

# Conservation Biology

## Considering connections between Hollywood and biodiversity conservation

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Keywords:	CITES, consumer research, Google trends analysis, impact evaluation, industry engagement, nature deficit disorder, social media, wildlife trade
Abstract:	<p>Cinema offers a substantial opportunity to share messages with a wide audience. Given its global range and potentially high impact, there is an urgent need for research that evaluates the effects of this form of visual media on conservation outcomes. Cinema can influence the awareness and behaviours of non-specialist audiences, and could therefore play an important positive and/or negative role in biodiversity conservation through behavioural change and social pressure on key stakeholders and policy makers. Limited awareness about the potential benefits and limitations of cinema for conservation, as well as a lack of evidence about impacts, currently hinder our ability to learn from previous and ongoing initiatives, and to engage productively with the movie industry. We discuss the key opportunities and risks that arise from cinematic representations of conservation issues and species of concern, making use of examples and case studies where they are available. We then provide a framework that enables conservationists to better understand the extent and form of cinema influences, from immediate audience perceptions through to social and ecological assessments of ultimate impact. We encourage conservation researchers to engage more with the movie industry, harness its potential, and work to mitigate any negative consequences. A robust evidence base is key for evaluating and planning these engagements, and for informing related policy and management decisions.</p>

## 1 **Considering connections between Hollywood and biodiversity conservation**

2

### 3 **Abstract**

4 Cinema offers a substantial opportunity to share messages with a wide audience. Given its  
5 global range and potentially high impact, there is an urgent need for research that evaluates the  
6 effects of this form of visual media on conservation outcomes. Cinema can influence the awareness  
7 and behaviours of non-specialist audiences, and could therefore play an important positive and/or  
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10 cinema for conservation, as well as a lack of evidence about impacts, currently hinder our ability to  
11 learn from previous and ongoing initiatives, and to engage productively with the movie industry. We  
12 discuss the key opportunities and risks that arise from cinematic representations of conservation  
13 issues and species of concern, making use of examples and case studies where they are available.  
14 We additionally provide a framework that enables conservationists to better understand and engage  
15 with the film industry, highlighting how this can facilitate engagement with the movie industry,  
16 harness its potential, and improve work to mitigate any negative consequences. A robust evidence  
17 base is key for evaluating and planning these engagements, and for informing related policy and  
18 management decisions.

## 19 Introduction

20 Watching Disney's new version of *The Jungle Book* (2016) inspired us to write this article. As  
21 a growing percentage of the world's population becomes concentrated in urban areas (Wigginton et  
22 al. 2016), citizens of post-industrial nations increasingly report a sense of disconnection from the  
23 natural world (Miller 2005). Meanwhile, our ability to simulate the 'wild' has increased dramatically;  
24 here was a film featuring a spectacular depiction of a South Asian jungle and its inhabitants, mostly  
25 created by Computer Generated Imagery (CGI), that the viewer could experience from the comfort  
26 of their chair. The movie also highlighted the plight of pangolins (*Manidae* spp.) through humour,  
27 and the pangolin character has subsequently been included in associated merchandise to promote  
28 its cause (see below and Flocken 2016).

29 Visual media (Vivanco 2002; Sandbrook et al. 2015) and arts (Curtis et al. 2014; Verma et al.  
30 2015) are becoming increasingly important channels, filters and mirrors of human understanding  
31 about the natural world. Their linkages to environmental engagement, attitudes, norms, policy  
32 support and, ultimately, human behaviour – key considerations of conservation concern worldwide  
33 (St John et al. 2013) – must therefore be considered. On the one hand, evocative footage of natural  
34 spaces and rare or charismatic species has the potential to increase media consumers' interest in  
35 and support for biodiversity conservation. For example, exposure to visual depictions of charismatic  
36 flagship species has been found to be associated with people's concern for that species and  
37 conservation intentions (Smith & Sutton 2008). Alternatively, however, spectacular imagery could  
38 create or reinforce simplified, romantic ideals of nature and wildlife that some might adopt as a  
39 comfortable substitute for challenging real-world encounters. Furthermore, watching wildlife on  
40 screen may not translate into conservation action, given the often limited or unclear effectiveness of  
41 environmental education as a single tool for effective behaviour change (Holmes 2003). At worst,  
42 increased exposure could produce new, unforeseen threats to species and locations thrown into the  
43 spotlight by their starring role in a blockbuster. As a result, it is important for conservation scientists  
44 to identify the opportunities provided by visual media for achieving conservation goals (Knight &

45 Cowling 2007), and to invest in anticipating the potential consequences of engaging with associated  
46 industries (Cook et al. 2014).

47 While nature documentaries might serve as sources of information about wildlife and  
48 conservation issues (Dingwall & Aldridge 2006), they are often targeted towards audiences with an  
49 existing interest in the topic. Movies, in contrast, may not offer the most direct way to highlight a  
50 specific conservation issue, but may reach larger, broader audiences. Documentaries are normally  
51 distributed via television, which makes viewing figures difficult to compare with cinema releases.  
52 However, perhaps the most successful cinema-format wildlife film, *March of the Penguins* (2005)  
53 took a lifetime box-office of \$77,437,223: the animated, animal-focused movie *Madagascar* (2005)  
54 took \$193,595,521 the same year (Box Office Mojo n.d.). Cinema is also generally considered a more  
55 immersive format and lends itself well to spectacular sound, imagery and sequences. It might  
56 therefore have greater emotional impacts on audiences than television (Visch et al. 2010;  
57 Baranowski & Hecht 2014). There is considerable variation in how the movie industry could influence  
58 conservation impacts. Films can vary in their environmental motives from feature-length  
59 documentaries such as *March of the Penguins*, through storylines with evident environmental  
60 motives (including many examples discussed below), to movies with no conservation message that  
61 may still influence behaviour. Our question, then, is: what role(s) does, or could, Hollywood play in  
62 conservation?

