IRIS AperTO

UNIVERSITÀ DEGLI STUDI DI TORINO

AperTO - Archivio Istituzionale Open Access dell'Università di Torino

The management of the introduced grey squirrel seen through the eyes of the media

This is the author's manuscript

Original Citation:

Availability:

This version is available http://hdl.handle.net/2318/1719520 since 2019-12-18T10:47:53Z

Published version:

DOI:10.1007/s10530-019-02084-9

Terms of use:

Open Access

Anyone can freely access the full text of works made available as "Open Access". Works made available under a Creative Commons license can be used according to the terms and conditions of said license. Use of all other works requires consent of the right holder (author or publisher) if not exempted from copyright protection by the applicable law.

(Article begins on next page)

12 October 2024

Biological Invasions (2019) 21:3723–3733

The management of the introduced grey squirrel seen through the eyes of the media

Simone Lioy · Andrea Marsan · Andrea Balduzzi · Lucas A. Wauters · Adriano Martinoli · Sandro Bertolino

Simone Lioy: Department of Agriculture, Forest and Food Sciences, Via Largo Braccini 2, Università di Torino, Italy.
Andrea Marsan · Andrea Balduzzi: Department of Earth, Environmental and Life Sciences, Corso Europa 26, 16132 Genova, Università di Genova, Italy.
Lucas A. Wauters · Adriano Martinoli: Department of Theoretical and Applied Sciences, Via J.H. Dunant 3, 21100 Varese, Università di Varese, Italy.
Sandro Bertolino: Department of Life Sciences and Systems Biology, Via Accademia Albertina 13, 10123 Torino, Università di Torino, Italy.

Abstract Communication plans are fundamental for the success of conservation programs, especially when dealing with alien species. In a media-saturated society the effectiveness of communication could be evaluated through the information reported by the media, as an indicator of public attitudes towards a particular issue. We evaluated the effectiveness of a communication campaign by analysing the perception of the media towards management activities to control grey squirrel populations. A media content analysis was performed to classify the news in categories regarding their attitude towards the project. A total of 166 articles were analysed, which corresponds to a mean of one article every nine days along the four-years project. News followed peaks of interest in specific periods, generally related with milestones of the project. Half of the negative news regarded management activities in an urban area, despite the softer management approach adopted, with surgical sterilization of animals instead of their euthanasia after live-trapping. A reinforcement of the communication focused in Liguria inverted the trend of negative news which decreased over time, indicating the effectiveness of communication activities. Public support is fundamental for the successful implementation of eradication and control plans. Considering the role of media in informing and driving public opinion, media monitoring is routinely included in the development of management projects. We suggest that a media content analysis can be used as a performance indicator to evaluate the communication effectiveness of conservation projects, helping to identify negative trends so to proactively react.

Keywords
alien species, control plan, eradication, media content analysis, public attitude

Introduction

It is now widely recognized that the introduction of alien species is one of the major threats to biodiversity and a driver of ecosystems changes (Vilà et al. 2010; Bellard et al. 2016). Since there is no sign of saturation in the increase in number of introduced species, the impacts they produce will inevitably exacerbate in the future (Seebens et al. 2017). Failing prevention, the control or eradication of populations are key conservation tools to mitigate the impacts caused by established alien species (Genovesi 2005; Jones et al. 2016).

However, science is only one part of the pathway for successful conservation actions. The conservation process should involve three main sectors of the society: scientists, the public, and policy makers (Baron 2010; Phillis et al. 2013). In facts, laymen and policy makers sometimes do not support, or deliberately oppose to, the efforts made by scientists to remove invasive species (Genovesi 2005; Bremner and Park 2007; García-Llorente et al. 2008). This choice originates from negative attitudes towards intrusive forms of wildlife management, which include wildlife trapping or killing. Negative attitudes could stem from mutualistic wildlife value orientations, common in urbanized areas (Manfredo et al. 2009), a well-known problematic context for management activities (Wauters and Martinoli 2018), and from negative emotions connected with wildlife killing (Jacobs et al. 2014). However, the effect of these two drivers of negative attitudes about wildlife management could be partially offset by providing citizens and decision makers with information about invasive species and their impacts. Information could change individual beliefs over a certain topic, paving the ground for attitude change, at least when attitudes are not grounded in complex belief networks (Heberlein 2012). Moreover, information could also re-frame a certain topic, making people adopt a different perspective about it and developing new emotional dispositions. These two tasks could be achieved by mass media, one of the main sources of information for citizens, which is regularly integrated into communication campaigns both by scientists involved in invasive species control and by their counterparts with conflicting interests (e.g. animal right associations).

Mass media have a major influence in defining issues that citizens consider as most priority and directing our attention to specific aspects of these issues. This influence of the media on setting priorities in the public society is referred to as the agenda-setting role of the news media (McCombs 2005). The theory comes from a study that showed how the issues that a group of undecided voters during US presidential elections regarded as the most important correlated with the coverage in the news media they used to follow (McCombs and Shaw 1972). Since then, hundreds of papers showed the agenda-setting influence of the media (McCombs 2018).

The study from McCombs and Shaw (1972) considered undecided voters, since they are more exposed to the influence of the media. In fact, the media-dependency hypothesis assert that public opinion could particularly be affected by mass media when the audience has little experience with a particular issue and its attitudes are not stable (Gamson and Modigliani 1989; Bengston 2000; McCombs 2018). According to Weaver (1977), an individual's need for orientation depends on the relevance of a topic to himself and the uncertainty he has. If an issue is not personally relevant, people do not feel to need for orientation on that issue. On the other hand, for issues considered relevant the level of uncertainty may influence the need for orientation. If a person already possesses all the information it needs about an issue, uncertainty is low as the need of orientation. However, when a topic is relevant and there is the feel to not have all the information needed, the request for orientation is high.

Media do not only give people information on the issue relevant for them, but also how to think about the issue. Firstly, the media could act in a passive way, transmitting the information correctly and faithfully. Secondly, the media could take a more active role, framing the message and influencing how people perceive an issue or an event (Shoemaker and Reese 1996; Roskos-Ewoldsen et al. 2002). Journalists, sometimes unconsciously, but often deliberately, choose words and images that have the power to influence how the audience interpret and evaluate issues (Park and Kleinschmit 2016).

