

The Group
Management Initiative

STRATEGIC FRAMEWORK

with plans for January 2023 - December 2024



Smithsonian
National Zoological Park
Conservation Biology Institute



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Introduction

The Need

Group-based population management (or “group management” for short) consists of genetic and demographic management of populations to reach defined goals, for any species in which data may be collected and/or management actions conducted only on groups of organisms, rather than at the individual level. Group management may comprise many different elements, but examples may include moving salamanders between populations to minimize their group mean kinships (Jimenez-Mena et al. 2016); increasing production of certain fish lines to equalize representation among founders (Bailey et al. 2019); or implementing rotational breeding to minimize inbreeding in frog populations (Lees et al. 2013).

Group management may take place across the spectrum of management intensity, from closely managed ex situ populations in human care, to lightly managed in situ populations in essentially natural conditions. Eventually, tools and methods for group management may need to be integrated across this entire in situ to ex situ spectrum (“pan situ”) for effective conservation. However, because of the enormity of that scope, at present we focus at the ex situ end of the spectrum, up to and including reintroductions, leaving the important task of greater integration with in situ management for future iterations of this document.

Although potentially useful for many species and conservation challenges, scientifically-based group management is not currently in wide use in species conservation. In animals, intensive population management is presently conducted largely at the individual level, and relies on individual IDs, known pedigrees, and mate-specific breeding recommendations (Ballou et al. 2010). However, many animals managed in schools, flocks, colonies or other groups cannot be managed effectively at the individual level for economic, biological, welfare, or other reasons, and so are not served well by current standard management in animals. In plants, some population management is conducted at the group level, in seed banks and other collections, but current tools and methods in some cases are insufficient for reaching the conservation goals that stakeholders envision (Fant et al. 2016).

Learning across these realms has been limited, and although several approaches to group management have been developed in the scientific literature (e.g., Sonesson & Weuwissen 2001; Wang 2004), they are not widely known and are not implemented in user-friendly tools and methods that are readily available to species managers.

In combination, this situation leaves many of the world's most imperiled taxa – including many fish, plants, arthropods, amphibians, corals, and many others – without the group-based population management needed to reduce their risk of extinction. The need for tools and methods for group management has been recognized since at least 20 years ago, when two scientific meetings were organized on the subject (Mace et al. 1998; Smith 2002), and members of the International Union for Conservation of Nature (IUCN) continue to acknowledge the importance of providing such tools and methods to support conservation in all species that need it, across the management spectrum (IUCN 2020).

A renewed effort to effectively address the challenges in group management began in late 2019, and actively continues as a voluntary collaboration among practitioners, managers, scientists, and other stakeholders that in August of 2020 decided to call themselves, the “Group Management Initiative” (GMI; Rodriguez-Clark & Traylor-Holzer 2020).



The Group Management Initiative (GMI)

The present document will not only guide us in addressing needs, it will support GMI's current lean structure, which emphasizes efficiency and flexibility with minimal administration. Organized during the global COVID-19 pandemic, GMI's efforts have been conducted entirely virtually to date, allowing unique collaborations across countries, disciplines, and taxonomic groups. GMI currently consists of a Director and a Steering Committee of practitioners and scientists from around the world (see Appendix 2), which set GMI's direction and lead many activities.

GMI members consist of ~70 additional practitioners, scientists, and other stakeholders, who volunteer their time to collaborate in and/or lead short-term teams to accomplish particular tasks. In this document we use the word "team" consistently to refer to these short-term collaborative groups, which are disbanded once their tasks are completed. An even wider set of ~150 participants have contributed to three virtual plenary events to date, and have expressed interest in using GMI products and in collaborating on future activities. Active GMI's participants are those who have elected to interact with GMI via a closed online wiki-style portal, built with the Confluence platform.

Together, this collection of people will use this Framework and Strategic Plan to set priorities, build support, explain their work to others, secure funding, and most importantly guide work to ensure that all collaborators understand how their activities join together to reach a common vision.

Critiques of initial statements suggested that they were not lofty enough, overused words (such as “management”), or focused too much on how to reach a desired endpoint, rather than on the endpoint itself. In the final version, words specifically defining genetics were excluded, as group-based population management transcends genetics to include other broad areas. The final vision statement was adopted by unanimous acclaim of the 54 participants in the August 2020 meeting.



The GMI Strategic Framework and 2023-2024 Plan

The purpose of this Framework is to guide GMI activities in order to successfully realize our overall vision -- or more colloquially, “to get where we want to end up.” The Framework does this by identifying goals -- the logical landmarks en route to that final destination – and it breaks those large goals down into smaller, operational objectives that must be met in order for those goals to be achieved. Each goal summary is followed by a full goal statement. All goal statements describe an overall desired state to reach (and not how it will be reached), thus with a focus on the noun that describes the goal. Similarly, objectives break goals down into intermediate states to reach, with a focus on what is to be achieved rather than how it is to be achieved. Although the objectives appear in a logical order to enhance understanding, they do not all necessarily need to be completed in the order presented, and indeed many have already been achieved and/or are being worked on simultaneously and in a different order.

We developed the Framework using processes developed by IUCN’s Conservation Planning Specialist Group (CPSG). First, in January 2021, we used digital surveys to collect information from GMI members about the challenges and barriers they perceived in achieving our vision, and about goals they wished to set. Two short-term teams, the Goals and Challenges teams (Appendix 2) then examined and organized this input, and proposed a draft structure for goals based on the Open Standards for the Practice of Conservation (Conservation Measures Partnership 2013) (Figure 2). Then, we placed draft goal statements on online whiteboards, and in March 2021 met in a plenary workshop of 42 participants to refine goal statements, to develop objectives for each goal, and to ensure that each challenge identified would be addressed by reaching at least one objective.



Figure 2. GMI structure for goals based on the Open Standards for the Practice of Conservation (Conservation Measures Partnership 2013).

In 2021 and 2022, another short-term team, the Strategic Plan team, took the whiteboard content, and turned it into the present document, taking it through several drafts that were reviewed and edited by short-term team members and the Steering Committee (Appendix 2).

Finally, in October 2022 we provided the draft Framework and Plan to participants in CPSG's Annual Meeting as briefing materials for a working group session.

Twenty-one session participants from five continents met virtually to validate the previously-developed goals and accompanying objectives, and to brainstorm additional action items for key upcoming objectives. Following a plenary session to introduce the draft document, three questions guided a second session of breakout rooms, in which we discussed ideas and developed additional action items, using an online whiteboard for collaborative work.

The questions we focused on, for tools and methods for group management, were: a) How do we identify key performance criteria?; b) How will we build these to select approaches for group management?; and c) How will we build these to apply group management? Participants suggested just a few adjustments to draft objectives, and developed more than 50 new actions to answer these questions, which editors worked into the final version.

In addition to specifying goals and objectives, this Framework identifies the actions that need to be taken to achieve objectives. Actions all start with a verb, and indicate how a given objective will be reached. Responsible and collaborating parties are indicated with a description of their role, or where appropriate with initials (full names are listed in Appendix 3).

