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Standard for Reference

Collections in Wildlife

Forensic Biology: Genetics

and Vertebrate Morphology

Wildlife Forensic Biology Subcommittee
Biology Scientific Area Committee
Organization of Scientific Area Committees (OSAC) for Forensic Science



Draft OSAC Proposed Standard

2021-S-0014 Standard for Reference Collections in Wildlife Forensic Biology: Genetics and Vertebrate Morphology

Prepared by
Wildlife Forensic Biology Subcommittee
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Foreword

This document recognizes the need for building and maintaining reference collections in wildlife forensic biology and provides standards for acquiring, verifying the taxonomic identity of, and curating reference specimens, as well as permanently removing reference specimens from a collection. Comparison of unknown materials to known reference specimens, such as, but not limited to, prepared skins, feathers, skeletons, and tissue, is a fundamental aspect of wildlife forensic examinations for taxonomic identification of evidence items. Reference specimens are not only used to identify evidentiary unknowns, but also to characterize variation, to develop new analytical methods, and to train new forensic practitioners. Moreover, they can be used for verifying the taxonomic identity of newly acquired reference specimens, as well as validation studies and proficiency tests. Proper maintenance of reference collections is essential. Reference specimens in wildlife forensic laboratories must generally be maintained in perpetuity to allow for their accessibility during future judicial proceedings.

This document does not address standards for capture and euthanasia of live animals to be used as reference specimens. This document also does not address the collection and storage of forensic evidence, nor the analytical process of using reference specimens in forensic casework.

This standard specifically addresses genetic and vertebrate morphology reference collections in wildlife forensic biology. It acknowledges, but does not attempt to duplicate, the extensive body of peer-reviewed literature that exists both on the importance of, and protocols for, curating comparative research collections, such as those residing in natural history museums. The standards set forth here recognize that the materials curated in wildlife forensic laboratories vary and may include diverse sample types, and in most instances, can be acquired without the need to take live animals from the wild.

This standard was developed by the Wildlife Forensic Biology Subcommittee of the Organization of Scientific Area Committees.

All hyperlinks and web addresses shown in this document are current as of the publication date of this standard.

Keywords: Curation, Reference specimens, Taxonomic identity

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40 **Standard for Reference Collections in Wildlife Forensic Biology: Genetics and Vertebrate**
41 **Morphology**

42 **1 Scope**

43 This standard provides requirements for acquiring, verifying the taxonomic identity of, and curating
44 reference specimens to be used in wildlife forensic casework, research, training, validation studies, and
45 proficiency testing related to taxonomic identification using genetics or vertebrate morphology. This
46 standard also provides requirements for permanently removing reference specimens from a collection.
47 This document does not address standards for capture and euthanasia of live animals to be used as
48 reference specimens. This document also does not address the collection and storage of forensic evidence,
49 nor the analytical process of using reference specimens in forensic casework.

50 **2 Normative References**

51 ANSI/ASB Standard 048 – *Wildlife Forensic DNA Standard Procedures*, First Edition, 2019

52 See Annex A, Bibliography, for other references.

53 **3 Terms and Definitions**

54 For the purposes of this document, the following definitions apply.

55 **3.1 curated collection**
56 **reference collection**

57 An assemblage of reference materials acquired and maintained with associated data according to explicit
58 quality control standards. (source: OSAC Lexicon)

59
60 **3.2 curation**

61 The process of managing and preserving a collection according to professional museum standards and
62 archival practices. (source: 36 C.F.R. 79.4(b))

63
64 **3.3 proficiency test**

65 Test to evaluate analysts, technical support personnel, or the quality performance of an organization. Four
66 examples are: 1) Open test—Analyst(s) and technical support personnel are aware they are being tested.
67 2) Blind test—Analyst(s) and technical support personnel are not aware they are being tested. 3) Internal
68 test—Conducted by the organization itself. 4) External test—Conducted by an organization independent
69 of the organization being tested. (source: OSAC Lexicon)

70
71 **3.4 reference specimens**

72 Whole animals and their parts or derivatives, or genetic material of known identity.

73
74 **3.5 taxonomic identification**

75 Analyses to establish the classification of an organism to family, genus, species, etc. These analyses are
76 based on class characters diagnostic for the taxonomic level in question. (source: OSAC Lexicon)