The framing of media coverage, i.e. the journalistic tendency to draw attention to certain features of an issue while minimizing attention to others, could affect public understanding of a topic, influencing the level of its acceptance (Cappella and Jamieson 1997; Shih et al. 2008). Therefore, media-coverage could be a key factor determining the level of support for management actions (Bremner and Park 2007).

The effectiveness of communication campaigns and the attitudes of the general public towards a particular issue, could be evaluated with different methods. Surveys are commonly adopted for this purpose. However, conducting a robust mixed-mode survey over a representative sample of respondents is often too expensive and too time-consuming for conservationists (Bremner and Park 2007; Hart et al. 2011). On the other hand, in a media-saturated society the information reported by the press could be considered as an indicator of public attitudes (Gamson and Modigliani 1989; Shoemaker and Reese 1996). Therefore, an alternative method to evaluate the effectiveness of communication campaigns is the content analysis of news published by media (Fish et al. 2002; Whatmough et al. 2011).

Analysing the content of media coverage, is a method that could help understanding the communication environment and public attitudes regards a topic of interest. This is traditionally done through content analysis, '*a research method that uses a set of procedures to make valid inferences from text. These inferences are about the sender(s) of the message, the message itself, or the audience of the message*' (Weber 1990). Media content analysis (MCA) is the systematic analysis of media content to determine the presence of specific terms or concepts in a text and to infer meaning from such content in a given context (Bengston 2000; Krippendorff 2004). MCA is a methodology used to describe '*who says what, through which channel, to whom and with what effect*' (Shoemaker and Reese 1996).

MCA was used since 1927 to study the effects of political propaganda and it was recently adopted in conservation biology to evaluate public attitude toward protected areas (Whatmough et al. 2011), large predators (Jacobson et al. 2012; Bathia et al. 2013; Chandelier et al. 2018), or citizen science (Fish et al. 2002). This method can be used with a quantitative criterion, identifying characteristic words or sentences inside the text that allows a successively categorization of the news, or with a qualitative criterion, analysing the text as a whole, considering the narrative, the rhetoric and the phrases' interpretation (Mayring 2000; Macnamara 2005). These two criteria can also be combined, increasing the efficiency of the analysis (Krippendorff 2004; Macnamara 2005).

A media content analysis was applied to evaluate the efficiency of a communication campaign during a wide scale control project with the aim to limit the spread of the Eastern grey squirrel (*Sciurus carolinensis*). The introduction of this American species in Europe is associated to a dramatic decline of the native Eurasian red squirrel (*Sciurus vulgaris*) through competitive (Gurnell et al. 2004; Bertolino et al. 2014) and disease-mediated interactions (Tompkins et al. 2002; Romeo et al. 2018). The survival of the Eurasian red squirrel in a great part of its range is therefore linked to the possibility of halting the spread of the grey squirrel in Italy and in the rest of Europe (Bertolino et al. 2008; Di Febbraro et al. 2016, 2019).

In 2010, a European funded project started with the aim to develop methods to control or eradicate grey squirrel populations in order to safeguard the red squirrel (Tattoni et al. 2006; Bertolino et al. 2008). Since grey squirrels were present also in urban and suburban areas, a major challenge of the project was to obtain a wide consensus of citizens for control measures suitable in different socio-ecological situations. This was particularly challenging because grey squirrels are cute and charismatic, with a positive appeal to people. In the past, grey squirrel management strategies in Italy have been influenced and even stopped by animal right groups (Bertolino and Genovesi 2003). Furthermore, a survey performed at the beginning of the project revealed a low level of awareness in the public about the presence of the grey squirrel and the threats it poses to native species (Authors unpublished data). Therefore, a large-scale public-relations campaign using both traditional and modern media was developed in order to sensitize the public opinion and gather support to the management activities.

Here we applied a MCA to evaluate the effectiveness of the communication actions performed by the project. Collected articles were classified as positive, neutral or negative in respect to the management targets and their temporal trends were correlated with important milestones of the project.

Methods

Management activities

The project area included three regions in north Italy where the grey squirrel was established with expanding populations: Piedmont, Lombardy and Liguria. Squirrel management actions were linked with the population size and the extent of the species distribution areas. In Lombardy and Piedmont, where the grey squirrel was present in many areas with populations of different sizes, the management aimed to a spatial containment of large grey squirrel populations and the eradication of more localized populations. Here animals were live trapped and euthanized. In Liguria, only a single and small population (about 300 animals) was present inside an urban park in Genoa Nervi, where citizens were accustomed to see and feed the animals. Here, a removal method with euthanasia of the animals was considered difficult to be accepted by citizens, with a possible strong opposition to the whole project. Therefore, a softer and generally more accepted approach was adopted, with the capture of the squirrels, their surgical sterilization and their release in another urban park (Bremner and Park 2007, Bertolino 2013, Scapin et al. 2019).

Media content analysis

A MCA, both qualitative and quantitative, was used to assess the effectiveness of the communication campaign. Media available to the public, such as newspapers, magazines, web news, radio and television programmes, were searched for information concerning the target species or the project. Since we expected a strong opposition to the project from animal right groups (Bertolino and Genovesi 2003), we were particularly interested into what was happening in the media arena. Therefore, from the beginning of the project, we collected all articles and podcasting related to the project or to squirrels and alien species more in general. We used Google search engine to screen the web and gather relevant articles from online newspapers and magazines. Furthermore, main national and local newspapers and magazines were also searched in the paper version.

MCA can be conducted either by hand or with the aid of a computer. In this work, a hand content analysis was used for article classification. After an initial training session that involved the entire research group, used to design and refine the coding procedure and its application, the primary researcher (SL) conducted most of the research, by reading news and highlighting words and phrases used for coding. A sub-sample of articles was also coded by another researcher (SB) to ensure consistency in the assessments (Krippendorff 2004; Macnamara 2005). Furthermore, the assessment of every article in respect to highlighted phrases was cross-checked by both authors.

