#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
1	56831	28	0	0	0	0	This chapter focuses slightly more on terrestrial and freshwater ecosystems then on marine ones. If the marine ecosystem is concerned the authors focus on the shelf or possibly upper slope system, but not on what is known of deep-sea systems. The benthos (the most heterogeneous marine ecosystem) is not referred to in detail compared to the pelagic environment. (Angelika Dr. Brandt, University of Hamburg)	Authors strive to achieve the balance between different natural and human systems to address essentially new findings in the recent (since 2007) publications under 25 page limit. Apparently, under such constrains not all matters could be addressed with the same and adequate level of detail.
2	57997	28	0	0	0	0	I suggest blending this into previous section on Infrastructure. This is all infrastructure. (Jennifer Francis, Rutgers University)	Comment seems to have no clear reference, but has been noted
3	58000	28	0	0	0	0	It seems there should be some discussion of projected security needs added to this section. (Jennifer Francis, Rutgers University)	Projected security needs are not included due to insufficient scientific literature linking this to climate change
4	58892	28	0	0	0	0	The chapter has given many interesting results and thoughts. I realize that all activity and life forms of Ch. 28-Polar regions are not really in the “polar regions”, but rather in a fringe around the polar regions, i.e. the lower latitudes of the Arctic and Antarctic. I realize that I have had an oversimplified view of poleward displacement of species as a result of climate change before I read this chapter. My general view has earlier been that poleward displacement of species should be accompanied by species extinctions at the extremes, i.e. species extinctions at the extreme warm end for the warmest-adapted species in the tropics, and species extinctions at the extreme cold end for the coldest-adapted species in polar regions. This view, I think, still holds for the tropics, but it is not correct for the polar regions, simply because of the extreme aridness in polar regions. In fact, it seems that there are hardly species at all near the poles, let’s say north and south of 80-85 degrees. This means that there will be no species extinctions at all in polar regions, only poleward displacement of species and species invasion of the regions. Am I right? If so, it would be interesting to give this consideration a couple of sentences in your chapter. (Svein Sundby, Institute of Marine Research)	This is not correct. One example is the polar bears, which are in danger because of the habitat loss. There are other examples as well. We changed the reference to refer to diversity in fish species rather than all species. For the Antarctic, both issues are covered where appropriate
5	58893	28	0	0	0	0	In the varous parts of the chapter there seems to be some degree of opposing views about how indigenous people will be able to handle climate change. Some places it seem to be the view that they are particularly vulnerable to climate change, other places they seem to be quite robust to climate change (Svein Sundby, Institute of Marine Research)	The author team appreciates this thoughtful comment. The seemingly opposing view reflects differences in vulnerability depending on whether we are looking at the past, current or future: Indigenous peoples have had a remarkable ability to adapt in the past, but questions are being raised about vulnerability and adaptability for the future. The ability of indigenous peoples to maintain traditional livelihoods is increasingly being threatened by the rate of climate change.
6	60219	28	0	0	0	0	This Chapter is well written and easy to read. (AUSTRALIA)	Acknowledged with appreciation
7	60220	28	0	0	0	0	More detail on the research and data gaps, and the priorities for significantly reducing uncertainty, is required in order to provide clear guidance to governments on what needs to be done in the future. (AUSTRALIA)	The Research and data gaps section has been significantly revised with more detail on research gaps.
8	60221	28	0	0	0	0	A more cohesive story of the impacts of climate change on these regions needs to be developed in Chapter 28. At present, much of the detail of change in the physical environment and in biota is referenced to other chapters and is not given any detail or understanding in this chapter. In the other chapters, the detail is insufficient to understand the change and how that might be important to the region. A coherent, but still concise, narrative needs to be developed that can be used by regional managers and governments. (AUSTRALIA)	Authors have strict page limits, and the general policy of IPCC is to make extensive use of cross referencing. This is why it is not always possible to tell the "whole story" at one place. Major edits were conducted to address this issue.
9	60222	28	0	0	0	0	Greater balance is needed between the two polar regions in detailing the impacts of climate change on biota, particularly marine mammals and birds; more consideration should be given to explaining how the responses of biota to climate change might be different or similar between the poles. (AUSTRALIA)	The differences and similarities between the two polar regions were not specifically addressed in this assessment report, partly because they have been analyzed in the previous two IPCC reports, but also due to strict page limits.
10	60446	28	0	0	0	0	Correct citation of SWIPA is: AMAP 2011. Snow, Ice, Water and Permafrsot in the Arctic (SWIPA); Climate Change and the Cryosphere. Arctic Monitoring and Assessment Programme (AMAP), Oslo, Norway. Xii+538 pp. Reference in text should be SWIPA (AMAP, 2011). (DENMARK)	Reference has been corrected
11	60462	28	0	0	0	0	Figures on undiscovered/undeveloped oil and gas resources in the Arctic mentioned in the chapter are inconsistent. (DENMARK)	Figures on oil and gas resources have been deleted

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
12	60466	28	0	0	0	0	Recognizing the importance of climate change impacts on traditional livelihood and indigenous peoples and communities in the Arctic, it is disappointing that the chapter does not attempt to also comprehensively addresss climate effect concerns and adaptation options for non-traditional indigenous communities/societies and for non-indigenous populations and inhabitants of the Arctic such as for instance the Faroese and the Icelandic populations. Given the rate of change in the Arctic and the many recognized second and higher order effects of climate change it is also somewhat surprising the the chapter does not attempt to address cumulative effects of climate change and the effects on human living conditions. (DENMARK)	This is acknowledged as a gap due to relatively small number of studies addressing the problem. We identify it as further research target in the "Research gaps" section of the chapter
13	62971	28	0	0	0	0	The chapter is well written but the organization is somewhat difficult. I don't find the text completely consistent with the titles of the sub chapters 28.2 Observed changes and Vulnerability under Multiple Stressors and 28.3 Key projected impacts and Vulnerabilities under Different Climate Pathways. More specifically, both sub chapters have information about observed changes and possible future changes. I choosen just one example (there are many): 28.2.2.1.1 Overview of Arctic marine plankton and fish is supposed to deal with observed changes and vulnability, but still in that text (p.13, line26-27) we find "there is low confidence that climate change will reduce the abundance of C. marshallae in the Bering Sea". This is a projected impact and should be in chap 28.3. In chap. 28.3 on the other hand, which is suppose to deal with projected impacts, we find (p.42, line 36-37) information about observed changes. Thus it is hard to see the difference between sub chapters 28.2 and 28.3 as it is written now. (Randi Ingvaldsen, Institute of Marine Research)	The text has been edited and efforts have been made to address the inconsistency.
14	63117	28	0	0	0	0	The chapter could be better organized as there is much repetition. Given that the chapter should focus on both impacts and adaptation, there is a lack of balance with respect to these two aspects (i.e. much more on impacts compared to adaptation). Progress has been made since TAR with respect to adaptation. In particular, there is greater acknowledgement that climate change needs to be considered in design of northern infrastructure and there is much effort to develop best practices etc. (certainly the case for Canada). This advance was highlighted in the permafrost chapter of SWIPA but does not come out clearly in this chapter (and should probably be a key finding in executive summary etc). (Sharon Smith, Geological Survey of Canada)	Efforts have been made to better balance the impact and adaptation parts of the text to the extent possible using available publications. Except for the infrastructure on permafrost, few adaptation practices have been developed and published for the polar regions.
15	63118	28	0	0	0	0	Regarding chapter organization - It is unclear why information in section 28.2.6.1 on Traditional Knowledge is not presented with information in sections 28.2.1 - 28.2.5 as these sections also provide evidence of observed changes in natural and human systems. It would be more effective to provide information on evidence/observation of changes acquired through scientific studies or TK together. This would provide a more focussed discussion with less repetition as well as demonstrate the importance of both scientific studies and TK in change detection. (Sharon Smith, Geological Survey of Canada)	Text has been restructured and repetitions in material on Traditional Knowledge have been addressed
16	63119	28	0	0	0	0	Organization could be greatly improved if changes in the physical environment were clearly discussed first followed by discussion of implication with respect to ecosystems, human populations, economic sectors etc. (Sharon Smith, Geological Survey of Canada)	Changes in the physical environment are addressed in the WG-1 report, and due to space constraint are not replicated here. Efforts have been made to improve cross-referencing with WG-1 chapters
17	63172	28	0	0	0	0	Congratulations! Much improved from the FOD version. (Ulf Molau, University of Gothenburg)	Acknowledged with appreciation
18	63173	28	0	0	0	0	Two new Arctic Council reports ought to be included, both released on May 15, 2013: the Arctic Biodiversity Assessment (ABA) and the Arctic Resilience Report (ARR). Both include a wealth of adequate information for Chapter 28. ARR can be downloaded from www.arctic-council.org/arr. The ABA is still incomplete as the chapter Terrestrial Ecosystems is missing (see CAFF website). (Ulf Molau, University of Gothenburg)	Reference has been added to the ARR. This is an interim report and to some extent a review of existing literature opportunities to reference it have been limited.
19	63788	28	0	0	0	0	Please use same wording in the whole Ch.: either 'the Antarctic' without 'a' (meaning the region in a whole) or just 'Antarctica' (which only means the continent itself, not the surrounding sea), better use "the Antarctic". (GERMANY)	Efforts have been made to correct this
20	64611	28	0	0	0	0	overall, a strong analysis of marine issues in the polar areas (Lena Menzel, Alfred Wegener Institute for Polar and Marine Research)	Acknowledged with appreciation

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
21	70811	28	0	0	0	0	Several references to potential for oil and gas development in chapter, but make sure there is consistency between these. Particularly use the same references and estimates for potential. These repetitions are noted below. Also - only one place(28.2.5.1.6) mentions that the estimates may be too optimistic. Add reference to: Lindholdt, L., & Glomsrød, S. (2012). The Arctic: No big bonanza for the global petroleum industry. Energy Economics, 34, 1465-1474. (Helene Amundsen, CICERO - Centre for international climate and environmental research - Oslo)	Inconsistency has been removed, and tables on oil and gas have been deleted from the text
22	71457	28	0	0	0	0	The chapter could be better organized as there is much repetition. For example it is unclear why the information in section 28.2.6.1 on Traditional Knowledge is not presented with information in sections 28.2.1 - 28.2.5 as these sections also provide evidence of observed changes in natural and human systems. It would be more effective to provide information on evidence/observation of changes obtained through scientific studies or TK together. This would also provided a more focussed discussion with less repetition. (CANADA)	Acknowledged. Section on traditional knowledge has been revised
23	71458	28	0	0	0	0	Organization of the chapter could also be greatly improved if the changes in the physical environment were clearly discussed first followed by discussion of implications with respect to ecosystems and human populations, economic sectors etc. (CANADA)	Changes in the physical environment are addressed in the WG-1 report, and due to space constraint are not replicated here.
24	71459	28	0	0	0	0	Chapter 28 might benefit from having a subsection that discusses the lack of infrastructure (especially transportation) in the Polar Regions and linking it to climate change (e.g., transportation challenges exacerbated by climate change). The following references provide useful insight on the subject: http://www.arctic.gov/publications/AMSA/infrastructure.pdf http://www.cmts.gov/downloads/CMTS_Draft_Arctic_MTS_Overview_and_Priorities_Paper_for_Public_Comment-Feb2013.pdf http://www.parl.gc.ca/Content/LOP/ResearchPublications/prb0808-e.htm http://www.statcan.gc.ca/pub/16-002-x/2009001/article/10820-eng.htm (CANADA)	Considerations about the effect of climate change on infrastructure, particularly on the northern sea route, ice roads, as well as buildings on permafrost, are presented in the relevant sections. These are based on the analysis of peer reviewed publications.
25	75485	28	0	0	0	0	A discussion of "here is why everyone should care about polar oceans" should be presented and perhaps highlighted as an FAQ. In part, this is due to the teleconnections between polar changes and impacts at lower latitudes. (UNITED STATES OF AMERICA)	Such discussion falls into the WG-1 domain
26	75486	28	0	0	0	0	A significant gap in the chapter is that it does not address the impacts of extreme events. There is a brief mention of "event-driven changes in ecosystems" on p. 25, but that hardly captures the importance of extreme events. These events (storms, extreme temperature swings, floods, droughts, etc.) affect humans and infrastructure as well as ecosystems. Their impacts are generally greater than the impacts of changes in the means. (UNITED STATES OF AMERICA)	Impacts of extreme events are important and deserve dedicated consideration. Due to severe space limits it is not addressed in this chapter. Instead in the "Summary of knowledge..." section references are made to the dedicated assessment reports (SWIPA, ACIA, etc.), which consider such impacts, for example ice-jam floods that may have dramatic damaging effect.
27	75487	28	0	0	0	0	All text should only relate directly to climate change - not to just general economic or population changes. (UNITED STATES OF AMERICA)	Efforts have been made to eliminate all text that is not directly relevant to the impacts of changing climate.
28	75488	28	0	0	0	0	Figures and Tables: there are only 2 tables and 8 figures. Figures (or perhaps tables) on the loss of sea ice would be very helpful for the reader. (UNITED STATES OF AMERICA)	We believe there is optimal number of figures and tables in the text to illustrate the key messages. As for the loss of sea ice by itself, this issue falls into the IPCC WG-1 domain, and here we discuss on the consequences of such changes exemplified by the increased duration of the navigation period along the northern Sea route or North-West passage.
29	75489	28	0	0	0	0	Overall, this chapter does a good job on presenting important information. There are some systemic problems, however. Some topics are quite unevenly treated. For example, consideration of species in the marine environment covers polar bears extensively but gives much less attention to other, top level predators. In the terrestrial environment, there is an over emphasis on reindeer. Box 28-1 focuses on Canada, and it is not clear why infrastructe in that conunty is emphaized ore whether it is in any way representative. (UNITED STATES OF AMERICA)	The text has been edited and chapter length significantly reduced, and the author team has strived towards achieving a more even balance has been sought. Box 28.1 on infrastructure in Canada has been deleted.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
30	75490	28	0	0	0	0	The authors have done a good job covering an enormous amount of literature in 52 pages of text; however, there are a number of sections that appear under-represented relative to other sections (see specific comments below- e.g., terrestrial environment in the Antarctic, ocean acidification research in the western Arctic, impacts of climate change by LME in the Arctic). The presentation would benefit from additional effort to provide syntheses of the available data, as well as focusing on impacts in a given region in the Arctic or Antarctic (as regional differences are significant [e.g., differences in climate and ecology of western and eastern Arctic). As written, the chapter includes a large number of references that are not linked to other references in the same region. The use of "in prep"or "submitted" papers is disturbing and should be strongly discouraged. As is often the case, the definition of the Arctic (i.e., whether it includes the Bering Sea) seems inconsistent throughout the chapter. The introductory section refers to a definition that defines the Arctic as the area above the Arctic Circle (p. 28); however, there is considerable text describing the environment and ecology of the southeast Bering Sea (which of course is partially ice-covered in the winter). This should be clarified in the text. In addition, climate change impacts on living marine resources would be easier to follow for sections on the Arctic and Antarctic if the authors were more careful to clarify the species and population structure, when making predictions about how climate will impact a given region or taxon. Finally, there is remarkably little on tourism in the Arctic (eastern or western), which doesn't seem in balance with the section on tourism for the Antarctic - at least as an emerging issue. References: Ice seal status: KELLY, B. P., J. L. BENGTSON, P. L. BOVENG, M. F. CAMERON, S. P. DAHLE, J. K. JANSEN, E. A. LOGERWELL, J. E. OVERLAND, C. L. SABINE, G. T. WARING, and J. M. WILDER. 2010. Status review of the ringed seal (Phoca hispida). U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-212, 250 p. (.pdf, 8.7 MB). Online. CAMERON, M. F., J. L. BENGTSON, P. L. BOVENG, J. K. JANSEN, B. P. KELLY, S. P. DAHLE, E. A. LOGERWELL, J. E. OVERLAND, C. L. SABINE, G. T. WARING, and J. M. WILDER. 2010. Status review of the bearded seal (Erignathus barbatus). U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-211, 246 p. (.pdf, 12.4 MB). Online. DBO Grebmeier, J.M., Biological community shifts in Pacific Arctic and sub-Arctic seas, 2012, Annual Review of Marine Science, Vol. 4. (in press). Note the paper will appear first as a web article in fall 2011 (http://www.annualreviews.org/toc/marine/forthcoming) Grebmeier, J. M., Moore, S. E., Overland, J. E., Frey, K. E., and Gradinger,R., EOS Trans. AGU, 91, 18, doi:10.1029/2010EO180001, 2010 RUSALCA http://www.arctic.noaa.gov/aro/russian-american/ Seabirds High latitude changes in ice dynamics and their impact on polar marine ecosystems [Download PDF] Moline, M. A., N. J. Karnovsky, Z. Brown, G. J. Divoky, T. R. Frazer, C. A. Jacoby, J. J. Torres and W. R. Fraser. 2008. Pp 267-319 in: The Year in Ecology and Conservation Biology 2008. R. S. Ostfeld and W. H. Schlesinger (eds.). Annals New York Acad. Sci., 1134. Supernormal delay in hatching, embryo cold tolerance and egg fostering in the Black Guillemot Cepphus grylle. Divoky, G.J. and B.B. Harter. 2010. Marine Ornithology 38:7-10. (UNITED STATES OF AMERICA)	The changes in the physical environment that are addressed in the first part of the comment fall into the domain of WG-1 report, which is why they are not discussed in the chapter. Like in the previous IPCC reports, the boundaries of the Polar regions are defined loosely, i.e. they also include adjacent territories which are directly linked to polar regions through atmospheric, hydrological and/or ecological processes, and thus should be considered in their integrity. Efforts were and will be made to assess first of all the peer reviewed publications, which explains why references to the Agency reports are kept at minimum. References to the papers in press has been eliminated in the final text.
31	75491	28	0	0	0	0	The chapter is much too long and too detailed. Many of the sections are more reviews of general changes in polar regions with little or no direct links to climate change. There is also little emphasis about what is new in this report since AR4. Although most of the references are new (this is good), it is not clear how the new information contradicts or amplifies what was reported before. Every section should begin with something like "Since AR4 the following important new developments have emerged in documenting changes in the XXXX system that are directly related to climate changes." The fact that climate change interacts in important complex ways with other changes in the systems is repeated over and over again; once is enough. All text should only relate directly to climate change, not to just general economic or population changes. Change "annual ice" to "seasonal ice" throughout the chapter. In the sea ice community, ice is divided between seasonal, first year, and multiyear ice. Seasonal ice is found in areas that commonly melt entirely in the summer. First year ice is ice that has not survived a summer melt - all seasonal ice is first year ice but first year ice is also found in areas that may or may not melt on a regular basis. (UNITED STATES OF AMERICA)	Comment noted. The chapter length has been significantly reduced and the text edited including elimination of text that is not directly linked to climate change. The executive summary is completely rewritten to specifically address what is new compared to AR4. Terminology will be double checked, particularly that on sea ice.
32	75492	28	0	0	0	0	The chapter is very uneven in its conveyance of confidence levels. Sections 28.2.1-28.2.3 and 28.3.2, for example, contain many expressions of "low confidence", "medium-to-high confidence", etc., while other sections such as 28.2.4-28.2.6 as well as 28.3 contain essentially no mention of confidence levels. The parts of the chapter seem to have been written by different authors who had different understandings about how confidence levels were to be included in the chapter. (UNITED STATES OF AMERICA)	Assigning confidence levels is always somewhat subjective, and not surprisingly uneven, since sections are written by different authors. However, more assignment of confidence statements has been sought.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
33	75493	28	0	0	0	0	The coverage of ocean acidifiation in the Arctic (p. 10, lines 42-50) is not adequate. The authors need to reference recent work and link to Fig 30-7 (which needs to be updated to include polar regions). The issue is not addressed sufficiently in the Oceans chapter and, given the fact that OA in the Arctic is amplified relative to the rest of the world (given solubility issues), it needs to be a key focus, especially given the chain of impacts that it will have on the Arctic food web and resulting impacts on Arctic populations. (UNITED STATES OF AMERICA)	A section on Ocean Acidification in the Asrctic and Antarctic has been included.
34	75494	28	0	0	0	0	The fact that climate change interacts in important ways with other changes in the systems is repeated over and over again, once is enough. (UNITED STATES OF AMERICA)	Noted. Text has been significantly shortened and edited.
35	75495	28	0	0	0	0	There is a tendency in Executive Summary to bias summary towards very high and high confidence findings. It conveys a false sense to decision makers that the science as a whole is well-understood. It is important to also summarize where there is low confidence and why (e.g. significant gaps in the observational record); or the example of polar bear extinction. It is important to highlight that something that has generated significant public concern (e.g. polar bear extinction) is low confidence. It is also important that low confidence findings are attached to a research gap that can be addressed. (UNITED STATES OF AMERICA)	This is the space limitation that led to apparent bias. Comment noted. The executive summary has been rewritten.
36	75496	28	0	0	0	0	We believe the chapter is too long, with uneven coverage of issues (e.g., some taxa receive extensive text, others little or none; impacts on herding extensive, wildlife harvests little or none.) It appears as though polar bears are singled out for long treatment, but economically and culturally more important Arctic mammals receive little attention. Sends message that scientific efforts should focus on iconic megafauna species. Several places (e.g., herding discussion) are long on detail but take-away is unclear. --- Important information on teleconnections between Arctic and lower latitude climates needs to be covered. (UNITED STATES OF AMERICA)	We appreciate this thoughtful comment. Efforts have been made to shorten the lengthy descriptions and achieve reasonable balance between different themes. Teleconnections between polar and lower latitudes are through physical mechanisms that are addressed in WG-1 report.
37	80005	28	0	0	0	0	Please add the scientific names for all species the first time they are mentioned with their common name. Done in some sub-chapters, but not in all. (NORWAY)	This is questionable, since the IPCC addresses very wide audience, which does not necessarily need such level of scientific details. Besides taking space it complicates reading for people outside the scientific community.
38	80006	28	0	0	0	0	Consider including more on effects on benthic communites, both in the Arctic and the Antarctic. (NORWAY)	Efforts will be made to explore such effects directly related to climate change using peer reviewed literature
39	80007	28	0	0	0	0	If not delt with in other chapters, more on costal ecosystems should be included. Less sea ice in costal areas has huge impact on these ecosystems, e.g. species composition, growth and production rates of for example macroalgae. (NORWAY)	This is discussed in detail in other reports, i.e. SWIPA, ACIA, etc., which are referenced in the introductory part.
40	80008	28	0	0	0	0	Change of species composition, including size classes for microalgae should be delt with more thoroughly, both for the Arctic and the Antarctic. Huge impact on total production and food quality for upper throphic levels. Now it is only touched upon a few (NORWAY)	This level of detail is beyond the level of generality adopted in such an assessment report, which is addressed to a wide audience including policymakers and business people. Under severe page limit such task is impossible.
41	80009	28	0	0	0	0	The Antarctic sections are more up to date in terms of literature coverage than the Arctic sections – which seem to largely "stop" with the SWIPA review. Please consider using those references: Gilg, O., Kovacs, K.M., Aars, J., Fort, J., Gauthier, G., Gra (NORWAY)	This comment is questionable, but authors strive to update the references as much as possible.
42	80436	28	0	0	0	0	General comment: We were surprised to find that this entire chapter contains few cross-references to the WGI AR5, with only very few citations to WGI Chapter 4 concerning observed changes in Sea Ice, Permafrost, and river ice. For example, there is no reference to WGI AR5 concerning projected changes in temperature/precipitation in the polar regions, or related impacts on the cryosphere. Please update relevant statements to ensure consistency and cross-referencing with the WGI AR5 chapters, including the Annex I: Atlas of global and regional climate projections, and the SREX Chapter 3. (Gian-Kasper Plattner, IPCC WGI TSU)	Efforts have been made to update cross-references.
43	81049	28	0	0	0	0	There are some missing/ incorrect citations in the chapter. These discrepancies have been highlighted in the ref check document for chapter 28 and is available in the supporting material web page. Chapter team may wish to rectify these errors before starting to work on SOD revisions and FGD preparation. (Monalisa Chatterjee, IPCC WGII TSU)	This has been corrected.
44	83856	28	0	0	0	0	1) Overall -- The chapter team has developed a strong assessment in its 2nd-order draft. In the final draft, the chapter team is encouraged to continue its prioritization of compact and rigorous assessment, effective figures, and clear writing. (Katharine Mach, IPCC WGII TSU)	Text has been revised, sections condensed, and chapter length significantly reduced

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
45	83857	28	0	0	0	0	2) Coordination across Working Group II -- In developing the final draft of the chapter, the chapter team should continue to ensure coordinated assessment, both in the chapter text and at the level of key findings. As appropriate, cross-references to the sections of other chapters and/or their assessment findings should be used, reducing overlaps and harmonizing assessment. (Katharine Mach, IPCC WGII TSU)	Efforts have been made to update cross-references.
46	83858	28	0	0	0	0	3) Harmonization with the Working Group I contribution to the AR5 -- In developing the final draft, the chapter team should also ensure all cross references to the Working Group I contribution are updated, with discussion of climate, climate change, and climate extremes referencing the assessment findings in that volume. (Katharine Mach, IPCC WGII TSU)	Efforts have been made to update cross-references.
47	83859	28	0	0	0	0	4) Tightening the assessment and supporting a maximally rigorous executive summary -- In developing the final draft, the chapter team is encouraged to revise each section so that the core nuanced key findings emerge clearly from each section with full and traceable support. Revision geared towards highlighting the key findings will further support an executive summary that richly communicates the assessment. The chapter team should aim to shorten the chapter text by at least 15 pages. Additionally, when presenting assessment and conclusions on observations, projections, and vulnerabilities/sensitivities, the chapter team should ensure that they are not conflated and that the reader can understand which type of information is being discussed at each point. (Katharine Mach, IPCC WGII TSU)	Noted. Chapter length has been shortened significantly.
48	83860	28	0	0	0	0	5) Characterization of future risks -- In characterizing future risks for Polar Regions, to the degree appropriate the chapter team should indicate the extent to which risks (or key risks) can be reduced through mitigation, adaptation, development, poverty reduction, etc. That is, is it possible to indicate how risks may increase as the level of climate change increases or, potentially, to indicate the relative importance of changes in mean conditions, as compared to changes in extreme events, as compared to potential non-linear changes associated with biome shifts or tipping points? And then, how much can risks be reduced through adaptation or development, in the near-term and long-term? How are factors or stressors that multiply risks relevant in this context? As supported by its assessment of the literature, the author team should consider communicating risks for the era of climate responsibility (the next few decades, for which projected temperatures do not vary substantially across socioeconomic/climate scenarios) and for the era of climate options (the 2nd half of the 21st century and beyond). As might be helpful to the chapter, the framing of table SPM.4 could be considered in characterization of future risks, along with the key and emergent risk typology of chapter 19. (Katharine Mach, IPCC WGII TSU)	This is not feasible due to the absence of the publications on risk assessment in the polar regions.
49	83861	28	0	0	0	0	6) Informing the summary products -- To support robust and insightful summary products for the report, the chapter team is encouraged to maximize nuance and traceability in its key findings, continuing to use calibrated uncertainty language effectively. In addition to nuanced characterization of future risks (see the previous comment), the chapter team is encouraged to consider themes emerging across chapters, indicating for example how extreme events have demonstrated adaptation deficits and vulnerabilities to date and may relate to future risks, how limits to adaptation may be relevant in the context of this chapter, how multidimensional inequality is relevant in the context of climate change, how adaptation experience has been relevant to date, and how interactions among mitigation, adaptation, and sustainable development may occur. (Katharine Mach, IPCC WGII TSU)	The chapter text has been significantly shortened including significant revisions, and contributions to summary products.
50	83862	28	0	0	0	0	7) Report release -- The chapter team should be aware that the final drafts of the chapters will be posted publicly at the time of the SPM release, before final copyediting has occurred. Thus, the chapter team is encouraged to continue its careful attention to refined syntax and perfected referencing. (Katharine Mach, IPCC WGII TSU)	Refinement of syntax and referencing has been dealt with in chapter editing
51	83863	28	0	0	0	0	8) Further distinguishing 28.2 versus 28.3 -- The chapter team should remove all future-oriented material from 28.2; doing so will substantially shorten the section. While vulnerabilities and sensitivities are relevant to both 28.2 and 28.3, a refined approach should be taken to reduce overlap. Observations should be restricted to 28.2, and projections restricted to 28.3. (Katharine Mach, IPCC WGII TSU)	Efforts have been made to further distinguishing 28.2 and 28.3, overlaps have been eliminated, and chapter length has been significantly reduced.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
52	84896	28	0	0	0	0	GENERAL COMMENTS: I congratulate the author team for all their work on the SOD, recognizing that there is more work to be done. When considering the suite of review comments, please look for opportunities to continue to focus the text in revision, reducing length and overlap wherever possible. Please see my detailed comments for suggestions related to such opportunities, as well as specificity of ES findings and traceable accounts, refining figures and tables, and specific clarifications. In addition, where likelihood terms are used ("likely," "very likely," etc.), it is also not always clear whether they are intended as calibrated language or not--please carefully check this and avoid casual usage. (Michael Mastrandrea, IPCC WGII TSU)	Concerns regarding chapter length, overlaps, and calibrated uncertainty language have been addressed in the revised draft. The ES has been completely rewritten.
53	84897	28	0	0	0	0	SUMMARY PRODUCTS: In preparing the final draft of your chapter and particularly your executive summary, please consider the ways in which your chapter material has been incorporated into the draft SPM and TS. For Chapter 28, relevant sections include presentation of observed impacts and vulnerabilities in section A.i, adaptation experience in section A.ii, sectoral and regional risks in section C.i, and interactions between adaptation and mitigation in section D.ii, as well as related figures and tables. Are there opportunities for presenting chapter findings and material in a way that further supports broad themes highlighted in the summary products and that facilitates additional cross-chapter synthesis in specific findings or figures/tables? Do the existing summary product drafts suggest additional coordination that should occur between Chapter 28 and other chapters at LAM4? (Michael Mastrandrea, IPCC WGII TSU)	The executive summary has undergone significant revisions, including text on addaptation. Considerations of the SPM and TS have been made.
54	57958	28	1	0	1	0	Organization: The order of topics in this chapter would be more logical, and thus flow better, if the Hydrology and Freshwater Ecosystems section directly preceded the Terrestrial Ecosystems section, as the hydrology more directly and substantially affects the terrestrial system. (Jennifer Francis, Rutgers University)	The order in which sections appear in the chapter has been discussed at the earlier stage of the writing process and could not be changed at this time.
55	57959	28	1	0	55	0	Various sections of the text use the IPCC qualitative terms (likely, very likely, etc) very inconsistently. For example, section 28.2.2.1.1 uses them well, while other sections almost not at all. (Jennifer Francis, Rutgers University)	Efforts have been made to address this inconsistency
56	57960	28	1	0	55	0	Focus on human impacts is almost exclusively on those in low-lying areas and almost nothing about humans living in Greenland. This seems to be a gap. (Jennifer Francis, Rutgers University)	Efforts have been made to access relevant literature and fill this gap to the extent possible. Text has been added on agriculture in Greenland has been included.
57	57002	28	1	1	1	1	The tile" Polar Regions" is hanging. Let the title capture the sprit of the underlying text in the entire document. In otherwords, the title always prepares the reader what he expects in the text of the document (KENYA)	It is unclear what action is expected in response to this comment.
58	57961	28	2	0	5	0	Executive summary needs to be better organized. Group statements according to topics in TOC, and begin each with more general comments followed by more specific ones. (Jennifer Francis, Rutgers University)	ES has been completely rewritten. General statements are followed by more specific ones
59	79675	28	2	33	0	0	Executive Summary. Organisation of section is unclear. It could more closely follow chapter sub-headings to improve clarity. Would also benefit from an introduction paragraph. Consider that some readers of the summary will be policymakers without technical knowledge - slight adjustments to the language and word choice throughout the summary would help readability for this audience. (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)	ES has been completely rewritten, including adjustments made to the language.
60	83864	28	2	33	0	0	Regional Key Risks in the Executive Summary -- The chapter team is strongly encouraged to present clearly the key regional risks for Polar Regions within the executive summary. For the key risks, how do they vary with level of climate change, and what is the potential for adaptation to reduce the risks? What are the risks in the near-term (which can be considered an era of climate responsibility) versus the long-term (which can be considered an era of climate options)? The framing of SPM table SPM.4 or the framing of chapter 25's executive summary and table 25-8 could be considered. Identifying key risks would enable the chapter team to continue to tighten the executive summary with a strong organizing principle. (Katharine Mach, IPCC WGII TSU)	There is lack of publications addressing risks in the polar regions due to climate change. This is why the task is not feasible.
61	83865	28	2	33	0	0	Clarifying the Role of Climate Change in the Executive Summary-- For each key finding, the chapter team should make sure the role of climate change is clear for the conclusion made. (Katharine Mach, IPCC WGII TSU)	ES has been completely rewritten and comment addressed
62	83866	28	2	33	0	0	Shortening and Refining the Executive Summary -- By reducing overlap across findings and paragraphs within the executive summary, the chapter team will create a richer executive summary. A length of 2 pages may be ideal. (Katharine Mach, IPCC WGII TSU)	ES has been completely rewritten, including shortened and refined

