

**National Fish, Wildlife, and Plants Climate Adaptation Strategy
Peer Review Panel**

September – November 2011

Peer Reviewers

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Comment	Peer Reviewer	Location in Document	Comment (minor edits and tracked changes are not included)	Response
1	Latham	Introduction	Consider including an explicit example of the impacts of climate change in the introduction to emphasize the importance of addressing climate change (it would be consistent with Table 1). The inset examples are good and would be even better if the reader was introduced to the connections early on. For example, a diagram similar to one of those presented in "Major Impacts: Climate Change" (2007) would be helpful to illustrate the process/results of reduced precipitation -> less streamflow -> saltwater intrusion -> altered physical habitat for fish -> less forage habitat, fewer reproductive opportunities. While plants are listed in the title, the effects of climate change on vegetation don't appear to be part of the document. Finally, ecosystem services are referenced briefly, but not tied to climate change and habitat.	Additional examples added throughout document.
2	Latham	Introduction	The goals listed are good and clear and the best part of the document. Consider focusing more on them in the introduction. Again, the importance of the actions should be emphasized more in the introduction.	Goals were emphasized in introduction.
3	Brinkman	Chapter 1	I suggest distinguishing between weather and climate early in the report (A short paragraph should suffice). I think it is important to note that a few very cold years will not reverse the long-term climate impacts we are seeing. Annual variability dominates trends in weather patterns on short time scales (less than a couple decades), however, climate dominates long-term patterns (multi-decadal). This issue is often an obstacle when engaging the public (Guiding principle # 7) on complicated climate patterns. It is important to note that small changes in mean values have significant impacts despite large fluctuations in annual values. Also, the document needs to be careful about contributing short-term variability in the weather to climate change.	Comment considered but topic is outside the scope of this report.
4	Latham	Chapter 1	Climate change is well documented and the authors might consider making a stronger statement, earlier, regarding this fact. [Chapter 1] indicate[s] there is much literature on these "topics" but seems to fall short of stating (and citing) the fact that climate change is real and is directly impacting fish, wildlife, and plants, and exacerbating previous impacts. The authors should be explicit about how the Strategy is different from the existing climate change documents, e.g. MEA, IPCC, Compass.	Change considered but this point is already made strongly in the document.
5	Latham	Chapter 1	Consider incorporating executive summary and conclusions sections. The message could be more concisely presented this way. "Inspiration and enabling" [Chapter 1] are not clear goals - but the developing and presenting clear actions that can be implemented to reduce the impacts of climate change on fish, wildlife, and plants is. "The strategy focuses on preparing for and reducing....", but the Strategy actually focuses on goals and actions for preparing and reducing...". One of the documents cited in the Strategy (MEA 2005) included a list of "messages" that were very effective as an executive summary.	An Executive Summary section was added and language was clarified.
6	Latham	Chapter 1	It seems like the authors [in the introduction] were avoiding some sort of confrontation with the <1% of scientists who question the influence of human development on climate change. NPR reported that the U.S. is the only developed nation in which climate change is still disputed.	Language was clarified.
7	Brinkman	Chapter 2	[A]void reporting a single value for future projections, especially out to 2100. Temperature projections for Arctic tundra in 2100 (http://www.snap.uaf.edu/ accessed Nov. 2011), will increase anywhere from 13 to 26°F (±6) depending on which emission scenario is used.	Addressed and temperature ranges provided.
8	Brinkman	Chapter 2	A recent study by Mack et al. (2011) in Nature reported that the largest tundra fire in recorded history occurred in 2007 releasing approximately as much carbon into the atmosphere as the tundra has stored in the previous 50 years. In other words, the amount of carbon released by one fire was equivalent to the amount of carbon stored by the global tundra biome. Also, Hu et al. (2010) published a nice paper on tundra fire, climate change, and sea ice retreat.	Addressed and text added.
9	Brinkman	Chapter 2	Explicitly state assumptions (Again, a short paragraph should suffice). Because future trends in fossil fuel use and human activities are uncertain, the document may be improved by explicitly stating key assumptions and extending on current explanations of how predictions were derived. Section 2.1 may be a good place for this. For instance, most of the quantitative predictions in this document probably used IPCC climate models (or something like it) based on a range of greenhouse gas emission scenarios (e.g., A1B, A2,...) (IPCC 2007). Each scenario has important assumptions.	Language in the Preface added to clarify assumptions.

