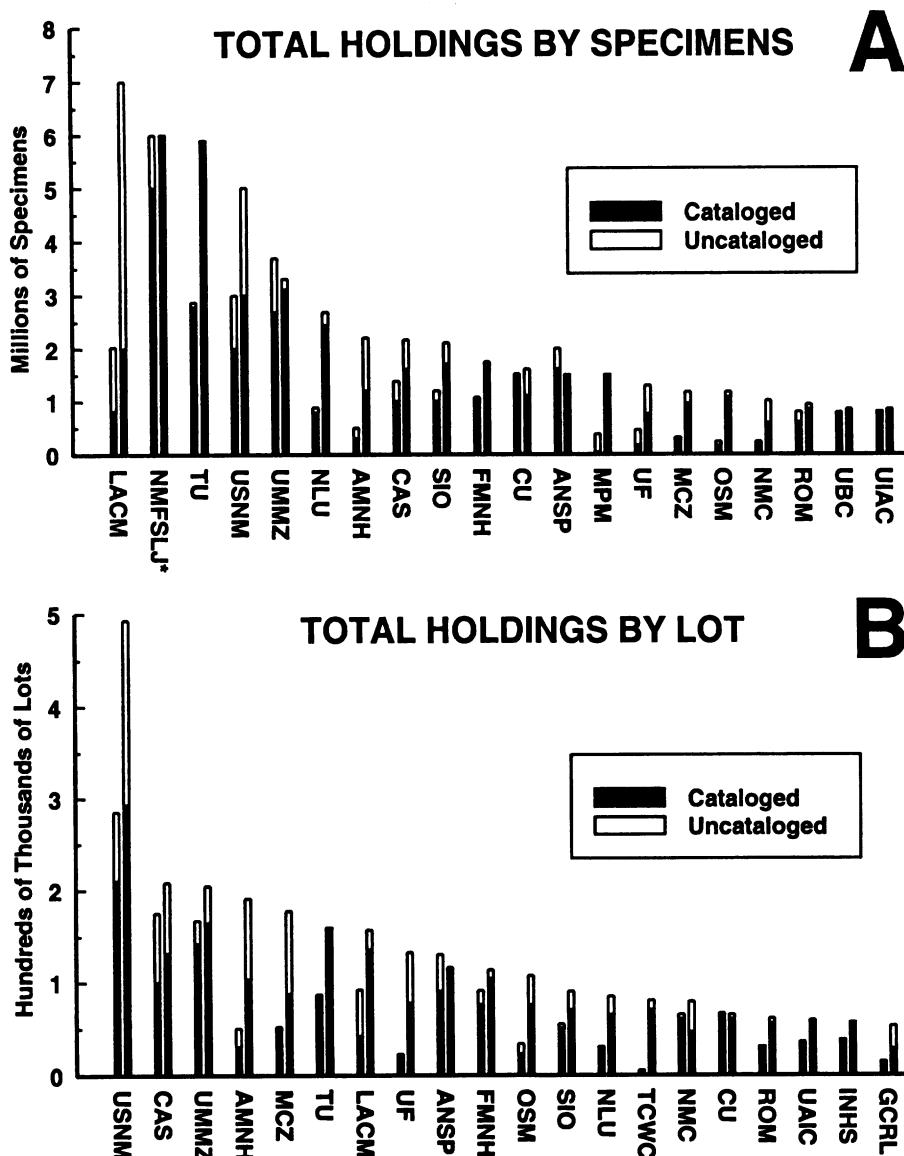


Fig. 1. Total holdings in the 20 largest collections: (A) total holdings in number of specimens; (B) total holdings in number of lots. Bar on left of each pair of vertical bars indicates survey 1; bar on right survey 2. Asterisk indicates provisional institutional code.

demonstrate in absolute terms. Some 77 collections report having freezers (down from 93), 45 have histology facilities (down from 78), 47 document radiographic equipment (down from 57), 69 indicate photographic facilities (down from 115), and 53 have access to SEM facilities (up from only one). Some 43 collections have TEM available. Low-temperature freezers are available at 48 collections. Use of air conditioning has increased to 71% (84 collections) up from 55%

(89 collections); this being important in the southern United States.

Type-specimen collections.—Significant improvements between surveys are reported in the use and care of type-specimen collections. Some 24 collections maintain computerized type catalogs (up from four). Type catalogs have been published for 18 collections (17 in the first survey). An additional 15 collections maintain type cat-

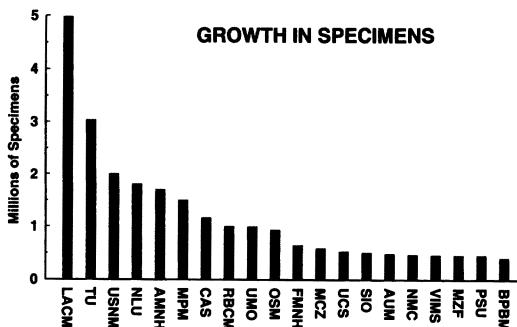


Fig. 2. The 20 collections showing the greatest increases in growth between surveys.

alogs of some kind (10 in the first survey). With computerization, there has been a decrease in the use of card files to maintain information about types (12 collections vs 24 in the first survey). Some 31 collections lend type-material, whereas 77 lend unique specimens.

Figure 10A shows the 20 collections with the greatest number of nominal species represented by primary and secondary type material; Figure 10B indicates those with the greatest number of species represented by primary types. The number of species represented by primary types was reported as 10,924 in the first survey whereas, in the second survey, 11,499 species are represented by primary types. A total of 13,137 lots of primary types is maintained at North American institutions, although the California Academy of Sciences (CAS) estimated it housed 310, and Museum of Comparative Zoology, Harvard University (MCZ) 230, fewer lots of primary types than in the first survey. Reported lots of secondary types number 27,651. The previous survey recommended that type material be deposited in major collections. This has largely been followed, with some notable exceptions. Some 11 type lots listed in the first survey at two nonresponding collections remain unaccounted for. The greatest increases in nominal species with primary types took place at USNM (940), BPBM (193), AMNH (158), the Field Museum of Natural History (FMNH; 105), and the University of Michigan Museum of Zoology (UMMZ; 103). The greatest increases in nominal species with secondary types took place at BPBM (936), CAS (620), AMNH (604), MCZ (535), and LACM (332).

Special collections.—Special collections, including those of larvae (Fig. 11) and skeletal material, both dried (Fig. 12A) and cleared and stained (Fig. 12B), have increased dramatically. Reported holdings of larval materials stand at

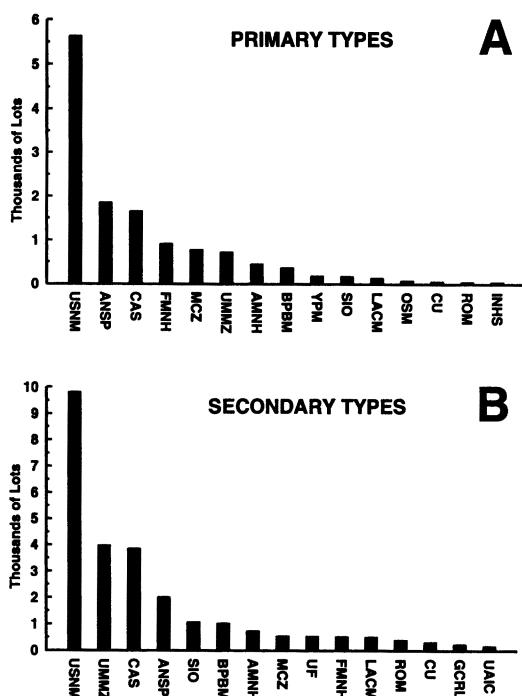


Fig. 3. The 15 collections reporting the largest number of type specimens: (A) primary types; (B) secondary types.

761,656 lots, a 24-fold increase over those reported in the first survey, which were unreported for many collections known to contain them. Presently, larvae compose roughly 26% of all holdings. Because of their size and methods of collection and storage, larval materials are often saved in large numbers and can skew simple comparisons with nonlarval materials. Large specimens are less well represented, be-

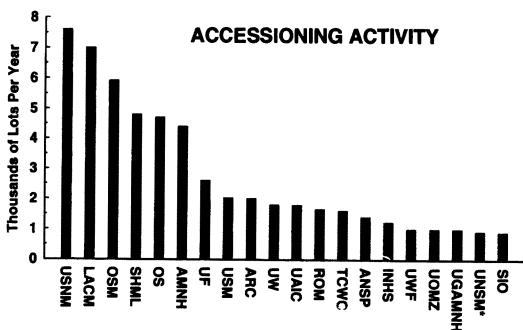


Fig. 4. The 20 collections reporting the greatest accessioning activity as measured by the average number of lots accessioned per year. The average is based on the most recent five-year period. Asterisk indicates provisional institutional code.

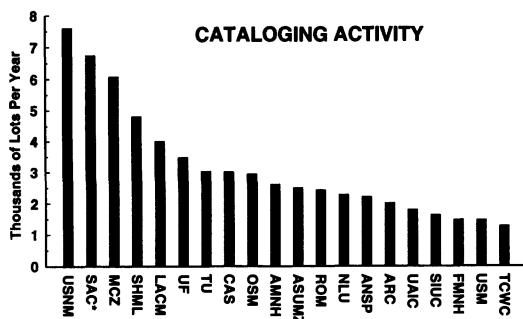


Fig. 5. The 20 collections reporting the largest amount of cataloging activity as measured by the average number of lots cataloged. The yearly average is based on the most recent five-year period. Asterisk indicates provisional institutional code.

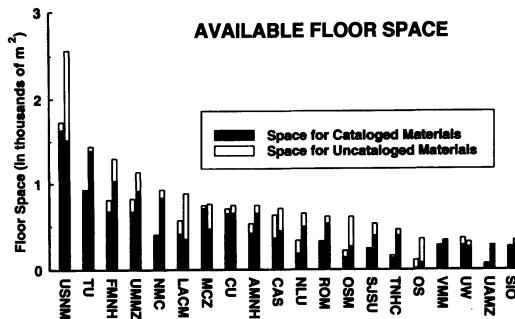


Fig. 6. The 20 collections reporting the largest amount of space available for collections. Space for uncataloged material may be used for other storage in some collections.

cause significant cost and effort are required for their maintenance. Nonetheless, 243,385 lots of tank material are now reported, with the largest holdings at UMMZ, which counts five-gallon jars as tanks (167,465), USNM (9600), AMNH (6000), and CAS (5000).

Collections holding extinct and endangered species have increased significantly, with increases of five to 26 and of five to 70, respectively. Rare species are more widely reported (from eight to 72 collections); the number of collections reporting hybrids has increased dramatically (from eight to 64). Seventy-four percent of collections now indicate that their holdings can be used to document environmental

change (up from 10%). Additional older materials are reported by collections. However, these increases may reflect a better accounting of previously held materials and an increased awareness of the importance of collections in monitoring faunal changes. Sizeable holdings of old materials exist, with seven major institutions reporting the bulk of materials collected before 1900 (Fig. 13). About 161,000 lots were collected before 1900 (4% of total holdings). About 705,000 lots (18%) were taken between 1900 and 1949. Roughly 2.8 million lots (74%) were taken after 1949. Remaining lots (4%) were of an unspecified age.

A total of more than 10,000 scientific publications were reported as utilizing specimens

TABLE 2. SPACE REQUIREMENTS, COLLECTIONS GROWTH (IN SPECIMENS), AND CATALOGING NEEDS AMONG THE 15 COLLECTIONS SHOWING THE GREATEST FLOOR SPACE.

Institution	Present collection space, m ²	Space 10-year needs, m ²	Current yearly collection growth in percent	Collections uncataloged, as percent of total
National Museum of Natural History (USNM)	2557.3	123.7	1.6	40.0
Tulane University (TUL)	1440.0	696.8	3.4	0.0
Field Museum of Natural History (FMNH)	1270.7	557.4	0.2	2.3
University of Michigan Museum of Zoology (UMMZ)	1114.8	204.4	0.4	6.0
Canadian Museum of Nature (NMC)	929.0	613.2	5.1	42.3
Los Angeles County Museum of Natural History (LACM)	882.6	—	1.5	71.4
Cornell University (CU)	743.1	92.9	0.4	31.3
Museum of Comparative Zoology (MCZ)	743.1	0.0	7.7*	25.7
American Museum of Natural History (AMNH)	743.1	0.0	2.3	45.5
California Academy of Sciences (CAS)	706.1	46.5	0.4	25.9
Northeast Louisiana University (NLU)	650.3	464.5	4.3	9.3
Royal Ontario Museum (ROM)	600.1	271.7	2.7	10.8
Ohio State University Museum (OSM)	466.8	93.7	5.5	10.2
Texas Natural History Collection (TNHC)	390.2	371.6	3.5	17

* Includes WHOI collection.

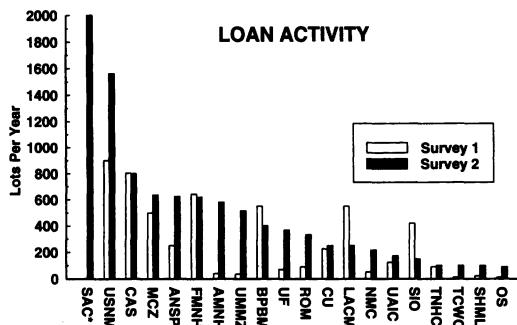


Fig. 7. The 20 collections reporting the highest levels of loan activity measured as numbers of lots. Asterisk indicates provisional institutional code.

contained in collections. However, accurate lists of such publications are not widely maintained, and it is not currently possible to determine what percentage of these result from duplicate listings. Improved documentation of publications resulting from the use of collections is needed to more clearly demonstrate the importance of scientific collections.

Sizeable holdings of osteological specimens exist in North American collections: 47,582 lots of dried skeletal preparations (1.2% of total holdings); 26,518 lots of cleared-and-stained preparations. This represents an increase of 108% and 15%, respectively. Collections of 524,460 lots of otoliths exist in North American collections, an increase of 13%. Materials such as otoliths, radiographs, and photographs are less consistently reported.

There are several major photographic slide collections worth noting: a collection of slides

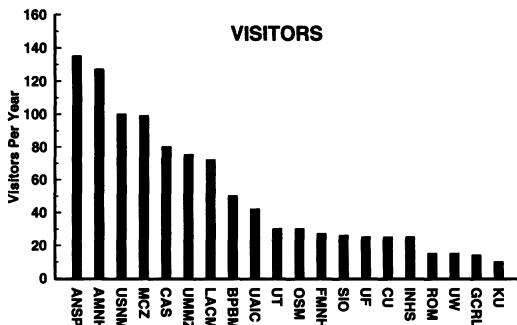


Fig. 8. The 20 collections reporting the most professional visitors.

of freshwater fishes from North America and another on the history of ichthyology, both belonging to Southern Illinois University (SIUC); a large collection of slides of marine species at BPBM; another at the Royal Ontario Museum (ROM); and the National Marine Fisheries Service/American Fisheries Society slide collection. These represent significant special collections that are not otherwise tabulated. In some collections, such as LACM, with large otolith holdings, and AMNH, with large skeletal collections, these special collections form an important fraction of the total collection. In many cases, such specialized holdings are not cataloged.