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
63	84898	28	2	33	0	0	Executive Summary: The current draft executive summary contains good material, but the clarity and specificity of the presentation can be improved while overlap can be reduced. Please group findings on similar topics together, and consider opportunities for condensation. Please also make the role of climate change as opposed to other drivers as clear as possible in each finding. To the extent possible as supported by the literature, please also emphasize what risks are projected to emerge over different time horizons (e.g., mid-century vs. end-of-century), as well as the potential or lack of potential for mitigation and adaptation to reduce them. See my specific comments for other suggestions. Finally, please provide calibrated uncertainty language for all findings, and please carefully check line of sight to chapter sections throughout the executive summary, as there are some instances where the wrong section is cited as well as a few cases where support in the chapter text is not clear (see specific comments). (Michael Mastrandrea, IPCC WGII TSU)	ES has been completely rewritten, the structure changed, and overlaps eliminated. Calibrated uncertainty language has been added for all statements. Incorrect section references have been corrected
64	80010	28	2	33	5	11	Excecutive summary: The risks and potential impacts related to nuclear powerplants, facilities and waste should be addressed in the excecutive summary. E.g. in connection to extreme events, sea-level rise, erosion and change in permafrost. E.g. see page 2 (NORWAY)	ES summarizes the key findings of the chapter and as such it builds upon the material of individual sections. The specific concerns addressed by the reviewer are not discussed in detail in the chapter, and thus could not be included in the ES.
65	84899	28	2	35	2	35	Please specify line of sight for the physical and biological impacts mentioned here, as the existing line of sight mainly covers socioeconomic impacts. (Michael Mastrandrea, IPCC WGII TSU)	ES has been completely rewritten, additional line of sight has been added.
66	60223	28	2	35	2	39	The bolded sentence here does not tell us anything - it is more like background infromation. The second unbolded sentence is of more improance, with the bolded sentence as background information. (AUSTRALIA)	ES has been completely rewritten. The ES is structured with a general statement up front followed by more specific ones. The statement has been expanded to include additional reference.
67	83867	28	2	37	2	37	For the phrase "there is evidence" it would be preferable to present summary terms for evidence and agreement, ideally within the parentheses at the end of the sentence, or to delete the phrase. (Katharine Mach, IPCC WGII TSU)	ES has been completely rewritten, including this phrase
68	84900	28	2	37	2	39	Please be more specific as to what evidence is available that climate change has compounded existing vulnerabilities, and how it has compounded them. Please also provide clear line of sight to the discussion of this evidence. (Michael Mastrandrea, IPCC WGII TSU)	ES has been completely rewritten, including additional example to support this statement
69	83868	28	2	41	2	43	Over what broad timeframe does this statement hold? Over what levels/scenarios of climate change? Is it possible to indicate more specifically what "changes" and "dramatic impacts" are meant? (Katharine Mach, IPCC WGII TSU)	ES has been completely rewritten, including this statement
70	84901	28	2	41	2	43	Please clarify the line of sight for this finding, as it is not supported by 28.4.2. In addition, are the changes referenced in the bold sentence specifically changes in sea ice, or a broader set? Please clarify this. (Michael Mastrandrea, IPCC WGII TSU)	ES has been completely rewritten, including new references to the revised statement.
71	80449	28	2	41	2	47	In addition to "rate of change" the large interannual variability should be mentioned especially for short term impacts. (Josefino Comiso, NASA Goddard Space Flight Center)	WG-2 report mostly addresses the impacts of climate change, the impacts of interrannual variability are yet to be addressed in the dedicated studies, which they are not accessed here.
72	71460	28	2	43	1	44	Suggest adding snow cover to statement "The decline of sea ice [and snow cover] in summer is occurring at a rate that exceeds most model projections" (Derksen, C. and R. Brown, 2012: Spring snow cover extent reductions in the 2008-2012 period exceeding climate model projections. Geophys. Res. Lett., 39, L19504, doi:10.1029/2012GL053387, 2012) (CANADA)	The suggestion "and snow cover" has not been included in the executive summary revisions
73	83869	28	2	45	2	47	In place of "there is some evidence," it would be preferable here to present any uncertainty language assigned within working group 1. (Katharine Mach, IPCC WGII TSU)	ES has been completely rewritten, including the supporting text in this statement
74	80450	28	2	47	2	49	Impacts in the Arctic and Antarctic are very different and should be discussed separately. (Josefino Comiso, NASA Goddard Space Flight Center)	We appreciate the reviewer´s suggestion. But due to space considerations the separation of the Arctic and Antarctic in the ES was not possible. The ES had to be condensed significantly to comply with strict space limitations.
75	65040	28	2	49	0	0	I do not see why we refer to the primary concern being polar bears. They are an iconic species, but many other species will be threatened by warming and loss of sea ice. Of greater concern, perhaps, are the ice-dependent pinnipeds, as they are not only the food source for the polar bears, but also for the subsistance hunters. (George Hunt, University of Washington)	ES has been completely rewritten. Polar bears are specifically noted there since there were many new studies since AR4.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
76	71461	28	2	49	1	52	Suggest deleting this bullet as it is repeated later in the Executive Summary in a more appropriate place (CANADA)	ES has been completely rewritten and repetition removed
77	83870	28	2	49	2	49	Is not clear what is meant by "over the foreseeable future or 3 generations." Additionally, this paragraph repeats on page 3, and later in the executive summary would seem to represent preferable placement for the paragraph. (Katharine Mach, IPCC WGII TSU)	ES has been completely rewritten including new placement for this paragraph. "Three generations" has been removed.
78	57260	28	2	49	2	52	This paragraph appears twice in the Executive Summary. (Erica Head, Fisheries and Oceans Canada)	ES has been completely rewritten and repetitions removed
79	57962	28	2	49	2	52	Why single out polar bears? They are an icon, but many other species are undergoing at least as rapid decline. Combine this bullet with the last one on page 3, also referring to polar bears. (Jennifer Francis, Rutgers University)	ES has been completely rewritten. Polar bears have been especially noted due to new studies since AR4
80	60224	28	2	49	2	52	This paragraph is repeated on page page 3, 51 to 54. Suggest deleting this paragraph and leaving the one on page 3. (AUSTRALIA)	ES has been completely rewritten, and repetition removed
81	60225	28	2	49	2	52	This paragraph on polar bears is repeated on pg 3. Suggest deleting the first reference (this page). (AUSTRALIA)	ES has been completely rewritten, and repetition removed
82	60447	28	2	49	2	52	Duplication from page 3 line 51-54. Should be deleted on page 2. (DENMARK)	ES has been completely rewritten, and repetition removed
83	62972	28	2	49	2	52	This text is repeated at the end and should be deleted. (Randi Ingvaldsen, Institute of Marine Research)	ES has been completely rewritten, and repetition removed
84	79676	28	2	49	2	52	Delete. Paragraph repeats later in Executive Summary at page 3 line 51. (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)	ES has been completely rewritten, and repetition removed
85	84902	28	2	49	2	52	This paragraph is repeated on page 3 lines 51-54. I recommend it be deleted here. But where retained, please provide the intended time horizon instead of "foreseeable future or three generations," as these phrases are ambiguous and also are not usually interpreted as equivalent. In addition, please clarify the timeframe over which population declines have been recorded, and provide line of sight for the paragraph (which it appears should be 28.2.2.1.3). (Michael Mastrandrea, IPCC WGII TSU)	ES has been completely rewritten, and repetition removed. "three generations" has been deleted.
86	83871	28	3	1	3	1	Are the described environmental changes and ecosystem responses those occurring due to climate change? It is important to clarify the role of climate change more explicitly. (Katharine Mach, IPCC WGII TSU)	ES has been completely rewritten, and statement deleted. Efforts have been made to clearly describe the role of climate change
87	63789	28	3	1	3	3	Please consider this para in the TS (p.13 l.29) (GERMANY)	Noted
88	84903	28	3	1	3	3	Please clarify the intended relationship between climate change and the environmental changes and ecosystem responses referenced here. (Michael Mastrandrea, IPCC WGII TSU)	ES has been completely rewritten, and statement deleted.
89	57963	28	3	1	3	7	For the less-informed reader, I think it would be helpful to emplasize that these changes are to the bottom of the food web, which will have a ripple effect to the rest of the ecosystem. (Jennifer Francis, Rutgers University)	Text was included at the beginning of the marine section that addressed this issue.
90	60226	28	3	1	3	7	This paragraph starts by noting there are differences in responses between the Arctic and the Antarctic - but only provides an example for the Arctic and West Antarctica. There are key differences between West and East Antarctica and this paragraph could benefit by highlighting an example for East Antarctica as well. (AUSTRALIA)	ES has been completely rewritten, and this statement has been deleted
91	83872	28	3	3	3	5	The timeframe of these observations should be clarified. Additionally, what are the "measurable changes"? (Katharine Mach, IPCC WGII TSU)	ES has been completely rewritten, and statement deleted.
92	84904	28	3	4	3	4	Please specify what is meant by measurable changes. (Michael Mastrandrea, IPCC WGII TSU)	ES has been completely rewritten, and statement deleted.
93	65041	28	3	5	0	6	appropriate to mention southeastern Bering Sea here and impact on both krill and largre lipid-rich copepods (George Hunt, University of Washington)	This is mentioned in the text
94	84905	28	3	5	3	7	Please clarify this point and/or its line of sight, as currently the description on page 19 of relevant material does not provide a clear basis for a high confidence statement. (Michael Mastrandrea, IPCC WGII TSU)	ES has been completely rewritten, and this statement has been edited out
95	83873	28	3	6	3	6	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. If being used as a likelihood term, it should be italicized. (Katharine Mach, IPCC WGII TSU)	ES has been completely rewritten. The use of likely is italicized when used as a likelihood term.
96	63790	28	3	9	3	10	Please consider this para in the TS (p.13 l.29) (GERMANY)	Noted. ES has been completely rewritten
97	83874	28	3	9	3	10	The timeframe for this statement should be specified. Also, can any further nuance be provided, in terms of differences across levels/scenarios of climate change and in terms of what species will be affected and what sort of variations in response are expected? (Katharine Mach, IPCC WGII TSU)	This statement has been rewritten, including more nuance

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
98	84906	28	3	9	3	14	Please provide line of sight for this paragraph, which it appears should be 28.2.2. (Michael Mastrandrea, IPCC WGII TSU)	ES has been completely rewritten, including line of sight for this statement
99	83875	28	3	10	3	11	What is the timeframe for this statement, and which types of marine species have demonstrated shifts in distribution? (Katharine Mach, IPCC WGII TSU)	As noted in the text the time frame is unknown.
100	83876	28	3	11	3	13	This finding should indicate more specifically how responses will differ by species. The statement also overlaps with line 10. (Katharine Mach, IPCC WGII TSU)	This was not addressed due to page constraints
101	65042	28	3	14	0	0	the krill will not only be farther south, they well may be less abundant (George Hunt, University of Washington)	ES has been completely rewritten, and the statement has been edited out
102	57964	28	3	16	3	16	Say "enhance secondary pelagic production" in a more lay fashion (Jennifer Francis, Rutgers University)	This conclusion was edited
103	58894	28	3	16	3	16	Would be clarifying to explain what is meant with "secondary pelagic production". Is it copepods? Copepods of boreal origin? I guess the endemic amphipods are expected to decrease? Should also use more understandable word for the public, e.g. zooplankton, instead of secondary pelagic production (Svein Sundby, Institute of Marine Research)	The conclusion was edited, some information is provided in the marine sections, due to page limitations, detailed descriptions of species specific impacts was not possible.
104	83877	28	3	16	3	16	Should a more conditional formulation be used to describe loss of sea ice? (Katharine Mach, IPCC WGII TSU)	ES has been completely rewritten
105	79677	28	3	16	3	19	"energy pathways." Not clear what this means in this context. Explain. (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)	ES has been completely rewritten, and this ES statement has been edited out
106	84907	28	3	16	3	19	Section 28.2.2.1 is supposed to be a section on observed changes, but this is a forward looking statement. Please clarify the placement of the traceable account--should it be in another section instead? (Michael Mastrandrea, IPCC WGII TSU)	ES has been completely rewritten. The correct tracable account should be 28.3.2.2
107	57965	28	3	21	3	21	Define phenologies and other technical terms the first time they appear in the Exec Summary, as non-technical folks will be reading just this section. (Jennifer Francis, Rutgers University)	This will be included in the glossary
108	83878	28	3	21	3	21	The role of climate change should be indicated more explicitly for this finding--shifts in timing due to climate change? Can differences across scenarios/levels of climate change be characterized? Across time frames? (Katharine Mach, IPCC WGII TSU)	The detail for this is in the chapter. Time frames are not known.
109	84908	28	3	21	3	28	Please provide further support for these statements in the referenced chapter text, as currently this is not clear. (Michael Mastrandrea, IPCC WGII TSU)	ES has been completely rewritten, including this statement
110	79678	28	3	21	3	30	"trophic levels" and "phenologies." Consider using less technical terms as summary readers may not understand. (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)	ES has been completely rewritten. Comment has been noted. Technical terms explained in glossary
111	71462	28	3	30	0	0	Suggest being more clear that stating "…but the scientific documentation for this is weak". Would an uncertainty assessment be appropriate here? (CANADA)	ES has been completely rewritten, and statement edited out
112	57966	28	3	30	3	30	This statement doesn't seem to jive with the discussion in 28.2.2.1.2 (Jennifer Francis, Rutgers University)	ES has been completely rewritten, and statement edited out
113	62030	28	3	30	3	30	I think you meant "Antarctic" instead of "Arctic." (Jon Rosales, St. Lawrence University)	ES has been completely rewritten. Statement has been deleted.
114	56832	28	3	32	0	0	ocean acidification only refers to pelagic key species, no mention of benthic response. (Angelika Dr. Brandt, University of Hamburg)	Space was limited in this chapter to deal with all issues. We have tried to address ocean acidification as a general issue
115	80452	28	3	32	3	32	Indicate areas of the Antarctic where ocean acidification has been observed. Not all are affected. (Josefino Comiso, NASA Goddard Space Flight Center)	Space was limited in this chapter to deal with all issues. We have tried to address ocean acidification as a general issue. We note that the effects will not be uniform.
116	78201	28	3	32	3	37	This fact reaffirms that SPM Pg. 10 line 41-43 needs to be revised to include farther-reaching consequences of acidification beyond just 'coral in coastal ecosystems', such as what is mentioned here. (Andrew Wong, University of Waterloo)	Noted. ES has been completely rewritten
117	83879	28	3	32	3	37	Lines 32-33 and 36-37 are heavily repetitive. Each statement within the paragraph should add new insight. Additionally, it would be preferable to indicate more specifically what is meant by "far-reaching" on lines 33 and 37. (Katharine Mach, IPCC WGII TSU)	ES has been completely rewritten and repetition removed
118	84909	28	3	34	3	35	Please clarify this point and/or its line of sight, as currently the short description on page 19 of relevant material does not provide a clear basis for a high confidence statement. (Michael Mastrandrea, IPCC WGII TSU)	ES has been completely rewritten, and chapter text revised including new section on ocean acidification.
119	83880	28	3	39	3	40	The role of climate change should be clearly specified. Also, how will outcomes vary with level/scenario of climate change and timeframe? (Katharine Mach, IPCC WGII TSU)	ES has been completely rewritten, including revisions to this statement.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
120	83881	28	3	40	3	44	The general time frames for these changes should be specified. (Katharine Mach, IPCC WGII TSU)	ES has been completely rewritten
121	63791	28	3	42	3	44	A short explanation of different impacts by increasing east-Antarctic sea-ice and decreasing west-Antarctic sea-ice is recommended. (GERMANY)	ES has been completely rewritten and shortened. Additional explanations are n ot feasible due to page limits
122	65043	28	3	44	0	0	sea ice what? Extent, thickness, duration??? (George Hunt, University of Washington)	ES has been completely rewritten
123	79679	28	3	44	3	44	Word choice of "physical," consider changing to "habitat" as would make more sense in this context. (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)	ES has been completely rewritten, including deletion of this sttatement
124	62031	28	3	46	3	46	Typo: change "Antarctica" to "Antarctic." (Jon Rosales, St. Lawrence University)	ES has been completely rewritten
125	79680	28	3	46	3	46	"some areas." Be more specific - how large and what sort of distribution? (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)	Many details are missed in the ES due to page limits. More information is given in the main text
126	57262	28	3	46	3	47	Change "the Antarctica and Arctic" to "Antarctica and the Arctic" (Erica Head, Fisheries and Oceans Canada)	ES has been completely rewritten, including rephrasing of this sentence
127	83882	28	3	46	3	47	The overall timeframe for this statement should be specified. Additionally, more specifically what types of ecosystems are being affected and how? (Katharine Mach, IPCC WGII TSU)	The body of the text provides the details regarding specific ecosystem impacts. We distinguish impacts on marine and terrestrial ecosystems, and also provide evidence of regional differences in responses.
128	60227	28	3	46	3	49	This paragraph notes climate change is impacting on terrestrial and freshwater ecosystems in some areas - this is quite vague and the paragraph could benefit from providing information on what types of impacts and which areas. (AUSTRALIA)	Many details are missed in the ES due to page limits. More information is given in the main text
129	78188	28	3	51	3	53	Point of clarification:"The primary conservation concern for polar bears over the foreseeable future or three generations..." - is that three generations of polar bears? Or of human generations? (Inga Smith, University of Otago)	ES has been completely rewritten, and "three generations" has been deleted.
130	57261	28	3	51	3	54	This paragraph appears twice in the Executive Summary. (Erica Head, Fisheries and Oceans Canada)	ES has been completely rewritten, and repetition removed
131	61671	28	3	51	3	54	This text is an exact copy of p. 2, ll. 49-52. (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	ES has been completely rewritten, and repetition removed
132	62032	28	3	51	3	54	This paragraph appears twice in the Executive Summary. (Jon Rosales, St. Lawrence University)	ES has been completely rewritten, and repetition removed
133	63792	28	3	51	3	54	Please delete this para, because it is already presented at p. 2 l.49-52 (duplication) (GERMANY)	ES has been completely rewritten, and repetition removed
134	66017	28	3	51	3	54	This paragraph on the conservation concern for polar bears appears to be a repetition of the text given on P.2, L.49-52. (Sebastian Gerland, Norwegian Polar Institute)	ES has been completely rewritten, and repetition removed
135	66388	28	3	51	3	54	The paragraph is repeated from previous page. May be you should consider deleting on page 2. (Carla Andreia Silva Mora, University of Lisbon)	ES has been completely rewritten, and repetition removed
136	75497	28	3	51	3	54	Please consider adding "and not up-to-date in several places." (UNITED STATES OF AMERICA)	ES has been completely rewritten and significantly condensed in size.
137	78202	28	3	51	3	54	This is a duplicate of Ch. 28 Pg. 2 line 49-52 and should be removed. (Andrew Wong, University of Waterloo)	ES has been completely rewritten, and repetition removed
138	83883	28	3	51	3	54	This location for this paragraph is preferable to the earlier instance on page 2. Additionally, what is meant by "over the foreseeable future or 3 generations" should be clarified. (Katharine Mach, IPCC WGII TSU)	ES has been completely rewritten, and repetition removed. The phrase "three generations" has been deleted.
139	84910	28	3	51	3	54	This paragraph is repeated on page 2 lines 49-52. Where retained, please provide the intended time horizon instead of "foreseeable future or three generations," as these phrases are ambiguous and also are not usually interpreted as equivalent. In addition, please clarify the timeframe over which population declines have been recorded, and provide line of sight for the paragraph (which it appears should be 28.2.2.1.3). (Michael Mastrandrea, IPCC WGII TSU)	ES has been completely rewritten. "Three generations" removed
140	80451	28	3	52	3	52	Change "annual ice" to "spring and summer sea ice." Changes in other seasons are not so relevant. (Josefino Comiso, NASA Goddard Space Flight Center)	This change has been made
141	83884	28	4	2	4	3	In place of "recent years" it would be preferable to indicate the timeframe more specifically. Also, is climate change being asserted as the probable primary driver of change? (Katharine Mach, IPCC WGII TSU)	ES has been completely rewritten, and sentence has been removed
142	84911	28	4	2	4	4	Please provide line of sight for this paragraph. (Michael Mastrandrea, IPCC WGII TSU)	ES has been completely rewritten, and sentence has been removed

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
143	83885	28	4	2	4	9	It seems these paragraphs should be merged. As is, it is not clear how the deciduous shrubs described on line 2 are different from those described on line 7. (Katharine Mach, IPCC WGII TSU)	ES has been completely rewritten, and repetition removed
144	80453	28	4	4	4	4	Specific how this information is different from what was reported in AR4. New results have come in since and refer to WG1/AR5/Chapter 4 (Josefino Comiso, NASA Goddard Space Flight Center)	ES has been completely rewritten and clearly indicates what are the new findings since AR4
145	62033	28	4	6	4	6	"northward" and "upward," not northwards and upwards" (Jon Rosales, St. Lawrence University)	ES has been completely rewritten, and the correction has been made
146	83886	28	4	6	4	7	What is the timeframe for this statement? Do "many places" include tundra and boreal regions?? (Katharine Mach, IPCC WGII TSU)	We appreciate this question on clarification, however the statement was not expanded to include these details due to space limitations.
147	83887	28	4	11	4	11	It would be preferable to say "warming" instead of "increased energy available (warming)" (Katharine Mach, IPCC WGII TSU)	ES has been completely rewritten, and the statement has been deleted
148	84912	28	4	11	4	17	Please provide line of sight for this paragraph. The referenced section does not exist. (Michael Mastrandrea, IPCC WGII TSU)	ES has been completely rewritten, and the sentence has been edited out
149	83888	28	4	13	4	13	"confounded" may not be the most illustrative word here--confounded, yes, for scientists looking at change, but a more precise descriptor of the interactions could be used here. (Katharine Mach, IPCC WGII TSU)	ES has been completely rewritten, and sttatement deleted
150	83889	28	4	14	4	14	Are research stations really a substantial stressor? (Katharine Mach, IPCC WGII TSU)	ES has been completely rewritten, and statement deleted.
151	63793	28	4	15	4	15	Add examples for non-native species: grasses, rodents (GERMANY)	ES has been completely rewritten, and statement edited out
152	83890	28	4	15	4	15	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Katharine Mach, IPCC WGII TSU)	This has been corrected
153	83891	28	4	16	4	16	Is it possible to indicate more explicitly what is meant by "greatest threat"? (Katharine Mach, IPCC WGII TSU)	ES has been completely rewritten, and this statement deleted
154	63794	28	4	19	4	20	Please consider this para in the TS (p.10 l.23). (GERMANY)	Suggestion has been noted
155	78203	28	4	19	4	20	Couldn't the same thing be said of Arctic lakes? Arctic lakes are seeing longer open water seasons (earlier break-ups and later freeze-ups) and higher productivity. (Andrew Wong, University of Waterloo)	ES has been completely rewritten, and statement deleted.
156	83892	28	4	19	4	23	The relevant time frames of changes and the role of climate change should be clarified for all statements within this paragraph. (Katharine Mach, IPCC WGII TSU)	ES has been completely rewritten, and statement edited out
157	83893	28	4	25	4	26	Can anything be said about the time frames of changes observed so far and protected in the future? Is it possible to indicate what precisely what is meant by "significant" or "increase"? (Katharine Mach, IPCC WGII TSU)	ES has been completely rewritten. Time frames not available
158	75498	28	4	25	4	33	What are the positive impacts? Please describe. (UNITED STATES OF AMERICA)	ES has been completely rewritten, including this statement. Climate change is likely to have positive impacts for agriculture, including extended growing season/... p/21, line 52. The focus on negative impact reflects the focus of current literature on the impacts on human health in the arctic.
159	57263	28	4	25	5	2	There seems to me to be a good deal of overlap in the ideas expressed in these four paragraphs. There could be some condensation and less words. (Erica Head, Fisheries and Oceans Canada)	ES has been completely rewritten and significantly condensed in size.
160	78204	28	4	25	5	11	This point and the rest of the points in this section describe the significant climate impacts that indigenous peoples of the North will face in the near to long term. It supports my recommendation for SPM Pg. 6 line 8-10 arguing that indigenous peoples don't actually have a high adaptive capacity to handle many of the impacts listed in this paragraph and are currently not prepared for all of these challenges. For example, little has been done to increase the resilience of housing infrastructure to permafrost melt. For SPM Pg. 6 line 8-10, the assessment of high adaptive capacity should be changed to 'low and uncertain adaptive capacity'. (Andrew Wong, University of Waterloo)	The comments made here about the ability of indigenous peoples to handle the impacts mentioned and their adaptive capacity have been addressed to reflect this comment as well as part of our overall editing review in a number of places (in the text of the chapter, the Executive Summary, Summary of Knowledge, Technical Summary and Summary for Policy Makers)
161	65044	28	4	28	0	0	some hunters speak of increased access, but now by boat (George Hunt, University of Washington)	inserted “or, in some cases, increase access for hunters, but now by boat” p. 24, l. 26 – following “…and fishing areas”

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
162	71463	28	4	35	0	42	Suggest revising the last sentence to better characterize adaptation in the context of Arctic indigenous people. While some examples of resilience and knowledge sharing have been found, vulnerability is high for this population as a result of isolation, socioeconomic issues (poor education, changes in market, high suicide rates, poor diets etc) - E.g., see Owens et at 2013 Climatic Change vol 115 (CANADA)	The comments made here about the ability of indigenous peoples to handle the impacts mentioned and their adaptive capacity have been addressed to reflect this comment as well as part of our overall editing review in a number of places (in the text of the chapter, the Executive Summary, Summary of Knowledge, Technical Summary and Summary for Policy Makers)
163	75499	28	4	35	4	37	This claim that "Food security of many indigenous and rural residents ...is being impacted by climate change" needs to be substantiated somewhere in the chapter. Examples are needed if this statement is to be made. (UNITED STATES OF AMERICA)	There are many examples to support the food security issue: e.g., 28.2.4.3, 28.2.5.1.7, 28.2.6, 28.4
164	64177	28	4	35	4	42	A well documented challenge for residents of northern communities effecting food security is a result of aboriginal people having abandoned their previously semi nomadic lifesyle which were at least parially accessing resources to settlement in permanent and in most cases rapidly growing settlements. Populations of country foods within esy access to communities is heavily harvested. Difficulties at least partially as a result of effects of climate change along with time limitations resulting from a "wage economy" make it difficult to access more distant resources, Store bought food shipped in to destinations beyond the road network are extremely expensive. In Canada elimination of the food mail program and replacement withthe Nutrition North Program has not resolved the problems. Examples of papers on the theme: Food security in Times of Change- A Policy Brief onFood Security for Northern Canada; Arctic Health Research Network-Yukon www.arctichealthyukon.ca http://www.naho.ca/inuit/health-determinants/food-security/ http://www.naho.ca/jah/english/jah08_02/08_02_food-security.pdf (Ian Church, Canadian Foundation for Climate and Atmospheric Science/ IPY Canada)	added the following sentence into Sept 4 draft p. 26, l. 4, directly following "(Hovelsrud et al, 2011)": Indigenous people are also increasingly having to abandon their semi nomadic lifestyles, limiting their overall flexibility to access traditional foods from more distant locations. (www.arctichealthyukon.ca)
165	83894	28	4	35	4	42	The timeframe of all statements within the paragraph should be clarified. Additionally, is it possible to indicate more precisely what is meant by "significantly" and how changes would differ with timeframe or scenario of climate change? (Katharine Mach, IPCC WGII TSU)	It has not been possible to include evidence on how changes would differ with timeframe or scenario of climate change.
166	84913	28	4	35	4	42	All references to 28.2.7.X should be 28.2.6.X, I believe. (Michael Mastrandrea, IPCC WGII TSU)	ES has been completely rewritten
167	60448	28	4	37	4	37	There is no section 28.2.7.1 in SOD (DENMARK)	Noted and corrected. ES has been completely rewritten. Statement deleted.
168	60449	28	4	39	4	42	There is no section 28.2.7.1 or 28.2.7.2 in SOD. Statement line 29-42 is suported by technical report section 28.2.6.1. (DENMARK)	Noted and corrected. ES has been completely rewritten. Statement deleted.
169	62034	28	4	40	4	40	I don't think it is accurate to say that, "Arctic indigenous people… and have begun to develop novel solutions…" It is more accurate to say that, "Arctic indigenous people… and novel solutions have begun …" In my experience, it has usually been the scientists initiating TEK and science projects and programs not indigenous peoples. (Jon Rosales, St. Lawrence University)	ES has been completely rewritten. Statement has been deleted.
170	79681	28	4	41	4	42	"such as .." Find a better example of how indigenous people have adapted, maybe related to food sources or fisheries management. (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)	ES has been completely rewritten. Statement has been deleted.
171	83895	28	4	44	4	45	It is not clear if this statement pertains to observed changes or future changes. What "other large-scale changes" are meant? Additionally, it would be preferable to provide uncertainty language to characterize the author team's degree of certainty in the statement. (Katharine Mach, IPCC WGII TSU)	ES has been completely rewritten, including this statement
172	84914	28	4	44	4	45	What other large-scale changes are meant here? In addition, the line of sight should be to 28.2.5.1.5 instead. (Michael Mastrandrea, IPCC WGII TSU)	ES has been completely rewritten. The words "other large scale event" have been removed.
173	83896	28	4	45	4	46	It would be beneficial to indicate more precisely what type of economic activity is meant. (Katharine Mach, IPCC WGII TSU)	ES has been completely rewritten
174	84915	28	4	49	4	49	The line of sight should be to 28.2.5.1.4 instead of 28.2.6.1.4 here. (Michael Mastrandrea, IPCC WGII TSU)	ES has been completely rewritten
175	83897	28	4	51	4	52	It would be preferable to provide calibrated uncertainty language to characterize the author team's degree of certainty in this statement. Additionally, to what broad time frames and level/scenarios of climate change does this this statement apply? (Katharine Mach, IPCC WGII TSU)	ES has been completely rewritten
176	83898	28	4	53	4	54	It would be preferable to specify the timeframe for this statement. (Katharine Mach, IPCC WGII TSU)	ES has been completely rewritten. Time frames not available
177	83899	28	5	1	5	2	To maximize directness of wording, the chapter team should consider presenting "high confidence" within parentheses at the end of the sentence. (Katharine Mach, IPCC WGII TSU)	ES has been completely rewritten
178	71464	28	5	2	0	0	Chapter reference (28.6.1.7) does not exist in document. Please review. (CANADA)	ES has been completely rewritten

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
179	62035	28	5	2	5	2	Delete "and greater risk for long-term viability of polar bear population." This point is already made elsewhere. (Jon Rosales, St. Lawrence University)	ES has been completely rewritten
180	84916	28	5	2	5	2	Line of sight should be to 28.2.5.1.7 instead here. (Michael Mastrandrea, IPCC WGII TSU)	ES has been completely rewritten
181	63120	28	5	4	5	5	suggested revision "..thawing of ice-rich permafrost and…." It is the ice-rich permafrost that is particularly problematic for infrastructure stability. (Sharon Smith, Geological Survey of Canada)	Suggestion noted. ES has been completely rewritten
182	75500	28	5	4	5	5	What are the changing precipitation patterns referred to here? There were no examples or further discussion in the chapter. The claim that precipitation patterns are changing needs, at a minimum, supporting references. (UNITED STATES OF AMERICA)	Executive summary was signif8icantly revised and shortened to comply with space constrainst. Further details were not provided on precipitation patterns.
183	70694	28	5	4	5	7	Suggest adding in the end of paragraph. "Permafrost thermal state in the Antarctic Peninsula region makes it also a highly sensitive region for permafrost degradation (Vieira et al. 2010, Bockheim et al. 2013), but impacts on infrastructure in this very environmentally sensitive region are lacking assessment." Bockheim J, Vieira G, Ramos M, Lopez-Martinez J, Serrano E, Guglielmin M, Wilhelm K, Nieuwendam A. 2013. Climate Warming and Permafrost Dynamics in the Antarctic Peninsula Region . Global and Planetary Change, 100: 215-223; Vieira, G., Bockheim, J., Guglielmin, M., Balks, M., Abramov, A.A., Boelhouwers, J., Cannone, N., Ganzert, L., Gilichinsky, D.A., Goryachkin, S., López-Martínez, J., Meiklejohn, I., Raffi, R., Ramos, M., Schaefer, C., Serrano, E., Simas, F., Sletten, R., Wagner, D. 2010 - Thermal State of permafrost and active-layer monitoring in the Antarctic: advances during the International Polar Year 2007-09. Permafrost and Periglacial Processes, 21(2): 182-197. (Goncalo Vieira, University of Lisbon)	ES rewritten and significantly condensed to meet strict page limit.
184	79682	28	5	4	5	7	Over approximately what time span do we expect these changes affecting infrastructure to take place? (UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND)	Lack literature on time span.
185	84917	28	5	4	5	7	Please provide further support for this finding. The material in 28.2.5.1.5 (please correct the line of sight) does not fully cover the scope laid out here. (Michael Mastrandrea, IPCC WGII TSU)	ES has been completely rewritten
186	75501	28	5	5	5	5	Have the potential to is a very weak statement. It could mean anything. Are there any positive impacts on infrastructure? (UNITED STATES OF AMERICA)	Details are provided in main text
187	75502	28	5	9	5	9	Redundant with line page 4, lines 25-49. Please revise removing the redundant material from the appropriate section. (UNITED STATES OF AMERICA)	ES has been completely rewritten
188	63795	28	5	9	5	11	Please consider this para in the TS (p.28 l.37) as a 3rd bullet point. (GERMANY)	Noted
189	83900	28	5	11	5	11	For the described "unprecedented challenges," is it possible to indicate broadly how they would vary with scenario/level of climate change and time frame? (Katharine Mach, IPCC WGII TSU)	Literature is lacking on variations with scenario/level of climate change and time frame.
190	84918	28	5	29	0	0	Summary of Knowledge Assessed in other Reports: Please aim to shorten this section substantially, to provide a more compact summary of other reports. Please also ensure clear cross-referencing to specific chapter sections of other IPCC reports/volumes. (Michael Mastrandrea, IPCC WGII TSU)	Text was shortened
191	63121	28	5	29	5	29	Note that IPY was not an assessment but rather a coordinated/comprehensive research program in the polar regions. It is important to highlight this research more in this section as climate change was an important focus. Advances were made regarding climate change impact assessment and also adaptation. A key outcome of IPY was quantification of changes that have occurred/are occurring in various components of polar regions including cryosphere, marine environments, terrestrial ecosystems etc. (Sharon Smith, Geological Survey of Canada)	Noted, this section was edited.
192	83901	28	5	29	5	29	This section should be reduced in length by well over 50%. (Katharine Mach, IPCC WGII TSU)	Text was shortened
193	63176	28	5	29	8	27	"Summay of knowledge assessed in other reports": include ABA and ARR (Ulf Molau, University of Gothenburg)	Reference to ARR included
194	75503	28	5	29	8	27	A brief one or two paragraph introduction to the observed changes outlined in WGI chapters is enough: It is warming and ice is shrinking. Much of this section is redundant with subsequent sections. Please consider deleting this section. (UNITED STATES OF AMERICA)	Text was shortened
195	66018	28	5	32	5	32	Here and later (e.g. P.5 L. 47, P. 6, L. 21) citations of SWIPA 2011 and SOAC 2010 (2011) appear. I did not see the abreviation SOAC explicitly explained (although it is written out in P.5, L.32), and I did not find the two references in the reference list at the end of the chapter. The shorter summary of the SWIPA report is referenced in the reference list as AMAP 2012. (Sebastian Gerland, Norwegian Polar Institute)	References have been fixed
196	63174	28	5	37	5	37	You probably mean "variables" instead of "parameters". Or both? (Ulf Molau, University of Gothenburg)	Introduction was shortened, and sentence was edited out

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
197	83902	28	5	41	5	41	All references to working group 1 and working group 2 reports should reference the specific relevant chapters at least, and ideally even the specific relevant chapter sections. (Katharine Mach, IPCC WGII TSU)	This has been considered in revisions where applicable.
198	63175	28	5	43	5	43	as above (Ulf Molau, University of Gothenburg)	This has been considered in revisions where applicable.
199	83903	28	5	43	5	43	It would be preferable to specify which "selected parameters" are meant here. (Katharine Mach, IPCC WGII TSU)	Introduction was shortened, and sentence was edited out
200	63796	28	5	43	5	45	It is 'the' Arctic, not only 'Arctic'. (GERMANY)	Has been corrected to read the Arctic
201	85240	28	5	43	7	5	The temperature of the Arctic is dominated by ocean currents , not surface temperatures. The area of the ice is misleading because the thickness chagnes.conceals (Vincent Gray, Climate Consultant)	noted, however all of the above is discussed in detail in WG1 report
202	63122	28	5	44	5	44	This should be "Assessment of such changes is essential for understanding a cascading…" (or characterization or understanding of such changes) (Sharon Smith, Geological Survey of Canada)	Text was shortened, and this wording has been edited out
203	80454	28	5	44	5	44	change "changes" to "phenomena." It is the rate of change that is being discussed (Josefino Comiso, NASA Goddard Space Flight Center)	Text was shortened, and this wording has been edited out
204	57264	28	5	44	5	45	Replace sentence that begins "Such changes are essential" with "An examination of these changes is essential to understand the cascade of societal impacts addressed in this chapter." (Erica Head, Fisheries and Oceans Canada)	Text was shortened, and this wording has been edited out
205	64245	28	5	44	5	45	The sentence beginning with “Such changes are essential for understanding a cascade...” does not make sense. Logically it is equivalent to saying “Global warming is essential for understanding the changes brought on by global warming”, and is probably not what the authors wanted to say. The sentence would make sense if it started with: “A solid grasp of these changes is essential for understanding the cascade....” (ICELAND)	We appreciate this comment. Text was shortened, and this wording has been edited out
206	57730	28	5	47	0	0	Sea ice extent declined… (Jeff Ridley, UK Met Office)	Introduction was signficantly shortened including this sentence. The word "extent" was not included in the revision.
207	66019	28	5	47	5	47	I suggest to write "Sea ice extent", and not just sea ice, since the number in the following line corresponds to sea ice extent. The number given is the number for a specific day, but by writing "September 2012", one might think this is a monthly mean. The day for the observation could be given, or instead the monthly mean could be listed. Same interesting as the total value, also the trend of Arctic sea ice extent for September since 1979 might be worth to be mentioned in the text. See for numbers and further reading: http://nsidc.org/arcticseaicenews/2012/10/, and http://nsidc.org/arcticseaicenews/2012/09/. (Sebastian Gerland, Norwegian Polar Institute)	Introduction was signficantly shortened including this sentence. The word "extent" was not included in the revision.
208	78205	28	5	47	5	49	May be worth including that the September 2012 sea ice extent was 49% below the 1979 to 2000 average: http://nsidc.org/arcticseaicenews/2012/09/arctic-sea-ice-extent-settles-at-record-seasonal-minimum/ (Andrew Wong, University of Waterloo)	This material is in the WG 1 report
209	80455	28	5	47	5	50	The paragraph needs to be updated to be consistent with WG1/AR5/Chapter 4. It should also be emphasized that it is the decline in the perennial ice as represented by sea ice minimum that may be causing the rapid change. The perennial ice represents the thick component and its rapid decline means that the Arctic summer ice will eventually disappear. (Josefino Comiso, NASA Goddard Space Flight Center)	This material was edited substantially
210	57731	28	5	48	0	0	quoting 18% is redundant information. Suggest "…which followed the previous record of 4.17 million km2 in 2007. (Jeff Ridley, UK Met Office)	Introduction has been significantly revised and shortened, and this text edited out
211	66216	28	5	48	5	48	"…which is 18%..." This is not exactly the value, so I recommend to state 18.23% or rephrasing as …"which is about 18%..." (David Velázquez, Universidad Autónoma de Madrid)	Introduction has been significantly revised and shortened, and this text edited out
212	80437	28	5	49	5	49	Please provide a specific reference to WGI AR5. (Gian-Kasper Plattner, IPCC WGI TSU)	Introduction has been significantly revised and shortened, and this text edited out
213	57732	28	5	49	5	50	sentence structure: Climate models project an nearly ice free Arctic Ocean this century, with some suggesting in may occur within the next 30-40 years. (Jeff Ridley, UK Met Office)	Introduction has been significantly revised and shortened, and this text edited out
214	83904	28	5	49	5	50	It would be preferable to specify if this is an outcome expected across all scenarios of climate change or just some? (Katharine Mach, IPCC WGII TSU)	Introduction has been significantly revised and shortened
215	80438	28	5	49	5	51	Please provide a specific reference to WGI AR5. (Gian-Kasper Plattner, IPCC WGI TSU)	Introduction has been significantly revised and shortened