63 Despite the long-standing tradition of the movie industry producing wildlife-focused content  
64 (the Oscar-winning *Serengeti shall not die* by Bernhard & Michael Grzimeks [1957] and Disney's  
65 *Bambi* [1942] are classic examples), surprisingly little attention has been given to critically reviewing  
66 its potential impacts (Jepson et al. 2011). Impacts, here, may be positive or negative, and may affect  
67 audiences (e.g. knowledge, perceptions and behaviour); socio-economic trends (e.g. increasing  
68 demand for a pet, visits to a location, or resource allocation to an issue); and/or, ultimately,  
69 conservation outcomes (e.g. habitat protection/disturbance, species recovery/decline). Here we  
70 discuss some of the opportunities and challenges movie fame can create for conservation. Although

71 we recognise the presence and potential importance of international movie industries and  
72 independent filmmaking, we primarily refer to mass-market productions of the American movie  
73 industry (aka Hollywood), which continue to attract the highest level of investment and dominate  
74 global box office receipts. However, much of the discussion here also applies to movies made  
75 elsewhere and on smaller budgets, and to other visual media targeted at general audiences (e.g.  
76 YouTube, TV shows etc.). We outline a range of methodological approaches, including both  
77 qualitative and quantitative techniques, to consider how the impact of silver screen appearances  
78 might be assessed and monitored, providing a framework to guide future research (Fig. 1; Table 1),  
79 encourage engagement with the industry, and inform policy decisions. Finally, we argue that better  
80 understanding the impacts of Hollywood on conservation can only be beneficial, and potentially  
81 enables the harnessing or mitigation of these impacts as tools for biodiversity conservation.

82

### 83 **Opportunities**

84 Movies provide a potent means of sharing biodiverse landscapes, wildlife spectacles and  
85 exotic or rare species with a wide audience. The extent to which awareness affects pro-conservation  
86 attitudes and behaviours is often complex and unclear, given the myriad other factors at play  
87 (Howell 2014; Moorhouse et al. 2016), but there is a clear role for cinema in introducing audiences  
88 to new places, species and conservation problems. To date this has most frequently been achieved  
89 by animated features that do not require rare wildlife or inhospitable environments to be found or  
90 filmed (see Yong et al. 2011), but continuing advances in CGI and motion-capture technologies may  
91 change this. Specific reference to the conservation status of the taxa involved may be important for  
92 raising the profile of particular species (but see Colléony et al. 2016). Blue Sky Studios' *Rio* (2011), for  
93 example, features the critically endangered Spix's macaw *Cyanopsitta spixii*, and several plot points  
94 involve conservation issues, including the illegal trade in exotic birds and captive breeding of  
95 threatened species. Although a positive conservation outcome for this species might be unrealistic,  
96 the issues highlighted affect many tropical parrots.

97           A second, subtler, example is the inclusion of a pangolin (*Manidae* spp.) in the  
98   aforementioned Disney remake of *The Jungle Book* (2016). It makes a cameo appearance, spectating  
99   while Mowgli, the protagonist, retrieves honey from a tall cliff. Fellow observer Baloo (a sloth bear  
100   *Melursus ursinus*) threatens the pangolin with the line "You have never been a more endangered  
101   *species than you are at this moment*", a knowing comedic reference to the precarious real-world  
102   status of pangolins in southern and eastern Asia. All four Asian species are threatened by hunting  
103   and illegal trade, listed as endangered or critically endangered on the IUCN red list, and listed by the  
104   Convention on International Trade in Endangered Species (CITES) (Challender et al. 2014). *The Jungle*  
105   *Book* director Jon Favreau has since revealed that Los Angeles zoo staff (acting as advisors to the  
106   filmmakers) had suggested the pangolin's inclusion (Flocken 2016). Favreau had previously been  
107   unaware of pangolins, but became an advocate of featuring the species and encouraged Disney to  
108   add a pangolin to their merchandise line-up as "a commitment to raise awareness for the pangolin  
109   and the overall efforts of the Disney Conservation Fund" (Flocken 2016). Even without a direct  
110   conservation message, featuring relatively little-known species can inspire public interest. The  
111   appearance of fossas (*Cryptoprocta ferox*) in Dreamworks' animated film *Madagascar* (2005), for  
112   example, led to a substantial increase in Google.com searches for 'fossa' in the USA (Fig. 2).

113           Cinema also has the potential to substantially increase awareness of a featured area or  
114   region. The release of *Wild* (2014), based on author Cheryl Strayed's 2009 solo hike along the Pacific  
115   Crest Trail (USA) – a route mostly through National Forest and protected wilderness – prompted a  
116   dramatic increase in footfall on the trail: the number of permits issued for hikes of >500 miles  
117   increased by 70% between 2014 and 2015 (Pacific Crest Trail Association 2014, 2015). The Pacific  
118   Coast Trail Association (PCTA) encourages fans of *Wild* to become members, thereby contributing to  
119   the upkeep and conservation of the scenic trail (<http://www.pcta.org/wild>). In conjunction with  
120   effective management, therefore, visitor increases to areas such as this could have positive  
121   outcomes by inspiring concern for – and investment in – their conservation.

122 A further potential advantage is the heightened emotional impact that movies can carry  
123 (Visch et al. 2010). Again, this is often associated with the use of nonhuman characters in animated  
124 or effects-driven films. *Happy Feet* (2006), for example, carries strong messages about overfishing  
125 and plastic pollution: in one scene ‘Lovelace’, a rockhopper penguin (*Eudyptes* spp.), suffers from  
126 entanglement in the plastic rings of a six-pack. Movies’ ability to portray conservation problems  
127 through the eyes of well-developed, sympathetic (albeit often anthropomorphic) animal characters  
128 could make the inclusion of such scenes an especially powerful tool. Negative conservation  
129 messages can be associated with feelings of guilt or powerlessness, emotions that animated films  
130 may not be seeking to inspire. However, optimistic messages – a better fit with animated movies –  
131 might also be more successful in achieving support and lasting behaviour change (Garnett &  
132 Lindenmayer 2011). From the earliest Disney movies to more recent animated and CGI productions,  
133 animals and the natural world are common themes of films targeting younger audiences, who will be  
134 actors in future social change, and on whom there may be greater emotional and long-term effects  
135 (Gifford & Nilsson 2014). An excellent illustration is provided by the “*Bambi effect*” (Hastings 1996),  
136 the impact that the emotive loss of the titular character’s mother in Disney’s 1942 film is believed to  
137 have had on audiences’ attitudes towards hunting.

