

1 **Title:** Exploring connections among the multiple outputs and outcomes emerging from 25 years of sea  
2 turtle conservation in Northern Cyprus

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16 **Abstract**

17 Monitoring and evaluation are essential stages of conservation implementation, offering a wide variety  
18 of benefits including the ability to engage in informed adaptive management. Understanding the  
19 relationship among actions, outputs, and outcomes can inform on factors acting to facilitate or hinder  
20 conservation success. Assessing these relationships is particularly important for projects with both social  
21 and ecological objectives given that they likely operate through a more complex theory of change.  
22 Performance measurement studies that assess both ecological and social variables can offer an  
23 informative and cost-effective evaluation method for such projects, but simultaneous assessment is  
24 rarely implemented. Using the case study of the Marine Turtle Conservation Project in North Cyprus, we  
25 aimed to demonstrate how social-ecological performance measure protocols can aid sea turtle  
26 conservation efforts in adaptive management through informing on connections among project actions,  
27 outputs, and outcomes. Our study employed a mixed-methods performance measurement approach  
28 integrating three distinct data sources: 31 project publications, the project's long-term dataset on sea  
29 turtle ecology, and 26 semi-structured interviews with key informants including residents, fishermen,  
30 local business owners, and project staff. The results indicated that the project has generated a wide  
31 range of social, economic, and ecological outcomes. Two primary connections among social and  
32 ecological factors emerged: 1) bridging the research-implementation gap through directing research into  
33 policy action and 2) enhanced operational capacity and achievement of ecological outcomes through  
34 extensively engaging with the community and generating local economic benefits. Insufficient  
35 government enforcement and a lack of widespread behavioural change on turtle nesting beaches were  
36 primary barriers. This study highlights the benefits of multi-disciplinary conservation and demonstrates  
37 the insight that can be gained from rapid, social-ecological performance measurement approaches.  
38 Channelling such information back into conservation through adaptive management can serve to both  
39 increase the achievement of ecological goals and improve human wellbeing.

40 **Keywords:** *Caretta caretta*; *Chelonia mydas*; conservation outcomes; monitoring and evaluation;  
41 performance measurement; social-ecological system

42 **Abbreviations<sup>1</sup>**

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<sup>1</sup> PM = Performance Measurement, Marine Turtle Conservation Project = MTCP, TRNC = Turkish Republic of Northern Cyprus, SPOT = North Cyprus Society for the Protection of Turtles, CCF = Cambridge Conservation Forum

43 **Introduction**

44 Monitoring and evaluation is an essential component of conservation program design; it facilitates  
45 internal and public accountability, measures the extent to which goals have been achieved, and provides  
46 an avenue for adaptive management, including a more cost-effective resource distribution (Baylis et al.,  
47 2016; Bottrill, Hockings, & Possingham, 2011; Ferraro & Pattanayak, 2006). In recognition of this value, a  
48 large body of literature has emerged over the last two decades calling for the need to implement  
49 evaluation protocols and debating various methodological approaches (Pullin, Sutherland, Gardner,  
50 Kapos, & Fa, 2013; Stern et al., 2012). Monitoring and evaluation can reveal a project's actions (i.e., the  
51 process that is carried out to influence what happens), outputs ("products, goods, and services"  
52 emerging from conservation action), and intended and unintended outcomes (change in target  
53 ecological, social, or economic, condition) (Mascia et al., 2014, pp. 260). However, evaluation can also  
54 deliver information on connections among actions, outputs, and outcomes, detail that could provide  
55 insight into the reasons underlying project success (or lack thereof). By identifying lessons from the  
56 evaluation of conservation initiatives and subsequently adapting our strategies within applied settings,  
57 we will also contribute to bridging the research-action gap (Cook, Mascia, Schwartz, Possingham, &  
58 Fuller, 2013).

59 Understanding connections among actions, outputs, and outcomes is particularly important for projects  
60 implementing both social and ecological components given that these projects often work through a  
61 complex theory of change, the assumed causal relationships between project outcomes (Margoluis et  
62 al., 2013). In other words, several desired social changes need to occur prior to the achievement of  
63 ecological outcomes. For example, a project could assume connections between environmental  
64 education, knowledge, attitudes, behaviours, and ultimately, ecological outcomes. Such conservation  
65 projects which act to influence both social and ecological factors are increasingly being implemented,  
66 resulting from widespread acknowledgement that conservation issues exist within complex social-  
67 ecological systems (Bennett et al., 2017). Evaluation at each stage of the theory of change can benefit  
68 these projects through facilitating the identification of factors acting to facilitate or hinder the  
69 transmission of results down the chain of expected outcomes (DeWan, Green, Li, & Hayden, 2013). One  
70 type of evaluation approach with particular potential to assist practitioners in testing their theory of  
71 change, and in identifying unexpected outcomes and connections, is performance measurement (PM)  
72 which has been implemented among conservation organizations since the 1990s (e.g., to inform habitat  
73 protection and protected area management) (Mascia et al., 2014; Stem, Margoluis, Salafsky, & Brown,  
74 2005).

75 PM studies aim to assess the progress of a conservation project towards its desired outputs and  
76 outcomes through measuring indicators along the theory of change. It differs from other evaluation  
77 approaches in its focus on adaptive management, or, delivering information that can be fed back into  
78 the project to improve effectiveness (Stem et al., 2005). Due to the highly connected nature of social  
79 and ecological factors, PM that jointly assesses progress in both dimensions can facilitate an  
80 understanding of how and why outcomes have, or have not, been achieved. Despite the value of  
81 measuring multiple performance objectives simultaneously, however, such integrated social-ecological  
82 monitoring and evaluation remains relatively rare (Bennett, 2016; Yang et al., 2013). More frequent  
83 application of PM studies that include both social and ecological indicators could facilitate an improved  
84 understanding of contextual and operational factors effecting the achievement of ecological outcomes  
85 (Miller, Caplow, & Leslie, 2012).

