

MAXIMISING THE VALUE OF RANGER-COLLECTED DATA FOR ENHANCED ADAPTIVE MANAGEMENT OF ZIMBABWE'S PARKS AND WILDLIFE ESTATE

Policy brief developed by the Zimbabwe Parks and Wildlife Management Authority in collaboration with the University of Oxford



FOREWORD/ENDORSEMENTS

Our ranger-based monitoring system in protected areas has stood the test of time and it is important to enhance the utility-value of ranger-collected data.

The Parks and Wildlife Management Authority remains committed to ensure cost-effectiveness of such data and this guiding framework is important to maintain functional feedback loops into park management decision making, in a standardised approach. Wildlife law-enforcement is one of the costly undertakings that we face on a daily basis and its effectiveness requires simple and sustainable monitoring tools. Improving ranger patrol efficiency can increase detection of illegal activities in protected wildlife areas and improve our wildlife resource protection endeavours.



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EXECUTIVE SUMMARY

Across Zimbabwe’s Parks and Wildlife Estate, which covers 13% of the nation’s land area, thousands of rangers go out on patrol, 365 days a year.

Rangers collect a variety of law enforcement data (illegal activities and poaching) as well as ecological data (animal sightings, status and distribution of water and vegetation). These data can inform the decisions and actions of Park Managers as they seek to conserve biodiversity and reduce illegal activities both inside and outside Protected Areas.

This policy brief is targeted at staff of the Zimbabwe Parks and Wildlife Management Authority (hereafter, ZPWMA). It provides guidelines for ZPWMA staff (senior management, ecologists

and research staff, and field operations staff) on how to maximise the use of ranger-collected data for biodiversity conservation and law enforcement across all the country’s Parks (National Parks, Recreational Parks, Sanctuaries and Safari Areas). Adaptive management, a form of structured decision making, is recommended as the main framework for ensuring that monitoring data inform better management decisions and action. The Spatial Monitoring and Reporting Tool (SMART) is recommended as a potential tool to help implement adaptive management and structured decision making, though other tools are also discussed.

We highlight four Key Action Areas (each with specific action points):

1. Create ownership:

This will involve addressing the concerns ZPWMA managers have with data-based adaptive management, and demonstrating clearly to them how the approach can help them. If Park Managers do not understand and see the value of adaptive management, it will not be adopted.

2. Promote collaboration between science and management:

ZPWMA scientific staff play a key role in helping management staff with the more technical aspects of adaptive management (like data analysis).

3. Boost human capacity:

Identify key ZPWMA staff at each Park and Station to act as “Data Champions” who take primary responsibility for promoting adaptive management at their site. There is also a need to train ZPWMA staff in adaptive management principles, as well as data management and interpretation.

4. Support translation of data to decisions:

Develop strategies and tools to translate data trends into improved management decisions in a systematic way (such as threshold threat levels or a traffic light system based on ranger-collected data that trigger specific management actions or decisions).

Finally, we specify eight practical steps for Park-level adoption of adaptive management and structured decision making, and make recommendations to ZPWMA on the next steps for implementation of these guidelines.

Overall recommendation:

Managers, Wildlife Officers, Data Champions, and Ecologists should work together to implement adaptive management at the Park level. The adaptive management cycle involves strategically using ranger-collected data to inform and update management decisions and actions.

Managers should set out to learn from monitoring data about whether their actions are working to achieve their management goals, and change them if not. Data Champions (trained staff at the station-level) and Ecologists should take primary responsibility for conducting analysis of trends in ranger-collected data and helping Managers interpret data outputs (computer graphs and maps).

Area Managers and Wildlife Officers should take responsibility for using these outputs to guide their decisions in a structured way, such as to evaluate the effectiveness of their management interventions and update them where necessary.

Suggested citation:

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PARTICIPATORY AND RESEARCH-BASED

This brief builds on three years of research on ranger-based monitoring of poaching in the Zambezi Valley, carried out by University of Oxford in collaboration with ZPWMA. Click the link below (or see QR code), for a research summary and the below two published papers: (Kuiper et al., 2020a*, 2020b**).

Senior ZPWMA staff have deemed the findings of this research relevant to national-level policy for ranger-based monitoring in Zimbabwe and have therefore worked with University of Oxford to develop this policy brief.

The recommendations herein have been developed using a participatory process in which the ZPWMA Directorate, Regional Managers, Ecologists, and field staff have provided inputs through online workshops.



*Kuiper, T., Kavhu, B., Ngwenya, N.A., Mandisodza-Chikerema, R., Milner-Gulland, E.J., 2020a. Rangers and modellers collaborate to build and evaluate spatial models of African elephant poaching. *Biol. Conserv.* 243, 108486. <https://doi.org/10.1016/j.biocon.2020.108486>.

**Kuiper, T., Massé, F., Ngwenya, N.A., Kavhu, B., Mandisodza-Chikerema, R.L., Milner-Gulland, E.J., 2020b. Ranger perceptions of, and engagement with, monitoring of elephant poaching. *People Nat.* pan3.10154. <https://doi.org/10.1002/pan3.10154>.

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This brief builds on three years of research on ranger-based monitoring of poaching in the Zambezi Valley.

Three rangers working in the Zambezi Valley, Zimbabwe. The data that rangers collect on patrol can help inform better law enforcement and biodiversity protection across all of Zimbabwe's Parks.



Steps in implementing these policy guidelines

Persons Responsible	Steps each group would be responsible for	When
Senior ZPWMA Management: Director General (DG), Deputy DG Conservation, Director Operations, Director Scientific Services, Chief Ecologists (Terrestrial and Aquatic)	STEP 1: Convene high-level meetings to evaluate these policy recommendations, and modify or adapt them to fit current ZPWMA institutional structures and processes. Identify key ways to implement the recommendations or to feed them into existing processes (like PA Management Plans). STEP 2: Review the four Key Action Areas and conduct an assessment of the feasibility and priority of each Key Action Point. Develop a strategy for how, when and where the most feasible and important action points will be implemented. This may involve selecting priority Regions for implementation, with a view to eventual national roll-out. STEP 3: Develop a clear budget for implementing the prioritised action points in the priority Regions. Assess financial feasibility and identify internal ZPWMA funding sources or external international funding.	Year 1
Mid-level ZPWMA staff: Regional Managers, Regional Ecologists	STEP 1: Work with Senior Management on steps 2 and 3 above. STEP 2: Conduct regional workshops to further develop the priority action points identified above into specific actions and operating procedures that are tailored to particular Parks in their Region.	Years 1-2
Park-level field staff: Area Managers, Wildlife Officers, Regional Ecologists	Implement the priority action points identified and developed above, and follow and adapt the eight steps for Park-level implementation of adaptive management (see page 28).	Years 2-3

FEEDING INTO ZPWMA'S NATIONAL AND INTERNATIONAL MANDATES TO CONSERVE BIODIVERSITY

Under the 1975 Parks and Wildlife Act (amended 1996 and 2001), the ZPWMA is mandated to sustainably manage and maintain all wildlife in Zimbabwe and has control over a Parks Estate covering 13% of the nation's land area.

