Independent Peer Review by the Center for Independent Experts (CIE)

River Herring (Alewife and Blueback Herring) Stock Structure and Extinction Risk Analysis

by

Jeffrey A. Hutchings
Department of Biology
Dalhousie University
1355 Oxford Street
PO Box 15000
Halifax, NS
B3H 4R2
CANADA

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EXECUTIVE SUMMARY

Purpose

The purpose of this independent review is to conduct a scientific peer review of Stock Structure and Extinction Risk Analysis Working Group Reports on river herring (alewife and blueback herring) prepared by the National Marine Fisheries Service (NMFS). The reports were prepared in response to a positive 90-day finding which determined that a petition to list river herring under the Endangered Species Act (ESA) may be warranted. NMFS will use these reports along with the Atlantic States Marine Fisheries Commission (ASMFC) river herring stock assessment to develop an ESA listing determination.

Comments and Recommendations

1. For the most part (possible exceptions indicated below), the River Herring Extinction Risk Analysis and Stock Structure Working Group Reports contain the best available information on the extinction risk and stock structure of alewife and blueback herring. All scientific findings are both reasonable and supported by valid information contained in the documents.

2. The best scientific information available is presented for the life history of river herring. Information on population dynamics, however, is sparse. There would appear to be additional information on stock-recruitment dynamics for alewife that could be considered.

3. The genetics, physiological, behavioural, and/or morphological data presented in the Working Group Report likely represent the best scientific information available.

4. The Extinction Risk Analysis Working Group Report could be interpreted as being deficient in three aspects. Some consideration of these factors would strengthen the Report. Consideration could be given to: (i) the utility of incorporating estimates of population growth rate derived from stock-recruitment relationships; (ii) providing scientifically legitimate and defensible extinction or quasi-extinction thresholds for the extinction risk analyses; and (iii) undertaking extinction probability analyses in accordance with those specified by the IUCN's Criterion E for Endangered and Threatened ('Vulnerable' in IUCN terminology) species.

5. Consideration could be given to the inclusion of landlocked alewives in the extinction risk analyses. Independent of whether landlocked alewives are considered to be part of the petition for listing, the scientific issue at hand

is whether landlocked alewives affect the persistence and extinction probability of anadromous forms.

6. Given the relative paucity of data related to stock structure for river herring in U.S. waters, the Stock Structure Working Group Report might be strengthened by a consideration of: (i) available information on stock structure in Canadian waters; and (ii) life-history and other data for a related species, American shad (*Alosa sapidissima*), as a means of evaluating the strengths and weaknesses associated with alternative stock structure proposals for river herring in U.S. waters.

REVIEWER REPORT

I. BACKGROUND

In August 2011, NMFS was petitioned to list alewife (*Alosa pseudoharengus*) and blueback herring (*Alosa aestivalis*), collectively referred to as river herring, under the Endangered Species Act (ESA). As a result of a positive finding that the petitioned action may be warranted, the agency is required to review the status of the species to determine if listing under the ESA is warranted. Part of this review will be to determine whether river herring might conceivably warrant listing as one or more Distinct Population Segments (DPSs).

Although a stock assessment of river herring undertaken earlier in 2012 will provide important information upon which the ESA review can take place, the assessment does not contain all elements needed to make a listing determination under the ESA. As a consequence, NMFS held two workshops in 2012 to address some of the perceived information gaps. Two of the workshops organized for this purpose address river herring stock structure and extinction risk. The Working Groups responsible for these workshops have prepared reports for the two workshops. NMFS will use these reports along with the ASMFC river herring stock assessment to develop an ESA listing determination.

II. DESCRIPTION OF THE INDIVIDUAL REVIEWER'S ROLE IN THE REVIEW ACTIVITIES

I received the River Herring Extinction Risk Analysis Working Group Report (NMFS 2012a), the River Herring Stock Structure Working Group Report (NMFS 2012b), and associated appendices on 13 August 2012 from Kim Damon-Randall, Acting Assistant Regional Administrator for Protected Resources, NOAA Fisheries Service, Northeast Regional Office, Gloucester, MA. On 17 August 2012, Kim Damon-Randall sent me a web address from which I could gain access to PowerPoint presentations, as background material, that

informed, to greater or lesser degrees, the Working Group Reports. I began my review on 20 August 2012 and completed it on 31 August 2012. The report was submitted to the Center for Independent Experts (CIE) on 31 August 2012, prior to the 2 September 2012 deadline stipulated in the Statement of Work (Appendix B of the present document).

III. SUMMARY OF FINDINGS IN ACCORDANCE WITH THE TERMS OF REFERENCE

1. Is the information regarding the life history and population dynamics of the species the best scientific information available? If not, please indicate what information is missing and if possible, provide sources.

To the best of my knowledge, the information regarding the life history of the two species is likely to represent the best scientific information available. I base this conclusion on my own knowledge of the species and on the considerable range of expertise on the life history of alewife and blueback herring that was available during the two workshops.