Preservatives used.—Ethanol is the most widely used preservative, being used for 57% of all lots (60% in the first survey). Isopropanol is also widely used, accounting for 34% of all fluid lots (33% in the first survey). Formalin is used to

TABLE 3. ANNUAL LOANS, EXCHANGES, AND ADDITIONS AMONG THE 13 COLLECTIONS SHOWING THE GREATEST ACTIVITY IN TERMS OF NUMBERS OF LOTS LOANED (WHOLLY LARVAL COLLECTIONS EXCLUDED). Numbers are based on five-year averages, where available (NA = Not Available).

Institution	Loans		Exchanges		Additions	
	Spec.	Lots	Spec.	Lots	Spec.	Lots
National Museum of Natural History (USNM)	9509	1562	2554	355	77,834	7600
California Academy of Sciences (CAS)	4500	800	300	60	9490	780
Museum of Comparative Zoology (MCZ)	2741	635	NA	NA	NA	NA
Academy of Natural Sciences, Philadelphia (ANSP)	4500	624	NA	NA	18,486	1400
Field Museum of Natural History (FMNH)	3134	620	7502	232	3503	213
American Museum of Natural History (AMNH)	3000	580	1300	307	51,262	4400
University of Michigan Museum of Zoology (UMMZ)	8646	514	389	51	13,963	740
Bernice P. Bishop Museum (BPBM)	1200	400	NA	NA	11,294	800
Florida Museum of Natural History (UF)	3355	369	354	101	25,577	2600
Royal Ontario Museum (ROM)	2415	332	1524	248	25,238	1656
Cornell University (CU)	3000	250	100	20	1833	100
Los Angeles County Museum of Natural History (LACM)	1751	250	597	62	103,704	7000
Canadian Museum of Nature (NMC)	2635	216	305	25	23,046	1815

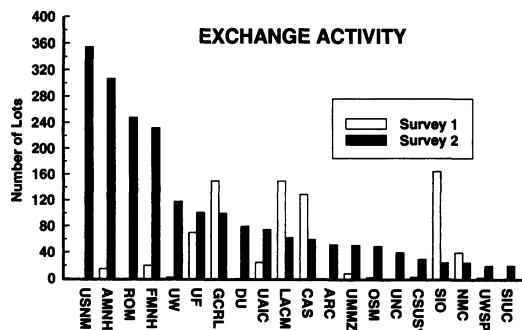


Fig. 9. The 20 collections reporting the highest levels of exchange activity measured in number of lots. Numbers are annual averages based on most recent five years. Asterisk indicates provisional institutional code. Data from first survey not available for some collections.

curate roughly 7.4% of all lots (up from 3.6%), particularly with larval materials. Glycerin is used as a preservation medium for about 0.7% of all holdings (26,518 lots). Although an overall 21% increase is reported, estimates of holdings in glycerin have decreased in many collections, one would hope the result of improved curation and more precise estimates and not reflecting loss of materials. Method of preser-

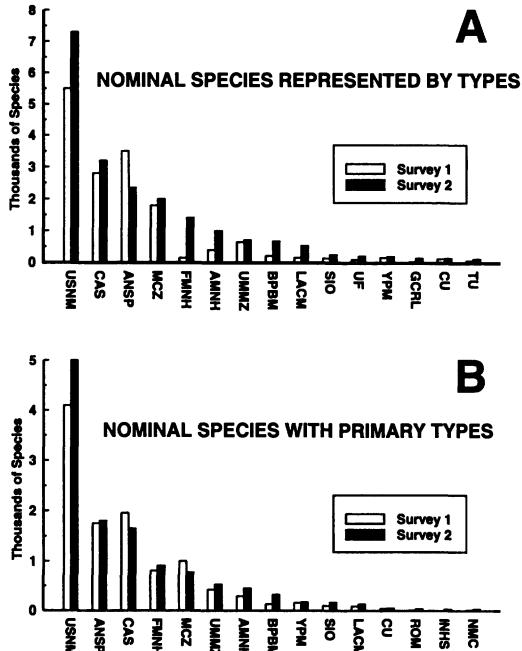


Fig. 10. The 15 collections reporting the greatest number of nominal species represented by type material: (A) both primary and secondary types, (B) primary types only.

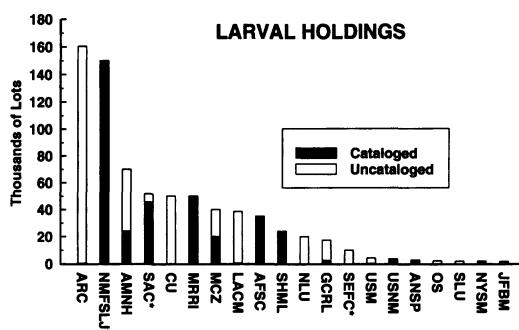


Fig. 11. The 20 collections reporting the largest holdings of larval materials. Asterisk indicates provisional institutional code.

vation was not reported for about 2.1% of the total lots, as compared to 12% in the first survey. Comparing alcohol usage only, 32% of collections (containing 43% of alcoholic lots) report using only ethanol, 44% of collections (18% of lots) report using isopropanol only, and 24% of collections report using both ethanol and isopropanol (39% of lots). In the first survey, cor-

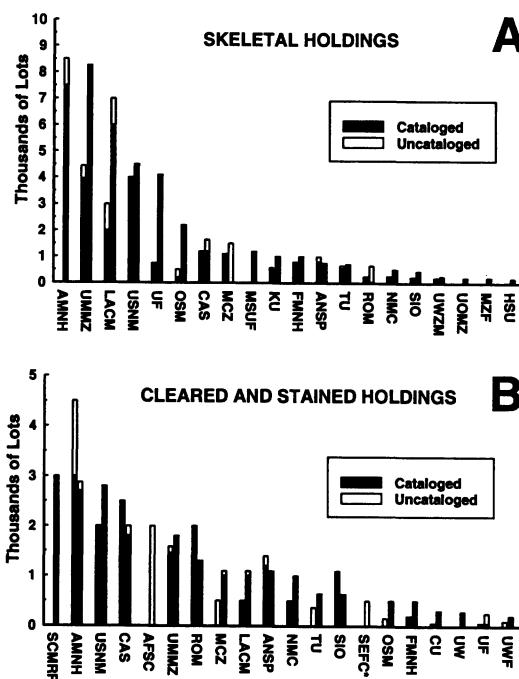


Fig. 12. The 20 collections reporting the largest holdings of osteological material: (A) dried skeletal material; (B) cleared-and-stained material. Bar on left of each pair of vertical bars indicates survey 1; bar on right survey 2. Asterisk indicates provisional institutional code. Data from first survey unavailable for some collections.

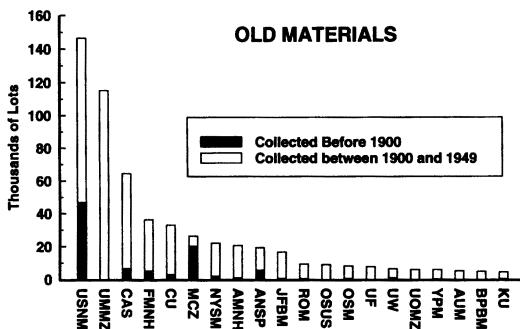


Fig. 13. The 20 collections reporting the largest holdings of materials collected at an early date.

responding percentages were 25% (43% of lots), 64% (32% of lots), and 11% (28% of lots), respectively. Holdings categorized by preservative type (glycerine excluded) for the largest collections are presented in Figure 14.

Geographic coverage.—Since the last survey, at least 26 collections have ceased to exist as independent entities, with 23 of these being incorporated into other collections. Three collections have become inactive, with only part of their holdings incorporated into other collections. Thus, geographic coverage has changed little, with 11 "new" collections being added. The status of 29 collections responding to the first survey could not be determined. The largest incorporation in terms of numbers of lots occurred primarily at AMNH, LACM, Oregon State University (OS), and MCZ. Several collections established since the last survey have grown dramatically (Table 1), such as those based largely on larvae. Knowledge of geographical coverage, particularly as it relates to detailed changes in collection composition, remains difficult to assess despite significant effort toward computerization. Certain regions, most notably the southeastern and south-central United States, appear to have multiple areas of overlap in coverage among collections. The greater number of collections in these regions may be a function of the greater diversity of the local fauna.

Based on lots calculated from total materials, freshwater holdings stand at 51%, whereas marine stand at 47%, designating brackish water species as marine. The status (marine/freshwater) of about 2% of material was not reported.

Systematic coverage.—The number of species represented in collections (Fig. 15) and the number of families (Nelson, 1984) represented

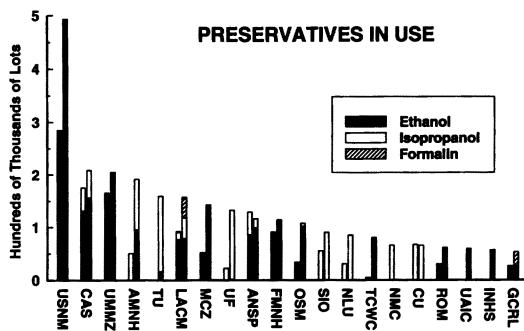


Fig. 14. Preservatives used in the 20 collections reporting the largest number of lots. Only partial breakdown available for many collections in first survey. Percentage of lots in glycerin usually less than 1%.

has increased between surveys. Unfortunately, detailed documentation and comparison of holdings among collections on a taxon-by-taxon basis cannot yet be made.

Computerization.—When the first survey was completed in 1976, only nine collections were being computerized, with only the Gulf Coast Research Laboratory (GCRL) fully computerized. Since that time, the extent of the pervasiveness of the computer revolution is evident in North American fish collections. Fifty-seven collections now report the use of computers to manage their holdings. Major computerized holdings by collections are shown in Figure 16. Nonetheless, only 47% of all lots are now electronically cataloged indicating the size and complexity of the task. The extent of computer database development is evident, with 30% of respondents indicating use in loan management and in accessioning. A variety of software and

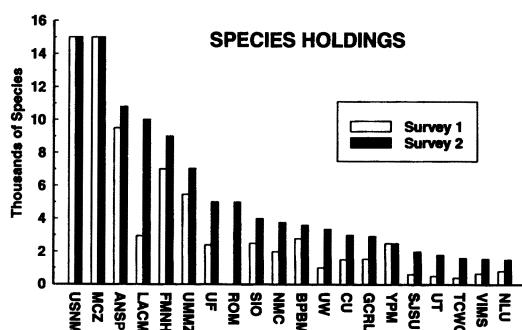


Fig. 15. The 20 collections reporting the greatest number of represented species. Presumably, the number of species in the USNM and MCZ collections were only roughly estimated in the first survey.

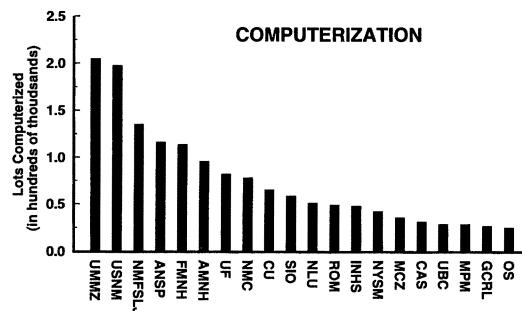


Fig. 16. The 20 collections reporting the greatest number of computer catalogued lots. Asterisk indicates provisional institutional code.

hardware configurations exist with 25 respondents (21%) indicating imminent plans to change computer systems. About 16% of respondents have computerized linkages within collections developed as computer networks. Modem availability is low (30%). BITNET is the most widely used network. Major Canadian collections are connected through CHIN (Cultural Heritage Inventory Network). Only 27% of collections reported access to InterNet. However, gate-

ways, already numerous on the InterNet (Quarterman, 1990), are being added rapidly. Fully integrated communitywide collections management could be a reality in the relatively near future.

Staff size.—In the 1976 survey, as many as 355.5 FTE (full-time equivalents) professionals were reported as employed in North American research collections (251 curator/researchers, 71 technical support personnel, 33 clerical personnel, and 0.5 data entry personnel). By contrast, in the second survey, this figure has fallen to 148.3 FTE professionals (67.3 curator/researchers, 65.5 technical support personnel, 9.1 clerical personnel, and 6.4 data entry personnel). Although precise estimates of the amount of time some curators/researchers listed in the first survey spent in curation are unavailable, there has been a decline in collections-associated personnel (Fig. 17), with staff artists nearly disappearing (0.3 FTE down from 16). Previously, most collections had one or more curator/researcher position associated with them. Presently, most collections have a single curator/researcher position or less. The number of volunteers and other unspecified workers has

MUSEUM PERSONNEL

FULL TIME EQUIVALENT STAFF

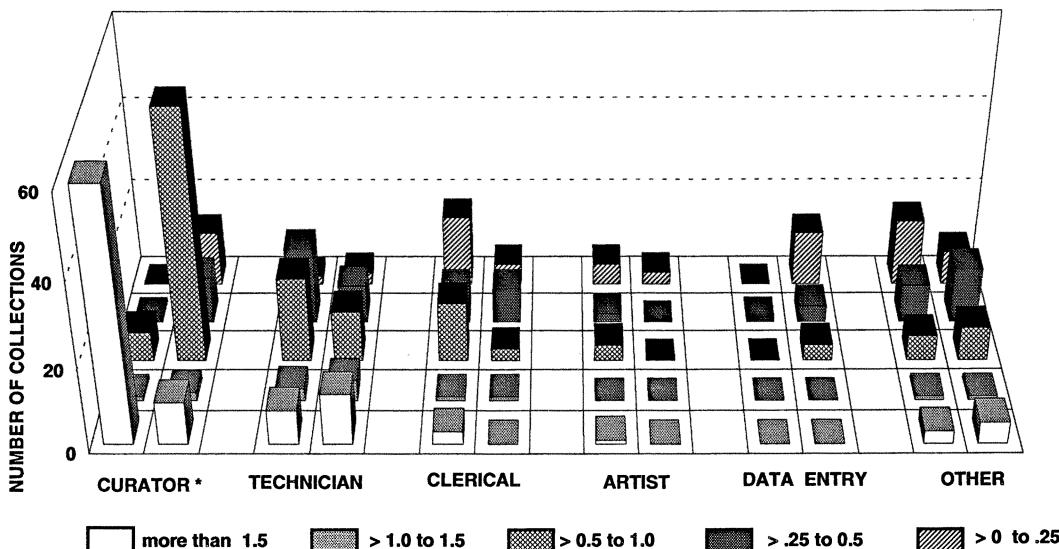


Fig. 17. Three-dimensional histogram of museum personnel expressed as full-time equivalent staff. The height of the bars (Y axis) indicates the number of collections reporting a given range of FTE positions. In each column (Z axis), collections with more employees are toward the front of the diagram, those with less are toward the rear. Bars on left in each employee category (X axis) correspond to survey 1; those on right to survey 2. Asterisk indicates that estimates of FTE status of some curators in survey 1 are not available. Totals of FTE positions by employee category for each survey are provided in the text.

