

Int. Zoo Yb. (2016) **50**: 1–12

DOI:10.1111/izy.12117

Developing an environmental-education programme using Black rhinoceros *Diceros bicornis* in Zambia as a case study

S. OFFORD-WOOLLEY¹, P. BAMFORD² & R. DESFORGES³

¹Deputy Director, Save the Rhino International, Unit 5, Coach House Mews, 217 Long Lane, London SE1 4PR, United Kingdom, ²Independent Consultant, Chile, and ³Discovery and Learning Officer, Zoological Society of London, Regent's Park, London NW1 4RY, United Kingdom

E-mail: susie@savetherhino.org

Environmental education is often recognized as a valuable conservation tool; however, programme managers can face many barriers that reduce the potential for success when implementing an environmental-education programme. Case studies of environmental-education programmes, from which other projects can learn lessons and use as an evidence base, can aid the development and implementation of future programmes and help managers overcome these barriers. This paper summarizes the development of 'Lolesha Luangwa', a Conservation Education Programme based in North Luangwa National Park in Zambia, and outlines the lessons learned from this case study.

Key-words: black rhinoceros; case study; conservation; environmental education; evaluation; North Luangwa; Zambia; zoos.

INTRODUCTION

The International Zoo Educators Association defines conservation education as 'the process of influencing people's attitudes, emotions, knowledge and behaviours about wildlife and wild places' (International Zoo Educators Association, 2015). The relevance of conservation education as a tool for tackling the global environmental crisis has been highlighted by Article 13 of the Convention on Biological Diversity and Aichi Biodiversity Target 1 (CBD, 2010). However, although conservation educators and practitioners understand the value of environmental education, they face many barriers to implementing effective conservation educa-

tion programmes (Ardoin & Heimlich, 2013). These include inadequate theoretical understanding, insufficient resources and the limited amount of published research that demonstrates a positive relationship between education and conservation impact, making it even harder to secure adequate funding to deliver such programmes (Howe, 2009). In developing countries, these barriers may also include the complex web of relationships between the development needs of the country, and its attitudes towards and use of natural resources.

In order for environmental-education initiatives to be successful drivers for change, they must first identify and overcome the barriers that are limiting their ability to engage with the target audience. Case studies of successful environmental-education programmes have been identified as the most useful tool for practitioners and educators when planning their own programmes (Ardoin & Heimlich, 2013). The following case study illustrates the redesign and ongoing development of an environmental-education programme in the North Luangwa ecosystem in Zambia through the application of a structured evaluation approach. This programme was established to raise awareness about conservation, in particular developing an understanding among local communities of the Critically

Endangered Black rhinoceros *Diceros bicornis* (IUCN, 2015).

BLACK RHINOCEROS IN NORTH LUANGWA

In the 1970s, Zambia had the third-largest Black rhinoceros population in Africa, estimated at 12 000 individuals; c. 2000 of which were found in the 4600 km² North Luangwa National Park. Aerial surveys using presence/absence assessments suggested that the minimum density of rhinoceros in the Luangwa Valley was 0.1 km⁻² (Dunham, 2001).

Extensive poaching of Black rhinoceros escalated in the late 1970s and by the mid-1980s the species was rare or locally extinct throughout the Valley. The decline was sharpest in North Luangwa National Park, where the anti-poaching effort was inadequate (Dunham, 2001). The species was declared nationally extinct in 1998.

The Zambia Wildlife Authority and the Frankfurt Zoological Society, Germany, have jointly managed the Park since 1986. This partnership, called the North Luangwa Conservation Programme (NLCP), successfully managed to bring poaching under control and, in 2001, the Southern African Development Community Regional Programme for Rhino Conservation carried out a positive evaluation of North Luangwa National Park and identified it as a suitable reintroduction site for Black rhinoceros (Dunham, 2001). By 2010, 25 Black rhinoceros had been translocated to North Luangwa to re-establish a viable founder population.

