



CONVENTION ON MIGRATORY SPECIES

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17TH MEETING OF THE
CMS SCIENTIFIC COUNCIL
Bergen, 17-18 November 2011
Agenda Item 17.3

CURRENT AND PREDICTED CONSERVATION STATUS OF CMS-LISTED ARCTIC MARINE SPECIES (in follow-up to Resolution 9.09)

(Prepared by the Secretariat)

1. Resolution 9.09 on Migratory Marine Species adopted at the 9th Meeting of the Conference of the Parties (Rome, 2008) calls for various actions relevant to Arctic marine species from both the CMS Secretariat and the Scientific Council. The Resolution was passed in response to concerns by Parties that marine species such as cetaceans, marine turtles, seabirds and migratory fish face a variety of threats that put cumulative and often synergistic pressure on populations. Of particular concern in this respect are the environmental changes to the Arctic region due to climate change, which can have grave consequences for migratory marine species occurring there and beyond.
2. In order to aid the Council in its task of reviewing the latest available information on the current and predicted conservation status, in relation to the possible consequences of climate change, of all Arctic migratory marine species listed on the CMS Appendices, the Secretariat had compiled a list of these species for the 16th Meeting of the Council (Annex 1 of ScC16/Doc.11). For this exercise, Arctic marine species were defined as those that spend at least part of their lifecycle within the Arctic Circle. The final list contains fourteen species of cetaceans, twenty-seven bird and three fish species (Annex 1 to this document).
3. Based on the comments received on the list of Arctic marine species, an intern of the Science Unit of the Secretariat, Mr Karan Kakouei, compiled Annex 1 from a variety of online sources, including IUCN Red List assessments and the ZSL Report published as ScC17/Inf.9.
4. The resulting table (Annex 1) contains four columns and shows for each species 1) the scientific and common name, current listing on CMS Appendices and IUCN Red List status; 2) the current conservation status, including information on population size and trend as well as threats; 3) the predicted conservation status in the light of climate change; and 4) a picture of the species and a distribution map. In addition to the forty-four species mentioned above, two seal species have been included, even though their listing on the CMS Appendices is regional and does not include the Arctic, to help determine whether an extension of the listing might be proposed.

5. Overall, all of the following processes appear to be affecting CMS-listed Arctic marine species:

- a) **Decreasing ice cover:** This has twofold effects by opening up new areas for human activities, such as new shipping routes, or oil and gas extraction, with all the risks associated to these activities; and by causing an overall deterioration of habitat. Many Arctic animals, such as polar bears, seals, walruses and seabirds, rely on the sea's biological productivity and on the presence of sea ice, both of which are highly dependent on climatic conditions.
- b) **Ocean acidification:** The ocean represents a major carbon sink with carbon dioxide dissolving in water, more strongly so in colder water such as in the Arctic. The oceans have become 30 percent more acidic since the industrial revolution. Most calcifying organisms such as corals, mussels, algae and plankton are reacting negatively, for example through thinner skeletons. However, the expected biological impact of ocean acidification remains uncertain. Squid, which are key prey for many deep-diving marine mammal species, such as the beaked and sperm whales, as well as krill, which are important food for baleen whales, may be especially vulnerable to ocean acidification.
- c) **Phenological mismatch and changes in prey abundance:** There is growing evidence of individual trophic levels of the food change becoming disconnected and the presence of predator and prey often not overlapping in time and space anymore as they used to. This is starting to have profound impacts, especially for long-distance migrants which appear to have greater difficulty sensing the climatic conditions at their next destination and therefore often do not arrive at the optimal period in terms of food availability. This is known as phenological mismatch. Changes in sea surface temperatures and currents could have a strong effect on Arctic fish stocks, which are an important food source for CMS species, as well as people.
- a) **Distribution shifts:** Many species or populations respond to climate change by shifting their distribution. This may result in their moving out of areas that have been established to protect them. Typical distribution shifts are polewards and uphill. This can cause compression of habitat towards the poles, or for species that already occur far north or in high altitudes a complete disappearance of suitable habitat.
- b) **Sea level rise and other impacts of global warming:** Whilst oceanic cetaceans are unlikely to be directly affected by rises in sea levels, important habitats for coastal species and species that require coastal bays and lagoons for breeding, such as gray whales (*Eschrichtius robustus*) and humpback whales (*Megaptera novaeangliae*), could be adversely affected. Several coastal bird species may lose breeding habitat. An increase in temperatures is already leading to earlier thawing, including of permanently frozen ground, which is also having an impact on terrestrial Arctic species and breeding sites of birds. The interactions are however only starting to be understood.
- c) **Extreme weather events:** Extreme events such as storms, which can cause disorientation leading to strandings, and strong precipitation events are predicted to become more frequent, which is likely to have impacts on the reproductive success of a number of Arctic species, especially those which are more exposed to the elements.

- d) **Pathogens and wildlife disease transmission:** Climate change also has the potential to increase pathogen development and survival rates, disease transmission and host susceptibility. Higher temperatures may also stress host organisms, increasing their susceptibility to some diseases, especially if they are at the upper end of their thermal tolerance. Climate change is expected to affect the range and migratory patterns of many marine mammals, which in turn could lead to an increased spread of viruses and the introduction of novel pathogens. Warmer waters may also favour the prevalence of some pathogens or toxic algal blooms. However, thus far there is little certainty regarding the scale of the impact on Arctic populations.
- e) **Invasive species:** Similar to pathogen transmission, invasive species are also predicted to spread in range. As a result the species composition of many Arctic communities could change, with profound impacts on previously relatively isolated and undisturbed migratory species in the Arctic.
- f) **Reproductive success:** There may be a link between climate and the reproductive success of whale species; for example, female sperm whales (*Physeter macrocephalus*) have been found to have lower rates of conception after periods of unusually warm sea surface temperature.

RECOMMENDED NEXT STEPS:

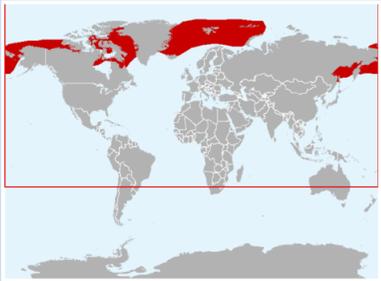
6. The taxonomic and climate change working groups of the Scientific Council are requested to review the document (Annex 1) and provide feedback to the Secretariat. Experts on the different species are encouraged to enhance the relevant sections based on information in peer-reviewed journals to make the best available information accessible to the Council. As far as feasible, working groups should identify the species with the highest priority for further action.
7. In parallel, and with the agreement of the working groups and Appointed Councillors, the Secretariat will approach GRID Arendal, the Conservation of Arctic Flora and Fauna (CAFF) Working Group of the Arctic Council, and other relevant bodies to obtain any further relevant information on the current and predicted conservation status of these species.
8. The 17th Meeting of the Scientific Council should decide how to follow-up on the request in Res.9.09 to identify marine priority issues, species and habitats for intervention by CMS in the next decade.
9. In preparation of the 18th Meeting of the Scientific Council, proposals might be prepared for any species for which changes in the listing (e.g. expansion of regional coverage), uplisting to Appendix I or new listings.

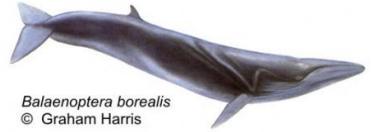
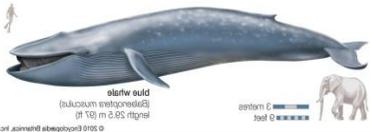
Key Sources:

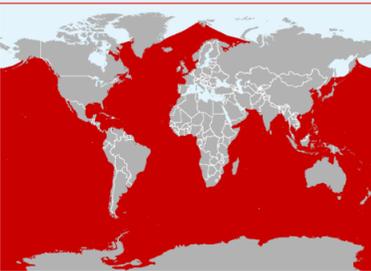
IUCN Red List (www.iucnredlist.org)

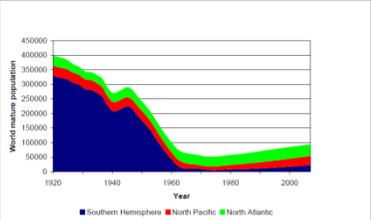
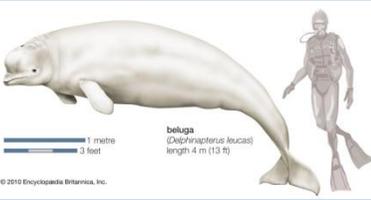
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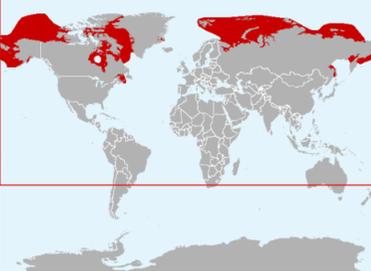
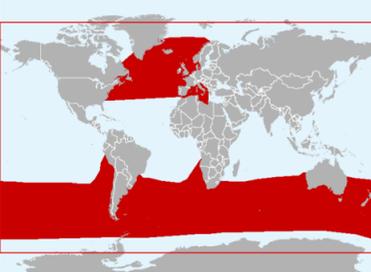
IPCC Fourth Assessment Report: Climate Change 2007 (AR4)

Species	Current conservation status	Predicted conservation status in the light of climate change	Range map
<p><i>Balaena mysticetus</i>, Bowhead whale</p> <p>*Appendix I.</p> <p>*Listed as ‘Least Concern’ species on the IUCN Red List of Threatened Species.</p> 	<p>*Population is increasing. *The vulnerability to climate change is high.</p> <p>*The Bering-Chukchi-Beaufort subpopulation size is well above the Vulnerable threshold for a non-declining population, <ul style="list-style-type: none"> ✓ current assessments suggest that this stock has recovered to close to its pre-whaling level. </p> <p>*Bowhead whale numbers in eastern Canada and West Greenland are probably still below their pre-whaling levels.</p> <p>*The seasonal distribution is strongly influenced by pack ice (Moore and Reeves 1993). (IUCN)</p> <p>*Population Estimate: <ul style="list-style-type: none"> ✓ 10,500 in the Bering and Chukchi-Beaufort Seas, ✓ 10,933 in the Hudson Bay and Foxe Basin and Baffin Bay-Davis Strait, ✓ No Data in the Okhotsk Sea and Svalbard-Barents Sea. (IUCN) </p> <p>*List of main impact factors: <ul style="list-style-type: none"> ✓ Commercial hunting from which the subpopulation has not recovered yet, ✓ Disturbance from oil and gas exploration ✓ Climate change and reduction of ice, (www.IUCNRedList.org) </p>	<p>*Climate change on high latitude Arctic waters will affect the habitats of Bowhead Whales such as: <ul style="list-style-type: none"> ✓ Reducing sea ice, ✓ warming of the oceans, ✓ alterations to the currents, ✓ variations in salinity and pH, ✓ ocean acidification and changes to ocean circulation, ✓ Reducing prey abundances, (CMS_ZSL_ClimateChangeReport_2011)</p> <p>→ With reduced sea ice, Bowheads will have: <ul style="list-style-type: none"> ○ A smaller habitat, ○ Less space to feed, and ○ No shelter from predators. </p> <p>→ They rely on extent of sea ice cover for: <ul style="list-style-type: none"> ✓ feeding, ✓ protection, ✓ migrating, and ✓ reproduction. → serious impacts on Bowhead whale.</p> <p>*The implications of rising temperatures in Arctic faster than the global average and reduction in the extent of sea ice (a complete disappearance in summer) is unclear for bowhead whales but warrant monitoring. (IUCN)</p>	 <p>© Wale.info</p>  <p>© IUCN Red List of Threatened Species</p>

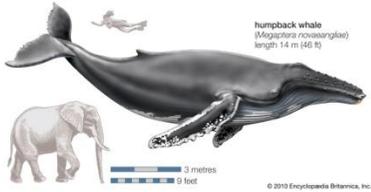
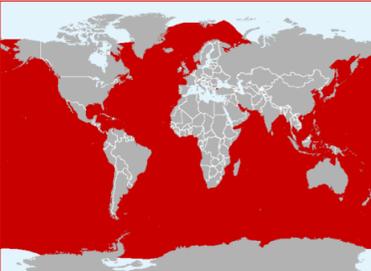
Species	Current conservation status	Predicted conservation status in the light of climate change	Range map
<p><i>Balaenoptera borealis</i>, Sei Whale</p> <p>*Appendices I/II.</p> <p>*Classified as Endangered Species⁴ on the IUCN Red List of Threatened Species.</p> <p>Extinct Threatened Least Concern</p> <p>EX EW CR EN VU NT LC</p>	<p>*The population trend is unknown.</p> <p>*The vulnerability to climate change is medium.</p> <p>*Population size estimate:</p> <ul style="list-style-type: none"> ✓ There are around 25000 individuals in total. <p>*List of Critical Sites</p> <ul style="list-style-type: none"> ✓ A drastic decline accrued in the southern hemisphere <p>*List of main impact factors</p> <ul style="list-style-type: none"> ✓ Commercial whaling, and ✓ Pollution <p>*The global mature population is estimated to have declined by about 80% over the last three generations</p> <ul style="list-style-type: none"> ✓ It is supported by observed declines in abundance in several regions. <p>*Major threats are due to Sei whale exploitation by modern whalers.</p> <p>*Sei whales appear to have been depleted in the eastern North Atlantic.</p> <p>*Sei whales are still abundant in the central North Atlantic (Iceland-Denmark Strait IWC stock area), especially southwest of Iceland south to 50°N in summer. (IUCN)</p>	<p>*The potential impacts of climate and oceanographic change on Sei Whales may affect:</p> <ul style="list-style-type: none"> ✓ Productivity (will decrease), ✓ prey distribution and availability, ✓ their habitat and food availability, ✓ their migration, ✓ Feeding and breeding, ✓ Ocean currents and water temperature have influences on their calving site selection, <p>→ Any changes in these factors could affect recovery by rendering currently used habitat areas unsuitable. (http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=34)</p>	 <p><i>Balaenoptera borealis</i> © Graham Harris</p>  <p>© IUCN Red List of Threatened Species</p>
<p><i>Balaenoptera musculus</i>, Blue whale</p> <p>*Appendix I.</p> <p>*Classified as Endangered Species⁴ on the IUCN Red List of Threatened Species.</p> <p>Extinct Threatened Least Concern</p> <p>EX EW CR EN VU NT LC</p>	<p>*Population is increasing.</p> <p>*The vulnerability to climate change is high.</p> <p>*The cause of the population reduction in this species (commercial whaling) is reversible, understood, and is not currently in operation.</p> <p>*Although there are uncertainties over present abundance, the total population has been depleted by at least 70%, and possibly as much as 90%, over the last three generations, assuming a 31-year average generation time.</p> <p>*The species therefore meets the criterion A1 for Endangered, and probably meets the same criterion</p>	<p>*The implications of rising temperatures in Arctic faster than the global average and reduction in the extent of sea ice (a complete disappearance in summer) is unclear for bowhead whales but warrant monitoring. (IUCN)</p> <p>*Requires climate change mitigation for long term survival.</p> <p>*The potential impacts of climate and oceanographic change on Blue Whales may affect:</p> <ul style="list-style-type: none"> ✓ Productivity (will decrease), ✓ prey distribution and availability, ✓ their habitat and food availability, ✓ their migration, ✓ feeding and breeding, 	 <p><i>Balaenoptera musculus</i> © 2010 Encyclopædia Britannica, Inc.</p>

