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2 WILDLIFE TOURISM, SCIENCE
3 AND ACTOR NETWORK THEORY

4 Kate Rodger

5 Susan A. Moore

6 David Newsome

7 Murdoch University, Australia

8 Abstract: Wildlife tourism is an important component of tourism worldwide. However, for
9 many species little is known about the possible impacts from tourist-wildlife interactions. Pre-
10 vious research has identified barriers to such science being undertaken but this science-wild-
11 life tourism interface remains poorly understood. Actor-network theory, with its attention to
12 the actors and relationships that make science possible, was used to describe and analyze the
13 development and decline of scientific research into the effects of tourism on wildlife in the
14 Antarctic region. This study concludes that actor-network theory provides a robust descrip-
15 tion of the complex role and positioning of science in wildlife tourism, while at the same time
16 suggesting that further attention to actors' relative power and scientists' normative beliefs are
17 essential elements of analysis. Keywords: actor-network theory, wildlife tourism, sociology of
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20

21 INTRODUCTION

22 The wildlife tourism industry is becoming an increasingly important
23 component of tourism worldwide (Roe, Leader-Williams and Dalal-
24 Clayton 1997). Paralleling the increased growth in wildlife tourism is
25 the greater demand for closer interaction with wildlife in their natural
26 habitats. Wildlife tourism is often considered to be a minimum impact

27 activity (Green and Higginbottom 2001), however, in recent years it
28 has been recognised that an increased understanding of tourist-wildlife
29 interactions is an essential contribution to the sustainability of the wild-
30 life tourism experience (Rodger and Moore 2004).

31 As wildlife tourism increases in popularity so does the need to re-
32 search, understand and manage potential impacts on the wildlife
33 and their environment. Science and research, complemented by long
34 term monitoring, can contribute to increasing knowledge and better
35 management. Long-term sustainability of this industry is critical and
36 of increasing concern (Reynolds and Braithwaite 2001). The contribu-
37 tion of science and research to wildlife tourism is central to under-
38 standing impacts. Rodger and Calver (2005) further identified how sci-
39 ence and research can contribute to increased conservation and
40 education as well as anticipate potential problems. However, large gaps
41 still remain in our understanding of impacts of tourists on wildlife, in
42 particular the cumulative and long term effects of these interactions
43 Q1 (Newsome, Dowling and Moore 2005).

44 Past research in Australia into barriers hindering scientists from
45 engaging in research on wildlife tourism has identified scientists' par-
46 adigmatic positioning along with difficulties faced in conducting inter-
47 disciplinary research (Rodger, Moore and Newsome in press). In the
48 past wildlife biologists and ecologists have not always seen the necessity
49 or importance of research into these tourist-wildlife interactions. And,
50 they regard wildlife tourism science as subjective rather than objective,
51 and therefore 'flawed'. Furthermore, interdisciplinary research is often
52 difficult to undertake, with this form of research bringing together dif-
53 ferent epistemologies (i.e., ways of understanding and studying the
54 world) and a need for a common goal by the researchers (Moore, New-
55 some, Rodger and Smith 2009; Rodger et al in press).

56 This paper reports on how a successful natural science program di-
57 rected towards wildlife tourism research and translated into manage-
58 ment was achievable. Much can be gleaned by examining a research
59 institution where wildlife tourism science was established as a research
60 priority. Actor-network theory is used as a theoretical and methodolog-
61 ical lens to analyze the development and subsequent decline of wildlife
62 tourism science in the Australian Antarctic Division (AAD).

63 Actor-network theory developed in the 80s, with its origins in the
64 sociology of science and technology. Since then actor-network theory
65 has diffused into other areas including environmental (Jakku 2004;
66 Kitchen 2000) and rural (Woods 1997) issues. In recent years actor-net-
67 work theory has been recognized as an important analytical framework
68 Q2 to study emerging tourism projects (Franklin 2004; Johannesson 2005;
69 Van der Duim 2007; Van der Duim and Van Marwijk 2006). Actor-net-
70 work theory was chosen for this research because it focuses analysis on
71 the relationships between non-humans and humans, natural and social
72 relationships, as a central part of the production of scientific knowl-
73 edge. Actor-network theory has also been described as “material semi-
74 otics” or “relational materiality” because it extends the semiotic
75 insight from language to include all materials (Law 1999). In this pa-
76 per attention is given particularly to the key actors and intermediaries
77 who were involved in the development and uptake of wildlife tourism
78 research in the Antarctic region.

79 ACTOR-NETWORK THEORY AND WILDLIFE TOURISM 80 RESEARCH

81 Also known as the sociology of translation (Callon 1986a), actor-net-
82 work theory developed within the sociology of scientific knowledge.

83 This body of work was developed by Bruno Latour (1983, 1986, 1987,
84 1996), Michel Callon (1986), John Law (1986, 1994, 1999, Law and
85 Hassard 1999) and more recently Murdoch (1995, 1997, 2001), and
86 Jakku (2004). Actor-network theory proposes a radical constructivist
87 semiotic approach advocating human and non-human entities should
88 be treated equally for purposes of analysis (Ashmore, Wooffitt and
89 Harding 1994). For actor-network theory, similarly to a number of
90 other constructivist theories, scientific knowledge is a social product
91 and contributes to the examination of the power actors hold or wield
92 especially in the fields of science and technology (Callon 1986a).

93 This analytical and theoretical framework is concerned with the pro-
94 cesses by which scientific disputes become closed, ideas accepted and
95 tools and methods adopted. This theory rejects distinctions between
96 science and technology. Instead it explores and follows the strategies
97 actors use to mobilize allies, as well as resources, which ultimately re-
98 sults in the construction of heterogeneous networks (Garrety 1997).
99 It examines how these networks result in science being “black boxed”,
100 meaning it becomes an established fact (Latour 1987). For actor-net-
101 work theory the “appropriate method for examining science is not
102 to start with particular assumptions about nature or scientists but, in-
103 stead, to follow and describe what scientists actually do, that is, their
104 interactions with other actors, both human and non-human, that they
105 seek to enrol” (Fountain 1999:344).

