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# Integrated Pest Management (IPM) for Vertebrates: Do We Need to Broaden this Concept?

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**ABSTRACT:** The concepts and practices of Integrated Pest Management (IPM) are historically grounded in programs aimed at insects and disease-causing organisms affecting agriculture. When applied to vertebrates, IPM concepts have most often been used in rodent control programs. Still, IPM is a powerful model that arguably can, and should, apply to conflicts with any “pest” or problem-causing organism. It may be time to examine contemporary IPM approaches and their relation to traditional vertebrate pest control more closely. Vertebrate IPM should encompass not only the development of sound and practical steps to shape decision-making and actions, but a dialogue about ethics as well. From such dialogue, codes of practice that combine IPM concepts with standards developed elsewhere for vertebrate pest control should be forthcoming.

**KEY WORDS:** animal welfare, integrated pest management, IPM, pest, urban wildlife, vertebrate pest control

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## INTRODUCTION

In the three decades since the term formally came into usage, IPM (Integrated Pest Management) has become almost a household word. To the homeowner, IPM is the “right” way to control pests since it involves approaches aimed at reducing the use of chemicals. To the agricultural producer, IPM incorporates a comprehensive and holistic management approach that helps maximize effective as well as economical ways to control crop pests. To the practitioner, IPM represents a highly successful combination of science, technology and policy (Fitzner 2002) that has rapidly become a dominant paradigm in pest control. IPM is also an educational and marketing success, being promoted through messages that resonate well with the general public (Quarles 2009). Today, with an emphasis on global climate change and the greening of technologies, IPM seems destined to become even more mainstream. Although IPM addresses organisms as varied as pathogens, plants (especially weeds), invertebrates and vertebrates, it has been so traditionally associated with the control of insects as to warrant the label “entomocentric” (Kogan 1998). IPM’s place and role with respect to Vertebrate Pest Control (VPC) is addressed here.

## BACKGROUND

Humans undoubtedly began to control plant pests as soon as agriculture appeared, probably around ten to fifteen thousand years ago. Such controls would at first have been mechanical, beginning with simple practices like hand removal. But, as soon as strategies such as altered planting schedules and the introduction (or encouragement) of predatory species began to be practiced, the multi-tactical approaches that define IPM would have been in place.

Modern approaches to the control of agricultural pests began to appear early in the nineteenth century, and by its close had become named disciplines. John Curtis, an English entomologist, was one of the first practitioners of “Economic Entomology,” as suggested in his 1860

publication *Farm Insects: being the natural history and economy of the insects injurious to the field crops of Great Britain and Ireland with suggestions for their destruction*. In the United States, C. Hart Merriam gave form to the control of vertebrate pests in agriculture by establishing an office of “Economic Ornithology” in 1885. That office almost immediately expanded to focus on mammals as well, and by the turn of the twentieth century had become the Division of Biological Survey, precursor to today’s USDA Wildlife Services (Robinson 2005). The principal focus of the Division was on agricultural and agropastoral concerns, while other pest issues – such as the control of commensal rodents – fell usually to municipal agencies or private entities (Fall and Jackson 1998). Still, in taking on the issue of rapidly growing populations of wildlife, especially introduced species such as the house sparrow (*Passer domesticus*), the Division was laying the ground upon which later programs aimed at “burgeoning” populations of wild animals would be focused (Moulton et al. 2010). The participation of state wildlife agencies in the control of problem-causing vertebrates is a quite recent and as yet highly eclectic activity (Hadidian 2008).

Approaches advocating “integrated control” and “integrated management” for agricultural pests first appeared in the 1930s, but these were overshadowed almost immediately by the rise of organosynthetic pesticides, creating for IPM a period in the 1940s and 50s that has been referred to as its “dark ages” (Kogan 1998). Then, Rachel Carson’s *Silent Spring* (1962) ended that age, as the environmental consequences of over-dependency on chemical controls rose as a societal priority. By 1965 the concept of “management” was replacing “control,” largely following the argument that control subsumed the working of biotic and abiotic factors acting independently of human action, whereas management implied direct human action and influence (Fitzner 2002).

In 1972, the term “Integrated Pest Management” and its acronym IPM came into popular use after President

Nixon used them in a message to Congress, followed shortly by their formal adoption in a report to Congress from the newly formed Council on Environmental Quality (CEQ). Significant federal investment in the concept of IPM dates from that time, with major projects being funded to both implement programs as well as begin an educational process whereby producers were encouraged to adopt IPM practices (Fitzner 2002, Kogan and Jepson 2007).