138 Director James Cameron intentionally sought emotional impact from his environmental fable  
139 *Avatar* (2009): “*I just want [people] to internalize a sense of respect and a sense of taking*  
140 *responsibility for the stewardship of the earth...I think the film can do that by creating an emotional*  
141 *reaction*” (quoted in Erbe 2011). *Avatar* has a more general environmental message that  
142 nevertheless touches on specific conservation issues, including natural resource extraction,  
143 maintaining ecosystem function, and habitat loss. Similarly, movies set in the midst or aftermath of  
144 environmental disasters can explore broader environmental issues through visions of a world  
145 devastated by climate change or food and energy crises: recent examples including *The Road* (2009),  
146 *Interstellar* (2014), and the recently reinvigorated *Mad Max* franchise.

147

148 **Risks**

149 Conservation is not, of course, the primary aim of the modern movie industry, and there are  
150 also potential negative impacts of silver-screen appearances for featured species, habitats and  
151 landscapes.

152 The global reach and influence of Hollywood movies enable them to ignite market trends,  
153 with challenging implications for conservation. An often-repeated example is the purported impact,  
154 on wild clownfish populations, of increased market demand for common clownfish *Amphiprion*  
155 *ocellaris* associated with the release of Disney/Pixar film *Finding Nemo* (2003) (Strange 2008; Yong et  
156 al. 2011; Bush et al. 2014). This is despite the film's plot implying that wild-caught tropical fish make  
157 unsuitable pets: Nemo's abduction from the reef, and subsequent imprisonment in a dentist  
158 surgery's tank, is key to the storyline. The example suggests that increased interest in a species  
159 might drive market demand for its consumption and/or trade, and indicates that a movie's key  
160 messages may not be received or interpreted as expected. Nevertheless, to our knowledge,  
161 evidence to support 'the Nemo effect' is scarce or virtually non-existent, and indeed, data to support  
162 assertions about the direct impacts of cinema are generally very limited (Gomis & Bonillo n.d.;  
163 Strange 2008). This therefore represents a prime example of why research investigating the type,  
164 magnitude and direction of any impacts is required. For example, analyses of the spatial and  
165 temporal distribution of illegal trade incidents could be related to movie release dates, to determine  
166 how they may have influenced the market.

167 A further potential issue is how particular species or people are portrayed. Contemporary  
168 cinema acts as both a reflection and propagator of villainous stereotypes, and repeatedly negative  
169 portrayals of particular species and peoples in popular culture can have long-lasting impacts on their  
170 'public image'. For example, though difficult to quantify, *Jaws* (1975) is strongly implicated as  
171 responsible for an increased awareness of sharks in the Western psyche, one often accompanied by  
172 an exaggerated perception of the risks they pose, with likely consequences for their conservation



173 (Neff 2015; Nosal et al. 2016). Stories behind human characters and cultures also risk being  
174 oversimplified, belying the real-world complexity of people's use of, and dependency on, natural  
175 resources (e.g. Knapp et al. 2017).

176 Positive and romanticised depictions of wildlife can also have inadvertent conservation  
177 impacts. The '*Bambi* effect' (see above), is unlikely to be solely or even primarily responsible for anti-  
178 hunting sentiments; rather, it may be indicative of broader shifts in cultural attitudes towards  
179 wildlife in the mid-20<sup>th</sup> Century (Hastings 1996). Nevertheless, the movie popularises and/or  
180 reinforces a narrative of separation between humans and wildlife, and promotes an ethic of non-  
181 intervention. This 'hands-off' attitude may be important in limiting the ability of conservation  
182 managers to kill deer, for example, despite the effects that substantial increases in deer populations  
183 could have on other species and forest regeneration (Chollet & Martin 2013).

184 Another complex and contradictory story that characterises the diversity and extent of  
185 cinema's impacts on conservation is Warner Bros' *Free Willy* (1993), in which a captive orca *Orcinus*  
186 *orca* is returned to the wild with the help of a dedicated young boy: in the famous climactic scene,  
187 the whale leaps to freedom over a harbour wall. The movie's impact continues to resonate more  
188 than twenty years later, but is multi-faceted. First, *Free Willy's* positive depiction of previously  
189 maligned 'killer whales' has been credited with an about-turn in how this species is perceived by  
190 Western publics: compare the gentle character of Willy with the dangerous, revenge-seeking  
191 creature in *Jaws*-inspired *Orca* (1977) (Lawrence & Phillips 2004). Second, the film inspired a  
192 popular campaign to 'Free Keiko', the whale starring as the titular Willy. Keiko became the poster-  
193 child of captive orcas and millions of dollars were poured into his rehabilitation and eventual release  
194 (though he died less than a year later) (Grimm 2016). The ethics of exhibiting captive orcas,  
195 ostensibly to represent and enable the conservation of their wild cousins, remain hotly disputed, and  
196 have since also served as the topic of the provocative and influential documentary *Blackfish* (2014).  
197 Third, *Free Willy* probably contributed to larger changes in cultural attitudes to whales that created  
198 the conditions for a commercial whale-watching industry (which, in turn, has both positive and

199 negative implications for conservation: Lawrence & Phillips 2004; Wearing et al. 2011). This case  
200 highlights the power of an animal movie star to raise the profile of both species and individual  
201 animals (like Keiko), but also the challenges created by the translation of complex, real-world  
202 conservation issues into neat, romantic Hollywood spectacles.