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
216	63036	28	5	50	5	51	I assume the reference here to "IPCC WG1 Fifth AR" to support the statement about future loss of Arctic sea-ice will be updated to a specific WG1 Chapter reference ? (This matter is dealt with on Page 6 of Chapter 11 of the WG1 SOD). (David Wratt, NIWA, New Zealand)	Introduction has been significantly revised and shortened
217	57733	28	5	51	5	52	sentence structure: The duration of snow extent and snow depth are dereasing in North America and increasing in Eurasia (SWIPA, 2011). (Jeff Ridley, UK Met Office)	Kept sentence strcture unchanged
218	57967	28	5	51	5	52	This statement is incorrect. Changes in snow cover extent vary by season. On both continents extent is generally increasing in fall and early winter, but decreasing dramatically in spring and early summer. Data can be viewed at climate.rutgers.edu/snowcover. (Jennifer Francis, Rutgers University)	We understand reviewer's concern about the accuracy and completeness of the statements in the introductory part. Meanwhile, due to strict space limitations it is impossible to discuss in detail changes in the physical environment. As stated at the very beginning of the Introduction, it is done in WG-1 report. While we do not consider seasonal features of the snow extent, we make a note in the Introduction that (1) snow period is decreasing; and (2) maximum snow depth is decreasing in North-America and increasing in Eurasia. Both statements are supported by SWIPA 2011 report, and do not contradict with reviewer's statement about the seasonal variations of the snow extent
219	75504	28	5	51	5	52	The statement about snow trends (particularly the increasing duration and extent in Eurasia) needs to be modified in view of recent paper by Derksen and Brown (2012, GRL), who showed that the May-June decrease of snow coverage is significant on both landmasses. There have been five consecutive years (2008-2012) of new record minima for June in Eurasia, according to Derksen and Brown. (UNITED STATES OF AMERICA)	This is discussed in detail in WG1 report, our text gives only general insight into such changes that are necessary for ounderstanding their impacts.
220	63123	28	5	52	5	54	Romanovsky et al. (2010) is the key reference that should be cited here regarding changes in permafrost temperature. Ref: Romanovsky, V.E., Smith, S.L., and Christiansen, H.H. 2010. Permafrost thermal state in the polar Northern Hemisphere during the International Polar Year 2007-2009: a synthesis. Permafrost and Periglacial Processes, 21: 106-116. (Sharon Smith, Geological Survey of Canada)	Reference has been added
221	63124	28	6	6	6	6	Note that "relocation" is a form of adaptation (Sharon Smith, Geological Survey of Canada)	Introduction has been significantly rewritten and shortened
222	60450	28	6	8	6	9	According to SWIPA (section 11.4.4.5 page 11-31) "Changing sea ice conditons (less multi-year ice, more seasonal ice, earlier melt, later freeze up) may lead to increased light availability for photosyntehsis and therefore increased biological productivity at all levels." Change "will" to "may" (DENMARK)	Introduction has been significantly rewritten and shortened
223	65045	28	6	12	0	0	why not fish, ice seals, polar bears. Why polar bears first? (George Hunt, University of Washington)	Introduction has been significantly rewritten and shortened
224	75505	28	6	13	6	13	p. 6, line 13: See the references below. The remark that ice dependent seals will be disadvantaged is likely too general. Ice seals that require spring ice for pupping and nursing (i.e., spotted and ribbon seals) may not be affected (at least in the next 50-100 years), whereas species dependent on sea ice for feeding outside of the spring (e.g., bearded seal) or dependent on sea ice with adequate snow cover for birth lairs (e.g., ringed seal) will likely be disadvantaged. (UNITED STATES OF AMERICA)	Introduction has been significantly rewritten and shortened
225	83905	28	6	13	6	15	Across which scenarios of climate change is this outcome expected? (Katharine Mach, IPCC WGII TSU)	Introduction has been significantly rewritten and shortened. Sentence has been edited out in the condensed text.
226	63177	28	6	21	6	21	Permafrost degradation and subsequent hydrological changes are highlighted in ARR. Also dealt with in ABA (under Freshwater Ecosystems). (Ulf Molau, University of Gothenburg)	Introduction has been significantly rewritten and shortened
227	80456	28	6	23	6	23	Note that global warming would cause less ice and therefore less ice jams. Other factors like more frequent storms may be the key reasons for the ice jams that cause the flooding. (Josefino Comiso, NASA Goddard Space Flight Center)	Introduction has been significantly rewritten and shortened
228	83906	28	6	27	6	28	Does this statement also pertain to the next decade? (Katharine Mach, IPCC WGII TSU)	Introduction has been significantly rewritten and shortened

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
229	63125	28	6	31	6	31	Permafrost is not seasonal but exists for more than two years. Use the term "seasonally frozen ground" if referring to seasonal occurrence of cryospheric components. Note that changes in permafrost distribution over time can also have implications for transportation and other infrastructure. (Sharon Smith, Geological Survey of Canada)	Introduction has been significantly rewritten and shortened. Sentence has been edited out in the condensed text.
230	66020	28	6	37	6	38	The statement on increase of navigation days along the Northern Sea Route is not followed by a citation (unless the citation of IPCC WG2 2007 at the end of the sentence refers also to this). Assuming the statement relates to work of the recent years, I wonder if there is one or several corresponding reference(s) to it, which could be added. Possibly references given in section 28.2.5.1.4 (page 31-32), including Mokhow and Khon 2008, also cited for Fig. 28-8 (P.92), could be relevant here. This Reference is not given in the reference list. (Sebastian Gerland, Norwegian Polar Institute)	Introduction has been significantly rewritten and shortened
231	61672	28	6	37	6	39	What proportion of the world's population (or absolute number) live in Arctic areas? i.e. what would the actual magnitude of reduced heating demand be for example? This is stated as being between 4-9 million in a different part of the chapter (page 26). (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	The size is estimated at either 4 or 9 million depending on what definition of the Arctic border is being used - which differs between publications.
232	83907	28	6	38	6	39	It would be preferable to specify the baseline for the described 15% decline. (Katharine Mach, IPCC WGII TSU)	Introduction has been significantly rewritten and shortened
233	78206	28	6	43	6	54	This is more evidence suggesting that Arctic idigenous adaptive capacity should be assessed as 'low and largely uncertain' instead of 'high' in SPM Pg. 6 line 8, due to 'an unprecedented combination of rapid and stressful changes…" (Andrew Wong, University of Waterloo)	Introduction has been significantly rewritten and shortened. Sentence has been edited out in the rewritten and condensed text.
234	62036	28	6	47	6	49	This thought should be finished. Why is it significant that adaptation be mainstreamed in to policy and win-win options? (Jon Rosales, St. Lawrence University)	Introduction has been significantly rewritten and shortened
235	64178	28	6	51	6	51	authors may want to add the word "living" or something equivlent to the term "natural resources". Likewise in line 54 (Ian Church, Canadian Foundation for Climate and Atmospheric Science/ IPY Canada)	Introduction has been significantly rewritten and shortened
236	57414	28	7	0	0	20	I've read through Ch 28, the Antarctic portion. The treatment is quite brief as well as highly localized compared to the Arctic portion. I realize doing the writing isn't easy and largely thankless. I have the comments below. At this point I'd be willing to contribute more substantively, i.e. help to expand, but only if current authors are amenable to incorporating what I might have to say. (David Ainley, H.T. Harvey & Associates Ecological Consultants)	The requirement to significantly reduce text in the chapter from the SOD to the final draft means that more consolidation has occurred, rather than expansion.
237	63178	28	7	2	7	5	TK is paramount in ARR (Ulf Molau, University of Gothenburg)	Acknowledged. A section on TK is included in the text referencing new and relevant literature.
238	75506	28	7	4	7	5	Recognition by whom of the value of traditional ecological knowledge? The sentence seems to be imply that local residents need to recognize the importance of traditional ecological knowledge, since it is their resilience and adaptive capacity that is needed. Are the local communities unaware of their TEK? If this statement means that external groups are the ones who need to do the recognizing, it say who those groups are. In any event, clarification is needed here. (UNITED STATES OF AMERICA)	Introduction has been significantly rewritten and shortened, including editing out this sentence
239	83908	28	7	8	7	8	All citations used within this section should be very carefully checked--given the scope of this section, ONLY citations to previous assessment reports should be used. (Katharine Mach, IPCC WGII TSU)	Noted. Introduction has been significantly rewritten and shortened
240	63035	28	7	8	8	27	You might like to provide a cross-reference somewhere in this section on Antarctica, to the section of WG1 Chapter 14 (Section 14.7.14 in the WG1 SOD) which assesses observed and predicted climate changes in Antarctica ? (David Wratt, NIWA, New Zealand)	Introduction has been significantly rewritten and shortened. Cross references to WGI have been improved

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
241	57391	28	7	10	0	24	This is a very one-sided treatment. While Stammerjohn et al. (2012, see also 2008) are cited for decreasing sea ice, these same authors document the expansion of sea ice in the Ross Sea sector and so much so that it accounts for a net increase in sea ice Southern Ocean wide (Zwally et al. 2002). The modeling of Joellen Russell (in Ainley et al. 2010) indicates that the sea ice expansion will continue for at least the next few decades (maybe the AR5 report discusses this, too????). A lot of this is related to the ozone hole. Nothing is said about retreat of ice shelves and consequences for benthic communities (well, not until p 18, quite briefly), as well as for range adjustments for land creatures (including seals, penguins). These ice shelf retreats have mostly to do with intrusion of warmer CDW, i.e. subsurface melting (Binschadler & Co). The increased freshening of the Ross Sea, in fact, has nothing to do with precipitation, as inferred in this paragraph, but has to do with intrusions of fresh water from melting Pine Island Glacier and vicinity (Jacobs et al. 2002, Jacobs 2006). (David Ainley, H.T. Harvey & Associates Ecological Consultants)	Introduction has been significantly rewritten and shortened to comply with strict page limit. This section is now revised to only summarise previous reports and to set the scene based on WGI results.
242	63034	28	7	10	7	10	This chapter contains the phrase: "While temperatures over the bulk of the Antarctic Continent have not changed markedly in recent decades …". I note that WG1 SOD Chapter 2 Page 29 lines 28-30 states: "Although these agree that Antarctica as a whole is warming, substantial differences in reconstructed magnitude and spatial trend structure yield only low confidence in Antarctic region LSAT changes". I suggest a little more congruence between the WG1 and WG2 statements would be useful, perhaps by including within the WG2 sentence a recognition that Antarctica as a whole has warmed, with a cross-reference back to WG1. (David Wratt, NIWA, New Zealand)	This section is now revised to only summarise previous reports and to set the scene based on WGI results. As a result, congruence should be achieved directly.
243	83909	28	7	10	7	10	It would be preferable to indicate more specifically the timeframe implied by "recent decades." (Katharine Mach, IPCC WGII TSU)	Introduction has been significantly rewritten and shortened. Reference to "recent decades" has been edited out.
244	57734	28	7	10	7	12	Misleading contect: The trend in total sea ice extent in the Antarctic has remained steady, or even increased slightly, over the past three decades, confounding climate model predictions showing moderate to strong declines. This apparent intransigence masks dramatic regional trends; declines in sea ice in the Bellingshausen Sea region that rival the high-profile decline in the Arctic have been matched by opposing increases in the Ross Sea. Over the Antarctic continent temperatures have remained constant over recent decades, except for marked warming over the West Antarctic ice sheet, the peninsula and the islands of the Scotia Arc. (Jeff Ridley, UK Met Office)	Introduction has been significantly rewritten and shortened. This section is now revised to only summarise previous reports and to set the scene based on WGI results.
245	57736	28	7	14	0	0	This addition is needed to tie in with 28-18-34. "As a consequence of the regional warming, number of ice shelves on the Antarctic Peninsula have collapsed in recent decades with large effects on the ice dynamics of the inland grounded glaciers [Scambos et al., 2004]" Scambos, T. A., J. A. Bohlander, C. A. Shuman, and P. Skvarca (2004), Glacier acceleration and thinning after ice shelf collapse in the Larsen B embayment, Antarctica, Geophys. Res. Lett., 31, L18402, doi:10.1029/2004GL020670. (Jeff Ridley, UK Met Office)	This section is now revised to only summarise previous reports and to set the scene based on WGI results. The suggested addition was not made
246	80457	28	7	14	7	18	There should be a discussion about the large regional differences, especially around Antarctica. For example, sea ice extent is increasing very rapidly in the Ross Sea but is decreasing also very rapidly in the Bellingshausen and Amundsen Seas. Refer to WG1/AR5/Chapter 4. (Josefino Comiso, NASA Goddard Space Flight Center)	Introduction has been significantly rewritten and shortened to comply with strict page limit.
247	83910	28	7	14	7	21	It would be beneficial to specify the approximate time frames for these statements. (Katharine Mach, IPCC WGII TSU)	Introduction has been significantly rewritten and shortened to comply with strict page limit.
248	57392	28	7	16	0	18	Please be specific. The only areas that have experienced 'significant' warming are northern Antarctic Peninsula and points north. You say Ross Sea, but the warming there, on annual average, might be something like -30 warming to -28C. Therefore, ecologically insignificant (but see LaRue et al. 2013). And for sure, there has been well documented increased snow fall in the Antarctic Peninsula region, contrary to what is said here (papers by Fraser and references therein). (David Ainley, H.T. Harvey & Associates Ecological Consultants)	Introduction has been significantly rewritten and shortened. This section is now revised to only summarise previous reports and to set the scene based on WGI results.
249	70692	28	7	17	7	17	after "permafrost habitats in the coastal margins" consider adding citation to Bockheim J, Vieira G, Ramos M, Lopez-Martinez J, Serrano E, Guglielmin M, Wilhelm K, Nieuwendam A. 2013. Climate Warming and Permafrost Dynamics in the Antarctic Peninsula Region . Global and Planetary Change, 100: 215-223, which is the 1st study with observation on permafrost degradation in the West Antarctic Peninsula region. (Goncalo Vieira, University of Lisbon)	Introduction has been significantly rewritten and shortened to comply with strict page limit.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
250	57735	28	7	19	7	21	Confusing description as winds drive the ACC. Suggest: "The Southern Annular Mode (SAM)describes the north–south movement of the westerly wind belt that circles Antarctica, dominating the middle to higher latitudes of the southern hemisphere. Recently the SAM has been in a possitive phase which means the band of westerly winds contracts towards Antarctica. Consequently the Antarctic Circumpolar Current, the extent of which is regionally variable, has moved to the south. (Jeff Ridley, UK Met Office)	This section is now revised to only summarise previous reports and to set the scene based on WGI results.
251	63179	28	7	21	7	21	Explain the acronym SAM (Ulf Molau, University of Gothenburg)	Introduction has been significantly rewritten and shortened.
252	63797	28	7	21	7	21	Please insert: '…with increasing Southern Annual Mode (SAM) is…'. (GERMANY)	Introduction has been significantly rewritten and shortened.
253	75507	28	7	21	7	21	SAM needs to be defined. (UNITED STATES OF AMERICA)	Introduction has been significantly rewritten and shortened.
254	64605	28	7	21	7	22	Summary of knowledge, Antarctic: Tying effects of ocean acidification to the saturation horizon of carbonates is an oversimplification as explained in WGII ch. 6. (Lena Menzel, Alfred Wegener Institute for Polar and Marine Research)	Introduction has been significantly rewritten and shortened. Sentence was edited out.
255	63798	28	7	22	7	24	Misplaced clause, connection to text before not clear. Please start a new para or at least a new line with 'Aragonite undersaturation…', because it is a new issue. (GERMANY)	Introduction has been significantly rewritten and shortened. Sentence was edited out.
256	83911	28	7	22	7	24	It would be preferable to specify the relevant scenarios of climate change for the expected change. Also, casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Katharine Mach, IPCC WGII TSU)	Introduction has been significantly rewritten and shortened. Sentence was edited out.
257	56833	28	7	23	0	0	undersatuarion of aragonite: effects on pteropods are described but not on benthic animals No effect? (Angelika Dr. Brandt, University of Hamburg)	Introduction has been significantly rewritten and shortened. Issues related to Ocean Acidification are discussed in the projected impacts section. Due to page limitations, a detailed description of species specific impacts for a broad spectrum of species was not possible. The text provides representative examples including projected impacts on crab.
258	58895	28	7	23	7	24	Under the Arctic paragraph above on page 6 there is no reference to aragonite saturation. Should perhaps mention the aragonite saturation in the Arctic, as well. The depth level of aragonite saturation will also rise considerably in the Arctic, although there might not be literature describing surfacing of the saturation level, but at least up above the Arctic shelves (e.g. Orr et al 2005) , and I would assume surfacing in certain areas here, as well. (Svein Sundby, Institute of Marine Research)	Introduction has been significantly rewritten and shortened. Issues related to Ocean Acidification are discussed in the projected impacts section. The revised text refers readers to Working Group 1 reports and the OA box that provide the information requested.
259	83912	28	7	26	7	28	As appropriate, the general time frame for these outcomes should be specified. (Katharine Mach, IPCC WGII TSU)	Introduction has been significantly rewritten and shortened.
260	63799	28	7	27	7	28	On Antarctic islands there is also an increase in abundance of alien species (King George Island). (GERMANY)	Introduction has been significantly rewritten and shortened.
261	64179	28	7	37	0	0	Surface freshwater systems- there are extensive hydrological systems beneath the ice. (Ian Church, Canadian Foundation for Climate and Atmospheric Science/ IPY Canada)	Introduction has been significantly rewritten and shortened.
262	66217	28	7	39	7	39	"…in a simple food web." I do not really thing that microbial mats food webs are simple, in fact there is a lack of knowledge about that. I recommned rephrasing as:"…in a relatively simple food web with many interactions (Velázquez et al, 2013). Velázquez D, Jungblut D, Rochera C, Rico E, Camacho A, Quesada A (2013). Seasonal dynamics and trophic interactions of a microbial mat in maritime Antarctica. Submitted to Environmental Microbiology. (David Velázquez, Universidad Autónoma de Madrid)	Introduction has been significantly rewritten and shortened.
263	63180	28	7	40	7	40	insert "aquatic" before "higher plants" (for clarity) (Ulf Molau, University of Gothenburg)	Introduction has been significantly rewritten and shortened.
264	57393	28	7	42	0	0	Authors are confusing the readers. Signy Island is not sub-Antarctic by the definition of Antarctic given above nor actually anyone's definition. Could get away with 'maritime Antarctic'. (David Ainley, H.T. Harvey & Associates Ecological Consultants)	Introduction has been significantly rewritten and shortened.
265	63800	28	7	43	0	0	Signy Island itself is not well known, maybe it is better to use the whole group of South Orkney Islands as an example. (GERMANY)	Introduction has been significantly rewritten and shortened.
266	75508	28	7	45	7	45	p. 7, line 45: It would be useful to specify the species and population referred to rather than "fur seal populations". (UNITED STATES OF AMERICA)	Introduction has been significantly rewritten and shortened.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
267	57394	28	7	48	0	50	Strange that micronutrient levels, i.e. Fe, not mentioned, particularly in the extinguishment of blooms, which few people for some reason don't consider. Seemingly, p 19 (ln 45) by referencing glacial melt as influencing PP you're implying a Fe role?? (David Ainley, H.T. Harvey & Associates Ecological Consultants)	Introduction has been significantly rewritten and shortened.
268	57968	28	7	49	7	49	I believe that "insolation" would be a better word than "irradiance" here, as it seems the discussion is about solar wavelengths. Irradiance does not refer to the wavelength of energy. (Jennifer Francis, Rutgers University)	Introduction has been significantly rewritten and shortened.
269	57395	28	7	50	0	52	This statement is false. In coastal waters, especially those of polynyas, Phaeocystis is the dominant phyto-producer. In fact, the Ross Sea contributes 28% of total Southern Ocean PP, and a large part of that is Phaeocystis (see Smith et al. 2012; also various Arrigo papers). (David Ainley, H.T. Harvey & Associates Ecological Consultants)	Introduction has been significantly shortened, especially by eliminating the description of the changes in physical environment, which are addressed in WG-1 report. This is why comment is non applicable anymore
270	57969	28	7	50	7	50	Has this paper been published yet? Check for all "submitted" references. (Jennifer Francis, Rutgers University)	Introduction has been significantly rewritten and shortened.
271	78189	28	7	51	7	51	Point of clarification: Should the word "which" be replaced with "and"? The word "and" would make it clear that diatoms are referred to, rather than waters. (Inga Smith, University of Otago)	Introduction has been significantly rewritten and shortened.
272	78190	28	8	2	8	6	[NOTE: Biology is not my area of expertise, but I think someone needs to check this]Explicit mention of Ross Sea ecosystem structure (silverfish versus krill) might be important? (Inga Smith, University of Otago)	Introduction has been significantly rewritten and shortened.
273	64606	28	8	4	8	5	Summary of knowledge, Antarctic: wouldn't krill dominated systems always be found south of the circumpolar current? (Lena Menzel, Alfred Wegener Institute for Polar and Marine Research)	Introduction has been significantly rewritten and shortened.
274	57396	28	8	8	0	0	What does 800m refer to? Is that an average depth? In fact, this number is often used to designate the shelf break, which means as an average it doesn't characterize shelf topography very well. 'Deep shelf areas' are much deeper than 800m. (David Ainley, H.T. Harvey & Associates Ecological Consultants)	Introduction has been significantly rewritten and shortened.
275	57397	28	8	10	0	0	hard to know what Constable has to say about this, but in the Ross Sea (largest of all Antarctic continental shelves) benthic communities are primarily determined by near-bottom current velocities, i.e. the rate of food delivery (Barry et al. 2003). (David Ainley, H.T. Harvey & Associates Ecological Consultants)	Introduction has been significantly rewritten and shortened.
276	78191	28	8	10	8	12	"Coastal polynyas are prevalent, caused by land forms, glacier tongues, bottom topography or grounded icebergs (Massom and Stammerjohn, 2010)" - presumably latent heat (wind driven) polynyas are what are being referred to here? Not sensible heat (warm water upwelling) polynyas? (Inga Smith, University of Otago)	Introduction has been significantly rewritten and shortened.
277	57398	28	8	11	0	0	No. Coastal polynyas are driven by winds, i.e. almost all are latent heat polynyas (Arrigo & van Dijken 2003). The little open water areas around grounded icebergs are insignificant, other than to very local creatures. Yes, there are a few sensible heat polynyas here and there but not a lot in the Antarctic. (David Ainley, H.T. Harvey & Associates Ecological Consultants)	Introduction has been significantly shortened, especially by eliminating the description of the changes in physical environment, which are addressed in WG-1 report. This is why comment is non applicable anymore
278	83913	28	8	16	8	25	The specific relevant chapter sections in the 4th assessment report could be specified here. (Katharine Mach, IPCC WGII TSU)	Introduction has been significantly rewritten and shortened.
279	75509	28	8	20	8	20	p. 8, line 20: it is not accurate to imply that all large whale populations and all ice seal populations were decimated by overharvesting - some were not. Perhaps revise "recovery of whales and seals from past over-exploitation" to "recovery of those populations of whale and seal species from past over-exploitation". (UNITED STATES OF AMERICA)	Introduction has been significantly rewritten and shortened.
280	64607	28	8	21	8	25	Summary of knowledge, Antarctic: several paragraphs need references (Lena Menzel, Alfred Wegener Institute for Polar and Marine Research)	Introduction has been significantly rewritten and shortened.
281	63181	28	8	23	8	23	should read" 5-10°C" (Ulf Molau, University of Gothenburg)	Introduction has been significantly rewritten and shortened.
282	78192	28	8	23	8	23	"may be vulnerable if water temperatures rise to 5-10oC" Is this "to" or "by" 5 to 10 degrees? And note that degree symbol should be superscripted. (Inga Smith, University of Otago)	Introduction has been significantly rewritten and shortened.
283	57970	28	8	27	8	27	this seems like an orphan comment. (Jennifer Francis, Rutgers University)	Introduction has been significantly rewritten and shortened.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
284	75510	28	8	30	0	0	If this section is about observed changes, then the authors should consider removing mentions of the future. Many sections speculate about what will happen under climate change or make general observations about changes that have or may occur. It could be made much tighter; focus only on recent observed changes. (UNITED STATES OF AMERICA)	Text has been modified to focus on observed impacts
285	84919	28	8	30	0	0	Section 28.2: Please undertake a careful edit to ensure that only observed changes are discussed in this section, as currently there are some projections mixed in, which makes for confusing overlap with 28.3. This is particularly an issue with 28.2.2. Throughout, be as clear as possible regarding the timeframe for specific observed changes, as this is often unclear. (Michael Mastrandrea, IPCC WGII TSU)	Text has been modified to focus on observed impacts
286	83914	28	8	32	0	0	Section 28.2.1. The chapter team should ensure that the observed changes are the focus throughout this section, eliminating future-oriented discussion, especially for projected impacts. (Katharine Mach, IPCC WGII TSU)	Text has been modified to focus on observed impacts
287	75511	28	8	38	8	47	Reference should be made to Zhang et al. (2012, GRL), who showed that the variations and trends of Eurasian river discharge are consistent with corresponding variations of atmospheric moisture flux convergence. (UNITED STATES OF AMERICA)	The authors agree that this is a good point to expand upon. While Zhang did publish a GRL paper in 2008 about Arctic atmospheric ciruclation, the authors suspect that the reviewer meant the Zhang (2013: published on line in 2012) in Nature: Climate Change, which deals with "enhanced poleward moisture transport" and flux convergence in the Eurasian basins. The text has been modifed to include this reference and point.
288	57265	28	8	40	8	41	Change this to "decreased flow in major high-latitude Canadian rivers etc." (Erica Head, Fisheries and Oceans Canada)	Text has been modifed as suggested.
289	57971	28	8	43	9	16	Much of this information seems to belong in the WGI report. (Jennifer Francis, Rutgers University)	Although WG1 does deal with some broad assessments of changes in the hydrological cycle, e.g., Chapter 2, Section 2.5, and some aspects of changes in permafrost, e.g, Chapter 4: they do not have the detailed focus on such physical impact changes as needed in this Polar Regions chapter. Cross-chapter refencing has been included where logical to reinforce points.
290	83915	28	8	50	8	53	The timeframe for these changes should be specified. (Katharine Mach, IPCC WGII TSU)	The time frame was identified several lines above on L48, i.e., [1960-2001]. The text has been reduced so this should be clearer now.
291	83916	28	9	1	9	3	The general time frame for these changes should be specified. (Katharine Mach, IPCC WGII TSU)	A general time frame of "primairly late 20th century" has been added to the text. The authors would have liked to detail the various spatial and temporal trends. and how their statstical signficiance varies by time window and length of period but, unfortunately, space restrcitons preclude this.
292	75512	28	9	6	9	6	"Others argue……." It would be more useful to present data instead of arguments. (UNITED STATES OF AMERICA)	Unfortunately, space restrictions preclude discussing the specific data and the text can only point to the major conclusion, i.e., P-E being the suggested dominat control. To try and further sharpen this essential summary point, the last two sentences of this paragraph have been merged.
293	83917	28	9	20	9	20	It would be preferable to indicate more precisely the timeframe for the described "recent" drying. (Katharine Mach, IPCC WGII TSU)	The timeframe has been succinctly noted as being late "20th c – early 21st c"
294	83918	28	9	29	9	29	The timeframe of the documented changes should be specified. (Katharine Mach, IPCC WGII TSU)	Timeframe has been noted as being "over the last half-century"

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
295	63126	28	9	29	9	37	Role of thaw slumping including possible increase is also discussed in Kokelj et al. (2009). Impacts on aquatic ecosystems has also been discussed by Kokelj et al. (2009); Lamoureux and Lafrenière (2009); Dugan et al. (2009). Refs: Kokelj, S.V., Zajdik, B., and Thompson, M.S. 2009. The impacts of thawing permafrost on the chemistry of lakes across the subarctic boreal-tundra transition, Mackenzie Delta region. Permafrost and Periglacial Processes, 20: 185-199. Kokelj, S.V., Lantz, T.C., Kanigan, J., Smith, S.L., and Coutts, R. 2009. Origin and polycyclic behaviour of tundra thaw slumps, Mackenzie Delta region, Northwest Territories, Canada. Permafrost and Periglacial Processes, 20(2): 173-184. Lamoureux, S.F., and Lafrenière, M.J. 2009. Fluvial Impact of Extensive Active Layer Detachments, Cape Bounty,Melville Island, Canada. Arctic, Antarctic, and Alpine Research, 41: 59-68. Dugan, H.A., Lamoureux, S.F., Lafrenière, M.J., and Lewis, T. 2009. Hydrological and sediment yield response to summer rainfall in a small high Arctic watershed. Hydrological Processes, 23: 1514-1526. (Sharon Smith, Geological Survey of Canada)	The authors appreciate the suggestion of additional citations. Although we have to restrict the text to a limited number of key articles, the Kokelj et al. (2009) is considered highly relevant. It was in fact included in the reference list of the SOD but somehow deleted from the original text body. It has now been reinstated as it supports strongly the point about permafrost-chemistry effects on lakes - just as the Frey & McClelland 2009 reference does for rivers.
296	83919	28	9	32	9	42	The timeframe of these changes should be specified. (Katharine Mach, IPCC WGII TSU)	The changes (not temporal) noted for thermokarst lakes are rom recent experimental studies, so this has been indicated in the text. For this and the other cases (i.e., changes in river delta and epishelf lakes), the text has been changed to point out that "While such bio-physical dependencies have been established, temporal trends in such river-delta and epishelf lake impacts and their linkages to changing climate remain to be quantified precisely. "
297	75513	28	9	39	9	42	This "decrease in the supply of ice-jam floodwaters" seems to run counter to the projected increase of ice-jam flooding on Siberian rivers (p. 6, lines 24-28). Some reconciliation is needed. (UNITED STATES OF AMERICA)	The text in 28.2.1. has been changed to simply point out the control of river ice jam flood levels (combined with sea level) on delta productivity. Moreover, the fact that ice jam flooding can increase or decrease has been embellished extensively in Section 28.3.1. Specifically, it is made clear that that ice-jam flooding has the potential to increase or decrease depending on synergistic/antagonitic hydro-climatic factors, and that no broad-scale analyses of such has been completed.
298	65046	28	9	40	0	0	here you speak of a decrease in the serverity of ice break-up whereas earlier there was mention of an increase in the serverity of ice break-up. Why should the severity change? (George Hunt, University of Washington)	This was not discussed due to page constraints
299	62973	28	10	0	0	0	Statification due to ice melt and the cold halocline is a substantial important issue for the Arctic Ocean. This stratification often prevents nutrient availability (Tremlay and Gagon, 2009) making the Arctic Ocean a low productive region even when ice vanish (Wassmann, 2011). This theme is poorly described in sub chapter 28.2.2. (Randi Ingvaldsen, Institute of Marine Research)	Text was added to address this issue
300	70693	28	10	3	10	17	Suggest considering including the most recent observations on permafrost, due to relationships with ecosystems: "Permafrost in the Antarctic Peninsula region has been shown to be at temperatures close to thaw and even lacking in lowest areas (Vieira et 2010). Bockheim et al. (2013) report on changes in permafrost in the region that follow the general warming that has been reported. Such changes should have significant impacts on the terrestrial ecosystems and surface hydrology." Bockheim J, Vieira G, Ramos M, Lopez-Martinez J, Serrano E, Guglielmin M, Wilhelm K, Nieuwendam A. 2013. Climate Warming and Permafrost Dynamics in the Antarctic Peninsula Region . Global and Planetary Change, 100: 215-223; Vieira, G., Bockheim, J., Guglielmin, M., Balks, M., Abramov, A.A., Boelhouwers, J., Cannone, N., Ganzert, L., Gilichinsky, D.A., Goryachkin, S., López-Martínez, J., Meiklejohn, I., Raffi, R., Ramos, M., Schaefer, C., Serrano, E., Simas, F., Sletten, R., Wagner, D. 2010 - Thermal State of permafrost and active-layer monitoring in the Antarctic: advances during the International Polar Year 2007-09. Permafrost and Periglacial Processes, 21(2): 182-197. (Goncalo Vieira, University of Lisbon)	WGI will be the source of physical environmental change. This section will deal with observed changes in relation to the ecosystem. Nonetheless, reference to permafrost has been made.
301	83920	28	10	4	10	6	The timeframe of these changes should be specified. Also, the relevant supporting citation could be specified. (Katharine Mach, IPCC WGII TSU)	Noted the time frame is 'in recent decades'
302	66218	28	10	14	10	14	I recommend to support the sentence by the reference:Quesada A and Velázquez D (2012). Global Change Effects on Antarctic Lakes. In: Effects of Global Warming on Freshwater Ecosystems of the World: what can be done to reduce negative impacts? (M Kumagai, CR Goldman and RD Robarts eds). Wiley-Blackwell Ltd .pp 367-382 (David Velázquez, Universidad Autónoma de Madrid)	the reference has been included and appropriate edits made to this text, noting that the original text has been substantially revised.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
303	57972	28	10	19	10	23	I would like to see a summary statement like this at the end of each major section in the report. (Jennifer Francis, Rutgers University)	These summary statements were removed because of space limitations
304	83921	28	10	19	10	23	The chapter team should ensure a focus on observed changes in the summary paragraph. Clear support for each statement in the preceding assessment should be ensured. "High confidence" could be placed within parentheses at the end of the 1st sentence to maximize direct of wording. Also, casual usage of "likely" on line 20 should be avoided. (Katharine Mach, IPCC WGII TSU)	Only observed changes are included in this section with confidence statements in parentheses
305	57266	28	10	20	10	21	Change this to "Antarctica. The exact nature of these impacts is likely to vary regionally depending on the magnitude of the temperature change, how much change is required for the temperature to rise above freezing, the depth to" (Erica Head, Fisheries and Oceans Canada)	These summary statements were removed because of space limitations
306	66219	28	10	23	10	23	I reommend to complete the sentence with: "..., but some international innitiatives have been carried out (Quesada et al., 2013)." Quesada, a, Lyons WB and Camacho A (2013) Byers Peninsula- A new refrence site for the maritime Antarctic. Antarctic Science- Special Issue. 25 (2) (David Velázquez, Universidad Autónoma de Madrid)	These summary statements were removed because of space limitations. Inclusion of reference cited is not required – but it is a good example of a long term monitoring initiaive along with the US LTER's
307	83922	28	10	26	0	0	Section 28.2.2. This section should be very carefully revised. 1st, focus on OBSERVED (not expected or projected) changes should be ensured throughout. 2nd, the length of the section should be reduced by much more than 50%. (Katharine Mach, IPCC WGII TSU)	Only observed changes are included in this section
308	84920	28	10	26	0	0	Section 28.2.2: Please undertake a careful edit to ensure that only observed changes are discussed in this section. Currently there are projections mixed in, which makes for confusing overlap with 28.3. Please also aim to shorten this section substantially, reducing background material as much as possible and focusing on the key messages emerging from assessment of the relevant literature. At the same time, please also be specific about the timeframes related to specific observed changes mentioned, as this is often unclear. (Michael Mastrandrea, IPCC WGII TSU)	Only observed changes are included in this section. Statements on the future have been moved to 28.3
309	75514	28	10	28	14	8	The linkages amongst species is difficult to follow for non-subject matter experts. It would be very helpful to have a food chain illustration to follow and (if such a thing exitsts) indications of where key impacts and strossors are effectng the system. The key take aways of this section didn't come through. Lot's of distributed impacts described. (UNITED STATES OF AMERICA)	Due to page constraints a figure showing the food-web was not possible. The text focuses on key impacts and stressors.
310	66021	28	10	31	10	31	I understand the statement on sea ice retreat is addressing seasonal retreat in spring and early summer. I suggest that also the timing (and especially delay) of seasonal sea ice return (late summer/autumn/winter) is mentioned here. The timing of onset of freezing/sea ice return has implications for (i) the amount of snow on sea ice in the following spring (which can be relevant for certain marine mammals, and for the optical transmittance of the snow and ice system, controlling the light conditions in and under the ice), (ii) the access for polar bears from drifting ice areas to coastal areas, and (iii) the availability of solar radiation in the water column around the time of onset of freezing/sea ice return (relevance depending on ambient light conditions relative to latitude and time of year). (Sebastian Gerland, Norwegian Polar Institute)	This text was deleted due to page constraints.
311	75515	28	10	31	10	31	Timing and extent of sea ice are important, but in many ways, volume is even more important. (UNITED STATES OF AMERICA)	We modified the text to mention areal extent of ice.
312	80011	28	10	32	10	32	Add "mixing processes and transport of water masses" to generate "increased freshwater supplies, mixing processes and transport of water masses". (NORWAY)	This text was deleted due to page constraints.
313	75516	28	10	34	10	34	This section (28.2) is about observed changes. Discussion of expected changes is out of place. (UNITED STATES OF AMERICA)	Text relevant to projected impacts was moved to 28.3.2.2
314	83923	28	10	34	10	34	This section should focus on observed impacts, not expected or projected impacts. (Katharine Mach, IPCC WGII TSU)	Text relevant to projected impacts was moved to 28.3.2.2
315	83924	28	10	36	10	40	Focus on observed changes should be ensured. The rigor of the logic of the last sentence of the paragraph, in terms of this support of the previous statements, should also be ensured. Also, on line 37, specific cross-reference to the relevant chapter and chapter sections within the working group 1 contribution is needed. (Katharine Mach, IPCC WGII TSU)	Text relevant to projected impacts was moved to 28.3.2.2
316	75517	28	10	42	10	42	"..impacted by" is quite vague. (UNITED STATES OF AMERICA)	This text was deleted due to page constraints.
317	75518	28	10	42	10	42	Again, this section is about observed changes. Discussion of expected changes is out of place. (UNITED STATES OF AMERICA)	Text relevant to projected impacts was moved to 28.3.2.2
318	83925	28	10	42	10	42	Focus on observed changes should be ensured. (Katharine Mach, IPCC WGII TSU)	Text relevant to projected impacts was moved to 28.3.2.2
319	80746	28	10	45	0	0	A link to Box CC-OA would seem very useful here. (Jean-Pierre Gattuso, Centre National de la Recherche Scientifique)	We make reference to the OA box in the ocean acidification section 28.3.2.1

