Chapter 579: Classification Attainment Evaluation Using Biological Criteria for Rivers and Streams

SUMMARY: Criteria to quantify aquatic life standards for Classes AA, A, B and C waters are defined in this chapter. The benthic macroinvertebrate community is used as a surrogate to determine conformance with statutory aquatic life standards, related statutory definitions, and statutory provisions for the implementation of biological water quality criteria, that are provided in Maine's standards for classification of fresh surface waters. Methods described in this chapter will be used to make decisions about classification attainment.

1. **Definitions.** The following terms are defined for use in this chapter:

   A. **Association value.** The probability (0.0-1.0), computed in the final decision model (Section 1(F) below), that a sample from a test community is comparable to statistically defined classification groups (see also Section 1(E)), representing the ecological attributes described in the water quality classification law.

   B. **Classification attainment evaluation.** An assessment to determine whether the aquatic life standards of a specified class are achieved. Classification attainment evaluations are performed by the department and reported in the department's biennial assessment report to the Legislature or may be required of an applicant for a waste discharge license or water quality certificate, as defined in this chapter.

   C. **Ecological attribute.** A process, function or characteristic of a biological community that is used to evaluate the attainment of the aquatic life standards of a classification and that can be quantified or documented through the use of metrics and indices of the aquatic community structure and function.

   D. **Indeterminate.** A term that describes an association value for a class of greater than 0.4 but less than 0.6 so that the conclusion of classification attainment for that class cannot be determined without further information.

   E. **Linear discriminant function.** An equation that is a weighted linear combination of predictor variables, derived to best distinguish among a set of classification groups having known statistical properties.

   F. **Linear discriminant model.** A set of one or more linear discriminant functions, used in combination, to derive strength of membership of an unknown sample within a water quality classification (e.g. Section 3 (F), the C or Better Model; the B or Better Model; the Class A Model). Membership strength can be converted into an association value for class membership on a 0.0-1.0 scale.

   G. **Quality assurance plan.** A plan submitted to, and approved by, the department that addresses study design, sample collection methods, sample processing methods, provisions for a taxonomic reference collection, data management and analysis methods, report preparation, professional oversight of technical staff, and management and security accountability.

   H. **Reference community.** Populations of organisms inhabiting a location that is free from known pollution sources or other activities that could bring about a change in the natural state of a

community, and is chosen for its similarity to a test community location according to criteria defined in "Methods for Biological Sampling and Analysis of Maine's Rivers and Streams" (DEP LW0387-B2002).

I. **Taxonomic reference collection.** An archived collection of one or more representative specimens of individual taxa identified by a person submitting taxonomic data to the department. Such specimens must be preserved in a separate vial for each taxon, labeled with collection site, collection date, taxonomic name, taxonomist name, and sample tracking identifier (e.g., sample log number).

J. **Test community**. A population of organisms inhabiting a location where classification attainment evaluation is being conducted.

2. **Responsibility for sampling**

A. **Assessment.** In general, it is the responsibility of the department, or its agents, to conduct sampling for the purpose of making decisions on the attainment of water quality classification (classification attainment evaluation).

B. **Licensing.** Under certain conditions, as listed below, sampling may be required of an applicant for a waste discharge license, water quality certification or other department issued permit. Sampling must be performed by persons who can demonstrate their qualifications and ability to carry out the department's sampling protocol set forth in "Methods for Biological Sampling and Analysis of Maine's Rivers and Streams" (DEP LW0387-B2002).

Prior to issuance or reissuance of a waste discharge license or other activities pursuant to 38 M.R.S.A. Chapter 3, Protection and Improvement of Waters and the State's responsibilities under the federal Clean Water Act, or issuance of a water quality certification pursuant to Section 401 of the Federal Clean Water Act, an applicant may be required to conduct a classification attainment evaluation. The department may also require monitoring as a condition of any license, permit or certification that it issues. Such monitoring must be conducted according to a plan provided to, and approved by, the department.

The decision by the department to require biological monitoring is based on the classification of the water, existing information about the condition of the biological community and other water quality information, past performance of existing controls for point and nonpoint sources of pollution, and the nature, magnitude, and variability of the activity relative to the affected water.