86 Sea turtle conservation is one context in which consideration for human dimensions is often of critical  
87 importance to program success due to the high degree of overlap between turtle nesting grounds and  
88 beaches of value for tourism and development (Davenport & Davenport, 2006), as well as the traditional  
89 cultural and economic importance of turtle products (Campbell, 1998; Liles et al., 2015). Indeed, several  
90 of the main threats to sea turtles relate directly to human behaviour (e.g., direct and incidental take in  
91 fisheries, loss of nesting habitat from beach development, egg harvesting, and nest disturbance) (Rees  
92 et al., 2016). Therefore, actions targeting social and economic outcomes are now widely included in  
93 many sea turtle conservation efforts in order to both improve the achievement of ecological outcomes  
94 and provide benefits, or minimize any negative effects, to human wellbeing (Campbell, Haalboom, &  
95 Trow, 2007; Dutton & Squires, 2008; Senko, Schneller, Solis, Ollervides, & Nichols, 2011). An  
96 understanding of the connections between conservation actions and social and ecological outcomes can  
97 be of significant value to sea turtle conservation efforts. For example, a sustainable sea turtle tourism  
98 initiative in Indonesia was found to be hindered by a failure to adequately communicate the link  
99 between turtles and local livelihoods, ultimately resulting in conflict among stakeholders (McCabe,  
100 2016). In another example, a sea turtle conservation project in Taiwan was hindered by local opposition  
101 when project activities were perceived to violate cultural beliefs and local customs (Liu, 2017). This type  
102 of information can facilitate informed change in intervention design. Such examples illustrate the  
103 benefits to be gained from monitoring both social and ecological variables and suggest that further  
104 social-ecological PM studies have the potential to greatly benefit sea turtle conservation.

105 Using the Marine Turtle Conservation Project (MTCP) in Northern Cyprus as a case study, we employed a  
106 mixed-methods PM approach, combining a document analysis with secondary data and key-informant  
107 interviews. We aimed to identify project actions, outputs, and outcomes and to explore connections  
108 among these factors that were acting to facilitate or hinder conservation effectiveness. Based on the  
109 lessons emerging from this case study, we then provide general recommendations that can be widely  
110 applied across sea turtle conservation efforts. More broadly, our objective was to demonstrate the type  
111 of information that can be gleaned from social-ecological PM protocols and how measuring social and  
112 ecological factors simultaneously can aid sea turtle conservation efforts in the achievement of both  
113 human wellbeing and biodiversity conservation objectives. The MTCP has been operating in North  
114 Cyprus since 1992 but has never been subject to a formal evaluation. This longevity offers substantial  
115 opportunity to learn from project successes and failures and presents a sufficient time period for  
116 observable outcomes to have taken place.

## 117 **Material and Methods**

### 118 **Study system**

119 The island of Cyprus lies off the coasts of Syria and Turkey in the eastern Mediterranean. Cyprus has  
120 been politically divided since 1974 and the declaration of the Turkish Republic of Northern Cyprus  
121 (TRNC) in 1983 (Warner, 1999). To date, the TRNC remains diplomatically separated from the Republic  
122 of Cyprus, who control Cyprus's southern two-thirds (Figure 1). However, the Republic of Turkey is the  
123 only government to legally recognize the TRNC, placing strains on their economic growth (Akis &  
124 Warner, 1994; Katircioglu, 2006). As a result of these limitations, much of the North Cyprus's landscape  
125 has remained relatively unspoilt (Gunsoy & Hannam, 2012). This pristine state, combined with the  
126 island's biodiverse flora and fauna, has made North Cyprus a region of significant conservation value to

127 the Mediterranean (Phillips & Bracewell, 2001). Of the many species found within the region, green  
128 (*Chelonia mydas*) and loggerhead (*Caretta caretta*) sea turtles are of particular importance.

129 The MTCP is a non-profit collaboration between the University of Exeter's Marine Turtle Research Group  
130 and the North Cyprus Society for the Protection of Turtles (SPOT) that has been undertaking annual  
131 turtle monitoring in North Cyprus since 1992 (see Appendix A for a more detailed history of sea turtle  
132 conservation in Cyprus and the MTCP). Having grown substantially since its conception, the project has a  
133 well-established and geographically extensive presence in North Cyprus. The majority of the MTCP's  
134 activities operate out of two field locations: a primary base at Alagadi on the north coast, and a  
135 secondary base in the village of Akdeniz in the west, with additional staff being based in the Karpaz  
136 Peninsula in some years (Figure 1). The project undertakes a wide variety of conservation activities (e.g.,  
137 sea turtle monitoring, environmental awareness efforts, restoring turtle nesting habitat, advocacy), was  
138 in its 25<sup>th</sup> season of operation at the time of the study, has an extensive amount of information available  
139 from reports and scientific publications, and a large number of people and different stakeholder groups  
140 have been involved; however, despite its lengthy history, the MTCP has never previously been subject to  
141 a formal evaluation. As such, there are many benefits to be gained from examining the extent of its  
142 conservation progress (including factors inhibiting or facilitating this progress) and the MTCP presents  
143 an ideal candidate for the application of a social-ecological PM study.

#### 144 Overview of study design

145 To identify the range of outputs and outcomes of the MTCP, we used a mixed methods approach,  
146 integrating results from three distinct data sources: published MTCP documents (e.g., newsletters,  
147 annual reports), secondary data collected by the MTCP, and key informant interviews. The Cambridge  
148 Conservation Forum (CCF) has developed an evaluation framework for conservation that can be used as  
149 an effective guiding tool for PM (Kapos et al., 2008). This framework separates project activities into  
150 seven broad activity types, each with an associated conceptual theory of change: Research, Policy and  
151 Legislation, Education and Awareness, Capacity Building, Livelihood Enhancement, Species  
152 Management, and Site Management. The MTCP undertakes a variety of activities in each of these  
153 categories and, therefore, the framework presented a useful guiding tool for our analysis. Research was  
154 approved by the University of Exeter's Ethics Committee (Ref. 2016/1423).

