Report of the Wildlife Disease Risk Analysis (DRA) Training Workshop

Singapore, 2013

Wildlife Reserves Singapore Group

Wildlife Reserves Singapore Conservation Fund

Report of Disease Risk Analysis workshop

Singapore Zoo, 24th to 25th July 2013

Workshop Participants:

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Choon Beng (National Parks)
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Cover photo: Female Rhinoceros hornbill, *Buceros rhinoceros* by Marc Cremades.

Jakob-Hoff R and Luz S (Eds) (2013) *Report of the Wildlife Disease Risk Analysis Workshop, Singapore.* IUCN SSC Conservation Breeding Specialist Group: Apple Valley, MN.

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Workshop Background

Over the past 6 years, the Singapore Hornbill Project (SHP) with the collaboration of Wildlife Reserves Singapore (WRS), National Parks (NParks), and private donors has greatly contributed to the return of the Oriental Pied Hornbill (*Anthracoceros albirostris convexus*) in Singapore. The project has resulted in an important increase of the population, significant scientific achievements and the publication of a book. It has received international awards and lots of local and international recognition and media attention.

The future agenda of the SHP is to continue promoting the conservation and reintroduction of hornbills in Singapore, with the possible return of the very spectacular and locally extinct Rhinoceros Hornbill (*Buceros rhinoceros rhinoceros*) with its specific role in its habitat.

As a collaboration effort the Rhinoceros Hornbill team has proposed a comprehensive approach to this delicate operation by coupling field studies on wild populations at the Harapan Forest (Sumatra), with a local risk assessment following the models developed by CBSG.

This multiple-site approach will contribute to a better evaluation of the parameters necessary to the return of this charismatic species to the Singapore forest. Data collected in captivity and in the wild will be compared and compiled to be discussed with all the project collaborators and Singapore nature interest groups to define the most appropriate strategy for the reintroduction into the Singapore habitat.

Workshop format

This training workshop was held over two consecutive days.

The first half day comprised an introduction of all participants, sharing personal goals and coming to agreement on overall workshop objectives and a set of guidelines for working in a collaborative manner (working agreement). This was followed by a two hour talk by Dr. Richard Jakob-Hoff introducing the IUCN-SSC Conservation Breeding Specialist Group (CBSG), its tools and workshop processes and providing a broad overview of the principles of wildlife disease risk analysis (DRA).

The remainder of the first day and most of the second day was structured to follow the sequential DRA framework. An example of each step in this framework was provided, followed by an interactive exercise and a group discussion until each step had been covered. As far as possible the exercises focused the DRA process on issues identified by the group as being of importance to the rhinoceros hornbill reintroduction project.

The final part of the workshop was a review of the kind of conservation planning workshop that would be best suited to this project, given the issues identified during the exercises. This was followed by a preliminary workshop planning session followed by a reflection on the usefulness, insights gained and issues arising from the workshop and an overall workshop evaluation by participants.

Introduction and Workshop Program and Objectives

Each participant introduced themselves and stated their personal goals and wishes for this workshop as follows:

Personal Goals

- To demonstrate due diligence to the public
- To breed rhino hornbills successfully
- To bring back rhino hornbills to Singapore (following the success of the Oriental Pied Hornbill)
- To continue the relationship with National Parks, Jurong Bird Park and Marc Cremades
- To go through a proper science-based risk assessment before reintroduction
- To understand DRA for application to other projects with National Parks and Wildlife Reserves Singapore
- To help in any way we can
- To review the Oriental Pied Hornbill project
- To increase the standard of conservation projects
- To protect the health, safety and welfare of hornbills
- To understand the requirements and risk of the species.

Workshop Objectives

- Create an enjoyable and effective learning environment
- Introduce the concept and elements of the DRA process and how it helps to make better and more evidence-based, decisions.
- Model the facilitation of a collaborative wildlife DRA workshop
- Have participants work through a draft wildlife DRA focused on the rhinoceros hornbill reintroduction project
- Assist participants to develop an action plan to prepare for a full Conservation Planning workshop
- Obtain feedback on the structure, content and delivery of the workshop as a training exercise.

Assumptions

Richard outlined the following assumptions to ensure all participants understood what they could expect from this workshop:

- Everyone in this room understands this is a training workshop and
- That a full risk analysis requires a considerable amount of preparation and communication with all participants prior to the workshop and, therefore,
- The exercises we will go through are for demonstration purposes only and, although they may clarify some issues, will not represent a fully considered risk analysis.
- That everyone in the room has something useful to contribute

Working Agreement

All participants agreed to adopt the following guidelines to enable a collaborative environment and to maximize the value of the time spent together over the two days of the workshop.

- Leave all personal and institutional agendas at the door
- All ideas are valid
- Everything is recorded
- Everyone participates; no one dominates

- Listen to each other
- Treat each other with respect
- Differences and problems are acknowledged - not "worked"
- Observe time frames
- Complete draft report by end of workshop

Introduction to the IUCN-SSC Conservation Breeding Specialist Group (CBSG)

Richard Jakob-Hoff, Co-convener, CBSG-Australasia Network; Manager, Conservation Science and Research, Auckland Zoo, New Zealand.

The CBSG is part of the International Union for the Conservation of Nature (IUCN) Species Survival Commission (SSC) and has a membership of 7,000 volunteers working in almost every country worldwide providing technical advice for biodiversity conservation. The SSC has over 100 specialist groups, taxon and discipline-based, plus 4 task forces.
The headquarters of CBSG are in Minneapolis, Minnesota, USA but there are nine CBSG Regional Networks covering a large part of the globe. Richard Jakob-Hoff and Caroline Lees are Co-conveners of the Australasian CBSG Regional Network. In this role he has been leading an international team of authors and editors in the development of two documents on wildlife Disease Risk Analysis (DRA) to be published jointly by the IUCN and the World Organisation for Animal Health (OIE) later this year.