Regarding population dynamics, it must be acknowledged that there was surprisingly little information on population dynamics *per se* in the documents available for review. For example, I was surprised to see no information presented on stock-recruitment relationships. These data have been presented for a number of alewife populations in Canada and the U.S. by Gibson and Myers (2003 a,b). Among other things, such information could potentially provide information on the spatial scale of similar patterns of recruitment variability and population dynamical structure that might be useful when delineating stock structure for alewife. And, as estimated by Gibson and Myers (2003b), such data analyses also lend themselves to the possibility of (i) estimating maximum rates of population growth and (ii) ascertaining whether there is any evidence of Allee effects, or depensatory population dynamics. The papers by Gibson and Myers (2003a,b) are cited, but not discussed, in the Extinction Risk Analysis Working Group Report (NMFS 2012a). The papers are not cited in the Stock Structure Working Group Report (NMFS 2012b).

2. Does the information on river herring genetics, physiological, behavioral, and/or morphological variation presented for the species' range represent the best scientific information available? If not, please indicate what information is missing and if possible, provide sources.

Compared to many other anadromous species, there appears to be relatively little information available on river herring physiological, behavioural, and/or morphological variation. When considered throughout the range of the two species, the genetic information appears to be the most substantive and the most

robust. This is rather unfortunate, and surprising, given the historical and present commercial importance of the species in question.

Ideally, there would be comparative life-history data available on traits such as age and size at maturity, fecundity, and individual growth rates. One might also have hoped for some age-specific data on survival that would allow for estimates of population growth rate (among other things). But, based on the Working Group reports, it would appear that relatively little of this information is available.

The genetics data would seem to be among the best of the available data. Recent analyses include (i) the coast-wide analyses of alewife and blueback herring undertaken by Palkovacs *et al.* and (ii) the regional (Maine, Canadian Maritimes) analyses undertaken by Bentzen *et al.* These analyses seem to have been competently undertaken by acknowledged experts in genetics and on the biology and life history of *Alosa*.

Thus, the information on river herring genetics, physiological, behavioural, and/or morphological variation presented for the species' range represents, in all likelihood, the best scientific information available.

3. Based on the scientific information presented, are the conclusions regarding species, subspecies, or distinct population segment delineations supported by the information presented? If not, please indicate what scientific information is missing and if possible, provide sources.

Pursuant to this Term of Reference, it should be noted that there are no specific conclusions regarding "subspecies or distinct population segment delineations" evident in the Working Group Reports. Nonetheless, I would conclude, based on the scientific information presented, that the conclusions regarding species are supported by the information presented.

The primary objectives of the Stock Structure Working Group Report (NMFS 2012b) were: (i) to determine whether there is evidence of stock structure for alewife and blueback herring; and (ii) provide NMFS with an expert opinion on the extent of stock structure for alewife and blueback herring. In my opinion, the working group report has met these objectives. The report provides substantive evidence of stock structure in river herring. Although a consensus view is not presented (nor was it sought), it would appear that the best available information would support the hypotheses in favour of the existence of four coastwide U.S stocks *each* of alewife and blueback herring.

Although it might not be germane to this ESA-related work, I will offer the comment that the grouping of all river herring into a single 'Canada stock' is probably not warranted scientifically, although it might be convenient. (I am

aware, for example, that species can be listed outside their U.S. jurisdictional range under the ESA, *e.g.,* polar bear, *Ursus maritimus*.) Bentzen *et al*.'s (2012) genetic work is clearly supportive of more than one Canadian stock of alewife. Hasselman *et al.*'s (2010) work on another species of the genus *Alosa* (American shad) also suggests the existence of multiple stocks north of the Canada:U.S. border.

Based on the materials examined, there are clearly very few range-wide data on blueback herring and alewife upon which an assessment of stock structure, or potential DPS structure, can be made. Life history and morphometric data are sparse (those that exist encompass relatively small spatial scales); seasonal movement data are limited; and other potential distinguishing variables (such as otolith shape) can be significantly influenced by environmental, rather than genetic, factors. The primary range-wide data remaining are the genetic analyses of microsatellite DNA.

These data, in conjunction with most of the received expert opinions (Anon 2012a), suggest that it is unlikely that river herring can be characterized as a single DPS. At the other extreme, the genetic data (in conjunction with straying rate estimates, some direct estimates being as high as 20%) would also suggest that recognizing hundreds of stock complexes representative of individual rivers would not be warranted. And, despite long (and often poorly documented) histories of stocking practices which appear to have obscured genetic patterns in some rivers (*e.g.,* Maine; Bentzen *et al.* 2012), geographically reasonable genetic differentiation is distinguishable at larger spatial scales.

