

PHASING OUT LEAD AMMUNITION IN SOUTHERN AFRICA

A Regional Strategy and
Transition Roadmap
(2026–2035)



Reduce lead
contamination



Protect wildlife
and biodiversity



Safeguard
human health



Support a sustainable
hunting sector



Strengthen ecosystems
and livelihoods

PREPARED BY

Dr Shylock Muyengwa
Dr Benjamin Mubemba
Brains Mucherwa

COMMISSIONED BY

BirdLife International



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LIST OF ACRONYMS

Acronym	Full name
AB	Assembly Bill (California legislative instrument)
AEWA	African-Eurasian Migratory Waterbird Agreement
ANAC	Administração Nacional das Áreas de Conservação (Mozambique National Conservation Areas Administration) [NEW]
BCR	Benefit-Cost Ratio
BWPA	Botswana Wildlife Producers Association
BWTI	Botswana Wildlife Training Institute
CAMPFIRE	Communal Areas Management Programme for Indigenous Resources (Zimbabwe)
CBA	Cost-Benefit Analysis
CBD	Convention on Biological Diversity
CBNRM	Community-Based Natural Resource Management
CHA	Controlled Hunting Area
CIF	Cost, Insurance and Freight
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CMS	Convention on Migratory Species (Bonn Convention)
CNC	Computer Numerical Control
DFFE	Department of Forestry, Fisheries and the Environment (South Africa)
DFI	Development Finance Institution [NEW]
DNPW	Department of National Parks and Wildlife (Zambia)
DWNP	Department of Wildlife and National Parks (Botswana)
ECHA	European Chemicals Agency
EMA	Environmental Management Agency (Zimbabwe)
EU	European Union
EWT	Endangered Wildlife Trust (South Africa) [NEW]
FCDO	Foreign, Commonwealth and Development Office (United Kingdom)
GBP	British Pound Sterling
GCF	Green Climate Fund
GDP	Gross Domestic Product [NEW]
GEF	Global Environment Facility
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (German Development Corporation)
GLTFCA	Great Limpopo Transfrontier Conservation Area
GMA	Game Management Area (Zambia)
GMX	Gilding Metal eXpanding (Hornady non-lead bullet design)
HS	Harmonised System (international trade classification)

Acronym	Full name
HWC	Human-Wildlife Conflict
IFC	International Finance Corporation
IRDNC	Integrated Rural Development and Nature Conservation (Namibia)
IUCN	International Union for Conservation of Nature [NEW]
KAZA	Kavango-Zambezi Transfrontier Conservation Area
LEAP	Law Enforcement and Anti-Poaching (SADC Strategy)
LEEP	Lead Exposure Elimination Project
MEFT	Ministry of Environment, Forestry and Tourism (Namibia)
MEL	Monitoring, Evaluation and Learning
MsAP	Multi-species Action Plan (African-Eurasian Vulture Multi-species Action Plan)
NACSO	Namibia Association of Community Based Natural Resources Management Support Organisations
NAPHA	Namibia Professional Hunting Association
NBSAP	National Biodiversity Strategy and Action Plan
NCE	Namibian Chamber of Environment
NCONGO	National Community-Based Natural Resource Management Organisation (Botswana)
NEMBA	National Environmental Management: Biodiversity Act 10 of 2004 (South Africa)
NGO	Non-Governmental Organisation
NHSA	National Hunting and Shooting Association (South Africa)
NNF	Namibia Nature Foundation
NPV	Net Present Value
PAC	Problem Animal Control
PH	Professional Hunter
PHASA	Professional Hunters' Association of South Africa
RDC	Rural District Council (Zimbabwe)
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals (European Union)
SADC	Southern African Development Community
SANBI	South African National Biodiversity Institute
SANParks	South African National Parks
SAPS	South African Police Service
SOAZ	Safari Operators Association of Zimbabwe
TEV	Total Economic Value
TFCA	Transfrontier Conservation Area
TOPS	Threatened or Protected Species Regulations (South Africa, GN 151 of 2007)
TSX	Triple Shock X (Barnes non-lead bullet design)

Acronym	Full name
TTSX	Tipped Triple Shock X (Barnes non-lead bullet design)
UNEA	United Nations Environment Assembly
UNEP	United Nations Environment Programme
USAID	United States Agency for International Development
USD	United States Dollar
VAP	Vulture Action Plan
VCSAP	Vulture Conservation Strategy and Action Plan (SADC, 2025–2035)
VSA	Vulture Safe Area
ZCRBA	Zambia Community Resources Boards Association
ZPHGA	Zimbabwe Professional Hunters and Guides Association
ZPWMA	Zimbabwe Parks and Wildlife Management Authority

EXECUTIVE SUMMARY

The transition from lead to non-lead ammunition in the five priority SADC countries is technically feasible, commercially achievable within a ten-year horizon, and normatively mandated under existing international commitments. The binding constraint is not technical adequacy, economic impossibility, or the absence of policy frameworks. It is institutional.

Southern Africa's vulture populations are declining at rates that are ecologically catastrophic and largely irreversible on human timescales. Lead ammunition deposited in gut piles, carcasses, and fragmented projectile residue across five priority hunting countries is a primary, preventable, and under-addressed driver of that decline. This consultancy draws on primary field data, comparative international evidence, regulatory analysis, and a full cost-benefit assessment to reach a single overarching conclusion: the transition is feasible, but it has not started because the three conditions it requires have not yet been assembled in any priority country. Those conditions are coordinated supply chain investment, regulatory activation, and sustained cross-sector advocacy. This report provides the evidence base, the barrier diagnosis, the design principles, and the implementation roadmap to assemble them. The question is no longer whether to act. It is whether the required institutional commitment will be organised in time.

CONSERVATION AND ECONOMIC STAKES

The SADC region supports a globally significant concentration of vulture diversity. Eight species occur across the priority countries; six are classified as Vulnerable, Endangered, or Critically Endangered. African vulture populations have declined by 80–97% over the past five decades. Demographic modelling confirms that even modest reductions in adult annual survival from a natural baseline of approximately 95% to 93% which are sufficient to drive population collapse over two to three generations on current trajectory. These are not recoverable losses: with generation times of 15–20 years and single-egg clutches, vulture populations cannot rebound on human planning timescales once breeding populations fall below viable thresholds.

The economic consequence of inaction is quantifiable. BirdLife International's 2025 ecosystem services valuation places the annual value of vulture populations in Botswana, Zambia, and Zimbabwe alone at USD 251.83 million, with an SADC-wide extrapolation of approximately USD 1.8 billion per year. The dominant service categories are disease control and carcass sanitation (USD 93.4 million annually) and sentinel function (USD 11.4 million annually); represent direct, quantifiable benefits to rural communities, livestock producers, and wildlife tourism operators. The Asian vulture crisis, in which a greater than 95% population collapse from diclofenac poisoning generated an estimated USD 34 billion in annual economic costs from feral dog proliferation and disease expansion, provides the most credible analogue for the consequences of continued inaction in Southern Africa.

WHAT THE EVIDENCE SHOWS

Lead use is near-universal and unregulated. Primary questionnaire data from Zimbabwe confirms that 76–99% of active ammunition across commercial, trophy, and community hunting operators contains lead. No SADC member state has enacted any restriction. UN Comtrade customs data confirms South Africa's structural dominance as the regional supply hub but cannot disaggregate lead from non-lead product flows which is a monitoring infrastructure gap that is itself a programme priority.

Supply chain failure is the binding constraint. The consultancy's six-domain barrier analysis confirms that supply chain barriers; not awareness, ideology, or technical performance which are rated at maximum severity across the most important hunting contexts. South African manufacturers including Peregrine Bullets produce non-lead alternatives that meet ballistic performance requirements for plains game, dangerous game, and large-calibre applications. The barrier is distribution: non-lead products are absent or

marginal in mainstream distribution channels for the calibres and volumes required for a practical transition. Until South Africa's distribution hub normalises non-lead stocking, supply chain failure will neutralise every other transition instrument deployed across every other country.

Lead dispersal is substantial and underestimated. The consultancy's formula-based model estimates approximately 606.6 kg of lead dispersed annually across modelled sectors in the five priority countries, of which approximately 343 kg enters the gut-pile and carcass pathway constituting the primary vulture exposure route. However, three large unmodelled residuals for example the Zimbabwe formal safari sector (~612 kg/yr), Botswana's problem animal control operations (~296 kg/yr), and South Africa's domestic hunting sector (~533 kg/yr) which point to a plausible true regional total of 2,000–2,500 kg per year.

International design lessons are unambiguous. Successful transitions in the European Union, the United Kingdom, and the United States share three features absent from the current SADC context: phased implementation that sequences demand signals ahead of supply investment; a flagship charismatic species narrative that sustains political support across electoral cycles; and a voluntary pre-regulatory phase that builds norm change before the mandatory instrument arrives. The SADC transition programme presented in this report is designed around all three.

THE ECONOMIC CASE

The cost-benefit analysis is unambiguous. Annual incremental costs to the modelled commercial hunting sector across all five priority countries which is approximately USD 91,000 to USD 182,000 at a 25–50% non-lead price premium which represent a fraction of normal operating cost variation for regional safari operations and are well within standard programme financing envelopes. Against this, even a 1–2% improvement in regional vulture survival rates under the phased transition scenario generates annual ecological benefits in the range of USD 18–36 million when applied against the BirdLife 2025 valuation. The benefit-to-cost ratio is strongly positive under every plausible sensitivity test. The price premium is the most important cost variable and is reducible through supply chain development and manufacturing scale economies. This making the Phase 1 supply chain investment simultaneously the most critical near-term programme activity and the most powerful lever for reducing long-term programme cost.

THE RECOMMENDATION: PHASED TRANSITION

Of the three scenarios modelled, namely immediate prohibition, phased transition, and voluntary commitment, the phased transition delivers the strongest result across all five assessment dimensions: ecological benefit, political feasibility, market readiness, institutional capacity, and cost efficiency. Immediate prohibition generates the largest theoretical ecological benefit but carries prohibitive enforcement costs and major implementation risk under current SADC market and institutional conditions. Voluntary transition is cheaper in the short term but is demonstrably insufficient: five years of high-profile voluntary commitment in the United Kingdom produced negligible measurable change, and SADC questionnaire respondents consistently identified cost and supply rather than intent as the binding constraints that voluntary advocacy cannot resolve.

The phased approach is not a compromise. It is the design that correctly sequences supply chain activation ahead of regulatory demand, builds norm change and field confidence, supports communities and agencies that cannot absorb higher costs unaided, and progressively formalises compliance through existing wildlife governance frameworks. It is fundable, implementable, and consistent with the institutional realities of all five priority countries.

THREE-PHASE ROADMAP: 2026–2035

Phase	Period	Strategic focus and phase gate
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Phase 1	2026–2027	Foundation: voluntary trials in Zimbabwe, Namibia, South Africa; South African distributor engagement; VCSAP national focal points designated in ≥3 priority countries; Zimbabwe successor VAP commissioned Q1 2026. Phase gate: non-lead stocked across ≥10 calibres through ≥2 distributors; trials completed in ≥3 countries.
Phase 2	2028–2031	Institutional activation: non-lead permit conditions in Namibia conservancies and Zimbabwe CAMPFIRE concessions; PHASA voluntary protocol formalised; SADC technical working group constituted; community health engagement initiated. Phase gate: 80% of active calibres commercially available; ≥2 countries with formal permit conditions; mid-term review confirms dispersal reduction trending as projected.
Phase 3	2032–2035	Regulatory consolidation: NEMBA TOPS Regulation (South Africa); Nature Conservation Amendment (Namibia); CAMPFIRE concession mechanism (Zimbabwe); SADC harmonised standard adopted at 2035 Council of Ministers cycle. Headline target: 75% reduction in confirmed poisoning-related vulture mortality across five priority countries.

EIGHT DECISIVE ACTOR GROUPS

- 1. BirdLife International and country chapters and other NGO partners:** Establish a dedicated, fully resourced SADC lead transition programme before end of 2026. Publish this report as the regional evidence anchor in collaboration with the 4Vultures coalition and formally engage the SADC Secretariat to activate VCSAP roll-out plan accountability. BirdLife country chapters including BirdLife Zimbabwe, BirdLife South Africa, BirdLife Botswana, and the Zambia Ornithological Society and Birdwatch Zambia are the primary in-country delivery vehicles; their adequate and sustained resourcing is a programme design requirement, not an aspiration.
- 2. South Africa — DFFE, SANParks, provincial authorities:** As supply chain hub, largest market, and most developed regulatory environment, South Africa is structurally indispensable. DFFE must commission an independent legal opinion on the scope for a NEMBA TOPS Regulation instrument constituting a species-based lead restriction in designated vulture range areas. Failure to achieve this and to initiate the PHASA voluntary protocol in Phase 1 will stall the regional transition irrespective of progress in neighbouring countries. Environment ministries across all five countries should additionally engage the transition through National Biodiversity Strategy and Action Plan processes, unlocking GEF and GCF co-financing eligibility. In Zimbabwe, the Environmental Management Agency holds a supplementary co-regulatory mandate under the Environmental Management Act that should be activated alongside ZPWMA.
- 3. Zimbabwe — ZPWMA, Ministry of Environment, BirdLife Zimbabwe, CAMPFIRE Association:** Formally activate the 2025–2035 Vulture Action Plan; commission a successor plan with a quantified lead reduction baseline as a Q1 2026 priority which is the critical path item for Zimbabwe's Phase 2 activation. Incorporate a non-lead condition into CAMPFIRE quota allocations through ZPWMA's existing compliance framework. Engage the CAMPFIRE Association and priority Rural District Councils (Hwange, Mbire, Binga, Bulilima) as community co-delivery partners from Phase 1.
- 4. Namibia — MEFT, NAPHA, NACSO:** Commission the communal conservancy permit condition pilot that will serve as the regional demonstration case by 2028. NAPHA should co-design a voluntary protocols before end of 2026; the Namibian Chamber of Environment's prior convening record on this issue makes it a natural co-facilitator. NACSO and communal conservancy management committees are the community access channel for the Namibia CBNRM pathway and should be formally engaged as Phase 1 partners.

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5. **Botswana and Zambia — DWNP, DNPW, BirdLife Botswana, ZOS, BirdWatch Zambia:** Both countries must designate VCSAP national roll-out plan focal points within DWNP and DNPW respectively and initiate formal plan development in H1 2027, with BirdLife Botswana and the Zambia Ornithological Society as technical support partners. The KAZA Secretariat, spanning both countries alongside Zimbabwe, Namibia, and Angola, should integrate lead ammunition transition compliance into its existing community poisoning response infrastructure as a Phase 2 sub-regional mechanism. Community Resource Boards and CBNRM trusts in both countries represent the Phase 2 community engagement pathway.
 6. **Professional hunting associations — PHASA, NAPHA, SOAZ, BWPA, ZPAHA, ZPHGA:** PHASA and NAPHA, as the most institutionally developed associations in the region, should engage BirdLife country chapters as co-designers of voluntary non-lead transition protocols before end of 2026. SOAZ and ZPHGA should adopt equivalent protocols aligned with Zimbabwe's VAP targets; primary data from SOAZ confirms that supply availability and not ideological resistance. This is the binding constraint, and a formal industry position statement ahead of regulatory action reduces compulsion risk for all associations.
 7. **Ammunition supply chain — SA manufacturers, distributors, regional importers:** South African manufacturers which include Peregrine Bullets, GS Custom Bullets, Impala Bullets, and Balistix Bullets and mainstream distributors must initiate commercial engagement to normalise non-lead stocking across the top fifteen hunting calibres by 2030. BirdLife South Africa should convene a formal distributor engagement forum in Phase 1. Zimbabwe importers LG Harrison and Feredays, and Namibia's firearm and ammunition dealers, are the priority distribution partners in markets where non-lead supply is currently most acute. Until this supply chain is activated, every other transition instrument is conditional.
 8. **SADC Secretariat and donors — SADC, GIZ, UK FCDO, GEF, IFC:** The SADC Secretariat must activate VCSAP 2025–2035 roll-out plan accountability for all twelve vulture range states and constitute a technical working group under the Protocol on Wildlife Conservation, targeting a harmonised regional standard for adoption at the 2031 Council of Ministers cycle. Individual country action cannot close the free-rider dynamic that only regional harmonisation can address. GIZ and UK FCDO are prioritised for Phase 1–2 core financing given established in-country wildlife programme presence; GEF and GCF biodiversity windows supplement from Phase 2; and IFC or regional development bank instruments should be scoped for the supply chain manufacturing investment gap that standard conservation grants will not cover.

A BROADER POLICY AGENDA

This transition must be framed beyond a narrow conservation campaign. The case for moving away from lead ammunition encompasses scavenger conservation, ecosystem health, food safety, public health, hunting-sector credibility, community governance, and tourism resilience. Wildlife authorities, environment ministries, public health and food safety agencies, hunting and safari bodies, community wildlife institutions, tourism actors, and development partners all have a legitimate stake. The best-documented indicator group remains vultures, but the policy constituency must be wider if the momentum required to reach the 2035 target is to be sustained.

CHAPTER 1: INTRODUCTION AND CONTEXT

1.1 Lead ammunition, scavenger exposure, and wildlife-sector risk

Southern Africa supports a globally important concentration of vulture diversity and abundance, yet it is also the region where their long-term viability is under the greatest pressure. The subcontinent supports the core global ranges of multiple threatened species including the African White-backed Vulture (*Gyps africanus*) and the range-restricted Cape Vulture (*Gyps coprotheres*) both now classified as Critically Endangered following population declines of 80–97% over the past five decades (BirdLife International, 2025; Linda van den Heever et al., 2023; Linzé van den Heever et al., 2019). While lead contamination from hunting carcasses and gut piles affects a broader scavenger guild including eagles, jackals, and hyaenas, vultures represent the most acutely and thoroughly documented taxon, functioning as ecological sentinels for landscape-level lead contamination (V. Naidoo et al., 2017).

As obligate scavengers, they remove carcass biomass rapidly and at scale, suppress disease transmission at the wildlife–livestock–human interface, and support wildlife surveillance — services valued at USD 251.83 million annually across Botswana, Zambia, and Zimbabwe alone (BirdLife International, 2025). Their loss therefore carries consequences that extend well beyond biodiversity conservation into public health, food safety, and law-enforcement effectiveness in remote wildlife landscapes.

Within this broader crisis, lead poisoning from spent ammunition has emerged as one of the most significant and most policy-addressable threat. The causal pathway is well established. When a lead-core bullet strikes a large-bodied animal, the projectile fragments and disperses small lead particles through tissue, organs, and body cavities. These fragments are frequently retained in carcasses, gut piles, and offal discarded after field dressing. Scavengers feeding on this material ingest the fragments directly (Garbett et al., 2018). At lower concentrations, lead can cause neurological impairment, immune suppression, behavioural dysfunction, and reproductive harm; at higher concentrations, it can cause acute toxicosis and death (Pain et al., 2019). Unlike deliberate poisoning events, which tend to be episodic and visible, ammunition-derived lead exposure operates as a recurring and often under-recognised contamination pathway that is active across every hunting season and across multiple land-use types, including hunting concessions, communal lands, private game properties, and problem animal control zones.

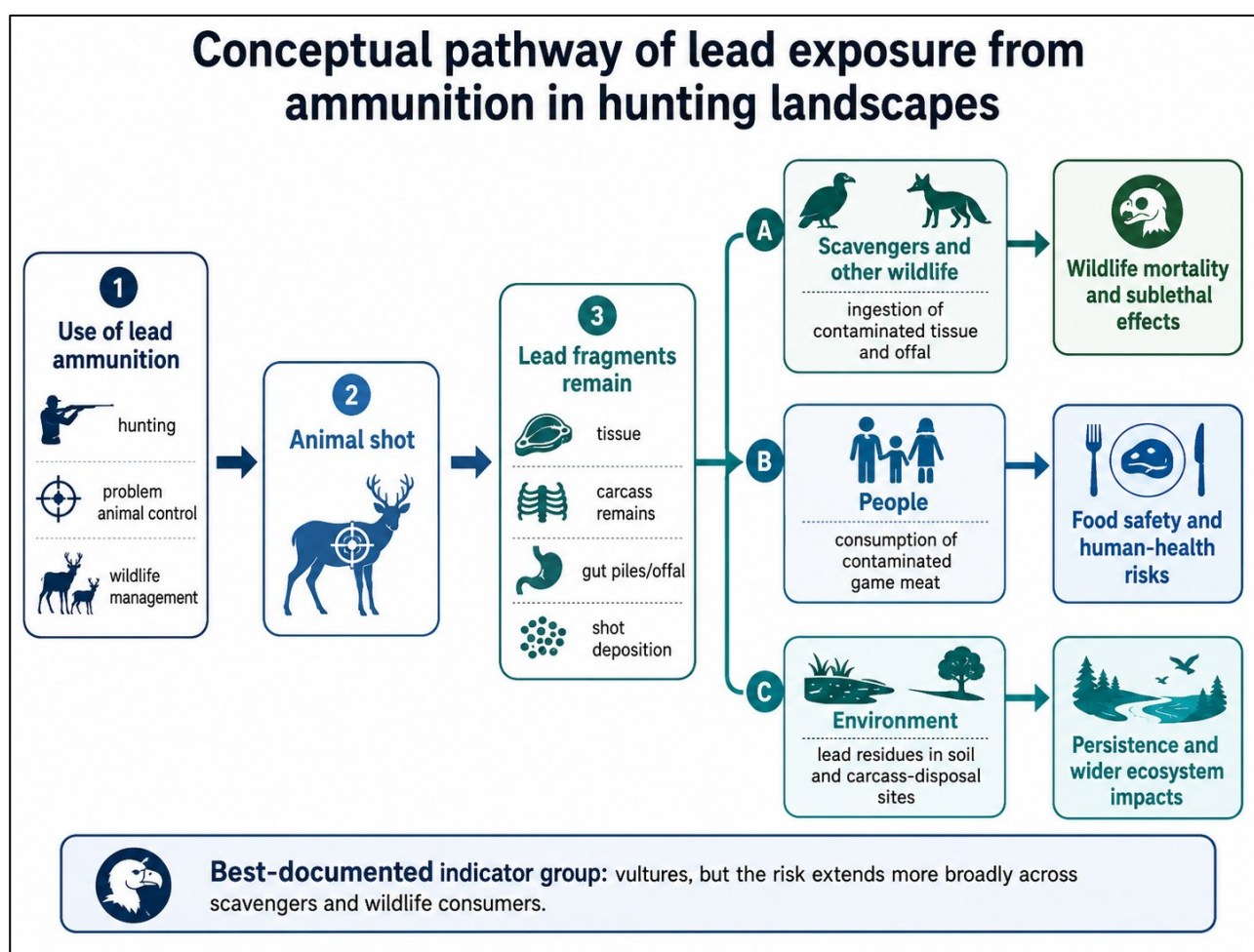


Figure 1: Lead exposure pathways from hunting ammunition

The scientific evidence from Southern Africa is already sufficient to justify action. Studies from the region have documented elevated lead levels in vultures and ground hornbills have identified ammunition as a primary source of contamination (Koeppel & Kemp, 2015); van den Heever et al., 2019(Hunt et al., 2006)). While lead toxicity is well studied in birds and humans, evidence from other wild mammalian species is limited. Acute lead poisoning has been documented in captive carnivores such as cheetahs fed on lead-shot game meat ((Hauw, Marker, et al., 2025; Hauw, Schmidt-Küntzel, et al., 2025; North et al., 2015)) while widespread lead exposure in wild leopards has also been reported (Hauw et al., 2025b). International evidence strengthens rather than substitutes for this case. Experience from North America and Europe shows that ammunition-derived lead can become a chronic and population-level threat to scavenging birds and raptors, even where wider conservation programmes are in place. The lesson for Southern Africa is not that more proof is needed before policy can move, but that scientific evidence must now be translated into an implementation model that is both regionally coherent and practically feasible.

The transboundary nature of wildlife ecology makes this a regional issue. Wide-ranging scavengers and other wildlife move across national boundaries in response to carcass availability, breeding requirements, seasonal resource patterns, and land-use dynamics. Exposure acquired in one country is therefore carried across a wider shared ecological system. For this reason, a transition achieved in only a few countries will generate only partial ecological benefit if neighbouring states remain fully dependent on lead ammunition. The logic of the assignment is therefore regional: the problem is shared, the exposure landscape is shared, and the solution must be designed accordingly.