106 Actor-network theory examines the mechanics of power through
107 the construction and maintenance of networks (both human
108 and non-human). Actors become involved in networks through the
109 process of translation. Callon (1986a:25–26) described translation as:
110 “Translation builds an actor-world from entities. It attaches character-
111 istics to them and establishes more or less stable relationships between

112 them. Translation is a definition and the delineation of a scenario.”

113 An important text in the actor-network theory literature is Latour’s
114 (1983) study of Pasteur’s scientific career in 1881 and his successful
115 enrolment and enlisting of outsiders into his study of anthrax disease.
116 Latour (1983) highlights how Pasteur convinces other actors that it is
117 his work, and his work alone, which will provide a solution to this dis-
118 ease. Michel Callon’s study of a scallop industry in St Briec Bay (north
119 western France) followed this and introduced and defined words such
120 as translation, enrolment, interessement, and obligatory passage point
121 (Callon 1986) (Fig. 1). He developed an actor-network account of mar-
122 ine biologists and their strategy to enrol the local fishermen, the scal-
123 lops (*Pectun maximus*) and scientific colleagues in an attempt to
124 preserve a population of scallops. The achievement of this was only
125 possible with the co-operation of the other actors: the fishermen, their
126 scientific colleagues, along with the role that the scallops played. This
127 example was used to illustrate how the actor-network, which was con-
128 structed by the three researchers, failed once other actors dissented
129 from the network (Callon 1986; Woods 1997). Most importantly the
130 study highlighted how power is in the relations, not in the actors them-
131 selves, as power is dependent upon the actions of others (Latour 1986).

132 Actor-network theory therefore, relies on a large number of con-
133 cepts including actors, networks, intermediaries and the elements of
134 translation (Fig. 1). Law (1991) identified networks as transforming
135 from heterogeneous into aligned, with such networks made up of peo-
136 ple, organizations, machines, animals and more. This attention to net-
137 works allows examination of how the networks emerge, who or what
138 each network involves, how they came to be, how they are maintained
139 and how they compete with other networks. It is a means of examin-
140 ing why some networks become established and why others fail.

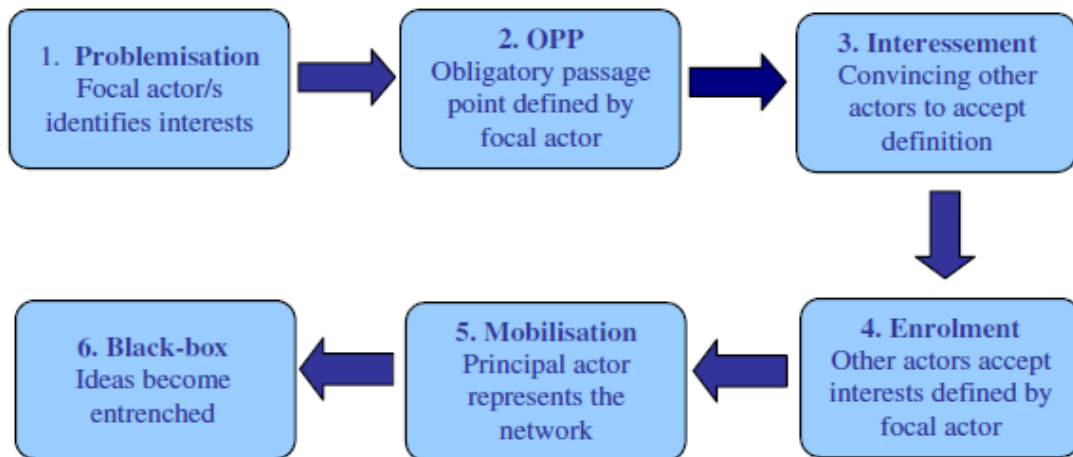


Figure 1. The Phases of Translation

141 Exploring how actors enlist other actors into their viewpoints to join
 142 their network and why this is not always successful (Latour 1996).

143 After networks have been formed, they may become unstable (Callon
 144 1986a). Translation is an ongoing process as it is never permanent and
 145 may fail in some circumstances. The entry of new actors, the departure
 146 of existing actors, or changes in alliances can result in the ‘black-boxes’
 147 (Callon 1986) being reopened and the contents reconsidered (Tatnall
 148 and Gilding 1999). A network only becomes strong and durable due to
 149 the bonds holding it together because it is comprised of a number of
 150 simplified networks. The network relies on the maintenance of these
 151 simplified networks for its continued existence. If not regularly main-
 152 tained the network can break down, due to actors dissenting, and even
 153 reform in a different configuration or as a different network (Callon
 154 1986a; Tatnall and Gilding 1999; Woods 1997).

155 Wildlife Tourism Research and the Australian Antarctic Division

156 Governance of Antarctica is a complex issue and falls under the
 157 Antarctic Treaty System (ATS). In 1961 there were 12 signatory nations
 158 to the ATS but this has increased over the years to 43 nations (Maher,
 159 Steel and McIntosh 2003). Australia, who has claimed national sover-
 160 eignty in the Antarctic, helped to broker the ATS, which established

161 governance for this area as no country has sole ownership. The ATS
162 was officially passed on June 23, 1961. Australia has claimed 42% of Ant-
163 arctica as sovereign territory and has had a continuous presence in this
164 region since 1947 (Antarctic Science Advisory Committee 1997). To
165 support the Treaty, the Protocol on Environmental Protection (The
166 Madrid Protocol) was negotiated. This is an agreement between ATS
167 nations focusing specifically on environmental management
168 including regulations, impacts, protection, and adverse effects on the
169 environment (Maher et al 2003). This protocol was originally drawn up
170 in 1991 but was not ratified until Japan signed in 1998.

171 Australia has a long history of conducting scientific research in
172 Antarctica. The AAD was established in 1948 by the Commonwealth
173 Government of Australia to administer and provide logistical support
174 for Australia's expeditions while maintaining four permanent research
175 stations and managing, as well as undertaking, scientific research
176 programs. The AAD, based in Hobart, Tasmania sends approximately
177 500 people south each year, of which 80 will spend the winter there
178 (Australian Antarctic Division 2000).