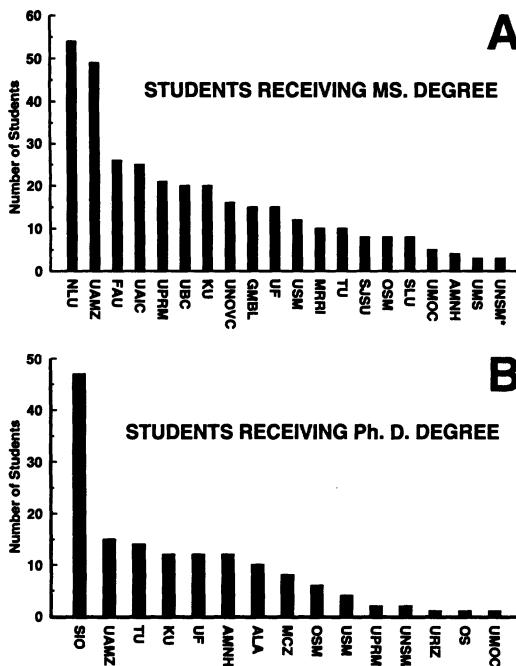


Fig. 18. Collections associated with largest academic programs: (A) master's degree programs, (B) Ph.D. programs. Asterisk indicates provisional institutional code. Data not consistently or completely reported for all collections.

changed little (33.5 FTE vs 34.3 in the first survey). Loss of personnel, which has occurred through consolidation and shrinkage, is widespread between surveys at both large and small institutions. Addition of nonreporting collections, which are likely to have only a single, part-time person on the staff, if anyone at all, would not markedly alter the nature of the reduction in personnel.

Educational function.—Graduate enrollment in systematic ichthyology or disciplines related to collections-based research continues to remain low, although it has increased between surveys. Some 54% of collections are used in degree-granting programs, but only 29% of collections report their use as part of academic study leading to an advanced degree. Less than 23% of the collections responding indicate their collections are used in Ph.D. programs, and some 28% report their use for master's degrees. Although there has been a considerable increase, an ichthyology course is taught at only 77 collections (65%) on an average of 0.9 times per year. Total course work reportedly involved 211 lecture hours/week and 156 hours/week of lab-

oratory instruction. Forty-eight percent of respondents indicated that a teaching collection is maintained, usually separate from the research collections. The ratio of academic and nonacademic collections remained roughly constant. There are 54 state/provincial university collections (68 in the first survey), eight private university collections (12 in the first survey), 19 collections that are neither state/provincial or private but associated with an academic program (34 in the first survey), and 37 nonuniversity collections (48 in the first survey).

Some 478 students are reported to have received training involving use of the collections. This includes some 152 Ph.D. and 326 master's degrees that have been based upon material contained in ichthyological collections. The largest programs reporting are indicated in Figure 18. The ratio of students trained relative to those who are employed in curation of collections is reported as 2.8:1. However, inadequate reporting of matriculations by several historically strong programs indicates that the number of Ph.D.s trained relative to the number of available jobs associated directly with collections is probably much greater. Statistics concerning the academic use of collections are often unreported.

Funding sources.—Federal supported collections remain a relatively constant fraction of all collections (nine of 94 responding vs 12 of 116 in the first survey). State or provincial government funding forms the major source of support for most collections (65 collections vs 81 in the first survey). County and municipal funding support five and three collections, respectively (six and four in the first survey). Private funding now supports 15 collections (27 in the first survey), with 13 collections indicating that they are solely private (24 in the first survey). Collections operated solely on state/provincial funds now number 65 (81 in the first survey).

Although detailed financial information documenting collections support was beyond the scope of the survey, such data would be extremely useful in interpreting current levels and trends in the growth, use, and care of collections. A total of \$5,886,674 (US) was reported as having been received by 11 United States collections from the National Science Foundation (NSF; Table 4). No comparable figures are available for Canadian collections.

Funding priorities.—Curators ranked need for additional clerical and curatorial staff as their greatest funding priority (Table 5). Additional space for collections was the second most cited

TABLE 4. UNITED STATES COLLECTIONS RECEIVING NSF COLLECTIONS SUPPORT GRANTS AS REPORTED BY RECIPIENTS.

Institution	No. of awards	Dates	Amount
CAS—California Academy of Sciences	6	1967–90	\$1,229,819
ANSP—Academy of Natural Sciences, Philadelphia	5	1972–91	\$1,051,985
MCZ—Museum of Comparative Zoology, Harvard	6	1973–92	\$1,048,566
UF—Florida Museum of Natural History	4	1979–90	\$424,633
LACM—Los Angeles County Museum	2	1980–83	\$382,000
UMMZ—University of Michigan Museum of Zoology	3	1980–90	\$379,163
BPBM—Bernice P. Bishop Museum	3	1978–85	\$375,508
FMNH—Field Museum of Natural History	1	1991–94	\$358,000
UW—University of Washington	2	1979–91	\$302,000
AMNH—American Museum of Natural History	1	1982–84	\$230,000
CU—Cornell University	2	1982–90	\$105,000
Total			\$5,886,674

need, followed by the need for additional research and technical staff. Although much attention has been given to the computerization of collections, the need to computerize ranked sixth in terms of priority and the need for computer equipment eighth.

DISCUSSION

Relative rankings.—There are several notable changes in relative rankings between surveys. Because all international centers, except MCZ, have over a million specimens, factors other than size differentiates them. Among international centers, UMMZ has moved into second position, because of increased diversity in the collections, the decrease in collections growth, and professional staff at Academy of Natural Sciences (ANSP); and CAS now reports a lower, but likely more accurate, estimate of the number of its type specimens and a decrease in professional staff. Improvement of the AMNH has

been the most dramatic, reporting an increase in professional staff, the development of a premier osteological collection, and a substantial increase in the diversity of its holdings.

Among national centers, the relative rankings have remained roughly constant. TU is ranked lower, primarily because its diversity, staff size, facilities improvements, and numbers of type specimens have not increased as rapidly as have other collections in this cohort. BPBM, with incorporation of the NMFS Honolulu Laboratory holdings and remarkable increases in type specimens, diversity, and size, now ranks among national centers. The University of British Columbia (UBC) collection has become relatively inactive, with some high-latitude materials transferred to the Canadian Museum of Nature (NMC). Although the categories of national centers and international centers remain distinct, the differentiation between the smaller national centers and the larger regional centers has lessened.

TABLE 5. FUNDING PRIORITIES OF RESPONDING COLLECTIONS. 1 = highest priority

Category	Priority*									
	1	2	3	4	5	6	7	8	9	10
Additional clerical/curatorial staff	40	19	13	6	4	5	3	2	0	2
Additional space for collections	18	14	7	12	13	2	8	5	4	7
Additional research staff	16	8	8	5	13	6	5	7	13	5
Additional technical staff	11	14	15	13	6	11	8	4	4	4
Purchase of supplies	9	14	10	11	9	7	13	8	6	4
Computerize collections	8	5	18	8	10	7	4	8	9	6
Additional space for curation/offices	3	6	9	10	9	13	12	11	4	5
Computer equipment	2	9	6	12	13	6	11	12	6	3
Non-computer equipment	0	2	7	4	12	19	6	14	17	2
Other	3	1	1	0	3	1	0	1	0	8

* Some numbers used more than once by a few respondents.

Among regional centers notable changes are evident. GCRL retains a relatively high ranking primarily because of increases in its type holdings, improvement in the diversity and geographic coverage, and incorporation of significant larval holdings. Collections at Ohio State University (OSM), UAIC, the University of Washington (UW); and INHS have grown much more rapidly than has that at the University of Kansas (KU) in terms of total numbers, type holdings, and in relative improvements in facilities. OSM, in particular, has increased dramatically in size and diversity and now incorporates significant historical materials. Collections at the University of Miami (UMML) and the Yale Peabody Museum (YPM), which have not grown appreciably since the first survey, no longer rank among regional centers. However, their diverse, historically important holdings continue to receive relatively high rankings.

These figures stress the effect of geographic location on the relative rankings among mid-sized collections. The strongest geographic coverage is in the immediate vicinity of the institution. Because Honolulu is removed from the United States mainland, BPBM has relatively low North American representation. In contrast, GCRL, NLU, and UAIC are in the southern United States with a larger fish fauna (both marine and freshwater) and, thus, score higher than do OSM, UW, INHS, or KU. GCRL differs significantly from the other regional centers in having more type specimens and greater representation from non-North American regions (throughout the Americas and Indo-Pacific) with 2936 species represented among its catalogued holdings.

Among remaining institutions, there is also much evidence of collection building, with many collections doubling or tripling in size. The most notable increases have taken place at the Milwaukee Public Museum (MPM) and at Auburn University (AUM). Several of these collections approach regional centers in terms of size and diversity. Given the cost of making and maintaining collections, all parties must make an effort to coordinate future collecting activities to minimize duplication. Widespread use of computerized lists and eventual networking among collections would be effective uses of resources toward developing complementary and well-defined specialization.

Endangered and nonreporting collections are smaller collections with local or regional coverage, typically at universities. Such environments expose considerable numbers of biologists to systematic collections at an important

time in their academic development. Efforts must be made to conserve and restore these environments, particularly now that the magnitude and severity of the biodiversity crisis are more widely recognized and its impact on research in other disciplines of science dramatically increasing. Significant nonresponse to our questionnaire, despite sustained and time-consuming efforts to obtain them, highlights the problem of evaluating the status of many previously reported ichthyological collections. Lack of reporting may be a sign of emerging problems relating to the permanence of the collections. It makes the potential costs of their incorporation into more established centers and the consequences of their loss to the scientific community more difficult to evaluate. It also limits dissemination of information about collections, which contributes to reduced awareness and diminishes their use.

Implications for long-term care.—What science knows about fishes is based on materials in research collections, on taxonomic publications based on museum specimens, or indirectly from publications that use such taxonomic publications as the basis for identification. Loss of materials from these collections would weaken the reliability of previous studies using identifications based upon these specimens. In some cases, such materials can no longer be collected, because local populations no longer exist in the wild. In many others, the cost of obtaining new materials for such validation would be prohibitive.

Probably the most significant threat to the long-term care of these collections documented by the second survey is the decrease in number of personnel available for their operation. The shrinkage is dramatic when collection staffs are considered relative to the increased amount of material in need of study and maintenance. The ratio of lots to curator/researcher has increased from about 8000:1 in the first survey to 60,000:1. Similarly, the ratio of lots per technical support position (non-curator/researcher) has risen from about 20,000:1 to 47,000:1. The consequences of this trend are disturbing because they represent a diminished capacity for material to be as intensively studied and as adequately maintained. They also draw attention to the alarming and real potential that existing materials, even in well-established centers, may not be properly curated for lack of staff to realcohol, repair gaskets, change jars, and accomplish other related tasks essential to long-term archival storage. One might be tempted to conclude that collections should cease to add new

materials to deal with this threat. However, such reasoning ignores the urgent scientific necessity to learn about uncollected, unknown, and unstudied species and populations before they become extinct, locally extirpated, or their habitats altered through human impact.

Nonresponse to our questionnaire is concentrated among smaller university collections. Assuming nonresponse is likely a reflection of reduced emphasis on collections, this survey indicates a serious decline in the number of researchers engaged in collections-based, biodiversity research and training at a time when they are desperately needed. Given the scientific necessity of preserving the integrity of unique research resources, it is not surprising that curators rank the need for curatorial support personnel as their highest priority. The reasons for nonresponse must be understood for all collections. Society members must assume an increased measure of responsibility for the health of smaller ichthyological collections, if further erosion of technical expertise and potential loss of materials is to be avoided.

The long-term preservation of materials in ethanol is well documented by the continued existence of the earliest collected material (mid-to late 1700s), which are preserved in this medium in European collections. The preservation characteristics of formalin and isopropanol over the long term are less well understood. The former, long in wide use, is detrimental to specimens after time and restricts their use for certain procedures, most notably clearing and alizarin staining and studies of molecular biology. Although there has been an increase in the proportion of collections using ethanol, a considerable fraction of material remains stored in isopropanol and formalin. The range of acceptable concentrations before notable deterioration is narrower for isopropanol than for ethanol. Personnel available to check alcohol levels is decreasing while collections are growing in size. Therefore, additional efforts must be made to increase funding for transfer of materials to ethanol and to conduct studies on other preservation problems. Otherwise, a significant fraction of irreplaceable archival collections is at real or potential long-term risk.

Improving documentation and integration of frozen collections may be of value by increasing interaction between the traditional collections community and the emerging discipline of molecular systematics. Most such collections remain too incompletely reported to adequately estimate. Further development and integration of special collections, most notably larval and skeletal collections, will continue to increase the

value of collections to a broader range of scientists.

Implications for continued development of National Plan.—Collette and Lachner (1976) grouped 153 collections reported in the first ASIH survey into five categories: international centers, national centers, regional centers, important nonpermanent collections, and other collections. International centers remain as a distinct group, with changes in rank ordering occurring because of small differences in index scores. In contrast, the rank orderings of national and regional centers and of smaller, but important, collections have changed more markedly. These changes have often resulted through the assimilation of smaller, more regional university collections into larger collections. Smaller collections with limited staffs, often that of a single research program, are most likely to be incorporated or lost. Of the 23 collections incorporated since the first survey, nine had regarded themselves as permanent. Given that only 82 collections now regard themselves as permanent, future loss of research materials appears most likely to continue among smaller collections. It is likely that significant knowledge of regional biodiversity will be lost in the process, because staffs at larger centers are now not that much larger than those at smaller collections, their collections contain greater holdings, and they are likely further removed geographically from collecting sites. Because prior knowledge of the importance of species is often key to their preservation, the loss of research and teaching collections at smaller academic institutions will likely have significant adverse impact on efforts to conserve fish populations.

Categorization by size has served as an important element in comprehensive recommendations for the long-term care, use, and funding of these collections (Lachner et. al., 1976). However, results of the second survey make evident the dilemma posed by the concentration of holdings. Although centers are necessary to ensure the highest level of support and research capability, a network with smaller, regional centers is essential for teaching ichthyology and highlighting the importance of fishes to a wider cross-section of the public. Increased local and global awareness of fishes sufficient to retard loss of biodiversity and to improve public understanding of the importance of research collections to such efforts is urgently needed.