3. **Aquatic life classification criteria for Maine rivers and streams.** Methods described in this section are used to make decisions about classification attainment. The models are constructed to sequentially amass evidence concerning the highest level of classification criteria that a test community attains, using quantitative predictor variables defined in Section 3(C). The pertinent question, in terms of the classification attainment, is whether or not a test community is attaining at least its statutory classification. The methods described in this rule may also be used to determine if a given waterbody attains a higher class and therefore may be subject to statutory antidegradation provisions or considered for water quality reclassification. The methods may also be used, where appropriate, for other purposes including assessment of pre-impact baseline conditions or site-specific impact evaluations.

A. **General provisions for aquatic life standards.** Except as otherwise provided in Section 3(G)(3), Professional judgement, of this chapter, all samples of benthic macroinvertebrates that are collected for the purpose of classification attainment evaluation using the linear discriminant model described in the following section, whether collected by the department or by any person submitting data to the department, must be collected, processed and identified in conformance with "Methods for Biological Sampling and Analysis of Maine's Rivers and Streams" (DEP LW0387-B2002).Selection of an appropriate sampling site must also conform to criteria set forth in "Methods for Biological Sampling and Analysis of Maine's Rivers and Streams" (DEP LW0387-B2002). Quantitative analysis of the sample must conform to the requirements set forth in Sections 3(B) through 3(F) of this chapter and must include a quality assurance plan approved by the department, as specified in "Methods for Biological Sampling and Analysis of Maine's Rivers and Streams" (DEP LW0387-B2002). Samples must be identified to the genus level, where practicable. Computation of indices and measures of community structure required for the linear discriminant models must be adjusted to the genus level of taxonomy (see Section 3(C), Variable number 2, Generic Richness).

Minimum Provisions. Samples that have been properly collected and analyzed but fail to meet either of the following criteria are unsuitable for further analysis through the linear discriminant models:

(1) Total mean abundance (Section 3(C) Variable number 1) must be at least *50* individuals (average per basket/cone/bag); and

(2) Generic richness (Section 3(C) Variable number 2) for three replicate basket/cone/bag samplers must be at least *15*.

Samples not attaining these criteria may be evaluated according to Section 3(G) of this chapter, Professional judgment.

B. **Aquatic life statistical decision models.** The following statistical decision models consist of linear discriminant functions developed to use quantitative ecological attributes of the macroinvertebrate community (see Section 3(C) through 3(E)) to determine the strength of the association of a test community to any of the water quality classes (Appendix 1).

The coefficients or weights (see Section 3(F)) are calculated using a linear optimization algorithm to minimize the distance, in multivariate space, between sites within a class, and to maximize the distance between sites between classes. The linear discriminant function has the form:

$$Z = C + W_1X_1 + W_2X_2 + \ldots W_nX_n$$

Where: Z = discriminant score
C = constant
W_i = the coefficients or weights (from Section 3(F))
X_i = the predictor variable values (from Section 3(C))

Association values are computed, using variable values from a test sample, for each classification by employing one four-way model and three two-way models. The four-way model uses nine variables pertinent to the evaluation of all classes and provides four initial probabilities that a given site attains one of three classes (AA/A, B, or C), or is in nonattainment (NA) of the minimum criteria for any class. Class AA and Class A have the same aquatic life standards and,

therefore, are treated as the same aquatic life class. These probabilities have a possible range from 0.0 to 1.0, and are used, after transformation, as variables in each of the three subsequent final decision models. The final decision models (the three, two-way models) are designed to distinguish between a given class and any higher classes as one group and any lower classes as the other group (e.g., Classes AA/A+B+C vs. NA; Classes AA/A+B vs. Class C+NA; Class AA/A vs. Classes B+C+NA). The equations for the final decision models use the predictor variables relevant to the class being tested (Section 3(F)). The resultant discriminant scores are known as the Mahalonobis Distance where:

Mahalonobis Distance = Z_t (sample x) = g_1 (x,t) + g_2 (t)

Where: Z_t = discriminant score for sample x, class t
g_1 (x,t) = $(x-m_t)' S^{-1} (x-m_t)$
g_2 (t) = $-2 \log_e (q_t) = 0$ (if prior probabilities areequal)

Where: x = a vector containing all the values of all thevariables for a given linear discriminant function, for a given sample, of class t
m_t = a vector, as for x, but containing the meansof all predictor variables in the given linear discriminant function, for the given sample, of class t
S = pooled covariance matrix (the variance of themultivariate observation)
q_t = value of the prior probability that a givensample is Class A, B, C, or NA.

