A generic method of engagement to elicit regional coastal management options

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Abstract :

Stakeholder engagement is important for successful management of natural resources, both to make effective decisions and to obtain support. However, in the context of coastal management, questions remain unanswered on how to effectively link decisions made at the catchment level with objectives for marine biodiversity and fisheries productivity. Moreover, there is much uncertainty on how to best elicit community input in a rigorous manner that supports management decisions. A decision support process is described that uses the adaptive management loop as its basis to elicit management objectives, priorities and management options using two case studies in the Great Barrier Reef, Australia. The approach described is then generalised for international interest. A hierarchical engagement model of local stakeholders, regional and senior managers is used. The result is a semi-quantitative generic elicitation framework that ultimately provides a prioritised list of management options in the context of clearly articulated management objectives that has widespread application for coastal communities worldwide.

The case studies show that demand for local input and regional management is high, but local influences affect the relative success of both engagement processes and uptake by managers. Differences between case study outcomes highlight the importance of discussing objectives prior to suggesting management actions, and avoiding or minimising conflicts at the early stages of the process. Strong contributors to success are a) the provision of local information to the community group, and b) the early inclusion of senior managers and influencers in the group to ensure the intellectual and time investment is not compromised at the final stages of the process.

The project has uncovered a conundrum in the significant gap between the way managers perceive their management actions and outcomes, and community's perception of the effectiveness (and wisdom) of these same management actions.

Highlights

► Stakeholder engagement is important for successful regional management. ► A generic decision support process is described using two case studies. ► Method to elicit management objectives and options, with priorities, are provided. ► A generic elicitation framework for use by others is suggested.

3. Introduction

Pressure on ecosystems in the coastal zone has increased with time due to population growth and the social and economic importance of these areas (Halpern et al., 2009). Effective management of this zone is important as they contain many iconic and threatened species (such as dugongs, water birds, turtles) and also key habitats (wetlands, seagrasses, mangroves).

The coastal zone of the Great Barrier Reef in Australia experiences the impacts of cumulative effects, most notably inputs of sediment, nutrient and contaminants from rural and urban land sources (Kroon et al., 2013). However, managing cumulative impacts can be seen as a "wicked" problem because interactions within and among the social, economic and ecological systems are highly complex, non-linear and mostly unknown, which has often led to management failure (Ludwig, 2001; Rittel and Webber, 1973). Science is categorised as only being able to solve "tame" problems (Rittel and Webber, 1973).

46 Two solutions have been put forward to address this dilemma: a) Adaptive

47 management, which involves iterative decision making, via evaluating the

48 outcomes from previous decisions and adjusting subsequent actions on the basis

49 of this evaluation (Sainsbury et al., 2000; Walters and Hilborn, 1976), and b)

50 effective stakeholder engagement to facilitate social learning improving

51 outcomes (Muro and Jeffrey, 2008). If these two processes are combined, they

52 form essential foundational steps to achieve effective environmental

53 management, through good information, development of identity, and

54 institutions and incentives (Van Vugt, 2009).

55 In the coastal zone, governance is complex with many organisations and

56 associated institutions designated to manage the system (local, regional, national

57 and international) and many forms of "ownership" models (government, semi-

58 government, public open access, private). To some, the solution to the complex

59 governance situation is to create boundary organisations either through a non-

60 government organisation (NGO) or develop collaborative efforts between

61 scientists and government organisations. Boundary organisations cross the

62 boundary between science and government as a network which draws on both

63 sides to facilitate evidence-based decisions (Guston, 2001). These organisations

64 attempt to solve problems by meeting three criteria, which are: a) creating

65 opportunities and incentives for boundary products, b) facilitating participation

66 of actors from different sides of the boundary and c) establishing or

67 strengthening links between politics and science (amongst others). Boundary

68 organisations are effective, for instance, in the health sector (Drimie and Quinlan,

69 2011) and in waterway management (Abal et al., 2005).

70   Whether attempting management with or without these boundary organisations,

71   stakeholder or community engagement is seen as crucial to management success

72   (Dietz et al., 2003; Ostrom, 2009; Van Vugt, 2009). Similarly, the scale of

73   management should include local input into regional management rather than

74   only distant high level and scale management (Ostrom, 2009). Stakeholder

75   engagement has been successfully applied in many single use applications such

76   as fisheries. Often engagement has been established through technical and

77   management boundary organisation (Smith et al., 1999) or various forms of

78   devolved management such as through Territorial User Rights (Chandra, 2011),

79   community based special marine protected areas (Ma et al., 2013) or self

80   management in fisheries (Townsend et al., 2008). However, moving from

81   stakeholder engagement to community engagement has generally not been

82   undertaken as many scholars have presumed that these resource users could not

83   self organise nor be representative (Cox et al., 2011). In this review by Cox et al.

84   (2011) of "self-organised regimes", their findings supported Ostrom's (2009)

85   eight design principles of local stable common pool resource management, which

86   includes well defined boundaries, institutions that are adapted to local

87   conditions, participatory decision-making processes, effective monitoring, scaled

88   sanctions for those who violate rules, mechanisms for conflict resolution,

89   recognition of community self-determination by higher-level authorities, and

90   nested enterprises for large common pool resources.

91   4.1. Study area

92   The Great Barrier Reef World Heritage Area (GBRWHA) includes the world's

93   largest coral reef system, the Great Barrier Reef (GBR), stretching over 2,300 km

94   of the coastline of Queensland, Australia (Fig. 1). The Australian

95   Commonwealth's Great Barrier Reef Marine Park Authority (GBRMPA) manages

96   much of the reef. Although GBRMPA manages the biodiversity assets and most

97   activities therein, fisheries and much of the coastal zone inshore of 3 nm are

98   managed by various other agencies such as the Queensland State Department of

99   Agriculture and Fisheries (DAF), and local councils. There is growing interest and

100   success in engaging local coastal communities to achieve reef management goals.

101   NGOs have played a key role through engaging especially with the farming

102   community to minimise the effects of agricultural runoff (sediments, nutrients

103   and pesticides) (http://reefcatchments.com.au/). Although these NGOs are in

104   many aspects boundary organisations, they have until recently only

105   concentrated on a few impacts areas.