The classification of collections largely brought into fruition through the United States National Plan, recommended in conjunction with the first survey, has largely worked as in-

tended in saving valuable research material from being lost. The size of these efforts, given limited staffs, testifies to the dedication of a concerted group of scientists. Efforts to study and manage fishes would be significantly enhanced through support of initiatives that facilitate training and increased coordination among collections-related personnel at all sites. These would be especially appropriate where the vital importance of this activity can be made visible and understandable to the public. Although this has been a thrust of NSF-funded efforts, and the second survey provides dramatic proof of the value of its program to provide support for collections, it remains unclear whether these efforts, and those of other funding agencies, will be large enough to have any appreciable effect on the long-term fate of most fish populations.

Although the Woods Hole Oceanographic Institution (WHOI) collection has been incorporated into the MCZ collection and much of the NMFS, Honolulu (Hawaii) collection included into the BPBM collection, as recommended in the first survey, transfer of materials from the NMFS, La Jolla (California) to LACM has not taken place. Should a mechanism be worked out to deposit the NMFS, La Jolla holdings at LACM as recommended in the first survey, or to establish a means of integrated data management without transfer, this would further secure this important larval collection. Nonetheless, collection utilization activity of NMFS and other federal agencies still remains largely outside activities of academic institutions with ichthyological collections involved in the United States National Plan. As a result, attendant potential for mutually beneficial joint research, training, and program development is going unrealized. Arrangements, such as the incorporation of the NMFS Alaska Fisheries Science Center ichthyoplankton collection into UW, should be encouraged, particularly in cases where transfers can facilitate cooperative research and training.

Potential impact of changes on ichthyological research and academic training.—If the decline in the number of specialists able to accurately identify fishes and to teach modern principles and methods of ichthyological systematics is to be reversed, increased efforts are needed to ensure that students can find employment at collections or at institutions affiliated with collections. Also needed are additional efforts to educate scientists outside the traditional boundaries of systematic biology about the research value of archival materials, particularly in situations where

they can become involved in the development and integration of specialized collections.

Despite incomplete reporting, this survey reveals that limited numbers of students are making use of research collections. Imaginative efforts are required to make it easier for students to overcome obstacles to a professional career in ichthyology. Distances isolate students from collections. Lack of personnel limits student access, particularly because collections must be kept secure. Lack of personnel often make collections-oriented programs vulnerable to shifts in research and teaching priorities. Increased use of emerging communication technologies is needed to ensure that sufficient numbers of ichthyologists are trained on a broad geographical basis. Such equipment would allow less advantaged programs and collections to use resources currently available only at larger, more active institutions. Participation with several regional collections would diversify activity available to larger programs. More formal interinstitutional agreements between larger and smaller programs should be encouraged to establish such networks on as broad a geographic basis as possible.

Recommendations for reporting.—Future surveys must make use of computerized catalogs to better characterize holdings and quantify resources. Although future surveys might be regularly made, a more productive approach by the ASIH may be to have all statistics monitored over a network by as many members as possible. Networking would prove valuable in avoiding problems, such as unnecessary duplication, in providing access to specialized expertise, and in dealing with issues that cannot be effectively addressed by collections individually. Networking and distributed monitoring algorithms would also make problems more immediately apparent to the community as a whole and strengthen programs aimed at training and research with wide geographic coverage. Wider use and dissemination of electronic lists of scientific names, such as that of Eschmeyer (1990), would greatly improve statistics on the composition of collections by facilitating standardization of nomenclature.

This survey utilized methods of rank weighting employed in the first survey. As Collette and Lachner previously noted (1976), the arbitrariness of some weights can change index values. Similarly, index scores differ depending on how several criteria are coded or interpreted. In particular, those for geographic coverage, historical value, and documentation limit the objec-

tivity and development of less arbitrary, computerized collections-evaluation strategy. These criteria were prepared before widespread computerized record keeping. Thus, for example, the specific classification of documentation, which relies heavily on the availability of multiple hard copy files, is now less relevant. In contrast, academic aspects of collections activity are underemphasized, whereas factors associated with the overall size of collections, such as number of specimens, receive greater weight, even though information on the redundancy of holdings is absent. Although the inherent ambiguity in some of the criteria used for classification precludes a more focused examination of the relative strengths and weaknesses of some collections, this information provides a basis for more refined study of ichthyological collections.

ACKNOWLEDGMENTS

Those who were patient enough to carefully complete the lengthy questionnaire are thanked for making the reporting of these data possible. We are grateful to E. Heal for assistance in preparing the questionnaire and for recording the data as they were received.

LITERATURE CITED

- COLLETTE, B. B., AND E. A. LACHNER.** 1976. Fish collections in the United States and Canada. *Copeia* 1976:625–642.
- ESCHMEYER, W. N.** 1990. Catalog of the genera of Recent fishes. California Academy of Sciences, San Francisco.
- HUMPHRIES, J. M.** 1992. Neotropical database project. *MUSE News* 7:3.
- KOTTELAT, M., J. NIELSEN, AND H. NIJSSEN.** 1993. Survey of ichthyological resources in European museums and collections. *Societas Europea Ichthyologorum*, Verlag Friedrich Pfeil, Munich, Germany.
- LACHNER, E. A., J. W. ATZ, G. W. BARLOW, B. B. COLLETTE, R. J. LAVENBERG, C. R. ROBINS, AND R. J. SCHULTZ.** 1976. A national plan for ichthyology. *Copeia* 1976:618–625.
- LEVITON, A. E., R. H. GIBBS, JR., E. HEAL, AND C. E. DAWSON.** 1985. Standards in herpetology and ichthyology: Part I. Standard symbolic codes for institutional resource collections in herpetology and ichthyology. *Copeia* 1985:802–832.
- MATSUURA, K., AND R. ARAI.** 1992. Catalog of the freshwater fish collection in the National Science Museum (Natural History Institute), Tokyo. Fish Specimens deposited in the former research Institute for Natural Resources (Shigenkagaku Kenkyusho). Part 1. National Science Museum, Tokyo.
- NELSON, J. S.** 1984. *Fishes of the world*. 2d ed. John Wiley and Sons, New York, New York.
- QUARTERMAN, J. S.** 1990. The matrix. Computer networks and conferencing systems worldwide. Digital Press, Bedford, Massachusetts.
- (SGP) GULF COAST RESEARCH LABORATORY, PO Box 7000, OCEAN SPRINGS, MISSISSIPPI 39566-7000; AND (BBC) NMFS SYSTEMATICS LABORATORY, NATIONAL MUSEUM OF NATURAL HISTORY, WASHINGTON, D.C. 20560.** Submitted: 17 June 1993. Accepted: 15 Sept. 1993. Section editor: R. Winterbottom.
- APPENDIX.**
ANNOTATED LIST OF NORTH AMERICAN FISH COLLECTIONS.
- Summary data for holdings in fish collections are arranged alphabetically by institutional code, within country and state, province, or territory. The list includes collections reported in the first survey but not now responding. Information on collections in the first survey now incorporated into other collections are noted, where information is available. Provisional institutional codes, not found in Leviton, et al. (1985), are indicated by an asterisk. Replacement institutional codes are indicated as such following annotations. Only administrative personnel are listed, and these in the following format: Administrator(s) in Charge of Collection; Collection Manager(s). Because of incomplete or inconsistent reporting, percentages of preservatives typically apply to juvenile and adult alcoholic holdings only and do not include larval materials, except for predominantly larval collections, or lots in glycerine or formalin; for some collections, percentage does not equal 100. Categories with 0 entries are not included.*
- CANADA**
- Alberta.*—UAMZ, University of Alberta Museum of Zoology, Edmonton, Alberta T6C 2E9. J. S. Nelson; W. E. Roberts. 6000 cataloged lots; 280,000 cataloged specimens; 1 secondary type; 50% computerized; catalog card file; 1000 cataloged and 50 cataloged tank specimens; 150 cataloged lots cleared and stained; 85% freshwater, 15% marine; 2% in ethanol, 98% in isopropanol. North American freshwater and Pacific coast. Index 107.
- British Columbia.*—RBCM, Royal British Columbia Museum, 675 Belleville Street, Victoria, British Columbia V8V 1X4. Alex Peden; James A. Cosgrove. 12,956 cataloged and 100 uncataloged lots; 50,000 cataloged and 2000 uncataloged specimens; 600 species represented; 10 nominal species represented by types; published type catalog; 1208 cataloged tank specimens; 200 cataloged larval lots; 200 cataloged lots cleared and stained; 40 cataloged otoliths; 33% freshwater, 66% marine; 95% in isopropanol. Northwestern Pacific; Gulf of Alaska; British Columbia. Formerly BCPM. Index 109.
- UBC, University of British Columbia Fish Museum, Department of Zoology, 6270 University Boulevard, Vancouver, British Columbia V6T 1Z4. J. D. McPhail; Robert G. Carveth. 27,522 cataloged and 1000 uncataloged lots; 800,000 cataloged and 50,000 uncataloged specimens; 2500 species represented; 43 nominal species represented by types; 11 primary types; 32 secondary types; 704 cataloged tank specimens; 280 cataloged cleared and stained; 50% freshwater, 50% marine; 100% in 40% isopropanol. Canada and USA Pacific Northwest Freshwater and marine; Easter Island; freshwater Panama. Index 83.
- Manitoba.*—MZF, University of Manitoba, Fish Collection, Zoology Department Museum, Department of Zoology, Winnipeg, Manitoba R3T 2N2. K. W. Stewart. 6000 cataloged and 500 uncataloged lots; 30,000 cataloged and 2000 uncataloged specimens; 1200 species represented; 200 cataloged and 50 uncataloged tank specimens; 150 cataloged and

20 uncataloged larval lots; 200 cataloged lots of skeletons; 150 cataloged lots cleared and stained; 85% freshwater, 15% marine; 95% in isopropanol. Manitoba. Temporary. Index 116.

New Brunswick.—ARC, Huntsman Marine Science Centre, Atlantic Reference Centre, Saint Andrews, New Brunswick E0G 2X0. K. Sulak; L. Van Guelpen. 10,000 cataloged and 5000 uncataloged lots; 11,530 cataloged and 147,140 uncataloged specimens; 750 species represented; 2 nominal species represented by types; 2 secondary types; 40% computerized; 700 cataloged and 50 uncataloged tank specimens; 500 cataloged and 160,000 uncataloged larval lots; 10 uncataloged lots of skeletons; 30 cataloged and 30 uncataloged lots cleared and stained; 300 cataloged and 1000 uncataloged otoliths; 5% freshwater, 95% marine; 10% in ethanol, 90% in isopropanol. Canadian Atlantic. Index 105.

Newfoundland.—MUDB, Memorial University, Department of Biology, Saint John's, Newfoundland A1B 3X9. J. M. Green. 20% freshwater, 80% marine. Newfoundland and Arctic.

Ontario.—NMC, Canadian Museum of Nature, Ichthyology Collection PO Box 3443, Station D, Ottawa, Ontario K1P 6P4. Brian Coad. 45,727 cataloged lots and 38,000 uncataloged lots; 580,683 cataloged and 425,000 uncataloged specimens; 3763 species represented; 60 nominal species represented by types; 27 primary types; 52 secondary types; 99% computerized; 1670 cataloged and 1000 uncataloged tank specimens; 500 cataloged lots of skeletons; 1000 cataloged lots cleared and stained; 100 cataloged and 1000 uncataloged otoliths; 56% freshwater, 44% marine. Worldwide; predominantly North American high latitudes. Index 66.

ROM, Royal Ontario Museum, Department of Ichthyology and Herpetology, 100 Queen's Park, Toronto, Ontario M5S 2C6. R. Winterbottom; Erling Holm. 55,000 cataloged lots and 6000 uncataloged lots; 838,000 cataloged and 101,000 uncataloged specimens; 5000 species represented; 108 nominal species represented by types; 37 primary types; 71 secondary types; 80% computerized; systematic card file; 4000 cataloged and 200 uncataloged tank specimens; 589 cataloged and 607 uncataloged larval lots; 48 cataloged and 614 uncataloged lots of skeletons; 1300 cataloged lots cleared and stained; 900 uncataloged otoliths; 60% freshwater, 40% marine; 97% in ethanol, 3% in formalin. Large photographic slide collection. Canada; Ontario; Indo-Pacific marine; South American freshwater. Index 63.

WLUB, Wilfrid Laurier University Zoological Museum Ichthyological Collection, Waterloo, Ontario N2L 3C5. E. Kott. 3205 cataloged lots and 124 uncataloged lots; 27,955 cataloged and 521 uncataloged specimens; 320 species represented; systematic card file; 3 cataloged tank specimens; 85% freshwater, 15% marine. Southern Ontario. Index 123.

UNITED STATES

Alabama.—AMRL, Alabama Marine Resources Laboratory, PO Box 189, Dauphin Island, Alabama 36528. M. S. Van Hoose. 941 cataloged lots; 500 species represented; 15% freshwater, 85% marine; 20% in ethanol, 80% in formalin. Alabama marine; Mobile Delta. Index 128.

AUM, Auburn University, Museum Fish Collection, Department of Zoology and Wildlife Science, 101 Cory Hall, Auburn, Alabama 36849. 26,000 cataloged and 9000 uncataloged lots; 600,000 cataloged specimens; 10 nominal species represented by types; 10 secondary types; 25% computerized; 200 cataloged and 100 uncataloged tank specimens; 53 cataloged lots of skeletons; 58 cataloged lots cleared and stained; 75% freshwater, 25% marine; 40% in ethanol, 60% in isopropanol. Alabama; Georgia; South Carolina; Gulf of Mexico deepsea; Neotropical freshwater. Index 105.

SHCIC*, Spring Hill College Ichthyological Collection, 4000 Dauphin Street, Mobile, Alabama 36608. A. F. Hemphill. 200 cataloged lots; 75% freshwater, 25% marine. Mobile Bay drainages; Alabama Gulf Coast. Index 131.

UAIC, University of Alabama, Department of Biology, Box 870344, Tuscaloosa, Alabama 35487-0344. R. L. Mayden; B. R. Kuhajda. 57,000 cataloged and 2000 uncataloged lots; 818,000 cataloged and 30,000 uncataloged specimens; 1500 species represented; 58 nominal species represented by types; 4 primary types; 54 secondary types; published type catalog; 10% computerized; 4350 cataloged tank specimens; 200 cataloged lots cleared and stained; 75% freshwater, 25% marine; 100% in ethanol. Southeastern United States; Gulf of Mexico. Index 86.

Alaska.—ABL, Auke Bay Fisheries Laboratory, National Marine Fisheries Service, PO Box 210,155, Auke Bay, Alaska 99821. B. L. Wing. 2,700 cataloged and 5 uncataloged lots; 16,600 cataloged and 20 uncataloged specimens; 310 species represented; 1 secondary type; systematic card file; 50 cataloged and 200 uncataloged larval lots; 12% freshwater, 88% marine; 5% in ethanol, 90% in isopropanol, 5% in formalin. Alaska. Nonpermanent.

