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Illegal Wildlife Trade (IWT) Challenge Fund
Final Report

*To be completed with reference to the "Writing a Darwin Report" guidance: (http://www.darwininitiative.org.uk/resources-for-projects/reporting-forms). It is expected that this report will be a **maximum** of 20 pages in length, excluding annexes.*

IWT Challenge Fund Project Information

Project reference	IWT044
Project title	Critical evidence to drive a reduction in Cambodia's ivory trade
Country(ies)	Cambodia
Lead organisation	Fauna & Flora International
Partner institution(s)	Royal Government of Cambodia, Royal University of Phnom Penh, Royal Zoological Society of Scotland
IWT grant value	£ 334,735
Start/end dates of project	1st July 2017 – 30th September 2021
Project Leader's name	Neil Furey
Project website/blog/social media	https://www.fauna-flora.org/projects/elephant-conservation-cambodia https://www.rzss.org.uk/conservation/our-projects/project-search/conservation-genetics/capacity-building-in-cambodia/
Report author(s) and date	Neil Furey, Alexander Ball & Laure Joanny, September 2021

1. Project summary

African elephant (VU) populations declined by 30% between 2007 and 2014, primarily due to a global increase in poaching for ivory. Illegal trade in ivory is also a threat to Asian elephants (EN), of which fewer than 52,000 now remain. Global illegal ivory trade, driven by organised crime networks, benefits the few while impoverishing communities local to source populations who bear the costs of poaching activities and enforcement responses e.g., insecurity, ecosystem degradation.

This project sought to reduce illegal ivory trade in Cambodia—a country at risk of becoming a driver of the global trade—by enabling more effective enforcement. FFI market surveys in 2015–2016 suggested Cambodian ivory trade networks are linked to other IWT networks, amplifying unsustainable harvest of domestic wildlife species. Little was known about these networks, but many of Cambodia's poorest, most natural resource-dependent communities live closest to source populations and are likely being impacted by poaching and wildlife depletion. Critically, with the closure of China's ivory markets in late 2017, there was a real risk of illegal ivory markets diverting to Cambodia, since FFI documented that buyers of worked ivory are mostly from China, where ivory trade is now illegal.

We provide essential evidence for urgent policy improvements, by tackling the lack of knowledge of Cambodian ivory markets and trading networks through research, including identifying links to communities living closest to source populations (Output 1). We also build capacity for genetic analysis of ivory to determine provenance and regional trade networks, further informing regional efforts to stop IWT (Output 2). Finally, building on FFI's long-standing relationships with government partners, we

address legislative weaknesses and support implementation of the Cambodian National Ivory Action Plan (NIAP) to strengthen effective enforcement and prevent trade in African and Asian ivory (Output 3).

Our ivory market surveys and ivory trade network surveys were carried out in the three cities most frequented by international and domestic tourists, namely Phnom Penh, Siem Reap, and Sihanoukville (Fig. 1). The Conservation Genetics Laboratory is located in the country's capital Phnom Penh.

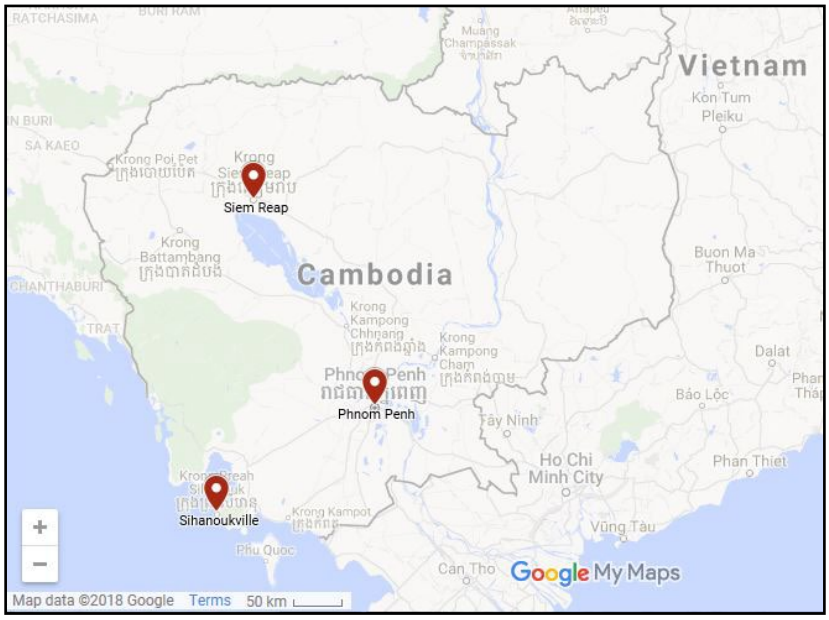

Fig. 1: Location of Conservation Genetics Laboratory (Phnom Penh) and ivory market surveys (three cites) undertaken by the project.

2. Project Partnerships

As the lead institution for the project, FFI convened all discussions with partners on design and subsequent implementation. FFI's specific roles and responsibilities included management and financial oversight, responsibility for ivory surveys and practice-oriented research (Output 1), and co-development of legislative frameworks and strengthening law enforcement in liaison with government authorities (Output 3). The main project partners were the Royal University of Phnom Penh (RUPP), the Royal Zoological Society of Scotland (RZSS) and the Royal Government of Cambodia's Forestry Administration (FA) of the Ministry of Agriculture Forestry and Fisheries (MAFF).

FFI has worked in partnership with RUPP since 2005 in the development and support of Cambodia's first postgraduate degree (MSc in Biodiversity Conservation) and first peer-reviewed scientific periodical (*The Cambodian Journal of Natural History*). In 2016, FFI partnered with RZSS to support the creation of the country's first Conservation Genetics Laboratory, which is housed in the RUPP Faculty of Science. RZSS was the technical lead for all activities under Output 2 of the project in partnership with RUPP who provided facilities and staff and directly managed the laboratory and its activities in liaison with RZSS. RZSS is one of the few genetics facilities that specialises in supporting underserved institutions and it's RZSS WildGenes Lab has extensive experience in IWT work and capacity-building of genetics facilities.

The Forestry Administration (FA) is a government authority in charge of forest management in Cambodia according to the National Forestry Sector Policy and the Forestry Law. FFI and FA have collaborated since 2000 under an ongoing MoU, particularly on conservation activities concerning both wild and domesticated elephants in Cambodia. The CITES Management Authority and CITES Scientific Authorities of Cambodia also sit under MAFF, within the FA, and have existing relationships with FFI. The roles of FA in the project included permissions for testing at the RUPP genetics lab (Output 2) and co-development and implementation of legislative frameworks and law enforcement (Output 3).

All three partners were involved heavily in planning and decision-making for the project and contributed to the final project report. Specific relationships and challenges are summarized below.

FFI-RUPP-RZSS: RUPP is a long-standing partner of FFI and as several staff work for both institutions, there was continuous exchange throughout the project. Despite this, finalizing the project agreement took longer than anticipated due to bureaucracy within the RUPP, although this did not ultimately impact project delivery. Nonetheless, the possibility of similar delays in future was mitigated by

formulating a MoA (Annex 4.1) which could be readily supplemented if needed. The staff and upper management at RUPP were extremely supportive of the genetics lab. Following inception meetings between FFI, RUPP and RZSS in July 2017, RZSS staff visited the lab each year to provide multi-week training for staff in conservation genetics and the various lab protocols and techniques required (Annex 4.2). They also undertook weekly virtual meetings to supervise progress and mentor lab staff throughout the project (Annex 4.3). In-country meetings between the wider project team occurred during the RZSS visits, in addition to regular skype catch-ups between FFI and RZSS when needed. Because RZSS visits were curtailed by travel restrictions related to COVID-19 in the final project year (2020-21), these regular contacts were pivotal to overcoming certain challenges (below).

Though not related to the partnership per se, staff changes in the RUPP genetics lab was a major and recurring challenge which meant staff had to be re-recruited on several occasions. This was difficult and time-consuming due to the chronic shortage of qualified lab technicians in Cambodia. It also resulted in the loss of human capacity and staff links with relevant contacts and affected knowledge transfers between staff, all of which caused delays in project activities. This was mitigated by additional recruitment to ensure that multiple staff had the required competencies to guard against future staff changes, and painstaking efforts to re-train staff and re-build networks, but nonetheless continues to pose a threat to the sustainability of the initiative. As a result, the lab will require continued support for longer than originally envisioned. Nevertheless, as there is substantial interest among in-country NGOs in using the lab, the continued need for its services is evident. As such, staff training emphasized DNA extraction and PCR techniques which are highly transferable to other illegally traded wildlife products to allow the lab to diversify its services.

FFI-FA/CITES Management Authority: FA is a long-standing partner of FFI and the focus of the collaboration was to ensure the development and enforcement of national legislation regarding ivory. This was successful. Following sharing of the project's findings (including the increase in ivory availability and carving activities, genetic evidence of African ivory and export activities to China), the MAFF ratified a new law (Annex 4.4) prohibiting trade and possession of African ivory in June 2018, extending protection to African elephants and 11 other non-native species including rhinos and pangolins. This closed a critical legal loophole highlighted during our work and in addition to training events, information from the project's market and online surveys was shared with the investigation unit of the Wildlife Rapid Rescue Team (WRRT) of FA, supporting a series of enforcement actions and ivory confiscations. In August 2019, MAFF established an inter-ministerial taskforce to investigate, prevent and supress illegal ivory trade (Annex 4.5) and to continue its support for effective legislation, the project seconded an FA member of the taskforce (Ms. Thi Sothearen) to its activities in Year 4.

The project collaborated with several other institutions who were not formal partners but important nonetheless in helping it to achieve its objectives. Several of these collaborations are described below, and additional institutions are identified where appropriate in later sections.

FFI-Ministry of Environment (MoE): Although not a formal project partner, FFI has a longstanding relationship with the MoE which has a specific interest in reducing elephant ivory trade in Cambodia. Contact was maintained with the Director-General of the General Directorate of Administration for Nature Conservation and Protection and the Deputy-Director of Department - Terrestrial Protected Areas Conservation) and the project met with His Excellency Say Samal (Minister of Environment) in January 2019. As a result, the project collaborated with MoE on several important activities, including ivory-related inputs to the development of the forthcoming Environment and Natural Resources Code legislation. Other collaborative activities included an Ivory Awareness & Reduction Campaign targeting airports (as overseas visitors comprise a major portion of demand for ivory) prior to Covid-19.

Since late 2018, the project has collaborated with TRAFFIC International which has been undertaking a regional ivory market monitoring project to compare ivory markets and trade fluctuations among five lower-Mekong countries (Laos, Thailand, Myanmar, Cambodia & Vietnam) (Annex 4.6). To avoid duplication of effort and strengthen our collective impact, FFI and TRAFFIC shared research findings and coordinated to strengthen the response of the Cambodian government through TRAFFIC's formal engagement with CITES authorities. This collaboration relates to Indicator 1.2 (*Findings of research into ivory trade networks and the links between IWT and poverty are used by key stakeholders (e.g. government, NGOs) to inform policy and intervention*). In June 2021, TRAFFIC issued a video highlighting the seriousness of illegal wildlife trade and ivory trafficking in the Lower Mekong region which called for stronger government action. Release of a joint publication focusing on the Cambodian and regional ivory markets is also anticipated by the end of 2021.