Some actions have already been taken to achieve objectives, and are recorded in this Framework to track overall progress. However, other actions that are underway or have targets to be completed in the next two years, **in particular those that comprise the current GMI “Strategic Plan,” are highlighted in green, and are to be executed January 2023 – December 2024.**

For actions that have been completed or that have specific target dates, we also identify a series of details that make the actions “SMART:” Specific, Measurable, Assignable, and Relevant, in addition to Time-bound (using a modification of Doran 1981). Listing the responsible and collaborating parties for each action makes them Assignable. Listing the Output, (the concrete products of the actions), makes them Specific and Measurable, while listing the larger Outcome that this Output engenders then ensures that actions are Relevant to the overall Objective.

Finally, some actions listed below have no specific timelines yet because they lack key elements required for execution (results from earlier actions, a champion, funding etc.). These are included in the current Framework in draft form so that they may be incorporated into future Strategic Plans.

Draft actions are subject to change and are presented in gray, and without SMART details, which remain to be developed. These may be edited or deleted in the future, and new actions may be added. Because actions are undertaken by many different stakeholders and institutions, balancing their own needs and interests with those of advancing group management, this adaptive approach is essential for maintaining momentum, maximizing collaborative efficiency, and minimizing wheel-reinvention. Momentum is further maintained by the organizational culture we have deliberately adopted and promoted, of collaborating whenever possible to achieve our joint vision and communicating advances via a shared wiki online platform.

Thus, to continue toward our shared vision while adapting to changing circumstances, (including funding, participants, and scientific developments), future short-term Strategic Plans will be updated periodically with corresponding Actions and SMART details, even while the overall Strategic Framework remains stable.





GOAL 1

ASSESS

GMI has developed a critical understanding of stakeholder needs and the current theory and practice in group management.

Background to Goal 1

Group-based population management is needed in a broad array of contexts and species, and so identifying and engaging with a broad spectrum of stakeholders is critical to: a) forming a thorough understanding of the needs related to population management of different types of taxa in different types of group management ‘environments’ and for different purposes; b) ensuring that methods and tools developed are effective in addressing these needs while also feasible in terms of complexity and resource use; and c) improving the uptake and engagement with methods, tools and guidance developed by GMI.

Stakeholder groups may include any of the following involved in population management: government natural resource management agencies; employees of aquarium, botanic garden and zoological institutions and their regional associations; zoo and aquarium registrars associations/working groups; breeders or researchers in livestock or other agricultural/aquacultural species; software companies such as Tracks, Species360, and the Species Conservation Toolkit Initiative; IUCN SSC taxonomic specialist groups and thematic groups such as the Conservation Genetics Specialist Group and the Conservation Translocation Specialist Group; academia, particularly groups managing populations of group-managed experimental organisms or carrying out group management for conservation research; research institutes; NGOs and conservation projects carrying out group management in the context of species conservation; and others.

The following objectives break down the overall goal of developing an understanding of needs and of the current state of group management, and in the process the objectives aim to produce a handful of products. These include: 1) internal, informal products (such as lists of species that are at risk, and will likely require some level of group management for their conservation); 2) freely-shared products (such as a ‘how-to’ group management guidelines, which summarizes the current state of best practices for group management, and will be updated as advances are made); 3) formal scientific publications (such as a review paper which analyzes how different program factors may influence which of the many existing group management strategies is applied).

Goal 1 Objectives & Actions

Objective 1.1: Stakeholders needing or interested in group management have been identified, and their representatives are actively working on GMI goals and objectives.

	ACTION	RESPONSIBLE	COLLABORATING	OUTPUT	OUTCOME	TIMELINE & STATUS
1.1.1	Develop a shared understanding of the species/taxa likely to benefit from group management.	KRC, Steering Committee.	Briefing material authors, October 2020 CPSG annual meeting breakout participants.	Briefing materials for October 2020 CPSG annual meeting, and results of taxon-focused breakout rooms available to all GMI members on Confluence platform.	GMI members are aware of the broad range of species and circumstances in which group management may be useful.	September 2020 briefing materials distributed; October 2020 breakout rooms held; November 2020 all meeting materials shared on Confluence platform. [Completed].
1.1.2	Identify the primary people and organizations worldwide that are, or want to be, engaged with group management, recognizing that in some cases knowledge of basic management may be absent.	KRC, Steering Committee.	GMI participants and their networks.	Spreadsheet of key stakeholders & types of stakeholders available to GMI participants.	GMI Members are aware of the range of stakeholders and are able to contact them. Director has input needed for Obj. 2.3.1.	2020 First draft shared on Confluence platform. [Completed; updates ongoing & included in Goal 6].
1.1.3	Engage stakeholders in GMI activities, aiming for taxonomic and geographic representation, via invitation, ongoing communication, follow-up, and group decision-making and responsibility-sharing.	KRC, Steering Committee, & short-term team leaders.	GMI participants and their networks.	Individuals representing the stakeholder groups incorporated in the GMI.	Stakeholder groups are engaged at all levels of GMI activities via co-creation and shared responsibility, ensuring their group management needs are understood and included.	2020-2022 [Completed; Updates ongoing & included in Goal 6].

Objective 1.2: Stakeholder needs have been elicited, analyzed, and presented so that they are available to GMI Members.

	ACTION	RESPONSIBLE	COLLABORATING	OUTPUT	OUTCOME	TIMELINE & STATUS
1.2.1	Elicit and organize needs for group management from taxon-specific stakeholders.	KTH and facilitators of October 2020 breakout rooms.	Participants in October 2020 CPSG annual meeting working groups.	Breakout room reports, 2020 Annual Meeting detailed report on Confluence platform and CPSG website.	First draft of group management needs by taxonomic group is available to GMI members.	December 2020 [Completed].
1.2.2	Elicit and organize challenges preventing the application of group-based management as perceived by practitioner, developer, and scientific stakeholders.	EF.	KL, RO.	A detailed list of stakeholder challenges as well as a conceptual framework in which to organize them.	GMI members understand challenges more clearly and can work with them in subsequent stages.	February 2021 [Completed].
1.2.3	Update drafts of needs and challenges, organize a logical framework of needs & challenges in taxonomic or regional groups, as needed.	To be determined.	To be determined.	List of needs by taxon and/or region, & causal flow diagram to facilitate identification of effective intervention points.	Needs and challenges are available as inputs for developing performance criteria (Obj. 2.1).	Target 2023.



Credits: Oryx dammah, Fossil Rim Wildlife Center.

Objective 1.3: The current state of science and practice of group management has been reviewed, and the open questions and problems that persist in this area have been identified and clarified in the minds of GMI members.