When the plans for the translocations were agreed, very little was known about the attitudes of local people towards the Black rhinoceros and the reintroduction. Residents of the Game Management Areas abutting the border of the National Park are subject to greater threat from wildlife, through human–wildlife conflict, crop raiding, destruction of life and property, parasite and disease constraints on keeping livestock, but equally are expected to protect such resources for the greater good;

hence, it could be perceived that wildlife was being managed for the benefit of outsiders, chiefly tourists and safari hunters (Leader-Williams & Albon, 1988). It was recognized that the benefits to local people would be minimal, at least in the early stages, as the rhinoceros would have a limited impact on tourism and jobs (Dunham, 2001). Community education was identified as a potential strategy to engage support from local communities who may never even see a Black rhinoceros.

NORTH LUANGWA'S CONSERVATION EDUCATION PROGRAMME

Background

The NLCP established a Conservation Education Programme (CEP) in 2001. The CEP aimed to: increase the community's understanding of and relationship with its local environment; suggest ways of improving the environment; provide support to the school curriculum by exposing children and adults to working examples of, for example, antilittering and environmentally responsible natural-resource use [i.e. water, agriculture, (non-timber) forest products, apiculture, caterpillar harvesting]. Save the Rhino International (SRI) partnered with NLCP in 2005, fundraising for it through the European Association of Zoos and Aquaria Rhino Campaign. Since 2005, SRI has maintained a strong focus on supporting the CEP.

In its original form, the CEP was aimed at Grade 5 pupils (11–14 years) in eight local schools. A manual (Teachers' Training Guide) containing 33 conservation-related lessons was distributed, and a Conservation Teacher, appointed from among the teaching staff at each school, would deliver lessons to the class throughout the year. This taught element was supplemented by the NLCP's Education Officer, who visited each school up to eight times throughout the year to deliver a special presentation recapping the topics covered in the lessons given by the Conservation Teachers. The lessons covered a range of

topics, including classification, food chains and sustainability related topics, although, at this point, there was little focus on the Black rhinoceros.

In 2003, to coincide with the first Black rhinoceros reintroduction, NLCP printed a colouring/activity booklet about the species for each Grade 5 school child in the eight schools. This was repeated for the 2006 translocations, and a revised booklet was produced for the 2008 translocations. Although targeting the same students, the Teachers' Training Guide and the booklets were not directly linked.

In 2008, the programme was expanded to a further two districts (an additional 13 schools) and over the next couple of years, while the Teachers' Training Guide remained the backbone of conservation teaching in the schools, the NLCP's Education Officer presentations evolved to focus solely on the Black rhinoceros reintroduction story.

In 2005, a third strand of the programme was introduced, to engage the wider community, with special events known as Community Conservation Days held once a year, in each district where the education programme was delivered. These events took place towards the end of the year, once the children had completed the curriculum, and were intended to reinforce the learning from the CEP through sharing experiences with other schools. Furthermore, these days made it possible to communicate key messages to secondary audiences, such as parents and elders in the community. The Community Conservation Days involved presentations, songs, dance and poetry from each school, as well as other activities, such as quizzes and displays of work generated by the students.

In 2014, funding was secured to purchase a truck that could be used to transport up to 20 students and two teachers into the Park. This facility allowed the programme to reinforce the curriculum through first-hand experience.

Challenges facing the CEP

By 2012, the CEP had been running, in various guises, for 11 years. However, it was

apparent from the basic evaluation being carried out that the teachers were unable to teach 33 lessons in a school year and would cherry-pick the easy lessons or never progress more than half way through the Teachers' Training Guide. Because the whole curriculum was not being delivered, there was concern about what knowledge was being passed on to the primary, let alone secondary, audiences, especially as this was not being monitored or evaluated. The programme-delivery team did not have the appropriate expertise and understanding of education and learning theory in-house to implement a framework and, therefore, these skills were sourced through a partnership with the Discovery and Learning team at the Zoological Society of London (ZSL), UK, whereby ZSL would provide technical support to the CEP. In the first instance, this involved a scoping visit to North Luangwa conducted by a member of the ZSL Discovery and Learning team and a representative from SRI to assess and evaluate the programme in its current state and make recommendations for its future redevelopment. Subsequently, ZSL has provided assistance with the implementation of the recommended changes, and continues to provide ongoing support with monitoring and evaluation, curriculum development and mentoring of CEP staff.

