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## Public acceptance of management methods under different human–wildlife conflict scenarios

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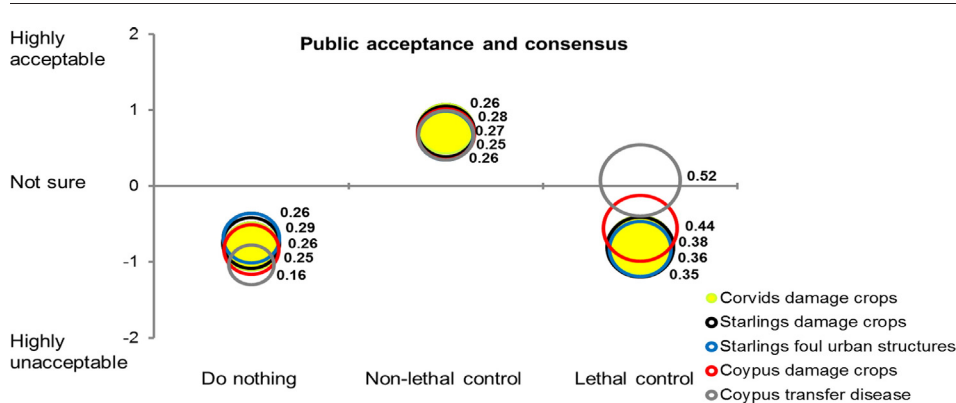
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### HIGHLIGHTS

- Public preferred non-lethal over lethal and no action options to control wildlife.
- Lethal control was controversial among segments of the public.
- Farmers and hunters were more supportive of lethal control than the general public.
- Support of lethal control increased with increasing threat level.
- Support of lethal control was higher for non-native than for native species.

### GRAPHICAL ABSTRACT



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### ABSTRACT

Wildlife management seeks to minimise public controversy for successful application of wildlife control methods. Human dimensions research in wildlife seeks a better understanding of public preferences for effective human–wildlife conflict resolution. In face to face interviews, 630 adults in Greece were asked to rate on a 5-point Likert-like scale their acceptance of 3 management methods, i.e., do nothing, non-lethal control, and lethal control, in the context of 5 human–wildlife conflict scenarios: 1) corvids damage crops; 2) starlings damage crops; 3) starlings foul urban structures; 4) coypus damage crops; and 5) coypus transfer disease. Univariate GLMs determined occupation, hunting membership and their interaction as the stronger predictors of public acceptance, generating 4 stakeholder groups: the general public, farmers, hunters, and farmers-hunters. Differences in acceptance and consensus among stakeholder groups were assessed using the Potential for Conflict Index<sub>2</sub> (PCI<sub>2</sub>). All 4 stakeholder groups agreed that doing nothing was unacceptable and non-lethal control acceptable in all 5 scenarios, with generally high consensus within and between groups. The lethal control method was more controversial and became increasingly more acceptable as the severity of scenarios was increased and between non-native and native species. Lethal control was unacceptable for the general public in all scenarios. Farmers accepted lethal methods in the corvids and starlings scenarios, were neutral in the coypus damage crops scenario, whereas they accepted lethal control when coypus transfer disease. Hunters' opinion was neutral in the corvids, starlings and coypus damage crops and starlings foul urban structures scenarios, but they accepted lethal methods in the coypus transfer disease scenario. Farmers-hunters considered lethal control acceptable in all 5 scenarios. Implications from this study could be used for designing a socio-ecological approach which incorporates wildlife management with public interests. The studied species have a wide distribution, therefore present findings might also prove useful elsewhere.

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## 1. Introduction

Human–wildlife conflict (HWC) occurs “when the needs and behaviour of wildlife impact negatively on the goals of humans or when the goals of humans negatively impact the needs of wildlife” (Madden, 2004, p. 248). HWC can lead to outcomes adversely affecting human societies in varying degree of severity, such as crop damage, damage of private or public property, disease transmission to humans and livestock (Conover, 2002; Treves et al., 2006). Management methods that have been developed and applied for the prevention and mitigation of HWC can be categorised into non-lethal, which do not cause direct harm on wildlife (e.g., exclusion from crops, translocation, contraception) and lethal, which aim at the direct reduction of the population of the species in question (e.g., shooting, poisoning). Conflicts can arise when the level of acceptability of management methods for a species varies between different segments of the public. In addition, the acceptability of a method may vary between different HWC situations.

An understanding of how the public perceives particular management methods can help wildlife authorities minimise controversy when choosing among management alternatives (Decker et al., 2006; Teel and Manfredo, 2010). There are several studies in the literature on the preferences for wildlife management methods, mainly from North America (e.g., Loker et al., 1999; Sponarski et al., 2015; Teel et al., 2002), but also from Europe (e.g., Bremner and Park, 2007; Dandy et al., 2011; Jacobs et al., 2014) and elsewhere (e.g., Akiba et al., 2012; Kaltenborn et al., 2006; Koichi et al., 2013). Jacobs et al. (2014) found that goose management interventions were controversial among Dutch people. However, the acceptance of invasive methods such as ‘shake eggs’ and ‘hunt’, increased with increasing severity of the conflict, namely ‘geese spoil recreation area’ versus ‘geese damage crops’. Frank et al. (2015) found that while the general public in Central Italy was in favour of providing preventive measures and compensation for ecological and economic damage of wild boar (*Sus scrofa*), they did not like approaches that directly impacted wild boar numbers. Farmers, the group most impacted by wild boar damages, supported all management tools as long as the approaches selected reduced wild boar economic impacts on agricultural land. Similarly to the general public, hunters were supportive of providing preventive measures and compensation. However, reducing wild boar density represented a controversial topic for this group since these practices subtract game from hunters and affect their ability to hunt. In this article, the acceptance among the Greek public of different management methods is examined in the context of different HWC scenarios to determine differences between stakeholder groups and inform sound wildlife management.