The project also collaborated with several conservation NGOs in its efforts to create a genetic database for wild elephants nationally and thereby assist the global traceability of ivory. Following data-sharing agreements to this end (Annex 4.7), the World Wildlife Fund and Wildlife Conservation Society (WCS) provided DNA samples of wild Cambodian elephants and other NGOs including the Elephant Valley Project and Wildlife Alliance (via the Phnom Tamao Wildlife Rescue Centre) were similarly approached and provided blood, hair and faecal samples from captive elephants. The samples from these collaborations were important in validating the project's molecular protocols for ivory samples. These efforts were assisted by Advice for Scottish Agriculture (SASA) who advised RZSS on ivory DNA extraction during a visit to their laboratories. The RUPP also engaged with other initiatives in Cambodia due to the project. This included introductory visits for WCS and Free the Bears for example, and the Siamese crocodile programme (of FFI) began using the laboratory in 2017 to determine the genetic status and suitability of crocodiles for reintroduction to the wild, an activity which remains ongoing.

3. Project Achievements

3.1 Outputs

Output 1. Improved understanding of Cambodian ivory markets and trading networks – including exploring links between drivers of IWT and poverty – informing policy and interventions to address ivory trade.

The project was successful in achieving its first output as a result of Activities 1.1 through 1.5 (Annex 1, 2), which are discussed below. At the onset of the project, very little was known about ivory markets, hotspots and trade networks in Cambodia. Interventions addressing the ivory trade were also minimal, as law enforcement authorities lacked knowledge of the trade and how to address it. This was addressed by capacity-building and sharing of research findings and actionable intelligence with government and NGOs (Indicator 1.1). These informed subsequent policy and interventions and also facilitated recognition that wealth (rather than poverty) was an important driver of the domestic ivory trade (Indicator 1.2). As surveys undertaken by FFI in 2016 recorded 1,116 items of genuine ivory for sale in physical ivory markets in Cambodia (Annex 4.8), this figure represented the baseline condition for subsequent change to be measured against.

Activity *1.1 Conduct annual surveys of markets to monitor and quantify ivory, and consumer profiles (Y4) in Siem Reap, Phnom Penh, and Sihanoukville, including vendor surveys and intelligence gathering to identify the supply chain networks – drawing on data mining of existing national reports and surveys, informant networks and triangulated interviews, and consumer surveys in the final year of the project informed by data gathered in the previous years;*

The original project intention was to survey physical ivory markets biannually, but this had to be reduced to a single yearly survey as team members began to be recognised by vendors (subject to approved change request). International travel restrictions related to Covid-19 also meant that a survey could not be undertaken in 2020, due to the lack of in-country personnel with experience in such surveys and identifying genuine ivory. The latter challenge was later overcome however, such that physical market surveys were completed in Oct–Nov 2017, Feb 2018 (Annex 4.9), May 2018 (Annex 4.10), Mar–Apr 2019 (Annex 4.11) and Feb 2021 (Annex 4.12). The project also assisted surveys led by TRAFFIC in Oct 2019 for the purposes of analysis of regional ivory markets. A great deal of information and data were generated by these surveys, all of which were shared and discussed with government and NGOs (Indicator 1.1, see Activity 1.4 below). In summary however, the most recent (Feb 2021) survey recorded a total of 631 items of genuine ivory for sale in Phnom Penh, Siem Reap & Sihanoukville, a decrease of 43% against the 2016 baseline.

Alongside physical market surveys, the project surveyed online vendors marketing ivory via Facebook accounts in Cambodia. Facebook is the most popular social media platform in the country, with 11,912,000 users registered as of Feb 2021[1]. Entrepreneurs use the platform to advertise and sell products unregulated and vendors of elephant products were surveyed in Jan 2015–Apr 2018 (Annex 4.9), Aug–Sep 2018 (Annex 4.13), Feb–Mar & Aug–Sep 2019, Feb–Mar 2020 (Annex 4.14) and Feb–Mar 2021 (Annex 4.15). These indicate that the overwhelming majority of products were ivory (with an overall mean of 97% and individual survey figures ranging from 93–99%) and suggest that online vending of elephant products may have increased following the national ban on African ivory in June 2018. For example, the number of accounts, products and advertisements registered in comparable periods (Feb–Mar) was 38 accounts, 466 elephant products and 210 advertisements in 2019; 48, 573

[1] https://napoleoncat.com/stats/facebook-users-in-cambodia/2021/02

and 257 (respectively) in 2020 and 24, 1551 and 342 (respectively) in 2021. Like the project's other surveys, data from these investigations was shared with government and NGOs (Indicator 1.1, see Activity 1.4 below).

The project also undertook surveys to track media reports of ivory seizures in Cambodia. These suggested a total of 6,310kg of ivory and 57kg of rhino horn were seized by national authorities between 2013 and 2017, 40% of which occurred in Phnom Penh, 30% in Sihanoukville, 20% in Siem Reap and 10% on the Cambodia-Vietnam border (Annex 4.9). Significant confiscations including the largest in Cambodian history were also reported in national media from Dec 2017 to Apr 2019, with four seizures of over 3,200kg in elephant ivory, all in Phnom Penh (Annex 4.16). Subsequent media reports for ivory confiscations were dramatically lower, totalling 6.8kg between Apr 2019 and Mar 2020 (Annex 4.17) and <1kg from Mar '2020 to Mar 2021 (Annex 4.18).

Buddhist figurines were the most common ivory product for sale in physical markets in 2021 (Annex 4.12). As a consequence, the project commissioned a study to guide future demand-reduction campaigns in Cambodia by improving understanding of the habits and motivations of Khmer consumers (Annex 4.19). This revealed that ivory figurine purchases are planned and often take place through personal networks involving secular religious individuals. Ivory figurines are valued for their spiritual properties and as a status symbol and are believed to bring good luck, happiness and protection. Rare and valuable materials such as luxury woods or gemstones are also believed to have equivalent properties. The study participants were discerning and had opinions on how real ivory can be distinguished from fake products and how Asian and African ivory can be differentiated. Awareness that the selling and buying of authentic and raw ivory is illegal was widespread. However, there were also misconceptions regarding the status of worked ivory and how regulations are enforced. Overall, the research suggested that encouraging religious leaders to advocate against ivory purchases and promoting wider awareness that elephants are killed to provide ivory products could be effective in reducing future demand among Buddhist consumers.

1.2 Produce national map of trading hotspots and networks

A national map of trading hotspots and networks was provided in the project's first annual report (April 2018) and survey publication (Nguyen et al. 2018, English & Khmer versions produced) and presented to government partners (Annex 4.9, Indicator 1.3). These and subsequent survey findings suggested trading networks were highly transient and fluid and could shift underground after possession and trade of African ivory became illegal in June 2018 and warnings were issued in September 2019. For this reason, and because the purpose of the collaboration with TRAFFIC International was to undertake in-depth analyses of regional ivory markets (Laos, Thailand, Myanmar, Cambodia & Vietnam) (section 2) and report publicly in this regard, it was felt that efforts to regularly update the map would not represent the most productive use of the project's finite time and resources.

1.3 Conduct gendered surveys of consumers and vendors to better understand the links between poverty and the ivory trade;

Results from the project's first survey of physical market vendors (2017) showed that 43% of shops selling ivory had sole-female owners (22 of 51 shops, Annex 4.9). The total value of ivory for sale in these was US$ (of US$ total) and comprised 547 items (of 2,907 total), whereas the value of ivory in solely male-owned shops was considerably higher at US$ (2,127 items). In 2021, the equivalent figures for solely female-owned shops were 73% (19 of 26 shops with genuine ivory), US$ (of US$ total) and 467 items (of 631 total), whereas solely male-owned shops accounted for five shops, US$ and 75 items respectively (Annex 4.12). *[Note: Each year, some shops were co-owned by a female and male or ownership could not be determined]*.

These figures contrasted with the results of our online market surveys. Between Jan 2015 and Apr 2018 for example, 90% of online vendors of ivory products were male (18 of 20 accounts) and 94% of comments were posted by males (Annex 4.9). A similar trend was apparent in A) Feb–Mar 2019, with 95% of 38 online accounts being male-owned and 95% of comments posted by males, B) Feb–Mar 2020, with 87% of 48 accounts male-owned and 96% of comments by males (Annex 4.14), and C) Feb–Mar 2021, with 71% of 24 accounts being male-owned (Annex 4.15).

The project undertook research on the relationship of poverty to the illegal ivory trade in 2018 (Annex 4.10). Data collection and reporting were led by an MSc student from the University of Kent. The most important findings of this work were that a growing number of Cambodians were buying ivory, alongside the main Chinese market, and that rarity and expense were values most associated with ivory among all consumers. Wealth, regardless of nationality, was a shared trait among buyers (Indicator 1.2). Gender

was relatively evenly divided, with slightly more female ivory vendors (55%). Further analysis of our 2019 market data also provided insights into the demographics of ivory sellers and consumers, supporting these findings that rarity and expense, and as such wealth, were driving the trade.

For instance, 14% of traders in 2019 mentioned the term “blood ivory” (Annex 4.11) unprompted as a sales tactic. The term is intrinsically Chinese and describes rare ivory which has been harvested from poached or live elephants, rather than from elephants that died of natural causes. This fetches higher prices and confirmed a prominent and affluent Chinese market. We also found that some carving factories had adopted mass production through advanced automated machinery, indicating a financial and logistical ability of traders to acquire increasing amounts of raw ivory and produce carved items for higher frequency sales. These findings were consistent with our 2018 research which showed that wealth, not poverty, was driving the trade (Indicator 1.2).

In a broader context, gender training was undertaken on two occasions in August 2018 and December 2020 for all project and partner staff (RUPP), including the wider FFI Cambodia programme. Evaluations in 2018 showed a raise in gender awareness scores (Annex 4.20) and in 2020 suggested a variety of additional actions FFI could undertake to improve gender awareness within the project and wider country programme (Annex 4.21).

Activity 1.4 Provide intelligence to law enforcement on ivory trade networks to facilitate effective enforcement;

All of the raw data, intelligence and analyses generated by the project (market and online surveys) was shared with the Forestry Administration (FA) (through copies of reports and raw data provided via email and personal meetings) and additionally to the investigation unit of the Wildlife Rapid Rescue Team (WRRT) of the FA, national police, Wildlife Alliance and Wildlife Conservation Society (WCS) (Annex 4.9–4.15, for examples) (Indicator 1.1).

In July 2018, the project provided training for the WRRT on ivory identification (Annex 4.22–4.23), which included a sharing session discussing specific shops, workshops, and emerging new products. The project remained in contact with the WRRT to ensure information was directly fed into enforcement. Subsequent seizures of ivory in physical markets were supported by the project’s collaboration with WRRT (Annex 4.16–4.18, Indicator 1.2).