REDEVELOPMENT OF THE CEP

ZSL's initial scoping visit in 2012 evaluated the programme through interviews with key members of NLCP staff, Conservation Teachers and Head Teachers from participating schools. Activities carried out during the visit also included lesson observations with the NLCP Education Officer, mapping the programme's structure to the Zambian National Curriculum, and a review of existing feedback and other outputs generated by the programme, including letters from teachers and materials created by participating learners.

As a result of this exercise, the CEP was given a makeover in terms of its identity

and branding to ensure it was recognized as a local initiative, being renamed 'Lolesha Luangwa' ('Look at Luangwa' in the local Bemba language); the Education Officer's job title was renamed Lolesha Luangwa Officer, and the aim and objectives of the programme were reviewed to give a greater focus on fostering pro-environmental knowledge, attitudes and behaviours among the target audience, to relate them to the NLCP's overarching objectives. In addition, a number of other steps were taken to redevelop the programme, particularly in relation to the specific problems that had been identified.

Redesign of the curriculum

Problem The curriculum consisted of 33 lessons; however, the Conservation Teachers were struggling to fit all the lessons into the academic year. In addition, the lesson-planning documents given to the teachers lacked specific, measurable learning objectives and a clear narrative structure to join them into a cohesive unit.

Solution This problem was addressed via a new Teachers' Conservation Guide, reducing the number of lessons to 20, enabling the Conservation Teachers to teach the whole curriculum without disrupting the narrative and the conceptual progression of the subject matter for the learners by missing out lessons.

The lessons were restructured around a specific narrative, beginning with learning about the living things found within the local ecosystem, then exploring the web of relationships and processes that connect them, and finally analysing the learners' own relationships with these mechanisms, identifying problems caused by the impact of their actions and proposing solutions to mitigate these problems. In addition to gaining knowledge of the subject matter, the learners were encouraged to develop reflective and critical skills, and to engage in positive actions towards environmental protection.

Each lesson plan in the Teachers' Conservation Guide was given an overall goal, with three to six specific learning outcomes, and against which the success of the lessons could be measured. All lessons were redesigned, with teaching and learning, where possible, to be delivered/achieved through activities within different domains of learning, including auditory, visual, reading, writing and practical activities, encouraging group participation and allowing the learners to engage creatively with the learning process, thereby providing more opportunities for learning and engagement than in the previous curriculum.

Resources are a limiting factor for the CEP because none of the classrooms has electricity or running water and stationery is in very short supply. These factors were considered when designing what was feasible in each lesson plan, to ensure that the Conservation Teachers could deliver their lessons and achieve the prescribed goals. The lessons were planned out in the Teachers' Conservation Guide with corresponding activities in new Activity Booklets given to each learner.

Target audiences and class sizes

Problem One of the ongoing challenges was the size of the classes involved in the programme. From its inception, the target audience of the programme had been Grade 5 pupils, which had an average class size of 70 (although this ranged from 28 to 135 in different schools). In an ideal world, lessons and materials for children should be designed for a specific age group, as children of different age groups will vary greatly in their learning abilities. However, in most participating schools, the number of learners increased dramatically with the addition of Grades 6 and 7 pupils for the NLCP's Education Officer presentations, which could triple the size of the class. Such large group sizes presented an obstacle to effective engagement with the Grade 5 learners and to NLCP's capacity to evalu-

ate the CEP. Nonetheless, previous experience had shown that actively excluding Grades 6 and 7 learners from lessons caused negative consequences, including disruption as a result of the disappointment of being excluded.

Solution To address this issue, Lolesha Luangwa's new lesson plans in the Teachers' Conservation Guide included activities designed to engage the older learners (Grades 6 and 7 pupils) through a restricted number of 'learning mentors', making use of their presence and prior exposure to the lessons to support the Grade 5 pupils, while reinforcing their own learning.

Capacity building

Problem The Lolesha Luangwa Officer plays a crucial role in the delivery of the CEP but, despite being very experienced, he had no formal teacher training. There was also a need to ensure that Conservation Teachers felt supported with the implementation of this new curriculum.

Solution Coaching was provided to develop the Lolesha Luangwa Officer's understanding of learning theory and practice in areas related to the learning environment, learning styles, active learning, evaluation, and lesson and scheme-of-work planning. Furthermore, a Lolesha Luangwa Assistant was hired to improve the capacity to deliver the programme.