#### 155 Stage I: Document analysis

156 The initial phase of data collection involved an extensive review of all available MTCP annual reports and  
157 newsletters, as well as key peer-reviewed publications (see Appendix B for the full list of examined  
158 documents). While a few of these documents were accessed from the MTCP's website, the majority  
159 were obtained through contacting one of the project's primary coordinators. These publications were  
160 reviewed in full. All documented project activities were first recorded to gain a comprehensive  
161 understanding of the project's history, guide our interview questionnaire design, and inform on  
162 potential outputs and outcomes. In addition, all outputs (e.g., growth in the number of Cypriot project  
163 volunteers, educational presentations given) were recorded and placed into their corresponding CCF  
164 category. Finally, we used this review to compile a preliminary list of key informants and potentially  
165 impacted stakeholder groups.

#### 166 Stage II: Secondary data analysis

167 Secondly, we analysed formally collected monitoring data from MTCP annual reports (e.g., number of  
168 nests, predation rate) to identify ecological outcomes relating to sea turtle ecology (e.g., changes in  
169 hatchling survival, population trends) (see Appendix B). Additional information was obtained from the  
170 project's peer reviewed journal publications. These outcomes were subsequently categorized into their  
171 corresponding CCF category.

### 172 Stage III: Key informant interviews & analysis

173 The final stage of data collection involved conducting semi-structured interviews with key informants.  
174 Five distinct stakeholder groups were identified: residents, fishermen, local business owners, tourists,  
175 and project staff. Key informants in our initial set of interviews consisted of project staff identified in  
176 project documents. We then used snowball sampling, requesting those directly contacted to  
177 recommend additional participants that may have relevant knowledge and experience, to ensure that  
178 the perspective of each stakeholder group was captured (Bottrill & Pressey, 2012). We ceased sampling  
179 when a point of data saturation was reached (i.e., when additional interviews provided no new  
180 substantive information with regards to project activities, outputs, or outcomes) (Guest, Bunce, &  
181 Johnson, 2006). Interviews took place from April 11 to May 13, 2016 in the U.K., and from May 27 to  
182 June 21, 2016 in North Cyprus. On average, interviews lasted 45 minutes with project staff and 15  
183 minutes with external individuals. All interviews were carried out in person and in English, with the  
184 exception of one participant who was interviewed over Skype and four participants who were  
185 interviewed with the aid of a Turkish translator. All interviews were carried out one-on-one, apart from  
186 one external individual interview which was carried out with a pair of interviewees (this interview was  
187 counted as one participant).

188 Prior to beginning each interview, participants were informed, either verbally or in writing, of the  
189 anonymity of their responses. Additionally, we requested the participant's consent to use a voice  
190 recorder. Participants were first asked to describe their history of involvement with the MTCP. This  
191 question allowed for an understanding of which CCF framework activity categories participants were  
192 involved. Secondly, we posed questions to determine what participants perceived to be the major  
193 outputs and outcomes of the project. To simplify the process for participants, we did not differentiate  
194 outputs from outcomes, but completed this step in our analysis phase. Alternatively, we asked  
195 participants to identify any ecological (e.g., habitat, population), economic (e.g., livelihoods), and social  
196 (e.g., behaviour, awareness, policy) impacts they had observed since they began their involvement with  
197 the project (see Appendix C1 and C2 for template interview questions). A specific domain was excluded  
198 if it was clear that the participant did not have the knowledge to comment in that area. We recognize  
199 that *impact* has a very specific meaning within the scientific literature, but for the purposes of our  
200 interviews, this word facilitated responses from participants relating to both outputs and outcomes.

201 During the interviews, we probed for information on connections among project activities, outputs, and  
202 outcomes in different CCF categories (e.g., Education and Awareness activities leading to Species  
203 Management outcomes). In particular, to draw out information on possible connections, we asked  
204 participants to expand on their response when they indicated an output or outcome to identify factors  
205 that facilitated its achievement. Project staff members were asked an additional range of questions  
206 relating to the history and goals of the overall project, as well as past and current barriers. Identifying  
207 barriers allowed us to explore areas in which the project had been less impactful than desired or did not  
208 achieve project goals. All recorded interviews were subsequently transcribed by hand.

209 Transcripts were first examined for mention of any project outputs or outcomes. Once an output or  
210 outcome was identified, it was placed into its corresponding CCF category. For each CCF category, we  
211 then calculated the frequency of response for outputs and outcomes (i.e., number of participants who  
212 indicated an output or outcome within that category) for both project staff and external individuals. For  
213 interviews with project staff we also extracted information related to project goals and barriers.

214 The final step of our analysis was to examine the broader discussion surrounding the activities, outputs,  
215 and outcomes using inductive content analysis to identify connections among these factors in different  
216 CCF categories. Content analysis has been defined as “a research method for the subjective  
217 interpretation of the content of text data through the systematic classification process of coding and  
218 identifying themes or patterns” (Hsieh & Shannon, 2005, pp. 1278). We employed an inductive approach  
219 as themes were emergent rather than pre-defined (Elo & Kyngäs, 2008). Particular attention was  
220 afforded to the informants’ discussion of factors underlying the achievement of outcomes (i.e.,  
221 information related to *how* and *why* outcomes were or were not achieved) to identify the relationship  
222 among activities, outputs, and outcomes in different categories and to explore barriers hindering project  
223 success. Once identified, statements relating to relationships among activities, outputs, and outcomes  
224 were grouped thematically to identify primary connections among CCF categories.

## 225 **Results**

226 Our document analysis included 23 annual project reports, 2 project peer-reviewed publications, 5  
227 project newsletters, and 1 external report (Appendix B). Data from the annual reports was used for our  
228 secondary data analysis.

229 Twenty-six semi-structured interviews were conducted, 8 with project staff members and 18 with  
230 external individuals. All project staff members interviewed had previously held, or were currently  
231 holding, a role as project leader, project coordinator, or both. Project staff interviewed had been  
232 involved with the MTCP for an average of 12 years, with the length of involvement ranging from 2 to 25  
233 years. Of the non-staff participants, 3 were integral to the project’s founding in 1992, 2 provided  
234 significant logistical support to the project, 2 had extensive involvement with the North Cyprus tourism  
235 industry, 6 owned businesses in the local area of the project and had regular interactions with the  
236 project, 2 were fishermen who had participated in the project’s fisheries research, 2 were involved with  
237 another local turtle conservation project under the responsibility of SPOT, and 1 was involved with  
238 environmental aspects of the North Cyprus government. Many of these individuals were central figures  
239 within their communities and had lived in the same village for decades. Such individuals could thus offer  
240 a long historical perspective.