77
78 **3.6 validation**
79 **validation study**

80 The process of performing and evaluating a set of experiments that establish the efficacy, reliability, and
81 limitations of a method, procedure or modification thereof; establishing recorded documentation that

82 provides a high degree of assurance that a specific process will consistently produce an outcome meeting
83 its predetermined specifications and quality attributes. May include developmental and/or internal
84 validation. (source: OSAC Lexicon)

85
86 **4 Requirements**

87 The following requirements address criteria for the acquisition (4.1), verification of taxonomic identity
88 (4.2), curation (4.3), and permanent removal (4.4) of wildlife forensic reference specimens.
89

90 **4.1** Acquisition – To ensure that specimens included in a reference collection have been appropriately
91 obtained, each laboratory acquiring reference specimens shall:

92
93 **4.1.1** comply with all relevant local, state, federal, and international laws, regulations, and
94 treaties regarding the acquisition and possession of biological samples;

95
96 **4.1.2** comply with all relevant ethical and welfare guidelines regarding specimen collection;
97

98 **4.1.3** designate a person or person(s) to be responsible for acquiring reference specimens from
99 sources that can include scientific researchers, law enforcement personnel, museum reference
100 collections, university collections, zoo collections, lay collectors, and/or commercial vendors;
101

102 **4.1.4** institute appropriate measures to ensure individual and public health safety (e.g., prevent
103 human and animal disease transmission and exposure to toxins);
104

105 **4.1.5** maintain a written scope of the reference collection that explains why it includes and
106 maintains particular specimens, including particular taxonomic groups and sample types.
107

108 This scope shall minimally describe:

109 a) specimens needed to conduct forensic casework;

110 b) accepted quality of associated data (e.g., provenance information, age, sex);
111

112 c) accepted condition of the specimen or specimen parts;
113

114 d) the need for representation of biological variation within and across species,
115 including variation associated with sex and age;
116

117 e) laboratory curation capabilities (e.g., preparation methods, storage facilities);
118

119 f) specimens needed to conduct training;
120

121 g) specimens needed to conduct proficiency testing;
122

123 h) specimens needed to conduct validation studies;
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125 i) specimens needed to conduct scientific research.
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129 **4.2** Verification of taxonomic identity – To ensure that specimens included in a reference collection have
130 been accurately identified to the relevant taxonomic level prior to its use in a forensic context, each

131 laboratory shall:

132

133 **4.2.1** verify the taxonomic identity of each specimen, regardless of specimen source, and with
134 consideration of associated data;

135

136 NOTE: Not all reference specimens require identification to species-level to be useful in
137 wildlife forensic comparisons. In some cases, reference specimens can serve as examples
138 of higher taxonomic levels (e.g., genus, family).

139

140 **4.2.2** designate a qualified person(s) to verify specimens who has sufficient knowledge of the
141 taxonomic groups under consideration;

142

143 **4.2.3** maintain a protocol for verification of taxonomic identity using morphology or genetic
144 methods that includes one or more of the following:

145

146 a) comparison of genetic data from taxonomically informative genetic loci/regions from
147 the specimen to known reference genetic data within the laboratory following ANSI/ASB
148 Standard 048;

149

150 b) comparison of genetic sequences from taxonomically informative genetic loci/regions
151 from the specimen to genetic sequences in a public database following ANSI/ASB
152 Standard 048;

153

154 c) comparison of taxonomically informative morphological characters of the specimen to
155 known reference specimens, either within the laboratory or within other reference
156 collections (e.g., natural history museums);

157

158 d) comparison of taxonomically informative morphological characters of the specimen to
159 data in published literature, such as but not limited to peer-reviewed journal articles,
160 taxonomic monographs, identification keys, field guides.

161

162 **4.2.4** document and maintain records regarding the person(s) who verified the reference
163 specimen, the date of verification of taxonomic identity, and the taxonomic authority used for
164 verification.

165

166 **4.2.5** require that personnel verifying taxonomic identity remain current on relevant taxonomic
167 changes in the scientific literature.