1.2 Policy and normative framework

This consultancy is grounded in a defined international and regional policy architecture. Three instruments are especially important. The first is **CMS Resolution 11.15**, which calls on Parties

to work toward the phase-out of lead ammunition across habitats and emphasises the importance of policy direction, awareness, and effective regulatory systems. The second is the **CMS Multi-species Action Plan for African-Eurasian Vultures** (CMS/CITES Vulture Multi-species Action Plan Consortium, 2017), which identifies lead ammunition as a priority threat requiring targeted management action. The third is the **SADC Vulture Conservation Strategy and Action Plan (2025–2035)**, which provides the principal regional framework within which this assignment is situated (Southern African Development Community, 2025). Together, these instruments establish both the legitimacy and the urgency of action on lead ammunition in the SADC wildlife context.

Of these, the SADC Vulture Conservation Strategy and Action Plan is the most directly operational for this report. The Strategy explicitly identifies lead ammunition as a major and addressable environmental threat to vultures and calls for national roll-out plans across member states. Its target of at least a 75 percent reduction in poisoning-related vulture mortality by 2035 provides the regional accountability benchmark against which this consultancy has been designed. The purpose of this assignment is therefore not to propose an independent advocacy agenda outside existing institutional processes, but to support implementation of a strategy that SADC has already adopted in principle.

Several complementary instruments also shape the governance landscape for transition. These include the SADC Protocol on Wildlife Conservation and Law Enforcement, the SADC LEAP Strategy, national vulture policy instruments in countries such as South Africa and Zimbabwe, cross-border conservation governance arrangements in major Transfrontier Conservation Areas, and community-based natural resource management systems such as CAMPFIRE in Zimbabwe and communal conservancies in Namibia (Jones et al., 2015; Kavango-Zambezi Transfrontier Conservation Area Secretariat, 2021; Taylor, 2009). These frameworks matter because a substantial proportion of hunting activity, problem animal control, and scavenger exposure occurs within or adjacent to CBNRM landscapes and cross-border wildlife systems. While relevant policy instruments are already in place, stakeholders generally see lead ammunition as one of several interacting conservation threats and favour a phased, consultative transition built on awareness, practical trials, market development, institutional readiness, and credible engagement rather than immediate blanket prohibition.

1.3 Consultancy mandate, scope, and objectives

BirdLife International commissioned this consultancy to develop a practical, evidence-based regional strategy for reducing, and ultimately eliminating, the use of lead ammunition in wildlife areas across the SADC region. Although the assignment was commissioned through a scavenger-conservation entry point, the report is written for a wider policy and sector audience, including wildlife authorities, environment ministries, public-health and food-safety actors, hunting and safari bodies, community wildlife institutions, tourism interests, and donor partners. The assignment is intended to generate the analytical, economic, and institutional foundations required for transition to non-toxic alternatives. It is not designed as a purely theoretical exercise. Its purpose is to produce decision-ready outputs that governments, conservation partners, and sector actors can use to support implementation.

The primary research scope covers five SADC countries: Botswana, Namibia, South Africa, Zambia, and Zimbabwe. These countries were selected because of their hunting-sector relevance, the importance of problem animal control and wildlife management activities, the significance of their vulture populations, and the availability of field-accessible research and stakeholder networks. Mozambique and Angola are treated as contextual countries within the wider regional framing and are considered priority candidates for a later engagement phase because of their ecological significance within transboundary vulture systems.

The assignment is structured around five objectives. First, it seeks to quantify current lead ammunition use across hunting, problem animal control, and anti-poaching activities in the five primary countries. Second, it aims to identify and catalogue commercially available non-lead rifle bullets, slugs, and shot across the selected SADC markets, including landed prices and an

availability score. Third, it develops a scored barrier matrix covering ecological, regulatory, economic, technical, human health, and institutional dimensions of resistance to transition. Fourth, it models the cost-benefit implications of three policy scenarios: an immediate prohibition, a five-year phased transition, and a ten-year incentive-led voluntary transition. Fifth, it develops an implementable transition roadmap for the period 2026 to 2035, aligned with the SADC Strategy's 2035 target.

A key cross-cutting finding emerging from the early consultation process is that resistance to transition is driven less by ideology than by practical concerns. Hunters, regulators, industry actors, and land managers repeatedly raised questions of ammunition cost, availability, performance, compatibility with existing firearms, and confidence in the practical adequacy of alternatives. Several respondents also highlighted a gap between scientific evidence and the way that evidence is communicated to end users. This means that the challenge is not only to generate evidence, but to convert evidence into forms that can support confidence, behaviour change, and ultimately policy implementation.

1.4 Structure of the report

The report is organised to move from context and evidence to strategy and implementation. Chapter 2 sets out the methodology, including data collection instruments, analytical frameworks, and limitations. Chapter 3 presents the quantitative assessment of lead ammunition use across the five priority countries and the wider regional context. Chapter 4 analyses non-lead alternatives, their availability, price, ballistic performance, and supply-chain structure. Chapter 5 presents the barrier analysis. Chapter 6 examines international experience and extracts lessons relevant to the SADC context. Chapter 7 reviews the policy and regulatory landscape. Chapter 8 presents the cost-benefit analysis. Chapter 9 maps the stakeholder landscape and proposes a differentiated engagement strategy. Chapter 10 sets out the phased transition roadmap for 2026–2035. Chapter 11 concludes with strategic recommendations for BirdLife International, national governments, the hunting sector, and the SADC Secretariat.

CHAPTER 2: METHODOLOGY

2.1 Research design overview

This consultancy employed a mixed-methods design combining quantitative data collection, qualitative stakeholder consultation, systematic literature review, policy analysis, and economic modelling. This design was selected because the transition away from lead ammunition is not only a technical question of toxicology and ballistics, but also an institutional, behavioural, and market-governance problem. Quantitative evidence is required to estimate the scale of lead use, compare price differentials, and assess the likely magnitude of environmental loading. Qualitative evidence is required to understand regulatory readiness, stakeholder incentives, implementation barriers, and the practical conditions under which transition may or may not be feasible. Neither strand of evidence would have been sufficient on its own.

The overall analytical orientation of the consultancy is a systems approach. Lead does not enter the environment as an isolated contaminant. It moves through interconnected ecological, commercial, and institutional systems: from manufacture and import to distribution and field use, to bullet fragmentation in carcasses, to ingestion by scavengers, and ultimately to wildlife health and conservation outcomes across transboundary landscapes. This systems perspective shaped both the evidence-gathering strategy and the interpretation of findings, with the intention of ensuring that recommendations respond to the wider structure of the problem rather than to symptoms at a single point in the chain.

2.2 Evidence quality and confidence approach

Because the consultancy covers five countries with differing data systems, different levels of stakeholder access, and unequal availability of administrative records, the evidence base is necessarily uneven across countries and sectors. For that reason, the report distinguishes between three broad levels of evidential confidence.

High-confidence findings are those supported by multiple sources, including either verified administrative data or triangulated documentary and primary evidence. Moderate-confidence findings are those supported by credible primary evidence and partial triangulation, but where administrative verification is incomplete or sectoral coverage is narrower. Indicative findings are those supported by partial primary data, qualitative evidence, or scenario-based modelling where full verification was not possible within the scope of the assignment.

This distinction is important because the report is intended to support action without overstating precision. In several cases, especially where offtake records were incomplete, private-sector data was inaccessible, or country responses were still pending at the time of drafting, the consultancy has preferred transparent qualification over false certainty. This should not be read as a weakness of the methodology, but as a deliberate choice to protect the integrity of the final analysis.

2.3 Primary data collection

2.3.1 Questionnaire instrument

A structured questionnaire was developed as the primary tool for collecting comparable information across the five priority countries. The instrument contained six components. The first captured respondent profile information, including organisational affiliation, country of operation, and sector role. The second focused on the quantification of ammunition use, including annual volumes by type, the proportion of lead-based versus non-lead ammunition, and the calibres most commonly used. The third addressed knowledge of, and experience with, non-toxic alternatives, including perceived availability, price, and ballistic performance. The fourth applied the barrier matrix, asking respondents to score the severity of specified transition barriers and to explain their reasoning. The fifth explored stakeholder preferences across alternative policy scenarios, including immediate prohibition, phased transition, and voluntary uptake supported

by incentives. The sixth provided space for additional observations, including existing initiatives and suggested actions for the study team.

The questionnaire was administered through purposive sampling across stakeholder categories most directly relevant to the transition question. These included wildlife and environmental authorities, hunting associations, safari operators, private landowners, ammunition retailers and importers, conservation organisations, community-based wildlife institutions, wildlife veterinarians, and selected public-health actors. Snowball referrals were used where initial respondents identified additional actors of strategic relevance.

2.3.2 Key informant interviews

Semi-structured key informant interviews were used to deepen and contextualise the questionnaire results. These interviews were particularly important in understanding implementation constraints, political economy dynamics, stakeholder perceptions, and regulatory realities that could not be fully captured through structured survey responses alone. Interview protocols broadly mirrored the main analytical domains of the questionnaire, but allowed for deeper probing, clarification, and discussion of commercially or politically sensitive issues.

Interview emphasis varied by stakeholder group. With government actors, discussion focused on legislation, enforcement feasibility, institutional roles, and regulatory constraints. With hunting-sector actors, interviews focused on supply chains, operational norms, ammunition performance, and views on the feasibility of voluntary versus mandatory transition. With conservation organisations, the emphasis was on institutional capacity, existing initiatives, and possible roles in a transition architecture. With community-based organisations, interviews explored the implications of ammunition transition for livelihoods, governance, and benefit-sharing within CBNRM systems. Where feasible, interviews were conducted in person; otherwise, they were undertaken by telephone or video conference. Notes and recordings were maintained, subject to respondent consent, and were reviewed for accuracy and consistency.

2.3.3 Country research assistant network

Primary data collection was supported by a structured network of country-level research assistants in each of the five priority countries. This network was central to the methodology because access to wildlife authorities, hunting-sector actors, community institutions, and local conservation organisations often depends on established relationships, contextual fluency, and country-specific institutional knowledge. Each research assistant worked within a common data collection protocol, maintained an interview and submission tracker, and submitted questionnaire responses and interview notes to the lead consultant for review and quality checks. The three technical leads also supported primary data collection directly.

2.4 Consultation record

The consultation process produced 29 confirmed respondents who submitted complete or substantially complete questionnaires. In cases where written submissions were incomplete, the consultancy triangulated across contemporaneous notes, correspondence, and wider stakeholder evidence to maintain analytical continuity, with the confidence level of those cases clearly signalled throughout the analysis.

2.5 Literature review strategy.

A systematic literature review was conducted in parallel with primary data collection. Its purpose was threefold: to frame the research questions, to validate and contextualise primary findings, and to support triangulation where primary data was incomplete. The literature review covered four broad domains.

The first domain consisted of peer-reviewed scientific literature on lead toxicology and exposure pathways in avian scavengers and raptors, especially in Southern Africa but also in North America and Europe where comparative policy lessons were relevant. The second domain covered legal and policy material, including wildlife legislation, ammunition regulations, game-meat safety frameworks, and official enforcement-related records across the five priority countries and the two contextual countries.

The third domain focused on international and regional policy architecture, particularly the SADC Vulture Conservation Strategy and Action Plan, CMS Resolution 11.15, the CMS Vulture Multi-species Action Plan, and related SADC instruments. The fourth domain covered international regulatory and policy experience, including the European Union REACH process, California's lead ammunition transition, and other documented attempts to regulate or phase out toxic ammunition.

Grey literature was also reviewed where it added relevant evidence not available in peer-reviewed form, including project reports, NGO databases, programme documentation, and ecosystem-service valuation studies. Standard academic databases were used alongside targeted review of institutional websites, government portals, and reference trails from major review articles.

2.6 Analytical framework

Four interconnected analytical frameworks structured the interpretation of evidence.

The first was the barrier matrix, which organised stakeholder responses across six domains: economic and market barriers, supply and availability constraints, technical and ballistic concerns, regulatory and policy gaps, institutional capacity limitations, and social or cultural resistance. Quantitative scores were aggregated by country and stakeholder type and then checked against qualitative evidence to identify where numeric ratings masked intra-country variation or sector-specific differences.

The second was the Total Economic Value (TEV) framework, which structured the cost-benefit analysis. Under this approach, the benefits and costs of transition were organised into ecological, human health, economic, and market-access categories. Three scenarios were then assessed: immediate legislative prohibition, a five-year phased transition, and a ten-year incentive-led voluntary transition.

The third was an influence-interest mapping framework, used to organise the stakeholder analysis. This positioned actors according to their level of influence over the transition process and their degree of interest in engaging with it. The purpose was to ensure that the later engagement strategy was differentiated rather than generic, recognising that high-influence/low-interest actors require different approaches from high-interest/low-influence actors.

The fourth was the broader systems approach, which connected the analytical pieces. The barrier matrix explains why lead dependence persists. The cost-benefit analysis clarifies the consequences of maintaining that status quo and the gains of changing it. The stakeholder framework identifies who can sustain or disrupt the current system. The roadmap then sets out the sequencing required to move toward a non-lead equilibrium. Taken together, these frameworks ensure that the consultancy moves from diagnosis to implementation logic.

2.7 Limitations and mitigation

Several limitations affect the evidence base and should be stated directly. The first is the absence, in most countries, of publicly accessible and disaggregated national ammunition import and sales data by calibre and type. This means that country-level quantum estimates could not be generated from administrative records alone and instead required triangulation across respondent-reported volumes, wildlife quota data, and available trade statistics. Where evidence was insufficient to support point estimates within the consultancy's stated confidence threshold, ranges were used instead.

The second limitation relates to informal and subsistence hunting. In many communal and peri-urban areas, hunting activity occurs outside fully documented permit and quota systems. This includes both legal subsistence uses and activities that fall outside formal reporting systems. Such activity is likely to contribute materially to environmental lead deposition but could not be quantified reliably within the scope of this assignment.

The third limitation is that Mozambique and Angola were covered through secondary data only. No primary fieldwork was undertaken in either country, or findings relating to them should therefore be treated as contextual rather than equivalent in confidence to the five priority-country analyses.

The fourth limitation concerns commercial and security-related sensitivity. Importers, retailers, and military-linked institutions were among the most guarded stakeholder groups, especially regarding import volumes, supplier relationships, and pricing structures. This constrained the precision of supply-chain analysis and meant that public market evidence and stakeholder experience had to carry more weight than direct disclosure in some areas.

A fifth limitation concerns uneven depth of qualitative engagement across countries. Some country cases, especially South Africa, benefited from richer stakeholder engagement and more extensive follow-up discussion, while others relied more heavily on questionnaire material. This variation does not invalidate the analysis, but it does mean that the later country findings should be interpreted with attention to the relative depth of evidence in each case.

Mitigation measures were applied throughout. These included triangulation across stakeholder categories and data types, the use of ranges where precision was low, structured qualification of weaker evidence, and explicit recommendations in the roadmap aimed at improving future data infrastructure. The intention throughout has been to maintain analytical usefulness without overstating certainty.

CHAPTER 3: THE SCALE OF LEAD AMMUNITION USE

3.1 Introduction

This chapter presents the report's central quantitative findings on lead ammunition use and environmental lead dispersal across the five priority countries. It draws on two complementary analytical streams.

The first is a quantum assessment, based on respondent-reported ammunition volumes, stakeholder interviews, and supplementary trade and quota information, used to estimate the scale and composition of lead ammunition in active use across selected hunting and wildlife management sectors. The second is a formula-based lead dispersal model, which applies a common deterministic equation to country-specific offtake or quota data in order to estimate the mass of metallic lead deposited annually in gut piles and discarded carcass material. Taken together, these approaches provide a more complete evidence base than either would support alone: the quantum assessment helps anchor the analysis in reported field practice, while the modelling framework provides a consistent basis for cross-country comparison and policy prioritisation.

The chapter supports four central conclusions. First, lead-based ammunition remains dominant across all five priority countries, with no evidence of a meaningful transition to non-lead ammunition. Second, the largest rifle-based lead burden is consistently associated with elephant operations, especially where trophy hunting and problem animal control overlap. Third, Namibia is a structural outlier because most of its modelled lead burden arises from shotgun game-bird hunting rather than rifle-based dangerous-game hunting. Fourth, the current country estimates should be treated as lower-bound or sector-bound estimates rather than complete national totals, because major hunting sectors remain unmodelled in several countries. South Africa professional hunter permits and does not capture game-bird shooting, which in many provinces requires only a provincial game-bird licence rather than a PH-supervised permit. This structural regulatory gap means game-bird hunting volumes are systematically undercounted in official statistics across the region. (Bird Hunters Africa, 2022; SA Hunters and Game Conservation Association, 2024; Sherratt, 2025). The five country models share a common methodology but differ in scope—varying in data sources, sector coverage, and assumptions making them valuable for identifying structural patterns and policy priorities but not directly combinable into a single regional total without careful adjustments for scope and missing sectors.

3.2 Core estimation methodology

3.2.1 Quantum assessment approach

The quantum assessment combined three sources of evidence to estimate country-level ammunition volumes. The first was respondent-reported annual ammunition use collected through the structured questionnaire, including rifle rounds, shotgun shells, and the reported proportion of lead-based versus non-lead ammunition. The second was sectoral quota and wildlife use data, particularly the communal conservancy quota sheets available for Namibia, which provided an indirect basis for triangulating the scale of likely ammunition use. The third was secondary literature and administrative material on hunting-sector scale, including offtake records, official notices, and trade data where relevant.

Lead content per unit of ammunition was estimated using the calibre-specific methodology described in the technical annex. For large-bore dangerous-game calibres commonly used in the region, including .375 H&H, .416-class cartridges, and .458-class cartridges, estimated lead content per bullet ranges from approximately 13 to 28 grams depending on calibre, bullet mass, and assumed lead fraction. For plains- and medium-game calibres more prevalent in Namibia and South Africa, including .300 Winchester Magnum, 6.5 Creedmoor, and .30-06 Springfield, lead content per bullet is lower, but potentially important in aggregate because of the larger numbers of medium-game animals harvested in some systems.

The quantum assessment is strongest where respondent-reported ammunition volume is supported by institutional credibility and partial triangulation. It is weaker where access constraints, incomplete submissions, or missing administrative records prevented tighter validation. For this reason, the chapter uses ranges rather than false precision where the underlying evidence does not justify point estimates.

3.2.2 Lead dispersal modelling approach

All five country models apply a common lead dispersal formula adapted from Hunt et al. (2006) and (Craighead & Bedrosian, 2008):

$$\text{Lead (kg/yr)} = \text{Offtake} \times \text{Rounds per Animal} \times \text{Bullet Weight (gr)} \times 0.0648 \times \text{Lead Fraction (0.97)} \times \text{Gut-Pile Fraction} \div 1,000$$

This formula estimates the mass of metallic lead deposited annually in gut piles and discarded carcass material, which represent the primary ingestion pathway for vultures and other terrestrial scavengers in rifle-based hunting systems. The conversion factor 0.0648 converts bullet weight in grains to grams; 0.97 represents the assumed lead fraction in conventional jacketed lead-core bullets; and the gut-pile fraction, typically ranging from 0.40 to 0.65 depending on species, estimates the proportion of lead retained in the eviscerated carcass. Species-specific parameters were applied consistently across country models.

These model outputs should be interpreted as environmental loading indicators, not direct toxicological exposure measures. Actual wildlife exposure depends on fragmentation patterns, bioavailability, carcass accessibility, soil and water conditions, and scavenger feeding ecology. Nonetheless, the lead mass estimates provide a robust and comparable metric for assessing relative burden and identifying where policy intervention is likely to yield the greatest ecological benefit.

3.3 Comparative methodology and scope boundaries

A core strength of the chapter is the use of a common modelling framework across countries. A core limitation is that the countries are not modelled from identical underlying datasets. Zimbabwe combines a formula-based community-sector estimate with a separate safari-sector quantum estimate. Zambia uses actual DNPW returns. Botswana and Namibia depend more heavily on quota-based scenario modelling. South Africa's model is explicitly narrow, covering only three CITES-listed trophy species and excluding the much larger domestic hunting industry. These differences do not invalidate comparison, but they do define the terms on which comparison is credible.

For this reason, the chapter uses cross-country comparison primarily to identify structural patterns rather than to imply that each country estimate represents a complete national lead budget. In practice, the most useful comparative outputs are the dominance of elephant-related rifle lead, the distinctiveness of Namibia's shotgun pathway, the contrast between actual-offtake and quota-based models, and the scale of unmodelled sectors in countries with large private or freehold hunting industries.

Table 1: Country level comparisons

Country	Data Basis	Sector / Scope	Years Covered	Offtake vs Quota	Scenario Structure
Zimbabwe	CAMPFIRE district annual returns; ZimParks PAC	Community sector (CAMPFIRE) + formal safari sector (SOAZ) -	2019-2024 (actual)	Actual recorded offtake + respondent-	Single estimate (formula); range

Country	Data Basis	Sector / Scope	Years Covered	Offtake Quota vs	Scenario Structure
	records; SOAZ questionnaire	excludes private freehold culling		reported volumes	estimate (quantum)
Zambia	DNPW national wildlife returns	Community (CBNRM) and wildlife sector; 35 species	2024 (actual)	Actual recorded offtake	Single estimate - actual data used directly
Botswana	Government Notice No. 482/2021 (verified gazette); 2023-2026 notices; BWTI questionnaire	National commercial hunting - full CHA-based quota system; institutional training use	2022-2026 quota years	Quota ceiling x utilisation + respondent volumes	LOW 40% / CENTRAL 65% / HIGH 80%
Namibia	MEFT communal conservancy quota (2023-2025 block); NGO's and MEFT questionnaires	Communal conservancies (90 conservancies); includes game birds (shotgun); commercial concession	2023-2025 annual average	Quota x utilisation + respondent volumes	LOW 35% / CENTRAL 65% / HIGH 90%
South Africa	DFFE Notice of Intention, February 2026; CITES Trade Database; qualitative stakeholder data	CITES Appendix I/II international trophy ONLY - excludes domestic hunting industry (qualitative only)	2026-27 proposed; qualitative insights current	Proposed quota utilisation x	LOW 40% / CENTRAL 65% / HIGH 80%

3.4. Country-Level Analysis

3.4.1 Zimbabwe

Zimbabwe provides the strongest combined evidence base in the current sample because it includes both a formula-based community-sector estimate and a respondent-based formal safari-sector volume estimate.

The CAMPFIRE community-sector model, based on district returns and ZimParks PAC records for 2019–2024, produces an annual average estimate of 24.382 kg/yr, of which 15.848 kg/yr is estimated to be gut-pile lead accessible to vultures and other scavengers. Elephant operations, combining trophy and problem animal control, are the dominant driver of this burden. The time-series signal is particularly important: estimated lead dispersal rises from approximately 20.1 kg in 2019 to 32.8 kg in 2024, a 63 percent increase driven mainly by escalation in elephant PAC rather than growth in trophy hunting volumes. This trend is ecologically significant because

vultures in Zimbabwe are critically endangered and rely on carcasses and gut piles for food, yet lead poisoning is a documented cause of mortality for these species. PAC meat is also frequently distributed to local communities, creating overlapping human exposure pathways alongside wildlife risks. This makes the gut-pile route both an ecological and public health concern. This is one of the chapter’s clearest findings and one of its most important policy signals.

The SOAZ formal safari-sector estimate, derived through the quantum assessment, is much larger in absolute terms. The Safari Operators Association of Zimbabwe reported an annual use of approximately 20,000 to 60,000 rifle rounds, of which 76 to 99 percent was estimated to be lead-based. Applying a midpoint lead share and a calibre-weighted average lead content yields an indicative central estimate of approximately 612 kg/yr of metallic lead dispersed by the formal safari sector alone, with a wide uncertainty range of roughly 197 to 1,663 kg/yr. This spread reflects real uncertainty in annual volumes and calibre mix rather than a simple modelling error.

Taken together, the two Zimbabwean streams establish that lead dispersal occurs across both the formal safari sector and the community-based PAC pathway, that the gut-pile component represents a structurally distinct and ecologically significant exposure route, and that PAC should be treated as a first-order transition priority rather than a secondary management issue in the Zimbabwean context.