The CBSG's challenge is formulating methods to bring people together to exchange information, share ideas, and work together. This is achieved by practical application of the following philosophy:

- Broad stakeholder participation
- Consensus decision making
- Agreement on a common goal
- Encouraging the sharing of knowledge in experts' heads (ie unpublished)
- The workshop product is owned by participants
- Results are considered advisory
- CBSG acts as a neutral facilitator

The CBSG develops science-based tools and processes for wildlife conservation management planning. A core process is the Population and Habitat Viability Assessment (PHVA) workshop. Over 129 PHVA workshops have been conducted to date in all areas of the globe. This workshop process:

- Has an intense focus on a small set of species or populations
- Emphasizes broad stakeholder participation
- Uses structured methods for problem identification and analysis
- Uses working groups to develop and evaluate alternative management plans
- Are always held in the range country of the species at the invitation of and with full participation of local wildlife authorities

Disease Risk Analysis (DRA) is used either separate from, or as part of, a PHVA

- When disease is known to be a significant threatening factor
- When the impact of disease is unknown
- When wildlife translocations are part of the conservation management strategy
- When a structured science-based process of risk analysis is needed to identify, evaluate and plan to mitigate risks

Key Concepts of Risk Analysis

The following summarises background information provided prior to the practical exercises which followed the DRA framework illustrated in Figure 1:

Figure 1: The Disease Risk Analysis Framework

The wildlife DRA process, illustrated in Figure 1, follows an 'adaptive management' approach i.e. the process itself generates information that can help refine the understanding of the original problem and provide insights to improved methods of risk management.

Definitions

Risk Analysis (RA) is

- A tool for decision makers to insert science into policy
- A formal process for estimating the likelihood and consequences of adverse effects occurring in a specific population, taking into consideration exposure to potential hazards and the nature of their effects. Thrusfield (2007*) Veterinary Epidemiology. Third edition. Blackwell Science, Oxford p. 482*

Disease Risk Analysis (DRA) is

The application of risk analysis to:

1. Identify disease-causing agents (hazards) which may enter a specified animal population
2. Identify the likelihood of such introductions
3. Assess their consequences and

4. Identify the measures that may be applied to mitigate either the likelihood of introduction or the magnitude of consequences.

A Hazard is

In relation to disease:

A biological, chemical or physical agent in, or condition of, an animal or animal product with the potential to cause an adverse health effect.

In more general terms:

- Something causing danger, peril, risk, or difficulty *e.g. the many hazards of the big city*.
- The absence or lack of predictability; chance; uncertainty

The term comes from an old dicing game – a game of chance or risk.

Features of risk analyses involving wildlife

Complexity

Risk analyses involving wildlife always involve complexity:

- Biological: e.g. multi-factorial drivers of disease and multi-species interactions
- Technical: e.g. deficiency of published data, uncertain validity of diagnostic tests, unfamiliarity with analytical tools
- Social: e.g. multiple stakeholders with multiple viewpoints, priorities and concerns
- Political: e.g. need for support of key decision makers

Human factors influencing decision making and problem solving

- We all have biases and make unconscious assumptions
- We look for patterns in events
- We choose a pattern or interpretation with limited analysis
- We select data that support our preferences
- We ignore data that disagree with our preferences
- We start our analysis with conclusions- rather than defining our problems and needs
- Difficult to evaluate in our heads all the interactions in complex problems such as biological systems.
- Groups of people are more productive of ideas and more inclusive of options than individuals working alone.

See Jones MD 1995, The thinker's toolkit, Random House Inc.

Collaboration

Risk analysis can be done by single individuals working alone or in collaborative groups. Both approaches have their pros and cons as shown in Table 1:

Table 1: Pros and cons of conducting a risk analysis in isolation vs collaboration

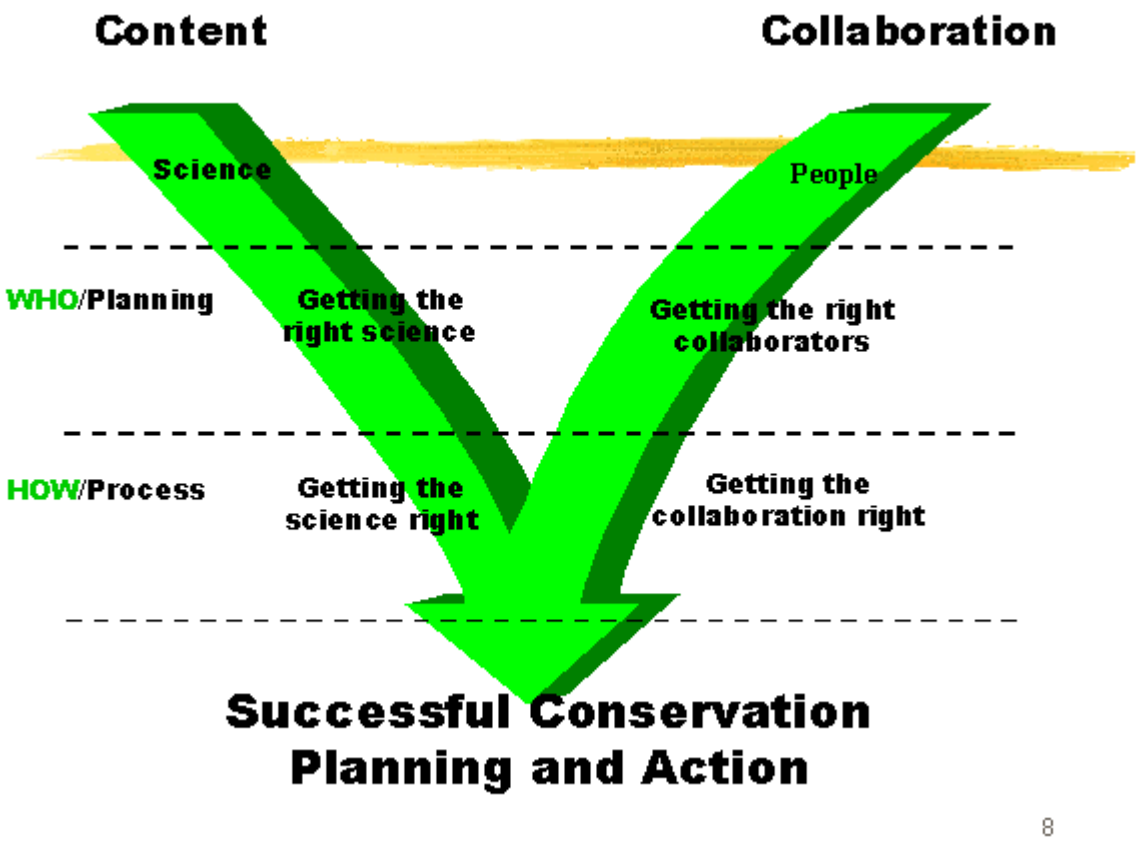
Working Alone		**Working in Collaboration**	
Pros	*Cons*	*Pros*	*Cons*
• rapid response to need • cheap • no disputes • relatively minimal effort	• Individual bias • knowledge/skill limitations • more prone to errors • less likely to get decision maker support • may alienate other stakeholders	• Broader understanding of problem • less influenced by individual bias • wider knowledge & skills • less prone to errors • more like to get stakeholder and decision maker support	• Slower • may be more expensive • can involve conflicts • significantly more effort