Project findings (Annex 4.9) were also shared with Cambodian customs officials (through hard copies distributed during a UNODC led 3-day training event on “*Risk profiling to enhance interception of Illegal Wildlife Trade*” in August 2018) (Annex 3.24, Indicator 1.2).

Further to this work, the project supported information-sharing with law enforcement by encouraging the public to report wildlife crime via the WRRT hotline through an ivory awareness-raising campaign at Phnom Penh International Airport (Annex 4.25, Indicator 1.2). This included a billboard and elephant statue located in the airport’s arrival areas, and a postcard including a call to action via the hotline number. The postcard was picked up by 1,000 travellers entering Cambodia in July–October 2019 and we estimate that ≈750,000 people saw the billboard. The elephant statue generated a lot of interest, especially from the customs agency and on Facebook, resulting in the highest organic reach (≈14,000) ever seen on the FFI Cambodia Facebook page.

While this action may have made investigations harder if it resulted in markets shifting underground, the directive will make judicial actions and prosecutions easier in the long term by providing the legal system with clear terms for imposing prosecutions (which were previously lacking) (Indicator 1.2).

Activity 1.5 Use existing Asian elephant population genetic data from 250-300 previously collected quality-screened DNA faecal samples to generate genotype data on a genetic marker system, which will enable Cambodian elephant population-level data to be used as a reference resource by laboratories within the ASEAN Wildlife Forensic Network (Asian elephant SNP marker data currently available for the region was developed with the assistance of the RZSS staff named on this project).

The project gained access to 1,792 elephant faecal samples collected from four protected areas within the Cardamom mountains and the Eastern Plains Landscape of Cambodia. The RUPP laboratory obtained DNA from 518 of these samples. During the project the laboratory generated genotype data using two complimentary genetic marker systems. The first, using mitochondrial sequence data, was generated for 320 of the samples and the second, based on 20 nuclear SNPs (single-nucleotide polymorphisms), was generated for 310 of the samples. The second marker system was developed by RZSS and validated by the RUPP laboratory during the project. Forty nuclear SNPs were screened before refining the 20-marker system. The laboratory now has 20 genetic probes as well as synthetic

DNA controls which allows equivalent datasets to be produced in other laboratories within the ASEAN Wildlife Forensic Network (Indicator 1.4).

Output 2. Strengthened national capacity for genetic analysis of ivory and regional collaboration for mapping of ivory trade to inform interventions to address ivory trade.

2.1 Establishment of species identification (Asian/African) testing from initial 30 market survey ivory samples and testing of samples to establish species provenance (mtDNA test);

The results of species identification testing of 15 ivory samples were reported at the end of Year 2 (Annex 4.26). Two samples were identified as Asian elephant ivory, whereas nine were African elephant ivory, two were woolly mammoth ivory, one was African elephant bone and one was a plastic replica. In Year 4, 18 samples were confiscated from an illegal ivory workshop, all of which were genetically identified as ivory from African elephants (Annex 4.27; Indicator 2.1). These were the first ever genetic tests of ivory in Cambodia and were made possible by the project undertaking multiple training sessions to provide RUPP technicians with the capacity necessary to complete this process. In total, five technicians received training in DNA extraction from ivory and species and provenance identification (Indicator 2.2). RZSS conducted six in-person practical training sessions and due to pandemic-related travel restrictions in Year 4 ran an online training session over two weeks with 12 accompanying practical videos (Indicator 2.3). Detailed written protocols were a key feature of training throughout the project (Annex 4.28). A more refined geographic origin of 23 African ivory samples and the two woolly mammoth samples was also performed using mtDNA. These revealed that the samples of African ivory were from diverse sources, from elephants in western, central, eastern and southern Africa (Annex 4.29), whereas the woolly mammoth ivory was most likely of North American origin (Annex 4.30).

2.2 Production of Cambodian Elephant reference genetic data from existing samples collected from wild elephant surveys to assist with global traceability of ivory (mtDNA, SNP based or microsatellite testing);

Development of a mtDNA reference database for Cambodian elephants was completed and the lab now has sequences from 320 samples (Indicator 2.2). Development of a SNP based database (a more robust method of determining origin) was also completed, comprising 310 samples genotyped at 20 SNP markers. In total, 40 SNP markers were tested and a panel of 20 were selected for their variability in the Cambodian elephants, using samples obtained from 14 captive elephants within the country. Wild elephant samples from across eight range countries were previously sequenced at the same mtDNA region as the Cambodian elephant samples, creating a combined database of 854 sequences.

2.3 Investigation of geographic origin of Asian ivory found in Cambodia;

The RUPP laboratory identified two ivory samples that originated from Asian elephants (Activity 2.1). The main method of determining a more defined geographic origin will rely on our SNP reference database, currently consisting of samples from Cambodia which can be related to other genomic reference data for Asian Elephants. However, the mtDNA reference database already includes samples from nine countries: Cambodia, Vietnam, Malaysia, Indonesia, Bhutan, Laos, India, Sri Lanka and Myanmar. Our mtDNA results show that neither of the two ivory samples match elephant haplotypes in Cambodia (Annex 4.31). One sample was identical to a mtDNA sequence only observed in central India and in matching a haplotype found in wild elephants in Peninsula Malaysia, Myanmar and Laos, the other likely originates from Southeast Asia. SNP based tests have indicated that neither sample is a good match to elephants in our reference database, although this currently only contains genetic data from four countries in Southeast Asia (Annex 4.32). As such, a key aim is to now build on this critical database by including genetic samples from elephants in Nepal and Vietnam as it is only by increasing the genetic representation in the database that precise geographic origins can be obtained.

2.4 Establishment of individualisation and sexing tests to allow for seizure inventory (SNP-based or microsatellite testing);

During the project, RZSS transferred a gel electrophoresis-based sexing test to the RUPP laboratory. As this correctly assigned the sex of 14 captive Cambodian elephant samples of known sex, it was subsequently used to determine the sex of eight ivory samples (six male and two female). Due to the low quality of DNA obtained from ivory samples it was not possible to sex all samples. The test was also used to sex 364 faecal samples from wild Cambodian elephants. This revealed equal sex ratios in elephant populations in the Cardamom mountains and Eastern Plains Landscape of Cambodia. Because male elephants are targeted for their tusks, equal sex ratios are expected in populations that have not

been severely affected by ivory poaching. This is welcome news for these populations and consistent with field surveys which have found very little evidence of elephant poaching.

The SNPs in our 20 SNP panel were selected based on their variation within Asian elephant samples. Our tests on 14 captive elephant samples from Cambodia show that the SNP panel is able to provide unique genetic signatures for each individual and can accurately discriminate between closely related individuals with >99% accuracy. In Year 4, all genotyped samples from each of the three wild populations in Cambodia were screened for duplicates (i.e. dung samples produced by the same elephant). This allowed us to confirm that the samples in our database for the southwest, southeast and northeast populations include 27,19 and 98 unique genotypes respectively. Both of our Asian elephant ivory samples were also genotyped and compared to the captive and wild elephant databases generated by the RUPP laboratory (Activity 2.3). As such, the SNPs can be used to identify samples from the same individual, as previously done with a microsatellite panel for elephant population estimates in 2016.

2.5 Establishment of seizure sampling, data-basing and chain of custody protocols;

Only one ivory seizure occurred during the fourth project year (July 2020) and the two lab technicians at RUPP who were trained using the first 15 samples obtained by the project (Activity 2.1) were ready to work with samples from the seizure. All 18 samples from the seizure were identified as originating from African elephants and this was reported to the enforcement agency (Annex 4.33; Indicator 2.4). This was made possible by the training that occurred throughout the project, the laboratory equipment purchased and construction of an ivory drilling room during the first project year. The RUPP lab technicians systematically record all sample details and test results in access databases. Gel electrophoresis test results are stored electronically in excel files and physical photographs of each gel are stored in a laboratory folder. Chain of custody protocols were set up in the RUPP laboratory during the second project year. These require the photographing and cataloguing of each sample that enters the laboratory and all visitors to the laboratory must sign a guest book and any samples that are received must be accompanied by a signed sample transfer form. All ivory samples are kept within a locked safe and the time and date that each sample leaves and returns to the safe is recorded.

2.6 Strengthen professional links of the lab with regional and international wildlife forensics/ elephant genetics network.

During the second and third project years, results were presented at international conferences and university research departments to build links within the community. Two team members attended the International Congress for Conservation Biology in Kuala Lumpur in July 2019. With >2000 delegates, this provided an excellent opportunity to expand our networks within the elephant conservation, wildlife trade and conservation genetics communities. During the event, a RUPP lab member presented a poster highlighting the work of the Conservation Genetics laboratory (Annex 4.34), whereas the RZSS WildGenes programme manager presented a talk on “Using genetics to reveal the origin of illegally traded ivory in Cambodia” (Annex 4.35). Contacts were made with a large number of conservationists in Southeast Asia and discussions held by the IUCN Asian Elephant Specialist Group were key to meeting Asian elephant biologists in the region. Unfortunately, year four plans for the RUPP lab staff to visit genetics labs outside Cambodia for training and networking with international researchers were effectively precluded by COVID-19. Several conferences were also cancelled or postponed, further limiting collaborative opportunities. Discussions with genetic laboratories in Vietnam and Nepal continued online but visits or exchange of samples were not possible due to the broader impacts of the pandemic and changing priorities of research partners. Notwithstanding this, the RUPP were able to instigate meetings with other elephant researchers in Cambodia and the laboratory continues to host a PhD student studying Asian elephants (affiliated with the Victoria University of Wellington, New Zealand).

Output 3. National legislation regarding ivory is in place and effectively enforced.

The project was largely successful in achieving its third output as a result of Activities 3.1 through 3.4 (Annex 1, 2), which are considered below. As mentioned earlier, the significant research data, molecular evidence and actionable intelligence generated by the project were shared with law enforcement agencies (Indicator 3.1). These were instrumental in the ivory trade being banned in June 2018 (Indicator 3.2). Law enforcement was actively improved through this process and several capacity-building activities. No ivory seizures were registered at airports during the project period (Indicator 3.3), though this may be partly attributable to their effective closure since early 2020 (in response to COVID-19).

3.1 Produce official report to the government with results from Outputs 1 and 2 highlighting the need for laws banning the sale of ivory;

Originally intended for Year 4 of the project (2020–2021), the purpose of this activity was effectively precluded when we presented the project's initial findings (including the increase in ivory availability and carving activities, genetic evidence of African ivory and export activities to China: Annex 4.9) which contributed to the ivory ban in June 2018 (Indicator 3.2, Annex 4.4). As such, the project shifted its subsequent focus to highlighting the need for strengthened enforcement, as demonstrated by its survey results in 2019–2021 (Annex 4.11–12, 4.14–4.15). In addition to regularly sharing these findings, it was agreed with government partners that formal presentations would be made to a wide variety of agencies invited to two national IWT events hosted by the FA and MoE in 2021. These regrettably did not prove possible however as both events had to be repeatedly postponed due to pandemic-related restrictions in Cambodia (which continue as of the time of writing).