179 Despite a reputation of remoteness and wilderness, or perhaps be-
180 cause of this reputation, tourism to this area including the sub-Antarctic
181 islands is growing at an ever increasing rate (Enzenbacher 1994; Giese,
182 Riddle and Kriwoken 2001; Maher et al 2003). Tourists travel to Antarc-
183 tica predominantly by boat, but once there use a variety of transporta-
184 tion, including helicopter, zodiacs, and over-snow vehicles, before
185 approaching wildlife as close as permissible by foot (Australian
186 Antarctic Division 2004a). Modern ship based tourism to Antarctica be-
187 gan in 1958 (Headland 1994) and other tour operators followed. By the
188 late 80s there were a minimum of four ships operating in Antarctica
189 with the tourist season running from October through to April. By

190 1992/93 this had increased to 12 ships ranging in capacity from 38 pas-
191 sengers up to 530, and the total number of passengers carried over the
192 season was 6,460 on a total of 60 cruises (Splettstoesser and Folks 1994).
193 This had increased to over 27,000 visitors (including ship and land pas-
194 sengers) by 2005 (IAATO 2006). Future projections for tourism indi-
195 cate that visitor numbers could reach 1.5 million tourists per season
196 by 2010 (Australian Antarctic Division 2004a).

197 The majority of visitors (including tourists and members of expedi-
198 tions) to this area are seeking close interactions with the wildlife
199 (Australian Antarctic Division 2004a).¹ The special attraction of
200 Antarctic is not just the unusual wildlife but also its lack of fear that al-
201 lows these close interactions. A survey undertaken in 2003 of tourists
202 joining a cruise ship to Antarctica found 94.2% of respondents were
203 interested in viewing Antarctic wildlife with there being most interest
204 in penguins (Tisdell and Wilson 2004). For this reason and because of
205 the available data on the numbers and population trends of penguins,
206 they became the focal species for the wildlife tourism research network
207 analysed in this paper.

208 As visitors to the Antarctic region tend to concentrate their visits to
209 only a few places, this raised concern about possible negative impacts
210 on fauna (Giese 1996; Mason and Legg 1999). In the mid 90s little sci-
211 entific knowledge was available on the short and long term impacts of
212 tourism on the physical environment of Antarctica including the wild-
213 life (Mason and Legg 1999). The desire of humans who were travelling
214 to this region to interact with or study the wildlife, in particular pen-
215 guins, raised questions on how tourist activities needed to be managed
216 to protect the environment. Despite there being a general understand-
217 ing and anecdotal evidence on how visitors can impact on birds, man-
218 agement agencies at this time were constrained by a lack of specific and

219 scientifically rigorous knowledge (Giese 1996). In particular, knowl-
220 edge as to how visitors may be impacting on wildlife and how to
221 manage these interactions with the wildlife, including the penguins,
222 was lacking (Australian Antarctic Division 2004b).

223 Even though the majority of tourism takes place on the Antarctic
224 Peninsula (which is not a part of Australian sovereignty) the AAD still
225 felt there was a need to begin examining the effect of increased visitor
226 numbers on wildlife. Antarctic visitors, whether they be tourists or
227 expeditioners, are having close interactions with breeding groups of
228 seabirds (Giese and van Polanen Petel 2001). Although penguins
229 spend up to 75% of their lives at sea they are often subjected to higher
230 levels of visitor activity when they breed due to limited availability of
231 suitable breeding sites and a breeding season coinciding with tourism
232 season (Holmes, Giese, Achurch, Robinson and Kriwoken 2006).
233 Therefore, the AAD established a research program into the distur-
234 bance of wildlife by visitors in 1995 (Australian Antarctic Division
235 2001). Much of their early research focused on the effects of visitors
236 on penguins, including approach distances (Giese 1996).

237 The study reported in this paper focused specifically on the develop-
238 ment of wildlife tourism research beginning in 1995 through to 2004 at
239 the AAD. Over this ten year period, much scientific knowledge on the
240 impacts of visitors on penguins as well as other species was produced
241 (see Engelhard 1996; Engelhard, Baarspul, Broekman, Creuwels and
242 Reijnders 2002; Giese 1996, 1998; Giese and Riddle 1999; Holmes,
243 Giese and Kriwoken 2005; Holmes et al 2006; van Polanen Petel
244 Q6 2005; Woehler and Croxall 1996). The overall aim of the research
245 was to provide information for the development of scientifically based
246 guidelines for managing interactions between people and the wildlife,
247 in particular penguins (Giese et al 2001). The knowledge gained from

248 this research was then taken up by the AAD in the development of
249 management plans. Furthermore, guidelines on distances to be main-
250 tained between visitors and wildlife were developed as well as codes of
251 conduct for pedestrian visits to wildlife breeding locations. From 2004
252 wildlife tourism research was no longer undertaken by the AAD. In the
253 most recent Antarctic Science Strategy 2004/05–08/09 (Australian
254 Antarctic Division 2004c), launched in 2004, wildlife tourism research
255 was no longer a priority, aim or theme. This paper will use actor-net-
256 work theory to examine the formation of wildlife tourism research
257 through to its discontinuance in 2004.

258 STUDY METHODS

259 To understand, using actor-network theory, how wildlife tourism re-
260 search in the Antarctic region developed, relevant actors needed to be
261 identified. Human actors can consist of individuals or groups of hu-
262 mans. Interviews were conducted with human actors involved in wild-
263 life tourism science in the Antarctic region, in particular those actors
264 whose research focused on visitor-penguin interactions. The main pro-
265 cedure to identify participants was purposive, therefore actors who
266 could provide insight into this case study were asked to participate. A
267 snowball sampling strategy was also used to identify interviewees
268 (Babbie 2001). At the end of each interview, the interviewee was asked
269 if they knew of anyone else who would be appropriate to interview for
270 this research. Interviews were conducted until theoretical saturation
271 had been reached (Strauss and Corbin 1990) meaning further inter-
272 views were not contributing new information.

273 A focused interview technique was used because it allowed interview-
274 ees the opportunity to expand on their responses based on their per-
275 sonal experiences while still ensuring structure to the interview

276 (Frankfort-Nachmias and Nachmias 1996). Those interviewed were em-
277 ployed by Government organisations including the University of
278 Tasmania, the Australian Government Antarctic Division and Tasma-
279 nian government departments including the former Department of
280 Primary Industries, Water, and Environment and the Department of
281 Tourism, Parks, Heritage and the Arts.