203 Cinema exposure can also have major implications for a featured region or ecosystem.  
204 Rapid changes in visitor pressure and behaviour can result from increased public awareness and  
205 media attention associated with movie appearances (Beeton 2016), a phenomenon known as ‘film-  
206 induced tourism’ that is sometimes incidental, but can also be orchestrated (e.g. *Australia* [2008]  
207 was publicised in collaboration with the country’s tourist board). From a conservation perspective,  
208 this could create problems if increases in visitor pressure are overwhelming or ecosystems are not  
209 resilient (Sakellari 2014). Furthermore, if not managed appropriately, increased tourism can have  
210 problematic socio-economic consequences, illustrating the need to consider a wide range of  
211 potential impacts. In the detailed example outlined by Cohen (2005) pertaining to *The Beach* (2000),  
212 modifications made by the filmmakers to a little-used beach in a Thai national park led to division  
213 between local business owners and challenges to democratic procedure, as well as environmental  
214 concerns.

215 Films with explicit environmental messages or subtexts may be perceived as depressing or  
216 sanctimonious, potentially limiting their effectiveness (and indeed, their popularity, as a visit to the  
217 cinema might be seen as an opportunity for escapism from the world’s problems). Sensationalised  
218 depictions of environmental issues can also obfuscate or misrepresent real problems; notably,  
219 disaster movie *The Day After Tomorrow* (2004), though igniting media debates about climate  
220 change, is also noted for its scientific inaccuracy (Leiserowitz 2004).

221

## 222 **Assessing the impact of films**

223 We have discussed some key opportunities and challenges the movie industry presents for  
224 biodiversity conservation, which have clear implications for policy and management decision-

225 making. However, the current lack of evidence surrounding most of these suppositions undermines  
226 our ability to effectively harness cinema as a conservation tool or adequately mitigate any negative  
227 impacts (Fig. 1). Consequently, assessing and monitoring public responses to movie appearances of  
228 species, systems and spaces of conservation concern will be imperative for understanding the  
229 impacts of Hollywood on conservation. This will require a cross-disciplinary approach, and in the  
230 following section we highlight some of the qualitative and quantitative approaches that could be  
231 used as part of our proposed research framework to assess and understand these impacts (Table 1).

232

### 233 ***Audience responses***

234 Engagement with cinema-going audiences will be important in investigating a movie's  
235 immediate effect on viewers. A range of qualitative and quantitative social research methods (such  
236 as questionnaire surveys, interviews or discussion groups) could be used to monitor: any increased  
237 interest or awareness in conservation issues following their appearance in a movie; the kind of  
238 messages communicated; and whether these are likely to lead to further action or behavioural  
239 change. This has often been previously studied using questionnaires that assess intention to act. For  
240 example, research surveying moviegoers before or after watching *The Day After Tomorrow* found  
241 that participants sampled after viewing were willing to allocate approximately 50% more in  
242 monetary donations to climate mitigation, when choosing between five good causes, than those  
243 questioned before (Balmford et al. 2004). However, they were no more likely to plan on taking  
244 emission-reducing actions. Other studies have additionally considered the effects of movies and  
245 documentaries on public perception of and attitude towards climate change and science by  
246 surveying the same moviegoers before *and* after watching using survey groups as well as  
247 questionnaires (Lowe et al. 2006) and/or investigating long-term impacts on perception (Reusswig &  
248 Leiserowitz 2005; Howell 2011). A similar approach could be applied to investigating awareness of  
249 more specific conservation issues, and any corresponding behavioural change. If possible, studies  
250 should address broader changes in attitude or find a way of directly measuring behaviour change in

251 addition to assessing the intention to act, as responses to this method alone can be susceptible to  
252 social desirability biases (Chao & Lam 2011). Comparative or experimental approaches could also be  
253 used to assess responses to different films and potentially identify which aspects of 'movie  
254 appearances' influence viewers, and how. Responses might be affected, for instance, by the realism  
255 of a setting (Schroepfer et al. 2011) or the soundtrack (Nosal et al. 2016).

256

### 257 ***Monitoring online responses***

258 Increasingly, it may be possible to monitor audience responses by looking to their online  
259 activity, the advantages and disadvantages of which are discussed by Arts et al. (2015). Recognising  
260 that human actions are increasingly played out in a digital realm, Roll et al. (2016) used page views  
261 of the Wikipedia online digital text archive as a metric of global interest in reptiles. Google trends  
262 statistics have also been used in relation to conservation (Proulx et al. 2014), for example, to explore  
263 factors influencing internet saliency of bird species (Correia et al. 2016). It is possible to download  
264 Google trends data directly, or to perform and display queries with the R package *gtrendsR*  
265 (Massicotte & Eddelbuettel 2016). We provide a clear example of a cinematic impact on Google  
266 trends statistics (Fig. 2), which illustrates the relationships between the release of films in the  
267 *Madagascar* (2005; 2008) and *Rio* (2011; 2014) franchises, as well as *Finding Dory* (2016), and  
268 Google searches in the USA for featured species. Currently, Google trends indicate interest in a  
269 specific attribute, without considering whether this is positive or negative for the species or  
270 ecosystem concerned. Further research is needed to understand the type of interest a film has  
271 elicited before drawing a link to possible conservation outcomes (see Table 1; Fig. 1). Search terms  
272 could subsequently be refined to explore the depth or geographic localisation of increased interest  
273 in an issue, and could help target subsequent efforts to capitalise on increases in salience or mitigate  
274 potential problems.