106   The communities who live in the coastal zone of the GBR value the GBR highly

107   (Marshall et al., 2013) and as such there is a significant desire to be involved in

108   local management. It is generally understood by managers that a) it is difficult to

109   regulate all impacts that affect the GBR coast and reef so stakeholder support is

110   essential, and b) given the size of the area and its complexity, it is not possible to

111   have both regional and local knowledge without local input.
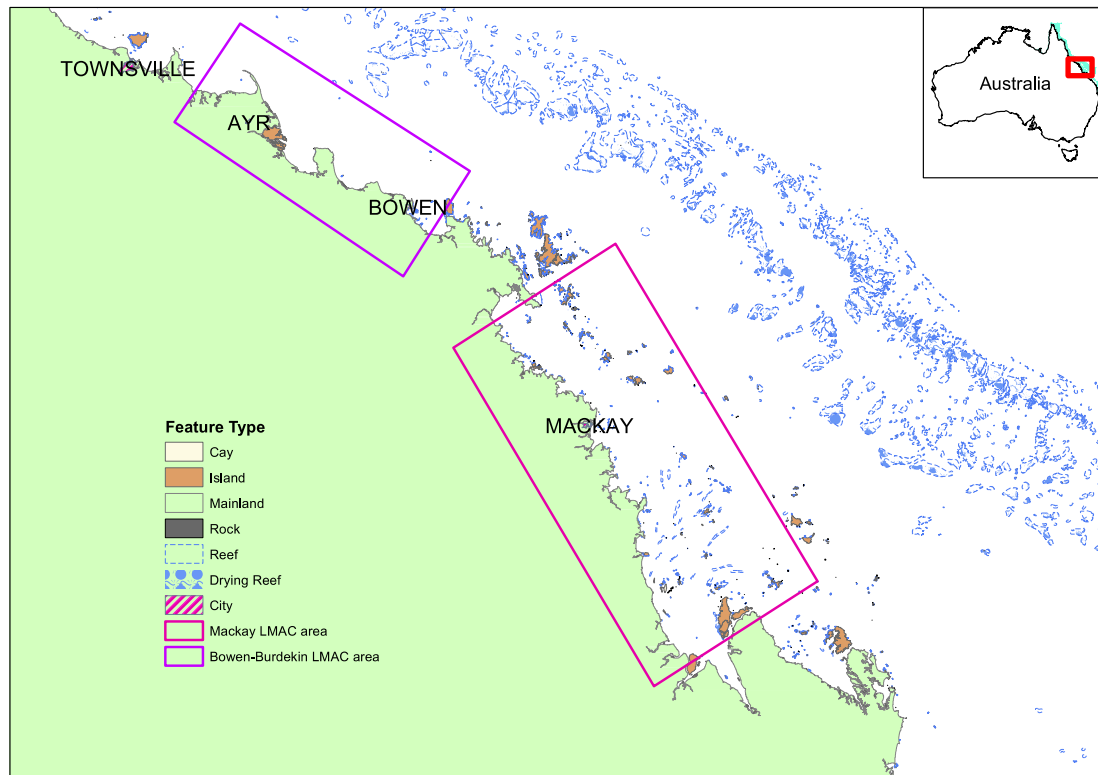
In a perfect world, high values attributed by a community to an area would generate voluntary compliance and regulation. However, the challenge remains on how to include community input in determining objectives for marine biodiversity and fisheries productivity and effectively link these objectives to decisions made by multiple management authorities, and to do this in a safe and cooperative manner. In an increasingly connected community in Queensland, social media has become a progressively useful medium to focus public opinion (for example the 2014 GetUp campaign against a port development – https://www.getup.org.au/campaigns/great-barrier-reef--3/protect-our-reef/protect-our-reef). However, these forums are seen as not engaging science, management and community in a non-adversarial long-term framework as

127 described in Cox et al. (2011). There are several case studies and suggestions of

128 what constitutes successful engagement. For example, a successful case study

129 (reviewed by Vural-Arslan and Cahantimur (2011)) in Turkey showed that that

130 community intelligence could be influential to the decision making process.

131 However, there are practical considerations when engaging the community over

132 a longer timeframe, including scheduling and other time commitments. Many

133 emphasise the importance of gaining trust and respect (Vural-Arslan and

134 Cahantimur, 2011), and provide models of engagement (Rowbottom and Bueno,

135 2009) and move beyond simple models of socio-ecological systems and the

136 perception that most resource users are the same (the "panacea") (Ostrom et al.,

137 2007).

138 **4. Method**

139 **4.1. Case studies**

140 Two coastal regions within the GBRWHA area were chosen as case studies.

141 Mackay was chosen as it represented a growing city of about 167,000 people

142 (Australian Bureau of Statistics, 2013) and a large associated Fly-In and Fly-Out

143 (FIFO) community servicing the local mining industry (Fig. 1). It also has an

144 active port, Hay Point, just south of Mackay with the main export being coal.

145 Another major economic driver and employer in the region is sugar cane, where

146 the cane is locally grown and refined into sugar. In terms of natural assets it has

147 national parks, many beaches, offshore islands, inshore and offshore reefs that

148 are part of the GBR. The environment is tropical with the marine environment

149 characterised by very large tidal ranges, key habitats such as mangroves and

150 seagrass, and threatened, endangered and protected (TEP) species groups such

151 as dugongs, turtles and inshore dolphins.

152 In contrast, for the second case study the Bowen-Burdekin Shire has a

153 population of about 26,000 people (Australian Bureau of Statistics, 2013) and is

154 approximately 60 km south of a major city Townsville (and about 350 km north

155 of Mackay) with Ayr and Home Hill as its main towns (Fig. 1). It is a region

156 characterised as being mainly rural with sugar cane farming as the major source

157 of economic development and employment.