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10	Brinkman	Chapter 2	Include uncertainty when reporting future projection values when possible. Because of the uncertainty associated with scientific predictions, reporting a range of values is ALWAYS better than reporting a single value, especially if projecting out to 2100. Reporting a single value gives a false sense of confidence. Also, it may be beneficial to the overarching argument for action to note that predictions classified as extreme a decade ago are now considered more likely and even conservative (Nakicenovic et al. 2001, Raupach et al. 2007).	Ranges of uncertainty have been included.
11	Brinkman	Chapter 2	Scientific data on the vulnerability of terrestrial mammals, especially game species, was limited compared to birds and aquatic species. Because of the importance and how effective hunting organizations (e.g., Rocky Mountain Elk Foundation) have been in habitat conservation, the report may engage more of this group by including a few game-species specific examples of the effects of climate change. Here are some well-studied mammal and game species examples to consider that will provide more balance to the document: pika (Ray et al. 2012) wolverines (Schwartz et al. 2009), moose (Murray et al. 2009), mountain sheep (Epps et al. 2004). A feral hog (Cambell et al. 2009) inset may be useful on page 67.	Additional examples were included.
12	Brinkman	Chapter 2	The document could be improved by being more spatially explicit when discussing changes in climate variable.	Comment considered and changes made where possible -- as this is a national document too much specificity is not possible.
13	Brinkman	Chapter 2	The document needs to be careful about excessive speculation in general. The paper cited (Martin et al. 2009) which also says that increased temperatures and longer open-water and growing seasons could increase invertebrate abundance (Martin et al. 2009, page 68). Relating to my comment above II.2.4, excessive pessimistic speculation without experimental data may be interpreted by some as dramatization or even "fear mongering" and will certainly reduce the credibility and impact of this document.	Comment was considered and addressed.
14	Brinkman	Chapter 2	there are many broad and qualifying statements (e.g., will change, will strain, will have an impact, will cause, will experience, will lead to) without citations or concrete examples. Consider adding a few well-cited examples (quantitative examples if possible to increase validity) of how changes in sectors will impact fish, wildlife and plants. Much of Chapters 2-4 recap key messages of the GCCIOUS (2009). I think they could be improved significantly by shifting more focus to fish, wildlife, and plants. I am not suggesting species-specific strategies. I am suggesting species specific examples to help qualify the document's statements.	Additional examples were included.
15	Brinkman	Chapter 2	Using vague statements, speculative examples, or coincidental correlation weakens the documents argument. Perhaps, a future speculation paragraph may be a valuable addition in each section. I suggest that you separate speculative reasoning from findings supported by experimental data that have been exposed to a rigorous peer-review process. The National Climate Assessments are very careful about the language used to express considered judgment. I suggest that this document give special attention to qualifying statements unaccompanied by data.	The final Strategy contains many concrete examples of climate change impacts, affects, and responses both in case study boxes and through the document text. General statements regarding climate change are also found, however, all major statements are supported by the literature.
16	Brinkman	Chapter 2	We simply do not have enough data to say whether insects activity will increase or decrease in future years. And if it does change, we do not have the information to say whether the extent of change will affect birds.	Language revised.
17	Brinkman	Chapter 2	When scientific data was used, I found it to be the best available. There are a few places where citations could be updated. Scientific information was limited in chapter 3 and 4. There are some speculations based on weak reasoning. For example, the following logic was used frequently: warming causes "A". "A" may be bad for species "B". Therefore, warming is bad for species "B". This is a dangerous given the uncertainty of climate change, the complexity of ecological systems, the adaptive capacity of individual species, and potential for negative feedbacks. Relating to my comment above (II.2.4), I urge the authors to focus on what we do know, and try to limit excessive speculation or qualifying statements. I comment on certain instances of this by location in Table 1.	Specific examples were addressed and citations were updated.