	ACTION	RESPONSIBLE	COLLABORATING	OUTPUT	OUTCOME	TIMELINE & STATUS
1.3.1	Review status, open questions and problems in Data & Standards as they relate to group management.	KSE.	Data & Standards team members.	Final Data & Standards review briefing document shared on GMI online platform.	Current status of data & standards in group management is available to active GMI participants.	2019-2020 [Completed July 2020].
1.3.2	Review status, open questions and problems in Theory & Simulations as they relate to group management.	PH.	Theory & Simulations team members.	Final Theory & Simulations review briefing document shared on GMI online platform.	Current status of approaches, theory and modeling in group management is available to active GMI participants.	2019-2020 [Completed July 2020].
1.3.3	Review status, open questions and problems in Molecular Tools as they relate to group management.	RO, AC.	Molecular Tools team members.	Final Molecular Tools review briefing document shared on GMI online platform.	Current status of molecular tools with respect to group management is available to active GMI participants.	2019-2020 [Completed July 2020].
1.3.4	Review status, open questions and problems in Software Tools as they relate to group management.	KM.	Software team members.	Final Software Tools review briefing document shared on GMI online platform.	Current status of software tools in group management is available to active GMI participants.	2019-2020 [Completed July 2020].
1.3.5	Review status, open questions and problems in Processes as they relate to group management.	GF, KL.	Process team members.	Final Process review briefing document shared on GMI online platform.	Current status of process in group management is available to active GMI participants.	2019-2020 [Completed July 2020].
1.3.6	Review challenges and needs in focal species needing group management across relevant focal species.	KRC.	Focal species team members.	Summary case information and presentation shared on GMI online platform.	Examples of real cases requiring group management are available to active GMI participants.	2019-2020 [Completed July 2020].

	ACTION	RESPONSIBLE	COLLABORATING	OUTPUT	OUTCOME	TIMELINE & STATUS
1.3.7	Hold a first plenary online meeting, to share and refine output of the short-term teams.	KTH, KRC, short-term team chairs and co-chairs.	GMI active participants.	Meeting held. Comments collected. Meeting minutes produced and shared.	Active GMI participants have a clearer understanding of the current status of group management and its remaining challenges.	2020 [Completed August].
1.3.8	Hold a larger second plenary online meeting to: a) introduce GMI; b) solicit input from stakeholders outside GMI on current status & challenges of group management, and c) increase stakeholder participation.	KTH, KRC, short-term team chairs and co-chairs, breakout room facilitators.	All members of Short-term teams to date, meeting participants.	Meeting held as a working group within the Conservation Planning Specialist Group's 2020 annual meeting, virtually in San Diego.	GMI is better known among relevant stakeholders, the number of active GMI participants is increased, and status review is made more complete.	2020 [Completed October].
1.3.9	Prepare meeting reports.	KRC, KTH.	GMI Steering Committee.	Report-back presentation given in plenary at CPSG 2020 annual meeting; summary and full reports prepared.	Initial review of status, open questions and remaining problems is complete and forms the basis of scientific manuscript to be shared more widely (Obj. 6.2.2).	2020 [Completed December].

Objective 1.4: Detailed practical guidelines for group-based population management are prepared, which promote common terminology and synthesize theory, evidence, case studies & outcomes, best practices, templates, and other existing tools, in order to fill some of the current group management needs of practitioners while GMI creates additional methods and tools to address unmet needs.

	ACTION	RESPONSIBLE	COLLABORATING	OUTPUT	OUTCOME	TIMELINE & STATUS
1.4.1	Form and engage short-term “How-to” team to champion this objective, of creating “how-to” guidelines for group management.	KRC, GF.	How-to team members.	How-to team is organized, has a workspace within the GMI online wiki, and is working.	Organizational structure and technical capacity are in place to accomplish Obj. 1.4.	2021 [Completed May].
1.4.2	Form and engage short-term “Records” team to champion the extensive sections of the guidelines relating to this theme.	KSE, AL.	Records team members.	Records team is organized, has a workspace within the GMI online wiki, and is working.	Organizational structure and technical capacity are in place to accomplish Obj. 1.4.	2021 [Completed June].
1.4.3	Create draft outline of the guidelines, aimed at an audience of practitioners at all levels.	KRC and How-to Team.	Records Team, EF, PH.	Outline developed.	Initial structure allows Steering Committee to consider if all relevant topics will be covered in a logical order.	2021 [Completed September].
1.4.4	Review and finalize outline.	KRC and How-to Team.	GMI Steering Committee, Records team.	Final version of outline that all active GMI participants think will meet stakeholder needs.	Structure covers all relevant topics in the review phase and enables an array of experts to contribute efficiently.	2022 [Completed August].
1.4.5	Identify lead writers for different sections.	KRC and How-to Team.	Simulations and Records Teams, GMI Steering Committee.	List of committed authors, by section.	All sections of outline have one or two people committed to write and prepare a draft needed content.	2022 [Completed November].

	ACTION	RESPONSIBLE	COLLABORATING	OUTPUT	OUTCOME	TIMELINE & STATUS
1.4.6	Identify the minimum taxon-specific data needed to be collected in order to group manage a population.	KSE, AL, and Records Team.	Records team.	Seven taxonomic sub-teams formed within the Records team; lists of minimum taxon-specific data prepared.	Future teams developing tools and methods understand the minimum data their tools must be able to store and analyze.	Target January 2023.
1.4.7	Identify the ideal taxon-specific data to collect to group manage a population.	KSE, AL and Records Team.	Records team.	Lists of ideal taxon-specific data are ready to be included in the How-to Guidelines.	Future teams developing tools and methods understand the range of data their tools will ideally be able to store and analyze.	Target January 2023.
1.4.8	Organize and present existing record-keeping tools (data templates, software, etc.) as examples for others to learn from and use as they collect data to inform group management.	KSE and AL.	Records team.	Appendices of record-keeping tools are prepared for the How-to group management guidelines.	Guidelines users will be able to easily find examples of existing tools for keeping records for group management.	Target January 2023.
1.4.9	Produce first draft of guidelines for group-based population management.	KRC, GF, and How-to Team.	AL, BL, EF, JF, KSE, PH and all other identified contributors.	All outline sections will have draft content with appropriate references.	Editors will have initial content to modify, request that authors build on, and find additional authors to complement.	Target May 2023.
1.4.10	Edit draft guidelines.	KRC and GF.	AL, BL, EF, JF, KSE, PH and all other identified contributors.	Manuscript edited for consistent language, with overlaps, gaps and other problems identified. Editorial requests made to contributors.	Contributors have consistent, useful feedback on how to ensure their sections advance the overall aims of the guidelines.	Target June 2023.

	ACTION	RESPONSIBLE	COLLABORATING	OUTPUT	OUTCOME	TIMELINE & STATUS
1.4.11	Create final V 1.0 guidelines with last author contributions and editing.	KRC, GF, and How-to Team.	AL, BL, EF, JF, KSE, PH and all other identified contributors.	Manuscript is complete and consistent with gaps filled.	Guideline content is complete and ready to be shared (Objective 6.2.3).	Target December 2023.





GOAL 2

PLAN AND SUSTAIN

GMI has developed key performance criteria from its status and needs assessments, and is continuously implementing and adapting collaborative and administrative work structures via a Strategic Plan, to produce outputs that meet criteria.