### 1.1. Potential for Conflict Index<sub>2</sub>

Research studies in human dimensions of natural resources apply survey and analysis methods to measure and understand complex concepts such as motivations, attitudes and norms, mainly aiming at informing and improving decision making (Vaske, 2008). The Potential for Conflict Index<sub>2</sub> (PCI<sub>2</sub>) and an associated graphic technique for displaying results were developed to facilitate understanding and interpretation of statistical information (Vaske et al., 2010). A detailed description of the program for calculating, graphing, and comparing PCI<sub>2</sub> values can be found at <http://warnercnr.colostate.edu/~jerryv/PCI2/index.htm>. PCI<sub>2</sub> ranges from 0.0 to 1.0. The least amount of consensus and greatest potential for conflict (PCI<sub>2</sub> = 1) occurs when responses are equally divided between two extreme values on a response scale (e.g., 50% highly unacceptable, 50% highly acceptable). A distribution with 100% at any one point on the response scale yields a PCI<sub>2</sub> of 0.0 and suggests complete consensus and no potential for conflict.

As an aid to understanding and interpretation, survey results can be visualised in bubble graphs (Vaske et al., 2010). Each bubble depicts the evaluation of a particular issue by the public or segments of the public (e.g., farmers, non-farmers). The size of the bubble depicts the

magnitude of the PCI<sub>2</sub> and indicates the degree of potential conflict (or consensus) regarding acceptance of that issue. A small bubble represents little potential for conflict (i.e., high consensus) and a larger bubble represents greater potential for conflict (i.e., low consensus). The center of a bubble represents mean evaluative response as plotted on the y-axis. The bubble’s location shows whether respondents’ average evaluations for a variable are above, below, or at the zero neutral point (i.e., a management action is, on average, acceptable, unacceptable, or neutral). A large bubble that straddles the neutral line suggests that, although the mean evaluation is neutral, an action would be controversial among respondents. On the other hand, a small bubble above or below the neutral line indicates consensus among respondents on the acceptance or rejection of the action.

### 1.2. Formulation of hypotheses

Human dimensions research posits that important sociodemographic factors that are likely to differentiate public attitudes towards and preferences for wildlife management methods include age and gender (Agee and Miller, 2009; Akiba et al., 2012), occupation and place of residence (Kansky et al., 2014; Naughton-Treves et al., 2003), hunting membership (Brooks et al., 1999; Frank et al., 2015), species’ provenance (Bremner and Park, 2007; Olszańska et al., 2016) and familiarity with local wildlife species and knowledge of impacts (Loker et al., 1999; West and Parkhurst, 2002).

Species commonly involved in HWCs in Greece include: a) corvids such as the hooded crow (*Corvus cornix*), the western jackdaw (*Corvus monedula*), and the Eurasian magpie (*Pica pica*); b) the European starling (*Sturnus vulgaris*); and c) the non-native Coypu (*Myocastor coypus*). Based on the literature and local knowledge, the effects of sociodemographic factors (i.e., age, gender, occupation and hunting membership), species’ provenance and knowledge of species’ presence in the area on the acceptability of three general management methods (i.e., do nothing, lethal control, and non-lethal control) were examined for five HWC scenarios: 1) corvids damage crops; 2) starlings damage crops; 3) starlings foul urban structures; 4) coypu damage crops; and 5) coypu transfer disease. Mean acceptance and PCI<sub>2</sub> were calculated and the following hypotheses were tested:

- H1.** Segments of the public will differ in mean acceptance of and consensus (i.e., PCI<sub>2</sub>) for different management methods.
- H2.** Species’ provenance (native or non-native) will influence mean acceptance of and consensus (i.e., PCI<sub>2</sub>) for different management methods.
- H3.** The severity of HWC will influence mean acceptance of and consensus (i.e., PCI<sub>2</sub>) for different management methods.

## 2. Methodology

### 2.1. Study area

The study area was in North Greece, in the District of Eastern Macedonia and Thrace, which includes a mosaic of forests, lowland plains and built environments. Agriculture is an important economic sector in the area, including seed producing crops (mainly corn, rice and sunflower), nuts (mainly almonds, walnuts and chestnuts), cotton, olives, fruits (mainly peaches, melons, figs, grapes, kiwis, cherries, apples and berries) and vegetables.

The family Corvidae includes species with widespread distribution, nine of which have been recorded in Greece (Handrinos and Akriotis, 1997). The hooded crow, the western jackdaw and the Eurasian magpie are lowland species resident in the study area. These species will hereafter collectively be referred to as corvids. The European starling, hereafter starling, also has a widespread distribution, being resident in North Greece, with migratory influxes in winter (Handrinos and

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