



## Article

# Beyond Protected Areas: Assessing Management Effectiveness of a Ramsar Site in Nepal

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**Abstract:** Ramsar Sites, wetlands of international importance, are an international category of protected wetland areas recognized under the Ramsar Convention on Wetlands. Protected areas around the world are not achieving the conservation objectives for which they were established, often due to a lack in effective management practices. Hence, protected area management effectiveness and its assessments are crucial elements of achieving responsive and pro-active management. Ramsar Sites that are not recognized as a protected area under the national park and wildlife conservation act in Nepal are often ignored for such assessments and receive little attention in terms of conservation and management. This study aimed to fill this gap by assessing Jagadishpur Reservoir Ramsar Site, which falls into the above category. The Ramsar Management Effectiveness Tracking Tool was used to assess the management effectiveness. Transformed into the global standard reporting format, the overall management effectiveness was 0.27 on a 0 to 1 scale. This score is considered to be in an inadequate range, requiring significant conservation intervention from government with support from conservation partners. This first assessment of Ramsar Site outside of protected area in Nepal and its comparison to global and European regional-level assessments provides the benchmark for future evaluation to track progress in management effectiveness. In conclusion, Ramsar Sites outside formally protected areas are often neglected and intermittent projects, and ad hoc implementation of small-scale activities seems inadequate to improve management effectiveness.

**Keywords:** biodiversity; human-made wetland; irrigation reservoir; important bird area; bird sanctuary; METT



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## 1. Introduction

Protected areas (PAs) are regarded as an important tool in regional and global conservation strategies [1]. Their establishment is often regarded as an indication of progress in the achievement of biodiversity conservation targets. However, their success in terms of conservation and management of biodiversity should not only be considered as the pure number and area of PAs established within a certain territory. How effectively these PAs are managed, how they succeed in achieving conservation objectives, and how able they are to support human welfare and sustainable development are equally important [2–4]. This fact is also considered in the recently adopted Kunming–Montreal Global Biodiversity Framework, especially in target 3 (out of 23 in total): “[...] especially areas of particular importance for biodiversity and ecosystem functions and services, are effectively conserved and managed through ecologically representative, well-connected and equitably governed systems of protected areas and other effective area-based conservation measures [...]” [5].

Ramsar Sites, i.e., wetlands of international importance, are an international category of protected wetland areas recognized under the Ramsar Convention on Wetlands (1971). The Convention on Wetlands is an intergovernmental treaty that provides the framework

for national action and international cooperation for the conservation and sustainable use of wetlands and their resources [6]. The contracting parties to the convention designate the sites to include in the list of wetlands of international importance if a site meets at least one of the nine defining criteria [7]. Although the number of Ramsar Sites and protected areas are increasing in number [8], their effective management in order to achieve conservation objectives is equally important to secure their biodiversity values. However, protected areas around the world are not achieving the conservation objectives for which they were established due to weak management [2]. Evidence can be found in the under-achievement of the Aichi Targets within the United Nations Decade on Biodiversity (2011–2020), in which the net proportion of PAs was among the few successful targets, but without any evaluation of its effectiveness [9].

Protected area management effectiveness (PAME) and its assessments are crucial elements in achieving responsive and pro-active management. PAME evaluation is defined as “evaluating the extent to which protected area management is protecting its values and achieving goals and objectives” [2]. Therefore, evaluating PAME can be used to evaluate its performance, as well as to ensure that PAs are being managed for biodiversity conservation, which ensures the maintenance of ecosystem services and hence results in socio-economic benefits [10–13]. PAME can also help to compare and contrast several protected areas managed at different administrative level [14]. On the other hand, some experts have raised the issue that the increased effectiveness of a single site or protected area is of little value if the protected area is not making a contribution to meeting biodiversity conservation objectives in a wider (landscape) scale [15]. This is because the reduction in human impacts in the reserve and/or protected area may actually have a leakage effect in nearby landscape, such as deforestation, where the overall effectiveness may be lower than otherwise [15].

The Convention on Biological Diversity (CBD) urged its member states to conduct management effectiveness evaluations of at least 30% of each member states’ PAs by 2010 and include the assessment results in the national report to CBD, as well as in adaptive management strategies [16]. So far, about 29% of the area that is protected globally has been assessed, whereas only 23% of the countries have reached up to a 60% rate of management effectiveness assessment [17]. Latin American and Caribbean countries conducted the highest number of management effectiveness assessments, followed by European countries, Asia and Oceania [18]. More than 17,000 PAME assessments have been carried out (as registered in the global database of PAME), representing over 9000 PAs worldwide. Of these, only 3600 PAs have conducted recurring assessments [19] that could indicate progress in the management effectiveness of PAs over time. As many as 50 different methodologies have been developed to assess PAME within the World Commission of Protected Areas (WCPA) framework of assessment [18]. However, 14 methodologies are most widely applied, with “Rapid Assessment and Prioritization of Protected Area Management” (RAPPAM) being the most preferred method, followed by the “Management Effectiveness Tracking Tool” (METT). The METT has been used in over 2500 protected areas worldwide covering 127 countries [20].

PAME assessments in Nepal have been carried out using different methodologies [21–23]. Nepal has achieved a 60% target of management effectiveness assessment for terrestrial PAs [24]. However, PAs such as Ramsar Sites that are not recognized as a protected area under the national park and wildlife conservation act are often excluded from such assessments and receive little attention for conservation and management. Therefore, to identify the current management position, it is important to assess the management effectiveness of such Ramsar Sites, which can then be used as a baseline indicator to measure improvements in conservation and management at a later stage. In Nepal, Ramsar Sites outside of the formal protected area system are under the responsibility of the Department of Forest and Soil Conservation through its Division Forest Office (DFO). In contrast, the formal Ramsar administrative authority in Nepal is the Department of National Parks and Wildlife Conservation (DNPWC), which administrates the Ramsar sites within PAs. While there is no obligation for Ramsar Sites to be legally protected, their designation can enhance

conservation quality [25]. In Nepal, ten wetlands are listed as a Ramsar Site, out of which four are located completely outside of PAs.

Based on this background, this study aimed to fill the gap in PAME assessment of Ramsar Sites outside PAs in Nepal. In particular, this study aimed to (i) assess the threats and pressure in Jagadishpur Reservoir Ramsar Site (JRRS), (ii) assess the current management effectiveness of JRRS and (iii) compare the overall management effectiveness of JRRS with that of global- and other regional-level assessments.