The articles were analysed with the combination of two techniques, the semantic analysis approach (qualitative criteria) and the key words approach (quantitative criteria, see supplementary material) (Macnamara 2005). Afterwards, the articles were divided into three categories in respect to its position to the project: *i)* neutral, the news is reported objectively and the journalist do not express its opinion; *ii)* positive, the news generally support the project or some of its activities; *iii)* negative, the news is reported highlighting critics or a clear opposition to the project or some of its activities (further details in Supporting Information). Categories were mutually exclusive, and a single article could only be placed in one of them. We consider that both positive and neutral articles might have contributed to increase awareness in the public opinion on the impacts caused by alien species and

therefore, they should be viewed in an additive way. Some examples of sentences used to allocate the articles into the three different categories are reported in the supplementary material.

Different variables were then collected for each article (Supplementary Table S2), in order to evaluate their correlation with positive, neutral or negative news. The influence of these variables was evaluated with a Multiple Correspondence Analysis with the Burt method. In addition, the publication date was recorded, and the trend of positive and neutral or negative news related to the activities carried out by the project. Statistical analyses were performed with the software R (R Core Team 2015).

Results

A total of 166 articles were analysed, which corresponds to a mean of one article every 8.8 days along the four-year project. Overall, 62 (37.4%) articles were classified as neutral, 52 (31.3%) as positive and 52 (31.3%) as negative towards the project, a distribution which did not deviate from an expected distribution of 1/3 in each category ($\chi^2_2 = 1.20$, $p = 0.55$). However, considering together positive and neutral articles, 114 of these (68.7%) allowed a potential increase of the awareness of citizens on environmental issues, overcoming the negative articles ($\chi^2_1 = 23.2$, $p < 0.001$).

Overall, 83 articles (50.0%) were focused specifically in the Liguria region, 29 (17.5%) in Lombardy, 7 (4.2%) in Piedmont and 47 (28.3%) in the whole project area. The frequency values of the three categories of articles were different between the three regions involved in the project (Fig. 1), with a higher frequency of negative articles in Liguria in respect to other areas of interest.

Local media published 120 (72.3%) articles, of these 44 (36.7%) were negative towards the project and 34 (28.3%) positive; conversely, national media published only 46 (27.7%; local vs. national $\chi^2_1 = 5.13$, $p < 0.05$) articles, of these only 8 (6.7%) were negative and 18 (39.1%) positive. Articles on the project were published mainly on web pages (54.2%) and followed immediately by daily newspapers (38.6%). In 84 cases, the journalists signed the news. On average they wrote about the project a mean of 1.2 (SD 0.5) times, however one author in Liguria wrote 19 (22.6%) articles about the project, 58% were negative. The topic mostly followed by the media was squirrel trapping and sterilization in Liguria (46.4%), followed by a general description of the project (30.1%); other topics were rarely followed by the media, e.g. control of grey squirrels in Piedmont or Lombardy (7.2%), squirrel trade (4.8%) and other minor topics. The number of articles with staff interview (31.3%) was lower than the number of news without staff interview (68.7%). When other people not working for the project were interviewed (43.4%), a higher number of negative news was published (44.4%) than strictly positive news (23.6%). Finally, 68 (41.0%) articles reported a reference to environmental, animal right NGOs or other type of associations: animal right NGOs had a more negative attitude towards the project (9 negative, 2 positive and 4 neutral articles) while, on the contrary, environmental NGOs have a more neutral or positive attitude (6 negative, 12 positive and 18 neutral articles) (Fisher's Exact test $p < 0.05$).

The Multiple Correspondence Analysis model which explains the largest variance of the data with the lower number of dimension corresponds to a model with four categorical variables and four supplementary categorical variables (Table 1 and Supplementary Table S3). With this configuration, the first dimension explains the 30.3% of the variance and the second dimension the 14.2% (total variance explained of 44.5%). The correlation of the categorical variables with the two dimensions are reported in Table 1. Negative articles were mainly published by daily media or web-news, with a geographic focus in Liguria and with topic on trapping squirrels in urban parks. Conversely, positive articles were highly related with national media with a geographic focus on the whole project area, with topics that covered invasive alien species, the ban for exotic squirrel trade and the description of project activities (Fig. 2 and Supplementary Table S3).

Articles on the project were not published uniformly along the years but followed peaks of interest in specific periods (Fig. 3), generally related with some activities of the project (Table 2).

After peaks of negative news in 2013, a new communication plan focusing on Liguria was launched in 2014, just before the start of trapping and sterilization of animals. The number of local negative articles decreased significantly from March 2013 until September 2014 (Fig. S1, $F_{1,7} = 6.05$, $p < 0.05$, $R^2 = 0.46$). However, a single event (a sterilized animal found as roadkill) was interpreted as negative by the media, changing the decreasing trend ($F_{1,8} = 3.27$, $p = 0.11$, $R^2 = 0.29$ see Supplementary Fig. S1).

Discussion

This study is the first effort to describe and understand how the media covered and framed a large-scale project on the management of an introduced species. We used a media content analysis to measure the efficiency of a communication campaign during a project aiming at controlling introduced grey squirrel populations. The control activities on the grey squirrel had an impact on the media in Italy, with a mean of one article published on the project every 8-9 days along four years, though news were not published evenly during the period. This confirms how the control of invasive species, especially those that induce empathy such as squirrels and many mammals and birds, may be perceived as controversial by the public and, consequently, by most media (Genovesi and Bertolino 2001; Breemmer and Park 2007).

News have been classified more or less one third in each of the three categories. Considering those classified 'neutral' as positive for the project, since they increase the awareness of citizens on this issue and more in general on the problems connected to invasive alien species, the project received, overall, a good support from the media, especially if we consider the critical target to control or eradicate an invasive squirrel. Indeed, approximately 70% of the published news were communicating positively or at least in a neutral way the issues addressed by the project, bringing to the media and consequently to the public the topic of invasive alien species.

