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Evaluating conditions for successful co-management of subsistence fisheries in KwaZulu-Natal, South Africa

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SUMMARY

Conditions important for the success of co-management have repeatedly been identified, but their relative influence has not been quantitatively evaluated. To investigate the implementation of co-management in 11 subsistence fisheries within seven rural communities in KwaZulu-Natal, South Africa, perceptions of the responsible authorities and the fishing communities were surveyed. Of 16 conditions often considered important for the success of co-management, only nine were correlated with perceived success, the most strongly correlated being (1) benefits of co-management must exceed costs of participation, (2) training and empowerment, and (3) existence of a long-term 'champion' to drive the process. The perceptions of the authorities concurred with those of the communities with regards to the attainment of conditions, but views on the success of co-management differed significantly owing to disagreements that were specific to three particular fisheries. Both groups agreed that co-management is a viable improvement on top-down authoritarian imposition of regulations. However, it takes time to become effective; perceived success was directly correlated with how long individual programmes had been operating. Failure to devolve power from national government to local institutions, and delays in awarding subsistence permits, remain the major stumbling blocks to full realization of co-management.

Keywords: co-management, intertidal, linefish, subsistence fisheries

INTRODUCTION

Crises in many of the world's fisheries have led to the realization that a unilateral centralized government approach to fisheries management is inadequate (McGoodwin 1992; Townsend 1995; Pauly *et al.* 2002). The participation of users is increasingly gaining support, as managers recognize that without their co-operation, sustainable use of resources will be impossible (Pomeroy & Berkes 1997). This is particularly true of subsistence fisheries, where hunger and accessibility of resources conspire to make it difficult to impose regulations.

Participatory resource management is generally referred to as 'co-management', defined as 'a partnership in which government agencies, local communities and resource users, non-governmental organizations and other stakeholders share, as appropriate to each context, the authority and responsibility for the management of a specific territory or a set of resources' (IUCN [The World Conservation Union] 1997, p. 71). Ideally, co-management involves power-sharing and decision-making between partners and provides a participatory and consultative democracy (Berkes 1994; Hara 2003). This should decrease challenges to governmental authority and allow resource users to influence management decisions (Pinkerton 1989; Pomeroy & Berkes 1997).

The oldest and most successful fisheries co-management regimes exist in Japan (Jentoft 1989; Lim *et al.* 1995), but there are many others, including those in the Philippines (Alcala & vande Vusse 1994), Norway (Jentoft 1989; Lim *et al.* 1995), Canada (Pinkerton 1994) and Chile (Minn & Castilla 1995).

Prior to the 1994 election of the first democratic government in South Africa, national laws and policies denied most black South African citizens access to natural marine resources (Hersoug & Holm 2000; Hauck & Sowman 2003). Local (mostly poor) communities dependent on marine resources to meet basic livelihood needs were not recognized in fisheries legislation and were deemed illegal, resulting in conflicts with the authorities (Harris *et al.* 2002*b*; Hauck & Sowman 2003).

Following the 1994 elections, many policies and laws were revised to correct past political and social inequities (Harris *et al.* 2002*a*). The Minister of Environmental Affairs and Tourism appointed a committee to design a new fisheries policy (Cochrane & Payne 1998) based on advice from a technical committee on the apportionment of rights (van der Elst *et al.* 1998). The process culminated in the promulgation of the Marine Living Resources Act (MLRA) in 1998. This formally recognized subsistence fishers as a distinct sector and led to legislation intended to protect their needs and the resources upon which they depend (Branch *et al.* 2002*a*). Marine and Coastal Management (MCM), the national agency

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responsible for marine resources, appointed a Subsistence Fisheries Task Group to survey their circumstances and advise on their management (Branch *et al.* 2002*a*, *b*; Clark *et al.* 2002; Cockcroft *et al.* 2002; Harris *et al.* 2002*b*; Hauck *et al.* 2002). Resulting recommendations included the need to involve resource users in co-management (Harris *et al.* 2002*a*).

Co-management projects have subsequently been initiated in several coastal rural subsistence communities throughout South Africa, particularly in KwaZulu-Natal on the east coast, where the provincial authority, Ezemvelo KwaZulu-Natal Wildlife (EKZN Wildlife) assumed responsibility from 2000 for implementation of co-management on behalf of, and in partnership with MCM.

Not all co-management attempts in South Africa have been successful. Some have suffered from discontinued funding (Hauck & Hector 2003) and others from confusing changes in government control (Sowman 2003). It is, however, recognized that different factors will affect individual co-management projects in different ways; there is no set recipe for co-management. Nevertheless, Pinkerton (1989, 1994), Ostrom (1990, 1992), Pinkerton and Weinstein (1995), Baland and Platteau (1996), Berkes *et al.* (2001) and Pomeroy *et al.* (2001) have all suggested conditions they believe are associated with the successful implementation of co-management. Following in these footsteps, Sowman *et al.* (2003) attempted the same in the context of South African co-management. There have, however, been few studies in which these conditions have been quantified to evaluate their relative contribution to the success of co-management. We attempted this by investigating 11 subsistence fisheries within seven rural communities in KwaZulu-Natal concerned with linefish (i.e. fish caught by hook and line) or intertidal invertebrates. Specifically, we addressed the following questions. (1) What were the circumstances surrounding the communities in which co-management was implemented? (2) What conditions contributed most to successful co-management? (3) Are authorities and communities in agreement about the attainment of these conditions and the success of co-management? (4) Is there a future for co-management in southern Africa, and what are the most important hindrances to its full implementation?

The approach we used was to obtain views on (i) the perceived success of co-management in each fishery, and (ii) the extent to which a series of 'conditions' had been fulfilled; and then (iii) to determine the degree to which achievement of each condition was correlated with perceived success.

METHODS

Seven subsistence communities (out of approximately 19) were selected along the KwaZulu-Natal coastline (Fig. 1). Most had two distinct fisheries for linefish and for intertidal rocky-shore invertebrates. These were analysed separately as they involved different and non-overlapping groups of people, thus yielding 11 fisheries (out of a possible 27).