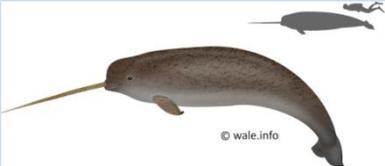
Species	Current conservation status	Predicted conservation status in the light of climate change	Range map
	<p>for Critically Endangered.</p> <p>*The global population of blue whales is uncertain,</p> <ul style="list-style-type: none"> ✓ The global total for the species is plausibly in the range 10,000-25,000, corresponding to about 3-11% of the 1911 population size. (www.IUCNRedList.org) <p>*Current conservation measures are effective at limiting impacts on populations.</p> <p>*It is estimated that about 5,000 blue whales are still survive today in three populations: North Atlantic, North Pacific, and the Southern Hemisphere.</p> <p>*The subspecies have been classified as follows:</p> <ul style="list-style-type: none"> ✓ <i>B. m. musculus</i>: (North Atlantic stock) Vulnerable (VU D1). This population is believed to number no more than 1,500 individuals. ✓ <i>B. m. musculus</i>: (North Pacific stock) Low Risk/conservation dependent (LR/cd). This population was estimated at about 2,000 in the early 1990s, with evidence suggesting an increase off the coast of California. ✓ <i>B. m. intermedia</i> (southern blue whale): Endangered (EN D). There could be as few as 250 individuals surviving. ✓ <i>B. m. breviceuda</i> (pygmy blue whale): Listed as Data Deficient (DD) because of uncertainty about its taxonomic status (http://www.edgeofexistence.org/mammals/species_info.php?id=88) 	<ul style="list-style-type: none"> ✓ Ocean currents and water temperature have influences on their calving site selection, <p>→ Any changes in these factors could affect recovery by rendering currently used habitat areas unsuitable. (http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=34)</p>	 <p>© IUCN Red List of Threatened Species</p>
<p><i>Balaenoptera physalus</i>, The fin whale</p> <p>*Appendices I/II.</p> <p>*Classified as Endangered</p>	<p>*The population trend is unknown.</p> <p>*The vulnerability to climate change is medium.</p> <p>*It is classified as Endangered species on the IUCN Red List of Threatened Species,</p> <ul style="list-style-type: none"> ✓ But this does not apply to Iceland, Norway 	<p>*The Pacific Arctic is a region of strong seasonal contrasts, both in sea ice extent and in ocean productivity.</p> <ul style="list-style-type: none"> ⇒ Threat to the fin whale that migrates there to feed during the ice-free summer-autumn period. <p>*Global warming → Spreading of viruses and pathogens → Promote epizootic events like morbillivirus infections</p>	 <p>© 2010 Encyclopædia Britannica, Inc.</p>

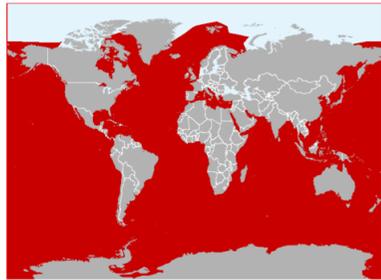
Species	Current conservation status	Predicted conservation status in the light of climate change	Range map
<p>Species on the IUCN Red List of Threatened Species.</p> <p>Extinct Threatened Least Concern</p> <p>EX EW CR EN VU NT LC</p>	<p>and Japan, who hold reservations.</p> <p>* the global population has declined by more than 70% over the last three generations (1929-2007), ✓ Although in the absence of current substantial catches it is probably increasing.</p> <p>*The global major decline over the last three generations → In the Southern Hemisphere.</p> <p>✓ The trend in the North Pacific subpopulation is uncertain.</p> <p>*Population: ✓ Fewer than 15,000 in the Southern Hemisphere, ✓ Around 40,000 in the Northern Hemisphere.</p> <p>*List of main impact factors: ✓ Commercial whaling, and ✓ Vessel collisions</p>	<p>(Agardy, 1996).</p> <p>*Global warming → Change in distribution and abundance of cetacean prey species → Inter- and intra-species competition (Aguilar, 2000).</p> <p>*Decrease of prey species → Increase vulnerability and mortality rates to diseases as a consequence of reduced immune function (Aguilar & Raga, 1993; Bearzi, 2002).</p> <p>*The potential impacts of climate and oceanographic change on Blue Whales may affect: ✓ Productivity (will decrease), ✓ prey distribution and availability, ✓ their habitat and food availability, ✓ their migration, ✓ feeding and breeding, ✓ Ocean currents and water temperature have influences on their calving site selection, →Changes could affect recovery by rendering currently used habitat areas unsuitable. (http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=34)</p>	 <p>© IUCN Red List of Threatened Species</p>  <p>Estimated population trajectory 1920-2007 (www.IUCNRedList.org, 2478pdf)</p>
<p><i>Delphinapterus leucas</i>, Beluga</p> <p>*Appendices I/II.</p> <p>*Classified as ,Near Threatened' on the IUCN Red List of Threatened Species.</p> <p>Extinct Threatened Least Concern</p> <p>EX EW CR EN VU NT LC</p>	<p>*The population trend is unknown.</p> <p>*The beluga whale is unquestionably a conservation-dependent species.</p> <p>*Beluga whales live in Arctic and sub-Arctic waters ✓ They are sociable and vocal animals.</p> <p>*Total numbers worldwide: ✓ Above 150,000 animals, with many portions of the range unsurveyed.</p>	<p>*The Pacific Arctic sea ice is melting (which is an important part of their habitat), ⇒ These physical changes have some effects on Beluga, such as: ○ changes in behaviour, ○ distributional shifts, ○ changes in health, ○ genetic effects. (IWC_SC&CC_Workshop_Vienna_2010)</p> <p>*Climate change affects Belugas both directly through ecological interactions and indirectly through its effects on human activity; →Easier access to formerly pristine areas that have long served as refuges for Belugas.</p> <p>*Climate change is happening, therefore: ⇒ The frequency and scale of the mortality from ice entrapment increase.</p>	 <p>© 2010 Encyclopædia Britannica, Inc.</p>

Species	Current conservation status	Predicted conservation status in the light of climate change	Range map
		<p>*Belugas are also susceptible to ice entrapments when sea ice conditions change rapidly. http://cmsdata.iucn.org/downloads/fact_sheet_red_list_beluga.pdf</p>	 <p>© IUCN Red List of Threatened Species</p>
<p><i>Globicephala melas</i>, Long-finned pilot whale</p> <p>*Appendix II.</p> <p>*Classified as Data Deficient* on the IUCN Red List of Threatened Species.</p>	<p>*The population trend is unknown. *The vulnerability to climate change is medium.</p> <p>*Is considered as data deficient by the IUCN. They are not considered as endangered species. *The taxonomy of populations worldwide is unresolved.</p> <p>* There are estimated to be:</p> <ul style="list-style-type: none"> ✓ about 200,000 long-finned pilot whales in summer south of the Antarctic Convergence in the Southern Hemisphere ✓ approximately 31,000 (CV = 0.27) in the western North Atlantic (Waring <i>et al.</i> 2006). <p>*They occur in relatively high abundance. (Reeves <i>et al.</i> 2003; Ross 2006).</p>	<p>* Predicted impacts of global climate change on the marine environment may:</p> <ul style="list-style-type: none"> ✓ affect long-finned pilot whales, ✓ induce changes in the species' range, abundance and/or migration patterns. (Learmonth <i>et al.</i> 2006) 	 <p>© Würtz-Artescienza</p>  <p>© IUCN Red List of Threatened Species</p>
<p><i>Hyperoodon ampullatus</i>, Northern Bottlenose Whale</p> <p>*Appendix II.</p> <p>*Classified as Data Deficient* on the IUCN Red List of Threatened Species.</p>	<p>*The population trend is unknown. *The current status of the population is unknown,</p> <p>*Global abundance has not been estimated,</p> <ul style="list-style-type: none"> ✓ A rough estimate is that about 40,000 occur in the eastern North Atlantic (NAMMCO Annual Report 1995) <ul style="list-style-type: none"> ○ including an estimated 5,827 (CV=16%) in the high latitudes of the eastern North Atlantic. 	<p>*Predicted impacts of global climate change on the marine environment may affect this species of whale, although the nature of impacts is unclear (Learmonth <i>et al.</i> 2006).</p> <p>*Climate change:</p> <ul style="list-style-type: none"> ✓ Causes cetaceans to move into new areas <ul style="list-style-type: none"> ○ Because of their thermal preferences, ○ prey changes, 	 <p>© Würtz-Artescienza</p>

Species	Current conservation status	Predicted conservation status in the light of climate change	Range map
	<ul style="list-style-type: none"> ✓ Estimates for Icelandic and Faroese waters were 3,142 and 287 whales respectively (Gunnlaugsson and Sigurjónsson 1990) 	<p>→ May bring them into new conflicts with human activities in such areas including novel interactions with fisheries, for example, or with loud noise sources. (Whalewatcher_Climate_FinalDraft_2010)</p> <p>*Predicted impacts of global climate change on the marine environment may affect this species of whale,</p> <ul style="list-style-type: none"> ✓ Although the nature of impacts is unclear, (Learmonth <i>et al.</i> 2006) 	 <p>© IUCN Red List of Threatened Species</p>
<p><i>Lagenorhynchus acutus</i>, Atlantic White-sided Dolphin</p> <p>*Appendix II.</p> <p>*Classified as ‘Least Concern’ on the IUCN Red List of Threatened Species.</p> 	<p>*The population trend is unknown.</p> <p>*IUCN Red List status is of Least Concern.</p> <p>*The species is:</p> <ul style="list-style-type: none"> ✓ widespread and abundant, ✓ There have been no reported population declines or major threats identified. <p>*There are some estimates:</p> <ul style="list-style-type: none"> ✓ About 51,640 (CV=38%) Atlantic white-sided dolphins off the eastern North American shoreline, (Waring <i>et al.</i> 2006) ✓ About 96,000 (CV=54%) off the west coast of Scotland, (MacLeod 2004). 	<p>* Distribution restricted to temperate and sub polar seas of the North Atlantic.</p> <p>(Marine Mammals in the English channel in relation to proposed dredging scheme, Dr Peter G.H. Evans).</p> <p>*Prey populations may be impacted by climate change and pollution.</p> <ul style="list-style-type: none"> ⇒ Affects their survival, <ul style="list-style-type: none"> ○ The level of impact on cetaceans is unknown. <p>(WDCS, Josephine Clark, Sarah J. Dolman and Erich Hoyt, Oct 2010)</p> <p>*Its primary threats in addition to climate change and predation are ocean pollution and entanglement in fishing gear.</p>	 <p>© Princeton University Press (2002)</p>  <p>© IUCN Red List of Threatened Species</p>
<p><i>Lagenorhynchus albirostris</i>, White-beaked dolphin</p> <p>*Appendix II.</p> <p>*Classified as ‘Lower Risk Least Concern’ on the IUCN Red List of Threatened</p>	<p>*The population trend is unknown.</p> <p>*The species is widespread and abundant:</p> <ul style="list-style-type: none"> ✓ There have been: <ul style="list-style-type: none"> ○ No reported population declines, ○ No major threats identified. ○ Population sizes in some areas have increased during the last few decades, ○ however others (such as those in 	<p>*Are only found in cold temperate waters;</p> <ul style="list-style-type: none"> ✓ Changes within these critical areas (areas used more than others) are likely to: <ul style="list-style-type: none"> ○ Hold key breeding, ○ Feeding grounds will probably have the most significant impact. <p>*Prey for cetaceans are Affected by:</p> <ul style="list-style-type: none"> ✓ Physical oceanographic features including temperature. (SC-N10-CCForInfo1_CC&Cetaceans) 	 <p>© Würtz-Artescienza</p>

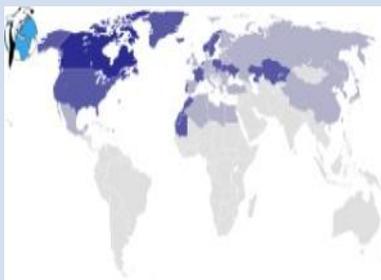
Species	Current conservation status	Predicted conservation status in the light of climate change	Range map
<p>Species.</p> <p>Extinct EX</p> <p>Threatened EW CR EN VU</p> <p>Least Concern NT LC</p>	<p>the Gulf of Maine) have declined. (http://marinebio.org/species.asp?id=362)</p> <ul style="list-style-type: none"> ✓ with current population estimates exceeding 100,000, ✓ scientists estimate tens to hundreds of thousands of animals throughout its entire range (Jefferson <i>et al.</i> 2008). <p>*Is hunted along some coasts:</p> <ul style="list-style-type: none"> ✓ Iceland, ✓ Newfoundland, and ✓ Norway. <p>*They are at risk of ocean pollution such as organochlorides and heavy metals.</p>	<p>*Climate change impacts:</p> <ul style="list-style-type: none"> ✓ Decreased reproductive capacity, ✓ Phenotypic mismatching, ✓ Increased susceptibility to disease, ✓ Loss of habitat. <p>*Climate change:</p> <ul style="list-style-type: none"> ✓ It causes cetaceans to move into new areas; <ul style="list-style-type: none"> ○ Because of their thermal preferences, and ○ prey changes, ⇒ May bring them into new conflicts with human activities in such areas including novel interactions with fisheries, for example, or with loud noise sources. (Whalewatcher_Climate_FinalDraft_2010) 	 <p>© IUCN Red List of Threatened Species</p>
<p><i>Megaptera novaeangliae</i>, Humpback whale</p> <p>*Appendix I.</p> <p>*Classified as Least Concern on the IUCN Red List of Threatened Species.</p> <p>Extinct EX</p> <p>Threatened EW CR EN VU</p> <p>Least Concern NT LC</p>	<p>*Population and Subpopulation trend is increasing.</p> <p>*The vulnerability to climate change is medium.</p> <p>*The available population estimates total more than 60,000 individuals</p> <ul style="list-style-type: none"> ✓ 6,000-8,000 in the North Pacific, <ul style="list-style-type: none"> ○ The North Pacific population returns to Hawaii in the winter months to breed. ✓ 12,000 in the North Atlantic, ✓ About 40,000 in the Southern Hemisphere. <p>*Subpopulations size estimate:</p> <ul style="list-style-type: none"> ✓ No subspecies of the humpback whale are recognized, ✓ The worldwide population is divided into three major oceanic divisions based on genetic differentiation: <ul style="list-style-type: none"> ○ North Atlantic, ○ North Pacific, and ○ Southern Hemisphere populations (Baker <i>et al.</i> 1993; Medrano- 	<p>*The Pacific Arctic is a region of strong seasonal contrasts, both in sea ice extent and in ocean productivity.</p> <p>→ Threat to cetaceans that migrate there to feed during the ice-free summer-autumn period.</p> <p>*The potential impacts of climate change on Humpback Whales:</p> <ul style="list-style-type: none"> ✓ Affects the habitat availability, <ul style="list-style-type: none"> ○ Migration, feeding, resting, and calving site selection may be influenced by ocean currents and water temperature. ✓ Affects the food availability, <ul style="list-style-type: none"> ○ Changes lead to decreased productivity and different patterns of prey distribution and availability. <p>(http://www.environment.gov.au/)</p>	  <p>© IUCN Red List of Threatened Species</p>