Surprisingly and unexpectedly at the beginning of the project, despite the softer approach adopted in Liguria with surgical sterilization of animals instead of euthanasia, half of the negative news regarded management activities in this area. In fact, control measures in urban parks frequented by citizens could generate higher media attention than similar or even more impacting management actions in low-density rural areas. This is also emphasized by the strong emotional link established between citizens visiting the urban park and the squirrels (Bertolino 2013). During many meetings in the last 10 years, animal right groups often proposed the sterilization of animals as an alternative to euthanasia in case of management projects aimed at controlling or eradicating populations. Therefore, having proposed from the beginning the use of this technique, our expectation was of a higher acceptability of the actions in Liguria in respect to the other regions. This expectation was also in agree with the results obtained by Bremner and Park (2007) with a questionnaire survey developed to understand public attitudes in relation to the management of invasive non-native species in Scotland, where they underline that animal sterilization is generally more accepted from the public than other techniques as trapping and euthanasia. Despite the non-lethal method proposed, the project was strongly opposed by a group of citizens that did not accept the loss of what they considered 'their animals'. This was reflected by the different topics of the news between local and national media. Negative articles were mainly published by daily local media with a geographic focus in Liguria, while national media had a focus on the whole project, underling more frequently positive aspects such as the conservation of the native red squirrel and the ban for exotic squirrel trade.

Framing is selecting the word to influence how people perceive an event (Shoemaker and Reese 1996; Roskos-Ewoldsen et al. 2002). In the description of Robert Entman (1993, p. 52, italics in the original) '*To frame is to select some aspects of a perceived reality and make them more salient in a communicating text, in such a way as to promote a particular problem definition, causal interpretation, moral evaluation, and/or treatment recommendation for the item described*'. Negative news often portrayed the control of grey squirrels with an echo to the extermination of Jews during

the holocaust. The euthanasia of animals was depicted as ‘gas chambers’ and the surgical sterilization and release into another park of squirrels as the ‘deportation’ of animals; ‘extermination’ was used in both cases. At least in these cases, the words used by the writers were selected to arouse a negative reaction thanks to the comparison with a historical phenomenon that is certainly one of the worst atrocities of the twentieth century.

On the other hand, invasion biology is often criticized itself for the use of language and words related to militaristic or xenophobic contexts (Simberloff 2003; Janovsky and Larson 2019). The term ‘invasion biology’ and ‘invasive species’ could be easily associated with militaristic ‘attacks’ or parallels xenophobic wording. This risk is largely discussed within the scientific community, with a call to use metaphors that do not evoke a militaristic framework (Larson 2005). For this reason, our communication was framed on the need to save the threatened red squirrel, our squirrel, and not on the grey squirrel as an invasive species (see Supplementary Fig. S2 and www.rossoscoiattolo.eu/en).

Shih et al. (2008) proposed a communication theory linking the idea of framing and the issue attention cycle. Framing of squirrels by the media is generally positive, probably reflecting their empathy and the role they have in cartoons and children’s books. The issue-attention cycle refers to the ups and downs of attention that an environmental issue receives either from the public or from mass media (Downs 1972). The coverage of our project issues was highly event based and the presented analyses allowed to link periodical flames on the media to project milestones. The public presentation of the project and the beginning of management activities lead to a higher media attention and to the amplification of local oppositions. For this reason, despite a communication campaign was prepared from the beginning of the project, we decided to further reinforce the communication strategy in the whole project area and particularly in Liguria. As a result, peaks of negative news, which initially anticipated positive articles, in a second phase occurred after positive peaks the latter resulting from a more proactive approach by the projcet staff. Moreover, the trend of negative news decreased over time in Liguria, indicating the effectiveness of communication activities. However, a sterilized animal found roadkill at the end of the project, suddenly inflamed the press, showing the necessity of a continuous attention to the media arena. Local media, especially in Liguria, covered the project much more than national media and with a higher percentage of negative news. This reflects a greater involvement of local journalists into what happens in urban areas, while national media can face the human dimension of management issues with more detachment, proposing neutral news. In fact, about a quarter of local articles, mostly negative, were prepared by a single journalist.

The publication of the trade ban for exotic squirrel species by the national authority was an important result of the project, that has been communicated positively mainly by national media. The ban has put into practice, for three squirrel species (*S. carolinensis*, *Sciurus niger* and *Callosciurus erythraeus*), the prevention approach highlighted by the European Regultation on invasive alien species published about two years after. Surprisingly, this ban did not generated an opposition by animal traders, and no news were framing negatively this event.

Public support is considered a necessary condition for the successful implementation of eradication and control plans (Bomford and O'Brien 1995) and activities should be organized with citizens to inform and explain the reasons behind these actions. Considering that the media represent one of the main sources of information for citizens and have an important role in driving public opinion (Takahashi 2011), we suggest that media monitoring should be routinely included in the development of management projects. The world of communication is changing fast. New media entered the arena through the diffusion of computers and mobile phones, and nowadays all newspapers and magazines are accessible through their web sites, or are exclusive to the web. Web-based media were included in our search for news on the project. However, very recently people use a plethora of new digital and social tools to communicate (e.g. Facebook, Twitter, Instagram). Social media enables the creation and exchange of user-generated content, changing the dynamic on how information spread in the society. In the future, content analysis related to conservation projects should therefore take into consideration these new communication tools (Lai and To 2015).

The reaction of media to invasive species management always presents a certain degree of uncertainty, which could change in relation to the country and the species involved (Fraser 2006; Breemmer and Park 2007). Therefore, we suggest to implement a media content analysis as a performance indicator to monitor the reaction of the media and the public to communication campaigns, developed to support management or conservation plans that may be perceived as controversial. Monitoring media coverage to better understand the framing of the messages, will help keeping the finger on the pulse developing a more proactive approach toward any negative perception of the project.

Acknowledgments

This work was realized under the LIFE09 NAT/IT/000095 EC-SQUARE project. This is paper n. 16 of the EC-SQUARE project. Jacopo Cerri and an anonymous referee provided useful suggestions to early drafts of the manuscript.

References

Baron N (2010) Escape from the ivory tower: a guide to making your science matter. Island Press, Washington, DC.

Bellard C, Cassey P, Blackburn TM (2016) Alien species as a driver of recent extinctions. Biol Lett 12: 20150623. doi: 10.1098/rsbl.2015.0623

Bengston DN (2000) Applications of computer-aided text analysis in natural resources. General Technical Report NC-211. St. Paul, MN: U.S. Dept. of Agriculture, Forest Service, North Central Forest Experiment Station.