## 2. Materials and Methods

### 2.1. Study Site

JRRS is located in Kapilvastu district ( $27^{\circ}35'00.0''$  N;  $83^{\circ}05'00.0''$  E), Lumbini province, Nepal. The reservoir is a purpose-built irrigation reservoir (built in 1972) to irrigate 6200 hectares of agricultural land. The surface area of the reservoir is 157 hectares and surrounded by small wetlands, fishponds, agricultural lands, villages and local roads (Figure 1). Earthen dike surrounds the reservoir and a 20 km long main canal with a subsidiary branch canal and sub-canal network are connected into the irrigation system. The site lies in the southern lowland at an elevation of 197m asl. This reservoir was listed as a Ramsar Site in August 2003, covering 225 hectares, and declared as an Important Bird Area in 2005. Recently, the Lumbini provincial government declared the site as a Bird Sanctuary.



**Figure 1.** Bird's eye view of Jagadishpur Reservoir Ramsar Site; photo credit: Cinema Satrang (Taulihawa) Kapilvastu.

JRRS recorded the highest abundance of wetland-dependent birds (23,363 individuals) among all the wetland sites during a winter water birds survey in 2017 along with the second-highest bird species diversity [26]. This diversity of birds comprised 56 species in 13 families in 2020 [27]. However, there have been fluctuations in both the abundance and diversity of birds over the years in the site [26–28]. Accounting for adjacent areas of JRRS for terrestrial as well as arboreal birds, the total number of recorded species (including wetland-dependent species) was 168 [29]. The wetland vegetation in the site is in the sub-

merged succession stage. The site contains several types of free-floating (e.g., Water velvet, *Azolla imbricata* and Duckweed *Lemna* spp.), submerged (e.g., Hydrilla *Hydrilla verticillata* and Hornwort, *Ceratophyllum demersum*) and floating leafed (e.g., Lotus *Nelumbo nucifera*) wetland plant species. The density of aquatic macrophytes (e.g., *Ipomea species*) indicates advancing eutrophic status and high sedimentation rate [7]. Terrestrial vegetation around the bank and dyke of the site consists mainly of Sisoo (*Dalbergia sisoo*), Khair (*Acacia catechu*), Simal (*Bombax ceiba*) and bamboo.

Water quality status of the site indicates that the water is suitable for irrigation and human consumption and normally comprises the national and WHO standards [30]. Parameters such as pH, electrical conductivity, total dissolved solids, dissolved oxygen and chemical oxygen demand, and minerals such as calcium, magnesium and potassium, are within the permissible limit [30,31]. The high growth of *Ipomea sps* and low transparency of water shows that the site condition may be in eutrophic status [32]; however, nitrate value is far below the permissible limit and phosphate is below the detection limit [31].

Besides its assignment to the DFO Kapilvastu, the reservoir and irrigation infrastructure maintenance is under the responsibility of the Banganga Irrigation Division Office (BIDO). The Water Users' Association (WUA), a community-based organization, manages the water usage from the reservoir to ensure that water is available to farmers for crop cultivation. Assigning the conservation and management responsibility between the two different government agencies have caused jurisdiction overlap with differing priorities. There have been neither regular staff nor a specific unit, other than irregular and intermittent projects, assigned to look after the ecological values and conservation issues relating to this Ramsar Site. BIDO presence is only concerned with irrigation and water management activity.

## 2.2. Data Collection: R-METT Implementation

The Ramsar Management Effectiveness Tracking Tool (R-METT) was used to assess the management effectiveness of JRRS. R-METT was adopted by the Ramsar Convention at the 12th meeting of the Conference of the Parties in 2015 [33]. R-METT is a revised version of the original version of the Management Effectiveness Tracking Tool (METT) adapted for Ramsar Sites [20]. METT is an established standard to evaluate the management effectiveness of PAs given the cost required for implementation and the depth of information acquired for the assessment [34]. This tool is used by the majority of member states in assessing their PA management effectiveness [18]. It is considered a straightforward and easy-to-use tool [35] in a participatory workshop setting, including a standardized assessment protocol [33,36].

A one-day workshop was conducted at the Division Forest Office (DFO), Kapilvastu with the support and participation of the DFO in August 2018 using the R-METT questionnaire (Appendix B). Participants in the workshop represented all local stakeholders: community members, the wetland user group, local government (ward chairperson and ward secretary), Water Users' Association, Jagadishpur Reservoir Management Multi-Stakeholder Forum (JRMMSF), Banganga irrigation division office and division forest office (Kapilvastu). In total, 23 participants attended the workshop.

At the start of the workshop, after familiarization with the R-METT and workshop objective, the list of threats and pressures were identified and discussed among participants. We used the threats classification from the International Union for Conservation of Nature and Conservation Measures Partnership (IUCN-CMP) classification of direct threats [37]. This has been adopted by the R-METT and has also been used to assess threats to wetland and wetland-dependent birds [38,39]. The score of the threats were assigned as either low, medium, high or not applicable depending on the severity and scope of the threats. In the second stage of the workshop, assessment questions were discussed, and scores assigned accordingly. All the 33 questions (and 12 additional questions) from the R-METT (Appendix B) that were relevant to the site were discussed among the workshop participants and assessed in as much detail as possible to accurately address the reality in the field. The complete set of assessment questions from R-METT were applicable to the JRRS and were

put forward among the workshop participants for discussion and score assignment. It was made clear to the participants that they should consider the effects beyond the Ramsar Site boundary (at the catchment level) while agreeing on the score. The score for the assessment questions ranged from zero (poor condition) to three (excellent or ideal situation). While assigning a numerical score to the assessment questions, consensus was reached among the workshop participants, and all agreed to the final assigned score.

Besides the workshop, information was also collected from field observation and during non-formal discussion with the members of the JRMMSF. Continuous site experience on JRRS in 2015 and 2016 and subsequent periodical interactions with the key stakeholders of the site, as well as expert knowledge on protected area management and wetland conservation, helped to evaluate and repeatedly verify the assessment results. Workshop participants representing different organizations also helped to check and balance the scores of different assessment questions, thus preventing them from either under-rating or over-rating. For example, when the issue about water use for irrigation was over-emphasized by the members of the Water Users' Association and/or BIDO, then this was checked by the representative from DFO. Similarly, when the issue of local community benefit from the site in terms of tourism or resource harvest was over-emphasized by the community members living near to the site, then this was checked by the DFO representative (in terms of conservation) or Water Users' Association (in terms of benefit sharing). Throughout the workshop we tried to reduce the bias in this way and significantly enhanced the assessment. Additionally, the involvement of participants from different organizations and with varied levels of expertise and experience meant that the assessment results, including threat analysis, were reported in a balanced way [39].

### 2.3. Data Analysis

The set of 33 (plus an additional 12) questions from the R-METT addresses 6 different elements of management effectiveness: context (1 question), planning (7 questions), input (8 questions), process (11 questions), output (1 question) and outcomes (2 questions) [2,29]. The R-METT has an additional 3 questions that are specific for Ramsar Sites. These 33 questions yield the maximum possible score of 99. The additional set of 12 questions refer to 3 questions on the management planning process, 3 questions on land and water use planning, 3 questions on impact on local communities/indigenous communities and 3 questions on conditions of biodiversity, ecological and cultural values. Therefore, when added together, the maximum possible score of any site assessed through the R-METT is 111. The possible maximum score of each R-METT question is three, but owing to additional questions regarding management planning process, land and water planning, impact on local communities and condition of values (Appendix B), these questions (with a combination of additional questions) can yield a maximum score of six in the ideal situation.