Table 2: Zimbabwe indicative total

Sector	LOW (kg/yr)	CENTRAL (kg/yr)	HIGH (kg/yr)
CAMPFIRE Community (trophy + PAC)	--	24.382	--
of which: Gut-pile component	--	15.848	--
Formal Sector (SOAZ quantum)	~197	~612	~1,663
Combined Indicative Total	~221	~636	~1,687

Note: CAMPFIRE estimate covers 2019-2024 annual average (actual offtake). The Safari Operators Association of Zimbabwe (SOAZ) formal safari estimate is derived from the quantum assessment. Both sectors operate independently and their estimates are additive. Community hunting and PAC outside CAMPFIRE remain unquantified.

3.4.2 Zambia

Zambia’s quantum evidence remains more limited, but its formula-based model is one of the strongest in the regional sample because it draws on actual 2024 DNPW returns across 35 species. This produces a central estimate of 54.325 kg/yr, the highest single-country formula-based central estimate in the current dataset, with an estimated gut-pile component of 35.3 kg/yr. Elephant, hippopotamus, and buffalo are the principal drivers.

Although respondent-based volumetric data for Zambia remained incomplete at the time of drafting, the DNPW offtake model is sufficiently strong to establish Zambia as a major lead-dispersal landscape within the modelled community and wildlife sector. The conservation relevance of this figure is amplified by the presence of GMAs and broader wildlife-use landscapes where hunting and scavenger exposure overlap.

Table 3: Zambia indicative totals

Sector	LOW (kg/yr)	CENTRAL (kg/yr)	HIGH (kg/yr)
DNPW National Returns 2024 - 35 species (actual offtake)	--	54.325	--
of which: Gut-pile component (estimated)	--	~35.3	--

Note: Based on actual 2024 DNPW offtake across 35 species. The quantum assessment is currently data-limited for Zambia; primary respondent volume data is pending (see Section 8).

3.4.3 Botswana

Botswana's model combines a quota-based national commercial hunting estimate with a smaller institutional quantum signal from the Botswana Wildlife Training Institute. Under the formula model, the commercial quota system produces a central estimate of 15.680 kg/yr, with elephant contributing the largest share. The institutional training figure reported by BWTI — 27,000 rounds per year, with 51 to 75 percent estimated to be lead-based — is analytically useful as contextual evidence of lead dependence, but it is not treated as a national hunting estimate.

Botswana's importance in the chapter rests less on absolute lead volume than on two strategic points. The first is that the quota system is comparatively comprehensive by regional standards, making Botswana one of the cleaner quota-based cases in the sample. The second is that Botswana provides some of the strongest exposure evidence in the literature through the Garbett et al. (2018) findings on elevated blood lead concentrations in White-backed Vultures associated with hunting activity. This makes Botswana a critical country for connecting modelled lead burden with real ecological exposure. The principal limitations are the reliance on quota scenarios rather than full actual-offtake coverage and the incomplete access to several community and private-sector submissions.

Table 4: Modelled Lead Dispersal Estimate (Botswana)

Sector	LOW (kg/yr)	CENTRAL (kg/yr)	HIGH (kg/yr)
National Commercial Quota (CHA-based) - formula model	10.22	15.680	19.30
of which: Gut-pile component	~6.6	~10.2	~12.5
BWTI institutional training (quantum)	--	Additional (unquantified)	--

Note: Formula model based on 2022 verified gazette quotas; 2023/2026 OCR-estimated +/- 15%. BWTI reported 27,000 rounds/yr (51-75% lead) but as institutional training data; not extrapolated to national total.

3.4.4 Namibia

Namibia is analytically important because it is the clearest structural outlier in the sample. Under the communal conservancy model, total lead dispersal is estimated at 37.230 kg/yr under the central scenario. However, 84 percent of this total arises from shotgun game-bird hunting, while only 3.85 kg/yr represents rifle-based gut-pile lead directly relevant to the vulture exposure pathway.

This distinction changes the interpretation of the country estimate. Namibia is not simply another high-rifle-lead country. It is a mixed lead system in which the dominant environmental pathway

is shotgun pellet deposition rather than dangerous-game rifle gut piles. That means Namibia cannot be compared uncritically with Zimbabwe, Zambia, or Botswana when the policy question is specifically vulture exposure from carcass lead. It also means that Namibia requires a dual policy logic: one for rifle transition in dangerous-game contexts, and a separate one for shotgun transition in communal game-bird hunting systems. Advocacy for a shotgun transition can be premised on lessons from Europe, where game- bird hunting near water bodies, which is the major driver of lead pellet deposition leading to lead poisoning for waterfowl and fish has been banned (Mateo & Kanstrup, 2019)

The respondent data from MEFT, the Namibia Safari Operation, and the Namibia Community Environment programme reinforces this interpretation. Across these sources, lead use remains dominant, non-lead alternatives are described as rarely or never available, and price premiums are seen as a major barrier. The major analytical gap is the large unmodelled freehold game-ranch sector, which likely contributes significant additional lead beyond the communal conservancy estimate.

Table 5 Modelled Lead Dispersal Estimate (Namibia)

Sector	LOW (kg/yr)	CENTRAL (kg/yr)	HIGH (kg/yr)
Communal conservancies - TOTAL (rifle + shotgun)	17.54	37.230	53.86
of which: Game birds (shotgun pathway)	~14.8	~31.3	~47.0
of which: Rifle gut-pile (vulture-relevant)	~2.0	3.85	~6.0

Note: 84% of total estimated lead dispersal is via the shotgun game-bird pathway, which operates through a fundamentally different environmental mechanism from rifle gut-pile deposition. Scavenger-relevant lead should be assessed from the rifle component only. Freehold game ranch sector (major export component) is excluded.

3.4.5 South Africa

South Africa's model estimates that the **international hunting sector alone** disperses approximately **475 kg of lead per year** under the central scenario, with a low estimate of **~380 kg/yr** and a high estimate of **~639 kg/yr**. Of this total, approximately **278 kg/yr** under the central scenario represents **gut-pile lead**, the component most directly relevant to vulture and scavenger exposure. The corresponding low and high gut-pile estimates are **~223 kg/yr** and **~374 kg/yr** respectively. This places South Africa among the largest quantified lead-dispersal systems in the study and indicates that the country's international rifle-hunting sector constitutes a major source of environmentally available lead within the regional landscape.

At the same time, this estimate should not be interpreted as a full national lead budget. The model is limited to the international client hunting segment captured in professional hunting records and excludes other potentially important pathways, especially resident or domestic client hunting and landowner or management offtake outside that reporting system. No shotgun game-bird pathway operates within the modelled sector; all dispersal occurs through the rifle gut-pile mechanism, meaning that the full estimate is directly relevant to scavenger exposure analysis. The central estimate uses the nine-year average inclusive of the COVID-affected 2020 season, while the low scenario applies conservative assumptions regarding partial copper-bullet uptake in the dangerous game segment together with lower gut-pile retention parameters, and the high scenario applies a COVID-normalised average excluding 2020 combined with upper-bound bullet mass and gut-pile assumptions.

South Africa’s revised international hunting-sector model, based on DFFE Professional Hunter Registers (2016–2024), produces a central estimate of approximately 475 kg/yr, of which 278 kg/yr is scavenger-relevant gut-pile lead. This makes South Africa one of the largest quantified lead-dispersal systems in the study, while still understating the likely national total because domestic hunting clients remain unmodelled.

Table 6 Modelled Lead Dispersal Estimate (South Africa)

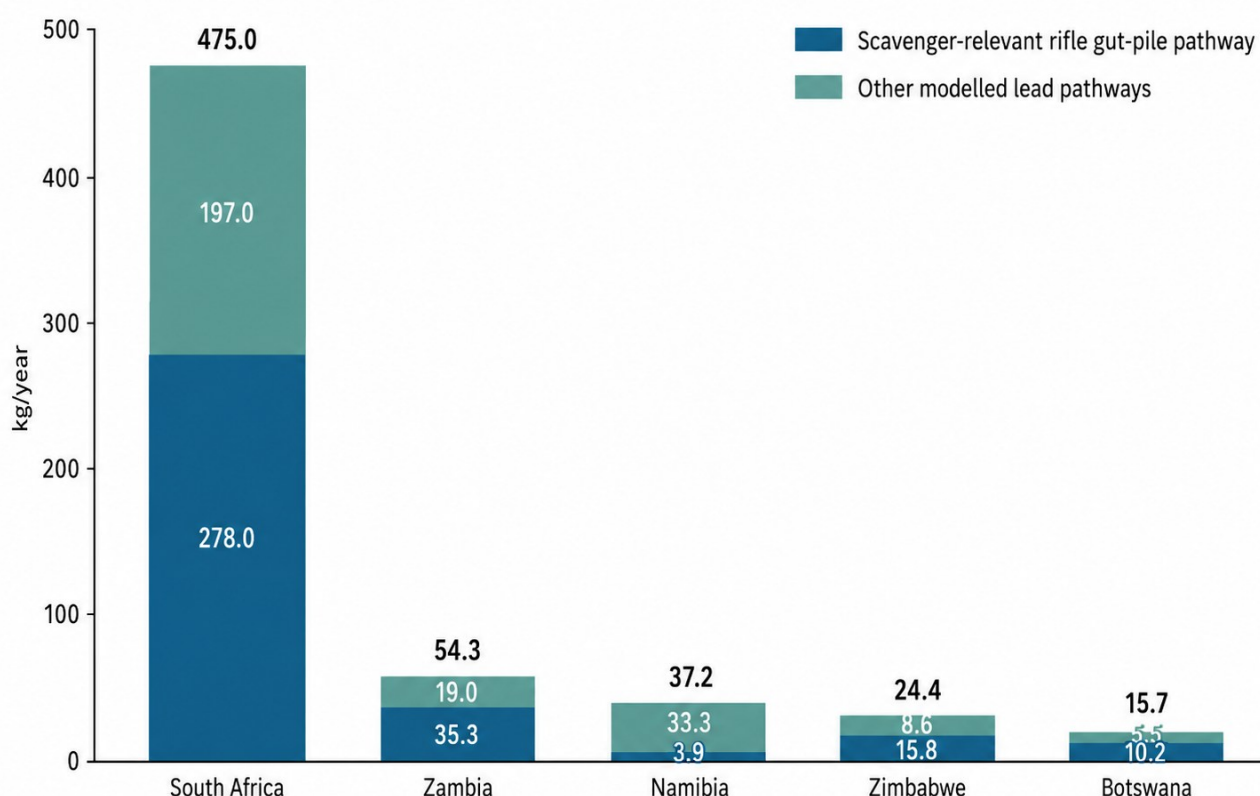
Sector	LOW (kg/yr)	CENTRAL (kg/yr)	HIGH (kg/yr)
International hunting sector — TOTAL (all rifles; international clients)	~380	475	~639
of which: Gut-pile lead (vulture-relevant component)	~223	278	~374

Note: Model covers DFFE Professional Hunter Registers 2016–2024, international clients only. Domestic hunting clients (a substantial additional sector) are excluded and represent an unmodelled lead source. No shotgun game-bird pathway operates in this sector; all lead dispersal is via the rifle gut-pile mechanism and is therefore fully scavenger-relevant. CENTRAL estimate uses the 9-year average inclusive of the COVID-affected 2020 season. LOW applies conservative assumptions on partial copper bullet uptake in the dangerous game segment (~15% of Category A) and conservative gut-pile parameters (–20% overall). HIGH applies the COVID-normalised 8-year average (excluding 2020; +12%) combined with upper-bound bullet mass and gut-pile fraction assumptions (+20%), yielding an overall +35% adjustment on the central estimate.

3.5 Combined estimate, scope boundaries, and uncertainty

Taken together, the country models point to three consistent regional patterns. First, elephant-related operations dominate the rifle-based lead burden across the regional sample. Second, Namibia is structurally distinct because most of its lead burden arises from shotgun game-bird hunting rather than rifle-based dangerous-game hunting. Third, the Zimbabwe time series indicates that problem animal control may be a more urgent and faster-growing pathway than trophy hunting alone. These patterns provide the context within which the combined estimate should be interpreted.

Indicative annual lead burden across modelled sectors (central estimates, kg/year)



Note: Central estimates only. Country model scopes differ and should not be interpreted as full national lead budgets.

Figure 2: Lead burden across five countries

Under central assumptions, the formula-based country models indicate a substantial annual lead burden across the modelled sectors. Zimbabwe's CAMPFIRE community sector contributes 24.4 kg/yr; Zambia's DNPW 2024 actual-return model contributes 54.3 kg/yr; Botswana's quota-based model contributes 15.7 kg/yr; Namibia's communal conservancy model contributes 37.2 kg/yr; and South Africa's international hunting-sector model contributes 475.0 kg/yr. Taken together, these figures yield a combined central estimate of approximately 606.6 kg/yr of environmental lead dispersed annually across the modelled sectors. Of this total, the component most directly relevant to scavenger exposure through rifle-based gut piles is approximately 343.2 kg/yr, comprising South Africa's 278.0 kg/yr, Zambia's estimated 35.3 kg/yr, Zimbabwe's 15.8 kg/yr, Botswana's approximately 10.2 kg/yr, and Namibia's 3.85 kg/yr rifle component. The order of magnitude is therefore clear: even under conservative assumptions and covering only the currently modelled sectors, the regional lead burden is already substantial.

3.6 Implications for scavenger conservation, ecosystem health, and public interest

The conservation relevance of these estimates is direct. Across much of Southern Africa, lead is being deposited in the same landscapes used by threatened scavengers and wider wildlife communities. In rifle-dominant systems, the key pathway is the gut pile and discarded carcasses, which provide a predictable recurring source of lead fragments to scavengers during the hunting season. Where dangerous-game hunting and PAC occur in communal or concession landscapes that overlap with scavenger movement ranges, the probability of exposure is high. The same landscapes also create a broader public-interest concern through food-safety, community meat distribution, and wildlife-management pathways.

Two features of the current evidence sharpen this concern. The first is the prominence of large-calibre dangerous-game lead, especially in elephant operations, which increases the mass of lead deposited per animal and therefore the likely fragment burden available to scavengers. The second is the apparent growth of PAC-derived gut piles in peri-agricultural settings, where wildlife conflict, scavenger access, and retaliatory poisoning risks can intersect. Together, these dynamics suggest that the lead burden is not merely persistent but, in some landscapes, may be intensifying at a time when several vulture populations are already under severe pressure.

Namibia adds a second, distinct ecological concern. There, the dominant issue is not gut-pile exposure but diffuse pellet deposition from game-bird hunting. This broadens the receptor community beyond vultures to include scavenging and ground-feeding birds, raptors, meso-carnivores, and other secondary consumers. The regional conservation problem is therefore not singular. It has at least two linked but distinct ecological expressions: gut-pile exposure in rifle systems, and pellet ingestion in shotgun systems.

3.7 Policy priorities emerging from the evidence

The first policy priority is to target PAC operations for immediate transition to non-lead rifle ammunition. PAC is one of the clearest high-impact entry points because it is ecologically consequential, often state-managed, and more administratively tractable than dispersed private hunting markets. A focused transition in PAC operations would likely produce disproportionate conservation benefit relative to effort.

The second priority is to treat rifle and shotgun transitions as separate policy tracks. Namibia's communal conservancy game-bird system cannot be addressed effectively through the same transition tools used for dangerous-game rifle hunting. The region therefore requires one track for rifle ammunition in dangerous game and PAC, and another for shotgun ammunition in bird-hunting systems.

The third priority is to close the private-sector data gap. The largest omissions in the current evidence base are not marginal activities but often the biggest ones: freehold game ranches, private concessions, safari-area hunting, domestic hunting clients, and culling operations. As already noted, the Zimbabwe SOAZ safari-sector estimate alone is roughly 25 times the CAMPFIRE formula figure, and South Africa's domestic hunters outnumber international clients by a factor of more than 30 — suggesting that the modelled totals capture only a fraction of actual regional lead dispersal. Without mandatory or harmonised annual offtake reporting across these sectors, national lead budgets will remain systematically underestimated.

The fourth priority is to establish standardised ecological monitoring, including blood-lead surveillance linked to hunting calendars and hunting geographies. This would provide the empirical bridge between modelled lead burden and actual wildlife exposure, strengthening both policy legitimacy and future evaluation.

The fifth priority is to integrate lead management into operating systems that already govern hunting practice, including concession agreements, CBNRM frameworks, and wildlife authority procedures. This would move lead transition from general advocacy into the realm of operational compliance and phased institutional practice.

3.8 Data gaps and research priorities

The current evidence base points to five priority areas for improvement. First, private-sector and freehold offtake records remain the single largest structural omission across countries. Second, PAC reporting systems outside Zimbabwe are weak or incomplete despite the apparent ecological importance of this pathway. Third, country-specific bullet construction data — especially the actual penetration of copper or other non-lead bullets in the field — is largely absent. Fourth, shotgun harvest and pellet-use data remain poorly developed outside Namibia. Fifth, spatial overlay work linking hunting intensity to vulture foraging ranges would materially improve targeting and exposure modelling in the next phase of this work.

CHAPTER 4: NON-TOXIC ALTERNATIVES

4.1 Scope and analytical focus

Chapter 4 addresses the supply side of the transition. It asks four practical questions: whether non-lead alternatives exist for the hunting systems prevalent in Southern Africa, whether they are technically adequate, whether they are commercially available at relevant calibres and volumes, and what features of the current supply chain would need to change for wider adoption to become feasible. The core finding is that the transition problem is not uniform across ammunition types. Non-lead rifle alternatives are already technically mature and commercially established in global markets, while shotgun transition remains more complex and less evenly developed.

The chapter therefore distinguishes between two supply pathways. The first is rifle ammunition for dangerous game and plains game, where the main constraints are price, stocking, distribution, and user confidence rather than technical viability. The second is shotgun ammunition for bird hunting, where transition is more demanding because product performance, firearm compatibility, and manufacturing economics are less straightforward. This distinction is central to the phased strategy developed later in the report. The chapter draws on respondent evidence from the five priority countries, trade and market data, manufacturer information, and comparative regulatory experience. It should be read together with Chapter 3, which quantifies the lead burden, and Chapter 5, which analyses barriers to transition. Chapter 4 focuses specifically on whether the market can support a realistic shift away from lead ammunition, and under what conditions

4.2 The regional supply chain: South Africa as the hub

The regional ammunition supply chain is highly concentrated. Across the five priority countries, South Africa functions as the dominant supply hub for both local use and intra-regional trade (United Nations Statistics Division, 2025). In practical terms, this means that the availability of non-lead alternatives in Zimbabwe, Botswana, Namibia, and Zambia is shaped to a significant degree by what is manufactured, imported, stocked, and distributed through South African channels. This concentration of supply has two important implications. First, where South African manufacturers and distributors do not supply suitable non-lead products in relevant calibres, operators elsewhere in the region face not only a price barrier but an absolute access barrier. Second, policy or market changes in South Africa have leverage beyond its borders because they affect the wider SADC import base.

This hub-and-spoke structure is one of the most strategically important findings in the chapter. It means that the regional transition does not depend on building five fully separate national supply systems from scratch. Rather, it depends to a considerable extent on whether South African manufacturing, import, and distribution systems begin to normalise non-lead products in the calibres most relevant to regional hunting and wildlife management. In that sense, South Africa is not only one national case among others; it is the main commercial gateway through which transition becomes more or less feasible for the region as a whole.

Trade data also suggest that South Africa's ammunition sector is embedded in a broader global realignment. Tightening restrictions on lead ammunition in some source markets, particularly in Europe, are likely to affect product availability, market incentives, and export orientation over time (European Chemicals Agency, 2018; *Commission Regulation (EU) 2021/57 of 25 January 2021 Amending Annex XVII to Regulation (EC) No 1907/2006 of the European Parliament and of the Council Concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) as Regards Lead in Shot for Use in or around Wetlands*, 2021). This does not automatically produce a non-lead transition in Southern Africa, but it does mean that the regional market is not static. External regulatory pressures may alter what South African manufacturers produce and what importers and distributors choose to stock. The policy implication is clear: SADC's transition prospects are shaped not only by domestic demand and

regulation, but also by how the South African supply hub responds to shifting upstream market conditions.

At the same time, trade and customs data have limits. Relevant tariff categories do not distinguish reliably between lead and non-lead products, so they are best used to show the geography and scale of supply chains rather than to estimate the lead fraction within traded volumes (United Nations Statistics Division, 2025). This distinction matters. Chapter 4 uses trade evidence to analyse supply structure and leverage, not to infer direct lead budgets, which remain the concern of Chapter 3

4.3 non-lead rifle ammunition: technical adequacy and market status

For rifle ammunition, the technical case for non-lead transition is already well established (Arnemo et al., 2016; Stokke et al., 2019) Solid copper and copper-alloy bullets have been in commercial use for decades and are available across the calibre range relevant to Southern African hunting, including dangerous-game, plains-game, and medium-game applications (Barnes Bullets, 2026; Hornady Manufacturing, 2026; McTee et al., 2023; Peregrine Bullets, 2022) Their ballistic properties are well understood: high weight retention, reliable penetration, and consistent expansion characteristics under appropriate design conditions In practical terms, this means that the question for rifle ammunition is no longer whether non-lead products can work. It is whether they are sufficiently available, affordable, and trusted in the contexts where they are needed.

Regional manufacturing capacity exists (Peregrine Bullets, 2022) South African producers have demonstrated that non-lead rifle bullets can be manufactured within the region rather than relying exclusively on imports from Europe or North America. This is strategically important because it reduces the argument that the region is wholly dependent on distant suppliers for transition. At the same time, market penetration remains weak. The presence of manufacturing capacity does not yet translate into reliable retail availability across countries, calibres, and hunting segments. The critical problem is therefore not invention, but diffusion. Respondent evidence reinforces this point. Professional users are often aware of non-lead rifle products by name and understand, at least in general terms, that alternatives exist. In several country contexts, respondents reported that non-lead rifle ammunition was rarely or never available locally, or available only through irregular channels, special orders, or limited specialist suppliers.

In other words, the commercial market is not yet functioning in a way that supports routine substitution. Users may know the alternatives, but that knowledge does not currently convert into dependable procurement. This gap between technical maturity and practical adoption is one of the chapter's central findings. It explains why the rifle transition can be described simultaneously as feasible and constrained. Feasible, because the products exist and have already demonstrated technical adequacy. Constrained, because availability, price, and confidence remain binding barriers in the field. The market challenge is therefore not to prove that non-lead rifle ammunition works, but to make it normal, accessible, and low risk enough for users to adopt it without bearing disproportionate cost or uncertainty.

4.4 Non-Lead Shotgun Ammunition: A More Complex Transition

Price remains one of the most consistent barriers to the uptake of non-lead ammunition. Respondents across multiple countries reported significant price premiums for non-lead products relative to conventional lead-core ammunition, sometimes in the range of 50 to 100 percent depending on calibre and availability (Thomas et al., 2019). These premiums matter in any hunting economy, but they matter especially in high-frequency use contexts, including professional hunting, wildlife management, culling, and problem animal control. Where ammunition is used repeatedly and at operational scale, even a moderate price differential can become a substantial cost factor over time.

Price, however, should not be treated as a stand-alone variable. Its effect is magnified by the broader market environment. A higher-cost product is more difficult to adopt when users are also uncertain about future stock availability, unsure whether they will be able to purchase the same load consistently or unwilling to absorb the cost of experimentation with unfamiliar ammunition. In this way, price interacts with supply inconsistency and user confidence (Krone et al., 2012). The premium does not simply raise the direct cost of switching; it also raises the perceived risk of switching.

This interaction is especially important for dangerous-game hunting and wildlife management. In these contexts, users are not making casual consumer decisions. They are making decisions under conditions where ammunition performance is tied to ethical kill standards, operational safety, and institutional responsibility. As a result, the transition cost is partly monetary and partly behavioural. Users are being asked not only to pay more, but to move away from ammunition types with which they already have established confidence. This means that price-equalisation mechanisms, pilot procurement arrangements, and practical demonstration programmes are likely to matter more than awareness messaging alone.

The policy implication is that cost barriers should be addressed early if transition is to move beyond principle. A market that asks users to absorb both higher costs and higher uncertainty will transition slowly. A market in which supply becomes more reliable, demonstration reduces perceived performance risk, and price differentials narrow through larger-scale stocking or procurement measures is far more likely to support routine uptake. Chapter 4 therefore supports a transition strategy that treats price reduction and supply activation as enabling conditions rather than secondary concerns.