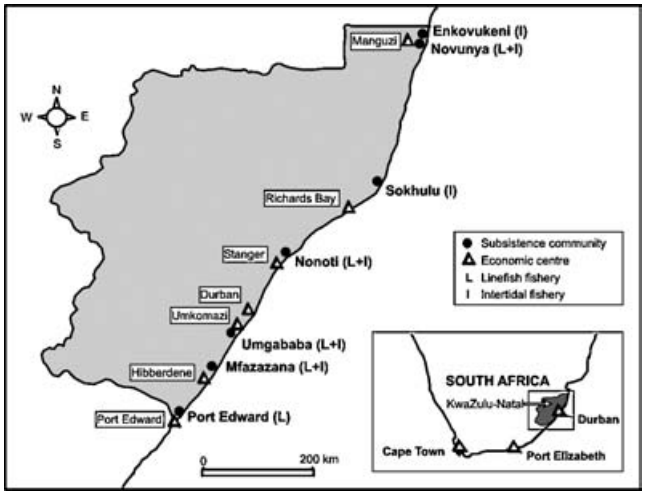

Figure 1 Locations of the fishing communities analysed and their proximity to economic centres.

Co-management has only recently been implemented in all 11 communities, the longest going back only 10 years and the youngest being in the early stages of establishment. The communities were selected to obtain a range of implementation dates and a good geographical spread.

Linefishers (who catch fish with hand lines and/or rods) were predominantly men and operated from the shore, although in the estuarine areas of St Lucia and Kosi Bay some operated from boats. Subsistence linefish permits are issued to individuals. To estimate the numbers of people in each community dependent on linefishing we multiplied the numbers of applicants for permits by two, assuming one dependent person would share the catch made by each licensed fisher. Collection of intertidal invertebrates such as mussels (*Perna perna*), limpets (*Fissurella* and *Scutellastra* species) and red bait (*Pyura stolonifera*) was undertaken by both recreational and subsistence harvesters, with the latter predominantly being women and children. Both types of resources are harvested within walking distance of the fishers' residences and are consumed by immediate family or sold locally. Permits for subsistence intertidal harvesting are issued one per household. To estimate the proportion of people in each community involved in intertidal harvesting, we divided the number of applications for permits by the total number of households (Clark *et al.* 2002).

Information was sourced from five key components of the co-management structure developed for subsistence fisheries in KwaZulu-Natal: (1) provincial coordinators who facilitate management of all 19 communities; (2) local key informants who act as facilitators or researchers, and may be independent or government employees; (3) authority representatives and (4) community representatives, both of whom sit on Local Subsistence Co-management Committees that have been formed for each fishery and constitute the level at which co-management is implemented and rules and regulations are

Table 1 Questionnaire relating to (A) the fulfilment of conditions, (B) perceived success of co-management and (C) background information on the communities. Questions were posed to specific groups indicated by the tick marks. The five groups interviewed were: provincial co-ordinators (PC); local key informants (LKI); authority representatives (ARC) and community representatives (CRC) on the Local Subsistence Co-management Committees; and focal fisher groups (FFG).

Questions	*Authorities*			*Community*	
	PC	***LKI***	***ARC***	***CRC***	***FFG***
A. Measures of the fulfilment of conditions					
1. Have legal rights to harvest resources been secured?		√		√	
2. Does the community benefit more than it costs to participate in co-management?	√	√	√	√	
3. Are both the fishers and the authorities committed to co-management?		√	√	√	
4. Is the committee accountable and representative of the local community?	√	√			√
5. Do both the fishers and the authorities agree on how the resource should be managed?		√	√	√	√
6. Has training and empowerment been provided to the community?	√	√		√	
7. Has effective monitoring and evaluation been implemented?	√	√			
8. Are management rules being effectively enforced?			√	√	√
9. Is the community clearly defined?	√	√			
10. Is there a long-term 'champion' leading the way in the co-management project?		√			
11. Are there enabling policies and legislation in place?	√				
12. Is there long-term government commitment?	√				
13. Are there adequate finances and realistic timeframes involved?	√				
14. Has there been a decentralization and devolution of authority?	√				
15. Do external agents provide support?	√				
16. Have any other means of earning money been identified?			√	√	
B. Measures of perceived success of co-management					
17. Have legal rights to harvest resources improved?		√		√	
18. Has effective monitoring and evaluation improved?	√	√			
19. Does the co-management committee represent you?					√
20. Are fishers obeying the rules more than before?		√	√	√	
21. Has there been an improvement in the scientific knowledge about the resources?	√	√			
22. Has scientific knowledge been applied by managers to improve management?		√	√		
23. Is use of the resources now more sustainable?	√	√	√	√	
24. Has co-management reduced any adverse human effects on the ecosystem?	√	√			
25. Has communication and trust between government and resource users improved?	√	√	√	√	
26. Have resource users gained greater access to information about regulations?		√			√
27. Have the authorities acknowledged and used indigenous knowledge?			√	√	
28. Have fishers gained knowledge about the resource?			√	√	√
29. Does the community now influence decisions?		√	√	√	
30. Has co-operation and leadership within the community improved?			√	√	
31. Has knowledge about the socio-economic circumstances of the users improved?	√	√			
32. Are you happy with the co-management project in general?		√	√	√	√
33. Do you think it will improve the community's life?		√	√	√	√
C. Background information on the communities					
34. How important is the resource to you?					√
35. Did the community have legal rights to resources before co-management began?	√				
36. What is the community profile? (See Tables 2 and 3 for details requested.)	√				
37. Where are the communities situated?	√				
38. What resources are they harvesting?	√				
39. Why are they harvesting?	√				
40. How long has co-management been running?	√				
41. When was the joint committee established?	√				
42. What were the historical limitations on the communities with regards to fishing?	√				
43. What was covered in community training sessions?	√				

developed; and (5) the fishers themselves, whose agreement is sought to comply with these rules and regulations. The first three form a loose group with allegiance to the authorities, whereas the last two represent and owe allegiance to the community.

