The Landscape of Leadership in Environmental Governance

Louisa S Evans[1,2*], Philippa J Cohen[2,3*], Peter Case[4,5], Christina C Hicks[2, 6], Murray Prideaux[5], David J Mills[1, 2]

[1] Geography, College of Life and Environmental Sciences, University of Exeter
[2] Australian Research Council Centre of Excellence for Coral Reef Studies, James Cook University
[3] WorldFish
[4] Bristol Business School, University of West England
[5] College of Business, Law and Governance, James Cook University
[6] Lancaster Environment Centre, Lancaster University, Lancaster, UK, LA1 4YQ

* **Corresponding authors**: The first two authors contributed equally in leading development of the manuscript

Louisa S Evans
Geography, College of Life and Environmental Sciences
University of Exeter
Email: Louisa.Evans@exeter.ac.uk

Philippa J Cohen
WorldFish
c/- Australian Research Council, Centre for Excellence for Coral Reef Studies
James Cook University
Email: p.cohen@cgiar.org

Keywords; coastal and marine governance; biodiversity; fisheries; food security; conservation; climate change

INTRODUCTION

Recognition that current patterns of human behaviour will radically alter the Earth's environment and impact negatively on human wellbeing (Myers 1996, Steffen *et al.* 2015, World Resources Institute 2005) has led to calls to substantially improve or even transform approaches to environmental governance (Kates *et al.* 2012, O'Brien 2012, Brown 2013). In this context, transformation often refers to significant advances towards more integrated approaches at increasingly larger scales (Olsson *et al.* 2008; Westley *et al.* 2011), which in practice requires the merging of objectives around conservation, development and climate change (see also the Sustainable Development Goals 2015).

The literature on environmental governance transformation is converging around a core set of factors that foster change processes, with leaders (or entrepreneurs) identified as one of the main drivers of significant change (Scheffer *et al.* 2003; Olsson *et al.* 2008; Biggs *et al.* 2010; Westley *et al*. 2011). Often key individuals or 'champions' are identified, who by virtue of their positions (e.g., traditional village chief / City Mayor), personalities (e.g., charismatic) or competencies (e.g., networking skills) garner the authority to drive environmental policy change and action (e.g., Manolis *et al.* 2008; Black *et al.* 2011; see review by Evans *et al.* 2015). For example, research on the transformation of the Great Barrier Reef Marine Park, Australia, focused almost exclusively on the leadership role of the Great Barrier Reef Marine Park Authority and its Chairperson (Olsson et al. 2008).

Emphasising the attributes of individual environmental leaders reflects notions of what is referred to in the field of leadership studies as heroic leadership (Case 2013). Such approaches focus on individual agency and can underplay the important institutional contexts that support the emergence of leaders as well as the potential for more distributed forms of leadership (Carroll *et al.* 2008; Westley *et al*. 2011; Denis *et al.* 2012). Moreover, environmental research on leadership tends to view leaders in a positive or normative light, as those who are aligned to environmental governance and sustainability initiatives (Evans *et al.* 2015; Case *et al.* 2015). Relatively few studies emphasise the potential of leaders and leadership to intentionally (and legitimately) block, disrupt, or co-opt change processes, or inhibit change in a particular direction (for exceptions see Pahl-Wostl *et al.* 2007; Zulu 2008; Njaya *et al.* 2012). By this, we do not only mean the leadership enacted by environmental activists blocking or stalling the activities of big polluters, logging companies or developers (Houck 2010; Martinez-Alier 2014), we mean the leadership shown by community groups, user groups and industry groups, for example, who are involved in negotiating environmental outcomes. Such approaches to understanding the role of leadership in governance transformations arguably misrepresent the complex and potentially contested concepts of environmental governance and sustainable development (Lélé 1991; Redclift 2005).

We bring new insights to environmental governance research from leadership studies where there is a growing recognition that leadership is a process that is enacted through a "web of interactions incorporating both people and objects" (Hawkins *et al.* 2015: 953). Leadership is broadly defined as a process of influence resulting in shared direction and commitment (following Bolden *et al*. 2012 and Haslam *et al.* 2011). To

illustrate what a more nuanced understanding of leadership can look like we employ a deliberately provocative analytical perspective inspired by Actor Network Theory which recognises that societal outcomes are shaped by relations among humans and non-human, including discursive, actants (Latour 2005; Dwiartama and Rosin 2014 and see discussion for detailed examples). We report on an empirical study of Solomon Islands' engagement with the multi-national, multi-objective Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security (CTI), an initiative that is labelled as potentially transformative. We aimed to understand how different actors perceive leadership for improved environmental governance in Solomon Islands in practice. First, we determine whether there are sources of leadership *in addition* to key individuals and organisations. We investigate the potential of organisations, policy and legislative instruments, and ideologies or discourses to enact leadership by influencing governance outcomes. Second, we establish how leadership varies across three different, potentially contested CTI goals – food security, biodiversity conservation and climate change adaptation – that in combination are expected to contribute to improved environmental governance. Third, we determine whether leadership can also disrupt or stall progress towards improved environmental governance outcomes. This paper aims to open up a broader debate about leadership research in environmental sciences – the empirical approach and evidence are illustrative rather than definitive.