3.2 Engage with the Ministry of Environment (MoE) to ensure that laws banning the sale and purchase of ivory are incorporated into the development of legislation;

The project supported the MoE in its development of a new Environment and Natural Resources Code which is intended to cover all aspects of the environment, including IWT. Comments and feedback were provided on several drafts submitted to the formal technical working group in 2018 and 2019 and language banning the sale and purchase of ivory forms part of the draft legislation. The draft Code also includes an article prohibiting the advertisement or selling of fake wildlife products and requiring that this be prosecuted to the same standard as real wildlife products. While the Code's development has been very collaborative process involving NGOs, it has also been very slow and mired in bureaucracy and has yet to be adopted. However, there is little that the project can do to change slow-moving government processes other than to persevere with partners and advocate for completion.

Early project efforts to engage the MoE in combatting the ivory trade were boosted by an official embassy reception on IWT led by the British Ambassador Tina Redshaw in September 2018, ahead of the London Conference. This showcased the project and was attended by the ministers of MoE and MAFF (Annex 4.36). These and related activities (below) encouraged the MoE to prompt the Department of Customs and Excise (Ministry of Economy & Finance) to issue a directive in March 2019 requiring all branches to crackdown on the import, export and transport of illicit ivory and rhino horn (and all derivatives) (Indicator 3.1, Annex 4.37). The effect of this was suggested during the project's 2021 vendor survey (Annex 4.12) which found that all vendors investigated were aware of the national ban, with several stating they would no longer purchase ivory for resale as a result.

Other project actions in support of law enforcement included an Ivory Awareness & Reduction Campaign at Phnom Penh Airport in July–October 2019 (as overseas visitors comprise a major portion of demand for ivory) which encouraged the public to report wildlife crime via the WRRT hotline (Annex 4.25). The project also engaged with the MoE to convene a national workshop on IWT issues in 2020, but as mentioned above, this was postponed on multiple occasions due to continuing Covid-19 safety measures in Cambodia and had yet to be officially sanctioned by September 2021.

3.3 Work with the Forestry Administration/CITES Management Authority, including through secondment contracts in Year 4, to encourage implementation of the National Ivory Action Plan, and close legislative loopholes to facilitate arrest and prosecution of ivory traders;

Following an expression of concern by the CITES Standing Committee (SC) over Cambodia's limited progress in implementing its National Ivory Action Plan (NIAP), key findings of the project's surveys were presented during a CITES Secretariat visit to the Cambodian CITES Management Authority in June 2018. These included a documented increase in ivory availability and carving activities, genetic evidence of African ivory and evidence of export activities to China (Annex 4.9). the MAFF ratified a new law (Annex 4.4) banning domestic trade and possession of ivory, extending legal protection to African elephants and 11 other non-native species including rhinos and pangolins. This closed a legislative loophole (Indicator 3.2) highlighted by our research and marked an important milestone.

The project specifically met with the Cambodian CITES Scientific and Management Authorities ahead of the CITES CoP 18 meeting in Geneva (August 2019) to offer technical support for implementing the NIAP. This included the use of survey findings to inform enforcement actions, and use of our genetic lab for ivory testing as part of confiscations. Through a policy brief (Annex 4.38), we also shared our survey findings with several key stakeholders at CoP 18, including TRAFFIC International and the Environmental Investigation Agency. The same month, MAFF established an inter-ministerial taskforce to investigate, prevent and supress illegal ivory trade (Indicator 3.1, Annex 4.5) and to continue

its support for the NIAP, the project seconded an FA member of the taskforce (Ms. Thi Sothearen) to its activities in Year 4 (following an approved change request).

As noted earlier (Activity 1.4), the project completed a variety of other actions in support of the NIAP. These included sharing of intelligence and analyses generated by the project's surveys (Annex 4.9–4.15), capacity-building on ivory identification (Annex 4.22–4.23) and risk profiling (Annex 4.24) for law enforcement officials and campaigns to reduce ivory demand among overseas visitors to Cambodia (Annex 4.25). Other activities included support for FFI's joint development of a 10-year National Elephant Conservation Action Plan which was adopted in May 2020. The project also engaged with FA to convene a national workshop on CITES enforcement issues, but like the MoE event (above), this was repeatedly postponed due to COVID-19 safety measures in Cambodia. As such, the project supported FA to produce and distribute a comprehensive publication (129 pages) on international obligations and domestic laws for wildlife protection in Cambodia to all of relevant enforcement agencies instead (Annex 4.41; following an approved change request).

3.4 Engage and train airport border controls and the Forestry Administration/CITES Management Authority to improve airport screening for ivory products entering and leaving Cambodia.

The project supported several training events for Customs & Excise and FA/CITES officials to improve screening for ivory products. These included capacity-building for ivory identification (Annex 4.22–4.23) and risk profiling (Annex 4.24) and awareness campaigns at Phnom Penh airport to reduce ivory demand among overseas visitors to Cambodia (Annex 4.25). The bilingual Ivory Identification Guide (Annex 4.23) and survey results produced by the project were also shared with the above agencies, NGOs and particularly the Wildlife Rapid Rescue Team of FA. As mentioned earlier, the directive issued by the Department of Customs & Excise in March 2019 on combatting the ivory trade was important (Annex 4.38), although plans to provide further training for Customs, FA and CITES officials through events hosted by the FA and the MoE were regrettably precluded by COVID-19 safety measures. Because Cambodian borders and airports have been effectively closed since early 2020 however, it is not possible to assess the impact of these activities

3.2 Outcome

The intended project outcome was "*Effective enforcement of illegal ivory trade in Cambodia, through improved knowledge of Cambodian ivory markets and trading networks, increased national capacity for genetic analysis of ivory, and strengthened legislation*". Though domestic trade in ivory undoubtedly continues, albeit seemingly to a lesser extent, the project was successful in promoting effective enforcement in all three respects.

First, the project's surveys and analyses made a substantial contribution to improving knowledge of Cambodian ivory markets and trading networks (Annex 4.9–4.15). They also suggest that quantities of ivory for sale in physical markets in early 2021 had declined 43% relative to the 2016 baseline (631 items vs. 1,116 items, respectively) (Indicator 0.1, Annex 4.9, 4.12). While this reduction is undoubtedly due in part to the national ivory ban in mid-2018, government warnings and increased enforcement actions, it is also possible that parts of the domestic trade may have become more covert or shifted online.

Likewise, the project made a significant contribution to increasing national capacity for genetic analyses of ivory. In establishing an in-country laboratory with two technicians trained to extract DNA from ivory and test for species identity within Cambodia for the first time, the project's efforts proved that the illegal ivory trade in Cambodia has had far-reaching effects, with confiscated ivory including samples of woolly mammoth (likely from North America) and African ivory trafficked from west, central, east and southern parts of the continent (Annex 4.9). In doing so, they confirmed the presence of African elephant ivory in Cambodian markets for the first time and this contributed to spurring the government to close the legal loophole that existed for African elephants until June 2018 (Annex 4.4, Indicator 0.2).

As noted earlier, the project engaged with Customs & Excise and FA/CITES officials to improve screening for ivory products through sharing of project findings, capacity-building for ivory identification and risk profiling, and an ivory awareness campaign at Phnom Penh airport. The directive issued in March 2019 by the General Directorate of the Customs & Excise Department to crackdown on illicit ivory and rhino horn was also important (Annex 4.37).

3.3 Monitoring of assumptions

The project had three outcome assumptions. The first (0.1) was that "*Market surveys capture the actual existing ivory market*". In the first two years of the project, the domestic trade in ivory was very open and surveys were able to adequately capture the market. However, quantities publicly available for sale subsequently decreased due to increased public attention and governmental action, though it remains unclear whether this represents an actual reduction in ivory or if the market has become more covert or shifted online. Despite this, the project contributed to a strong foundation upon which on-going governmental actions can continue to deter ivory trade in the long term, which was lacking at the onset of the project.

The second outcome assumption (0.2) was that "*Government and enforcement authorities are open to creating and enforcing strengthened laws concerning ivory trade*". The inclusion of the African elephant to the national protected species list in June 2018 (Annex 4.4), establishment of the inter-ministerial taskforce on ivory (Annex 4.5) and directive to crackdown on illicit ivory by the Customs & Excise Department (Annex 4.37) support this assumption. The third outcome assumption (0.3) was that "*Government and airport authorities release ivory confiscation figures*". This was supported by our secondment of a FA official in Year 4 of the project, although data shared with the project were not publicly released and so must remain confidential.

Output 1 of the project had two assumptions. The first (1.1) was "*Potentially sensitive information is shared*". After team members began to be recognised in market surveys, we employed experienced consultants to ensure subsequent surveys could extract sensitive trader information. The second assumption (1.2) was "*Government supports strengthened law enforcement*".

Output 2 of the project had one assumption (2.1) which was "*Government is open to continued [genetic] testing of ivory*". While we believe officials have a specific interest in genetically testing ivory, its heightened political sensitivity has slowed progress on seizure and stockpile procedures. Coupled with the often-confusing processes regarding confiscated ivory products, this has stifled officials from making decisions. However, as the tasks of the NIAP and inter-ministerial taskforce include DNA testing of ivory, a significant interest and need for the government to make use of established resources remains. For instance, cooperation in Year 4 of the project resulted in our testing of 18 samples of confiscated ivory.

Output 3 of the project had two assumptions. The first (3.1) was "*Engaging with our existing partners at the Forestry Administration, and feeding information to Wildlife Alliance will have an impact on improving law enforcement*". Through their Wildlife Rapid Rescue Team (WRRT), Wildlife Alliance undertakes 90% of investigations of wildlife offences in Cambodia through 12 seconded government officials. The second assumption (3.2) was "*Wildlife Alliance will continue to have resources and the will to improve law enforcement*". We work closely with Wildlife Alliance and believe there is a strong will to make resources available to improve law enforcement.

3.4 Impact: achievement of positive impact on illegal wildlife trade and poverty alleviation

The proposed impact of the project was "*Reduction of the illegal ivory trade in Cambodia contributing to decreased threat to elephant populations from IWT globally*". Over its course, the project filled critical knowledge gaps regarding the ivory trade in Cambodia, built the country's capacity to actively reduce international and domestic trade and demonstrated a 43% reduction in ivory available in physical markets relative to the 2016 baseline. As such the project may have contributed to the overall decrease in the proportion of illegally killed African and Asian elephants since 2015 (CITES MIKE 2020). Before the project, very little was known about Cambodia's place in the international ivory trade, and it was widely considered unimportant. Since then, the project contributed to national and international discussions on ivory trade (e.g., CITES Elephant Trade Information System report (CoP18 Doc. 69.3 - Rev. 1, which refers to Nguyen & Frechette (2017, Annex 4.8), subsequent CITES Cop 18 discussions (Annex 4.38), as well as international attention in media and discussion pieces (see section 10). Our work attracted new collaborations and our findings and methods have been replicated by others who have undertaken ivory surveys in Cambodia (e.g., TRAFFIC International). In its second year, the project findings also contributed to critical steps taken by the government to close legal loopholes which previously facilitated trade in African ivory (Annex 4.4, something we originally anticipated would happen by Year 4). Our research also confirmed that the livelihoods of impoverished people are not dependent on the domestic ivory trade, but that the ultimate drivers of the trade are wealthy and connected parties that contribute to the widening economic gap between rural and urban areas in Cambodia and deplete the natural heritage of African elephant range states (see section 3.1, Activity 1.3).