Data gathering

Data were collected by questionnaires and interviews during June–July 2003, directed at all five components of the co-management structure. The questionnaires (Table 1)

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provided three types of information: (i) the extent to which conditions thought to be necessary for successful co-management were fulfilled; (ii) perceptions about the relative success of co-management; and (iii) background information on the nature of the communities and fisheries. Not all questions were posed to all five components of the institutional structure (see Table 1). Questions regarding management of the fishery on which both the authorities and the communities would have knowledge were asked of at least one source representing the authorities and one representing the community. Those questions for which the community was not expected to have adequate knowledge were addressed to the provincial coordinators and/or local key informants. The provincial coordinators gave written responses to the questionnaire providing an overview of each community (section C of the questionnaire). The local key informants, community and authority representatives on each Local Subsistence Co-management Committee were interviewed. Lastly, approximately 5–10 fishers per fishery were interviewed (with the aid of a translator) through a fisher focal-group discussion. To standardize the data and thus facilitate comparisons, a single interview was conducted for each group, irrespective of the number of people involved.

All answers to sections A and B of Table 1 were scored using a 1–5 rating. Conditions were ranked as (1) not been met at all, (2) met to a limited extent, (3) partly met, (4) largely met, and (5) fully met. Questions addressing the perceived success of co-management (Table 1, section B) were ranked as (1) strong dissatisfaction, (2) dissatisfaction, (3) satisfaction, (4) substantial satisfaction and (5) complete satisfaction. The background information for each community (Table 1, section C) was summarized qualitatively to provide context.

Quantitative analyses

The mean score obtained for each of the questions in sections A and B of Table 1 was calculated by averaging the scores across all groups interviewed per fishery (Sokal & Rohlf 1969), and then (where necessary for the analysis) averaging across all fisheries to obtain a single value per question.

Significant relationships ($p < 0.05$) were then sought between the extent to which conditions were met and the perceived success of co-management within each fishery. First, for each fishery the average score for all conditions (Table 1, section A) was plotted against the average score for the perceived success of co-management (Table 1, section B). This provided an overall measure of whether perceived success was related to the overall fulfilment of conditions.

Second, each individual condition was tested separately to assess whether (and how strongly) it correlated with the perceived success of co-management, by plotting the average score for each particular condition, per fishery, against the average score of the perceived success of co-management for that fishery. The strength of the Spearman rank correlation reflected the relative degree to which each condition contributed to success.

Third, correlations and Wilcoxon's matched-pairs tests (Zar 1999) were used to test whether there were significant differences between the views of the authorities (the averaged scores for each question obtained from the provincial coordinator, the local key informant and the authority representative on the committee) and the views of the community (the average scores for each question derived from the community representatives on the committee and the fisher focal group). This approach was used in two different ways. The first was directed at the level of individual fishing communities (with linefish and intertidal fisheries treated separately), and tested whether there was agreement between communities and authorities within fisheries, based on the average values obtained from all questions. The second was run on each individual condition or measure of success, averaging the values supplied by all fisheries, and tested whether agreement existed between the authorities and the communities about the answers to particular questions. The correlations indicated whether or not there was an overall association between the perceptions of the authorities and those of the communities, whereas the Wilcoxon matched-pairs tests revealed which particular fisheries and/or questions showed significant differences between the perceptions of the two groups.

RESULTS

Community circumstances

There were five qualitative indicators of poverty in the seven communities (Table 2). Most villages were 5–38 km distant from any economic centre. All had mainly gravel or sand roads and lacked public transport, although served by an informal mini-bus taxi system. Five had no piped running water and relied on community boreholes. Four had no electricity, and in two of the remaining three, most people could not afford the electricity supplied. Education was usually provided to the level of primary school only; health facilities were lacking or limited to a basic clinic. Using these indicators, it was possible to rank the communities from least poor (Umgababa) to most poor (Enkovukeni), but the overall message was that all the communities were poor, had limited infrastructure and limited opportunities for employment, and depended at least partially on natural resources.

The nature of the fisheries

Between 3 and 60% of each community were involved in fishing for either linefish or intertidal resources (Table 3). The ranked poverty level of the seven communities was significantly correlated with the proportion of people fishing ($r_s = 0.96$, $df = 6$, $p < 0.01$). Most communities practised illegal harvesting before and even during the implementation

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Table 2 Background information on the circumstances surrounding each community, derived from a questionnaire completed by the provincial co-ordinator. The number of people was estimated using a household size of 6.6 people per household (Clark *et al.* 2002). Poverty is ranked from 1 (least poor) to 7 (most poor).

Community	*Nearest economic center*	*Community size*	*Status of roads*	*Education facilities*	*Health facilities*	*Availability of clean water*	*Availability of electricity*	*Poverty ranking*
Enkovukeni	Manguzi (15 km)	2640	No tarred roads, only footpaths	No schools	No clinic	Water drawn from Kosi Bay Lakes	No electricity	7
Novunya	Manguzi (10 km)	1980	No tarred roads, sandy roads accessed by 4 × 4s	No schools	No clinic	No clean water	No electricity	6
Sokhulu	Richards Bay (38 km)	9504	One tarred road; other roads gravel	Primary and high school	One clinic	Communal borehole points	Majority without	3
Nonoti	Stanger (19 km)	5000	Gravel roads in bad condition	Only a primary school	No clinic	One communal borehole point	No electricity	5
Umgababa	Umkomazi (8 km)	2640	Main road is tarred, small gravel roads in bad condition	Primary and high school	One clinic	Communal water points; some have own water points	90% have electricity; others cannot afford it	1
Mfazazana	Hibberdene (5 km)	4620	Gravel roads; only main road tarred	Only a primary school	No clinic	Have access	Only those who can afford it	4
Port Edward	Port Edward (5 km)	1980	Only have gravel roads	Two primary and three high schools	One clinic	Communal borehole points	Only those who can afford it	2

Table 3 Details of the fisheries within each of the communities at the time of the survey. Information obtained from questionnaires completed by the provincial coordinator. * Indicates fisheries that were not analysed in this study.