METHODS

Case-study

We selected the Solomon Islands' engagement with the Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security as our illustrative case-study. The CTI is a regional partnership between Malaysia, Philippines, Indonesia, Timor-Leste, Papua New Guinea and Solomon Islands launched in 2009. It is funded by USAID in collaboration with WWF, The Nature Conservancy and Conservation International, the Global Environment Facility through the Asian Development Bank, and Australian Aid. The CTI member states have committed to five goals with the explicit ambition of transforming coastal and marine governance in the region (see Fidelman et al. 2012; Fidelman et al. 2014 for more detailed information). The CTI is now established and supports many new investments and activities aimed at integrating multiple objectives around conservation, development and climate change. It, therefore, provides a rich context to examine processes of influence and integration, in order to highlight the multiple facets of leadership, broadly defined.

We conducted our research in Solomon Islands, one of the six CTI member states in which we have established research connections. In Solomon Islands a multi-agency National Coordinating Committee (NCC) has responsibilities for monitoring, implementing and coordinating the CTI activities in-country. It is co-chaired by the Environment, Conservation, Disaster Management and Meteorology and the Ministry of Fisheries of Marine Resources. The NCC can be considered as a governance network (*sensu* Newig *et al.* 2010), or a field-policy or organizational leadership network (*sensu* Hoppe and Reinelt 2010), in that it was deliberately formed (rather than emergent) to align resources and co-ordinate activities to address the common goals of the CTI.

133

134 **Data collection**

135 We conducted face-to-face expert interviews with the named representatives of
136 organisations that are members of the Solomon Islands National Co-ordinating
137 Committee (NCC). We aimed to survey all NCC member organisations. The Chair of
138 the Solomon Islands NCC provided the names of the 17 experts who were the regular
139 attendees of NCC meetings who act as representatives of the NCC member
140 organisations. In 2013 we interviewed 12 of these experts; five were unavailable for
141 interview. We asked each respondent to represent the experiences of their organisation.
142 Our sampling approach is consistent with other research employing expert elicitation,
143 network and participatory approaches (e.g., Cohen *et al.* 2012; Game *et al.* 2013) and it
144 aligns with methodological approaches in leadership studies (e.g., Mailhot et al. 2016)

145

146 The face-to-face expert interview involved a participatory network mapping activity to
147 map leadership influences on the respondents' organizations. First we asked
148 respondents to identify "*Who* and *what* provides leadership in the work that your
149 organisation does (e.g., activities on the ground, policies your organisation develops,
150 research your organisation undertakes, etc.) related to the three core goals of the Coral
151 Triangle Initiative in Solomon Islands?". The three core goals were food security,
152 biodiversity conservation and climate change adaptation. Following accepted
153 definitions in leadership studies, respondents were asked to consider leadership broadly
154 as influence. To encourage respondents to openly consider the influence of
155 conventional (human) and non-conventional (material and discursive) actants on the
156 activities of their organisations, we asked them to consider four overarching categories

157 of ‘actants’ that could constitute potential sources of leadership, and we described each
158 in lay terms; a) organisations and networks (i.e., described to respondents as any group
159 of social entities working together), b) donors and funding (i.e., sources of finance), c)
160 policies and strategies (i.e., a document that articulates how actions should or must be
161 taken), and d) beliefs and discourses (i.e.,the over-arching views that people or
162 organisations hold). In each of these four categories we provided a few broad and
163 specific, but standardised, examples to clarify our meaning (Table 1). The specific
164 examples we provided were those organisations, donors, policies and discourses that
165 were frequently mentioned in key CTI documents. *Importantly*, respondents could
166 include or *exclude* the example provided in their network map, and then were
167 encouraged to list any further actants in any of the four categories (Figure 1A). Note,
168 respondents could not nominate themselves/their own organisation. Thus, the
169 leadership influence of any organisation was determined by others. In the network
170 diagrams, responses were recorded as binary figures: a one (i.e., presence of influence)
171 or a zero (i.e., absence of influence) against the list of actants.
172
173 TABLE 1
174
175 To address our second objective of establishing whether leadership varied across the
176 three CTI goals, respondents ranked the relative influence of different actants in their
177 network for each goal. First, we asked respondents to allocate 100 counters across the
178 three goals according to where the most progress had been made by the CTI in
179 Solomon Islands since it started in 2009. We then asked respondents to consider one
180 CTI goal at a time and to distribute the allocated number of counters across the actants