282 Human and non-human actors were identified from the interviews
283 and documentation. The interviews were supplemented by documen-
284 tation including journal articles, policy documents, tourism bro-
285 chures, press statements, as well as a variety of reports including
286 the Australian National Antarctic Research Expeditions (ANARE)
287 strategic plans. Any public domain text with relevance to this research
288 project was analysed.

289 The key data analysis method was discourse analysis to build theory
290 using QSR Nvivo software for qualitative research. Discourse analysis al-
291 lows the researcher to closely examine the language in use to look for
292 patterns while Nvivo provided a means of storing, retrieving, categoriz-
293 ing and coding large amounts of text (Wetherell, Taylor and Yates
294 2001; Gibbs 2002). Analysis focused on interviewees' words, actions
295 and the documentation to gain an in-depth understanding of the re-
296 search topic. Excerpts from the data are presented in the results and
297 discussion in order to let the human actors speak for themselves where
298 possible (Maykut and Morehouse 1994).

299 The principal actor followed in this network was a small group of
300 scientists who supported research into the effects of visitor-penguin
301 interactions. They are referred to as the wildlife tourism scientists.
302 They were either directly employed by the AAD or funded by a
303 grant scheme from the AAD. Their aim was to advance scientific
304 knowledge on possible impacts from visitor-wildlife interactions, with

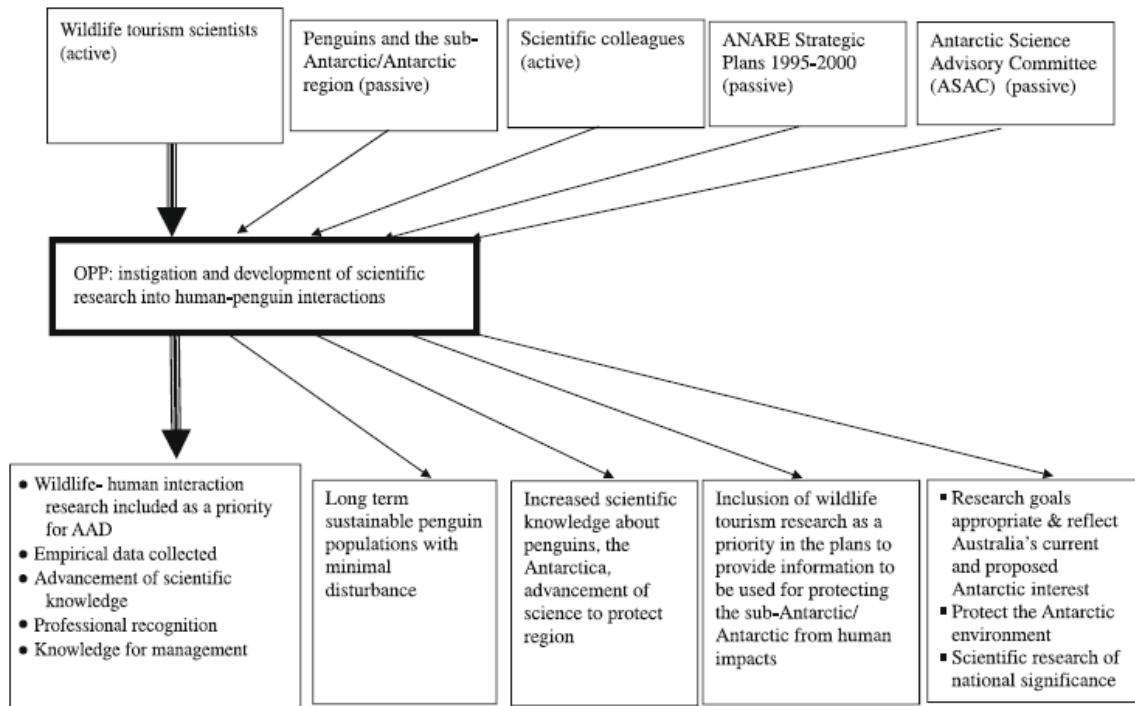


Figure 2. Wildlife Tourism Science Actor-Network

305 a focus on penguins. The non-human actors identified in this net-
 306 work included the penguins, Antarctica and the ANARE Strategic
 307 Plans. The human actors were the wildlife tourism scientists, the
 308 Antarctic Science Advisory Committee (ASAC) and scientific
 309 colleagues (Fig. 2).

310 RESULTS AND DISCUSSION

311 Formation of the Wildlife Tourism Research Actor-network

312 Problematisation, the first step in establishing an actor-network
 313 (Fig. 1), defines the nature of the problem and identifies the involved
 314 actors, both human and non-human (Law 1986). As actor-network the-
 315 ory is concerned with how an idea is conceived and then developed
 316 with or without resistance by those actors involved (Woods 1997),
 317 the various actors and their relationships need to be identified (Martin
 318 2000). The relationships between the different actors contribute to

319 understanding why some networks are successful and others fail. How-
320 ever, one needs to remember that the actors within the network dis-
321 cussed here also have roles in other overlapping networks.

322 The success of problemisation relies upon the principal actor defin-
323 ing the issue in such a compelling way it ensures the other actors ac-
324 cept their definition of the problem (Arksey 1998; Callon 1986a;
325 Woods 1997). Problemisation for this network involved the wildlife
326 tourism scientists becoming concerned about the possible effects of vis-
327 itor-wildlife interactions in the Antarctic region:

328 Antarctic tourism was increasing, expeditions to visit wildlife were
329 increasing and we needed to understand what impact this could or
330 would have. Wildlife is vulnerable to start with so we needed to study
331 the cause and effect of tourism. (Scientist)

332 If the wildlife tourism scientists were to achieve their aim of under-
333 taking wildlife tourism research, they needed to construct the problem
334 in a certain way in order to engage the interests of other actors to be in
335 line with their goal—the obligatory passage point (OPP) (Fig. 1). How-
336 ever, for the wildlife tourism research network to eventuate, the wildlife
337 tourism scientists needed their scientific research to become
338 “indispensable in the network” (Callon 1986a:204). To achieve this
339 both the human and non-human actors in this network needed to
340 be determined and defined in a way that a proposal for the instigation
341 and development of wildlife tourism research would eventuate (Fig. 2).