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18	Kennedy	Chapter 2	[G]lobal changes in temperature will affect the atmosphere and winds, which will affect water circulation patterns. This is mentioned in the Marine section but not in the other two aquatic sections. Water circulation plays a vital role in transport of invertebrate and fish larvae, nutrients, dissolved oxygen, etc. in the Coastal as well as the Marine ecosystems, and perhaps also in the larger Great Lakes (not my area of expertise).	Addressed and text added.
19	Kennedy	Chapter 2	Nowhere is there any reference to changes in atmospheric weather patterns. Such patterns will result in changes to water circulation patterns in coastal and marine systems. For example, wind-driven circulation patterns have been implicated in transport of invertebrate (blue crab) and fish larvae into estuaries in the mid-Atlantic Bight. Changes in these transport systems may radically affect population dynamics of circulation-dependent species, many of which have commercial as well as ecological importance.	Additional language on weather and circulation patterns added.
20	Kennedy	Chapter 2	Under Changing precipitation patterns, seacoast Coastal systems will experience changes in salinity, nutrient, and sediment flow and new productivity patterns just as predicted for Marine systems, so that should be indicated in the Coastal box. In addition, freshwater input to estuaries will result periodically in stratified conditions leading to increased bottom hypoxia and anoxia.	Addressed and text added.
21	Kennedy	Chapter 2	Under Drying conditions/drought, seacoast Coastal systems will experience changes in nutrient and sediment flow and new productivity patterns just as predicted for Marine systems, so that should be indicated in the Coastal box.	Addressed and text added.
22	Kennedy	Chapter 2	Under Increase in atmospheric CO ₂ , such an increase will result in more CO ₂ dissolved in the water, affecting phytoplankton production and perhaps phytoplankton species assemblages in Inland Water, Coastal, and Marine systems (for example, see U. Riebesell. 2004. Effects of CO ₂ Enrichment on Marine Phytoplankton. Journal of Oceanography 60:719-729 as well as the Gulf of Maine report by Nye 2010 cited in this Agency Review). Production of underwater grasses should also be affected. Presumably there would also be increased productivity of emergent plants in Inland Water as well as seaweeds (not thought of as emergent plants) on Coastal shores (note however that the paper by Harley et al. 2006 cited in the Agency Review suggests that seaweeds may in some instances be replaced by seagrasses).	Considered but no change made, details are outside the scope of the document.
23	Kennedy	Chapter 2	Under More extreme rain/weather events, Coastal systems may experience storm damage to aquaculture facilities that are currently increasing in number and size. Increased rainfall events from hurricanes and tropical storms can also have the same effect as described in the "changing precipitation patterns" paragraph.	Addressed and text added.
24	Latham	Chapter 2	Consider integrating the following impacts reduced connectivity among habitats due to loss of stream corridors, reduced carbon sequestration, reduced aquifer recharge and base flows to streams, reduced water quality, reduced water availability, increased expansion of non-native and invasive species, altered fish migration and reproduction patterns, altered nutrient patterns, exposed or reduced snag habitats, altered plant distributions and resulting habitat alterations.	Some additional examples included.
25	Latham	Chapter 2	Most importantly (within the context of this document, inland waters ARE the connectivity that provide the opportunities for travel corridors for fish and wildlife, while vegetation along these corridors provide forage, habitat, shelter for those same species. Line 297. Add small section on importance of inland waters and what their loss due to impacts of climate change could be. Sea level rise and loss of Everglades, reduced stream flows and increased salt water intrusion, greater runoff and poor water quality/loss of seagrasses, reduced recharge and lower lake levels. Explanation of impacts to flora and fauna should follow, e.g. exposed habitat, dry wetlands, invasion/replacement by upland species, changes in fire regime, higher salinity, soil moisture, evapotranspiration, and runoff, water balances, affect spawning, larval development, growth and reproduction. Consider providing brief explanation and then referencing reader to something like the IPCC (2008) and the ICCATF (2011) for specific impacts to inland waters. Coastal Louisiana would also provide a good example of changes to freshwater inland systems. Carbon sequestration is referenced under Forest ecosystems, but not inland waters – MEA (2005) write: "although covering only an estimated 3–4% of the world's land area, peatlands are estimated to hold 540 gigatons of carbon, representing about 1.5% of the total estimated global carbon storage and about 25–30% of that contained in terrestrial vegetation and soils."	The text has been modified to briefly address this comment. Additional information is outside the scope of this document.