As I understand the information at hand, and accounting for the 13 August 2012 genetic analysis update by Palkovacs *et al.* (Anon 2012b), the emergent stock structure is one that recognizes 4 stock complexes of alewife (Northern New England; Southern New England; Mid-Atlantic; North Carolina; Figure 1, Anon 2012b) and 4 stock complexes for blueback herring (Northern New England; Southern New England; Mid-Atlantic; Southern; Figure 2, NMFS 2012b).

I note that the presentation by Palkovacs and Gephard to the NMFS River Herring Stock Structure Working Group states that alewife have been collected in South Carolina but that they did not have any samples. They also suggest that alewife in Neuse and Cape Fear (NC) might be extirpated. This might mean that there was/is another stock complex ('Southern') of alewife that no longer exists, or is at historically depleted levels. The existence of alewife in South Carolina is also mentioned by Bozeman and Van Den Avyle (1989).

Regarding the behavioural data on run timing, I was surprised by the conclusion on page 10 that "there is no noticeable consistency" in run timing for six New Hampshire rivers (Figures 8, 9; NMFS 2012b). In the past decade, the peak runs do bear some temporal consistency (*e.g.,* the 2002-2005 periods).

(The different scales on the x-axes do not assist one's visual assessment of run-timing consistencies.)

In summary, I agree with the Working Group's Discussion points (pages 16-18) concerning: (i) the potential utility of the available data on genetics (useful for ESA listing purposes); (ii) morphological/physiological variables (not particularly useful for ESA listing purposes), (iii) behavioural/life-history traits (not particularly useful for ESA listing purposes); and (iv) marine migration patterns (not particularly useful for ESA listing purposes).

4. Based on the scientific information presented in the extinction risk analysis report, does this analysis consider all of the best available data and are the conclusions appropriate and scientifically sound? If not, please indicate what information is missing and if possible, provide sources.

Based on the scientific information presented in the River Herring Extinction Risk Analysis Working Group Report (NMFS 2012a), the analyses presented in the report do an adequate job of considering all of the best available data. But one could argue that some elements of extinction risk analysis are missing.

One of these are estimates of population growth rates, which could be obtained from analyses such as those undertaken by Gibson and Myers (2003a,b), as mentioned above. Secondly, as elaborated upon further below, there is no justification offered for the population abundance quasi-extinction thresholds that are offered in the Working Group Report (NMFS 2012a). Thirdly, I suggest that there is utility in undertaking extinction probability analyses analogous to those considered by the IUCN.

On page 16, paragraph 1, reference is made to the fact that parameters estimated by the MARSS package include "interactions between the hidden states". Assuming that 'hidden states' refers to populations, are the interactions meant to refer to temporal autocorrelations in abundance/biomass? In any event, a one-sentence clarification as to what the 'interactions' refer to might be useful. I also note that in "Supplementary materials to the extinction risk analysis working group report for CIE peer review" that the following key questions will be addressed: What do multiple hidden states really mean? How are dataset weightings represented? If you have multiple hidden states, do you come out with multiple probabilities of extinction?

Also, on page 16, it is suggested that only the daytime NEFSC bottom trawl survey tows should be used to quantify relative abundance "because catchability is greatest during the day when river herring are distributed lower in the water column". For clarity, this is not, in itself, a valid reason for excluding

night-time tows. If catchability differs between day and night, then one should indeed use only those tows conducted *either* during day *or* night.

On page 17, the first sentence states that a drawback to the NEFSC trawl survey is that it does not sample the entire range of both species, leaving out the southern portion of the coast of North Carolina. Assuming that availability remains constant (and perhaps it does not, in which case the drawback is appropriate), then I do not see this as a drawback if one wishes to use the NEFSC data as a means for inferring temporal changes in abundance.

With reference to Figure 9, have the survey sampling strata changed over time, either in size, location, or number? The reader will assume that they have not, *i.e.,* that the time series shown in this figure are presented *only* for those strata that have been sampled in the same manner year after year.

Figures 11-13 present the output of forward-projection analyses for alewife. Two population thresholds are identified: 5000 and 10000. However, there is no empirical or theoretical basis provided for these threshold levels of abundance? At a minimum, even if these graphs are simply intended to provide the reader with an idea as to how the method works, it would have been useful if there had been some justification provided for these thresholds. (I would also note that 'threshold' is misspelled in Figures 4 and 6.)

One final correction is warranted. As has been known since at least the early 1950s (Cole 1954), and supported by recent empirical analysis (Hutchings *et al.* 2012), population growth is *not* affected by fecundity in teleost fishes (see line 10, page 32, of NMFS 2012a).

5. In general, are the scientific conclusions in the reports sound and interpreted appropriately from the information? If not, please indicate why not and if possible, provide sources of information on which to rely.

In my opinion, the scientific conclusions in the reports are sound and have been interpreted appropriately based on the information provided therein. That said, I found some of the caveats, while not unreasonable in an absolute sense, to have relatively little bearing on an ESA listing decision, including the identification of potential DPSs (which I assume will be forthcoming).