### 241 **Project goals**

242 Although several project staff members stated an overall goal of turtle conservation (N = 6), most listed  
243 more specific goals in terms of how this conservation would be achieved. Several staff members  
244 indicated that a primary goal of the project was using research to direct conservation (N = 4). In  
245 particular, acquiring the knowledge necessary to direct local governments to prioritize nesting beaches  
246 was stressed by several staff members, articulated well by a participant who said “*The primary goal is*  
247 *conservation, but through research. Not just making decisions based on what others are doing. The*  
248 *research is to feed into the conservation*”. A second more specific goal that was highlighted was  
249 influencing public awareness and behaviour (N = 6).

250 Primary outputs, outcomes, and connections

251 The number of identified outputs and outcomes varied substantially among CCF categories, with only  
252 Site Management found to be lacking any prominent outputs or outcomes (Table 1). Primary outputs  
253 and/or outcomes in all categories apart from Site Management and Livelihood Enhancement were  
254 identified from project documents, while primary outputs and/or outcomes in the Species Management  
255 and Research categories were identified through secondary data. In terms of key informant interviews,  
256 nearly every participant indicated an output and/or outcome in the realm of Education and Awareness  
257 (N = 23), while only a single participant described an output and/or outcome in the Site Management  
258 category (Figure 2).

259 From all three data sources, several Research outputs were identified, primary among which was the  
260 production of extensive long-term data sets on various aspects of turtle ecology (e.g., nesting  
261 abundance) (Table 1; Table 2). In addition, 25 years was suggested in a project publication to be long  
262 enough time period for the data to accurately represent long-term trends (Stokes et al., 2014). Finally,  
263 through the publication of its research, the project made a notable contribution to the available  
264 scientific literature on sea turtle biology and ecology, publishing a total of 55 peer-reviewed papers as of  
265 2016.

266 Using its long-term dataset, the project was able to estimate the relative importance of North Cyprus  
267 nesting turtle populations to the Mediterranean as a whole. The numbers of loggerheads and greens  
268 nesting on North Cyprus were calculated to represent 10% and 30% respectively of the Mediterranean's  
269 adult females, values high enough to add weight to the project's call for protection (Broderick, Glen,  
270 Godley, & Hays, 2002). Finally, due to their annual monitoring, the project identified the most important  
271 nesting beaches in Northern Cyprus. In accordance with its goal of bridging the research-action gap,  
272 these data were subsequently used as evidence in the project's advocacy efforts, both to demonstrate  
273 the overall importance of the turtle populations of North Cyprus, as well as to direct protection to the  
274 most important nesting grounds (Table 3).

275 As a result of the project's advocacy efforts, and through connecting research with policy actions,  
276 reports and interviews indicated that several Policy and Legislation outputs had emerged including the  
277 main nesting beaches at Alagadi being designated a Special Protected Area (Table 1; Table 2).  
278 Participants asserted that these policy changes were impactful ecologically (i.e., translated into  
279 ecological outcomes) in that, had it not been for the legislative protection, severe degradation of turtle  
280 nesting habitat would have occurred. The importance of this protection was stressed by several  
281 participants given the intensive development pressure to North Cyprus beaches. For example, a project  
282 staff member with long term involvement stated that *"Without the project, Alagadi would have been*  
283 *gone. Definitely, one-hundred-percent gone. There would have been a 5-star hotel there"*.

284 Key informant interviews suggested that several social outcomes had occurred in the Education and  
285 Awareness category (Table 1; Table 2). Firstly, as a result of their extensive community involvement and  
286 educational activities, interviews suggested that the project had attained a high level of local visibility  
287 and support (i.e., local community members providing direct assistance to the project and project staff),  
288 particularly in the specific areas where the project operated (i.e., Alagadi and Akdeniz) (Table 1; Table 2).  
289 Second, participants suggested that positive changes had occurred in the local community with regards  
290 to awareness of and attitudes towards sea turtles. This perceived change in awareness and attitudes



291 was linked by several participants to the educational efforts of the project since it was one of the first  
292 sea turtle conservation project to have emerged in North Cyprus.

293 Participants also indicated that two distinct behavioural changes had occurred in the Education and  
294 Awareness category as a result of educational activities in Akdeniz (e.g., presentations, public hatchling  
295 releases) and with the fishing community (e.g., educational workshops with over 100 fishermen,  
296 educational materials and kits to reduce bycatch distributed). Firstly, both a long-term research staff  
297 member and a central community member of Akdeniz indicated that the consumption of turtle eggs had  
298 ceased in Akdeniz since the MTCP started operating in the village (Table 1; Table 2). This long-time  
299 community member highlighted the shift when he said *“I remember before, old times, before this  
300 project. All the turtles come out and the people kill and eat them. The [Akdeniz] villagers at that time,  
301 they don’t know anything about the turtles and they take the eggs at that time and fry and eat them”*.  
302 Secondly, research staff and fishermen indicated that there had been a reduction in the intentional  
303 killing of turtles caught as bycatch among fishermen. Speaking to this shift, a fisherman stated: *“Now  
304 that [we] are aware of and see the energy that [the project] puts into trying to protect [turtles], [we]  
305 have a bigger respect for the turtles and are less inclined to treat them negatively”*. These outcomes  
306 suggest that, due to the active presence and educational work of the MTCP within Akdeniz and the  
307 fishing community, Education and Awareness activities can be connected to ecological outcomes (Table  
308 3).

309 The outcomes achieved in the Education and Awareness category can also be connected to outputs and  
310 outcomes related to the project’s operational capacity. Specifically, educational efforts and the visibility  
311 of the project within the community facilitated its expansion through attracting local and international  
312 support and participation (Table 3). Primary among the project outputs in the Capacity Building category  
313 (Table 1; Table 2) was the growing involvement of local Cypriots in project activities. Through training  
314 provided by the project, several British ex patriots also increased the project’s capacity through initiating  
315 extensions of the MTCP, or turtle conservation projects of their own. Overall, the growth of the MTCP in  
316 terms of the number of personnel had risen exponentially through the years, with over 600 individuals  
317 having been trained by the project as of 2014. This growth contributed to the achievement of Research  
318 outputs and Species Management outcomes through facilitating an increased overall data collection and  
319 nest protection capacity (Table 3).