Community	*Type of fishery*	*Percentage involved in fishery*	*History of fishing (yrs)*	*Legality and law enforcement*	*Co-management started*	*Permit status*
Enkovukeni	Intertidal	50%	> 80	Policy allows harvesting; restricted types of tools used. No law enforcement	1997/8	Had provincial permits for one year only in 1996/7
	Linefish*	10%	> 65			
Novunya	Intertidal	47%	> 30	Policy allows it; no law enforcement	2002	Never had permits
	Linefish	10%	> 30	Illegal; no law enforcement		
Sokhulu	Intertidal	8%	> 50	Now legal, controlled by monitors and law enforcement	1995	Before 1995, no permits. Subsistence permits issued from 2002
	Linefish*	3%	> 50			
Nonoti	Intertidal	12%	> 30	Illegal, controlled by law enforcement	2001	Never had permits. Have now applied for subsistence permits
	Linefish	3%	> 30	Some have recreational permits		
Umgababa	Intertidal	2%	> 83	Illegal, controlled by law enforcement	2001	Never had permits. Have now applied for subsistence permits
	Linefish	3%	> 60	Some have recreational permits		
Mfazazana	Intertidal	7%	> 50	Illegal, controlled by law enforcement	2001	Never had permits. Have now applied for subsistence permits
	Linefish	3%	> 65	Some have recreational permits		
Port Edward	Intertidal*	3%	?	Illegal, controlled by law enforcement	2001	None, however a few have recreational permits
	Linefish	4%	?			

of co-management. Law enforcement by the Natal Parks Board and later EKZN Wildlife made it difficult for communities to harvest without permits, as patrols were regular. However, there was no law enforcement in the north at Enkovukeni and Novunya, where a tacit policy allowed subsistence harvesting of intertidal resources. The Sokhulu intertidal fishery was the oldest co-management system examined (implemented in 1995), followed by the Enkovukeni

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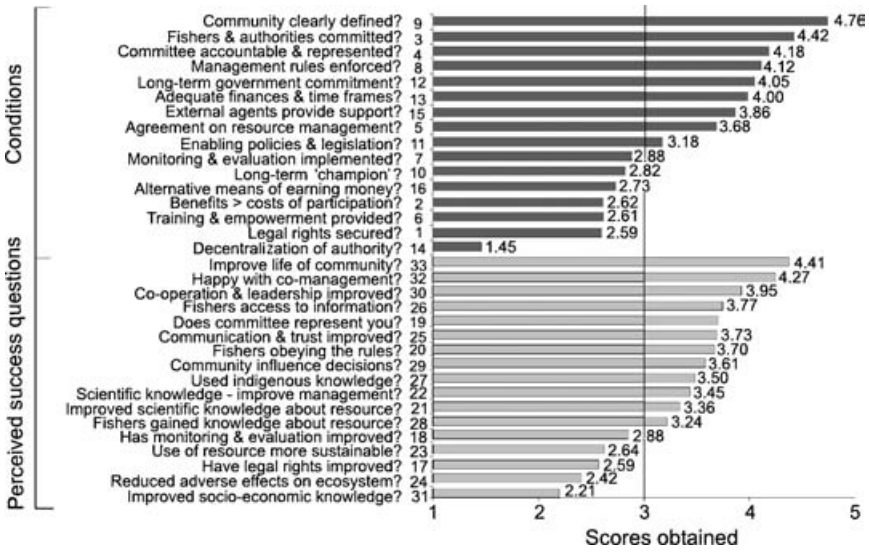

Figure 2 Scores obtained for all questions relating to attainment of conditions and to perceived success of co-management.

intertidal fishery (1997/98). The remaining communities began co-management in 2001 or 2002. Sokhulu was the only community to have successfully obtained a national permit (in 2002) for intertidal subsistence harvesting under the new legislation that formally recognizes subsistence fishers, but had previously been granted a provincial 'experimental' subsistence permit from 1996. At Enkovukeni, provincial permits were issued in 1996/7, but lapsed. None of the remaining fisheries had yet received permits legalizing subsistence fishing, although most had applied for national subsistence permits. In some cases, linefishers resorted to obtaining recreational permits to legalize their activities although they would prefer to be registered as subsistence fishers.

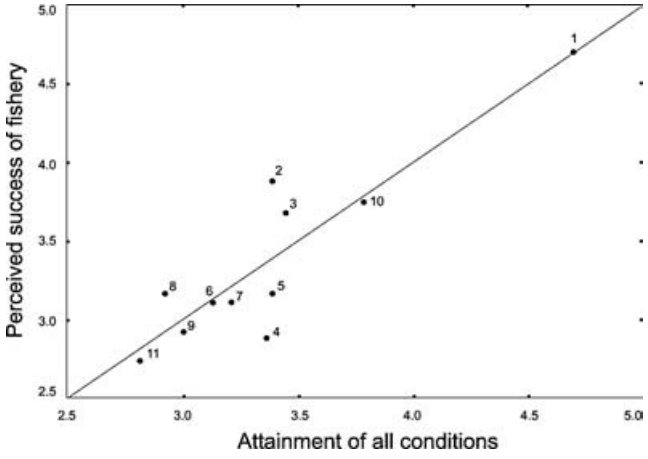

Figure 3 Plot of the perceived success of co-management of each fishery against the level of attainment of conditions assumed to be important for success of co-management. Scores were calculated as the average score across all groups interviewed for each condition, averaged overall for each fishery. 1 = Sokhulu intertidal; 2 = Nonoti intertidal; 3 = Nonoti linefish; 4 = Umgababa intertidal; 5 = Umgababa linefish; 6 = Mfazazana intertidal; 7 = Mfazazana linefish; 8 = Novunya intertidal; 9 = Novunya linefish; 10 = Enkovukeni intertidal; 11 = Port Edward linefish.

Perceived success versus attainment of conditions

Just over half the implemented conditions were scored as at least 'partially met' (i.e. a ranking of > 3, Fig. 2). All questions relating to co-management success scored > 2, and most > 3. Thus, in no case did any measure of co-management yield a rating of 'strongly dissatisfied' or 'dissatisfied', and most had ratings of 'satisfied' or better.