For example, the five caveats to the genetics analyses on page 6 of the stock structure report (NMFS 2012b) do not strike me as being particularly germane to the question of whether putative DPSs of river herring can be recognized as being distinct or significantly different from one another. Based on Hasselman's (2010) work, and the genetics analyses presented in NMFS (2012b), the likelihood that the sampling regime might have contributed to an under-estimation of within-river stock structure seems moot. And the caveat that microsatellites represent presumably neutral loci, rather than loci under selection,

is common to virtually every population genetics analysis that is based on microsatellite DNA. As another example, the point noted on page 20 that river herring "appear to function as a mixed stock" in the marine environment also strikes me as moot given that Atlantic salmon (and all (?) Pacific salmon) also share marine habitat yet are readily acknowledged to exist as separate stocks.

Nonetheless, I agree with the main conclusions of the Stock Structure Working Group Report that: (i) that more than one stock, or stock complex, exists in both alewife and river herring; and (ii) that the most parsimonious delineation of stock structure is likely to be the 4 U.S. units identified for each species separately by the Palkovacs *et al.* genetics analyses.

6. Where available, are opposing scientific studies or theories acknowledged and discussed? If not, please indicate why not and if possible, provide sources of information on which to rely.

I will note that I find it rather odd that landlocked alewives are excluded from consideration. Irrespective of NMFS's decision that the original petition pertains only to anadromous populations, the scientific issue at hand is whether landlocked alewives are likely, or not likely, to affect the persistence and extinction probability of anadromous forms.

For example, there are numerous examples of a lack of differentiation between anadromous and non-anadromous forms of the same species inhabiting the same watershed in salmonids (*e.g.,* Atlantic salmon, Arctic char, brook trout, brown trout, rainbow trout/steelhead). To its credit, the report (page 18; NMFS 2012b) appears to acknowledge the potential importance of non-anadromous alewives to anadromous populations, but little is made of this thereafter.

7. In general, is the best scientific and commercial data available for the stock structure and extinction risk analysis of river herring presented in the reports? If not, please indicate or provide sources of information on which to rely.

7.1 Stock Structure Working Group Report

Given the relative paucity of data related to stock structure for river herring, I was surprised that information on stock structure in Canadian waters, and for other species of the genus *Alosa*, were not used as a means of evaluating the strengths and weaknesses associated with alternative stock structure proposals in U.S. waters. For example, Bentzen *et al.* (2012) reported strong evidence of stock structure for alewife in Canadian waters (Figure 4; NMFS 2012b). This observation could be used to strengthen the argument that stock structure for alewife in U.S. waters might be evident at similar geographical

spatial scales (notwithstanding the greater physical structure and complexity of the Canadian coastline).

Perhaps more importantly, however, is the absence of discussion or presentation of range-wide data on *Alosa sapidissima* (American shad). Given the comparative lack of data on *A. pseudoharengus* and *A. aestivalis*, there is ample and strong justification for considering data for a closely related species – in this case, a member of the same genus – in the assessment of stock structure for river herring.

In this regard, one relevant populations genetics study is that undertaken by Hasselman *et al.* (2010). Based on analyses of 13 microsatellite loci, they reported significant and temporally stable genetic differences in shad among 12 drainages. They also reported a significant pattern of isolation by distance among all drainages.

Based on his range-wide population genetic analysis of shad, Hasselman (2010) concluded that the latitude of 40 degrees (roughly Atlantic City, New Jersey) identified a significant geographically based 'breakpoint' that appeared to differentiate shad populations. This would correspond roughly to the proposed geographical boundary separating the alewife Southern New England and Mid-Atlantic stocks. Hasselman (2010) also reported a significant isolation-by-distance pattern in genetic variability among U.S. populations. Concordant with Bentzen *et al.*'s (2012) and Willis's (2012; PowerPoint presentation) conclusions regarding alewife, Hasselman (2010) concluded that the stocking of shad in U.S. waters might well be responsible for weakening signals of spatial genetic differentiation.

One potentially useful life history study in this regard (perhaps more so for blueback herring than alewife because of the former's greater range) is that undertaken by Leggett and Carscadden (1978). They documented significant differences in shad life history throughout the species geographical range from St. Johns River in the south to Miramichi River (New Brunswick) in the north (Table 1).

The 10 U.S. rivers included in Leggett and Carscadden's (1978) study are located in the proposed Southern and Mid-Atlantic stocks for blueback herring and the Mid-Atlantic and Southern New England stocks for alewife. With the exception of the Neuse River, the proposed blueback herring stock structure, based on microsatellite data, corresponds well with geographical differences in shad life history (Table 1). The correspondence between shad life history data and alewife stock structure is less definitive, ranging from being strong for 'relative fecundity', medium for '% repeat spawning', and negligible for male and female 'age at maturity' (Table 1).