The probability (association value) of a sample x, belonging to a particular class t, is:

$$P_t(x) = \frac{e^{[-0.5 Z_t(x)]}}{\sum_{A}^{NA}\left[e^{[-0.5 Z_{A,B,C,NA}(x)]}\right]}$$

Where: $P_t(x)$ = the probability that sample x belongs to class t (for Classes A, B, C, NA)
e = the exponential function
-0.5 = a standardization constant from the normal distribution
Z_t = the discriminant score or Mahalonobis Distance for class t (Classes A, B, C, NA)

C. Methods for the calculation of indices and measures used in the linear discriminant models Variables (1) to (30) are as follows.

(1) Total mean abundance. Count all individuals in all replicate samplers from a site and divide by the number of replicates to yield the mean number of individuals per sampler.

(2) Generic richness. Count the number of different genera found in all replicate samplers from one site.

Counting rules for generic richness:

(a) Species-level counts. All population counts at the species level are aggregated to the generic level.

(b) Family-level counts, no more than one genus. A family level identification that includes no more than one taxon identified to the generic level is counted as a separate taxon in generic richness counts.

(c) Family-level counts, more than one genus. A family level identification with more than one taxon identified to generic level is not counted toward generic richness. Counts are divided proportionately among the genera that are present.

(d) Phylum, Class, or Order counts. A higher level taxonomic identification (Phylum, Class, Order) is not counted toward generic richness unless it is the only representative.

(e) Pupae. Pupae are ignored in all calculations.

(3) Plecoptera mean abundance. Count all individuals from the order Plecoptera in all replicate samplers from one site and divide by the number of replicates to yield mean number of Plecopteran individuals per sampler.

(4) Ephemeroptera mean abundance. Count all individuals from the order Ephemeroptera in all replicate samplers from one site and divide by the number of replicates to yield the mean number of Ephemeropteran individuals per sampler.

(5) Shannon-Wiener Generic Diversity. Shannon-Wiener generic diversity is computed after adjusting all counts to genus, as described under paragraph (2) above.

$$\bar{d} = \frac{c}{N}\left(N \log_{10} N - \sum n_i \log_{10} n_i\right)$$

where: $\bar{d}$ = Shannon-Wiener Diversity
$c = 3.321928$ (converts base 10 log to base 2)
N = Total abundance of individuals
n_i = Total abundance of individuals in the ith taxon

(6) Hilsenhoff Biotic Index. HBI is calculated using all taxa in the sample that have assigned tolerance values. Tolerance values are provided in Hilsenhoff, William. 1987. An Improved Biotic Index of Organic Stream Pollution, *The Great Lakes Entomologist* 20:31-39.

$$HBI = \sum \frac{n_i a_i}{N}$$

Where: HBI = Hilsenhoff Biotic Index
N_i = number of individuals in the ith taxon
a_i = tolerance value assigned to that taxon
N = total number of individuals in sample with tolerance values

(7) Relative Chironomidae abundance. Calculate the mean number of individuals of the family Chironomidae, following the counting rules in Variable 4, and divide by total abundance (Variable 1).

(8) Relative Diptera richness. Count the number of genera of the Order Diptera, following counting rules in Variable 2, and divide by generic richness (Variable 2).

(9) *Hydropsyche* abundance. Count all the individuals from the genus *Hydropsyche* in all replicate samplers from a site, and divide by the number of replicates to yield mean number of *Hydropsyche* individuals per sampler.

(10) Probability (A+B+C) from first stage model. The sum of probabilities for Classes A, B, and C from first stage model.

(11) *Cheumatopsyche* abundance. Count all individuals from the genus *Cheumatopsyche* in all replicate samplers from one site and divide by the number of replicates to yield mean number of *Cheumatopsyche* individuals per sampler.

(12) EPT-Diptera richness ratio. Divide EPT generic richness (Variable 19) by the number of genera from the order Diptera, following counting rules in Variable 2. If the number of genera of Diptera in the sample is 0, a value of 1 is assigned to the denominator.

(13) Relative Oligochaeta abundance. Calculate the mean number of individuals of the class Oligochaeta, following counting rules in Variable 4, and divide by total abundance (Variable 1).

(14) Probability (A+B) from first stage model. The sum of probabilities for Classes A and B from first stage model.