In addition, to ensure buy-in for the redesigned curriculum, and to allow for the changes to be communicated effectively, teacher-training workshops were provided to introduce all the Conservation Teachers to the new curriculum, and to explore the underlying theory and practice upon which it was built. These workshops provided opportunities for the Conservation Teachers to discuss the programme's development, to receive feedback on any specific concerns they may have, and to ensure that their needs and expectations for Lolesha Luangwa were understood.

Establishment of a monitoring and evaluation framework

Problem The CEP had developed a basic monitoring and evaluation plan that required feedback from the Conservation Teachers on lessons taught as well as anecdotal evaluation of the NLCP's Education Officer presentations. This anecdotal evidence showed strong support for the CEP. However, there was no triangulation of data or longitudinal comparison that could allow meaningful study of the impact of the CEP. There was also no feedback to drive and inform updates to the content and structure of the curriculum over time. Following the initial assessment and redesign of the curriculum, there was a need to put in place a framework for the ongoing monitoring and evaluation, to ensure that future changes and updates were evidence based and, therefore, more likely to have a positive impact.

Solution Once the initial redevelopment of the programme had been completed, ZSL worked with NLCP staff to establish a framework for ongoing monitoring and evaluation (Table 1), to assess the impact of the curriculum on the learners and the wider community. An analysis of the outputs from the framework (i.e. questionnaires, photographs of school displays) is used to evaluate whether the intended learning outcomes are achieved, and to ensure that Lolesha Luangwa continues to improve and evolve in response to new opportunities and challenges, as and when they occur.

USING MONITORING AND EVALUATION TO INFORM ONGOING IMPROVEMENTS TO LOLESHA LUANGWA

The results of the first year's monitoring and evaluation provided invaluable data, which enabled immediate changes and updates to be made for the following year, even before the full analysis had been completed. One important theme that began to

TIMING	FOCUS OF EVALUATION	METHOD	CONDUCTED ON	COMMENTS
Over course of year (ongoing)	cognitive and affective impacts of curriculum on learners	pre- and post-curriculum learner questionnaires	Learners	'start of curriculum' and 'end of curriculum' questionnaires to be provided at beginning and end of course, in local languages (10% of Learners selected) feedback form to be completed after visits to schools by LLO/LLA LLO/LLA to distribute forms to Conservation Teachers at beginning of their presentations and collect in at end LLO/LLA to observe one another and give constructive feedback; at least two observations each should be carried out per year, where possible (this could be an observation of a presentation in school or of an activity during a Park visit)
Over course of year (ongoing)	LLO/LLA practice (and general assessment of curriculum)*	reflective self-evaluation Conservation Teacher feedback on LLO/LLA presentations peer observations	LLO/LLA LLO/LLA LLO/LLA	conducted on four out of 12 visits if picture annotations also undertaken, or six out of 12 if picture annotations are not undertaken (50% of Learners selected at random) conducted on four out of 12 visits if picture annotations also undertaken, or six out of 12 if picture annotations are not undertaken (50% of Learners selected at random) conducted on four out of 12 visits (50% of Learners selected at random)
Over course of year (ongoing)	cognitive and affective impacts of Park visits on Learners	pre- and post-visit questionnaires pre and post mind maps	Learners Learners	
Over course of year (ongoing)	general assessment of Park visits content	pre- and post-visit picture annotations (TBC – pending outcome of analysis of 2014 Park visits) exit feedback forms exit feedback forms	Learners Learners Conservation Teachers	
Over course of year (ongoing)	LLO/LLA practice (and general assessment of Park visit content)	reflective self-evaluation	LLO/LLA	feedback form to be completed by LLO/LLA after school Park visits