Transparency

The thinking behind every statement, decision and recommendation in a Risk Analysis should be clear to the reader. This is achieved by clearly stating all assumptions and limitations and the level of acceptable risk. For instance:

- Assumptions :
    - Selection and interpretation of diagnostic tests
    - Availability of sufficient suitable habitat
    - Intra- and inter-species interactions *in situ*
- Limitations:
    - Time
    - Access to information and expertise
    - Funds
- Acceptable risk:
    - Zero risk is not realistic ('no action' also carries risk)
    - Benefits vs risk discussed up front
    - Generally social and political in nature

Consequently thorough planning and risk analysis combines science with people as illustrated in the diagram below:



The DRA framework was followed and adapted to non-disease project hazards in the training workshop.

Training Exercises

Problem Description

The first step in the Risk Analysis process is to describe the problem for which the risk analysis is required. This step provides the broad context of the problem and asks "What is the specific question for this DRA and what kind of risk analysis is needed?" This was illustrated with an example focused on the risk of transmission of tuberculosis within an orangutan rehabilitation centre in Central Kalimantan, Borneo.

The group then applied these steps to the rhino hornbill reintroduction project as follows:

A. Context

A presentation prepared by Dr. Geoffrey Davison (National Parks) and Dr. Sonja Luz (WRS) summarized the project as follows:

Vision:

- A free-ranging Rhino Hornbill population in urban Singapore
- Improved sustainability of the forest (through presence of seed dispersers)
- Knowledge gained from each project component

Objectives:

- To successfully breed Rhino Hornbills in captivity
- To create a soft-released population in a semi-urban environment
- Through breeding and research, to understand the requirements and tolerance of the species towards a modified environment

Benefits:

- Reproductive experimentation under controlled conditions
- Long-term prospects for release (in Singapore or elsewhere i.e. Harapan Forest, Sumatra)
- If 'unsuccessful', lessons learnt
- If 'successful', significant conservation achievement, publicity, lessons learnt, prospects for duplication

Phasing:

	Phase	**WRS**	**Marc & Prof Soon Chye**	**N-Parks**
DRA	Pre-Implementation	Common vision, strategy and plan developed		
DRA		Birds	Protocol	Habitat improvement*
DRA	Captive breeding	Husbandry	Research	Venue
	DECISION MAKING	Breeding success?	Recommendations!	Suitable habitat?
	Offspring release	Handling	Research	Monitoring
	Consolidation	Exchange**	Research	Monitoring
	Wrap-up or follow-up	Common approach and decision***		

The Team
National Parks, Hornbill Project Singapore, Wildlife Reserves Singapore (Jurong Bird Park, Night Safari, River Safari, Singapore Zoo, Wildlife Reserves Singapore Conservation Fund)

B. Scope and Focus

To identify the scope and focus of the risk analysis the participants used post it notes to individually write down the issues they felt presented a risk to the success of this project and placed them on a white board surface while explaining them to the group. The group then sorted the notes into broad themes from which a brief descriptive statement of the issues was derived and agreed to. Each individual then identified the top three issues of concern to them and prioritized them on a scale where 3= high and 1 = low priority. The numbers of scores of 3, 2 and 1 against each issue were counted to give an overall priority ranking for the group as shown in the table in Appendix 2.

Thus the top five priority ranking by the group was as follows:
1. Availability of suitable habitat
2. Impact (of rhino hornbills) on local ecology
3. Conflicting concerns and opinions from stakeholders
4. Common agreement between partners
5. Captive breeding success

C. Question for this Risk Analysis:

The group agreed the following was the overall question to be addressed by the rhino hornbill risk analysis:

"Can Singapore Island provide a suitable habitat for a sustainable population of Rhino Hornbills?"

D. Assumptions (for success of the project)

1. Big trees (10-15m) are needed by the birds
2. Fruiting trees are needed to feed the birds
3. Trees with cavities are needed for nesting
4. The birds need a protein source in the form of small animals
5. The birds require minimum interaction with people
6. The habitat needs to have a minimum of predators (civet cats and monitor lizards)

E. Limitations

1. Incomplete information
2. Limited resources to collect the missing information
3. Available expertise
4. Time – the risk analysis needs to be completed within 12 months

Risk Communication

The second step in the risk analysis process was to identify all people and organizations with an interest in, or knowledge of value to, or who can influence the outcome of this project. Individual stakeholders may fulfill more than one of these categories.
A template was provided to help participants in the development of a preliminary stakeholder list and communications plan as shown below:

Project Stakeholders Communications Plan

Experts

Name	Organisation	Expertise	Information needs*	Communication methods**
Dr Shawn Lum	Nature Society Singapore	Local biodiversity and ecology	Technical information	Meeting
Pillai Ponswat	Hornbill Research Foundation Thailand	Field research	Summary information	Email
Alan Kemp	Hornbill Research Foundation Thailand	Field research	Summary information	Email
Dr Wee Yeow Chin	Bird Ecology Study Group	Local bird ecology	Technical information	Meeting
Dr Luis Neves	Jurong Bird Park	Captive management/breeding	All	Meeting
Mr Wong Tuan Wah	National Parks Board	Local ecology/conservation		
Marc Cremades	Singapore Hornbill Project	Hornbill biology/captive management		
Prof Ng Soon Chye	Singapore Hornbill Project	Reproductive biology		
Prof Peter Ng	Raffles Museum of Biodiversity Research	Local ecology		
Subaraj	Strix Wildlife Consultancy	Local ecology		

* eg Pre-workshop information – intentions, participants, project details, program
** eg e-mail , meetings, formal reports, press release etc

Influencers

Name	Organisation	Type of influence*	Information needs	Communication methods
	Nature Society Singapore	Public/political opinion		
	Agri-veterinary Authority of Singapore	Health control/political opinion		
	Animal Concerns Research and Education	Welfare/public opinion		

	Society ? (ACRES)			
	Bird Ecology Study Group	Bird ecology/public opinion		
Ria Tan	WildSingapore	Public opinion		
Sivasothi	National University of Singapore	Public opinion		
Prof Ng Soon Chye	Singapore Hornbill Project	Public opinion/Political influence		
Prof Tommy Koh	Ambassador-at-large	Public opinion/political influence		