342 Penguins were one of the key non-human actors involved in this net-
343 work. Penguins were chosen as the focal species for the wildlife tourism
344 scientists because they are abundant, as well as being the species that
345 most visitors wish to interact with, placing them in a potentially vulnera-
346 ble position. Scientific knowledge was needed to ensure that interactions
347 between penguins and visitors were not resulting in negative environ-

348 mental impacts and effective guidelines could be put in place where nec-
349 essary. This was particularly important as many of these interactions were
350 taking place during the penguins' breeding period, a time when the pen-
351 guins could be particularly vulnerable to disturbance (Giese 1996).

352 Scientific colleagues were the next actor of importance to this net-
353 work. This group consisted of scientists who were involved in the re-
354 search in the Antarctic region from the AAD, organisations such as
355 the Antarctic Cooperative Research Centre (funded by the Common-
356 wealth Government of Australia and industry interests), universities
357 conducting research in Antarctic and other scientists involved in the
358 establishment of the scientific goals and priorities for the AAD (Austra-
359 lian Antarctic Division 1994). Enrollment of scientific colleagues by the
360 wildlife tourism scientists was possible because of the latter's emphasis
361 on the requirement for empirical knowledge on visitor-wildlife interac-
362 tions for the protection of the wildlife and their environment. A dual
363 emphasis on the need for increased scientific knowledge on penguins
364 and such research advancing science, by the wildlife tourism scientists,
365 contributed to movement of the network through the obligatory pas-
366 sage point (Fig. 1).

367 The ANARE Strategic Plans 1995–2000 were the fourth key actor. This
368 was because wildlife tourism research needed to be incorporated into
369 these plans for the AAD if research into the impacts of visitor-wildlife
370 interactions was to take place. These were the first strategic plans for sci-
371 ence in the AAD. Several new programs each with a Program Leader
372 were developed, of which the Human Impacts Research Program was
373 the most relevant to wildlife tourism (Australian Antarctic Division
374 Q3 1992, 1994). The Program Leader, Impacts Research Program, was ap-
375 pointed in 1994. Their responsibility was to develop the Human Impacts
376 Research Program's strategic plans for the next 5 years of scientific re-

377 search in the Antarctic region. After consultation with a variety of scien-
378 tists involved in the Antarctic region, clear goals were identified and
379 resources were allocated to areas of highest priority (Australian Antarc-
380 tic Division 1992, 1994). Thus, the ANARE Strategic Plans included wild-
381 life tourism science as a priority area of research.

382 The final actor was the Antarctic Science Advisory Committee
383 (ASAC). In 1985 this committee, independent of the AAD, was formed
384 to report directly to the Commonwealth Minister for the Environment
385 Q4 (ASAC 1987). Their role was evaluating and reporting to the Govern-
386 ment on the Antarctic program in meeting Australia's scientific objec-
387 Q5 tives (ASAC 2003). The Committee includes internationally recognized
388 scientists and sets the scientific directions for Australia's Antarctic sci-
389 entific program as well as recommendations for future research (ASAC
390 2003). If the wildlife tourism research network was to be successful,
391 ASAC needed to be enrolled and support research into wildlife tourism
392 interactions. To enroll ASAC the wildlife tourism scientists needed to
393 persuade them that they would only achieve their goal of protecting
394 the environment through research into visitor-penguin interactions.

395 Although they play an important role in this actor-network commer-
396 cial tour operators and tourists (referred to collectively here as the
397 tourism industry) to the Antarctic region were not included as actors
398 in this network. This is because the scientific network, which identified
399 the actors in the wildlife tourism research network through self-refer-
400 encing and snowballing, did not recognize the tourism industry as ac-
401 tors. This lack of recognition had adverse consequences for the
402 network, an issue returned to later in this paper.

403 The next phase in translation is interessement (Fig. 1). In this study,
404 it was where the wildlife tourism scientists attempted to impose their
405 priorities on the other actors by blocking new possible alignments

406 (Callon 1986a). Each actor enlisted into the problemisation phase
407 can be integrated into the plan or can “refuse the transaction by defin-
408 ing its identity, its goals, projects, orientations, motivations, or interests
409 in another manner” (Callon 1986a:207). This stage of translation is
410 reliant on the principal actor reinforcing the identities and associa-
411 tions identified in the problemisation stage. Here, the principal actor
412 seeks alliances with other actors and attempts to convince them that
413 their solution is the way forward (Kitchen 2000).

414 Interessement is a crucial phase of the actor-network process (Callon
415 1986) and is a competitive part of the building of an actor-network since
416 actors are often implicated in the problemisation of other networks. In
417 this case, the wildlife tourism research network developed with little
418 resistance from other actors. Although the idea of wildlife tourism re-
419 search was instigated primarily by a small group of scientists, it came
420 about at an opportune time when most of the involved actors appeared
421 to be open to the idea. The commencement of the Human Impacts Re-
422 search Program, the employment of a Program Leader, and strategic
423 planning developing for the AAD, made it an ideal time for the wildlife
424 tourism scientists to establish their actor-network based in the Human
425 Impacts Research Program. Furthermore, as one scientist commented:
426 I guess the focus of science in general began to change. The scientists
427 began to think more about the impacts ... there was a paradigm shift,
428 people started to think about their effect on the animal. (Scientist)
429 Interessement of the actors was straightforward and proceeded with
430 little contest. It was assisted by several key opportunities available to
431 and managed by the wildlife tourism scientists. These included the
432 quantitative design of the research, general recognition by the scien-
433 tific community (and managers) of the importance of scientific knowl-
434 edge, anecdotal reports suggesting visitor-penguin interactions were

435 having a negative impact, managers' need for knowledge and govern-
 436 ment reports (Table 1).