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
320	64608	28	10	45	10	51	Tying effects of ocean acidification to the saturation horizon of carbonates is an oversimplification as explained in WGII ch. 6. WGI ch. 6 is a good reference for changing ocean physicochemistry but not for biological impact. Cross-referencing to WGII ch.s 5, 6 and the cross-chapter box on ocean acidification appears warranted. (Lena Menzel, Alfred Wegener Institute for Polar and Marine Research)	We added references to include other biological impacts.
321	83926	28	10	48	10	48	Focus on observed changes should be ensured. (Katharine Mach, IPCC WGII TSU)	Text relevant to projected impacts was moved to 28.3.2.2
322	80747	28	10	48	10	49	This sentence misses key papers by Comeau et al. Which are mentioned elsewhere. (Jean-Pierre Gattuso, Centre National de la Recherche Scientifique)	We make reference to the Comeau et al papers in the ocean acidification section 28.3.2.1
323	75519	28	11	1	0	0	Section 28.2.2.1.1 should be omitted. It does not say much about impacts that are not covered elsewhere in the chapter. (UNITED STATES OF AMERICA)	The text was reduced text by over 50%
324	83927	28	11	1	0	0	Section 28.2.2.1.1. This section should be very substantially reduced and tightened in revision, shortening its length by much more than 50%. (Katharine Mach, IPCC WGII TSU)	The text was reduced text by over 50%
325	80012	28	11	3	11	3	Unclear what is meant with fall ice algal bloom, please clarify. (NORWAY)	This text was deleted due to page constraints.
326	80013	28	11	14	11	14	Calanus in italics. (NORWAY)	The text was corrected
327	75520	28	11	21	11	21	Retention of phytoplankton in water column of Bering Sea is a response to climate change. That is not clear in this text. (UNITED STATES OF AMERICA)	This sentence was deleted due to page constraints
328	65047	28	11	30	0	0	what about the recent papers by Bluhm et al about grey whales consuming euphausiids in the southern Chukchi Sea (George Hunt, University of Washington)	This sentence was deleted due to page constraints
329	64246	28	11	34	11	36	There is something missing in the latter part of this sentence: “In general, dominant pelagic species are smaller sized fish capable of rapid growth in the first year of life (e.g. capelin, Mallotus villosus) and in some cases antifreeze proteins to tolerate cold temperatures (e.g. polar cod, Boreogadus saida)” . The latter part will have to contain “with” or “having” to read something like ".....and in some cases with anti freeze proteins .....". (ICELAND)	This sentence was deleted due to page constraints
330	57267	28	11	35	11	35	Change to "the first year of life (e.g. capelin, Mallotus villosus) and in some cases have antifreeze proteins to enable them to tolerate cold" (Erica Head, Fisheries and Oceans Canada)	This sentence was deleted due to page constraints
331	63182	28	11	35	11	35	insert "have" or something before "antifreeze" (Ulf Molau, University of Gothenburg)	This sentence was deleted due to page constraints
332	57268	28	11	38	11	38	Change "Spebcer" to "Spencer" (Erica Head, Fisheries and Oceans Canada)	This sentence was deleted due to page constraints
333	75521	28	11	40	11	43	This is a not very useful statement - there are not many taxa that have NOT evoloved such traits. (UNITED STATES OF AMERICA)	This sentence was deleted due to page constraints
334	80014	28	11	49	11	49	In addition to stratification, the depth of the upper mixed layer will change. It is very important for total production and should be included here. Please consider rephrasing to "… and stratification, as well as the depth of the upper mixed layer…" (NORWAY)	Reference to the mixed layer depth was made in section 28.3.2.2.1
335	83928	28	11	49	11	49	Focus on observed changes should be ensured. (Katharine Mach, IPCC WGII TSU)	Text relevant to projected impacts was moved to 28.3.2.2
336	83929	28	11	53	11	53	Focus on observed changes should be ensured. (Katharine Mach, IPCC WGII TSU)	Text relevant to projected impacts was moved to 28.3.2.2
337	57269	28	11	54	11	54	Omit the word "trophic". (Erica Head, Fisheries and Oceans Canada)	Text has been corrected
338	58896	28	11	54	11	54	Suggest to delete the word "trophic" (Svein Sundby, Institute of Marine Research)	Text has been corrected
339	80015	28	11	54	11	54	Consider adding that there will be local differences. (NORWAY)	Throughout this section we emphasize regional heterogeneity
340	80016	28	12	2	12	2	What is the difference between this statement and the one on the previous page (line 53-54) other than the latter using climate change and the first physical and chemical change (which also is related to climate change)? Please clarify. (NORWAY)	Text has been removed in revisions
341	83930	28	12	2	12	22	Throughout these paragraphs, focus on the observed changes should be ensured. (Katharine Mach, IPCC WGII TSU)	Text relevant to projected impacts was moved to 28.3.2.2
342	80017	28	12	10	12	11	To what extent? Please give more details. (NORWAY)	A detailed description of this study was not possible due to page limitations
343	57270	28	12	20	12	21	Change "2011) however, these adjustments etc" to "2011) although these adjustments etc" (Erica Head, Fisheries and Oceans Canada)	The text was corrected to refer to many generations.
344	75522	28	12	20	12	22	"...long time periods" is too vague. What is important is the rate of change relative to generation time (i.e., evolutionary adaptation time horizons for bacteria are very different than those for walruses). (UNITED STATES OF AMERICA)	Corrected text to refer to many generations

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
345	64609	28	12	27	13	6	Observed spatial shifts in response to climate: Many phenomena described under this subtitle are projections rather than observations. (Lena Menzel, Alfred Wegener Institute for Polar and Marine Research)	Text relevant to projected impacts was moved to 28.3.2.2
346	75523	28	12	27	13	6	Relate this section to previous sections 28.2.3 Terrestrial Ecosystems: Changes in tree line, changes in animal population cycles systems and section 28.2.2 Oceanographic and marine ecosystems . (UNITED STATES OF AMERICA)	This is a good research idea but suggested text was not added due to time constraints
347	83931	28	12	28	12	31	Focus on observed changes should be ensured. (Katharine Mach, IPCC WGII TSU)	Text relevant to projected impacts was moved to 28.3.2.2
348	60451	28	12	30	12	30	"impact the decrease the" Some text seems missing. (DENMARK)	The text was corrected.
349	65635	28	12	30	12	30	impact the derease --> decrease (?) (Sukgeun Jung, Jeju National University)	The text was corrected.
350	80018	28	12	31	12	31	Genus name should be spelled out the first time the species is metioned in a new sub-chapter. Check the whole chapter for this. (NORWAY)	The text was corrected.
351	75524	28	12	32	12	33	"Additional observations are needed" is vague. Explain further. (UNITED STATES OF AMERICA)	Text was not added due to time constraints
352	83932	28	12	35	12	35	Focus on observed changes should be ensured. Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Katharine Mach, IPCC WGII TSU)	Text relevant to projected impacts was moved to 28.3.2.2
353	64247	28	12	39	12	42	The sentence refers to four sea areas and four references are listed at the end. One of the sea areas "west Greenland Sea". None of the reference mentioned specifically covers the west Greenland Sea. Instead of "west Greenland Sea" should be written "the Northeast Atlantic Ocean and Icelandic waters". The references Hátún et al., 2009 and Valdimarsson et al., 2012 cover these two areas. Further, it is unclear if any one of the other references cover the Chukchi Sea. The authors have to the authors carefully check if bringing the Chukchi Sea into the discussion on the basis of these references is valid. (ICELAND)	We appreciate the reviewer´s comment and the suggestions for correction. The text was corrected accordingly.
354	75525	28	12	44	12	48	This seems like a key and general point to guiding the reader through the section yet is nested within the spatial shifts. We recommend an earlier highlight of this point. (UNITED STATES OF AMERICA)	We disagree, the referenced papers are relvant to spatial shifts.
355	57271	28	12	45	12	45	Change "abundance of marine fish throughout its life cycle" to "abundance of marine fish throughout their life cycles" (Erica Head, Fisheries and Oceans Canada)	The text was corrected.
356	75526	28	12	46	12	47	Again, relative to generation time is important. (UNITED STATES OF AMERICA)	This sentence is bringing out the factors that influence spatial shifts, generation timing is not the key issue in this context
357	75527	28	12	52	12	52	Clarify why winter is important. (UNITED STATES OF AMERICA)	There was insufficient room to fully explain the mechanisms underlying this response. Literature is provided that explains the mechanisms.
358	83933	28	12	53	12	53	Focus on observed changes should be ensured. (Katharine Mach, IPCC WGII TSU)	Text relevant to projected impacts was moved to 28.3.2.2
359	75528	28	13	1	13	6	"Shfits" is too vague. Overall productivity? Community composition? Functional dynamics? (UNITED STATES OF AMERICA)	The text was corrected.
360	83934	28	13	2	13	5	Focus on observed changes should be ensured. (Katharine Mach, IPCC WGII TSU)	Text relevant to projected impacts was moved to 28.3.2.2
361	75529	28	13	19	13	23	These lines seem more appropriate to the discussion of projections (Section 28.3.2). (UNITED STATES OF AMERICA)	Text relevant to projected impacts was moved to 28.3.2.2
362	83935	28	13	19	13	28	Focus on observed changes should be ensured. (Katharine Mach, IPCC WGII TSU)	Text relevant to projected impacts was moved to 28.3.2.2
363	57272	28	13	20	13	21	Change "across its geographic range (Beaugrand and Kirby, 2010) and the ability of the species to adapt" to "across their geographical ranges (Beaugrand and Kirby, 2010) and the abilities of species to adapt" (Erica Head, Fisheries and Oceans Canada)	The text was corrected.
364	75530	28	13	25	13	28	Logic of this paragraph is unclear. Are you saying that there is low confidence that the Bering Sea will warm by 2100? (UNITED STATES OF AMERICA)	The text was corrected.
365	75531	28	13	30	13	43	There doesn't seem to be a coherent take away from this listing. The significance of these species, in relation to each other or a part of the big picture, is not clear. (UNITED STATES OF AMERICA)	Detailed causal linkages for individual fish and shellfish species could not be discussed due to page limitations
366	64610	28	13	37	0	0	Observed variations in fish and shellfish: The next lines are not so much about the mechanisms but again on statistical relationships between abiotic or biotic conditions and the effect observed. (Lena Menzel, Alfred Wegener Institute for Polar and Marine Research)	A brief description of the mechanisms was added

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
367	75532	28	13	41	13	43	Ch 28 p 13 lines 41 - 43. More recent observational work on trophic linkages in the Bering Sea indicates that temperature alone is not sufficient to predict year class strength in pollock (Coyle et al. Fisheries Oceanography 20:2, 139-156, 2011). The fact that year class strength in pollock does not appear to vary in concert with warm and cold years is due to the changes in food-web pathways created by changes in species composition of zooplankton (see Coyle et al. 2011; Stabeno et al. 2012 Deep-Sea Research II 65-70, 14-30 and Stabeno et al. 2012 Deep-Sea Research II 65-70, 31-45). (UNITED STATES OF AMERICA)	A brief description of the mechanisms was added that includes reference to prey quality
368	75533	28	13	46	0	0	This section is mostly about what will happen, not observed changes. Drop the section. (UNITED STATES OF AMERICA)	Text relevant to projected impacts was moved to 28.3.2.2
369	80439	28	13	48	13	48	Please provide a specific reference to WGI AR5. (Gian-Kasper Plattner, IPCC WGI TSU)	Text was removed due to space limitations
370	83936	28	13	48	13	48	Instead of saying "as described" it would be preferable to specify what the changes are. Specific reference to the relevant chapters and chapters sections of working group 1 should be provided. (Katharine Mach, IPCC WGII TSU)	Text was removed due to space limitations
371	83937	28	13	48	13	53	Focus on observed changes should be ensured. (Katharine Mach, IPCC WGII TSU)	Text relevant to projected impacts was moved to 28.3.2.2
372	83938	28	13	52	13	52	It would be preferable to indicate more specifically what is meant by "implications" and "considerable." (Katharine Mach, IPCC WGII TSU)	Text was removed due to space limitations
373	64612	28	13	52	13	53	Other stressors: The degree of ocean acidifciation effects does not depend upon undersaturation as explained before. (Lena Menzel, Alfred Wegener Institute for Polar and Marine Research)	The discussion of OA was moved to the projection section and references to WG 1 and the OA Box were included to provide the reader with more information.
374	75534	28	13	53	0	0	..exposure to environmental contaminants, and infectious diseases Hueffer K, Parkinson AJ, Gerlach R, and Berner J. Zoonotic infectious in Alaska: Disease prevalence, potential impact of climate change and recommended actions for earlier disease detection, research, prevention and control. Int J Circumpolar Health 2013 72: 19562 http://dx.doi.org/10.3402/ijch.v72i0.19562 (UNITED STATES OF AMERICA)	Text was removed due to space limitations
375	64613	28	14	5	14	6	Other stressors: while fully agreed on the paucity of analyses, esp if it concerns a whole region, cross-referencing to chapter 6 appears warranted where the principles of such multiple stressor effects have been addressed. (Lena Menzel, Alfred Wegener Institute for Polar and Marine Research)	Text was removed due to space limitations. In the acidification section we reference the chapter box
376	83939	28	14	6	14	6	Focus on observed changes should be ensured. (Katharine Mach, IPCC WGII TSU)	Text relevant to projected impacts was moved to 28.3.2.2
377	80019	28	14	11	15	28	Please specify why ivory gull (which has received attention by scientists because of effects of climate change) is not mentioned? (NORWAY)	Ivory gull i smentioned in the projection ch (28.3). In the new draft the text on sea birds is shortened considerably and space limitations do not allow a full and detailed assessment
378	62974	28	14	13	0	0	Upwelling or convergence areas should be changed to Upwelling or subsurface convergence areas. Upwelling is often caused by changes at surface causing divergence in the surface layer and thereby causing convergence at the subsurface layer. (Randi Ingvaldsen, Institute of Marine Research)	Text has been corrected
379	83940	28	14	15	14	15	Focus on the observed changes should be ensured. (Katharine Mach, IPCC WGII TSU)	agree, but this is in the intro to the section and sets the stage for the topic and we have therefor kept it as it is
380	75535	28	14	16	0	0	Add Levintova 2010 reference. (UNITED STATES OF AMERICA)	Added reference
381	57273	28	14	19	14	22	Change "Such spatial mismatch between prey base and breeding has been" to "Such spatial mismatches between prey base and breeding have been" Change "The percentage of important prey in the diet etc" to "The percentage of Arctic Cod in the diet etc" and "which was the habitat of the prey" to "which is the habitat of the prey" (Erica Head, Fisheries and Oceans Canada)	The text has been changed completely
382	57274	28	14	29	14	30	"Current trends suggest that continued warming etc." I looked in the reference (Gaston et al., 2009), but did not find this idea expressed there. The reference is inappropriate and either the correct on should be given, or the sentence omitted. (Erica Head, Fisheries and Oceans Canada)	Thanks. It should have been Gaston et al. 2005. Has been changed
383	75536	28	14	33	14	33	p. 14, line 33: Many of the references in this section on seabirds refer to the SE Bering Sea. References to some of the work by Divoky and others should be included. See below. (UNITED STATES OF AMERICA)	There are to refs in this paragraph on from the Bering Sea and one from the Barents Sea
384	80020	28	14	33	14	33	Correct spelling: Brünnich's guillemot (NORWAY)	Text has been changed

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
385	80021	28	14	33	14	33	Capitalize species names: Brünnich's guillemots and Common guillemots. This should be done throughout the text. (NORWAY)	Text has been changed
386	64614	28	14	37	14	39	28.2.2.1.2. Is any explanation available for these contrasting observations? (Lena Menzel, Alfred Wegener Institute for Polar and Marine Research)	No, not as far as we know about
387	75537	28	14	43	14	46	The Grebmeier et al. (2006) reference seems dubious, as it is seven years old. The Bering Sea has turned colder in the past six years, with below-normal water temperatures and above-normal ice extent in winter, so how likely is it that the northward ecosystem shift is still ongoing? (UNITED STATES OF AMERICA)	We have added a new sentence with this information
388	67940	28	14	44	14	0	(Typo) "1990tiescaused" should be replaced with "1990s caused." (JAPAN)	This has been corrected
389	57275	28	14	44	14	46	Change "1990tiescaused" to "1990s caused" and "these populations in the area have declined" to "these populations have declined in the area" (Erica Head, Fisheries and Oceans Canada)	This has been corrected
390	83941	28	15	2	15	2	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Katharine Mach, IPCC WGII TSU)	Deleted and added other uncertainty language
391	64615	28	15	2	15	3	28.2.2.1.2.Unless there is a full understanding of underlying principles this may be overstated. Reasons should be specified more than done here. Otherwise the term likely does not really apply. (Lena Menzel, Alfred Wegener Institute for Polar and Marine Research)	Likey is deleted. Used medium confidence. Reasons cannot be specified more because of space limit, but should be evident from the studies referred to
392	57276	28	15	3	15	6	The Gaston and Woo 2008 reference is used inappropriately. I suggest changing "While phenological changes and changes in productivity of some breeding colonies related to climate change etc" to "Phenological changes and changes in productivity of some breeding colonies have been observed, as well as northward expansions for sub-artic species, as ice cover decreases and their prey species move north (e.g. Razorbills, Alca torda, Gaston and Woo, 2008). Negative trends in population size, observed over the last few decades for several species of widespread Arctic seabirds, may be related to over-harvesting and pollution as well as climate change effects (Gaston, 2011)." Reference: (Erica Head, Fisheries and Oceans Canada)	Changed the text as suggested
393	57277	28	15	3	15	6	Gaston, A. J. (2011) Arctic seabirds: Diversity, populations, trends, and causes. in R. T. Watson, T. J. Cade, M. Fuller, G. Hunt, and E. Potapov (Eds.). Gyrfalcons and Ptarmigan in a Changing World, Volume I. The Peregrine Fund, Boise, Idaho, USA. Pp. 147-160, http://dx.doi.org/10.4080/gpcw.2011.0201 (Erica Head, Fisheries and Oceans Canada)	Thanks, see comment 393
394	83942	28	15	8	15	25	Focus on the observed changes should be ensured. (Katharine Mach, IPCC WGII TSU)	Has been removed to 28.3 projections
395	75538	28	15	9	15	9	Item #2 Fishtahler(L.E.&C.R.): Chapter 28 pg. 15, line 9 Sec. 28.2.2.1.2. Current changes in Arctic seabird populations Title: Cite current literature #2 Issue: cite current literature Change: "(Wang and Overland, 2009)" To: "(Wang and Overland, 2012)" Rationale: Wang and Overland (2012) is an update of Wang and Overland (2009) Wang, M., and J. E. Overland (2012), A sea ice free summer Arctic within 30 years: An update from CMIP5 models, Geophys. Res. Lett., 39, L18501, doi:10.1029/2012GL052868. (UNITED STATES OF AMERICA)	Paragraph moved to section 28.3 projections. Wang and Overland 2009 is replaced by Wang and Overland 2012
396	57973	28	15	18	15	25	There must be a more recent reference available than the ACIA 2005 report. (Jennifer Francis, Rutgers University)	Has been corrected in revisions
397	75539	28	15	28	16	39	Polar bears should be folded in with other marine mammals and the text devoted to bears should be shortened. Pulling them out as here since the wrong message about their overall importance in the ecosystem. (UNITED STATES OF AMERICA)	Done . The text on marine mammals, polar bear, and sea birds have been merged into one section and considerably shortened in the new draft
398	65048	28	15	40	0	0	mention polar bears so that one knows that this paragraph focuses on them (George Hunt, University of Washington)	Polar bear is mentioned
399	71465	28	15	47	15	54	The difference between the terms "declining body condition" and "lower body condition" is not clear - do these both refer to lower mass? Suggest clarifying. (CANADA)	yes both refer to body mass and fat content. Cannot see the need for clarification
400	83943	28	15	50	15	52	To maximize directness of wording, "high confidence" could be placed within parentheses at the end of the statement. (Katharine Mach, IPCC WGII TSU)	Tried to change this as suggested
401	65049	28	16	0	0	0	section 28.2.21.4: This section seems weak. My understanding is that there is considerable concern about walrus and bearded seal in the Pacific Arctic when ice retreats over the basin. (George Hunt, University of Washington)	May be, but we have to assess existing scientific publications and do belive that we have made a fairly objective assessment of them. Both Bearded seal and Walrus are mentioned in the text
402	64180	28	16	5	0	0	Unclear what "the Southern Beaufort Sea is projected to decline by 99%....." refers to. Probably bear population growth rate. Likewise the next sentence. (Ian Church, Canadian Foundation for Climate and Atmospheric Science/ IPY Canada)	has been changed and clarified. Part of the paragraph have been moved to 28.3 projections

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
403	63127	28	16	5	16	5	Do you mean "population decline"? (Sharon Smith, Geological Survey of Canada)	Yes, has been changed
404	75540	28	16	5	16	5	Something is missing after "The Southern Beaufort Sea". (UNITED STATES OF AMERICA)	Changed, see comment 403
405	80022	28	16	5	16	5	Please consider rephrasing the start of the sentence: "The Southern Beaufort Sea subpopulation is projected to decline by 99% by 2100…" (NORWAY)	changed, see comment 403
406	83944	28	16	5	16	10	Focus on observed changes should be ensured. (Katharine Mach, IPCC WGII TSU)	Moved to 28.3 projections
407	80023	28	16	6	16	6	Please consider rephrasing the start of the sentence: "The Northern Beaufort Sea subpopulation is currently stable although decline…" (NORWAY)	Has been changed accordingly
408	75541	28	16	12	16	12	What the level of evidence (if it can be quantified) supports the finding that "Projected extinction of polar bears has low confidence." (UNITED STATES OF AMERICA)	That is the assessment of the experts based on the references sited both in section 28.2 and 28.3
409	64181	28	16	15	0	0	First sentence should be reworded for clarity. I assume it means that at periods of maximal melt multiyear ice is used. (Ian Church, Canadian Foundation for Climate and Atmospheric Science/ IPY Canada)	Text deleted due to shortening
410	63128	28	16	15	15	20	Shouldn't changes in physical environment (sea ice) be discussed first, followed by implications of changing sea ice conditions. (Sharon Smith, Geological Survey of Canada)	Paragraph deleted due to shortening
411	75542	28	16	15	16	15	Is multiyear or seasonal ice better habitat? Can we say why? (UNITED STATES OF AMERICA)	Text has been deleted
412	62037	28	16	15	16	16	As in the first order draft, this first sentence is still unclear to me. I suggest: "Since multiyear ice is used by some polar bears at maximal ice melt (Ferguson et al., 2010), replacement of multiyear ice by annual ice could increase polar bear habitat (Derocher et al., 2004)." (Jon Rosales, St. Lawrence University)	Text has been deleted
413	83945	28	16	26	16	27	To maximize directness of wording, "high confidence" could be placed within parentheses at the end of the statement. (Katharine Mach, IPCC WGII TSU)	This has been corrected
414	75543	28	16	29	16	39	Occupying the terrestrial niche exposes polar bears to additional threat from hybridization with grizzly bears (Kelly, B. P., A. R. Whiteley, and D. A. Tallmon. 2010. Arctic melting pot. Nature 468:891.). (UNITED STATES OF AMERICA)	OK, not an important point and we have chosen not to include it because of space limitations
415	83946	28	16	35	16	35	Focus on the observed changes should be ensured. (Katharine Mach, IPCC WGII TSU)	Most of projected changes have been moved to 28.3
416	75544	28	16	50	16	53	Most populations of ringed and bearded seals are associated with sea ice year round. (UNITED STATES OF AMERICA)	The last part of this para has been deleted during shortening of the text
417	83947	28	17	4	17	4	In place of "vary" it would be preferable to indicate more precisely the variations expected. (Katharine Mach, IPCC WGII TSU)	The variety of effects on marine mammals is detailed further in the paragraph, which is why no changes have been made in response to reviewer's comment
418	83948	28	17	4	17	49	For all statements in these paragraphs, focus on the observed changes should be ensured. (Katharine Mach, IPCC WGII TSU)	Most projections have been moved to 28.3
419	75545	28	17	8	17	8	Reference to the possibility of species adapting should not be made without reference to generation time. Evolutionary adaptation has to occur over multiple generations, so the rate of environmental change to generation time is critical. (UNITED STATES OF AMERICA)	Agree on that, but we do not have space to mention all the details and assess all topics
420	83949	28	17	12	17	12	What is the timeframe for these observed effects? (Katharine Mach, IPCC WGII TSU)	Timeframe is not given
421	75546	28	17	12	17	23	Laidre et al. used a very crude set of indicator variables to make very broad extrapoloations to likely impacts. For example, they assumed that species with broad distributions and broad diets were less vulnerable than species with narrow distributions and diets. In that way, they built a matrix, assigned arbitrary weightings, and, based on the sum of those scores, predicted which species would and would not be vulnerable. Much more detailed and recent analyses of habitat requirements, however, came to the opposite conclusion. That is, ringed seals (http://www.afsc.noaa.gov/Publications/AFSC-TM/NOAA-TM-AFSC-212.pdf) and bearded seals (http://www.afsc.noaa.gov/Publications/AFSC-TM/NOAA-TM-AFSC-211.pdf) were the MOST sensitive to changing ice (and snow) conditions. See also Hezel et al (2012) cited elsewhere in this chapter. (UNITED STATES OF AMERICA)	But these references are not peer-reviewed articles in journals and we have chosen to avoid grey litterature as far as possible
422	75547	28	17	15	17	15	p. 17, line 15: See note above regarding references to status review on ringed and bearded seals in the western Arctic. We do not believe ringed seals and bearded seals would be considered "least sensitive" in the western Arctic. (UNITED STATES OF AMERICA)	We have moderated the text at this point a little in order to take the comments into consideration.H790
423	83950	28	17	25	17	25	"medium agreement" should be used instead of "moderate agreement." (Katharine Mach, IPCC WGII TSU)	This has been done

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
424	75548	28	17	27	17	31	More significant to walrus populations is the decoupling of nursing substrate (pack ice) and feeding areas (on-shelf benthos) (Kelly 2001 - cited elsewhere in this chapter). (UNITED STATES OF AMERICA)	The text has been shortened
425	83951	28	17	30	17	37	The timeframe for observed changes and effects should be specified. (Katharine Mach, IPCC WGII TSU)	The text has been shortened considerably and we do not think this is relevant anymore here
426	80024	28	17	33	17	33	Is "Baltic" correct? Please check whether it should not be "Barents" instead. (NORWAY)	No Baltic is correct
427	75549	28	17	44	17	44	remove future tense (UNITED STATES OF AMERICA)	ok, has beeen done
428	83952	28	17	44	17	44	"high confidence" could be placed within parentheses at the end of the statement to maximize directness of wording. (Katharine Mach, IPCC WGII TSU)	OK, has been done
429	75550	28	17	44	17	49	p. 17, line 44-49: The concerns for ringed and bearded seals in the western Arctic should be incorporated into this concluding paragraph. (UNITED STATES OF AMERICA)	The paragraph has been edited out in revisions
430	80025	28	18	1	20	27	If possible, more details should be presented and with the same approach (sub-chapters) as for 28.2.2.1 Arctic? One example: little on ice algal communities in the Antarctic, but also other groups and themes should be discussed more thoroughly. (NORWAY)	Space is limited to give detailed reviews. Where possible, a similar structure has been applied.
431	80026	28	18	1	20	27	Section 28.2.2.1. For Arctic, some of the statements are connected to confidence (high, medium, low). Where possible, this should also be done for 28.2.2.2 Antarctic. (NORWAY)	Confidence statements now included for Antarctica
432	83953	28	18	5	18	12	The relevant time frames for these observed changes should be specified. (Katharine Mach, IPCC WGII TSU)	(time scale 1- 10 years)
433	80027	28	18	8	18	8	Please use the proper spelling: "Emiliania huxleyi". (NORWAY)	This has been corrected
434	80028	28	18	8	18	8	"Noctiluca scintillans" in italics. (NORWAY)	This has been corrected
435	80029	28	18	8	18	9	"McLeod, Hallegraeff et al. 2012" isnot in the reference list, please check for consistency. (NORWAY)	References have been checked
436	56834	28	18	11	0	0	Antarctic vulnerabiity and change…lithodid crabs on WAP line 11 – but benthos? (Angelika Dr. Brandt, University of Hamburg)	Text on lithodid crabs and benthos has been extensively revised
437	57974	28	18	11	18	11	Define lithodid (Jennifer Francis, Rutgers University)	This word is no longer present in the text
438	83954	28	18	11	18	15	Are the statements on lines 11-12 and 14-15 consistent? (Katharine Mach, IPCC WGII TSU)	Text on lithodid crabs and benthos has been extensively revised
439	83955	28	18	19	18	20	Focus on observed changes should be ensured. (Katharine Mach, IPCC WGII TSU)	Text has been modified to ensure a focus on observed changers
440	60228	28	18	19	18	32	This is a good summary of ocean acidification impacts in the Antarctic drawing on relevant recent research. (AUSTRALIA)	Noted - this has been combined with Arctic text in a general section
441	78193	28	18	20	18	21	[NOTE: Paleoclimate is not my area of expertise, but I think someone needs to check this as I found it confusingly worded]"Shell thickness in foraminifera in the Southern Ocean are thinner than in the Holocene " is this a reference to results from Moy, Howard et al. (2009)? If so, they referred to shell "weights" being less, rather than any reference to thickness? Also, the Holocene includes present day, although it was used interchangably with "pre-industrial" in the Moy and Howard (2009) paper, so perhaps change to "pre-industrial Holocene"? (Inga Smith, University of Otago)	Text on ocean acidification has been extensively revised. This comment was taken account of in that revision.
442	64616	28	18	23	18	26	28.2.2.2.1.Arctic studies should not be cited here? (Lena Menzel, Alfred Wegener Institute for Polar and Marine Research)	Text on ocean acidification has been extensively revised. This comment was taken account of in that revision.
443	83956	28	18	29	18	30	What is the timeframe for this observation? (Katharine Mach, IPCC WGII TSU)	Text on ocean acidification has been extensively revised. This comment was taken account of in that revision.
444	83957	28	18	31	18	31	It would be helpful to clarify what is meant by "short-term negative effects need to be considered together with..." (Katharine Mach, IPCC WGII TSU)	Text on ocean acidification has been extensively revised. This comment was taken account of in that revision.
445	56835	28	18	34	0	0	Collaps of ice shelves may alter benthic communities (Gutt et al. only citation). What about ocean acidification, food-web and deeper water including benthos? See: Ingels, J., Vanreusel, A., Brandt, A., Catarino, A.I., David, B., De Ridder, C., Dubois, P.; Gooday, A.J.; Martin, P.; Pasotti, f.; Robert, H. (2012): Possible effects of global environmental changes on Antarctic benthos: a synthesis across five major taxa. Ecology and Evolution, pp. 453-485. doi: 10.1002/ece3.96 (Angelika Dr. Brandt, University of Hamburg)	The chapter aims to provide an assessment of observed and project effects of climate change. This reference is valuable for guiding further work but it focusses on an expert review of possible effects. Given the space available in the chapter, the reference was not used but could provide a useful summary of directions given the gaps identified later in the chapter.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
446	83958	28	18	34	18	40	Focus on observed changes should be ensured. (Katharine Mach, IPCC WGII TSU)	The text is now focussed on observed changes
447	60229	28	18	43	19	43	Observed and expected changes on krill outlined in this section are significant, particularly for the Antarctic food web. Suggest a comment on krill is included in the Executive Summary. (AUSTRALIA)	This has been done
448	57399	28	18	45	19	43	This discussion of krill in a very small part of the Southern Ocean is fine but really doesn't this give a very narrow view of what is happening, and especially elsewhere? Especially as sea ice expands elsewhere, especially Ross Sea sector? The text cites Montes-Hugo et al. 2009 (see also Scofield et al. 2010) which have a much broader view of biotic changes in this region, including certain fish species whose presence, or not, likely has little to do with E superba. (David Ainley, H.T. Harvey & Associates Ecological Consultants)	The evidence of the effects of climate change is strongest for the Antarctic Peninsula. Reference to other areas has been made clearer as far as possible in the space available
449	83959	28	18	46	18	52	The time frames for these observations could be specified. (Katharine Mach, IPCC WGII TSU)	Have done this as far as possible
450	80030	28	19	1	19	21	In connection to climate, does it make sense to distinguish between Antarctic krill (E. superba) occuring in areas with sea ice as opposed to those areas never experiencing sea ice? (NORWAY)	Individual krill will be affected by sea ice and associated waters at some stage in their life history. It is difficult to separate them in this way. The text has been clarified where possible.
451	75551	28	19	6	19	8	Reword - confusing prose. (UNITED STATES OF AMERICA)	This text has been edited extensively
452	57278	28	19	7	19	7	Change "indicates" to "gives" (Erica Head, Fisheries and Oceans Canada)	Has been deleted
453	64617	28	19	19	19	21	28.2.2.2.2. This should be put into context and CO2 levels mentioned, see chapter 6 for a broader discussion. (Lena Menzel, Alfred Wegener Institute for Polar and Marine Research)	Text on ocean acidification has been extensively revised. This comment was taken account of in that revision.
454	84921	28	19	19	19	21	As mentioned in the context of the executive summary, it is not clear that this is a basis for a high confidence statement as presented there. Please clarify. (Michael Mastrandrea, IPCC WGII TSU)	Confidence statements now included for Antarctica and have been checked
455	57975	28	19	20	19	20	Saba, Schofield et al, 2012 missing from references (Jennifer Francis, Rutgers University)	References has been checked
456	57400	28	19	26	0	36	This Forcada et al. paper is based on 3 flights over a one week period, and then a whole lot of modeling. And, so, this statement is going to be based on that analysis? Which ice-breeding seals? Weddells, crabeaters, leopards or Ross? See Siniff et al. 2008 on likelihoods of how Antarctic seals will respond to climate change. (David Ainley, H.T. Harvey & Associates Ecological Consultants)	This paper was examined and the conclusions were similar to those presented in the gaps section of this chapter. The paragraph has been revised but the conclusion of the paragraph is similar to the conclusion of this paper that the mechanisms of change in seals and penguins need more quantative studies. There was insufficient space to expand the paragraph to include the details of this paper. Clarification in this and other areas of the chapter has been attempted. The paper has been cited in section 28.3.2.3.
457	75552	28	19	26	19	29	Reword - confusing prose. (UNITED STATES OF AMERICA)	Text has been simplified
458	83960	28	19	27	19	27	The mechanism through which this outcome is expected should be clarified. (Katharine Mach, IPCC WGII TSU)	This has been moved to 28.3.2.3 and clarified
459	75553	28	19	34	19	35	Reword - confusing prose. (UNITED STATES OF AMERICA)	Text has been simplified
460	84922	28	19	34	19	43	As mentioned in the context of the executive summary, it is not clear that this is a basis for a high confidence statement as presented there. Please clarify. (Michael Mastrandrea, IPCC WGII TSU)	This has been moved to 28.3.2.3 and clarified
461	83961	28	19	35	19	35	In place of "believed" it would be preferable to indicate the basis of evidence. (Katharine Mach, IPCC WGII TSU)	This has been deleted
462	57401	28	19	38	0	0	What is being talked about here, i.e. greater range of prey items, re Gentoo penguins, e seals??? Emslie & Paterson 2007 conclude that diet of these sorts of predators has become more simplified. (David Ainley, H.T. Harvey & Associates Ecological Consultants)	the text has been substantially revised and the ambiguity removed.
463	57402	28	19	41	0	43	Again, why just the talk about WAP? (David Ainley, H.T. Harvey & Associates Ecological Consultants)	the text has been substantially revised and, within space limitations, reflects more on other areas, although most evidence is available from the WAP.
464	63801	28	19	42	19	43	Where does the iron come from specifically? Please mention at least the relevant key-processes. (GERMANY)	there was insufficient space to discuss what was requested, although it is a valid point.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
465	75554	28	19	46	19	46	p. 19, line 46: This section would be more helpful if the references to marine mammals and birds were specific to population or region. (UNITED STATES OF AMERICA)	there was insufficient space to divide the text by region and keep the references appropriate to region. References are given by example to support the statements.
466	57403	28	19	48	0	50	Complex? Then also cite Scofield et al., Trivelpiece et al., Lynch et al. (David Ainley, H.T. Harvey & Associates Ecological Consultants)	Greater clarity is provided in this and subsequent paragraphs with reference to the key citations to support the examples.
467	57279	28	19	48	19	48	Change to "The response of marine mammals, penguins and flying birds will be complex, involving a number of direct and" (Erica Head, Fisheries and Oceans Canada)	This sentence has been clarified.
468	57404	28	19	50	0	52	This statement in general is false at least as climate change may be involved. The other half of the Barbraud et al. paper deals with fishery bycatch; and the Ainley & Blight 2008 paper deals with population change related to fishery harvest levels. (David Ainley, H.T. Harvey & Associates Ecological Consultants)	The wording has been changed and better reference to the possible confounding influence of fisheries has been given
469	83962	28	19	50	19	54	It would be preferable to specify the timeframe for these observations. Additionally, on lines 53-54 are the described declines and increases for population size? It could be helpful to indicate this more specifically. (Katharine Mach, IPCC WGII TSU)	Have added the time frame of recent decades
470	57405	28	19	53	0	0	according to cited reference, Adelies have been increasing in southern WAP and gentoos maybe decreasing in some locations in north WAP. (David Ainley, H.T. Harvey & Associates Ecological Consultants)	Text has been clarified
471	57406	28	19	54	0	0	Wilson et al. (2001) and Ainley et al. (2005) indicate that penguins populations have long been increasing in the Ross Sea region. Is that East Antarctica? (David Ainley, H.T. Harvey & Associates Ecological Consultants)	Text has been corrected.
472	57407	28	20	1	0	0	There is no evidence that emperor penguins are generally decreasing, except at a few places way in the north of their range. However, there are lots of predictions of eventual decrease among cited references but that's not 'evidence'. (David Ainley, H.T. Harvey & Associates Ecological Consultants)	Text has been corrected.
473	57408	28	20	2	0	4	Unfortunately many of the declines correspond with fishery depletion (Ainley & Blight 2008). (David Ainley, H.T. Harvey & Associates Ecological Consultants)	Text has been added to reflect this point.
474	83963	28	20	6	20	6	Presumably these are observed direct effects? Over what time frame have they been observed? (Katharine Mach, IPCC WGII TSU)	Text added to address this point
475	57409	28	20	7	0	0	. I thought earlier it had been said that there are no precipitation trends? (David Ainley, H.T. Harvey & Associates Ecological Consultants)	Text has been clarified
476	57411	28	20	9	0	12	This dome shaped response was long ago discussed by Smith et al. 1999, and has been cited widely. (David Ainley, H.T. Harvey & Associates Ecological Consultants)	citations have been restricted to primarily since AR4.
477	75555	28	20	9	20	10	Explain "dome shaped relationships" (UNITED STATES OF AMERICA)	text has been simplified
478	57410	28	20	12	0	0	. I thought earlier it had been said that there are no precipitation trends? (David Ainley, H.T. Harvey & Associates Ecological Consultants)	text has been clarified
479	78194	28	20	13	20	13	Typographical error: "can decreases" should be "can decrease"? (Inga Smith, University of Otago)	Has been corrected
480	57280	28	20	16	20	17	Change to "Movement south of the frontal systems, and therefore movement of productive foraging areas, in the Indian sector have been linked to declines in King penguin colonies etc." (Erica Head, Fisheries and Oceans Canada)	Clarified text
481	83964	28	20	16	20	27	It would be preferable to specify the relevant time frames for the statements in these paragraphs. Additionally, use of "attributed" on line 17 could be avoided given the broader context of attribution in the report. (Katharine Mach, IPCC WGII TSU)	Clarified text
482	57412	28	20	21	0	23	It's far more complex than incidental mortality in regard to fishery effects; clearly direct effects due to fishery extraction (Ainley & Blight 2009, Barrera-Oro/Casaux papers for WAP; see also papers by Murphy et al., Croxall et al. etc). (David Ainley, H.T. Harvey & Associates Ecological Consultants)	Clarified text
483	57413	28	20	24	0	25	Cite Branch (2012) for results of IWC circumpolar surveys. (David Ainley, H.T. Harvey & Associates Ecological Consultants)	Reference list is already long and this does not add to the point being made.
484	57281	28	20	24	20	24	Insert thus "some Antarctic whale populations are recovering, such as" (Erica Head, Fisheries and Oceans Canada)	This has been done
485	57282	28	20	40	20	41	Change to "Phenological responses attributable to warming are apparent in Arctic terrestrial ecosystems (medium confidence), although compare to temperate regions, there have been few long-term studies in the Arctic." (Erica Head, Fisheries and Oceans Canada)	Text has been changed