158 These two case studies were chosen for what they have in common while

159 recognising their differences. Both case studies are in rural areas where farming

160 is very important for the areas' wealth generation and employment. A lot of

161 management effort has gone into reducing the amount of sediment, nutrient and

162 pesticide runoff to the GBR in both case study areas. However, the two regions'

163 ports are distinct in size and activity and importantly in terms of active

164 development and extension proposals. During the study period, a major port

165 upgrade in the Abbott Point area (just south of Burdekin), with associated

166 dredging, was proposed. This port upgrade was a source of conflict in the local

167 region and also created great controversy in wider Australia. Whereas the

168 Mackay port was well established with no upgrades happening at the time this

169 research was undertaken and therefore activities in the Mackay port was not as

170 controversial as the Abbott Point development. The population size was also

171 very different with Mackay having a far larger urban footprint with a growing

172 city although this may have slowed down in recent years due to the general

173 downturn in mining activity.

174   **4.2. Engagement process**

175   A hierarchical system of engagement was attempted in both regions. At the

176   highest level, a community group, the Local Marine Advisory Committee (LMAC)

177   run by GBRMPA was already established in each of the regions; although the one

178   in the Bowen-Burdekin was more recently established than the one in Mackay.

179   Their charters are to advise GBRMPA on local management issues

180   (http://www.gbrmpa.gov.au/about-us/local-marine-advisory-committees).

181   Although the chair is elected and paid a nominal fee, the members are volunteers

182   sourced from the community. LMACs have a 3-year term and calls for

183   nominations are made normally to stakeholder groups, although a nominee can

184   be independent. There is some vetting based on experiences GBRMPA (or a

185   referee) has had with individuals and their ability to contribute constructively.

186   Membership of the LMACs in our case studies included representatives from

187   GRBMPA, cane growers, commercial and recreational fishers, and local Port and

188   Council employees. The LMACs aim is to achieve a balanced representation,

189   although this is not always achieved. The quality of participation and 'team'

190   output can be highly variable.

191   Since the LMACs met every quarter with a full agenda, a sub-committee was

192   formed and called the LMAC Reference Group (RG). This was made up of LMAC

193   members who volunteered for the group and additional members (i.e. people

194   who were previously on the LMAC) that would cover a broader skill set. The

195   project lead facilitated the RG meetings, with a member elected as the RG chair.

196   In addition to the project team, who facilitated and attended the RG meetings,

197   "managers" (defined as people that either directly or indirectly influence

198   management decisions) from DAF and GBRMPA, and social, economic,

199   mathematical and environmental scientists from State and Commonwealth

200   agencies participated in the RG meetings.

201   Within a few months of project engagement in the Bowen-Burdekin area,

202   historical and present issues (such as the Abbott Point port development

203   controversy; members of the LMAC being stretched over two distinct regions

204   meaning members often had to travel long distances to attend meetings,

205   previous poor engagement processes) meant that participation was minimal. An

206   alternative approach was undertaken described in detail in Dichmont et al.

207   (2014), but generally it meant the project team engaged with individuals directly

208   and separately instead of in a group. Outside this one-to-one engagement

209   interactions between the different RG and LMAC members were minimal. In

210   Mackay, the RG was very successful and there was engagement with this group

211   throughout the process. However, the indigenous member resigned from the

212   group due to circumstances external to the RG.

213   At various stages in the process (described further below) community and senior

214   level managers' input was sought. All documentation was kept in a traceable

215   format, i.e. iterations of all steps could be traced through the various meetings to

216   its original source.

217   A local Mackay GBRMPA person devoted an enormous amount of time on

218   support and engagement in-between meetings. This support was essential and

219   provided local continuity.

220   A sequence of steps were undertaken – see Dichmont et al. (2014) for more

221   details. Steps 3 to 12 were undertaken in the Mackay case study only:

1. Qualitative modelling (Dambacher et al., 2003; Dambacher and Ramos-Jiliberto, 2007) of the Mackay coastal system was carried out (Dichmont et al., 2014) (both case studies). The RG was asked to list assets of importance to them in the region and identify the impacts on these assets. They were then asked to select their priority asset for which the impacts and feedback were modelled in more details. An introduction on terminology and how the method works were also provided to the group (see Dichmont et al. (2014));

2. A review of existing objectives from government organisations, NGOs and Natural Resource Management (NRM) bodies that were directly or indirectly relevant to the region was undertaken (both case studies). This was then combined into a hierarchical tree format using input from a series of workshops attended by the RG and LMAC (Dichmont et al., 2014; Van Putten et al., 2015). After this stage, the Bowen-Burdekin case study was discontinued given the controversy around the Port development and its overwhelming impact on the issues being discussed.

3. A survey of the RG, LMAC and Mackay public was undertaken to ascertain the relative importance of different objectives. Dichmont et al. (2014) describe the analysis details and survey methods in detail but two approaches were undertaken – the recommended Analytical Hierarchical Process (Pascoe et al., 2013; Saaty, 1980) and a new Point Allocation method at each level of the objective tree and called the Hierarchical Point Allocation method (Dichmont et al., 2014). The survey form is provided for illustration in Supplementary Material (SM) Section 1;

246   4. Managers gave presentations to the RG about existing management

247   actions that were being undertaken in the Mackay coastal zone so that

248   they could subsequently discuss any remaining management actions that

249   needed to be addressed for the different assets;

250   5. Topics relevant to the focal question of management of biodiversity and

251   fisheries in the coastal zone were developed in session (see SM Section 2).

252   These described both key assets (such as mangroves and seagrass) and

253   key issues (such as development).

254   6. Over a period of just over 12 months, the RG undertook a series of

255   workshops that discussed management options for these topics. Each

256   workshop included:

257   a. Presentation by an expert of background information pertinent to

258   Mackay about the specific topic being discussed at the workshop;

259   b. The RG, project team and invited expert workshopped an issues

260   register, direct and indirect management options, and responsible

261   agencies for each issue (Dichmont et al., 2014) (see SM Section 2).

262   The discussions were held either in small groups or as a whole

263   group, depending on the number of workshop participants. Direct

264   management options were defined as a management action that is

265   undertaken directly by the agency responsible for managing the

266   issue and could include proposing legislative changes, whereas

267   indirect management options were those that could have the same

268   impact as the direct option, but undertaken indirectly through a

269   non-responsible agency or the community. Issues or management

270   options could be geo-located using a Google™ map of the study

271 region. Relevant qualitative models were also made available to

272 assist with highlighting past discussions on the relationships

273 within the system on that topic.