(15) Perlidae mean abundance. Count all individuals from the family Perlidae (Section 3(E)) in all replicate samplers from one site and divide by the number of replicates to yield mean number of Perlidae per sampler.

(16) Tanypodinae mean abundance. Count all individuals from the subfamily Tanypodinae (Section 3(E)) in all replicate samplers from one site and divide by the number of replicates to yield mean number of Tanypodinae per sampler.

(17) Chironomini mean abundance. Count all individuals from the tribe Chironomini (Section 3(E)) in all replicate samplers from one site and divide by the number of replicates to yield mean number of Chironomini per sampler.

(18) Relative Ephemeroptera abundance. Variable 4 divided by Variable 1.

(19) EPT generic richness. Count the number of different genera from the order Ephemeroptera (E), Plecoptera (P), and Trichoptera (T) in all replicate samplers, according to counting rules in Variable 2, generic richness.

(20) Variable reserved.

(21) Sum of mean abundance of *Dicrotendipes* & *Micropsectra* & *Parachironomus* & *Helobdella*. Sum the abundance of the 4 genera and divide by the number of replicates (as performed in Variable 4).

(22) Probability of Class A from first stage model.

(23) Relative Plecoptera richness. Count number of genera of Order Plecoptera, following counting rules in Variable 2, and divide by generic richness (Variable 2).

(24) Variable reserved.

(25) Sum of mean abundance of *Cheumatopsyche* & *Cricotopus* & *Tanytarsus* & *Ablabesmyia.* Sum the number of individuals in each genus in all replicate samplers and divide by the number of replicates (as performed in Variable 4).

(26) Sum of mean abundance of *Acroneuria* & *Stenonema.* Sum the number of individuals in each genus in all replicate samplers and divide by the number of replicates (as in Variable 4).

(27) Variable reserved.

(28) Ratio of EP generic richness. Count the number of different genera from the order Ephemeroptera (E), and Plecoptera (P) in all replicate samplers, following counting rules in Variable 2, and divide by 14 (maximum expected for Class A).

(29) Variable reserved.

(30) Ratio of Class A indicator taxa. Count the number of Class A indicator taxa as listed in Section 3(D) that are present in the community and divide by 7 (total possible number).

D. Indicator taxa for Class A

Brachycentrus ---	(Trichoptera: Brachycentridae)
Serratella --------	(Ephemeroptera: Ephemerellidae)
Leucrocuta -------	(Ephemeroptera: Heptageniidae)
Glossosoma ------	(Trichoptera: Glossosomatidae)
Paragnetina -----	(Plecoptera: Perlidae)
Eurylophella ------	(Ephemeroptera: Ephemerellidae)
Psilotreta --------	(Trichoptera: Odontoceridae)

E. Family functional groups

PLECOPTERA

Perlidae

Acroneuria	*Agnetina*
Attaneuria	*Beloneuria*
Eccoptura	*Neoperla*
Paragnetina	*Perlesta*
Perlinella	

CHIRONOMIDAE

Tanypodinae

Ablabesmyia
Coelotanypus
Djalmabatista
Hudsonimyia
Larsia
Natarsia
Paramerina
Procladius
Rheopelopia
Telopelopia
Trissopelopia
Clinotanypus
Conchapelopia
Guttipelopia
Labrundinia
Meropelopia
Nilotanypus
Pentaneura
Psectrotanypus
Tanypus
Thienemannimyia
Zavrelimyia

Chironomini

Pseudochironomus
Chironomus
Cryptochironomus
Demicryptochironomus
Einfeldia
Glyptotendipes
Harnischia
Lauterborniella
Microtendipes
Pagastiella
Paracladopelma
Paratendipes
Polypedilum
Stelechomyia
Stictochironomus
Xenochironomus
Axarus
Cladopelma
Cryptotendipes
Dicrotendipes
Endochironomus
Goeldichironomus
Kiefferulus
Microchironomus
Nilothauma
Parachironomus
Paralauterborniella
Phaenopsectra
Robackia
Stenochironomus
Tribelos