### IPM CODES OF PRACTICE

Despite (or perhaps because of) its rapid development as a practical model, IPM is even today a concept without an agreed-upon definition (Kogan 1998). Rather, IPM remains associated more with a set of major principles, such as “integration” (meaning the harmonious use of multiple methods), “management” (as a set of decision rules based on ecological, economic and social considerations) and “economic injury level” (as a trigger for management action). The traditional steps taken in an IPM approach can be loosely described as: 1) Identify the species causing the damage, 2) assemble information on its biology and ecology, 3) monitor the damage being caused, 4) determine the damage threshold that will trigger action, 5) choose among available management options, 6) act (manage), 7) monitor for the consequences of that action, and 8) evaluate the efficacy of the action (e.g., Dent 1995, Witmer 2007). Such steps have been contemporized into what can be called “practitioner’s” approaches, such as 11-step procedure advocated for National Park Service employees (DiSalvo 2009):

- Describe your site management objectives and long-term priorities
- Build consensus with stakeholders (ongoing throughout the process)
- Document decisions and maintain records (ongoing throughout the process)
- Know your resource (site description and ecology)
- Know your pest
- Monitor pests, pathways, and human and environmental factors, including population levels and phenological data
- Establish “action thresholds,” the point at which no additional damage or pest presence can be tolerated
- Review available IPM tools and best management practices
- Define responsibilities and implement the lowest risk, most effective pest management strategy, in accordance with applicable laws, regulations, and policies
- Evaluate results, determine if objectives have been achieved, and modify strategy if necessary (adaptive management)
- Education and outreach. Continue the learning cycle, return to Step 1.

Approaches such as this underscore the idea of “continual improvement,” a key component of contemporary IPM (Fitzner 2002), as well as introduce concepts already influencing theory in the wildlife sciences, such as Best Management Practices and Adaptive Management. The familiarity of much of what

is practice in IPM with accepted approaches in VPC leads to a central question: are they already one and the same?

### IS VERTEBRATE PEST CONTROL IPM BY ANOTHER NAME?

Within two decades following the arrival of IPM as a named discipline, Berryman (1992) reported that “integrated damage management” was being “widely accepted” by wildlife managers, and suggested its expansion beyond methodology to involve the human dimension of control programs, including coordination, public support, and cooperation. Fall and Jackson (1998) noted that actual IPM approaches had been slow to come into use in VPC, but that IPM had given vertebrate pest managers the “framework” with which to consider the future. Conover called it “incumbent” on wildlife managers to “use their knowledge to identify an integrated solution...” (2002:395) and provided examples of these in closing the first comprehensive text on wildlife damage management. Most recently, Witmer (2007) provided an in-depth look at the use of IPM approach in the control of vertebrate pests, noting that it had not been as “fully explored and implemented” as IPM for invertebrates and that there would be challenges that practitioners of vertebrate IPM were likely to face in the future. On the other side of the street, IPM traditionalists have not seemed especially keen on including vertebrates as yet into their disciplinary efforts. The National Research Council’s (1996) report on ecologically based pest management, for one example, makes no mention at all of vertebrates as pests, and many contemporary texts (e.g., Dent 1995) appear to follow suit.

Clearly, there is no current movement to establish VPC and IPM within the exact same domain. The reasons for this may have to do with adherence to tradition (on both sides), concern over methodologies that would be applied to organisms so different as vertebrates and invertebrates, and competition with concepts arising from within more traditional disciplinary areas. Early in the development of IPM, Marsh (1981), as one example, expressed concerns about whether IPM would work for vertebrates because of their quite different life histories than those of invertebrates, as well as concern that the IPM practice of biological control, especially the release of one introduced species to control another, might be problematic – a concern well appreciated today. Then there is the practical issue that many current VPC practices simply cannot be considered to be IPM at all. The aerial application of organophosphate avicides and use of ground-based fuel-air explosions to control redbilled quelea (*Quelea quelea* sp.) in South Africa (Lotter 2008) is but one example of VPC practices that fall well outside the parameters of IPM.