Background to Goal 2

A tree needs roots, a trunk and leaves, along with some internal genetic instructions, to eventually bear fruit. Goal 2 is about ensuring that GMI has the full “tree” (people, organization and funding) and “genetic instructions” (this Framework and a system for periodically updating Plans) to bear the fruit of our Vision.

GMI’s newness means it has a lean structure for efficiency and flexibility, and so needs a plan to match. As mentioned above, GMI currently consists of a Director and a Steering Committee (of about a dozen practitioners and scientists from around the world; see Appendix 2), which set GMI’s course, lead many activities, and represent key stakeholders. GMI members consist of ~50 additional practitioners, scientists, and other stakeholders, who volunteer their time to collaborate in and/or lead short-term teams to accomplish particular tasks, which are disbanded once tasks are completed. An even wider set of ~150 participants have contributed to three virtual plenary events to date, and have expressed interest in using GMI products and in collaborating on future activities. In particular, “active” GMI participants interact with GMI via a closed online wiki-style portal, built on a Smithsonian-supported Confluence platform.

As work progresses, however, the need for financial and administrative support may change and governance may have to be re-optimized. Roles, responsibilities, and resource commitments of participating individuals and institutions may need re-evaluation. Having key performance indicators is thus essential to have measurable standards against which to measure success, and to guide course-corrections along the way. And equally essential is having a functional system, able to define roles and responsibilities and resource commitments to make use of indicators to enact course-corrections. This goal provides both.

Note in this goal that while objectives are clear, some activities do not yet have target dates, and may not even be finalized in draft form yet, and so as described in the Introduction above, are indicated in gray. These do not yet have “SMART” elements formulated, and may well evolve before they coalesce in a future Strategic plan.

Goal 2 Objectives & Actions

Objective 2.1: Stakeholder needs and existing theory and practice have been synthesized into performance categories, criteria and indicators, which may be used to guide the design of and evaluate the effectiveness of GMI activities and outputs.

	ACTION	RESPONSIBLE	COLLABORATING	OUTPUT	OUTCOME	TIMELINE & STATUS
2.1.1	Precisely define classes of situations & species needing different performance criteria. E.g., in situ vs ex situ. E.g., Within ex situ, pops that may one day return to the wild vs those with other ex situ roles. E.g., taxonomic groups, like plants vs. hoof stock.	-	-	-	-	Target 2024.
2.1.2	For each class, define categories of performance indicators for GMI outputs that are not (so) situation dependent. E.g., For insurance populations, gene diversity, inbreeding and adaptation to captivity are categories of indicators that tools will always need to consider (but transfer costs, welfare constraints may differ). Consider both average & extreme outcomes.	-	-	-	-	Target 2024.
2.1.3	Develop additional categories of performance indicators for GMI outputs that are independent of class. E.g., tool user friendliness; compatibility with other tools; affordability for users.	-	-	-	-	Target 2024.

	ACTION	RESPONSIBLE	COLLABORATING	OUTPUT	OUTCOME	TIMELINE & STATUS
2.1.4	Define initial performance criteria within each category, even when precise numbers not possible (e.g., direction when clear target not possible).	-	-	-	-	Target 2024.
2.1.5	Once classes and performance categories and criteria are shared with managers, organize a discussion to get qualitative feedback.	-	-	-	-	Target 2024.
2.1.6	Define measurable criteria to evaluate these factors. In the case of simulations, this is reasonably straightforward. In the case of real-world trials, it is likely much more complex. An example of a way that may help with measuring includes measuring phenotypic variation and impact (e.g., reduction in first year survival).	-	-	-	-	Target 2024.
2.1.7	Develop and incorporate a metric for when tools and methods are used. E.g., citing tools when used in reports and papers, number of downloads.	-	-	-	-	Target 2024.

Objective 2.2: Using principles of adaptive management, the multi-stakeholder, collaborative GMI Strategic Plan is continuously reviewed, adapted, developed, and implemented to effectively meet performance criteria.

	ACTION	RESPONSIBLE	COLLABORATING	OUTPUT	OUTCOME	TIMELINE & STATUS
2.2.1	Hold a first plenary online meeting, to develop a vision to guide GMI strategy.	KTH, KRC, short-term team chairs and co-chairs.	Short-term Vision team, GMI steering committee, GMI participants	Meeting held. Visioning process completed. Vision statement produced.	Active GMI participants have a shared understanding of our joint direction.	2020 [Completed August].
2.2.2	Elicit and organize challenges preventing the application of group-based management.	EF.	KL, RO.	A detailed list of stakeholder challenges as well as a conceptual framework in which to organize them.	GMI participants have a draft framework within which to organize goals that will meet stakeholder challenges.	2021 [Completed February].
2.2.3	Elicit and organize goals to realize this vision, which if reached will meet stakeholder needs (Obj. 1.2.3).	GF, KRC, JF, PH.	GMI participants.	Goals solicited, analyzed, winnowed, and word smithed to fewer than 10 statements.	GMI participants have draft goals as an input to more in-depth thinking about how to reach the vision.	2021 [Completed March].
2.2.4	Hold a second plenary online meeting, to develop a GMI strategic framework.	KTH, KRC, breakout room facilitators.	GMI participants.	Meeting held. Strategic structure finalized. Goal statements finalized. Objectives brainstormed and drafted. Results shared on GMI platform.	A smaller Strategic Plan team has the inputs it needs from the wider set of GMI participants to draft a strategic plan.	2021 [Completed April].
2.2.5	Form and engage short-term "Strategic Plan" team to guide GMI to produce a Framework and Plan.	KL, KRC.	Strategic Plan team members.	SP team is organized, has a workspace within the GMI online wiki, and is working.	Organizational structure and technical capacity are in place to produce Framework and Plan.	2021 [Completed November].

	ACTION	RESPONSIBLE	COLLABORATING	OUTPUT	OUTCOME	TIMELINE & STATUS
2.2.6	Produce and circulate draft Strategic Framework and Plan.	KRC, KL, LP.	Strategic Plan team members, Steering Committee members, short-term team leaders.	Inputs from second plenary, short-term goals and challenges teams synthesized into zero draft. Input obtained from interested collaborators, and incorporated. Draft circulated.	Draft Framework and Plan available to all interested GMI participants as Briefing materials for a fourth plenary meeting to finalize the Framework and Plan.	2022 [Completed October].
2.2.7	Hold a fourth online meeting, to develop a GMI strategic framework.	KRC, LP, breakout room facilitators.	GMI participants.	Meeting held. Gaps in Goals and Objectives revealed. Actions for key objectives brainstormed and organized.	A smaller Strategic Plan team has the inputs it needs from the wider set of GMI participants to draft a strategic plan.	2022 [Completed October].
2.2.8	Produce final GMI Strategic Framework and 2023-2024 Strategic Plan.	KRC, LP, AE.	Strategic Plan team members, Steering Committee members, other short-term team members.	Meeting inputs incorporated. Steering Committee, short-term team members review draft. Text finalized.	Final GMI Strategic Framework and 2023-4 Plan is ready to be designed and shared (Obj. 6.2.6).	Target January 2023.
2.2.9	GMI Director and Steering Committee meets regularly to review and guide 2023-2024 actions.	KRC.	Steering Committee members.	Strategic plan updated and shared.	Director, Steering committee, members, participants and funders are aware of ongoing efforts.	Target June and November, 2023.
2.2.10	Evaluate 2023 & 2024 accomplishments, adjust actions, plan for 2025 & 2026, and produce updated GMI 2025-2026 Strategic Plan.	KRC.	Steering Committee Members, short-term team leaders	Accomplishments and current circumstances reviewed, draft circulated and finalized.	Updated 2024-2025 Strategic Plan is available to all to guide GMI activities.	Target November 2024.