*eg Decision maker, political, policy maker, community support etc

Other Stakeholders

Name	Organisation	Interest*	Information needs	Communication methods
	National Environment Agency	Human health		
	Public Utilities Board	Water catchment quality		
Corporate Communications department	WRS and NParks	Project promotion/communication		
Tan Chuan Jin	Ministry of National Development and Ministry of Manpower	Government Minister; policy concerns		
WRSCF Board	Wildlife Reserves Singapore Conservation Fund	Funder/local conservation		
WRS	Wildlife Reserves Singapore	Funder/partner		
NParks	National Parks Board	Funder/partner		
	Lady McNiece Foundation	Potential funder		
	Shaw Foundation	Potential funder		
Students/researchers	Varied	research		

*eg Media, sponsors, special interest groups, international collaborators, etc

Hazard Identification

The aim of this step is to identify all possible hazards to the issue of concern and to make an initial assessment of priority for further risk analysis.

An example was provided using a preliminary list of diseases of hornbills extracted from the *EAZA Hornbill Management and Husbandry Guidelines*, 1st Edition 2002, compiled by Wieke Galama, Catherine King and Koen Brouwer as follows:

Infectious	**Non-infectious**
Bacteria Pseudotuberculosis (Yersinia pseudotuberculosis Fungi Aspergillosis Candidiasis Parasites Nematodes (Syngamus, Ascaris, Trichostrongylus, Strongyloides)	Metabolic/Nutritional Haemochromatosis (Iron storage disease) Neoplasia (cancer) Squamous cell carcinoma of the casque Toxins Heavy metals (lead, zinc) Rodenticides Trauma Bill and casque injuries Predation Snakes, civets, wild boar, leopard cat, feral dogs Malformations Genetic, developmental, nutritional, trauma?

A process of paired ranking was demonstrated. This is a tool for group prioritization and decision making in which the likelihood and consequence of each hazard is systematically compared and ranked against each of the other hazards according to agreed selection criteria. To ensure transparency, the reasons for the choices made are explained as shown below for three of the diseases selected from the table above:

1. List diseases of hornbills	**2. Select ranking criteria**	**3. Compare disease 1 to disease 2**	**4. Compare disease 1 to disease 3**	**5. Compare disease 2 to disease 3**	**6. Count up the X's to establish the rank order**
Yersiniosis Aspergillosis Gape worm	Impact on population (likelihood x consequence)	Yersiniosis X Aspergillosis Gape worm	Yersiniosis XX Aspergillosis Gape worm	Yersiniosis Aspergillosis Gape worm X	Yersiniosis 2 Aspergillosis 0 Gape worm 1

In the above, in descending order of impact on the population, the diseases are ranked 1. Yersiniosis, 2, Gapeworm, 3. Aspergillossis.

Explanation of ranking

- Yersiniosis is more contagious and has a higher mortality rate than either of the other two diseases and will therefore have a greater negative impact on the population
- Gapeworm is more contagious than Aspergillosis and has a higher morbidity and mortality rate (especially for chicks) and can therefore have a greater population-level impact than Aspergillosis which is generally a sporadic infection affecting single birds.

For the purposes of this training exercise, the group decided to examine the hazards associated with one of the highest ranking issues identified in the Problem Description step:

Issue: Impact of Rhino Hornbills on Local Ecology

Hazard	**Paired ranking score**	**Rank**
Predation of threatened species eg reptiles and amphibians	6	1
Seed dispersal*	4	2
Disease transmission	4	2
Affect on breeding of other bird species	4	2
Competition for nest sites	3	3
Pest control (positive impact)	2	4
Depletion of food supply	0	5

***** Debatable whether seed dispersal is pro or con. Pro if RH disperses native plants, con if RH disperses non-native plants. Here ranked as a positive impact

Explanation of top rank: Predation of local threatened species

a) Singapore has many species that are nationally endangered
b) This is a concern of some groups including general public and nature interest groups
c) During breeding season Rhino Hornbills will start foraging for animal protein sources

Explanations for the lower rankings would be added here.

Research Gaps Identified

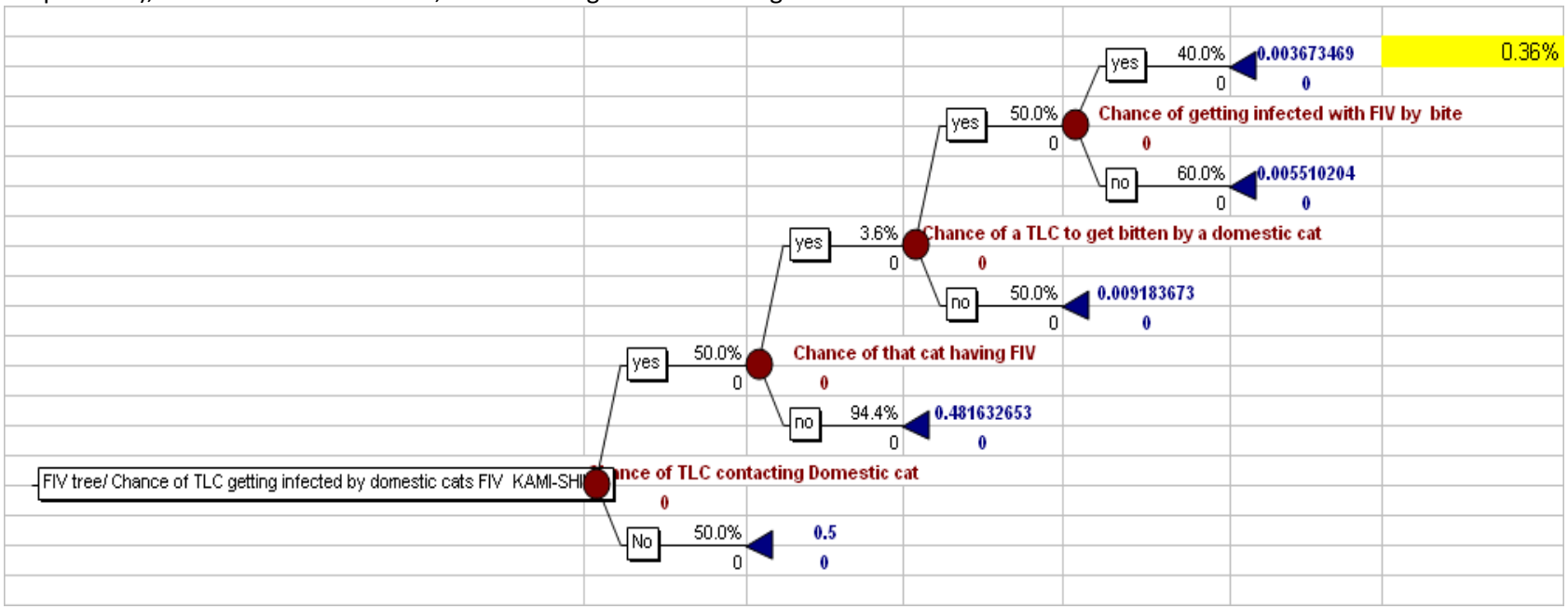
1. What is the minimum habitat size for a sustainable population?
2. Will rhinoceros hornbills use fragmented habitat?
3. How can a Singapore rhinoceros hornbill population link with the regional population?

