Arabian Oryx and High Temperature in Saudi Arabia

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Abstract

The phenomenon of rising temperatures caused by global warming, which is an alarming phenomenon of continuous increase in the future, as a result of the accumulation of carbon dioxide, nitrous oxide, methane, ozone and other greenhouse gases that have been increased since the 18th century. Thus, scientists expect an increase in temperature for 3-5 degrees at the end of the 21st century in Saudi Arabia. Some evidences of this increase in temperature is the increase of the world's average temperature and the increase of sea level because of ice melting in the poles. High temperature affects wildlife, which lead to extinction or change distribution patterns.

In this research I want to know the reason of Arabian Oryx extinction. and I chose this animal, because it is a desert animal threatened with extinction due to high temperature that reaches up to 45-50 ℃ and soil temperature reaching up to 60 ℃. This research show some information about Arabian Oryx, and the effect of high temperature on their reproduction, nutrition and agonistic. It will also discuss the number of deaths, how will Oryx respond in the next century and some solutions that may help us to decrease temperature such as nature energy.

1. Research Question and Hypothesis

The main question addressed in this paper are how does high temperature affect Arabian Oryx and its population? Where did this happen? And when?

In 2008 the number of the Arabian Oryx in Saudi Arabia lowered(Ismael, 2010), so I assumed the high temperature has an effect on nutrition(Williams et al. 2012), reproduction, agonistic and the number of births and deaths(Ismael, 2010). After careful Study I suggest the explanation for the extinction of the Arabian Oryx is a high temperature that causes dehydration, lack of food and lack of productivity for the Arabian Oryx. Also, I found the major causes for this increase in temperatures which are carbon dioxide and methane. In this paper, I will shows that high temperature causing drought is leading to raise extinction probability in the future.

2. Materials and Methods:

I took observations and measurements of air temperature from GLOBE program in my school by digital dual sensor thermometer (Fig.1) for three days (24, 25, 26) in November (2013, 2014, 2015). Temperature readings were obtained from presidency of meteorology environment protection in (2011, 2012, 2013) - Saudi Arabia. I focused on average maximum and minimum temperatures in Jeddah or Saudi Arabia. To document high temperature in Saudi Arabia.

Figure.1 Digital dual sensor thermometer in my school

3. Data summary and Analysis:

(Fig.2) and (Fig.3) shows temperature change or high temperature (maximum and minimum) in Saudi Arabia and Jeddah. In 2013 the maximum temperature in Jeddah has increased to 38.5C, and 40.1 in 2014, then decreases to 33.8 in 2015(Fig.1). In 2011 the maximum temperature of Saudi Arabia increased to 26.7C, then decreases to 26.1C in 2012, after that it increased to 30.9 in 2013(Fig.2). Thus, Previous studies have reveled that happens because of increasing greenhouse gases which lead to global warming (Nordell, 2003).

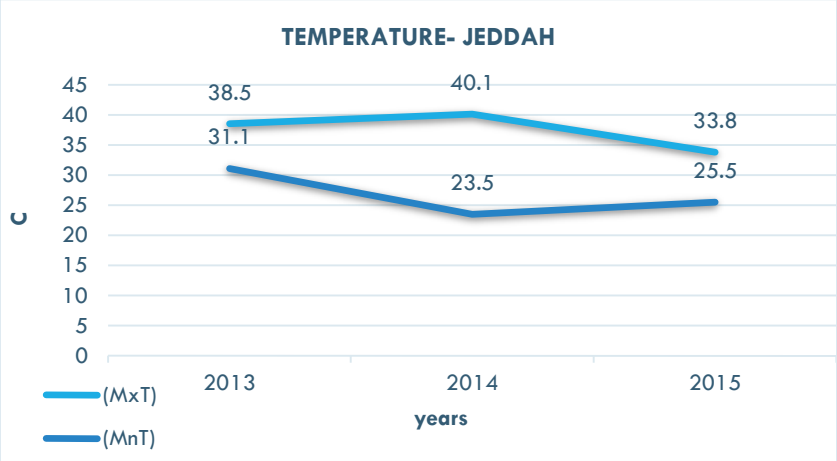

Figure.2 Jeddah temperature in the last three years on November to three days 24, 25, 26. (MxT) average maximum temperature, (MnT) average minimum temperature.