This policy brief identifies specific ways that ZPWMA can boost this mandate through more effective use of ranger-collected data for enhanced adaptive Park management. Innovation is listed as one of the core values of ZPWMA in its 5-year (2019-2023) Strategic Plan (ZPWMA, 2018¹) and this policy brief identifies key opportunities for innovation. In particular, more effective adoption of ranger-based monitoring and adaptive management across Zimbabwe's Parks and Wildlife Estate will:

National

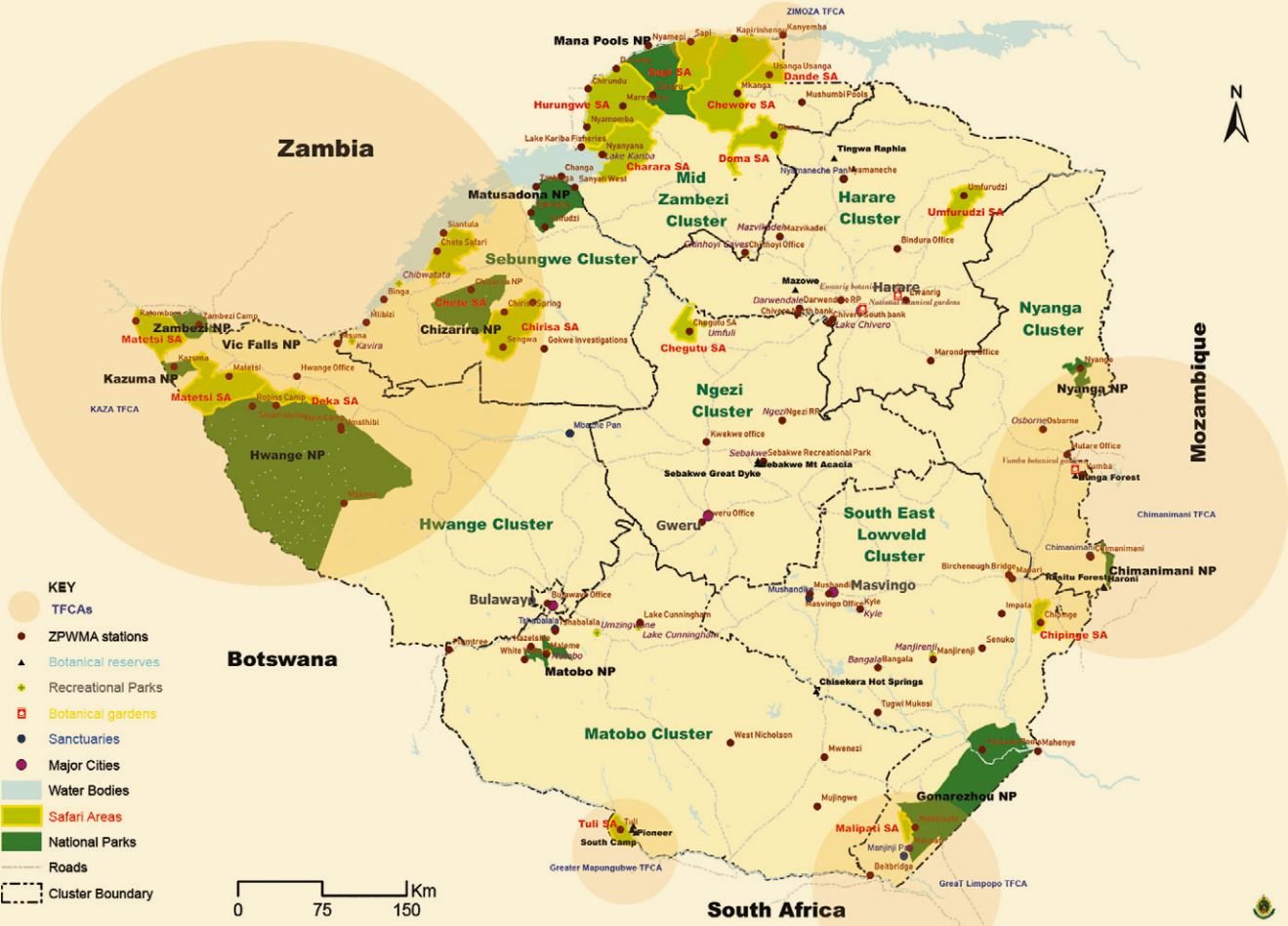
- Improve Park-level management, leading to reduced poaching and better protection of wildlife resources, which will in turn boost the potential for revenue generation and commercialisation.
- Feed into the Protected Area Management Plans (PAMP) in each of Zimbabwe's Parks (ranger-based monitoring and adaptive management are key tools to support effective management).
- Feed into the computerized integrated management system (ICE) being adopted across ZPWMA.
- Feed into the Elephant Management Plan and other Species-specific management plans.
- Feed into the ZPWMA Research Policy to help ensure research informs practical adaptive management.
- Align well with the ZPWMA structure of decentralised management Regions, by providing key tools and information for strategic local management.
- Feed into the National SMART Implementation Plan currently being implemented by ZPWMA under a Global Environmental Facility (GEF 6) grant.

Regional and international

- Help ZPWMA fulfil its obligations to The Southern African Development Community Law Enforcement and Anti-Poaching strategy (SADC LEAP), which recommends that "the collection of management-relevant monitoring data is crucial, as is management's understanding [and use] of the data provided" (SADC, 2016²).
- Help achieve the vision of ZPWMA "to become a world leader in sustainable wildlife conservation". More effective adaptive management will help ZPWMA excel at meeting its obligations to global conventions such as the Convention on Biological Diversity (CBD), the Convention on the International Trade in Endangered Species (CITES), and the World Heritage Convention (WHC).

The recommendations in this policy brief are relevant to National Parks, Safari Areas, and Sanctuaries across Zimbabwe.

Parks and Wildlife Management Authority



“
Ranger-collected data helps inform elephant anti-poaching strategies

Inform decisions:

“We can make some decisions from those trends in poaching.”

Evaluate management:

“If every year rangers record more and more carcasses...then you must know your management plans are lacking somewhere.”

Track poaching:

“Help us to know, ‘is poaching increasing or decreasing and why?’”

Target hotspots:

“We can plan areas of deployment based on carcass hotspots.”

Quotes from Park Managers in the Zambezi Valley, Zimbabwe

PART 1 -
WHAT IS ADAPTIVE MANAGEMENT?

Adaptive management is an effective tool for translating ranger-collected data into better Park management decisions. ZPWMA strongly promotes adaptive management as it seeks to align itself with other countries who have adopted this approach with success (van Wilgen and Biggs, 2011³). Notably, the ZPWMA 5-year Strategic Plan (2019-2023) has identified adaptive management as one of five top guiding principles for the organisation. So, what is adaptive management?

Adaptive management is designed to help managers make good decisions in the face of uncertainty. It is a form of structured decision making in which managers use trends in monitoring data to inform their decisions in a strategic way.