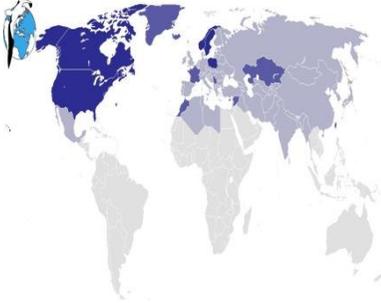
Species	Current conservation status	Predicted conservation status in the light of climate change	Range map
	<p>González <i>et al.</i> 2001) (www.IUCNRedList.org)</p> <p>*List of main impact factors:</p> <ul style="list-style-type: none"> ✓ Entanglement in fishing gear, ✓ Ship strikes 		
<p><i>Monodon monoceros</i>, Narwhal</p> <p>*Appendix II.</p> <p>*Classified as ‘Near Threatened’ on the IUCN Red List of Threatened Species.</p> <div style="display: flex; justify-content: space-between; align-items: center; margin-top: 10px;"> <div style="text-align: center;">Extinct ↓</div> <div style="text-align: center;">Threatened ↓</div> <div style="text-align: center;">Least Concern ↓</div> </div> <div style="display: flex; justify-content: space-around; margin-top: 5px;"> <div style="border: 1px solid black; border-radius: 50%; padding: 2px;">EX</div> <div style="border: 1px solid black; border-radius: 50%; padding: 2px;">EW</div> <div style="border: 1px solid black; border-radius: 50%; padding: 2px;">CR</div> <div style="border: 1px solid black; border-radius: 50%; padding: 2px;">EN</div> <div style="border: 1px solid black; border-radius: 50%; padding: 2px;">VU</div> <div style="border: 1px solid black; border-radius: 50%; padding: 2px; background-color: #2e8b57; color: white;">NT</div> <div style="border: 1px solid black; border-radius: 50%; padding: 2px;">LC</div> </div>	<p>*The population trend is unknown.</p> <p>*The aggregate circumpolar population of Narwhals is probably greater than 80,000 (all ages).</p> <p>*Narwhal populations are potentially threatened by hunting, climate change, and industrial activities.</p> <p>*The Narwhal is actively hunted in:</p> <ul style="list-style-type: none"> ✓ Canada, and ✓ Greenland. <p>*Areas inhabited by narwhals are subject to:</p> <ul style="list-style-type: none"> ✓ Drilling and mining, <p>→this produces waste that is dangerous to their populations.</p>	<p>*The effects of climate change on narwhals are uncertain.</p> <p>*Narwhals are well adapted to live in the pack ice as there is a very little open water in their winter habitat. (Laidre and Heide-Jørgensen 2005b)</p> <p>*They spend much of their time in heavy ice,</p> <ul style="list-style-type: none"> ⇒ Are vulnerable to ice entrapments, ⇒ Hundreds can become trapped in a small opening in the sea ice (savssat) and die. <ul style="list-style-type: none"> ✓ Occurs when sudden changes in weather conditions (such as shifts in wind or quick drops in temperature) freeze shut leads and cracks they were using. <p>*An assessment of the sensitivity of Arctic marine mammals to climate change ranked the narwhal as one of the three most sensitive species due to:</p> <ul style="list-style-type: none"> ✓ Its narrow geographic distribution, ✓ Specialized feeding and habitat choice, ✓ High site fidelity (Laidre <i>et al.</i> in press). <p>*Some changes are likely to affect the Narwhal’s habitat:</p> <ul style="list-style-type: none"> ✓ Temperature, ✓ Sea ice cover, ✓ Ocean circulation, ✓ Ocean salinity and pH. (CMS_ZSL_ClimateChangeReport_2011) <p>*Variable Arctic weather have negative effects on the Narwhals;</p> <ul style="list-style-type: none"> ⇒ Increase in variability could cause an increase in entrapments which the Narwhals already suffer from, 	 <p style="text-align: center;">© Wale.info</p>  <p style="text-align: center;">© IUCN Red List of Threatened Species</p>

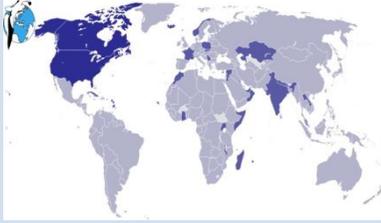
Species	Current conservation status	Predicted conservation status in the light of climate change	Range map
		<p>⇒ Sudden cold spells can cause areas of water the Narwhals use to become iced over, leaving only limited access to the air (Jefferson et al, 2008)</p> <p>*Other potential impacts of climate change on Narwhals:</p> <ul style="list-style-type: none"> ✓ Productivity (will decrease), ✓ Prey distribution and availability, ✓ Feeding and breeding 	
<p><i>Orcinus orca</i>, Killer whale</p> <p>*Appendix II.</p> <p>*Classified as ,Data Deficient * on the IUCN Red List of Threatened Species.</p>	<p>*The population trend is unknown.</p> <p>*Abundance estimates for the areas that have been sampled:</p> <ul style="list-style-type: none"> ✓ About 50,000 killer whales. <p>*Considered as endangered in:</p> <ul style="list-style-type: none"> ✓ Oregon, ✓ Washington, and ✓ California. <p>(http://www.npca.org)</p> <p>*Pollution and chemical contamination make them more susceptible to:</p> <ul style="list-style-type: none"> ✓ Disease, and ✓ Likely cause reproductive difficulties. <p>*Currently the IWC has no jurisdiction over dolphins such as orcas.</p> <p>*Habitat destruction in the form of water diversion for agriculture as well as dams has been implicated in the failure of Southern Resident killer whales (<i>Orcinus orca</i>) to recover.</p>	<p>*Increasing ocean temperature can:</p> <ul style="list-style-type: none"> ✓ Decrease the extent of occurrence of the Killer Whale, <ul style="list-style-type: none"> ○ Because of warmer water extending southwards. <p>*Killer Whales:</p> <ul style="list-style-type: none"> ✓ Are dependent on sea ice for foraging in Antarctica, <ul style="list-style-type: none"> ➔ Is especially vulnerable to changes in sea ice coverage due to climate change (Andrews et al. 2008). <p>*Impacts of global warming on the marine environment:</p> <ul style="list-style-type: none"> ✓ Negatively affect certain killer whale subpopulations more than others through changes in prey availability. (Learmonth <i>et al.</i> 2006). <p>*Killer whales feed on sea otters, sea lions and harbor seals,</p> <ul style="list-style-type: none"> ✓ They migrate due to changes in fish migration patterns, <ul style="list-style-type: none"> ⇒ Move out of the killer whales' habitat range, ⇒ No prey to feed. 	 <p>© wale.info</p> <p>© Wale.info</p>  <p>© IUCN Red List of Threatened Species</p>
<p><i>Phocoena phocoena</i>, Harbour porpoise</p> <p>*Appendix II.</p>	<p>*The population trend is unknown.</p> <p>*It is widespread and abundant.</p> <p>*The global abundance,</p> <ul style="list-style-type: none"> ✓ About 700,000 individuals. <p>*They are still abundant throughout their range,</p>	<p>*In case of warmer ocean temperature,</p> <p>⇒ Have been seen in Svalbard waters for the first time,</p> <p>⇒ They are shifting their summer distributions northward into the Arctic. (SC-N10-CCForInfo4_ArcticSeaIce)</p>	 <p>© wale.info</p>

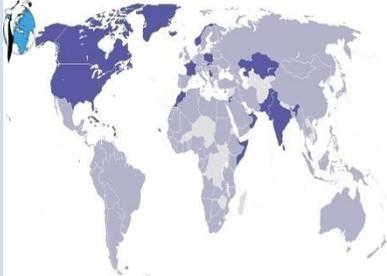
Species	Current conservation status	Predicted conservation status in the light of climate change	Range map
<p>*Classified as Least Concern on the IUCN Red List of Threatened Species.</p> 	<ul style="list-style-type: none"> ✓ But, populations have declined. *They are at-risk of: <ul style="list-style-type: none"> ✓ Entanglement in salmon and cod nets in the eastern North Atlantic; and ✓ In trawl and gill nets in the Pacific. * populations have declined due to drive fisheries in some areas such as: <ul style="list-style-type: none"> ✓ The Baltic sea, and ✓ Black sea. *These porpoises are also at-risk of: <ul style="list-style-type: none"> ✓ Pollution from pesticides, ✓ Destruction of habitat by coastal development, and ✓ Marine traffic. (http://marinebio.org) *There is evidence of decline in abundance in: <ul style="list-style-type: none"> ✓ The Black Sea (Reeves and Notarbartolo di Sciara 2006), and ✓ Inland waterways of Washington State, USA (Osmeck <i>et al.</i> 1996). *Important threats for local harbour porpoises: <ul style="list-style-type: none"> ✓ Severe habitat degradation, ✓ Prey depletion caused by intensive fishing in the Black Sea, ✓ Explosive growth of invasive species, (Reeves and Notarbartolo di Sciara 2006) 	<p>*The key prey species, sandeels, <i>Ammodytes marinus</i>, are known to be affected by climate change,</p> <p>⇒ Have serious negative effects on harbour porpoise populations (Starvation in harbour porpoise) (MacLeod <i>et al.</i> 2007).</p>	<p>© Wales.info</p>  <p>© IUCN Red List of Threatened Species</p>
<p><i>Physeter macrocephalus</i>, Sperm Whale</p> <p>*Appendices I/II.</p> <p>*Classified as Vulnerable</p>	<p>*The population and subpopulation trend is unknown.</p> <p>*The vulnerability to climate change is medium.</p> <p>*The species is listed as endangered on the United States Endangered Species Act. (http://en.wikipedia.org).</p> <p>*In some areas there is concern that populations are</p>	<p>*There may be an important link between climate and the reproductive success of whale species.</p> <p>⇒ e.g. Female sperm whales have been found to have lower rates of conception after periods of unusually warm sea-surface temperature (Whitehead, 1997).</p>	 <p>© Wales.info</p>

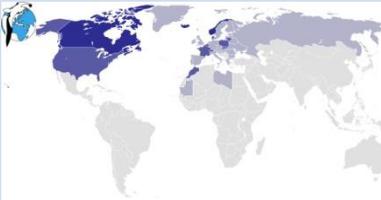
Species	Current conservation status	Predicted conservation status in the light of climate change	Range map
<p>on the IUCN Red List of Threatened Species.</p> 	<p>continuing to decline.</p> <p>*Worldwide population size estimate:</p> <ul style="list-style-type: none"> ✓ 360.000 animals (CV = 0.36), or ✓ About 29% of the pre-whaling population size. (Whitehead, 2002) <p>*They are protected practically worldwide, ⇒ Commercial whaling has ceased. (http://en.wikipedia.org).</p> <p>*Current population threats:</p> <ul style="list-style-type: none"> ✓ Entanglement in fishing nets, ✓ Collisions with, ✓ Ingestion of marine debris, ✓ Ocean noise, ✓ Chemical pollution, (http://en.wikipedia.org) <p>*List of Critical Sites:</p> <ul style="list-style-type: none"> ✓ Indonesia: Whaling (no recent recordings), ✓ Japan, taking 10 Sperm Whales annually under IWC Special Permit, ✓ South East Alaska, Chile, South Georgia and several other southern ocean island areas, North Atlantic: Depredation of long-line catches, ✓ The Mediterranean population appears to have declined over the past 20 years, with bycatch in driftnets a likely principal cause (Reeves and Notarbartolo di Sciara 2006), ✓ The south-eastern Pacific population, heavily whaled during the period 1950-1980, has an extremely low recruitment rate (probably below replacement), perhaps because of the social disruption caused by intense whaling (Whitehead <i>et al.</i> 1997) (www.IUCNRedList.org) <p>* List of main impact factors:</p> <ul style="list-style-type: none"> ✓ Depredation of long-line catches (increasing phenomenon) ✓ Whaling (decreasing phenomenon) ✓ Population depletion: with a maximum rate 	<p>*Researchers anticipate that:</p> <ul style="list-style-type: none"> ✓ Pelagic diversity will decline in the tropics (low latitudes), ⇒ Will increase at higher latitudes. (Whalewatcher_Climate_FinalDraft_2010) 	 <p>© IUCN Red List of Threatened Species</p>

Species	Current conservation status	Predicted conservation status in the light of climate change	Range map
	<p>of increase around 1 percent per year, not well adapted to recover</p> <ul style="list-style-type: none"> ✓ Bycatch (potential major factor) (www.IUCNRedList.org/)/ (www.cms.int) 		
<p><i>Branta bernicla</i>, Brent goose</p> <p>*Appendix II.</p> <p>*Classified as ‘Least concern’ on the IUCN Red List of Threatened Species.</p> 	<p>*The population trend is not known,</p> <ul style="list-style-type: none"> ➤ But is not believed to be decreasing rapidly to approach the thresholds under the population trend criterion (>30% decline over ten years or three generations). <p>*The global population though to be:</p> <ul style="list-style-type: none"> ✓ Around 215,000 birds. (http://www.southendrspb.co.uk/) <p>*This species is threatened by:</p> <ul style="list-style-type: none"> ✓ Hunting, ✓ In future by reductions in food supplies, <ul style="list-style-type: none"> ○ Following the return of a disease of the eelgrass <i>Zostera marina</i> ✓ Arctic fox <i>Vulpes lagopus</i> predation, ✓ Avian influenza (future outbreaks of the virus) ✓ Persecute by farmers, <ul style="list-style-type: none"> ○ As it has taken to grazing on cultivated grasslands and winter cereal fields near the coast, 	<p>*Climate change:</p> <ul style="list-style-type: none"> ✓ May indirectly destroy overwintering habitat, <ul style="list-style-type: none"> ○ Increased sea levels may squeeze saltmarsh into a smaller area reducing potential food supplies, ○ Deeper water may have a detrimental affect on areas of eelgrass. (http://www.southendrspb.co.uk/) 	 <p>© Jón Baldur Hlíðberg 2002</p>  <p>© GlobalTwitcher.com 2004-2011</p>
<p><i>Bucephala clangula</i>, Common goldeneye</p> <p>*Appendix II.</p> <p>*Classified as ‘Least concern’ on the IUCN Red List of Threatened Species.</p>	<p>*The population trend appears to be stable;</p> <ul style="list-style-type: none"> ✓ Population size is extremely large, <p>*A crude estimate of population size in North America:</p> <ul style="list-style-type: none"> ✓ About 1 million birds. (www.seaduckjv.org/infoseries/cogo_sppfactsheet.pdf) <p>*Is threatened by:</p> <ul style="list-style-type: none"> ✓ Wetland degradation and loss in North America, 	<p>*Face a range of pressures:</p> <ul style="list-style-type: none"> ✓ Various climate change related factors; <ul style="list-style-type: none"> ⇒ Temperature changes, ⇒ Salinity changes, and ⇒ Sea-level rise. <p>*Have declined in numbers in recent years due to:</p> <ul style="list-style-type: none"> ✓ Climate change effects; <ul style="list-style-type: none"> ⇒ Redistribution of wintering birds across north-west Europe. 	 <p>© Josef Hlasek</p>

Species	Current conservation status	Predicted conservation status in the light of climate change	Range map
<p>Extinct EX EW CR EN VU NT LC Threatened Least Concern</p>	<ul style="list-style-type: none"> ✓ Atmospheric acid deposition (e.g. acid rain) throughout a large part of its breeding range. ✓ Pollution in its wintering range (e.g. from coastal oil spills) <p>*Is hunted sustainably in Denmark, ⇒ However, the influence of hunting on global populations is unknown.</p> <p>*The species will use nest boxes, ⇒ Population increase may have occurred due to abundant nest boxes. (http://sdakotabirds.com)</p> <p>*Have recently begun to take advantage of northern areas with industrial effluent discharge, ⇒ It keeps the water free of ice in areas that are typically frozen in the winter.</p> <p>*Acid-tolerant insects provide plentiful prey, ✓ Fishes cannot live in these highly acid environments, ⇒ No competition. (http://www.birdweb.org)</p>	<p>(http://www.scotland.gov.uk/Publications/2011/03/16182005/57)</p> <p>*Climate change is expected to affect freshwater supplies; ⇒ Could jeopardize landscapes and the birds they support.</p>	 <p>© GlobalTwitcher.com 2004-2011</p>
<p><i>Calidris alba</i>, Sanderling</p> <p>*Appendix II.</p> <p>*Classified as 'Least concern' on the IUCN Red List of Threatened Species.</p> <p>Extinct EX EW CR EN VU NT LC Threatened Least Concern</p>	<p>*The population trend is not known, ✓ But is not believed to be decreasing rapidly, ✓ The population size is very large, ⇒ It has an extremely large range.</p> <p>*The worldwide population estimate is: ✓ 620,000 - 700,000 (Birdlife International 2010)</p> <p>*The species is: ✓ Sensitive to disturbance on beaches; ○ From Recreational activities, and ○ Free-running dogs, ✓ Susceptible to avian influenza, ⇒ May be threatened by future outbreaks of the virus.</p>	<p>*Global warming and associated changes in sea level: ✓ Have a long-term impact on breeding, staging and non-breeding grounds of migratory waders. (Harding et al. 2007; Melville 1997)</p> <p>*Prey may potentially be impacted by global climate change.</p> <p>*The population has been declining in New Jersey in recent years due to: ✓ Climate change, ✓ Severe weather at their breeding grounds, ✓ Loss of prey during migration, Or some combination of all of those. (http://www.conservewildlifenj.org/)</p>	 <p>© Terry Sohl</p>