320 Further contributing to the project’s capacity were the economic outcomes that interviews suggested  
321 the project had brought about in the community (Table 1; Table 2). By far the most common outcome  
322 identified was the benefits to local restaurants in Alagadi and Akdeniz resulting from the large number  
323 of tourists attracted by the project’s ecotourism activities (e.g., night watches of nesting turtles, public  
324 hatchling releases) It was suggested that these locations would not otherwise have received much  
325 revenue from tourism. These local economic benefits were observed to have aided the project’s  
326 capacity, with several residents associated with local businesses playing active roles within the project  
327 itself (Table 3).

328 Finally, from secondary data and interviews, two primary project outcomes emerged in the Species  
329 Management category: reduced predation rates and an upward trend in the number of annual green  
330 turtle nests (Table 1; Table 2). The rising number of nests was suggested in a publication of the project  
331 to indicate that green turtles in North Cyprus were in recovery (Stokes et al., 2014). Although there are  
332 many factors likely to be contributing to this increase in nesting numbers, the trend was attributed, in

333 part, to the project's intensive nest caging regime. Given that it takes over 20 years for loggerhead and  
334 green turtles to reach sexual maturity, however, the outcomes of the project's nesting regime are likely  
335 yet to be fully observed. The aforementioned behavioural changes in fishermen and the Akdeniz  
336 community may also be contributing to this success. While some participants suggested that these  
337 Species Management outcomes could be attributed to the work of the MTCP, others stated that the  
338 extent of the project's relative contribution to increasing turtle populations cannot yet be accurately  
339 estimated.

#### 340 Project barriers

341 Although the MTCP had seen success in many areas, several themes emerged from interviews with  
342 project staff as barriers inhibiting project success (see Appendix D for representative quotes from  
343 interviews with project staff). One primary barrier that consistently emerged was a deficiency in  
344 monetary resources (N = 4). Secondly, several participants indicated that a lack of government support  
345 in terms of enforcing legislation, as well as government instability, were primary barriers limiting the  
346 effectiveness of Policy and Site Management activities (N = 6). These individuals expressed a sense of  
347 frustration that reporting to the government was often ineffective. Many project staff indicated that a  
348 lack of enforcement had limited the project's success with regards to desired behavioural changes (e.g.,  
349 reducing littering, quad biking) on beaches aside from Alagadi, where project staff themselves were the  
350 primary enforcers. A final prominent barrier to emerge was a lack of public awareness relating to the  
351 impact of these behaviours on nesting beaches (N = 4).

#### 352 Discussion

353 Combined, our three data sources indicated that the activities of the MTCP had generated important  
354 outputs and/or outcomes in the majority of CCF categories, many of which were in direct alignment with  
355 project goals. These outputs and outcomes were not mutually exclusive, but rather cumulative and  
356 interlinked, with activities, outputs, and outcomes in one CCF category indirectly facilitating outputs and  
357 outcomes in others. Particularly noteworthy were the indirect ecological outcomes of the project's 1)  
358 research and 2) visibility in local communities. The project compounded its achievement of ecological  
359 outcomes through directing research into policy lobbying efforts and increasing its capacity as a result of  
360 local engagement (e.g., direct contribution of ex-patriots and Cypriots). In other words, through bridging  
361 the research-implementation gap and community engagement, the MTCP was able to achieve greater  
362 ecological success (e.g., beaches received protection, increased nest protection capacity) than if they  
363 had limited their efforts to research and ecological activities alone. Such connections add support to the  
364 benefits of adopting a multi-disciplinary approach to conservation.

#### 365 Bridging the research-implementation gap

366 Closing the research-implementation gap has been the focus of much discussion in the literature  
367 (Toomey, Knight, & Barlow, 2017). Given the limited resources available for conservation, ensuring that  
368 projects are informed by rigorous science is of great importance. At the same time, for scientific data to  
369 be useful in practice, the information produced must be salient, credible, and legitimate (Cash et al.,  
370 2003). Adopting the dual roles of researchers and conservation practitioners assisted the MTCP in  
371 meeting these requirements. Since they are both producing the information and using it to inform  
372 action, the project can ensure that the data is relevant, it will be viewed as reliable, and they can ensure  
373 that it is appropriate in the specific context of North Cyprus due to their understanding of existing

374 community and political dynamics. Boundary organizations, or those that “operate in both scientific and  
375 practical spheres but retain distinct lines of accountability to both groups”, have been promoted as a  
376 type of institutional framework that can bridge the knowledge-action gap (Cook et al., 2013, pp. 673). As  
377 a joint venture between a research institution and a local conservation society, the MTCP acts as such an  
378 organization.

#### 379 Community involvement to enhance conservation

380 The MTCP did not operate in isolation, but was highly integrated within the community, not only  
381 through targeted education, but also in their day-to-day activities. This high level of interaction  
382 facilitated the creation of a positive feedback loop between local awareness and project capacity,  
383 particularly in the specific communities where the project operated. Enhancing local support to an even  
384 greater degree was the revenue brought to the community through the project’s ecotourism activities.  
385 A positive relationship between long-term conservation effectiveness and local participation has been  
386 well documented in the literature (Andrade & Rhodes, 2012). In addition, greater community  
387 engagement has been found to enhance conservation learning outcomes (Evely, Pinard, Reed, & Fazey,  
388 2011). The results of this study provide further evidence for the benefits that can be gained from  
389 considering and collaborating with the local community in project design and implementation. One  
390 avenue of particular interest through which engagement has been found to enhance conservation is  
391 through instilling a sense of pride in participants, encouraging pro-environmental behaviour  
392 (Grodzińska-Jurczak & Cent, 2011). Interviews suggested that the MTCP’s awareness raising activities  
393 had introduced a greater sense of pride and respect for the two sea turtle species within the  
394 communities with whom the project was closely involved (e.g., Alagadi, Akdeniz, fishing community).  
395 Although further research is needed to explore this connection, these results indicate that promoting a  
396 sense of pride and ownership in the natural environment can be an effective tool to encourage  
397 behavioural changes.