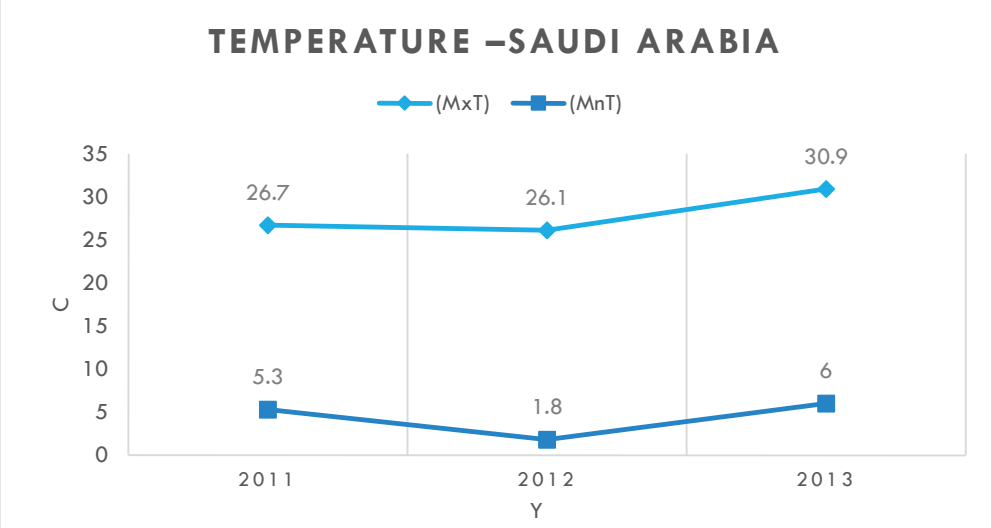

Figure.3 (MxT) maximum temperature ,(MnT)minimum temperature in Jan (presidency of meteorology envirnment protection).

4. Literature review:

4-1. High Air Temperature:

The main cause of high temperature is global warming which is an alarm to further increase in the world's temperature as a result of increasing the concentration of gases in the atmosphere such as carbon dioxide, methane, nitrous oxide, ozone and other greenhouse gases (Fig.4), which have been increased since 1800 (nordell,2001). These gases which are the result of burning fossil fuels that increased 3-5 degrees in world temperature at the end of the 21st century in Saudi Arabia (Al Zawad, 2008).

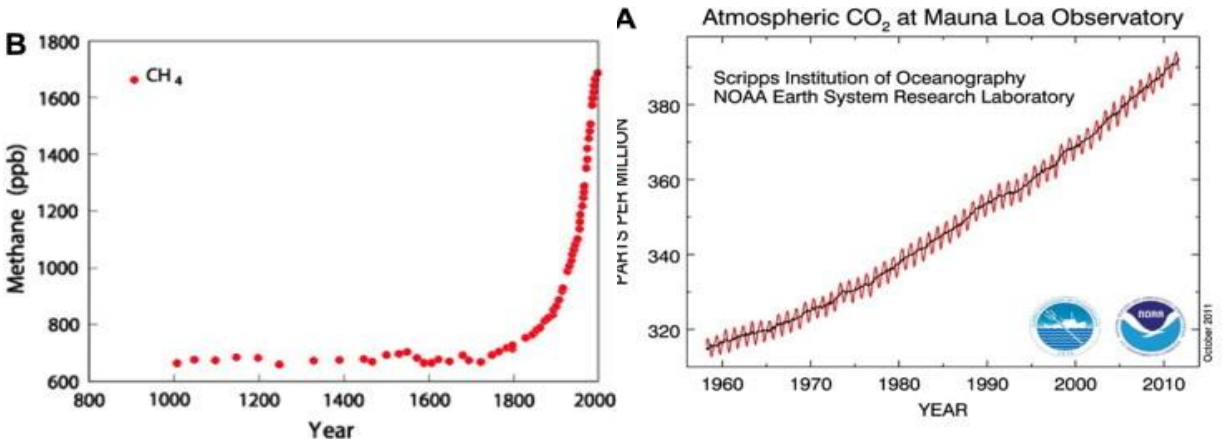

Figure.4 (A) The increase in atmospheric carbon dioxide measured at Mauna Loa, Hawaii. Units are parts per million per volume (B) The increase in methane gas in the atmosphere. Units are parts per billion (Williams et al,2012).