275

### 276 ***Media, discourse and case analyses***

277           Beyond the initial impact of movies on their audiences, researchers should also examine the  
278 secondary response (i.e. influence on wider public discourses) and longer-term effects. Digital  
279 technology now plays a vital role in promoting both conservation and movies (Arts et al. 2015), and  
280 how movie messages are propagated and reported by news and social media will affect the power  
281 and longevity of their influence. The use of media content and discourse analyses could be especially  
282 powerful in teasing apart responses across multiple platforms, and semi-longitudinal case studies of  
283 movie impacts and legacies could also reveal important insights (see above examples of *Free Willy*  
284 and *The Beach*).

285

### 286 ***Industry-based research***

287           Researchers should investigate the aims and motives of filmmakers, studios and others  
288 involved in producing movies featuring certain species, environments or conservation problems. This  
289 might involve, for example, interviews, focus groups or ethnographic research with writers,  
290 producers and scientific advisors involved in developing conservation-relevant stories. Direct  
291 engagement will be central to developing an understanding of the movie industry and how to work  
292 effectively within it; fostering cinema-conservation relationships; clarifying aims and objectives with  
293 filmmakers; and identifying potential areas of engagement or collaboration. Assessing the  
294 engagement of potential stakeholders in this way has previously been demonstrated to be an  
295 effective method in conservation planning (Raymond & Knight 2013).

296

### 297 ***Biodiversity impacts***

298           If conservationists aim to explore the potential role of movies in promoting positive  
299 conservation and environmental behaviours (e.g. enhance financial support for specific conservation  
300 projects, or decrease demand for illegally-traded species), ultimate effects must also be considered.  
301 If a specific ecosystem or species is portrayed in a movie, indicators of conservation status, such as  
302 abundance trends, could be explored, taking into account peak cinema-screening and home-release

303 periods. However, given the time and spatial scales at which these processes can occur, the time lags  
304 between intervention (e.g. movie release) and measurement of indicator trends, and the potential  
305 difficulty in directly attributing any changes that occur to single factors, other indicators may be  
306 essential for assessing biodiversity impacts. CITES records (Challender et al. 2015) could be used to  
307 investigate changes in trade for some species, while in other situations market surveys (Harris et al.  
308 2015) and online media (Hinsley et al. 2016) could be monitored to better assess demand for goods  
309 of conservation concern (although this will not be possible for all species). These will also provide  
310 key information on wildlife consumers and how media influences them, ultimately providing insights  
311 about how to mitigate potential negative impacts.

312

### 313 **Harnessing the power of Hollywood: the beginning of beautiful friendship?**

314 Andrew Stanton, writer/director of *Wall-E* (2008) – in which the last robot on earth cleans  
315 up the detritus of long-departed humans – has said: “*I don't have an ecological message to push.*  
316 *[But] I don't mind that it supports that kind of view*” (Simon 2008). While in this instance the  
317 environmental message was incidental to the story, movies might nevertheless be purposefully  
318 employed by conservationists to highlight issues of concern; brand placement is already common in  
319 big-budget movies. Productions that feature wildlife or naturalistic settings often employ scientific  
320 advisors who may have, or could form, links with interested organisations. There are therefore at  
321 least two established frameworks within which conservationists might engage with the industry  
322 (Cook et al. 2013).

323 The impact of movie references to a conservation issue could be enhanced by providing  
324 additional information and/or highlighting relevant campaigns and organisations in the credits and  
325 associated promotional materials (Arendt & Matthes 2014), and this may provide an excellent  
326 starting point for conservationists to engage with other forms of visual media (e.g. YouTube). A good  
327 example is the ‘Home Tree Initiative’, a scheme led by James Cameron and 20<sup>th</sup> Century Fox, in  
328 association with the Earth Day Network, which was launched alongside *Avatar's* home release (on

329 Earth Day). Buyers of DVDs could register a code online and adopt a tree; the initiative achieved its  
330 goal of planting a million trees worldwide in 2010-11 (Taylor 2013).

331 Involving informed conservationists at the outset of a project can allow for horizon scanning  
332 for potential conservation-related issues that may arise (Cook et al. 2014), and the inclusion of  
333 additional information or existing evidence can contribute to this. For example, following the  
334 apparent but unanticipated impact of *Finding Nemo*, Disney/Pixar worked with the Association of  
335 Zoos and Aquariums for advice on mitigating the 'Nemo effect' following the sequel, *Finding Dory*  
336 (2016; starring the regal blue tang *Paracanthurus hepatus*). The collaborators encouraged  
337 responsible fish buying and ownership as part of the film's promotional campaign (e.g. a 'Selecting  
338 the Right Pet Fish' poster), and produced an educator's guide including information about marine  
339 species and their conservation. This example neatly highlights the benefits that could be obtained by  
340 using research on the conservation outcomes of previous movies to guide future engagement with  
341 the film industry.

342 This mitigation strategy draws some parallels with the suggestion that film studios that take  
343 advantage of particular species or ecosystems should contribute to their conservation (Jepson et al.  
344 2011), equivalent to the idea of payments for ecosystem services (Redford & Adams 2009).  
345 However, as well as generating some controversy (Jepson & Jennings 2013; Wunder & Sheil 2013),  
346 this proposal revealed how difficult it would be to determine to what extent such an approach might  
347 work, given the lack of research and evidence surrounding movie impacts on biodiversity. Once  
348 again, this demonstrates the need to robustly assess these impacts.

349 If this comes across as a plea to Hollywood, we are not suggesting the movie industry  
350 become conservation campaigners. Rather, we are primarily advocating greater efforts from  
351 conservationists and researchers to understand, access, and take advantage of the opportunities  
352 cinema offers to share unsung species, key habitats and important issues. Industry engagement  
353 strategies need to be positive, collaborative and, at least initially, proposed and promoted by  
354 conservationists. In an information-saturated and screen-dominated age, it is vital that

355 conservationists engage with the media through which they are attempting to be heard, and  
356 therefore the widest possible audiences. There are a number of possible avenues for developing  
357 partnerships and initiatives, such as using existing industry communication channels with non-  
358 governmental organisations or professional bodies within conservation to propose collaborations or  
359 offer advice; the development of voluntary certification schemes for conservation credentials (cf. the  
360 American Humane Society's 'No Animals Were Harmed' certification); and recognition or  
361 endorsement of good examples and role-models. Indeed, many filmmakers are already interested in  
362 conservation and environmental issues. Providing opportunities for industry professionals to  
363 enhance audience awareness and encourage behavioural change therefore has the potential to be a  
364 very powerful tool.