Species	Current conservation status	Predicted conservation status in the light of climate change	Range map
	<p>*In the Chinese, North Korean and South Korean regions of the Yellow Sea (East Asian flyway route);</p> <ul style="list-style-type: none"> ✓ Is threatened by degradation and loss of wetland habitats through: <ul style="list-style-type: none"> ○ Environmental pollution, ○ Reduced river flows, and ○ Human disturbance. 	<p>species/fieldguide/view/Calidris%20alba/</p>	 <p>© GlobalTwitcher.com 2004-2011</p>
<p><i>Calidris alpina</i>, Dunlin</p> <p>*Appendix II.</p> <p>*Classified as ,Least concern' on the IUCN Red List of Threatened Species.</p> <p>Extinct Threatened Least concern </p>	<p>*It has a large global population:</p> <ul style="list-style-type: none"> ✓ Estimated to be 4,200,000-6,400,000 individuals, (Wetlands International 2002). <p>*The population trend appears to be decreasing,</p> <ul style="list-style-type: none"> ✓ But the decline is not believed to be sufficiently rapid, <p>*The population size is extremely large, and has an extremely large range,</p>	<p>*In the Arctic tundra, climate change will cause:</p> <ul style="list-style-type: none"> ✓ Dramatic losses in waterbird breeding habitat, <p>*Climate change will have broad-scale impacts on:</p> <ul style="list-style-type: none"> ✓ Breeding and nonbreeding habitat, ✓ The position, frequency and seasonality of storms (Severe weather) <ul style="list-style-type: none"> ○ That will affect the subspecies migration. <p>*Global warming and associated changes in sea level:</p> <ul style="list-style-type: none"> ✓ Have a long-term impact on breeding, staging and non-breeding grounds of migratory waders. (Harding et al. 2007; Melville 1997) 	 <p>© Jifí Bohdal</p>  <p>© GlobalTwitcher.com 2004-2011</p>
<p><i>Calidris canutus rufa</i>, Red knot</p> <p>*Appendices I/II.</p> <p>*Classified as ,Least concern' on the IUCN Red List of Threatened Species.</p>	<p>*The population trend appears to be decreasing,</p> <ul style="list-style-type: none"> ✓ But the decline is not believed to be sufficiently rapid, ✓ It has an extremely large range, <p>*The Canadian Wildlife Service estimates the global population at:</p> <ul style="list-style-type: none"> ✓ 1,290,000 Red Knots, <ul style="list-style-type: none"> ⇒ With 400,000 in North America. <p>(http://birdweb.org/birdweb/bird_details.aspx?id=165)</p>	<p>*Climate change:</p> <ul style="list-style-type: none"> ✓ Threatening the red knot's breeding grounds in the Arctic Circle. <p>*Climate change will have broad-scale impacts on:</p> <ul style="list-style-type: none"> ✓ Breeding and nonbreeding habitat, <ul style="list-style-type: none"> ○ By affecting the distribution and quality of coastal habitats, <p>*Global warming;</p> <ul style="list-style-type: none"> ⇒ Reduced precipitation and increased evaporation, 	 <p>© Bill Dalton</p>

Species	Current conservation status	Predicted conservation status in the light of climate change	Range map
<p>Extinct Threatened Least Concern</p> <p>EX EW CR EN VU NT LC</p>	<p>*The species is vulnerable to:</p> <ul style="list-style-type: none"> ✓ Extensive land reclamation projects that encroach upon staging areas, (in Western Europe) <p>*The species is threatened by:</p> <ul style="list-style-type: none"> ✓ Industrial pollution and oil exploration, (Argentina) ✓ The over-exploitation of shellfish' <ul style="list-style-type: none"> ⇒ Reductions in prey availability. ✓ Future outbreaks of the influenza virus, ✓ Disturbance in the non-breeding season as a result of tourism, ✓ Foot-traffic on beaches, ✓ Recreational activities and ✓ Over-flying aircraft, <ul style="list-style-type: none"> ⇒ Which together reduce the size of available foraging areas. ✓ The species is hunted illegally in New Zealand 	<p>⇒ Reducing Wetland Habitats for Breeding and Feeding of this species, (CMS_ZSL_ClimateChangeReport_2011)</p>	 <p>© GlobalTwitcher.com 2004-2011</p>
<p><i>Calidris ferruginea</i>, Curlew sandpiper</p> <p>*Appendix II.</p> <p>*Classified as Least concern on the IUCN Red List of Threatened Species.</p> <p>Extinct Threatened Least Concern</p> <p>EX EW CR EN VU NT LC</p>	<p>* The population trend:</p> <ul style="list-style-type: none"> ✓ Appears to be increasing, ✓ Has an extremely large range and size, <p>* It has a large global population;</p> <ul style="list-style-type: none"> ✓ Estimated to be 1,400,000 individuals, (Wetlands International 2002) <p>*Listed under:</p> <ul style="list-style-type: none"> ✓ The <u>Japan-Australia Migratory Bird Agreement</u> (JAMBA). ✓ The <u>China-Australia Migratory Bird Agreement</u> (CAMBA). ✓ The <u>Republic of Korea-Australia Migratory Bird Agreement</u> (ROKAMBA). <p>*Threats:</p> <ul style="list-style-type: none"> ✓ Loss of feeding and roosting habitat, ✓ Fragmentation of sites within feeding areas resulting in decreasing abundance, ✓ Human disturbance at roost and feeding 	<p>*Climate change has also been proposed as:</p> <ul style="list-style-type: none"> ✓ A potential threat to curlew sandpiper in its breeding grounds, (Nebel <i>et al.</i> 2008) <p>*Average temperatures in the arctic have risen at almost twice the rate of the rest of the world</p> <ul style="list-style-type: none"> ⇒ May affect the Curlew Sandpiper that nest in open tundra. <p>*Two different climate models predict:</p> <ul style="list-style-type: none"> ✓ Losses of 41% and 70% of breeding habitat of Curlew Sandpipers by the end of the 21st century, (Callaghan 2010) <p>*Key Threatening Processes in New South Wales under the <i>Threatened Species Conservation Act</i> 1995 are:</p> <ul style="list-style-type: none"> ✓ ‘Anthropogenic Climate Change’, and ✓ ‘Alteration to the natural flow regimes of rivers and 	 <p>© Age Fotostock / SuperStock</p>  <p>© GlobalTwitcher.com 2004-2011</p>

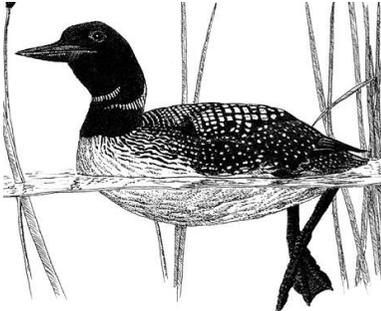
Species	Current conservation status	Predicted conservation status in the light of climate change	Range map
	<p>sites, ✓ Disturbance by dogs at roost and feeding sites, ✓ Pollution. http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=856</p>	<p>streams and their floodplains and wetlands’.</p>	
<p><i>Calidris maritima</i>, Purple sandpiper</p> <p>*Appendix II.</p> <p>*Classified as ‘Least concern’ on the IUCN Red List of Threatened Species.</p> 	<p>*The population trend: ✓ Appears to be decreasing, ⇒ The decline is not believed to be sufficiently rapid to approach the thresholds for Vulnerable under the population trend criterion.</p> <p>✓ The population size is very large, ✓ This species has an extremely large range,</p> <p>*It has a large global population estimated to be 190,000-270,000 individuals, http://www.birdlife.org/datazone/speciesfactsheet.php?id=3054&m=1</p> <p>*Recent infos: ✓ Analysis of count data in Canada: ○ It shows a statistically significant decline in numbers, ✓ In the US: ○ Identifying and protecting winter habitat is a management priority. http://www.allaboutbirds.org/guide/Purple_Sandpiper/lifehistory</p>	<p>*Threats: ✓ Climate change & severe weather, ⇒ Habitat shifting & alteration.</p> <p>*Climate change has also been proposed as: ✓ A potential threat to migratory shorebirds such as Purple sandpiper in their breeding grounds, (Nebel <i>et al.</i> 2008)</p>	 <p>© Alex Auer 2010</p>  <p>© GlobalTwitcher.com 2004-2011</p>
<p><i>Calidris minuta</i>, Little Stint</p> <p>*Appendix II.</p> <p>*Classified as ‘Least concern’ on the IUCN Red List of Threatened Species.</p>	<p>*It has a large global population: ✓ Estimated to be 1,400,000 individuals, (Wetlands International 2002)</p> <p>*The population trend: ✓ Appears to be decreasing, ⇒ The decline is not believed to be sufficiently rapid to approach the thresholds for Vulnerable under the population trend criterion.</p>	<p>*Threats: ✓ Climate change & severe weather, ⇒ Habitat shifting & alteration.</p> <p>*Climate change has also been proposed as: ✓ A potential threat to migratory shorebirds such as Little Stint in their breeding grounds, (Nebel <i>et al.</i> 2008)</p> <p>*Global warming and associated changes in sea level:</p>	 <p>© Jari Peltomäki</p>

Species	Current conservation status	Predicted conservation status in the light of climate change	Range map
<p>Extinct EX EW CR EN VU NT LC</p> <p>Threatened</p> <p>Least Concern</p>	<ul style="list-style-type: none"> ✓ The population size is very large, ✓ This species has an extremely large range 	<ul style="list-style-type: none"> ✓ Have a long-term impact on the breeding, staging and non-breeding grounds of migratory waders, (Harding et al. 2007) 	 <p>© GlobalTwitcher.com 2004-2011</p>
<p><i>Calidris temminckii</i>, Temminck's Stint</p> <p>*Appendix II.</p> <p>*Classified as 'Least concern' on the IUCN Red List of Threatened Species.</p> <p>Extinct EX EW CR EN VU NT LC</p> <p>Threatened</p> <p>Least Concern</p>	<p>*The population trend:</p> <ul style="list-style-type: none"> ✓ Is not known, <ul style="list-style-type: none"> ⇒ The decline is not believed to be rapidly to approach the thresholds for Vulnerable under the population trend criterion. ✓ Is not believed to approach the thresholds for the population decline criterion of the IUCN Red List, <ul style="list-style-type: none"> ⇒ Declining more than 30% in ten years or three generations, ✓ The population size is very large, ✓ Has an extremely large range, <p>*It has a large global population:</p> <ul style="list-style-type: none"> ✓ Estimated to be 170,000-1,300,000 individuals, (Wetlands International 2002), and (http://www.birdlife.org/datazone/speciesfactsheet.php?id=3054&m=1) 	<p>* They rely on nest concealment,</p> <ul style="list-style-type: none"> ⇒ In case of climate related changes: <ul style="list-style-type: none"> ⇒ It leads to more growth and reduced predation of clutches, particularly by avian predators, <ul style="list-style-type: none"> ⇒ May increase nesting success. (See Thyen & Exo, this volume) ⇒ Temminck's stint may benefit in this way, which nests on coastal, open and short vegetated habitats. (Smart, J. & Gill, J.A. Climate change and the potential impact on breeding waders in the UK) <p>*In particular, those breeding in the far north:</p> <ul style="list-style-type: none"> ✓ Do not have any choice other than to compete with the northwards shifting individuals of the same and of other species. <ul style="list-style-type: none"> ⇒ But some Temminck's Stint will most likely be able to adapt, ⇒ These species might possibly benefit from a change in vegetation. (Christoph Zöckler and Igor Lysenko, Water Birds on the Edge) 	 <p>© Mike Danzenbaker</p>  <p>© GlobalTwitcher.com 2004-2011</p>
<p><i>Calidris tenuirostris</i>, Great Knot</p> <p>*Appendix II.</p> <p>*Classified as 'Vulnerable' on the IUCN Red List of Threatened Species.</p>	<p>*This species has been uplisted to:</p> <ul style="list-style-type: none"> ✓ Vulnerable owing to a rapid population decline caused by: <ul style="list-style-type: none"> ⇒ Reclamation of non-breeding stopover grounds, and ⇒ Under the assumption that further proposed reclamation projects will cause additional declines in the 	<p>*Great Knot is potentially threatened by climate change:</p> <ul style="list-style-type: none"> ⇒ because it has a geographically bounded distribution; <ul style="list-style-type: none"> ○ its global distribution is restricted to within c.10° latitude from the polar edge of continent and within which 20-50% of current vegetation type is projected to disappear under doubling of CO2 levels, (http://www.birdlife.org/datazone/) 	

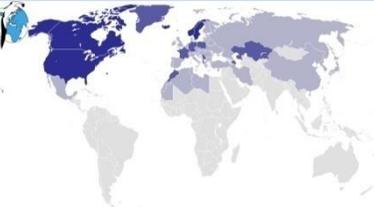
Species	Current conservation status	Predicted conservation status in the light of climate change	Range map
<p>Extinct EX EW CR EN VU NT LC Threatened Least Concern</p>	<p>future.</p> <ul style="list-style-type: none"> *It has a global population of: <ul style="list-style-type: none"> ✓ About 290,000 individuals, *The global population was about 380,000 (Wetlands International, 2006), but declined; <ul style="list-style-type: none"> ✓ Following the reclamation of the tidal flats at Saemanguem, c.90,000 non-breeding individuals disappeared from the area, <ul style="list-style-type: none"> ⇒ In South Korea, the reclamation of 40,000 hectares of tidal flats at Saemangeum thought to have reduced the global population of great knots by up to 20% 	<p>speciesfactsheet.php?id=3040)</p> <ul style="list-style-type: none"> *Threats: <ul style="list-style-type: none"> ✓ Climate change & severe weather, <ul style="list-style-type: none"> ⇒ Impact on nests. * Hydrological changes to inland lakes: <ul style="list-style-type: none"> ⇒ Modify or remove important areas of suitable habitat for those individuals that overwinter in Australia. 	 <p>© Nik 2005 © GlobalTwitcher.com 2004-2011</p>
<p><i>Clangula hyemalis</i>, Long-tailed duck</p> <p>*Appendix II.</p> <p>*Classified as ,Least concern' on the IUCN Red List of Threatened Species.</p> <p>Extinct EX EW CR EN VU NT LC Threatened Least Concern</p>	<ul style="list-style-type: none"> *It has a large global population estimated to be 6,200,000 - 6,800,000 individuals (2011). (http://www.birdlife.org/datazone/speciesfactsheet.php?id=490&m=1) *The population trend: <ul style="list-style-type: none"> ✓ Is decreasing, <ul style="list-style-type: none"> ⇒ The decline is not believed to be sufficiently rapid to approach the thresholds for Vulnerable under the population trend criterion. ✓ although some populations may be stable and others have unknown trends (Wetlands International 2006) ✓ The population size is very large, ✓ This species has an extremely large range, *According to monitoring data from the Baltic Sea, where the western Siberian and northern European populations winter, <ul style="list-style-type: none"> ✓ this population decreased by up to 70% between 1995 and 2009 (Hario <i>et al.</i> 2009, Ellermåa <i>et al.</i> 2010, 	<ul style="list-style-type: none"> * Climate envelope modelling is the approach taken in the climatic atlas of European breeding birds, (Huntley <i>et al.</i> 2007) <ul style="list-style-type: none"> ○ It is Arctic breeders that appear to be most at risk. ○ E.g. Long-tailed Duck <i>Clangula hyemalis</i> is likely to contract their range considerably due to loss of climate space. (AEWA, 4th session of the meeting of the parties) *Threats: <ul style="list-style-type: none"> ✓ Climate change & severe weather, <ul style="list-style-type: none"> ⇒ Impact on nests (Long term), ⇒ Habitat shifting and alteration, (http://www.birdlife.org/datazone/speciesfactsheet.php?id=490&m=1) *The availability of snow-free nesting ground may constrain the start of egg laying in ground nesting ducks such as <i>Clangula hyemalis</i> has been suggested by <i>pehrsson (1986)</i>. 	 <p>© Michigan Science Art © GlobalTwitcher.com 2004-2011</p>