7.2 Extinction Risk Analysis Working Group Report

The Extinction Risk Working Group Report (NMFS 2012a) raises the question as to what the population quasi-extinction thresholds ought to be for river herring. One might adopt absolute population sizes (as appears to have been done here, albeit with justification for the thresholds used). Alternatively, one might adopt thresholds that represent a percentage of B_0 or B_{MSY}.

Another alternative that could be considered is the potential utility of applying the IUCN's quantitative extinction criterion (Criterion E; IUCN 2010). This criterion stipulates extinction probabilities for Endangered and Threatened species. (These criteria are used not only by the IUCN, but by many national agencies responsible for assessing species' extinction risks, e.g., the Committee on the Status of Endangered Wildlife in Canada; www.cosewic.gc.ca.)

'Endangered' species are those for which there is an estimated 20% probability of extinction over the longer of 20 years or 5 generations (to a maximum of 100 years). 'Threatened' species are those for which there is an estimated 10% probability of extinction within 100 years. One strength to including these probabilities and associated timeframes is that they are widely used elsewhere.

As mentioned previously, the proposed extinction risk analyses could have drawn attention to the possibility of estimating population growth rates *sensu* Gibson and Myers (2003a,b). Or, if the working group members feel that such estimates are not obtainable, or that there are problems with the analyses undertaken by Gibson and Myers (2003a,b), it would be helpful to have these deficiencies explicitly acknowledged.

IV. CONCLUSIONS AND RECOMMENDATIONS

1. The best scientific information available is presented for the life history of river herring. Information on population dynamics is sparse. There is additional information on stock-recruitment dynamics for alewife that could be profitably incorporated in the Extinction Risk Analysis and Stock Structure Working Group Reports.

2. The genetics, physiological, behavioural, and/or morphological data presented in the Working Group Reports are likely to represent the best scientific information available.

3. The extinction risk analysis appears to not incorporate the best available scientific information. Consideration should be given to the utility of incorporating estimates of population growth rate derived from stock-recruitment relationships. Consideration should be given to providing scientifically legitimate and defensible extinction or quasi-extinction thresholds for the extinction risk analyses. Consideration should be given

to undertaking extinction probability analyses that would allow for assessment of the degree to which the IUCN's Criterion E might apply for Endangered or Threatened species.

4. Consideration should be given to the inclusion of landlocked alewives in the extinction risk analyses. Irrespective of NMFS's decision that the original petition pertains only to anadromous populations, the scientific issue at hand is whether landlocked alewives are likely, or not likely, to affect the persistence and extinction probability of anadromous forms.

5. Given the relative paucity of data related to stock structure for river herring in U.S. waters, it might be worthwhile to consider available information on stock structure in Canadian waters. It might also be worthwhile to consider life-history and other data for other species of the genus *Alosa* (notably American shad, *Alosa sapidissima*) as a means of evaluating the strengths and weaknesses associated with alternative stock structure proposals for river herring in U.S. waters.

Table 1. Life-history data for river populations of American shad, in accordance with proposed regional stock structure for blueback herring and alewife (data from Leggett and Carscadden 1978).

River	Proposed blueback herring stock	Proposed alewife stock	% Repeat spawning	Relative fecundity	Male age at maturity (yrs)	Female age at maturity (yrs)
St. Johns	Southern	not applicable	0	high	3.8	4.2
Ogeechee	Southern	not applicable	0			
Edisto	Southern	not applicable	0			
Neuse	Mid-Atlantic	not applicable	5			
James	Mid-Atlantic	Mid-Atlantic	28			
York	Mid-Atlantic	Mid-Atlantic	24	medium	4.2	4.7
Potomac	Mid-Atlantic	Mid-Atlantic	20			
Susquehanna	Mid-Atlantic	Southern New England	37			
Hudson	Mid-Atlantic	Southern New England	57	low		
Connecticut	Mid-Atlantic	Southern New England	51	low	4.1	4.8

BIBLIOGRAPHY OF MATERIALS REVIEWED

2012 River Herring Working Groups Goals, Agenda, & Notes for Stock Structure. Meeting June 20-22, 2012. NMFS Northeast Regional Office, Gloucester, MA. 101p.

Anon. 2012a. Appendix A. Expert opinions from the river herring stock structure workshop. June 20-22, 2012. 23p.

Anon. 2012b. Appendix B. Updated Palkovacs *et al.* alewife stock complexes. 2p.

Bentzen, P., Paterson, I., M. McBride, and T. Willis. 2012. Genetic analysis of anadromous alewife populations in Maine. Marine Gene Probe Laboratory, Halifax, Canada.

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NMFS. 2012a. River Herring Extinction Risk Analysis Working Group Report. Report to the National Marine Fisheries Service, Northeast Regional Office. August 13, 2012. 40 p.