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
486	83965	28	20	40	20	46	It would be preferable to indicate the general time frame for statements in this paragraph. (Katharine Mach, IPCC WGII TSU)	Done in the next sentences and paragraphs
487	57283	28	20	42	20	42	Insert a very important comma after vary - thus "Phenological responses to warming vary, from little overall trend etc" (Erica Head, Fisheries and Oceans Canada)	Text has been changed
488	83966	28	21	4	21	4	It would be preferable to indicate more specifically what time frame is meant by "recent years." (Katharine Mach, IPCC WGII TSU)	Text has been changed
489	75556	28	21	6	21	7	Reconcile "_steadily intensifying reindeer grazing/trampling" and evidence presented in 28.2.3.5 about broad population declines. Probably just a geographic qualifier saying where there is intensified grazing versus where there is less. (UNITED STATES OF AMERICA)	It is clear from the text that "steadily intensifying …." is only in some parts of Eurasia. Population declines are only for some populations, others have increased
490	75557	28	21	14	21	14	The decrease in NDVI in easternmost Russia is not apparent in Fig. 28.3. There is at least as much green as yellow in that area. (UNITED STATES OF AMERICA)	The fig is changed. The new fig is taken from the most updated and extensive analysis of NDVI (Xu et al. 2013).
491	75558	28	21	16	21	16	What is "Nenets Autonomous Okrug"? It is not in Fig. 28.1; many readers will not know what (or where) it is. (UNITED STATES OF AMERICA)	This has been deleted
492	57976	28	21	24	21	26	I think there should be a figure illustrating the NDVI changes (Jennifer Francis, Rutgers University)	There was one also in FOD. A new fig from the most recent paper is in the final draft (Xu et al. 2013)
493	63129	28	21	24	21	28	Increases in degree days per month is confusing and misleading. Usually we express the "thawing degree days" as a total for the year (summer season) and then consider the long-term trend (magnitude of increase per year). Perhaps this could be expressed better. Alternatively you could say monthly total degree days are xx higher. (Sharon Smith, Geological Survey of Canada)	Text is changed. Hopefully clearer now
494	75559	28	21	29	21	29	Is landslide activity natural, accelerated, etc.? It is not clear if this is a climate change factor or not. (UNITED STATES OF AMERICA)	This paragraph (last one on page 12 in the final text) addresses the use of satellite data, specifically NDVI, as the cumulative indicator of climate change. Surface disturbance, exemplified by landslide, has been mentioned only as a factor that may complicate the interpretation of NDVI data. It is beyond the scope of our assessment to explore whether such factors are in turn dependent of climate change, although in case of landslides there is apparent link with changing climate."
495	63183	28	21	38	21	38	delete an "a" in "aand" (Ulf Molau, University of Gothenburg)	OK,text has been changed
496	63184	28	21	44	21	44	and in NE Siberia (Blok et al. 2011, Biogeoscience 8, 169-179) (Ulf Molau, University of Gothenburg)	We had to shorten the text and delete references further and have chosen not include this reference as it does not bring any additional info to what we already have
497	57977	28	21	46	21	46	define fell field (Jennifer Francis, Rutgers University)	In glossary
498	83967	28	21	52	21	53	Over what time frame was this study conducted? (Katharine Mach, IPCC WGII TSU)	The text is changed
499	57978	28	22	10	22	33	define bryophytes, graminoids, herbivory (Jennifer Francis, Rutgers University)	graminoids and bryophyte are defined, most of this para has been deleted in the new draft
500	75560	28	22	23	22	33	Given the breadth of the synthesis document discussed in this section, it lacks a clear take away, e.g. is forage better or worse; are indigenous species being choked out? The synthesized message is not clear. (UNITED STATES OF AMERICA)	These studies do not say anything about forage or the effects on indigenous peoples. They are simply monitoring the development of vegetion on certain spots or sites over a long period. The message is that where this is has been done, the amount of vegetaion is generally increasing
501	57979	28	22	38	22	42	Perhaps tree line is more sensitive to the variability in temperature (rather than mean) or to extreme events? (Jennifer Francis, Rutgers University)	Could be, but we have no information on that
502	57284	28	22	38	22	49	The second paragraph repeats much of what is said in the first. I suggest condensing them into one. (Erica Head, Fisheries and Oceans Canada)	The text is shortened
503	83968	28	22	39	22	39	It would be preferable to provide specific reference to the relevant chapters and chapter sections. Also please note that the acronym used refers to the 1st assessment report, not the 4th assessment report. (Katharine Mach, IPCC WGII TSU)	This has been done

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
504	75561	28	22	40	22	42	Unclear - reword. (UNITED STATES OF AMERICA)	Cannot see why it is unclear and has not changed it
505	83969	28	22	40	22	42	To maximize directness of wording, "high confidence" could be placed within parentheses at the end of the statement. (Katharine Mach, IPCC WGII TSU)	Has been done
506	66220	28	22	44	22	49	I recommend to include a most recent reference like: Laura Parducci, et al. (2012) Glacial Survival of Boreal Trees in Northern Scandinavia. Science 335, 1083 (David Velázquez, Universidad Autónoma de Madrid)	We do not consider this a highly relevant paper for this assessment
507	75562	28	22	44	22	53	Scale issues confounded. Clarify. (UNITED STATES OF AMERICA)	scales should be clear. The first para is about Arctic in general, while the next para regards specific areas (sub-arctic sweden, Russian Taiga)
508	83970	28	23	4	23	5	The relevant baseline for the described projections is not clear. Additionally, the focus of this section should be on observations, not projections. (Katharine Mach, IPCC WGII TSU)	Disagree. In this paragraph we compare projections with observations and we do think it fits in here, instead of in the projection-section. It is obvious that the baseline is approx now for these oprojections. The treeline has changed very little up to now.
509	75563	28	23	4	23	9	Very good and important paragraph. This information seems to merit mention in the Executive Summary. (UNITED STATES OF AMERICA)	We thank the reviewer for this suggestion. The executive summary was significantly revised and condensed in length. Due to page restrictions it was not possible to include this paragraph or further details.
510	83971	28	23	7	23	9	Given the wording of this statement, presumably these are average rates over the entirety of the 20th century? (Katharine Mach, IPCC WGII TSU)	Yes they are, rate has increased in the last decades
511	83972	28	23	11	23	11	It would be preferable to indicate more precisely what's meant by "robust and consistent." (Katharine Mach, IPCC WGII TSU)	We think it is clear to characterize evidence as "robust and consistent" and have not changed the text
512	75564	28	23	22	23	28	Odd discussion - of course, herbivory and disturbance can influence plants. (UNITED STATES OF AMERICA)	The text has been changed and shortened. The discussion here is about different factors that could cause the observed changes.It is not climate that can be attributed to cause the changes
513	63185	28	23	25	23	26	does "large herbivores" include hares? In northern Fennoscandia, mountain hare (Lepus timidus) is the main grazer on dwarf birch. Reindeer graze om that species only when willows are absent (strongly preferred), as shown by ongoing research. Hare grazing is important in retarding the treeline expansion. Mentioned in Callaghan et al. 2013, Phil. Trans. Roy. Soc. B. Biology, in press (online publ. 8 July, 2013) (Ulf Molau, University of Gothenburg)	Hares are not big herbivores. We have included the mentioned reference in the latest draft, but hares are not dealt with due to space limitations
514	63130	28	23	30	23	40	There is no discussion regarding the impact that changing drainage conditions resulting from changing permafrost conditions has on vegetation (e.g. transition from black spruce that favour poor drainage condition of frozen soils to species that favour better drainage conditions) (Sharon Smith, Geological Survey of Canada)	we mention moisture as one factor, but space limitations do not allow us to og into all the details.
515	83973	28	23	31	23	35	It would be helpful to specify the relevant time frame for these statements. (Katharine Mach, IPCC WGII TSU)	The text has been changed
516	75565	28	23	37	23	38	Consider using more precise language: e.g. the probability of fire that will have a positive feedback on climate <warming> or similar. To a lay reader "a positive feedback on climate" suggests that something good is going to happen versus "climate warming" which is more indicative of a vicious cycle. (UNITED STATES OF AMERICA)	has been clarified in the text by adding (increase warming) after "positive feedback"
517	63186	28	23	40	23	40	Mann et al. 2012 (Arct Antarct Alp Res 44, 319-331) from observations and modeling show that northernmost conifer forests in Alaska are changing into broadleaf forest, becoming a carbon source rather than sink. (Ulf Molau, University of Gothenburg)	OK, we missed this one

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
518	63187	28	23	43	24	16	In addition to animals, a strong cyclicity is known in a few plant species, i.e., arctic cottangrass Eriophorum vaginatum. It shows mass flowering about every fourth year in northern Alaska (Shaver et al., several papers, e.g,. 1986, J. Ecol. 74, 257-278) but follows a 3-yr cycle in northern Fennoscandia (Molau 2010, Plant Ecology & Diversity 3, 29-34). Cottongrass cyclicity is synchronized over large areas (e.g., NW North America, entire Beringia, northern Fennoscandia) and mainly coupled with summer temperature (best fit when expressed as thawing degree days 3-4 years before flowering), but grazing during lemming peak year may set off the cyclicity 1-2 years. In the taiga and temperate forest biomes, E. vaginatum is common in peat bogs but show no cyclicity whatsoever, why a disintegration of mass flowering is expected in a warmer climate in the Arctic. (Ulf Molau, University of Gothenburg)	OK interesting, but space limitations do not allow us to deal with all aspects in the Arctic that is affected by warming.
519	63188	28	24	3	24	3	see also Hansen et al. 2013 (Science 339, 313-315) for the effect of rain-on-snow events in Svalbard (Ulf Molau, University of Gothenburg)	the paper is now included and mentioned in the text
520	83974	28	24	13	24	14	The timeframe for this expansion could be specified. Casual usage of "likely" should be avoided as it is a reserved likelihood term. (Katharine Mach, IPCC WGII TSU)	Ok, has been changed
521	63190	28	24	13	24	16	Scabies (mange) dispersed by red fox has recently infected the already weak population of arctic fox in Norway and Sweden. A massive vet programme is undertaken at present to cure the animals one by one. (Ulf Molau, University of Gothenburg)	OK, has been changed
522	75566	28	24	15	24	15	It is unclear whether "this species" refers to the red fox or the arctic fox. (UNITED STATES OF AMERICA)	Text has been changed
523	75567	28	24	19	24	19	p. 24, line 19: The subheading refers to reindeer and muskox, but the text makes no mention of muskox specifically. Again, population specific predictions regarding impacts, unless they really are Arctic wide, would be helpful. (UNITED STATES OF AMERICA)	the sub-section heading has been changed and muskox deleted. Sorry, but there are almost no scientific studies from the Arctic we can base "population specific predictions regarding impacts" as the reviewer ask for
524	75568	28	24	20	24	20	p. 24, line 20: This section seems a little brief, at least relative to the section on Arctic terrestrial systems. (UNITED STATES OF AMERICA)	This is Arctic terrestrial systems. There are much fewer scientific studies on CC and terrestrail animals compared to vegetaion from the Arctic and this is probably the reason why the section onvegetaion is more comprehsnive than the section on animals
525	63189	28	24	28	24	34	see also Hansen et al. 2013 (Science 339, 313-315) for the effect of rain-on-snow events in Svalbard (Ulf Molau, University of Gothenburg)	Has included the paper in the new version
526	83975	28	24	36	24	48	Focus on observed changes should be ensured. (Katharine Mach, IPCC WGII TSU)	This para is not strictly about projectiosn and we do think it fits better in here than under the section on projections
527	83976	28	24	40	24	41	The timeframe of these changes could be specified. (Katharine Mach, IPCC WGII TSU)	We acknowledge the comment. However, it was not possible to specifiy the time frame.
528	57980	28	24	43	24	48	define ungulate populations and behavioral plasticity (Jennifer Francis, Rutgers University)	Will do in glossary
529	75569	28	24	50	24	51	It would be helpful to state what was the cause of decline in populations if it was not ice (if the cause is clear). Or to so state if the cause has not been determined. (UNITED STATES OF AMERICA)	Sorry, but space limitations do not allow us to og into the details on what has caused the decline in these populations other than icing events, see the paper we are referring to
530	75570	28	25	1	25	1	Through effects other than greenhouse gas warming? (UNITED STATES OF AMERICA)	yes
531	83977	28	25	7	25	8	It would be helpful to clarify in what systems and in what sense tipping points are being referred to here. (Katharine Mach, IPCC WGII TSU)	We do not have space to go into details. It should be quite clear fromthe text that "tipping point" refers to changes in vegetation and animal populations
532	57981	28	25	7	25	9	It seems that this statement should be made much earlier in the report, and the effects of long-term change vs tipping points addressed in other sections, as well. (Jennifer Francis, Rutgers University)	The reviewer comment is acknowledged. However, it was not possible to include long-term change vs tipping points.
533	83978	28	25	22	25	22	Focus on observe changes should be ensured. (Katharine Mach, IPCC WGII TSU)	Observed changes have been made the focus
534	83979	28	25	27	25	32	The general time frame for these observations could be specified. (Katharine Mach, IPCC WGII TSU)	text added to address this point

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
535	64184	28	25	30	25	32	There is little recognition in this and other statements that many people of aboriginal descent are also now engaged in what could be termed the western economy. It could also be added that for most of these people identification with traditional values and lifestyles/ activities is still a very important culturaly- something that is often expressed in various ways including art, recreational and leasure pursuits. I am not sure if included in the multiple stressors includes things such cultural influences from elsewhere, loss of tradtional languages, education systems, economic pressures, employment etc. (Ian Church, Canadian Foundation for Climate and Atmospheric Science/ IPY Canada)	Incorrect reference to text in the chapter
536	75572	28	25	48	0	0	This entire introduction is not neededì - get to the direct climate impacts right away. (UNITED STATES OF AMERICA)	Introduction has been mostly eliminated (to reduce length of text) – as suggested
537	78207	28	25	48	0	0	The opening section on human populations has a distinct difference in writing style/tone compared to the previous pages on polar science. The editors should look into this to make the writing style more unified. (Andrew Wong, University of Waterloo)	Opening section, meant to introduce section, has mostly been eliminated as suggested
538	75571	28	25	48	29	32	Page 25, lines 51-54 note that the "human populations" section "focuses on indigenous, isolated and rural populations" rather than urban residents. Given that most of the Arctic population (more than two-thirds, according to p. 26) lives in urban areas, which are susceptible to climate-related energy costs and other challenges, it seems that there could be a better balance here. Indigenous/rural residents should certainly be addressed in this chapter, but so should other segments of the arctic population. Furthermore, there may be value in clarifying how an "urban area" in the Arctic differs from that in the more traditional sense as presented in Ch 8. (UNITED STATES OF AMERICA)	We are thankful for the reviewer´s comment. Wording has been inserted in different places in text to increase focus on urban areas
539	64182	28	25	51	0	0	The phrase- "where people have been addressing change for centuries" is correct but because the focus of this report is climate change it might be appropriate to say something like "cultural, economic and environmental change including changes driven by climate" (Ian Church, Canadian Foundation for Climate and Atmospheric Science/ IPY Canada)	This section has been largely eliminated to shorten text – the thought in this comment is however expressed later in text
540	63080	28	25	51	0	52	“while it is recognized that several large industrial Arctic cities in Russia…..this section focuses on indigenous, isolated, and rural populations…” This is a fundamental choice that I consider a dangerous bias of the whole report’s part on human population. Arguing that the report focuses on indigenous, isolated, and rural populations because “they are especially vulnerable to climate change” doesn’t seem to me a convincing argument. The report recognized that the highest calculation of native inhabitants is 1.3 million (p. 35, lines 44-45) for at least 4 million inhabitants for the Arctic. The paper also recognizes that “two-thirds of the Arctic population live in relative large settlements of over 5,000 residents” (p. 26, lines 13-14). How, then, a report on human population in the Arctic can openly ignore two-third of the Arctic population? Indigenous people need obviously specific interest and protection, but that doesn’t justify the exclusion of the majority of Arctic population from a report that presents itself as inclusive. At least one subsection should be devoted to non-indigenous populations and urban challenges, discussing demographic and migration changes, urban governance, infrastructures challenges, and the growing internationalization of Arctic cities, with a multiplicity of new actors, from migrants to private investors. Moreover, a growing number of indigenous people leave their traditional place of life for the city. An accurate analysis of challenges faced by indigenous people thus means to take into account the “modernization” of everyday life of a lot of indigenous people, and not to focus on a folkloristic definition of their way of life. At several occasions, the paper mentions ‘Arctic residents’ as a generalizing terms while in fact it means indigenous people. (Marlene Laruelle, George Washington University)	Authors appreciate this thoughtful comment, which stimulated productive discussion among the author team. Text to address this gap has been added in a number of places throughout the chapter
541	63131	28	25	51	25	54	There is still a need however to develop adaptation strategies for industry, natural resource development project etc. especially since impacts on infrastructure performance resulting from climate change could have potential environmental consequences (further causing stresses on the environment). This is an important consideration given the potential for increased development activity in the polar regions. (Sharon Smith, Geological Survey of Canada)	This issue was discussed directly in 28.4.2
542	70812	28	25	51	25	54	Rephrase this sentence, particularly 'ultimate survival' (Helene Amundsen, CICERO - Centre for international climate and environmental research - Oslo)	deleted “ultimate survival” and reworded sentence.
543	64183	28	25	52	0	0	It could be argued that arctic urban populations partially because of their size and dependence on infrastructure and services such as transportation and supply from southern centres are also very vulnerable to climate and weather disruptions. This is alluded to in the next paragraph on page 26- lines 5 to 9 (Ian Church, Canadian Foundation for Climate and Atmospheric Science/ IPY Canada)	Additional language re urban vulnerabilities has been added

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
544	57982	28	25	53	25	53	I have heard other social scientists say that Arctic communities are NOT vulnerable to change because they have always had to deal with huge seasonal swings and interannual variability in their environment, and thus are especially adaptable. Both sides of this issue should be addressed and supported. (Jennifer Francis, Rutgers University)	Both sides of this argument are argued in several different sections of text
545	60453	28	26	21	26	23	Not all indigenous populations and individuals depend on traditional lifestyles. suggest to add: …are especially impacting the [traditional lifestyles of] indigenous populations… (DENMARK)	section has been deleted in text-shortening
546	60452	28	26	23	26	24	Numbers do not add up. Uncertainties seem very high. (DENMARK)	These numbers are quoted directly from references & section has been deleted in text-shortening
547	70813	28	26	30	26	32	Connect this sentence with the following paragraph, which includes a discussion of stressors non-associated with climate change. (Helene Amundsen, CICERO - Centre for international climate and environmental research - Oslo)	section has been deleted in text-shortening
548	57983	28	26	34	26	54	This section dwells on the negative effects, but what about the postive ones? More jobs, easier access to necessities, more tolerable temperatures? (Jennifer Francis, Rutgers University)	Positive ones have been added in several sections
549	63132	28	26	48	27	23	Most of this discussion focusses on changes to the physical environment. As mentioned in earlier comments, it would have been better to discuss changes to the physical environment first and then comment on implications with respect to human activity/systems etc. (Sharon Smith, Geological Survey of Canada)	Agree, but order of chapter sections was given to us as is
550	64185	28	26	50	27	10	While the statements in this paragraph are correct and it does address all residents in the first line there is little recognition that in todays north people do not just live in tradtional ways, travel on land and water in the pursuit of tradtional activites etc. As a result challenges and hazards are in some ways more problematic for the people who are less prepared who live in inadequate hosuing in communities, who are at risk because they are dependent on central utility systems and have no backup, who travel by air or on roads and are equally at risk in adverse conditions. While changes "on the land" pose risks for northerners equally "poorly adaptation" and adoption of western lifestyles and technologies operating in northern environments also put peole at risk- something not unique to the north. Watch the evening news this last winter as massive highway accidents invovleing hundreds of people occured during various storm events in the southern 48 states, provinces and in Europe. (Ian Church, Canadian Foundation for Climate and Atmospheric Science/ IPY Canada)	We are thankful to the reviewer for this comment. More material has been added explicitly to address the issue of non-indigenous and/or urban populations. See also author responses to comments 540 and 538
551	83980	28	27	1	27	1	Focus on observed changes should be ensured. (Katharine Mach, IPCC WGII TSU)	Literature cited following these listings of changes within this and other paragraphs in this section are focused specifically on observed changes
552	62038	28	27	6	27	6	"or inundated by large storm surges" (AKSIK 2013). This is the most disruptive and pressing fact we have found with our Alaskans Sharing Indigenous Knowledge (www.AKSIK.org) project. Our findings are "in revision"and have been resubmitted to the journal Climatic Change: Ignatowski, John and Jon Rosales. 2013. "Identifying the Exposure of Two Subsistence Villages in Alaska to Climate Change Using Traditional Ecological Knowledge and Climate Science." Climatic Change. In revision. If you are able to use an article that has been revised and resubmitted, I will suggest this article to support a few more points made in this chapter. If you cannot use an article in revision, our findings are documented on our website at www.AKSIK.org and could be cited as AKSIK 2013. (Jon Rosales, St. Lawrence University)	Add “or inundated by large storm surges (AKSIK, 2013) “ p.24 (9/4 SOD) l. 22
553	70814	28	27	12	27	13	Is it relevant to state that people get frostbite when the weather is cold? (Helene Amundsen, CICERO - Centre for international climate and environmental research - Oslo)	Frostbite is one of the documented potential health impacts of many climate change-induced conditions which cause exposure
554	66221	28	27	12	27	23	This parragraph seems to me very specualtive, but I am not human physiologist (David Velázquez, Universidad Autónoma de Madrid)	Statements in this section are all linked back to referenced literature - not speculation
555	83981	28	27	14	27	15	It would be preferable to indicate the timeframe over which this association was observed. (Katharine Mach, IPCC WGII TSU)	The statement was not changed and was left as is – a generalized statement – because this is also the summary statement in the original paper (which included both short and long-term studies)
556	70815	28	27	17	27	17	reference missing after 'Finland' (Helene Amundsen, CICERO - Centre for international climate and environmental research - Oslo)	Add the reference “Revich and Shaposhmikov, 2010)” to end of sentence “Finland” p. 24, l.35 9/4 SOD (in para before “indirect” impacts)
557	83982	28	27	18	27	19	Focus on observed changes should be ensured. Additionally, in place of "believed," a discussion of the relevant basis in evidence would be preferable. (Katharine Mach, IPCC WGII TSU)	Replace “It is believed” with “Researchers project “

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
558	75573	28	27	28	29	32	Section 28.2.4 Section on Arctic definition and population not well defined. Suggest a map outlining circumpolar administrative regions and population. Suggest using a map and population data from www.circumpolarhealthjournal.net/public/journals/32/chs/CHS_2008_3.pdf . Another source for Arctic Health is the recently published Circumpolar Health Atlas, University of Toronto Press, Kue Young Ed. www.utppublishing.com (UNITED STATES OF AMERICA)	graphics presently under review – map would be useful
559	69814	28	27	33	27	34	The statement "local and traditional … unsusual environmental conditions" is based on the observations at two sites in North America. Although it may be likely that this applies to the whole arctic, that is currently not supported. Also, it may be better to first mention "increasingly unusual conditions", as the two references mainly support this statement. (NETHERLANDS)	sentence has been removed
560	83983	28	27	34	27	34	It would be preferable to specify which "extremes" and types of "unusual environmental conditions" are meant here. (Katharine Mach, IPCC WGII TSU)	sentence has been removed
561	62039	28	27	35	27	35	The citation Ignatowski and Rosales, 2012 should be changed to 2013 if you can use articles in revision and resubmitted. Otherwise you could cite as AKSIK, 2013. (Jon Rosales, St. Lawrence University)	sentence has been removed
562	69815	28	27	35	27	35	The reference "Ignatowski and Rosales, 2012" is unclear. It appears to be referring to a website that contains videos. (NETHERLANDS)	sentence has been removed
563	75574	28	27	35	27	36	Same information is presented on p. 28. (UNITED STATES OF AMERICA)	sentence has been removed
564	70816	28	27	35	27	37	Explain better what these are (Helene Amundsen, CICERO - Centre for international climate and environmental research - Oslo)	sentence has been removed
565	83984	28	27	39	27	39	It would be preferable to specify the specific relevant sections in Chapter 11. (Katharine Mach, IPCC WGII TSU)	Human Health section has so many specific sections which can be cross-referenced with the Human Health (11) chapter, it became impractical to reference each one
566	62040	28	27	42	27	42	The term "Underlying" is not accurate; contaminants don't underlie climate change, they are in addition to climate change. (Jon Rosales, St. Lawrence University)	replace “Underlying” with ”In addition to”
567	75575	28	27	46	27	47	Is there solid evidence for climate-related increases of transport to and from the Arctic? If the evidence exists, it should be cited here. Otherwise drop the part about increased transport. (UNITED STATES OF AMERICA)	yes, proper citation is at end of sentence (UNEP/AMAP, 2011 739;28;39;53;0;0;I assume ""thicknes"" is ice thickness (Church, Ian, Canadian Foundation for Climate and Atmospheric Science/ IPY Canada)"
568	83985	28	28	12	28	14	It would be helpful to specify the general time frame for these changes. (Katharine Mach, IPCC WGII TSU)	The statement was not changed because the sentence was meant to be an introductory statement to the following paragraphs (which are more specific), and the different examples vary widely as to the time frame within which they occur.
569	83986	28	28	18	28	18	Focus on the observed changes should be ensured. (Katharine Mach, IPCC WGII TSU)	All of the studies cited in this entire section are supported by focused observations in the scientific studies cited.
570	83987	28	28	23	28	25	The key findings of chapter 6 could be cross-referenced here, with harmonized assessment ensured. (Katharine Mach, IPCC WGII TSU)	Added “(Chapter 6 and 11)” at end of first sentence.
571	78208	28	28	23	28	26	Harmful algal blooms are mentioned here, there is no mention of their relationship with the Arctic environment. Perhaps a discussion on harmful algal blooms in the Arctic context should be included here. See: 'Massive Phytplankton Blooms Under Arctic Sea Ice' by Arrigo et al., 2012: http://www.sciencemag.org/content/336/6087/1408.abstract and 'Trophic cascades and future harmful algal blooms within ice-free Arctic Seas north of Bering Strait. A simulation analysis' by Walsh et al., 2011: http://www.sciencedirect.com/science/article/pii/S0079661111000164 (Andrew Wong, University of Waterloo)	Add the following words to p. 25, l. 36: “and have been observed and projected in future Arctic seas (Walsh et al, 2011 570;28;28;23;28;25;The key findings of chapter 6 could be cross-referenced here, with harmonized assessment ensured. (Mach, Katharine, IPCC WGII TSU);Cross referenced chapter 6 and chapter 11. Add “Chapter 6
572	75576	28	28	23	28	30	This paragraph could be dropped. No new observed changes are reported. (UNITED STATES OF AMERICA)	Section was shortened slightly but HABs are considered important issue for human health and authors believe it should remain in.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
573	83988	28	28	27	28	27	What is the timeframe for this observation? (Katharine Mach, IPCC WGII TSU)	This was a documented study of a one-time occurrence of this Vibrio outbreak, as implied by the wording of the sentence and outlined in detail in the literature citation. Thus, it is believed that the statement is ok as is because the current wording implies its one-time occurrence.
574	62041	28	28	37	28	37	Gathering should be added to "hunting, fishing, and herding" (Jon Rosales, St. Lawrence University)	Has been added.
575	58897	28	28	40	28	42	This sentence does not reflect the nuances in the description of the marine mammals on pages 16 and 17 (Svein Sundby, Institute of Marine Research)	This sentence is a summary, more global statement regarding impacts of climate change on subsistence foods and food security and was phrased generally to include “populations” (not “all populations”) as well as habitats of animals to give a general overview of the situation. Marine mammals are discussed in a number of places in the report so we believe that these nuances are addressed sufficiently.
576	75577	28	28	40	28	42	Need mention of respiratory diseases caused by increases in dust, pollens molds and smoke. Exposure to these airborne pollutants increase the risk of respiratory diseases, incite asthma attacks bronchitis and compromise peoples with respiratory disease, the elderly and mothers and newborns (Rylander C. 2011, Odland J.O., Sandanger TM. Climate change and environmental impacts on maternal and newborn health with a focus on Arctic populations. Global Health Action 2011; 4: 10.3402/gha.v4i0.8452). (UNITED STATES OF AMERICA)	Insert at end of paragraph p. 26, l. 22: “Complicating these impacts are respiratory diseases caused by airborne pollutants (e.g., dust, molds, pollen, smoke). (Rylander et al, 2011 575;28;28;40;28;42;This sentence does not reflect the nuances in the description of the marine mammals on pages 16 and 17 (Sundby, Svein, Institute of Marine Research);?Not sure what to do with this 574;28;28;37;28;37;Gathering should be added to ""hunting, fishing, and herding"" (Rosales, Jon, St. Lawrence University)"
577	83989	28	28	40	28	42	It would be preferable to specify the general time frame for these changes. (Katharine Mach, IPCC WGII TSU)	Added “In recent years,” to the beginning of the sentence, p.17, l.46 (most recent version Oct 4) – a time frame which has to be relatively non-specific because we refer to a wide spectrum of populations.
578	62042	28	28	42	28	42	We also have documented these changes. Ignatowski and Rosales 2013 could be cited here if you can use an article in revision, or you could cite AKSIK 2013. (Jon Rosales, St. Lawrence University)	“Ignatowski and Rosales, 2013” added as reference at end of sentences: p. 25, l. 49, p. 25, l. 52
579	70817	28	28	48	28	49	general globalisation pressures' is impresise (Helene Amundsen, CICERO - Centre for international climate and environmental research - Oslo)	We would like to use this because of its general nature, helping to describe broad pressures
580	75578	28	28	53	28	53	Relate this section to previous sections (28.2.3 Terrestrial Ecosystems: Changes in tree line, changes in animal population cycles) which explains the rational for flora and fauna northward movement, changing insect and animal vectors patterns and potential spread of infectious diseases. (UNITED STATES OF AMERICA)	Insert after “temperatures” p. 25, l. 26: “and resulting changes in terrestrial vegetation and animal populations (section 28.2.3) Insert “animal”, p. 25, l. 27, following “bird”
581	63133	28	29	6	29	7	Salt water intrusion - are we referring to surface or groundwater supplies? There is a need to be clear here. If referring to groundwater supplies, then information should be provided on where this is an issue (groundwater use is very limited in most of the polar regions, therefore not an issue everywhere) (Sharon Smith, Geological Survey of Canada)	Referring primarily to surface supplies
582	63134	28	29	7	29	15	This discussion could be more specific with respect to where these things are already happening - where is it currently an issue? Impacts will not be the same everywhere and this will depend on the design of sewage lagoons and other infrastructure. (Sharon Smith, Geological Survey of Canada)	We have been instructed to cut our text by 50% thus eliminating more examples
583	63135	28	29	11	29	11	It would be better to say "no municipal water supply" rather than "no in-house piped water" as several locations in the Canadian Arctic for example, receive their water supplies (and sewage removal) by truck but it is still from a municipal supply. (Sharon Smith, Geological Survey of Canada)	Replace “lower water availability” on p. 26, l. 20 [following “in villages with”] with “no municipal water supplies” .
584	57984	28	29	17	29	32	It seems that the suffering of Arctic communities should be placed into context relative to people elsewhere who are dealing with effects of climate change: Africa, Bangledesh, Pacific Islanders, even New Yorkers come to mind. (Jennifer Francis, Rutgers University)	Author role is to provide the facts of climate change impacts in polar regions and so that the reader may make his/her own evaluation