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26	Latham	Chapter 2	The information presented in the document is relevant and substantiated and support the coals and strategies presented. Table 1 is exactly what is needed and could be expanded. Some of the text would benefit from simply carrying the example or thought all the way through.	Table 1 was expanded.
27	Waring	Chapter 2	"oxygen production" There is no net oxygen production by terrestrial ecosystems. Respiration rates takes the oxygen produced in photosynthesis and return it to the atmosphere as carbon dioxide. The O2 in the atm. is a product of billions of years of burial of unoxidied organic matter converted to limestone and other sedimentary rocks. Although it is often stated that terrestrial vegetation affects atmospheric O2, some simple calculations show this is not so (p. 267, from Waring and Schlesinger 1985. Forest Ecoystems: Concepts and Management. Academic Press.	Comment considered and some revisions made to the language to clarify.
28	Waring	Chapter 2	Much of the variation in the CO2 effect on above-ground growth is attributed to shifts in allocation of photosynthate belowground to roots and root exudates if nitrogen and other nutrients are limiting. Johnsen, K., C. Maier, F. Sanchez, P. Anderson, J. Butnor, R. Waring, and S. Linder. 2007. Physiological girdling of pine trees via phloem chilling: proof of concept. Plant, Cell & Environment 30: 128-134. Also see Butnor et al. 2003 Global Change Biology 9:849-861.	Comment considered but topic is outside the scope of this report.
29	Waring	Chapter 2	The tables are o.k., but I doubt many people will read them.	No action needed.
30	Brinkman	Chapter 3	Although the document acknowledges that goals were developed collectively by a diverse group of experts, the criteria, indicators, and selection process was not discussed.	Comment considered but no change made.
31	Brinkman	Chapter 3	Ecosystem-specific actions may not be needed in chapter 3 because the appendices do a better job of organizing this information. Also, if the authors are would like to reduce length, I suggest eliminating ecosystem specific actions from chapter 4 and listing pertinent subsections parenthetically.	Ecosystem-specific actions were consolidated and removed into separate appendices.
32	Brinkman	Chapter 3	I'm uncomfortable with goal 7. Non-climatic stressors are endless. The climate adaptation strategy will have a better chance of staying on course if the focus is on climate and only non-climatic stressors that strongly link with and exacerbate climate-related factors. I suggest rewording this goal. As written, it has too much breadth and not enough depth.	Comment considered. Non-climate stressors are important to consider not only because they are some of the things decision makers can control, they are also likely to interact with climate change to magnify negative impacts on fish, wildlife, and plants.
33	Brinkman	Chapter 3	Many of the ecosystem-specific actions are not ecosystem specific and could be applied anywhere. Some example of general statements that could be applied to any system are: (1.1.7) "assess ... for value in protecting against and/or building resilience to climate change..."; (1.2.9) "incorporate climate change into land acquisition plan"; (1.2.10) "capitalize on unique opportunities and funding sources"; (3.1.8) "increase scientific capacity"; (3.1.10) "evaluate the effectiveness of adaptation strategies...". Many of the ecosystem specific actions could be interpreted as overly broad or vague talking points rather than specific actions, which contribute to my concern above (II.1.1). Because I am unaware of the details on how actions were identified, I am hesitant to offer specifics as to how to revise. My general suggestion is to search for significant overlap between actions and attempt to merge (e.g., 2.3.3 & 2.1.6).	Ecosystem-specific actions were consolidated and removed into separate appendices.
34	Brinkman	Chapter 3	Within some ecosystem-specific sections, the changes discussed are not ecosystem specific and could apply to any ecosystem. For example, a statement like "stream changes prevent fish passage" is an issue in all ecosystems and there is no evidence this will be an important issue in Arctic tundra.	Ecosystem-specific actions were consolidated and removed into separate appendices.
35	Waring	Chapter 3	Add Examples of success in accommodating major changes in a species' distribution, or having models illustrate that successfully predict what can be easily observed from satellites (i.e. wild fires associated with climatic variation, floods, major outbreaks of insects, conversion of forests to grasslands or shrub cover since 1975.	Comment considered but additional examples were outside the scope of this report.