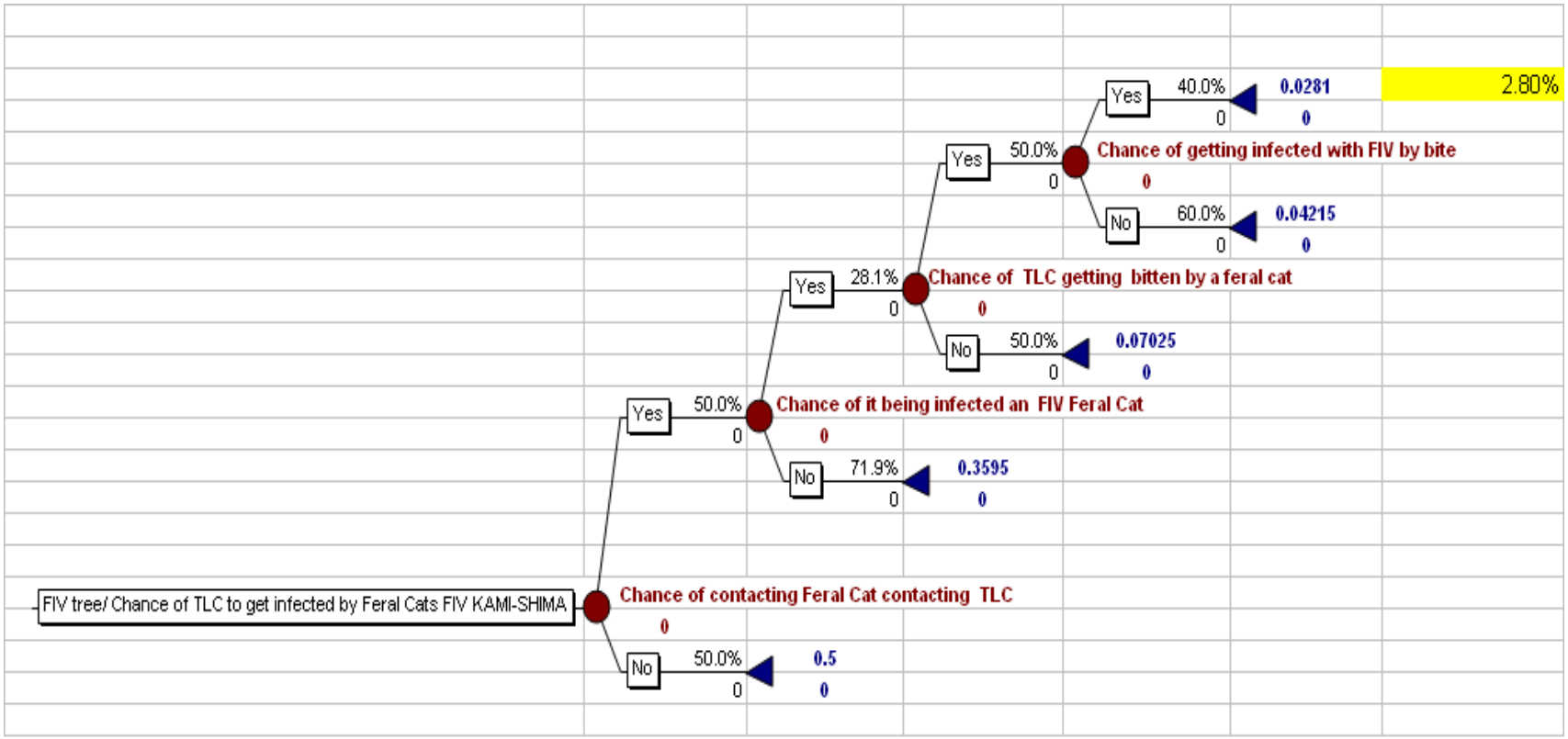
Risk Assessment

The Risk Assessment step provides an analysis of the likelihood and consequences of an identified hazard occurring within an identified pathway. The following background and example was provided prior to practicing this step on the rhino hornbill project.

- Most wildlife-related risk assessment are qualitative due to a lack of quantifiable data
- Even when quantitative data is available an initial qualitative assessment is usually done
- Where numerical data is available quantitative tools can help to provide relative risk assessments and sharpen thinking in comparing the likelihood and consequences of varying scenarios

For instance, in the case of the critically endangered Tsushima Leopard Cat (TLC), some surveillance data was available that provided an estimate of the frequency of TLC and domestic and feral cat exposure to Feline Immunodeficiency Virus (FIV). These figures could be incorporated into a decision tree to help identify where resources could be most effectively directed for risk management. Where no numerical data was available to assess probabilities within the decision tree, the expertise in the risk analysis group was used to make a judgment. Precision Tree (Palisade Corporation), a Microsoft Excel add-on, was used to generate the diagrams below:





(0.5 x 0.036 x 0.5 x 0.4 x 100 = 0.36%)

Although this tool does not provide absolute answers, it was clear in the example above that the likelihood of a TLC being exposed to FIV by feral cat (2.8%) was much greater than from a domestic cat (0.36%).

As disease transmission had not been considered a high priority hazard for the rhino hornbill project, the group chose to apply a risk assessment approach to a hazard identified as of high concern in the Problem Identification step:

Identified Hazard to the Rhino hornbill project: Conflicting Opinions and Concerns from Stakeholders

The group listed the concerns that they felt were held by a range of stakeholders and then matched the concerns with the various stakeholder groups they identified. The number of times the same concern was allocated to the different stakeholders was counted to see how broadly the different concerns were thought to be shared. (Note that Wildlife Reserves Singapore and National Parks, who were represented in the room, shared all of these concerns to some extent).