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
585	75579	28	29	17	29	32	This paragraph seems to imply that climate change is contributing to the increasing suicide rate (lines 29-30). There are certainly other stressors on indigenous residents, especially youth, but has a climate-suicide linkage really been documented? If so, the connection should be explained more explicitly. (UNITED STATES OF AMERICA)	Yes. This is well-documented in recent literature (see references cited in section)
586	83990	28	29	19	29	19	It would be preferable to specify the specific relevant subsections of Chapter 11. (Katharine Mach, IPCC WGII TSU)	Same as 565
587	63136	28	29	19	29	21	There is a need to be clear about natural changes/processes vs impacts resulting from a changing climate. Note that shoreline or coastal erosion is a natural process that would occur under a stable climate - i.e. river shorelines and coastal zones are dynamic environments. Effects of these processes may be exacerbated by changing climate including higher water levels, increased storminess, wave activity etc. (Sharon Smith, Geological Survey of Canada)	Good point. During latest review of text we have tried to address this point while cutting and editing latest version
588	75580	28	29	32	29	32	Add reference Hueffer K, Parkinson AJ, Gerlach R, and Berner J. Zoonotic infectious in Alaska: Disease prevalence, potential impact of climate change and recommended actions for earlier disease detection, research, prevention and control. Int J Circumpolar Health 2013 72: 19562 http://dx.doi.org/10.3402/ijch.v72i0.19562 (UNITED STATES OF AMERICA)	Added reference: Hueffler et al, 2013
589	75581	28	29	37	30	2	We recommend that the authors consider revising this introduction deleting it. As written, it doesn't add much to the material in the section. (UNITED STATES OF AMERICA)	The introduction has been deleted.
590	62043	28	29	45	29	45	Add gathering to "Hunting and herding, and fishing" (Jon Rosales, St. Lawrence University)	The introduction has been deleted. But suggested addition has been added to informal economy section
591	62044	28	29	53	29	53	Ignatowksi and Rosales, 2012 should be 2013 if an article in revision can be used, otherwise you could cite AKSIK 2013. (Jon Rosales, St. Lawrence University)	Has been corrected.
592	69816	28	29	53	29	53	The references refer twice to the website Aksik.org: once directly, and once through the reference "Ignatowski and Rosales, 2012" (NETHERLANDS)	The website link has been removed.
593	62046	28	30	4	31	6	Pollock and halibut could be added to this list. (Jon Rosales, St. Lawrence University)	Has not been added.
594	75582	28	30	5	30	5	p.30, line 5: A section on tourism in the Arctic should be included. There is a strong expectation that the number of cruise ships tours in the High Arctic in the Chukchi and Beaufort Seas will increase in the next few decades. Given the anthropogenic noise from all sources is a source of concern, cruise ships could be an important contribution to anthropogenic noise in the High Arctic. In addition, references to publications by Lawson Brigham (e.g. Brigham and Sfraga 2010) on shipping should be incorporated into the text and integrated with projections for other regions in the Arctic. (UNITED STATES OF AMERICA)	Texts have been significantly reduced in size due to strict page limit. Increased cruise tourism is noted in revised section 28.3.4.3 on infrastructure and marine transportation
595	83991	28	30	9	30	10	Focus on the observed changes should be ensured. Casual usage of "very likely" should be avoided. Additionally, over what geographic area are positive impacts for agriculture expected? (Katharine Mach, IPCC WGII TSU)	This has been corrected
596	58898	28	30	9	30	19	As far as I know there has been developed a tree planting campaign in Iceland over the last 40 years. I think climate alone cannot explain the increase in forest in Iceland. (Svein Sundby, Institute of Marine Research)	Not discussed due to space limitation.
597	64186	28	30	9	30	21	Previously ACIA and IPCC talked about Spruce Bark Beetle infestations in boreal Alaska and Yukon. In the last few years the Pine Bark Beetle has encroached upon the pine forests of the Yukon and NWT. Lodepole Pine, a commercial species is commonly found in the southern areas of both of these jurisdicitons. http://www.scientificamerican.com/article.cfm?id=pine-bark-beetles-poised-for-new-attacks-on-canadas-boreal-forests and http://www.emr.gov.yk.ca/forestry/pdf/forest_health_report_2012_web.pdf pages 8-15. There is also no mention of the role of climate in species change and fire frequency and the potential impact on commercial forest harvesting activity (Ian Church, Canadian Foundation for Climate and Atmospheric Science/ IPY Canada)	We appreciate the reviewer´s comment. However, this section has been revised and length reduced. Page limitation has made it difficult to consider additional text.
598	64248	28	30	11	30	11	the word "latitudes" should be replaced by "altitudes" (ICELAND)	Has been corrected accordingly.
599	64249	28	30	11	30	11	The reference to Bjornsson et al, 2011 is missing (Correct reference is: Bjornsson H., T. Johannesson and A. Snorrason, 2011. Recent climate change, projected impacts and adaptation capacity in Iceland. Í: Linkov, I. & T. S. Bridges (Ed.) Global change and local adaptation. NATO Science for Peace and Security Series - C: Environmental Security. Springer, Dordrecht, s. 465-475.) Correct reference needs to be added, see further comment on ch 28. p 57. l . 4 (ICELAND)	Reference has been added
600	70835	28	30	12	30	12	Aaheim et al, 2009 is not in reference list (Helene Amundsen, CICERO - Centre for international climate and environmental research - Oslo)	Reference has been added

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
601	83992	28	30	12	30	12	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Katharine Mach, IPCC WGII TSU)	Has been corrected.
602	75583	28	30	13	30	14	Reword - confusing prose. (UNITED STATES OF AMERICA)	Has been reworded
603	63137	28	30	14	30	14	Is it forestry activities or transportation systems that are vulnerable? (Sharon Smith, Geological Survey of Canada)	It is forestry activities that are vulnerable.
604	64250	28	30	16	30	16	(Björnsson et al, 2011) should be replaced by (Sigurdsson et al, 2007; Björnsson et al, 2011). See also comment below (ch 28. p 77, line 40) (ICELAND)	This has been corrected.
605	64251	28	30	16	30	16	To the sentence beginning with “Tree limits in Iceland, ..” add a subsentence behind the reference: “(Sigurdsson et al, 2007; Björnsson et al, 2011), but number of new insect pests on trees and shrubs has also increased significantly in Iceland during the past 20 years and there is a strong relationship between rate of new insect pest colonisation and outbrake intensity in forests with changes in annual temperature during the past century (Halldorsson et al, 2013).” See also comment below (ch 6. p. 65 l.6). (ICELAND)	This has been added.
606	83993	28	30	16	30	16	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Katharine Mach, IPCC WGII TSU)	This has been corrected.
607	63138	28	30	16	30	19	Can we be more specific about how much expansion of agricultural activities and where this might be. It would seem that there are many factors in addition to climate that would influence suitability for agricultural activities such as soil, drainage conditions etc. (Sharon Smith, Geological Survey of Canada)	Many details have not been included due to page limitation. Small text on agriculture in Greenland has been included
608	83994	28	30	16	30	19	Focus on observed changes should be ensured. (Katharine Mach, IPCC WGII TSU)	Text has been edited to consider only observed impacts.
609	83995	28	30	17	30	17	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Katharine Mach, IPCC WGII TSU)	This has been corrected
610	60454	28	30	21	30	21	Appears to be a key finding which has lost its way (DENMARK)	Sentence has been moved
611	62045	28	30	21	30	21	This sentence should be moved to the beginning of the previous paragraph. (Jon Rosales, St. Lawrence University)	Sentence has been moved
612	75584	28	30	21	30	21	No examples or substantiation of the climate-related costs/benefits for forestry and agriculture are provided. Something more than the isolated sentence is needed here. (UNITED STATES OF AMERICA)	Sentence has been moved to the beginning of the section. The text that follows substantiates the sentence.
613	75585	28	30	21	30	21	This finding is overly vague, non-specific as written. (UNITED STATES OF AMERICA)	Sentence has been moved to the beginning of the section. The text that follows substantiates the sentence.
614	83996	28	30	21	30	21	It is not clear how this statement is distinct from the statement on line 9 or how it is supported by the assessment of the chapter. Casual usage of "very likely" should be avoided. (Katharine Mach, IPCC WGII TSU)	Sentence has been moved to the beginning of the section. The text that follows substantiates the sentence.
615	78209	28	30	26	30	54	Really important for this section on Open water fisheries is to make specific mention of how the international waters of the Central Arctic Ocean are opening up and are expected to be ice-free during summer by mid-century. Since commercial fishing has never occurred here, no fishing regulations currently exist in this region. See: http://oceansnorth.org/resources/international-waters-central-arctic-ocean-protecting-fisheries-emerging-ocean. In summer 2012, 40 percent of the Central Arctic Ocean (the region outside each nation’s 200-nautical-mile exclusive economic zone (EEZ)) was open water (see Page 3 of the PDF in the link). (Andrew Wong, University of Waterloo)	This issue was briefly addressed in the text.
616	62975	28	30	30	0	0	With reference to figure 28-4 it is argued that there are low volume subsidence fisheries in the coastal regions of the Arctic Ocean. These regions have No data according to figure 28-4. How can that be interpreted as low volume? (Randi Ingvaldsen, Institute of Marine Research)	Deleted low volume reference
617	66022	28	30	34	30	34	AMSA is listed as a source, but it is not included in the reference list. I assume this relates to the AMSA report from 2009 (Arctic Council). (Sebastian Gerland, Norwegian Polar Institute)	Figure was deleted to comply with page constraints
618	75586	28	30	36	30	44	This paragraph is not needed. We recommend that it be deleted. (UNITED STATES OF AMERICA)	Deleted most of this paragraph, kept the lead sentence to differentiate management in high yield areas from potential fisheries in the Arctic ocean
619	75587	28	30	46	30	53	This discussion also should reference the moratorium on commercial fishing north of Bering Strait as well as TEK and other observations of salmon moving in to Beaufort Sea. (UNITED STATES OF AMERICA)	Included text on moratorium

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
620	75588	28	30	47	30	47	should read "lack of infrastructure" (UNITED STATES OF AMERICA)	Has been changed accordingly
621	75589	28	31	7	31	8	We believe stating that "survival depends on complex suite of conditions" without describing those conditions is not particularly useful. Please expand the discussion to describe those conditions (with appropriate references), refer to the appropriate section that does or delete the statement. (UNITED STATES OF AMERICA)	Deleted sentence
622	75590	28	31	8	31	9	Type of comment: partial page, IPCC WGII AR5 Chapter 28, Start Page Number 31, Start Line Number 8, End Page Number, 31 End Line Number, 9 Comment: Citation is incorrect, "Mundy 2011 Cite is correctly written in the references Mundy and Evenson 2011, and it should not be cited in the context of salmon survival. The correct reference to Mundy and Evenson is, "Successful conduct of Arctic coastal subsistence fisheries for salmon is dependent on the timing of the salmons' marine exit, which is tightly coupled to environmental conditions that are linked to climate (Mundy and Evenson 2011). (UNITED STATES OF AMERICA)	Has been accepted
623	63139	28	31	14	32	3	Why is there not a similar discussion of terrestrial transportation? Note that there other challenges associated with changing marine and sea ice conditions such as challenges to oil and gas development, design of infrastructure in coastal and nearshore areas etc. (Sharon Smith, Geological Survey of Canada)	Not included due to page limitation
624	63191	28	31	14	32	3	It would be good if you could provide some numbers on traffic increase here. Something in the order of 5-10 freighters passed through the North-East Passage in 2007 and over 100 in 2011. Understandable increase since cruising time (and fuel consumption) from e.g. Rotterdam to Yokohama is reduced by 30% - and no waiting at Suez and no pirates! (Ulf Molau, University of Gothenburg)	Acknowledged but not included
625	75591	28	31	16	31	16	Be specific - not ice free - nearly ice free in late summer. (UNITED STATES OF AMERICA)	Corrected accordingly. Text edited and moved to projection section
626	75592	28	31	16	31	16	Future tense. Drop speculations about the future. (UNITED STATES OF AMERICA)	Corrected accordingly
627	75593	28	31	16	31	25	A paper with more current information on changes in marine access (via the Northern Sea Route and Northwest Passage) is Smith and Stephenson (2013, PNAS). Among other improvements over the earlier studies (e.g., Mokhov and Khon, 2008), this new paper uses CMIP5 models rather than CMIP3 models. It also includes distributions of access paths for future timeslices, preserving the interannual variability that will be a part of any future scenarios of marine access. Information from this new paper should be included. (UNITED STATES OF AMERICA)	Stephenson et al (2011) has been included.
628	75594	28	31	16	31	45	Some of the references in the section Marine Transportation in the Arctic Ocean seem to be in error. Peters 2011, referenced several times on this page, is not listed in the bibliography. Is it this Citation? Peters, G. P., Nilssen, T. B., Lindholt, L., Eide, M. S., Glomsrìüd, S., Eide, L. I., and Fuglestvedt, J. S.: Future emissions from shipping and petroleum activities in the Arctic, Atmos. Chem. Phys., 11, 5305-5320, doi:10.5194/acp-11-5305-2011, 2011. "Mokhow and Khon" line 23 is like "Khon and Mokhov"? The reference for Mikkelsen (page 71 line 53) bibliographic information is incomplete. Meschtyb (page 31 line 29) is not in the bibliography. Is it this article from 2009? http://pubs.aina.ucalgary.ca/arctic/Arctic58-3-322.pdf Social Impact Assessment along Russia‰Ûªs Northern Sea Route: Petroleum Transport and the Arctic Operational Platform (ARCOP) by Nina A. Meschtyb, Bruce C. Forbes and Paula Kankaanpì_ì_ The work referenced to Furgal 2008 - could it possibly be really be the work by Furgal and Prowse 2008? http://www.nrcan.gc.ca/earth-sciences/climate-change/community-adaptation/assessments/132 See chapter 3 (UNITED	References have been corrected
629	83997	28	31	16	31	54	Throughout these paragraphs, a focus on observed, not expected or projected, changes and outcomes should be ensured. (Katharine Mach, IPCC WGII TSU)	Text has been edited and focus on observed changes has been ensured
630	75595	28	31	27	31	27	What is a "vulnerable natural resource?" (UNITED STATES OF AMERICA)	Word "vulnerable" has been removed
631	83998	28	31	32	31	32	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Katharine Mach, IPCC WGII TSU)	Has been corrected.
632	62976	28	31	34	0	0	The sentence: "In the case of Svalbard, oil spills have increased due to the growth in activities related to tourism and research" need a reference, the AMSA 2009 report is probably suitable. (Randi Ingvaldsen, Institute of Marine Research)	Sentence has been edited out
633	70818	28	31	34	31	35	reference missing (Helene Amundsen, CICERO - Centre for international climate and environmental research - Oslo)	Sentence has been edited out
634	66023	28	31	37	31	37	NorACIA 2010 is cited but not included in the reference list. (Sebastian Gerland, Norwegian Polar Institute)	Reference has been added
635	57985	28	31	45	31	49	this information on Great Lakes seems out of place here (Jennifer Francis, Rutgers University)	Text on Great Lakes has been removed

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
636	64187	28	31	45	31	49	Unless this sentence can somehow inform projected water levels in the Arctic it seems to be more apppropriately added to the Norht America Chapter (Ian Church, Canadian Foundation for Climate and Atmospheric Science/ IPY Canada)	Text on Great Lakes has been removed
637	63140	28	31	47	31	47	What Great Lakes are being referred to here? Great Slave, Great Bear (Great Lakes in southern Ontario- polar relevance?) (Sharon Smith, Geological Survey of Canada)	Text on Great Lakes has been removed
638	83999	28	31	50	31	50	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Katharine Mach, IPCC WGII TSU)	This has been fixed
639	63081	28	32	0	0	0	The references offered this section, and the mention that “Arctic resources will likely play a growing role in the world economy” could be seen as outdated: with the oil and gas “shall revolution,” the global picture of hydrocarbons changed drastically in 2011-12, with probably a decreasing interest for Arctic resources. This important and recent change should be better reflected in the text, that seems to have been written before the “shall revolution”. Same comments for p. 33, lines 27-28: Arctic hydrocarbons have more than an uncertain future, and must be clearly separated from the mining prospects, that are indeed growing. (Marlene Laruelle, George Washington University)	This sentence has been edited out
640	70819	28	32	1	32	3	unclear meaning - increase in black carbon leading to increase economic activity? (Helene Amundsen, CICERO - Centre for international climate and environmental research - Oslo)	Sentence has been checked for clarity, and has not been changed
641	84000	28	32	1	32	3	A focus on observed changes should be ensured. (Katharine Mach, IPCC WGII TSU)	Has been corrected.
642	60455	28	32	8	32	23	It is very surprising that infrastructure impact from changes in permafrost conditions and that combined effects of climate change (cryospheric changes) and climate change impacts on infrastructure are only dealt with superficially in section 28.2.5.1.5. (DENMARK)	Sections dealing with infrastructure have been significantly revised and shortend due to space limitations.
643	63141	28	32	13	32	14	This sentence could be better written. Note thawing permafrost may still be an issue but it may or may not be a result of a changing climate as construction and operation of infrastructure can have impacts on permafrost resulting in warming and thawing of the ground. For infrastructure that has a long operating life, climate change becomes a more important consideration (especially if ice-rich permafrost). (Sharon Smith, Geological Survey of Canada)	The text had to be further cut and condensed, and addition details were not incorporated due to space limitation.
644	75596	28	32	20	32	23	We recommend deletion of this paragraph. (UNITED STATES OF AMERICA)	Sections on infrastructure have been revised. The paragraph has not been deleted.
645	63142	28	32	22	32	33	Remove Prowse et al. (2009) and just cite Smith and Riseborough (2010) which is the reference for this material and also provides a more detailed discussion regarding the relative importance of climate change and ground distrubance. (Sharon Smith, Geological Survey of Canada)	This has been fixed in revisions
646	63143	28	32	26	0	0	Section 28.2.5.1.6 - Why is resource extraction not considered here? This may also be affected by climate change especially since the activity occurs over a longer time period and there is potential for increased impacts on the environment. This section could also be more focussed on the climate change effects. Other issues related to climate change that could be mentioned are reduced ice road seasons, issues with drilling sumps (including impact of storm surges in low lying areas). (Sharon Smith, Geological Survey of Canada)	We appreciate the reviewer´s thoughtful comment. However, this section has been revised and shortened. The focus has remained narrow due to space limits.
647	75597	28	32	26	32	47	This section is not about observed changes. Please revise it accordingly. (UNITED STATES OF AMERICA)	This has been corrected.
648	75598	28	32	26	32	47	This section should include increased emissions from in-Arctic resource exploration associated with refining, gas flaring, smelting, etc. that will affect air quality, human health and introduce short-lived climate forcers into the Arctic. (UNITED STATES OF AMERICA)	We appreciate the reviewer´s comment. However, this section has been revised and length reduced. Page limitation has made it difficult to consider additional text.
649	57986	28	32	28	32	28	Haven't the large reserves been proven? Suggest deleting "potentially". (Jennifer Francis, Rutgers University)	Noted, but not changed. Potential is a more correct term here than proven
650	70821	28	32	28	32	28	Reference Linholdt, 2006 missing from reference list (Helene Amundsen, CICERO - Centre for international climate and environmental research - Oslo)	Reference has been corrected and added
651	70820	28	32	28	32	47	Section is called resource exploitation, but few reference to resources other than petroleum. (Helene Amundsen, CICERO - Centre for international climate and environmental research - Oslo)	Section has been revised, but in terms of recource exploitation the focus is on oil and gas. The text on oil and gas however has been significantly reduced in order to include only text that is directly related to climate change impacts.
652	70822	28	32	29	32	30	Is the amount of reserves certain or an estimate? (Helene Amundsen, CICERO - Centre for international climate and environmental research - Oslo)	It is an estimate. Sentence has been edited out.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
653	70823	28	32	33	32	33	Add reference to Lindholdt, L., & Glomsrød, S. (2012). The Arctic: No big bonanza for the global petroleum industry. Energy Economics, 34, 1465-1474. (Helene Amundsen, CICERO - Centre for international climate and environmental research - Oslo)	Reference has been added
654	84001	28	32	33	32	40	Focus on observed, not expected or projected, changes should be ensured. (Katharine Mach, IPCC WGII TSU)	Has been corrected.
655	84002	28	32	37	32	37	Here it would seem more appropriate to provide a level of confidence instead of a likelihood term. (Katharine Mach, IPCC WGII TSU)	The sentence has been edited out
656	60653	28	32	39	0	0	Due to expected increases in economic activity from shipping, oil and gas exploration, land-based mineral extraction, and tourism, the storminess of the Arctic may routinely result in a confluence of accidents that will complicate disaster preparedness and exacerbate resource requirements. (George Backus, Sandia National Laboratories)	Noted, but lack of literature on this topic with link to climate change
657	57987	28	32	50	33	32	It seems this section could be blended with sec. 28.2.4.2 (Jennifer Francis, Rutgers University)	The sections have been merged.
658	62047	28	32	52	32	52	"The" should be added to the front of this sentence. (Jon Rosales, St. Lawrence University)	This has been corrected.
659	63144	28	33	1	33	7	Repetition of material presented earlier. (Sharon Smith, Geological Survey of Canada)	Repetition has been removed
660	75599	28	33	2	33	2	Odd to highlight polar bears - several marine mammals more important to subsistence hunters in Arctic. (UNITED STATES OF AMERICA)	Acknowledged, but space limitation has also been an issue. A lot of new literature on polar bears.
661	75600	28	33	9	33	15	Much of this information repeated on p. 38. Please consider revising as appropriate. (UNITED STATES OF AMERICA)	Sections have been revised and repetition has been removed.
662	63082	28	33	27	0	28	The references offered this section, and the mention that “Arctic resources will likely play a growing role in the world economy” could be seen as outdated: with the oil and gas “shall revolution,” the global picture of hydrocarbons changed drastically in 2011-12, with probably a decreasing interest for Arctic resources. This important and recent change should be better reflected in the text, that seems to have been written before the “shall revolution”. Same comments for p. 33, lines 27-28: Arctic hydrocarbons have more than an uncertain future, and must be clearly separated from the mining prospects, that are indeed growing. (Marlene Laruelle, George Washington University)	Sections have been revised and condensed, and this sentence has been edited out
663	75601	28	33	27	33	32	This paragraph is not climate-related. (UNITED STATES OF AMERICA)	Text has been deleted that is not climate related
664	57285	28	33	27	33	33	"the increasing global demaind for energy etc" these exact same word are repeated in Chapter 28, Page 38, Lines 23-26. This degree of repetition seems a bit much. (Erica Head, Fisheries and Oceans Canada)	Repetition has been removed
665	63802	28	33	38	0	0	Since Antarctica has no real communities besides scientific stations, please delete "and communities". To avoid misunderstanding please add in the text:'…communities of local species.' (GERMANY)	This text has been revised, and sentence deleted
666	63803	28	33	41	0	0	It is not section 28.2.7 but 28.2.6. (GERMANY)	governance section has been removed
667	63804	28	33	54	0	0	Please insert:'…for by Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR)…'. (GERMANY)	clarified where needed
668	84003	28	33	54	33	54	This acronym should be specified. (Katharine Mach, IPCC WGII TSU)	This has been fixed
669	63145	28	34	10	0	0	Section 28.2.4.2.2 - Why is there no discussion of toursim in the Arctic? (Sharon Smith, Geological Survey of Canada)	Section has been revised and an abreviated text on cruise tourism is included in new section 28.2.6.2
670	75602	28	34	10	34	26	This section is not about climate change. Please tie it to climate change or consider deleting it. (UNITED STATES OF AMERICA)	The section on Governance in the Arctic has been deleted
671	61673	28	34	14	35	3	Have all potential benefits from reduced distances/emissions for shipping across previously unnavigable parts of the Arctic been quantified? Reduced shipping costs of 15% are mentioned on page 50, line 17. (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	We don´t have literature on that
672	63805	28	34	16	0	0	Please add: In general the Antarctic Peninsula and the surrounding islands receive the highest amounts of all visits. The region is characterized by a comparatively mild climate and rich flora and fauna. Tourism can only take place during the Antarctic Summer from November until March - the breeding period for the Antarctic fauna. So most tourists visit the Antarctic at exactly the time and exactly the region when and where the wildlife is most fragile. (GERMANY)	The author team acknowledges the importance of tourism. However, there is insufficient space to provide general details on tourist requirements
673	63806	28	34	17	0	0	Please add: As the number of tourists have increased and the activities offered by organizers have strongly diversified, concerns… (GERMANY)	insufficient space to provide general details on tourist requirements - text has been reduced

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
674	63807	28	34	19	0	0	Please add: Additionally the encroachment of the tourists to pristine areas is an issue of concern. (GERMANY)	this is not a climate change issue and space was limited.
675	63146	28	34	29	0	0	Section 28.2.6 - It is difficult to see how this discussion on Governance is relevant to climate change adaptation - Should focus on concrete examples of how this advances adaptation policy etc. This section should probably come later within the discussion on adaptation. Also, why are sections on Traditional Knowledge and Reindeer Husbandry included as sub sections? (Sharon Smith, Geological Survey of Canada)	Section edited out////Adaptation is dealt with elsewhere.
676	71466	28	34	29	0	0	This section (28.2.6) covers a mix of things which do not appear to have much to do with Governance in Polar Regions. Sub sections 28.2.6.1 and 28.2.6.2 appear to focus on impacts and implications of climate change as well as other stressors rather than governance. In the section that does discuss governance the linkages to climate change policy and adaptation are not clear - this material should probably come later in the report where adaptation is discussed. (CANADA)	Section on governance has been deleted.
677	63808	28	34	37	34	53	Named are the Antarctic Treaty, the Protocol on Environmental Protection and CCAMLR, in order to complete the list of agreements that follow the AT please add the Convention on the Conservation of Antarctic Seals (CCAS). Furthermore the annual Antarctic Treaty Consultative Meetings (ATCM) should be mentioned at least because this is the international forum for management and administration in the treaty-region. Treaty Parties - especially the consultative parties have the option to develop the existing legal regulations further by their decisions and resolutions. (e.g. allocation of protected areas or regulations for the tourism industry) (GERMANY)	This section has been removed
678	63809	28	34	37	34	53	Please add the current work within the framework of CCAMLR to develop a representative system of Antarctic Marine Protected Areas (MPAs) with the aim of conserving marine biodiversity in the Convention Area, and in accordance with the decision at the World Summit on Sustainable Development to achieve a representative system of MPAs. Actual there are discussed two proposals for a MPA in the Ross Sea and in the East Antarctic within CCAMLR. But also ATCM should make use of the responsibilities for the protection and preservation of the Antarctic environment and, in particular, their responsibilities under Article IX, paragraph 1 (f) of the Antarctic Treaty in respect of the preservation and conservation of living resources in Antarctica, and under Annex V of the Environmental Protocol in order to establish Antarctic Specially Protected Areas. (GERMANY)	This section has been removed
679	75603	28	34	52	34	52	Some specific examples of "mechanisms for managing the effects of climate change in their areas of jurisdiction" would add some substance to this section. (UNITED STATES OF AMERICA)	This section has been removed
680	75605	28	35	0	0	0	The second half of this page has a lot of repetition of earlier statements. Examples are lines 30-32 and 45-49, among others. (UNITED STATES OF AMERICA)	This section has been removed
681	63083	28	35	1	0	0	Governance in the Arctic cannot begin with the role of the Arctic Council: Arctic governance is before all national governances by the littoral states. It is important to be better dissociated the international status of Antarctica from the nationally-governed status of Arctic. The Arctic Council cannot be compared to the Antarctic Treaty: it is mostly a coordination organ for nationally-based systems of governance. (Marlene Laruelle, George Washington University)	This section has been removed
682	63810	28	35	1	35	1	The Arctic Council is not comparable to the Antarctic Treaty System for the last is an international treaty system. The Arctic council however is an institution. From this point of view, the Antarctic Council is comparable to the ATCM. (GERMANY)	This section has been removed
683	78210	28	35	1	35	1	It is inaccurate to call the Arctic Council the 'parallel' of the Antarctic Treaty for the Antarctic. The Arctic Council, as described, is an intergovernmental forum, but is not a treaty. To correct this, the sentence could be started by saying: "The Arctic region is governed by the Arctic Council, which was formally...." (Andrew Wong, University of Waterloo)	This section has been removed
684	63192	28	35	1	35	11	(on Governance): here you shold absolutely insert reference to ARR (Ulf Molau, University of Gothenburg)	This section has been removed
685	63811	28	35	1	35	11	The opportunities concerning the reinforcement of international regulation relating to the Arctic are too brief. Options within the framework of UNCLOS or opportunities for action through the IMO should be added, e. g.: • UNCLOS: The claims could make use of their responsibilities under Article 234, 208 and 214 of UNCLOS, the contracting parties should make use of Article 194 of UNCLOS; both in respect of their responsibility for the protection of the marine environment through activities with adverse impacts (shipping or mining). • IMO should bring forth the work on the Polar Code with strict environmental regulations for the polar regions and should tighten the requirements for the introduction of pollutants (especially in regard to short-lived climate forcers), garbage and sewage concerning the Arctic (options: Arctic as Particularly Sensitive Sea Area). (GERMANY)	This section has been removed

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
686	70824	28	35	4	35	6	unclear meaning (Helene Amundsen, CICERO - Centre for international climate and environmental research - Oslo)	This section has been removed
687	70825	28	35	10	35	11	an institution being 'tentative' is not the same as being a 'soft law regime' (Helene Amundsen, CICERO - Centre for international climate and environmental research - Oslo)	This section has been removed
688	63147	28	35	42	0	0	Section 28.2.6.1 - It is not clear why this discussion on Traditional Knowledge etc. is included as a sub section of the section on Governance. As mentioned in earlier comments, part of this section provides evidence based on TK of impacts of changing climate etc. and should be included with scientific observations (not clear why this is considered separately). There is also much repetition in this section. (Sharon Smith, Geological Survey of Canada)	This section has been reorganized. Indigenous/traditional knowledge section has been shortened to eliminate repetition. Indigenous Peoples/Traditional Knowledge section was added to provide information for readers that are unfamiliar with climate change issues as they pertain to this important and vulnerable sector of the Arctic human community
689	84004	28	35	42	0	0	Section 28.2.6.1. The chapter team should reduce all overlap of this section with 28.2.4. (Katharine Mach, IPCC WGII TSU)	This section has been shortened to eliminate repetition
690	57988	28	35	42	37	33	this whole section seems redundant and could be combined with previous sections, particularly with 28.2.4. (Jennifer Francis, Rutgers University)	This section has been shortened to eliminate repetition
691	75604	28	35	42	37	33	This section is not about observed changes due to climate. Some has to do with policy. The entire section should be dropped. (UNITED STATES OF AMERICA)	The section has been shortened and was added to provide information for readers that are unfamiliar with climate change issues as they pertain to this important and vulnerable sector of the Arctic human community
692	71467	28	35	44	0	46	Suggest including % of arctic indigenous people in Canadian Arctic as well. (CANADA)	As part of shortening of text, all percentages were dropped
693	60456	28	35	44	35	46	Repetition from page 26. Suggest to delete here. (DENMARK)	Repetition in this section from SOD p. 26 (march 20) has been addressed by deletion of the 3 paragraphs in the “Human Populations” section (28.2.4)
694	64188	28	35	44	35	46	I have begun to spot repetitious statements in this Chapter. This may be internetioanl since often readers will not read the entire document but pick and choose particular secitons that refer to the informaiton that they are interested in. In this case page 26 lines 5-32 contained this information plus more. Lokewise some of the information on pages 37 line 52 to page 36 line 6 is the same as page 33 lines 12-17. (Two examples of many I have noticed) (Ian Church, Canadian Foundation for Climate and Atmospheric Science/ IPY Canada)	Repetition in this section from SOD p. 26 (march 20) has been addressed by deletion of the 3 paragraphs in the “Human Populations” section (28.2.4)
695	62048	28	35	44	35	52	These sentences also appear on page 26. (Jon Rosales, St. Lawrence University)	Repetition in this section from SOD p. 26 (march 20) has been addressed by deletion of the 3 paragraphs in the “Human Populations” section (28.2.4)
696	60457	28	35	47	35	47	Suggest to add: Indigenous populations [with traditional lifestyles] are considered.. (DENMARK)	Reworded first sentence of Indigenous Peoples section to read as follows: “Indigenous populations in the Arctic – the original inhabitants of the region – and especially those with traditional lifestyles are considered particularly vulnerable to climate change, due to their close relationship with the environment and its natural resources for physical, social, and cultural well-being.”
697	78312	28	35	52	35	52	(Nakashima et al 2011) has now been peer-reviewed and formally published. Therefore please now cite as (Nakashima et al 2012): Nakashima, D.J., Galloway McLean, K., Thulstrup, H.D., Ramos Castillo, A. and Rubis, J.T. 2012. Weathering Uncertainty: Traditional Knowledge for Climate Change Assessment and Adaptation. Paris, UNESCO, and Darwin, UNU, 120 pp. (Douglas Nakashima, UNESCO)	Changed to “Nakashima et al, 2012”
698	70826	28	36	4	36	6	awkward sentence, rephrase 'scientists are forced to think…' (Helene Amundsen, CICERO - Centre for international climate and environmental research - Oslo)	Changed sentence to read “”…scientists must therefore think in terms of….” (get rid of “are forced to think”)
699	62049	28	36	7	36	13	Ignatowski and Rosales 2013 could be added to this list if articles in revision and resubmitted are acceptable, otherwise these findings are consistent with what we found with the AKSIK project. (Jon Rosales, St. Lawrence University)	Not included

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
700	71468	28	36	15	0	25	Suggest that this information regarding TEK emerging as a critical source of information for comprehensively addressing the impacts of environmental and other changes as well as the development of appropriate adaptation and response strategies for indigenous populations could be highlighted in the Executive Summary. (CANADA)	Text has been revised and a new section on "Indigenous Peoples and Traditional Knowledge" has been included - section 28.2.5
701	84005	28	36	24	36	24	It may be most appropriate to delete "for the IPCC 5th assessment report" given that all literature published by the cutoff date is relevant to the report. (Katharine Mach, IPCC WGII TSU)	Deleted in rewrite/shortening
702	70827	28	36	42	36	44	reference missing (Helene Amundsen, CICERO - Centre for international climate and environmental research - Oslo)	Deleted in rewrite/shortening
703	70828	28	36	51	36	51	should reference be: Berkes & Jolly, 2001? (Helene Amundsen, CICERO - Centre for international climate and environmental research - Oslo)	Reference corrected: Berkes and Jolly, 2001
704	62050	28	37	1	37	3	Ignatowski and Rosales 2013 could be added to this list if articles in revision and resubmitted are acceptable, otherwise these findings are consistent with what we found with the AKSIK project. (Jon Rosales, St. Lawrence University)	Added Ignatowski and Rosales, 2013 reference in text
705	69817	28	37	3	37	5	Not clear if the Gearheard et al. 2010 reference provides explicit wind data and methodology used, outside of reporting on the general overview of the Igliniit project. (NETHERLANDS)	Added Overland et al, 2012
706	75606	28	37	13	37	13	p. 37, line 13; This could be generalized to include the western Arctic as well. Subsistence hunters along the north and western coast of Alaska refer to the unpredictability of sea ice as well. (UNITED STATES OF AMERICA)	Rewrite of this and other sections added words to include Western Arctic
707	60458	28	37	20	37	20	Suggest to add: While Arctic indigenous peoples [with traditional lifestyles] are considered.. (DENMARK)	Added “with traditional lifestyles” after “Peoples” p. 37, l. 20
708	69818	28	37	20	37	23	"life ways" should be ammended to either 'ways of life' or 'livelihoods' (NETHERLANDS)	Replaced “lifeways” with “ways of life”
709	60459	28	37	24	37	24	Indigenous knowledge..replace by "traditonal knowledge". Alternatively define term. (DENMARK)	Replaced “indigenous knowledge” with “traditional knowledge”
710	60460	28	37	31	37	31	Indigenous knowledge..replace by "traditonal knowledge". Alternatively define term. (DENMARK)	Replaced “indigenous knowledge” with “traditional knowledge”
711	84006	28	37	31	37	31	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Katharine Mach, IPCC WGII TSU)	Sentence was deleted as part of shortening text
712	60461	28	37	32	37	32	Indigenous knowledge..replace by "traditonal knowledge". Alternatively define term. (DENMARK)	Sentence was deleted as part of shortening text
713	84007	28	37	36	0	0	Section 28.2.6.2. The chapter team should reduce all overlap with 28.2.5.1.7, most especially for the 1st 2 paragraphs of this section. (Katharine Mach, IPCC WGII TSU)	this entire section was integrated into 28.2.5.1.7 and duplicative material deleted
714	57989	28	37	36	38	47	This section is also redundant and could be combined with 28.2.5.1.7 (Jennifer Francis, Rutgers University)	This entire section was integrated into 28.2.5.1.7 and duplicative material deleted
715	75607	28	37	38	37	50	How does herding compare to wildlife harvests in subsistence economies? (UNITED STATES OF AMERICA)	There is a short discussion of these in section 28.2.5.1.7
716	75608	28	37	52	38	47	This section generally repeats what has been said earlier in the chapter. For example, much of p. 38 has already appeared on p. 33. (UNITED STATES OF AMERICA)	this entire section was integrated into 28.2.5.1.7 and duplicative material deleted
717	75609	28	38	1	38	15	Too much detail on herding - lack of balance. (UNITED STATES OF AMERICA)	Added more discussion of Inuit and reduced length of reindeer discussion to create better balance (and this entire section was integrated into 28.2.5.1.7 and duplicative material deleted)
718	69819	28	38	6	38	9	The single reference within this sentence is a study focused on northernmost Finland. Suggested for additional reference to be included supporting this trend in other geographic areas. (NETHERLANDS)	this entire section was integrated into 28.2.5.1.7 and discussion includes other areas
719	70829	28	38	12	38	12	repetition from earlier in chapter (Helene Amundsen, CICERO - Centre for international climate and environmental research - Oslo)	this entire section was integrated into 28.2.5.1.7 and duplicative material deleted
720	57286	28	38	23	38	26	"the increasing global demaind for energy etc these same word also appeard on page 38, lines 23-26. This degree of repetition seeems a bit much. (Erica Head, Fisheries and Oceans Canada)	this entire section was integrated into 28.2.5.1.7 and duplicative material deleted
721	75610	28	38	30	38	31	p. 38, line 30-31: It seems like additional references are needed. (UNITED STATES OF AMERICA)	Added (Kumpala et al, 2011)
722	70830	28	38	33	38	35	repetition from earlier in chapter (Helene Amundsen, CICERO - Centre for international climate and environmental research - Oslo)	this entire section was integrated into 28.2.5.1.7 and duplicative material deleted

