



Global Warming: A Threat to Arctic Mammals

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Abstract

Climate change is a long term phenomenon, several changes observed in the climate of earth since 20th century are because of anthropogenic activities that includes burning of fossil fuels that increases the level of heat trapping greenhouse gases in the atmosphere, and it is raising earth's average surface temperature. The Arctic has a rich biodiversity and provides shelter to numerous plants and animals including human population of around four million. It also helps in balancing our world's climate. However, global warming due to anthropogenic activities is increasing the Arctic temperature by melting the sea ice. The root cause of this warming is the rise in concentration of greenhouse gases and the deposition of soot on Arctic ice. This temperature is increasing at a rate twice the global average and it has been estimated by some experts that ocean will rise by 23 feet by 2100 also it will lead to starvation of polar bears which indicates a major threat to Arctic's flora and fauna as well as a matter of concern. As per the report of NSIDC major drop in arctic sea ice was seen in satellite record on 17th September 2012 that is 3.39 million square kilometres. The average data for extension in the entire month of September 2012 was 3.57 million square kilometres. Changes in the arctic climate is a serious matter of concern for whole world because arctic acts as refrigerator for the entire world – it helps to cool the planet. Changes encountered in the arctic environment may also have effects that falls through the food chain, from phytoplankton to mammals. Hence, the aim of this article is mainly focused on impacts of climate change on Arctic mammals and the steps taken to save this polar habitat.

Keywords: Global Warming; Arctic Mammals; Climate Change

Introduction

Climate change is a long-term phenomenon, several changes observed in the climate of earth since 20th century are because of anthropogenic activities that includes burning of fossil fuels that increases the level of heat trapping greenhouse gases in the atmosphere, and it is raising earth's average surface temperature. The Arctic is a region surrounding the north pole of earth. The average winter temperature recorded here is -34°C while the average summer temperature varies between 3-12°C [11]. Generally, winters in the Arctic are long and cold while summers are short and

cool. There is seasonal variation of snow and ice cover in the Arctic region [1]. The Arctic is crucial due to many reasons. Arctic sea helps to maintain an even temperature on earth by acting as a huge white reflector present at the top of our planet by bouncing back some of the sun's rays. It also helps in the movement of warm and cold water all around the world by circulating the ocean currents. The Arctic is considered as one of the most biologically productive and unique ecosystem on earth. The frozen kingdom of Arctic is home to more than 21,000 known species of highly cold adapted mammals, birds, fishes, invertebrates, plants, etc. In this polar re-

gion, we will find tundra vegetation which is composed of different plants like dwarf shrubs, herbs, mosses and lichens and these grow relatively close to the surface of ground [2]. There are nearly 20 species of land animals including wolf, fox, reindeer, squirrel, musk ox, polar bear and about six species of marine mammals like walrus, seals and several cetaceans including baleen whales, belugas, narwhals and killer whales [2,3,12]. According to a recent census, there are about 240 species of fishes found in the Arctic including cods, salmon, trouts, sculpins, shrimps, eelpouts and snail fishes.

Global warming and its impact on arctic mammals

Climate change due to global warming has resulted in increased temperature of the Arctic which is warming at twice the rate as the global average (Figure 1). Sea ice is declining in area, extent and volume with a decline rate of -4.7% per decade [4]. As per the report of NSIDC major drop in arctic sea ice was seen in satellite record on 17th September, 2012 ie;3.39 million square kilometres. The average data for extension in the entire month of September 2012 was 3.57 million square kilometres. Now, the Arctic sea ice is in unfrozen condition for a longer period of time due to earlier break up and melting in the spring season and later freezing during the winter season. This loss of sea ice habitat is already causing major problems for some Arctic mammals.



Figure 1: Melting Arctic Sea ice.

Polar bear

The polar bear (*Ursus maritimus*) is the largest extant species of bear. They reside on the ice covered waters of the Arctic but spend most of their time on sea ice (Figure 2). Polar bears are found in low numbers in the far north extending up to the North Pole. The major threat to these mammals due to climate change is malnutrition and starvation which occurs due to loss of habitat. Polar bears

use sea ice as platform to hunt seals. Due to rising temperature, the sea ice melts much earlier in the year, causing them to drive near shore before they have built sufficient amount of reserved fat which helps them during the season of food scarcity. Reduction in the sea ice also forces them to swim for longer distances which eventually cause the reduction of energy stores and sometimes drowning. Malnutrition in adult females leads to lower rate of reproduction and in cubs, causes lower survival rates [5]. In addition to this, changes in sea ice affect the ability of pregnant females to build dens on the land. As the distance increases between the coast and packed ice, females have to swim longer distances to reach the desirable denning areas on the land. Thinner ice cover deforms easily and creates an obstacle in hunting seals. Warmer climate also favours the growth of disease causing bacteria and parasites.



Figure 2: Polar bear along with cubs.

Due to increasing temperature, ice-floe breakup in Western Hudson Bay, Canada started three weeks earlier than it was thirty years ago, thus reducing the duration of their feeding season [13]. This has resulted in the reduction of weight in polar bears. Polar bears are now moving towards new territory and travelling much further to inland which would result in their increased dependence on terrestrial food and increased human interaction [14]. According to U.S. geological survey, if the sea ice keeps on melting, two third population of polar bear will extinct by 2050 [15].

Arctic fox

The Arctic fox (*Vulpes lagopus*), also known as polar fox, white fox or snow fox, is a small sized fox found throughout the tundra regions of the Arctic (Figure 3). Arctic foxes are among the smallest species in their family (Canidae) with a weight ranging between 2.5 to 4 kg. They are well adapted to live in cold and extreme climate with the help of their thick and warm fur. These species prey on many creatures like lemmings, fishes, seabirds, insects, seal pups, etc. The foxes living in the lower tundra regions are in danger because of habitat loss due to climate change. They can't survive in the warming temperature of the forest [6]. Lemming population is also declining due to change in vegetation. Therefore, it will increase the food scarcity for the Arctic fox [16]. The foxes which live in northern areas and rely on sea ice could be threatened because of retreating sea ice which is used by them to travel at longer distances in search of food and to breed [17].



