THE TOP DOWN CONTROL IN TERRESTRIAL ECOSYSTEM: A REVIEW TO UNDERSTAND DOMINANT PREDATOR EFFECT ON SUB-ORDINATE PREDATOR.

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ABSTRACT:

Majority of papers address the top down control of predator in aquatic environment and effect on prey and vegetation in terrestrial habitat. Understanding the regulation of sub-ordinate predator by dominant predator in terrestrial environment is important to manage the ecosystem. The interaction in carnivore community is difficult to document in natural environment yet is an important aspect of carnivore conservation and management. The monitoring and maintenance of a) top predator prevent trophic cascade and mesopredator release, b) prey and habitat according to carrying capacity of carnivore guild helps in co-existence of sympatric carnivore, as well as in mitigating human-carnivore conflict. However, the studies oriented to understand relationship of top predator with sub-ordinate predator is limited and dominantly addressed in one of the three axis of niche partitioning (the diet, diel and habitat usage). The effect on mesopredator in abundance or absence of top predator is found to be patchily studied for major predator species across the world.

KEYWORDS: top-down control, carnivore, terrestrial habitat.

INTRODUCTION:


In a Predator Prey system both Mesopredator release and Intra-guild predation occur (Palomere et al 1995) as in Top predator (limited by competition), mesopredator (limited by predation and competition) and prey (limited by predation); though the indirect effect on vegetation by top predator is a debated question (Polis et al 1999, Schmitz et al 2000). Also, the Optimal foraging theory doesn't link top predator with small sized prey, however the research development in top down control contradicted the theory (Palomere et al 1995, Courchamp et al 1999, Letnic 2009, Brashares et al...
Since studies to understand trophic cascade due to elimination, decimation, reintroduction of top predator requires long-term data in natural ecosystem, it is considered difficult logistically and being ethically challenging (Trewby 2007). However, due to elimination of top predator in natural ecosystem like wolf, dingoes and African lion provided such opportunity (Glen et al 2007, Berger et al 2008, Sinclair et al 2011, Ripple et al 2013). Experimentally certain studies prove individual behavioral shift in sympatric sub-ordinate predator due to top predator (Watt et al 2010).

The present literature review investigated the following question in a terrestrial top down control:

**The effect on the lower carnivore community with Increase /Decrease in abundance and elimination/reintroduction of top terrestrial predator.**


**RESULT:**

The literature search for terrestrial carnivore top down control synthesized into 28 research. Multiple research from similar area especially oriented to fox, coyote was eliminated. Terrestrial predator effect on only herbivore and involving invertebrate predator was further eliminated from the synthesis. The top predator whose effect and regulation on lower trophic carnivore is observed in natural environment is tiger, wolf, lion, dingoes, lynx, coyotes, puma, badger and feral cats. Hypothesis of few of the individual studies on sympatric carnivore did not include to understand top down control and inter-specific competition. The studies which concluded niche overlap but no direct effect on subordinate predator by dominant predator was excluded from the following synthesis.

<table>
<thead>
<tr>
<th>S.No</th>
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<th>Top predator status</th>
<th>Effect of Top-down control/ trophic cascade</th>
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<tbody>
<tr>
<td>1</td>
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<td>Author(s)</td>
<td>Year</td>
<td>Region/Species</td>
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</table>

**DISCUSSION:**

The literature synthesis established top down regulation by predator in terrestrial ecosystem. The diversity in predator level can affect the intensity of top-down effects by niche complementarity or intraguild predation and interference between predator species (Straub et al 2008, Stachowicz et al 2007). However, such intensity observation is difficult for terrestrial mammalian predator due to their cryptic behavior. The terrestrial mammalian community studies mainly focus on three axes to understand co-existence of sympatric carnivores; The diet partitioning, the diel partitioning and the habitat partitioning. The body size decides the social dominance amongst predator and hence the subordinate carnivore avoid the dominant predator on one or more of the above-mentioned axes. Studying the overlap between sympatric carnivore on any one of the three axes fail to highlight the top down control due to body size by tiger (Wang 2009, Sevlan, 2013, Lovari 2015, Sugimoto et al 2016). Where top down control and biodiversity regulation is reported for wolf (Beschta and Ripple, 2007, Ripple and Beschta, 2008), Dingo (Letnic et al 2012, Dickman 2009), lion (Sinclair et al 2010), it was observed that such studies lacked for tiger. The avoidance of tiger by subordinate predator leopard and dhole is reported (Morse 1974, Harihar et al 2011, Mondol et al 2012). The co-existence amongst tiger, leopard and dhole is driven by principal prey (Ramesh et al 2012) or habitat heterogeneity (Karanth et al 2000), large size prey density (Seidensticker, 1976), contradicts the theory of top-down control by tiger. The
co-existence of sympatric carnivore is said to be facilitated by expulsion rate of subordinate predator by dominant predator (Seidensticker, 1976).

Apart from few, diversity of carnivore studies proffers that top down control regulates the carnivore communities. The mesocarnivore whose distribution may widely be affected not only by habitat, anthropogenic effects but also by carnivore community interaction cannot be monitored over large scale due to logistic constraints and elusive nature of the species. However, certain management intervention has been undertaken which had been positive as well as negative in long run e.g controlling exotic rodents by feral cats to conserve endangered kakapo (Courchamp et al. 1999), persecution of dholes was undertaken to save livestock but it resulted in increase in wild boar hence more crop raiding and loss of agricultural fields (Wangchuk 2004). The management of ecosystem can benefit from understanding carnivore community.

The social impact of loss of top predator has also resulted spread of diseases and change in living condition of people apart from change in attitude e.g. reduction of lion and leopard resulted in olive baboon release, more crop raiding and spread of diseases in humans and also the children had to leave school to guard the agricultural fields (Brashares et al 2010). The estimation and monitoring of carrying capacity of various trophic carnivore and their prey can involve timely managerial intervention. This would prevent dispersal of sub-ordinate carnivores to fringe areas of forest causing human wildlife conflict.

REFERENCES


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