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
723	64189	28	38	39	38	43	IN addition to the placement of infrastructure. Pollution etc. just the destruction of the vegetation communities and environment(soils, water regimes, localized topography etc.) that support them- plant and environment associations (ecological relationships) that have taken centuries to develop. (Ian Church, Canadian Foundation for Climate and Atmospheric Science/ IPY Canada)	Entire section integrated elsewhere, but this comment's substance was integrated into section 28.2.3.5. (Changes in Reindeer and Muskox). Added on p. 23, l. 7 following the word "development" the words: "accompanied by associated pollution and destruction of basic ecosystems as well as their supporting environment".
724	75611	28	39	1	39	1	A small introductory paragraph should set the stage for what this section hopes to ,accomplish. (UNITED STATES OF AMERICA)	Introductory paragraphy not included due to space limitation.
725	75612	28	39	1	50	27	No mention is made anywhere of any different climate pathways. Presumably the future impacts should be tied to different climate forcing scenarios. Few if any of the projections mentioned in this section have any time horizon, so they are largely useless. (UNITED STATES OF AMERICA)	Noted.There is insufficient literature on future impacts and different climate pathways.
726	75613	28	39	1	50	27	There is an inconsistent use of confidence levels. Some sections list many findings an no confidence levels. We suggest a more coherent approach or a discussion in the section introduction about what approach will be taken. (UNITED STATES OF AMERICA)	The difference in use of confidence level reflects differences in availability of literature, and different author contributions. An introduction on approach was not feasible due to tight page limitations and extensive revisions to shorten text.
727	63193	28	39	5	0	0	Section 28.3.1.1.: see ARR, Chapter 4, on hydrological changes brought about by a shrinking cryosphere (thawing permafrost, disappearing snowbeds) (Ulf Molau, University of Gothenburg)	The authors appreciate being directed to the newly released Arctic Reslience, Interim Report 2013. Although it is hoped to include a general reference to it along with other arctic assessments at the start of the report, the authors would prefer to retain only direct references to original journal literature in this section, and to other sections of the WG1 and WGII 5th Assessment Report that deal with related issues, such as permafrost thaw. Such chapter cross-referencing has been conducted as part of this revision.
728	80031	28	39	5	40	45	We find no information/discussion regarding effects on freshwater fish or anadrome salmon populations. Please consider including findings related to this topic. (NORWAY)	The authors agree and have included some additional text about this in Section 28.2.1.1.
729	57991	28	39	7	39	7	Should this be WGI? (Jennifer Francis, Rutgers University)	Broad-scale hydrologic changes are discussed in WGI but the details of the hydrologic impacts (and their regional controls) for a specific region, such as the Arctic, falls within the domain of WGII. Cross-referencing to relevant chapters is included to make logical links. Please also note that WGII also includes an entire chapter dedicated to Freshwater Resources (Chapter 3) in which details of hydrologic drivers, changes and impacts are also discussed, although again, not at the level of detail specific to the Arctic, as in this Polar Regions chapter.
730	84008	28	39	7	39	7	It would be preferable to indicate the specific relevant section of chapter 3. (Katharine Mach, IPCC WGII TSU)	Cross-referencing is made more explicit to specific sections. Furthermore, an additional cross-reference is made to a WGI chapter. Specifically, they now include: WGI Ch.12.4.5.4. and WGII Ch. 3.4.5
731	84009	28	39	11	39	11	The baseline for these projected increases should be specified. (Katharine Mach, IPCC WGII TSU)	In condensing the chapter to meet page limits, the text about the magnitude of change in sediment load has been deleted thereby eliminating the need to reference the baseline.
732	63148	28	39	15	39	15	WG1 Ch4 focusses more on observations of change rather than projections. (Sharon Smith, Geological Survey of Canada)	Cross-reference has been changed to WGI Chapter 12, Section 12.4.6.2. which specifcially focusses on "Changes in Snow Cover and Frozen Ground", i.e., climate-model projections of such.
733	84010	28	39	15	39	15	It would be preferable to indicate the specific relevant sections of chapter 4. (Katharine Mach, IPCC WGII TSU)	Cross-reference has been changed to WGI Chapter 12 and made specific to Section 12.4.6.2.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
734	75614	28	39	15	39	39	This seems to be material more appropriate to Working Group I. (UNITED STATES OF AMERICA)	A similar response as to Comment #729, i.e., "Broad-scale hydrologic changes are discussed in WGI but the details of the hydrologic impacts (and their regional controls) for a specific region, such as the Arctic, falls within the domain of WGII. Cross-referencing to relevant chapters is included to make logical links. Please also note that WGII also includes an entire chapter dedicated to Freshwater Resources (Chapter 3) in which details of hydrologic drivers, changes and impacts are also discussed, although again, not at the level of detail specific to the Arctic, as in this Polar Regions chapter."
735	64190	28	39	23	0	0	I have noted that on several occaisions the use of technical terms that are so specialized that even the probable audience of these reports won't know their meaning. A Glossary is probably needed or terms might be foot noted- hyporheic zone was one of those for me though I am very farmiliar with the concept and use it often when discussing hydrology. Stamukhi lakes is another example (line 44) (Ian Church, Canadian Foundation for Climate and Atmospheric Science/ IPY Canada)	These terms have been identified for inclusion in a glossary of terms. If not, the authors will endeavour to use footnote definitions as suggested by the reviewer - although space restrictions are a problem for the inclusion of such at the exclusion of other written text.
736	57891	28	39	27	0	0	These results are reinforced by those in Nakaegawa et al. (2013) Nakaegawa, T., A. Kitoh, M. Hosaka. 2013: Discharge of major global rivers in the late 21st century climate projected with the high horizontal resolution MRI-AGCMs -overview-. Hydrological Processes. 27. DOI: 10.1002/hyp.9831 (Toshiyuki Nakaegawa, Meteorological Research Institute)	The authors thank the reviewer for the reference to this interesting article. However, the nature of this type of global assesssment is within the domain of WGI, specifically Chapter 12, which reviews climate model driven changes of the water cycle, including humidity, precipiation, soil moisture, runoff and evaporation, and extreme events.
737	84011	28	39	31	39	31	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Katharine Mach, IPCC WGII TSU)	The sentence has been deleted.
738	57990	28	39	44	39	48	define stamukhi lakes and lentic ecology (Jennifer Francis, Rutgers University)	Similar to the response to comment #735: the term "stamukhi" has been identified for inclusion in a glossary of terms. If not, the authors will endeavour to use a footnote definition. The same applies to "lentic", which means "still-water or lake".
739	64191	28	39	53	0	0	I assume "thicknes" is ice thickness (Ian Church, Canadian Foundation for Climate and Atmospheric Science/ IPY Canada)	The authors assumed that "thicknes" was a typo in the reviewer's comment and did not refer to one made in the chapter text. Hence, the comment is interpreted as the adjective "ice" should be used to modify the word thickness, which has been done.
740	66222	28	40	4	40	5	It would be good to expose what those affected processes are for a better comprenhension (David Velázquez, Universidad Autónoma de Madrid)	Unfortunately, chapter space precludes the listing of all aquatic processes noted by Prowse and Brown 2010a. However, becasuse the following text in this paragraph describes the specifics of some of these aquatic processes found by other researchers, the second sentence has been linked to the first with a "For example..." to indicate that the examples provided relate to some of those noted by Prowse and Brown.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
741	64192	28	40	16	40	18	In what ways- I can imagine direct impact on some that are preyed on by fish while other species that depend on increased detritus from fish carcases may be negatively impacted. Obviously "lower" species dependent on higher oxygen levels would be positively impacted etc. (Ian Church, Canadian Foundation for Climate and Atmospheric Science/ IPY Canada)	The authors emphathize with the desire to embellish the specifics of these cascading effects but, unfortunately, space limitations imposed on the chapter authors simply preclude including more descriptive text. Hence, the authors can only be hopeful that interested readers will review the original paper by Balayla et al. for the more detailed information that had to be so succintly summarized here.
742	69820	28	40	28	40	31	Possible to internally cite the forthcoming Working Group 1 climate warming scenarios, in place of IPCC 2007 report? (NETHERLANDS)	Unfortuantely, the cited results on carbon burial conducted by Gudasz et al. (2010) was from work conducted using previous climate model projections and hence the necessity to cite the IPCC 2007. No similar results/literature was found on this subject using the most recent modelling projections.
743	66389	28	40	53	40	53	Recent papers emphasise on this problem in the region, linking it to the high temperaturesof permafrost. therefore, I would add after "can have widespread ecosystem impacts", "including permafrost, active layer and hydrological changes (Vieira et al. 2010, Bockheim et al. 2013)". Vieira, G., Bockheim, J., Guglielmin, M., Balks, M., Abramov, A.A., Boelhouwers, J., Cannone, N., Ganzert, L., Gilichinsky, D.A., Goryachkin, S., López-Martínez, J., Meiklejohn, I., Raffi, R., Ramos, M., Schaefer, C., Serrano, E., Simas, F., Sletten, R., Wagner, D. 2010 - Thermal State of permafrost and active-layer monitoring in the Antarctic: advances during the International Polar Year 2007-09. Permafrost and Periglacial Processes, 21(2): 182-197; Bockheim J, Vieira G, Ramos M, Lopez-Martinez J, Serrano E, Guglielmin M, Wilhelm K, Nieuwendam A. 2013. Climate Warming and Permafrost Dynamics in the Antarctic Peninsula Region . Global and Planetary Change, 100: 215-223. (Carla Andreia Silva Mora, University of Lisbon)	Text added to address this point
744	57992	28	40	54	40	54	Define epishelf lakes (Jennifer Francis, Rutgers University)	Text has been clarified
745	84012	28	41	16	41	16	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Katharine Mach, IPCC WGII TSU)	Text has been clarified
746	69821	28	41	16	41	18	Likelihood statement in this sentence would require a reference to back it. (NETHERLANDS)	Text has been clarified
747	66223	28	41	18	41	18	I recommend to support the sentence by: Velázquez D, Frías A, Lezcano MA and Quesada A (2013). Ecological relationships and stoichiometry within a maritime Antarctic watershed. Antarctic Science 25(2) 191-197. (David Velázquez, Universidad Autónoma de Madrid)	Text added to address this point
748	66224	28	41	18	41	19	I recommend to complete the sentence as: "...benthos and plankton and mismatched dynamic populations (Quesada and Velázquez, 2013)." Quesada A and Velázquez D (2012). Global Change Effects on Antarctic Lakes. In: Effects of Global Warming on Freshwater Ecosystems of the World: what can be done to reduce negative impacts? (M Kumagai,CR Goldman and RD Robarts eds). Wiley-Blackwell Ltd .pp 367-382 (David Velázquez, Universidad Autónoma de Madrid)	Text added to address this point
749	84013	28	41	27	41	27	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Katharine Mach, IPCC WGII TSU)	Language has been improved
750	66225	28	41	29	41	30	I do not really follow this sentence for an Antarctic scenario. For example, a complete dry up of lakes could be difficult if the water discharded (e. g.) from glaciers would increased. Please, reconsider rephrasing. (David Velázquez, Universidad Autónoma de Madrid)	This has been clarified
751	84014	28	41	33	41	33	To maximize directness of wording, "medium confidence" could be placed within parentheses at the end of the sentence. (Katharine Mach, IPCC WGII TSU)	This has been clarified
752	64193	28	41	40	0	0	Are these surface lakes or sub-glacial lakes? (Ian Church, Canadian Foundation for Climate and Atmospheric Science/ IPY Canada)	This has been clarified
753	75615	28	41	44	41	44	p. 41, line 44: It would help the reader to be more specific as to species and population of fur seal. (UNITED STATES OF AMERICA)	Text added to address this point
754	57993	28	41	47	41	47	Something's missing here! (Jennifer Francis, Rutgers University)	Language has been improved

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
755	84015	28	42	1	0	0	Section 28.3.2. In revising this section, the chapter team should very carefully consider material assessed here as compared to in 28.2. The focus here should be on future-oriented assessment of impacts, risks, and vulnerability. All assessment of observed changes should occur in 28.2. (Katharine Mach, IPCC WGII TSU)	This issue was addressed
756	84923	28	42	1	0	0	Section 28.3.2: Just as section 28.2.2 should focus on observed changes, this section should focus on projected changes. Please ensure a clear handoff between these sections. (Michael Mastrandrea, IPCC WGII TSU)	This issue was addressed
757	57287	28	42	5	42	9	To prevent repetition, I suggest changing the sentence that begins "While there is abundant evidence" to "On the other hand, however, predictions of the magnitude and spatial extent of ecosystem change for the entire Arctic region are uncertain." (Erica Head, Fisheries and Oceans Canada)	Accepted suggested text
758	84016	28	42	7	42	7	How will marine ecosystems be impacted? It would be preferable to be a bit more specific here. (Katharine Mach, IPCC WGII TSU)	This has been addressed in revised text
759	84017	28	42	14	42	21	Deletion of these paragraphs could be considered. The paragraph on lines 14-16 could be moved to 28.2. (Katharine Mach, IPCC WGII TSU)	The text was reduced considerably
760	75616	28	42	15	42	15	"hindcasted", not "projected". (UNITED STATES OF AMERICA)	Moved this reference to the observed section and revised
761	80032	28	42	16	28	26	Other studies show variability with respect to increase , if any, in marine primary productivity. Please consider including a reference here (e.g. Wassmann 2011, already in the reference list). (NORWAY)	Addressed through modification of text
762	62977	28	42	18	42	19	The sentence "There is medium confidence that in the deep basins of the Arctic Ocean changes in stratification and the number of ice free days will lead to greater drawdawn of nutrients and higher pelagic primary production". This sentence is unclear. What is "drawdawn" of nutrients? Do you mean higher sedimentation to deeper layers or larger utilization of the nutrients available? What is pelagic primary production? What kind of primary production is not pelagic? I suggest to rewrite the sentence and include the following aspects: With less ice due to climate change, the length of the productive season may become somewhat extended (Slagstad et al., 2011). However, due to the strong stratification preventing nutrient availability (Tremblay and Gagon, 2009), the central Arctic Ocean will most probably remain a low productive region (Wassmann, 2011). The benthic fauna, which is an intergral component of the food web, exhibits a strong association with the overlying primary productivity regime (Tremblay et al., 2011). A shift from an ice-influenced tightly coupled pelagic-benthic system, to a less coupled ice-free system, can be expected in regions experiencing future reductions in ice cover. (Randi Ingvaldsen, Institute of Marine Research)	Revised text
763	80033	28	42	19	42	19	With respect to higher pelagic primary production, it is important do distinguish between short and long term. After some time primary production is not likely to increase further due to stratification and low nutrient concentrations. (NORWAY)	Revised text
764	57288	28	42	20	42	20	Change "may" to "will" (Erica Head, Fisheries and Oceans Canada)	Revised text accordingly
765	57289	28	42	27	42	27	"diet" is not a rate, and cod don't make the active choice to "shift" their vital rate, so change this to "Historical records show Atlantic cod respond to differences in local conditions via changes in feeding behaviour (diet), key vital rates (growth rate" (Erica Head, Fisheries and Oceans Canada)	Text edited out
766	80034	28	42	34	43	11	Not clear the reasons behind which organisms groups are mentioned/discussed in the different areas. Please clarify. (NORWAY)	Due to page constraints the text is limited to case studies for primary production, zooplankton, fish and crab.
767	75617	28	42	36	42	37	No evidence of northward movement of walruses. (UNITED STATES OF AMERICA)	changed
768	57290	28	42	39	42	40	Change to "Further climate warming may lead to a further northward movement of these conditions (e.g. into the Chukchi Sea). If this occurred it would provide higher levels of prey for pelagic planktivores and baleens whales in the Bering Sea, but could have a negative impact on the macro-benthic community that sustains the walrus and grey whales." (Erica Head, Fisheries and Oceans Canada)	Text has been accepted
769	80035	28	42	42	42	42	"Calanus" in italics. (NORWAY)	Text has been fixed

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
770	57291	28	42	42	42	43	Karnovsky et al. 2010 were talking about the Greenland Sea, where the currents from the south bring C. finmarchicus north and where currents from the north bring both C. glacialis and C. hyperbroeus south through Fram Strait. C. hyperboreus does not get transported south through Bering Strait and does not occur in the Bering Sea, and C. finmarchicus is an Atlantic species, which is not going to be transported north from the Pacific. The Calanus species found in the Pacific is C. pacificus, but I am not aware that it has ever been seen in the Bering Sea. Overall, this sentence is rubbish and the reference is inappropriate. I suggest replacing it with this. "In addition, changes in the zooplankton community composition, including a decrease in the abundance of larger forms, such as the lipid-rich Arctic species, Calanus glacialis, could have a negative impact on some planktivorous predators." (Erica Head, Fisheries and Oceans Canada)	We have modified the text to reflect the current literature on this subject. We discuss the implications of prey quality on higher trophic levels
771	64618	28	42	45	42	47	28.3.2.1.2.reference to the respective discussion in WG II ch. 6 may be useful. (Lena Menzel, Alfred Wegener Institute for Polar and Marine Research)	Drawing linkages to chapter 6 was not possible due to page limitations.
772	84018	28	42	49	42	49	To maximize directness of wording, "medium confidence" could be placed within parentheses at the end of the sentence. (Katharine Mach, IPCC WGII TSU)	This sentence was dropped due to page limitations
773	64619	28	43	8	43	11	28.3.2.1.2. this is an interesting statement, however it lacks references. It should be considered in ch6 in the part on species migration due to warming, as an ideal example illustrating that not only high-latitude species may face "barriers" for poleward migration. (Lena Menzel, Alfred Wegener Institute for Polar and Marine Research)	This sentence was dropped due to page limitations, we now cite a cross-chapter box CC-MB on movements and biodiversity
774	75618	28	43	9	43	9	"fewer" relative to what? relative to Atlantic species? (UNITED STATES OF AMERICA)	This sentence was dropped due to page limitations
775	80036	28	43	14	43	23	What is the reasons for presenting this in a seperate section? Could this be included in the previous section? (NORWAY)	Throughout the marine sections we have distinguished responses based on changes in phenology, spatial distribution and abundance. We acknowledge that all three of these responses will be occuring at the same time.
776	57292	28	43	16	43	17	Change "In the Bering Sea etc." to "There is medium confidence, based on observations, that increased summer sea surface temperatures will cause a decrease in the abundance of the large, energy rich copepod, Calanus marshallae, and euphausiids over the Bering Sea shelf (Coyle et al., 2011). This is expected to etc." The reference is already in the reference list. (Erica Head, Fisheries and Oceans Canada)	Text has been modified as suggested
777	75619	28	43	16	43	23	Seabirds?? Marine Mammals?? (UNITED STATES OF AMERICA)	Responses of seabirds and marine mammals are addressed in another section
778	80037	28	43	26	43	31	Why is cumulative effects only discussed for fish and shellfish, but not for other organism groups? (NORWAY)	deleted cumulative effects
779	84019	28	43	28	43	31	These statements should be rigorously supported by citations, or they should be deleted. (Katharine Mach, IPCC WGII TSU)	deleted cumulative effects
780	84020	28	43	36	43	36	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Katharine Mach, IPCC WGII TSU)	text has been clarified
781	57293	28	43	36	43	37	Insert "ectothermic" thus "metabolic costs in many ectothermic pelagic species". Insert "limit" and change "temperature" to "temperate" thus "movement south of the northern distribution limit of polar species and southern distribution limit of temperate and subantarctic species." (Erica Head, Fisheries and Oceans Canada)	text reduced and clarified
782	64620	28	43	36	43	37	28.3.2.2.The metabolic generalizations are far from clear as warm acclimatization may reduce metabolic costs. Warm acclimtaization has been described in several species. (Lena Menzel, Alfred Wegener Institute for Polar and Marine Research)	the text reflects the conclusions in the literature. there was insufficient space to give detailed discussion on these issues.
783	75620	28	43	38	43	38	Should "temperature" be "temperate"? (UNITED STATES OF AMERICA)	yes - the text has been clarified
784	84021	28	43	45	43	45	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Katharine Mach, IPCC WGII TSU)	text has been clarified
785	84022	28	43	50	43	50	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Katharine Mach, IPCC WGII TSU)	text has been clarified
786	57294	28	44	4	44	4	Change "are" to "is" and add (WAP) thus "western Antarctic Peninsula (WAP) is expected to" (Erica Head, Fisheries and Oceans Canada)	text has been clarified
787	63160	28	44	6	0	0	References - Several references cited in text do not appear in the list. This makes it difficult for reviewers to check that material in the text correctly reflects conclusions in publications. (Sharon Smith, Geological Survey of Canada)	referencing has been edited

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
788	57295	28	44	9	44	10	Change "can" to "could" and omit "on" thus - "This mismatch in timing could also propagate through the food web to impact krill and upper trophic levels etc." (Erica Head, Fisheries and Oceans Canada)	text has been clarified
789	63194	28	44	23	0	0	Section 28.3.3.1.: there is nothing mentioned on invasive species for the Arctic but very much information for the Antarctic in the subsequent section. Consult ABA for information on invasives in the Arctic! (Ulf Molau, University of Gothenburg)	Suggestion noted, but due to page constraints not included
790	80038	28	44	23	45	25	We find the information/discussion regarding effects on fauna quite limited, please consider extending it. (NORWAY)	Not possible to add further details due to strict page constraints
791	75621	28	44	25	44	30	Enumerate the two approaches in order to make it clear what is the second approach. (UNITED STATES OF AMERICA)	text has been deleted during general shortening of ch 28 SOD
792	60833	28	44	38	44	38	Insert additional references on this topic: Jiang, D., Zhang, Y., and Lang, X.: Vegetation feedback under future global warming, Theor. Appl. Climatol., 106, 211–227,2011; Falloon, P. D., Dankers, R., Betts, R. A., Jones, C. D., Booth, B. B. B., and Lambert, F. H.: Role of vegetation change in future climate under the A1B scenario and a climate stabilisation scenario, using the HadCM3C earth system model, Biogeosciences 9, 4739-4756,doi:10.5194/bg-9-4739-2012; Strengers, B. J., M¨uller, C., Schaeffer, M., Haarsma, R. J., Severijns, C., Gerten, D., Schaphoff, S., van den Houdt, R., and Oostenrijk, R.: Assessing 20th century climate–vegetation feedbacks of land-use change and natural vegetation dynamics in a fully coupled vegetation–climate model, Int. J. Climatol., 30, 2055–2065.doi:10.1002/joc.2132, 2010; Swann, A. L., Fung, I. Y., Levis, S., Bonan, G., and Doney, S.: Changes in Arctic vegetation induce high-latitude warming through the greenhouse effect. P. Natl. Acad. Sci. USA, 107, 1295–1300, doi:10.1073/pnas.0913846107, 2010. (Peter Falloon, Met Office Hadley Centre)	Most of these references are not about the Arctic. The topic is covered by the terrestrial ch of WG II. We have included the Swann et al. 2010 paper
793	70831	28	44	40	44	42	what is the time range for this projection? (Helene Amundsen, CICERO - Centre for international climate and environmental research - Oslo)	Text has been deleted
794	84023	28	44	40	44	42	For this projection, what are the relevant time frames, scenarios of climate change, and baselines for the percentage increase? Also, what exactly is the percentage increase a measure of? It would be helpful to indicate this more specifically. (Katharine Mach, IPCC WGII TSU)	Text has been deleted
795	84024	28	44	44	44	46	It would be helpful to specify the relevant scenarios of climate change for this projection. (Katharine Mach, IPCC WGII TSU)	sorry they are not available
796	57994	28	45	24	45	24	Ims reference? (Jennifer Francis, Rutgers University)	This has been corrected
797	84025	28	45	31	45	31	What type of organisms are the "colonists"? The chapter team should ensure that the reader would not think that people are meant. (Katharine Mach, IPCC WGII TSU)	This has been clarified
798	66226	28	45	32	46	1	I guess the citation format for references with more than 2 co-authors in this section is different from the rst of the document. Please, consider revising (David Velázquez, Universidad Autónoma de Madrid)	referencing has been edited
799	84026	28	46	13	46	13	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Katharine Mach, IPCC WGII TSU)	likelihood terms have been used more carefully
800	75622	28	46	13	46	16	Excellent point that seems to deserve inclusion in the Executive Summary. (UNITED STATES OF AMERICA)	We acknowledge this is an important point. However, the executive summary had to be further condensed, and in the revisions it was not possible to include this paragraph.
801	84027	28	46	15	46	15	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Katharine Mach, IPCC WGII TSU)	likelihood terms have been used more carefully
802	63195	28	46	19	0	0	Section 28.3.4.: see ARR for in-depth review of this field (Ulf Molau, University of Gothenburg)	ARR reference has been addded to the introduction of the chapter
803	57996	28	46	19	46	48	What about Greenlanders? (Jennifer Francis, Rutgers University)	Incomplete review comment
804	84028	28	46	23	46	23	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Katharine Mach, IPCC WGII TSU)	likelihood terms have been used more carefully
805	57995	28	46	25	46	25	insert "traditional" before "way of life"? (Jennifer Francis, Rutgers University)	"Traditional" has not been added tho the wording.
806	57296	28	46	27	46	27	"thru" - are you kidding me? Replace it with "through", please! "Arctic communities are exposed to the effects of climate change through multiple pathways etc" (Erica Head, Fisheries and Oceans Canada)	Corrected text
807	57297	28	46	31	46	31	Replace "with" with "within" thus "Communities within the same eco-zone etc" (Erica Head, Fisheries and Oceans Canada)	Corrected text

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
808	57298	28	46	35	46	35	Change thus - "Economic cost estimates have been made for the case of the Alaskan economy, which suggest that a heavy reliance etc" (Erica Head, Fisheries and Oceans Canada)	Corrected text
809	75623	28	46	35	46	48	Citations not in Literature cited. (UNITED STATES OF AMERICA)	Reference has been added
810	63149	28	46	40	46	41	Better terminology should be used - "Thawing of ice-rich permafrosst can cause hydrocarbon pipelines…." Note that it is the thawing of ice-rich permafrost (or ice-rich frozen ground) which may or may not be in tundra envrionments (it occurs below treeline also) that will have these impacts. Epstein et al 2008 is not a good reference. Prowse et al. 2009 may be better. Ref: Prowse, T.D., Furgal, C., Chouinard, R., Melling, H., Milburn, D., and Smith, S.L. 2009. Implications of climate change for economic development in Northern Canada: energy, resource, and transportation sectors Ambio, 38(5): 272-281. (Sharon Smith, Geological Survey of Canada)	The section has been revised and the text referred to here has been edited out.
811	64194	28	46	41	0	0	design yes but also operations monitoing and maintenance (Ian Church, Canadian Foundation for Climate and Atmospheric Science/ IPY Canada)	The section has been revised and the text referred to here has been edited out.
812	64195	28	46	46	47	22	The emphahsis in this chapter is frozen soils (permaforst) and challenges it poses with warming such as subsidence. There is little recognition of other terraine hazards to infrastructure such as some related to permaforst (examples slumps, land slides hydrological shallenges etc.) and others related to climate and weather such as avalanches. A classic example of such a challenge was the Mt Steele landslide probably triggered by degrading permaforst.(example of a publication on this event http://www.sfu.ca/cnhr/papers/Lipovsky%20Landslides%202008.pdf) This event did not actually impact infrastructure but is a classic example of how cumulative processes in a simlar landscape could cause a catastrophic impact on infrastructue. The mapping along the the Alaska Highway corridor by the Geological Survey of Canada (50 1:50,000 NTS map sheets) illustrates the diversity of natural hazards northern environments can poss for infrastructue- many of which have at least a partial weather of climate signature. (GEOLOGICAL SURVEY OF CANADA, OPEN FILE 6654, Landslide inventory along the Alaska Highway Corridor, Yukon, Blais-Stevens, A., Couture, R., and Page, A.) Mt Steele and other related publications are listed the web site, http://www.geology.gov.yk.ca/pdf/Selected_Publications.pdf. I also am reviewing this after the highway connecting the Yukon with Skagway Alaska through the White Pass has been intermitantly closed over a period of several days as a result of avalanches- not a new phenomenon but occurences that are likely to be more common as a result of greater variability of temperatures impacting the stability of alpine snow packs.- also an issue for the next session-transportation (Ian Church, Canadian Foundation for Climate and Atmospheric Science/ IPY Canada)	The text has been revised and shortened significantly. It has not been possible to include additional details due to space limitations
813	75624	28	47	5	47	7	Section 28.3.4.1, Page 47 Line 5 to Line 7 Page 47. Although included in the literature cited of Chapter 28, the information and citation for Mundy and Evenson 2011 was left out of Section 28.3.4.1, Page 47 Line 5 to Line 7 Page 47. It should read as follows, "Climate change will impact coastal Arctic fisheries for salmon because of the relation between ice cover and timing of marine exit for salmon (Mundy and Evenson 2011). Loss of sea ice cover in the spring will change fish behavior in ice bound areas, making fishery management more challenging. Subsistence harvesters are place-based, having limited mobility." (UNITED STATES OF AMERICA)	Has been fixed
814	75625	28	47	7	47	10	Apparent poleward changes in latitudinal gradients of Bering Sea epibenthic invertebrate megafauna and fishes is associated with short-term (5-yr) fluctuations in position of cold pool, which is under the influence of spring sea ice distribution (Stevenson and Lauth 2012 Deep-Sea Research II 65-70, 251-259; Stabeno et al. 2012 Deep-Sea Research II 65-70, 14-30). Warming of the Bering Sea and associated effects have been recently called into question (Overland et al. 2012 Deep-Sea Research II 65-70; Lomas et al. 2012 Deep-Sea Research II 65-70, 126-140; Stabeno et al. 2012 Deep-Sea Research II 65-70, 14-30; Stabeno et al. 2012 Deep-Sea Research II 65-70, 31-45). (UNITED STATES OF AMERICA)	We are aware of the referenced material. The material supports the observation that fish move in response to shifts in climate conditions, warm or cold. The text acknowledges that interannual and decadal variability can still occur.
815	84029	28	47	8	47	8	Here it would be preferable to present a level of confidence in italics, in place of "medium certainty," following the guidance for authors. (Katharine Mach, IPCC WGII TSU)	Addressed, but was decided to keep as is.
816	84030	28	47	30	47	30	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Katharine Mach, IPCC WGII TSU)	Has been corrected.
817	84031	28	47	30	47	30	For the described "access conditions and plant illnesses" it would be helpful to specify the context--farming or forestry? (Katharine Mach, IPCC WGII TSU)	Has been corrected.
818	84032	28	47	34	47	34	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Katharine Mach, IPCC WGII TSU)	Has been corrected.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
819	80039	28	47	40	47	40	What is meant by “limited storage space” for wood? Limited timber weight on trucks? Please clarify. (NORWAY)	By this is meant both: limited storage space for wood on ground, and limited timber weight on trucks due to changes in carrying capacity of ground and road accessibility.
820	80040	28	47	41	47	43	A warmer climate and prolonged growing season are probably more important than reduced snow damage in this respect? (NORWAY)	Point taken. But the text refects the current literature
821	63150	28	47	49	47	49	for a range of activities including economic development (Sharon Smith, Geological Survey of Canada)	Noted, but not included. Significant page reduction since the previous draft limited the introduction of furter details
822	63151	28	48	4	48	8	The design of the infrastructure will also influence its vulnerability. For example, shallow foundations on ice-rich soils will be more vulnerable than deep foundations (e.g. piles driven into bedrock). (Sharon Smith, Geological Survey of Canada)	Noted, but further details not included in final draft due to significant page constraints and the need to cut chapter length significantly
823	84033	28	48	4	48	15	Citations fully supporting these statements must be provided. (Katharine Mach, IPCC WGII TSU)	Section has been revised, including condensed and merged with transportation and terrestrial resources
824	70832	28	48	4	48	22	very few references in this paragraph (Helene Amundsen, CICERO - Centre for international climate and environmental research - Oslo)	Section has been revised
825	75626	28	48	7	48	8	Unclear sentence. For structures on which type of soils are the impacts likely to be negligible? Sentence needs rewording. (UNITED STATES OF AMERICA)	The section has been revised, and the sentence has been edited out.
826	84034	28	48	8	48	8	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Katharine Mach, IPCC WGII TSU)	This has been fixed
827	84035	28	48	11	48	11	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Katharine Mach, IPCC WGII TSU)	This has been fixed
828	63152	28	48	11	48	12	Note that the operating temperature of the pipeline is important and they can operate at temperatures above 0°C - this is not uncommon and is the reason the pipeline in Alaska was built above ground where permafrost existed. A buried warm pipeline can have greater impacts on permafrost and ground thermal regime than climate change. (Sharon Smith, Geological Survey of Canada)	The section has been revised.
829	57300	28	48	13	48	14	What does NGL stand for??? (Erica Head, Fisheries and Oceans Canada)	The section has been significantly revised and figures on oil and gas have been deleted
830	75627	28	48	21	48	22	The meaning of thise sentence is not clear. It would benefit from being rewritten. (UNITED STATES OF AMERICA)	Noted, but sentence left unchanged
831	57299	28	48	41	48	43	Change thus "Several communities have reported the need for more frequent water-quality testing for both municipal systems and untreated water sources to ensure its suitability for drinking (Furgal, 2008)." (Erica Head, Fisheries and Oceans Canada)	Has been changed accordingly
832	84036	28	48	43	48	43	Casual usage of "likely" should be avoided, as it is a reserved likelihood term. (Katharine Mach, IPCC WGII TSU)	Has been corrected.
833	84037	28	48	49	48	50	Citations supporting these statements are needed. (Katharine Mach, IPCC WGII TSU)	Section has been significantly revised
834	66227	28	48	52	48	52	This sentence seems to be disconnected with the previous and next parragraph. Please, consider revising (David Velázquez, Universidad Autónoma de Madrid)	Has ben deleted
835	70833	28	49	1	49	4	repetition from earlier in chapter, but with new references and estimates (Helene Amundsen, CICERO - Centre for international climate and environmental research - Oslo)	Section has been significantly revised, and this material has been edited out.
836	57998	28	49	1	49	10	I suggest combining this paragraph with sec. 28.2.5.1.6 (Jennifer Francis, Rutgers University)	Section has been significantly revised, and this material has been edited out.
837	57999	28	49	13	49	53	This is not discussing projections. I suggest moving to section 28.2 (Jennifer Francis, Rutgers University)	Section has been significantly revised, and this material has been edited out.
838	62051	28	49	24	49	24	Something should be said here about the connection between fossil fuels and climate change. As the chapter reads there is a clear disconnect between all the documented impacts of climate change in the polar regions in the first part of the chapter and then simply stating that there is oil and gas in the Arctic, the cause of the impacts in the first place. Could a statement about the estimated ppm increase that would come from burning the estimated amounts of oil and gas be included? (Jon Rosales, St. Lawrence University)	Data on oil and gas have been deleted
839	75628	28	49	25	49	25	According to Table 28-1, the Arctic's share is projected to increase as a % of non-OPEC production but decrease as a % of world oil production. This apparent contradiction seems to call for an explanation. (UNITED STATES OF AMERICA)	Table has been edited out