Species	Current conservation status	Predicted conservation status in the light of climate change	Range map
	Nilsson and Månsson 2010)		
<p><i>Eurynorhynchus pygmeus</i>, Spoon-billed sandpiper</p> <p>*Appendices I/II.</p> <p>*Classified as ,Critically Endangered‘ on the IUCN Red List of Threatened Species.</p> 	<p>*Population trend: ✓ Declining.</p> <p>*Population: ✓ 150-320 breeding pairs, ✓ Equating to 450-1,000 individuals (Zockler and Syroechkovskiy in prep)</p> <p>*It has an extremely small population, ✓ It is undergoing an extremely rapid population reduction, ✓ Factors: <ul style="list-style-type: none"> ○ Habitat loss in its breeding, ○ Disturbance of passage and wintering grounds, ○ Hunting, and ○ Climate change. ⇒ Action is now urgently required to prevent the extinction of this species. (IUCN)</p> <p>*List of main impact factors: <ul style="list-style-type: none"> ✓ Habitat loss in its breeding, passage and wintering grounds ✓ Hunting ✓ Effects of climate change (IUCN) </p>	<p>*climate change: <ul style="list-style-type: none"> ✓ Threats on the Breeding Grounds as it is in Arctic region; <ul style="list-style-type: none"> ⇒ That is predicted to be the most heavily influenced by climate change within the whole circumpolar Arctic, (Grebmeier et al. 2006) ⇒ As the coastal lowlands at about sea level are expected to suffer from ocean level rise (ACIA 2005) <ul style="list-style-type: none"> ○ Spoon-billed Sandpiper breeds in the most vulnerable area. ✓ Threats on the Staging and Wintering Areas; <ul style="list-style-type: none"> ⇒ Climate Change is expected to have a major impact on coastal mudflats. ⇒ In the long-/medium-terms sea-level rise, floods will affect wader habitats considerably. <ul style="list-style-type: none"> ○ It does not mean that climate change is not a serious threat for non-breeding Spoon-billed Sandpiper habitats, ○ Future years might reveal the extent of the real impact on the flyway coasts. (CMS Technical Series, International Single Species Action Plan for the Conservation of the Spoon-billed Sandpiper)</p>	 <p>© Jan van de Kam / Birds Korea</p>  <p>© IUCN Red List of Threatened Species</p>
<p><i>Gavia adamsii</i>, White-billed diver, Yellow billed loon</p> <p>*Appendix II.</p> <p>*Classified as ,Near</p>	<p>*Global population: <ul style="list-style-type: none"> ✓ About 16,000-32,000 individuals, <ul style="list-style-type: none"> ○ with 3,000-4,000 in Alaska, ○ 20,000 in Canada, and ○ 8,000 in Russia. (U.S. Fish and Wildlife Service 2009)</p> <p>*It is suspected to be undergoing a moderately rapid</p>	<p>*Threats: <ul style="list-style-type: none"> ✓ Climate change & severe weather, <ul style="list-style-type: none"> ⇒ Habitat shifting & alteration, ⇒ Impact on breeding area, ⇒ Impact on nests. </p> <p>*It is affected by climate change through:</p>	

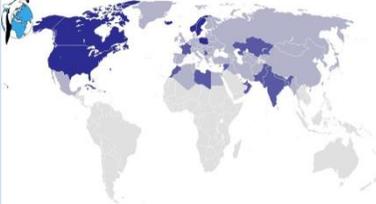
Species	Current conservation status	Predicted conservation status in the light of climate change	Range map
<p>Threatened* on the IUCN Red List of Threatened Species.</p> <p>Extinct Threatened Least Concern EX EW CR EN VU NT LC</p>	<p>population decline owing to unsustainable subsistence harvest.</p> <ul style="list-style-type: none"> ✓ However, accurate data is lacking and further surveys need to be conducted to quantify the current rate of harvest. 	<ul style="list-style-type: none"> ✓ Geographic shifts of their breeding, staging and wintering grounds; ✓ Loss and fragmentation of their habitats; ✓ Changes in timing of seasonal aspects in their life cycle; ✓ Possible long-term changes in their survival and productivity; (AEWA, 4th session of the meeting of the parties) 	 <p>© Len Blumin</p>  <p>© GlobalTwitcher.com 2004-2011</p>
<p><i>Gavia arctica arctica</i>, Black-throated Diver</p> <p>*Appendix II.</p> <p>*Classified as Least concern* on the IUCN Red List of Threatened Species.</p> <p>Extinct Threatened Least Concern EX EW CR EN VU NT LC</p>	<p>*Global population estimates:</p> <ul style="list-style-type: none"> ✓ It has a large global population estimated to be 130,000-2,000,000 individuals, (Wetlands International 2002) <p>*These species are not considered at risk of extinction.</p> <ul style="list-style-type: none"> ✓ Rather they are reasonably widespread and abundant. <p>*Populations are probably fairly large but with progressive decline throughout the southern part of the range.</p> <p>*The Black-throated Diver is vulnerable to:</p> <ul style="list-style-type: none"> ✓ Human disturbances on the breeding areas, ✓ Changes in the habitat, ✓ Alterations of water levels, ✓ Acidification of these waters, and ✓ Oil and heavy metal pollution. 	<p>*If climate change causes loch temperatures to rise,</p> <ul style="list-style-type: none"> ✓ The small fish the birds feed on could grow too large to eat. (http://news.bbc.co.uk/2/hi/uk_news/scotland/highlands_and_islands/6980265.stm) <p>*Dr Mark Eaton, an RSPB scientist, said:</p> <ul style="list-style-type: none"> ✓ We feared the numbers of red-throated divers might drop because the warming of the North Sea seems to be reducing stocks of the fish they feed on. <p>*The black-throated diver could also be at risk in the future, despite the recent increases.</p> <ul style="list-style-type: none"> ✓ If climate change causes loch temperatures to rise, the small fish the birds feed on could grow too large to eat. (http://www.innovationsreport.de/html/berichte/umwelt_naturschutz/bericht-90298.html) 	 <p>© Michigan Science Art</p>  <p>© GlobalTwitcher.com 2004-2011</p>
<p><i>Gavia arctica suschkini</i>, Black-throated Diver</p>	<p>*Same as the previous one</p>	<p>*Same as the previous one</p>	<p>*Same as the previous one</p>

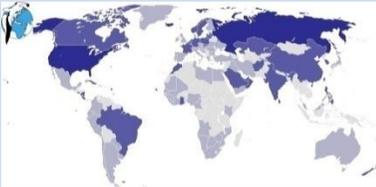
Species	Current conservation status	Predicted conservation status in the light of climate change	Range map
<p>*Appendix II. *Classified as ‘Least concern’ on the IUCN Red List of Threatened Species.</p>			
<p><i>Gavia immer</i>, Great Northern diver, Common loon</p> <p>*Appendix II. *Classified as ‘Least concern’ on the IUCN Red List of Threatened Species.</p> 	<p>*It has a large global population:</p> <ul style="list-style-type: none"> ✓ Estimated to be 580,000 individuals, (Wetlands International 2002). <p>*The population trend:</p> <ul style="list-style-type: none"> ✓ Is decreasing, <ul style="list-style-type: none"> ➔ The decline is not believed to be sufficiently rapid to approach the thresholds for Vulnerable under the population trend criterion. ✓ The population size is very large, ✓ This species has an extremely large range, <p>*Some decrease in numbers in southern parts of summer range due to:</p> <ul style="list-style-type: none"> ✓ Human disturbance, ✓ Water quality decreases, <ul style="list-style-type: none"> ⇒ Good indicator being quite sensitive to water quality. 	<p>*The common loon exemplifies a species that is likely sensitive to climate change.</p> <p>*Common Loons show preference for specific coves and that individual loons have some degree of site fidelity.</p> <p>*Wintering loons do not appear to be good indicators of short term climate change effects,</p> <ul style="list-style-type: none"> ✓ Because margins of coves and upper bays freeze, ✓ Seems unsuitable for habitat, <p>✓ However a decrease in sea ice could lead to significant shifts in habitat use,</p> <ul style="list-style-type: none"> ○ Both providing loons with more wintering areas, ○ Exposing them to a new range of threats. <p>(http://eco.confex.com/eco/2010/techprogram/P24273.HTM)</p> <p>*If climate change causes loch temperatures to rise, then:</p> <ul style="list-style-type: none"> ✓ The small fish the birds feed on could grow too large to eat. <p>(http://news.bbc.co.uk/2/hi/uk_news/scotland/highlands_and_islands/6980265.stm)</p>	 <p>© Julius T. Csotonyi (csotonyi.com) © Canadian Museum of Nature</p>  <p>© GlobalTwitcher.com 2004-2011</p>
<p><i>Gavia stellata</i>, Red-throated diver</p> <p>*Appendix II. *Classified as ‘Least concern’ on the IUCN Red List of Threatened Species.</p> 	<p>*It has a large global population</p> <ul style="list-style-type: none"> ✓ Estimated to be 490,000-1,500,000 individuals, (Wetlands International 2002) <p>*The overall population trend:</p> <ul style="list-style-type: none"> ✓ Appears to be decreasing, <ul style="list-style-type: none"> ➔ The decline is not believed to be sufficiently rapid to approach the thresholds for Vulnerable under the population trend criterion. ✓ The population size is very large, ✓ This species has an extremely large range, <ul style="list-style-type: none"> ⇒ These species are not considered at risk of extinction. <p>*This species:</p> <ul style="list-style-type: none"> ✓ Has had stable population trends over the 	<p>*They are likely to be highly sensitive to climate change,</p> <ul style="list-style-type: none"> ✓ Impacts on their habitat <ul style="list-style-type: none"> ○ With one leading study predicting their disappearance as a UK breeding bird by the end of the century. <p>(http://www.natural-research.org/environmental-research-charity/current-research-projects/diver-ecology-scotland/)</p>	 <p>© Thomas Seilnacht</p> 

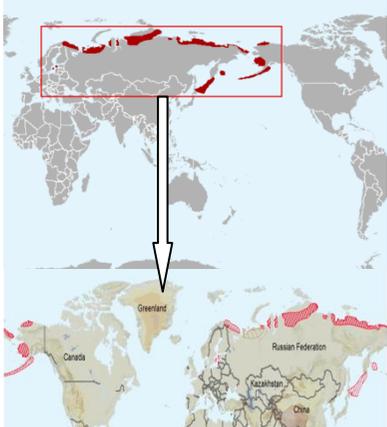
Species	Current conservation status	Predicted conservation status in the light of climate change	Range map
	<p>last 40 years in North America, (data from Breeding Bird Survey and/or Christmas Bird Count: Butcher and Niven 2007)</p>		<p>© GlobalTwitcher.com 2004-2011</p>
<p><i>Haliaeetus albicilla</i>, White-tailed Eagle</p> <p>*Appendices I/II.</p> <p>*Classified as ‘Least concern’ on the IUCN Red List of Threatened Species.</p> <p>Extinct EX EW CR EN VU NT LC</p> <p>Threatened</p> <p>Least Concern</p>	<p>*Vulnerability to climate change is medium. (CMS_ZSL_ClimateChangeReport_2011)</p> <p>*The breeding population in Europe:</p> <ul style="list-style-type: none"> ✓ Is estimated to number 5,000-6,600 breeding pairs, <ul style="list-style-type: none"> ⇒ Equating to 15,000-19,800 individuals, (BirdLife International 2004) ✓ Europe forms 50-74% of the global range, <ul style="list-style-type: none"> ⇒ Estimate of the global population size is 20,300-39,600 individuals, ⇒ Further validation is needed. <p>* The population trend:</p> <ul style="list-style-type: none"> ✓ Appears to be increasing, <ul style="list-style-type: none"> ⇒ The species does not approach the thresholds for Vulnerable under the population trend criterion. ✓ No longer approaches the thresholds for the IUCN Red List criteria. <p>*The population size:</p> <ul style="list-style-type: none"> ✓ May be moderately small to large, <ul style="list-style-type: none"> ○ But it is not believed to approach the thresholds for Vulnerable under the population size criterion. <p>*List of main impact factors:</p> <ul style="list-style-type: none"> ✓ Loss and degradation of wetlands, ✓ Human disturbance and persecution, ✓ Environmental pollution, ✓ Collision with wind generators, ✓ Indiscriminate use of poisons, and ✓ Modern forestry methods reduce the availability of suitable nesting habitat. (IUCN) 	<p>*Globally, current threats include loss and degradation of wetlands,</p> <ul style="list-style-type: none"> ⇒ Due to climate change and human impacts. 	 <p>© Oláh János</p>  <p>© GlobalTwitcher.com 2004-2011</p>

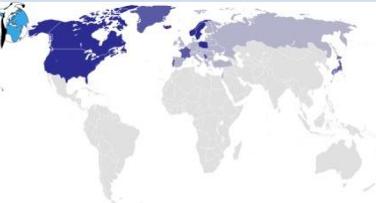
Species	Current conservation status	Predicted conservation status in the light of climate change	Range map
<p><i>Melanitta nigra</i>, Common scoter</p> <p>*Appendix II.</p> <p>*Classified as Least concern on the IUCN Red List of Threatened Species.</p> <p>Extinct Threatened Least Concern </p>	<p>*Population Size:</p> <ul style="list-style-type: none"> ✓ >1,000,000 individuals, ✓ No precise estimates available, but minimum numbers are: <ul style="list-style-type: none"> ○ At least 500,000 individuals in western Europe in winter (early 1970's), ○ 500,000 individuals in North America, ○ Additional large numbers in eastern Asia (Madge and Burn 1988). <p>*The overall population trend:</p> <ul style="list-style-type: none"> ✓ Appears to be decreasing (long term Moderate decline to relatively stable (25% change to 50% decline)), <ul style="list-style-type: none"> ⇒ The decline is not believed to be sufficiently rapid to approach the thresholds for Vulnerable under the population trend criterion. ✓ The population size is very large, ✓ This species has an extremely large range, <ul style="list-style-type: none"> ⇒ These species are not considered at risk of extinction. <p>*Large global population:</p> <ul style="list-style-type: none"> ✓ With very large and widely dispersed continental subpopulations, ✓ Fairly low degree of threat, <ul style="list-style-type: none"> ○ particularly on breeding grounds. ○ <p>(http://export.nbii.gov/xml/natureserv/html/Anatidae/0/ELEMENT_GLOBAL_2_101245.html)</p> <p>*A national survey of breeding common scoters in 2007 found that:</p> <ul style="list-style-type: none"> ✓ The population had fallen by 45% since the previous survey in 1995, to just 52 breeding pairs. 	<p>*Climate change:</p> <ul style="list-style-type: none"> ✓ Warmer winters and springs could lead to aquatic insects such as mayflies and caddis flies hatching earlier in the season, <ul style="list-style-type: none"> ⇒ Not being available to the scoter ducklings when they hatch out themselves. ✓ And warmer winters may, over time, lead to more predators surviving and that could make an impact. <p>(http://www.rspb.org.uk/media/releases/270202-rspb-battles-to-save-the-notso-common-scoter)</p>	 <p>© Jón Baldur Hlíðberg 2002</p>  <p>© GlobalTwitcher.com 2004-2011</p>