Adaptive management is not the same as “trial and error”. The key difference is that adaptive management is strategic - making sure that the

monitoring data you gather feed into actions in a planned and iterative way, in order to meet pre-determined goals. You also set out to learn, whether actively (through experimentation) or passively (through collecting the right kind of data and analysing it to see whether your plans are working and changing them if not). Ecologists/scientists have an important role to play through analysing monitoring data and helping managers to interpret and use the results.

An example of an adaptive management cycle to reduce bushmeat hunting is shown in Figure 1. Managers first implement targeted patrols and community intelligence to tackle bushmeat/ subsistence snaring (step 1), but careful analysis of ongoing data from ranger patrols (steps 2 and 3) shows that bushmeat snaring continues to increase. Managers therefore adapt their management actions, perhaps choosing to increase patrol effort and coverage (step 4). Then the cycle begins again.


A. Goal: Reduce bushmeat poaching

Possible Management Actions:




More patrols

Increase patrol effort and coverage to find and deter poachers




Targeted patrols

Focus on areas where snares found previously (hotspots)



Fines

Increase fines for people caught poaching



Community intelligence

Informants in the community to help catch poachers

Which strategy is best?



B. Adaptive management to achieve the goal



Figure 1. An example of adaptive management, showing (A) the management goal and possible actions, with the question being which strategy (combination of actions) would work best and (B) the adaptive management cycle to achieve the goal, with some examples of actions in the boxes.

There is a lot of uncertainty about how ecological systems work and how they might respond to management actions. A protected area involves complex interactions between biodiversity and people, and it is difficult to understand these interactions and how they will respond to management. Questions might include: Will tree cover return if elephants are translocated? Are poaching levels increasing or staying the same? Will rhino poachers avoid the Park if patrol effort is doubled?

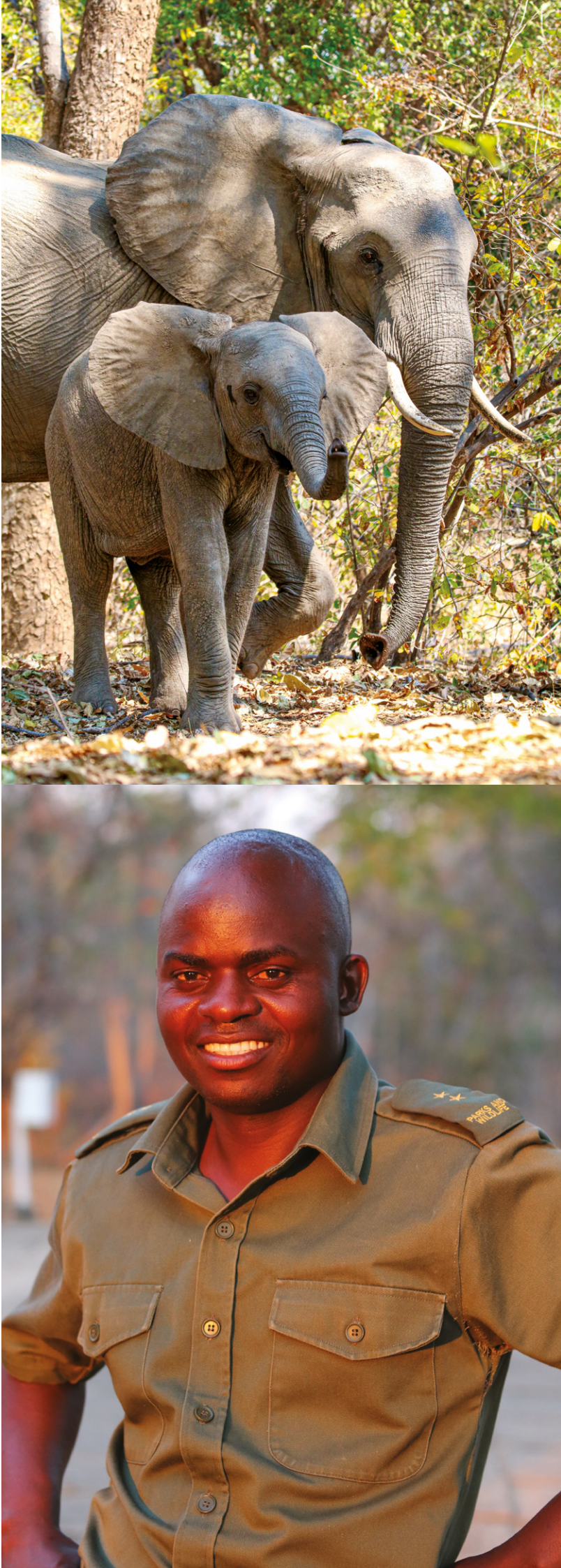
Adaptive management helps managers to answer these kinds of questions through a process of “learning by doing”. It involves a repeated cycle of learning from the success or failure of management actions by collecting ongoing monitoring data to see how key species and threats respond to management actions, and then changing (adapting) management actions where needed. In this way, management action taken now can lead to learning, supporting improved management later on. Importantly, adaptive management is NOT just “trial and error”. Instead, it involves a systematic approach to identifying knowledge gaps that may reduce the effectiveness of management and collecting information to fill those gaps.

Managers can use adaptive management to tackle many different management problems (such as fires, big game poaching, illegal fishing or mining, woodcutting, or invasive species). Rangers are able to collect data on all these threats while on patrol, and these data can contribute to effective conservation action if they are analysed well and feed into management decisions. Importantly, adaptive management does not always involve quantitative data and can also be based on qualitative data. For example, a manager may use notes from a discussion with local residents (local ecological knowledge), or a report from an intelligence and investigations team, to guide management decisions.

Research interviews with Park Managers helped us better understand what they think of data analysis and adaptive management. The policy recommendations developed here take into account these perspectives and the challenges that managers face (see below for a full summary of research results).



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Box 1:

A case-study of adaptive management in Kruger National Park, South Africa

In Kruger National Park, adaptive management has helped guide policy around artificial waterpoints, fire management, and elephant population control³. In the 1980s, Park Managers implemented artificial waterpoints to help boost⁸ the populations of various key species (such as antelope and the predators dependent on them).

Managers were uncertain about how Park ecosystems would respond so they worked with scientists to collect ongoing data on populations of elephants, antelopes, lion and other species. Managers and scientists eventually learned from the data that the waterpoints created many new problems (such as elephant overpopulation, or common antelope species benefiting from water and outcompeting rare antelope).

Current management in Kruger now involves closing down many of these waterpoints. A similar route was taken by the management of Gonarezhou National Park, with the closing down of most artificial pumping.



“

What do Park Managers think of adaptive management?

“To date I have not used a graph and I have no problem with that. Graph or no graph...I know what is happening in my area.”

“Currently management in the Zambezi Valley is reactive, it’s not adaptive management that is data driven.”

NGO Leader

“The research guys have the responsibility to analyse the data, and then give us managers advice.”