4.5 Shotgun ammunition: a different transition problem

The transition challenge for shotgun ammunition is materially different from the rifle case (European Chemicals Agency, 2018; Mateo & Kanstrup, 2019). While non-lead shotgun alternatives such as steel, bismuth, and tungsten-based products are commercially available, their use involves more complicated trade-offs related to cost, performance, and firearm compatibility. This is especially relevant in contexts where older firearms, particular choke configurations, or user familiarity with lead shot remain significant (European Chemicals Agency, 2018). In practical terms, shotgun transition is not impossible, but it is less straightforward and less commercially mature than rifle transition.

This distinction is particularly important because of the Namibia case. Chapter 3 showed that the largest share of modelled lead dispersal in Namibia's communal conservancies arises from shotgun game-bird hunting rather than rifle-based dangerous-game hunting. The environmental pathway is also different. Instead of lead concentrated in gut piles, pellets are dispersed diffusely across land and water. This affects both the type of exposure and the receptor community, broadening concern beyond vultures to other birds and secondary consumers (Mateo & Kanstrup, 2019; Pain et al., 2010). As a result, the policy logic for shotgun transition cannot simply mirror the logic for rifle ammunition. It requires different sequencing, different technical support, and, in some cases, different regulatory instruments.

For this reason, the regional transition strategy should not assume a single ammunition pathway. Rifle transition can move earlier and faster because the products are technically settled and the main challenges are market and confidence related. Shotgun transition will likely require a more gradual sequence, including practical guidance on compatibility, targeted support in priority ecological settings such as wetlands and communal bird-hunting areas, and a clearer understanding of how users will absorb cost and equipment implications. Chapter 4 therefore reinforces the need for dual-track transition planning: one for rifle ammunition, and one for shotgun ammunition.

4.6 Market readiness and the role of user confidence

A recurring finding across the five-country evidence is that user confidence matters almost as much as technical performance. Even where non-lead products are available, adoption is slowed if users believe they will need to re-test loads, re-sight rifles, or accept greater uncertainty in the field. This is not irrational resistance. It is a predictable feature of high stakes use contexts. Ammunition in dangerous-game hunting, PAC, or wildlife management is not treated as an ordinary consumer good. Users want repeatability, familiarity, and a low margin of uncertainty.

This helps explain why purely informational strategies are unlikely to be sufficient. In many cases, especially among professional operators, the issue is not that non-lead alternatives are unknown. The issue is that users do not yet have enough local evidence, field-based validation, or procurement confidence to treat those alternatives as routine. This suggests that the most effective near-term interventions are likely to be practical rather than rhetorical: demonstration shoots, performance comparisons under local conditions, pilot procurement schemes, and early adopter programmes tied to specific species or management contexts.

The concept of market readiness is therefore broader than simple product availability. A market can technically contain a product without being transition ready. Transition readiness requires sufficient calibre coverage, regular stocking, manageable price differentials, and enough practical familiarity among users that substitution becomes credible. Chapter 4 shows that the rifle segment is closer to this threshold than the shotgun segment, but neither is there yet at meaningful regional scale.

4.7 External regulatory pressure and market direction

Southern Africa's market for ammunition does not operate in isolation. Regulatory developments in major producing and importing regions, especially in Europe, are already reshaping incentives around lead and non-lead products (European Chemicals Agency, 2018; *Commission Regulation (EU) 2021/57 of 25 January 2021 Amending Annex XVII to Regulation (EC) No 1907/2006 of the European Parliament and of the Council Concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) as Regards Lead in Shot for Use in or around Wetlands*, 2021). For the SADC region, this matters less because of direct legal spillover and more because upstream regulation affects what global manufacturers produce, what distributors prioritise, and what products are more likely to enter or leave regional markets over time. In other words, external regulation can influence domestic transition conditions even where SADC countries do not yet have equivalent restrictions in place.

This creates both risk and opportunity. The risk is that poorly regulated markets can become recipients of products displaced from more tightly regulated jurisdictions. The opportunity is that if major source markets continue to move away from lead, manufacturers and distributors may increasingly normalise non-lead lines, thereby improve availability and reduce long-run price penalties in import-dependent regions. SADC is therefore affected not only by its own policy decisions, but by the direction of change in the global ammunition market.

The implication for this report is not that external regulation will solve the regional problem automatically for example in the UK (UK Department for Environment, Food and Rural Affairs, 2025). It is that the regional transition strategy should recognise changing international market conditions as a source of leverage. Combined with South Africa's role as the regional supply hub, this means that the market context may become more favourable for non-lead transition if policy timing, procurement strategy, and supply activation are aligned.

CHAPTER 5: BARRIER ANALYSIS

5.1 Purpose and analytical approach

This chapter identifies the barriers that prevent or delay transition from lead to non-lead ammunition across the five SADC priority countries. The primary analytical base is the questionnaire dataset — 29 respondents covering Zambia, Botswana, Zimbabwe, Namibia, and South Africa — supplemented throughout with structured interview evidence from South Africa. The chapter's purpose is not to restate that lead remains dominant, but to show which barriers matter most, how they differ across sectors and context, and which are most amenable to near-term action.

The questionnaire covered seven scored barrier domains: economic cost, supply availability, technical performance, regulatory absence, barrel wear, awareness, and social or traditional resistance. Barrier severity scores (scale 1–5) are available for approximately 19 questionnaire submissions with completed barrier tables, spanning Botswana, Namibia, Zimbabwe, and Zambia. South Africa's nine structured interviews were not scored using the same scale, but they provide the richest qualitative material in the dataset and are used to interpret patterns throughout the chapter.

Two analytical cautions apply. First, severity is not the same as tractability. Some of the most severe barriers can be addressed relatively quickly through practical interventions; some moderate barriers require slower institutional change. Second, the chapter reads barriers at sector level, not merely by country, because sector-level variation is often more diagnostic than geography.

5.2 Barrier severity matrix

Table 5.1 summarises the severity of the seven barrier domains, combining indicative mean scores from the questionnaire with evidence rationale and an interpretive implication for each domain. The scoring is transparent rather than asserted: the ratings align with where the questionnaire evidence clusters, not with a predetermined hierarchy.

Table 7: Barrier Severity Matrix — Lead Ammunition Transition in SADC

Barrier Domain	Severity	Mean	Questionnaire Evidence	Interpretive Implication
Economic Cost	Moderate-High	3.20	7 of 19 scored responses rated cost at 4–5. Price premiums ranged from approximately +25% (a Botswana professional hunting operator) to +100% (a high-volume Namibian commercial operator). 22 of 29 respondents supported tax relief or subsidies. South Africa interviews confirmed cost compounds when combined with supply absence.	Cost constrains transition but rarely operates alone. Its force is greatest where supply is thin and users lack confidence in alternatives.

Barrier Domain	Severity	Mean	Questionnaire Evidence	Interpretive Implication
Supply Availability	High	3.85	13 of 19 scored responses rated supply at 4–5 with no low ratings. Two Namibian respondents described non-lead products as absent or irregular. Zimbabwe's safari operators association rated supply as critical. South African interviews confirmed uneven stock by calibre and region.	Supply is the key enabling barrier. Without reliable product on the shelf, neither awareness campaigns nor regulation can generate uptake.
Technical Performance	Moderate	2.50	Only 4 of 19 rated technical concerns at 4–5; 10 rated them at 1–2. Most concerns relate to confidence and calibration rather than rejection of non-lead products. PHAs and commercial hunters expressed ballistic uncertainty under dangerous-game conditions.	Tractable through field demonstration and local testing. Not a structural barrier but a confidence gap addressable through practical engagement.
Regulatory / Policy	High	3.68	12 of 19 scored responses rated this at 4–5. Namibia's government wildlife authority and South Africa's defence procurement agency both rated regulatory absence as critical. Across countries, respondents requested predictable transition rules rather than immediate prohibition. South Africa's environmental regulatory authority confirmed no current regulatory framework for lead ammunition.	The issue is implementation uncertainty, not ideological resistance to policy. Phased guidance, concession conditions, and procurement standards can provide early entry points before full legislative reform.
Barrel Wear / Damage	Low	1.85	16 of 19 scored responses rated this at 1–2. Only isolated cases rated it high.	A secondary concern. Should not drive transition narratives or

Barrier Domain	Severity	Mean	Questionnaire Evidence	Interpretive Implication
			Concern exists in anecdotal debate but is not reflected in the scored data.	be a front-end policy obstacle.
Awareness / Information	High	3.95	13 of 19 scored responses rated awareness at 4–5 with no low ratings. Two Botswana community trusts reported unrecognised lead risks across all three pathways (vultures, human health, environment). Nationally, 20 of 29 respondents supported training and demonstration days.	Awareness gaps are segmented. Commercial actors need practical transition information. Community and field-level actors often need more basic problem recognition. Uniform messaging will underperform.
Social Tradition	Moderate	3.00	Mixed scores: 6 rated social resistance at 4–5 and 5 rated it at 1–2. Resistance is higher where hunting practice is embedded in local systems or where transition is perceived as externally imposed. Lower in commercial settings where EU client pressure already opens dialogue.	Social barriers become decisive mainly in specific sectors. Reduce structural barriers first; norm change follows through demonstration and local adaptation.

Note: Mean scores are drawn from approximately 19 scored barrier submissions with completed barrier tables across Botswana, Namibia, Zimbabwe, and Zambia. Severity labels: High = mean ≥ 3.5 ; Moderate-High = 3.0–3.49 with strong qualitative corroboration; Moderate = 2.5–2.99; Low = below 2.5.

5.3 Economic and financial barriers

Economic cost sits in the moderate-to-high range across the dataset, with 7 of 19 scored submissions rating it at 4 or 5. Price premiums ranged from roughly 25 percent (a Botswana professional hunting operator) to 100 percent (a Namibian commercial operator), with the majority of respondents experiencing a 30–50 percent uplift. The economic barrier, however, must be read carefully. Ammunition costs represent a relatively small proportion of a full safari package for commercial operators, and several South African interviews confirmed that the issue for that sector is less about outright affordability than about absorbing higher input costs without a guaranteed market premium from clients.

In community and government settings, the calculus is more direct. Fixed procurement budgets and limited institutional flexibility mean that even modest price differentials are constraining. This explains why tax relief or subsidies attracted the broadest support of any facilitation

measure in the dataset; 22 of 29 respondents endorsed it. The economic barrier is most decisive when it compounds with supply scarcity. Where alternatives are difficult to source at any price, cost comparisons are academic. Fiscal policy intervention therefore needs to be paired with supply activation to have practical effect.

5.4 Supply and market availability

Supply availability is the most operationally decisive barrier in the dataset. Thirteen of the 19 scored submissions rated it at 4 or 5, with no low ratings, a pattern of consistent severity that distinguishes supply from every other domain. Namibian respondents illustrated this with particular clarity. A Namibian government wildlife authority official described non-lead products as unavailable across most supply channels; a high-volume commercial hunting operator reported that non-lead ammunition was entirely absent from his supply chain, rendering cost comparisons irrelevant. Zimbabwe's safari operators association identified supply and affordability together as the decisive constraint for that sector. South African interviews described an uneven picture by calibre and location, where availability is improving in some commercial channels but remains sparse for the calibres used most heavily in problem animal control and culling.

Supply conditions the effectiveness of almost every other transition measure. Awareness campaigns cannot drive uptake if alternatives are not stocked. Regulatory change cannot be enforced if compliant products are absent. Price mitigation through subsidies has no practical effect where there is nothing to purchase. The evidence therefore supports a strong sequencing conclusion: supply activation must precede or accompany every other intervention in the transition roadmap. This points toward distributor engagement, pooled procurement arrangements, and formal stocking commitments as near-term priorities, particularly in Namibia and Zimbabwe where the supply deficit is most acute.

5.5 Regulatory and policy barriers

Regulatory barriers are consistently important across the dataset. Twelve of 19 scored submissions rated this domain at 4 or 5, and the qualitative evidence is equally clear. Namibia's government wildlife authority rated regulatory absence as a critical barrier and described it as the primary reason voluntary transition remains minimal. South Africa's defence procurement and manufacturing agency was conditionally supportive but made its willingness to develop civilian non-lead product lines contingent on an explicit policy mandate. South Africa's environmental regulatory authority acknowledged the absence of any dedicated regulatory framework for lead ammunition, with awareness of the issue having been driven primarily through NGO partners rather than government initiative.

The questionnaire reveals that respondents are not uniformly resistant to regulation. What they resist is uncertainty. The most common preference across the dataset and endorsed by 17 of 29 respondents — was phased transition, not status quo. This distinction matters: respondents want direction and timeline predictability, not indefinite voluntarism and not immediate prohibition. The regulatory barrier should therefore be understood as a demand for implementation clarity rather than as ideological opposition to change. Administrative guidance, wildlife-authority procurement standards, concession conditions, and sectoral codes of practice can provide earlier regulatory entry points than full legislative reform, and they are more likely to achieve cross-sector compliance without triggering the defensive reactions that a rapid blanket ban typically provokes.

5.6 Awareness and information barriers

Awareness is the highest-rated barrier in the dataset, with 13 of 19 scored submissions rating it at 4 or 5 and no respondents rating it low. The aggregate figure, however, obscures a critical structural distinction: awareness is not one problem but two.

In the commercial and professional hunting sectors, most respondents could name non-lead brands, describe general product characteristics, and reference existing scientific work on lead exposure. In these settings the gap is not introductory recognition but practical transition information where products can be reliably sourced, how they perform under the specific calibres and game conditions encountered locally, and what the transition process will involve. A multi-stakeholder demonstration programme run by a South African conservation NGO exemplifies an approach that addresses this tier effectively by convening stakeholders from conservation, hunting, and ammunition manufacturing in a single forum focused on practical evidence rather than advocacy.

The picture is qualitatively different in community and field-level contexts. Two Botswana community trusts reported unrecognised lead risks across all three impact pathways of vultures, human health, and environmental contamination. Zambia's community-based respondent similarly reported no awareness of lead impacts on scavengers. This sector is not starting from partial knowledge; it is starting from near-zero recognition of the problem. A uniform awareness strategy pitched at the commercial-sector level will largely bypass this audience. The strategic implication is clear: awareness programming must be segmented, with basic problem recognition for community and field actors running in parallel with practical transition support for commercial operators.

5.7 Social and cultural barriers

Social and cultural barriers sit in the moderate range overall, but with a wide spread of scores that makes the average less informative than the distribution. Six respondents rated this domain at 4 or 5 and five rated it at 1 or 2, indicating that social resistance is real but highly context dependent. It is neither negligible nor universal.

The pattern shows that social resistance is most pronounced where hunting practice is embedded in local authority or community systems, or where the transition is perceived as externally imposed. This includes some CBNRM settings in Botswana and Zimbabwe, where long-standing procurement arrangements and community conventions around hunting practice create institutional inertia that goes beyond individual preference. By contrast, in the commercial hunting sector, EU client demand is already opening voluntary conversations about transition, and South Africa's professional hunting association acknowledged that lead is becoming a market differentiation issue among outfitters competing for international clients. In those settings, social resistance is lower than the aggregate score implies.

The practical implication is that social barriers are best addressed through sequencing. The structural barriers of cost, supply, and regulatory clarity must be reduced first. As alternatives become available and affordable, norm change follows through demonstration, peer validation, and local adaptation. Confronting social resistance before structural enablers are in place typically intensifies rather than reduces it.

5.8 Technical performance and barrel concerns

Technical and ballistic concerns are present in the dataset, but they are not the dominant barrier. Only 4 of 19 scored submissions rated technical performance at 4 or 5, while 10 rated it at 1 or 2. The predominant concern is not that non-lead ammunition is fundamentally incapable, but that respondents lack confidence in its performance under demanding local conditions. This applies particularly to dangerous-game hunting, where stopping power and terminal ballistics carry serious safety implications, and to problem animal control, where field conditions are variable and second shots may not be available. This finding was confirmed by South Africa's professional hunting sector: performance certainty rather than availability of research is the

threshold that professional hunters require before recommending a product switch to their clients.

Barrel wear and damage is the weakest barrier in the matrix. Sixteen of 19 scored submissions rated it at 1 or 2. This is an important corrective: barrel-damage concerns circulate prominently in informal debate among ammunition users, but the questionnaire evidence does not support treating them as a primary constraint. Technical barriers are best addressed through locally credible field demonstration, calibre-specific testing, and engagement with PHAs who can vouch for performance under conditions their members actually encounter. Barrel wear should remain a secondary issue and should not delay transition discussions.

5.9 Severity, tractability, and sequencing

The seven-domain barrier analysis reduces to a clearer and more actionable picture when severity is read alongside tractability. Three barriers are consistently high and cross-cutting: supply, regulatory clarity, and awareness. Economic cost is close behind and compounds the effect of weak supply. These four constraints are the ones most likely to prevent transition even where recognition of the lead problem is present. Technical concerns, social resistance, and barrel-wear fears are more uneven and become decisive mainly in specific sectors or settings.

Critically, the most severe barriers are also among the most tractable. Supply can be improved through distributor commitments, pooled procurement, and targeted stocking arrangements in under-served markets. Economic barriers are addressable through tax relief, subsidies, or differentiated procurement support. Awareness is segmented but responsive to practical, locally grounded communication. Regulatory clarity can be advanced through phased administrative guidance and wildlife-authority practice well before comprehensive legislation is in place. The most effective near-term strategy is therefore not to attempt to resolve all seven domains simultaneously, but to reduce the practical structural barriers first so that deeper behavioural and institutional change becomes more feasible.

The support preference data from the full 29-respondent dataset reinforces this conclusion and provides an empirical guide to sequencing. The three highest-supported measures — tax relief or subsidies (22 of 29), clearer regulations (22 of 29), and training and demonstration days (20 of 29) which map directly onto the three most tractable barriers. Together they constitute the clearest empirical reading of what the sector wants and what would most plausibly unlock early movement.

Table 8: Facilitation Measure Support

Facilitation Measure	Supported by	Significance
Tax exemptions / subsidies for non-lead ammunition	22 / 29	Strongest cross-country signal. Reflects shared recognition that cost is a real barrier without being prohibitive if addressed through fiscal measures.
Clearer government regulations / guidelines	22 / 29	Equally the most supported measure. Respondents seek transition direction and timing clarity, not necessarily an immediate ban.
Training and demonstration days on non-lead ballistics	20 / 29	Strong cross-sector support. A South African conservation NGO's demonstration programme cited as a working model. Particularly needed in CBNRM and PAC contexts.

Facilitation Measure	Supported by	Significance
Clean Meat / Vulture-Safe certification schemes	11 / 29	Supported mainly by conservation NGOs and operators with EU client base. Less relevant in community and government procurement contexts.
Buy-back schemes for existing lead ammunition stocks	9 / 29	Lowest support. Most respondents do not see a transition as contingent on removing existing stocks.

Note: Buy-back schemes (9 of 29) and, to a lesser extent, certification (11 of 29) are supported but should be treated as later-phase or sector-specific measures. The buy-back instrument is most relevant after a formal regulatory phase-out creates a stock-disposal obligation; certification is most relevant where market differentiation for international clients is the primary commercial driver.

A final analytical point concerns the distinction between chronic and acute poisoning, raised by a South African hunting sector representative with dual conservation management responsibilities. Lead poisoning from ammunition is primarily a chronic, sub-lethal process that accumulates across a bird's exposure history rather than producing discrete mortality events. This has implications for how barriers are communicated. Commercial hunters who do not observe vulture deaths at their hunting sites may perceive the evidence base as weak precisely because the mechanism is cumulative and diffuse. Awareness programming and policy framing that clarifies the chronic pathway and links it to the reduced breeding success and collision vulnerability that follow is likely to be more persuasive than event-based mortality framing in those settings.

CHAPTER 6: LESSONS FROM INTERNATIONAL EXPERIENCE

6.1 Why international experience matters

Chapters 4 and 5 established that the binding constraints on transition in SADC are supply scarcity, regulatory uncertainty, awareness gaps, and economic cost. The purpose of this chapter is not to revisit those findings but to ask whether the international record shows how equivalent constraints have been overcome elsewhere and whether the mechanisms that worked can be adapted to the Southern African context.

Three cases are used: California's comprehensive legislative prohibition (AB 711, 2013–2019), the European Union's partial restriction under REACH (Regulation 2021/57, in force 2023), and the voluntary transition model piloted by the UK shooting and retail sector during the 2015–2022 period. A supplementary section examines how regulatory developments in source countries are already reshaping the supply chain on which SADC depends. Each case is read for one thing only: the transferable design of mechanisms to overcome the constraints

6.2 California: regulation works, but only with sequencing and supply

California's Assembly Bill 711, signed in October 2013 and fully implemented by July 2019, established the world's first legislatively mandated, comprehensive prohibition on lead ammunition for all hunting. The political trigger was the California condor: stable isotope research published in 2012 demonstrated unambiguously that condors reintroduced to the wild were being re-poisoned by lead from hunter-deposited gut piles, at rates that prevented genuine population recovery (Finkelstein et al., 2012). The condor's status as a recognisable conservation symbol with a costly, publicly funded captive-breeding programme underway since the 1980s made the scientific finding politically impossible to ignore (U.S. Fish and Wildlife Service, 2013). The parallel with vultures in the SADC context is direct and should be used: the SADC Vulture Conservation Strategy mortality reduction target is the functional equivalent of the condor recovery narrative.

The design element most transferable to SADC is phased implementation. AB 711 did not impose a single cliff-edge transition date (*Assembly Bill No. 711: Hunting: Lead Ammunition*, 2013). It phased expansion by species group and geographic zone, beginning in condor range areas and expanding progressively over several years to statewide application. This sequencing allowed manufacturers to scale non-lead production in response to sequenced demand signals rather than facing simultaneous market disruption across all product lines. By the time statewide implementation arrived in 2019, a commercially viable range of non-lead rifle ammunition existed across most common hunting calibres. The predicted market failure did not materialise because the industry co-operated willingly, but because the phasing gave it time to adjust.

Two cautionary lessons are equally important. First, hunter compliance in non-condor-range areas before the 2019 mandate was materially lower than in areas where years of awareness programming had already shifted social norms. Norm change among the hunting community precedes and enables regulatory compliance; it does not follow from it. An awareness programme begun before regulatory milestones are imposed is not merely preparatory it is itself a compliance mechanism. Second, industry resistance was organised, sustained, and strategic across the entire implementation period. Legal challenges, delays in implementation guidance, and lobbying against phased expansion added cost and delay without preventing the outcome. In SADC, where wildlife agency administrative capacity is more constrained than in a California state agency, the transition strategy must anticipate organised resistance and build independent compliance monitoring into the architecture from the outset.

6.3 EU/REACH: system-wide standards and the scope entry point

Commission Regulation (EU) 2021/57, in force from February 2023, prohibits the use or carrying of lead shot in or around wetlands. Its adoption followed approximately a decade of scientific and regulatory work under REACH: a formal European Food Safety Authority risk (European Food Safety Authority, 2010), European Chemicals Agency restriction dossier published in 2018 (European Chemicals Agency, 2018), and multi-year stakeholder consultation that included extensive industry challenge. The process was long because the evidence base required was comprehensive and the resistance was organised. That timeline is itself a lesson: jurisdictions considering regulatory action on lead ammunition should begin building the evidentiary and coalition infrastructure well before a regulatory deadline becomes urgent.

Two features of the EU case are directly transferable. The first is the deliberate scope limitation. The restriction covers wetlands only, using shotgun ammunition, where the scientific evidence of harm was strongest and the supply of non-lead alternatives most advanced. This was not a compromise it was a design choice. A restricted scope that is scientifically defensible and commercially manageable creates the supply chain conditions for subsequent expansion. The lesson for SADC is that a PAC-first or waterfowl-first regulatory entry point is not a concession to the hunting sector; it is the operationally rational starting point for a system that will need to expand.

The second feature is the displacement effect. Trade data from UN Comtrade suggest that EU export volumes of shotgun cartridges to markets without equivalent restrictions including Southern Africa increased in the period coinciding with the wetland restriction's entry into force (United Nations Statistics Division, 2025). The mechanism is plausible: residual lead-shot stock no longer deployable in European wetland markets is redirected to export markets where no restriction applies. If correct, the EU restriction has created a dynamic that reinforces the case for concurrent SADC action. Without regional restrictions, Southern Africa risks becoming a de facto outlet market for the lead ammunition if the European supply chain can no longer sell at home.