F. Model coefficients

First Stage Model

Variable number	Transformation	Coefficients Class A	Class B	Class C	Nonattainment
Constant		-99.95508	-105.70948	-112.67581	-107.74283
1	nLog (value +0.001)	10.77061	11.46981	11.80888	11.26793
2		-0.38619	-0.43340	-0.50051	-0.48822
3	nLog (value +0.001)	0.23940	0.03946	-0.60923	-0.95480
4	nLog (value +0.001)	-0.59970	-0.55500	-0.67722	-1.79032
5		21.22732	20.91256	21.07602	19.46547
6		8.01620	9.12163	10.31492	10.72746
7	nLog (value +0.001)	-11.70298	-11.52650	-11.49414	-11.66371
8		70.77937	71.09637	72.46514	70.22517
9		-0.00535	-0.00398	-0.00152	0.00007

Final Classification Models

Class C or better model

Variable number	Transformation	Coefficients Class A-B-C	Nonattainment
Constant		-25.70020	-8.55844
10	Arcsin	19.98470	3.36032
11	nLog (value +0.001)	-0.26001	-0.43781
12	Sq. root	5.57672	5.92732
13	nLog (value +0.001)	-2.33229	-1.89945

Class B or better model

Variable number	Transformation	Coefficients Class A-B	Class C-nonattainment
Constant		-17.81016	-6.93836
14	Arcsin	12.04826	3.63707
15	nLog (value +0.001)	-1.11091	-1.03934
16	nLog (value +0.001)	-0.10582	0.01978
17	nLog (value +0.001)	0.17813	0.10825
18		4.03202	-1.14508
19		0.87400	0.63310
21	nLog (value +0.001)	-0.69360	-0.53194

Class A model

		Coefficients	
Variable number	**Transformation**	**Class A**	**Class B-C-nonattainment**
Constant		-9.59254	-4.08552
22	Arcsin	8.34341	1.52080
23		3.78999	4.27447
25	nLog (value +0.001)	0.53110	0.77851
26	nLog (value +0.001)	-0.55838	-0.51448
28		12.32529	9.81592
30		6.94828	-0.67475

G. **Professional judgment.** Where there is documented evidence of conditions that could result in uncharacteristic findings, allowances may be made to account for those situations by adjusting the classification attainment decision through use of professional judgement, as provided in this section, paragraphs 3(G)(1) to 3(G)(3). The department may make adjustments to the classification attainment decision based on analytical, biological, and habitat information or may require that additional monitoring of affected waters be conducted prior to issuing a classification attainment decision.

(1) Sampling procedures and minimum provisions conform but other confounding factors exist. When samples of test communities conform to criteria provided in "Methods for Biological Sampling and Analysis of Maine's Rivers and Streams" (DEP LW0387-B2002) and Section 3(A) of this chapter, they are suitable to be analyzed by the linear discriminant models for classification attainment evaluation. These models are not suitable for use in areas of impoundments that thermally stratify or in areas where there is a net annual deposition of fine sediment. Professional judgement may be utilized when conditions are found that are atypical to the derivation of the linear discriminant model, as provided in Section 3(B-F). Factors that may allow adjustments to the model outcome include but are not limited to: habitat factors, including lake outlets from waters classified GPA, unusual naturally-caused substrate character, tidal effects, cataclysmic events, oligotrophic conditions; sampling factors, including disturbed samples, unusual taxa assemblages, and documented human error in sampling; and sample processing factors, including subsample vs. whole sample analysis and documented human error in processing. The following adjustments may be made to correct for these conditions:

(a) Raise the finding. On the basis of documented evidence of specific conditions such as those defined above, the department may decide:

(i) To raise the classification attainment outcome predicted by the model from nonattainment of any class to indeterminate or to attainment of Class C; or

(ii) To raise the classification attainment outcome predicted by the model from attainment in one class to attainment in the next higher class; or

(iii) To determine that a sample with an indeterminate outcome for a given class attains that class.

(b) Lower the finding. On the basis of documented, substantive evidence that the narrative aquatic life criteria for the assigned class are not met, the department may decide to lower the classification attainment finding.

(c) Indeterminate. Where the department cannot make a finding as described in 3(G)(1)(a-b), additional monitoring of the test community may be required before a determination of class attainment can be made.

(2) Minimum provisions do not conform. For classification evaluation of test communities that do not conform to criteria provided in Section 3(A) of this chapter, minimum provisions, professional judgement may be used as follows:

(a) Determination of nonattainment. Those samples having any of the ecological attributes not attaining the minimum provisions (Section 3(A)), and where there is no evidence of confounding factors that could result in uncharacteristic findings as defined above (Section 3(G)(1)), must be determined to be in nonattainment of the minimum provisions of the aquatic life criteria for any class.