168

169 **4.2.6** reevaluate reference specimens using laboratory protocols established in 4.2.3 following
170 relevant taxonomic changes identified in the scientific literature as needed.

171

172 NOTE: In some cases, reevaluation may result in reference specimens being identified to
173 higher taxonomic levels (e.g., genus, family).

174

175 **4.3** Curation – To ensure that specimens included in a reference collection are maintained
176 in a manner that preserves their integrity (including associated data), longevity, and chain of
177 documentation, each laboratory shall:

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179 **4.3.1** maintain a protocol that:

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181 a) designates laboratory personnel responsible for collection curation;

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- b) designates laboratory personnel who will be allowed access to the reference collection;
 - c) describes laboratory procedures used for preparing specimens;
 - d) describes laboratory procedures for labeling specimens;
 - e) describes laboratory procedures for cataloging specimens;
 - f) describes laboratory procedures for protecting reference specimens from damage (e.g., pest control and management, humidity and temperature controls, light exposure, archival storage materials);
 - g) lists taxonomic authorities used for verification and reevaluation of taxonomic identity.

NOTE: The extensive literature on curation provides protocols that can readily be adapted to fulfill requirements 4.3.1c, d, e, and f. See the Bibliography (Annex A) for selected references.

4.3.2 maintain a reference database (paper and/or digital) that includes a unique identifying number and taxonomic identity for each reference specimen, along with its associated data if available, including but not limited to:

- a) date of specimen collection,
- b) date of specimen donation,
- c) name of specimen collector,
- d) name of specimen donor,
- e) name of person who verified taxonomic identity,
- f) date of verification of taxonomic identity,
- g) taxonomic authority used for verification,
- h) collection locality (e.g., GPS coordinates, city, county, state, country),
- i) condition of specimen upon collection (e.g., live, dead, roadkill),
- j) method of collection,
- k) sex of specimen,
- l) age or age class of specimen,
- m) specimen type (e.g., complete skeleton, partial skeleton, skin, feather, fresh tissue, blood, bone, hair, DNA),

232 n) other pertinent information, such as necropsy report (e.g., from a zoo, rehabilitation
233 facility, veterinarian), available genetic data, previous collection numbers, and duplicate
234 samples from the same specimen.

235
236 **4.3.3** ensure that the reference database is backed up routinely to preserve the data.

237
238 **4.3.4** maintain a protocol that describes laboratory procedures and personnel responsible for
239 reference database access, data entry, data storage, and data management.

240
241 **4.4** Permanent removal of reference specimens from a reference collection – Each laboratory shall
242 have a protocol for permanently removing reference specimens that shall require long-term chain of
243 documentation and maintenance of:

244
245 **4.4.1** any data associated with permanently removed specimens (see 4.3.2 above);

246 **4.4.2** information regarding the reason for permanently removing a specimen;

247 **4.4.3** information regarding the disposition of permanently removed specimens (e.g., consumed in
248 analysis, disposed, transferred to another facility);

249 **4.4.4** information regarding compliance with any permit requirements governing permanent
250 removal of the specimen.

251 NOTE: In keeping with 4.1, which ensures that specimens included in reference collections have
252 been appropriately obtained, 4.4.4 ensures that specimens are appropriately removed in line with
253 any applicable laws and regulations governing possession of specific specimens.

254 **Annex A (informative)**

255 This is not meant to be an all-inclusive list as voluminous other publications on this subject exist. At the
256 time this standard was drafted, these were examples of foundational literature available for reference.

257 In addition to the references below, there are several professional organizations and peer-reviewed
258 journals that publish on the curation of biological collections and their associated documentation. Such
259 professional organizations include, but are not limited to, The Society for the Preservation of Natural
260 History Collections, the Natural Sciences Collections Association, and the International Society for
261 Biological and Environmental Repositories.

262 Peer-reviewed journals on this subject include, but are not limited to, *Collections: A Journal for Museum*
263 *and Archives Professionals*, *Collection Forum*, *Collection Management*, *Curator: The Museum Journal*,
264 and the *Journal of Natural Science Collections*.

265 See also additional publications and resources available through the NIST Biorepository:

266 <https://www.nist.gov/programs-projects/nist-biorepository>

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