“Our reports from ranger patrols are straight away pins on the operations map, showing carcasses and poacher activities.”

“People prefer to use what they are used to, like the map on the wall, unlike this data-management and analysis. These sophisticated tools take time...”

“Until managers see how these [data-based management] systems improve what they do, they find it hard to buy into it.”

Senior ZimParks staffer

Quotes from park managers (unless otherwise indicated) in the Zambezi Valley, Zimbabwe

Thinking strategically: structured decision making (SDM)

Adaptive management is a type of structured decision making (SDM) - a widely used tool for improving the quality of decisions in natural resource management around the world (Gregory et al., 2012⁴). SDM is a way of thinking strategically about achieving management objectives, and we recommend that ZPWMA adopts this approach alongside adaptive management (they go hand in hand). **SDM involves three basic parts:**



1. Setting management objectives (e.g., to reduce invasive species coverage in a Park by 50%).



2. Identifying possible alternative management actions to choose from.



3. Predicting the potential consequences of these actions (Lyons et al., 2008⁵).

The overall idea is to think strategically and clearly about how well the different management options will meet the management objectives. An important part of SDM is that scientists/ecologists must work closely with managers to suggest potential management actions, and help predict and monitor the outcomes of these actions. The SDM approach also allows managers to incorporate the perspectives and values of different stakeholders affected by the management problem (local communities, tourists, scientists, sport hunters, etc.) at step 2, and the costs and trade-offs of those actions, at step 3. It is important to note it is not a rigid and prescriptive set of procedures for making decisions, but rather a way of thinking strategically about decisions using some key concepts (like having a clear objective and a set of management actions to evaluate).

A practical example of SDM from Zimbabwe is the establishment of semi-permanent anti-poaching base camps in Mana Pools NP in 2016-2017. At this time the Zambezi Valley was experiencing high elephant poaching levels, and managers began thinking strategically about management options (normal patrols were not reducing the threat). Analysis and maps of the locations of elephant carcasses detected by rangers in Mana Pools (long-term monitoring) helped identify the best locations to erect new anti-poaching sub-camps. Key stakeholders helped implement the fly camps and over time many poachers were apprehended, and poaching levels declined. Ongoing monitoring revealed this positive effect and completed the feedback loop indicating that these fly camps should be retained.

SMART as a tool for adaptive management and structured decision making

SMART (Spatial Monitoring and Reporting Tool) is a piece of computer software designed to help managers actually carry out adaptive management. It provides tools for storing, analysing, and reporting data to help address specific management problems. As part of its 5-year strategy (2019-2023), ZPWMA aims to “introduce state of the art Park monitoring and reporting technology” (like SMART) as part of Key Result Area 1: Conserving Biodiversity (ZPWMA, 2018). Starting in 2021, SMART is being rolled out nationally by ZPWMA with the help of a large Global Environmental Facility (GEF 6) grant. To date, however, SMART roll-out has been mostly

externally driven, and there is need for greater internal investment in and ownership of SMART within ZPWMA structures. SMART is not the only tool for storing and analysing data to inform management (there are other real-time tools like Earth Ranger, the Domain Awareness System, and Sapelli), but it is a widely used tool around the world so there is a lot of experience and support to draw upon. We recommend that ZPWMA continue to promote and roll out these tools and we provide specific recommendations for this in Part 3 (see page 26).

Managers already use ranger-collected data to guide patrols - how is adaptive management different and what are its advantages?

Our research found that managers do see ranger-collected data as important. During patrol briefing sessions, managers regularly instruct rangers to monitor and report on illegal activities and other observations (like water and vegetation status or animal sightings) during patrols.

After the patrol, rangers provide a debrief on their activities and observations, and then managers use this information to guide future patrols. However, we found that managers currently use ranger-collected data in basic and short-term ways, such as using data from one hardcopy patrol report to guide the next one or two patrols, or identifying poaching hotspots using pins on a physical map in the office. Managers also rely heavily on experience, a qualitative understanding of past poaching trends, informer feedback, as well as instinct (gut feeling) when making anti-poaching decisions.

These traditional and ‘paper-based’ forms of management can be very effective in many contexts and should not be abandoned. Managers’ experience and instinct are hugely valuable. Adaptive management is not about replacing traditional management, it is about complementing and enhancing management overall.

Adaptive management – and data management tools like SMART – will help managers use data in a more systematic and longer-term way, to strategically learn about the success or failure of management actions. There is a need to move beyond only using data from one patrol debrief in the briefing for the next patrol and instead to embrace longer-term and more strategic analyses of data to inform decisions. This will have many advantages (see Box 2 on page 16).



Box 2:

Advantages of data-based adaptive management

1. Track threats to biodiversity:

Allows managers to keep track of longer-term patterns in ranger-collected data (such as SMART bar graphs of illegal fishing levels from year to year, or digital maps of illegal woodcutting locations). This can help flag up new and growing threats.

2. Improve management actions:

Allows managers to evaluate how these longer-term patterns respond to management actions, so that they can better measure the performance of actions:

- a. If bushmeat snaring continues to increase this may indicate current patrol strategy or effort is not sufficient to deter poachers, or that other strategies are needed.
- b. If elephant poaching declines after investment in community intelligence operations, this may show this is an effective strategy and encourage greater investment.

3. More accurate conclusions:

Helps managers avoid poor conclusions that may come from using short-term raw data directly. For example, carcasses detected by rangers in the last few months may not represent overall poaching hotspots but only show where rangers have been patrolling recently. A systematic digital analysis of the locations of carcasses and patrol coverage over the last few years can lead to a better understanding of poaching dynamics and hotspots and thus better strategic patrols.

4. Monitor patrol coverage:

Allows managers to track patrolled and unpatrolled areas more accurately. This information can then be used to guide decisions to ensure good strategic patrol coverage.

5. A long-term and standardised database:

Comprising all patrol observations, to be used for current and future management (compared to manager knowledge/ experience otherwise being lost when a manager is transferred).

6. Effective reporting against targets:

Allows Regional Managers and the directorate to receive standardised reports on biodiversity and poaching data trends, which can be used as indicators of management performance and progress towards Park-level, national and international targets.

PART 2 -

WHAT CAN ZPWMA DO TO BOOST ADAPTIVE PARK MANAGEMENT THROUGH MORE EFFECTIVE USE OF RANGER-COLLECTED DATA?

Adaptive management remains an abstract and unclear concept for many managers on the ground in Zimbabwe, and the uptake of SMART has been slow. The biggest barrier is poor buy-in (managers do not understand and value adaptive management). Our research has identified key reasons for the poor uptake of adaptive management, and in this policy brief we identify opportunities for achieving more effective on-the-ground uptake.

We recommend actions in four areas, before specifying eight steps for Park-level implementation of adaptive management.



KEY ACTION AREA 1 -
Create buy-in and understanding of
adaptive management among Regional and
Area Managers, Ecologists, and Rangers.