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
840	84038	28	49	25	49	33	Citations for this material should be specified. (Katharine Mach, IPCC WGII TSU)	The tables and text have been deleted
841	58899	28	49	38	49	40	The definition of Arctic in Figure 28.6 deviates from what is considered in this chapter as the Faroes and Iceland is included here. Figure is basd on the AMAP definition of the Arctic, I guess. (Svein Sundby, Institute of Marine Research)	Figure has been deleted
842	57301	28	49	42	49	44	In Line 42 "Figure 28-6" should be replaced by "Figure 28-7". Also, there should be a sentence added somewhere which makes reference to Figure 28-7. I suggest adding it to the end of this paragraph - something like this. "are the major elements in the Faroe Islands, Greenland and Iceland. Russia has by far the highest rates of natural gas production among the Arctic nations, although contributions from other regions are expected to increase in future (Figure 28-7)." (Erica Head, Fisheries and Oceans Canada)	The Figure has been deleted
843	64252	28	49	42	49	44	This discussion is too narrow in scope with regards to Iceland. As in Russia and Canada the energy industry is an important part of the economy. Virtually 100% of electricity use in Iceland derives from renewable sources, hydropower plants producing 73% and geothermal plants 27%, but 3⁄4 of the electricity produced is used by power-intensive aluminium smelters operated in the country (Thorsteinsson Th. 2012). In 2011 energy sector was about 4.6% of the economy and the industry was 11.4%. In comparison the fishing sector mentioned in the sentence was 10.9% of the economy (Sigurdardottir et al 2012). The sentence needs to be rewritten to better reflect the economic reality. The references here are: a) Thorsteinsson, Th (2012) Renewable Energy in Iceland. In Thorsteinsson, Th., and H. Björnsson, eds. Climate Change and Energy Systems. Impacts, Risks and Adaptation in the Nordic and Baltic Countries. Nordic Council of Ministers, TemaNord 2011:502, 91–111. and b) Sigurdardottir R. et al (2012) The Economy of Iceland. Published by Central Bank of Iceland, Reykjavik Oct 2012; ISSN 1024-6680 (ICELAND)	The author team acknowledges this thoughtful comment and agree this is an important issue. However, the section has been merged with other sections and condensed, with main focus on infrastructure and marine transportation. Major text revisions and condensing had to be made to conform to a strict chapter length and page limitations. Additional details could not be incorporated.
844	57302	28	50	4	50	7	The acronyms GCM, NSR and NWP should be explained the first time they are used. Thus Line 4 becomes "Global Climate Models (GCMs) generally underestimate etc". (Erica Head, Fisheries and Oceans Canada)	Provided in section 28.2.6.1.3
845	75629	28	50	4	50	21	As noted, the more current information on model-projected arctic marine access is in Smith and Stephenson (2013, PNAS). Preference should be given to the CMIP5-based projections used by Smith and Stephenson, not the CMIP3-based projections cited here. (UNITED STATES OF AMERICA)	We added results from the earlier paper of the same authors (Stephenson and Smith, 2011), which has been published in Nature Climate change, to supplement data from the Russian paper by Mokhow and Khon. These studies use different climatic projections, indeed, but the differences in projected usability of the sea routes are not so dramatic. This is why we discuss consistent results from both papers, which is in our view better than plotting a storyline using a single study.
846	66025	28	50	7	50	10	The text does not discuss why the NWP projection in Fig. 28-8 (P.92) is reaching only to about 2012, but levels throughout and for the end of 21. century are discussed/listed. As mentioned with another comment above, the reference Mokhow and Khon 2008 is not listed in the reference list. (Sebastian Gerland, Norwegian Polar Institute)	There was a misprint in the figure caption, the solid line shows the observed data on NSR (up to 2012), while NWP is not shown at all. The figure was replaced by the correct one.
847	57303	28	50	12	50	12	I think that Figure 28-8 should include another panel showing where the NSR and NWP routes are expected to go (even if only approximately). (Erica Head, Fisheries and Oceans Canada)	Data not provided
848	75630	28	50	13	50	14	Figure 28-8: is missing most of the time series for the Northwest Passage. (UNITED STATES OF AMERICA)	Data not provided
849	75631	28	50	16	50	21	Demand for ice breakers expected to increase as more vessels attempt to operate in more variable ice conditions. Note, winter ice will still form. (UNITED STATES OF AMERICA)	Paragraph was deleted in revisions
850	84039	28	50	21	50	21	Casual usage of "unlikely" should be avoided, as it is a reserved likelihood term. (Katharine Mach, IPCC WGII TSU)	This sentence has been edited out
851	57304	28	50	23	50	25	Question - do the containment facilities have to maintain their structural integrity ONLY while projects are active? Surely there should, in addition, be plans for continued containment or remediation after projects are finished - no? (Erica Head, Fisheries and Oceans Canada)	This sentence has been edited out

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
852	63153	28	50	30	0	0	Section 28.4 - This section could benefit from inclusion of more concrete examples of adaptation efforts to illustrate the advances that have been made. Adaptation is to be a focus of WG2 but very little attention is given to it in this chapter compared to the amount of material on impacts. There are several Canadian examples (some of which are provided below) that could be given. There may be a reluctance to include too many examples from one country but these are examples others could follow and go beyond some of the academic publications that are cited in this section. Note that the North American ch 26 (pg 40 line 46) makes reference to efforts in Nunavut including study on vulnerabiltiy of mining sector mentioned below. (Sharon Smith, Geological Survey of Canada)	We have tried to include some examples of adaptation practices but we are constrained by the page length and by the lack of adequate references from other countries than Canada. It should also be noted that an IPCC Assessment Report is not a technical reference.
853	63154	28	50	30	0	0	Section 28.4 - There are several key examples of adaptation efforts in Canada that should be mentioned: (1) The Nunavut Climate Change Partnership (see Mate & Reinhart 2011) which had a focus on community adaptation (and included collaboration with Canadian Institute of Planners). (2) A more recent effort is the Regional Adaptation Collaboratives (for one related to Nunavut see: http://www.climatechangenunavut.ca/en/project/nunavut-regional-adaptation-collaborative). Relevant Refs: Mate DJ and Reinhart, F (ed.) 2011. Nunavut climate change partnership workshop, Feb 15-16 2011. Geological Survey of Canada Open File 6867 http://geoscan.ess.nrcan.gc.ca/cgi-bin/starfinder/0?path=geoscan.fl&id=fastlink&pass=&format=FLSHORTORG&search=R=288645 (Sharon Smith, Geological Survey of Canada)	These references are very useful and some effort was made to include some of them in the text. However, while the authors believe it would be useful to include some examples of actual adaptation,this is an assessment exercise and not a comprehensive literature review nor a recipe book. Furthermore, demanding space restrictions have meant even less coverage than in earlier drafts. We regret this.
854	63155	28	50	30	0	0	Section 28.4 - Additional examples showing advances with respect to adaptation. There have been efforts in Canada to assess the vulnerabiltiy of the northern mining sector and develop best practices and there are specific examples for Nunavut including reports available on the Nunavut Adaptation Collaborative web site (http://www.climatechangenunavut.ca/en/project/nunavut-regional-adaptation-collaborative). The relevant reports are: Golder (2012) Vulnerability Assessment of the Mining Sector to Climate Change Task 1 Report. Prepared for Nunavut Regional Adaptation Collaborative. AND Golder (2012) Good Environmental Practices for Northern Mining and Necessary Infrastructure Task 2 Report. Prepared for Nunavut Regional Adaptation Collaborative. Reports produced by Mine Environmental Neutral Drainage (MEND) Program that are available at http://www.mend-nedem.org. These include a general report on climate change risks to mining (MEND 1.61.7) that does include references to northern mines. Others that are relevant are associated with cover design for northern mine waste disposal facilities and include MEND 1.61.4, 1.61.5a, 1.61.5b. (Sharon Smith, Geological Survey of Canada)	These references are very useful and some effort was made to include some of them in the text. However, while the authors believe it would be useful to include some examples of actual adaptation,this is an assessment exercise and not a comprehensive literature review nor a recipe book. Furthermore, demanding space restrictions have meant even less coverage than in earlier drafts. We regret this.
855	71469	28	50	30	0	0	Section 28.4 could benefit from inclusion of more concrete examples of adaptation efforts to illustrate the advances that have been made. Adaptation is to be a focus of WG2 but very little attention is given to it in this chapter compared to the amount of material on impacts. There are several key examples in Canada that should be mentioned: (1) The Nunavut Climate Change Partnership (see Mate & Reinhart 2011) which had a focus on community adaptation (and included collaboration with Canadian Institute of Planners). (2) A more recent effort is the Regional Adaptation Collaboratives (for one related to Nunavut see: http://www.climatechangenunavut.ca/en/project/nunavut-regional-adaptation-collaborative). Relevant Refs: Mate DJ and Reinhart, F (ed.) 2011. Nunavut climate change partnership workshop, Feb 15-16 2011. Geological Survey of Canada Open File 6867 http://geoscan.ess.nrcan.gc.ca/cgi-bin/starfinder/0?path=geoscan.fl&id=fastlink&pass=&format=FLSHORTORG&search=R=288645 (CANADA)	These references are very useful and some effort was made to include some of them in the text. However, while the authors believe it would be useful to include some examples of actual adaptation,this is an assessment exercise and not a comprehensive literature review nor a recipe book. Furthermore, demanding space restrictions have meant even less coverage than in earlier drafts. We regret this.
856	75632	28	50	30	50	30	Again, a small introductory paragraph saying what you want to accomplish with this section would help constrain its scope. (UNITED STATES OF AMERICA)	A useful suggestion, done.
857	78195	28	50	30	53	5	Change of section title needed: "28.4. Adaptation in the Polar Regions" - section 28.4, as it is written, is exclusively about the Arctic. However, the title implies that it covers both Antarctica and the Arctic. Although it is clear from some subsections that only the Arctic is discussed, this is not the case for subsection "28.4.2.Adaptation and Industrial Development", which talks about access to minerals and fossil fuels without making it explicitly clear that only the Arctic is being discussed. I suggest changing the title of 28.4 to "28.4. Adaptation in the Arctic". Although information on human "Adaptation in Antarctica" might be interesting, it is probably too late to insert it now, so the change of title I suggest would be the most simple approach. (Inga Smith, University of Otago)	Accepted and text modified
858	64196	28	50	43	50	47	Likewise riversand lakes (frozen and unfrozen) in terrestrial regions. Most communities have been strategically located along water courses for similar reasons as coastal communities (Ian Church, Canadian Foundation for Climate and Atmospheric Science/ IPY Canada)	Noted, and text added.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
859	62052	28	50	46	50	46	Ignatowski and Rosales 2013 could be added to this list after Ford et al. 2010 if articles in revision and resubmitted are acceptable, otherwise these findings are consistent with what we found with the AKSIK project. (Jon Rosales, St. Lawrence University)	Too late for inclusion in this draft.
860	75633	28	50	51	50	51	National guidelines for adaptation?? Please clarify. (UNITED STATES OF AMERICA)	Corrected to emphasise we are only referring to adaptation.
861	70834	28	51	2	51	2	Amundsen et al, 2010 is not in reference list (Helene Amundsen, CICERO - Centre for international climate and environmental research - Oslo)	References have been edited
862	63196	28	51	16	0	0	Section 28.4.1.: see ARR for in-depth review of this field (Ulf Molau, University of Gothenburg)	This is presumably the Arctic Resilience Report. I understand only an interim report has only recently been released and thus not appropriate here.
863	78211	28	51	16	0	0	This assessment of Arctic indigenous peoples' adaptive capacity is too optimistic and slightly simplified. Please read Arctic Council's report on Arctic resilience to understand the complexities of Arctic adaptive capacity and why their Indigenous present adaptive capacity is not necessarily high: http://www.arctic-council.org/arr/wp-content/uploads/2012/01/Arctic-Resilience-Interim-Report-2013-Part-III.pdf. It is worth including content from the Arctic Council report in the AR5 report. (Andrew Wong, University of Waterloo)	Noted: see comment 862.
864	60463	28	51	21	51	21	Is this statement corroborated by science? (DENMARK)	Unclear what comment refers to.
865	62053	28	51	21	51	22	Sharing should be added to this list, "patience, persistence, …" (Jon Rosales, St. Lawrence University)	Have been added as suggested
866	75634	28	51	41	51	44	These adaptation measures, mostly use of new technology, would be undertaken even if there were no change in climate. (UNITED STATES OF AMERICA)	Debatable, but illustrates win-win solutions.
867	58001	28	51	48	51	54	It sounds as though these groups are adapting very well on their own! (Jennifer Francis, Rutgers University)	Depends on one's point of view.
868	64197	28	52	2	52	4	This may be a good point to mentionthe role of the Aborigianl Organizatons that are Arctic Council Permanent Particiapnts and who sit on other national and international bodies such as those dealing with Biodiversity. They have become proponents and spokespersons for driving adaptive strategies at different scales. (Ian Church, Canadian Foundation for Climate and Atmospheric Science/ IPY Canada)	Will be mentioned elsewhere.
869	71470	28	52	4	0	0	Abele et al 2009 reference not in reference list. (CANADA)	References have been fixed
870	58002	28	52	9	52	14	Again, this emphasizes all the possible negative effects. What about higher paying jobs? More jobs? Better incomes? A higher standard of living? (Jennifer Francis, Rutgers University)	Discussed elsewhere
871	75635	28	52	16	52	16	Relate to previous section 28.2.1 .1 Hydrology and Freshwater systems and section 28.2.2 (Oceanographic and marine ecosystems) which describes increases in nutrient loading and higher abundance of phytoplankton and zooplankton. (UNITED STATES OF AMERICA)	Section has been edited out
872	64198	28	52	20	52	25	Cha;llenges Shell expierenced with their Beaufort Sea drilling program appears to have resulted in industry looking to adapt by bringing on line an entirely new suite of technology- See Macleans Magazine- April 29 2013- pages 44 & 45 - "Oil Firms want to put offshore rigs on the ocean floor". (Ian Church, Canadian Foundation for Climate and Atmospheric Science/ IPY Canada)	Section has been edited out
873	63156	28	52	36	52	36	CEAA (2003) deals with environmental impact assessment and may not be the correct reference. The screening tool for considering climate change in engineering design was included in CSA (2010) and also discussed by Hayley and Horne (2009). (Sharon Smith, Geological Survey of Canada)	Section has been edited out
874	63157	28	52	44	52	54	This section misses the main contribution of CSA (2010) which is the development of guidelines for adaptation to climate change. As mentioned above, there have been efforts to develop guidelines and best practices in addition to assessments of vulnerability of various econonmic sectors, infrastructures and communities. These are important as they can assist communities, practitioners and decision makers with development of climate change adaptation plans. The Transportation Association of Canada (2010) has also developed guidelines for the transportation sector. Ref: Transportation Association of Canada (2010) Guidelines for development and management of transportation infrastructure in permafrost regions. May 2010 TAC, Ottawa. (Sharon Smith, Geological Survey of Canada)	Section has been edited out

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
875	64199	28	52	44	52	54	An important adaptive strategy that is part of the CSA approach is to attempt to project utilizing climate modelling- to project the rate of change and design for the projected service life of infrastructure. There are several other initiatives underway that also build upon the NRTEE True North report under the banner of the Northern INfrastructue Standards Initiative 9nisi http://www.scc.ca/en/stakeholder-participation/roadmaps-and-standardization-solutions/northern-Infrastructure-standardization-initiative) (Ian Church, Canadian Foundation for Climate and Atmospheric Science/ IPY Canada)	Section has been edited out
876	71471	28	52	44	52	54	This section misses the main contribution of CSA (2010) which is the development of guidelines for adaptation to climate change. As mentioned in the comments above there have been efforts to develop guidelines and best practices in addition to assessments of vulnerability for various economic sectors, infrastructure and communities. These are important as they can assist communities, practitioners and decision makers with climate change adaptation plans. The Transportation Association of Canada (2010) has also developed guidelines for the transportation sector, and there are also other adaptation techniques that are being studied in Canada's territories/provinces (e.g., heat drains, longitudinal culverts and sun/snow sheds are all potential adaptation techniques for highway embankments). Refer to these references for additional information: Transportation Association of Canada (2010) Guidelines for development and management of transportation infrastructure in permafrost regions. May 2010 TAC, Ottawa http://pubs.aina.ucalgary.ca/cpc/CPC6-526.pdf http://ygsftp.gov.yk.ca/YukonPermafrostNetwork/MacBride%20Lecture%20Series%202012%20Paul%20Murchison.pdf (CANADA)	Box has been deleted
877	71472	28	52	44	52	54	There might be some value in distinguishing between housing/building infrastructure and transportation infrastructure. In its present form, it is unclear whether some of the adaptation techniques (e.g., air convection embankments) are applied to all types of infrastructure or whether it is specific to one. (CANADA)	Box has been deleted
878	84040	28	53	10	0	0	Section 28.5. This section is highly overlapping with previous sections. The chapter team should strongly consider integrating material from 28.5 into earlier assessment of health, for example in 28.2.4.2 or 28.3. (Katharine Mach, IPCC WGII TSU)	Sections have been edited and condensed and overlaps have been removed. 28.5 has been incorporated into section on Health
879	75636	28	53	10	53	38	This section seems light in terms of detail and assessment. The discussion should include (or strongly restate lighter comments in 28.2.5.1.4 and 28.2.5.1.6) in-Arctic pollution expected from increased resource extraction activities (shipping, flaring, smelting, etc.) It should include a discussion of black carbon, as a short-lived climate forcer, an air quality issue (e.g. Arctic Haze) and a health issue for residents. Likewise with tropospheric ozone - increasing in-Arctic emissions (and precursors) act as short-lived climate forcer, air quality/health issue. Also, Ma et al. and Hung et al., AMAP 2011 and UNEP/AMAP 2011 were all missing from the bibliography. (UNITED STATES OF AMERICA)	The section has been deleted, but with key points incorporated into the Health Section
880	75637	28	53	12	53	18	A significant gap (at the interface of Working Groups I and II) is the failure to address changes in atmospheric pathways (circulation pathways) as they pertain to contaminant transport. This concern also applies to the ocean transport pathways. The chapter should either address this gap by including relevant discussion of changes in pathways, or it should acknowledge that there is a gap in our knowledge of this issue. (UNITED STATES OF AMERICA)	Section Arctic Pollution and Climate Change has been deleted, small text with considerations how pollution affects human health has been moved to section 28.2.4.2. Indirect Impacts of Climate Change on the Health of Arctic Residents. Changes in the atmospheric pathways, although important in this context, may not be discussed here because of the space limitations, and also because more appropriate would be to address the physical aspects of such changes in WG-1
881	75639	28	53	41	0	0	This section does not really address the heading. Please revise to be more specific and directly address the sebjuect matter of the section title. (UNITED STATES OF AMERICA)	Section has been completely rewritten
882	75638	28	53	41	54	7	Overall this section is very weak, full of generalizations, and not a good synthesis of the gaps that were detailed in the chapter as a whole. For example, I found (p.14, lines 5-8; p. 15, lines 23-25; p.25 lines 14-17; p.25 lines 24-25; etc) all very well articulated. "Systematic monitoring will be essential" is sort of a "motherhood" comment; while there are very good examples of systematic monitoring gaps that are provided in the text of the chapter. Please summarize the major ones or try to define them in higher roll-up categories (increased spatial density; improved technology in xyz; better collaboration between observers and modellers, etc.). These can also be "motherhood" comments, but at least a bit more specific. (UNITED STATES OF AMERICA)	Section has been completely rewritten

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
883	61674	28	53	43	53	48	Tipping points are not discussed much in this chapter, particularly those which could influence the large scale climate system. E.g. rapid permafrost thaw risk. Although these will be discussed elsewhere (e.g. WGI), some cross-referencing could be beneficial. (European Union DG Research, Directorate Environment Climate Change & Environmental Risks Unit)	Acknowledged, but too late to include that for the final draft
884	63158	28	53	43	53	48	Derksen et al. (2012) also made recommendations with respect to monitoring. It should be noted that a focus of IPY was to enhance observation networks, in fact some of the key results were based on information gathered from monitoring networks. The challenge will be to maintain these in the long-term. Ref: Derksen, C., Smith, S.L., Sharp, M., Brown, L., Howell, S., Copland, L., Mueller, D.R., Gauthier, Y., Fletcher, C., Tivy, A., Bernier, M., Bourgeois, J., Brown, R., Burn, C.R., Duguay, C., Kushner, P., Langlois, A., Lewkowicz, A.G., Royer, A., and Walker, A. 2012. Variability and change in the Canadian cryosphere. Climatic Change, 115: 59-88. (Sharon Smith, Geological Survey of Canada)	Section on research gaps has been rewritten, and with consideration of tight space restrictions.
885	75640	28	53	47	53	48	p. 53, line 47-48: In general, the report does not adequately summarize on-going monitoring at least in the western Arctic. (UNITED STATES OF AMERICA)	Section on research gaps has been rewritten, and with consideration of tight space restrictions.
886	64200	28	53	50	53	54	This point is needs more emphasis though I would suspect that WG 1 has probably dealt with it. The role of the poar regions in the global biophysical systems including extreme weather events but also that the challenges of polar change be it environmental or socio economic is usually over shadowed by events some where else in the world but that often these events have at least a polar fingerprint. (Ian Church, Canadian Foundation for Climate and Atmospheric Science/ IPY Canada)	Section on research gaps has been completely rewritten and with consideration of tight space restrictions.
887	84041	28	53	54	53	54	Wording here should be considered to ensure a policy neutral statement. (Katharine Mach, IPCC WGII TSU)	Section has been rewritten.
888	58004	28	54	0	0	0	It seems there should be an FAQ parallel to 28.2 about changes in land ice. (Jennifer Francis, Rutgers University)	Due to space limitations only 2 FAQs were produced
889	84042	28	54	3	54	3	Wording here should be considered to avoid a prescriptive formulation. (Katharine Mach, IPCC WGII TSU)	Section has been rewritten. Policy prescriptive language has been removed.
890	84043	28	54	7	54	7	Wording could be reconsidered in order to avoid a prescriptive formulation. (Katharine Mach, IPCC WGII TSU)	Section has been rewritten
891	63159	28	54	10	0	0	FAQs - This seems to repeat information already provided - are these necessary? It is also unclear how choice of questions was made. (Sharon Smith, Geological Survey of Canada)	FAQs have been edited.
892	58307	28	54	10	55	3	Why is Arctic sea ice rapid decreasing but Antarctic sea ice increasing? (Juqi Duan, National Climate Center, Chinese Meteorological Administration)	Physical interactions in the climate system, including changes in the sea ice, ozone hole, etc. fall into the domain of WG-1, which is why they are not discussed here
893	58308	28	54	10	55	3	What is role of ozone hole to the changes in the Antarctic environment, ice sheets and sea ice? (Juqi Duan, National Climate Center, Chinese Meteorological Administration)	Physical interactions in the climate system, including changes in the sea ice, ozone hole, etc. fall into the domain of WG-1, which is why they are not discussed here
894	80647	28	54	10	55	3	Why is the Arctic sea ice rapid decreasing but Antarctic sea ice increasing? It is a hot topic of the latest study. SUGGESTION: enrich and add latest literatures on this. (Jiahua PAN, Chinese Academy of Social Sciences)	Physical interactions in the climate system, including changes in the sea ice, ozone hole, etc. fall into the domain of WG-1, which is why they are not discussed here
895	80648	28	54	10	55	3	What is role of the ozone hole to changes in the Antarctic environment, ice sheets and sea ice? It is also a hot topic of the latest study. SUGGESTION: enrich and add latest literatures on this. (Jiahua PAN, Chinese Academy of Social Sciences)	Physical interactions in the climate system, including changes in the sea ice, ozone hole, etc. fall into the domain of WG-1, which is why they are not discussed here
896	81284	28	54	12	0	0	FAQ 28-1 An excellent question with a lot of details. To make all these details easy to access, authors may wish to use some categories. At present the prose style with out any text break or organzing priniciple will negatively impact general audience interest. (Monalisa Chatterjee, IPCC WGII TSU)	Noted, but no space for rearranging into categories
897	58003	28	54	12	54	37	Again, what about increased tourism and more employment opportunities for northern residents? (Jennifer Francis, Rutgers University)	Brief acknowledgement of tourism employment opportunities has been included. Employment opportunities is reflected in economic diversification and changes to economic sectors.

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
898	62054	28	54	12	54	37	The question posed on line 12 is not answered in the narrative that follows. The response, as written, simply identifies some positive and many negative impacts of climate change in Polar Regions. Could a statement such as, "On balance, the numerous negative impacts of climate change seem to outweigh the positive impacts in the Arctic, and XXX (I cannot comment for the Antarctic)." This would answer the question posed on line 12. (Jon Rosales, St. Lawrence University)	It is not possible with sufficient confidence to provide an answer to the question of whether the overall net effect is positive or negative
899	75641	28	54	12	54	37	The "Frequently Asked Question" 28.1 is not really answered in the accompanying paragraph. This entire FAQ could easily be omitted. (UNITED STATES OF AMERICA)	Noted, but in our view a sufficient answer has been provided. Space limits precluded a longer answer
900	60464	28	54	16	54	16	Accessibility to onshore resources could also grow as a result of deglaciation and increased shipping opportunities. Suggest to delete "offshore" (DENMARK)	The wording "offshore" has not been deleted
901	84044	28	54	16	54	16	For the described percentage decline, what is its baseline? If it is not approximately 2010, it should be specified. (Katharine Mach, IPCC WGII TSU)	The baseline is approximately 2010
902	60465	28	54	22	54	28	this section is not balanced with the rest of the statements in the box and should be shortened. (DENMARK)	Section has been revised
903	84045	28	54	26	54	27	More context is needed for the reader to understand the percentages given. (Katharine Mach, IPCC WGII TSU)	FAQ has been edited and the percentages referred to here have been edited out
904	64201	28	54	34	54	35	No where is the potential of the introduction of disease into the seasoanlly isolated semi permanent or seasonal research stations and also arctic communiteis by visiting tourists been mentioned. "Residents" are often isolated and have not developed immunities to the latest infections and often isoloated communiteis don't have adequate capacity to manage these outbreaks. (Ian Church, Canadian Foundation for Climate and Atmospheric Science/ IPY Canada)	Point acknowledged. Many details were left out due to space limits. Arctic cruise tourism is briefly mentioned under infrastructure and marine transportation
905	71473	28	54	39	0	0	Suggest that this FAQ be revised to "Why are changes in sea ice so important to the polar regions?". While sea ice change have broader implications as well, the response to this FAQ focuses on issues specific to the polar regions, and other issues are covered elsewhere in the report. (CANADA)	The title has been changed to include "polar regions"
906	81285	28	54	39	0	0	FAQ 28-2 Authors may wish to categorize on the basis of impacts on human and natural systems. (Monalisa Chatterjee, IPCC WGII TSU)	Noted, but section not reorganized
907	80041	28	54	39	54	39	The correctly formulated question should be "Why are changes in sea ice so important for Arctic food webs?", or the answer should include sections referring to the importance of sea ice to physical processes as well, e.g. albedo. (NORWAY)	The FAQ deals with both of the polar regions
908	66024	28	54	40	54	41	I suggest to explain in more detail what growing season refers to. I assume it addresses either ice growth or algae growth. (Sebastian Gerland, Norwegian Polar Institute)	Not necessary to explain in detail. It should be clear from the text that we use "growing season" for the periode when green plants grow (photosyntetically active)
909	80042	28	54	49	54	49	Inaccurate to indicate in parenthesis that polar bears are one species that utilize sea ice as haul-outs during foraging trips. Sea ice is the main habitat for polar bears, and you can't really say that polar bears are hauling out. Please consider rephras (NORWAY)	This is not rephrased as we disagree with the reviewer. For sure, sea ice is the main habitat for polar bears, but it is apparent that they also utilize it as haul-out in foraging trips to hunt for seals. The text is written by a scientist that has studied polar bears for 25 years. We do not think such fine level of differentiation is appropriate in FAQs
910	84046	28	54	50	54	53	This may be a statement where presentation of a level of confidence within a frequently asked question is merited. (Katharine Mach, IPCC WGII TSU)	Acknowledge the suggestion, but decided to leave both FAQs similar in format, and therefore without level of confidence presented in one of two FAQs
911	63812	28	55	5	0	0	Please add as 3rd FAQ: 'Why the Arctic climate is changing so rapidly?' (GERMANY)	Not included due to space limitation
912	64253	28	57	4	57	4	In accordance with comment above (ch 28, p.30, l. 11), the missing reference is: Bjornsson H., T. Johannesson and A. Snorrason, 2011. Recent climate change, projected impacts and adaptation capacity in Iceland. Í: Linkov, I. & T. S. Bridges (Ed.) Global change and local adaptation. NATO Science for Peace and Security Series - C: Environmental Security. Springer, Dordrecht, s. 465-475. (ICELAND)	Correct reference has been included
913	64254	28	65	6	65	6	In accordance with comment above (ch 6. p 30 l. 16) the following reference should be added: Halldorsson, G., B.D. Sigurdsson, B. Hrafnkelsdottir, E.S. Oddsdottir, O. Eggertsson and E. Olafsson, 2013: New pests on trees and shrubs and changes in pest dynamics: a review. Icelandic Agricultural Sciences, 26, 16-25. (ICELAND)	Correct reference added

#	ID	Ch	From Page	From Line	To Page	To Line	Comment	Response
914	64255	28	65	45	65	45	Mismatch in reference style: The surnames of Hjálmar Hátún and Mark Payne are written out full but for conformity with other references "Hjálmar" should only be "H" and "Mark" should be "M" (ICELAND)	References have been edited
915	62055	28	67	13	67	14	If articles in revision can be included here, this citation should be changed to: Ignatowski, J.A., and J. Rosales, 2013: Identifying the Exposure of Two Subsistence Villages in Alaska to Climate Change Using Traditional Ecological Knowledge and Climate Science. Climatic Change. In revision. If you cannot use an article in revision, our findings are documented on our website at www.AKSIK.org and could be cited as AKSIK 2013. (Jon Rosales, St. Lawrence University)	Reference list has been edited
916	70800	28	73	22	0	0	*Observation: Incorrect reference details *Reference should read: Nakashima, D.J., K. Galloway McLean, H.D. Thulstrup, A. Ramos Castillo, and J.T. Rubis (2012). Weathering Uncertainty: Traditional Knowledge for Climate Change Assessment and Adaptation. UNESCO and UNU, Paris and Darwin, 120pp. (Kirsty Galloway McLean, United Nations University - Institute of Advanced Studies)	Reference list has been edited
917	78313	28	73	22	73	25	(Nakashima et al 2011) has now been peer-reviewed and formally published. Therefore please now cite as (Nakashima et al 2012): Nakashima, D.J., Galloway McLean, K., Thulstrup, H.D., Ramos Castillo, A. and Rubis, J.T. 2012. Weathering Uncertainty: Traditional Knowledge for Climate Change Assessment and Adaptation. Paris, UNESCO, and Darwin, UNU, 120 pp. (Douglas Nakashima, UNESCO)	Reference list has been edited
918	64256	28	77	40	77	40	In accordance with comment above (ch 28., p. 30., l. 16) a reference should be added: Sigurdsson, B. D., A. Snorrason, B.Th.Kjartansson and J.A. Jonsson, 2007: Total area of planted forests in Iceland and their carbon stocks and fluxes. In: Effects of afforestation on ecosystems, landscape and rural development [Halldórsson, G., E. S. Oddsdóttir, and O. Eggertsson (eds.)]. TemaNord 508. Nordic Council of Ministers, pp. 211-217. (ICELAND)	Reference list has been edited
919	75642	28	82	0	0	0	Table 28-1: We do not believe that this table is needed because it is not climate-related. Please consider deletion. (UNITED STATES OF AMERICA)	Table has been deleted
920	75643	28	82	0	0	0	Table 28-2: We do not believe that this table is needed because it is not climate-related. Please consider deletion. (UNITED STATES OF AMERICA)	Table has been deleted
921	75644	28	84	0	0	0	Table 28-2: Not needed and too specific. (UNITED STATES OF AMERICA)	Table has been deleted
922	84047	28	84	0	0	0	Tables 28-1 and 28-2. Citations for the information presented in these tables must be provided. (Katharine Mach, IPCC WGII TSU)	Tables have been deleted
923	68149	28	85	0	0	0	Figure 28-1 contains a world map with national borders. It is suggested to use a map without borders to avoid unnecessary disputes. (CHINA)	Figure has been changed
924	81455	28	85	0	92	0	All Figure captions (except Figure 28-2): The author team should further develop the caption for these figures to provide guides for the reader in interpreting the information illustrated. The author team should include a sentence in the figure caption explaining the main message of each figure. (Yuka Estrada, IPCC WGII TSU)	Has been considered in the fine-tuning of graphics
925	63197	28	86	0	0	0	Fig. 28-2; legend: under (b), provide the time period over which changes were assessed. (Ulf Molau, University of Gothenburg)	Has been considered in the fine-tuning of graphics
926	75645	28	86	0	0	0	Figure 28-4: For what year? (UNITED STATES OF AMERICA)	Figure has been deleted
927	63198	28	87	0	0	0	Fig. 28-3: Fennoscandia and Iceland not included in the figure. Why? (Ulf Molau, University of Gothenburg)	The figure was available as provided here
928	75646	28	88	0	0	0	Figure 28-4: This is an excellent graphic, as it clearly notes the importance of regional influences in the Arctic. In general, the report should attempt to be more specific as to how climate change will impact specific regions, as for the most part, the impacts will vary considerably by region. (UNITED STATES OF AMERICA)	Noted, and attempts had been made to provide nuances where possible. It has not been possible to introduce extensive new text between the second order and the final draft. We have had to cut the chapter length very significantly.
929	58005	28	89	0	0	0	Fig. 28-5: Define bboe (Jennifer Francis, Rutgers University)	Figure has been deleted
930	75647	28	89	0	0	0	Figure 28-5: We do not believe that this table is needed because it is not climate-related. Please consider deletion. (UNITED STATES OF AMERICA)	Figure has been deleted
931	84048	28	89	0	0	0	Figure 28-5. The acronym NGL should be specified within the caption. (Katharine Mach, IPCC WGII TSU)	Figure has been deleted
932	75648	28	90	0	0	0	Figure 28-6:We do not believe that this table is needed because it is not climate-related. Please consider deletion. (UNITED STATES OF AMERICA)	Figure has been deleted
933	75649	28	91	0	0	0	Figure 28-7: We do not believe that this table is needed because it is not climate-related. Please consider deletion. (UNITED STATES OF AMERICA)	Figure has been deleted

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934	84049	28	91	0	0	0	Figure 28-7. It would be helpful to indicate further what is meant by "reference scenario" within the caption, in the descriptions of parts A and B. (Katharine Mach, IPCC WGII TSU)	Figure has been deleted
935	58006	28	92	0	0	0	Fig. 28-8: Why is (1) so short? Is it not a projection? (Jennifer Francis, Rutgers University)	The figure has been edited
936	63199	28	92	0	0	0	Fig. 28-8: y axis legend in Russian! (Ulf Molau, University of Gothenburg)	This has been fixed
937	66228	28	92	0	0	0	Figure 28-8 Is stated in Russian. Please, consider translation to English (David Velázquez, Universidad Autónoma de Madrid)	This has been fixed
938	75650	28	92	0	0	0	Figure 28-8: What does the shading signify? Make it more visible. Make caption in English. Label x axis (UNITED STATES OF AMERICA)	This has been fixed
939	84050	28	92	0	0	0	Figure 28-8. For what scenarios of climate change is this projection being made? What is the y-axis? (Katharine Mach, IPCC WGII TSU)	The figure has been edited
940	66026	28	92	1	92	1	The vertical axis label for Fig. 28-8 is not given in English. The figure contains some gray shading (possibly indicating standard dev., starting at around 1984 on y-axis values from about 25 to 60) which is not explained in the caption or text. See also comment on corresponding section in text (page 50). (Sebastian Gerland, Norwegian Polar Institute)	The figure has been edited