(b) Determination of attainment when minimum provisions are not met. Where there is evidence of factors that could result in minimum provisions not being met, professional judgment may be used to make a professional finding of attainment of the aquatic life criteria for any class. Such decisions will be provisional until appropriate resampling is carried out.

(3) Standard sampling procedures are not feasible or appropriate. For classification attainment evaluation of test communities that do not conform to criteria provided in "Methods for Biological Sampling and Analysis of Maine's Rivers and Streams" (DEP LW0387-B2002), the department may make an assessment of classification attainment or aquatic life impact in accordance with the following procedures:

(a) Approved assessment plan. A quantitative sampling and data analysis plan must be developed in accordance with methods established in the scientific literature on water pollution biology, and the department must approve the plan.

(b) Determination of sampling methods. Sampling methods are determined on a site-specific basis, based on habitat conditions of the sampling site, and the season sampled;

(i) The preferred method for sampling hard-bottomed substrates is the rock basket/cone/bag method as described in "Methods for Biological Sampling and Analysis of Maine's Rivers and Streams" (DEP LW0387-B2002).

(ii) Soft-bottomed substrates will, whenever ecologically appropriate and practical, be sampled by core or dredge of known dimension.

(c) Other methods. Other methods may be used where ecologically appropriate and practical.

(d) Classification attainment decisions. Classification attainment decisions may be based on a determination of the degree to which the sampled site conforms to the narrative aquatic life classification criteria provided in statutory standards for water quality classification.

The decision is based on established principles of water pollution biology and must be fully documented.

(e) Site specific impact decisions. Site specific impact decisions may rely on established methods of analysis of comparative data between a test community and an approved reference community.

(f) Determination of detrimental impact. A determination of detrimental impact to aquatic life of a test community without an approved reference community may be made if it can be documented, based on established methods of the interpretation of macroinvertebrate data, and based on established principles of water pollution biology, that the community fails to demonstrate the ecological attributes of its designated class as defined by the narrative aquatic life standards in the water quality classification law.

4. **Determination of decision results.** A waterbody's attainment class is determined by following the process described below, and as shown in Appendices 1 and 2.

A. **Assess data appropriateness and minimum requirements.** The first step is to determine if the sample meets minimum requirements (Section 3(A)) and is appropriate to run through the Linear Discriminant Models (LDM). If the minimum provisions or sampling procedures are not appropriate, then professional judgment may be used to determine the appropriate course of action (Sections 3(G)(2) and 3(G)(3)).

B. **Determine if sample attains at least Class C.** The second step is to use the association value from the "C or better" LDM (pABC) to determine if the sample meets at least Class C or is in nonattainment of minimum aquatic life criteria. If the association value is equal to or greater than 0.6, the sample attains Class C. If the association value is less than 0.4, the sample does not attain Class C and is determined to be in nonattainment of any classification. If the association value (pABC) is greater than 0.4 and less than 0.6, then professional judgment is used to determine if the sample is (1) Class C, (2) in nonattainment, or (3) indeterminate of Class C (see Section 3(G)(1)).

C. **Determine if the sample attains at least Class B.** For those samples that attain at least Class C, the next step is to use the association value from the "B or better" LDM (pAB) to determine if the sample is (1) at least Class B with an association value equal to or greater than 0.6, (2) Class C with an association value less than 0.4, or (3) indeterminate of Class B with an association value greater than 0.4 and less than 0.6 (Section 3(G)(1)).

D. **Determine if the sample attains Class A.** For those samples that are at least Class B, the final step is to use the association value from the "A" LDM (pA) to determine if the sample is:

(1) Class A with an association value equal to or greater than 0.6,

(2) Class B with an association value less than 0.4, or

(3) Indeterminate of Class A with an association value greater than 0.4 and less than 0.6 (Section 3(G)(1)).