Bertolino S (2013) Eradicating American Eastern grey squirrels in Genoa Nervi urban park. In van Ham C, Genovesi P, Scalera R (Eds) Invasive alien species: the urban dimension. Case studies on strengthening local action in Europe. IUCN European Union Representative. Office, Brussels, Belgium, pp. 63–66.

Bertolino S, Genovesi P (2003) Spread and attempted eradication of the grey squirrel (*Sciurus carolinensis*) in Italy, and consequences for the red squirrel (*Sciurus vulgaris*) in Eurasia. Biol Conserv 109:351–358.

Bertolino S, Lurz PWW, Sanderson R, Rushton SP (2008) Predicting the spread of the American grey squirrel (*Sciurus carolinensis*) in Europe: A call for a co-ordinated European approach. Biol Conserv 141:2564–2575.

Bertolino S, Montezemolo NC, Preatoni DG, Wauters LA, Martinoli A (2014) A grey future for Europe: *Sciurus carolinensis* is replacing native red squirrels in Italy. Biol Invasions 16:53–62.

Bhatia S, Athreya V, Grenyer R, Macdonald DW (2013) Understanding the role of representations of human–leopard conflict in Mumbai through Media-Content Analysis. Conserv Biol 27:588–594.

Bomford M, O'Brien P (1995) Eradication or control for vertebrate pests? Wildl Soc Bull 23:249–255.

Bremner A, Park K (2007) Public attitudes to the management of invasive non-native species in Scotland. Biol Conserv 139:306–314.

Cappella JN, Jamieson KH (1997) Spiral of Cynicism: The Press and the Public Good. Oxford University Press, New York.

Chandelier M, Steuckard A, Mathevet R, Diwersy S (2018) Content analysis of newspaper coverage of wolf recolonization in France using structural topic modeling. Biol Conserv 220:254–261.

Di Febbraro M, Martinoli A, Russo D, Preatoni D, Bertolino S (2016) Modelling the effects of climate change on the risk of invasion by alien squirrels. Hystrix 27:22–29.

Di Febbraro M, Menchetti M, Russo D, Ancillotto L, Aloise G, Roscioni F, Preatoni DG, Loy A, Martinoli A, Bertolino S, Mori E (2019) Integrating climate and land–use change scenarios in modelling the future spread of invasive squirrels in Italy. Divers Distrib 25:644–659.

Downs A (1972) Up and down with ecology – the "Issue–Attention Cycle". The Public Interest 28:38–50.
Entman RM (1993) Framing: Toward Clarification of a Fractured Paradigm. Journal of Communication 43:51–58.
Fish TE, Recksiek H, Fan DP (2002) Uses, values, stakeholders, and opinions associated with marine protected areas: a content analysis of news media, 1995–2001. Technical Paper, Coastal Services Center, National Oceanic and Atmospheric Administration, Charleston, South Carolina.
Fraser A (2006) Public attitudes to pest control: a literature review. Department of Conservation, Wellington, New Zealand.
Gamson WA, Modigliani A (1989). Media discourse and public opinion on nuclear power: a constructionist approach. Am J Sociol 95:1–37.
García-Llorente M, Martín-López B, González JA, Alcorlo P, Montes C (2008) Social perceptions of the impacts and benefits of invasive alien species: Implications for management. Biol Conserv 141:2969–2983.
Genovesi P (2005) Eradications of invasive alien species in Europe: a review. Biol Invasions 7:127–133.
Genovesi P, Bertolino S (2001) Human dimension aspects in invasive alien species issues: the case of the failure of the grey squirrel eradication project in Italy. In: McNeely JA(Ed) The Great Reshuffling: Human Dimensions of Invasive Alien Species. IUCN, Gland Switzerland and Cambridge, UK, pp. 113–119.
Gurnell J, Wauters LA, Lurz PWW, Tosi G (2004) Alien species and interspecific competition: effects of introduced eastern grey squirrels on red squirrel population dynamics. J Animal Ecol 73:26–35.
Hart PS, Nisbet EC, Shanahan JE (2011) Environmental values and the social amplification of risk: an examination of how environmental values and media use influence predispositions for public engagement in wildlife management decision making. Society and Natural Resources 24:276–291.
Heberlein TA (2012) Navigating Environmental Attitudes. Oxford University Press, Oxford, UK.
Jacobs MH, Vaske JJ, Dubois S, Fehres P (2014) More than fear: role of emotions in acceptability of lethal control of wolves. Eur J Wildl Res 60:589–598.
Jacobson SK, Langin C, Carlton JS, Kaid LL (2012) Content analysis of newspaper coverage of the Florida panther. Conserv Biol 26:171–179.
Janovsky RM, Larson ER (2019) Does invasive species research use more militaristic language than other ecology and conservation biology literature? NeoBiota 44:27–38.
Jones HP, Holmes ND, Butchart SHM, Tershy BR, Kappes PJ, Co Jones HP, Holmes ND, Butchart, SHM, Tershy BR, Kappes PJ, Corkery I, Aguirre-Muñoz A, Armstrong DP, Bonnaud E, Burbidge AA, Campbell K, Courchamp F, Cowan P, Cuthbert RJ, Ebbert S, Genovesi P, Howald GR, Keitt BS, Kress SW, Miskelly CM, Oppel S, Poncet S, Rauzon MJ, Rocamora G, Russell JC, Samaniego-Herrera A, Seddon PJ, Spatz DR, Towns DR, Croll DA (2016) Invasive mammal eradication on islands results in substantial conservation gains. PNAS 113:4033–4038.
Krippendorff K (2004) Content Analysis: An Introduction to its Methodology. Thousand Oaks.
Larson BM (2005) The war of the roses: demilitarizing invasion biology. Front Ecol Environ 3:495–500.
Lai LSL, To WM (2015) Content analysis of social media: A grounded theory approach. J Electron Commer Re 16:138–152.
Macnamara J (2005) Media content analysis: its uses, benefits and best practice methodology. Asia Pacific Public Relations Journal 6:1–34.
Manfredo MJ, Teel TL, Henry KL (2009) Linking society and environment: A multilevel model of shifting wildlife value orientations in the western United States. Soc Sci Q 90:407–427.
Mayring P (2000) Qualitative content analysis. Forum: Qualitative Social Research 1: Art.20.
McCombs M (2005) A look at agenda-setting: Past, present and future. Journalism stud 6:543–557.