UAM, University of Alaska Museum Aquatic Collection, 907 Yukon Drive, Fairbanks, Alaska 99775-1200. N. R. Foster. 3188 cataloged and 200 uncataloged lots; 3296 cataloged and 1463 uncataloged specimens; 180 species represented; 2 nominal species represented by types; 1 primary type; 1 secondary type; published type catalog; 60% computerized; catalog card file; 83 cataloged tank specimens; 787 uncataloged larval lots; 4 uncataloged lots of skeletons; 2 cataloged lots cleared and stained; 23 cataloged and 476 uncataloged otoliths; 40% freshwater, 60% marine. Bering Sea; Gulf of Alaska; Alaskan drainages. Index 124.

Arizona.—UAZ, University of Arizona Fish Collection, Department of Ecology and Evolutionary Biology, Tucson, Arizona 85721. D. DeKoven. 1780 cataloged and 5600 uncataloged lots; 30,502 cataloged and 70,000 uncataloged specimens; 918 species represented; 6 nominal species represented by types; 10 secondary types; 14 cataloged tank specimens; 20 uncataloged lots of skeletons; 10 uncataloged lots cleared and stained; 90 uncataloged otoliths; 100% in isopropanol. Index 112.

Arkansas.—ARK, University of Arkansas Fayetteville, The Museum, 30 Vol Walker, Fayetteville, Arkansas 72701. N. McCartney. 1793 cataloged and 62,395 cataloged specimens; 147 species represented; catalog card file; 31 uncataloged lots of skeletons; 95% freshwater, 5% marine; 100% in ethanol. Arkansas. Index 124.

ASUMZ*, Arkansas State University, Arkansas State University Museum, Ichthyofaunal Collection, PO Box 60, State University, Arkansas 72467-0060. J. K. Beadles. 12,445 cataloged and 169,565 cataloged specimens; 200 species represented; 2 cataloged tank specimens; 100% freshwater; 100% in isopropanol. Arkansas. Index 123.

ATFC, Arkansas Tech Fish Collection, Department of Biological Science, Arkansas Tech University, Russellville, Arkansas 72801. C. Gagen. 350 cataloged and 140 uncataloged lots; 7000 cataloged and 4900 uncataloged specimens; 80 species represented; 100% freshwater; 50% in formalin, 50% in ethanol. Ozark and Ouachita Streams. Index 125.

SAU*, Southern Arkansas University, Department of Biology, Magnolia, Arkansas 71758. Formerly SSC* (Southern State College). No longer active maintained.

WCC*, Westark Community College Fish Collection, Westark Zology Collection, Fort Smith, Arkansas 72901. 500 cataloged lots 8600 cataloged specimens; 180 species represented; 100% in isopropanol. Did not respond.

California.—CAS, California Academy of Sciences, Department of Ichthyology, Golden Gate Park, San Francisco, California 94118. W. N. Eschmeyer and T. Iwamoto; D. Catania. 131,500 cataloged and 76,540 uncataloged lots; 1,600,000 cataloged and 558,742 uncataloged specimens; 14,500 species; 3200 nominal species represented by types; 900 primary types; 2300 secondary types; 15% computerized; 1500 cataloged and 4000 uncataloged tank specimens; 300 uncataloged larval lots; 1200 cataloged and 450 uncataloged lots of skeletons; 1800 cataloged and 200 uncataloged lots cleared and stained; 35% freshwater, 65% marine; 75% in ethanol; 25% in isopropanol. Worldwide; predominantly western North America; tropical Indo-Pacific; South America. Includes SU (Stanford University), GV (George Vanderbilt Foundation, in major part), MVZ, and SFSU (in part). Index 43.

CSPU*, California State Polytechnic University Fish Collection, Pomona Biology Department, 3801 West Temple Avenue, Pomona, California 91768. 300 cataloged and 1000 uncataloged lots; 2000 cataloged and 10,000 uncataloged specimens; 100 species represented; 100 uncataloged lots of skeletons; 200 uncataloged lots cleared and stained; 40% in isopropanol. Did not respond.

CSUS-IC, California State University Sacramento, Ichthyology Collection, Department of Biological Science, 6000 J Street, Sacramento, California 95819. M. R. Brittan. 3200 cataloged and 250 uncataloged lots; 28,000 cataloged and 2500 uncataloged specimens; 700 species represented; 5 nominal species represented by types; 5 secondary types; 50% computerized; catalog card file; systematic card file; geographic card file; 30 cataloged and 50 uncataloged tank specimens; 2 cataloged and 11 uncataloged lots of skeletons; 20 cataloged and 15 uncataloged lots cleared and stained; 60% freshwater, 40% marine; 5% in ethanol, 90% in isopropanol. California. Index 116.

HSU, Humboldt State University, Fisheries Collections, Department of Fisheries, Arcata, California 95521. R. A. Fritzsche. 3786 cataloged and 210 uncataloged lots; 39,500 cataloged and 5600 uncataloged specimens; 1180 species represented; systematic card file; 110 cataloged and 10 uncataloged tank specimens; 350 uncataloged larval lots; 71 cataloged and 100 uncataloged lots of skeletons; 50 uncataloged lots cleared and stained; 30% freshwater, 70% marine; 5% in ethanol, 90% in isopropanol. Northwestern California. Index 115.

LACM, Natural History Museum of Los Angeles County, LACM Fish Collection, 900 Exposition Boulevard, Los Angeles, California 90007. R. J. Lavenberg; J. Seigel. 135,000 cataloged and 22,200 uncataloged lots; 2,000,000 cataloged and 5,000,000 uncataloged specimens; 10,000 species represented; 530 nominal species represented by types; 130 primary types; 400 secondary types; systematic card file; 5000 cataloged and 500 uncataloged tank specimens; 500 cataloged and 38,000 uncataloged larval lots; 6000 cataloged and 1000 uncataloged lots of skeletons; 1000 cataloged and 100 uncataloged lots cleared and stained; 100 cataloged and 400,000 uncataloged otoliths; 25% freshwater, 75% marine; 50% in ethanol, 25% in isopropanol. Eastern Pacific, shore and deepsea; Antarctic; Central and South American freshwater; Central-West Pacific; Indian Ocean; Pakistan. Includes CSLB; CSF, and WLRI* (World Life Research Institute). Index 52.

MLML*, Moss Landing Marine Laboratories, Ichthyology Collection, PO 450, Moss Landing, California 95039 [Temporary address: 887 Vertein Avenue, Salinas, California 93901]. G. M. Caillet. 1172 cataloged and 40 uncataloged lots; 3900 cataloged and 150 uncataloged specimens; 500 species represented; 31 cataloged tank specimens; 141 cataloged larval lots and 20 uncataloged lots of skeletons; 400 cataloged and 30 uncataloged otoliths; all but larvae in 50% isopropanol. Index 119.

MWFB, University of California, Davis Museum of Wildlife and Fish Biology, Section of Fishes, Davis, California 95616. R. E. Cole. 1895 cataloged lots; 50 cataloged tank specimens; 50 cataloged lots cleared and stained; 250 cataloged otoliths; 75% freshwater, 25% marine; 100% in ethanol. California. Index 126.

NMFSJL*, National Marine Fisheries Service La Jolla Laboratory, Ichthyoplankton Collection, PO Box 271, La Jolla, California 92038. H. G. Moser. 150,000 cataloged lots; 6,000,000 cataloged larval specimens; 700 species represented; 100% marine; 98% in formalin, 1% in isopropanol, 1% in ethanol. Eastern Pacific. Nonpermanent collection.

OC, Occidental College Fish Collection, Moore Laboratory of Zoology, 1600 Campus Road, Los Angeles, California 90041. 1500 cataloged and 500 uncataloged lots; 15,000 cataloged specimens; 900 species represented; 2 cataloged tank specimens; 20 cataloged lots of skeletons; 200 cataloged lots cleared and stained; 500 cataloged otoliths; 50% in isopropanol. Did not respond.

SDSU, San Diego State University Fish Collection, Department of Biology, San Diego, California 92182-0057. L. Chen. 2095 cataloged and 500 uncataloged lots; 11,000 cataloged and 9000 uncataloged specimens; 750 species represented; 500 cataloged and 200 uncataloged tank specimens; 100 uncataloged lots of skeletons; 50 uncataloged lots cleared and stained; 800 uncataloged otoliths; 100% in isopropanol. California; Taiwan. Temporary. Index 121.

SFSU, San Francisco State University Vertebrate Museum, Department of Biology, San Francisco, California 94044. No longer actively maintained.

SIO, University of California San Diego, Scripps Institution of Oceanography, Marine Vertebrates Collection, La Jolla, California 92093-0208. R. H. Rosenblatt; H. J. Walker, Jr. 70,000 cataloged and 20,000 uncataloged lots; 1,700,000 cataloged and 400,000 uncataloged specimens; 4000 species represented; 243 nominal species represented by types; 165 primary types; 228 secondary types; 65% computerized; 4300 cataloged and 200 uncataloged tank specimens; 500 cataloged larval lots; 444 cataloged lots of skeletons; 631 cataloged lots cleared and stained; 8350 cataloged otoliths; 1% freshwater, 99% marine. Worldwide, deepsea and pelagic; Eastern Pacific. Index 59.

SJSU, San Jose State University Ichthyology Collection, Biology Department, San Jose, California 95192-0100. R. Hassur. 4000 cataloged lots; 2000 species represented; 100% computerized; 300 cataloged tank specimens; 100 cataloged lots of skeletons; 50 cataloged lots cleared and stained; 50 cataloged otoliths; 35% freshwater, 65% marine; 100% in isopropanol. California freshwater and estuarine. Index 110.

UCSB*, University of California Fish Museum, Department of Biological Sciences, Santa Barbara, California 93106. A. Ebeling; W. Strong. 800 cataloged and 200 uncataloged lots; 5000 cataloged specimens; 438 species represented; 75% computerized; catalog card file; 50 cataloged tank specimens; 50 cataloged larval lots; 50 cataloged lots of skeletons; 25 uncataloged lots cleared and stained; 25% freshwater, 75% marine. South-central California. Index 117.

VC*, Ventura College Fish Collection, Department of Biology, Ventura, California 93003. G. S. Arita. 300 cataloged and 125 uncataloged lots; 5800 cataloged and 4000 uncataloged specimens; 75 species rep-

resented; 10 cataloged and 15 uncataloged lots of skeletons; 30% freshwater, 70% marine; 100% in isopropanol. Temporary. Index 129.

Canal Zone.—STRI, Smithsonian Tropical Research Institution, Box 2072 Balboa, Canal Zone. 500 cataloged lots; 250 species represented; 70% in ethanol. Did not respond.

Colorado.—BSFC*, National Ecology Research Center, Biology Survey/Fort Collins, 4512 McMurray Avenue, Fort Collins, Colorado 80525-3400. M. A. Bogan; C. Ramotnik. 4640 cataloged and 1200 uncataloged lots; 257,000 cataloged specimens; 180 species represented; 300 cataloged and 500 uncataloged tank specimens; 100 cataloged larval lots; 25 cataloged lots of skeletons; 10 cataloged lots cleared and stained; 99% freshwater, 1% marine; 99% in isopropanol. Colorado and Upper Colorado Basin; Rio Grande, New Mexico. Index 120.

CSU, Colorado State University Fish Collection, Colorado Cooperative Fishery Unit, Fort Collins, Colorado 80521. R. Behnke. 350 cataloged lots; 2500 cataloged specimens; 8 cataloged tank specimens. Temporary.

UCM, University of Colorado at Boulder, University of Colorado Museum, Campus Box 315, Boulder, Colorado 80309-0315. S.-K. Wu. 1253 cataloged and 50 uncataloged lots; 1270 cataloged and 60 uncataloged specimens; 1280 species represented; 80% freshwater, 20% marine; 2% in ethanol. Colorado; British Guiana; Laos. Index 127.

Connecticut.—UCS, University of Connecticut Ichthyology Museum, Department of Natural Resources, 1376 Storrs Road, Storrs, Connecticut 06269-4087. W. R. Whitworth. 8300 cataloged and 100 uncataloged lots; 700 species represented; 90% freshwater, 10% marine; 100% in ethanol. Connecticut; Eastern United States. Index 121.

YPM, Yale University Peabody Museum of Natural History, Division of Vertebrate Zoology, 170 Whitney Avenue, New Haven, Connecticut 06511. J. Moore. 9800 cataloged and 2500 uncataloged lots; 33,108 cataloged and 8446 uncataloged specimens; 2500 species represented; 189 nominal species represented by types; 174 primary types; 64 secondary types; published type catalog; 100% computerized; 100 cataloged and 150 uncataloged tank specimens; 100 cataloged lots of skeletons; 40 cataloged and 30 uncataloged lots cleared and stained; 50% freshwater, 70% marine; 1% in ethanol, 84% in isopropanol. Gulf of Mexico; Eastern Pacific; Central and South America; Maldives; Seychelles; Sri Lanka; Comores I.; African Rift Lakes. Index 94.

District of Columbia.—USNM, Smithsonian Institution, National Museum of Natural History, Division of Fishes, Washington, D.C. 20560. G. D. Johnson, L. Parenti; S. L. Jewett, J. T. Williams. 292,932 cataloged and 200,000 uncataloged lots; 3,000,000 cataloged and 2,000,000 uncataloged specimens; 15,000 species represented; 7300 nominal species represented by types; 5040 primary types; 2260 secondary types; published type catalog (in part); 40% computerized; 9600 cataloged tank specimens; 3650 cataloged larval lots; 4500 cataloged lots of skeletons; 2800 cataloged lots cleared and stained; 1000 uncataloged otoliths; 50% freshwater, 50% marine; 100% in ethanol. Worldwide. Includes majority of former SOSC. Index 34.

Florida.—FAU, Florida Atlantic University, Vertebrate Collections-Fish, Department of Biological Sciences, Boca Raton, Florida 33432. W. R. Courtenay, Jr. 3800 uncataloged lots; 8000 uncataloged specimens; 350 species represented; 1 nominal species represented by types; 1 secondary types; 40 uncataloged tank specimens; 80 uncataloged lots cleared and stained; 100% in 60% isopropanol. Index 128.

FSBC, Marine Research Fish Collection, Florida Department of Natural Resources, 100 Eighth Avenue Southeast, Saint Petersburg, Florida 33701. M. Leiby; R. Ruiz-Cruz. 18,000 cataloged and 4000 uncataloged lots; 44,000 cataloged and 12,000 uncataloged specimens; 1053 species represented; 350 cataloged tank specimens; 70 cataloged lots of skeletons; 200 cataloged lots cleared and stained. 100% marine. Florida. Formerly FDNR. Index 108.

JU*, Jacksonville University Vertebrate Division, Fish Collection, Biology Museum, Jacksonville, Florida 32211. 2000 cataloged and 100 uncataloged lots. Did not respond.

SAC*, Florida Marine Research Institute, SEAMAP Ichthyoplankton Archiving Center, 100 Eighth Avenue, Southeast, Saint Petersburg, Florida 33701-5095. J. V. Gartner, Jr. 244 species represented; 100% computerized; 45,729 cataloged and 6,000 uncataloged larval lots; 100% marine; 100% in ethanol. Gulf of Mexico. Index 118.