A. Evidence for high temperature and global warming:

The leading international body for the assessment of climate change, the Intergovernmental Panel on Climate Change (IPCC) produced a synthesis report in 2007 that concluded "warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice and rising global average sea level"(Williams, 2012) (Fig. 5). To further emphasize how the

planet is warming, the IPCC pointed out that eleven of the last twelve years (1995–2006) ranked among the warmest years on record. Increases in sea level are consistent with global warming (Fig. 5b). Global average sea level rose at an average rate of 1.8 mm per year over 1961–2003, and at a rate of about 3.1 mm per year from 1993 to 2003. More than half of the increase in sea level can be attributed to the thermal expansion of ocean water whereas about 30% came from melting of glaciers and polar ice sheets. Satellite data since 1978 showed that the extent of the annual average Arctic sea ice has shrunk by 2.7% per decade, with larger decrease in summer of 7.4% per decade. The maximum areal extent of seasonally frozen ground has decreased by about 7% in the Northern Hemisphere since 1900 (Fig. 5c), with decrease in spring of up to 15%. Glacial ice atop mountains the world over has been rapidly melting (Thompson, 2010) . Since 1912, 85% of the ice on the African mountain Kilimanjaro has melted, visible evidence of warming in the air (Thompson et al, 2009) . In 1910, there were 100 glaciers in Glacier National Park in Northern USA. In 2011 there remain 26 glaciers, and by 2030, it is projected that all glacial ice will have melted in this park (Williams et al,2012).

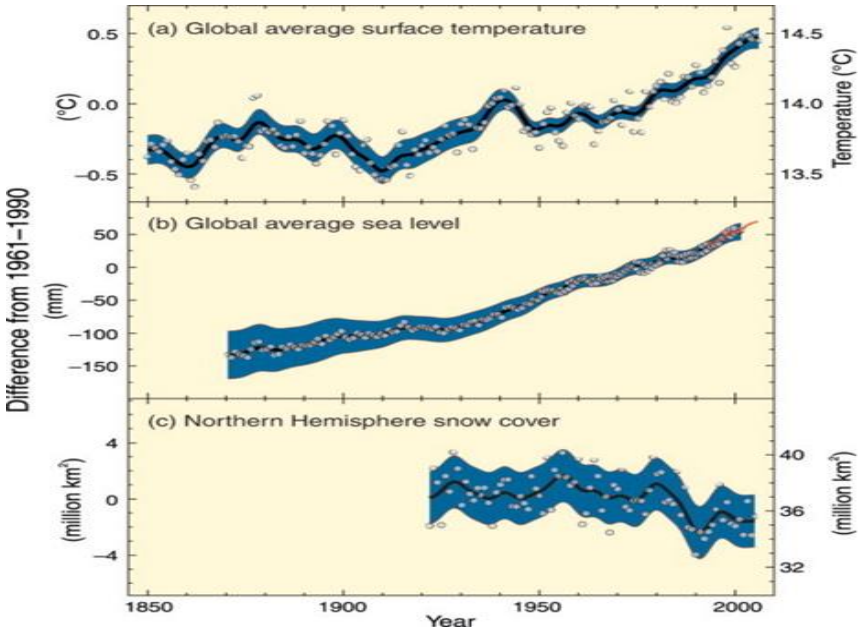

Figure.5 (a) global average surface temperature; (b) global average sea level from tide gauge (blue) and satellite (red) data; and (c) Northern Hemisphere snow cover for March –April (Williams et al,2012).

B. The effect of high temperature on animals:

The desert animals that live in Saudi Arabia Can't immigration because the temperature that is often 45℃ in the air and 60 ℃ in the soil (Tieleman et al., 2003). And this heat maybe effect on animals, then animals must change their distribution patterns, extinction and change in community (Hughes, 2000) (Fig.6).