Objective 2.3: Effective processes and administrative structures are implemented to stimulate, facilitate and coordinate actions, evaluate progress towards performance indicators and vision, and evaluate and implement needed adaptations to the Strategic Plan and or administrative structures.

	ACTION	RESPONSIBLE	COLLABORATING	OUTPUT	OUTCOME	TIMELINE & STATUS
2.3.1	Solicit representatives of key stakeholder groups and experts to serve on the Steering Committee, replace past members as they step off.	KRC.	SC members.	SC of ~7-10 people actively engaged in GMI work.	Director has expert advice and collaboration to accomplish actions and achieve vision.	Completed June 2020, ongoing.
2.3.2	Hold regular virtual Steering Committee Meetings to review, coordinate and implement actions, evaluate against key performance categories, adapt Strategic Plan, and adapt processes.	KRC.	SC members.	SC meeting minutes, other management documents, shared among SC.	Strategic Framework and Plans are used effectively to achieve vision.	2020-2022, ongoing.
2.3.3	Solicit leaders for short-term teams, support them in forming teams and achieving objectives via virtual meetings and other methods, wind down teams when objectives complete.	KRC.	SC members.	Short term team meeting minutes, documents, products shared among active participants on GMI platform.	Strategic Framework and Plans are used effectively to achieve vision.	2020-2022, ongoing.
2.3.4	Maintain GMI online wiki collaboration platform using Confluence.	KRC.	SI information technology staff.	Online platform accessible to all active GMI participants. Logical file structure containing all documents & videos. Streamlined commenting, communication and feedback.	GMI participants are aware of what other participants are doing, can find information when they need it, and can contribute effectively without being hampered by technology.	Completed August 2021, ongoing.

	ACTION	RESPONSIBLE	COLLABORATING	OUTPUT	OUTCOME	TIMELINE & STATUS
2.3.5	Maintain regular communication via electronic methods and in-person meetings throughout GMI.	KRC, Short-term team leaders.	SC members, GMI participants.	E-mails, telephone calls, texts, videoconferences, transcripts, minutes between communication participants.	GMI participants are aware of what other participants are doing, can find information when they need it, and can contribute effectively without being hampered by technology.	2019-2022, ongoing.
2.3.6	Ensure all GMI meetings, events, and products are accessible as possible to global participants and users.	All meeting/event leaders.	KRC.	Auto-transcripts in other languages enabled in virtual meetings; products freely available for download or on request if internet connection unavailable.	GMI attains vision more quickly because more people from around the world can participate and use outputs.	2019-2022, ongoing.



Credits: *Sander vitreus* eggs a few days prior to hatching, Samuel Stukel/USFWS.

Objective 2.4: A realistic funding strategy is ensuring sufficient support for the GMI Strategic plan actions, processes and administrative structures to reach the GMI vision.

	ACTION	RESPONSIBLE	COLLABORATING	OUTPUT	OUTCOME	TIMELINE & STATUS
2.4.1	Secure funding to hire temporary person to develop GMI.	BS.	Other SI staff.	Smithsonian Secretary Scholar 5-year funding secured; KRC hired with 10% dedication to GMI.	GMI comes into being.	2018 [Completed].
2.4.2	Secure funding to extend director for GMI.	KRC.	BS, other SI staff.	Smithsonian Collections Care and other funding applications completed and approved.	GMI has effective leadership.	Completed through 2025.
2.4.3	Secure funding to maintain director for GMI.	KRC.	BS, other SI staff, BL, KM, SC members, GMI members.	Allen Family Foundation stage 1 concept and/or NSF proposal submitted; other opportunities in discussion.	GMI has stable, effective leadership.	Target 2025.
2.4.4	Secure funding to advance activities in Goals 3 & 4.	KRC.	BS, other SI staff, BL, KM, SC members, GMI members.	Allen Family Foundation stage 1 concept and/or NSF proposal submitted; other opportunities in discussion.	GMI is able to achieve key components of Goals 3 & 4.	Target 2025.
2.4.5	Develop broader funding strategy, including in-kind support, to achieve actions.	-	-	-	-	Target 2024.

Objective 2.5: Funding partners, implementation partners and other key stakeholders are aware of and regularly support and collaborate with GMI due to effective outreach and communication.

	ACTION	RESPONSIBLE	COLLABORATING	OUTPUT	OUTCOME	TIMELINE & STATUS
2.5.1	Repeat and Cross-reference relevant actions from Goal 6; Share.	-	-	-	-	-





GOAL 3

ACT - CREATE, TO SELECT

GMI has created accessible and user-friendly methods and tools for decision-making, so that practitioners may select group management strategies appropriate for any given species program.

Background to Goal 3

After Assessing and Planning, the next step is to Act – the focus of Goals 3 and 4. In the case of group management, broadly speaking, “Act” consists of creating new (or improving existing) tools and methods for group management. However, ‘group management’ is not a single approach, but rather a suite of more than a dozen approaches (depending on how these are defined). Thus, before applying an approach or approaches to any given program, managers will also be faced with the problem: which approach(es) should I use? For managers most familiar with individual-based population management, this problem is new, because essentially one method of genetic management (minimization of mean kinship) is optimal in most cases, and because demographic management options are presently applied based largely on informal logistical considerations.

Thus, in the case of group management, the “create” that comprises the “act” part of the development cycle must be split into two parts. Goal 3 is focused on the first, solving the problem of selecting the group management approach(es), by creating decision-support mechanisms -- methods and tools for selecting which approach(es) to apply in any given case or program. Note we consider a program to be an instance in which a particular species must be managed in a particular place to meet particular goals; not all populations of a given species will benefit from the same management, and even the same populations may require different management through time as goals change.

The factors that may influence the optimal selection of which approach reaches program goals most efficiently could include (but may not be limited) to the program goals themselves; the stakeholders involved in planning and execution (population managers, program coordinators, and others); the life history and current husbandry of the species in question; relevant existing and new theories and approaches to group-based management; relevant existing and required empirical data, samples, and recordkeeping systems; relevant available and required software and other support tools; budgetary, time, personnel, space, infrastructure, and other logistical constraints and opportunities; the particular populations of the species in the program that currently exist (captive/wild, living/

cryopreserved, or otherwise); and the cultural context of the species program and prevailing attitudes toward possible management interventions such as euthanasia, contraception, or capture from or release to wild populations.