4. Project support to the IWT Challenge Fund Objectives and commitments under the London Declarations and Kasane Statement

The project directly worked towards strengthening law enforcement and the role of the criminal justice system in Cambodia, IWT Challenge Fund's 2nd objective. Through its research efforts, the project built national understanding and evidence of Cambodian ivory markets and trade networks, information that the criminal justice system lacked. The establishment and ongoing capacity building of the conservation genetics lab not only supported but amplified this effort in demonstrating the origins of ivory sold in Cambodian markets. Notable contributions in relation to IWTCF objectives included:

- IWTCF Objective 1: In Years 2 and 3, the project completed research investigating the relationship of poverty to the illegal wildlife trade in ivory. This indicated that the ultimate drivers of the trade are wealthy and connected parties whose actions contribute to the widening economic gap between rural and urban areas in Cambodia (Section 3.1, Activity 1.3);
- IWTCF Objective 2: All of the project's research findings were shared with government agencies and these directly led to enforcement actions undertaken by the Wildlife Rapid Rescue Team (and subsequent prosecutions) (Section 3.2);
- IWTCF Objective 3: DNA evidence provided by the project confirmed the presence of African ivory in domestic markets for the first time. This supported the inclusion of African elephant on the national protected species in June 2018, which closed an important legal loophole (Section 3.1, Activity 3.3). The project also built a database for captive Cambodian elephants, ultimately aimed at providing the government with direct measures to protect the remaining individuals;
- IWTCF Objective 4: Grounded in our findings, and in close collaboration with the MoE, the project completed an ivory awareness-raising campaign at Phnom Penh International Airport aimed at reducing demand for ivory among overseas visitors (Section 3.1, Activity 3.2).

In addition, the project directly supported TRAFFIC International in its national ivory surveys aimed at monitoring regional ivory markets. As a result, its activities specifically linked to the London Declaration commitments I., V., VII., X., XI., XII. and XVII., to the Kasane Statement commitments Number 2, 3 and 5, as well as to the Hanoi Statement commitments A, B, and C.

5. Impact on species in focus

Though difficult to quantify the project's impact on a species level, the project sought to reduce threats to global elephant populations by reducing Cambodian trade in ivory. Before the project, very little was known about Cambodia's place in the international ivory trade, and it was widely considered unimportant. In clarifying the true scale of the country's ivory market, the project's efforts were important in rectifying this oversight. More specifically, in documenting the domestic ivory market and trade networks over time, the project showed that Cambodia had transformed into an end-user destination for African and Asian elephant ivory and thus a country which contributed to the international ivory trade.

In addition to a variety of other capacity-building efforts, all data generated by the project was shared with the government and other stakeholders to actively disrupt and reduce the domestic ivory market (Annex 4.8-4.18, Indicators 1.1–1.3), and thus threats to elephants globally. The building of capacity in-country for genetic analysis of ivory samples (Annex 4.28, Indicators 2.1–2.4) and subsequent development of genetic markers (Annex 4.32, Indicator 1.4) also promoted understanding of ivory trade networks in Asia which will in turn safeguard regional elephant populations. The database currently includes data from 10 of the 13 Asian elephant range countries, paving the way for a regional approach to identifying illegal trade networks and poaching hotspots affecting Asian elephants.

Taken as a whole, the project's efforts contributed to several critical steps in combating contemporary threats to African and Asian elephant populations. These included the inclusion of African elephants on the protected species list of Cambodia (June 2018: Annex 4.4, Indicator 3.2), an official directive requiring all Customs and Excise departments to crackdown on the import, export and transport of illicit ivory and rhino horn (March 2019: Annex 4.37), establishment of an inter-ministerial taskforce to investigate, prevent and supress illegal ivory trade (August 2019: Annex 4.5), widely publicised government warnings and enforcement actions against ivory traders in Cambodia (Annex 4.16–4.18, Indicators 3.1, 3.4), and most recently, the Cambodian government's adoption of 10-year National Elephant Conservation Action Plan (May 2020).

Looking forwards, we are actively engaged in monitoring important wild elephant populations in Indochina, specifically in the Cardamom Mountains, Prey Lang and Virachey areas of Cambodia. These

currently appear to be stable, and there have been no poaching incidences in the Cardamom Mountains for over a decade. According to our research however, there is a market preference for Asian (and especially Cambodian) ivory over African ivory due to the notion this is more valuable due to its perceived uniqueness, quality and rarity. This may intensify threats to remaining elephant populations in Cambodia from ivory traffickers and we will continue to monitor for emerging threats, particularly any indications that poaching may be driven by demand for ivory.

6. Project support to poverty alleviation

The primary beneficiaries of the project were its government and academic partners, whose capacity was built in IWT management and who acquired knowledge of ivory trade networks, including their links to poverty. In addition to targeted capacity-building events to strengthen law enforcement for example, the project's surveys and analyses made a substantial contribution to improving knowledge of Cambodian ivory markets and wildlife trading networks. This increased the capacity of the Royal Government of Cambodia to respond to and address wildlife crime, helping them to uphold national laws and meet international commitments (Indicator 1.2). Likewise, the project made a significant contribution to increasing Cambodian capacity for genetic analyses of elephant ivory and other wildlife species and products. In establishing an in-country laboratory with five technicians trained to extract DNA from ivory and test for identity and origins in Cambodia for the first time, the project's efforts will have far-reaching benefits for (i) the university's knowledge and teaching of conservation issues (ii) the research and analytical skills of staff and (iii) future conservation initiatives in-country.

The project's research also provided important insights into the relationship of poverty to the illegal ivory trade (Annex 4.10–4.11). Among these was the finding that rarity and expense were the values most associated with ivory among consumers and that wealth, irrespective of nationality, was a shared trait among buyers (Indicator 1.2). This is consistent with previous research showing that the demand for high-value wildlife products in Southeast Asia is largely driven by wealth. The project's research also indicated that a growing number of Cambodians are buying ivory, alongside the existing Chinese market, and suggested that ivory vendors form part of a wealthy and influential network. This was highlighted during our Year 3 research which found that much of the market was geared towards prominent and affluent Chinese and indicated high financial and logistical capacity among traders. This collectively suggests that banning of ivory is highly unlikely to impoverish local vendors. Our surveys of vendors also provided considerable insights into the degree and nature of local- and foreign- demand for ivory in Cambodia. These highlight the need for future interventions to include demand-reduction efforts.

Secondary beneficiaries of the project included communities in source countries, including Cambodia. Loss of iconic elephants, and other wildlife species traded via the same networks, undermines their livelihood and income opportunities, deteriorates essential environmental services and destroys natural heritage, representing significant opportunity costs in terms of future development options lost. The project contributed to addressing the illegal trade in African and Asian ivory, and also to a greater understanding of wildlife trade networks that unsustainably harvest other wildlife species whose source populations are invariably closest to poor communities dependent on natural resources (Annex 4.8). To maximise its impact, the project ensured that findings were shared widely, both through FFI's global programmes (including critical elephant sites in Africa and Asia) and FFI's global partner network, as well as externally with interested parties through conference attendance and publications not previously available. As such, it indirectly benefitted local communities closest to source populations in Africa, Asia, and Cambodia specifically. Allied to this, the inclusion of African elephants on the protected species list of Cambodia (which criminalised African elephant ivory in Cambodian markets) was an important achievement benefitting source countries.

7. Consideration of gender equality issues

Gender was documented in all of the project's surveys so as to account for gender issues in IWT. In Cambodia, women often perform major roles in running small businesses and household finances but are under-represented in governmental and policy-making roles. Our survey of the online trade of ivory products over time showed that only a very small margin of online shops (≤10%) were operated by women and very few online commentators (approx. 5%) were female. This contrasted with our physical market surveys: while surveys in 2017 showed that there were slightly less female vendors (43%, Annex 4.9), females operated 73% of the shops selling genuine ivory in 2021 (Annex 4.12). These findings will be employed to inform future demand-reduction strategies in Cambodia.

RZSS published several blogs to coincide with the International Day of Women in Science over the course of the project.

The project also sought to ensure gender inclusiveness at all levels and ensure a gender inclusive environment in all hiring processes and selection for training opportunities. All interview panels for the RUPP lab technician positions consisted of a gender mix and each recruitment drive attracted female and male applicants. While it was planned that the RZSS and RUPP laboratory staff would be entirely female, due to changed commitments of previous staff and selection of the most suitable candidates, the RUPP project team now consists of two female staff members, whereas the RZSS team is 1/3rd female. The IWT team of FFI consists of 100% female staff.

8. Sustainability and legacy

The project attracted a great deal of interest within and outside Cambodia. This was partly due to the efforts it made to promote its work (see section 10) but primarily because of the seminal contribution it made to confirming and ensuring recognition that Cambodia had become an end-user destination for African and Asian elephant ivory and thus a country which actively contributed to the international ivory trade. Before the project, Cambodia's role in the international ivory trade was widely considered unimportant. Evidence for increasing interest and capacity regarding IWT due to the project included the first legal protection for African elephant and 11 other non-native species (Annex 4.4), Customs & Excise crackdowns on the import, export and transport of ivory and rhino horn (Annex 4.37), creation of an inter-ministerial taskforce to prevent illegal ivory trade and support implementation of the National Ivory Action Plan (Annex 4.5), government warnings and multiple enforcement actions against ivory vendors (see section 3.1, Activity 3.3) and formal adoption of a 10-year National Elephant Conservation Action Plan. These achievements are highly likely to endure and as other law enforcement agencies such as UNODC, US State Department and TRAFFIC showed interest in engaging with the project, they collectively bode well for future inter-agency efforts to reduce Cambodia's role in IWT.

Though challenged by staff changes (see section 2), the project likewise made a significant contribution to increasing Cambodian capacity for genetic analyses of elephant ivory and other wildlife species and products. In establishing the first in-country laboratory with two technicians trained to extract DNA from ivory and genetically test species identities and origins, the project's efforts will have far-reaching benefits for (i) the university's knowledge and teaching of conservation issues (ii) the research and analytical skills of staff and (iii) future conservation initiatives in-country. While the laboratory will require continued support for longer than originally envisioned, the continued need for its services is evident and there is substantial interest among in-country NGOs in using the lab. We will therefore continue to explore possibilities for further support from government departments, and establishing other partnerships. A secondary project on the genetics of Siamese crocodile has been ongoing for several years and projects are in development on the testing of other illegally traded wildlife products. These come at an opportune time as FFI plans to transfer ownership of a long-term and highly successful University Capacity Building Programme, on which the genetics lab builds, to the RUPP.

9. Lessons learnt

Several important lessons were learned during the project. One of the first was how long it took to finalize the project agreement due to bureaucracy within the RUPP (See Section 2) and the possibility of similar delays in future was mitigated by formulating a MoA which could be readily supplemented if needed. The project's engagement in supporting the new Environment and Natural Resources Code was a similar experience in some ways (See Section 3.1, Activity 3.2). Despite beginning in 2015, before the project started, progress on the Code has been very slow and mired in bureaucracy, such that it has yet to be adopted. As mentioned earlier however, there was little that the project could do to change slow-moving governmental processes aside from supporting their completion.