365

## 366 **Conclusions**

367 Hollywood offers enormous opportunities to raise broad, if shallow, awareness of a wide  
368 variety of conservation issues. Conservationists should therefore be prepared to interact with the  
369 movie industry, and filmmakers might also be encouraged to realise their potential to make a  
370 difference. Further, generating a better understanding of the impacts of cinema on conservation  
371 issues (applying the framework provided in Figure 1 and Table 1) will be integral to both harnessing  
372 the power of the silver screen in the future, and to mitigating any negative impacts it may have. A  
373 robust evidence base will be crucial for enabling these processes.

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496 biodiversity. *Tropical Conservation Science* **4**:244–253.

497 Table 1. The potential positive and negative impacts of cinema on biodiversity conservation and suggested research questions and methods to investigate them,  
498 from the raising of audience awareness through direct conservation impact to increased industry engagement.

Potential contribution	Opportunities	Risks	Suggested research questions	Example research approaches
Engagement with film industry	<ul style="list-style-type: none"> <li>• Collaborations between filmmakers and conservation organisations</li> <li>• Co-production of movie content with conservation messages</li> </ul>	<ul style="list-style-type: none"> <li>• Primary interests of movie industry are commercial, which may produce conflicts of interest</li> </ul>	<ul style="list-style-type: none"> <li>• What environmental awareness is there within the industry?</li> <li>• What common gains could industry and conservation work towards?</li> <li>• How to foster positive relationships between the movie industry and conservation community?</li> </ul>	<ul style="list-style-type: none"> <li>• Social research into industry engagements with conservation (<i>e.g. interviews, focus groups, expert shadowing</i>)</li> <li>• Socioeconomic research into audience interests and market trends</li> </ul>
Raising audience interest and awareness	<ul style="list-style-type: none"> <li>• Disseminating information about conservation issues among wider audiences</li> <li>• Increasing interest in species/ecosystems/issues of conservation concern</li> </ul>	<ul style="list-style-type: none"> <li>• Sensationalist or romanticised representations may be problematic by altering audience perception of the species/people involved</li> <li>• Reinforcement of uneven societal interest in certain species/ecosystems</li> </ul>	<ul style="list-style-type: none"> <li>• How are different types of messaging around conservation understood and interpreted?</li> <li>• What movie characteristics are more effective at increasing public environmental awareness and/or interest?</li> </ul>	<ul style="list-style-type: none"> <li>• Google trends analyses (<i>e.g. species or site searches</i>)</li> <li>• Audience surveys (<i>e.g. evaluating environmental awareness and intention to support specific conservation intervention</i>) and experimental viewings</li> <li>• Discourse and/or content analyses</li> </ul>
Behaviour change	<ul style="list-style-type: none"> <li>• Increased public, political and financial support for conservation</li> <li>• Beneficial changes in consumer and socio-cultural practices (<i>e.g. reduced market demand for threatened species/products; increase in pro-conservation behaviours</i>)</li> </ul>	<ul style="list-style-type: none"> <li>• Increased visitor pressure and development at vulnerable sites</li> <li>• Increased market demand for threatened species (or products)</li> </ul>	<ul style="list-style-type: none"> <li>• Is the film a catalyst for change or part of a gradual shift?</li> <li>• What movie characteristics, if any, are more effective at producing behavioural change?</li> <li>• What type of behavioural changes can effectively be attributed to films?</li> </ul>	<ul style="list-style-type: none"> <li>• Correlation of behavioural change to movie release dates and peak screening and audience demographics (<i>e.g. charitable contributions, visitor numbers, market trends</i>)</li> <li>• Longitudinal audience surveys based on self-reported behaviours</li> <li>• Direct approaches to measuring behaviour change (where possible)</li> </ul>
Biodiversity conservation impact	<ul style="list-style-type: none"> <li>• Identifiable contribution to conservation of species or sites (<i>e.g. increased wildlife abundance or reduced habitat loss</i>)</li> <li>• Measurable reduction in behaviour of conservation concern (<i>e.g. trade of threatened species or products</i>)</li> </ul>	<ul style="list-style-type: none"> <li>• Identifiable increase in loss or degradation of vulnerable species or sites</li> <li>• Measurable increase of trade in threatened species or products</li> </ul>	<ul style="list-style-type: none"> <li>• Are biodiversity conservation outcomes correlated to movie releases?</li> <li>• Is there evidence of causality?</li> <li>• If so, what is the nature of the impact?</li> </ul>	<ul style="list-style-type: none"> <li>• Trend analysis of changes in species or site condition and/or CITES data in relation to film release date and peak screening/movie popularity</li> <li>• Mixed-methods case studies, ideally initiated prior to movie release and monitoring reception/impact</li> </ul>