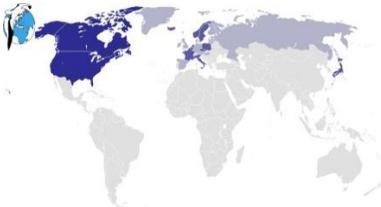
Species	Current conservation status	Predicted conservation status in the light of climate change	Range map
	<p>http://www2.btcv.org.uk/display/cc_win_lose</p>		
<p><i>Mergus merganser</i>, Gooseander, Common merganser</p> <p>*Appendix II.</p> <p>*Classified as ‘Least concern’ on the IUCN Red List of Threatened Species.</p> 	<p>*Aerial surveys and Christmas Bird data suggest:</p> <ul style="list-style-type: none"> ✓ A total population size of 600,000 to 1 million birds within North America. <p>* The population trend:</p> <ul style="list-style-type: none"> ✓ Appears to be increasing, <ul style="list-style-type: none"> ⇒ Although some populations may be stable and others have unknown trends (Wetlands International 2006) ✓ The population size is very large, ✓ This species has an extremely large range, <ul style="list-style-type: none"> ⇒ These species are not considered at risk of extinction. <p>* Numbers appear to be:</p> <ul style="list-style-type: none"> ⇒ Stable across North America, <p>*The Christmas Bird Count has reflected:</p> <ul style="list-style-type: none"> ⇒ A slight increase in Washington in recent years. <p>*Common Mergansers are:</p> <ul style="list-style-type: none"> ⇒ An important indicator of the health of wetlands. 	<p>*Threatened by:</p> <ul style="list-style-type: none"> ⇒ The degradation of freshwater lakes; <ul style="list-style-type: none"> ○ through drainage and petroleum pollution in Russia, and ○ As a result of acid rain in North America (Kear, 2005b) <p>http://www.birdlife.org/datazone/speciesfactsheet.php?id=502</p> <p>*In recent years, tens of thousands of birds have perished from botulism that is erupting in the lakes,</p> <ul style="list-style-type: none"> ⇒ Which some scientists believe is partly a result of climate change. <ul style="list-style-type: none"> ○ Species impacted include the common loon, Minnesota’s state bird; mergansers, which summer and winter on portions of the lakes; <p>http://www.nationalparkstraveler.com/2009/08/climate-change-and-national-parks-survival-guide-warming-world-loon-and-other-birds-great-la</p> <p>*May stay further north in the winter and breed further north in the spring.</p> <ul style="list-style-type: none"> ⇒ In the increasingly-warmer Northwest Territories of Canada, the common merganser has expanded its ranges north of the treeline in the Thelon River Valley. <p>http://www.ff.org/centers/csspp/pdf/waterfowl.pdf</p>	 
<p><i>Mergus serrator</i>, Red-breasted merganser</p> <p>*Appendix II.</p> <p>*Classified as ‘Least concern’ on the IUCN Red List of Threatened Species.</p>	<p>*It has a large global population:</p> <ul style="list-style-type: none"> ✓ estimated to be 510,000-600,000 individuals, (Wetlands International 2002) <p>*The population trend:</p> <ul style="list-style-type: none"> ✓ Appears to be stable, <ul style="list-style-type: none"> ⇒ It does not approach the thresholds for Vulnerable under the population trend criterion. ✓ The population size is very large, ✓ This species has an extremely large range, 	<p>*Treats:</p> <ul style="list-style-type: none"> ✓ Climate change & severe weather (Level 1) <ul style="list-style-type: none"> ○ Habitat shifting & alteration (Level 2) <ul style="list-style-type: none"> ⇒ Indirect ecosystem effects, Ecosystem degradation. <p>*Long-term climate change leads to increase:</p> <ul style="list-style-type: none"> ✓ Their population size, ✓ Breeding timing, and ✓ Migration <ul style="list-style-type: none"> ○ As these have all increased due to the increasing 	

Species	Current conservation status	Predicted conservation status in the light of climate change	Range map
<p>Extinct EX EW CR EN VU NT LC</p> <p>Threatened</p> <p>Least Concern</p>	<p>⇒ Are not considered at risk of extinction.</p> <p>*Population:</p> <ul style="list-style-type: none"> ✓ Total regarded as a minimum by Wetlands International (2006). <p>*Breeding populations in the North Pacific:</p> <ul style="list-style-type: none"> ✓ Seem to have increased over the last ten years. <p>(http://www.birdweb.org/birdweb/bird_details.aspx?id=94)</p>	<p>change.</p> <p>*Global climate change impacts:</p> <ul style="list-style-type: none"> ✓ It has caused <i>Mergus serrator</i> previously seen in Turkey, to shift their routes northward. ✓ This species is usually found in the southern states. However: <ul style="list-style-type: none"> ○ Recently you are able to find this species enjoying the warmer winter waters as it has shifted its ranges north by an estimated 393, 272 and 226 kilometers away from their southern homes. ○ Sadly it has been noted that while other birds are moving to accomidate climate change others are not. This brings up the fear that there could be potential probelms for these animals and a struggle to find them a new home to live in. <p>(http://enviromentalscience2.wikispaces.com/Birds+%26+Climate+Change)</p>	 <p>© GlobalTwitcher.com 2004-2011</p>
<p><i>Numenius borealis</i>, Eskimo curlew</p> <p>*Appendices I/II.</p> <p>*Classified as 'Critically Endangered' on the IUCN Red List of Threatened Species.</p> <p>Extinct EX EW CR EN VU NT LC</p> <p>Threatened</p> <p>Least Concern</p>	<p>*Eskimo curlews are extremely rare and Possibly Extinct.</p> <p>*Eskimo curlews:</p> <ul style="list-style-type: none"> ✓ has not been recorded with certainty since the early 1980s (and none have been confirmed on the wintering grounds since 1939). ✓ It was formerly abundant, but declined rapidly over a century ago as a result of hunting and habitat loss. <p>*It cannot yet be presumed to be Extinct until:</p> <ul style="list-style-type: none"> ✓ All potential breeding areas have been surveyed, and ✓ The series of occasional unconfirmed reports ceases. <p>*Any remaining population is likely to be tiny, as:</p> <ul style="list-style-type: none"> ✓ There have been no confirmed sightings since the early 1980s, and ✓ For these reasons it is treated as Critically 	<p>*Treats:</p> <ul style="list-style-type: none"> ✓ Climate change & severe weather, (Level 1) <ul style="list-style-type: none"> ○ Habitat shifting & alteration, (Level 2) <ul style="list-style-type: none"> ⇒ Indirect ecosystem effects, Ecosystem degradation, ⇒ Threats to wintering grounds. <p>*In 19th century there was also a marked climate change throughout the Arctic;</p> <ul style="list-style-type: none"> ⇒ A few Eskimo Curlews may still exist, <ul style="list-style-type: none"> ○ But in such low numbers that it may be impossible for the birds to locate mates on their vast arctic breeding grounds. <p>(http://www.abcbirds.org/abcprograms/science/watchlist/eskimo_curlew.html)</p> <p>*Impacts on its breeding area by some factors such as:</p> <ul style="list-style-type: none"> ✓ Climate change, and ✓ The projected loss of low Arctic tundra to shrubs and, ultimately, forest. <ul style="list-style-type: none"> ⇒ Further concentration of them in restricted areas, ⇒ It facilitates hunting (Gill <i>et al.</i> 1998). 	 <p>© CCNAB</p>  <p>© IUCN Red List of Threatened Species</p>

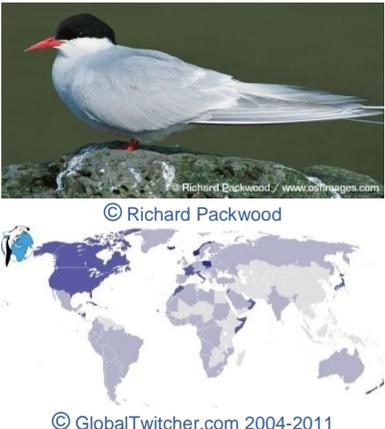
Species	Current conservation status	Predicted conservation status in the light of climate change	Range map
	<p>Endangered (Possibly Extinct).</p> <p>*List of main impact factors:</p> <ul style="list-style-type: none"> ✓ Hunting (North America), ✓ Near total loss of prairies to agriculture, ✓ Suppression of prairie wildfires, and ✓ Extinction of <i>M. Spretus</i> (IUCN) 	<p>(http://publications.gc.ca/collections/collection_2011/ec/CW69-14-176-2010-eng.pdf)</p> <p>*Factors that may have contributed to the decline of this species include:</p> <ul style="list-style-type: none"> ✓ Storms during transoceanic migration, ✓ Global Warming, ✓ Drought, and ✓ Volcanic eruptions that reduced solar radiation (Banks 1977; Gill <i>et al.</i> 1998) 	
<p><i>Phalaropus fulicarius</i>, Grey phalarope</p> <p>*Appendix II.</p> <p>*Classified as ,Least concern‘ on the IUCN Red List of Threatened Species.</p> <p>Extinct Threatened Least Concern EX EW CR EN VU NT LC</p>	<p>*It has a large global population:</p> <ul style="list-style-type: none"> ✓ Estimated to be 1,000,000-1,900,000 individuals, (Wetlands International 2002) <p>*The overall population trend:</p> <ul style="list-style-type: none"> ✓ Appears to be decreasing, <ul style="list-style-type: none"> ⇒ The decline is not believed to be sufficiently rapid to approach the thresholds for Vulnerable under the population trend criterion. ✓ Some populations have unknown trends (Wetlands International 2006) ✓ The population size is very large, ✓ This species has an extremely large range, <ul style="list-style-type: none"> ⇒ These species are not considered at risk of extinction. 	<p>*Climate change,</p> <ul style="list-style-type: none"> ⇒ Sea level rises, <ul style="list-style-type: none"> ⇒ Habitat loss, <ul style="list-style-type: none"> ⇒ Impact on breeding area, <p>*Treats:</p> <ul style="list-style-type: none"> ✓ Climate change & severe weather, (Level 1) <ul style="list-style-type: none"> ○ Habitat shifting & alteration, (Level 2) <ul style="list-style-type: none"> ⇒ Indirect ecosystem effects, Ecosystem degradation, ⇒ Threats to wintering grounds. <p>*It is included in a group with some other species:</p> <ul style="list-style-type: none"> ✓ They are mainly pagophilic (ice-loving) and inhabit the northern part of the region, (SC-N10-CCForInfo5_BeringSea) 	 <p>© Rob Cross</p>  <p>© GlobalTwitcher.com 2004-2011</p>
<p><i>Polysticta stelleri</i>, Steller’s eider</p> <p>*Appendices I/II.</p> <p>*Classified as ,Vulnerable‘ on the IUCN Red List of Threatened Species.</p>	<p>*The population and Subpopulation trends is Declining. (population trend 2010) (CMS_ZSL_ClimateChangeReport_2011)</p> <p>*The vulnerability to climate change is high. (CMS_ZSL_ClimateChangeReport_2011)</p> <p>*The total current population estimate is:</p> <ul style="list-style-type: none"> ✓ 110,000-125,000 individuals, ✓ The total for Europe and Russia is: <ul style="list-style-type: none"> ○ About 23,060-36,160 individuals. 	<p>*Treats:</p> <ul style="list-style-type: none"> ✓ Climate change & severe weather, (Level 1) <ul style="list-style-type: none"> ○ Habitat shifting & alteration, (Level 2) <ul style="list-style-type: none"> ⇒ Indirect ecosystem effects, Ecosystem degradation, ⇒ Threats to wintering grounds. <p>*Steller's Eider has a restricted arctic breeding range.</p> <p>*The species has a limited global wintering distribution, occurring in:</p>	 <p>© 1996-2011 Oiseaux.net</p>

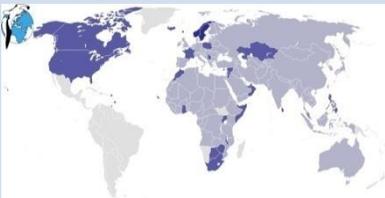
Species	Current conservation status	Predicted conservation status in the light of climate change	Range map
<p>Extinct EX EW</p> <p>Threatened CR EN VU NT</p> <p>Least Concern LC</p>	<p>*Population that wintering in different areas:</p> <ul style="list-style-type: none"> ✓ In east Asia may have declined by 20-40% to c.20,000-25,000 birds, <ul style="list-style-type: none"> ○ About 10,000-15,000 winter in the Russian Far East (D. Solovieva <i>in litt.</i> 2005), ✓ In Bering Island, in Russia, declined from estimates of 10,000 in the 1960s (Marakov 1965) to between 3,356-4,994 in 2005, 2006 and 2007 (Y. Artukhin, per K. Laing <i>in litt.</i> 2007), ✓ 10,000-15,000 estimated to winter in N Norway and SE Baltic [Krasnov <i>et al.</i> 2004], 2,250 in S Baltic in 2003 (Zydelis <i>et al.</i> 2006) ✓ and 2,000-4,000 wintering off Norway, ✓ 100,000-110,000 estimated to winter in N. Pacific. (http://www.birdlife.org/datazone/speciesfactsheet.php?id=487) <p>*This species has been uplisted to Vulnerable:</p> <ul style="list-style-type: none"> ✓ As it is undergoing a rapid population reduction, particularly in the key Alaskan populations, <ul style="list-style-type: none"> ○ Declines might reflect population shifts; if so, the species may warrant downlisting. (http://www.avibirds.com/euhtml/Stellers_Eider.html) <p>*Is listed as Vulnerable:</p> <ul style="list-style-type: none"> ✓ Because it is undergoing a rapid population reduction, <ul style="list-style-type: none"> ○ particularly in the key Alaskan populations. <p>*Population:</p> <ul style="list-style-type: none"> ✓ Changes in world population: <ul style="list-style-type: none"> ○ It has decreased by 50 % 	<ul style="list-style-type: none"> ✓ Marine habitats in north-east Europe, ✓ Islands close to Kamchatka in Russia, and ✓ The eastern Aleutian Islands and south-west Alaska. <ul style="list-style-type: none"> ⇒ Climate change, ⇒ Impacts on this species. <p>*Changes in annual numbers in Norway were correlated with:</p> <ul style="list-style-type: none"> ✓ Winter North Atlantic Oscillation indices. (http://journals.cambridge.org/action/displayAbstract?fromPage=online&aid=458743) 	 <p>© IUCN Red List of Threatened Species</p>

Species	Current conservation status	Predicted conservation status in the light of climate change	Range map
	<p>throughout its range,</p> <ul style="list-style-type: none"> ✓ The European winter population <ul style="list-style-type: none"> ○ It is considered as stable. However, the Baltic winter population has declined since 1992. ⇒ Causes of the decline world-wide and in Alaska are not known. <p>(http://www.helcom.fi/environment2/biodiv/endangered/Birds/en_GB/Polysticta_stelleri/)</p> 		
<p><i>Somateria mollissima</i>, Common eider</p> <p>*Appendix II.</p> <p>*Classified as ‘Least concern’ on the IUCN Red List of Threatened Species.</p> <p>Extinct Threatened Least Concern</p> <p>EX EW CR EN VU NT LC</p>	<p>*The total current population estimate is:</p> <ul style="list-style-type: none"> ✓ 29,000 pairs nesting in 320 colonies. (http://www.maine.gov/IFW/wildlife/species/plans/birds/commoneider/speciesassessment.pdf) <p>*The overall population trend:</p> <ul style="list-style-type: none"> ✓ Is not known, <ul style="list-style-type: none"> ⇒ but the population is not believed to be decreasing sufficiently rapidly to approach the thresholds under the population trend criterion. ✓ Some populations are decreasing, while others are increasing, stable, or have unknown trends (Wetlands International 2006) ✓ The population size is very large, ✓ This species has an extremely large range, <p>* The Common Eider is distributed over:</p> <ul style="list-style-type: none"> ✓ Northern coasts of Europe, ✓ North America, ✓ Eastern Siberia, and ✓ Southern Greenland. <p>*An insignificant increase had undergone over the last 40 years in North America (Butcher and Niven 2007),</p> <ul style="list-style-type: none"> ⇒ However, these surveys cover less than 50% of the species's range in North America. 	<p>*Weather fluctuation has some impacts on short-distance migrants:</p> <ul style="list-style-type: none"> ⇒ They may respond strongly to climate change, (Lehikoinen et al. 2006, Novoa et al. 2008) <ul style="list-style-type: none"> ⇒ Because the females use endogenous reserves for incubation, (i.e. they are capital breeders; Meijer & Drent 1999) <p>*Impact of severe weather during the coldest months of the year:</p> <ul style="list-style-type: none"> ⇒ It can increase adult mortality and affect population size (Sæther et al. 2004). <p>*Iceland is not the coldest part of the common eider distribution range,</p> <ul style="list-style-type: none"> ⇒ Weather effects on the common eider are mostly indirect (i.e. via food and habitat availability) rather than direct (i.e. affecting the health of the adult common eiders themselves), therefore: <ul style="list-style-type: none"> ⇒ Arrival and clutch size were more likely to be affected by weather than are breeding numbers. ⇒ Unfavourable conditions during autumn, winter and spring may interfere with accumulation of body reserves which sustain the females during breeding and into brood rearing. ⇒ Unfavourable changes in the distribution and frequencies of depressions within each season could affect future breeding numbers of this species. (http://www.int-res.com/articles/cr2009/38/c038p237.pdf) 	 <p>© Photo by Thomas Reich</p>  <p>© GlobalTwitcher.com 2004-2011</p>