The extent of attainment of conditions presumed important for success was strongly correlated with the perceived success of co-management when the conditions were pooled across all the fisheries (Fig. 3; $r = 0.90$, $p < 0.0001$). The Sokhulu intertidal harvesting fishery, the longest running of the co-management programmes examined, achieved the highest ratings for both attainment of conditions and perceived success. Novunya's linefish and intertidal fisheries and Port Edward's linefish fishery, all recently introduced co-management systems in which conditions have yet to be fully met, achieved low ratings.

The relative contribution of each individual condition was gauged from its correlation with perceived success of co-management (Fig. 4). Only nine of the 16 conditions were in fact significantly correlated with success ($p < 0.05$). Lack of a correlation does not necessarily indicate that a condition did not contribute to success, but it does indicate that it was relatively unimportant.

Perceptions of the authorities and the community

Individual fisheries

The overall perceptions of the authorities regarding the attainment of conditions were significantly correlated with those of the communities (Fig. 5*a*: $r = 0.86$, $p = 0.001$). However, the level of the scores provided by the communities

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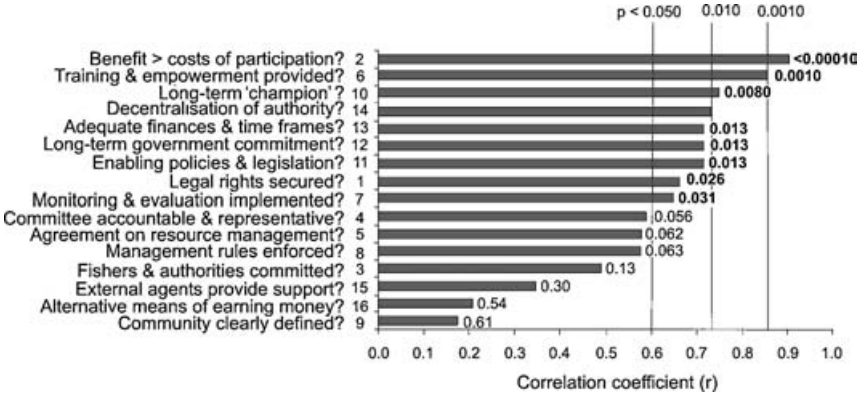

Figure 4 Correlation coefficients between the attainment of each condition and the perceived success of co-management. Probability values for the correlation coefficients are shown on the right of each bar, with bold text indicating significant correlations.

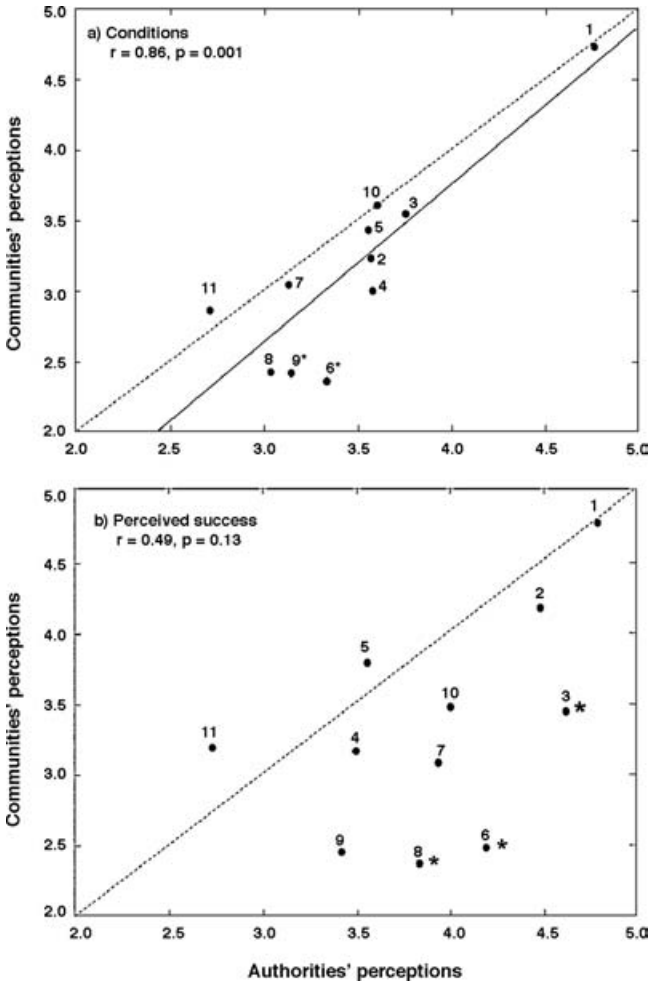

Figure 5 Plots of the perceptions of the community against those of the authorities in individual fisheries for (*a*) attainment of conditions assumed important for success of co-management, and (*b*) the perceived success of co-management. Dashes indicate lines of equal perceptions of the communities and the authorities; the solid line shows the regression for the significant relationship in (*a*). Numbers indicate individual fisheries (see caption to Fig. 3); *Indicates those communities in which the views of the community and the authorities differed significantly (Wilcoxon matched pairs test, $p < 0.05$).

was significantly lower than that of the authorities (Wilcoxon matched-pairs test, $n = 11$, $z = 2.29$, $p = 0.022$). This difference was specifically because within the Mfazazana intertidal (numbered 6 in Fig. 5*a*) and Novunya linefish fisheries (9 in Fig. 5*a*), the authorities provided significantly higher scores than the communities.

The correlation between the authorities' and the communities' perceptions with respect to the success of co-management was not significant (Fig. 5*b*; $r = 0.49$, $p = 0.13$). Again, the authorities' scores were significantly higher than those of the communities (Wilcoxon matched pairs test, $n = 11$, $z = 2.09$, $p = 0.039$), owing to significant differences in the Mfazazana intertidal, Novunya intertidal and Nonoti linefish fisheries (respectively numbered 6, 8 and 3 in Fig. 5*b*).

If the questions relating to both conditions and success were combined, then the scores for the authorities were positively correlated with those of the communities ($r = 0.64$, $p = 0.033$).

Individual questions

Responses to individual questions showed a significant correlation between the perspectives of the authorities and those of the communities when the attainment of conditions was considered (Fig. 6*a*; $r = 0.97$, $p < 0.0001$), and no significant difference in the levels of the scores (Wilcoxon matched pairs test, $n = 8$, $z = 1.36$, $p = 0.17$).