SEFC*, Southeast Fisheries Center, 75 Virginia Beach Drive, Miami, Florida 33149. W. J. Richards. 100,000 uncataloged specimens; 80% computerized; 10,000 uncataloged larval lots; 500 uncataloged lots

cleared and stained; 1000 uncataloged otoliths; 100% marine; 80% in ethanol. Formerly TABL (larval specimens only). Nonpermanent collection.

UCF, University of Central Florida, Fish Collection, Orlando, Florida 32816. F. F. Snelson, Jr. 800 uncataloged lots; 21,000 uncataloged specimens; 50 uncataloged tank specimens; 20 cataloged lots of skeletons; 30 uncataloged lots cleared and stained; in 45% isopropanol. Index 120.

UF, University of Florida, Florida Museum of Natural History, Gainesville, Florida 32611. C. R. Gilbert; G. Burgess. 77,150 cataloged and 55,000 uncataloged lots; 758,950 cataloged and 541,000 uncataloged specimens; 5000 species represented; 200 nominal species represented by types; 23 primary types; 194 secondary types; published type catalog; 62% computerized; 1500 cataloged tank specimens; 4100 cataloged lots of skeletons; 50 cataloged and 200 uncataloged lots cleared and stained; 35% freshwater, 65% marine; 1% in ethanol, 99% in isopropanol. Includes FSU (Florida State University, Tallahassee), IRCZM, NMFS/SPC (National Marine Fisheries Service, Gulf Coastal Fisheries Center, Panama City), and TABL (Tropical Atlantic Biological Laboratory) nonlarval. Western and Eastern Atlantic; Central and South America; Southeastern United States. Index 63.

UMML, University of Miami Fish Collection, Rosenstiel School of Marine Science, 10 Rickenbacker Causeway, Miami, Florida 33149. C. R. Robins. 35,000 cataloged and 4000 uncataloged lots; 100 nominal species represented by secondary types; 100% in isopropanol. Index 93.

USF, University of South Florida, Zoology Collections-Fish, Tampa, Florida 33620. P. Motta. 600 cataloged lots; 5000 cataloged specimens; 165 species represented; 10 uncataloged lots of skeletons; 20 uncataloged lots cleared and stained. Index 116.

UWF, University of West Florida Fish Collection, Pensacola, Florida 32314. S. Bortone. 10,000 cataloged lots; 500 species represented; 5 secondary types; published type catalog; 50 cataloged tank specimens; 100 cataloged larval lots; 50 cataloged lots of skeletons; 200 cataloged lots cleared and stained; 600 cataloged otoliths; 25% freshwater, 75% marine; 90% in isopropanol. Coastal Gulf of Mexico; Caribbean; Southeastern United States. Index 122.

Georgia.—UGAMNH, University of Georgia Museum of Natural History, D. C. Scott Ichthyological Collection, Athens, Georgia 30602. J. Laerm. 20,000 cataloged and 1500 uncataloged lots; 200,000 cataloged and 15,000 uncataloged specimens; 600 species represented; 1 nominal species represented by a type; 1 secondary type; 30% computerized; systematic card file; 200 cataloged tank specimens; 100 cataloged lots of skeletons; 20 cataloged lots cleared and stained; 90% freshwater, 10% marine; 100% in ethanol. Georgia. Index 104.

Guam.—UGM, University of Guam, Fish Collection, Marine Laboratory, Box EK, Agana, Guam 96910. 4500 cataloged and 100 uncataloged lots; 15,000 cataloged specimens; 25 uncataloged lots of skeletons. Did not respond.

Hawaii.—BPBM, Bernice P. Bishop Museum, Zoology Department, Ichthyology Collection, PO Box 19,000-A, Honolulu, Hawaii 96817-0916. J. E. Randall; A. Y. Suzumoto. 34,000 cataloged and 2000 uncataloged lots; 480,000 cataloged and 3333 uncataloged specimens; 3600 species represented; 671 nominal species represented by types; 321 primary types; 310 secondary types; 100 uncataloged and 100 uncataloged tank specimens; 50 cataloged lots cleared and stained; 99% marine. Large collection of photographic slides. Western and Central Pacific; Indian Ocean, reef and shore; Hawaiian and Central Pacific deepwater. Includes NMFS Hawaii (in part). Index 76.

Idaho.—IMNH*, Idaho State University, Idaho Museum of Natural History, Campus Box 8096, Pocatello, Idaho 83201. C. R. Peterson; M. E. Dorcas. 554 cataloged and 100 cataloged lots of skeletons; 98% freshwater, 2% marine; 100% in isopropanol. Idaho; intermountain West. Index 131.

Illinois.—FMNH, Field Museum of Natural History Division of Fishes, Roosevelt Road at Lakeshore Drive, Chicago, Illinois 60605. B. Cherkoff, M. Westneat; M. A. Rogers, K. Swagel. 103,547 cataloged and 10,000 uncataloged lots; 1,700,000 cataloged and 40,000 uncataloged specimens; 9200 species represented; 1415 nominal species represented by types; 905 primary types; 510 secondary types; published type catalog; 100% computerized (81,353 records); 1200 cataloged and 100 uncataloged tank specimens; 1000 cataloged and 50 uncataloged lots

of skeletons; 600 cataloged and 15 uncataloged lots cleared and stained; 50% freshwater, 50% marine; 100% in ethanol. Includes CM* (Carnegie Museum of Natural History, in part), NIU, and Chicago Sanitary District Commission Collection. Central and South America; Mexico; North American marine; West Tropical Atlantic; Eastern and Southeastern Asia; Central and South Indian and Pacific. Index 51.

INHS, Illinois Natural History Survey, 607 East Peabody Drive, Champaign, Illinois 61820. L. M. Page; K. S. Cummings. 56,000 cataloged and 300 uncataloged lots; 600,000 cataloged and 5500 uncataloged specimens; 1000 species represented; 68 nominal species represented by types; 31 primary types; 38 secondary types; published type catalog; 85% computerized; systematic card file; 2000 cataloged tank specimens; 20 cataloged lots cleared and stained; 95% freshwater, 5% marine; 100% in ethanol. Illinois; Southeastern United States; Amazon Basin; Orinoco Basin. Index 87.

SIUC, Southern Illinois University Ichthyology Collection, Department of Zoology, Carbondale, Illinois 62901-6501. B. M. Burr. 20,000 cataloged and 2000 uncataloged lots; 250,000 cataloged and 10,000 uncataloged specimens; 905 species represented; 16 nominal species represented by types; 800 cataloged tank specimens; 100 uncataloged larval lots; 137 cataloged lots of skeletons; 30 cataloged lots cleared and stained; 10 uncataloged otoliths; 85% freshwater, 15% marine. Photographic slide collection. Illinois; Kentucky; Missouri; North Carolina; Tennessee. Index 105.

Indiana.—ISU, Indiana State University Fish Collection, Department of Life Sciences, Terre Haute, Indiana 47809. 2306 cataloged and 20 uncataloged lots; 14,000 cataloged and 120 uncataloged specimens; 200 species represented; 100% in isopropanol.

Iowa.—GC*, Grinnell College Biology Department, Fish Collection, Grinnell, Iowa 50112. Did not respond.

ISUA, Iowa State University Fish Collection, Department of Zoology and Entomology, Ames, Iowa 50010. B. Menzel. 1900 cataloged and 300 uncataloged lots; 40,000 cataloged and 2000 uncataloged specimens; 160 species represented; 40% in isopropanol.

Kansas.—KU, University of Kansas Museum of Natural History, Dyche Hall, Lawrence, Kansas 66045-2454. E. O. Wiley; J. T. Collins. 22,394 cataloged and 5000 uncataloged lots; 323,672 cataloged and 15,000 uncataloged specimens; 44 nominal species represented by types; 10 primary types; 44 secondary types; 1% computerized; systematic card file; geographic card file; 794 cataloged tank specimens; 1017 cataloged lots of skeletons; 95% freshwater, 5% marine; 100% in ethanol. North America; Midwest and Great Plains Drainages. Index 85.

WSU*, Wichita State University Fish Collection, Department of Biology, Wichita, Kansas 67208. 20 cataloged and 180 uncataloged lots; 12 uncataloged lots of skeletons; 70% in ethanol. Did not respond.

Kentucky.—EUK, Eastern Kentucky University Museum Fish Collection, Richmond, Kentucky 40475. 580 cataloged and 450 uncataloged lots; 20,000 cataloged specimens; 500 species represented; 6 cataloged tank specimens; 500 cataloged lots of skeletons. Did not respond.

MSUKY*, Murray State University Biology Department, Murray, Kentucky 42071. T. Timmons. 1300 cataloged and 2000 uncataloged lots; 5000 cataloged and 10,000 uncataloged specimens; 100% freshwater; 100% in isopropanol. Index 128.

UL, University of Louisville, Collection of Fishes, Biology Department, Louisville, Kentucky 40292. W. D. Pearson. 14,000 cataloged and 2000 uncataloged lots; 200,000 cataloged and 2775 uncataloged specimens; 384 species represented; 1 nominal species represented by type; 1 secondary type; systematic card file; 300 cataloged and 200 uncataloged tank specimens; 500 uncataloged larval lots; 25 uncataloged lots of skeletons; 95% freshwater, 5% marine; 95% in ethanol, 4% in isopropanol. Kentucky; Ohio River. Index 122.

Louisiana.—NLU, Northeast Louisiana University, Museum of Zoology, Collection of Fishes, Monroe, Louisiana 71209. N. H. Douglas. 64,532 cataloged and 20,000 uncataloged lots; 2,430,000 cataloged and 250,000 uncataloged specimens; 1508 species represented; 17 nominal species represented by types; 17 secondary types; published type catalog; 60% computerized; systematic card file; 50 cataloged tank specimens; 20,000 uncataloged larval lots; 15 uncataloged lots of skeletons; 90% freshwater, 10% marine; 100% in isopropanol. Southeastern United States; Mexico; Hawaii; Korea; Viet Nam. Index 81.

LSUMZ, Louisiana State University, Division of Fishes, Museum of Zoology, Baton Rouge, Louisiana 70803. J. M. Fitzsimons. 9565 cata-

loged and 350 uncataloged lots; 227,238 cataloged and 5000 uncataloged specimens; 964 species represented; 5 nominal species represented by types; 5 secondary types; 28% freshwater, 72% marine; 70% in ethanol. Louisiana; Hawaiian freshwater. Includes SLU. Index 106.

LTU, Louisiana Tech University Vertebrate Museum, Department of Biological Sciences, Ruston, Louisiana 71272. B. J. Davis. 3650 cataloged and 50 uncataloged lots; 80,000 cataloged and 2000 uncataloged specimens; 700 species represented; 100% computerized; catalog card file; systematic card file; 80% freshwater, 20% marine. Louisiana; Texas; Oklahoma; Arkansas; Missouri. Temporary. Index 120.

LWF*, Louisiana Wildlife and Fisheries, Marine Biological Laboratory Museum PO Box 37, Grand Isle, Louisiana 70358. 300 cataloged and 50 uncataloged lots; 700 cataloged and 200 uncataloged specimens; 130 species represented; 100 cataloged and 20 uncataloged lots of skeletons; 100 cataloged and 100 uncataloged lots cleared and stained. Did not respond.

SLU, Southeastern Louisiana University Fish Museum Department of Biological Sciences, PO Box 814, Hammond, Louisiana 70402. R. W. Hastings. 4129 cataloged and 500 uncataloged lots; 31,515 cataloged and 10,000 uncataloged specimens; 400 species represented; 100% computerized; 2000 uncataloged larval lots; 60% freshwater, 40% marine; 100% in isopropanol. Southeastern Louisiana. Temporary. Index 123.

TU, Tulane University Museum of Natural History, Belle Chase, Louisiana 70037. H. L. Bart. 159,000 cataloged lots; 5,900,000 cataloged specimens; 111 nominal species represented by types; 27 primary types; 111 secondary types; published type catalog; 100 uncataloged tank specimens; 714 cataloged lots of skeletons; 638 cataloged lots cleared and stained; 75% freshwater, 25% marine; 10% in ethanol, 90% in isopropanol. Southeastern United States; Central America. Includes SAU* (former SSC*) (in part). Index 74.

UNOVC*, University of New Orleans Vertebrate Collection, New Orleans, Louisiana 70148. R. C. Cashner. 9100 cataloged and 2000 uncataloged lots; 100 cataloged tank specimens, 50 cataloged lots of skeletons; 1000 species represented; 75% freshwater, 25% marine; 100% in isopropanol. Southeastern United States. Temporary. Index 121.

Maine.—BCB*, Bowdoin College, Fish Collection, Department of Biology. Brunswick, Maine 04011. 400 uncataloged lots; 70% in ethanol. Did not respond.

UMO, University of Maine Zoology Fish Collection, Department of Zoology, Orono, Maine 04469-0146. H. H. DeWitt. 3000 uncataloged lots; 1 secondary type; 500 uncataloged larval lots; 9 cataloged and 8 uncataloged tank specimens; 30% freshwater, 70% marine; 1% in ethanol, 94% in isopropanol. Maine; Gulf of Maine; New England; Antarctic. Includes Ira C. Darling Center Ichthyological Collection. Index 123.

UNE*, University of New England, Teaching and Research Fish Collection, Department of Life Sciences, Biddeford, Maine 04005. J. Carter. 1500 uncataloged lots; 3800 uncataloged specimens; 10% freshwater, 90% marine; 100% in isopropanol. New England freshwater, estuarine and marine. Formerly Saint Francis College. Index 128.

Massachusetts.—AFS*, National Marine Fisheries Service, American Fisheries Society Fish Photo Collection, Woods Hole, Massachusetts 02543. D. Flescher. Large color slide collection, no specimens. Slides for sale.

GMWH*, Gray Museum, Marine Biological Laboratory Fish Collection, Woods Hole, Massachusetts 02543. R. Backus. 368 cataloged lots 975 cataloged specimens; 109 species represented; 12 cataloged lots cleared and stained; 90% in ethanol. Includes BU* (Boston University Collection) (in part).

MCZ, Harvard University, Museum of Comparative Zoology, 26 Oxford Street, Cambridge, Massachusetts 02138. K. F. Liem; K. E. Hartel. 87,460 cataloged and 55,000 uncataloged lots; 953,000 cataloged and 730,000 uncataloged specimens; 15,000 species represented; 2000 nominal species represented by types, 770 lots of primary types, 535 lots of secondary types; 25% computerized; catalog card file; systematic card file; 3500 cataloged and 1100 uncataloged tank specimens; 20,000 cataloged and 20,000 uncataloged larval lots; 1500 uncataloged lots of skeletons; 1000 cataloged and 100 uncataloged lots cleared and stained; 5000 uncataloged otoliths; 30% freshwater, 70% marine. Worldwide; Atlantic Ocean; midwater; New England freshwater; South America; Africa; Thailand. Includes WHOI. Index 49.