Species	Current conservation status	Predicted conservation status in the light of climate change	Range map
	<p>http://www.birdlife.org/datazone/speciesfactsheet.php?id=484)</p> <p>*In Canada and north arctic some local extinctions happened, ⇒ Due to hunting.</p>	<p>*Climate change decreases ice cover in the Arctic, therefore: ⇒ The increasing potential for the Beaufort Sea as a commercial shipping route will pose added risk to migrating and breeding eiders via oil spills and other contamination. (Also for some other Sp. Or generally at the end) http://www.fws.gov/migratorybirds/CurrentBirdIssues/Management/FocalSpecies/Plans/PacificCommonEider.pdf</p> <p>*It is included in a group inhabits both areas with ice and without and includes some species with circumpolar distribution, (SC-N10-CCForInfo5_BeringSea)</p>	
<p><i>Somateria spectabilis</i>, King eider</p> <p>*Appendix II.</p> <p>*Classified as ‘Least concern’ on the IUCN Red List of Threatened Species.</p> <p>Extinct Threatened Least Concern </p>	<p>* It has a large global population estimated to be: ⇒ 4,500,000 - 5,700,000 individuals, (Wetlands International 2002)</p> <p>*The population trend: ✓ Is decreasing, ⇒ The decline is not believed to be sufficiently rapid to approach the thresholds for Vulnerable under the population trend criterion.</p> <p>✓ Although some populations may be stable, and others have unknown trends (Wetlands International 2006),</p> <p>✓ The population size is very large,</p> <p>✓ This species has an extremely large range,</p> <p>*Breeding areas: ✓ Arctic coasts of Europe, ✓ North America, ✓ Asia, ✓ North-east and north-west coast of North America, ✓ Iceland, ✓ Islands north of the United Kingdom, and ✓ On the Pacific coast of Asia to the tip of the Kamchatka Peninsula (Russia)</p>	<p>*Climate change decreases ice cover in the Arctic, therefore: ⇒ The increasing potential for the Beaufort Sea as a commercial shipping route will pose added risk to migrating and breeding eiders via oil spills and other contamination. (Also for some other Sp. Or generally at the end) http://www.fws.gov/migratorybirds/CurrentBirdIssues/Management/FocalSpecies/Plans/PacificCommonEider.pdf</p> <p>*Treats: ✓ Climate change & severe weather, (Level 1) ○ Habitat shifting & alteration, (Level 2) ⇒ Indirect ecosystem effects, Ecosystem degradation, ⇒ Threats to wintering grounds.</p> <p>*It is included in a group with some other species: ✓ They are mainly pagophilic (ice-loving) and inhabit the northern part of the region, (SC-N10-CCForInfo5_BeringSea)</p>	 <p>© Jón Baldur Hlíðberg 2002</p>  <p>© GlobalTwitcher.com 2004-2011</p>

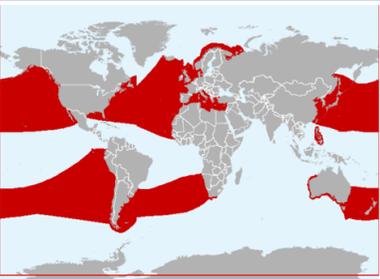
Species	Current conservation status	Predicted conservation status in the light of climate change	Range map
<p>Sterna albifrons, Little Tern</p> <p>*Appendix II.</p> <p>*Classified as ‘Least concern’ on the IUCN Red List of Threatened Species.</p> 	<p>(del Hoyo <i>et al.</i> 1992)</p> <p>*It has a large global population:</p> <ul style="list-style-type: none"> ✓ About 140,000-410,000 individuals (Wetlands International 2002) <p>*The population trend:</p> <ul style="list-style-type: none"> ✓ Appears to be decreasing, <ul style="list-style-type: none"> ⇒ The decline is not believed to be sufficiently rapid to approach the thresholds for Vulnerable under the population trend criterion. ✓ Although some populations have unknown trends (Wetlands International 2006), ✓ The population size is very large, ✓ This species has an extremely large range, <p>*There are Declines in:</p> <ul style="list-style-type: none"> ✓ Denmark, ✓ Germany, and ✓ Poland, (Grell, 1998; Hälterlein et al., 2000; BirdLife International, 2004, Winiecki, 2004). <p>*The declines are based on:</p> <ul style="list-style-type: none"> ✓ Habitat deterioration, <ul style="list-style-type: none"> ⇒ Due to recreational activities and increases in predators (foxes, mink, Grell, 1998; Hälterlein et al., 2000) <p>*Breeding populations of the Little Tern can be found through:</p> <ul style="list-style-type: none"> ✓ Much of Europe, ✓ Scattering along the coast and inland in parts of Africa, ✓ In much of western, central and the extreme east and south of Asia, and ✓ In northern parts of Australasia. 	<p>*Global climate change</p> <ul style="list-style-type: none"> ✓ Is a potential threat to this species, <ul style="list-style-type: none"> ○ But there appear to be no other global threats that are likely to affect the Australian population. <p>(http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=813)</p> <p>*Climate change impacts:</p> <ul style="list-style-type: none"> ✓ Rising sea-levels: <ul style="list-style-type: none"> ⇒ Many colonies are facing an increasing risk of being washed out, ✓ Beach scouring and dune encroachment: <ul style="list-style-type: none"> ⇒ A reduction in size of breeding beaches. ✓ More frequent storm events: <ul style="list-style-type: none"> ⇒ In the future could act to reduce habitat availability. <p>(http://www.norfolkbiobiodiversity.org/actionplans/species/littleterns.asp)</p> <p>*Seabirds that nest along the shoreline are currently undergoing declines in breeding numbers;</p> <ul style="list-style-type: none"> ✓ It is caused by successive years of poor breeding, due to nests being washed away by tidal surges, as well as from predation and human disturbance, (Pickerell, 2004) ✓ Rising sea levels will exacerbate such effects by reducing the amount of safe breeding habitat available, ✓ Winter storms can cause large-scale mortality of seabirds and summer storms can wash whole colonies from cliffs, (http://www.mccip.org.uk/annual-report-card/2006/healthy-and-biologically-diverse-marine-ecosystem/seabirds/jncc-evidence.aspx) 	 <p>© Lubomir Hlasek</p>  <p>© GlobalTwitcher.com 2004-2011</p>

Species	Current conservation status	Predicted conservation status in the light of climate change	Range map
<p><i>Sterna paradisaea</i>, Arctic Tern</p> <p>*Appendix II.</p> <p>*Classified as Least concern on the IUCN Red List of Threatened Species.</p> <p>Extinct Threatened Least Concern</p> <p>EX EW CR EN VU NT LC</p>	<p>*It has a large global population estimated to be:</p> <ul style="list-style-type: none"> ✓ 1,000,000 individuals, (Wetlands International 2002) ✓ Worldwide numbers of Arctic Terns may be 1-2 million breeding pairs, <p>*Population justification:</p> <ul style="list-style-type: none"> ✓ Total is regarded as a minimum by Wetlands International (2006). <p>*The population trend:</p> <ul style="list-style-type: none"> ✓ Appears to be decreasing, <ul style="list-style-type: none"> ⇒ The decline is not believed to be sufficiently rapid to approach the thresholds for Vulnerable under the population trend criterion. ✓ Although some populations have unknown trends (Wetlands International 2006) ✓ The population size is very large, ✓ This species has an extremely large range, 	<p>*Treats:</p> <ul style="list-style-type: none"> ✓ Climate change & severe weather, (Level 1) <ul style="list-style-type: none"> ○ Habitat shifting & alteration, (Level 2) <ul style="list-style-type: none"> ⇒ Indirect ecosystem effects, Ecosystem degradation, ⇒ Threats to wintering grounds. ✓ Impacts around the world: <ul style="list-style-type: none"> ○ Changing their habitats, ○ Food sources, and ○ Migration cycles. ✓ Food shortages: <ul style="list-style-type: none"> ○ Due to overfishing and climate change may also be affecting populations. (http://projectpuffin.org/arte.html) <p>*Climate change:</p> <ul style="list-style-type: none"> ✓ Is already a problem for Arctic terns in their northern habitat, <ul style="list-style-type: none"> ○ They can no longer find suitable conditions in Denmark and are being forced to fly further north before settling down to breed, causing more adults to die, (http://www.newscientist.com/article/dn18379-arctic-tern-crowned-king-of-commuters.html) ✓ Is happening most rapidly at the Poles: <ul style="list-style-type: none"> ○ The Arctic tern is one of the only species that spends significant amounts of time at both extremes, <ul style="list-style-type: none"> • There is no doubt that it will be affected. (http://www.timesonline.co.uk/tol/news/science/biology_evolution/article6984164.ece) 	 <p>© Richard Packwood</p> <p>© GlobalTwitcher.com 2004-2011</p>

Species	Current conservation status	Predicted conservation status in the light of climate change	Range map
<p><i>Tringa erythropus</i>, Spotted redshank</p> <p>*Appendix II.</p> <p>*Classified as ‘Least concern’ on the IUCN Red List of Threatened Species.</p> 	<p>*It has a large global population estimated to be:</p> <ul style="list-style-type: none"> ✓ 120,000-360,000 individuals (Wetlands International 2002). <p>*The population trend:</p> <ul style="list-style-type: none"> ✓ Appears to be stable, <ul style="list-style-type: none"> ⇒ Hence the species does not approach the thresholds for Vulnerable under the population trend criterion. <ul style="list-style-type: none"> ✓ Although some populations have unknown trends (Wetlands International 2006) ✓ The population size is very large, ✓ This species has an extremely large range, 	<p>*Threats:</p> <ul style="list-style-type: none"> ✓ Climate change & severe weather, <ul style="list-style-type: none"> ⇒ Habitat shifting & alteration, ⇒ Stresses: <ul style="list-style-type: none"> ○ Indirect ecosystem effects, and ○ Ecosystem degradation. <p>(http://www.birdlife.org/datazone/speciesfactsheet.php?id=3016&m=1)</p> <p>*This species is threatened by habitat loss in its wintering range and on migration in some areas. (http://www.esabii.org/database/migrantbirds/45.html)</p>	 <p>© 2005-2011 Claude Ruchet</p>  <p>© GlobalTwitcher.com 2004-2011</p>
<p><i>Tringa glareola</i>, Wood sandpiper</p> <p>*Appendix II.</p> <p>*Classified as ‘Least concern’ on the IUCN Red List of Threatened Species.</p> 	<p>*Global population:</p> <ul style="list-style-type: none"> ✓ Is estimated to be 3,055,000–4,320,000 individuals. <p>*An estimated 100,000–1,000,000 Wood Sandpipers</p> <ul style="list-style-type: none"> ✓ Occupy the East Asian-Australasian Flyway, (Bamford et al. 2008) <p>*Population:</p> <ul style="list-style-type: none"> ✓ Total regarded as a minimum by Wetlands International (2006). <p>*The population trend:</p> <ul style="list-style-type: none"> ✓ Appears to be stable, <ul style="list-style-type: none"> ⇒ Hence the species does not approach the thresholds for Vulnerable under the population trend criterion. ✓ Although some populations have unknown trends (Wetlands International 2006) ✓ The population size is very large, ✓ This species has an extremely large range, 	<p>*The species is threatened in some European countries (such as Finland) from:</p> <ul style="list-style-type: none"> ✓ Exploitation, ✓ Peatland drainage, and ✓ Destruction for forestry and agriculture. <p>*The populations in southern Sweden, Germany and Poland have also declined:</p> <ul style="list-style-type: none"> ✓ Due to the threats of climatic change. (del Hoyo <i>et al.</i> 1996) & (IUCN) <p>*The greatest threat is:</p> <ul style="list-style-type: none"> ✓ Indirect and direct habitat loss, (Melville 1997) <p>*Global warming and associated changes in sea level are likely to have a long-term impact on:</p> <ul style="list-style-type: none"> ✓ Breeding grounds, ✓ Staging grounds, and ✓ non-breeding grounds of migratory waders. (Harding et al. 2007) 	 <p>© Adolf Rosenstingl</p>  <p>© GlobalTwitcher.com 2004-2011</p>

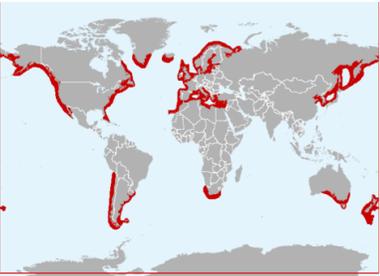
Species	Current conservation status	Predicted conservation status in the light of climate change	Range map
	<p>* The Wood Sandpiper:</p> <ul style="list-style-type: none"> ✓ is not globally threatened, <ul style="list-style-type: none"> ⇒ But the breeding population had declined in some European countries, e.g. Finland, Sweden, Germany and Poland, (del Hoyo et al. 1996) 		
<p><i>Tringa nebularia</i>, Common greenshank</p> <p>*Appendix II.</p> <p>*Classified as ‘Least concern’ on the IUCN Red List of Threatened Species.</p> 	<p>*The global population is:</p> <ul style="list-style-type: none"> ✓ About 440,000–1,500,000 (BirdLife International 2009) <p>*Internationally, four populations are recognised:</p> <ul style="list-style-type: none"> ✓ Europe/west Africa (200,000–500,000 birds), ✓ South-west Asia/east and south Africa (wintering, >100,000), ✓ Southern Asia (wintering, 10,000–100,000), and ✓ Eastern/south-eastern Asia and Australia (Delaney & Scott; 2002; Rose & Scott 1997). <p>*The population trend:</p> <ul style="list-style-type: none"> ✓ Appears to be stable, <ul style="list-style-type: none"> ⇒ Hence the species does not approach the thresholds for Vulnerable under the population trend criterion. ✓ Although some populations have unknown trends (Wetlands International 2006) ✓ The population size is very large, ✓ This species has an extremely large range 	<p>*Global warming and associated changes in sea level are likely to have a long-term impact on:</p> <ul style="list-style-type: none"> ✓ Breeding grounds, ✓ Staging grounds, and ✓ Non-breeding grounds of migratory waders. (Harding et al. 2007) <p>*The species:</p> <ul style="list-style-type: none"> ✓ Is not globally threatened, and ✓ Is considered secure due to its extensive breeding range. (del Hoyo et al. 1996) <p>*The greatest threat is:</p> <ul style="list-style-type: none"> ✓ Indirect and direct habitat loss, (Melville 1997) 	 <p>© photo by Thomas Reich</p>  <p>© GlobalTwitcher.com 2004-2011</p>

Species	Current conservation status	Predicted conservation status in the light of climate change	Range map
<p><i>Tringa totanus</i>, Common redshank</p> <p>*Appendix II.</p> <p>*Classified as ‘Least concern’ on the IUCN Red List of Threatened Species.</p> 	<p>*Its European breeding population is large:</p> <ul style="list-style-type: none"> ✓ More than 300,000 pairs. ✓ In Europe bird underwent moderate, still continuing decline. <p>*The countries with higher populations are:</p> <ul style="list-style-type: none"> ✓ Iceland, ✓ Russia, ✓ Norway, ✓ UK, ✓ Belarus, ✓ Denmark, ✓ Netherlands, and ✓ Germany. <ul style="list-style-type: none"> ○ The conservation status in Europe is Declining. <p>http://www.life-senne.sk/english/index_eng.php?page=species</p> <p>*In Europe, trends since 1980 show:</p> <ul style="list-style-type: none"> ✓ Populations have undergone a moderate decline ($p < 0.01$), <ul style="list-style-type: none"> ○ Based on provisional data for 21 countries from the Pan-European Common Bird Monitoring Scheme (P. Vorisek in litt. 2008) <p>*The population trend:</p> <ul style="list-style-type: none"> ✓ Is unknown, <ul style="list-style-type: none"> ⇒ But the population is not believed to be decreasing sufficiently rapidly to approach the thresholds under the population trend criterion. ✓ Some populations are decreasing, while others are stable, increasing or have unknown trends (Wetlands International 2006) ✓ The population size is very large, and hence does not approach the thresholds for Vulnerable under the population size criterion 	<p>*Climate change impacts on Common Redshank:</p> <ul style="list-style-type: none"> ✓ Responses governed by sea-level rise, <ul style="list-style-type: none"> ○ Will affect Common Redshank breeding in coastal areas, and ○ Have effect on all populations outside the breeding season, when the majority move to coastal areas to feed on intertidal invertebrates, (Smart and Gill 2003; Watkinson <i>et al.</i> 2004) <ul style="list-style-type: none"> ⇒ Erosion of coastal habitats (Habitat loss, e.g. Salt marsh), ✓ Responses to temperature changes, <ul style="list-style-type: none"> ○ Could have both positive and negative effects, have advanced the timing of egg laying in response to milder climates, (Crick & Sparks 1999) ○ Earlier laying dates may increase the length of the breeding season, resulting in some species either laying more clutches or having the option to relay following clutch loss, which is especially advantageous to relatively late breeding species such as Common Redshank, (Kruk <i>et al.</i> 1996) ✓ Responses driven by changes in water regimes, <ul style="list-style-type: none"> ○ Particularly on breeding habitats. <p>http://www.sfbayjv.org/pdfs/Migratory_wildlife_climate_BTO_9-05.pdf</p>	 <p>© photo by Thomas Reich</p>  <p>© GlobalTwitcher.com 2004-2011</p>