McCombs M (2018). Setting the agenda: Mass media and public opinion. John Wiley & Sons.
McCombs ME, Shaw DL (1972) The agenda-setting function of mass media. Public Opin Q 36:176–187.
Park MS, Kleinschmit D (2016) Framing forest conservation in the global media: an interest-based approach. Forest Policy Econ 68:7–15.
Phillis C, O'Regan C, Green SM, Bruce SJ, Anderson Linton JN, Earth2Ocean Research Derby, Favaro B (2013) Multiple pathways to conservation success. Conserv Lett 6:98–106.
R Core Team (2015) R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. Available from https://www.R-project.org.
Romeo C, McInne, CJ, Dale TD, Shuttleworth C, Bertolino S, Wauters LA, Ferrari N (2018) Disease, invasions and conservation: no evidence of squirrelpox virus in grey squirrels introduced to Italy. Anim Conserv 22:14–23. doi:10.1111/acv.12433
Roskos-Ewoldsen DR, Roskos-Ewoldsen B, Dillman-Carpentier FR (2002) Media priming: a synthesis. In: Bryant J, Zillmann D (Ed) Media effects: advances in theory and research. Lawrence Erlbaum Associates, Mahwah, NJ, Unites States, pp. 97–120.
Scapin P, Ulbano M, Ruggiero C, Balduzzi A, Marsan A, Ferrari N, Bertolino S (2019) Surgical sterilization of male and female grey squirrels (*Sciurus carolinensis*) of an urban population introduced in Italy. J Vet Med Sci 81:641–645.
Seebens H, Blackburn TM, Dyer EE, Genovesi P, Hulme PE, Jeschke JM, Pagad S, Pyšek P, Winter M, Arianoutsou M, Bacher S, Blasius B, Brundu G, Capinha C, Celesti-Grapow L, Dawson W, Dullinger S, Fuentes N, Jäger H, Kartesz J, Kenis M, Kreft H, Kühn I, Lenzner B, Liebhold A, Mosena A, Moser D, Nishino M, Pearman D, Pergl J, Rabitsch W, RojasSandoval J, Roques A, Rorke S, Rossinelli S, Roy HE, Scalera R, Schindler S, Štajerová K, Tokarska-Guzik B, van Kleunen M, Walker K, Weigelt P, Yamanaka T, Essl F (2017) No saturation in the accumulation of alien species worldwide. Nat Commun 8: 14435. https://doi.org/10.1038/ncomms14435
Shih TJ, Wijaya R, Brossard D (2008) Media Coverage of Public Health Epidemics: Linking Framing and Issue Attention Cycle Toward an Integrated Theory of Print News Coverage of Epidemics. Mass Commun Soc 11:141–160.
Shoemaker P, Reese S (1996) Mediating the message: theories of influences on mass media content. White Plains, NY, Longman.
Simberloff D (2003) Confronting introduced species: a form of xenophobia? Biol Invasions 5: 179–192.
Takahashi B (2011) Framing and sources: A study of mass media coverage of climate change in Peru during the V ALCUE. Public Underst Sci 20:543–557.
Tattoni C, Preatoni D, Lurz P, Rushton S, Tosi G, Bertolino S, Martinoli A, Wauters L (2006) Modelling the expansion of a grey squirrel population: implications for squirrel control. Biol Invasions 8:1605–1619.
Tompkins DM, Sainsbury AW, Nettleton P, Buxton D, Gurnell J (2002) Parapoxvirus causes a deleterious disease in red squirrels associated with UK population declines. Proc R Soc of London Series B Biol Sci 269:529–533.
Vilà M, Basnou C, Pyšek P, Josefsson M, Genovesi P, Gollasch S, Nentwig W, Olenin S, Roques A, Roy D, Hulme PE, DAISIE partners (2010) How well do we understand the impacts of alien species on ecosystem services? A pan-european, cross-taxa assessment. Front Ecol Environ 8:135–144.
Wauters LA, Martinoli A (2018) Urban Biological Invasions: When vertebrates come to town. In: Ossola A, Niemelä J (Eds) Urban biodiversity: from research to practice. Routledge studies in urban ecology, Oxon, UK, pp. 87–100.
Weaver D (1977) Political issues and voter need for orientation. In: Shaw D, McCombs M (Eds) The emergence of American political issues: the agenda-setting function of the press. St. Paul, West Pub. Co, pp. 107–119.

Weber RP (1990) Basic content analysis (2nd ed.). Newbury Park, Sage.
Whatmough S, Van Putten I, Chin A (2011) From hunters to nature observers: a record of 53 years of diver attitudes towards sharks and rays and marine protected areas. Mar Freshw Res 62:755–763.

Table 1 Correlation of the categorical variables with the two first dimensions of the Multiple Correspondence Analysis.

Categorical variables	Dimension 1		Dimension 2	
	R^2	p-value	R^2	p-value
Area of interest	0.76	< 0.001	0.65	< 0.001
Media type	0.64	< 0.001	0.55	< 0.001
Topic*	0.58	< 0.001	0.47	< 0.001
Media diffusion	0.44	< 0.001	0.15	< 0.001
News	0.37	< 0.001	0.15	< 0.001
Other interview*	0.07	< 0.001	< 0.01	0.84
Staff interview*	0.02	0.06	< 0.01	0.56
NGO reference*	< 0.01	0.88	< 0.01	0.82

* supplementary categorical variables of the MCA model

Table 2. Main peaks of media publications during the implementation of the project and project milestones related to the peaks; numbers in the ID column are related to numbers of Fig. 3.

ID	Period	Project milestones
1	02-03/2011	The project was presented to the public through press releases and communication activities
2	05/2012	Starts of the management activities in Piedmont and Lombardy (trapping of animals and euthanasia)
3	07-10/2012	Communication activities of staff members focused on explaining the competition between the two species
4	02/2013	Publication of the trade ban of exotic squirrel species by the national authority
5	04/2013	Public presentation of project activities in Liguria
6	07/2013	Start of the public procedure for the recruitment of the veterinary clinic for squirrel sterilization in Liguria
7	01-02/2014	Start of a new communication plan focused on Liguria and start of the management activities in Liguria
8	12/2014	One sterilized animal found road kill near the area of intervention

Figures legend

Fig. 1 Frequencies of the three categories of news, negative (red), neutral (blue) and positive (green), in respect to their geographical focus: LI (Liguria), LO (Lombardy), PI (Piedmont), PR (whole Project Area).