TIMING	FOCUS OF EVALUATION	METHOD	CONDUCTED ON	COMMENTS
On special-event days (e.g. theatre roadshow in August)	cognitive and affective impacts on secondary audiences	interviews with community	Community	interviews and/or focus groups to be conducted with community members on special-event days, public open days/visits (LLO/LLA and theatre group to conduct these)
At end of each year's curriculum delivery (ongoing)	general assessment of curriculum	post-module Teacher questionnaires assessment of Activity Booklet completion rate	Conservation Teachers Activity Booklets	questionnaire to be completed after each module (i.e. three per year) (LLO/LLA to distribute and collect) data collected by LLO/LLA on completion rate of student Activity Booklets [10% of Booklets selected: c. 5–10 pages per book (exact number may change depending on which pages of the new Activity Booklets need to be reviewed)] Suggested pages: <i>Page 4</i> to see pre-course choice of ticks <i>Page 25</i> to see post-course choice of ticks, and what children have chosen to be the most important things about each subject <i>Page 13</i> and/or <i>Page 16</i> to see if systems concepts have been taught <i>Page 19</i> to see if importance of conservation has been taught <i>Page 22</i> to see if 'picture circling', 'linking words' and 'written activity' system works <i>Page 23</i> to see if local-language activity works <i>Page 26</i> to see if conservation promise has been signed <i>Page 32</i> to see if rhinoceros promise has been completed

Table 1. The monitoring and evaluation framework for Lolesha Luangwa in 2015/2016. The aim is to assess the impact of the Conservation Education Programme on learners and the wider community, and inform its future development. The page numbers given in the 'assessment of Activity Booklet completion rate' relate to the printed Activity Booklet (not shown) given to each student participating in Lolesha Luangwa: LLA, Lolesha Luangwa Assistant; LLO, Lolesha Luangwa Officer; TBC, to be confirmed; *these methods would primarily be aimed at developing the LLO/LLA practice, but may also provide some interesting feedback on the curriculum itself.

emerge early on from feedback from the Conservation Teachers was that the level of English used in the Activity Booklet was too advanced for many of the students. As a result, alterations were made to the Activity Booklet for 2014. In 2015, the Activity Booklet was reduced from 20 to 17 lessons, and given a more comprehensive rewrite to simplify some of the longer written activities, in order to address the same concepts but be more accessible to the linguistic abilities of learners. The age of the students participating in Lolesha Luangwa was also increased from Grade 5 to Grade 6 in 2014 for the same reason. Current feedback indicates that these changes have adequately addressed the language problems students were experiencing.

Finally, the format of the Community Conservation Days was revised, to remove the elements that did not work so well in 2013. For example, the role-play performances by the learners were replaced with a presentation by the Lolesha Luangwa Officer, which sought to engage directly with secondary audiences; that is, the members of the community in attendance.

Adaption and evolution of the monitoring and evaluation methodology

Following these adjustments to Lolesha Luangwa, the monitoring and evaluation itself has also had to adapt and evolve, to assess effectively the updated and newly introduced elements, and establish which methodologies work best and produce the most useful data. Changes to the methodology are also driven by the particular data that need to be captured for funders and for the needs of the CEP.

In 2014, for example, new data-collection techniques, such as personal-meaning mapping, which is designed to capture cognitive and affective changes in learners after a particular intervention (in this case, the Park visits), were trialled, and the learner questionnaires were also redesigned and simplified to require only one-word answers and make greater use of tick boxes. This

was in order to mitigate for the many learners who were not able to answer more lengthy questions, because their reading and writing ability was lower than had been anticipated. In 2015, a pre-post methodology is being used for the first time, which will attempt to capture changes in the knowledge, understanding and attitudes of individual learners over the course of Lolesha Luangwa.

The evaluation data are also important because they make it possible to develop a better understanding of both the schools and community audiences, and identify any cultural, social or economic barriers to pro-environmental behaviours in order to inform improvements to Lolesha Luangwa and the wider work of the NLCP. For example, the community interviews conducted in 2014 revealed that a fear of witchcraft and of being beaten by other members of their community could stop both adults and children from reporting poaching by someone they know to the Zambian Wildlife Authority.

Ongoing development of Lolesha Luangwa

ZSL, SRI and NLCP continue to work together to plan future monitoring and evaluation, creating new materials, collecting and analysing data, making further recommendations for improvements to the programme, developing curriculum materials, and training and developing Lolesha Luangwa staff. Continued monitoring and evaluation will ensure that the programme adapts to the changing needs of the NLCP, the community and the environment.

Capacity building is also important, as it is hoped that in the long term the programme could become self-sustaining, with the appropriate knowledge and skills having been transferred to Lolesha Luangwa staff so that they can continue to develop and refine the programme for themselves.