For questions about the success of co-management, the correlation between the authorities' and communities' perceptions was not significant (Fig. 6*b*; $r = 0.46$, $p = 0.16$) and the perceptions of the two groups were significantly different (Wilcoxon matched-pairs test, $n = 11$, $z = 1.99$, $p = 0.047$). This difference was exclusively owing to two questions (26: 'Have resource users gained greater access to information about regulations?' and 28: 'Have fishers gained knowledge about the resources?'). Combining questions about both conditions and success yielded a positive correlation between the scores of the authorities and those of the communities ($r = 0.63$, $p = 0.007$).

Both the degree to which conditions had been met and the perceived success of co-management were linearly related

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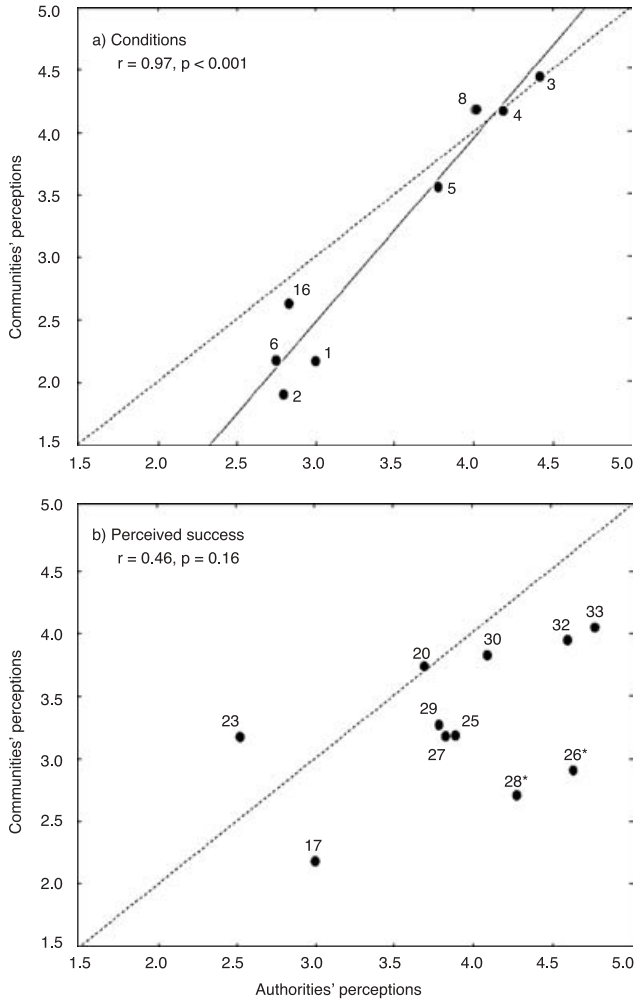

Figure 6 Plots of the perceptions of the community against those of the authorities in individual questions for (*a*) attainment of conditions assumed important for success of co-management, and (*b*) the perceived success of co-management. Dashes indicate lines of equal perceptions of the communities and the authorities; the solid line shows the regression for the significant relationship in (*a*). Numbers indicate the individual questions listed in Table 1; *Indicates those questions for which there was significant disagreement between the communities' and the authorities' perceptions (Wilcoxon matched pairs test, $p < 0.05$).

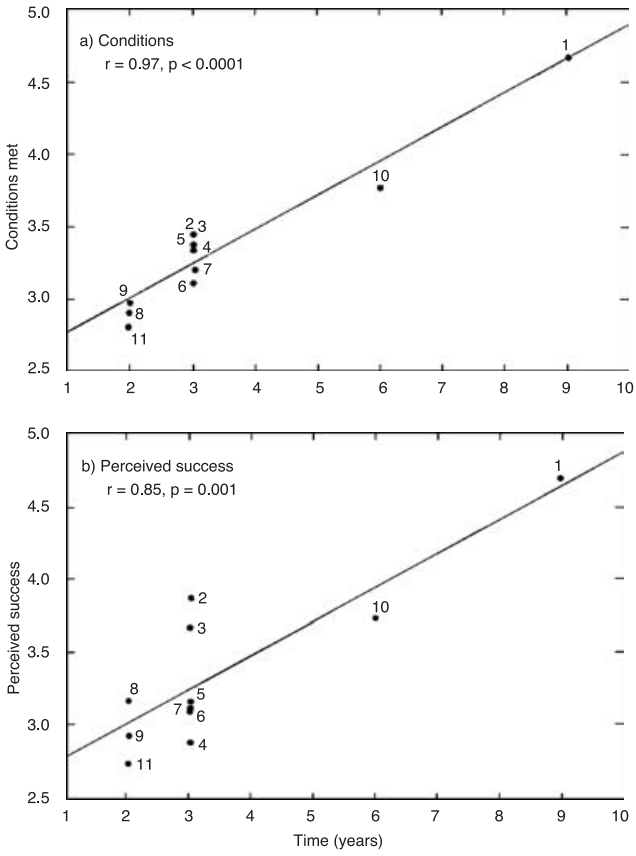

Figure 7 Plots of number of years since co-management was implemented against (*a*) attainment of conditions, and (*b*) perceived success of co-management programmes. Numbers indicate individual fisheries (see caption to Fig. 3).

to the amount of time for which co-management had been operating (Fig. 7).

DISCUSSION

Our study provides the only known statistical tests of the relative importance of conditions assumed to be important for co-management, although Agrawal (2001), Pomeroy *et al.* (2001), Berkes *et al.* (2001), Bardhan and Dayton-Johnson (2002) and Sowman *et al.* (2003) provide recent overviews of the importance of various conditions. Agrawal (2001) specifically points to the lack of rigorous quantitative statistical analyses of the effects of different conditions on the success of co-management as a deficiency in previous approaches. In our analysis, there were substantial differences in the degree to which conditions assumed to be important for successful co-management were correlated with success. Indeed, only nine of the 16 conditions examined were correlated with success. In general, there was close agreement between the perceptions of authorities and community, although the latter yielded lower scores of success. A key finding was that perceived success was strongly correlated with the length of time co-management had been operating.