Table 1. Interesement of Wildlife Tourism Research

Actor	Interesement	Supportive evidence
Scientific Colleagues	Wildlife tourism scientists established alliances by appealing to their colleagues' normative beliefs about quantitative research and data to advance scientific knowledge. Quantitative design and method for their research.	"Consequently, despite having a general understanding of the effects of human disturbance on Adelie penguins, management agencies remain constrained by a lack of specific and scientifically rigorous information. Experiments designed to quantify the effects of breeding success of specific types and intensities of human activity could provide information for the management of human behaviour around Adelie penguin colonies." (Giese 1996:157)
ANARE Strategic Plans 1995–2000	Appealed to the need for good scientific data for management of human impacts as raised by 1992 report by ASAC. Highlight the importance of their particular area of research over other human impact studies.	I think it [wildlife tourism research] filled a management gap that they [managers] were aware of...if there is reasonably robust scientific information around that they can base management on then they will. (Scientist) Science assists in providing data and measurement to provide the basis of the policy. (Manager) looked at the full spectrum on what you might consider to be human impacts. Anything from the old fashioned perspectives of fuel and waste through to more integrative ways of looking at the environment. It was felt research on disturbance was needed. Australia really led the way... (Scientist)
Penguins	Needed to illustrate signs of disturbance from interactions with humans.	"In a 1984 review of the status of seabird populations world-wide, 85 seabird species were either considered endangered or were being measurably affected by human activity. Recreational visits and tourism contributed to population decreases for almost 25% of these." (Giese 1999)
ASAC	Only possible if interesement of scientific colleagues was achieved. ASAC consults with wide range of scientists to advise on future research priorities.	There is a body called the Antarctic Science Advisory Committee which is an external committee independent of [the AAD]. And that body advises the government, so in the Antarctic Division [staff] work very closely with that Committee and in constructing the strategic plan, the plan is actually their plan although [staff] do all the work to establish it. (Scientist)

437 Following on from intersement is enrolment (Fig. 1, Phase 4). In
438 this study, this was where the wildlife tourism scientists sought to rein-
439 force the alliances they formed earlier on, and can in principle be
440 achieved through negotiation (Callon 1986). Central to the enrolment
441 of actors in the wildlife tourism research network was the Madrid Pro-
442 tocol and increasing tourism activity. In 1994, four years before its
443 international ratification, Australia enacted legislation to implement
444 the Protocol. This bound all Australians by law to observe its provisions.
445 The Protocol had developed due to growing concern among the par-
446 ties to the Antarctic Treaty about the global importance of this environ-
447 ment and the increasing need to protect it from the effects of
448 increasing visitor activity (Australian Antarctic Division 2000).

449 The Madrid Protocol was an important tool because it supported the
450 need for wildlife tourism research. The Protocol highlighted the
451 importance not only of Australia's obligation to undertake research
452 to protect the wildlife but also how this research needed to include
453 the effects of visitor-wildlife interactions, including tourism. Research
454 was important to ensure detrimental changes to penguin populations
455 were prevented and populations sustainably managed. If enrolment
456 was to be successful then the wildlife tourism research needed to be ap-
457 proved by ASAC and included in the ANARE Strategic Plans.

458 To ensure the enrolment of scientific colleagues, ANARE Strategic
459 Plans and ASAC the wildlife tourism scientists highlighted the robust-
460 ness of their findings and their relevance to management. They also
461 highlighted the quantitative approach used for their research. As one
462 scientist remarked "It was quantitative. It was the figures that sold it."

463 Mobilisation of the network, the penultimate stage of translation
464 (Fig. 1), was dependent on the actors all accepting the need for re-
465 search into visitor-penguin interactions. The key task for the wildlife

466 tourism scientists was to ensure that their role of representing the other
467 actors within the actor-network was secured (Arksey 1998). This was
468 achieved through the establishment of strategic plans for the Human
469 Impacts Research Program for 1995–2000, which included specific
470 themes and goals relating to wildlife tourism science, for example
471 Theme 3, Characteristics of the Antarctic Environment, which aimed to:

472 Examine the effects of physiological stress to mammals and birds
473 (caused by operational procedures, scientific research manipulations
474 and recreational activities) to determine whether stress can reduce
475 the viability of individuals or populations. (Australian Antarctic Divi-
476 sion 1994:76)

477 By the inclusion of relevant themes and goals in the strategic plans
478 for the Human Impacts Research Program, the wildlife tourism scien-
479 tists had consolidated their position as representative for all the entities
480 in their network. These plans were supported by their scientific col-
481 leagues, and were agreed to by ASAC. This resulted in the wildlife tour-
482 ism scientists undertaking wildlife tourism research to examine the
483 effects of visitor-wildlife interactions.

484 However, to fully complete mobilisation of the wildlife tourism
485 research network, these themes and goals needed to become actual
486 research projects. By the 1996/97 season, wildlife tourism projects had
487 begun and continued to increase in number over the next eight years:
488 within our program, in our human impacts program, we have people
489 who are looking at the effect of tourists from some aspects of animal
490 physiology, the animals being mainly seals and penguins in the Ant-
491 arctic as that is what people want to see. So we are putting a part of
492 our resources into a series of studies. (Scientist)
493 Projects included the effects of helicopters on Antarctic wildlife; im-
494 pact of disturbance on breeding behaviour and physiology of southern

495 elephant seals (*Mirounga leonina*); and population monitoring of
496 Adélie penguins (*Pygoscelis adeliae*).

497 Translation successfully occurred resulting in the wildlife tourism
498 research network being “black-boxed” as all actors identified were
499 enrolled. Complete stabilization of the wildlife tourism research
500 actor-network could be seen in 2004 when not only were projects into
501 the effects of visitor-wildlife interactions being undertaken, but manag-
502 ers were using the derived knowledge for management purposes:

503 Information arising from this research is being used to develop the
504 Australian Antarctic Division’s guidelines for managing human inter-
505 actions with wildlife. This includes codes of conduct for pedestrian
506 visits to wildlife breeding groups and guidelines for use of helicopters
507 around aggregations of animals. Results from this research are also
508 being made available to commercial tour operators and other Treaty
509 Nations. (Australian Antarctic Division 2004b)

512 Disbanding of the Wildlife Tourism Research Network

513 Actor-networks are only possible while all the actors remain enrolled.
514 Despite the increased number of projects and the uptake of knowledge
515 for guidelines and management, the wildlife tourism research network
516 came to what Callon (1986) referred to as “dissidence”. Dissidence re-
517 sulted in the wildlife tourism research network disbanding and illus-
518 trates how changing identities and relationships can result in the
519 disbanding of established networks (Jakku 2004).