The recognition of team members in repeated ivory market surveys posed a problem as there was little in-country capacity for these kinds of surveys. Though overcome through hiring of external consultants, finding suitably-qualified individuals proved a challenge and the project's research on physical ivory markets had to be reduced to a single yearly survey (from the biannual surveys intended). It also necessitated a much more detailed risk assessment and mitigation strategy, although this was helpful in improving daily reporting lines during the survey periods.

As mentioned earlier (Section 2), staff changes at the RUPP genetics lab posed major and recurring challenges which meant staff had to be re-recruited on several occasions. This was time-consuming and difficult due to the chronic shortage of qualified lab technicians in Cambodia. The challenge was addressed by additional recruitment to increase redundancy and guard against future staff changes, and painstaking efforts to re-train staff and re-build their links, but still presents a concern, such that the lab will require continued support for longer than originally anticipated. Flexibility in responding to changing

pressures was also important throughout the project but especially during Year 4 when the training program and testing capacity of the lab had to be adapted to staff changes and travel restrictions, shipping delays and lockdowns imposed by the pandemic.

9.1 Monitoring and evaluation

No major changes were made to the project design and log frame, although minor changes were approved in Year 3 (April 2020–March 2021) and September 2021 as follows. The original project intention was to survey physical ivory markets on a biannual basis, but this had to be reduced to a single survey annually as our original in-country surveyors began to be recognised by vendors. As the project resources were sufficient, the log frame was also changed to allow A) a survey to improve understanding of ivory consumers in Cambodia, B) secondment of a government official to assist its efforts in promoting effective legislative and enforcement and C) production and distribution of a publication on international obligations and domestic laws for wildlife protection to law enforcement agencies. Apart from the annual evaluations of the project's work facilitated by LTS, no other external evaluations were undertaken.

The main indicators for the project outcome were the status of the ivory trade in Cambodia and legislative developments and subsequent enforcement actions in relation to this. The first was monitored through regular surveys. This may still be the best approach but might not prove effective or feasible should significant portions of the domestic trade shift underground. The second was tracked through the assistance of the project's government partners and the secondment of an Forestry Administration official was helpful in this respect. The third indicator was more challenging.

On an operational level, the FFI Cambodia IWT team met regularly to discuss progress and necessary steps, specifically in regards to information sharing and meetings with government officials. The Project lead had quarterly skype meetings with the Senior Technical Specialist IWT of the FFI Conservation Partnerships Team to review the overall project progress and discuss challenges. Progress was tracked in a project workplan. As mentioned earlier, RZSS conducted weekly skype meetings with the RUPP conservation genetics laboratory. These were used to plan the work schedule and the meeting minutes were circulated so that the wider project team were up-to-date with developments and progress (Annex 4.3). This collectively facilitated ongoing evaluation of progress, discussion of questions and planning for each phase of work.

9.2 Actions taken in response to annual report reviews

No issues were raised in feedback on annual reports submitted in 2018 and 2019. Two comments received on the 2020 annual report were addressed as follows. Comment 1: "*A more detailed description of the market survey methodology would be valuable in a future report*". This was addressed in a response letter which formed part of the half-year report and outlined the survey methods in more detail. It was also addressed in our 2021 vendor survey report (Annex 4.12), which included a methodology section, and will be similarly addressed in a joint-publication with TRAFFIC International whose release is anticipated by end 2021. Comment 2: "*An indication of what if any contingencies will be put in place to account for challenges to future ivory testing*". As explained in our letter (half-year report), the project had difficulties obtaining confiscated ivory for testing due to political sensitivities, which forced it to focus more on its development aims. Several in-country meetings with partners were held in January and February 2020 to discuss contingency plans. However, due to the staff challenges discussed in section 2, re-building of capacity for ivory testing had to be prioritized first. As there is significant interest among in-country NGOs in using the lab and the DNA extraction and PCR techniques it employs are highly transferable, staff capacity was also built to allow the lab to diversify to other wildlife groups and IWT products. As a consequence, the lab has been testing the genetic status of Siamese crocodiles for several years and there is potential for it to expand to groups such as marine turtles and tigers in future.

10. IWT Challenge Fund Identity

Significant efforts were made by the project to publicise the IWT Challenge Fund as a UK government funding stream. These efforts included a variety of media (e.g., Annex 4.9, 4.12, 4.23) and other activities which specifically sought to acknowledge the support provided by IWT Challenge Fund, UK government and project partners, including:

- —at the onset of the project—A news piece on the FFI website and a poster displayed in the RUPP Conservation Genetics Lab and RZSS (Annex 4.39); A webpage was also created on the project's capacity building for genetic research in Cambodia;
- An open day at the RUPP Conservation Genetics Lab (July 2018) which provided presentations to in-country NGOs regarding the lab's work on ivory and elephant genetics (Annex 4.39);

- An official embassy reception on IWT led by the British Ambassador to Cambodia (September 2018) which showcased the project (Annex 4.36);
- A series of blogs published on the RZSS website to coincide the "International Day of Women in Science" in 2018, 2019, 2020 and 2021 (see section 7);
- Project presentations at conferences and meetings in Finland (June 2018), Thailand (August 2018), UK (two events in October 2018) & Malaysia (July 2018, July 2019) (Annex 4.34-35, 4.39);
- An article in the IWT Challenge Fund Newsletter which focused on Innovation and Technology (January 2019);
- A news article and footage produced by BBC Scotland regarding the project's discovery of mammoth ivory among samples confiscated in Cambodia (January 2019);
- The project's press release on this discovery also led to significant international interest and numerous media articles. This included widespread coverage in Southeast Asia, including an article in the regional Globe magazine, and enquiries from researchers and government officials;
- An ivory awareness-raising campaign at the Phnom Penh International Airport in July–October 2019 (Annex 4.25) and corresponding Facebook post;
- A policy brief distributed and discussed during the CITES CoP18 meeting in Geneva, Switzerland (August 2019, Annex 4.38);
- Articles showcasing the project's work in the November 2019 Newsletter of the World Association of Zoos and Aquariums and UK media (The Scotsman, January 2020, Annex 4.40).

These efforts collectively ensured the support provided by the IWT Challenge Fund was recognized as a distinct element of broader efforts being undertaken by FFI and its partners to address wildlife trade issues. As a result, all of the government officials and individuals from non-government agencies that the project interacted with will be familiar with the IWT Challenge Fund. The same should be true to a lesser extent of all the interested members of the public that the project reached through its activities.

11. Finance and administration

11.1 Project expenditure

Significant variations in expenditure (+/- 10%) against the original budget were incurred in costs for 'Travel and subsistence' and 'Capital items' during the project (per table below). Costs for travel and subsistence were somewhat lower (%) than originally anticipated due to travel and other restrictions related to public safety measures introduced as a result of the COVID-19 pandemic in 2020–2021. The overspend in capital items (%) was due to the purchase of essential PCR equipment for the RUPP genetics laboratory in 2018–2019, although total expenditure under this category only accounted for % of the overall budget.

Project spend (indicative) since last annual report	**2017-2021 Grant (£)**	**2017-2021 Total actual IWT Costs (£)**	**Variance %**	**Comments (please explain significant variances)**
Staff costs (see below)				
Consultancy costs				
Overhead Costs				
Travel and subsistence				
Operating Costs				
Capital items (see below)				
Others (see below)				
TOTAL				

Staff employed (Name and position)	**Cost (£)**
Pablo Sinovas, FFI Flagship Species Manager	
Regina Weckauf, FFI Technical Advisor	

Laure Joanny, FFI Wildlife Trade, Technical Specialist	
Rebecca Drury, FFI Wildlife Trade Senior Technical Specialist	
Trang Nguyen, FFI Wildlife Trade, Technical Specialist	
Jackin Lam, Ivory Trade Market Specialist	
Sok Samet, FFI IWT Project Officer	
Thi Sothearen, FFI IWT Project Officer	
Ahab Downer, FFI Country Director, Cambodia Programme	
Jeremy Parker, FFI Country Director, Cambodia Programme	
Kong Phanith, FFI Finance & Admin Manager	
Oung Chanmony, FFI Finance & Admin Manager	
Jennifer Kaden, RZSS Wet Laboratory Support / Training	
RUPP Genetics Laboratory Staff	
TOTAL	

Capital items – description	**Capital items – cost (£)**
PCR Machine QPCR Machine	
TOTAL	

Other items – description	**Other items – cost (£)**
DNA Reagents (RZSS / RUPP)	
TOTAL	

11.2 Additional funds or in-kind contributions secured

Source of funding for project lifetime	**Total (£)**
FFI Flagship Species Fund	
M.A.Cargill	
WWF Russell E Train Fellowship	
RZSS In-Kind	
Australia Zoo	
TOTAL	

Source of funding for additional work after project lifetime	**Total (£)**
USAid	
TOTAL	

11.3 Value for Money

From the authors perspective, the project provided very good value for money considering its contributions to actively improving the Cambodian policy environment and public awareness regarding the illegal ivory trade, as well as in establishing the knowledge basis and technical capacity essential to enable more effective law enforcement and deliver the country's NIAP (as summarized in section 5). Allied to these achievements, it was also successful in securing a significant amount of co-funding towards its efforts and overall purpose (as summarized in section 11.2).

12. OPTIONAL: Outstanding achievements of your project during the (300-400 words maximum). This section may be used for publicity purposes

I agree for the IWT Secretariat to publish the content of this section (please leave this line in to indicate your agreement to use any material you provide here)

A key achievement of this project has been the establishment of the first conservation genetics laboratory in Cambodia. This has not only benefitted this project directly by allowing the first ever genetic testing of ivory in Cambodia, but has created a legacy that will support regional conservation priorities into the future. The genetic techniques that have revealed the diverse origin of illegally traded ivory in Cambodia—originating from African elephants, Asian elephants and Woolly mammoth—are highly transferable to other species. The regular commitment to discussions and training throughout the duration of the project has also fostered strong connections between the partners on this project and we hope that this will benefit other conservation initiatives in country.

Annex 1 Project's original (or most recently approved) logframe, including indicators, means of verification and assumptions.