The nature of the fishing communities

To determine who should qualify as a subsistence fisher in the context of the Living Marine Resource Act governing fishing in South Africa, Branch *et al.* (2002*a*, p. 481) advocated the following definition: 'Subsistence fishers are poor people who

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personally harvest marine resources as a source of food or to sell them to meet the basic needs of food security; they operate on or near to the shore or in estuaries, live in close proximity to the resource, consume or sell the resources locally, use low-technology gear (often as part of a long-standing community-based or cultural practice), and the kinds of resources they harvest generate only sufficient returns to meet the basic needs of food security.'

Key elements in this definition were clearly evident in the surveyed communities: poverty (limited access to employment, lack of infrastructure, absence of piped water or electricity, limited health and educational facilities), personal harvesting, shore-based operations and close proximity to residence, non-technological harvesting methods, consumption of resource by immediate family or local sale to meet basic needs of life, and a long history of involvement. In all these respects, the communities fell within the scope of socio-economic circumstances of subsistence fishers investigated as case histories by Branch *et al.* (2002*b*). Subsistence fishers in KwaZulu-Natal were among the poorest around the whole coast, falling well below the 25th percentile of earning power. There were, however, differences in the level of poverty among the communities; when ranked, poverty level was directly correlated with reliance on marine resources (Branch *et al.* 2002*b*).

All communities surveyed fell in the middle of the spectrum of possible co-management models. Joint committees involving authorities and users had been established and charged with developing regulations to achieve sustainable harvesting. Only enforcement remained in the hands of the authorities, but even that was by joint agreement (Harris *et al.* 2003).

Correlations between conditions and perceived success of co-management

There is a long history of specifying conditions believed to promote co-management, catalysed by Ostrom (1990, 1992) and Pinkerton (1989, 1994), and refined in syntheses by Pinkerton and Weinstein (1995), Baland and Platteau (1996), Pomeroy *et al.* (2001) and Berkes *et al.* (2001).

Overall, the level of achievement of conditions assumed important for successful co-management (Sowman *et al.* 2003) was correlated with the success of co-management (Fig. 3). This indicates that the more these conditions are fulfilled, the greater will be the chance of success (Pomeroy *et al.* 2001), empirically upholding the assumption that the conditions deemed important really are important.

However, of the 16 individual conditions (Sowman *et al.* 2003) only nine were significantly correlated with perceived success (Fig. 4). The factor most strongly correlated with success was that the benefits of co-management must exceed the costs of participation. Pomeroy *et al.* (2001) also argued that this condition is essential, as it provides the incentive to participate. Assessing costs and benefits in the fisheries investigated is not simple, because co-management is still in its infancy, and the full benefits and costs remain to be realized. Nevertheless, multiple potential benefits have been identified, including sustainable harvesting (Sowman *et al.* 2003), decreased conflict because of greater legitimacy (Pinkerton 1989; Hara 2003), increased trust and communication between stakeholders (Pinkerton 1989), legal access to resources (Sowman *et al.* 2003), community empowerment (Pomeroy & Pido 1995; Sowman *et al.* 2003), increased knowledge (Jentoft 1989; Sowman *et al.* 2003), improved data collection and monitoring (Pinkerton 1989; Berkes 1994), and greater protection of resources (Berkes 1994). However, benefits also incur costs, including restricted access to resources, limitations on collecting methods, and commitment of time and money (Sowman *et al.* 2003). Most communities interviewed considered the ultimate benefit to be the attainment of legal rights. Until this is achieved, they will perceive the costs of participating in co-management to be greater than the benefits (Fig. 2).

The condition ranked second in terms of the strength of its correlation with success was training and empowerment (Fig. 4). For co-management to succeed, all parties need to be equipped to participate. Conservation managers need training in fisheries management, conflict resolution and the principles of co-management. Communities often initially lack a scientific understanding of the resource and the concept of sustainable use; but the evidence is that once they gain this knowledge their attitude changes. The mussel fishery in Sokhulu demonstrates this point. The community participated in 'learn-by-doing' experiments to monitor the effects of fishing. As a result, they came to comprehend the overexploited nature of the mussel stocks and why harvesting had to be controlled to achieve sustainability (Harris *et al.* 2003). However, even when subsistence fishers grasp this concept, many still weigh sustainability against the short-term need to provide food (Kuperan & Abdullah 1994).

The extent to which a 'champion' was involved was tightly correlated with perceived success (Fig. 4). Supporting this, Agbayani and Siar (1994) found that a full-time project leader was essential for implementation of co-management in the Philippines.

Decentralization of authority, sufficient funding and time to allow co-management to take root, and long-term government commitment all featured as being tightly correlated with success, supporting the views of Pomeroy and Berkes (1997) about their importance. Enabling policies and legislation also seem important. However, even though policies now theoretically support co-management in South Africa, they still need to be implemented. MCM committed itself to co-management in 1998; however, there has been a reluctance to devolve power and responsibility to local institutions (Sowman *et al.* 2003). Laws may gain legitimacy through co-management if communities obtain a say in management decisions. Education and training that allow users to understand the reasons for regulations are also important. Thus, effective enforcement may be a product of co-management rather than a precondition essential to its success.

Obtaining access rights allows harvesting without fear of arrest, which Sowman *et al.* (2003) regard as a major incentive for communities to participate in co-management. Although this condition was significantly correlated with the success of co-management, it was far from having the strongest correlation (Fig. 4, question 1). Of the communities studied, Enkovukeni and Novunya rejected a permit system, as they had not previously been subject to any law enforcement, and could not perceive any benefits of it. Even communities that were favourably disposed to co-management expressed frustration with the slow process of issuing subsistence permits. Such delays undermine trust in co-management, as evidenced by the collapse of co-management at the Olifants Estuary on the west coast of South Africa (Sowman 2003).

The last condition found to be significantly correlated with the success of co-management was effective resource monitoring. Co-management has provided employment to some community members by appointing them as monitors (Harris *et al.* 2003). Employment of monitors is, however, a sensitive issue: payment of community members to enforce compliance can result in monitors being ostracized or threatened if agreement has not been reached on regulations.