To calculate the management effectiveness score (MES) of individual evaluation elements (i.e., context, planning, input, process, output and outcome), the following formula was used:

$$MES = \frac{\text{Actual score in the individual evaluation element}}{\text{Maximum possible score in an individual evaluation element}} \times 100\% \quad (1)$$

Similarly, Overall Management Effectiveness (OME) score was calculated by using the following formula:

$$OME \text{ Score} = \frac{\text{Total score of all the elements combined}}{\text{Maximum possible score of all the elements combined}} \times 100\% \quad (2)$$

### 2.4. Common Scale Translation and Rating/Scoring

Management effectiveness score data from JRRS were translated/converted into the common scoring/rating scale of zero to one for comparison purpose with the global and European regional-level assessment [18,40]. To convert the score from JRRS from the scale

of zero (no score) to three (maximum possible score) to zero to one, we used the method developed by Leverington et al. [18]. This method was also used by Nolte et al. [40] for European regional-level assessment.

Although the conversion of these data into common reporting format enabled cross-analysis of management effectiveness assessment score from different methodologies, it may also lead to loss of data richness [40]. Therefore, the result, which is an estimate of management progress, requires careful interpretation. We translated all the original scores of management effectiveness indicator from JRRS onto a scale of zero to one as presented below (Table 1).

**Table 1.** Conversion of R-METT score from JRRS onto a common scoring system.

Methodology		Ratings			
		Lowest	Mid	Best	
R-METT	Original score of JRRS	0	1	2	3
	Original general meaning of response	no progress	slight progress	good progress	ideal situation
	Translated score of JRRS	0	0.33	0.67	1

Source: adapted and modified from Leverington et al. [18].

### 2.5. Matching Individual R-METT Indicators to Common Headline Indicators

R-METT indicators were cross-matched with the main headline indicator as proposed by Leverington et al. [18]. This enabled us to compare and evaluate the JRRS management effectiveness score with that of global and European regional-level PAME scores. Leverington et al. [18] developed 32 headline indicators for a common reporting format by analysing different PAME methodologies consisting of more than 1800 indicators. These indicators have also been used to assess PAs at the European level [40]. We followed this approach to cross-match indicators from the R-METT to the headline indicators. Some of the multiple indicators from the R-METT were matched to one headline indicator. In this situation, we weight-averaged the source indicators from the R-METT to derive a score for the headline indicator that could range between zero and one. However, some of the source indicators are considered more influential than others, thus demanding more weight while contributing a score to the headline indicator. To address this, each of the source indicators was allocated a certain weight between zero and one based on its overall contribution to the headline indicator so that the sum of the weight equalled one [18]. While cross-matching, we felt that some of the WCPA elements from the R-METT did not match exactly with the element as proposed [18]. For example, PA gazetted or PA legal status in the R-METT is assigned as a context element, but it is assigned as a planning element in Leverington et al. [18]. However, we believe that this did not affect the overall score for comparison purposes.

We also found that some proposed headline indicators [18] did not match with R-METT indicators. For example, there is no question in the R-METT addressing threats explicitly in the assessment questions; however, there is a separate section to evaluate threats. We evaluated the threats during the workshop and then assigned a numerical score from one (no threat) to three (high threat). All the threat scores were averaged and then reverse-scored because a high threat score signifies a low management effectiveness score and vice versa. Similarly, the adequacy of human resource policies, skill levels of staff/other management partners, tenure security and issues in the headline indicators were also not addressed by the R-METT assessment questions. We assessed these headline indicators with the members of the JRMMSF in a non-formal meeting to enable cross-evaluation with global and regional level assessment of all the indicators.

### 2.6. Data Analysis from Translated Score

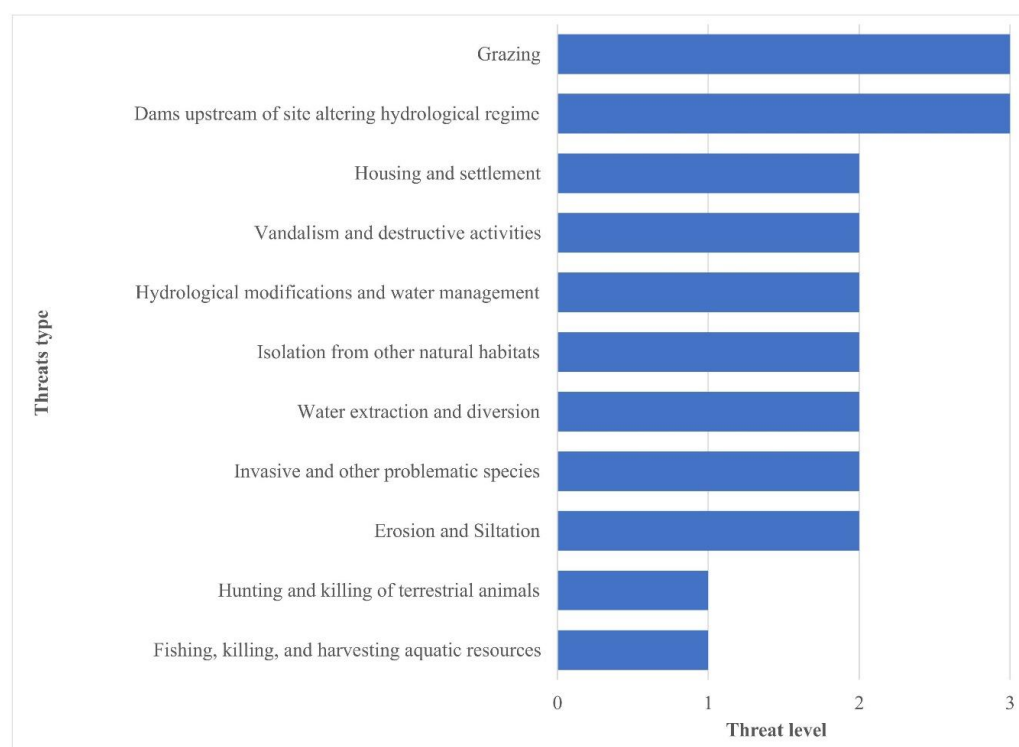
After matching individual indicators from the R-METT to headline indicators, we assigned a weighted average translated score to headline indicators for JRRS due to some

headline indicators consisting of more than one R-METT indicator. The overall mean score was calculated comprising all indicators to evaluate the overall management effectiveness, and for six different management effectiveness evaluation indices of JRRS. This mean score was then compared with the results of the global and European regional-level assessments of PAME [18,40] to classify the management effectiveness position of JRRS.