they felt were influential for that particular goal, i.e., placing more counters on the more influential actant (Figure 1B). For example, if the respondent had indicated relative progress by assigning 60 percentage points to food security, 30 to biodiversity conservation, and 10 to climate change adaptation, they then had 60 counters to distribute across the specific actants influential on food security, 30 across actants influential on biodiversity conservation and 10 on influential climate change adaptation actants. We then asked respondents to discuss why they had identified particular actants as the most influential in each of the three rounds of scoring.

FIGURE 1

To address our third objective on whether leadership might also inhibit progress towards environmental governance outcomes, we asked the respondent to identify "Who and what hinders, stalls or halts the work that your organisation does?" across all three CTI goals combined. We recorded responses against the established list of actants again using a binary code: one to indicate the presence of influence or zero to indicate the absence of influence. We then asked respondents to discuss why they had identified particular actants as the most influential in hindering, stalling or halting CTI progress.

Data Analysis

Using Ucinet version 6.288, we created two network visualisations representing: a) all identified sources of positive influence on progress of NCC organisations towards the CTI goals combined; and b) all identified sources of negative influence on progress

205 towards the CTI goals combined. In each network, the actant (i.e., source of influence)
206 is the node. In total, respondents identified 122 actants as influential on CTI progress.
207 Therefore, to create networks in Ucinet we produced 7 x 122 cell matrices (one matrix
208 for positive, and a separate matrix for negative influences), where cells contained either
209 a one or a zero indicating the presence or absence of influence. If we had interviewed
210 more than one respondent from a particular NCC member organisation, their responses
211 were aggregated, therefore, the responses of the 12 respondents were incorporated into
212 seven rows; one for each organisation. The size of the nodes represents the frequency
213 with which respondents identified a particular actant as influential, i.e., in-degree
214 (Degenne and Forsé 1999). To examine the different levels of influence for each CTI
215 goal, we summed and sorted (from highest to lowest) total scores from each of the three
216 rounds of scoring with counters. In Microsoft Excel we organised and analysed
217 supporting qualitative data on why respondents ranked particular actants as the most
218 influential. Qualitative responses were analysed to determine patterns in explanations
219 of the participatory network data (i.e., why particularly actants were highly influential).
220 Given the small size of the NCC network, we do not apply statistics to our network
221 data. Instead, we present this empirical study as illustrative of the potential for a
222 broader approach to environmental leadership research.
223
224
225 # RESULTS
226
227 **Multiple sources of influence on CTI progress**

228 In the participatory network mapping activity respondents identified a total of 54
229 organisations, 18 donors, 32 policies and 18 discourses (represented as the nodes in the
230 network diagram) as being influential (indicated by the lines in the network diagram,
231 Figure 2A) in progressing the three main goals of the CTI in Solomon Islands. The five
232 most frequently cited actants, in descending order of frequency, were: the National Plan
233 of Action (NPOA), Equality, the Ministry of Environment, Conservation, Disaster
234 Management and Meteorology (MECDM), the Ministry of Fisheries of Marine
235 Resources (MFMR) and The Nature Conservancy (TNC).
236
237 The actants ranked as the most influential by respondents (as indicated by the highest
238 number of counters summed) across all three CTI goals combined were: MECDM,
239 NPOA, Poverty, The Nature Conservancy (TNC), and WorldFish (Table 2). The
240 MECDM emerged as the most influential actant with a score almost twice that of other
241 potential sources of influence. Poverty was the most influential discourse overall. It
242 was identified as important in less than 25% of responses but where it was identified it
243 was felt to be highly influential over CTI progress. Similarly, equality was felt to be a
244 very influential discourse by those that identified it.
245
246 **Different sources of influence on three overarching CTI goals**
247 We disaggregated perceptions of influence by the three overarching goals of the CTI in
248 Solomon Islands. Proportionate ranking by respondents indicated that they perceived
249 that relatively equal progress had been made across the three goals in Solomon Islands
250 as a whole, with slightly higher emphasis on climate change adaptation (37% of total
251 points), than biodiversity conservation (34%), or food security (29%). Importantly,