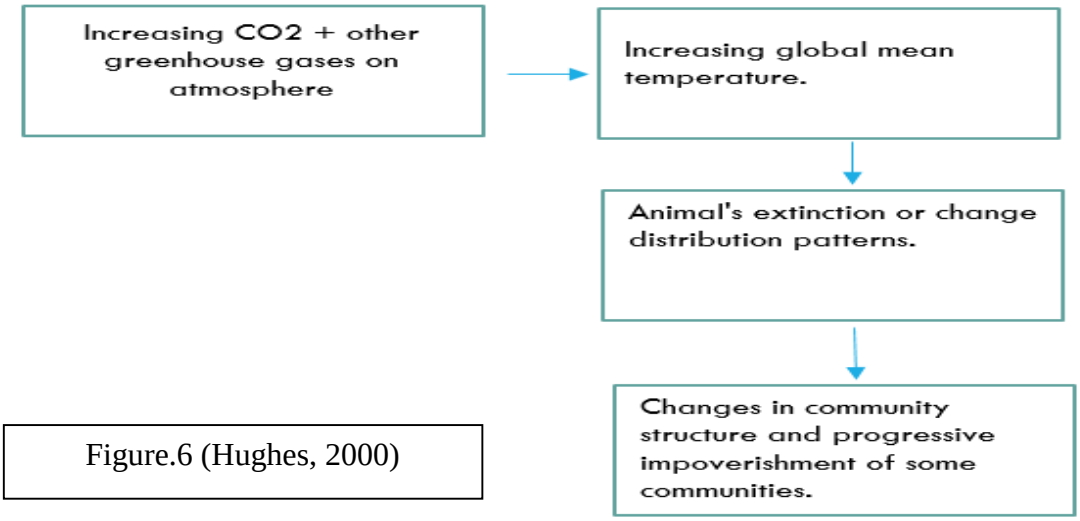

Figure.6 (Hughes, 2000)

4-2. Arabian Oryx:

Arabian Oryx or (Oryx Leucoryx) is one of the wild animals having the ability to live in the harsh desert environments where temperature is up to 50℃ in the summer. The Oryx ranged throughout the Arabian Peninsula was extirpated from the wild by 1972 (Henderson, 1974). In 1990, Arabian Oryx were reintroduced into Mahazat as-Sayd, a large protected area (160·km north-east in Taif).

A. Scientific classification:

Kingdom: animals, phylum: Chordata, Class: Mammalia, Order: artiodactyla, Family: bovidae, Sub family: Horse-like Antelopes or Hippotraginae. Arabian Oryx is classified according to the classification (IUCN) as at risk and it is included in Appendix one of the Convention on International Trade in species of wild flora and fauna endangered (CITES) since 1975 (Ismael,2010).

B. Places where Arabian Oryx live:

Arabian Oryx lives in Saudi Arabia on plateaus or desert like Al-Dahnaa, Al-Nafud, Rub al-Khali. (Fig.7) explain Arabian Oryx distribution areas in Saudi Arabia in 18,19 century and the possible corridor areas(Stewart,1963).

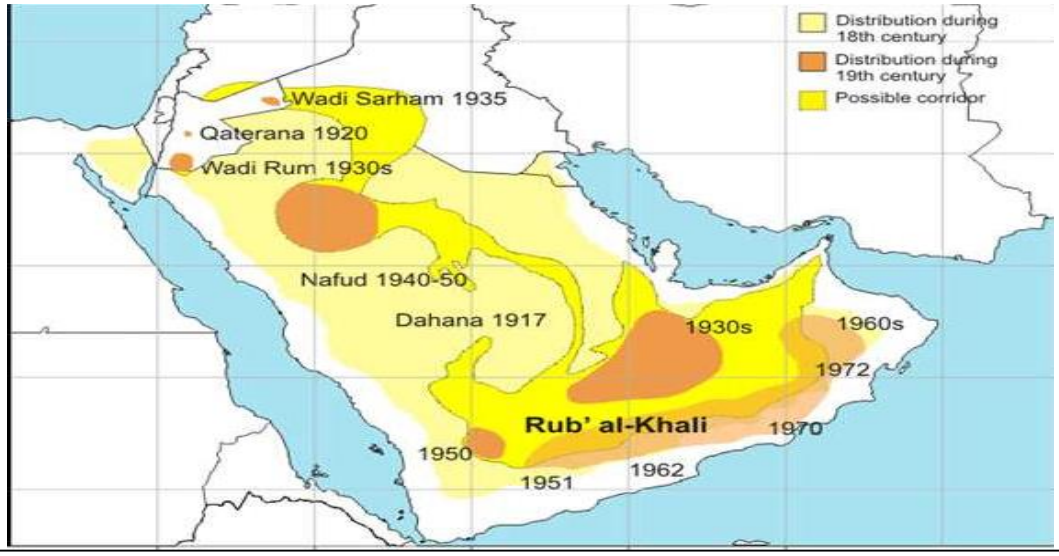

Figure.7 (Stewart, 1963)

C. Arabian Oryx description:

Arabian Oryx has bright white coat reflecting the sun's rays, and splayed hooves, shovel-like, providing a large surface area which give them the ability to walk on the sandy ground (Macdonald, 2001). The legs are brown in color, with white bands on the ankles. Arabian Oryx of both sexes have magnificent straight, ringed horns that can reach up to 68 cm in length: those of the female are thinner and longer than the male. Males have a tuft of hair on the throat, and the tails of both sexes are tufted at the ends (Nowak,1999). For other qualities of Arabian Oryx is Length: 160 cm, Shoulder height: 81 – 102 cm, Average male weight: 90 kg, Average female weight: 80 kg (www.arkive.org).