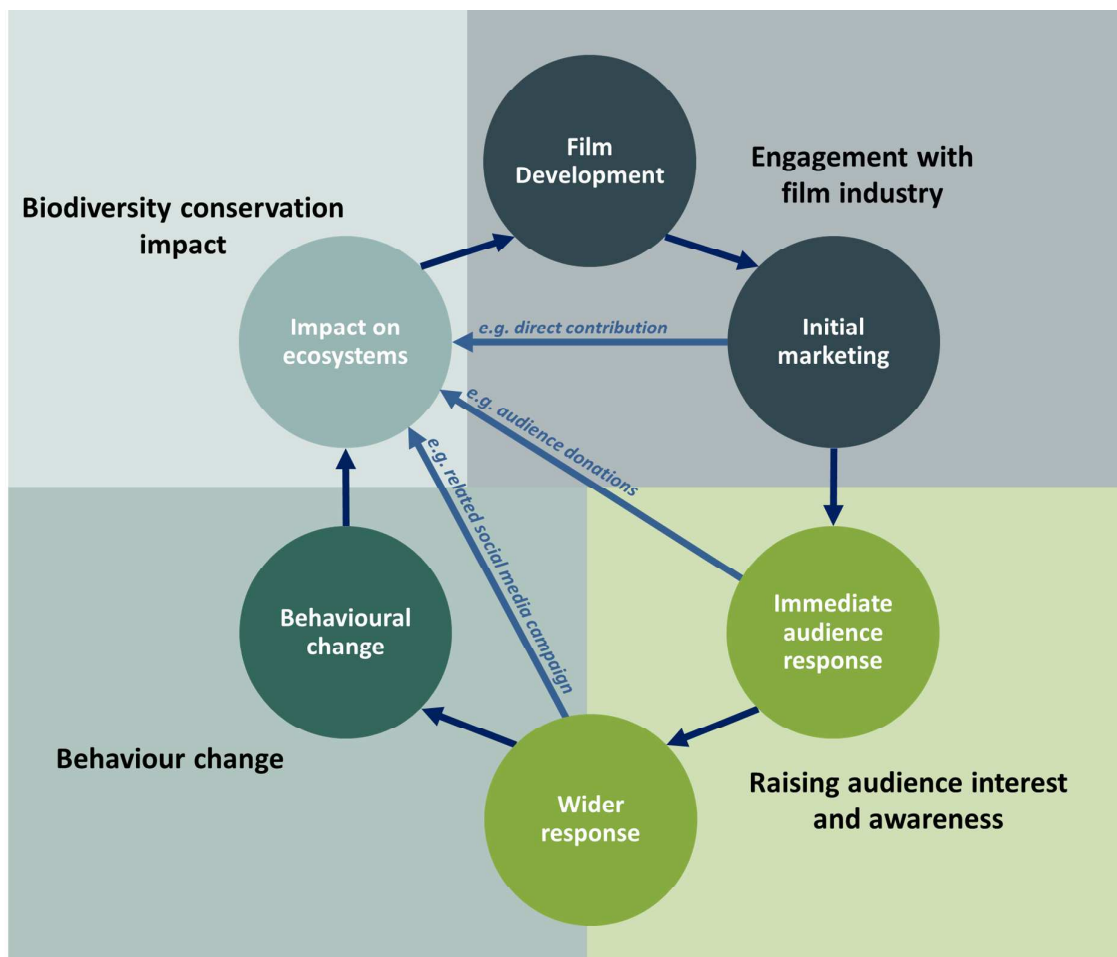
499 **Figure Legends**

500 **Figure 1.** A framework to understand the influence of cinema on biodiversity conservation, from  
501 initial engagement with the industry, through effects on audience awareness, to behaviour change  
502 and conservation outcomes. We highlight that this framework is iterative and conservation  
503 outcomes can be used to inform future engagements with the industry. Central lines (with  
504 examples) indicate potential more direct routes to conservation impact from earlier stages in the  
505 process.

506

507 **Figure 2.** Google trends statistics for searches in the USA for three species featured in animated  
508 films, in relation to a timeline of relevant movie releases. The fossa (*Cryptoprocta ferox*) were the  
509 antagonists of *Madagascar* (2005) (light/blue line); the blue tang (*Paracanthurus hepatus*) is the  
510 species of the titular character in *Finding Dory* (2016) (dark/green line); and the Spix's macaw  
511 (*Cyanopsitta spixii*), takes centre stage in the *Rio* (2011; 2014) franchise (mid/orange line). The  
512 google searches used are in the following categories: Fossa – animal, Blue Tang – search term, and  
513 Spix's macaw – organism classification, and data was extracted directly from the google trends  
514 information online. The Google trends statistic represents relative search effort (with the time  
515 period of maximum search effort having a value of 100). Lines have been smoothed with local  
516 polynomial regression fitting (for more information and R code refer to the supplementary material).  
517 Of note is the small peak in searches for "Fossa" related to the release of *Madagascar 2*, despite the  
518 fact that the film did not include this character (and these additional searches therefore likely  
519 representing an increase in people watching the prequel).

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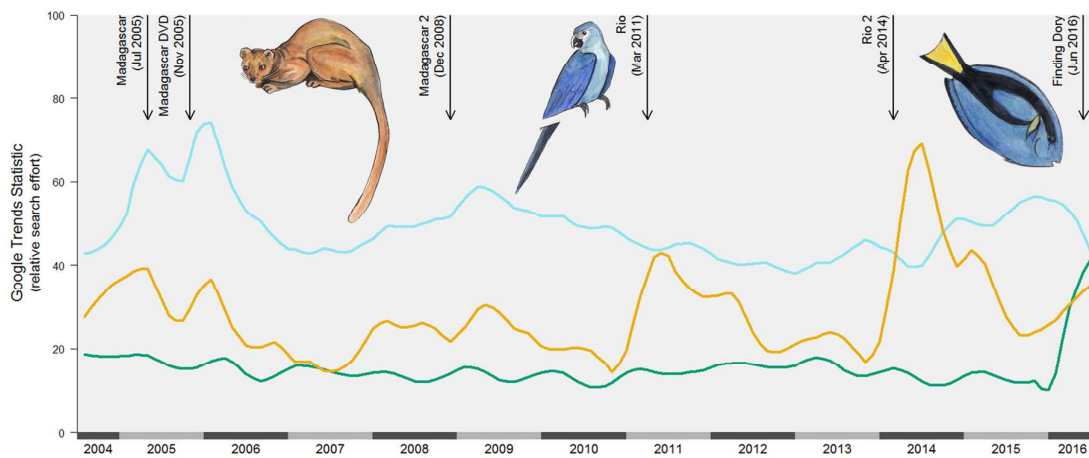