Project summary	Measurable Indicators	Means of verification	Important Assumptions
Impact: Reduction of illegal ivory trade in Cambodia contributing to decreased threat to elephant populations from IWT globally.			
Outcome: Effective enforcement of illegal ivory trade in Cambodia, through improved knowledge of Cambodian ivory markets and trading networks, increased national capacity for genetic analysis of ivory, and strengthened legislation.	0.1 50% decrease from the 2016 baseline (1,116 pieces) of the recorded amount of ivory available for sale in markets in Cambodia by Y4 0.2 Legislation in place to close loopholes regarding ivory 0.3 Authorities begin confiscating ivory, and arresting/fining ivory market vendors by Y4 0.4 By the end of Y4 airport confiscations of ivory products increase 50% from Y1 baseline	0.1 Market survey reports 0.2 Official legislation 0.3 Law enforcement records and CITES reports 0.4 Official airport seizure records and CITES reports	- The market surveys capture the actual existing ivory market, i.e. do not miss large underground components which might grow as enforcement tactics tighten. (Market surveys will include monitoring and evaluation of available underground information throughout the project.) - The government and enforcement authorities are open to creating and enforcing strengthened laws concerning ivory trade. (Governmental relationships and the political environment will be analysed and monitored throughout the project.) - The government and airport authorities release ivory confiscation figures. (Awareness, capacity, and relationships will be built and monitored throughout the project.)
Outputs: **1**. Improved understanding of Cambodian ivory markets and trading networks – including exploring links between drivers of IWT and poverty – informing policy and interventions to address ivory trade.	1.1 Results of annual market surveys and consumer survey are shared and discussed with government and NGOs 1.2 Findings of research into ivory trade networks and the links between IWT and poverty are used by key stakeholders (e.g. government, NGOs) to inform policy and intervention 1.3 Existing wildlife trade data from government and NGOs are collated annually and mapped	1.1 Survey and data mining reports, meeting and workshop minutes, final report 1.2 Survey report, final report, statements from stakeholders 1.3 Map of wildlife trade network, workshop reports, presentations, records of law enforcement 1.4 Publications, conference presentations, records of law enforcement	- Potentially sensitive information is shared. (The project will carefully build on the existing trust between project partners and monitor relationships to react and adapt to changes.) - Government supports strengthened law enforcement. (Capacity will be built and monitored throughout the project.)

	1.4 Cambodian elephant population genetics used to develop regional markers and used for law enforcement		
2. Strengthened national capacity for genetic analysis of ivory and regional collaboration for mapping of ivory trade to inform interventions to address ivory trade.	2.1 By Y2, the origin of an initial 30 independent samples of illegally trafficked ivory is genetically determined 2.2 By Y4, there is a genetic knowledge base to trace Asian ivory routes to Cambodia and the wider region by laboratories within the ASEAN Wildlife Forensic Network 2.3 By end Y4, two female RUPP lab technicians and one local FFI senior staff are fully trained by RZSS to genetically test collected ivory 2.4 By end of Y4, law enforcement officials from FA and Conservation NGOs (e.g. Wildlife Alliance) workers are genetically identifying ivory utilising the lab	2.1 DNA analysis reports and publications 2.2 Reports and publications 2.3 Training and work protocols of genetic lab 2.4 Meeting and workshop reports, training materials	- Government is open to continued testing of ivory. (Awareness, capacity, and infrastructure and networks are built to ensure sustainability of the project.)
3. National legislation regarding ivory is in place and effectively enforced	3.1 By Y3, the official report to Government incorporating data and evidence gathered on ivory trade to support law enforcement is disseminated through workshops to authorities, and utilised within 12 months from that point 3.2 By end of Y4, government legislation makes the sale and buying of Asian and African ivory illegal 3.3 By end of Y4, 50% increase of ivory seizures at the airports from 2017 baselines 3.4 By end of Y4, arresting and/or fining wildlife criminals for ivory related crimes is effectively carried out	3.1 Project report, workshop and meeting reports, Secondment Terms of References 3.2 Draft legal proclamation 3.3 Data on ivory seizures at airports 3.4 Data on prosecutions	- Engaging with our existing partners at the Forestry Administration, and feeding information to Wildlife Alliance will have an impact on improving law enforcement. (The project will build on and monitor existing relationships and capacity) - Wildlife Alliance will continue to have resources and the will to improve law enforcement. (The project will build on and monitor existing relationships)

Activities (each activity is numbered according to the output that it will contribute towards, for example, 1.1, 1.2 and 1.3 are contributing to Output 1)

1.1 Conduct annual surveys of markets to monitor and quantify ivory, and consumer profiles (Y4) in Siem Reap, Phnom Penh, and Sihanoukville (target areas informed by prior research by FFI), including vendor surveys and intelligence gathering to identify the supply chain networks – drawing on data mining of existing national reports and surveys, informant networks and triangulated interviews, and consumer surveys in the final year of the project informed by data gathered in the previous years;

1.2 Produce national map of trading hotspots and networks;

1.3 Conduct gendered surveys of consumers and vendors to better understand the links between poverty and the ivory trade;

1.4 Provide intelligence to law enforcement on ivory trade networks to facilitate effective enforcement;

1.5 Use existing Asian elephant population genetic data from 250-300 previously collected quality-screened DNA faecal samples to generate genotype data on a genetic marker system, which will enable Cambodian elephant population-level data to be used as a reference resource by laboratories within the ASEAN Wildlife Forensic Network (Asian elephant SNP marker data currently available for the region was developed with the assistance of the RZSS staff named on this project).

2.1 Establishment of species identification (Asian/African) testing from initial 30 market survey ivory samples and testing of samples to establish species provenance (mtDNA test);

2.2 Production of Cambodian Elephant reference genetic data from existing samples collected from wild elephant surveys to assist with global traceability of ivory (mtDNA, SNP based or microsatellite testing);

2.3 Investigation of geographic origin of Asian ivory found in Cambodia;

2.4 Establishment of individualisation and sexing tests to allow for seizure inventory (SNP-based or microsatellite testing);

2.5 Establishment of seizure sampling, data-basing and chain of custody protocols;

2.6 Strengthen professional links of the lab with regional and international wildlife forensics/ elephant genetics network.

3.1 Produce official report to the government with results from Outputs 1 and 2 highlighting the need for laws banning the sale of ivory;

3.2 Engage with the Ministry of Environment to ensure that laws banning the sale and purchase of ivory are incorporated into the development of legislation;

3.3 Work with the Forestry Administration/CITES Management Authority, including through secondment contracts in Year 4, to encourage implementation of the National Ivory Action Plan, close legislative loopholes to facilitate arrest and prosecution of ivory traders and promote knowledge of laws on illegal wildlife trade;

3.4 Engage and train airport border controls and the Forestry Administration/CITES Management Authority to improve airport screening for ivory products entering and leaving Cambodia.

Annex 2 Report of progress and achievements against final project logframe for the life of the project

Project summary	Measurable Indicators	Progress and Achievements
Impact Reduction of illegal ivory trade in Cambodia contributing to decreased threat to elephant populations from IWT globally.		Though difficult to quantify the impact on a species level, the project's efforts supported several pivotal steps in combating threats to African and Asian elephant populations. These included the first legal protection for African elephants in Cambodia (June 2018), a directive to all Customs & Excise departments to crackdown on the import, export and transport of ivory and rhino horn (March 2019), creation of an inter-ministerial taskforce to prevent illegal ivory trade (August 2019), and the formal adoption of a 10-year National Elephant Conservation Action Plan (May 2020).
Outcome Effective enforcement of illegal ivory trade in Cambodia, through improved knowledge of Cambodian ivory markets and trading networks, increased national capacity for genetic analysis of ivory, and strengthened legislation.	0.1 50% decrease from the 2016 baseline (1,116 pieces) of the recorded amount of ivory available for sale in markets in Cambodia by Y4 0.2 Legislation in place to close loopholes regarding ivory 0.3 Authorities begin confiscating ivory, and arresting/fining ivory market vendors by Y4 0.4 By the end of Y4 airport confiscations of ivory products increase 50% from Y1 baseline	The project made a seminal contribution to improving knowledge of Cambodian ivory markets and trading networks and indicate that quantities of ivory for sale in domestic markets in early 2021 were 43% of the 2016 baseline (631 vs. 1,116 items). In confirming the presence of African elephant ivory in Cambodian markets (genetic evidence), increased ivory availability and export activities to China, they also supported the release of new legislation (June 2018) extending protection to African elephants and 11 other non-native species including rhinos and pangolins, which closed important legal loopholes. No ivory seizures were reported at airports during the project period, although this may be partly due to their effective closure in early 2020 due to Covid-19 (which remains in effect).
Output 1. Improved understanding of Cambodian ivory markets and trading networks – including exploring links between drivers of IWT and poverty – informing policy and interventions to address ivory trade.	1.1 Results of annual market surveys and consumer survey are shared and discussed with government and NGOs 1.2 Findings of research into ivory trade networks and the links between IWT and poverty are used by key stakeholders (e.g. government, NGOs) to inform policy and intervention 1.3 Existing wildlife trade data from government and NGOs are collated annually and mapped 1.4 Cambodian elephant population genetics used to develop regional markers and used for law enforcement	The project was successful in achieving output 1 as a result of activities 1.1 through 1.5 (see section 3.1 and below). At the onset of the project, very little was known about ivory markets, hotspots and trade networks in Cambodia. Interventions addressing the ivory trade were also minimal, as law enforcement authorities lacked knowledge of the trade and how to address it. This was comprehensively addressed by a series of surveys (Annex 4.9-4.15) whose findings were actively shared with government and NGOs. These supported several policy developments (Annex 4.4–4.5, 4.37) Two genetic marker systems were developed by the project, a mtDNA sequence system and a 20-SNP marker system. Genotyping of Asian elephants from ten range countries were used to generate the systems and the results of species identity and provenance tests of 33 samples of ivory confiscated in Cambodia were provided to enforcement agencies during the project.

Activity 1.1 Conduct annual surveys of markets to monitor and quantify ivory, and consumer profiles (Y4) in Siem Reap, Phnom Penh, and Sihanoukville (target areas informed by prior research by FFI), including vendor surveys and intelligence gathering to identify the supply chain networks – drawing on data mining of existing national reports and surveys, informant networks and triangulated interviews, and consumer surveys in the final year of the project informed by data gathered in the previous years;		Surveys to quantify and monitor ivory in physical markets in three cities were undertaken in Oct–Nov 2017, Feb 2018 (Annex 4.9), May 2018 (Annex 4.10), Mar–Apr 2019 (Annex 4.11) and Feb 2021 (Annex 4.12). Online ivory vendors were surveyed in Jan 2015–Apr 2018 (Annex 4.9), Aug–Sep 2018 (Annex 4.13), Feb–Mar & Aug–Sep 2019, Feb–Mar 2020 (Annex 4.14) and Feb–Mar 2021 (Annex 4.15). The project also undertook surveys to track media reports of ivory seizures in Cambodia between 2013–2021 (Annex 4.9, 4.16–4.18). Ivory consumers were first assessed in 2018–2019 (Annex 4.10–4.11), followed by an in-depth assessment in May–July 2021 (Annex 4.19).
Activity 1.2 Produce national map of trading hotspots and networks;		A national map of trading hotspots and trading networks was provided in the project's first annual report (April 2018) and publication (English & Khmer versions produced) (Annex 4.9). As these suggested trading networks were highly transient and fluid and the purpose of a collaboration with TRAFFIC international was to undertake in-depth analyses of regional ivory markets, it was felt that creating regular updates of the map would not be the most productive use of the project's time and resources.
Activity 1.3 Conduct gendered surveys of consumers and vendors to better understand the links between poverty and the ivory trade;		Gender was documented in all of the project's surveys (see Activity 1.1) so as to account for gender issues in IWT. Research on the relationship of poverty to the illegal ivory trade was undertaken in 2018–2019 (Annex 4.10–4.11). Consistent with previous research showing that the demand for high-value wildlife products in Southeast Asia is largely driven by wealth, these found that rarity and expense were the values most associated with ivory among consumers and that wealth, irrespective of nationality, was a shared trait among buyers.
Activity 1.4 Provide intelligence to law enforcement on ivory trade networks to facilitate effective enforcement;		All data, intelligence and analyses generated by the project was shared with the Forestry Administration (FA), particularly the investigation unit of the Wildlife Rapid Rescue Team, plus Customs & Excise officials (Annex 4.9–4.18). A series of capacity-building were also undertaken to promote and facilitate effective law enforcement (Annex 4.22–4.24), as were awareness campaigns at Phnom Penh airport to reduce ivory demand among overseas visitors to Cambodia (Annex 4.25).
Activity 1.5 Use existing Asian elephant population genetic data from 250-300 previously collected quality-screened DNA faecal samples to generate genotype data on a genetic marker system, which will enable Cambodian elephant population-level data to be used as a reference resource by laboratories within the ASEAN Wildlife Forensic Network (Asian elephant SNP marker data currently available for the region was developed with the assistance of the RZSS staff named on this project).		Two genetic marker systems were developed during the project, a mtDNA sequence system and a 20-SNP marker system (Annex 4.28 & 4.32). Genetic data of Asian elephants from ten range countries were used to generate these systems.
Output 2. Strengthened national capacity for genetic analysis of ivory and regional collaboration for mapping	2.1 By Y2, the origin of an initial 30 independent samples of illegally	The species origin of 33 ivory samples was identified. In Year 2, 15 ivory samples, two of which were known fakes, were provided to the RUPP laboratory for testing. Species identification of these samples showed that nine originated