Training managers in adaptive management and SMART is essential (this is discussed in Key Action Area 3 below), but **a first step before training is to ensure managers show interest and buy-in to adaptive management in the first place.** Interviews with Area Managers and Wildlife Officers revealed that they did not fully understand or appreciate how data-based adaptive management could improve their work. While managers do value and use patrol data, their use of data is very basic (such as carcass pins on a map on the wall) and short-term (the data from one patrol guides the next patrol). Most managers did not see the advantage of tools like SMART and computer-based management (such as digital maps of patrol coverage, or bar graphs of changes in poaching over time) compared to traditional management based on intuition, experience and basic use of patrol data. **Two actions points will help create greater uptake among managers:**

Key Action Point 1: Conduct workshop consultations with Area Managers and Wildlife Officers to raise awareness about adaptive management and allow them to share their concerns.

These consultations will have two main goals:

1. Allow managers to share their thoughts about adaptive management and SMART, and how these tools can be better designed to meet their management context and needs.

Where possible, it is important that this is done before the full roll-out of data-based adaptive management, so that manager feedback can be incorporated into the implementation strategy. This will help managers feel like their views and concerns have been considered beforehand, and they will then be more likely to adopt and effectively implement adaptive management and SMART within their respective Parks and Stations.

2. Raise awareness among managers of what adaptive management is, and demonstrate clear, specific and tangible examples of how it might work in practice to help address their management problems.

There is a need to demonstrate more clearly to managers what data-driven adaptive management is, how it works, and specific ways it can help them address their management priorities (Part 1 outlines some of this). Our research suggests that adaptive management remains unclear for many managers. Managers need to be given clear examples of adaptive management in practice – specific ways that they can use data analysis to improve their management. Without a clear idea of examples and advantages of adaptive management, managers are likely to prefer traditional approaches.

Research also suggests that the current organisational culture of ZPWMA strongly emphasizes collecting data and reporting it to higher levels (regional and national) without actually using the data locally. ZPWMA senior and mid-level staff should compile a set of compelling examples of adaptive management in practice, that are relevant to managers and field staff, and talk them through at the consultations (and potentially create a booklet). These examples may be drawn from areas in Zimbabwe where adaptive management is being implemented successfully (e.g., Gonarezhou National Park).

Key Action Point 2: Conduct consultations with ZPWMA Ecologists to get their perspectives on adaptive management and raise awareness of the crucial role of science in adaptive management.

As highlighted above, managers may not carry out adaptive management effectively without the collaboration of scientific staff (see also Key Action Area 2 below). It is thus crucial that scientific staff within ZPWMA (Ecologists) are given an opportunity to share their thoughts on adaptive management. Similar to Area Managers and other field staff, Ecologists may also not have been trained in SDM processes or adaptive management. Therefore, they too may need capacity-building to enable them to support the managers in adaptive management.

*Training managers in
adaptive management
and SMART is essential*

KEY ACTION AREA 2 -

Promoting greater collaboration between ZPWMA management and scientific staff to implement adaptive management together.

The effective implementation of adaptive management relies heavily on good science and research. It is therefore essential that ZPWMA Managers engage the services of ZPWMA scientific staff for the more technical aspects of adaptive management and structured decision making. Similarly, managers should take steps to communicate their management objectives clearly to scientific staff so that they can carry out the analyses that managers need. External researchers and scientists (outside ZPWMA), at both local and international institutions, can also play an important role conducting research and data analysis to help

inform local adaptive management. For example, Kuiper et al., 2020⁶ analysed ranger-collected data from Chewore Safari Area to identify long-term poaching hotspots. This can help address capacity and resources shortages within ZPWMA.

Note: not every Park will have a resident ZPWMA Ecologist, so some Ecologists may need to visit several Parks under their jurisdiction to fulfil their role in helping managers with adaptive management. Where budget allows and if there are other scientific needs, employment of additional Ecologists may be beneficial.

Key Action Point 1: ZPWMA scientific and management staff (Wildlife Officers, Area Managers, Ecologists and database managers) must work together to develop a shared adaptive management workplan, with each player having a specific role.

In the eight steps for practical implementation below, we recommend that each Park develops its own adaptive management strategy guided by the Regional operations strategy. It is crucial that ZPWMA Ecologists are involved in this process. While managers will take the lead in identifying the key management objectives (the first step of structured decision-making), Ecologists can help predict the outcomes of different possible actions, and also identify the protocols for analysing ongoing ranger-collected data (and other research data) to assess whether these management objectives are being met. Ecologists therefore need to take the lead on the analysis element of adaptive management and help promote the learning that leads to improved management.

Specific actions: (a) Provide training to Ecologists on the concepts and analytical tools for SDM and adaptive management. (b) Give Ecologists the Continuing Professional Development time to attend this training and develop their skills. (c) Consult on how best to support Ecologists to do these analyses, for example through a Community of Practice and/or regular opportunities to update their skills (e.g., via the international SMART consortium). (d) Provide training for Managers and Wildlife Officers in the understanding and interpretation of data outputs such as computer GIS maps, and bar and line graphs of varying complexity.

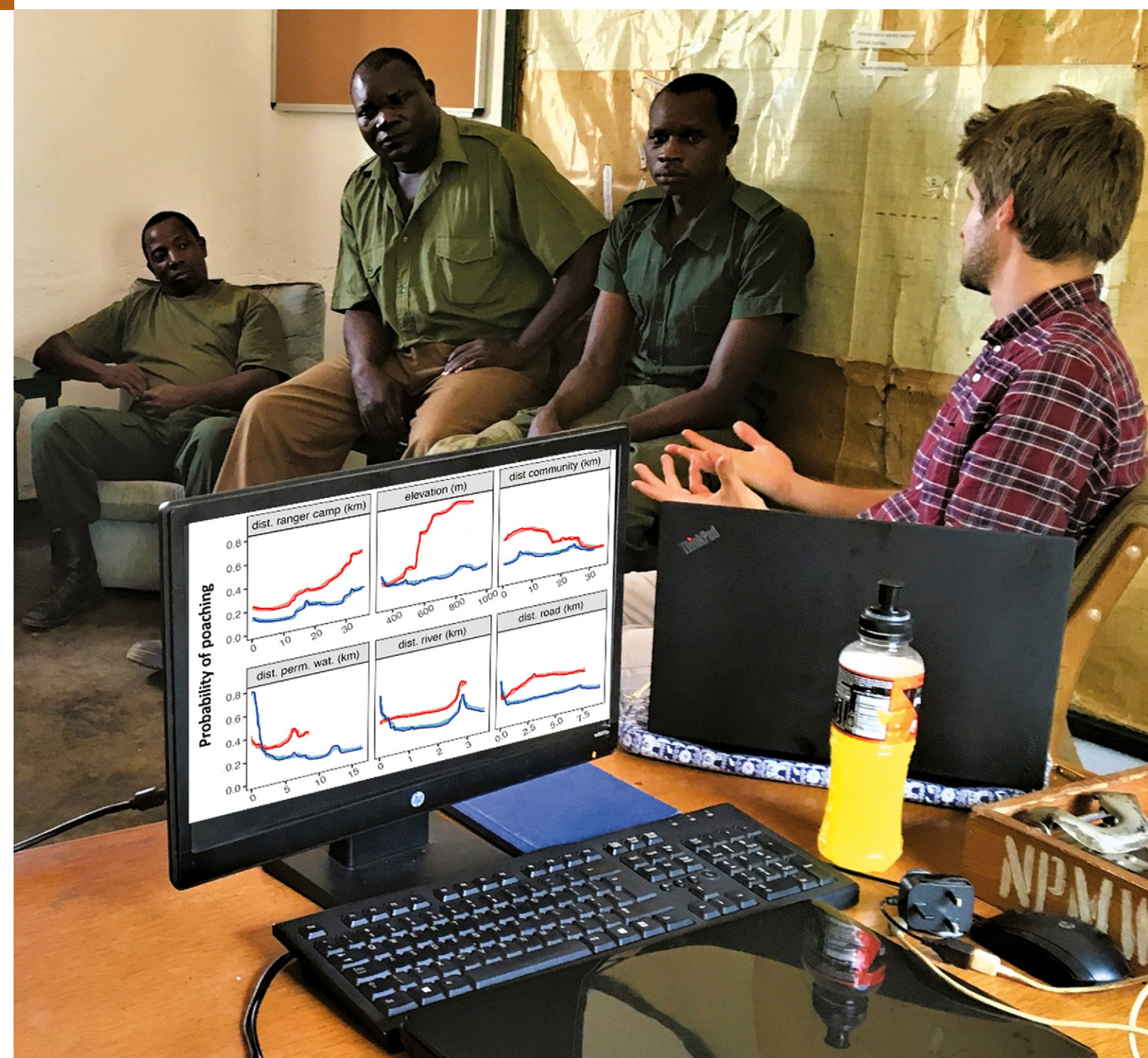
Key Action Point 2: Ensure ZPWMA Ecologists work more closely with managers to conduct analyses of data to address specific management problems.