274 c. Initially, the issues list was developed separately from the

275 management actions, but this was seen as inefficient. The meeting

276 length was increased from a couple of hours to half a day and all

277 aspects of a topic (i.e. issues and actions) were covered together as

278 described above.

279 d. The topic sequence was generally down the catchment (i.e.

280 geographically in direction of flow from source to river mouth and

281 then into near-shore domain), but most of the contentious topics

282 (port and urban development, fisheries) were addressed as the last

283 topic.

284 7. The project team combined all the management options into management

285 strategies (see SM Section 3), which were presented to the RG and these

286 were subsequently modified during two workshops. In order to articulate

287 the pathway of combining management options, the project team used the

288 well-known United Nations Environment Program risk assessment

289 framework known as DPSIR (Drivers, Pressures, States, Impacts and

290 Response) (Pirrone et al., 2005; Smeets and Weterings, 1999). A more

291 simplified form of Pressure-State-Response –was ultimately used. The

292 results were presented with an associated storyline for each Management

293 Strategy that provided background and a list of the relevant management

294 options (see example SM Section 4).

295   8. An impact assessment was undertaken in two phases (with the analysis

296   method described in Dichmont et al. (2014):

297   a. The RG was asked to rate each management strategy from -3

298   (''considerably worse than current situation'') to +3 (''considerably

299   better than current situation'') against the low level objectives.

300   b. They were also asked to score their level of confidence in their

301   ability to answer question a) for each objective from a score of 1

302   ("very unsure") to 5 ("certain").

303   c. A subsequent workshop was then held where the RG, Mackay

304   coastal managers and NRMs were asked to undertake the same

305   impact assessment scoring. However, due to time constraints

306   scores were made during the meeting against the high level goals

307   only (although well-being was split into social and economic

308   goals).

309   9. The overall priority list and final set of management strategies (SM

310   Section 3) were provided to the RG for comment, and thereafter to the

311   management workshop.

312   10. Storylines in the form of report cards were developed that described the

313   management strategies and actions for use by RG and LMAC members.

314   These were made available online for the community.

315   11. Letters to the two management agencies most affected were also written,

316   but drafted in language more appropriate for this target audience.

317   12. All documentation was always approved by RG members before release.

318   A review of the successes and failures of the two case studies by the project team

319   were undertaken through questionnaires to the Mackay RG and managers. A

320   final framework was developed for future engagement.

321   **5. Results and Discussion**

322   **5.1. Comparing the case studies**

323   The progress of the different case studies was heavily impacted by external

324   factors, in the case of Bowen-Burdekin a contentious port development proposal

325   and previous unsuccessful engagement processes, amongst others. The Bowen-

326   Burdekin LMAC was also split over two reasonably different regions and was

327   also the newest formed committee of the LMACs. This case study also did not

328   have a local GBRMPA member (as opposed to the Mackay case), which helped

329   build trust and continuity. The level of distrust and at times acrimony divided the

330   volunteers from the Bowen-Burdekin RG and LMAC such that the engagement

331   process was not completed in this case study. In that context, however, it was

332   still possible to complete the objective review and hierarchy through individual

333   or smaller group interactions that produced a useful product (Van Putten et al.,

334   2015). In contrast, the RG in Mackay was highly functional and delivered more

335   than 150 hours of volunteer time (not including the project team time). Given the

336   time and energy they put in, ownership of the output by the Mackay RG

337   increased over time with members controlling the final product (in terms of both

338   content and detailed wording). This was not the case in the Bowen-Burdekin

339   where the project team was more influential on the final product. However,

340 despite these differences in approach the final objective trees from each case

341 study were quite similar which allowed generic objectives to be developed.

342 A further issue in the Bowen-Burdekin case study was stakeholder fatigue.

343 Previous studies had used several of the members for other strategy discussions

344 especially on fisheries. There had been significant progress in developing

345 regional management strategies for the Burdekin area, with genuine interest and

346 support by the then Minister for Fisheries, but which failed to be progressed

347 because of poor overall project management and poor communication of the

348 objectives of the project to the community. Vocal opposition to the project by a

349 particular influential stakeholder group also influenced this outcome, but who

350 were not resident in the area. This meant that some of the members felt the

351 project was repeating previous work and were worried that the end result would

352 be the same. The Mackay case demonstrated that the process followed as part of

353 this project could in fact lead to avoiding conflict and that a rigorous semi-

354 quantitative sequential approach contributes to a successful completion and

355 overall outcomes.

356 Interestingly, as the Mackay RG increased in confidence and realised the value of

357 their contribution and increased knowledge due to access to experts, the link

358 between the RG and LMAC became more tenuous. RG members expressed their

359 frustration with the LMAC and developed a perception that they only discussed

360 small-scale issues compared to RG discussion.

361 Aspects that contributed most to the successes in Mackay were that:

362 • There were a large number of highly dedicated local volunteers within the

363 local community, scientific community, and amongst the managers.

364   • The scientific input was of an excellent standard with well-pitched

365   presentations due to verbal or written communications indicating what

366   was required provided beforehand. These presentations were very

367   motivational to RG members who indicted they valued them and that they

368   influenced the way they understood both management and biophysical

369   processes.

370   • Of key importance in terms of generating interest and knowledge was the

371   dedication to provide mostly local content. In addition RG members (and

372   managers) also gained immense local knowledge through visits to local

373   examples of good and bad management practices.

374   • There were strong links established between managers and RG members.

375   Discussions about contentious issues occurred, but debates over these

376   occurred in a climate of mutual respect and understanding.

377   However, senior management support for the uptake of the final

378   management strategies was variable. Lack of uptake of the final outcome by

379   some agencies were because:

380   • The RG had no broad official mandate to represent Mackay, as they were

381   not elected, which makes management action perceived as being more

382   risky.

383   • There was basic resistance on behalf of management to change and lack of

384   enthusiasm to undertake the effort that would be required to effect any

385   change. This is related to the conundrum that as part of the project the

386   managers needed to be open and or empathetic to community input (as

387   presented through the RG) despite this input being given by a community

388   group that by nature was not representative of a large region. This meant

389   that there was a perception that it would be difficult or less attractive to

390   act on the basis of their advice.