#### 398 Looking ahead: Overcoming barriers

399 Data indicated that the success achieved at Alagadi was due to the project’s extensive and immediate  
400 presence, facilitating a combination of concentrated enforcement and education. The prevalence of  
401 undesired behaviours on other beaches was still thought to present a major issue, compounded by a  
402 lack of government enforcement. Even on Akdeniz beaches, although turtle egg consumption had  
403 largely stopped, certain destructive behaviours remained (e.g., quad biking). Although informants  
404 indicated that there had been an increase in public awareness of the existence of turtles, the data  
405 suggest that more education, and other actions such as social marketing, is needed to connect individual  
406 actions with turtle nesting success. Significantly expanding awareness raising efforts, however, is likely  
407 to pose an issue given that monetary constraints were already listed as a primary barrier. Given the  
408 success achieved at Alagadi and Akdeniz, resources are perhaps best placed in more concentrated  
409 efforts at a limited number of beaches, rather than spreading project efforts across numerous sites.  
410 Working more closely and increasing knowledge sharing with other turtle conservation projects could  
411 also assist in expanding the MTCP’s educational and outreach capacity.

#### 412 Social-ecological performance measurement: A useful tool for evidence-based conservation

413 The connections among outputs and outcomes produced by the MTCP are a common occurrence in  
414 conservation given the complicated and extensive linkages between biological and social dimensions.

415 This is particularly true in the case of projects like the MTCP that undertake a highly diverse range of  
416 activities. The interconnected nature of CCF categories denotes that feedback in one category can  
417 inform on the mechanisms underlying the level of success, or lack thereof, in another. In this way, social-  
418 ecological PM studies can provide a holistic picture of a conservation project, including underlying  
419 factors facilitating or hindering project success. The range of information that can be generated from  
420 such an evaluation was highlighted by this study, the next step being to apply such knowledge in the  
421 future management of the project through adaptive management. Feedback from such studies can,  
422 among other things, aid in fostering greater levels of community support, improve internal functioning,  
423 and minimize bottlenecks in the results chain inhibiting the translation of outcomes through to the final  
424 conservation target. In addition, as with other types of evaluation, social-ecological PM studies inject a  
425 measure of accountability into a project and aid in funding acquisition (Mascia et al., 2014).

#### 426 Strengthening evidence for conservation evaluation

427 Although two of the authors, including the lead author, were external to the project, one of the authors  
428 played a key role within the MTCP (please see the Declaration of Interest). In addition, some results  
429 relied on a limited number of perceptions from individuals who were involved with the project. We  
430 acknowledge that these limitations have the potential to inject bias into our results (e.g., positive  
431 outcomes could be overstated). Therefore, steps were taken to maximize objectivity and emphasize  
432 results with the strongest supporting evidence. Firstly, for outcomes relying heavily on perceptions, we  
433 focused our emphasizing results internal to the project itself (e.g., increased capacity resulting from  
434 community engagement) rather than on more widespread changes that are more difficult to assess  
435 (e.g., awareness levels, attitudes). We did, however, highlight two specific behaviour changes (e.g.,  
436 reduction in poaching and bycatch) that were identified exclusively via perceptions. For these outcomes,  
437 we recommend that a more rigorous evaluation be undertaken going forward to collect quantifiable  
438 evidence of change. However, many conservation projects lack the funding or time to collect preliminary  
439 baseline data or to undertake a rigorous experimental evaluation approach (Curzon & Kontoleon, 2016;  
440 Roe, McConney, & Mansfield, 2014). Perceptions present a cost-effective alternative with many unique  
441 benefits (e.g., provide an avenue for local participation) and their value should not be underestimated,  
442 particularly in the case of local experts with traditional ecological knowledge (Bennett, 2016). Finally, we  
443 directly asked project staff to explore barriers that have hindered project success to prompt a more  
444 critical examination of outcomes (or lack thereof).

445 Rather than aiming to demonstrate the extent of outcome achievement or conclusively prove causality,  
446 we focused on identifying underlying factors that have facilitated or hindered success. As such, PM,  
447 which places the emphasis on adaptive management and often relies on expert perceptions, was an  
448 appropriate evaluation approach (Mascia et al. 2014). Given these benefits and limitations, we  
449 recommend this approach for internal evaluations which are aimed at self-improvement and providing  
450 general lessons to the broader conservation community. Encouragingly, an abundance of academic and  
451 grey literature exists for designing effective rapid evaluations, including guidance for reducing bias (e.g.,  
452 Bennett, 2016; Dickson et al., 2017; Johnson & Wouters, 2008; Kleiman et al., 2000).

453 Despite the limitations of key-informant perceptions as evidence, as previously mentioned, those  
454 directly associated with a project also offer benefits that are often lacking from outsiders. For example,  
455 those closest to a project could provide in-depth detail on the complexities of a community or social-  
456 ecological system, knowledge that could only be gained through long term involvement. Furthermore,  
457 project staff who have an established foundation of trust with local communities are often the best-

458 placed to gather information on wider project impacts. Regular internal evaluations conducted by  
459 project staff combined with less frequent external evaluations could provide a way to make use of the  
460 advantages of both methods (Kleiman et al., 2000).

#### 461 **Conclusion**

462 The results of this study highlight the benefits that can be gained from adopting a multi-disciplinary  
463 approach to conservation. In particular, operating at the science-policy interface, or collaborating with  
464 action-oriented local organizations, can aid research institutions in bridging the research-  
465 implementation gap. Secondly, working in an integrative manner with the local community can  
466 significantly aid conservation efforts, not only through facilitating desired changes in social processes  
467 (e.g., behaviours), but also through engendering local support and increasing project capacity.  
468 Ultimately, multi-disciplinarily can compound the ecological effectiveness of an intervention. This study  
469 offers an example of the benefits that can be gained from integrating social and ecological factors within  
470 PM. We encourage the more frequent use of this approach as a cost-effective method of assessing  
471 project outcomes and factors facilitating or hindering success. Ultimately, monitoring and evaluation is  
472 necessary for conservation projects to engage in informed adaptive management that will enhance the  
473 extent of positive outcomes for people and nature.