5. **Application of decision results**

A. **Attainment of statutory classification.** A waterbody shall be determined to be in attainment of the designated aquatic life uses and characteristics of its assigned water classification, if the association value, as determined according to Sections 3 and 4 of this chapter, following methods outlined in "Methods for Biological Sampling and Analysis of Maine's Rivers and Streams" (DEP LW0387-B2002), is shown to be equal to or greater than 0.6 for that class or any higher class, or where the provisions for professional judgement determine that the water should be determined to be in attainment of its assigned water classification or any higher classification; and where other standards and criteria pertinent to protecting the aquatic life uses of the classification are determined to be attained (including, but not limited to, support of indigenous fish or other aquatic species, as required in the water quality classification law).

B. **Reporting.** Results of classification attainment evaluation must be reported in the department's biennial water quality assessment report and Section 305(b) of Federal Clean Water Act. Waters that are determined not to attain their statutory classification are listed in the state's list of impaired waters as required in Section 303(d) of the Federal Clean Water Act.

C. **Antidegradation.** Waters that attain the aquatic life use standards of a higher classification must be protected in accordance with the applicable statutory provisions for antidegradation. For the purposes of antidegradation, attainment of aquatic life use standards of a higher classification shall be based on classification attainment evaluations of 2 or more consecutive sampling outcomes, from different sampling years, that attain a higher class, and taking into account critical water quality conditions including, but not limited to, conditions of low flow, high water temperature, maximum loading from point source and nonpoint source discharges, and conditions of acute and chronic effluent toxicity.

D. **Licensing, permitting and water quality certification activities.** An activity regulated by the Department may be approved when a classification attainment evaluation finds that the standards of classification of the water body are met and will continue to be met, notwithstanding the approved activity. An activity regulated by the Department may be approved when a classification attainment evaluation finds that the standards of classification of the water body are not met if it can be shown that the activity does not, or a new activity will not, cause or contribute to non-attainment of designated aquatic life uses and other standards of the assigned water classification.

If the classification attainment evaluation shows that the standards of classification of the water body are not met, and the applicant is unable to show that the activity does not, or a new activity will not cause or contribute to non-attainment, then a license, permit or water quality certification may only be issued when it can be demonstrated that modifications to the proposed activity, as required by the new license, permit or certification, will provide attainment conditions. If two or more activities can be shown to cause or contribute to non-attainment of the assigned water classification, then a license, permit or water quality certification may only be issued when it can be demonstrated that modifications to the activity, as required in the license, permit or certification, in conjunction with modifications to other sources in the watershed that contribute to the non-attainment, including modifications that are a part of a Department approved total maximum daily load, will provide attainment. The department may require additional monitoring of the affected waters following issuance of any license, permit or water quality certificate.

6. **Provisions for transition.** All aquatic life samples collected for Classification Attainment Evaluation after January 1, 2000 are subject to the provisions of this chapter. All determinations of classification attainment or nonattainment made by the department for samples collected prior to January 1, 2000

are subject to analytical requirements and provisions described in "Maine Biological Monitoring and Biocriteria Development Program" (DEP-LW-108) and "Methods for Biological Sampling and Analysis of Maine's Rivers and Streams" (DEP LW0387-B2002).

Appendices

APPENDIX 1: Process Of Calculating Model Variables And Association Values Using Linear Discriminant Models.

Computer calculates model variables (*Var1 – Var30*) using taxa counts from a sample event using procedures described in *Section 3(C)*.

First Stage Linear Discriminant Model (LDM)
(4-way model: A vs. B vs. C vs. NA)

1. Model calculates Discriminant Score[1] using *Var1 – Var9*.
2. Model uses Discriminant Score to calculate the following Association Values[1]:
   - probability Class AA/A (*pA1*)
   - probability Class B (*pB1*)
   - probability Class C (*pC1*)
   - probability Nonattainment (*pNA1*)

"C or Better" Second Stage LDM
(2-way model: A, B, or C vs. NA)

1. Model calculates Discriminant Score[1] using *Var10* (*pA1+pB1+pC1*) and *Var11 – Var13*.
2. Model uses Discriminant Score to calculate the following Association Values[1]:
   - probability C or better (*pABC*)
   - probability NA (*pNA*)

"B or Better" Second Stage LDM
(2-way model: A or B vs. C or NA)