The selection support mechanisms resulting from Goal 3 may consist of both tools (such as software or templates) and methods (such as processes, protocols or defined roles). Tools may be sophisticated (such as software decision-making support tools), or simpler (such as decision trees or other analog tools), or both. As such, the flexible structure of this plan will allow additional experts to be brought in appropriately as previous work makes clearer the best direction for later work. For example, software design experts may need to be recruited to re-formulate objectives for this goal if software ends up being involved.



Goal 3: Objectives & Actions

Objective 3.1: Factors relevant to deciding which group management strategy(ies) to apply have been identified and compiled, along with the taxon-specific data types relevant to these factors.

	ACTION	RESPONSIBLE	COLLABORATING	OUTPUT	OUTCOME	TIMELINE & STATUS
3.1.1	Conduct and prepare a literature review on approaches to group management, clearly stating research questions (see Action 6.2.3).	KRC.	Manuscript co-authors.	Scientific publication reviewing current methods and practice in group management prepared from objective 1.3.	Initial set of factors relevant to deciding which strategies to apply have been identified and compiled.	Target June 2023.
3.1.2	Review examples of group management presented in the How-to Guidelines to identify additional factors.	-	-	-	-	-
3.1.3	Identify current approaches to group management in other living collection sectors (e.g., research populations) with expert elicitation and identify additional factors relevant to approaches used (e.g., game ranch management).	-	-	-	-	-
3.1.4	Identify natural (in situ) “strategies” that group-living species may be “managing” themselves and use these to identify additional factors.	-	-	-	-	-
3.1.5	Compile taxon-specific data types relevant to the final list of factors.	-	-	-	-	-

Objective 3.2: Existing methods and tools for decision-making and for selecting group management strategies are compiled, and a technical review and gap analysis have been completed with respect to performance indicators.

	ACTION	RESPONSIBLE	COLLABORATING	OUTPUT	OUTCOME	TIMELINE & STATUS
3.2.1	Compile and review the suite of possible or existing decision tools, including pros, cons and requirements of each, examples for each, and data requirements.	-	-	-	-	-
3.2.2	Conduct a gap analysis to determine how performance indicators are met with possible and existing decision tools.	-	-	-	-	-

Objective 3.3: A set of novel tools and methods (and/or improvements to existing ones) have been designed and built for selecting group management strategies, based on identified gaps, performance indicators, theory, experience, and decision-making tools used in other contexts.

	ACTION	RESPONSIBLE	COLLABORATING	OUTPUT	OUTCOME	TIMELINE & STATUS
3.3.1	Form and engage short term "Simulations" team.	PH, EF.	Simulation team members.	Simulation team is organized, has a workspace within the GMI online wiki, and is working.	Organizational structure and technical capacity are in place to accomplish Actions 3.3.2 & 3.3.3.	Formed May 2021, team engagement postponed until Act. 3.3.2 completed. Target 2023.
3.3.2	Select a platform with which to build a research tool to simulate the consequences of various management approaches.	PH.	EF, BL.	Vortex selected as platform. Reasons identified as to why other platforms are not suitable.	Simulation team can focus energy on learning a single platform in depth and adapting it to their needs.	July 2021 [Completed].

	ACTION	RESPONSIBLE	COLLABORATING	OUTPUT	OUTCOME	TIMELINE & STATUS
3.3.3	Build a research tool to simulate the consequences of the suite of available management approaches.	PH.	BL, SCTI, KRC.	Extension of Vortex (or other tool), with template projects implementing group management approaches.	Simulation team has a means of identifying key factors that influence optimality of alternative management approaches.	Target 2023.
3.3.4	Hold a 2-day workshop/course for the Freshwater teleost TAG to develop and select group management strategies for their species. (See also 4.2.1).	EF.	PH, other willing GMI collaborators.	Potentially novel strategies for selecting management approaches for the 9 Freshwater fish EEPs. A short report to share results.	Experience is gained in training managers to select group management strategies. A better understanding of practical limitations is gained.	Target March 2023.
3.3.5	Refine simulation tool to incorporate molecular genetic information into simulations and decision-making.	-	-	-	-	-
3.3.6	Using the research tool, and simulations based on theory and actual population scenarios, identify key factors that influence the optimality of alternative management approaches, including risk scenarios.	-	-	-	-	-
3.3.7	Build a prototype decision tree for selecting group management approach(es) based on the factors above, and an analysis of existing case studies.	-	JM.	-	-	-
3.3.8	Based on results, refine decision tree, or proceed to develop a more complex tool (software) to support decision-making.	-	JM.	-	-	-

Objective 3.4: The performance of new, improved, and existing tools and methods for decision-making have been pilot-tested, comparing and contrasting them in a few real programs needing group management.

	ACTION	RESPONSIBLE	COLLABORATING	OUTPUT	OUTCOME	TIMELINE & STATUS
3.4.1	Pilot test and compare new and existing tools for decision-making, in a set of real management cases as well as in simulations.	-	JM.	-	-	-
3.4.2	Develop tools to identify cases and circumstances when reality deviates from theory.	-	-	-	-	-

Objective 3.5: The most promising tools and methods for decision-making have been revised and adapted based on pilot testing results, and have been used effectively to select the group management strategies to apply in pilot programs.

	ACTION	RESPONSIBLE	COLLABORATING	OUTPUT	OUTCOME	TIMELINE & STATUS
3.5.1	Select the most promising tools.	-	-	-	-	-
3.5.2	Revise and adapt the most promising tools based on pilot results.	-	JM.	-	-	-
3.5.3	Begin to implement tools to select group management strategies in pilot cases.	-	-	-	-	-



GOAL 4

ACT - CREATE, TO APPLY

GMI has created accessible and user-friendly methods and tools for *record-keeping, analysis, and management*, so that practitioners may apply group management to reach species program goals.

Background to Goal 4

Once an appropriate approach or approaches to group management have been selected, managers need to be able to apply the approach(es). Application of group management involves keeping appropriate records to provide the data and samples to guide management; storing, retrieving and analyzing those data at appropriate moments; making decisions based on those analyses; and then executing management decisions, before repeating the cycle.

New methods and tools may be required for all of these activities, or existing ones may be appropriate. In both cases, methods and tools must be accessible, user-friendly and adaptable to specific program needs and goals, including genetic, demographic, economic, welfare, cultural, logistical and other goals.

Objectives to achieve this goal may have to adapt based on results from Goal 3.

Presently, Goal 4 is broken down into objectives of “conceptualizing” the methods and tools, and then “building” them; however, as in Goal 3, above, Goal 4 is likely to involve producing software, and so objectives below may need to change as Goal 3 progresses, according to current best practices in software design. In particular, it may be appropriate for objectives to be broken down around the different uses of the new methods and tools, with separate objectives for record-keeping, storage and retrieval; analysis and decision-making; and ongoing management.