NMFS. 2012b. River Herring Stock Structure Working Group Report. Report to the National Marine Fisheries Service, Northeast Regional Office. August 13, 2012, 60pp.

PowerPoint PDF Presentations by the following individuals:
Extinction Risk Workshop: Kirsten Curti, Gary Nelson, John Sweka, Katie Drew, Kimberly Damon-Randall, Marta Nammack, Matt Cieri
Stock Structure Workshop: Michael Armstrong, Paul Bentzen, Matt Cieri, Eric Palkovacs and Stephen Gephard, Adrian Jordaan, Dan Kircheis, John Kocik, Tara Trinko Lake, Marta Nammack, Kevin Sullivan, Theodore Willis, Daniel Zapf and Roger Rulifson.

Supplementary materials to the extinction risk analysis working group report for CIE peer review. 2012. 11p.

Sweka, J. *et al.* 2012. 2012 River Herring Stock Assessment. Atlantic States Marine Fisheries Commission.

APPENDIX 1:
BIBLIOGRAPHY OF MATERIALS PROVIDED FOR REVIEW

2012 River Herring Working Groups Goals, Agenda, & Notes for Stock Structure. Meeting June 20-22, 2012. NMFS Northeast Regional Office, Gloucester, MA. 101p.

Appendix A. Expert opinions from the river herring stock structure workshop. June 20-22, 2012. 23p.

Appendix B. Updated Palkovacs et al. alewife stock complexes. 2p.

Bentzen, P., Paterson, I.G., McBride, M., and T. Willis. 2012. Genetic analysis of anadromous alewife populations in Maine. May 2012. 8p.

NMFS. 2012a. River Herring Extinction Risk Analysis Working Group Report. Report to the National Marine Fisheries Service, Northeast Regional Office. August 13, 2012. 40 p.

NMFS. 2012b. River Herring Stock Structure Working Group Report. Report to the National Marine Fisheries Service, Northeast Regional Office. August 13, 2012, 60pp.

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Sweka, J. *et al.* 2012. 2012 River Herring Stock Assessment. Atlantic States Marine Fisheries Commission.

APPENDIX 2:
STATEMENT OF WORK FOR DR. JEFFREY HUTCHINGS

Attachment A: Statement of Work for Dr. Jeffrey Hutchings

External Independent Peer Review by the Center for Independent Experts

River Herring (Alewife and Blueback Herring)
Stock Structure and Extinction Risk Analysis

Scope of Work and CIE Process: The National Marine Fisheries Service's (NMFS) Office of Science and Technology coordinates and manages a contract providing external expertise through the Center for Independent Experts (CIE) to conduct independent peer reviews of NMFS scientific projects. The Statement of Work (SoW) described herein was established by the NMFS Project Contact and Contracting Officer's Technical Representative (COTR), and reviewed by CIE for compliance with their policy for providing independent expertise that can provide impartial and independent peer review without conflicts of interest. CIE reviewers are selected by the CIE Steering Committee and CIE Coordination Team to conduct the independent peer review of NMFS science in compliance the predetermined Terms of Reference (ToRs) of the peer review. Each CIE reviewer is contracted to deliver an independent peer review report to be approved by the CIE Steering Committee and the report is to be formatted with content requirements as specified in **Annex 1**. This SoW describes the work tasks and deliverables of the CIE reviewer for conducting an independent peer review of the following NMFS project. Further information on the CIE process can be obtained from www.ciereviews.org.

Project Description: NOAA's National Marine Fisheries Service (NMFS) was petitioned to list alewife (*Alosa pseudoharengus*) and blueback herring (*Alosa aestivalis*), collectively referred to as river herring, under the Endangered Species Act (ESA) on August 5, 2011. NMFS reviewed the petition and published a positive 90-day finding determining that the information in the petition, coupled with information otherwise available to the agency, indicated that the petitioned action may be warranted. As a result of the positive finding, the agency is required to review the status of the species to determine if listing under the ESA is warranted. River herring are commercially important US-Canada transboundary species that have an expansive coast-wide range; therefore, determinations from this process have the potential to be highly controversial.

Approximately three years ago, the Atlantic States Marine Fisheries Commission (ASMFC) technical committee began working on a river herring stock assessment. The ASMFC is scheduled to complete the assessment in May 2012. NMFS is collaborating with ASMFC on this effort and intends to use

the information in the stock assessment as a primary source of information in making the 12-month listing determination. Because the stock assessment does not contain all elements needed to make a listing determination under the ESA, NMFS has identified the missing required elements and intends to hold specific workshops focused on addressing these information gaps. Two of the workshops organized for this purpose will address River Herring Stock Structure and Extinction Risk Analysis, and reports from each workshop will be compiled this summer.