Researchers and scientists can take responsibility for the more technical aspects of data management and analysis, boosting adaptive management success. The ZPWMA Ecologists in each Region have scientific training and could be tasked with specific responsibility for more in-depth analysis of ranger-collected data on a less frequent basis (every 3-6 months). This would be different from the more basic and frequent data summaries produced by the SMART database officer or 'Data Champion' (see key action area 3 and 4 below).

More in-depth analyses done by the Ecologist may include spatial Geographical Information System (GIS) modelling of poaching hotspots (accounting for patrol bias), or statistical analyses of trends in poaching and how these relate to various drivers and management action. This will help take the burden of data interpretation and analysis off field staff. The Ecologist must work closely with the Area Manager to identify which analyses are most useful, and also communicate results in an easy-to-understand way with clear management recommendations. This may require focussed training for ZPWMA Ecologists in key methods like statistical analyses in R, and or spatial modelling in GIS. Such training should be arranged by the Scientific Services section of ZPWMA, or The Zimbabwe Institute of Wildlife Conservation (see Key Action Area 3 below). It may also be useful for ZPWMA to collaborate with external researchers with specific skills.

Specific actions: (a) Carry out a needs assessment for specific skills required by Ecologists to carry out the analyses required, and ensure that they are trained in these areas and given ongoing scientific support and top-up training (also for specific analyses required by a particular Park Manager). (b) Ensure Ecologists are given the time (and the recognition) for working with managers to produce the data summaries on a regular basis and to interpret them within an SDM framework. (c) External researchers who wish to carry out research in Parks should be directed towards questions of relevance to strategic Park management goals and their work should be integrated within the adaptive management framework.

Below: An external researcher discussing graphs of ranger-collected data with Rangers in the Zambezi Valley, Zimbabwe.





Above: Data Champions. A Ranger in the Zambezi Valley, Zimbabwe, accessing the SMART database of ranger-collected data.

KEY ACTION AREA 3 - Boosting human capacity for Park-level implementation of adaptive management.

It is essential to identify who will be responsible for carrying out each part of the adaptive management cycle (data collection, collation, storage/ database management, analysis, reporting, and evaluation of data trends to inform decisions) and then ensuring that each individual has the capacity and resources to fulfil their role (see Figure 2 on page 28).

The following four actions are recommended:

Key Action Point 1: Data Champions - identify one or two key field staff at each Park station to take primary responsibility for managing SMART and other databases, and promoting data-driven adaptive management.

These individuals may be Area Managers but will more likely be at the Senior Ranger or Wildlife Officer level. Individual leaders are essential to the success of any project. Our research showed that there are already a few key managers and rangers who are particularly enthusiastic about SMART and the value of analysing ranger-collected data for management. These individuals have great potential to influence their peers to ensure greater practical appreciation for and adoption of adaptive management, if they are given a formal role as 'Data/SMART Champions'. These Data Champions may also take the burden of managing data and performing routine analyses off the shoulders of Area Managers who may have many other responsibilities.

In each Region and Park, a small number of individuals should be identified and be given a formal, paid, 'Data Champion' role (with appropriate allowances/bonuses for the extra responsibilities). ZPWMA or other partners should offer focussed professional development and training for data champions, so that they can act as agents for sustainable innovation and change in their work environment. It is important that these data/SMART champions do not take responsibility away from Park Managers, but rather help managers use SMART and ranger-collected data more effectively. Crucially, Area Managers must still understand data trends and work closely with data champions to make decisions based on these trends. These data champions can play a key role in achieving many of the other action points, such as helping managers see the value of adaptive management and helping to identify specific ways that ranger-collected data can help address key management priorities.

Specific actions: (a) Identify, train and support Data/SMART Champions at a range of seniorities and in different positions in Parks around the country. (b) Build a network for Data/SMART Champions to exchange ideas and receive training, to ensure knowledge and skills are maintained after staff transfers.

Key Action Point 2: Training for Regional and Area Managers and Wildlife Officers on (a) adaptive management and structured decision-making in general, (b) data literacy, and (c) how to interpret the data outputs of tools like SMART and use them to guide their management decisions.

This training should focus specifically on the process of moving from trends in the data to actual management decisions. Operations/ management staff must be trained to understand the bar graphs, statistics, and digital maps that are produced by tools like SMART. Importantly, managers also need training in systematic or structured decision-making – the process of going from looking at a data summary to making a decision based on that summary. It may not be necessary for managers to be trained in actually conducting the data analyses to produce the data summaries and trends. This can be the responsibility of the Data Champion or Ecologist, although some managers may themselves be comfortable with conducting basic analyses of data and this should be encouraged if so. Either way, it is crucial that managers are trained to work closely with those



who analyse the data in order to be able to interpret the data analysis outputs and feed them into their decision-making.