4-3. The Effect High of Temperature and Drought on the Arabian Oryx Behavior

A. Arabian Oryx nutrition:

Arabian Oryx has one of the lowest mass-specific water-influx rates among ungulates living in hot environments: 76.9% below allometric prediction in summer (Williams et al, 2012). During the hot Arabian summer, Oryx on average consumed 1310 mL H2O per day in their food, whereas in spring when the vegetation contained more water, they consumed 3438 mL H2O per day. Estimated that Oryx would have to increase their water intake by 19%, a requirement that would be difficult to meet in their desert environment. During summer Oryx feed at night when the relative humidity is higher than during the day, because a night allows them to avoid the extremes of daytime solar radiation. The evidence for that is Taylor experience (1968) when he dried the leaves of Diasperma, a desert plant, and then placed the leaves at 17° C-85% RH, 23° C-39% RH, and 40° C-17% RH (Fig.8). He noted that the leaves at the highest relative humidity and lowest temperature gained the most moisture. So when the global temperature warms, air temperature will increase at night, and humidity will decrease. This will result in Oryx obtaining less water in the grasses they eat (Williams et al,2012).

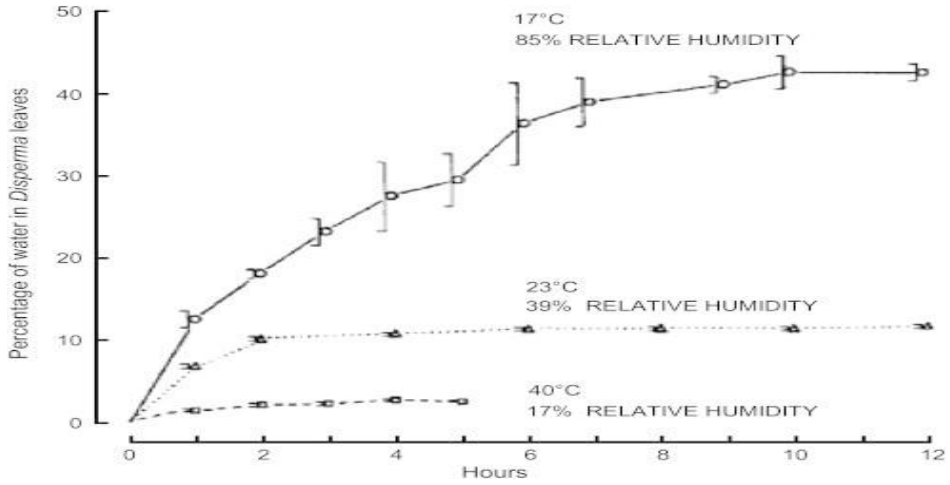

Figure.8 (Williams et al,2012)

B. Arabian Oryx reproduction:

During the study period, Arabian Oryx has record 333 cases of mating in the summer and spring, 57 cases (17%) in the dry period, 276 cases in the spring. and that explains the difference between the two cases. Strauss Researcher found that The best behaviors mating's in the spring compared to the summer and autumn, then they found the babies of female Arabian Oryx increase in the rain years of Rub' Al-khali. In 1995 the rate of Arabian Oryx female who has baby was 62%. but After increasing rain, the rate was 97%, then Decreased to 13% between 1999-2000 (Ismael, 2010). That means the reproduction decreased in drought and when the air temperature increasing. In 1988-1997 a study was conducted on Arabian Oryx born in wilds and Arabian Oryx born in captivity (Ostrowski et al, 1998)(Fig.9). We can notice in (Fig.9) the wilds-born are increased that captive-born.