The extinction risk and stock structure meetings will bring together appropriate scientists to discuss the available information and perform the necessary analyses. The invited participants for these meetings will not come to a consensus; rather, they will provide their individual expert opinions related to stock structure and various methods to determine extinction risk of these two species. NMFS will take this information as compiled in the reports and determine which extinction risk method and stock structure analysis will best inform the listing determination. These reports will not contain any listing advice or reach any ESA listing conclusions – such synthesis and analysis is solely within the agency's purview. NMFS will use these reports along with the ASMFC river herring stock assessment to develop an ESA listing determination and is required to publish its finding in the *Federal Register* on or before August 5, 2012 (within 12 months of receiving the petition).

Given the significant public interest in river herring, it will be critical for NMFS to obtain a transparent and independent review of the associated meeting reports. The information and analysis in these reports will likely contain essential factual elements upon which the agency may base its ESA listing determination. Accordingly, it is critical that these reports contain the best available information on the stock structure and extinction risk of the species, and that all scientific findings be both reasonable and supported by valid information contained in the documents. Therefore, we seek a CIE review of the scientific information in the workshop reports on river herring based on the Terms of Reference (ToRs) to be developed. The CIE reviewers will help to ensure an independent, scientific review of information for a management process that is very public and is likely to be highly controversial no matter what NMFS' listing decision is. The Terms of Reference (ToRs) of the peer review are attached in **Annex 2**.

Requirements for CIE Reviewers: Three CIE reviewers shall conduct an impartial and independent peer review in accordance with the SoW and ToRs herein. CIE reviewers shall have combined working knowledge and recent experience in one or all of the following: 1) fisheries population dynamics, expertise in stock assessment and life history of anadromous species; and/or 2) expertise in extinction risk analysis and population modeling; and/or 3) expertise in stock structure and genetics analysis. It is desirable that the extinction risk analysis expertise be familiar with applications in fisheries, particularly

anadromous species. Each CIE reviewer's duties shall not exceed a maximum of 10 days to complete all work tasks of the peer review described herein.

Location of Peer Review: Each CIE reviewer shall conduct an independent peer review as a desk review, therefore no travel is required.

Statement of Tasks: Each CIE reviewers shall complete the following tasks in accordance with the SoW and Schedule of Milestones and Deliverables herein.

Prior to the Peer Review: Upon completion of the CIE reviewer selection by the CIE Steering Committee, the CIE shall provide the CIE reviewer information (full name, title, affiliation, country, address, email) to the COTR, who forwards this information to the NMFS Project Contact no later than the date specified in the Schedule of Milestones and Deliverables. The CIE is responsible for providing the SoW and ToRs to the CIE reviewers. The NMFS Project Contact is responsible for providing the CIE reviewers with the background documents, reports, and other pertinent information. Any changes to the SoW or ToRs must be made through the COTR prior to the commencement of the peer review.

Pre-review Background Documents: Two weeks before the peer review, the NMFS Project Contact will send (by electronic mail or make available at an FTP site) to the CIE reviewers the necessary background information and reports for the peer review. In the case where the documents need to be mailed, the NMFS Project Contact will consult with the CIE Lead Coordinator on where to send documents. CIE reviewers are responsible only for the pre-review documents that are delivered to the reviewer in accordance to the SoW scheduled deadlines specified herein. The CIE reviewers shall read all documents in preparation for the peer review.

Desk Review: Each CIE reviewer shall conduct the independent peer review in accordance with the SoW and ToRs, and shall not serve in any other role unless specified herein. **Modifications to the SoW and ToRs can not be made during the peer review, and any SoW or ToRs modifications prior to the peer review shall be approved by the COTR and CIE Lead Coordinator.** The CIE Lead Coordinator can contact the Project Contact to confirm any peer review arrangements.

Contract Deliverables - Independent CIE Peer Review Reports: Each CIE reviewer shall complete an independent peer review report in accordance with the SoW. Each CIE reviewer shall complete the independent peer review according to required format and content as described in Annex 1. Each CIE reviewer shall complete the independent peer review addressing each ToR as described in Annex 2.

Specific Tasks for CIE Reviewers: The following chronological list of tasks shall be completed by each CIE reviewer in a timely manner as specified in the **Schedule of Milestones and Deliverables**.

1) Conduct necessary pre-review preparations, including the review of background material and reports provided by the NMFS Project Contact in advance of the peer review.
2) Conduct an independent peer review in accordance with the ToRs (**Annex 2**).
3) No later than 4 September 2012, each CIE reviewer shall submit an independent peer review report addressed to the "Center for Independent Experts," and sent to Mr. Manoj Shivlani, CIE Lead Coordinator, via email to shivlanim@bellsouth.net, and CIE Regional Coordinator, via email to Dr. David Sampson david.sampson@oregonstate.edu. Each CIE report shall be written using the format and content requirements specified in Annex 1, and address each ToR in **Annex 2**.

Schedule of Milestones and Deliverables: CIE shall complete the tasks and deliverables described in this SoW in accordance with the following schedule.