An ideal training centre: The Zimbabwe Institute of Wildlife Conservation in Masvingo (ZIWC):

ZIWC has recently integrated SMART and other technologies into the curriculum for their wildlife certificate course, and has stand-alone training in SMART and law enforcement data management. The Institute is thus an ideal location to organise and conduct training in adaptive management (and tools like SMART) - both in the form of repeated “training weeks” for existing ZPWMA staff and longer-term training for new recruits following the standard curricula. There will however be a need to review and develop training modules to ensure that they include training in the concepts and principles of adaptive management and structured decision making, not only tools like SMART. The Institute can act as an effective demonstration centre as the campus has large screens, computers, and GPS units, and uses SMART on site. Selected well-trained personnel within each Region can then go on to train their colleagues, perhaps moving from Station to Station (following a train the trainer philosophy).

In order to evaluate and update these training programmes, there will need to be independent assessments of the extent to which trained individuals are using their new skills, and identification of any barriers to final end use and how they can be overcome.

Key Action Point 3: Data Champions and Area Managers to give regular feedback to rangers on the data they collect (such as SMART graphs and maps).

Our research found that rangers do not get much feedback on the data they collect and how it is used for management. Results from interviews with rangers (see here) suggest that rangers will collect data more accurately and consistently if they receive such feedback. There is a need to develop among rangers a greater appreciation of the value and purpose of data collection, and to give them greater recognition for their data-collection efforts.

Specific actions: (a) Develop mechanisms for feedback to rangers, e.g., a quarterly all-staff catch-up at each Park about the data collected and how it can inform management. (b) Develop a strategy of rewarding rangers based on their data-collection performance (consistency in use of the SMART tool, accuracy of data recording, etc.).

Key Action Point 4: Identify and fulfil key resource needs for adaptive management and SMART.

Effective adaptive management, and the implementation of tools like SMART, require sizable investment in essential resources such as computers, large screens, handheld data collection devices, GPSes, and batteries. This is over and above the basic equipment required by rangers for effective regular patrolling (such as boots, uniforms, and camping equipment). Investment in electricity infrastructure (e.g., solar power) may also be necessary at some stations.

Specific actions: (a) Develop Region- and Park-level budgets for the resources required. (b) Assess internal funding availability, and/or identify suitable partners and donors.



2020 Officers training at the Zimbabwe Institute of Wildlife Conservation

KEY ACTION AREA 4 - Strategies to help translate data to decisions

Moving from data trends to improved management decisions is the most important and the most challenging step in the adaptive management process. It is crucial that managers evaluate and reflect on data trends, understand how these relate to their management problems, and then actively change and adapt their management actions based on the data. We recommend three actions to achieve more effective translation of data into better management decisions:

Key Action Point 1: Identify specific and simple management-relevant data summaries and ensure they are clearly and frequently communicated between Data Champions and Park Managers.

Many different factors affect how a manager makes decisions about a problem like poaching - such as budget, resources, staff capabilities, the need to report to superiors, and time commitments. Ranger-collected data is therefore one among many factors influencing manager decisions, so it is important to ensure that there are simple, clear, and systematic ways for data to feed into management decisions. The first step is to identify the specific kinds of data summaries (e.g., bar graphs of poaching levels or maps of patrol coverage) that are most relevant to the management goals and problems in each Park. The Data Champion, Ecologist, Wildlife Officers and the Area Manager can all be involved in this process. Once identified, these data summaries should be produced by the Data Champion or Ecologist at appropriate time intervals. It is crucial that these summaries are then communicated clearly and effectively to managers, so that managers feel that these summaries are both understandable and useful for their decision-making. This action point is expanded on in steps 4, 6 and 7 of our guidelines for Park-level implementation of adaptive management (see page 28).

Key Action Point 2: Decision-making from data: decision support tools for translating data summaries and trends into improved management.

A key challenge within adaptive management is knowing when to act based on trends in

monitoring data. ZPWMA should develop clear decision support tools for linking data trends to management action. For example, a threshold level of threat could be defined such that when ranger patrol data show that this threshold has been exceeded, managers make a decision and respond with a specific action. A similar threshold approach is used in Kruger National Park, South Africa, for the adaptive management of fires, elephants, and rivers³. Traffic light systems for measuring threat levels (low=green, medium=orange, high=red) from ranger patrols (e.g., the number of bushmeat snares detected per month) may also help translate data into decisions. Decision triggers, where trends in monitoring data trigger specific management actions, may be another approach (Cook et al., 2016⁷). Future work by ZPWMA and partners will be required to identify the most suitable decision-support tools for each Park and management problem.

A full review of available decision support tools may be required as ZPWMA develops Standard Operating Procedures (SOPs) for adaptive management (see page 28). External researchers could be approached to help ZPWMA identify and test appropriate indicators that a change in strategy is needed (triggers, thresholds, traffic lights, and others) and decision support tools into which to embed these indicators.

Key Action Point 3: Data visualisation to aid decision-making: invest in large digital screens to present data summaries clearly for managers to visualise patterns and make decisions.

Data visualisation is one of the best ways to bridge the gap between data trends and better management decisions. Visuals engage the human brain and help people understand data, pick up patterns, and make decisions based on these patterns. This is why large paper maps in anti-poaching operations rooms are so effective. There is a need for digital versions of these maps in the form of large (30-inch plus) monitors in operations rooms and station offices to allow for visualising the key data summaries mentioned above. This may include SMART maps of the locations of illegal activities, bar graphs of bushmeat snares recorded each month, or the locations of patrolled and unpatrolled areas. It will be easier to make good decisions from this information if it is presented in a useful and clear way on a large screen that managers, officers, and rangers can all see and discuss together.

PART 3 - EIGHT PRACTICAL STEPS FOR PARK-LEVEL IMPLEMENTATION OF ADAPTIVE MANAGEMENT AND SMART

The action points highlighted above will help lay a strong foundation for rolling out adaptivment management practically at each of Zimbabwe's Parks. In this section, we outline eight specific steps that we recommend for the practical implementation of adaptive management at each Park and station.

These practical steps draw and build on the key action areas outlined above, and will help maximise the adoption and effectiveness of adaptive management for improved biodiversity conservation and law enforcement.



STEP 1

Review the existing Protected Area Management Plan (PAMP) for each Park and ensure the adaptive management strategy (step 2 below) integrates well with this plan.

Adaptive management is a tool to help achieve the management goals already specified in the existing PAMP for each Park, and should therefore be strongly aligned with these plans. Each PAMP will have a long-term (10 year) plan divided into medium-term (3-year) action plans and then annual workplans. Adaptive management provides an ideal way to think strategically about achieving the goals of these management plans, and to evaluate the specific management actions designed to achieve these goals. The repeated adaptive management cycle of implementation, monitoring, learning and evaluation, and updating of management actions fits naturally with the annual and medium-term review cycle that is already a part of the Protected area planning process. It is therefore essential that any adaptive management strategy is strongly aligned with the PAMP for each Park. In those parks with no recently revised PAMP, this will need to be developed first, with the adaptive management strategy integrated.

STEP 2

Develop a site-specific adaptive management strategy. Identify clear ways that ranger-collected data and tools like SMART can inform the specific management priorities at the station.