of ivory trade to inform interventions to address ivory trade.	trafficked ivory is genetically determined 2.2 By Y4, there is a genetic knowledge base to trace Asian ivory routes to Cambodia and the wider region by laboratories within the ASEAN Wildlife Forensic Network 2.3 By end Y4, two female RUPP lab technicians and one local FFI senior staff are fully trained by RZSS to genetically test collected ivory 2.4 By end of Y4, law enforcement officials from FA and Conservation NGOs (e.g. Wildlife Alliance) workers are genetically identifying ivory utilising the lab	from African elephants, two from Asian elephants and two from woolly mammoths (Annex 4.26–4.31). Additional tests were developed due to two challenging samples, which proved to be woolly mammoth ivory (Annex 4.30). A further 18 ivory samples were seized in Year 4, all of which were identified as originating from African elephants. Development of a mtDNA reference database for the Cambodian elephant samples was completed. The lab now has sequences for 320 Cambodian samples, giving a combined total of 854 Asian elephant sequences from nine range countries. The more appropriate SNP-based database has been completed for 310 Cambodian elephant samples and has been combined with samples from another three range countries. Genetic Probes and synthetic controls have been produced for use by other labs within the ASEAN network. Five RUPP staff were trained in genetic techniques for ivory testing (two female and three male). There is currently one female and one male technician at RUPP that have been trained to complete ivory extractions and species ID tests (Annex 4.2–4.3). RUPP staff conducted an information session for law enforcement officials in Year 2. Efforts were made with enforcement officials to better communicate the benefits of ivory testing. In Year 4, the laboratory received 18 seized samples and genetically confirmed all of these as originating from African elephants of diverse origin. Results were passed back to the enforcement agency (Annex 4.33).
Activity 2.1 Establishment of species identification (Asian/African) testing from initial 30 market survey ivory samples and testing of samples to establish species provenance (mtDNA test);		Species provenance was successfully determined for all of the 33 ivory samples provided to the RUPP laboratory (Annex 4.27).
Activity 2.2 Production of Cambodian Elephant reference genetic data from existing samples collected from wild elephant surveys to assist with global traceability of ivory (mtDNA, SNP based or microsatellite testing);		Access to genetic samples from wild Cambodian elephants in four protected areas was obtained. The mtDNA reference database for Cambodian wild elephants is complete (*n*=320 samples). The SNP reference database is also complete (*n*=310 samples).
Activity 2.3 Investigation of geographic origin of Asian ivory found in Cambodia;		The two ivory samples identified as Asian elephant were tested against the mtDNA database which now consists of 854 samples from nine counties. This test indicated that one sample matches elephants in central India and the other sample matches elephants in Southeast Asia (Peninsular Malaysia, Myanmar & Laos). They were also tested against the SNP database which shows they are unlikely to originate from Cambodian elephants (Annex 4.31–4.32).
Activity 2.4 Establishment of individualisation and sexing tests to allow for seizure inventory (SNP-based or microsatellite testing);		A gel electrophoresis-based sexing test and SNP-based individualisation tests were developed by RZSS and transferred to the RUPP lab. The sexing tests was verified with samples from 14 captive elephants of known sex and tests were conducted on all ivory samples with eight providing successful results. Subsequent sexing of the wild elephant samples (*n*=364) revealed an even sex-

		ratio in the wild Cambodian populations which is consistent with low levels of ivory poaching. The individualisation test was successfully run on our two Asian elephant ivory samples, confirming its validity for seizure inventories. It was also applied to our dung samples from the three wild populations of elephants in Cambodia and confirmed the numbers of individuals in each sample collection.
Activity 2.5 Establishment of seizure sampling, data-basing and chain of custody protocols;		Data-basing, sampling and chain of custody protocols were established in the laboratory during the project.
Activity 2.6 Strengthen professional links of the lab with regional and international wildlife forensics/ elephant genetics network.		In Years 2 and 3, RUPP and RZSS staff presented results at exchange sessions, international conferences and university research departments to build links within the elephant conservation, wildlife trade and conservation genetics communities (Annex 4.34–4.35). Plans for conference attendance and training and networking visits to overseas labs were precluded by pandemic travel restrictions in Year 4, although online discussions continued with labs in Vietnam and Nepal and the RUPP lab continues to host an overseas PhD student studying Asian elephants.
Output 3. National legislation regarding ivory is in place and effectively enforced.	3.1 By Y3, the official report to Government incorporating data and evidence gathered on ivory trade to support law enforcement is disseminated through workshops to authorities, and utilised within 12 months from that point 3.2 By end of Y4, government legislation makes the sale and buying of Asian and African ivory illegal 3.3 By end of Y4, 50% increase of ivory seizures at the airports from 2017 baselines 3.4 By end of Y4, arresting and/or fining wildlife criminals for ivory related crimes is effectively carried out	The project was largely successful in achieving output 3 as a result of activities 3.1 through 3.4 (see section 3.1 and below). As mentioned earlier, the significant research data, molecular evidence and intelligence generated by the project (Annex 4.9–4.18) were regularly shared with law enforcement agencies. These were instrumental in the ivory trade being banned in June 2018 (Annex 4.4). Law enforcement was actively improved through this process, several capacity-building activities (Annex 4.22–4.24). and awareness campaigns to reduce demand for ivory among overseas visitors to Cambodia (Annex 4.25). No ivory seizures were reported at airports during the project period, though this may be partly attributable to their effective closure in early 2020 (in response to Covid-19 concerns), which remains ongoing.
Activity 3.1 Produce official report to the government with results from Outputs 1 and 2 highlighting the need for laws banning the sale of ivory;		Planned for Year 4 of the project, the aim of this activity was precluded by the legal ban on African elephant ivory in June 2018 (Annex 4.4) which the project's initial findings contributed to (Annex 4.9). As a result, the project shifted its focus to highlighting the need for strengthened enforcement, as demonstrated by its research findings in 2019–2021 (Annex 4.11–4.12, 4.14–4.15).
Activity 3.2 Engage with the Ministry of Environment [MoE] to ensure that laws banning the sale and purchase of ivory are incorporated into the development of legislation;		The project supported the MoE in its development of a new Environment and Natural Resources Code (Code) which is intended to cover all aspects of the environment, including IWT. While development of the Code has been very

	collaborative, it has also been mired in bureaucracy and has yet to be adopted. However, there was little that the project could do to hasten these slow-moving government processes. Notwithstanding this, the project engaged with MoE, undertake awareness campaigns to reduce demand for ivory among overseas visitors to Cambodia (Annex 4.25). The project also engaged with MoE to convene a national workshop on IWT issues, but this was repeatedly postponed due to continuing Covid-19 safety measures in Cambodia and had yet to be sanctioned at the time of writing.
Activity 3.3 Work with the Forestry Administration/CITES Management Authority, including through secondment contracts in Year 4, to encourage implementation of the National Ivory Action Plan [NIAP], close legislative loopholes to facilitate arrest and prosecution of ivory traders and promote knowledge of laws on illegal wildlife trade;	A Forestry Administration official (Ms. Thi Sothearen) was seconded to the project in Year 4 and as mentioned above, the project's sharing of its initial findings (Annex 4.9) contributed to the legal protection for African elephants in Cambodia (June 2018, Annex 4.4) and creation of an inter-ministerial taskforce to prevent illegal ivory trade (August 2019, Annex 4.5). These and subsequent survey findings (Annex 4.10–4.15) Other actions in support of the NIAP included capacity-building for law enforcement officials (Annex 4.22–4.24), campaigns to reduce ivory demand among overseas visitors to Cambodia (Annex 4.25) and support for the development of a 10-year National Elephant Conservation Action Plan which was adopted in May 2020. The project also engaged with FA to convene a national workshop on CITES enforcement issues, but as this could not be undertaken due to Covid-19 safety measures, the project supported production and distribution of a comprehensive publication on international obligations and domestic laws for wildlife protection in Cambodia to the relevant enforcement agencies instead (Annex 4.41).
Activity 3.4 Engage and train airport border controls and the Forestry Administration/CITES Management Authority to improve airport screening for ivory products entering and leaving Cambodia.	The project supported capacity building for Customs & Excise and FA/CITES officials to improve screening for ivory products. These included training for ivory identification (Annex 4.22), risk profiling (Annex 4.24) and awareness campaigns at Phnom Penh airport to reduce ivory demand among overseas visitors to Cambodia (Annex 4.25). This was supported by a Customs & Excise Department directive on combatting ivory trade (March 2019, Annex 4.37). Plans to provide further training for Customs, FA and CITES officials through separate events hosted by the FA and the MoE were unfortunately curtailed by the pandemic.

Annex 3 IWT Contacts

Ref No	IWT044
Project Title	Critical evidence to drive a reduction in Cambodia's ivory trade
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Annex 4 Onwards – supplementary material (optional but encouraged as evidence of project achievement)

Checklist for submission

	Check
Is the report less than 10MB? If so, please email to IWT-Fund@ltsi.co.uk putting the project number in the subject line.	
Is your report more than 10MB? If so, please discuss with IWT-Fund@ltsi.co.uk about the best way to deliver the report, putting the project number in the subject line.	X
Have you included means of verification? You need not submit every project document, but the main outputs and a selection of the others would strengthen the report.	X
Do you have hard copies of material you want to submit with the report? If so, please make this clear in the covering email and ensure all material is marked with the project number.	
Have you involved your partners in preparation of the report and named the main contributors	X
Have you completed the Project Expenditure table fully?	X
Do not include claim forms or other communications with this report.	