The impact and learning from Lolesha Luangwa have been extended to other conservation field programmes in Zambia, the

Teachers' Conservation Guide and Activity Booklets have been adopted and adapted by several other programmes, and the monitoring and evaluation framework is being rolled out to four other programmes in 2015.

CONSIDERATIONS WHEN PLANNING AN ENVIRONMENTAL-EDUCATION PROGRAMME

If environmental-education programme planners are to overcome the challenges they face, they must learn to identify these challenges and develop strategies to mitigate against them. Using the processes learned from the Lolesha Luangwa case study, the areas described below should be considered.

What is the objective of the programme?

The environmental-education component of any conservation programme must be guided by the conservation goals, and directed at an achievable impact, in order for it to be relevant to the programme's needs. This requires clear identification of the problem, the target audience and the necessary impact, and the specific, realistic and measurable targets must be defined based upon those needs. Without understanding these objectives, it will be impossible after the fact to know what needs to be done and how it is to be done, or to understand (through evaluation) if the desired outcome has been achieved and to what extent it has impacted on the conservation goal.

Who is the best audience to involve?

Environmental-education programmes can be aimed at a wide range of target groups, such as village officials, local women's groups, elders and school children. A programme should identify what messages it needs to communicate, which target group these messages are aimed at and the best way to reach the target audience. Some

groups may be reluctant, suspicious or inaccessible depending on the culture and situation. In these cases, it may be possible to include others as a mechanism to reach these more difficult groups by proxy. In Uzbekistan, for example, in areas where Saiga *Saiga tatarica* poaching is high, local women's embroidery groups are educated about the importance of Saiga in the local ecosystem and the threats they face, in an attempt to reach male family members who may be involved in the poaching.

School children can be a conduit for conservation education especially among close-knit communities where multi-generational families live together. In the example of Lolesha Luangwa, one of the objectives of the programme is to 'promote key messages to secondary audiences'. This led to activities being included in the Activity Booklet that required the children to complete them at home with their parents, and the development of the Community Conservation Days to help engage the wider community with messages being shared by the children through plays and poems.

Another successful case study that uses school children as message multipliers is 'Rafiki wa Faru' ('Rhino friend' in Swahili) in Mkomazi National Park in Tanzania, which has been developed and supported by Chester Zoo's Education Department, UK, with financial support again sourced by SRI. The programme wanted to address rumours in the community that were questioning the efficacy of the conservation work. Local villagers were suspicious about the activities inside the National Park and the coming and going of international visitors, who they believed were there for illegal game hunting. Rumour also had it that the machinery that villagers saw going into the Park was for the purpose of (illegal) gem mining and the gems were then flown out of the country in a small plane. The plane is actually used for anti-poaching patrols to protect the wildlife and the machinery is used for all-weather road building, the construction of a wildlife

protection fence and other conservation infrastructure. The international visitors were in fact conservationists. The programme took pupils at the start of secondary education out of school and into the Park so they could witness the conservation work and see for themselves the wildlife legacy that is being established. The intention was that the pupils would report what they have seen to their families when they returned home in an attempt to dispel these rumours. This was reinforced by the provision of an Activity Booklet, also designed to be taken home and read by parents.

In addition to identifying the target audience, it is also important to identify who are the best people to deliver the programme. This person/group needs to be a trusted voice for the audience with whom you are communicating and have influence. This can often be local teachers, but can also be an influential figure from within the community.

Does the programme have the appropriate skills and resources?

Many conservation practitioners do not have the appropriate pedagogical training as they have to fulfil their role as educators in addition to their main work responsibilities, which could be wildlife monitoring and anti-poaching activities. In the example of Lolesha Luangwa, and with Rafiki wa Faru, it was felt that sourcing the appropriate skills from within the zoo community was the best way to recruit the necessary expertise for the programme. In addition to the skill sharing from the education departments in both ZSL and Chester Zoo, in early 2015, an exchange visit was arranged for the Lolesha Luangwa's Officer to go to the Mkomazi National Park so he could see how Rafiki wa Faru operated. This provided an opportunity for sharing of experiences, ideas and teaching methods between the two programmes, and for peer networking, so often absent from environmental-education programmes where educators work in isolation.

