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A Review of the Trophic Cascade Concept Using the Lens of Loop Analysis: “The Truth is the Whole”^{1,2}

by

Patricia A. Lane³

Abstract:

Trophic cascades have been assigned an exaggerated even mythic status by some ecologists, but they are only one type of pathway in a complicated food web. The human mind is drawn to patterns like the proverbial ‘moth to the flame’. The distinctive checkerboard pattern of alternating + - + - + changes in populations on adjacent trophic levels in a trophic cascade is no exception. Unfortunately, this pattern has been too frequently equated with unrealistic ecological significance. Loop analysis, a qualitative network methodology, analyses all pathways and feedbacks in a food web simultaneously and it identifies many aspects of food web structure and function like trophic cascades, distinguishes operating from non-operating pathways, and predicts changes in standing crops and their correlation patterns. In this paper, the trophic relationships of food chains are expanded systematically into food web models that help illustrate some of the earliest claims about trophic cascades and their role in food webs. Several current definitions are contrasted to the loop analysis results. A more precise definition for a ‘top-down’ trophic cascade is proposed as well as the term ‘trophic escalade’ for particular types of ‘bottom-up’ trophic pathways that are also consistent with loop analysis. Suggestions for identifying trophic cascades are provided. Loop analysis, as an observing lens, provides an improved perspective on the role of trophic cascades. As Hegel claimed, “The truth is the whole”, and it cannot be found in an isolated part, in fact, the process of isolation precludes this possibility.

Key Words: Trophic Cascade, Trophic Escalade, Food Web, Loop Analysis, Keystone Predator

¹ Quotation from the German philosopher, George Hegel, (1807). In: “The Phenomenology of the Mind”. Preface: Paragraph 20. In German: “Das Wahre ist das Ganze”.

² Abbreviations: ATCH = Apparent Trophic Cascade Hypothesis, EEH = Ecosystem Exploitation Hypothesis, FW(s) = Food Web(s), GWH = Green World Hypothesis, KP(s) = Keystone Predator(s), LA = Loop Analysis, PI(s) = Parameter Input(s), TC(s) = Trophic Cascade(s), TDC = Trophic Dynamic Concept, and TE(s)= Trophic Escalade(s)

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