Involving resource users in research and evaluation is linked to monitoring. Involvement facilitates education and fosters 'ownership' and stewardship (Sowman *et al.* 2003). At Sokhulu, mussel harvesters participated in experiments to determine (1) the tool that minimized bycatch and (2) sustainable harvesting levels, which led to agreement to set catch limits to prevent overfishing; this was a reversal of the harvesters' previous views that stocks are unlimited God-given resources (Harris *et al.* 2003).

The identification of alternative forms of income for fishers was, surprisingly, not significantly correlated with success. In the long term, however, this condition cannot be discounted, as people will need to find other means of support if they are to reduce dependency on limited natural resources. Co-management of subsistence fisheries is expensive relative to the value of the resources, so investment in alternative livelihoods may yield better dividends.

The need for time and funding

Co-management is not a quick-fix solution (Hutton & Pitcher 1998) and adequate finances and realistic time frames are important for success (Fig. 4). For the co-management enterprises we examined, the duration they had been operating was strongly correlated with perceived success (Fig. 7). This reflects the need to develop infrastructure, establish trust and communications, train people and implement rights and management systems. Premature withdrawal of funding or support leads to failure, as demonstrated elsewhere in South Africa (Hauck & Hector 2003).

It is unrealistic to expect external non-governmental funding and support to continue indefinitely, but they are particularly important in the initial phases when structures are being established and relationships built. Our data suggest that approximately six years of support are necessary to accomplish this. 'What happens after that?' is a key question. Ideally, co-management should become self-sustaining, but poverty pervades the communities we investigated (Branch *et al.* 2002*b*), and the resources harvested only provide food to meet basic needs of life and are unsuited to commercialization (Cockcroft *et al.* 2002). Only to a very limited extent would fishers be able to contribute financially to co-management, although they can provide manpower. We believe that authorities should fund co-management, as recommended by the Subsistence Fishers Task Group (Harris *et al.* 2002*a*).

Agreement between the authorities and the community

Individual fisheries

Co-management is a relationship between partners (Pinkerton 1989), and successful partnerships demand understanding and mutual agreement. In our analysis, the communities and the authorities concurred about the degree to which conditions had been fulfilled, although the communities were more conservative in their ratings (Fig. 5*a*). However, the authorities' and the communities' perceptions about success were not significantly correlated owing to significant differences in Novunya and Mfazazana intertidal, and Nonoti linefish fisheries (Fig. 5*b*).

Novunya was opposed to co-management because they were antagonistic to a permitting system that would bring restrictions where there were none before. They also argued that if the harvesting of intertidal species really were unsustainable, then the resources would have disappeared: the fact that resources still exist upheld the community's view that harvesting is sustainable. Clearly this belief depends on the definition of sustainability; the mere persistence of very low levels of resources is not a desired target, but communities are unlikely to be persuaded of this unless the benefits of constraint are personally realized.

Within Mfazazana and Nonoti, the difference in opinion between authorities and communities was a direct result of delays in issuing subsistence permits. Pomeroy *et al.* (2001) have previously shown that when access rights are granted, users shift towards conservation of the resource.

Sokhulu emerged as the most successful co-management venture examined and is one of the longest-running co-management systems on the coast of South Africa, although co-management has been operating considerably longer at Kosi Bay (Kyle 2003). The link between longevity and success implies that if co-management can become established, the relationship between the authorities and the community strengthens and both parties attain agreement more readily.

Individual questions

The views of the authorities and the communities were tightly correlated when they concerned questions about the fulfilment of conditions (Fig. 6*a*). Nevertheless, the ratings given by the communities were almost always less generous than those of

the authorities. The question eliciting the largest difference in rating was 'Did the community benefit more than it costs to participate in co-management?' Central to this difference was the fact that most communities had not yet received tangible benefits in the form of permits. Consequently, it was not surprising that most communities took a more jaundiced view, focusing on the present situation of providing for themselves and their families rather than on potential long-term benefits.

Agreement between the authorities and the communities broke down in the ratings of co-management success (Fig. 6*b*), because of their responses to two questions, namely 'Have resource users gained access to information about regulations?' and 'Have fishers gained knowledge about resources?' These questions are clearly linked. The view of the authorities is that the communities did gain information because courses were provided for the committees in each community. However, the committees may not be transferring this information to the greater community.

In only one case did the communities give a higher rating to a question than the authorities; this was 'Is the use of resources now more sustainable?' This reflects conservatism of the authorities because they are concerned with stock sustainability, versus optimism by the fishers who stand to benefit if stocks appear to have improved.

Is co-management a viable option in South Africa?

Twelve of the 17 questions measuring perceptions about the success of co-management obtained scores between three and five (Fig. 2). In particular, 'Are you happy with co-management in general?' and 'Do you think it will improve the life of the community?' both elicited near-maximal ratings. Thus, co-management was generally perceived as successful.

Pitfalls and solutions

Ultimately, resource users control the extent to which a management system works, and should have a say in management decisions (McCay & Jentoft 1996). None of the four conditions we found to be most strongly correlated with success (Fig. 4) obtained scores greater than three ('partially met') when scored in terms of their implementation (Fig. 2). If co-management is to succeed, the conditions most significantly correlated with success must be effected as a priority.

There is no single recipe for successful co-management, and conditions are context-specific. Our approach sharpens appreciation of regional circumstance, but the findings cannot be extrapolated haphazardly elsewhere. Nevertheless, for co-management to reach its full potential in southern Africa, the nine conditions found to be strongly correlated with success should be prioritized in the process. Two specific conditions need attention. First, legal rights to subsistence fisheries need to be awarded timeously because delays undermine faith in co-management. Second, dependent on capacity, control by central authorities should shift to the local level. The devolution of authority from the central national management authority to EKZN Wildlife was a trigger for success in KwaZulu-Natal. 'Champions' seldom operate well at a distance.

Failure to act on problems such as those identified during this survey will undermine the process of co-management. In the long-term, however, training, empowerment and the development of alternative sources of income will be essential for communities to break free of the poverty trap that compels subsistence on dwindling natural resources.

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