### 3. Results

#### 3.1. Threat and Pressures at JRRS

We identified 11 different threats (second-level comprehensive threats) that posed challenges for the long-term survival of JRRS and biodiversity therein. Among the threats identified, grazing in the Ramsar Site and dams upstream of the site altering the hydrological regime were identified as high-level threats. Two other threats were low-level and seven threats were medium-level (Figure 2). When analysed at the first-level threats, hydrological change was the highest threat, followed by natural system modifications and agriculture and aquaculture. Biological resource use (a first-level threat) contained two second-level threats, but this was the lowest among all the threats (Appendix A).

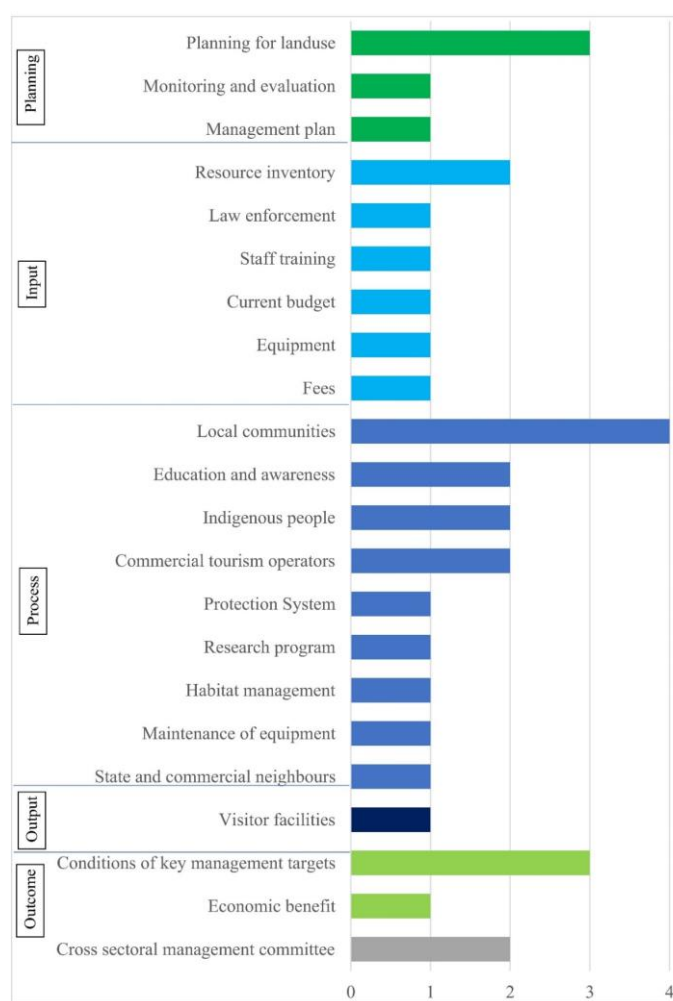


**Figure 2.** Types and level of threat in JRRS. Note: a numerical value of zero refers to no threat, one refers to low, two refers to medium and three refers to high threat.

#### 3.2. Management Effectiveness of JRRS

The score in the context category of management effectiveness was 0 (zero), as this Ramsar Site is not legally protected. JRRS is designated only as a wetland of international importance under the criteria based on species and ecological communities (criteria 2) of the Ramsar Convention [41]. For the planning element, assessment questions were about protected area legislation and policy, protected area designation (at system and individual level) and management planning, and monitoring and evaluation [2]. Only the indicators of management plan, land-use planning, and monitoring and evaluation achieved the combined score of five points (Figure 3). Indicators of input elements such as law enforcement, resource inventory, staff training, budget availability, equipment and fees achieved the combined score of seven points. In the process element, 9 out of 11 indicators achieved scores of 15 points. Indicators on local communities that assessed local peoples'

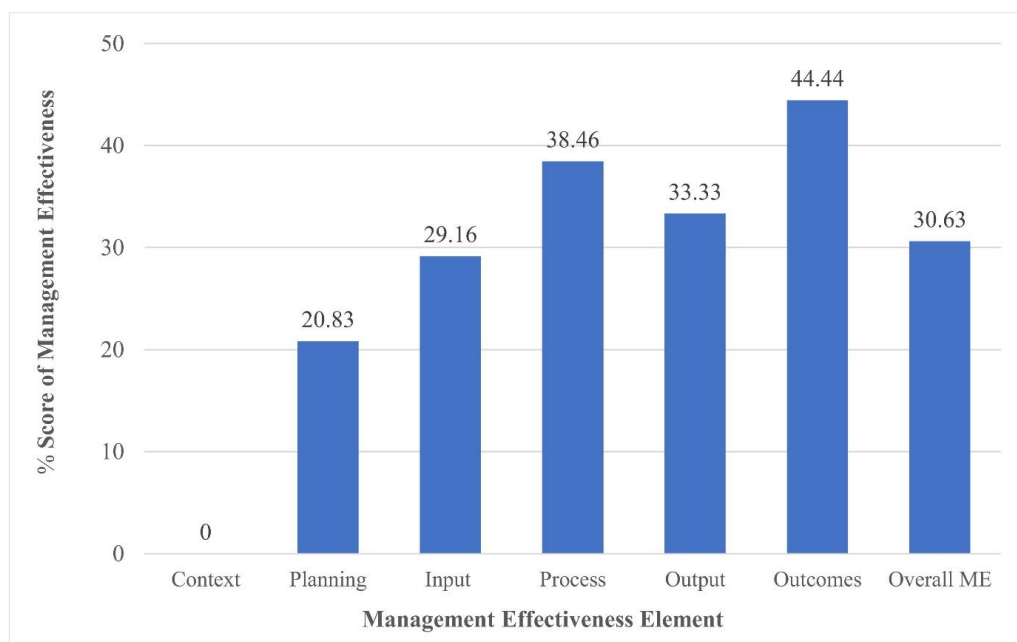
participation in management decisions and impact on communities scored the highest. The output element of management effectiveness assessment evaluates the action of the protected area authority, and the products and services it produces or delivers [2]. The R-METT has only one indicator in the output element that assesses visitor facilities, in which JRRS achieved a score of one point. The outcome element of the management effectiveness assessment evaluates if the conservation management activities resulted in the achievement of the objectives and desired outcomes of a particular protected area or a whole system [2]. The R-METT has two indicators within the outcome element, and JRRS achieved score of four points in this element. Further, the R-METT assesses specific issues about Ramsar Sites with an additional three questions on ecological character, cross-sectoral management committee and communication mechanism with the Ramsar administrative authority. Among those indicators, JRRS achieved a score of two points in only one indicator (Figure 3).



**Figure 3.** Scores of the individual indicator, based on R-METT questions, representing five elements of management effectiveness (there was no score in the context element; some indicators have additional questions generating additional score values >3).