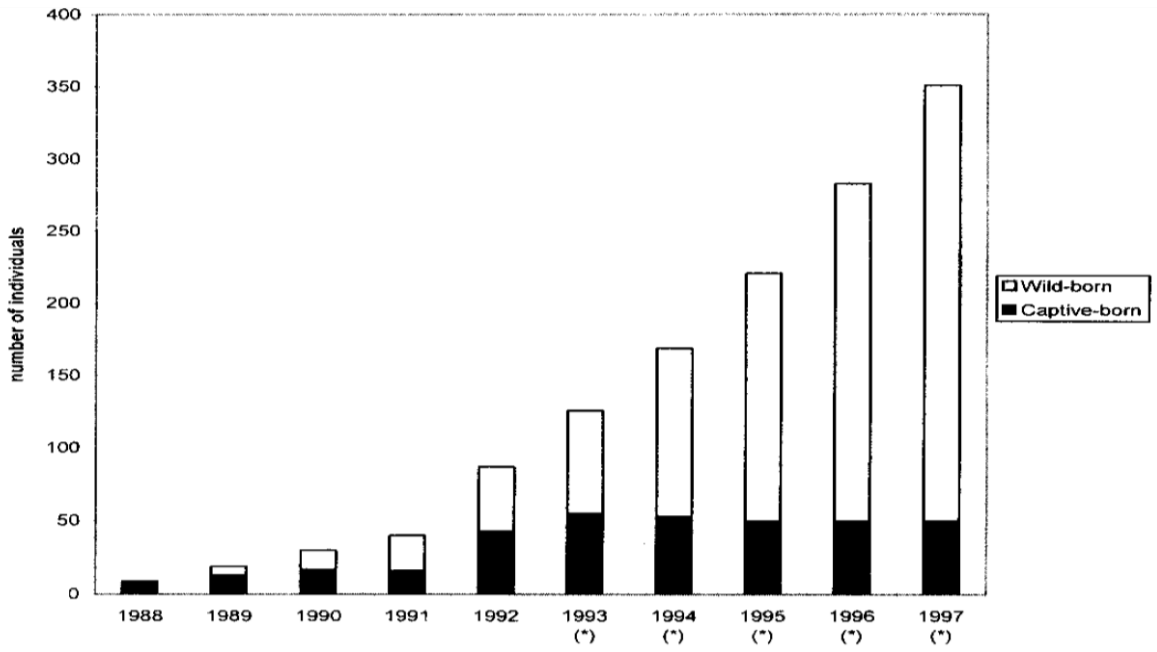

Figure.9 (Ostrowski et al,1998)

C. Agonistic:

In Feb 2008 - May 2009 the researchers found in the drought 2 cases of agonistic, but after rainy season the cases increased to 62. The researchers said that agonistic Decreased, because in the drought period the demand for food become less (Ismael, 2010).

D. Arabian Oryx respond in the next century:

We expect an increase in air temperature from 3 to 5 in the next century, then daytime and nighttime temperatures will be higher. Hence, Arabian Oryx will not be able to reduce their body's temperature as low at night as they are used to do now (thermoregulate), so they will likely be forced to use more water to thermoregulate themselves to their worm environment. However, it would be difficult to meet water in their desert environment (williams et al, 2012).

4-4. Number of deaths:

In the begin of 1999, scientists recorded in Mahazat as-said protected areas many deaths and this Continuous until the present time, that happened inasmuch to high temperature, which in turn led to obtain periods of drought successive protected struck from 1999 to 2008 (Table 1). High temperature and drought lead to poverty, less food, or maybe the female of Oryx aborts her baby's or dead due to hunger. As for Oryx child, scientists recorded cases for leaving the mother of her children, because lack of food or harsh climate. And this phenomenon happened in the summer of Namib desert (Fig.10) (Ismael, 2010).

Figure.10 (Ismael, 2010)

Year	No of mortalties
1993	9
1994	4
1995	7
1996	11
1997	9
1998	30
1999	34
2000	26
2001	35
2002	20
2003	37
2004	36
2005	13
2006	52
2007	71
2008	159

Year	Number of calves
1993	32
1994	47
1995	65
1996	76
1997	86
1998	87
1999	40
2000	24
2001	94
2002	75
2003	61
2004	17
2005	81
2006	62
2007	8
2008	2

Table 1 (left) number of deaths, (right) number of births in (Mahazat as-said)

5. Results, Conclusions, and Discussion:

The researcher Williams and presidency of meteorology environment protection showed that air temperature in Saudi Arabia or in the world is increasing (Fig.3)(Fig.5), but in (Fig.1) the result change because the data I have took from GLOBE were imprecise, so that the data differ from researchers data. I concluded that Oryx mothers usually leave her babies in the drought period. also the reproduction, agonistic and the humidity in the Oryx food will lessen in the future. For more evidences we can notice that the number of births decreases to 2, but the number of deaths increasing to 159 and the Oryx who born in the wilds have the ability to survive more than the Oryx born in the captive.

In conclusion, the researcher and I suggest many ideas to reduce environment pollution that lead to Arabian Oryx extinction, such as solar energy, wind energy, heat energy, tidal energy, sea wave energy and hydro energy to generation electric energy and don't use Fossil fuels that lead to high temperature and global warming.

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