6.4 Voluntary transition models: useful as phase 1, insufficient alone

The UK experience provides a strong caution against treating voluntary transition as a standalone strategy. In February 2020, nine leading UK shooting and rural organisations announced a voluntary commitment to phase out lead shot for live quarry shooting by 2025. The intention was to reduce wildlife and environmental harm while preserving market access for game meat (British Association for Shooting and Conservation and Others, 2020). However, the most recent SHOT-SWITCH evidence shows that the initiative did not produce a meaningful market shift. In the final study season (2024/25), 99% of pheasants from sampled retailers and game outlets had still been shot with lead ammunition, while all 78 red grouse carcasses from which shot was recovered contained lead (Green et al., 2025). Over the five-year transition period, the decline in lead-shot use was slight and non-significant, indicating that voluntary efforts did not move the market at anything close to the rate required for full transition. Researchers concluded that the intended voluntary transition had failed (Green et al., 2025).

The subsequent decision by the Department for Environment, Food and Rural affairs in the UK to introduce legislation by 2026 to enforce a full ban in force 01 April 2029 on sale and use selected lead shots and lead bullets reflects the challenges and failures of moral suasion in the fight against lead in wildlife and target shooting.

The proposed UK ban follows closely the Danish model that enforced a total ban on lead shots in 1996 in response to the failure of voluntary appeals since the 1980s. The ban, which was buttressed with supply and availability of high-quality non-lead alternatives, covered lead shots in all hunting and target shooting and all trade and possession of lead cartridges. The results have been more than satisfactory (*Statutory Order on the Use of Lead Shot* (\textit{Bekendtgørelse Om Forbud Mod Anvendelse Af Hagl Indeholdende Bly}), 1996). To evaluate the effects of this ban in Denmark, Kanstrup¹ examined 730 pheasants and mallard carcasses and 690 mallard gizzards from 2016-2017. Up to 2,2% of pheasants and 3.1% of

mallards had showed traces of lead ammunition shots, with the 690 mallard gizzards having no trace of lead shots(Kanstrup, 2019). This confirms that where moral persuasion fails, effective bans being supported by introduction of non-lead alternatives are very effective.

The policy lesson for SADC is clear. Voluntary measures can support awareness, demonstration, and early familiarisation with non-lead products, but they are unlikely to deliver transition at scale where users face no binding requirement to change and where cost, supply weakness, and entrenched practice remain intact. The UK case is especially instructive because the voluntary pledge was high-profile, sector-led, and supported over several years, yet still produced negligible uptake. This helps explain why the UK subsequently moved toward regulation under UK REACH, with government decisions in 2025 introducing a phased restriction on lead ammunition rather than continuing to rely on voluntary adoption alone. For SADC, the implication is not that voluntary measures do not work, but that they should be treated as Phase 1 instruments within a broader sequenced transition framework, not as a substitute for eventual regulatory direction.

6.5 Source-country regulation and the SADC supply chain

The regulatory trajectory in the EU and UK is relevant to SADC not only as a governance model but as an upstream commercial driver already operating on the supply chain that Southern African markets depend upon. Three developments are directly material.

First, the EU's wetland restriction is widely understood within the regulatory community as an initial step. The European Chemicals Agency's restriction dossier explicitly noted that the scientific basis would extend, in principle, to all outdoor uses of lead ammunition. A further restriction covering terrestrial habitats is under preliminary assessment. If enacted which the regulatory trajectory makes more likely than not within a ten-to-fifteen-year horizon — South African manufacturers with EU export exposure will face compliance requirements that directly incentivise non-lead product development. The EU trajectory functions as a latent commercial driver for regional supply chain transformation, and SADC advocacy should make that commercial logic visible to South African manufacturers and distributors.

Second, UK retail commitments have already expanded the non-lead product ranges available through South African channels. Products developed to meet UK demand are present in South African retail at price points closer to lead equivalents than five years ago. The supply improvement documented in Chapter 4 is, in part, a downstream effect of UK market pressure on manufacturers.

Third, the United States federal vacuum is a countervailing factor (U.S. Environmental Protection Agency, 2010). No comprehensive US federal restriction on lead ammunition has been enacted, and the commercial logic of continuing lead production for the large US domestic market reduces the urgency of non-lead investment for manufacturers with US-dominated revenue. This matters because US-anchored manufacturers supply some South African import channels(U.S. Environmental Protection Agency, 2010; U.S. Fish and Wildlife Service, 2022). The absence of US regulatory pressure sustains lead production economics in a way that EU and UK regulation has not yet fully offset. The implication is that SADC cannot rely on source-country regulation alone to transform supply conditions; active distributor engagement and demand-side signals from the regional market itself remain necessary.

6.6 What SADC should borrow, avoid, and adapt

International experience does not provide a replicable model for SADC. It provides something more useful: a tested set of design principles and a clear record of where transitions have stalled. The synthesis below is organised as an explicit decision framework shows what to borrow directly, what to avoid, and what must be adapted to the SADC institutional and market context. These principles are elaborated operationally in Chapter 10.

Table 9 Transferable design principles for the SADC transition

Action	Design principle	SADC application
Borrow	Phased implementation with clear milestones	Structure transition around 2027, 2031, and 2035 entry points that give manufacturers sequenced demand signals and agencies sequenced enforcement targets.
Borrow	Supply readiness before regulatory mandate	Use 2025–2027 to build South African distributor capacity and expand non-lead product range before any regulatory milestone is imposed.
Borrow	Voluntary trials as Phase 1 norm-change	Deploy demonstration and trial programmes through hunting associations to build user confidence and social acceptance in advance of regulatory action.
Borrow	Flagship species as political anchor	Foreground the vulture — specifically the Cape Vulture and White-backed Vulture mortality pathway — in all policy communications, as California used the condor.
Borrow	Common market standard to close free-rider gaps	Pursue SADC-level coordinated standards so that operators cannot source lead ammunition from an unregulated neighbouring market.
Avoid	Regulation before market readiness	Do not impose a compliance requirement before non-lead alternatives are reliably available in-country. Premature mandates produce paper compliance and discredit the regulatory instrument.
Avoid	Indefinite voluntarism without a regulatory floor	Voluntary programmes plateau without a backstop. Phase 1 must be explicitly framed as transitional, with regulatory milestones communicated from the outset.
Avoid	Assuming awareness alone shifts behaviour at scale	Norm change in the hunting sector is a precondition for regulatory compliance, not a substitute for it. Awareness programming must be accompanied by supply and cost enablers.
Avoid	Underestimating organised resistance	California's experience shows that industry and association resistance will be sustained and strategic. Build independent compliance monitoring into the transition architecture from the start.
Adapt	Use PAC as the regulatory entry point	Problem animal control operations — government-mandated, large-calibre, publicly visible — are the most defensible first-phase regulatory target and carry lower political resistance than trophy hunting.
Adapt	Use South Africa as the supply leverage point	South Africa supplies approximately 80 percent of the regional non-lead market. Engaging South African manufacturers and distributors upstream

Action	Design principle	SADC application
		is more efficient than five separate national supply interventions.
Adapt	Allow country-specific pacing within a regional framework	Botswana and Namibia — with smaller hunting sectors and stronger CBNRM governance — may move faster. Zimbabwe and Zambia need longer supply-side preparation. The framework should accommodate that.
Adapt	Prioritise administrative instruments before legislation	Concession conditions, procurement standards, and wildlife-authority practice can provide earlier regulatory entry points than full legislative reform and are more proportionate to current institutional capacity.

Note: The 'Borrow' principles are drawn primarily from the California and EU cases. The 'Avoid' principles reflect failure modes documented across all three cases. The 'Adapt' principles are derived from applying the international lessons to the specific institutional, supply-chain, and governance conditions identified in Chapters 4 and 5.

The chapter's core argument is that international experience shows that transition succeeds when voluntary familiarisation, ready availability of alternatives, and regulatory sequencing are aligned. It stalls when any one of those three elements is absent. California stalled in its early years because the supply of non-lead alternatives lagged behind the regulatory signal. The EU process was slowed because the coalition and evidence base took time to build. Voluntary models plateau because the regulatory floor that makes adoption economically rational is absent. SADC's position in 2026 is unusual in that it can design for all three elements simultaneously rather than discovering the need for each sequentially. Those three elements are a voluntary phase, supply activation, and a communicated regulatory pathway. That is the practical value of the international record.

CHAPTER 7: POLICY AND REGULATORY LANDSCAPE

This chapter seeks to identify the fastest legally available pathway to a lead restriction in each of the five priority countries, and to document the enforcement gap that constrains it. It does not describe governance systems in general terms, and it does not repeat the regulatory absence finding already established in Chapter 5 or the international regulatory logic examined in Chapter 6. What it establishes is the specific legislative mechanism; the primary statute, secondary regulation, permit condition, or concession clause through which the transition roadmap in Chapter 10 can operate in each national context, and the realistic limits of what each mechanism can achieve given current institutional capacity.

7.1 Regional and international obligations

Table 10 summarises the international instruments that create normative obligations relevant to lead ammunition across the SADC region. None imposes a directly enforceable prohibition on lead ammunition in any priority country. Their value is political and procedural: they provide the mandate language for national advocacy, the accountability framework for VCSAP roll-out plan reporting, and, in the case of AEWA(UNEP/AEWA Secretariat, 1995), a formal legal obligation for the three Contracting Parties that can be referenced in domestic regulatory processes.

Table 10: International instruments relevant to lead ammunition in SADC

Instrument	Lead-relevant obligation	Countries bound	Legal status
CMS Resolution 11.15 (2014)	Recommends phase-out of lead ammunition across all habitats in all range states.	All range states, including all five priority countries.	Non-binding recommendation; provides political justification.
SADC Vulture Conservation Strategy and Action Plan 2025–2035 (VCSAP)	Commits all twelve SADC vulture range states to national roll-out plans and a 75% reduction in poisoning-related mortality.	All five priority countries plus Mozambique and Angola.	Adopted 2025; politically binding on signatories; no enforcement mechanism.
African-Eurasian Migratory Waterbird Agreement (AEWA)	Requires lead shot restrictions in waterbird habitats for Contracting Parties.	South Africa, Zambia, and Botswana are Contracting Parties. Zimbabwe and Namibia are not.	Binding for Contracting Parties; formal implementation required.
SADC Protocol on Wildlife Conservation and Law Enforcement (1999, in force 2003)	Provides framework for harmonised wildlife standards and enforcement across SADC.	All SADC member states.	In force, provides legal basis for regional coordination.
Convention on Biological Diversity / Kunming-Montreal Global Biodiversity Framework (Convention	National biodiversity targets and action plans; no lead-specific obligation.	All five priority countries.	Non-specific to lead; provides general conservation mandate.

Instrument	Lead-relevant obligation	Countries bound	Legal status
on Biological Diversity, 1992, 2022)			

Note: 'Binding' refers to the formal legal status of the instrument as between state parties. All listed instruments lack direct enforcement mechanisms that would compel domestic regulatory action in the absence of national political will.

7.2 South Africa

South Africa's primary enabling instruments are the National Environmental Management: Biodiversity Act 10 of 2004 (NEMBA) (*National Environmental Management: Biodiversity Act 10 of 2004*, 2004) and its Threatened or Protected Species Regulations (*Threatened or Protected Species Regulations (TOPS)*, GN 151 of 2007, 2007). NEMBA grants the Minister of Forestry, Fisheries and Environment authority to issue species-specific protection notices and to impose conditions on the hunting, possession, and use of listed threatened species without requiring primary legislative amendment. Cape Vultures and White-backed Vultures are listed under TOPS, which means that a ministerial notice attaching non-lead ammunition as a condition of lawful hunting activity in vulture-sensitive areas is legally available through existing secondary legislation (*Threatened or Protected Species Regulations (TOPS)*, GN 151 of 2007, 2007). The Firearms Control Act 60 of 2000 governs ammunition generally but does not provide a direct environmental regulation pathway; it is not the relevant instrument for transition purposes.

The secondary pathway most readily available in the near term is administrative rather than legislative. SANParks can incorporate non-lead conditions into hunting permits for national park concession operations as a matter of procurement and contract policy, without statutory change (*National Environmental Management: Biodiversity Act 10 of 2004*, 2004). Provincial conservation authorities hold concurrent jurisdiction and could adopt equivalent permit conditions within their estate (*Constitution of the Republic of South Africa, 1996 (Act 108 of 1996)*, 1996). DFFE's TOPS enforcement capacity is constrained by resourcing and by the fragmented provincial compliance landscape, which means that a permit-condition approach confined to national parks and premier concessions is more credibly enforceable in Phase 2 than a sector-wide regulation. The relevant entry point for Phase 3 legislative action is a ministerial notice under NEMBA section 97, supported by the evidence base this consultancy provides.

7.3 Namibia

Namibia presents the strongest near-term regulatory pathway in the region. The Ministry of Environment, Forestry and Tourism holds approving authority over all communal conservancy hunting quotas and trophy permits under the Nature Conservation Ordinance 4 of 1975 and subsequent amendments (*Nature Conservation Ordinance 4 of 1975 (as Amended)*, 1975). MEFT can attach ammunition-type conditions to permit approvals as a matter of ministerial discretion, without legislative amendment. The communal conservancy system covering approximately 86 registered conservancies already operates under a quota-and-conditions framework that MEFT administers annually (Namibia Association of Community Based Natural Resources Management Support Organisations, 2023). Adding a non-lead condition to permits for specific species or zones is procedurally straightforward and has administrative precedent in the form of existing conditions attached to elephant and dangerous game permits.

Namibia's enforcement capacity is the strongest among the five priority countries. MEFT's field monitoring infrastructure, reinforced by the conservancy management committee system, provides a compliance oversight layer that does not depend solely on central agency resources (Jones et al., 2015; Namibia Association of Community Based Natural Resources Management Support Organisations, 2023). The enforcement gap is geographic rather than institutional: remote conservancies in the Kavango and Zambezi regions have lower monitoring density than Erongo and Kunene. The recommended Phase 2 pilot is a non-lead permit condition applied to a

defined subset of registered conservancies is achievable within the existing regulatory framework and would generate the compliance data needed to inform Phase 3 national expansion.

7.4 Zimbabwe

Zimbabwe's primary wildlife legislation, the Parks and Wildlife Act (Chapter 20:14), vests regulatory authority in the Zimbabwe Parks and Wildlife Management Authority. ZPWMA administers the CAMPFIRE programme through a quota-allocation framework under which Rural District Councils receive hunting quotas that are already subject to conditions, including compliance with ZPWMA species-specific management protocols (*Parks and Wildlife Act (Chapter 20:14)*, 1975). A non-lead ammunition requirement can be incorporated into the annual CAMPFIRE quota allocation as a conditional term without primary legislative change, using the existing quota compliance framework as the enforcement mechanism. The Environmental Management Act (Chapter 20:27) provides a supplementary pathway via pollutant regulation, though it has not previously been applied to ammunition (*Environmental Management Act (Chapter 20:27)*, 2002).

The enforcement gap in Zimbabwe is significant. ZPWMA's institutional capacity has been constrained by funding shortfalls and personnel disruption, and CAMPFIRE governance quality varies materially across Rural District Councils (CITES Secretariat, 2023). A permit-condition approach is legally available, but its enforceability depends on RDC compliance monitoring capacity, which is uneven (Frost & Bond, 2008). The recommended entry point is a CAMPFIRE-specific non-lead condition piloted in the three or four RDCs with the strongest governance track record, generating a compliance demonstration before wider rollout. Full legislative consolidation is a Phase 3 objective, contingent on ZPWMA willingness to support this transition.

7.5 Botswana

Botswana's Wildlife Conservation and National Parks Act (Cap 38:01), administered by the Department of Wildlife and National Parks, provides the primary instrument (*Wildlife Conservation and National Parks Act (Cap 38:01)*, 1992). The Minister can attach conditions to hunting permits and licences through ministerial order, and the post-2019 resumption of commercial hunting has required DWNP to develop new permit frameworks for the first time since the 2014 suspension (Ministry of Environment, Natural Resources Conservation and Tourism, Botswana, 2019). These frameworks are still being refined, which creates a practical window to incorporate non-lead conditions into permit design before the frameworks are fully settled. CBNRM community trust agreements through which communities receive hunting rights from DWNP provide a parallel contractual pathway that does not require ministerial action.

Botswana's enforcement capacity is constrained relative to the size of its wildlife estate (Arntzen et al., 2007). DWNP field presence is concentrated in national park and game reserve areas; monitoring in community wildlife management areas is less consistent (Mbaiwa, 2004). The recommended entry point is a permit condition applied initially to the most commercially significant concession operators, were self-reporting and reputational incentives support compliance, with CBNRM trust agreement conditions following in Phase 2. Formal legislative consolidation is a Phase 3 objective.

7.6 Zambia

The Zambia Wildlife Act No. 14 of 2015 established the Department of National Parks and Wildlife as the successor to the former Zambia Wildlife Authority (*Zambia Wildlife Act No. 14 of 2015*, 2015). DNPW holds authority to issue and condition hunting concession leases and operator licences in Game Management Areas. Non-lead requirements can be incorporated as concession lease conditions without legislative amendment, using the existing operator compliance framework. The Game Management Area system covers the majority of Zambia's communal

hunting lands and provides the administrative channel through which a phased non-lead condition could be introduced.

The 2015 reform created a period of institutional disruption that reduced DNPW's operational capacity, and persistent human-wildlife conflict pressures continue to divert enforcement resources (CITES Secretariat, 2021). Problem animal control operations which represent a high-volume, government-sanctioned ammunition use are a particular challenge because they are reactive and operationally difficult to condition in advance. The recommended entry point for Zambia is the GMA concession lease condition for commercial safari operators, which is administratively controllable, before extending to PAC and community-level operations. Phase 2 engagement should prioritise DNPW capacity support alongside the regulatory condition, rather than treating the condition alone as sufficient.

7.7 Mozambique and Angola

Mozambique and Angola are contextual countries under the VCSAP 2025–2035 and are not near-term regulatory targets. In Mozambique, the National Administration for Conservation Areas administers a concession system for protected area hunting that provides a formal channel, but enforcement infrastructure is fragmented and institutional capacity is weak. In Angola, the wildlife governance framework remains substantially a legacy of pre-independence legislation and has not been sufficiently updated to provide a functional regulatory pathway in the near term. For both countries, the primary engagement mechanism in the transition programme is the VCSAP national roll-out plan obligation, which requires designated focal points and annual reporting as a condition of SADC membership. That accountability mechanism rather than national regulatory action is the realistic Phase 3 entry point for Mozambique and Angola.

7.8 Comparative regulatory entry points

Table 11 consolidates the country-by-country analysis into a single comparative framework. The pattern is consistent with the barrier severity findings in Chapter 5: South Africa and Namibia offer the strongest near-term regulatory pathways, Zimbabwe and Botswana have viable secondary pathways that require governance support, Zambia has available instruments but constrained enforcement, and Mozambique and Angola remain Phase 3 engagement countries only. No country in the region currently has comprehensive lead ammunition restriction and the gap is uniform, but the distance to the nearest viable entry point varies significantly.

Table 11: Comparative regulatory entry points across priority countries

Country	Primary instrument	Secondary pathway	Enforcement capacity	Fastest entry point	Phase readiness
South Africa	NEMBA (2004); Firearms Control Act (2000); TOPS Regulations	DFFE ministerial notice under NEMBA without primary legislation; SANParks and provincial permit conditions	Moderate-high; DFFE stretched but SANParks has operational capacity	TOPS-style ministerial notice; SANParks procurement policy as pilot	Phase 2 regulatory action; Phase 1 voluntary
Namibia	Nature Conservation	Communal conservancy	Strongest in region; MEFT	Conservancy permit	Phase 2 pilot

Country	Primary instrument	Secondary pathway	Enforcement capacity	Fastest entry point	Phase readiness
	Ordinance (1975, amended); MEFT trophy hunting regulations	permit conditions: MEFT approves all quotas and can attach ammunition conditions without new legislation	field monitoring well-developed	condition pilot; MEFT quota approval mechanism	(earliest in region)
Zimbabwe	Parks and Wildlife Act; Environmental Management Act	CAMPFIRE concession conditions via ZPWMA quota framework; RDC hunting agreements already conditional on compliance standards	Constrained; ZPWMA institutional disruption; variable RDC governance	CAMPFIRE quota framework non-lead condition via ZPWMA	Phase 2 via concession; Phase 3 legislative
Botswana	Wildlife Conservation and National Parks Act (Cap 38:01); DWNP regulations	DWNP minister can attach conditions to hunting permits; new permit frameworks post-2019 resumption can incorporate non-lead conditions	Constrained relative to wildlife estate; CBNRM governance less developed than Namibia	DWNP hunting permit condition; CBNRM trust agreement condition	Phase 2 permit condition; Phase 3 legislative
Zambia	Zambia Wildlife Act No. 14 of 2015; DNPW operator licensing	DNPW can attach conditions to GMA concession leases and operator licences without legislative amendment	Significantly constrained; 2015 reform disrupted continuity; human-wildlife conflict pressures divert capacity	GMA concession lease condition; DNPW operator licence condition	Phase 2 with support; Phase 3 legislative
Mozambique	Lei de Florestas e Fauna Bravia	ANAC conservation area	Weak; enforcement	VCSAP roll-out plan engagement;	Phase 3 engagement only

Country	Primary instrument	Secondary pathway	Enforcement capacity	Fastest entry point	Phase readiness
	(Law 10/99); ANAC regulations(<i>Lei de Florestas e Fauna Bravia</i> (Lei N\textdegree 10/99, de 7 de Julho de 1999), 1999)	concession conditions; very limited practical reach	infrastructure fragmented	ANAC concession condition (limited)	
Angola	Largely pre-independence framework; partially updated post-independence	Minimal viable secondary pathway in near term	Very weak; limited institutional architecture	VCSAP roll-out plan engagement only	Phase 3 engagement only

Note: 'Phase readiness' refers to the earliest phase at which the country can realistically sustain regulatory action — not when engagement begins. Phase 1 voluntary engagement applies to all countries from 2025. Green = strong pathway; Amber = viable with governance support; Red = near-term regulatory action not realistic.

The critical cross-cutting finding is that secondary pathways from permit conditions, concession clauses, to ministerial administrative instruments are available in all five priority countries without primary legislative reform. This matters because primary legislation in the SADC context typically requires multi-year parliamentary processes, faces organised opposition from hunting industry associations, and is subject to implementation delays that dwarf the transition timeline. The roadmap in Chapter 10 is structured to use administrative pathways in Phases 1 and 2 precisely because they are available now, within existing legal authority, and can create enforceable conditions in commercially significant operations before the legislative consolidation of Phase 3 arrives.

CHAPTER 8: COST BENEFIT ANALYSIS

8.1 Analytical framework and scenario definitions

This chapter presents the cost-benefit analysis (CBA) constituting Objective 4 of the consultancy. Its purpose is to move beyond the descriptive finding that lead ammunition is harmful and the barrier finding that transition is constrained, to a structured appraisal of whether, how, and at what cost the transition delivers net positive outcomes for the SADC region under each of three plausible scenarios. The analytical framework adopted the Total Economic Value (TEV) approach, which organises benefits into four streams: ecological, human health, economic and market, and governance and institutional. Costs are organised into three streams: direct transition costs to the hunting sector, supply chain development programme costs, and regulatory enforcement costs (The Economics of Ecosystems and Biodiversity, 2010).

The TEV framework structures value in four tiers. Direct Use Values capture the immediate economic outputs of the wildlife system: hunting revenues, game meat, and livelihoods dependent on functioning ecosystems. Indirect Use Values encompass the ecosystem services delivered by intact vulture populations: carcass removal, disease suppression, and sanitation functions that underpin the economic viability of pastoral and conservation landscapes. Option Values represent the future benefits preserved by maintaining population viability, including the potential for recovery of currently depressed populations under improved conditions. Non-Use Values, comprising existence and bequest values, reflect the intrinsic and cultural significance of vultures to SADC communities and to the global conservation constituency that financially supports the region's protected areas. The benefit streams in section 8.2 map directly onto this typology, with ecological benefits spanning indirect use and option values, market benefits anchored in direct use value, and governance benefits embedded in the option and non-use tiers.

Three scenarios are evaluated, defined in the inception report and maintained consistently throughout the analysis. The first is an immediate prohibition: a regulatory instrument imposing a binding ban on lead ammunition use across all hunting categories within the five priority countries within 24 months of adoption, aligned with the most aggressive CMS timeline. The second is a phased transition: incremental restrictions by sector and species category over the period 2027 to 2035, aligned with the SADC Vulture Conservation Strategy and Action Plan (VCSAP 2025 to 2035) milestone architecture. The third is an incentive-led transition: a voluntary programme supported by subsidies, demonstration zones, and certification incentives, with no binding regulation within the evaluation horizon.