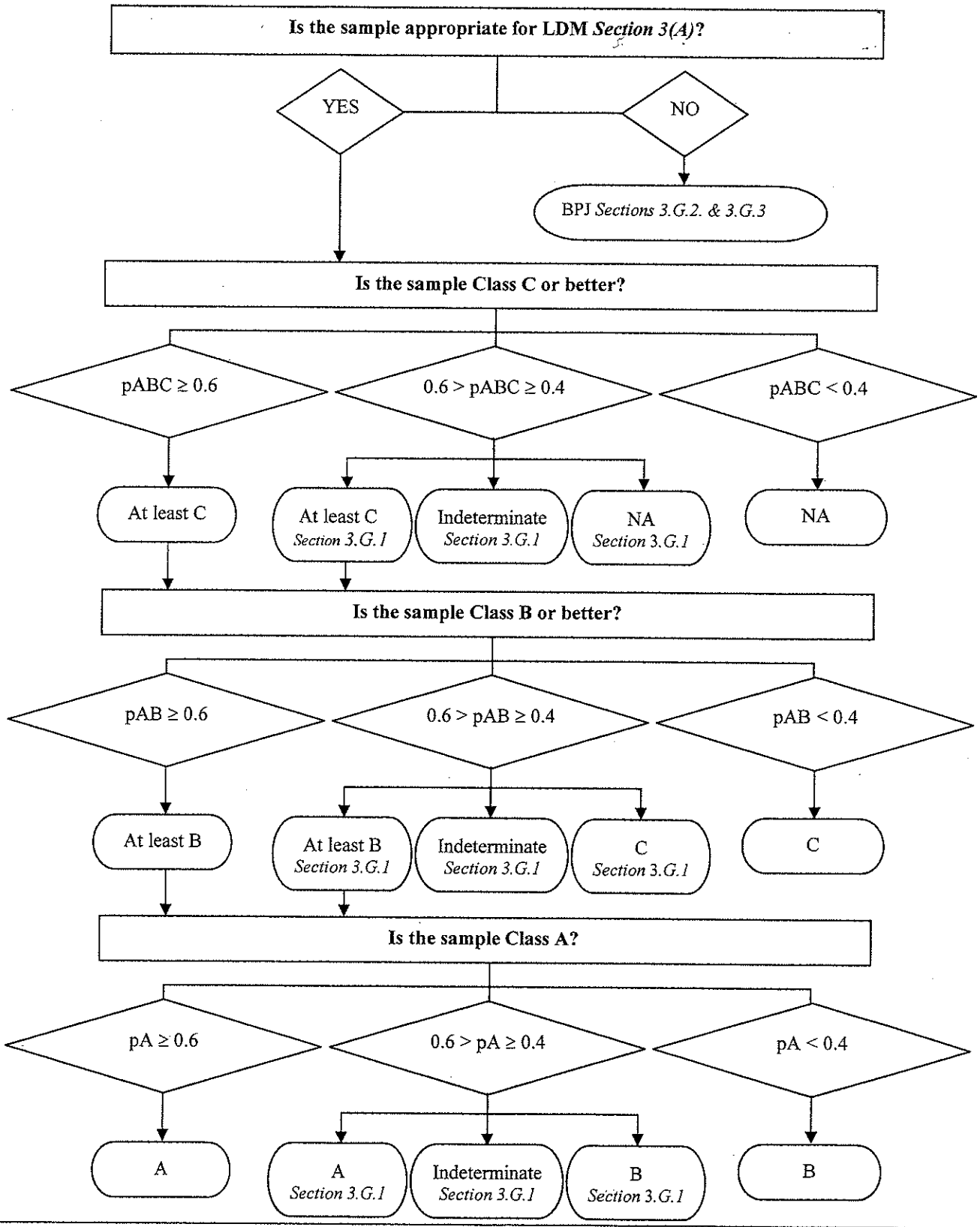
1. Model calculates Discriminant Score[1] using *Var14* (*pA1+pB1*) and *Var15 – Var21*.
2. Model uses Discriminant Score to calculate the following Association Values[1]:
   - probability B or better (*pAB*)
   - probability C or NA (*pCNA*)

"A" Second Stage LDM
(2-way model: A vs. B, C, or NA)

1. Model calculates Discriminant Score[1] using *Var22* (*pA1*) and *Var23 – Var30*.
2. Model uses Discriminant Score to calculate the following Association Values[1]:
   - probability AA/A (*pA*)
   - probability B, C, or NA (*pBCNA*)

[1] Discriminant Scores and Association Values are defined in *Section 3(B)*.

APPENDIX 2: Process For Determining Attainment Class Using Association Values.



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