252 respondents perceived that different actants had been influential for different goals
253 (Table 2). Overall, *organisations* feature as the most important category of actants
254 accounting for 45% of the total points. The MECDM emerged as the most influential
255 actant on all three CTI goals. The NPOA and RPOA were among the top five sources
256 of influence for all three goals. Discourses around poverty, equality and food security
257 were among the most highly ranked influences on progress under the food security and
258 climate change adaptation goals of the CTI.
259
260 TABLE 2
261
262 The MECDM and MFMR hold formal leadership roles as co-chairs of the National Co-
263 ordinating Committee for the CTI, and both are among the four most important
264 organisations influencing CTI objectives overall. MECDM is the most influential
265 organisation for each of the three goals when they are considered separately, whereas
266 MFMR was among the four most influential actants under the biodiversity conservation
267 objective, but was substantially less influential under the climate change adaptation
268 objective (ranked 12th). For both food security and climate change adaptation objectives
269 WorldFish is considered by respondents to be more influential on their on-ground
270 activities than MFMR. For both biodiversity conservation and climate change
271 adaptation TNC is also perceived to be more influential on organisations'
272 implementation practices than MFMR.
273
274 Two other trends to note in these data are, first, the identification of customary rights as
275 a source of influence on food security and biodiversity conservation objectives. Second,

276 the presence of donors in the top sources of influence under climate change adaptation;
277 the objective for which data suggested most progress (37%) had been made over the
278 last five years. Several respondents' comments noted the intense donor focus on
279 climate change, with one respondent suggesting that: "*there are enough* [externally
280 funded] *projects on climate change for everyone*".
281
282 **Blocking or stalling influences on CTI progress**
283 Actants viewed to be influential in the progress of CTI goals were, in some cases, also
284 considered to be influential in stalling or hindering progress (Figure 2B). Tradition was
285 the most influential factor stalling progress. Respondents related tradition to customary
286 rights and identified land disputes, in particular, as a challenge to progress. One
287 respondent explained that "*When customary rights issues, such as disputes, arise we*
288 *leave people to sort it out and we walk away. We don't have the capacity to address or*
289 *solve these issues. That is the responsibility of the community or a mediator. It's*
290 *frustrating but you have to respect and understand this*". Respondents explained that
291 while these cultural factors were important for guiding the implementation of CTI
292 objectives (i.e., particularly through community-based approaches) they could also
293 significantly stall action.
294
295 Despite their formal position as the co-chairs of the NCC, both MECDM and MFMR
296 also feature highly as actants that hindered progress. One respondent suggested that the
297 NCC co-chairs can't fulfil their leadership roles, "[they] *can't implement what they talk*
298 *about and so stall progress on the ground*". Finally, donors and the government
299 financing department were identified as influences that stalled or blocked progress

300 under CTI objectives. In particular, respondents perceived that donor agencies impose
301 conditions around the provision of finances that stalled progress resulting in, what
302 respondents viewed as, an administrative burden on management resources. For
303 example, donor funding was viewed as a hindrance to progress because it is often
304 difficult to access, distribution is delayed and it comes with (excessively) high
305 expectations. They used words such as *rigid*, *time-consuming* and *unrealistic* to
306 describe the funding and reporting requirements of certain donors. Some respondents
307 also argued that donors pursued their own priorities not the country's priority needs.
308
309 FIGURE 2A AND B
310
311
312 # DISCUSSION
313
314 Our participatory analysis of a governance network uncovered a landscape comprising
315 multiple human and non-human sources of leadership that are objective specific and
316 operate in ways that can both facilitate and hinder progress. Our data show that over
317 122 actants have influenced the direction and progress of the CTI in Solomon Islands.
318 Organisations were the most often identified sources of leadership influence, and the
319 NCC co-chairs – MECDM and MFMR – were, as expected, ranked among the most
320 influential actants alongside key supporting NGOs and donors. Nevertheless, more than
321 a third of the sources of leadership identified were not agents or actors in the
322 conventional sense, but non-human material and discursive entities. Four of the most
323 influential sources of leadership overall were discourses, including 'Centre of
324 Biodiversity' – which is an emerging motif of the CTI (CTI Secretariat 2009; Veron *et*