Learning professionals from most backgrounds will be experienced in learning theory and practice, and knowledgeable about the needs of a school audience. However, what makes teaching staff from zoological institutions an ideal fit for these field-based projects is that they have specific experience in communicating biological principles and wildlife-conservation issues, as well as in designing activities that aim to foster long-term sustainable behaviours. To ensure that an environmental-education programme can deliver real conservation outcomes, conservation practitioners need to ensure the programme has access to the appropriate expertise, whether that is in-house or sourced from an appropriate third party.

Is the programme achieving its objectives?

Conservation programmes often suffer from limited funding, and a lack of long-term support and capacity, so it is essential that any activity, including the environmental-education programme, is working towards its goals effectively. Monitoring and evaluation is important to ensure early identification of any activities in an environmental-education programme that are not performing well so they can be corrected (Pádua & Jacobson, 1993). However, adequate monitoring and evaluation of environmental-education programmes are often absent. O'Neill (2007) reviewed 37 conservation projects that ran environmental-education programmes, and fewer than one-third of these programmes included formal systems for evaluating effectiveness and impact. Frameworks for monitoring and evaluation also need to include education outcomes, such as 'the children have a good understanding of the benefits rhinos bring to their communities', not only a list of outputs (i.e. 2000 pupils have attended the programme).

Monitoring and evaluation of Lolesha Luangwa identified priority key areas for improvement, such as reducing the number of lessons in the curriculum. Continuous

cyclical monitoring and evaluation that feeds into adaptations to the programme are essential. In the case of Lolesha Luangwa, this has allowed important improvements to be made even after the initial assessment, such as reducing the amount of written English required to complete the Activity Booklets and, instead, providing other ways for learners to demonstrate their knowledge and understanding of the subject matter; for example, drawing, using tick boxes and matching, 'fill in the missing word' activities, identifying and circling bad/good practices in diagrams and labelling pre-drawn pictograms.

The monitoring and evaluation framework must seek to measure whether the objectives of the environmental-education programme are being met to provide evidence of success of both the education goals and ultimately the conservation goals of the overall programme.

Is the monitoring and evaluation process appropriate for the target audience?

Monitoring and evaluation are essential to all environmental-education programmes; however, there is no universal way these should be applied as so many factors will vary, particularly between different countries and cultures. Questionnaires can be a useful tool but where rates of illiteracy are high, face-to-face interviews can offer an alternative. However, this approach presents its own set of challenges, in that an eagerness to please is more pronounced in some cultures than others, often providing misleading results. Gaining access to research participants can be another issue. For example, in some cultures, the voices of children and women are never heard, and access may be prohibited or oppressively monitored by teachers or other figures of authority. Therefore, it is important that evaluation methods are adapted to suit the situation. The chances that an effective evaluation framework will be implemented will be higher when there is a good understanding of the target audience. Chester

Zoo's Education Department has experimented with the use of drawings as an evaluation tool when dealing with school children to overcome some of the difficulties staff faced. They found this to be a child-centred, inclusive approach, which allowed the voices of pupils to be heard. Chester Zoo adapted and applied this approach using slightly different methods in several countries with differing degrees of success. When it was applied as an evaluation tool for Rafiki wa Faru, it was found that the children were prepared to write but not to draw because they were unfamiliar with drawing, having never had the opportunity or the materials to do so (Esson & Moss, 2016). Therefore, the evaluation tool had to be amended to suit the capabilities of this target audience. A similar problem was identified in some of the drawing exercises in the Activity Booklet in Lolesha Luangwa, where the learners were also unfamiliar with drawing from scratch. This highlights the need for cultural insight when designing an evaluation framework.

CONCLUSION

The Lolesha Luangwa CEP is ongoing and, therefore, no final-impact evaluation has been carried out as yet. To date, the focus has been on evaluating learning outcomes to measure whether the programme is achieving its key aims. Lolesha Luangwa operates within a complex multifaceted conservation strategy with changing external factors (i.e. demand, social, economic, enforcement, training, management) all playing a part. Because these factors are ever changing, the impact of one element within that landscape (e.g. Lolesha Luangwa) is also changeable.