Goal 4: Objectives & Actions

Objective 4.1: Existing methods and tools for group-based record-keeping, analysis and management are compiled, and a technical review and gap analysis have been completed with respect to performance indicators.

	ACTION	RESPONSIBLE	COLLABORATING	OUTPUT	OUTCOME	TIMELINE & STATUS
4.1.1	Compile methods and tools for record-keeping, analysis and management from Software Team August 2020 briefing materials.	-	JM.	-	-	-
4.1.2	Update this list by reviewing and identifying capabilities of any additional software and technical tools developed or uncovered since then.	-	Those that have built, designed, or programmed current software, JM.	-	-	-
4.1.3	Based on priority approaches/analyses results from 3.3.2, identify if existing software can or cannot execute all the desired approaches to a level of the performance indicators (gap analysis).	-	-	-	-	-
4.1.4	Compile prioritized list of desired approaches that cannot be executed to the level of performance indicators.	-	-	-	-	-

Objective 4.2: A set of novel tools and methods (and/or improvements to existing ones) have been designed and built to implement the most promising methods for implementing group management and meeting needs in record-keeping, analysis and management, based on identified gaps, performance indicators, theory, and experience.

	ACTION	RESPONSIBLE	COLLABORATING	OUTPUT	OUTCOME	TIMELINE & STATUS
4.2.1	Hold a 2-day workshop/course for the Freshwater teleost TAG to develop and select group management strategies for their species (see also 3.3.4).	EF.	PH, other willing GMI collaborators.	Potentially novel strategies for applying group management for the 9 Freshwater fish EEPs. A short report to share results.	Experience is gained in training managers to apply group management strategies. A better understanding of practical limitations is gained.	Target March 2023.
4.2.2	Create a multilingual record-keeping standard for group management, according to different taxa needs and program goals, which may be incorporated into new tools and methods.	-	JM.	-	-	-
4.2.3	Improve existing software used for individual-based population management to serve group-based programs.	-	Regional associations, Species360, JM.	-	-	-
4.2.4	Design new user-friendly, open-source, software and/or packages that integrate with existing or new record-keeping software and/or packages (written in different programming languages as R, Python, Julia, etc.) integrating diverse technologies, practices, and processes.	-	JM.	-	-	-
4.2.5	Develop strategies for the collection of biomaterials for population analysis and management.	-	-	-	-	-

Objective 4.3: The performance of novel/improved tools and methods for record keeping, analysis, and ongoing management of groups have been pilot-tested in a few programs needing group management.

	ACTION	RESPONSIBLE	COLLABORATING	OUTPUT	OUTCOME	TIMELINE & STATUS
4.3.1	Pilot-test new/improved tools and methods for record-keeping in groups.	-	-	-	-	-
4.3.2	Pilot-test new/improved tools and methods for analysis in groups.	-	-	-	-	-
4.3.3	Pilot-test new/improved tools and methods for ongoing management in groups.	-	-	-	-	-

Objective 4.4: The novel improved tools and methods for record keeping, analysis, and management of groups have been revised and adapted based on pilot testing results, and are ready for beta testing.

	ACTION	RESPONSIBLE	COLLABORATING	OUTPUT	OUTCOME	TIMELINE & STATUS
4.3.1	Pilot-test new/improved tools and methods for record-keeping in groups.	-	-	-	-	-
4.3.2	Pilot-test new/improved tools and methods for analysis in groups.	-	-	-	-	-





GOAL 5

TEST AND ADAPT

GMI has evaluated the effectiveness of the group-management methods and tools reviewed and developed, in a range of group management programs.

Background to Goal 5

In Goals 3 and 4 above, tools and methods are developed to select and then apply group management to a handful of pilot programs. Here Goal 5 tackles fuller and more formal testing of these ‘products’, in a wider and more strategic set of programs and circumstances than in earlier goals. Testing is against the criteria developed in Goal 2, and a centralized process of review, quality control, and organization is implemented to evaluate and modify outputs developed to date.

Because outputs of Goals 3 and 4 remain undetermined in this version of the Plan, the steps for testing and adapting them, and thus achieving Goal 5, are similarly less specified in this version.



Goal 5: Objectives & Actions

Objective 5.1: A set of existing and pilot-tested methods and tools for selecting, record-keeping, decision-making, analysis, and ongoing group management has been identified for evaluation through wider beta-testing.

	ACTION	RESPONSIBLE	COLLABORATING	OUTPUT	OUTCOME	TIMELINE & STATUS
5.1.1	Review the compiled list of tools and approaches that have been effective in meeting group management goals.	-	-	-	-	-
5.1.2	Create a list of data which can be used to test approaches.	-	-	-	-	-

Objective 5.2: A beta-testing study has been designed to collect and analyze data using GMI's performance indicators and criteria for the aforementioned methods and tools in a set of real programs.

	ACTION	RESPONSIBLE	COLLABORATING	OUTPUT	OUTCOME	TIMELINE & STATUS
5.2.1	Design an evaluation method for group-based management tools' efficiency, effectivity, reliability, etc., focused on program goals for a variety of taxa.	-	-	-	-	-

Objective 5.3: Participants that want to beta-test group management methods and tools have been identified and recruited to participate in the study.

	ACTION	RESPONSIBLE	COLLABORATING	OUTPUT	OUTCOME	TIMELINE & STATUS
5.3.1	Identify potential volunteers that represent focal species with taxonomic diversity and different group structures.	-	-	-	-	-

	ACTION	RESPONSIBLE	COLLABORATING	OUTPUT	OUTCOME	TIMELINE & STATUS
5.3.2	Recruit individuals from the volunteer group that are willing to commit to testing the tools and processes.	-	-	-	-	-

Objective 5.4: Beta-test study has been conducted with identified participants and results have been analyzed, synthesized and written up.

	ACTION	RESPONSIBLE	COLLABORATING	OUTPUT	OUTCOME	TIMELINE & STATUS
5.4.1	Include component actions in conducting beta-testing study.	-	-	-	-	-

Objective 5.5: Tools and methods have been adapted or refined based on beta-test study conclusions.

	ACTION	RESPONSIBLE	COLLABORATING	OUTPUT	OUTCOME	TIMELINE & STATUS
5.5.1	Include component actions for refining tools and methods.	-	-	-	-	-





GOAL 6

SHARE

GMI has shared its group management results and products via an integrated set of effective reference materials, software and training options, that are used effectively by all relevant stakeholders.

Background to Goal 6

For the actions described above to be effective, their results need to be shared beyond the Group Management Initiative. GMI's actions will result in multiple products (documents, techniques, software programs, standards, etc.) for different subsets of stakeholders (including managers and practitioners, technical experts, funders, authorities, and more). Thus to be effective, sharing will need to take place on multiple platforms and media, in different ways, to deliver the needed information, tools and methods to the right audience.