Concerns	Stakeholders and associated concerns
1. Impact on local ecology/Oriental Pied Hornbill 2. Disease transmission 3. Animal welfare 4. Public nuisance 5. Funding 6. Better uses of funds 7. Bad publicity 8. Choice of species 9. Clarity of roles 10. Insufficient supporting data 11. Long term land management 12. No environmental impact assessment	Nature Society (1, 2, 3, 6, 8, 10, 12) General public (1, 2, 3, 4, 5, 6, 8, 11) AVA (2, 4, 7, 9) NEA (2, 4, 9) PUB (2, 4, 9) ACRES (2, 3, 4, 7, 8) NGOs (1, 2, 4, 5, 6, 7, 10, 12) Researchers (1, 2, 3, 5, 8, 10, 12) WRS (1-12) NParks (1-12) Media (4, 5, 7, 10, 11, 12) Army (2, 4, 7, 8, 11) Local Farmers Association (2, 4, 8, 11) Singapore Land Authority (1, 4, 7, 11) Istana Office (1, 7, 8)

Number of stakeholders that are thought to share the concerns listed above are:

Concern	Number of stakeholders sharing this concer
Public nuisance	12
Disease transmission	11
Impact on local ecology/Oriental Pied Hornbill	8
Bad publicity	9
Choice of species	9
Animal welfare	7
Long term land management	7
Funding	6
Insufficient supporting data	6
Better use of money	5
Clarity of roles	5
No environmental risk assessment	5

This exercise helped to identify the specific areas of concern and the range of stakeholders thought, by the group, to have these concerns. It was agreed that this hazard required more data to assess the magnitude of the perceived risk and develop an appropriate risk management strategy.

This data could be obtained through a survey of the identified stakeholders to find out if the perceived concerns matched those expressed by survey respondents. Such a survey should avoid pre-empting responses by using open questions such as "Do you have any concerns regard the re-introduction of rhino hornbills to Singapore? YES/NO. If yes, please explain. Stakeholders should also be given the opportunity to express their positive views about the project.

It was noted that, prior to the survey the stakeholders could be ranked according to their level of influence so that a communications strategy can be developed that took this into account.

Risk Management

This step looks at what can be done to decrease the likelihood of a hazardous event and what can be done to reduce the implications once a hazardous event has occurred?
A risk management option decision matrix was discussed but not found to be helpful in the context of the rhino hornbill project.

An alternative (not discussed at the workshop but provided here for information) is to assess a range of risk management options according to their feasibility and effectiveness. The *feasibility* takes into consideration technical, operational and economic factors and the cultural, ethical and political acceptability of each risk management option. The *effectiveness* is the degree to which each option reduces the likelihood or magnitude of the potential adverse consequences of the hazard. The table below provides a guide to a qualitative option evaluation using a scale of High(H), Medium (M) and Low (L).

Option	Feasibility	Effectiveness	Decision
A	H	H	Yes
B	H	M	Possible
C	H	L	No
D	M	H	Yes
E	M	M	Possible
F	M	L	No
G	L	H	Possible
H	L	M	No
I	L	L	No

In this table, options with a high to medium feasibility and high effectiveness (A & D) are the most desirable options. An option with low feasibility but high effectiveness (G) might be considered but would probably need further investigation before making a decision.

The group modified a template provided to capture the essential details of a risk management action plan for two hazards identified in the previous steps as shown below.

Hazard Management Action Plan

Hazard	**Strategy**	**Actions (what)**	**Responsibility**	**Deadline**	**Resources needed**
Conflicting opinions and concerns of stakeholders	Pre-workshop engagement with stakeholders, with special attention to influencers. eg. Survey, and/or hold individual meetings	1. Identify stakeholders and contact details of individuals 2. Develop communications plan 3. Implement	Sonja	December 2013	Manpower, Funding
Hazard	**Strategy**	**Actions (what)**	**Responsibility**	**Deadline**	**Resources needed**
Lack of breeding success	Bring in another RH pair Apply best-practice husbandry Research breeding behaviours	1. Discussion and negotiation with RH owners 2. Document best-practice husbandry and assess against current practices (JBP) 3. Apply necessary changes (DF) 4. Ongoing monitoring	1. Marc 2 - 4 Luis/Marc	1. December 2015 2. End September 2013 3. End November 2013	1. Funding, commitment of partners 2-4 Funding, manpower

Implementation and Review

This step clarifies how the agreed risk management actions will be implemented and how their effectiveness will be monitored and evaluated. A template was used by the group to capture this information for the hazards considered in the previous step.

Overall Aim: Reintroduction of the rhinoceros hornbill into Singapore

Hazard	Rationale	Strategy	Evaluation questions	Source of evaluation data
Conflicting opinions and concerns of stakeholders	Disagreement of stakeholders could compromise success of project	1. Pre-workshop engagement with stakeholders, with special attention to influencers. eg. Survey, individual meetings 2. Clarity and transparency to stakeholders	1. Did pre-workshop engagement take place? 2. Do we have the support of most/all the stakeholders? 3. Was clarity and transparency achieved?	1. Organisers' records 2. Feedback survey of stakeholders 3. Feedback survey of stakeholders
Lack of breeding success	Lack of breeding success of Jurong Bird Park pair could mean early termination of project	1. Bring in another RH pair 2. Apply best-practice husbandry 3. Research breeding behaviours	1. Were they brought in? 2. Was best-practice husbandry applied? 3. Was research conducted?	1. Organisers' records 2. Manager's evaluation 3. Organisers' records

In this table the Rationale provides transparency by ensuring that everyone involved understands why this hazard is of concern. The formulation of evaluation questions enable the source of data to answer each question is identified and can be incorporated from the outset into the planning of the implementation program.

Group Discussion: What kind of workshop is needed for the rhinoceros hornbill reintroduction project?

Having completed the training exercises the group discussed the type of planning workshop that would be most useful in light of the issues identified associated with the reintroduction of rhinoceros hornbills into Singapore. As disease threats were only one concern and the larger concerns were associated with habitat and population viability and socio-political issues, it was agreed that a Population and Habitat Viability Assessment (PHVA), which could include a DRA, would be most appropriate.