UMD*, University of Massachusetts Dartmouth, Fish Collection, Department of Biology, North Dartmouth, Massachusetts 02747. J. Hoff. 500 cataloged and 800 uncataloged lots; 3000 cataloged and 5500 uncataloged specimens; 550 species represented; 10 cataloged tank specimens; 10 cataloged and 45 uncataloged lots of skeletons; 300 cat-

aloged and 500 uncataloged otoliths; 2% in ethanol, 85% in isopropanol. Formerly SMU*. Temporary. Index 131.

Michigan.—MSUF, Michigan State University Museum, Collection of Fishes, East Lansing, Michigan 48824-1045. J. A. Holman. 7075 cataloged specimens; 1180 cataloged lots of skeletons. Red Cedar River; Ecuador. Temporary. Index 125.

UMMZ, University of Michigan Museum of Zoology Division of Fishes, Ann Arbor, Michigan 48109-1079. G. R. Smith; W. L. Fink; D. W. Nelson. 164,557 cataloged and 40,000 uncataloged lots; 3,104,903 cataloged specimens; 7033 species represented; 711 nominal species represented by types; 528 primary types; 560 secondary types; 100% computerized; 162,465 cataloged and 5000 uncataloged tank specimens; 1200 uncataloged larval lots; 8244 cataloged lots of skeletons; 1801 cataloged lots cleared and stained; 75% freshwater, 25% marine; 100% in ethanol. North America; Mexico; Central America; South America; Southeast Asia; Japan. Index 42.

Minnesota.—JFBM, University of Minnesota, J. F. Bell Museum of Natural History, 10 Church Street, Minneapolis, Minnesota 55455. J. C. Underhill. 24,500 cataloged and 500 uncataloged lots; 195,000 cataloged and 4000 uncataloged specimens; 1009 species represented; published type catalog; 15% computerized; systematic card file; 260 cataloged and 1500 uncataloged larval lots; 40 uncataloged lots cleared and stained; 95% freshwater, 5% marine; 90% in isopropanol. Minnesota and adjacent drainages. Index 107.

Mississippi.—GCRL, Gulf Coast Research Laboratory Museum, PO Box 7000, Ocean Springs, Mississippi 39564-7000. S. G. Poss; C. Aadland. 27,510 cataloged and 25,000 uncataloged lots; 185,030 cataloged and 175,000 uncataloged specimens; 2936 species represented; 141 nominal species represented by types; 224 secondary types; type catalog in preparation; 100% computerized; catalog card file; systematic card file; 375 cataloged and 40 uncataloged tank specimens; 2500 cataloged and 15,000 uncataloged larval lots; 130 cataloged lots cleared and stained; 5% freshwater, 95% marine; 100% in ethanol. Gulf of Mexico; Central America; South America; Indo-Pacific; Papua New Guinea; Southern Mississippi. Index 77.

MMNS, Mississippi Museum of Natural History, Ichthyology Collection, 111 North Jefferson Street, Jackson, Mississippi 39202. R. Weill. 13,000 cataloged and 50 uncataloged lots; 100,000 cataloged specimens; 193 species represented; 90% computerized; 1 cataloged tank specimens; 98% freshwater, 2% marine; 5% in ethanol, 95% in isopropanol. Index 119.

MSU, Mississippi State University Ichthyological Collection, PO Box GV, Mississippi State, Mississippi 39762. M. S. Peterson. 6500 cataloged lots; 1 nominal species represented by types; 1 secondary types; 95% freshwater, 5% marine. Northeastern Mississippi. Index 124.

UMS, University of Mississippi Ichthyological Collection, Department of Biology, University, Mississippi 38677. G. L. Miller. 1600 cataloged and 2000 uncataloged lots; 100,000 uncataloged specimens; 300 species represented; 10 cataloged tank specimens; 85% freshwater, 15% marine; 95% in isopropanol. Northern Mississippi; Tallahatchie Drainage; Gulf Coast. Index 118.

USM, University of Southern Mississippi, Museum of Ichthyology, Department of Biological Sciences, Hattiesburg, Mississippi 39406-5018. S. T. Ross. 9333 cataloged and 5870 uncataloged lots; 170,527 cataloged and 117,350 uncataloged specimens; 280 species represented; 100% computerized; catalog card file; 10 cataloged tank specimens; 288 cataloged and 4,000 uncataloged larval lots; 35 uncataloged lots cleared and stained; 60% freshwater, 40% marine; 100% in isopropanol. Mississippi freshwater and coastal. Index 109.

Missouri.—UMOC, University of Missouri, Museum of Zoology Fish Collection, Fisheries and Wildlife Program, 112 Stephens Hall, Columbia, Missouri 65211. D. B. Noltie. 3500 cataloged lots 18,727 cataloged specimens; 100% freshwater. Missouri. Temporary. Index 126.

NEMS, Northeast Missouri State University, Department of Zoology, Kirksville, Missouri 64501; 300 uncataloged lots; 5000 uncataloged specimens; no types; Midwest. Did not respond.

MDC*, Missouri Department of Conservation, 1110 College Avenue, Columbia, Missouri 65201. 400 uncataloged lots; 4000 uncataloged specimens; no types; Missouri. Did not respond.

Montana.—MSUB, Montana State University Fish Collection, Biology Department, Bozeman, Montana 59715. 1200 cataloged lots 50,000

cataloged specimens; 100 species represented; 12 cataloged tank specimens; 50% in ethanol, 50% in isopropanol. Did not respond.

UMM, University of Montana, Division of Biological Sciences, Missoula, Montana 59812-1002. A. Sheldon. 1200 cataloged lots 250 species; 50 cataloged lots of skeletons; 50 cataloged lots cleared and stained; 10 cataloged otoliths; 70% freshwater, 30% marine; 100% in ethanol. Temporary. Montana. Index 129.

Nebraska.—UNO, University of Nebraska at Omaha, Fish Collection, Department of Biology, Omaha, Nebraska 68101. 50 cataloged and 50 uncataloged lots; 500 cataloged and 5000 uncataloged specimens; 150 species represented; 5 cataloged tank specimens; 50 cataloged lots of skeletons; 70% in ethanol, 15% in isopropanol. Did not respond.

UNSM*, University of Nebraska State Museum, Division of Zoology, W436 Nebraska Hall, Lincoln, Nebraska 68588-0514. P. W. Freeman. 5479 cataloged and 1400 uncataloged lots; 5550 cataloged and 1402 uncataloged specimens; 100% computerized; catalog card file; systematic card file; geographic card file; 1 cataloged tank specimen; 70 cataloged lots of skeletons; 99% freshwater, 1% marine; 100% in ethanol. Great Plains; Nebraska; Missouri. Index 122.

Nevada.—UNR, University of Nevada Fish Collection, Biology Department, Reno, Nevada 89507. 1500 cataloged and 200 uncataloged lots; 16,750 cataloged specimens; 110 species represented; 4 nominal species represented by types; 10 cataloged tank specimens; 22 cataloged lots of skeletons; 58 cataloged lots cleared and stained; 30% in isopropanol. Did not respond.

New Hampshire.—DCM*, Dartmouth College Museum Fish Collection, Hanover, New Hampshire 03755. Did not respond.

New Jersey.—NMFC*, Newark Museum, Fish Collection, 43 Washington Street, Newark, New Jersey 07101. 500 cataloged and 20 uncataloged lots; 1500 cataloged and 100 uncataloged specimens; 75 cataloged lots of skeletons. Did not respond.

SHML, NMFS Sandy Hook Marine Laboratory, MARMAP Larval Fish Collection, Northeast Fisheries Center, Highlands, New Jersey 07732. M. Fahay. 24,000 cataloged lots 250,000 cataloged specimens; 250 species represented; 24,000 cataloged larval lots; 30 cataloged lots cleared and stained; 100% marine; 100% in ethanol. Gulf of Maine; Georges Bank; Middle and South Atlantic Bights. Lots listed in first survey destroyed by fire in 1985. Nonpermanent collection.

New Mexico.—MSB, University of New Mexico, Museum of Southwestern Biology, Department of Biology, Albuquerque, New Mexico 87131. S. Platania; A. Snyder. 7700 cataloged and 1500 uncataloged lots; 400,000 cataloged and 25,000 uncataloged specimens; 225 species represented; 1 secondary type; 375 cataloged tank specimens; 175 cataloged and 100 uncataloged larval lots; 100 cataloged lots of skeletons; 25 cataloged lots cleared and stained; 99% freshwater, 1% marine; 60% in ethanol, 35% in isopropanol, 5% in formalin. Southwestern United States; New Mexico. Index 120.

New York.—AMNH, American Museum of Natural History, Department of Ichthyology and Herpetology, Central Park West at 79th Street, New York, New York 10024. G. Nelson, M. Stiassny; M. N. Feinberg. 103,000 cataloged and 88,000 uncataloged lots; 1,200,000 cataloged and 1,000,000 uncataloged specimens; 1000 nominal species represented by types; 450 primary types; 700 secondary types; 50% computerized; systematic card file; geographic card file; 5000 cataloged and 1000 uncataloged tank specimens; 24,000 cataloged and 46,000 uncataloged larval lots; 7500 cataloged and 1000 uncataloged lots of skeletons; 2700 cataloged and 175 uncataloged lots cleared and stained; 70% freshwater, 30% marine; 50% in ethanol, 50% in isopropanol. Worldwide. Includes USA and VPI* (Virginia Polytechnic Institute). Index 49.

CU, Cornell University Ichthyology Collection, 83 Brown Road, Building 3, Ithaca, New York 14850. J. Humphries, A. McCune. 60,000 cataloged and 5000 uncataloged lots; 1,100,000 cataloged and 500,000 uncataloged specimens; 3000 species represented; 125 nominal species represented by types; 50 primary types; 100 secondary types; published type catalog; 100% computerized; 500 uncataloged tank specimens; 100 cataloged and 50,000 uncataloged larval lots; 100 cataloged lots of skeletons; 300 cataloged lots cleared and stained; 80% freshwater, 20% marine; 100% in ethanol. Eastern North America. Includes CM (Carnegie Museum of Natural History, in part). Index 74.

NYSM, New York State Museum, Biological Survey Laboratory, 145 Jordan Road, Troy, New York 12180. R. A. Daniels. 40,000 cataloged and 2000 uncataloged lots; 42,695 cataloged and 2000 uncataloged specimens; 520 species represented; 3 nominal species represented by types; 1 primary type; 2 secondary types; 100% computerized; 575 cataloged tank specimens; 75 cataloged skeletons; 45 cataloged lots cleared and stained; 1,500 uncataloged otoliths; 85% freshwater; 15% marine; 99% in ethanol; 1% in formalin. New York and northeastern United States. Index 106.

VMM, Vanderbilt Museum, Box F 180 Little Neck Road Centerport, New York 11721. J. Cardinali. 1760 cataloged lots 3000 cataloged specimens; 27 nominal species represented by types; 27 primary types; published type catalog; catalog card file; systematic card file; 2% freshwater, 98% marine; 100% in ethanol. Gulf of Mexico; Caribbean; South-central Pacific; Indian Ocean; Mediterranean. Index 118.

North Carolina.—DU, Duke University Vertebrate Collections Department of Zoology, Durham, North Carolina 27706. J. Lundberg. 1080 cataloged and 2420 uncataloged lots; 176 species represented; 8 secondary types; 99 cataloged and 50 uncataloged lots of skeletons; 28 cataloged and 70 uncataloged lots cleared and stained; 98% freshwater, 2% marine; 100% in ethanol. Carolinas; Venezuela. Index 116.

NCSM, North Carolina State Fish Collection, Museum of Natural History, PO Box 27647, 102 North Salisbury Street, Raleigh, North Carolina 27611. 6000 cataloged and 2600 uncataloged lots; 45,000 cataloged and 30,000 uncataloged specimens; 368 species represented; 9 cataloged tank specimens; 75 cataloged lots of skeletons; 70% in ethanol, 45% in isopropanol. Did not respond.

UNC, University of North Carolina Institute of Marine Sciences, 3407 Arendell Street, Morehead City, North Carolina 28551. F. J. Schwartz. 17,900 cataloged and 353,000 cataloged specimens; 780 species represented; 20% freshwater, 80% marine; 100% in isopropanol. Western Atlantic, shelf and estuaries. Index 117.

UNCC, University of North Carolina Zoological Museum Collection Biology Department, Charlotte, North Carolina 28213. E. Menhinick. 8000 cataloged and 100 uncataloged lots; 100,000 cataloged and 1000 uncataloged specimens; 700 species represented; 3 cataloged tank specimens; 90% freshwater, 10% marine; 100% in isopropanol. Index 127.

Ohio.—DATM, Dayton Museum of Natural History, Fish Collection 2629 Ridge Avenue, Dayton, Ohio 45414. Did not respond.

OSM, Ohio State University Museum of Zoology Division of Fishes, 1813 North High Street, Columbus, Ohio 43210. T. M. Cavender; T. Nickell. 74,888 cataloged and 32,000 uncataloged lots; 1,059,429 cataloged and 120,000 uncataloged specimens; 724 species represented; 25 nominal species represented by types; 15 primary types; 10 secondary types; 5% computerized; 2200 cataloged lots of skeletons; 500 cataloged lots cleared and stained; 90% freshwater, 10% marine; 95% in ethanol, 5% in isopropanol. Includes IU (Indiana State University). Eastern United States; Mississippi River Basin; Ohio River Basin; Great Lakes and Erie Basin. Index 79.

Oklahoma.—OSUS, Oklahoma State University Collection of Vertebrates Zoology Department, Stillwater, Oklahoma 74078. A. A. Echelle. 18,000 cataloged and 3000 uncataloged lots; 692,261 specimens; 14 nominal species represented by types; 14 secondary types; 50% computerized; catalog card file; 100 cataloged tank specimens; 98% freshwater, 2% marine. Southwestern United States; Oklahoma. Index 109.

OKMNH, University of Oklahoma, Oklahoma Museum of Natural History, Fish Range, Norman, Oklahoma 73019. W. J. Matthews. 20,000 cataloged lots 200,000 cataloged specimens; 200 species represented; 5 nominal species represented by types; 5 secondary types; 100% computerized; 50 cataloged tank specimens; 100 cataloged larval and 200 cataloged lots of skeletons; 200 cataloged lots cleared and stained; 100% freshwater. Oklahoma. Formerly UOMZ. Index 109.

UTT*, University of Tulsa Fish Collection Department of Life Sciences, Tulsa, Oklahoma 74104. 500 uncataloged lots; 20,000 uncataloged specimens. Did not respond.

Oregon.—OS, Oregon State University Fish Collection, School of Oceanography, Corvallis, Oregon 97331. D. Markle. 12,300 cataloged and 23,100 uncataloged lots; 180,000 cataloged and 264,000 uncataloged specimens; 600 species represented; 2 primary types; 44 secondary types; 100 cataloged lots cleared and stained; 10 cataloged and 300 uncataloged otoliths; 95% in isopropanol, 5% in formalin. Northern Pacific deepsea; Oregon freshwater. Includes OSUO. Index 96.