520 From 1995–2004, the Antarctic Science Strategies included wildlife
521 tourism research. However, in a recent Antarctic Science Strategy
522 2004/05–08/09 (Australian Antarctic Division 2004c), launched in
523 2004, wildlife tourism research was no longer a priority, aim or theme.
524 From the 2004/05 season onwards, the AAD approved only one wildlife

525 tourism research project which involved monitoring for long-term or
526 cumulative impacts on Southern Ocean seabirds (Australian Antarctic
527 Division 2005).

528 Networks are only as stable as their alliances. Although the wildlife
529 tourism scientists and wildlife remained enrolled in the network, dissi-
530 dence came from scientific colleagues and the broader community
531 who in turn affected the “alliance” with the ANARE Strategic Plans
532 and ASAC. The wildlife tourism research network was reliant on their
533 scientific colleagues remaining enrolled as the latter have influence
534 and power in deciding the direction of future research by the AAD:

535 Australia’s Antarctic science program for the next five years has been
536 finalized after thorough external evaluation by the Antarctic Science
537 Advisory Committee and widespread consultation with the scientific
538 community. (Australian Antarctic Division 2004c:2)

539 Without the support of their scientific colleagues, research into the
540 effects of visitor-wildlife interactions was no longer considered a prior-
541 ity for the ANARE Strategic Plans 2004/05–08/09. With both these pri-
542 mary actors (scientific colleagues and ANARE Strategic Plans)
543 dissenting, the wildlife tourism research network disbanded. The de-
544 cline of the wildlife tourism research network, once the scientific col-
545 leagues had dissented, illustrates that power is associative. Power is
546 invested in the relations rather than the actors. As Latour (1986)
547 noted, the exercise of power depends on the actions of others, result-
548 ing in power being translated.

549 Exploring the Wildlife Tourism Science Network

550 The above section used actor-network theory and a narrative style to
551 explain the role of various actors in the development and decline of

552 wildlife tourism research in the Australian Antarctic Division. This al-
553 lowed for the influence of the actors in the development and disband-
554 ing of the wildlife tourism research network to be described. This
555 section, with the use of extensive theoretical and empirical work from
556 within the sociology of science, further explores the formation and dis-
557 banding of the wildlife tourism science network.

558 The establishment of the wildlife tourism research network at the
559 AAD and affiliated organisations in 1995 was possible for a variety of
560 reasons. The network developed at an opportune time when both
561 the human and non-human actors were receptive to such research.
562 In part this was due to concerns regarding increasing numbers of tour-
563 ists and associated impacts. Therefore, translation of the network was
564 straightforward. Additional explanations lie with scientists' normative
565 beliefs, particularly with respect to the scientific method and profes-
566 sional recognition, and a changing environmental external to but
567 impinging on the network's focus and research activities.

568 Scientists use the scientific method to ensure value free experi-
569 ments are undertaken that use replication, quantification and statisti-
570 cal analysis to ensure data and findings are free from contextuality
571 (Altrichter 1986). Empiricism and objectivity are fundamental to
572 the positivistic Western notion of the scientific method. These con-
573 cepts, especially empirical research, were used by the wildlife tourism
574 scientists to interesse and enrol other actors into their network. The
575 wildlife tourism scientists built an association with their scientific col-
576 leagues in large part due to the empirical approach they sought to
577 apply to their work. This was needed because many of their scientific
578 colleagues were from the natural sciences and held strong views on
579 the importance of the scientific method and quantitative research.
580 As one scientist commented "It is good solid science, so there is

581 no scientific weakness to it’.

582 Professional recognition, an important feature of the scientific com-
583 munity, contributed to the association holding the wildlife tourism re-
584 search network together. In science, professional recognition is
585 dependent upon the conformity to social norms of the scientific com-
586 munity (Storer 1966). Professional recognition and reputation are reli-
587 ant on the exchange of new information. Communication can take
588 place in a variety of forms, from publishing scientific work in a peer re-
589 viewed journals through to presenting at conferences, to being asked
590 to give an invited review lecture (Mulkay 1991; Ziman 1984). Recogni-
591 tion by their peers of the importance of their work helped consolidate
592 the wildlife tourism network. As one scientist remarked:

593 Very quickly there were other countries jumping on the band wagon.

594 They were seeing that yes, good solid science in this area is something
595 that we can do. Australia really led the way and lot of other groups
596 then jumped on the band wagon. I felt that one of the major suc-
597 cesses to come out of ... [our] work is the recognition that it is good
598 important work that should be done. (Scientist)

599 For the wildlife tourism research network to continue to remain
600 black-boxed, the wildlife tourism research needed to become socially
601 institutionalised at the AAD. Social institutionalisation is the creation
602 and maintenance of formal structure (Rochester and Vakkari 1997)
603 and includes the foundation of research associations and formal
604 communication channels such as scientific conferences and journals
605 along with the degree of integration of the discipline into university
606 departments, government departments and teaching curricula
607 (Rochester and Vakkari 1997). However, in this case social institu-
608 tionalisation was not possible for the wildlife tourism research net-
609 work. Examining power relationships within the network helps

610 explain why.

611 Power is the probability of one actor within a social relationship
612 being in a position to carry out their will despite resistance (Weber
613 1964). Power is achieved through associations, and actor-network the-
614 ory illustrates how the use of power depends upon the actions of others
615 in the network (Latour 1986). To achieve continued power associa-
616 tions the wildlife tourism scientists needed to promote their area of re-
617 search and communicate the importance of their findings to their
618 scientific colleagues and the tourism industry. Yet, in many ways this
619 goes against the norms of the scientific community, which encourages
620 scientists to remain disengaged and objective (see Cortner 2000; Mitr-
621 off 1972). Instead of entering into the political arena to highlight the
622 importance of their findings and the necessity of their work, the wild-
623 life tourism scientists relied upon everyone viewing their work with the
624 same level of importance as themselves.