Figure 3: Arctic fox.

Seals

Several species of seals including the ringed seals (*Pusa hispida*), ribbon seals (*Histiophoc fasciata*) and bearded seals (*Erignathus barbatus*) are dependent on sea ice (Figure 4). The reduction of sea ice is posing a threat to them because these seals use ice as a platform to give birth and nurse their pups. The most highly affected species of seal are the ringed seals. Ringed seals require sufficient amount of snow cover for the construction of lairs. The sea ice must be stable enough during the spring for the proper rearing of pups [7]. Earlier ice breakup due to warming can result in premature separation of mothers and pups which could lead to high mortality rates among pups. Adapting to life on land in the absence of sum-



Figure 4: Ringed seal.

mer sea ice would be dangerous for them as their newborns will be under higher risk of being eaten by predators [18]. Other species of seals like spotted seals (*Phoca largha*) and harp seals (*Pagophilus groenlandicus*) are also affected as they require sea ice for shelter and ice edges for breeding [19].

Walrus

The walrus (*Odobenus rosmarus*) is a large flippers marine mammal which is discontinuously distributed along the North Pole in the Arctic Ocean and subarctic seas (Figure 5). Adult walrus are characterized by the presence of notable tusk and whiskers. For walrus in many areas, the ice edge provides them an ideal place for resting and feeding because they are bottom feeders feeding on clams and benthic shellfishes on the continental shelf [8]. As the ice edge retreats away from the shelves to deeper areas due to climate change, clams would disappear which would affect their diet. Due to warming temperatures, the Arctic sea ice is forming later and disappearing earlier, which is limiting the amount of space available for walrus to assemble together. This forces them to leave the ice and seek refuge on land where they must travel much longer distances to get their food. These massive haul outs of walrus could lead to violent stampedes and is lifethreatening for young walrus [20].

Bowhead whales

Bowhead whales (*Balaena mysticetus*) are endemic species of the Arctic and subarctic waters. Historically, the major threat to them was commercial hunting. By the time, hunting ceased to oc-



Figure 5: Walruses.

cur. Presently, the major threat to these whales is loss of sea ice due to climate change [9]. The climate change and melting ice have jeopardized the ecology of the feeding grounds of bowhead whales. The reduced sea ice cover increases the absorption of ultraviolet rays in the Arctic water which cause skin lesions in whales. With reduced ice cover, the invasive species like killer whales have been moving towards north, creating a possible competition for food and space with this endemic species. Other factors contributing to the change in population dynamics of this species are increased tourism, commercial shipping and exploration of oil and gas [21].



Figure 6: Bowhead whale.

Conservation and Further Discussions

Most of the conservation measures aims to mitigate the effects of climate change. These measures are mostly short termed and species specific, with captive care of mammals with slow growth, vaccination against various diseases and protection of multiple stocks for ensuring survival of these animals. Other conservation measures aims to protect the genetic diversity among certain species of mammals, regulation of anthropogenic activities and monitoring of population status from time to time. Various Arctic nations and participants of Arctic council are working for international protections for the Arctic Ocean. This includes working towards various treaties signed to ensure cooperation on management of marine fauna and development of a network of Marine Protected Areas. In 1973, the Worldwide Fund for Nature (WWF) convinced the five governments of the Arctic region to sign a treaty for the protection of polar bears and it was successful as ten years later, the polar bear population doubled in Norway. Presently, it is protecting more than 350,000 sq km of the Arctic from mining and oil drilling. The Arctic marine mammal commission is helping in management of risks to marine mammals in a changing Arctic. To help the Arctic from the impact of climate change, experts agreed on some ways we can take action. First of all, we need to fund research which will help us in better understanding of what the Arctic might look like in future [10]. Then we need to develop technology to reduce the quantity of carbon dioxide in the atmosphere. We also need to help the people living in the Arctic to adapt which could be done by relocating communities. We need to provide scientists with tools so that they can help us to understand and adapt to a changing Arctic more precisely. Lastly, we need to create a unified voice for Arctic action with continued global talks and decision making.

Conclusion

According to researchers the changes in the arctic are matter of concern, because they may lead to certain effects that signifies further warming. The moment white sea ice melts in summer certain areas of dark open water are revealed that has potential to absorb more heat from the sun. The extra heat that got trapped promotes melting of more ice. Now the case is that lost sea ice acts as driving force for arctic amplification. Because of all these the arctic atmosphere warms, it tendency of holding water vapour increases, and water vapour itself is an important greenhouse gas. A warmer climate due to global warming will have a crucial impact on the Arctic

and result in major changes for plant and animal species, making their survival difficult. Melting of sea ice will cause large amount of methane and carbon dioxide to be released in the atmosphere, increasing global temperatures already on the rise. The melting sea ice is creating nutritional stress in polar bears and Arctic fox. Retreating sea ice is a major threat to most seal species as they are dependent on sea ice for shelter and rearing of pups. Walrus are also being affected by the depleting ice covers and are compelled to seek refuge on land which could be dangerous for them. Whales are also exposed to UV radiation because of climate change which results in skin lesions. It is also increasing their competition for food and space with the invasive species. Immediate reduction in greenhouse gas emissions can prevent this catastrophic change, so action is required now. Awareness should be spread along with proper decision making.

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Conflict of Interest

All authors declare that they have no conflict of interest.

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