9 August 2012	CIE sends reviewer contact information to the COTR, who then sends this to the NMFS Project Contact.
13 August 2012	NMFS Project Contact sends the stock assessment report and background documents to the CIE reviewers. Background documents may be sent to the CIE reviewers one week earlier.
20 August – 2 September 2012	Each reviewer conducts an independent peer review as a desk review.
4 September 2012	CIE reviewers submit draft CIE independent peer review reports to the CIE Lead Coordinator and CIE Regional Coordinator.
18 September 2012	CIE submits the CIE independent peer review reports to the COTR.
25 September 2012	The COTR distributes the final CIE reports to the NMFS Project Contact and regional Center Director.

Modifications to the Statement of Work: This 'Time and Materials' task order may require an update or modification due to possible changes to the terms of reference or schedule of milestones resulting from the fishery management decision process of the NOAA Leadership, Fishery Management Council, and Council's SSC advisory committee. A request to modify this SoW must be approved by the Contracting Officer at least 15 working days prior to making any permanent changes. The Contracting Officer will notify the COTR within 10

working days after receipt of all required information of the decision on changes. The COTR can approve changes to the milestone dates, list of pre-review documents, and ToRs within the SoW as long as the role and ability of the CIE reviewers to complete the deliverable in accordance with the SoW is not adversely impacted. The SoW and ToRs shall not be changed once the peer review has begun.

Acceptance of Deliverables: Upon review and acceptance of the CIE independent peer review reports by the CIE Lead Coordinator, Regional Coordinator, and Steering Committee, these reports shall be sent to the COTR for final approval as contract deliverables based on compliance with the SoW and ToRs. As specified in the Schedule of Milestones and Deliverables, the CIE shall send via e-mail the contract deliverables (CIE independent peer review reports) to the COTR (William Michaels, via William.Michaels@noaa.gov).

Support Personnel:

William Michaels, Program Manager, COTR
NMFS Office of Science and Technology
1315 East West Hwy, SSMC3, F/ST4, Silver Spring, MD 20910
William.Michaels@noaa.gov Phone: 301-427-8155

Manoj Shivlani, CIE Lead Coordinator
Northern Taiga Ventures, Inc.
10600 SW 131st Court, Miami, FL 33186
shivlanim@bellsouth.net Phone: 305-383-4229

Roger W. Peretti, Executive Vice President
Northern Taiga Ventures, Inc. (NTVI)
22375 Broderick Drive, Suite 215, Sterling, VA 20166
RPerretti@ntvifederal.com Phone: 571-223-7717

Key Personnel:

NMFS Project Contact:

Kimberly Damon-Randall
NOAA Fisheries, Northeast Regional Office
55 Great Republic Drive
Gloucester, MA 01930
Email: Kimberly.Damon-Randall@noaa.gov Phone: (978) 282-8485

Annex 1: Format and Contents of CIE Independent Peer Review Report

1. The CIE independent report shall be prefaced with an Executive Summary providing a concise summary of the findings and recommendations, and specify whether the science reviewed is the best scientific information available.

2. The main body of the reviewer report shall consist of a Background, Description of the Individual Reviewer's Role in the Review Activities, Summary of Findings for each ToR in which the weaknesses and strengths are described, and Conclusions and Recommendations in accordance with the ToRs.

3. The reviewer report shall include the following appendices:

   Appendix 1: Bibliography of materials provided for review
   Appendix 2: A copy of the CIE Statement of Work

Annex 2: Terms of Reference for the Peer Review

River Herring (Alewife and Blueback Herring)
Stock Structure and Extinction Risk Analysis

Provide a scientific peer review of Stock Structure and Extinction Risk Analysis reports on river herring (alewife and blueback herring) in accordance to the following terms of reference:

1. Is the information regarding the life history and population dynamics of the species the best scientific information available? If not, please indicate what information is missing and if possible, provide sources.
2. Does the information on river herring genetics, physiological, behavioral, and/or morphological variation presented for the species' range represent the best scientific information available? If not, please indicate what information is missing and if possible, provide sources.
3. Based on the scientific information presented, are the conclusions regarding species, subspecies, or distinct population segment delineations supported by the information presented? If not, please indicate what scientific information is missing and if possible, provide sources.
4. Based on the scientific information presented in the extinction risk analysis report, does this analysis consider all of the best available data and are the conclusions appropriate and scientifically sound? If not, please indicate what information is missing and if possible, provide sources.
5. In general, are the scientific conclusions in the reports sound and interpreted appropriately from the information? If not, please indicate why not and if possible, provide sources of information on which to rely.
6. Where available, are opposing scientific studies or theories acknowledged and discussed? If not, please indicate why not and if possible, provide sources of information on which to rely.
7. In general, is the best scientific and commercial data available for the stock structure and extinction risk analysis of river herring presented in the reports? If not, please indicate or provide sources of information on which to rely.