Although it is not possible to relate the participating children's knowledge about rhinoceros directly to improved protection, Lolesha Luangwa has created the conditions for developing personal connections to wildlife and has placed these in an educational framework that allows the participants to envelop that process within a

cognitive understanding of the ecological context, including the role and influence of human beings. Using the 'head, heart and hands' concept, there is some degree of certainty that the programme is achieving impacts in the first two categories, which can be justified with the data available. In theory, this should create a more positive atmosphere and improve community support for other direct management activities (e.g. enforcement, habitat management, external drivers), although this cannot be conclusively stated from the current data.

Environmental-education programmes can be a useful tool to achieve a conservation impact; however, they require investment of resources and can often take a substantial amount of time to achieve their intended outcome (Engels & Jacobson, 2007; Ardoin & Heimlich, 2013). When deciding what conservation tools to employ, practitioners and educators need to consider whether or not they have the correct elements in place to make an environmental-education programme, an effective conservation tool.

The Lolesha Luangwa case study, with the various changes it has gone through and challenges it has overcome throughout its existence, provides a valuable example of an environmental-education programme from which other projects can learn and use as an evidence base to aid the development and implementation of their own programmes. Ultimately, working towards a position where well-designed curriculums, based on solid learning theory, that are constantly evaluated and updated to suit the needs of the learners and the local environment, is the norm among conservation projects throughout the world.

ACKNOWLEDGEMENTS

We would like to thank the Discovery and Learning team at the Zoological Society of London (ZSL) for their ongoing support to Lolesha Luangwa. We would also like to thank Cathy Dean from Save the Rhino International for her support both to Lolesha Luangwa and the development of this paper. We would like to thank Dr Maggie Esson, Education Programme Manager at Chester Zoo. Maggie has mentored and sup-

ported Rafiki wa Faru and has contributed to this manuscript. Finally, we would like to thank Claire Lewis, Technical Advisor to the North Luangwa Conservation Programme, whose leadership and dedication has driven so much of the development and implementation of Lolesha Luangwa.

REFERENCES

- ARDOIN, N. M. & HEIMLICH, J. E. (2013): Views from the field: conservation educators' and practitioners' perceptions of education as a strategy for achieving conservation outcomes. *Journal of Environmental Education* **44**(2): 97–115.
- CBD (2010): *Strategic plan for biodiversity 2011–2020 and the Aichi targets: "living in harmony with nature"*. Montreal, QC: Secretariat of the Convention on Biological Diversity. Available at <https://www.cbd.int/sp/targets>
- DUNHAM, K. M. (2001): *Reintroduction of black rhino in the Luangwa Valley, Zambia*. Harare: Southern African Development Community Regional Programme for Rhino Conservation.
- ENGELS, C. A. & JACOBSON, S. K. (2007): Evaluating long-term effects of the golden lion tamarin environmental education program in Brazil. *Journal of Environmental Education* **38**(3): 3–14.
- ESSON, M. & MOSS, A. (2016): Evaluating conservation education across cultures. *International Zoo Yearbook* **50**: in press.
- HOWE, C. (2009): *The role of education as a tool for environmental conservation and sustainable development*. PhD thesis, Imperial College London, UK.
- INTERNATIONAL ZOO EDUCATORS ASSOCIATION (2015): *Conservation education*. Tampa, FL: International Zoo Educators Association. Available at <http://izea.net/education/conservation-education-theory-and-practice> (accessed 8 June 15).
- IUCN (2015): *The IUCN Red List of Threatened Species*. Gland, Switzerland and Cambridge, UK: International Union for Conservation of Nature. Available at <http://www.iucnredlist.org>
- LEADER-WILLIAMS, N. & ALBON, S. D. (1988): Allocation of resources for conservation. *Nature* **336**: 533–535.
- O'NEILL, E. (2007): *Conservation audits: auditing the conservation process. Lessons learned, 2003–2007*. Washington, DC: Conservation Measures Partnership. Available at http://cmp-openstandards.org/wp-content/uploads/2014/03/Conservation_Audits_FINAL_DRAFT_31_July_2007.pdf (accessed 8 June 2015).
- PÁDUA, S. M. & JACOBSON, S. K. (1993): A comprehensive approach to an environmental education program in Brazil. *Journal of Environmental Education* **24**(4): 29–36.

Manuscript submitted 29 June 2015;
revised 3 February 2016; accepted 5 February 2016