Each scenario is assessed against five dimensions: net ecological benefit, net economic impact on the hunting sector, enforcement burden, feasibility and political acceptability, and long-term net benefit-to-cost ratio. The chapter concludes with a comparative verdict grounded in these dimensions and identifies the scenario most consistent with the evidence base assembled throughout this report.

Two methodological qualifications apply. First, the CBA does not produce a single monetised net present value figure, because the data required to do so with defensible precision does not exist at SADC regional scale. The evaluation horizon is 2027 to 2035, aligned with the VCSAP milestone architecture. The chapter produces structured qualitative and semi-quantitative comparisons anchored in the best available evidence, clearly distinguishing primary field data, published secondary sources, and informed estimates with stated assumptions. Second, the data coverage is uneven. Botswana has the strongest ecological evidence base from the (Garbett et al., 2018) blood lead study.

8.2 Benefit streams

8.2.1 Ecological benefits: lead dispersal reduction

The primary ecological benefit of the transition is the reduction of lead dispersed into wildlife habitat through gut piles, carcasses, and unfragmented projectile residue. The consultancy has constructed lead dispersal estimates for all five priority countries using a consistent bottom-up methodology applied to national quota data, actual offtake returns, and hunting volume data collected through the primary questionnaire programme. Results are presented in Table 12. Across the five priority countries combined, the formula-based central-scenario estimate is approximately 606.6 kg of lead dispersed annually, of which approximately 343 kg enters the gut-pile and carcass pathway that constitutes the primary vulture exposure route. This figure is a lower-bound estimate of the modelled sectors only.

The three largest unmodelled residuals are the Zimbabwe formal safari sector, for which the SOAZ quantum assessment indicates an additional central estimate of approximately 612 kg/yr; Botswana's PAC and institutional training operations, for which the BW-01 questionnaire respondent implies an additional approximately 296 kg/yr beyond the quota formula figure; and South Africa's domestic hunting sector, which given approximately 200,000 active domestic hunters relative to approximately 6,000 international clients is likely to represent a multiple of the modelled figure, with an order-of-magnitude estimate of approximately 533 kg/yr in additional dispersal. These three residuals alone sum to approximately 1,441 kg/yr, suggesting a plausible full regional total in the range of 2,000 to 2,500 kg/yr.

Community conservancies beyond the NACSO quota sample in Namibia, private game ranch operations throughout the region, and PAC operations in Zambia and Zimbabwe beyond the CAMPFIRE time series remain additionally unquantified. The actual dispersal total is therefore likely substantially higher than the formula-based central figure, though the precise magnitude cannot be determined without a dedicated national-level survey across all hunting and wildlife management sectors.

Table 12: Lead dispersal estimates by country, central scenario (kg/yr)

Country	Total lead dispersed (kg/yr)	Gut-pile lead (kg/yr)	Primary data basis	Coverage notes
Namibia	37.2	3.85 (rifle only)	NACSO communal conservancy quota 2023–2025	Communal conservancies only. 84% of total (31.3 kg/yr) arises from the shotgun game-bird pathway and is not vulture-relevant; the rifle gut-pile component of 3.85 kg/yr is the ecologically significant figure. Freehold game-ranch sector excluded.
Zimbabwe	24.4	15.8	CAMPFIRE district returns and ZimParks PAC records 2019–2024; actual offtake	CAMPFIRE community sector only. The SOAZ safari-sector quantum assessment indicates an additional ~612 kg/yr (central; range ~197–1,663 kg/yr) from the formal safari sector, representing a major unmodelled residual. Private freehold culling and community hunting beyond CAMPFIRE districts also excluded.
Zambia	54.3	35.3	DNPW national quota returns 2024; actual offtake across 35 species	National trophy quota only; 65% utilisation rate applied. Private and non-DNPW hunting channels unmodelled. Quantum assessment data-limited at time of drafting.
Botswana	15.7	10.2	Government Notice No. 482/2021; 2023–2026 quota gazettes; formula model	Quota-based formula only; LOW 10.2 kg/yr, HIGH 19.3 kg/yr. The BW-01 questionnaire respondent (DWNP/BWTI) reported 27,300 rounds per year, yielding an alternative quantum estimate of approximately 311.5 kg/yr. The residual of approximately 296

Country	Total lead dispersed (kg/yr)	Gut-pile lead (kg/yr)	Primary data basis	Coverage notes
				kg/yr reflects PAC, government training, and institutional operations not captured in the commercial quota model.
South Africa	475	278	DFFE Professional Hunter Registers 2016–2024; international clients only	LOW ~380 kg/yr, HIGH ~639 kg/yr. Domestic hunting clients (~200,000 annually), game-bird shooting, and PAC operations excluded. A broader sector assumption of 100,000 rounds/yr yields an alternative order-of-magnitude estimate of ~1,008 kg/yr; the residual of ~533 kg/yr represents the unmodelled domestic sector.
TOTAL	606.6	343.2		Formula-based lower-bound estimate across modelled sectors. Quantum-indicated residuals — Zimbabwe SOAZ (~612 kg/yr), Botswana PAC/institutional (~296 kg/yr), and South Africa domestic sector (~533 kg/yr) — sum to approximately 1,441 kg/yr, suggesting a plausible full regional total in the range of 2,000–2,500 kg/yr, consistent with the sensitivity analysis in Section 8.5.

Note: Gut-pile lead is calculated at 65% of total rifle bullet lead throughout, consistent with the Chapter 3 lead estimation model methodology. For Namibia, only the rifle component (3.85 kg/yr) is included in the gut-pile total, as shotgun pellet dispersal operates through a fundamentally different environmental pathway and is not directly relevant to vulture exposure. All figures are central-scenario estimates; country-level LOW and HIGH ranges are presented in the Chapter 3 country tables (Tables 2–6).

The ecological significance of this dispersal volume is substantial. The (Garbett et al., 2018) study in Botswana demonstrated elevated blood lead levels in vultures sampled during active hunting seasons, with a clear association between proximity to hunting areas and lead burden. Importantly, that study also documented elevated lead burdens in vultures sampled after Botswana's 2014 hunting moratorium, indicating that legacy lead in the environment sustains exposure even after active hunting ceases. This finding cautions against assuming a simple linear relationship between the removal of gut-pile lead sources and an immediate reduction in vulture blood lead levels; the ecological benefit of transition will accumulate progressively as legacy lead dissipates, rather than accruing immediately upon source removal.

The 2025 BirdLife International economic valuation of vulture ecosystem services provides a contextual frame for the scale of ecological value at stake. The valuation yields approximately USD 1.8 billion per year across the full SADC region in total economic value, comprising sanitation and pest control services (37%), existence and bequest values (55%), and direct use including tourism (8%). To illustrate the order of magnitude of ecological benefit that transition could ultimately deliver: if a fully implemented phased transition achieves even a 1 to 2% improvement in regional vulture survival rates attributable to reduced lead exposure over the full evaluation horizon, this is consistent with annual ecological benefit flows in the range of USD 18 million to USD 36 million, based on a proportional application of the BirdLife valuation. This illustration is conditional on the dose-response assumption holding across the full transition period and on the valuation's extrapolation accuracy. It should be treated as an order-of-magnitude anchor for policy discussion rather than a precise benefit projection. Under any plausible scenario, however, the transition programme costs modelled in section 8.3 are well below this threshold, which is consistent with a positive ecological benefit-to-cost ratio.

8.2.2 Human health benefits

The human health benefit dimension of the CBA cannot be quantified with precision from the primary data collected in this consultancy, because no SADC-specific study has yet measured lead exposure in hunting-sector workers, professional hunters, households receiving distributed game meat, or communities consuming meat from lead-shot animals. This gap is acknowledged explicitly. However, the international evidence base provides sufficient grounds for a qualitative finding. The European Chemicals Agency (ECHA) risk assessment established that fragmented lead bullet residues are detectable in game meat at levels exceeding food-safety thresholds, and that regular consumers of lead-shot venison face measurable neurological and developmental risk. The ECHA assessment projected avoidance of IQ loss in up to 7,000 children per year in Europe alone from full lead ammunition restrictions, with associated social costs avoided across health and education systems (European Chemicals Agency, 2018; European Food Safety Authority, 2010).

In the SADC context, the exposed population most likely to carry elevated lead burden from game meat consumption includes professional hunting staff who consume carcass remnants regularly (Yabe et al., 2020), community members in CAMPFIRE and conservancy areas where game meat is distributed as wildlife income benefit, and international hunting clients consuming trophy game meat. The benefit of transition in this dimension is real but currently unquantifiable at SADC scale, and this gap represents a priority for future research. The chapter treats this as a qualitative benefit stream that strengthens the case for transition without being assigned a monetary value in the scenario comparison.

8.2.3 Economic and market benefits

The economic benefit of transition operates through two mechanisms. The first is the protection of the hunting sector's long-term market access and reputational viability. As established in Chapter 4, progressive tightening of EU REACH regulations is reshaping the global ammunition supply chain away from lead, and EU hunting clients constitute the largest source of trophy hunting revenue in Namibia, Zimbabwe, and Zambia (Lindsey et al., 2007). Professional hunters and safari operators in these countries who transition to non-lead products ahead of regulatory mandates in source countries will be better positioned to retain EU client bookings as due-diligence requirements on hunting tour operators intensify. Conversely, operators who delay transition face potential market access risk as EU tour aggregators respond to regulatory pressure.

The second mechanism is the avitourism sector, where vulture and other raptor populations are a material component of the photographic wildlife product. Southern Africa hosts some of the world's most sought-after birds of prey viewing destinations, and documented vulture population declines attributable to lead poisoning and other threats reduce the quality and distinctiveness of the photographic tourism offering. No quantified willingness-to-pay data from international photographic tourism markets was collected in this consultancy, and this gap limits the precision of the market benefit calculation. The directional finding is nonetheless clear: reduced vulture mortality from lead transition supports the long-term commercial viability of the photographic tourism sector, which in most SADC countries generates higher revenue per visitor than trophy hunting (Lindsey et al., 2007; R. Naidoo et al., 2016). This benefit stream is treated as directional in the scenario comparison.

8.2.4 Governance and institutional benefits

The fourth TEV stream covers the governance and institutional benefits that flow from a structured transition programme, independent of the direct ecological and economic effects. These benefits operate at three levels. At the regional level, a SADC-coordinated transition programme advances implementation of the VCSAP 2025 to 2035 Priority Area 1 target and contributes directly to demonstrated compliance with CMS Resolution 11.15 on preventing poisoning of migratory birds. At the national level, the process of developing secondary legislative instruments to restrict lead ammunition use (as mapped in Chapter 7) builds regulatory capacity in wildlife management authorities that has broader application across

wildlife governance challenges. At the programme level, the establishment of a functioning monitoring and enforcement system for ammunition type compliance creates infrastructure that can be applied to other wildlife product verification requirements, including CITES documentation and hunting concession compliance audits.

These governance benefits are non-trivial in a regional context where institutional capacity is a binding constraint across multiple conservation objectives. They do not carry a monetary valuation in this analysis but contribute to the long-term net benefit-to-cost assessment, particularly for the phased transition scenario, which is the only option that actively builds this institutional infrastructure rather than either mandating it immediately (beyond current capacity) or foregoing it entirely.

8.3 Cost streams

8.3.1 Direct transition costs to the hunting sector

The most consistently cited and directly quantifiable cost of transition is the price premium for non-lead ammunition over equivalent lead products. Primary questionnaire data from 29 respondents across five countries yielded a range of 15% (at the lower bound from a community-sector respondent in Zambia) to 100% (from a high-volume commercial hunting operator in Namibia). The modal response cluster across the professional hunting and safari operator category falls between 25% and 50%, representing the most reliable basis for cost modelling. Using the 25-50% premium range applied to the central-scenario SOAZ volume estimate of 40,000 rifle rounds per year at an assumed average cost of USD 3.00 per lead rifle round, the annual incremental cost to the Zimbabwe professional safari sector is estimated at USD 30,000 to USD 60,000 per year. Scaling this to the full five-country professional sector applies the same 25-50% premium to proportional volume estimates for each country: Namibia at approximately 50,000 rifle rounds per year (NACSO communal sector plus an indicative private sector adjustment), Zambia at approximately 15,000 rounds (derived from the 2024 DNPW quota offtake), Botswana at approximately 8,000 rounds (BW-01 data), and South Africa at approximately 30,000 rounds (commercial trophy and PAC operations combined). This proportional scaling yields a total annual incremental cost across the professional hunting sector in the range of USD 150,000 to USD 350,000 per year under a full transition scenario.

For the community hunting sector, the incremental cost operates differently because community institutions typically operate on subsistence budgets with no cost recovery mechanism. Questionnaire data from community trust respondents in Botswana and Zimbabwe consistently identified cost as a severe barrier (rated 4 to 5 out of 5), and the absence of any cross-subsidy or support mechanism under the current programme structure means the community sector cannot absorb a 25-50% price increase without either reducing hunting activity or receiving targeted financial assistance. The cost modelling for the phased and incentive-led scenarios explicitly includes a community sector subsidy line as a necessary programme component.

For government wildlife authorities conducting problem animal control (PAC) and culling operations, the cost picture is different again. The Zambian government authority respondent (ZM-01) reported approximately 23,000 rounds per year in human-wildlife conflict (HWC) context operations, and the South African government wildlife authority (SA-09) reported significant volumes in culling and PAC contexts. These are state budget expenditures subject to procurement cycles, and the transition cost is a fiscal implication for conservation agency budgets rather than a private sector absorption. The phased transition scenario models a graduated procurement requirement linked to tender cycle timelines, which substantially reduces the fiscal shock relative to immediate prohibition.

8.3.2 Supply chain development programme costs

Supply-chain development costs are unavoidable if the transition is to move beyond principle. These include market activation, distributor engagement, demonstration and trial programmes,

product-information development, limited community and agency procurement support, and the transactional costs of improving regional stocking consistency for priority calibres. In practical terms, these are not ancillary expenditures but enabling costs: without them, the region is unlikely to overcome the supply and confidence barriers identified in Chapters 4 and 5

8.3.3 Enforcement costs

Enforcement cost is the cost dimension that differentiates most sharply between the three scenarios and that most strongly favours the phased transition approach. Under an immediate prohibition scenario, enforcement requires a national-level inspection and compliance programme covering hundreds of hunting concessions, dozens of ammunition retailers, and thousands of hunting events annually across five countries with highly variable institutional capacity. The regulatory landscape analysis in Chapter 7 established that none of the five priority countries currently has the inspection infrastructure necessary for this level of enforcement. Building it would require substantial investment in personnel, equipment, training, and inter-agency coordination. For planning purposes and based on a component-level assessment of the personnel, equipment, and coordination requirements derived from Chapter 7's institutional readiness findings, an immediate prohibition enforcement programme is estimated to cost in the range of USD 500,000 to USD 1,500,000 per country per year in the initial years, declining as compliance rates improve. This is a programme design assumption rather than a benchmarked figure and should be validated against actual wildlife authority budget structures at the programme design stage.

Under the phased transition scenario, enforcement is concentrated on progressively narrower categories of use in designated priority landscapes, beginning with dangerous game hunting in KAZA and SADC vulture safe zones. This focus substantially reduces the enforcement surface area and allows compliance monitoring to be integrated into existing CITES monitoring and quota verification systems. The phased transition enforcement cost is estimated at approximately 30 to 40% of the immediate prohibition cost, representing a programme saving of USD 1.5 million to USD 5 million per year across the region.

Under the incentive-led scenario, regulatory enforcement costs are minimal in the short term, as no binding instrument exists to enforce. The cost instead shifts to programme management, monitoring of voluntary uptake, and the ongoing subsidy and certification infrastructure. This cost profile is lower in the short term but delivers substantially reduced ecological benefit, as section 8.4 demonstrates.

8.4 Scenario comparison

Table 13 presents a structured comparison of the three scenarios across the five assessment dimensions. The ratings reflect the qualitative and semi-quantitative analysis presented in sections 8.2 and 8.3.

Table 13: Scenario comparison across CBA dimensions

Assessment dimension	Scenario 1: Immediate prohibition	Scenario 2: Phased transition (2027-2035)	Scenario 3: Incentive-led (voluntary)
Net ecological benefit	HIGHEST: Full sector transition within 24 months eliminates primary commercial-sector vulture exposure pathway. Benefit accumulates progressively as legacy lead	HIGH: 75-80% reduction in commercial sector lead dispersal by 2031; community and PAC sectors follow 2031-2035. Ecological benefit accrues progressively within	LOW to MODERATE: Dependent on voluntary uptake. Barrier data (Ch. 5) indicates stall at 15-25% adoption without structural supply intervention. Insufficient for measurable vulture population-level benefit within VCSAP timeframe.

Assessment dimension	Scenario 1: Immediate prohibition	Scenario 2: Phased transition (2027-2035)	Scenario 3: Incentive-led (voluntary)
	dissipates (Garbett 2018).	VCSAP milestone architecture.	
Net economic cost to hunting sector	HIGHEST: Immediate 25-50% cost increase across all operators; community sector unable to absorb without support; supply disruption risk at current market volumes creates operational uncertainty.	MODERATE: Graduated cost increase phased over 8 years; supply chain development programme reduces unit premium over time; community sector subsidy built into programme design.	LOW: Cost increase absorbed voluntarily by early adopters only; majority of sector unaffected in short term. No cross-sector cost redistribution mechanism.
Enforcement burden	HIGHEST: Full-spectrum compliance monitoring required immediately. Estimated USD 2.5-7.5M per year across five countries; exceeds current institutional capacity in all five priority countries (Ch. 7).	MODERATE: Phased enforcement focusses on priority landscapes and species categories; integrates with CITES quota verification systems. Estimated 30-40% of immediate prohibition cost.	MINIMAL: No binding instrument; programme management cost only. Voluntary compliance monitoring via existing platforms (hunting association returns, BirdLife partner networks).
Political and stakeholder acceptability	LOW: No primary survey respondent supported immediate prohibition. Hunting associations in all five countries expressed strong opposition. Government authorities cited institutional unreadiness (ZM-01, ZM-02, BW-01, NM-05, SA-09).	HIGH: Preferred approach of 22 of 29 respondents. Consistent with stated government preference in Namibia, Zimbabwe, and Zambia. Aligns with VCSAP 2025-2035 milestone architecture.	MODERATE: Broadly acceptable to hunting sector; insufficient for conservation and regulatory stakeholders who require demonstrated ecological progress. Risk of indefinite deferral without binding milestones.
Long-term net benefit-to-cost ratio	UNCERTAIN to NEGATIVE in short term: enforcement cost and sector disruption erode near-term net value. Positive if enforcement succeeds by 2030, but high	POSITIVE: Incremental costs manageable within existing sector economics with programme support. Governance and institutional co-benefits add long-	UNCERTAIN: Net positive only if voluntary adoption reaches 60% or above within 5 years. Primary survey data and comparable voluntary programmes indicate a ceiling of 30-40% without supply-side intervention (Ch. 6).

Assessment dimension	Scenario 1: Immediate prohibition	Scenario 2: Phased transition (2027-2035)	Scenario 3: Incentive-led (voluntary)
	implementation risk given institutional constraints.	term value. Net positive return against BirdLife 2025 valuation consistent with VCSAP completion timeline.	

The phased transition scenario (Scenario 2) is the approach most consistent with the evidence base across all five dimensions. It delivers the highest achievable ecological benefit given current institutional and supply chain constraints, at a cost structure that the hunting sector can absorb when programme support is provided, with a political acceptability profile that makes adoption realistic in all five priority countries within the VCSAP timeframe.

8.5 Sensitivity analysis and key assumptions

The CBA rests on five key assumptions. None of the variations tested below alters the core verdict that the phased transition scenario delivers the best net outcome across all five assessment dimensions, but several have material implications for programme design and financing.

Price premium (25–50%). The modelled commercial sector cost of approximately USD 91,000–182,000 per year compresses to USD 37,000–73,000 if the premium falls to 10–15% as supply chain development generates scale economies further strengthening the benefit-to-cost ratio. If the premium remains at or above 50%, community sector subsidy requirements increase materially. Price premium is the most important cost variable, and supply chain development in Phase 1 is the primary mechanism for reducing it.

BirdLife (2025) ecosystem services valuation of USD 1.8 billion per year. Even if the true SADC-wide value is half the estimate, the annual ecological benefit illustration of USD 9–36 million remains well above the total programme cost envelope. The directional conclusion is robust across any plausible range: transition costs are a small fraction of the ecological value at stake.

65% quota utilisation rate. At 35% utilisation, formula-based dispersal falls to approximately 520–540 kg/yr; at 90%, it rises to approximately 690–720 kg/yr. This is a narrow band because Zimbabwe and South Africa which dominate the modelled total use actual offtake rather than quota scenarios. The more consequential uncertainty lies in the unmodelled residuals, which together point to a plausible true regional total of 2,000–2,500 kg/yr regardless of the utilisation rate applied to the formula model.

Voluntary adoption ceiling under Scenario 3. The incentive-led scenario is modelled on voluntary adoption stalling below 40% without binding milestones, consistent with the UK experience documented in Chapter 6. The assumption is conservative but well-grounded: respondents across all five countries identified supply availability and cost as binding constraints, neither of which is addressed by voluntary commitment alone.

Regional non-lead shotgun manufacturing cost of USD 1–3 million. This planning-stage estimate has not been verified against minimum viable production parameters for the SADC context. If fixed infrastructure costs dominate at low volumes, the true capital requirement could exceed this range by a factor of two to three a specific justification for the manufacturing feasibility study recommended as a Phase 1 priority in Section 8.6.

8.6 Conclusions

The cost-benefit analysis supports a clear and evidence-grounded conclusion: the phased transition scenario (2027-2031-2035, aligned with VCSAP milestones) delivers the best net outcome across all five assessment dimensions. The immediate prohibition scenario generates the largest short-term ecological benefit but carries enforcement costs and sector disruption risks that substantially erode net value and that cannot be managed within current institutional capacity. The incentive-led scenario minimises direct costs but delivers insufficient ecological progress within the VCSAP timeframe, and evidence from comparable voluntary programmes indicates that voluntary adoption will not reach the threshold required for material vulture population benefit without structural supply chain intervention.

The phased transition is not the easiest path. It requires sustained programme management, a functioning community sector subsidy mechanism, coordinated supply chain investment across the South African manufacturing and distribution hub, and phased enforcement capacity-building in all five priority countries. It is, however, the path that the evidence supports, that the stakeholder landscape will accept, and that aligns the pace of transition with the SADC Vulture Conservation Strategy's 2035 target of a 75% reduction in lead poisoning-related vulture mortality. The subsequent chapters of this report build their recommendations within this temporal framework.

Three priority research and data investments would materially strengthen the CBA in subsequent programme evaluations and should be reflected in the Phase 1 Programme Design document:

- First, a systematic national-level ammunition use survey covering all five priority countries, to replace the indicative estimate used for South Africa in order to capture community sector and PAC volumes currently absent from the dispersal model.
- Second, a SADC-specific study of dietary lead exposure in professional hunting staff, community members receiving game meat distributions, and international hunting clients, to establish a regional human health benefit baseline.
- Third, a manufacturing feasibility study for regional non-lead shotgun cartridge production, to test the USD 1 million to USD 3 million capital cost estimate against actual minimum viable production parameters and identify the most cost-effective supply chain configuration for the SADC market. These three investments collectively represent the difference between the structured qualitative appraisal presented in this chapter and a fully monetised CBA capable of withstanding formal government scrutiny.

CHAPTER 9: STAKEHOLDER LANDSCAPE AND ENGAGEMENT STRATEGY

9.1 Why stakeholder strategy matters

The transition from lead to non-lead ammunition in Southern Africa is not primarily a technical challenge. It is a political economy problem: actors whose costs are concentrated, immediate, and highly visible are being asked to change behaviour in order to generate benefits that are diffuse, delayed, and largely invisible to those bearing the costs. Non-lead alternatives exist, are ballistically adequate, and their ecological benefits are unambiguous. What is not yet in place is the aligned set of actor behaviours that will move transition from strategic intent to operational reality. This chapter identifies who must be moved, with what message, through which channels, and in what sequence. The engagement strategy matrix in Table 15 consolidates these elements; the narrative below explains the strategic logic behind the actor-specific choices.