Each Park will have its own specific conservation issues, field staff numbers, and resources. The first step is to develop a Park-level adaptive management plan, within a Structured Decision Making framework, that is specific to this context. This must be done in a participatory way - the people developing this plan must include the Area Manager, Wildlife Officers, and the resident Ecologist (in consultation with the Regional Manager).

These staff must work together to identify (or clarify) their Park's key goals, the specific management problems (fishing, poaching, invasive species, etc.) that need to be addressed to reach these goals, and the potential management actions that could be implemented in a strategy to address these problems. Staff must also clarify the specific forms of data that rangers can collect (e.g., poachers' spoor, animal sightings, water status) and how these relate to the management problems. They should identify gaps and mismatches between these datasets, the problems to be solved and the actions to be undertaken. Staff must identify the specific data summaries and data analyses that will help inform these management decisions and actions. In other words, specific ways that ranger-collected data could be used should be identified and clearly described. Finally, there should be a plan for using the results of the analyses to improve understanding of the problems that are affecting Park performance and how to tackle them, and therefore enhance management (the all-important feedback loop).

This adaptive management strategy should be closely aligned with and feed into the broader Protected Area Management Plan for each Park (see step 1). During the first phase of adaptive management implementation, it may be best to identify just one or two ways that data analysis could be used for management decisions and take these forwards as a pilot. This will reveal barriers and opportunities for implementation and this learning can be taken into the next phase. As part of this Park-level adaptive management plan, specific resource needs should be identified and budgeted, such as computers/laptops for data storage and analysis, large monitors for data visualisation (see below), data collection devices like Cybertrackers, the cost of training courses and professional development, and of payment for additional responsibilities (e.g. for the Data Champions).

There should be a plan for using the results of the analyses to improve understanding of the problems that are affecting Park performance and how to tackle them.

STEP 3

Define roles for specific individuals at each stage of the adaptive management cycle (data collection, SMART data management and analysis, and the use of data for decisions).

Effective implementation will depend heavily on key individuals carrying out specific roles. As highlighted under Key Action Area 3 above, a Data Champion will need to be identified and their responsibilities clarified. The specific roles for the resident Ecologist,

the Wildlife Officers, the Area Manager, and the rangers should also be clarified. The figure below provides a guideline for defining roles, but the specific roles and responsibilities will vary by station.

Defining Roles for Adaptive Management

The first step is to develop a park-level adaptive management plan that specifies the management goals, the management strategies available, the data to be collected, and specific roles and responsibilities. The Regional Manager, Area Managers, Wildlife Officers and Ecologists should all participate in this process.



Figure 2: Specific roles for Park-level adaptive-management. This can be used as a guideline for step 3 in the seven practical steps for Park-level implantation of adaptive management. The roles suggested above are only guidelines. In some Parks, the Area Manager may feel comfortable conducting basic analyses themselves, and this should be encouraged where feasible.

STEP 4

Identify the specific data summaries that are most relevant for the station (patrol effort graphs, maps of poacher spoor, etc.) and how frequently each data summary should be produced.

Different forms of data will be relevant to different management problems and strategies. The data needed will vary between Parks, and over time. Building on the adaptive management plan from step 2 above, field staff must identify and agree on (a) the specific summaries and analyses of patrol observations that are required to guide management, and (b) how frequently these analyses should be conducted. Examples might include digital maps of the locations of illegal activities produced on a quarterly basis, maps of patrolled and unpatrolled areas produced on a monthly basis, or bar graphs of the number of poacher's spoor detected each month. These priorities will change over time as threats change and should be updated on an annual or semi-annual basis.

STEP 5

Critically assess whether summaries and trends from ranger-collected data are accurate enough to capture true spatial and temporal trends of interest (e.g., poaching levels and hotspots).

Rangers cannot patrol all areas and detect all poaching incidents. It is important for managers to be aware that sometimes ranger-collected data are not able to accurately capture real trends. Some of the data summaries identified under action point 3 may therefore not be effective. For example, research on ranger-based monitoring of elephant poaching in the Zambezi Valley suggests that only medium to large changes in annual poaching levels can be reliably detected with current levels of patrol effort. If the power of data to detect trends is not assessed, managers could be making decisions based on unreliable data. A functional SMART database will also help provide a consistent record of patrol effort and coverage and identify shortfalls, and provide the raw patrol effort data needed to correct for patrol bias in space or time. The resident Ecologist, or collaborating researchers and academics, may need to be identified to carry out these assessments.

STEP 6

The Data Champion (database officer) produces basic and frequent reports summarising patrol effort and patrol observations.

Once the appropriate type and frequency of data summaries and analyses have been identified, the assigned Data Champion(s) (see Key Action Area 3, action point 1) should take responsibility for producing these summaries (using SMART or other tools) in a way that is relevant to key management questions and easy to understand (see below). These data reports should also be integrated into the standard ZPWMA reporting system.

STEP 7

Data communication: ensure frequent updates on SMART data summaries between the Data Champion, the Area/Station Manager, and patrol leaders.

It is essential that the Data Champion (database officer) regularly communicates data summaries and trends to the Area Manager and those leading patrols. There may be a need to establish weekly meetings specifically for this purpose. Our research showed that one of the complaints that managers have about SMART and adaptive management is that it can be "too slow" to address more immediate threats that happen in real time. More frequent communication of data summaries and trends will help address this problem.

STEP 8

Feed the Park-level data and analyses up to the national and international levels.

Data outputs (e.g., graphs and maps of poaching incidents) from the Park level may also feed into national level databases and influence management, human resource, and budget decisions at ZPWMA Regional and Headquarter levels. These data may also feed into reporting processes for international conventions to which Zimbabwe is part (e.g. CITES, CBD, WHC).

NEXT STEPS - IMPLEMENTATION

These recommendations will have no impact if they are not implemented. Table 1 at the beginning of this brief provides a suggested outline and timeline for implementation, clarifying which ZPWMA staff would be responsible for each step.

We further recommend six ways to ensure sustainable implementation:

1. ZPWMA should develop Standard Operating Procedures (SOPs) for implementing adaptive management at the Regional and then Park level. These procedures should be formalised and aim to expand on the seven steps for Park-level implementation of adaptive management suggested above.

2. ZPWMA should integrate adaptive management into existing Protected Area Management Plans (PAMPs).

3. ZPWMA should employ/identify and support at each station a dedicated Data Champion (see above) with explicit responsibility for managing the database of ranger-collected data and communicating data to Area Managers and patrol leaders for strategic decision-making.

4. ZPWMA should integrate basic summaries and analyses of ranger-collected data (typically produced by the Data Champion) into the standard reporting system for each Park (e.g., monthly and quarterly reports submitted from each station to regional and higher offices).

5. ZPWMA should include responsibilities for different stages of adaptive management into the job descriptions and competencies for particular ZPWMA field and office staff.

6. ZPWMA should invest in one-off and ongoing training and professional development for all staff whose remit will expand or change as a result of these recommendations, and ensure that they are properly resourced to implement them.

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