325 *al.* 2009) – 'poverty', 'equality' and 'customary tenure rights'. In Solomon Islands
326 customary tenure is the main form of property right, it is enshrined in the Constitution
327 and, as our data indicate, it both facilitates and hinders progress towards CTI goals.
328
329 Our analysis can be interpreted in different ways. The data could be understood in
330 terms of organisations and donors exhibiting leadership influence within a context of
331 other influential, non-human discursive (e.g., equality) and institutional (e.g., Regional
332 Plan of Action) contextual factors. This would reflect a body of work in leadership
333 studies that argues for more attention to the dialectic relationship between leadership
334 and context i.e., to understand what type of leadership is effective in particular
335 situations and how leadership itself shapes context (Pettigrew 1992; Denis *et al.* 2010;
336 Endrissat and von Anx 2013). Some authors further posit that leaders can lead *through*
337 context as well as through other more direct leadership actions (Endrissat and von Anx
338 2013). In our case, this would mean that discourses and policies are created deliberately
339 by lead agencies to enact more indirect influence over actors within a broad governance
340 context in which direct influence or leadership is not possible (i.e. actors work for
341 different organisations and are not accountable to particular lead agencies).
342
343 Alternatively, our data can be seen to reflect a distributed form of leadership. In this
344 paper, we took a provocative stance to argue that both human and non-human actants
345 can enact leadership influence within a distributed leadership network. This is a
346 reaction to the over-emphasis on individual and charismatic people or single
347 organisations as leaders in much of the environmental sciences literature. We defined
348 leadership broadly as a process of influence resulting in shared direction and

commitment (Haslam *et al.* 2011; Bolden *et al*. 2012) and suggest that influential discourses and policies can engender as much of a shared vision as organisations or charismatic individuals can. We show that actants, in addition to conventional agents, can direct and motivate the activities of the key CTI implementing organisations (i.e., the NCC) and influence processes and outcomes in different ways, thereby enacting leadership broadly defined.

Our approach follows an emerging stream of research in leadership studies on the role of people *and* objects/artefacts in distributed leadership (Spillane *et al*. 2004; Bryson *et al.* 2009; Oborn *et al.* 2013; Mailhot *et al.* 2016). Some scholars analyse how human agents employ objects (i.e., concepts, committees or technologies) to achieve outcomes through their leadership practice (Mailhot *et al.* 2016). Other scholars take a slightly more 'radical' approach which views the objects themselves as *performative*, meaning the objects have their own agency and can frame interactions and recruit other actors to their 'cause', even in the absence of particular human agents who created, mobilised or utilise the object (Mailhot *et al.* 2016). Spillane et al. (2004: 27) state that "the practice of leadership is stretched over leaders, followers, and the material and symbolic artefacts in the situation". Similarly, Bryson *et al*. (2009: 200) identify artefacts or objects including strategy maps "that changed the minds of their producers and guided subsequent action across time and space" as influential actants in inter-organisational collaboration. In the context of public policy making, Oborn *et al.* (2013) highlight that socio-material configurations of human agents and objects (such as data and communication technologies) can resolve conflicts and legitimise re-thinking of leadership outcomes. They too emphasise that "these materials are not passive

373 mediators or neutral channels for leadership but are consequential". Yet, the agency of
374 these objects emerges in relation to different actors and specific practices or activities,
375 rather than being inherent in a material's properties (Oborn *et al*. 2013). In our case,
376 agency emerges through the interactions between the NCC organisations and the
377 human and non-human actants they identify as influential on their policy and
378 implementation practices.
379
380 This approach to leadership research falls within the pluralist tradition of the leadership
381 studies literature which focuses on the "combined influence of multiple leaders in
382 specific organisational situations" or, in our case, inter-organisational situations (Denis
383 *et al.* 2012: 211). The pluralist approach is at the forefront of leadership studies and
384 informs numerous strands of enquiry into how leadership emerges and plays out in
385 group settings and through group processes (Hoppe and Reinelt 2010; Haslam *et al.*
386 2011; Denis *et al.* 2012). As Oborn and colleagues (2013) argue, taking an inclusive
387 view of distributed leadership is appropriate for understanding how leadership emerges
388 in complex policy contexts involving diverse stakeholder groups with multiple
389 conflicting interests, as is characteristic of environmental governance transitions.
390
391 Recognising leadership as distributed and contested is rare in environmental leadership
392 research and our study took this broad approach to distributed leadership to respond
393 directly to these critiques. In doing so we consider leadership broadly, we unpack
394 environmental governance into component and potentially contested objectives, and we
395 explicitly examine forms of leadership that may block or stall particular trajectories. In
396 addition to showcasing how leadership influence can be widely distributed among the