Species	Current conservation status	Predicted conservation status in the light of climate change	Range map
	<ul style="list-style-type: none"> ✓ The population size is very large, ✓ This species has an extremely large range. 		
<p><i>Cetorhinus maximus</i>, Basking shark</p> <p>*Appendices I/II.</p> <p>*Classified as 'Vulnerable' on the IUCN Red List of Threatened Species.</p> 	<p>*The population trend:</p> <ul style="list-style-type: none"> ✓ Is decreasing (population trend 2010), (CMS_ZSL_ClimateChangeReport_2011) <p>*Climate change vulnerability is medium. (CMS_ZSL_ClimateChangeReport_2011)</p> <p>*There are approximately 8,200 basking sharks left in the world (Fordham, S.V., 2006. <i>Shark Alert</i>);</p> <ul style="list-style-type: none"> ✓ These are widely distributed and only regularly seen in a few locations (Fowler, S.L. 2000. <i>Cetorhinus maximus (North Pacific subpopulation)</i>) ✓ There is some debate as to whether the Northern and Southern hemisphere populations may have evolved into different species (Solandt, J.-L., 2009. <i>Basking Shark – Cetorhinus maximus – Information – ARKive – facts and status</i>) <p>*Life history characteristics:</p> <ul style="list-style-type: none"> ✓ Long-lived, ✓ Slow-maturing, and ✓ Low reproductive potential), therefore: <ul style="list-style-type: none"> ⇒ Is considered to be extremely vulnerable to overfishing, and ⇒ Is described as 'vulnerable' by the World Conservation Union (IUCN) red List of threatened Species, (http://www.marineconservation.org.uk/baskingsharks.html) <p>*The basking shark:</p> <ul style="list-style-type: none"> ✓ Has never fully recovered from the large scale commercial fisheries of the 1950s and 	<p>*Climate change threats:</p> <ul style="list-style-type: none"> ✓ May be vulnerable to climate change, <ul style="list-style-type: none"> ⇒ Particularly in terms of their geographic range. ✓ Reduced food availability, <ul style="list-style-type: none"> ⇒ Basking sharks are selective feeders and depend on enhanced productivity near transient oceanographic features. (http://www.durhambiodiversity.org.uk/pdfs/species/fish/Baskingshark.pdf) ✓ The Britain's biggest fish (basking shark) may be moving north, <ul style="list-style-type: none"> ○ Possibly as a result of climate change and changes in the distribution of their plankton prey. <ul style="list-style-type: none"> ⇒ Leading to send the sharks north. (http://www.dailymail.co.uk/news/article-352618/Climate-change-forcing-basking-sharks-north.html) ✓ Rising sea temperatures <ul style="list-style-type: none"> ○ May be having an effect on the timing and distribution of plankton blooms (zooplankton), which are the sharks' primary food source. (http://www.wildlifeextra.com/go/news/basking-shark011.html#cr) 	 <p>© A. Lingford / Archipelagos 2009</p>  <p>© IUCN Red List of Threatened Species</p>

Species	Current conservation status	Predicted conservation status in the light of climate change	Range map
	<p>remain over-fished in the North Atlantic. (http://marinebio.org/species.asp?id=193)</p> <p>*The global status is assessed as Vulnerable, with:</p> <ul style="list-style-type: none"> ✓ The North Pacific and Northeast Atlantic stocks, which have been subject to target fisheries, assessed as Endangered. ✓ These assessments are based primarily on past records of rapidly declining local populations of basking sharks <ul style="list-style-type: none"> ○ As a result of short-term fisheries exploitation and very slow population recovery rates. (IUCN) 		
<p><i>Lamna nasus</i>, Porbeagle</p> <p>*Appendices II.</p> <p>*Classified as ‘Vulnerable’ on the IUCN Red List of Threatened Species.</p> 	<p>*The population trend:</p> <ul style="list-style-type: none"> ✓ Is decreasing, <p>*Three subpopulations of porbeagles are Critically Endangered and Endangered:</p> <ul style="list-style-type: none"> ✓ Porbeagle Mediterranean subpopulation: <u>Critically Endangered A2bd</u>; ✓ Porbeagle Northeast Atlantic subpopulation: <u>Critically Endangered A2bcd+3d+4bd</u>; and ✓ Porbeagle Northwest Atlantic subpopulation: <u>Endangered A1abd</u>. (http://marinebio.org/species.asp?id=378) <p>*North Atlantic tagging studies (DFO 1999, Kohler <i>et al.</i> 2002, Stevens 1990) indicate that:</p> <ul style="list-style-type: none"> ✓ Only one trans-Atlantic movement (Kohler and Turner 2001), ✓ Implying that the two north Atlantic populations are distinct. (IUCN) <p>*Biomass of the Northwest Atlantic Porbeagle:</p> <ul style="list-style-type: none"> ✓ Population was estimated at 4,409 t (11% of virgin biomass), and ✓ Female spawners estimated at 6,075 (10% of the virgin abundance) 	<p>*Global climate change:</p> <ul style="list-style-type: none"> ✓ Is posing a long-term threat to Porbeagle sharks and their recovery from severe depletion. ✓ Global ocean temperatures have increased by 0.10° C in the upper 700 m (ibid), <ul style="list-style-type: none"> ⇒ Porbeagles have been caught as deep as 700 m (Campana and Joyce 2004) ✓ The largest increases in global ocean temperature have occurred in the upper ocean where primary production is concentrated, <ul style="list-style-type: none"> ⇒ Warming appears to be affecting global ocean productivity (Behrenfeld <i>et al.</i> 2006) ⇒ This may result in significant future effects on some issues such as: <ul style="list-style-type: none"> ▪ The distribution of the prey resources favoured by porbeagles, ▪ The distribution of potential competitors for prey resources, and ▪ On the porbeagle’s thermoregulatory system. <p>→ Any of these adverse impacts can severely limit the potential for recovery.</p>	 <p>© Oceanwide Images</p>  <p>© IUCN Red List of Threatened Species</p>

Species	Current conservation status	Predicted conservation status in the light of climate change	Range map
	<p>(Campana <i>et al.</i> 2001)</p> <ul style="list-style-type: none"> ✓ The number of subpopulations in the southern oceans is unknown. 	<ul style="list-style-type: none"> ✓ Is leading to increase Ocean Acidification, <ul style="list-style-type: none"> ○ Affects the marine ecosystem as it affects the physiology of numerous marine organisms, with ripple effects through the food chain, (Fabry <i>et al.</i> 2008) ○ With increases in the ocean’s carbon dioxide levels, fish and other marine species may experience an accumulation of carbon dioxide in their tissues, called hypercapnia, leading to increases in internal acidity, (Fabry <i>et al.</i> 2008) ✓ This condition affects some factors such as: <ul style="list-style-type: none"> ○ Acid-base regulation, ○ Metabolic activity, ○ Respiration, and ○ Ion exchange, <ul style="list-style-type: none"> ⇒ These impacts can lead to impaired growth and higher natural mortality. (Fabry <i>et al.</i> 2008) <p>(http://www.humanesociety.org/assets/pdfs/wildlife/sharks/porbeagle_petition_01212010.pdf)</p> <p>*Some factors that potentially have adverse effects on NW Atlantic porbeagle sharks:</p> <ul style="list-style-type: none"> ✓ Global climate change ✓ Coastal pollution, ✓ Ocean temperatures, and ✓ Ocean acidification 	
<p><i>Squalus acanthias</i>, Spiny dogfish</p> <p>*Appendices II.</p> <p>*Classified as ‘Vulnerable’ on the IUCN Red List of Threatened Species.</p>	<p>*The population trend:</p> <ul style="list-style-type: none"> ✓ Is decreasing, <p>*The IUCN Red List status in different areas:</p> <ul style="list-style-type: none"> ✓ ‘Critically Endangered’ in the Northeast Atlantic, ✓ ‘Endangered’ in the Mediterranean, and ✓ ‘Vulnerable’ in the Black Sea. <p>(http://na.oceana.org/en/our-work/protect-marine-wildlife/sharks/species-at-risk/spiny-dogfish)</p>	<p>*Climate change threats:</p> <ul style="list-style-type: none"> ✓ The confounded effects of changes in climate and density on a population's demography are hard to separate for long-lived species, <ul style="list-style-type: none"> ○ Because demographic traits are usually the aggregated result of conditions faced over years. ✓ A large-scale, long-term shift in distribution rather than a transient effect associated with a particular season or short-term climate impact. <p>(http://www.freepatentsonline.com/article/Canadian-</p>	 <p>© 2007 Scott Boyd</p>

Species	Current conservation status	Predicted conservation status in the light of climate change	Range map
<p>Extinct EX EW CR EN VU NT LC</p> <p>Threatened</p> <p>Least Concern</p>	<p>*Most stocks are highly migratory, but:</p> <ul style="list-style-type: none"> ✓ There is no regional fisheries management for the species. ✓ Management is in place in only a few range states and in only a limited part of the range of highly migratory stocks. <p>*Little mixing occurs between populations;</p> <ul style="list-style-type: none"> ✓ They are found from the intertidal zone to depths of 900 m, <ul style="list-style-type: none"> ○ But mostly <200 m (at least in the Mediterranean). ✓ Usually coastal and demersal, they migrate north and south as well as near shore and offshore in 7 to 15°C water. (Compagno 1984) <p>*Is vulnerable to overfishing because of its:</p> <ul style="list-style-type: none"> ✓ Late maturity, ✓ Low reproductive capacity, and ✓ Longevity. <p>(http://marinebio.org/species.asp?id=97)</p> <p>*Fisheries stock assessments demonstrate that:</p> <ul style="list-style-type: none"> ✓ The two main North Atlantic stocks of spiny dogfish are significantly depleted. (HEESSEN 2003, SARC 2003) <p>(http://www.bfn.de/fileadmin/MDB/documents/skript118.pdf)</p>	<p>Journal-Fisheries-Aquatic-Sciences/198850540.html)</p> <ul style="list-style-type: none"> ✓ Nothing is known about how the population might be impacted by changes in prey availability or predator abundance. <p>(http://wiki.cbr.washington.edu/qerm/sites/qerm/images/1/1c/Ian_Taylor_FinalDissertation.pdf)</p>	 <p>© IUCN Red List of Threatened Species</p>

*These two pinnipeds on the table below are listed in Appendix II only regionally, for the Baltic and Wadden Seas for *Phoca vitulina* and the Baltic for *Halichoerus grypus*. Therefore, we separate them on an extra table as it is mentioned in the 16th scientific council report that they should be removed from the list.

Species	Current conservation status	Predicted conservation status in the light of climate change	Range map
<p><i>Phoca vitulina</i>, Harbour seal</p> <p>*Appendices II.</p>	<p>*The population trend is stable.</p> <p>*Some populations are small and declining.</p> <p>*Recent world-wide population estimates:</p> <ul style="list-style-type: none"> ✓ 350,000 to 500,000 animals. 	<p>*Climate induced changes to the sea ice may result in:</p> <ul style="list-style-type: none"> ✓ Changes to the prey species available to polar bears. <ul style="list-style-type: none"> ⇒ There are indications that harbour seal (<i>Phoca vitulina</i>) populations are 	

Species	Current conservation status	Predicted conservation status in the light of climate change	Range map
<p>*Classified as Least Concern on the IUCN Red List of Threatened Species.</p> 	<p>*Harbour seals live in coastal areas, ⇒ They are heavily fished, *Significant by-catch issues in some populations, ✓ e.g. in northern Japan (Burns 2002)</p> <p>*Facts that impact food chains (Prey) of harbour seals: ✓ Over fishing, ✓ Oceanographic regime shifts, ✓ Global climate change.</p> <p>*The harbour seal population in Svalbard is on the national Red List for Norway, ⇒ It is afforded complete protection.</p> <p>*Licensed killing to protect fisheries is allowed in: ✓ UK, ✓ Canada, and ✓ USA.</p> <p>*Illegal hunting probably occurs throughout the harbour seal's range.</p> <p>*Are protected in U.S. coastal waters by the Marine Mammal Protection Act.</p> <p>*Northwestern seals: ✓ Have already begun to use rocky habitats, and ✓ In Glacier Bay some have moved to new glacier sites or occupied terrestrial haulouts.</p>	<p>increasing,</p> <p>*Effect of climate change is likely to be through changes in: ✓ Distribution of their prey, and ✓ Availability of their prey.</p> <p>*Climate change has effects on sea ice: ⇒ It results in an increase of suitable habitat in the northern part of its range, and ⇒ Also results in upward migration due to global warming.</p> <p>*Glacial ice has some roles in harbour seal life, such as: ✓ Providing a birthing and molting platform, ✓ Protecting them from terrestrial predators, ✓ Providing a dry location for their first weeks of life, and ✓ Some impacts due to climate change. (Burns <i>et al</i> 1970; Johnston <i>et al</i> 2005). ⇒ There would be new factors in population conservation: ○ Disease, and ○ Predation.</p> <p>*In eastern Canada, reductions in sea ice: ✓ Increase the risk of neonatal mortality, and ✓ Epizootics due to crowding. (Johnston <i>et al</i> 2005)</p> <p>*Changes in ice coverage can have indirect effects on seal populations through: ✓ Loss of primary production, and ✓ Subsequent trophic interactions. (Garrison <i>et al</i> 1987; Honer and Schrader 1982)</p>	 <p>© 2003 Jon B. Hlidberg</p>  <p>© IUCN Red List of Threatened Species</p>

Species	Current conservation status	Predicted conservation status in the light of climate change	Range map
<p><i>Halichoerus grypus</i>, Grey seal</p> <p>*Appendices II.</p> <p>*Classified as ‘Least Concern’ on the IUCN Red List of Threatened Species.</p> <p>Extinct Threatened Least Concern </p>	<p>*Population is increasing.</p> <ul style="list-style-type: none"> ✓ But are declining in a few localities: <ul style="list-style-type: none"> ○ Continued declines in Icelandic waters give cause for concern. <p>*Current population size estimates is:</p> <ul style="list-style-type: none"> ✓ > 400,000 <p>*Total population estimates for other regions:</p> <ul style="list-style-type: none"> ✓ USA - 7,300 → increasing (Waring <i>et al.</i> 2005); ✓ Iceland - 11,600 → declining (Hauksson 2007); ✓ Norway - 3,100 → trend unknown (Wiig 1986); ✓ Ireland - 2,000 → increasing; ✓ Russia - 1,000-2,000 → unknown; ✓ Baltic Sea - 22,000 → increasing (2007, Helcom portal). <p>*Gray seal populations has reduced in the Baltic Sea due to some reasons such as::</p> <ul style="list-style-type: none"> ✓ Hunting, and ✓ Severe pollution, <ul style="list-style-type: none"> ○ Although the population appears to be recovering. <p>*Has a large population;</p> <ul style="list-style-type: none"> ✓ Which is increasing in most areas of study. <p>*Has increased 8% per year in recent years. (ICES CM 2008/ACOM: 44.)</p>	<p>*The potential effects of climate change are not well known.</p> <p>*It is unknown how decreases in sea-ice cover affect Grey Seals,</p> <ul style="list-style-type: none"> ✓ Although it will undergo a decrease in its range because of climate change. (Learmonth <i>et al.</i> 2006) <p>*Less ice due to global warming,</p> <ul style="list-style-type: none"> ⇒ Reducing the mean long-term growth rate in this population. (Jussi <i>et al.</i> 2008) <p>*Climate change has been linked to phenotypic changes in sexually selected traits. (West & Packer 2002; Møller & Szép 2005)</p>	 <p>© 2002 Michigan Science Art, LLC.</p>  <p>© IUCN Red List of Threatened Species</p>