391   - Managers' perception of what was happening on the ground was

392   considerably different from that of the RG. This was due to a mixture of

393   managers not being aware of local issues and RG members not being

394   aware of what work management agencies were, or were not,

395   undertaking.

396   - The final management strategies were seen as "wishy-washy" and not

397   radical, and also managers perceived that many of the strategies had

398   already been implemented. However, this again highlighted differences in

399   manager's perception about what had been implemented and what had

400   actually happened on the ground as understood by the RG. Evidence of

401   bad and good practices and of the discrepancy between management

402   decisions and on-ground actions was shown to the project team and to

403   some of the managers. These demonstrated that manager's perception

404   that issues had already been addressed was not always borne out by the

405   evidence and therefore their developed management strategies still had

406   great significance to the RG members.

407   The process followed was accepted as comprehensive, but required significant

408   volunteer input. Some of this time commitment was due to the test case nature of

409   the work where several approaches were trialled by RG members. A shorter, less

410   time consuming version is suggested below as a refinement based on the

411   outcomes of our work.

5.2. Review of process

The qualitative modelling was used as an introduction for the members to discuss their present knowledge of the area, for their views were valued and to inform the project team on key issues that needed to be addressed and which assets needed to be protected. Although the project team provided the qualitative models to the RG at the time of management strategy development, the RG members did not use the models. Since the process of qualitative model development is quite extensive – in this case partly due to the fact that different methods were trialled – and because the models were not used later in the process, this step could be removed from the process. Alternatively it could be enhanced, or further value could be added to the models, by developing them into Bayesian Belief Networks (Hosack et al., 2008). This enhanced approach may be more useful to developing management strategies and the additional effort thus beneficial.

Undertaking the objective development process before discussing management options was essential to encourage group cohesion and trust. This sequence of events was based on the adaptive management loop (Sainsbury et al., 2000; Walters and Hilborn, 1976), where objectives are defined so that management strategies can be contextualised and actions can be reviewed once they are implemented. Conflict is reduced because all objectives can be included in the objectives setting process (i.e. there is no need to exclude any specific objective). In addition, each participants' individual weightings are preserved in the objectives scoring process giving each participant a sense that their opinions are considered and important. In summary, at this early stage of the process, the

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436 group is new and trust has yet to be developed. The objective stage does not

437 need consensus or agreement as a person can down weight an objective they

438 disagree with and highlight those they feel are most important. For this reason,

439 undertaking the objective process first builds trust. Conflicts are diffused and

440 informal feedback from the group indicated that generally participants found

441 this aspect interesting and unique, particularly given that their past experiences

442 mostly bypassed this part and instead moved straight to the management

443 strategies.

444 The objective review was surprisingly quick and easy (given that most of the

445 agencies had a strong online presence and documents were therefore easily

446 obtainable). In addition, the process followed with the Mackay RG to develop the

447 hierarchy led to increased group cohesion and the process was generally

448 enjoyed. However, a successful review was also achieved in the other case study

449 site through a more individual approach although perhaps with not as much

450 attachment to the final product.

451 Several approaches were trialled when developing the management strategies

452 with the RG in Mackay. Group input in the process highlighted that discussing the

453 each asset in conjunction with the issues that pertain to as one topic, and

454 covering only one topic per meeting, worked best. At each meeting, access to an

455 expert with local knowledge on each topic was essential. Undertaking the 'Issues

456 Register', and listing direct and indirect management options at the same time

457 was the most productive and produced a more cohesive product.

458 The sequence by which topics were discussed roughly reflected a progression

459 from the top of the catchment, down along the catchment to the ocean. This

460   sequence made intuitive sense, reduced overlap and highlighted the connectivity

461   of the system. The most controversial topics arose at the end of the discussion

462   process (at the bottom of the catchment) and by this stage the group was very

463   familiar with each other's views and therefore more open to opposing proposal

464   for management actions. The motive for undertaking the most controversial

465   topics towards the end is that the investment of the RG by this stage was high

466   thereby reducing the incentive to abandon the process but rather to remain

467   engaged in finding a solution. Members were also aware of the different weights

468   given to the various objectives, so many of the contentious views were already

469   generally known and were often discussed out of session. In other words,

470   members were more prepared to "agree to differ" or accommodate their ideas

471   rather than increase conflict and risk breaking the process, which was now more

472   than a year long. In the Burdekin the group was unable to progress past the

473   objectives stage. In this case study, extant conflict in the community already

474   existed due to past experiences and the controversial Port development. This

475   indicates that existing conflicts may not be easily be resolved by the process

476   proposed in this research, but that the process is better at deferring potential

477   future conflicts as was evident from the Mackay case study.

478   Traceability about where the objectives and management options came from was

479   an essential component that maintained trust between participants and trust in

480   the process. The RG feedback emphasised this point and that they felt their views

481   were listened to through having this transparency.

482   Explicitly making the relative importance of the defined objectives to the whole

483   group helped highlight that there was in fact quite a lot of consistency in the RG's

484   view and their attribution of the relative importance for each goal. In session

485   discussion of the results allowed general articulation of RG member's values and

486   opinions in a more factual manner.

487   By embedding managers in the project team and RG was an extremely important

488   component of linking the community with the management system and, as such,

489   was successfully implemented. However, connection to more senior

490   management and leaders in strategic thinking which has been shown to be very

491   influential in other studies, for example Dutra et al. (2014), was weak in our

492   process partly due to the project team's work load and other commitments of the

493   participants and managers. The lack of connection to senior management made it

494   more difficult to get traction (with regard to implementation) at the end of the

495   process. However, senior managers were approached at the early stages of the

496   process and the project team was told to wait until the end when there was more

497   substance. Some of the reason for this was that senior managers wanted to stay

498   at arms length from the process so they could wait to pick and choose options

499   that are possible to implement without having directly or indirectly endorsed

500   them by being involved in the process. As a consequence, the final manager

501   meeting was destructive for some RG members even though the project team

502   warned the RG that some negative response from managers could be expected.