The scores for each of the six elements of management effectiveness were calculated as 0% for context, 21% for planning, 29% for input, 38% for process, 33% for output, 44% for outcome and 22% management effectiveness for Ramsar-site-specific issues. The overall management effectiveness score of JRRS was 34 points out of a maximum score of 111 points, resulting in 31% management effectiveness (Figure 4).





**Figure 4.** Percentage score on six elements of management effectiveness and overall management effectiveness of JRRS.

### 3.3. Management Effectiveness of JRRS on a Global Scale

Overall management effectiveness of JRRS in a global standard reporting format was 0.27 on a 0-to-1 scale. The maximum score was in adequacy of relevant and available information, effectiveness of governance and leadership and conservation of nominated values (0.66). This was followed by the involvement of communities and stakeholders (0.60) and the communication program (0.44). Seven headline indicators did not score any points (Table 2).

**Table 2.** Average score of management effectiveness of each headline indicator of JRRS. The right two columns presented are from the global and European regional-level management effectiveness assessment score for comparison purposes with JRRS.

WCPA Element	Headline Indicator	JRRS Score	Global Score <sup>1</sup>	European Score <sup>2</sup>
Context	Constraint or support by external environment	0.33	0.55	0.57
Context	Extent and severity of threats	0.33	0.51	0.5
Context	Level of significance	0	0.67	0.72
Planning	Tenure security and issues	0.33	0.6	0.65
Planning	Management planning	0.17	0.52	0.5
Planning	Appropriateness of design	0.033	0.65	0.69
Planning	Park gazettal (legal establishment)	0	0.86	0.9
Planning	Adequacy of PA legislation	0	0.63	0.58
Planning	Marking and security/fencing of park boundaries	0	0.62	0.65
Input	Adequacy of relevant, available information	0.67	0.57	0.55
Input	Adequacy of infrastructure, equipment and facilities	0.33	0.47	0.47
Input	Adequacy of current funding	0.33	0.37	0.43
Input	Security or reliability of funding	0.07	0.39	0.47
Input	Adequacy of staff number	0	0.43	0.45

Table 2. Cont.

WCPA Element	Headline Indicator	JRRS Score	Global Score <sup>1</sup>	European Score <sup>2</sup>
Process	Effectiveness of governance and leadership	0.67	0.68	0.55
Process	Involvement of communities and stakeholders	0.60	0.51	0.6
Process	Communication program	0.44	0.49	0.52
Process	Threat monitoring	0.33	0.59	0.58
Process	Skill level of staff/other management partners	0.33	0.51	0.54
Process	Adequacy of staff training	0.33	0.49	0.51
Process	Visitors catered for and impact managed	0.33	0.46	0.46
Process	Adequacy of building and maintenance system	0.33	0.45	0.53
Process	Management effectiveness evaluation undertaken	0.33	0.39	0.5
Process	Appropriate program of community benefit/assistance	0.33	0.3	0.28
Process	Natural resource and cultural protection activities	0.264	0.49	0.51
Process	Research and monitoring	0.264	0.45	0.5
Process	Adequacy of law enforcement capacity	0.17	0.52	0.6
Process	Effectiveness of administration	0	0.52	0.57
Process	Adequacy of human resource policies and procedures	0	0.5	0.51
Output	Results and outputs have been produced	0.40	0.53	0.55
Outcome	Conservation of nominated value condition	0.67	0.56	0.52
Outcome	Effect of park management on local communities	0.33	0.58	0.55

Source: own data and calculation, [18] (p. 693) and [40] (pp. 35–36). <sup>1</sup> Global-level protected area mean score of management effectiveness. <sup>2</sup> European-level protected area mean score of management effectiveness.

#### 4. Discussion

We evaluated the management effectiveness of JRRS, which has conflicting jurisdictional overlap between two different government authorities. We identified 11 different types of threats that are potentially harmful for this Ramsar Site. Grazing of livestock in the Ramsar Site and dam infrastructure upstream of Banganga river for irrigation purposes were identified as the highest threats, whereas poaching was the lowest threat. The overall management effectiveness score of JRRS was 31% (using R-METT), which was equivalent to 27% (0.27) management effectiveness in the common reporting and translation procedure.

The IUCN [29] found illegal fishing to be the highest biodiversity threat, followed by flooding/sedimentation/river cutting and water level fluctuation in JRRS. Livelihood-related activities of local people, such as agricultural intensification, also posed a threat to JRRS and nearby wetlands. Some of the threats identified in JRRS were common to that of national-level conservation threats of Nepal. For example, encroachment, infrastructure development, poaching, illegal grazing or illegal resource harvest, flooding, erosion and sedimentation are some of the common conservation threats in Nepal [11,42]. However, experience has shown that conservation threats may change over time. While some threats can be managed or addressed to some extent, it is inevitable that new threats may also emerge over time [29,42]. In industrialized countries, threats for nature conservation are mostly related to pollution from domestic sewage, industrial effluents and solid waste [43], which is different from developing countries such as Nepal. Global assessment of management effectiveness also identified natural resource harvesting, such as fishing/logging/hunting, non-timber forest product utilization, tourism and recreational activities and adjacent land-use patterns, to be the most serious threats to protected areas [44].

Management effectiveness of JRRS appeared to be lower than any other protected areas in Nepal that are legally established and assessed. The management effectiveness score of those protected areas in Nepal ranged from 56% to 82% [21–23]. Although it may be irrelevant to compare the JRRS management effectiveness score with other PAs in Nepal as the assessment methods were mostly different, this provides sufficient information to compare with the overall management trends. The mean score of the global and European regional-level management effectiveness was found to be 53% (0.53) and 56% (0.56), respectively, for the most recent assessment [18,40], while the JRRS score was found to be 27% (0.27) effectiveness. The management effectiveness of JRRS is clearly below the global and

regional average, which is in the inadequate range (<0.33 or 33%) of management [18] and thus requires significant attention and subsequent action. Providing legal protection to the site and investment in terms of resources, equipment, human capital and appropriate site planning can boost its management. PAME improved in successive assessments when conservation projects (intervention) were ongoing or recent, especially with active project funding [18].

The conservation of JRRS and its management responsibility being divided between two different government agencies make it complex to undertake any sustainable conservation decision. The different, and sometimes conflicting, objectives of irrigation (purposely built infrastructure) and conservation (wetland of international importance) pose a challenge to focusing on conservation activities and delivering benefits to human wellbeing. This could be the main reason for the low score of management effectiveness in JRRS. Management effectiveness is often associated with the management status of the protected area, such as whether it has its own management authority [35]. However, a higher overall management effectiveness score does not necessarily mean an indication of absence of any issues, nor does a lower level of management effectiveness indicate a lack of any management strengths of protected areas or protected area systems [45]. Protected wetland areas may not receive as high attention as other PA types, which is why wetlands are poor performers in general in this regard [43].