397 human and non-human, we also show that actants that may block and stall progress are
398 not necessarily "devious" but can be limited by the mandates that guide them,
399 competing priorities, limited capacity to act or indeed active disagreement with the
400 direction a particular initiative is taking. We hope that our study has highlighted why
401 these different aspects of leadership must be considered in future efforts that seek to
402 explain the function and performance of leadership in environmental change processes.
403
404 We recognise that our inclusive approach may be too broad for some analysts. While
405 Grint (2005, pace Gallie, 1955/56) notes that leadership is an 'essentially contested
406 concept' which will frustrate any attempt by researchers to nail-it-down in definitional
407 terms, he also attempts to articulate what is 'sacred' about the leadership concept. Grint
408 (2010: 89) observes that "in attempting to escape from the clutches of heroic leadership
409 we now seem enthralled by its apparent opposite—distributed leadership: in this post-
410 heroic era we will all be leaders so that none are". Grint refers to a spectrum of
411 distributed leadership from leadership as moderately shared to more radical
412 interpretations where leadership is unnecessary or so widely shared it dissipates
413 altogether. Even with its broad focus on human and non-human agents we suggest that
414 our study falls into the former category: it does not preclude the role of individuals and
415 organisations, but aims to highlight a much broader platform on which to situate further
416 environmental leadership research.
417
418 Moreover, we acknowledge several key limitations to our empirical study. First, the
419 NCC network we analysed gave a small sample size that precludes statistical analysis
420 of the data. Nevertheless, we suggest that the relative ranking of actants (i.e., to the

extent that several non-human actants feature in the top ten sources of leadership overall and that some new actants are recognised in the top ten sources of leadership for particular objectives) is important and sufficient to illustrate the potential of broader approaches. Second, by defining leadership as influence we facilitate a more open view of leadership processes than may result from using more specific terms such as leader. Third, we did not comprehensively assess *how* the different human and non-human actants *actively* influence, stall or alter trajectories of progress in the CTI over time. Our network data provide the foundations for an interesting extension of this research. For example, further research could use longitudinal and ethnographic methods to investigate in more depth how different actants influence the concepts, mandates, approaches and actions of the NCC organisations; in particular, how non-human entities like policies and discourses act as sources of influence independently of the human actors and organisations that formulate or construct them.

CONCLUSION

Environmental governance needs to be transformed to address resource over-exploitation, poverty and inequality, and climate change. Our study shows that there are subtly different sources of influence underpinning multiple objectives communicated under the rubric of regional conservation and development initiatives. This is a challenge for governance but also indicates multiple potential entry points for bolstering Coral Triangle Initiative outcomes and similar global initiatives that seek to be transformative. As such, strengthening leadership may not be limited to a focus on

key individuals, which can make system change and progress vulnerable to loss of these individuals, but may consider investment in a web of reinforcing actants that, in combination, constitute 'leadership' and both facilitate and direct collective action.

Acknowledgements

This work was funded by a "Collaboration Across Borders" grant from James Cook University. We are grateful to the Solomon Islands NCC for their participation in this study. We would also like to thank Rebecca Weeks and Vera Horigue for feedback on our original methodology. PJC and DJM are grateful for support from an Australian Centre for International Agricultural Research grant (FIS/2012/074) and the CGIAR Research Program on Aquatic Agricultural Systems.

Compliance with Ethical Standards:

Funding: This study was funded by a "Collaboration Across Borders" grant from James Cook University and PJC and DJM are grateful for support from an Australian Centre for International Agricultural Research grant (FIS/2012/074).

Conflict of Interest: The authors declare that they have no conflict of interest.

REFERENCES

Biggs R., Westley F. R. and Carpenter. S. R. (2010). Navigating the back loop: fostering social innovation and transformation in ecosystem management. Ecology and Society 15(2): 9.

Black S. A., Groombridge J. J. and Jones C.G. (2011). Leadership and conservation effectiveness: finding a better way to lead. Conservation Letters 4(5):329–339.

Bolden R., Gosling J. O'Brien A. Peters K. Ryan M. and Haslam A. (2012) Academic leadership: Changing conceptions, experiences and identities in higher education in UK universities. Final Report, Research & Development Series. Leadership Foundation for Higher Education, London.

Brown K. (2013). Global environmental change I: A social turn for resilience? Progress in Human Geography 38(1): 107-117.

Bryson J. M., Crosby B. C. and Bryson J. K. (2009). Understanding strategic planning and the formulation and implementation of strategic plans as a way of knowing: The Contributions of Actor-Network Theory. International Public Management Journal 12(2): 172-207.