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#### 479 **Declaration of Interest**

480 One of the co-authors, Brendan Godley (BG), is also one of the founders, and current coordinators, of  
481 the Marine Turtle Conservation Project that is the focus of the paper. However, BG was not involved  
482 with collecting or analysing the data. Therefore, he did not contribute to identifying project impacts, or  
483 lack thereof, limiting the potential for bias to occur. To add further transparency, we also clarify the  
484 roles that each author played in the creation of this paper: all three authors conceptualized the project;  
485 BG connected the lead author, Rachael Edwards (RE), to individuals and resources in Cyprus; Ana Nuno  
486 (AN) and RE designed the data collection and analysis methodology; RE collected and analysed the data;  
487 RE and AN wrote the manuscript; and all three authors were involved in the final editing process.

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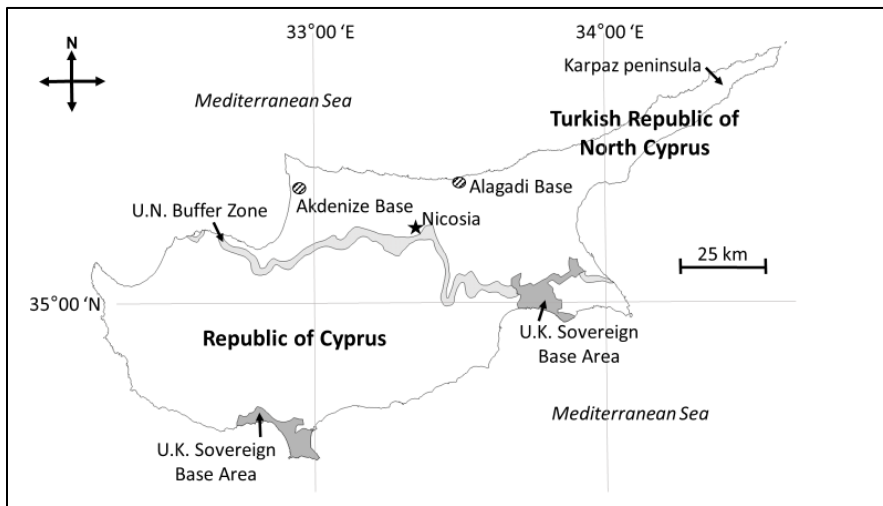
620 **Figure legends**

621 **Figure 1:** A map of Cyprus showing the Marine Turtle Conservation Project's bases at Alagadi and  
622 Akdeniz. Base map obtained from <http://www.dogakoruma.eu/>.

623 **Figure 2:** The number of project staff and external individuals who stated a specific output and/or  
624 outcome in each Cambridge Conservation Forum (CCF) framework category (N = 26).

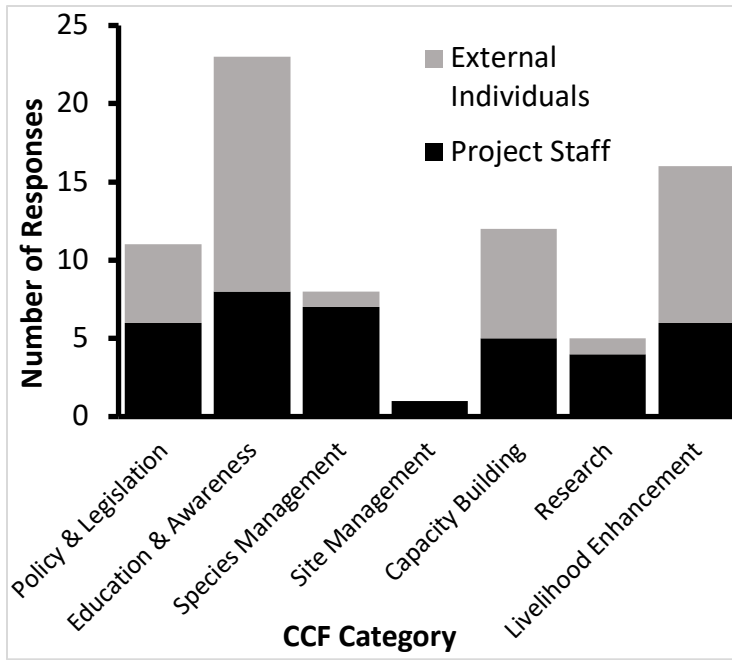
625 **Figures**

626 **Figure 1**



627

628 **Figure 2**



629

630 **Tables**

631 **Table 1:** A summary of the primary outputs and outcomes of the Marine Turtle Conservation Project  
 632 (MTCP) in each of the seven Cambridge Conservation Forum (CCF) framework categories. The source(s)  
 633 of evidence from which each output/outcome was identified is also included: secondary data, reports,  
 634 and/or interviews (N = 26). Note that frequencies are relative given that not all participants were  
 635 able to comment on all outputs and outcomes.