It may be common to have a varying degree of management effectiveness of protected areas even if the management responsibility or management authority is made clear. For example, in Ecuador, management effectiveness ranged from 12.5% to 99% despite clear jurisdiction [45]. However, management effectiveness can be influenced by several factors, such as availability of budget and other required resources, such as labour, societal relations, communication and reliable inventories of those resources [46]. Galapagos National Park, which achieved a 99% management effectiveness score, benefitted from a large budget in comparison to other national parks in Ecuador, whereas their lack of resources lowered the PAME. Similarly, private reserves and state-protected areas that have been able to secure stable funding had a higher level of management effectiveness than protected areas without such financial security [47]. Improvements in PAME may take time and older protected areas tend to have a higher management effectiveness score [10]. Adequacy of infrastructure, equipment and facilities, natural and cultural resource management processes, effectiveness of governance (administration) and communication programs were also strongly related to overall management effectiveness [18]. Experience from Taiwan suggests that strengthening management planning would help to improve PAME. The lack of a comprehensive management plan, inadequate quality of human resources and insufficient funding limit achieving higher management effectiveness [43]. PAME is also dependent on the development indicators of the country, such as its Human Development Index [44].

There is also a possibility that management effectiveness may vary depending on the assessment methodologies adopted and the country assessed. However, it is equally likely to be influenced due to the certain sample of protected areas and/or the socio-economic environment of the PA system being evaluated. This is justified, as PAs assessed through the RAPPAM methodology scored more in Africa than PAs assessed through the METT methodology because the METT had been used in newly established PAs and those supported by donor projects [44]. New PAs often achieve lower scores while the PAs with donor support and continuity with conservation activities or intervention achieve higher scores. MEE methodologies employed in Europe focused more on ecological significance of a site, visitor management and specific activities on resource use and management [40]. Non-European and/or international-level methodologies focused on the capacity of the evaluated site to cope with threats, such as adequacy of law enforcement, human resource policies, skills/training and infrastructure [40].

Planning indicators were the weakest elements in JRRS and there is no legal status of the site for protection. Law enforcement was found to be weak, even though there is a

legal basis for the establishment of a PA and existing regulations to support conservation. Despite several challenges in managing JRRS, the outcome score was highest because of some efforts from the local people, as well as from government agencies and conservation organizations that offered support, albeit on an ad hoc basis. This may, however, be based on the perception of the workshop participants and not reflect the actual ecological surveys and/or monitoring. It is no surprise that the context, planning and outcome elements of the assessment had the highest average score, whereas input, process and output elements had the lowest average score [45,47].

Protected areas having an international status, such as World Heritage Site and/or Ramsar Site, do not necessarily guarantee the effective management of the site. For example, the management effectiveness of Sagarmatha National Park (Natural World Heritage and Ramsar Site status) and Langtang National Park (Ramsar Site status) had lower management effectiveness scores than other national parks in Nepal [21]. Improved management was determined by factors such as accessibility of protected areas, resource investment and support from national and international conservation partners [21].

## 5. Conclusions

This study was the first PAME evaluation of JRRS and perhaps the first study among all Ramsar Sites of Nepal. The management effectiveness score of JRRS was in an inadequate range, requiring significant conservation intervention from the government with support from conservation partners. This assessment provides the benchmark for future evaluations to track the progress in management effectiveness. A strong partnership between two government agencies with differing roles and responsibilities in the site could help address much of the conservation problems. Effective mobilization of community-based organizations, such as the Water Users' Association and JRMMSF, would help enhance partnership. While Ramsar Sites inside the PA enjoy more conservation and monitoring from authorities, sites such as JRRS are often ignored by the government authority responsible for Ramsar Site management. Intermittent projects and ad hoc implementation of small-scale activities seem inadequate to address the conservation challenges and to improve management effectiveness. This can be addressed, to some extent, by ensuring guaranteed conservation and management project/programme and annual ear-marked budget from the Division Forest Office and assigning a dedicated team of conservationists to look after the site. Further, the active mobilization of local people can also aid in research and monitoring of this Ramsar Site and its biodiversity through a citizen science approach, whereas appropriate citizen management would help tackle conservation problems at low or no cost. These strategies already have been proved successful in butterfly research and monitoring [48] and coastal wetland conservation [49] elsewhere.

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### Appendix A

Hierarchical level (first- and second-level) classification of threats and their scores in JRRS (based on [37]).

First-Level Threats	Second-Level Threats	Threat Score	
Hydrological change	Dam upstream of site altering hydrological regime	3	High
	Water extraction and diversion	2	Medium
Natural system modifications	Hydrological modifications and water management	2	Medium
	Isolation from natural habitats	2	Medium
Biological resource use and harm	Hunting and killing of terrestrial animals	1	Low
	Fishing, killing and harvesting aquatic resources	1	Low
Agriculture and aquaculture	Grazing	3	High
Residential and commercial development	Housing and settlement	2	Medium
Human intrusions and disturbance	Vandalism and destructive activities	2	Medium
Invasive and other problematic species	Invasive species	2	Medium
Geological events	Erosion and siltation	2	Medium

### Appendix B

Assessment questions used in the workshop to assign management effectiveness score in JRRS. Note: WCPA elements of management effectiveness are provided in the brackets (first column). Assessment questions adapted from Ramsar Convention, Resolution XII.15 [33].

	Assessment Questions and Criteria	Score
1. Legal status Does the Ramsar Site have legal status (or, in the case of private reserves, is covered by a covenant or similar)? (Context)	The Ramsar Site is not legally protected	0
	There is agreement that the Ramsar Site should be legally protected, but the process has not yet begun	1
	The Ramsar Site is in the process of being legally protected but the process is still incomplete	2
	The Ramsar Site has been formally legally protected	3
2. Ramsar Site regulations Are regulations in place to control land use and activities (e.g., hunting)? (Planning)	There are no regulations for controlling land use and activities in the Ramsar Site	0
	Some regulations for controlling land use and activities in the Ramsar Site exist but these are major weaknesses	1
	Regulations for controlling land use and activities in the Ramsar Site exist but there are some weaknesses or gaps	2
	Regulations for controlling inappropriate land use and activities in the Ramsar Site exist and provide an excellent basis for management	3
3. Law enforcement Can staff (i.e., those with responsibility for managing the site) enforce Ramsar Site rules well enough? (Input)	The staff have no effective capacity/resources to enforce Ramsar Site legislation and regulations	0
	There are major deficiencies in staff capacity/resources to enforce Ramsar Site legislation and regulations (e.g., lack of skills, no patrol budget, lack of institutional support)	1
	The staff have acceptable capacity/resources to enforce Ramsar Site legislation and regulations but some deficiencies remain	2
	The staff have excellent capacity/resources to enforce Ramsar Site legislation and regulations	3