To a large extent, IPM concepts have to be viewed as but a part of, and perhaps competing with, a rich variety of theoretical constructs in wildlife science and policy, all of which have relevance for VPC. Integrated Wildlife Damage Management (IWDM) is an important element in USDA Wildlife Services’ strategic planning (USDA 2010) and NEPA compliance (USDA 1994), and concepts such as Adaptive Management (e.g. Parkes et al.

2006), Structured Decision Making (Lyons et al. 2008), Theory of Reasoned Action (Laufer and Knuth 2004), Adaptive Resource (ARM) and Adaptive Impact (AIM) Management (Enck et al. 2006) and Ecologically Based Rodent Management (Belmain 2007) all crowd a field of ideas intended to help direct managers navigate the increasingly complex environment of both biological control as well as sociocultural engagement.

The context within which such ideas are expressed is significant as well. Demands for environmental responsibility, interest in biodiversity conservation, and concern for the right or wrong treatment of animals are associated to a significant extent with the rise of an urban demographic (Kellert 1984). The growth of subdisciplines such as urban wildlife and the concentration of many human-wildlife conflicts within urban and suburban areas create special environments for the practice of vertebrate pest control where traditional paradigms are both unlikely to work or to be accepted (Hadidian 2008). Both IPM and VPC should look beyond their current conceptual and methodological frameworks to include ethical constructs as well.

### IPM, ETHICS, and VPC

That there is an ethical framework already for IPM would be argued by those quick to point out that *Silent Spring* was, among other things, a seminal discussion about environmental ethics. But given that organisms such as weeds, pathogens, and insects dominate its program focus, it is perhaps understandable that little consideration might be given within IPM for the interests of individuals. This is not to say, however, that the subject has gone entirely unaddressed. Lockwood (1987), for example, argued for a "minimum ethic" (we should not cause harm to those who cause us no harm) for insects, and Samways (1990) extended that moral principle (do not be cruel) within an ethics framework (biodiversity conservation) to argue that it is "right" to preserve the genotype-phenotype relationship (that is, individuals) since this tends to preserve genetic diversity.

With vertebrates there has been little reluctance to look at ethical issues associated with control (e.g., Feare 1994, Eggleston et al. 2003, Mellor and Littin 2003, Warburton and Norton 2007), even if the question of whether the interests of individuals and their treatment remains open. Given the focus of VPC on populations (and sometimes entire species) and their control, such concerns can often be minimized. This produces some interesting problems. By way of example, while the ethics of rodent control is now being discussed more broadly within VPC (Mason and Littin 2003), even while standards for and regulation of their treatment is of far greater societal concern when they are the subjects of experimental research than when they are being treated as pests (Meerburg et al. 2008).

### VERTEBRATE PEST CONTROL – CODES OF PRACTICE

The very general acceptance that wild animals are subjects of moral concern, even when their behavior is injurious to human interests, represents a significant step forward within vertebrate pest control. Beyond the

circulating moral concerns and discussions about ethics lies action, of course. A practical next step in examining the relationship of VPC and IPM would be to bring a set of principles and standardized practices into focus. Combining with theory emerging from within the wildlife sciences, contemporary IPM principles can provide an ideal framework from which to think about establishing codes of practice for VPC.

Some of this ground has already been covered well enough that elements can be taken from existing sources (e.g., Fisher and Marks 1996, Marks 1999, Littin et al. 2004) to compile a preliminary stepwise approach following both the IPM model as well as considerations more germane to the control of vertebrates. A minimum prescriptive approach for control of vertebrate pests might ask that the:

- The need to act be clear (justification)
- Benefits be realistic (achievability)
- Methods reliably achieve benefits (effectiveness)
- Approach be targeted (specificity)
- Methods be morally grounded (humaneness)
- Consequences be known (evaluation)
- Benefits be maintained (follow-up).

The similarities to IPM codes of practice should be apparent, and the need for further refinement obvious. These, in conjunction with the pluralistic ethical strategies advocated as necessary in addressing vertebrate control (Eggleston et al. 2003, Warburton and Norton 2007), may arm practitioners with approaches that could effectively cut through much of the discord and disagreement surrounding vertebrate pest control. A modest, if largely symbolic, gesture to move IPM and VPC into better alignment might be to change the oft-used term "Vertebrate Pest Control" to "Vertebrate Pest Management." Following that, an effort might be undertaken to find an alternative to using the term "pest" in both.

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