503   As a result, a balance between the RG and managers' needs is required, where

504   more regular contact is made rather than using the manager's approach of

505   'connecting towards the end'. Closing this engagement and timing gap between

506   managers and the RG (highlighted in the Mackay example) throughout the

507   process is a priority. If these gaps were addressed this may assist in solving the

508   conflict in perception such that managers felt much work is already being

509   undertaken in some areas whereas the RG believe these were ineffective or

510   absent in the ground actions.

511   Managers suggested the most useful part of the process was the impact

512   assessment. This provided them with a list of relative priorities for each

513   management strategy they could use for funding purposes. It also uncovered a

514   significant gap between what managers thought was a priority and this same

515   perception by the community, in addition to the mismatch in the eyes of the

516   community of the effectiveness (and wisdom) of the management action(s) that

517   addressed the managers perceived priorities.

518   After the managers meeting, the final set of management strategies was

519   separated into products specific to the two major agencies relevant to the coastal

520   zone (fisheries management – DAF and local government arrangements –

521   Regional Council) and these were much more successful in terms of uptake.

522   These included letters to each agency that highlighted the possible management

523   solutions to specific issues highlighted by the RG. These two letters were also

524   promoted behind the scenes by key members of the project team and were

525   worded in the language used in the bureaucratic system of government agencies

526   rather than those of the RG. Both products were needed for the process, as there

527   was a demonstrated disconnect between local and manager's views.

528   Disputes (potential or actual) were resolved with the aid of very clear ethics

529   guidance processes, by the sequence of the stepwise process allowing open and

530   transparent discourse, by the independence of the project team, and imbedding a

531   local in the project team. In Burdekin, adapting the process to one based on an

532   individual rather than workshop format reduced additional conflict in that area

533   (where conflict was already extant). In Burdekin, the LMAC and other

534   participants agreed to stop half way through. The acceptance that circumstances

535   were too difficult and stopping the process was an important learning outcome

536   that can be drawn from this project. In Mackay, a RG member was the chair but

537   the facilitator was from the project team, which meant that these two were able

538   to control any conflict without compromising the local or the research team.

539   Clear guidance on workshop behaviour has been provided at the start of the

540   process to all participants, and these were consistently adhered to.

541   **5.3. Generic process**

542   The following describes a generic community engagement process. However, it is

543   not a recipe for engagement, but more a guide that helps outline what is possible.

544   The community engagement process can be simplified into four steps (Fig. 2):

545   i) developing the engagement process;

546   ii) defining objectives (which includes the review of existing objectives, creating

547   the hierarchy and obtaining their relative importance);

548   iii) developing the management strategies (provide information, define issues

549   and develop actions); and

550   iv) setting the priorities through a relative impact assessment.

551   It is recommended that community engagement be conducted following the

552   approach in the Mackay RG but with enhanced LMAC (generically called the

553   Header Group) involvement where the header group gives direction by defining

554   the RGs tasks and timelines (Fig. 3). The header group should meet less

555   frequently than the RG. Managers should be embedded in the RG. The header

556   group should preferably have some authority and representativeness, whereas

557   the RG membership should maintain some representation but mainly consists of

558   volunteers willing to generously provide their time. Important influencers

559   should be identified at an early stage in the process so that they can be included

560   in the discussions as much as possible. The RG chair should be elected from the

561   RG membership but facilitation should be provided by the project team to allow

562   all RG members equal access to the discussion, but also for the chair to be able to

563   contribute to the discussion. A local person that is a member of the project team

564   is a huge advantage as this person can be a conduit for out of session

565   conversations.

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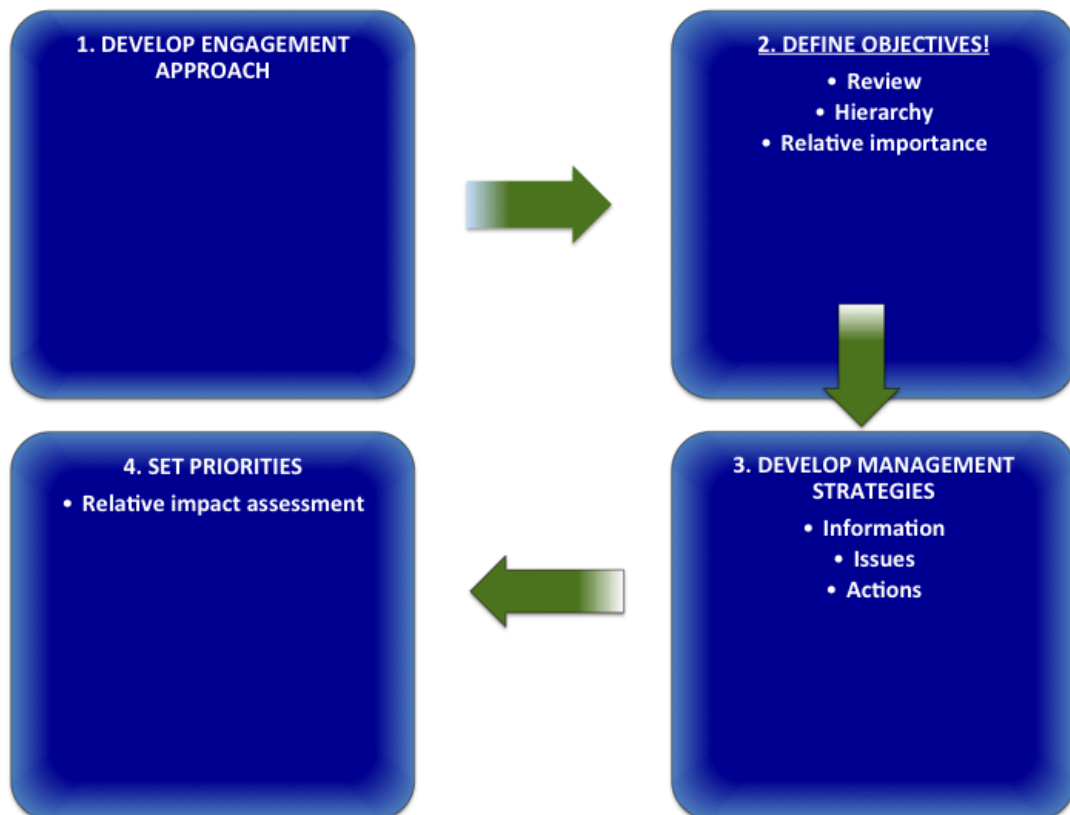
Fig. 2: Generic process of developing management strategies using local community input