Fig. 2 Multiple Correspondence Analysis plot. The categories of the variables (black) are positioned in respect to their correlation with the first (Dim1) and second (Dim2) dimension (supplementary categorical variables are not displayed). The articles are grouped for negative (red), neutral (blue) and positive (green); the ellipses identify the 30% of articles more close to the grouping categories.

Fig. 3 Trend of negative (red), positive (green) and neutral (blue) news during the implementation of the project in the whole area (above) and only Liguria (below). Relevant news peaks have been identified with numbers and the related project milestones explained in Table 2.

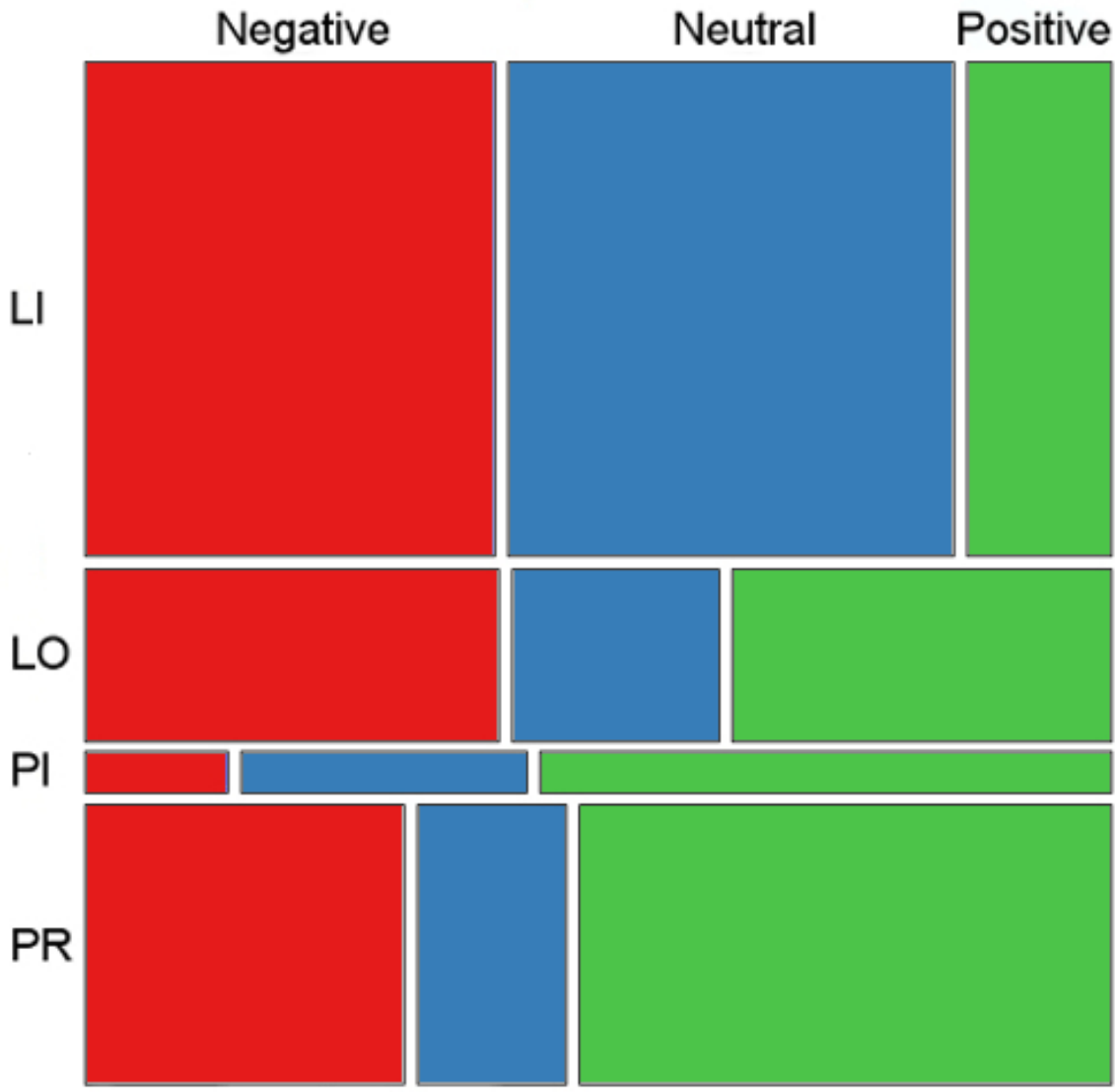


Figure 1.