489 Carroll B., Levy L., and Richmond D. (2008). Leadership as practice: Challenging the
490 competency paradigm. Leadership 4(4): 363–379.
491 Case P. (2013). Review essay: Grint, K. The Arts of Leadership and Leadership.
492 Leadership and the Humanities 1(1): 59-62.
493 Case P., Evans, L. S., Fabinyi, M., Cohen, P. J., Hicks, C.C., Prideaux M., and D.
494 Mills. (2015). Rethinking environmental leadership: The social construction of
495 leaders and leadership in discourses of ecological crisis, development, and
496 conservation. Leadership 11(4): 396-423.
497 Chapin F. S., Carpenter S. R., Kofinas G. P. Folke C., Abel N., Clark W. C., Olsson P.,
498 Smith D. M. S., Walker B., Young, O. R., Berkes, F., Biggs R., Grove J. M.
499 Naylor R. L., Pinkerton E., Steffen W., and Swanson F. J. (2010). Ecosystem
500 stewardship: sustainability strategies for a rapidly changing planet. Trends in
501 Ecology & Evolution 25: 241-249.
502 Cohen P. J., Evans, L. S. and Mills M (2012). Social networks supporting governance
503 of coastal ecosystems in Solomon Islands. Conservation Letters. 5: 376-386.
504 CTI Secretariat. (2009). Regional Plan of Action; Coral Triangle Initiative on Coral
505 Reefs, Fisheries and Food Security (CTI-CFF). Interim Regional CTI
506 Secretariat, Manado.
507 Degenne A., and Forsé M. (1999). Introducing social networks. Sage Publications,
508 London.
509 Denis J-L., Langley A., and Sergi V. (2012). Leadership in the Plural. The Academy of
510 Management Annals 6(1): 211-283.
511 Denis J-L., Langley A., and Rouleau L. (2010). The Practice of Leadership in the
512 Messy World of Organizations. Leadership 6(1): 67–88

513 Dwiartama A., and Rosin C. (2014). Exploring agency beyond humans: the
514 compatibility of Actor-Network Theory and resilience thinking. Ecology and
515 Society 19(3): 28
516 Evans L. S., Hicks C.C., Cohen P. J., Case P., Prideaux M., and Mills, D. J. (2015).
517 Understanding leadership in the environmental sciences. Ecology and Society
518 20(1): 50.
519 Endrissat N., and von Arx W. (2013). Leadership practices and context: Two sides of
520 the same coin. Leadership 9(2): 278–304.
521 Fidelman P., and Evans LS. and Foale S. Weible C. von Heland F. and Elgin D. (2014).
522 Coalition cohesion for regional marine governance: A stakeholder analysis of
523 the Coral Triangle Initiative. *Ocean & Coastal Management* 95: 117-128
524 Fidelman P. Evans LS. Fabinyi M. Foale S. Cinner J. Rosen F. (2012). Governing
525 large-scale marine commons: contextual challenges in the Coral Triangle.
526 *Marine Policy*. 36: 42–53
527 Game E. T., Fitzsimons J. A., Lipsett-Moore G., and McDonald-Madden E. (2013).
528 Subjective risk assessment for planning conservation projects. *Environmental*
529 *Research Letters* 8: 045027.
530 Grint K. (2010). The Sacred in Leadership: Separation, Sacrifice and Silence.
531 Organisation Studies 31(1): 89-107.
532 Haslam S. A., Reicher S. D. and Platow M. J. (2011). The new psychology of
533 leadership: Identity, influence and power. Hove. Psychology Press.
534 Hawkins, B. (2015). Ship-shape: Materializing leadership in the British Royal Navy.
535 Human Relations 68(6): 951-971.

536 Hoppe B., and Reinelt C. (2010). Social network analysis and the evaluation of
537 leadership networks. The Leadership Quarterly 21: 600-619.
538 Houck O. A. (2010). Taking back Eden eight environmental cases that changed the
539 world. Washington, DC, Island Press.
540 Kates R. W., Travis W. R., and Wilbanks T. J. (2012). Transformational adaptation
541 when incremental adaptations to climate change are insufficient. Proceedings of
542 the National Academy of Science United States of America 109(19): 170-182.
543 Latour B. (1996). On actor-network theory. A few clarifications plus more than a few
544 complications. Soziale Welt 47**:** 369-381.
545 Lele S.M. (1991). Sustainable Development: A critical review. World Development
546 19(6): 607-621.
547 Mailhot C., Gagnon S., Langley A., and Binette L-F. (2016). Distributing leadership
548 across people and objects in a collaborative research project. Leadership 12(1):
549 53–85.
550 Manolis J. C., Chan K. M., Finkelstein M. E., Stephens S., Nelson, C.R., Grant, J. B.
551 and Dombeck M. P. (2009). Leadership: a New Frontier in Conservation
552 Science. Conservation Biology 23(4): 879-886.
553 Martinez-Alier J. (2014). The environmentalism of the poor. Geoforum 54: 239–241.
554 Myers N. (1996). The biodiversity crisis and the future of evolution. Environmentalist
555 16(1): 37-47.
556 Njaya F., Donda S., and Béné C. (2012). Analysis of power in fisheries co-
557 management: experiences from Malawi. Society and Natural Resources 25(7):
558 652-666.