36	Waring	Chapter 3	The conservation goals and actions are clearly outlined but many are unrealistic; we need to show some ability to predict correctly what is happening now before assuming forecasts are reasonable.	No action needed.

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37	Brinkman	General	Clearly distinguish and link climatic and non-climate stressors throughout the document. These drivers are often haphazardly mixed. Although they may be additive, many of the non-climatic stressors have been conservation issues for long before rapid climate change was on our radar (As mentioned in section 2.2, line 439. I thought that disproportionate attention given to non-climatic stressors results in digression from the intentions of the document. I suggest that when non-climatic stressors are discussed, they be linked to climate change. If they cannot, I would consider removing them. All conservations programs continually strive to do a better job to address ongoing issues such as habitat fragmentation and invasive species, which brings into question the appropriateness of climate adaptation strategy goal seven. To scientists and managers already doing their best every day to improve on this, it just says "try harder".	Issue clarified in final document.
38	Brinkman	General	I suggest that the document avoids the use of examples without clear cause and effect relationships.	Examples and case studies reflect current state of knowledge regarding potential impacts of climate change on fish, wildlife and plant populations.
39	Brinkman	General	I think the document does "enable" by providing an agreed upon path. There is no assurance that the path is the right one, but that is where adaptive management comes in to correct it.	No action needed.
40	Brinkman	General	Much of the document presented information on the harmful consequences of climate change. Staying positive is often the best way to inspire others. Therefore, the audience may be more inspired by: 1) examples of successful adaptation to climate change; 2) giving more attention to beneficial opportunities that climate change presents; or 3) simply expressing that an effective strategy is feasible. Perhaps these inspirational moments could be appropriately placed as inset boxes throughout the document. Personally, I thought the document was more depressing than inspirational. Nearly all speculative statements took a pessimistic approach, even when existing data tells us that we really do not know if changes will help or hinder the current situation.	Examples of successful actions and potential beneficial opportunities were included.
41	Brinkman	General	Please consider putting more effort into making the report more concise. This document can be shortened without losing important information. Repetition of statements and calls for action (especially National Actions and Ecosystem Specific Actions) within and among chapters and appendices will reduce the likelihood that intended audiences will read this report in "entirety" (line 38, page 3; line 76, page 78). For example, the draft requests more collaboration 15 times, more connectivity 34 times, more restoration of habitats 56 times, and notes that sea level has risen eight inches and ocean temperatures have risen 0.2 degrees in four places. Much of the information presented in section 2.1 repeats the bullets points in section 1.2.1 and the information provided in Table 1. Repetition is acceptable when used in different contexts to explain a different relationship; however, this was not the case in many parts of the document.	The final document was shortened and made more concise.
42	Brinkman	General	Provide concrete and well-supported examples. The specific fish and wildlife examples used to illustrate the extent of the impact of climate change need to be scientifically sound and have a clear cause and effect relationship. General statements such as "warming affects ecosystems" or "climate impacts fish, wildlife, and plants in different ways" do not contribute to the overall intentions of document.	The final Strategy contains many concrete examples of climate change impacts, affects, and responses both in case study boxes and through the document text. General statements regarding climate change are also found, however, all major statements are supported with valid references and most show a real world example.
43	Brinkman	General	The overall organization of the chapters of the document is clear and logical. Many of the insets (e.g., Jurisdiction of State, Tribal, and Federal Agencies) seem out of place or poorly connected to the body of text that they are embedded in. Consider including captions to explain the relevance to the section each is within.	Some insets have been relocated and rewritten. Captions and subheadings were included for clarity.
44	Brinkman	General	Throughout the document, there is inconsistent use of scientific names.	Addressed and scientific names added to Appendix.

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45	Brinkman	General	Try to make the document more concise.	The document was shortened and made more concise.
46	Kennedy	General	In terms of the science, the report is generally dependable with regard to Coastal and Marine systems. I've made some suggestions for more relevant papers that should be cited. I expect that the report will contribute importantly to action on the part of scientists, managers, and policy makers if they have an open mind about climate change. I am not trained as a conservation biologist, but the seven Goals seem reasonable. It is useful to provide the various actions in the Appendices as a summary for each ecosystem.	No action needed.