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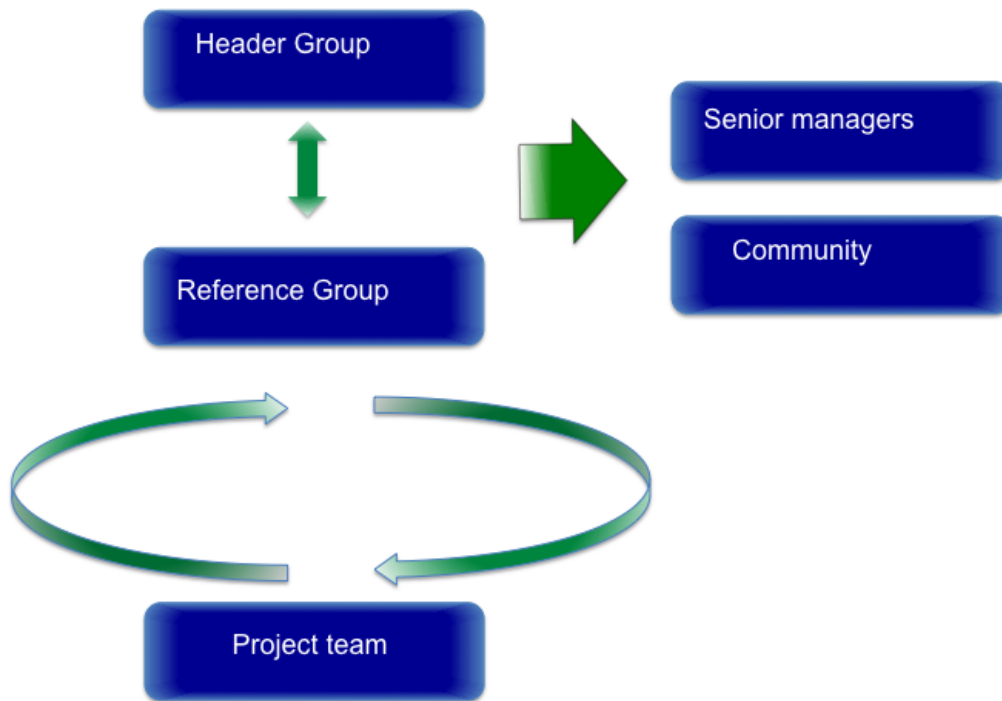
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573 A very important aspect of building trust is for the objectives review to maintain

574 links to source documents and also to keep track of versions when the RG and

575 Header Group input is obtained. If there is a need to speed up the process, a

576 generic objective tree to develop management strategies for coastal zone

577 fisheries and biodiversity can be used and the lower level (the objectives) can be
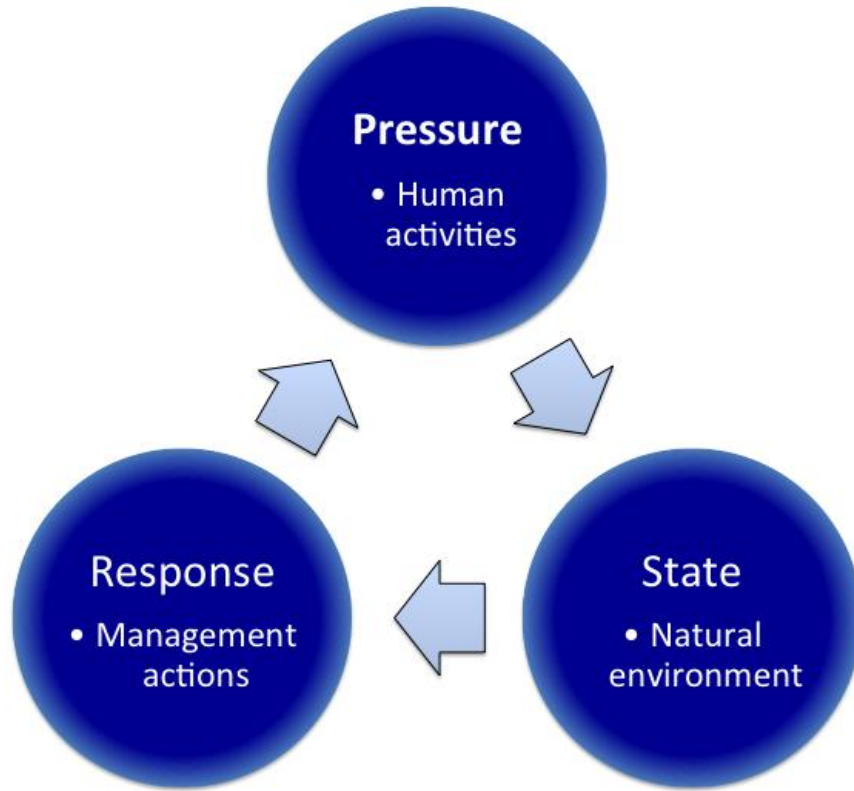
578 subsequently added for more local content (Fig. 4).

Environment	Well-being	Governance
Improve biodiversity	Promote sustainable growth of industry sectors and create local employment	Encourage and improve community participation and create co-management solutions
Conserve coastal living resources and their use	Increase social capacity and sense of ownership	Implement and increase flexible and pro-active approach to natural resource management
Improve water quality and ensure adequate water quantity	Increase equity and improve access	Increase support for management solutions and increase the effectiveness of management integration

579

580   **Fig. 4: Generic objectives hierarchy for the management of the coastal zone fisheries and**

581   **biodiversity (Van Putten et al., 2015).**

582   Determining the objective relative weighting can be kept within the Header

583   Group and RG (rather than going to the community as well), as this data will be

584   used when the management strategies are created by the Header Group and RG.