9.2 Core actor groups and what they need

Governments and regulatory authorities. Governments are simultaneously the most influential and most institutionally constrained actors. No transition becomes mandatory without their action, yet they are rarely initiating actors in conservation transitions of this kind. The engagement approach must therefore create the conditions within which government action becomes tractable: evidence, political space, capacity support, and an accountability structure. The VCSAP roll-out plan obligation provides exactly this — a structured accountability mechanism that BirdLife country chapters can activate without framing engagement as external pressure. Environment ministries represent a parallel track offering access to GEF and CBD co-financing that wildlife agencies alone cannot unlock.

The hunting and safari industry. This is the actor category whose behaviour the transition most directly requires changing. Professional hunting associations — PHASA, NAPHA, and ZPHGA — are the most strategically important targets because they set professional norms and shape compliance culture before any regulatory mandate arrives. The engagement approach is co-design of voluntary protocols that position associations as proactive leaders rather than regulated subjects. Safari operators need field performance data and cost-subsidy access; distributors and manufacturers need a credible commercial case built on converging EU regulatory pressure and early-mover advantage.

Conservation and civil society organisations. The primary challenge for BirdLife country chapters is coordination rather than advocacy. Fragmented or contradictory messaging across the BirdLife network undermines the scientific credibility that gives these organisations their comparative advantage in government engagement. The 4 Vultures coalition is the coordination vehicle; this programme should operate as a component of it, not a parallel initiative.

The tourism and birding economy. Photographic tourism operators and birding businesses are coalition expanders whose economic weight opens ministerial access that conservation organisations typically cannot reach. Tourism contributes materially to GDP across all five priority countries — ranging from approximately 4–15% — and documented vulture population declines directly erode the product quality that drives this contribution. The engagement frame is asset protection, not conservation advocacy.

Communities and CBNRM structures. Communities are simultaneously potential cost-bearers and potential beneficiaries. The engagement approach must be grounded in livelihood and human health framing, not regulatory compliance. The human health exposure pathway — lead fragments in distributed game meat reaching children and pregnant women — is a distinct and underutilised entry point that community health networks can carry more effectively than conservation organisations. CAMPFIRE Association and NACSO are the institutional

intermediaries through which community engagement can reach the scale that BirdLife country chapter networks alone cannot achieve.
Donors and financing institutions.

Donor engagement operates across three horizons: BirdLife and aligned partners established network for Phase 1 core financing; GEF and bilateral development partners for Phase 2 market activation; and emerging biodiversity finance instruments for Phase 3 sustainability. The MEL framework in Chapter 10 is explicitly designed to generate verified impact data compatible with biodiversity credit market requirements — an investment in long-term financing optionality that costs nothing to build in now.

9.3 Cross-cutting engagement principles

Four principles govern all actor interactions and should be applied consistently throughout the programme lifecycle.

1. **Differentiation.** Each actor group requires a distinct message frame calibrated to its specific interests: regulatory accountability and capacity support for governments; cost, supply, and market access for industry; livelihood and health for communities; feasibility and investment logic for donors. A single-track conservation message underperforms across every audience simultaneously.
2. **Sequencing.** Phase 1 is concentrated on actors whose cooperation creates the enabling conditions for Phase 2; the industry co-design process and the government VCSAP roll-out plan activation. Community and health sector engagement is most productive when grounded in an operational programme with visible resources attached, making it a Phase 2 priority.
3. **Coalition architecture.** No single organisation can deliver this strategy alone. BirdLife International coordinates; BirdLife country chapters deliver; specialist partners such as the Vulture Conservation Foundation (VFC) also called the 4Vultures coalition¹, CAMPFIRE Association, NACSO, research universities, bilateral development partners — contribute the technical credibility, community access, and government convening that BirdLife cannot replicate independently.
4. **Constructive industry engagement.** The hunting industry holds legitimate economic interests and, in several SADC countries, provides the primary financing mechanism for community wildlife management. The programme's success depends on industry as a partner in change. Every engagement interaction should expand the space for voluntary action and reduce the perceived cost and risk of transition, not document resistance or assign blame for inaction.

9.4 Stakeholder engagement strategy matrix

Table 14 consolidates the engagement strategy across all actor categories, specifying for each the primary message frame, the engagement channel, the lead organisation responsible for delivery, and the phase timing. The matrix is designed to function as a programme planning tool, providing sufficient specificity to guide implementation while remaining flexible enough to accommodate country-specific variations.

Table 14: Stakeholder engagement strategy matrix

Actor / Sub-track	Message frame	Primary channel	Lead organisation	Phase
Governments and Regulatory Authorities				

¹¹ This worked on protecting four vulture species in Europe and is critical for exchange of lessons learnt

Actor / Sub-track	Message frame	Primary channel	Lead organisation	Phase
Wildlife management agencies (ZPWMA, MEFT, DWNP, DNPW, DFFE)	VCSAP roll-out plan obligation; SADC accountability; long-term wildlife economy protection; capacity support offer	Bilateral meetings; VCSAP national focal point process; BirdLife country chapter technical assistance	BirdLife International; BirdLife country chapters	Phase 1 (2026-2027), ongoing
Environment ministries	CBD NBSAP pollution targets; GEF/GCF co-financing eligibility; toxic substance regulatory pathways	CBD reporting cycle; SADC Secretariat channels; environment ministry bilateral	BirdLife International	Phase 2 (2028-2031)
SADC Secretariat	Regional harmonisation dividend; VCSAP implementation support; convening authority for multi-country accountability	SADC Protocol on Wildlife Conservation; VCSAP Secretariat process	BirdLife International (regional affairs)	Phase 1 (2026-2027)
Hunting and Safari Industry				
Professional hunting associations (PHASA, NAPHA, ZPHGA)	Co-design of voluntary transition protocol; proactive positioning ahead of EU market pressure; professional standards leadership	Annual conferences; direct industry roundtables; association policy committees	BirdLife South Africa; BirdLife Zimbabwe; NNF Namibia	Phase 1 (2026-2027)
Safari operators	Non-lead ballistic performance data; field trial results; cost-subsidy access; EU client retention argument	Operator field trials; dealer stocking incentive programme; calibre-by-calibre product guide	BirdLife country chapters; ammunition distributors	Phase 1-2 (2026-2031)
Retailers, distributors, and manufacturers	Growing non-lead product category; early-mover margin advantage; EU regulatory certainty creating demand signal	Commercial partnership discussions; market demand data sharing; technical field data provision to manufacturers	BirdLife International; BirdLife South Africa	Phase 2 (2028-2031)
Conservation and Civil Society Organisations				
BirdLife country	Coordinated messaging and	4Vultures coalition	BirdLife International	Ongoing from Phase 1

Actor / Sub-track	Message frame	Primary channel	Lead organisation	Phase
chapters and partners	advocacy positions; evidence-sharing; avoid duplicative or contradictory campaign activities	platform; BirdLife Africa regional network; joint campaign planning cycles	(coordination lead)	
Universities and research institutions	Scientific credibility partnership; peer-reviewed evidence generation; independent validation of key programme claims	Research partnership agreements; joint publications; academic conference presentations	BirdLife country chapters; Namibian Bird Club; SANBI; university partners	Phase 1-3 (ongoing)
Tourism and Birding Economy				
Photographic tourism operators and birding tourism businesses	Vulture population recovery as tourism product protection; living vulture economic value; coalition legitimacy for ministerial access	Tourism industry associations; birding festival platforms; operator networks	BirdLife country chapters; national tourism boards	Phase 1-2 (2026-2031)
Communities and CBNRM Structures				
Rural District Councils, conservancy committees, community resource boards, CBNRM trusts	CBNRM revenue protection; livelihood co-benefits; human health (game meat lead exposure); cost-support access under programme	Rural District Councils; conservancy management committees; community health networks; CAMPFIRE Association; NACSO	BirdLife country chapters; CAMPFIRE Association; NNF conservancy programme	Phase 2 (2028-2031)
Donors and Financing Institutions				
BirdLife donor network (near-term); bilateral development partners (GIZ, USAID, FCDO)	VCSAP 2025-2035 as investment anchor; measurable vulture population outcomes; government access and convening value	BirdLife International donor relations; bilateral country office engagement; partner co-financing discussions	BirdLife International (global fundraising)	Phase 1-2 (2026-2031)
GEF / GCF national focal points	Biodiversity pollution and wildlife trade linkages; CBD NBSAP co-financing eligibility;	GEF/GCF national focal points; CBD reporting cycle; environment ministry channel	BirdLife International; national BirdLife chapters	Phase 2 (2028-2031)

Actor / Sub-track	Message frame	Primary channel	Lead organisation	Phase
	VCSAP institutional backing			
Biodiversity finance instruments (credits, impact bonds)	Verifiable outcomes pipeline; M&E framework designed for biodiversity credit market compatibility	Emerging biodiversity finance platforms; impact investment networks	BirdLife International	Phase 3 (2032-2035)

The matrix structure reflects three actor-level observations that the narrative sections above establish. First, Phase 1 engagement is concentrated on actors whose cooperation is needed to create the enabling conditions for later phases: wildlife management agencies, professional hunting associations, and the BirdLife country chapter network. Second, industry engagement is front-loaded relative to community engagement because the voluntary protocol track must be activated before regulatory pressure escalates, while community engagement is most productive when it can be grounded in an operational programme with visible resources attached. Third, donors and bilateral partners appear across multiple phases because their role shifts from initial programme financing in Phase 1 to co-financing for market activation in Phase 2 and biodiversity finance access in Phase 3.

9.5 Supporting communications environment

The media and public communications landscape in each priority country shapes the political environment within which regulatory actors operate and the social norms within which industry decisions are made. A proactive communications strategy that positions vulture conservation and the lead transition as a compelling public interest story rather than a technical debate to reinforce all other engagement tracks. The primary objective is not to generate public pressure for regulatory action, but to ensure that when regulatory conversations occur within government, they take place in an environment where the transition is understood as broadly beneficial. BirdLife country chapters with established media presence and birding tourism programme components are well placed to lead this work.

CHAPTER 10: PHASED TRANSITION ROADMAP

10.1 Theory of transition

This chapter translates the preferred phased transition scenario from Chapter 8 into an implementation roadmap for 2026 to 2035, specifying sequencing, institutional responsibilities, financing logic, and monitoring architecture. The roadmap is built around four conditions that must be met in sequence before the transition becomes self-sustaining: awareness and norm change among operators and communities; supply chain readiness through mainstream South African distribution; institutional activation of wildlife management agencies and professional associations; and regulatory consolidation that converts voluntary adoption into durable legal architecture. Three rules govern the roadmap throughout. Phases are sequential and activating Phase 2 regulatory instruments before Phase 1 supply conditions are met is the most likely path to failure. Milestones are evidence-triggered rather than calendar-triggered. No single organisation carries a critical function alone, because the architecture is explicitly designed to absorb the loss of any actor without collapse.

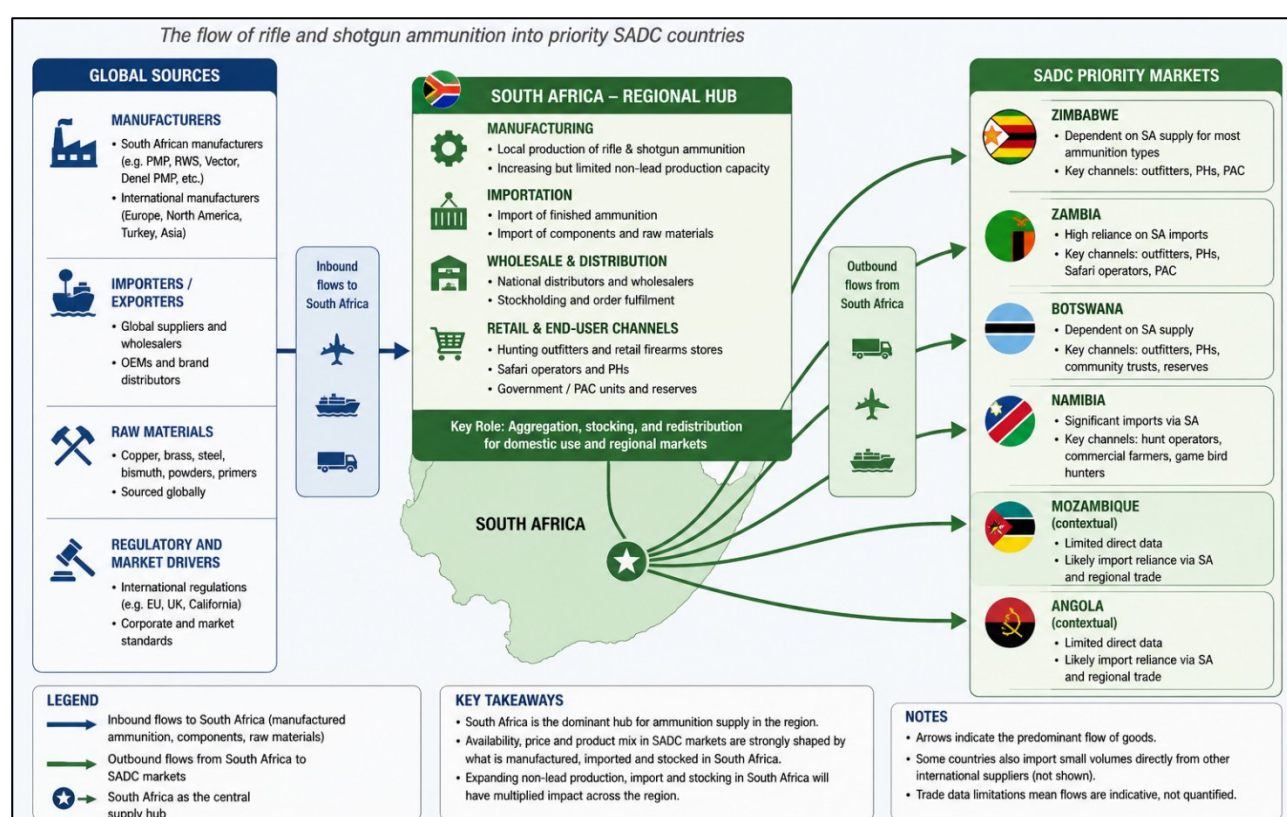


Figure 3: Flow of rifles and ammunition in SADC countries

10.2 Phase 1: Foundation and voluntary engagement (2026-2027)

Phase 1 creates the awareness, market signal, and institutional relationships that make subsequent phases viable. Five activities drive this: structured voluntary trial programmes in South Africa, Namibia, and Zimbabwe coordinated through BirdLife country chapters in partnership with PHASA, NAPHA, and ZPHGA; engagement of the top five South African ammunition distributors with a commercial case for early non-lead stocking; initiation of VCSAP national roll-out plan processes in all five priority countries, with formally designated agency focal points achieved in South Africa, Namibia, and Zimbabwe by end of Phase 1; publication and dissemination of this report as the regional evidence anchor; and commissioning of an independent legal opinion on the scope for a NEMBA Threatened or Protected Species Regulation instrument in South Africa as the primary Phase 2 regulatory preparation.

Phase gate: *The programme advances to Phase 2 only if: non-lead alternatives are commercially stocked through at least two South African distributors for a minimum of ten of the top fifteen hunting calibres; voluntary trial programmes have been completed in at least three countries with documented operator conversion data; VCSAP roll-out plan frameworks are formally initiated with designated agency focal points in at least three priority countries; and the NEMBA legal opinion has been delivered and reviewed.*

10.3 Phase 2: Institutional activation and market development (2028-2031)

Phase 2 converts Phase 1 market signals into supply chain investment and permit-based conditions. The supply chain milestone is non-lead alternatives commercially available through mainstream South African distribution for at least 80% of calibres in active use across the five priority countries. The institutional milestone is the incorporation of non-lead conditions into existing hunting permit or concession systems in at least two priority countries: a communal conservancy permit condition pilot in Namibia; the formalisation of the PHASA voluntary protocol in South Africa; and non-lead conditions incorporated into CAMPFIRE concession agreements in Zimbabwe through the 2025–2035 Vulture Action Plan framework. Botswana and Zambia complete their VCSAP roll-out plan frameworks and initiate permit condition processes in Phase 2. Phase 2 also constitutes a SADC technical working group under the Protocol on Wildlife Conservation to develop a harmonised regional standard and initiates a community health engagement track in Zimbabwe and Zambia to generate blood lead level data from communities with high game meat consumption.

Phase gate: *The programme advances to Phase 3 only if: non-lead alternatives are commercially available for at least 80 per cent of active hunting calibres through South African distribution; at least two priority countries have formally incorporated non-lead conditions into hunting permit or concession systems; the SADC technical working group on the harmonisation instrument is constituted and operational; and the mid-term independent review confirms that lead dispersal reduction indicators are trending in the projected direction.*

10.4 Phase 3: Regulatory consolidation and regional harmonisation (2032-2035)

Phase 3 converts the voluntary and permit-based transition of Phase 2 into durable regulatory architecture. In Namibia, a restriction incorporated into the Nature Conservation Amendment Act regulations or attached to the communal conservancy permit system by ministerial notice provides the primary legal instrument. In South Africa, a NEMBA Threatened or Protected Species Regulation amendment combined with a DFFE policy notice is the most viable pathway. Zimbabwe, Botswana, and Zambia reach regulatory consolidation through CAMPFIRE and GMA concession mechanisms rather than primary legislation, with formal legislative processes following as institutional readiness matures. Mozambique and Angola enter the roadmap in Phase 3 as VCSAP roll-out plan development partners; their engagement is a process commitment rather than a regulatory target, but their inclusion is essential for regional coherence given the Transfrontier poisoning risk they present to the five priority countries. The SADC harmonisation instrument is targeted for adoption by the SADC Council of Ministers by 2035. The headline accountability commitment is a 75% reduction in confirmed poisoning-related vulture mortality across the five priority countries by 2035, measured against the primary data baseline established in this consultancy.

10.5 Country-specific transition pathways

Table 15 summarises the earliest viable entry point, lead institution, enabling condition, principal risk, and phase readiness for each country. Two cross-cutting observations apply. South Africa's supply chain role makes it structurally indispensable, and failure to achieve distributor stocking targets in Phase 1 will stall regulatory implementation across all five priority countries in Phase 3. Zimbabwe's pathway is materially strengthened by the completed 2025 to 2035 Vulture Action Plan, which means Phase 1 engagement focuses on activating an existing framework rather than building a successor.

Table 15: Country-specific transition pathways

Country	Earliest entry point	Lead institution	Enabling condition	Main risk	Phase readiness
South Africa	Phase 1: PHASA voluntary protocol co-design and distributor stocking engagement	BirdLife South Africa; PHASA; DFFE	NEMBA legal opinion secured in Phase 1; PHASA co-design process initiated	Prolonged PHASA co-design without output; distributor resistance to early stocking investment	Phase 3: National NEMBA-based restriction (2033-2035); supply chain hub operational from Phase 2
Namibia	Phase 2: Communal conservancy non-lead permit condition pilot in defined subset	MEFT; NAPHA; Namibia partners	NAPHA Phase 1 co-design engagement completed; MEFT policy mandate confirmed	Industry resistance to formalisation of pilot into national standard; private ranch sector exclusion from pilot	Phase 3: National restriction via Nature Conservation Amendment Act regulation (2033-2035)
Zimbabwe	Phase 1: Activation of existing 2025-2035 Vulture Action Plan and Lead Ammunition Strategy; CAMPFIRE pilot	ZPWMA; BirdLife Zimbabwe; CAMPFIRE Association	Operational activation of the 2025-2035 VAP lead reduction targets and VCSAP roll-out plan submission	ZPWMA capacity constraints; CAMPFIRE governance variability across 57 districts	Phase 2-3: CAMPFIRE concession conditions; legislative consolidation post-2035
Botswana	Phase 2: VCSAP roll-out plan completion and CBNRM non-lead permit condition initiation	DWNP; BirdLife Botswana	South African distributor stocking targets met by end of Phase 1	Small commercial hunting sector reduces urgency; supply chain entirely dependent on SA hub	Phase 3: CBNRM trust permit conditions (2032-2035)

Country	Earliest entry point	Lead institution	Enabling condition	Main risk	Phase readiness
Zambia	Phase 2: VCSAP roll-out plan completion; GMA framework non-lead condition pilot	DNPW; Zambia Ornithological Society	Phase 2 roll-out plan completion; DNPW focal point designated	Significant HWC/PAC volumes (ZM-01: ~23,000 rounds/yr) outside hunting permit system; fiscal cost to agency budgets	Phase 3: GMA concession conditions (2032-2035)
Mozambique and Angola	Phase 3: VCSAP roll-out plan development process initiation	BirdLife International; SADC Secretariat	SADC Secretariat technical working group operational; VCSAP accountability mechanism active	Low institutional capacity; limited BirdLife country partner presence; political prioritisation	Process commitment only; regulatory consolidation beyond 2035 horizon

Two observations cut across all six entries. South Africa's transition is the supply chain condition for the entire region: if it does not achieve distributor stocking targets within Phase 2 and a PHASA voluntary protocol within Phase 1, the supply barrier will prevent Phase 3 regulatory implementation in all five priority countries. Zimbabwe's pathway has been materially strengthened by the completion of the 2025 to 2035 Vulture Action Plan and Lead Ammunition Strategy, which provide the institutional framework and lead reduction targets that were absent from the previous 2019 to 2022 plan; Phase 1 engagement in Zimbabwe now focuses on activating and operationalising this existing framework rather than developing a successor from scratch.

10.6 Monitoring, evaluation, and learning framework

The MEL framework is structured around three indicator tiers. Tier 1 draws directly from the SADC VCSAP 2025 to 2035 Priority Area 1, covering the headline accountability indicators all twelve range states are already committed to but which currently lack the data systems to report against meaningfully. Tier 2 adapts the Zimbabwe Vulture Action Plan 2019 to 2022 monitoring indicators for regional adoption in all five countries' VCSAP roll-out plans. Tier 3 introduces new transition-specific process indicators covering supply chain readiness, operator adoption rates, and import volume tracking, which provide the early warning system for the programme's causal chain. Table 16 presents all indicators with frequency and responsible party. Reporting is consolidated in an annual programme monitoring report. An independent mid-term review at end of 2031 assesses Phase 2 milestones, and a final independent evaluation at end of 2035 produces the accountability assessment against the VCSAP headline target.

Table 16: Monitoring and evaluation indicator framework

Indicator	Source / tier	Frequency	Responsible party
Number of range states with operational VCSAP national roll-out plans	SADC VCSAP 2025-2035, Priority Area 1	Annual	BirdLife International / SADC Secretariat
Confirmed vulture poisoning events per annum (all five countries combined)	SADC VCSAP 2025-2035, Priority Area 1	Annual	BirdLife country chapters / wildlife agencies
Vulture population trend index against 75% mortality reduction target	SADC VCSAP 2025-2035, Priority Area 1 headline	Biennial	4Vultures coalition / national wildlife agencies
Number of lead-related vulture mortalities recorded and attributed	SADC VCSAP 2025-2035, Priority Area 1	Annual	BirdLife country chapters / wildlife veterinary units
National poisoning incident database: entries per country per year	Zimbabwe VAP 2019-2022, M&E indicator (adapted for regional use)	Annual	National wildlife management agencies
Annual coordinated vulture count: countries participating and counts completed	Zimbabwe VAP 2019-2022, adapted	Annual	BirdLife country chapters / national agencies
Number of active national Vulture Working Group coordinators	Zimbabwe VAP 2019-2022, adapted	Annual	BirdLife country chapters and other partner NGOs
Status of national vulture management legislation review: initiated / completed / enacted	Zimbabwe VAP 2019-2022, adapted	Biennial	National wildlife agencies / BirdLife chapters
Percentage of licensed safari operators using non-lead ammunition for at least 50% of operations	New indicator: recommended for adoption in national VCSAP roll-out plans	Annual	Professional hunting associations / BirdLife chapters
Non-lead calibre availability index: proportion of top 15 hunting calibres stocked non-lead by at least 3 major SA distributors	New indicator: recommended for adoption in national VCSAP roll-out plans	Annual	BirdLife South Africa / distributor survey
Number of field trials completed, and operators converted to non-lead following trial	New indicator: Phase 1 and 2 programme monitoring	Six-monthly	BirdLife country chapters
Number of national VCSAP roll-out plans with an explicit lead reduction target and timeline	New indicator: recommended for adoption in national VCSAP roll-out plans	Annual	BirdLife International / SADC Secretariat
Volume (kg) of non-lead rifle and shotgun ammunition	New indicator: derived from UN	Annual	BirdLife International / national customs data

Indicator	Source / tier	Frequency	Responsible party
imported into each priority country	Comtrade HS 930621 / 930630 monitoring		

Tier colour guide: blue rows = SADC VCSAP 2025-2035 indicators; amber rows = Zimbabwe VAP 2019-2022 (adapted); green rows = proposed new transition-specific indicators. Reporting against all three tiers is consolidated in an annual programme monitoring report produced by BirdLife International with inputs from country chapters and national wildlife management agencies. An independent mid-term review at end of 2031 assesses cumulative progress against Phase 2 milestones and produces a forward-looking assessment of adjustments required for Phase 3. A final independent evaluation at end of 2035 assesses programme achievement against the VCSAP headline target and full three-tier indicator set, producing the evidence base for the next phase of regional conservation planning.