47	Kennedy	General	Overall, the document is arranged in a logical fashion. The three aquatic ecosystems include the Inland Waters, Coastal, and Marine ecosystems. A number of changes in their aquatic milieu due to temperature, CO2 concentrations, acidification, and air and water circulation patterns may have similar effects in all three ecosystems, even though each ecosystem will harbor different species of plants and animals with different physiologies for handling fresh or salt water. In the Draft at the moment, recommended actions that could apply to all the ecosystems or to two of the three are sometimes only applied to one, perhaps two. Climate change may affect temperature, CO2 concentrations, acidification, pH, phenology, and water circulation patterns in generally similar ways for all three systems, even though the plants and animals will be of different species and facing different stressors depending if they are in fresh or salt water.	Ecosystem-specific actions were consolidated and removed into separate appendices.
48	Latham	General	1.4 Some species are provided with their scientific names (e.g. bears), but not others (plants, e.g. line 429). The document appears to be somewhat fish-centric, and that is probably appropriate for the north latitudes – consider pointing that out to the reader.	Scientific names were added at the end of the document.
49	Latham	General	Conservation goals, and actions needed to attain goals are clearly outlined.	No action needed.
50	Latham	General	I think the Strategy is well organized and it is clear that a lot of effort went into compiling the document. Good idea to have the call for actions instead of spending what would be an enormous amount of time on climate change. There are several sections that would benefit from clarification and I have made numerous comments that I hope are helpful.	No action needed.
51	Latham	General	Importantly, the use of the word adaptation should be clarified (I don't think we're using the word adaptation for biological adaptation and the definition would benefit from an example). The Strategy lists goals and actions that, if implemented, may provide mechanisms by which to allow fish, wildlife, and plants to persist in the face of climate change. We cannot, obviously, "help" plants and animals develop adaptations (aka evolve) to climate change. The reference to adaptation is to our ability as a nation to impose policies, regulations, etc., that will help us, too, persist – this is not clear in the document.	Language added to address point and clarify this issue.
52	Latham	General	The document does not misinterpret important scientific data or draw errant conclusions from them. However, defining adaptation strategies of human invention need to be defined with respect to biological adaptation, as described in comments.	Adaptation was better defined and differentiated from biological adaptation.
53	Latham	General	The report uses the best scientific information available, but it could be stated more strongly.	No action needed.
54	Latham	General	Throughout: citations are not consistent - law journal footnoting included with standard scientific citations.	Citations have been standardized and corrected.
55	Waring	General	Might consider an eco-watch website or TV program that documents yearly changes in the pattern of disturbance, departures from average conditions, and shifts in the boundaries of major biomes.	Comment considered but no change made.
56	Waring	General	Restricting the analysis to the United States is highly artificial, as everything moves across borders. I don't know what you can do about this, other than admit it, and try to link to programs sponsored by NASA.	International issues were referenced, though the Strategy focuses on US species and habitats. Language was added to note this.
57	Waring	General	The document is a well-balanced presentation with excellent photographs and examples of on-going changes in different ecosystems. The recommendations reached in the document appear reasonable and well supported.	No action needed.

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58	Waring	General	The need to estimate funding levels is mentioned. I expect, however, that the cost of adaption and damage repair to ecosystems will be an order of magnitude above available funding. The public, and their representatives in Congress, need to see broad priorities listed and what can be accomplished in the next decade at three budget levels: current, minimum to be worthwhile, and what is really needed.	This suggestion was outside the scope of the project.
59	Waring	General	The vision might be more realistic if it recognized areas where change is predicted to be slow rather than extremely rapid.	Comment considered but no change made.
60	Waring	General	There is an unrealistic emphasis on ground-based monitoring. Satellites can provide coverage of changes in climatic conditions and record disturbance patterns. Models are available to predict changes, including that of invasive species. I suggest that more reliance be based on models to explain the reasons behind predicted changes and serve more as the basis for where and when to send out ground crews to confirm or reject the predictions than expanding monitoring networks.	Additional language around modeling was included.
61	Waring	General	To most people reading the document, they will be depressed with the magnitude of the well documented challenge.	Language was revised to address.