585   Obtaining objectives weightings from the community is time consuming.

586   However, if a community survey is part of the project plan can be obtained,

587   doing local radio interviews in which the link to online surveys is publicised

588   seems to work well in obtaining participation (Dichmont et al., 2014). A paper

589   backup survey available from a local office is also needed for those people who

590   wish to participate but are not able to access the internet. There should be a

591   preference for the simplest cognitive method to obtaining relative objective

592   weightings. More confusing and controversial approaches such as the Analytical

593   Hierarchical Process as described in Dichmont et al. (2014) should be used only

594   in appropriate circumstances. An example of the simple survey using the generic

595   objectives approach is provided (Supplementary materials Section 1).

596   To ensure that the existing management situation can be adequately described

597   before the management strategies are fleshed out, it is suggested that this part of

598   the process starts with a meeting between managers and the RG and Header

599   Group in which existing management measures are comprehensively described.

600   The management strategy question should be divided into topics that combine

601   key assets and with the relevant issues that pertain to them. The topic sequence

602   should allow for connectivity in the system to be highlighted but controversial

603   topics should be raised toward the end of the process when trust and awareness

604   have already been established. For each topic, an expert with local knowledge on

605   that topic should attend. Using the simpler Pressure-State-Response framework

606   (Fig. 5) – the precursor to the Driver-Pressure-State-Impact-Response approach

607   (Pirrone et al., 2005; Smeets and Weterings, 1999) – an issues register can be

608   developed with direct and indirect management actions (Table 1). Some

609   flexibility on the day is needed in terms of whether discussions are made in small

610   groups or the whole. The project team should collate these using a database and

611   provide these to the RG for input. The Header Group should support the final

612   product.

| Topic		
Issue	**Direct management action**	**Indirect management action**
Issue 1	Action 1a	Action 1b
Issue 2	Action 2a	Action 2b
	Action 3a	Action 3b

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618   Given the time usually available, particularly to senior managers, the impact

619   assessment should be undertaken for the highest level objectives by both the RG

620   and the Header Group prior to the key managers meeting. It can be repeated in

621   session at the managers meeting to obtain information on influence – see

622   example tables in Dichmont et al. (2014). Undertaking the impact assessment at

623   these two separate meetings highlights relative priorities and the difference

624   between managers and RG members. The analysis method is provided in

625   Dichmont et al. (2013) and Dichmont et al. (2014).

626   At least one managers meeting between senior managers, embedded managers,

627   the Header Group and RG should be undertaken. In order to increase the chance

628   of implementation, it is likely that follow up meetings with managers are

629   essential and documents specific to their needs and communication style will

630   need to be produced.

631   A generic strategy communication tool (Fig. 6) can be used for each of the

632   different management strategies to ensure that all bases are covered. All

633   management actions can be the result of either direct actions on individual

634   impacts, such as reducing littering and runoff from farms and development

635   (outer ring at top), or responses by means of resource management, added

636   compliance, and basic research (inner top semi-circle). Coordinated educational

637   campaigns targeted at the local community, industries and government agencies

638   (bottom ring) are a key action that can help influence positive behaviour and

639   attitudes towards inshore resources. The final outcomes expected from the

640   management strategies are:

641   1.   Healthy communities and natural environment

642   2.   Integrated and inclusive management

643   3.   Profitable local industries
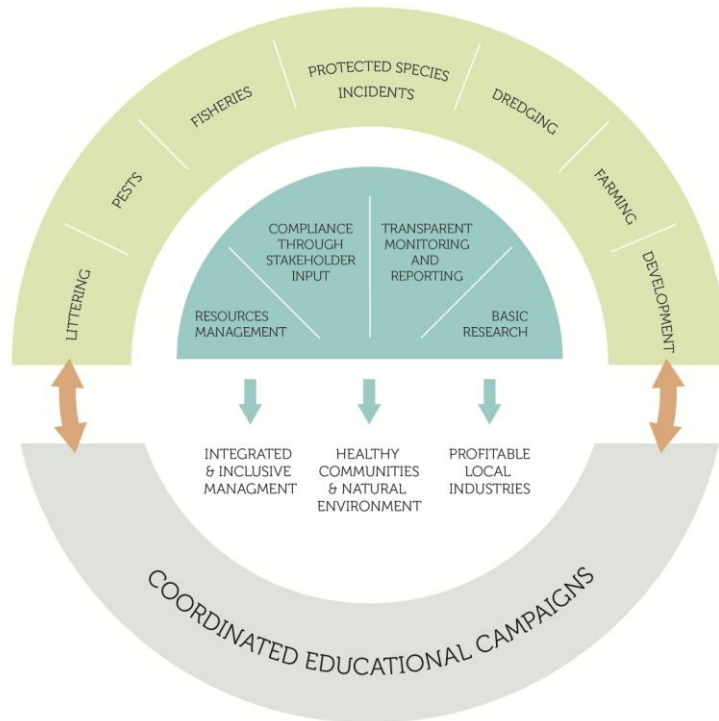
648 A clear ethics approval process that includes the stage at which further

649 engagement with communities or an individual member of the group is deemed

650 as potentially damaging is important. The steps described in the ethics

651 application used for this research was in fact used for one of the two case studies

652 where engagement was discontinued. A flexible approach is therefore still

653 important to keep in mind, as each situation is likely to bring its own

654 idiosyncrasies.

655 **6. Conclusions**

656 A generic approach to developing management strategies based on two case

657 studies is outlined. The case study experience highlights that embedding

658   managers and person from a local government agency within the community

659   group that develops the objectives and prioritises the management actions is

660   essential to successful implementation. In addition, senior managers and thought

661   leaders should be part of the process from the start rather than coming in only at

662   the end at which time a more tangible but less controversial product is available.

663   Continuous engagement by senior managers and thought leaders is important

664   because failure is most likely to occur at the implementation phase. Throughout

665   the process steps are needed to ensure reduced risk of conflict. The most

666   important step in risk reduction is to discuss objectives prior to management

667   strategies. This allows the group to value and understand each other's

668   perspective. The gap between the perception of managers that their

669   management actions are in place and outcomes are achieved, and the

670   community's perception of the effectiveness of the same actions needs to be at

671   least narrowed but preferably closed. This is particularly important as the

672   significant volunteer time required to support the process evident in this project,

673   showed the wish for local scientists and community members to be part of

674   regional management.

675   **7. Acknowledgements**

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