	Assessment Questions and Criteria	Score
4. Ramsar Site objectives	No firm objectives have been agreed for the Ramsar Site	0
Is management undertaken according to agreed objectives? (Planning)	The Ramsar Site has agreed objectives, but is not managed according to these objectives	1
	The Ramsar Site has agreed objectives, but is only partially managed according to these objectives	2
	The Ramsar Site has agreed objectives and is managed to meet these objectives	3
5. Ramsar Site design	Inadequacies in Ramsar Site design mean achieving the major objectives of the Ramsar Site is very difficult	0
Is the Ramsar Site the right size and shape to protect species, habitats, ecological processes and water catchments of key conservational concern? (Planning)	Inadequacies in Ramsar Site design mean that achievement of major objectives is difficult but some mitigating actions are being taken (e.g., agreements with adjacent land owners for wildlife corridors or introduction of appropriate catchment management)	1
	Ramsar Site design is not significantly constraining achievement of objectives, but could be improved (e.g., with respect to larger scale ecological processes)	2
	Ramsar Site design helps achievement of objectives; it is appropriate for species and habitat conservation; and maintains ecological processes such as surface and groundwater flows at a catchment scale, natural disturbance patterns, etc.	3
6. Ramsar Site boundary demarcation	The boundary of the Ramsar Site is not known by the management authority or local residents/neighbouring land users	0
Is the boundary known and demarcated? (Process)	The boundary of the Ramsar Site is known by the management authority but is not known by local residents/neighbouring land users	1
	The boundary of the Ramsar Site is known by both the management authority and local residents/neighbouring land users but is not appropriately demarcated	2
	The boundary of the Ramsar Site is known by the management authority and local residents/neighbouring land users and is appropriately demarcated	3
7. Management plan	There is no management plan for the Ramsar Site	0
Is there a management plan and is it being implemented? (Planning)	A management plan is being prepared or has been prepared but is not being implemented	1
	A management plan exists but it is only being partially implemented because of funding constraints or other problems	2
	A management plan exists and is being implemented	3
Additional points: Planning		
7a. Planning process	The planning process allows adequate opportunity for key stakeholders to influence the management plan	+1
7b. Planning process	There is an established schedule and process for periodic review and updating of the management plan	+1
7b. Planning process	The results of monitoring, research and evaluation are routinely incorporated into planning	+1
8. Regular work plan	No regular work plan exists	0
Is there a regular work plan and is it being implemented? (Planning/Outputs)	A regular work plan exists but few of the activities are implemented	1
	A regular work plan exists and many activities are implemented	2
	A regular work plan exists and all activities are implemented	3
9. Resource inventory	There is little or no information available on the critical habitats, species and cultural values of the Ramsar Site	0
Do you have enough information to manage the area? (Input)	Information on the critical habitats, species, ecological processes and cultural values of the Ramsar Site is not sufficient to support planning and decision making	1
	Information on the critical habitats, species, ecological processes and cultural values of the Ramsar Site is sufficient for most key areas of planning and decision making	2
	Information on the critical habitats, species, ecological processes and cultural values of the Ramsar Site is sufficient to support all areas of planning and decision making	3
10. Protection systems	Protection systems (patrols, permits, etc.) do not exist or are not effective in controlling access/resource use	0
Are systems in place to control access/resource use in the Ramsar Site? (Process/Outcome)	Protection systems are only partially effective in controlling access/resource use	1
	Protection systems are moderately effective in controlling access/resource use	2
	Protection systems are largely or wholly effective in controlling access/resource use	3

	Assessment Questions and Criteria	Score
11. Research	There is no survey or research work taking place in the Ramsar Site	0
Is there a programme of management-orientated surveys and research work? (Process)	There is a small amount of survey and research work but it is not directed towards the needs of Ramsar Site management	1
	There is considerable survey and research work but it is not directed towards the needs of Ramsar Site management	2
	There is a comprehensive, integrated programme of survey and research work, which is relevant to management needs	3
12. Habitat management	No active management of critical habitats, species, ecological processes and/or cultural values is being undertaken	0
Is active habitat management being undertaken? (Process)	Very few of the requirements for active management of critical habitats, species, ecological processes and/or cultural values are being implemented	1
	Many of the requirements for active management of critical habitats, species, ecological processes and/or cultural values are being implemented but some key issues are not being addressed	2
	Requirements for active management of critical habitats, species, ecological processes and/or cultural values are being substantially or fully implemented	3
13. Staff numbers	There are no staff	0
Are there enough people employed to manage the Ramsar Site? (Input)	Staff numbers are inadequate for critical management activities	1
	Staff numbers are below optimum level for critical management activities	2
	Staff numbers are adequate for the management needs of the Ramsar Site	3
14. Staff training	Staff lack the skills needed for Ramsar Site management	0
Are staff adequately trained to fulfil management objectives? (Inputs/Process)	Staff training and skills are low relative to the needs of the Ramsar Site	1
	Staff training and skills are adequate, but could be further improved to fully achieve the objectives of management	2
	Staff training and skills are aligned with the management needs of the Ramsar Site	3
15. Current budget	There is no budget for management of the Ramsar Site	0
Is the current budget sufficient? (Input)	The available budget is inadequate for basic management needs and presents a serious constraint to the capacity to manage	1
	The available budget is acceptable but could be further improved to fully achieve effective management	2
	The available budget is sufficient and meets the full management needs of the Ramsar Site	3
16. Security of budget	There is no secure budget for the Ramsar Site and management is wholly reliant on outside or highly variable funding	0
Is the budget secure? (Input)	There is very little secure budget and the Ramsar Site could not function adequately without outside funding	1
	There is a reasonably secure core budget for regular operation of the Ramsar Site but many innovations and initiatives are reliant on outside funding	2
	There is a secure budget for the Ramsar Site and its management needs	3
17. Management of budget	Budget management is very poor and significantly undermines effectiveness (e.g., late release of budget in financial year)	0
Is the budget managed to meet critical management needs? (Process)	Budget management is poor and constrains effectiveness	1
	Budget management is adequate but could be improved	2
	Budget management is excellent and meets management needs	3
18. Equipment	There are little or no equipment and facilities for management needs	0
Is equipment sufficient for management needs? (Input)	There are some equipment and facilities but these are inadequate for most management needs	1
	There are equipment and facilities, but still some gaps that constrain management	2
	There are adequate equipment and facilities	3
19. Maintenance of equipment	There is little or no maintenance of equipment and facilities	0
Is equipment adequately maintained? (Process)	There is some ad hoc maintenance of equipment and facilities	1
	There is basic maintenance of equipment and facilities	2
	Equipment and facilities are well maintained	3
20. Education and awareness	There is no education and awareness programme	0
Is there a planned education programme linked to the objectives and needs? (Process)	There is a limited and ad hoc education and awareness programme	1
	There is an education and awareness programme but it only partly meets needs and could be improved	2
	There is an appropriate and fully implemented education and awareness programme	3