521

522 **Figure 1**

523





524

525 **Figure 2**

526

or review only

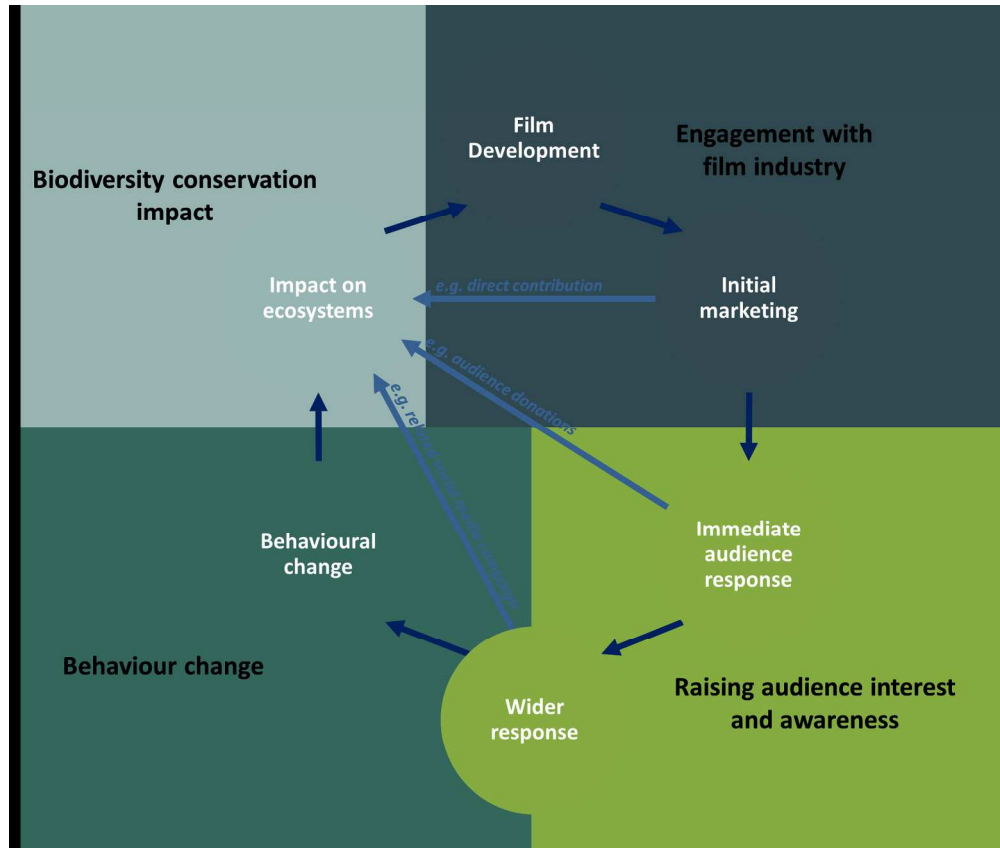


Figure 1. A framework to understand the influence of cinema on biodiversity conservation, from initial engagement with the industry, through effects on audience awareness, to behaviour change and conservation outcomes. We highlight that this framework is iterative and conservation outcomes can be used to inform future engagements with the industry. Central lines (with examples) indicate potential more direct routes to conservation impact from earlier stages in the process.

361x304mm (150 x 150 DPI)



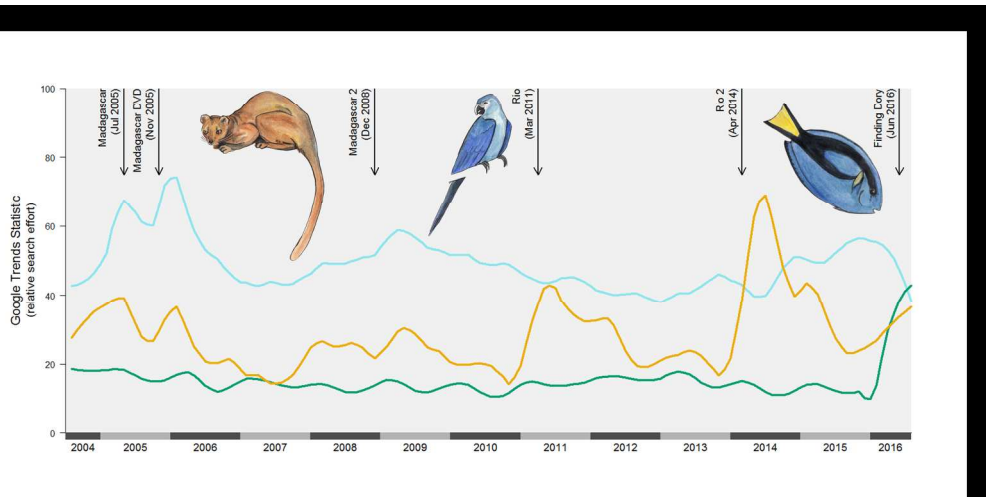


Figure 2. Google trends statistics for searches in the USA for three species featured in animated films, in relation to a timeline of relevant movie releases. The fossa (*Cryptoprocta ferax*) were the antagonists of Madagascar (2005) (light/blue line); the blue tang (*Paracanthurus hepatus*) is the species of the titular character in Finding Dory (2016) (dark/green line); and the Spix's macaw (*Cyanopsitta spixii*), takes centre stage in the Rio (2011; 2014) franchise (mid/orange line). The google searches used are in the following categories: Fossa – animal, Blue Tang – search term, and Spix's macaw – organism classification, and data was extracted directly from the google trends information online. The Google trends statistic represents relative search effort (with the time period of maximum search effort having a value of 100). Lines have been smoothed with local polynomial regression fitting (for more information and R code refer to the supplementary material). Of note is the small peak in searches for "Fossa" related to the release of Madagascar 2, despite the fact that the film did not include this character (and these additional searches therefore likely representing an increase in people watching the prequel).

359x177mm (150 x 150 DPI)