625 Over the eight years that wildlife tourism research was being under-
626 taken, new scientists were employed at the AAD and the broader
627 agenda of the Division changed. These appointments led to a change
628 in the network. One of the new appointments, in an influential posi-
629 tion, dissented from the network. Two interrelated reasons for their
630 dissention are possible. The first was their perceptions of the benefits
631 and importance of wildlife tourism research compared to other new
632 areas of research and the second was their normative beliefs about
633 science. With their dissention the power of association between the
634 human and non-human actors was lost. This ultimately contributed
635 to the network and wildlife tourism research declining. As this col-
636 league stated, they had difficulty in seeing the relevance of wildlife
637 tourism research:

638 We have our own protocol posters around the place saying you can
639 not go within 10 meters or 50 meters at some time of the year to pen-
640 guins. That is rubbish because if you sit down near a colony they actu-
641 ally come up and climb on you. (New scientific colleague)

642 For this actor, the results from the wildlife tourism research were not
643 providing evidence of negative impacts. Instead there were other more
644 urgent areas where research was needed:

645 Waste disposal, mining, nuclear, leaking oil pipelines that are sending
646 out millions of liters daily. Having said that we reckon there are some-
647 where between 1 and 10 million cubic meters of contaminated waste
648 in the Antarctic. (New scientific colleague)

649 Antarctica's public profile was increasing during this period of time
650 along with the many environmental issues that the region faced. It was
651 also highlighted how there was much research needed to ensure the
652 pristine environment was conserved. The increasing awareness placed
653 pressure on the AAD to broaden their agenda and ensure they were
654 undertaking relevant scientific research contributing to the area's con-
655 servation. The majority of funding for the AAD comes from the Austra-
656 lian government and they play an important role in dictating future
657 research. As the new scientific colleague noted "We're paid by the gov-
658 ernment, the government sets its strategic plan for our activities and we
659 have to deliver to the government on that strategic plan". The Antarc-
660 tic Science Advisory Committee (ASAC) advises the government on fu-
661 ture research areas "in the AAD we work closely with that committee
662 and in constructing the strategic plan, however, the plan is their plan".
663 (new scientific colleague)

664 The new influential colleague's normative views on research into vis-
665 itor-wildlife interactions was the second factor underpinning their dis-
666 sension from the network. The paradigmatic position a scientist takes

667 will influence their research, as scientists approach their work from dif-
668 fering philosophies (Crotty 1998). Many natural scientists are ecolo-
669 gists and biologists who have a positivistic approach to their work.
670 This world view or paradigm has a strong belief in objective empirical
671 science and the scientific method. This was similar to the view held by
672 this actor who commented: “That is the most important attribute, it’s
673 got to be objective.” Furthermore, they commented:

674 I think people who tend to work in this area [wildlife tourism] are on
675 the whole, less objective maybe than those who work in other areas.
676 Frequently they are doing research in that area in order to find some
677 numbers to support a position that they held at the beginning. That’s
678 not the way that science works. (New scientific colleague)

679 Scientists operate within their paradigms or world views. The ap-
680 proach taken to research is determined by the epistemological and
681 ontological position a scientist holds. This has implications not only
682 for the research undertaken but also for the methodology used. This
683 colleague perceived wildlife tourism research as being subjective rather
684 than objective therefore allowing for personal interpretation, although
685 the wildlife tourism scientists felt they were undertaking objective,
686 quantitative research.

687 CONCLUSION

688 This paper used actor-network theory to examine how a natural sci-
689 ence program directed towards wildlife tourism research and trans-
690 lated into management was achieved. The phase of translation, as
691 developed in actor-network theory by Latour (1983, 1986, 1987,
692 1996), Callon (1986, 1986a) and Law (1986, 1994, 1999), enabled iden-
693 tification of the critical actors and then description of their actions

694 leading to a successful wildlife tourism research program. These actors
695 included wildlife tourism scientists and their colleagues, the Antarctic
696 Science Advisory Committee, the ANARE Strategic Plans and the pen-
697 guins themselves. Achieving an obligatory passage point, where the
698 importance of wildlife tourism science was identified and shared,
699 and interesement, where others (such as colleagues) become equally
700 as committed, seemed critical phases. Enrolment of colleagues was in
701 large part due to a common belief in the scientific method accompa-
702 nied by quantitative methods.

703 Although the network was black-boxed (i.e., existed as a stable en-
704 tity) for about eight years, this situation was not permanent (Callon
705 1986, 1986a). Primary reasons for disbandment were a change of actors
706 in the network, and in priorities external to but influencing the net-
707 work. A secondary reason was the inability of the wildlife scientists to
708 promote their science where it mattered. In particular, the tourism
709 industry not being enrolled into the network coinciding with the views
710 of a new actor about the impacts of visitors on Antarctic wildlife relative
711 to other threats and priorities to the Antarctic (other research was
712 identified as having greater importance) and their judgment that the
713 subjective nature of wildlife tourism research detracted from its quality
714 contributed to declining support. The result was research resources
715 being directed elsewhere.

716 Of importance theoretically and conceptually, this paper has illus-
717 trated that actor-network theory is a useful method for describing
718 how wildlife tourism research developed in the Antarctic region. With
719 assistance from the broader sociology of science literature it allowed
720 for in-depth analysis of the reasons behind the outcomes observed.
721 As such, actor-network theory is likely to provide a robust method for
722 describing the development or otherwise of science and associated re-

723 search agendas in wildlife tourism. These findings, suggest, however,
724 that this application should be complemented by reliance on current
725 and past efforts in the sociology of science, especially those focused
726 on better understanding the power of actors and normative influences
727 on the practices of science.

728 For tourism research, as a multidisciplinary enterprise, often with
729 strong interest from and involvement of end users from the industry
730 in research, it is essential to understand and be able to reflect on
731 and ‘manage’ (as much as is ever possible) how science is practiced
732 and what makes it succeed and fail. For tourism research with its
733 numerous stakeholders and researchers, often with differing paradig-
734 matic positions (Patterson and Williams 1998) and normative beliefs,
735 actor-network theory provides a powerful way of revealing and then
736 understanding how these differences affect scientific practices and suc-
737 cess. And even more importantly for an applied area of research such
738 as tourism, this theory potentially provides insights into how these dif-
739 ferences can be successfully managed and optimized. The future of sus-
740 tainable tourism depends on being able to manage these differences.

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