	Assessment Questions and Criteria	Score
21. Planning for land and water use Does land and water use planning recognise the Ramsar Site and aid the achievement of objectives? (Planning)	Adjacent land and water use planning does not take into account the needs of the Ramsar Site and activities/policies are detrimental to the survival of the area	0
	Adjacent land and water use planning does not take into account the long-term needs of the Ramsar Site, but activities are not detrimental to the area	1
	Adjacent land and water use planning partially takes into account the long-term needs of the Ramsar Site	2
	Adjacent land and water use planning fully takes into account the long-term needs of the Ramsar Site	3
	Additional points: Land and water planning	
21a: Land and water planning for habitat conservation	Planning and management in the catchment or landscape containing the Ramsar Site incorporates provision for adequate environmental conditions (e.g., volume, quality and timing of water flow, air pollution levels, etc.) to sustain relevant habitats	+1
21b: Land and water planning for connectivity	Management of corridors linking the Ramsar Site provides for wildlife passage to key habitats outside the Ramsar Site (e.g., to allow migratory fish to travel between freshwater spawning sites and the sea, or to allow animal migration)	+1
21c: Land and water planning for ecosystem services and species conservation	Planning addresses ecosystem-specific needs and/or the needs of particular species of concern at an ecosystem scale (e.g., volume, quality and timing of freshwater flow to sustain particular species, fire management to maintain savannah habitats, etc.)	+1
22. State and commercial neighbours Is there co-operation with adjacent land and water users? (Process)	There is no contact between managers and neighbouring official or corporate land and water users	0
	There is contact between managers and neighbouring official or corporate land and water users but little or no cooperation	1
	There is contact between managers and neighbouring official or corporate land and water users, but only some co-operation	2
	There is regular contact between managers and neighbouring official or corporate land and water users, and substantial co-operation on management	3
23. Indigenous peoples Do indigenous peoples resident in or regularly using the Ramsar Site have input to management decisions? (Process)	Indigenous peoples have no input into decisions relating to the management of the Ramsar Site	0
	Indigenous peoples have some input into discussions relating to management but no direct role in management	1
	Indigenous peoples directly contribute to some relevant decisions relating to management but their involvement could be improved	2
	Indigenous peoples directly participate in all relevant decisions relating to management, e.g., co-management	3
24. Local communities Do local communities resident in or near the Ramsar Site have input to management decisions? (Process)	Local communities have no input into decisions relating to the management of the Ramsar Site	0
	Local communities have some input into discussions relating to management but no direct role in management	1
	Local communities directly contribute to some relevant decisions relating to management but their involvement could be improved	2
	Local communities directly participate in all relevant decisions relating to management, e.g., co-management	3
	Additional points: Indigenous peoples and local communities	
24 a. Impact on communities	There is open communication and trust between indigenous peoples and local communities, stakeholders and Ramsar Site managers	+1
24b. Impact on communities	Programmes to enhance community welfare, while conserving Ramsar Site resources, are being implemented	+1
24c. Impact on communities	Indigenous peoples and local communities actively support the Ramsar Site	+1
25. Economic benefit Is the Ramsar Site providing economic benefits to local communities, e.g., income, employment and payment for ecosystem services? (Outcomes)	The Ramsar Site does not deliver any economic benefits to local communities	0
	Potential economic benefits are recognised and plans to realise these are being developed	1
	There is some flow of economic benefits to local communities	2
	There is a major flow of economic benefits to local communities from activities associated with the Ramsar Site	3



	Assessment Questions and Criteria	Score	
26. Monitoring and evaluation Are management activities monitored against performance? (Planning/Process)	There is no monitoring and evaluation in the Ramsar Site	0	
	There is some ad hoc monitoring and evaluation, but no overall strategy and/or no regular collection of results	1	
	There is an agreed and implemented monitoring and evaluation system but results do not feed back into management	2	
	A good monitoring and evaluation system exists, is well implemented and used in adaptive management	3	
27. Visitor facilities Are visitor facilities adequate? (Outputs)	There are no visitor facilities and services despite an identified need	0	
	Visitor facilities and services are inappropriate for current levels of visitation	1	
	Visitor facilities and services are adequate for current levels of visitation but could be improved	2	
	Visitor facilities and services are excellent for current levels of visitation	3	
28. Commercial tourism operators Do commercial tour operators contribute to Ramsar Site management? (Process)	There is little or no contact between managers and tourism operators using the Ramsar Site	0	
	There is contact between managers and tourism operators but this is largely confined to administrative or regulatory matters	1	
	There is limited co-operation between managers and tourism operators to enhance visitor experiences and maintain Ramsar Site values	2	
	There is good co-operation between managers and tourism operators to enhance visitor experiences, and maintain Ramsar Site values	3	
29. Fees If fees (i.e., entry fees or fines) are applied, do they help Ramsar Site management? (Input/Process)	Although fees are theoretically applied, they are not collected	0	
	Fees are collected, but make no contribution to the Ramsar Site or its environs	1	
	Fees are collected, and make some contribution to the Ramsar Site and its environs	2	
	Fees are collected and make a substantial contribution to the Ramsar Site and its environs	3	
30. Condition of key management targets What is the condition of the important values of the Ramsar Site as compared to when it was first designated? (Outcomes) Additional points: Condition of values	Many important biodiversity, ecological or cultural values are being severely degraded	0	
	Some biodiversity, ecological or cultural values are being severely degraded	1	
	Some biodiversity, ecological and cultural values are being partially degraded but the most important values have not been significantly impacted	2	
	Biodiversity, ecological and cultural values are predominantly intact	3	
	30a: Condition of values	The assessment of the condition of values is based on research and/or monitoring	+1
	30b: Condition of values	Specific management programmes are being implemented to address threats to biodiversity, ecological and cultural values	+1
	30c: Condition of values	Activities to maintain key biodiversity, ecological and cultural values are a routine part of management	+1
Additional questions specific to Ramsar Sites			
31. Ecological Character Description	Work on the description of the ecological character of the Ramsar Site has not begun	0	
	Work has begun to create a description of the ecological character of the Ramsar Site, but no draft is yet available	1	
	A description of the ecological character of the site has been drafted, but is incomplete or out of date	2	
	A description of the ecological character of the site has been completed	3	
32. Cross sectorial Management Committee	No cross-sectorial management committee is in place	0	
	Potential stakeholders for the creation of a cross-sectorial management committee have been identified, but no management committee has been established	1	
	A management committee has been established, but is not significantly involved in the management of the site	2	
	A functioning cross-sectorial management committee is in place	3	
33. Communication mechanisms with Ramsar administrative authority	There are no mechanisms in place for communication between the Ramsar Administrative authority and site managers	0	
	Communication between the Ramsar Administrative authority and site managers exists but is ad hoc and poorly developed	1	
	Communication mechanisms are in place but could be improved	2	
	Mechanisms are in place for communication between the Ramsar Administrative authority and site managers and function well	3	

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