<b>Research</b>	<b>Source(s) of Evidence</b>
<b>Outputs</b>	
Extensive long-term data sets produced on turtle nesting numbers	Secondary data; Interviews (N = 4)
Estimated the relative importance of North Cyprus nesting turtle populations to the Mediterranean as a whole	Secondary data
Identified the most important turtle nesting beaches in Northern Cyprus	Reports; Interviews (N = 1)
Significantly contributed to the existing body of literature on sea turtles	Reports; Interviews (N = 2)
<b>Policy and Legislation</b>	<b>Source(s) of Evidence</b>
<b>Outputs</b>	
Main nesting beaches at Alagadi legally closed to the public at night in 1994	Reports
Main nesting beaches at Alagadi designated a Special Protected Area in 1997	Reports; Interviews (N = 4)
Six potential NATURA 2000 sites containing important turtle nesting grounds identified under the EU Habitats Directive and designated Special Environmental Protection Areas	Reports
Stipulation to maintain daylight only hours placed on Alagadi bay restaurant	Reports; Interviews (N = 2)
<b>Outcomes</b>	
Important nesting beaches remained undeveloped due to legal protection	Interviews (N = 6)
<b>Education and Awareness</b>	<b>Source(s) of Evidence</b>
<b>Outputs</b>	
A significant amount of educational material was distributed, and many educational presentations and workshops were given	Reports; Interviews (N = 9)
<b>Outcomes</b>	
Local support attained at Akdeniz and Alagadi	Interviews (N = 4)
Improvement in both local awareness levels and local attitudes towards turtles	Interviews (N = 17)
Turtle egg consumption at Akdeniz largely ceased	Interviews (N = 2)
Reduction in turtle bycatch by fishermen due to behavioural changes	Interviews (N = 4)
<b>Capacity Building</b>	<b>Source(s) of Evidence</b>
<b>Outputs</b>	
Over 600 volunteers trained by the project as of 2014	Reports
Growing number of Cypriot volunteers trained by the project in recent years	Reports; Interviews (N = 5)
Several British ex-patriots trained by the MTCP initiated extensions of the project	Reports; Interviews (N = 3)
<b>Livelihood Enhancement</b>	<b>Source(s) of Evidence</b>
<b>Outcomes</b>	
Local restaurants benefitted economically from influx of tourists visiting MTCP	Interviews (N = 13)
<b>Species Management</b>	<b>Source(s) of Evidence</b>
<b>Outputs</b>	
One hundred percent of located nests screened since 1999	Reports
<b>Outcomes</b>	
Reduction in nest predation following adoption of nest screening protocol in 1999	Secondary data; Interviews (N = 4)
Distinct upward trend in the number of green turtle nests on the project's core beaches	Secondary data; Interviews (N = 7)

636 **Table 2:** Example quotes from key informant interviews (N = 26) on the outputs and outcomes of the  
 637 Marine Turtle Conservation Project in each of the seven Cambridge Conservation Forum framework  
 638 categories.

<p><b>Research</b></p> <p><i>"Because we've done such a really good job of marking these individuals and being there every year for more than twenty years, it now becomes a great testing ground for sea turtle biology around the world. Actually, there are very few places where there's such a level of detail of study."</i></p> <p><i>"The vast wealth of research that we've contributed to the global understanding of sea turtle biology."</i></p>
<p><b>Policy and Legislation</b></p> <p><i>"More of Cyprus is subject to protection because [the project] got in and started showing where the important bits were, where development couldn't happen."</i></p> <p><i>"A lot of [development] you can't necessarily stop but [the project has] quite a good position on the island in that [they] are listened to. And that's due to during 25 years of conservation effort."</i></p> <p><i>"The restaurant on Alagadi beach has always been shut down after dark. That was part of the [project's] original recommendations ... in 1992."</i></p>
<p><b>Education and Awareness</b></p> <p><i>"in [Akdeniz], and around here in the other villages, everybody knows [about turtles] and when the season opens. When the students come here, the people of the villages know why the students are here. And if the students need something everybody ... tries to help."</i></p> <p><i>"People started to know about the turtle project and turtles being there in Cyprus, and Cyprus being important for turtles."</i></p> <p><i>"I think everybody knows about the turtles now. I think that's quite a big shift."</i></p> <p><i>"With [the] project, now the fishers know more about the turtles and they know how to work on the sea with also protecting the turtle's life. Also, before his project, fishermen don't care about the turtles. Now it's nearly 90% of fishermen, they respect [the] project."</i></p>
<p><b>Capacity Building</b></p> <p><i>"I think there's more community recognition because we're actually getting more Cypriots coming to visit and coming to work on the project."</i></p> <p><i>"Previously we had no Cypriot volunteers, maybe one a year. In the last couple of years, the number of Cypriot volunteers is going up dramatically which is massive."</i></p> <p><i>"We had met so many different students at Alagadi so we were learning from them, we were spending nights on the beach, we were helping with excavations at times."</i></p>
<p><b>Livelihood Enhancement</b></p> <p><i>"In Alagadi, just in terms of the number of restaurants that are there, kind of gives you an indication of how many tourists they have coming through. For, I think, 6 restaurants to be open in such a tiny village and running well most of them, it's quite impressive."</i></p> <p><i>"...in Akdeniz it's had a huge effect because tourist would never come otherwise. Nobody knows where Akdeniz is if it weren't for the fact that there's quite a large turtle project presence here."</i></p>
<p><b>Species Management</b></p> <p><i>"We've had significant increases in nesting numbers at Alagadi, which is directly from [the project's] conservation efforts. From about 2008 we started to see a significant increase and the last three years have all been record years..."</i></p> <p><i>"The number of nests has increased a lot that I've seen. Of course, we don't know 100% whether it's because of [the project's] protection or because of the destruction elsewhere."</i></p> <p><i>"Whether we've seen that benefit [of caging] yet, whether 24 or 25 years is enough time for those particular hatchlings to mature, is hard to say. But I think given the number of nests that were predated beforehand that has to have a dramatic effect."</i></p> <p><i>"If not for the nest protection scheme we'd be in a much worse state. We'd have far fewer turtles, you can be quite confident of that."</i></p>

640 **Table 3:** A summary of the primary connections among the activities, outputs, and outcomes of the  
 641 Marine Turtle Conservation Project in the seven Cambridge Conservation Forum (CCF) framework  
 642 categories. The specific CCF categories involved in each connection are also shown, along with the  
 643 direction of connection.

Connections Among CCF Categories	CCF Categories Involved
Research results used to direct and provide evidence for protection efforts	Research ↓ Policy & Legislation
Education/engagement activities and outputs contributed to behavioural changes in the Akdeniz and fishing communities, resulting in declines in turtle deaths from poaching and bycatch respectively	Education & Awareness ↓ Species Management
Education/engagement activities and outputs led to increased Cypriot and ex-patriot involvement, increasing the project’s research and species management operational capacity	Education & Awareness ↓ Capacity Building ↓ Research; Species Management
Ecotourism activities produced local economic benefits, contributing to the formation of direct links between the project and local businesses at Alagadi and Akdeniz, increasing project capacity	Education & Awareness ↓ Livelihood Enhancement ↓ Capacity Building

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