10.7 Financing architecture

Three financing horizons underpin the programme. In the near term, BirdLife International's donor network combined with bilateral grants from GIZ, and the UK FCDO provides the Phase 1 core financing. This report's evidence base, barrier analysis, and phased roadmap constitute the fundraising case and donor accountability structure. From Phase 2, GEF and GCF biodiversity financing windows supplement bilateral grants, while the supply chain development component represents the gap least likely to be covered by conservation donors and is therefore the candidate for development finance institution engagement, specifically IFC or regional development bank instruments applicable to South African non-lead ammunition manufacturing capacity. As the programme matures into Phase 3, domestic government budget lines and emerging biodiversity credit market instruments provide the long-term sustainability pathway. The MEL framework is explicitly designed to generate verified impact data compatible with biodiversity credit market requirements, at no additional cost.

10.8 Risk register

Table 17 presents the seven principal implementation risks with likelihood and impact ratings and specified mitigation measures. Two principles govern the design throughout. The first is sequencing fidelity, since the most significant risks arise from treating phases as interchangeable rather than sequential. The second is accountability redundancy, ensuring no single actor, institution, or financing source is the sole bearer of a critical programme function.

Table 17: Transition roadmap risk register (L = Low, M = Medium, H = High)

Risk	Likelihood	Impact	Mitigation measure
Supply chain failure: non-lead products do not reach adequate scale, calibre range, or price point within the Phase 1-2 window	M	H	Sequence distributor engagement before regulatory milestones; Peregrine Bullets and regional manufacturers engaged as early partners; EU and North American import facilitation as bridge supply; calibre coverage index used as Phase 2 gate criterion
Regulatory reversal: political change or intensified industry lobbying leads to rollback of voluntary commitments or permit conditions	M	H	Embed transition conditions in SADC VCSAP roll-out plans (multilateral accountability) rather than relying on bilateral government commitments; document and publish voluntary commitments to increase the reputational cost of reversal
Donor fatigue: programme financing for the 2026-2035	M	M	Phase 1 designed to generate measurable outcomes that provide re-funding evidence; GEF and DFI financing phased in to reduce

Risk	Likelihood	Impact	Mitigation measure
horizon fails to be sustained across political and funding cycles			dependence on a single donor; government budget lines targeted from Phase 2; MEL framework generates the performance data that donor reporting requires
Free-rider escalation: unregulated imports from Mozambique, Angola, or other non-restricting countries undermine compliance in restricting countries	M	M	SADC harmonisation instrument pursued from Phase 2; Mozambique and Angola VCSAP engagement initiated in Phase 3; KAZA and TFCA management frameworks used as sub-regional compliance mechanisms in advance of formal instrument
Institutional capacity collapse: further deterioration in wildlife management agency capacity renders institutional activation impossible within the phase timeline	M	H	BirdLife country chapter capacity support embedded in programme design; permit condition mechanisms (conservancy, CAMPFIRE) are contractual rather than agency-enforcement-dependent; SADC Secretariat coordination reduces single-country dependence
Community resistance: communities perceive transition as imposing cost without benefit, generating local opposition that undermines CBNRM-based implementation	L	M	Community engagement initiated in Phase 2 with livelihood and human health framing; CAMPFIRE Association and NACSO engaged as community-accountable co-delivery partners; targeted cost-support mechanisms for subsistence hunters identified in financing architecture
Data infrastructure failure: absence of disaggregated monitoring data prevents evidence-based phase gate decisions and invalidates the mid-term review	M	H	Phase 1 includes establishment of the Tier 3 process indicator reporting system before regulatory milestones begin; UN Comtrade customs monitoring activated from programme launch; annual programme monitoring report contracted to BirdLife International as a binding programme deliverable, not an optional output

Two overarching risk management principles govern the programme design. Sequencing fidelity is the most critical: the most significant risks arise when phase milestones are treated as interchangeable rather than sequential. Activating Phase 2 regulatory instruments before Phase 1 supply chain conditions are met is the single most likely path to programme failure, and the phase gate criteria specified after sections 10.2 and 10.3 are the operational expression of this principle. Accountability redundancy is the second: no single organisation, government actor, or financing source should be the sole bearer of a critical programme function. The multi-actor engagement architecture, the three-tier indicator framework, and the multi-source financing structure are all expressions of this principle, ensuring that the programme can absorb the loss of any single actor or commitment without structural collapse.

CHAPTER 11: CONCLUSIONS AND STRATEGIC RECOMMENDATIONS

11.1 Overarching Conclusion

This report has established a single overarching conclusion: the transition from lead to non-lead ammunition in the five priority SADC countries is technically feasible, commercially achievable within a ten-year horizon, and normatively mandated through existing international and regional commitments. The binding constraint is not technical adequacy, since non-lead alternatives perform acceptably for the hunting contexts prevalent in Southern Africa, nor is it economic impossibility, since the price premium is manageable at sector level and reducible through supply chain development. The binding constraint is institutional: the absence of coordinated supply chain investment, regulatory activation, and sustained advocacy that only a deliberately sequenced, adequately resourced, and regionally coherent programme can provide. Lead use is currently near-universal, no SADC member state has enacted any restriction, and non-lead products are absent or marginal from mainstream distribution in three of the five priority countries. Against this baseline the case for urgent programme action is unambiguous, the normative framework is in place, and the question is no longer whether to act but whether the institutional commitment will be assembled in time for the 2035 target to remain achievable.

11.2 Summary of key findings

Finding 1 — Scale of the challenge. Lead ammunition dominates all five priority countries and all hunting sectors without exception, with 76–99% of active ammunition lead-based in Zimbabwe's best-documented case. Trade flow data cannot currently disaggregate lead from non-lead products, meaning no country has the monitoring infrastructure to track a market transition is itself a programme priority.

Finding 2 — Commercial landscape. Non-lead rifle alternatives are technically adequate for plains game, dangerous game, and large calibre applications, with South African manufacturer Peregrine Bullets demonstrating regional production capacity. The barrier is distribution, not performance: until mainstream South African distributors normalise non-lead stocking, supply chain failure will neutralise every other transition instrument across the region.

Finding 3 — Barrier hierarchy. Supply chain and economic barriers are the binding constraints whose resolution is a prerequisite for all other interventions. Awareness and regulatory barriers, though significant, are secondary. Regulatory action imposed before supply chain readiness generates compliance failures that delegitimise the instrument and this finding is the analytical foundation of the phased roadmap.

Finding 4 — International design lessons. Successful lead ammunition transitions share three design features absent from the current SADC context: phased implementation that sequences demand signals ahead of supply investment; a charismatic flagship species narrative that sustains political support across electoral cycles; and a voluntary pre-regulatory phase that builds norm change before the binding mandate arrives. The programme is designed around all three.

Finding 5 — Regulatory architecture. The legislative instruments required for transition already exist in all five priority countries. Permit condition mechanisms within existing wildlife management frameworks do not require primary legislative reform. The gap is functional capacity and political will, not legal authority. The VCSAP roll-out plan obligation is the accountability mechanism that can convert latent will into active commitment.

11.3 Strategic recommendations

Table 18: Strategic recommendations

Sector	Stakeholders by country	Priority recommendation	Phase
Governments	Zimbabwe: Ministry of Environment, Climate &	Environment ministries should engage the lead	Phase 2
—			

environment ministries	Wildlife; Environmental Management Agency (EMA, Ch.20:27) — South Africa: DFFE — Namibia: MEFT — Botswana: Ministry of Environment & Tourism — Zambia: Ministry of Green Economy & Environment	ammunition transition through two parallel tracks. First, existing Environmental Management Act provisions governing toxic and hazardous substances offer a supplementary regulatory pathway that does not require amendment of primary wildlife legislation. Second, incorporating lead ammunition reduction as a quantified target in each country's CBD National Biodiversity Strategy and Action Plan unlocks GEF and GCF co-financing eligibility, creating a fiscal incentive for ministry engagement that the wildlife permit pathway alone cannot generate. In Zimbabwe, the EMA should be engaged as a co-regulatory actor alongside ZPWMA, given its mandate under the Environmental Management Act to regulate environmental pollutants.	
Wildlife management agencies	Zimbabwe: ZPWMA, Department of Veterinary Services — South Africa: DFFE, SANParks, provincial conservation authorities — Namibia: MEFT, Directorate of Scientific Services — Botswana: DWNP, Department of Veterinary Services — Zambia: DNPW	Zimbabwe: Formally activate the 2025–2035 Vulture Action Plan and Lead Ammunition Strategy; incorporate a non-lead condition into CAMPFIRE quota allocations via ZPWMA's existing compliance and quota allocation framework; designate a VCSAP national roll-out plan focal point by end of 2026; engage BirdLife Zimbabwe and the CAMPFIRE Association as primary implementation support partners. South Africa: Commission an independent legal opinion on the scope for a NEMBA TOPS Regulation instrument constituting a species-based restriction in designated vulture range areas without amending the Firearms Control Act. Namibia: Commission a non-lead permit condition pilot in a defined subset of communal	Phase 1 all; Namibia pilot Phase 2

		conservancies with an integrated monitoring protocol targeting a functional pilot by 2028. Botswana and Zambia: Designate VCSAP roll-out plan focal points within DWNP and DNPW respectively and initiate formal plan development processes in H1 2027.	
Professional hunting sector	Zimbabwe: SOAZ, ZPHGA — South Africa: PHASA, SA Hunters & Game Conservation Association — Namibia: NAPHA — Botswana: BWPA — Zambia: Zambia Professional Hunters Association	PHASA and NAPHA, as the most institutionally developed associations in the region, should engage BirdLife country chapters as co-designers of voluntary non-lead transition protocols before end of 2026, specifying adoption targets, product trial mechanisms, dealer stocking commitments, and reporting structures. SOAZ and ZPHGA should adopt equivalent protocols aligned with Zimbabwe's VAP lead reduction targets; the SOAZ interview data confirms that supply availability — not ideological resistance — is the binding constraint, and a formal industry position statement ahead of regulatory action reduces compulsion risk.	Phase 1
Ammunition supply chain	South Africa (regional hub): Peregrine Bullets, GS Custom Bullets, Impala Bullets, Balistix Bullets (manufacturers); mainstream SA distributors — Zimbabwe: LG Harrison, Feredays (importers), Zimbabwe Defence Industries — Namibia: firearm dealers and importers — Regional: Stryker, Stronghold	South African manufacturers and distributors should initiate commercial engagement to expand non-lead stocking across the top fifteen hunting calibres by 2030, building on converging EU client demand, upstream regulatory trajectories, and early-mover advantage. Zimbabwe and Namibia importers should be engaged as priority distribution partners given current supply scarcity in those markets. BirdLife South Africa should convene a formal distributor engagement forum in Phase 1 to establish the investment	Phase 1–2

		calculus before Phase 2 demand requires it.	
Conservation and civil society	Regional: BirdLife International, 4Vultures coalition — Zimbabwe: BirdLife Zimbabwe, Victoria Falls Wildlife Trust, Tikki Hywood Foundation — South Africa: BirdLife South Africa, EWT Birds of Prey Programme, Wildlife ACT, Zululand Vulture Project — Namibia: NNF, Namibian Chamber of Environment — Botswana: BirdLife Botswana, Kalahari Conservation Society — Zambia: Zambia Ornithological Society, BirdWatch Zambia	BirdLife International should establish a dedicated SADC lead transition programme resourced for 2026–2035 and publish this report as the regional evidence anchor in collaboration with the 4Vultures coalition. BirdLife Zimbabwe should prioritise a successor Vulture Action Plan with a quantified lead reduction baseline and functional MEL system in Q1 2026 — the critical path item for Zimbabwe's Phase 2 activation. All country chapters should coordinate messaging and trial delivery through the 4Vultures platform; the Namibian Chamber of Environment's prior convening role on this issue makes it a natural co-facilitator for industry engagement in Namibia.	Phase 1 all; Zimbabwe VAP urgent Q1 2026
Community and CBNRM structures	Zimbabwe: CAMPFIRE Association, Rural District Councils (Hwange, Mbire, Binga, Bulilima priority districts) — Namibia: NACSO, communal conservancy management committees — Botswana: CBNRM community trusts, NCONGO — Zambia: Community Resource Boards, ZCRBA	CAMPFIRE Association (Zimbabwe) and NACSO (Namibia) should be formally engaged as co-delivery partners from Phase 1. Community engagement must be grounded in livelihood and human health framing — the game meat lead exposure pathway provides a specific entry point through rural health networks that conservation organisations cannot access independently. Community sector cost-support mechanisms should be built into programme financing from the outset, not treated as secondary, given questionnaire findings that rated cost as a severe barrier across all community respondents.	Phase 2
Regional coordination	SADC Secretariat (Gaborone), KAZA Secretariat (Kasane), GLTFCA structures, Lower Zambezi–Mana Pools TFCA structures	The SADC Secretariat should activate VCSAP 2025–2035 roll-out plan accountability for all twelve vulture range states and constitute a technical working group	Phase 1 engagement; Phase 2 working group; Phase 3 instrument

		under the Protocol on Wildlife Conservation to develop a harmonised regional standard, targeting a draft instrument for the 2031 Council of Ministers cycle. The KAZA Secretariat should integrate lead ammunition transition compliance into its existing community poisoning response infrastructure as a Phase 2 sub-regional mechanism ahead of the formal SADC instrument.	
Donors and financing	Phase 1–2 core: GIZ, UK FCDO — Phase 2 supplementary: GEF national focal points, GCF — Phase 2–3 supply chain: IFC, regional development banks — Phase 3 future: biodiversity credit markets, conservation impact bonds	Donors with existing Southern African wildlife portfolios should finance Phase 1 and Phase 2 components as a high-leverage investment anchored in the VCSAP headline accountability target and the three-tier MEL framework. GIZ and UK FCDO are prioritised for Phase 1 core financing given their established in-country wildlife programme presence across all five priority countries. The supply chain development component — the financing gap standard conservation grants will not cover — should be scoped with IFC and regional development bank instruments applicable to South African non-lead ammunition manufacturing. The MEL framework is designed to generate verified impact data compatible with biodiversity credit market requirements as those mechanisms mature through the 2030s.	

11.4 Conditions for success

Four conditions are non-negotiable. Supply chain development must precede regulatory milestones, and under-resourcing this work in Phase 1 is the single most likely path to programme failure. BirdLife country chapter capacity must be adequate and sustained, particularly in Zimbabwe where the successor Vulture Action Plan is the critical path item for Phase 2 activation. South Africa must move: if it does not achieve distributor stocking targets, complete the NEMBA legal opinion, and initiate the PHASA protocol in Phase 1, the regional transition stalls regardless of progress elsewhere. The SADC Secretariat must be formally

engaged before the end of Phase 1, since individual country regulatory action cannot close the free-rider gap that only regional harmonisation can address.

11.5 Closing statement

The eight vulture species that range across the SADC region are among the most ecologically important and most conservation-pressured birds on the African continent. Their population trajectories, declining across all species and all countries and driven by poisoning events that are preventable, represent one of the most significant conservation failures of the past two decades in Southern Africa. Lead ammunition is not the only cause of that failure, but it is a primary cause, and it is the cause most amenable to targeted intervention within a defined timeframe.

The SADC Vulture Conservation Strategy and Action Plan 2025 to 2035 has established the normative framework. The CMS, the SADC Wildlife Protocol, and the national legislative frameworks of all five priority countries provide the institutional channels. The science is settled. The international precedents are documented. The alternatives exist. This report has assembled the evidence, diagnosed the barriers, mapped the actors, and designed the roadmap.

What remains is the decision to act consistently, collaboratively, and with the sequencing discipline that the barrier analysis demands. The vulture populations of Southern Africa, and the communities and ecosystems that depend on them, cannot wait for a more convenient moment. The transition begins now.

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ANNEX I: Primary Data Collection Instrument

Stakeholder Questionnaire: Transitioning from Lead to Non-Lead Ammunition in Southern Africa

Commissioned by: BirdLife International • Study: SADC Vulture Conservation and Lead Ammunition Transition 2026

Introduction

Thank you for participating in this study commissioned by BirdLife International. This research supports the SADC Vulture Conservation Strategy and Action Plan 2025 to 2035 and aims to develop a practical, evidence-based roadmap for transitioning from lead to non-lead ammunition across the five priority SADC countries: Zimbabwe, South Africa, Namibia, Botswana, and Zambia.

Purpose: To gather data on current ammunition use, identify barriers to transition, map non-toxic alternatives, and understand stakeholder perspectives on policy options.

Confidentiality: Your individual responses will remain strictly confidential and will be aggregated for analysis. No personal or sensitive business data will be shared with third parties without your consent.

Completion: Please answer all questions to the best of your knowledge. If a question does not apply to your context, please indicate N/A. The questionnaire contains six parts and should take approximately 30 to 45 minutes to complete.

PART A: RESPONDENT PROFILE

1. Name (optional)

2. Organisation or institution

3. Country of operation

- | | |
|-----------------------------------|--|
| ☐ Zimbabwe | ☐ South Africa |
| ☐ Namibia | ☐ Botswana |
| ☐ Zambia | ☐ Other (specify below) |

If other, please specify

4. Primary sector or role (select one)

- | | |
|---|--|
| ☐ Government authority (wildlife or environment) | ☐ Professional hunting association or professional hunter |
| ☐ Safari operator or private landowner | ☐ Ammunition importer, retailer, or manufacturer |
| ☐ Conservation NGO or researcher | ☐ Community-based organisation (CBNRM) |
| ☐ Veterinary or health professional | ☐ Other (specify below) |

If other, please specify

5. Years of experience in your current sector

- | | |
|--|---|
| ☐ Less than 5 years | ☐ 5 to 10 years |
| ☐ 11 to 20 years | ☐ More than 20 years |

PART B: QUANTIFYING LEAD AMMUNITION USE

Objective 1: Establish the scale of current lead ammunition use in your area of operation.

6. What are the primary activities involving firearms in your area of operation? (Select all that apply)

- | | |
|---|--|
| ☐ Trophy or recreational hunting | ☐ Subsistence or pot hunting |
| ☐ Problem animal control (PAC) | ☐ Anti-poaching operations |
| ☐ Culling or cropping | ☐ Training or target shooting |
| ☐ Game bird shooting | ☐ Other (specify below) |

If other, please specify

7. Please estimate the approximate annual volume of ammunition used in your operations or area of operation.

Ammunition type	Estimated annual volume (rounds/year)
Rifle rounds	
Shotgun shells	
Other (specify)	

8. What percentage of this ammunition is currently lead-based?

- | | |
|--|--|
| ☐ 0% (fully non-lead) | ☐ 1 to 25% |
| ☐ 26 to 50% | ☐ 51 to 75% |
| ☐ 76 to 99% | ☐ 100% (fully lead) |
| ☐ Do not know | |

9. Which three calibres are most commonly used in your operations? (Please list)

Calibre 1	Calibre 2	Calibre 3

PART C: NON-TOXIC ALTERNATIVES AND SUPPLY

Objective 2: Map the availability and characteristics of non-lead alternatives in your local market.

10. Are non-lead alternatives (such as monolithic copper, steel, or bismuth) currently available in your local market?

- | | |
|--|--|
| ☐ Yes, widely available | ☐ Yes, but limited stock or variety |
| ☐ No, rarely or never available | ☐ Do not know |

11. If available, how does the price of non-lead ammunition compare to equivalent lead ammunition?

- | | |
|---|---|
| ☐ Much cheaper (more than 20% lower) | ☐ Slightly cheaper (up to 20% lower) |
| ☐ About the same | ☐ Slightly more expensive (10 to 30% higher) |
| ☐ Much more expensive (more than 30% higher) | ☐ Do not know or not applicable |

If you can, please indicate the approximate percentage premium: _____%

12. How do you perceive the ballistic performance of non-lead alternatives compared to lead ammunition for your most common hunting applications?

- | | |
|---|--|
| ☐ Superior to lead | ☐ Comparable, no significant difference |
| ☐ Inferior, with concerns about stopping power | ☐ Varies by application or calibre |
| ☐ No experience or insufficient information | |

13. Please list any specific brands or types of non-lead ammunition you have used, tested, or observed in use in your area.

14. What are the main supply chain gaps that would need to be addressed for non-lead products to become routine in your operations?

PART D: BARRIERS TO TRANSITION

Objective 3: Identify and rate the severity of barriers preventing or delaying transition.

Please rate each barrier from 1 (not a barrier in your context) to 5 (critical barrier that would prevent transition), and add comments where helpful.

15. Barrier severity rating

Barrier category	1 Low	2	3	4	5 Critical	Additional comments
Economic: high cost of alternatives	☐	☐	☐	☐	☐	
Supply: limited local availability	☐	☐	☐	☐	☐	
Technical: concerns about accuracy and stopping power	☐	☐	☐	☐	☐	
Regulatory: no legal requirement to switch	☐	☐	☐	☐	☐	
Equipment: concerns about barrel wear or firearm damage	☐	☐	☐	☐	☐	
Awareness: limited knowledge about lead risks	☐	☐	☐	☐	☐	
Social: resistance to change / tradition	☐	☐	☐	☐	☐	

16. Are there additional barriers specific to your country or sector that are not listed above?

17. Are you aware of the impacts of lead ammunition on the following? (Indicate yes or no for each)

- | | |
|--|---|
| ☐ Vultures and other scavengers | ☐ Human health (via game meat consumption) |
| ☐ Soil and water contamination | ☐ Non-target wildlife and raptors |

PART E: POLICY SCENARIOS AND ROADMAP PREFERENCES

Objectives 4 and 5: Assess stakeholder preferences across transition policy options.

18. Which policy approach do you believe would be most effective and feasible in your country?

- | | |
|---|---|
| ☐ Immediate ban: full legislative ban within two years | ☐ Phased transition: gradual phase-out over five to ten years, beginning with specific species or landscapes |
| ☐ Incentive-based: voluntary transition supported by subsidies, certification, or tax relief | ☐ Status quo: no change to current regulations |

Please briefly explain your preference:

19. What support measures would most effectively facilitate a transition in your context? (Select all that apply)

- | | |
|--|---|
| ☐ Tax exemptions or subsidies for non-lead ammunition | ☐ Certification schemes recognising non-lead operators |
| ☐ Funded field trials and demonstration days | ☐ Buy-back schemes for existing lead ammunition stocks |
| ☐ Clearer government regulations or guidelines | ☐ Technical guidance on product selection and use |
| ☐ Community and staff training programmes | ☐ Other (specify below) |

If other, please specify

20. Over what timeline do you believe a full transition to non-lead ammunition is realistic for your sector?

- | | |
|--|---|
| ☐ Within 2 years | ☐ 2 to 5 years |
| ☐ 5 to 10 years | ☐ More than 10 years |
| ☐ Not realistic in the foreseeable future | ☐ Do not know |

21. Is your organisation willing to participate in a pilot project or voluntary transition initiative?

- | | |
|--|--|
| ☐ Yes, willing to participate | ☐ Possibly, subject to conditions (specify below) |
| ☐ No | |

If conditions apply, please specify

PART F: ADDITIONAL INSIGHTS AND REGIONAL CONTEXT

22. Are you aware of any existing initiatives, champions, working groups, or pilot programmes currently addressing lead ammunition transition in your region or country?

23. In your view, which single action would have the greatest impact in accelerating the transition from lead to non-lead ammunition in your country?

24. Are there any other observations, concerns, or recommendations you would like to share with the study team?

Thank you for your participation. Your responses contribute directly to the evidence base for the SADC Vulture Conservation Strategy and Action Plan 2025 to 2035 and to the design of a practical, regionally appropriate lead ammunition transition roadmap.

ANNEX II: Summary of survey responses by country

INTERVIEW COUNT BY COUNTRY

Country	Interviews
Botswana	5
Namibia	5
South Africa	9
Zambia	5
Zimbabwe	5
TOTAL	29