Effect of Polychlorinated Biphenyls (PCB) on the immune system and survival of killer whales.

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ABSTRACT

Polychlorinated Biphenyls (PCB) have been used as coolants in electrical devices such as air conditioners, capacitors since they are good insulators. Though PCB was banned more than 30 years ago, PCB led to enormous contamination of the biosphere and has affected the wildlife population. PCB concentrations have been found to be very high in the tissue of the high trophic level killer whales (Orcinus orca). This has led to disruption of their immune system, has increased risk of disease like cancer which is leading to declination of killer whale population and causing local extinction.

The effect of PCB on whale population was studied by compiling available data on blubber PCB concentrations of killer whales around the world, then this data was compared to the known concentration of PCB and response relationship graphs to find out the reproductive success, their survival rate and mortality rate due to immunotoxicity related disorders. The loss and gain of PCB in blubbers is simulated through lactational or placental transfer to the fetus or calf. Potential annual population growth rate (λ) was also calculated in order to study the effect of PCB on the killer whale population.

It has been found that chronic exposure to PCB can have long term effects. Killer whales residing in the Brazilian, Japanese, Canary island regions have a greater risk of their population collapsing in the coming 100 years, whereas Canada Southern and Alaskan transient whale populations are at a moderate risk of population collapse. Earlier killer whales were found to be present in every ocean of the world, but nowadays they are found mostly in the clean waters of Arctic and Antarctic oceans. PCB contamination is a big reason to this. Food source has been also found to be an important factor for PCB accumulation, since PCB accumulation occurs via biomagnification through the trophic levels. Killer whales feeding on marine mammals accumulate 10-20 times more PCB than those whales feeding on lower trophic level fish. Females also show lower PCB accumulation than males due to maternal lactation during fetal development.

Keywords : Biomagnification, Contamination , Lactation, Survival, Whale