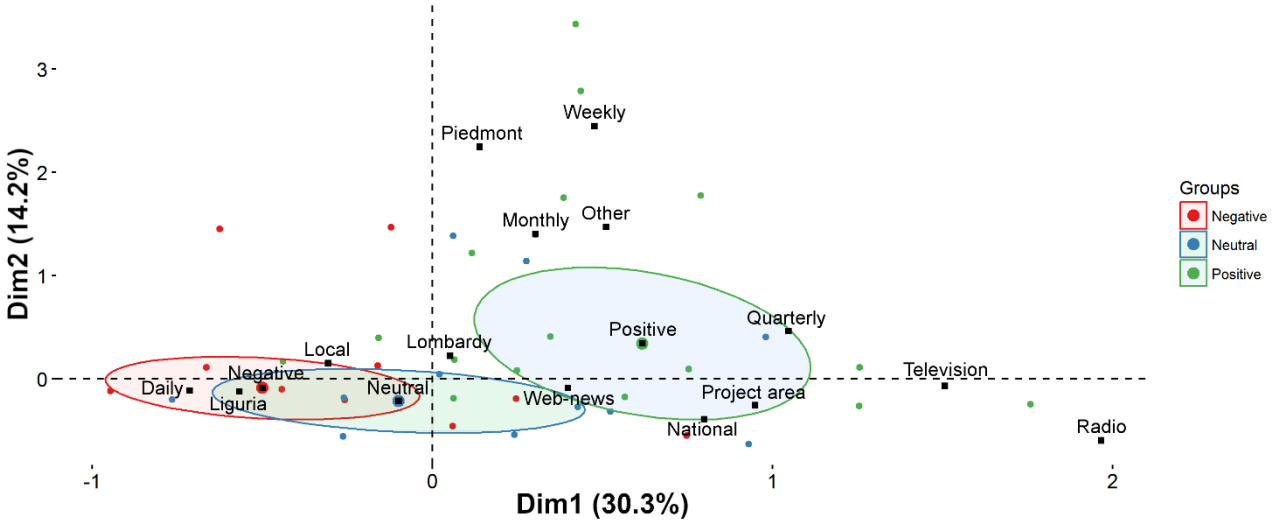
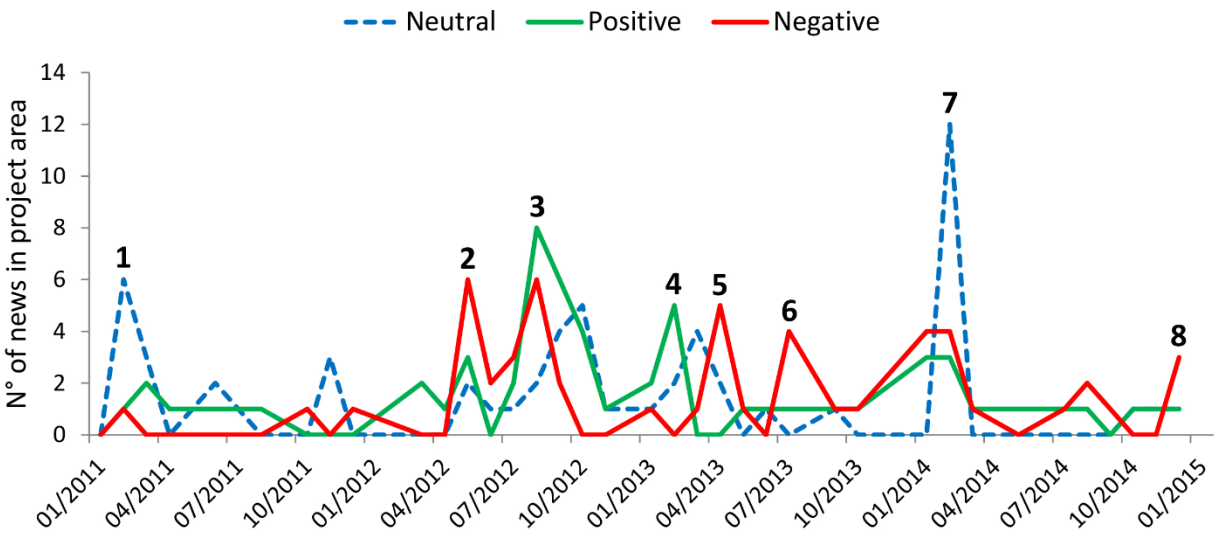

Dim2 (14.2%)
Dim1 (30.3%)
Groups
Negative
Neutral
Positive
Weekly
Piedmont
Monthly
Other
Quarterly
Positive
Local
Lombardy
Negative
Daily
Liguria
Neutral
Web-news
Project area
National
Television
Radio

Figure 2.


Neutral
Positive
Negative
N° of news in project area
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
8
01/2011
04/2011
07/2011
10/2011
01/2012
04/2012
07/2012
10/2012
01/2013
04/2013
07/2013
10/2013
01/2014
04/2014
07/2014
10/2014
01/2015

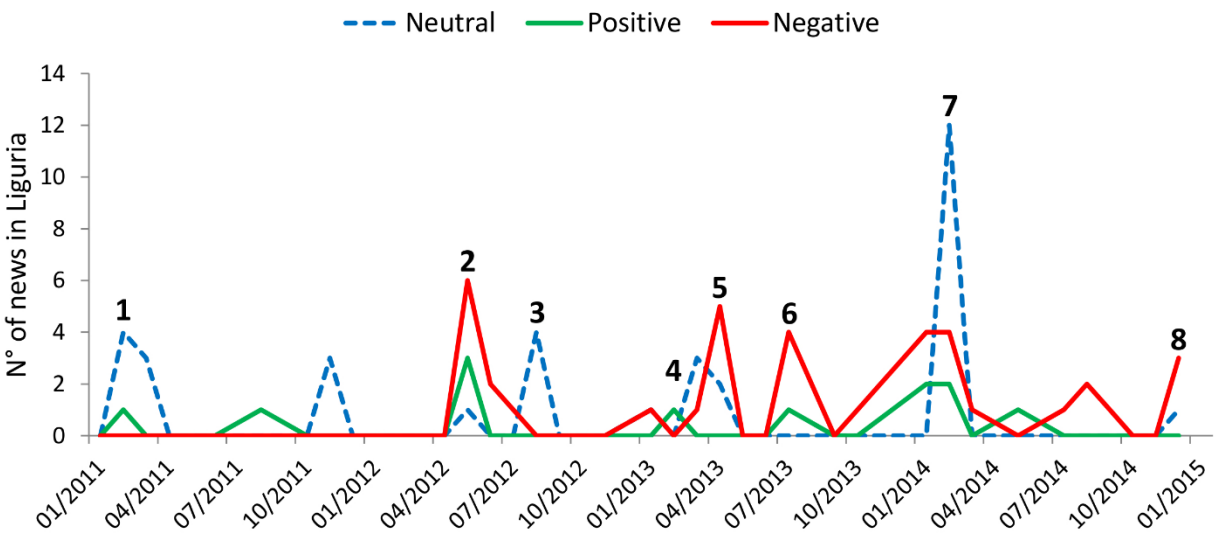

Neutral
Positive
Negative
N° of news in Liguria
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
8
01/2011
04/2011
07/2011
10/2011
01/2012
04/2012
07/2012
10/2012
01/2013
04/2013
07/2013
10/2013
01/2014
04/2014
07/2014
10/2014
01/2015

Figure 3.