Pennsylvania.—ANSP, Academy of Natural Sciences, Department of Ichthyology, 19th and The Parkway, Philadelphia, Pennsylvania 19103. S. Schaefer; W. G. Saul. 113,600 cataloged and 2500 uncataloged lots; 1,500,000 cataloged and 2700 uncataloged specimens; 10,800 species represented; 2350 nominal species represented by types; 1800 primary types; 2000 secondary types; published type catalog; 100% computerized; systematic card file; 3200 cataloged and 200 uncataloged tank specimens; 2900 cataloged larval lots; 750 cataloged lots of skeletons; 1100 cataloged lots cleared and stained; 20 cataloged otoliths; 40% freshwater, 60% marine; 85% in ethanol, 15% in isopropanol. Western Atlantic; Indo-Pacific shorefishes; North and South American freshwater. Index 49.

PSU, Pennsylvania State University Fish Museum, University Park, Pennsylvania 16802. J. R. Stauffer, Jr.; E. L. Cooper. 20,000 cataloged and 6000 uncataloged lots; 350,000 cataloged and 100,000 uncataloged specimens; 400 species represented; published type catalog; 5% computerized; 90% freshwater, 10% marine; 20% in ethanol, 80% in isopropanol. Pennsylvania; West Virginia; Lake Malawi. Index 105.

YC*, York College Fish Collection, Biology Department, York, Pennsylvania 17405. 200 uncataloged lots; 8000 uncataloged specimens; 100% in isopropanol. Did not respond.

Puerto Rico.—UPRM, University of Puerto Rico Department of Marine Sciences, PO Box 5000 Mayaguez, Puerto Rico 00709-5000. D. A. Hensley. 3398 cataloged and 2227 uncataloged lots; 14,369 cataloged and 19,307 uncataloged specimens; 500 species represented; 19 nominal species represented by types; 19 secondary types; 41 cataloged and 101 uncataloged tank specimens; 1240 uncataloged larval lots; 22 uncataloged lots of skeletons; 32 uncataloged lots cleared and stained; 250 uncataloged otoliths; 1% freshwater, 99% marine; 100% in ethanol. Puerto Rico and United States Virgin Islands. Index 115.

Rhode Island.—NMFSN*, National Marine Fisheries Service, Northeast Fisheries Center Fish Collection Narragansett, Rhode Island 02882. 600 cataloged and 400 uncataloged lots; 80,000 cataloged and 20,000 uncataloged specimens; 30 species represented. Nonpermanent collection.

URIZ, University of Rhode Island, Department of Zoology, Kings-ton, Rhode Island 02881. W. H. Krueger. 1075 cataloged and 1500 uncataloged lots; 27,000 cataloged and 98,000 uncataloged specimens; 180 species represented; 10% computerized; 200 uncataloged tank specimens; 200 uncataloged larval lots; 30 uncataloged lots of skeletons; 50 uncataloged lots cleared and stained; 150 uncataloged otoliths; 20% freshwater, 80% marine; 5% in ethanol, 90% in isopropanol. Rhode Island; Southeastern New England. Temporary. Index 121.

South Carolina.—CHM, The Charleston Museum, Fish Collection, 121 Rutledge Avenue, Charleston, South Carolina 29401. A. E. Sanders. 5975 cataloged lots, 700 uncataloged and 60,850 cataloged lots; 7000 uncataloged specimens; 30 cataloged tank specimens; 30 cataloged skeletons; 360 species represented; 70% freshwater, 30% marine; 100% in ethanol. South Carolina; adjoining states. Index 109.

CUSC, Clemson University Vertebrate Collections, Clemson, South Carolina 29634-1903. R. R. Montanucci; S. M. Miller. 6654 cataloged and 500 uncataloged lots; 33,270 cataloged and 5000 uncataloged specimens; 500 uncataloged larval lots; 285 species represented; 95% freshwater, 5% marine; 6% in formalin, 94% in ethanol. Western South Carolina. Index 115.

GMBL, College of Charleston Grice Marine Biological Laboratory, 205 Fort Johnson, Charleston, South Carolina 29412. W. D. Anderson, Jr. 12,500 cataloged and 15,000 uncataloged lots; 125,000 cataloged and 150,000 uncataloged specimens; 1200 species represented; 1 nominal species represented by a type; 1 secondary type; systematic card file; 725 cataloged and 100 uncataloged tank specimens; 85 cataloged lots of skeletons; 71 cataloged lots cleared and stained; 5% freshwater, 95% marine; 1% in ethanol, 99% in isopropanol. South Carolina estuarine; continental shelf from Florida to North Carolina. Index 106.

SCMRRI, Marine Resources Research Institute, Wildlife and Marine Resources Department, Larval Fish Collection, PO Box 12559, Charleston, South Carolina 29412. V. G. Burrell, Jr.; B. W. Stender. 50,000 cataloged lots; 600 species represented; 50,000 cataloged larval lots; 3000 cataloged lots cleared and stained; 1% freshwater, 99% marine; 30% in ethanol. Southeastern United States and South Atlantic Bight. Temporary. Index 112.

South Dakota.—USDOM*, University of South Dakota, W. H. Over Museum, Vermillion, South Dakota 57069. Did not respond.

Tennessee.—MSUMZ, Memphis State University Museum of Zoology, Department of Biology, Memphis, Tennessee 38152. W. Simco. 1600 cataloged and 300 uncataloged lots; 98% freshwater, 2% marine. Eastern Tennessee; North Mississippi. Index 115.

UT, University of Tennessee Research Collection of Fishes Department of Zoology, Knoxville, Tennessee 37996-0810. D. A. Etnier. 14,000 cataloged and 500 uncataloged lots; 200,000 cataloged and 2000 uncataloged specimens; 1800 species represented; 30 nominal species represented by types; 30 secondary types; catalog card file; systematic card file; 1500 cataloged and 20 uncataloged tank specimens; 70% freshwater, 30% marine; 100% in isopropanol. Southeastern United States. Index 106.

UTMCV*, University of Tennessee at Martin Fish Collection Biology Department, Martin, Tennessee 38237. W. A. Sliger. 2000 cataloged and 100 uncataloged lots; 50 cataloged and 10 uncataloged tank specimens; 150 species represented; 90% freshwater, 10% marine; 100% in isopropanol. 99% computerized. Western Tennessee. Index 124.

Texas.—SMBU, Baylor University, Strecker Museum Ichthyology Collection, Waco, Texas 76798. C. B. Smith; D. O. Lintz. 302 cataloged and 1900 uncataloged lots; 6000 cataloged and 4000 uncataloged specimens; 395 species represented; 50% computerized; 100 cataloged tank specimens; 15 cataloged lots of skeletons; 95% freshwater, 5% marine; 100% in isopropanol. Texas. Index 121.

TAIC, Texas A & I University, Ichthyological Collection, Biology Department, Kingsville, Texas 78363. 400 cataloged lots; 300 uncataloged lots; 1200 cataloged and 2000 uncataloged specimens; 150 species represented; 3 cataloged and 5 uncataloged tank specimens. Did not respond.

TCWC, Texas A&M University Texas Cooperative Wildlife Collection, Department of Wildlife and Fisheries Science, College Station, Texas 77843. J. D. McEachran; F. S. Hendricks. 70,000 cataloged and 10,000 uncataloged lots; 200,000 cataloged and 30,000 uncataloged specimens; 1600 species represented; 10 nominal species represented by types; 10 secondary types; published type catalog; 1% computerized; catalog card file; systematic card file; 500 cataloged and 100 uncataloged tank specimens; 50 cataloged and 1000 uncataloged larval lots; 100 cataloged and 50 uncataloged lots of skeletons; 50 cataloged and 50 uncataloged lots cleared and stained; 50% freshwater, 50% marine; 97% in ethanol, 2% in isopropanol. Northern Gulf of Mexico; Texas. Includes TAMU/DO* (Texas A&M University Systematic Collection of Marine Organisms, Department of Oceanography). Index 94.

TNHC, University of Texas, Texas Memorial Museum, Texas Natural History Collection, 2400 Trinity, Austin, Texas 78705. D. A. Hendrickson. 19,000 cataloged and 4000 uncataloged lots; 297,083 cataloged and 60,784 uncataloged specimens; 1150 species represented; 54 secondary types; 100% computerized; 200 cataloged tank specimens; 100 cataloged lots of skeletons; 50 cataloged lots cleared and stained; 200 cataloged otoliths; 90% freshwater, 10% marine; 81% in ethanol, 90% in isopropanol. Texas; Southwestern United States; Venezuelan Amazon; Zambia; Mexico; Central America. Includes UTMSI* (University of Texas Marine Science Institute, Port Aransas). Index 102.

TTU, Texas Tech University Museum Ichthyology Collection, PO Box 4499 Lubbock, Texas 79409-3191. C. Jones, R. Baker; S. L. Williams. 750 uncataloged lots; 95% freshwater, 5% marine; 100% in isopropanol. Southwestern United States. Index 124.

UTA, University of Texas at Arlington Fish Collection Merriam Museum, Arlington, Texas 76019. 550 cataloged and 150 uncataloged lots; 7000 cataloged and 2000 uncataloged specimens; 100 species represented; 40% in isopropanol. Did not respond.

Utah.—BYU, Brigham Young University, Ichthyology Collection, Life Sciences Museum, Provo, Utah 84601. 1725 cataloged lots 17,250 cataloged specimens; 350 species represented; 4 nominal species represented by types; 3 primary types; 4 secondary types; 50 cataloged and 5 uncataloged tank specimens; 25 cataloged lots of skeletons; 10 cataloged lots cleared and stained; 60% in ethanol. Did not respond.

Virginia.—ODU, Old Dominion University Fish Collection Department of Biology, Norfolk, Virginia 23508. R. Birdsong. 2800 uncataloged lots; 28,000 uncataloged specimens; 50 uncataloged tank specimens; 24 uncataloged lots of skeletons; 150 uncataloged lots cleared and stained; 100% in isopropanol. Index 126.

RC, Roanoke College Fish Collection, Department of Biology, Salem, Virginia 24153-3794. R. E. Jenkins. 7500 uncataloged lots; 120,000 uncataloged specimens; 200 uncataloged tank specimens; 100% freshwater; 100% in isopropanol. Virginia and adjoining drainages. Temporary. Index 128.

VIMS, Virginia Institute of Marine Science Fish Collection, Gloucester Point, Virginia 23062. J. A. Musick. 12,350 cataloged and 500 uncataloged lots; 80,000 cataloged and 3000 uncataloged specimens; 1550 species represented; 1 secondary type; 50% computerized; 500 cataloged tank specimens; 50 cataloged and 200 uncataloged larval lots; 50 cataloged and 50 uncataloged lots of skeletons; 50 cataloged lots cleared and stained; 20% freshwater, 80% marine; 2% in ethanol, 98% in isopropanol. Chesapeake Bay; Norfolk Canyon; Virginia; Maryland. Includes CMBL. Index 117.

UR, University of Richmond Fish Collection, Department of Biology, Richmond, Virginia 23173. E. C. Maurukis. 5371 cataloged and 100 uncataloged lots; 45,869 cataloged specimens; 100 species represented; 5 cataloged tank specimens; 100% in isopropanol. Index 126.

Washington.—AFSC, Alaska Fisheries Science Center, National Marine Fisheries Service, 7600 Sand Point Way Northeast, Seattle, Washington 98115-0070. A. W. Kendall, Jr.; A. C. Matarrese. 200 species represented; 75% computerized; 35,000 cataloged larval lots; 12 uncataloged lots of skeletons; 2000 uncataloged lots cleared and stained; 100,000 uncataloged otoliths; 1% freshwater, 99% marine; 40% in ethanol. Northeastern Pacific from Northern California to Arctic Ocean. Non-permanent collection.

CRCM, Washington State University, Fish Collection, Charles R. Conner Museum, Pullman, Washington 99163. 93 cataloged and 20 uncataloged specimens; 48 species represented. Did not respond.

UW, University of Washington Fish Collection, FTR Building HF-15, Seattle, Washington 98195. T. W. Pietsch. 21,426 cataloged and 14,726 uncataloged lots; 150,000 cataloged and 79,400 uncataloged specimens; 3350 species represented; 14 nominal species represented by types; 14 secondary types; published type catalog; 33% computerized; systematic card file; 3000 cataloged and 10 uncataloged tank specimens; 100 cataloged larval lots; 25 cataloged lots of skeletons; 285 cataloged lots cleared and stained; 25% freshwater, 75% marine; 100% in ethanol. Eastern North Pacific. Index 84.

Wisconsin.—MPM, Milwaukee Public Museum, 800 West Wells, Milwaukee, Wisconsin 53233. R. Mooi. 30,000 cataloged lots; 1,500,000 cataloged specimens; 750 species represented; 2 nominal species represented by types; 2 secondary types; 95% computerized; 26 cataloged tank specimens; 10 uncataloged larval lots; 10 uncataloged lots of skeletons; 100 uncataloged lots cleared and stained; 95% freshwater, 5% marine; 50% in ethanol, 50% in isopropanol. Wisconsin; inshore western Mexico; Peru; Central America. Index 101.

UWM, University of Wisconsin Fish Collection Zoology Department, Milwaukee, Wisconsin 53201. C. R. Norden. 2000 cataloged and 470 uncataloged lots; 400 species represented; 100 cataloged lots of skeletons; 100 cataloged; 60% in isopropanol. Did not respond.

UWSP, University of Wisconsin Museum of Natural History George Becker Ichthyological Collection, Stevens Point, Wisconsin 54481-3897. W. H. LeGrande. 8000 cataloged and 2500 uncataloged lots; 120,000 cataloged and 250,000 uncataloged specimens; 800 species represented; 700 cataloged and 200 uncataloged tank specimens; 100 uncataloged lots of skeletons; 50 cataloged and 100 uncataloged lots cleared and stained; 85% freshwater, 15% marine; 90% in ethanol. Wisconsin; Gulf Coast; synoptic worldwide. Index 116.

UWZM, University of Wisconsin Zoological Museum Fish Collection, 250 North Mills Street, Noland Teaching Building, Madison, Wisconsin 53711. J. D. Lyons. 9800 cataloged and 1500 uncataloged lots; 10,005 cataloged and 2630 uncataloged specimens; 700 species represented; 3 nominal species represented by types; 3 secondary types; systematic card file; 5 cataloged and 30 uncataloged tank specimens; 50 uncataloged larval lots; 200 cataloged and 50 uncataloged lots of skeletons; 75% freshwater, 25% marine; 100% in ethanol. Wisconsin and Laurentian Great Lakes; Aleutian I.; Cape Hatteras; Upper Mississippi R. Index 124.

Wyoming.—UWL, University of Wyoming Fish Collection, Zoology Museum, Laramie, Wyoming 82071. 1300 cataloged and 50 uncataloged lots; 20,000 cataloged specimens; 80 species represented; 50% in ethanol. Did not respond.