Consequently the following information was provided to assist in planning such a workshop for early 2014:

Stage 0: Initiation of the Workshop

- Contact potential convener
- Develop statement of purpose
- Map out Political Scene
- Identify Key players/stakeholders
- Provide reference material
- Obtain funding

Stage 1: Pre-workshop information session

- Formal global conservation presentation to participants, donors, organizers
- Visit field site
- Informal discussion
- Selection of key stakeholders to invite
- Further explore political and social dynamics

Stage 2: Pre-workshop organization

- Encourage active participation of host wildlife authority
- Send out invitations
- Prepare briefing book
- Confirm logistics
- Prepare draft agenda
- Locate facilitators
- Potential data gathering (PRA)

Stage 3: Introduction to workshop

- Informal briefing meeting with workshop leaders
- Opening ceremony
- PHVA evaluation questionnaire
- Present workshop process guidelines
- Introduce issues process: stakeholder needs assessment/ expectations and goals/ issues
- Presentations from local experts
- Population biology overview
- Important process note: working groups should begin by the end of the first day

Stage 4: Introduction to Vortex (and DRA if required)

- Formal presentation vs. working session (depending on size of the group)
- Introduction of modeling concepts
- Demonstration of vortex
- Gaining acceptance of modeling process and results.

Stage 5: Small group work

- Identify working group topics (predetermined with workshop organizers or emerging from issues identification)
- Select working group facilitators

- Identify group roles
- Begin Analysis
- Formulate long and short term goals
- Generate alternatives and criteria
- Formulate recommendations
- Repeated reports to plenary

Stage 6: Workshop wrap-up

- Distribute draft working group reports
- Develop recommendations and seek consensus in plenary
- Follow-up questionnaire
- Formal closing

To begin the planning process the group began to complete a workshop preparation action plan:

Workshop Preparation Action Plan

Stage	Tasks	Strategy (how)	Actions (what)	Responsibility	Deadline	Resources needed
Workshop initiation	Appoint convenor and organising committee	WRS CEO approval required WRS takes the lead with support of NParks Sonja requires approval to take on Convenor role Identify members of the organising committee and confirm appointment	Make a proposal to the WRS CEO Approach candidates and obtain their commitment eg Geoffrey Davidson	Sonja	Sept 2013	WSCF Board meeting
	Develop statement of purpose	Identify a core group to develop a statement of purpose and seek relevant input	Make point that this workshop has wider application to wildlife management but the focus of this one is the RH reintroduction project	Sonja	August 2013	Input of the identified group
	Identify political issues	Discussion by organising group with relevant input	Include this in the agenda of the organising group meeting	Sonja	Sept 2013	Input of people with relevant knowledge
	Identify key players and stakeholders	Use outputs of the DRA Training Workshop	Refine and add detail to those outputs	Organising Ctee	October 2013	Time allocated
	Provide reference material	Identify information needs and assemble	Include this in the agenda of the organising group meeting	Organising Ctee	October 2013	Time allocated
	Obtain funding	Proposal to WSRCF and NParks	Draft a budget Make proposal and obtain approval	Organising Ctee	October 2013	Time allocated WRSCF board meeting

Reflections Exercise

Each participant reflected on the workshop and answered three questions put to the group.

1. **What was useful?**

- Now we have a well-tested science-based framework and international process
- Can follow to make decisions easier and to move forward with confidence in conservation projects
- Means we can defend and justify any public opinions
- To know we have done due diligence
- To have the tools to handle a problem
- To understand the risk analysis process and its complexities
- To get everybody on one page and understand the process
- Group contributed positively and communicated issues
- Process to rank concerns instead of lumping them all together
- Acceptable risks and adaptive management protocol
- Different organisations, but coming together, gives different points of view to ensure most things are covered
- Often will respond to problems with knee-jerk solutions, whereas this gives a clear structure
- Putting structure to brainstorming
- Understand the project better to support student research
- Better equipped to communicate the project to external parties
- Everybody more comfortable about the project and justifying it to management
- Forced to go into detail to define issues
- Something closest to an environmental impact assessment in Singapore, potential for applying this in other projects
- To be disciplined enough to follow a systematic structure

2. **What did you learn?**

- That it will be challenging
- Unsure whether we have the capacity to go through the whole process
- That we have to be global in our analyses
- That the analysis is not limited to diseases
- We must be committed in following-through
- Still a bit confusing so next time need to fit this framework into what we want in a project

3. **What issues arose?**

- Can we succeed to bring enough participants for a suitable workshop?
- That perhaps a PHVA is more appropriate than a DRA
- Do we have sufficient data and expertise to support?
- We must all work together/collaborate and each individual feeding into the process
- Limited research. How to find expertise to look into each issue? Who is going to do the research on collecting data gaps?
- Everybody in the group is on the same page but we also disagree so having other stakeholders joining will multiply these differences
- Personal knowledge in understanding the entire process
- Perhaps not have such a detailed workshop, potentially too complex for other projects

- Four days is long for senior staff – perhaps have senior staff in first day or two, then all staff attend entire process

Appendix 1: Workshop program

24 July 2013

09.00	Opening and welcome
09.10	Introductions
09.40	Program overview and Workshop goal agreement and objectives
09.55	Working agreement
10.00	Morning tea
10.15	Introduction to CBSG and its PHVA and DRA Processes
11.30	Key concepts and structure of Risk Analysis
12.00PM	LUNCH
1.15	Background and overview of the Rhinoceros Hornbill Reintroduction Project
1.30	Group set up and allocation of roles
1.40	Problem description talk
2.00	**Exercise 1**: Problem description including overall goal of risk analysis and key issues identification
2.30	Group discussion
3.00	Afternoon tea
3.20	Risk communication talk
3.50	**Exercise 2**: Risk Communication
4. 50	Group discussion
5.00	End of day