559 Oborn E., Barrett M. and Dawson S. (2013). Distributed leadership in policy
560 formulation: A sociomaterial perspective. Organization Studies 34(2): 253–276.
561 O'Brien, K. (2012). Global environmental change II: From adaptation to deliberate
562 transformation. Progress in Human Geography 36(5): 667-676.
563 Olsson P., Folke C., and Hughes T.P. (2008). Navigating the transition to ecosystem-
564 based management of the Great Barrier Reef, Australia. Proceedings of the
565 National Academy of Science United States of America 105(28): 9489-9494.
566 Pahl-Wostl C., Craps M., Dewulf A., Mostert E., Tabara D., and Taillieu T. (2007).
567 Social learning and water resources management. Ecology and Society 12(2): 5.
568 Pettigrew A.M. (1992). On Studying Managerial Elites. Strategic Management Journal
569 1(winter): 163–82.
570 Redclift M. (2005). Sustainable development (1987-2005): an oxymoron comes of age.
571 Sustainable Development 13(4): 212-227.
572 Rosen F. and Olsson P. (2013). Institutional entrepreneurs, global networks, and the
573 emergence of international institutions for ecosystem-based management: The
574 Coral Triangle Initiative. Marine Policy 38: 195-204.
575 Scheffer M., Westley F., and Brock W. (2003). Slow response of societies to new
576 problems: causes and costs. Ecosystems 6: 493-502.
577 Spillane J.P., Halverson R. and Diamond J.B. (2004). Towards a theory of leadership
578 practice: a distributed perspective, Journal of Curriculum Studies 36(1): 3-34.
579 Stafford-Smith M., Horrocks L., Harvey A., and Hamilton C. (2011). Rethinking
580 adaptation for a 4°C world. Philosophical Transactions of the Royal Society B
581 369(1934): 196-216.

582 Steffen W., Richardson K., Rockstrom J., Cornell S. E., Fetzer I., Bennett E. M., Biggs
583 R., Carpenter S. R., de Vries W., de Wit C. A., Folke C., Gerten D., Heinke J.,
584 Mace G. M., Persson L. M., Ramanathan V., Reyers B., and Sorlin S. (2015).
585 Planetary boundaries: Guiding human development on a changing planet.
586 Science 347(6223).
587 United Nations Department of Economic and Social Affairs. (2010). The Millenium
588 Development Goals Report 2010, New York.
589 Veron J., Devantier L. M., Turak E., Green A. L., Kininmonth S., Stafford-Smith M.,
590 and Peterson N. (2009). Delineating the coral triangle. Galaxea, Journal of
591 Coral Reef Studies 11: 91-100.
592 Walker B., Holling, C. S., Carpenter S. R., and Kinzig A. (2004) Resilience,
593 Adaptability and Transformability in Social-ecological Systems. Ecology and
594 Society 9(2): 5.
595 Westley F., Olsson P., Folke C., Homer-Dixon T., Vredenburg H., Loorbach D.,
596 Thompson J., Nilsson M., Lambin E., Sendzimir J., Banerjee B., Galaz V., van
597 der Leeuw S. (2011). Tipping toward sustainability: emerging pathways of
598 transformation. Ambio 40(7): 762-780.
599 World Resources Institute. (2005). Millennium Ecosystem Assessment: Ecosystems
600 and Human Well-being: Synthesis. Washington, DC.
601 Young O. R., Osherenko G., Ogden J., Crowder L. B., Ogden J., Wilson J. A., Day J.
602 C., Douvere F., Ehler C. N., McLeod K. L., Halperin B. S., and Peach R.
603 (2007). Solving the crisis in ocean governance: Place-based management of
604 marine ecosystems. Environment 49(4): 20-32.

605 Zulu L.C. (2008) Community forest management in southern Malawi: solution or part
606 of the problem? Society and Natural Resources 21(8): 687-703.
607
608 **Figure 1.** A schematic of the participatory method use with respondents to identify
609 different sources of leadership and their relative influence on the three CTI goals; (A)
610 illustrates the initial map of actants considered to be influential (data used for the
611 quantitative network diagrams), and (B) depicts how respondents ranked the relative
612 influence of actants on the three different CTI goals (data in table 2).
613
614 **Figure 2.** Network diagrams illustrating the relative frequency (indicated by the size of
615 the point) that different actants (individual points) were identified by respondents as
616 being influential on (indicated by lines) CTI goals: (A) positive influences and (B)
617 negative influence. Respondents' organisations are indicated by triangles; the arrows
618 point towards the actants that respondents identified. Categories of leadership are
619 indicated by different colours; black = organisations and networks, blue = donors and
620 funding, red = policies and fora, and green = beliefs and discourses.
621
622