25 July 2013

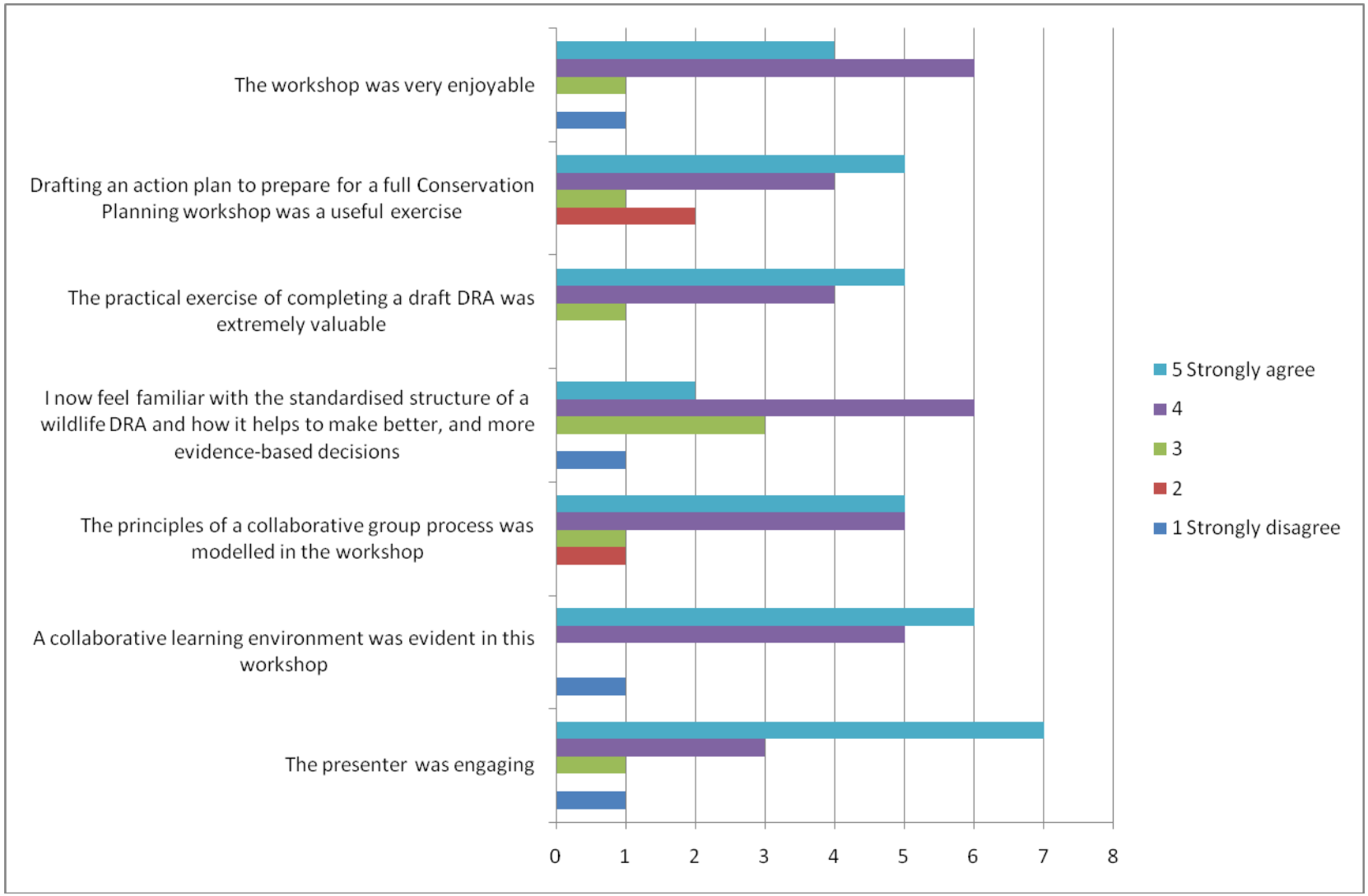
09.00	Announcements and review of previous day
09.20	Hazard identification talk
09.35	**Exercise 3**: Hazard identification and paired ranking
10.05	Group discussion
10.15	Risk assessment talk
10.30	Morning tea
10.45	**Exercise 4**: Risk assessment
11.45	Group Discussion
12.10	Risk management talk
12.30	LUNCH
1.30	**Exercise 5**: Risk management: Option ID and evaluation
2.00	Implementation and Review talk
2.15	**Exercise 6**: Implementation and Review
2.45	Group discussion
3.00	Afternoon tea
3.20	Group discussion: What kind of planning workshop is needed for the rhinoceros hornbill project?
3.40	Review of preparation for the planning workshop
4.00	Action plan for the planning workshop
4.30	**Exercise 7:** Training Workshop Reflections
4.45	**Exercise 8**: Workshop evaluation
5.00	Workshop ends with closing waiata by participants

Appendix 2: Rhino hornbill issues identification and ranking

Table 2: Issues identified by the group:

Group Rank	Issue	3 Count	(x 3)	2 Count	(x2)	1 Count	(x1)	Overall Score 3+2+1
1	Availability of a suitable habitat	7	21	0	0	2	2	32
2	Impact on local ecology	0	0	6	12	0	0	18
3	Conflicting opinions and concerns from stakeholders	0	0	3	6	2	2	13
4	Common agreement between partners	1	3	1	2	2	2	11
5	Captive breeding success	0	0	2	4	2	2	10
	Illegal capture of released hornbills	0	0	0	0	0	0	0
	Risk of disease transmission	1	3	0	0	0	0	4
	Security of captive birds	0	0	0	0	0	0	0
	Funding for long-term support	2	6	0	0	0	0	8
	Lack of biology information	0	0	0	0	2	2	4
	Impact of failure on future projects	0	0	0	0	1	1	2

Appendix 3: Workshop Evaluation Results



CONSERVATION BREEDING SPECIALIST GROUP

Auckland ZOO

Evaluation Comments

Ways in which future workshops could be improved?

- Too much time spent on debating the details of the draft, since this is essentially a training program and the draft was an exercise
- Maybe after every two sections or so, refer back to the entire structure (DRA framework) so it will be less confusing
- Nil. This workshop is well organised
- Larger number of participants
- Planning it to be more specific for it to be DRA/PHVA
- It was a little dry although informative. Not sure if more interactivity, video, sound etc could be incorporated if and when relevant
- Could add a slide on the summary of the workflow so that the whole process could be understood clearer
- Could directly ask quieter participants what they think as was dominated by a few. Could be a one day workshop with less time spent on each activity

1. **Any other comments about the workshop?**

- I would like to visit the Auckland Zoo!
- Richard is patient and makes participants feel valued. He is also willing to admit any mistakes made, instead of excusing them
- Thanks for the chocolates!
- Appreciate it if more time could be given to inform us of the workshop so that we can plan our other meetings
- The poor number of participants
- Very helpful to understand
- We should encourage more like-minded people to participate in this workshop. There are enough relevant participants to fill this room
- The workshop provided a very conducive environment for discussion. Richard makes a perfect facilitator to bring everyone together
- Energy dropped on the second day - best bit was sticky note brainstorm! Great facilitator/speaker - thanks!