A core aspect of sharing is understanding target audience(s) needs. For example, managers may need streamlined, practical materials to meet the demands of their limited time, while technical experts may need details to troubleshoot future problems or develop studies to resolve questions. Furthermore, some outputs may need to be tailored to audiences from different taxonomic groups. For example, approaches for managing species in which social structure, euthanasia and contraception are major issues will need to be modified for managers of groups in which these may be irrelevant.

Finally, sharing is in itself an ongoing process. Materials need to be regularly updated and easily accessible to global end users with varied backgrounds, so that practitioners are not only competent but also confident in applying group management to their program of interest. Once GMI's outputs are shared and used, the development cycle described in this plan can begin anew (with assessing, planning, and acting all based on the new status quo).

Goal 6: Objectives & Actions

Objective 6.1: An accessible, secure, public GMI website that allows for rapid updating of material has been developed and shared.

	ACTION	RESPONSIBLE	COLLABORATING	OUTPUT	OUTCOME	TIMELINE & STATUS
6.1.1	Compare web/cloud-based storage sites that can handle large data to identify a platform to share group management tools and methods, that is secure, easy to share, and freely available .	-	-	-	-	-
6.1.2	Identify additional platforms where materials can be shared, including the database of the Conservation Evidence website, and zoo and aquarium websites.	-	-	-	-	-
6.1.3	Develop draft content and design for chosen platform(s).	-	-	-	-	-
6.1.4	Share with the Steering Committee for feedback.	-	-	-	-	-
6.1.5	Incorporate feedback and finalize the platform(s).	-	-	-	-	-
6.1.6	Open final platform(s) to the public.	-	-	-	-	-
6.1.7	Encourage use of the platform(s) using social media (e.g., LinkedIn, Twitter).	-	-	-	-	-

Objective 6.2: Objective 6.2: Outputs from earlier goals are being made available on the public GMI website, as they are being produced.

	ACTION	RESPONSIBLE	COLLABORATING	OUTPUT	OUTCOME	TIMELINE & STATUS
6.2.1	Share Strategic Framework & 2023-4 Plan (Goal 2).	KRC, LP, AEA.	CPSG publications staff.	Document published by CPSG and available on their website.	All GMI participants have an effective tool to explain their joint efforts, inspire trust, raise funds, and guide efforts.	Target March 2023.
6.2.2	Share stakeholder analysis (Goal 1).	KRC.	Developers of stakeholder analysis.	Spreadsheet of key stakeholders & types of stakeholders available to GMI participants.	GMI participants can interact with and include key stakeholders at all needed stages.	Target 2024.
6.2.3	Share organized needs and challenges (Goal 1).	KRC.	Developers of organized needs and challenges.	Website explaining how the current needs and challenges organized in Obj. 1.2 relate.	Stakeholders see needs reflected, trust that GMI collaboration and outputs are useful.	Target 2024.
6.2.4	Publish & post paper reviewing current group management methods & practice (Goal 1).	KRC.	Manuscript co-authors. AEA:	Scientific publication reviewing current methods and practice in group management prepared from materials produced in Obj. 1.3.	Scientific community is aware that group management is an important challenge, additional research is spurred, new collaborators and funding are identified.	Target December 2023.
6.2.5	Share how-to guidelines 1.0 (Goal 1) on a public website.	KRC, GF.	How-to contributors, SI staff in information technology.	Wiki-style website containing content developed in Act 1.4. 10 available to all stakeholders.	Practitioners have an effective new tool to use to apply group management to species that need it for their conservation.	Target 2024.

	ACTION	RESPONSIBLE	COLLABORATING	OUTPUT	OUTCOME	TIMELINE & STATUS
6.2.6	Publish short peer-reviewed article to reference how-to guidelines in the scientific literature (Goal 1).	KRC.	How-to contributors. AEA.	Scientific publication presenting website developed in Obj. 6.2.3 published and shared.	More stakeholders are aware of the how-to guidelines and use it.	Target 2024.
6.2.7	Share synthesis of performance categories, criteria and indicators (Goal 2).	KRC.	SI staff in information technology.	Wiki style website containing content developed in Obj. 1.2.	GMI participants are publicly accountable for ensuring outputs will be effective.	-
6.2.8	Share links to sites housing pre-existing and newly-developed tools and methods for deciding among group management strategies (Goal 3).	-	-	-	-	-
6.2.9	Share links to sites housing pre-existing and newly-developed tools and methods for applying group management strategies (Goal 4).	-	-	-	-	-
6.2.10	Publish & post paper testing methods and tools relative to performance indicators (Goal 5).	-	-	-	-	-

Objective 6.3: An updated version of the guidelines for group management (“How-to Guidelines 2.0”), including templates, case studies, and additional reading has been produced and is available on the public GMI website.

	ACTION	RESPONSIBLE	COLLABORATING	OUTPUT	OUTCOME	TIMELINE & STATUS
6.3.1	Identify 1) platform and 2) medium (written/visual) and ensure that the generic high-level template for the handbook for different user groups and regions (e.g., program goals, genetic testing; see Goal 1) is available in formats that are able to be updated and expanded to remain current.	-	-	-	-	-
6.3.2	Compile existing materials and case studies for additional reading and ensure the list is updated regularly.	-	-	-	-	-
6.3.3	Develop templates for diverse different groups to meet needs of all taxa (to be included with handbook in 1.1.1).	-	-	-	-	-
6.3.4	Translate the How-To guidelines to different languages.	-	-	-	-	-
6.3.5	Identify printing options (with funding) for those who may not have regular access to Wi-Fi.	-	-	-	-	-

Objective 6.4: Effective training modules, and/or materials (including user manuals) have been developed for new tools and methods for selecting and applying group management.

	ACTION	RESPONSIBLE	COLLABORATING	OUTPUT	OUTCOME	TIMELINE & STATUS
6.4.1	Identify key areas that group management may need training in and develop training courses for 1) trainers and 2) users.	-	-	-	-	-

	ACTION	RESPONSIBLE	COLLABORATING	OUTPUT	OUTCOME	TIMELINE & STATUS
6.4.2	Identify the best format and medium for training.	-	-	-	-	-
6.4.3	Develop materials for those formats and media.	-	-	-	-	-
6.4.4	Develop a (small) team to periodically review materials to confirm integrity and determine when updates and revisions are needed.	-	-	-	-	-
6.4.5	Apprise upcoming group planning meetings of available GMI tools and training.	-	-	-	-	-
6.4.6	Evaluate and adapt training modules, materials and opportunities.	-	-	-	-	-
6.4.7	Produce and periodically update a new version of the Guidelines for Group Management.	-	-	-	-	-



Credits: *Brighamia insignis*, Jeremie Fant and Jeremy Foster.

Objective 6.5: Aforementioned reference materials, software and training options are offered and easily accessible, in formats that are translatable and updatable, and at events relevant to practitioners.

	ACTION	RESPONSIBLE	COLLABORATING	OUTPUT	OUTCOME	TIMELINE & STATUS
6.5.1	Ensure software tools are not cost prohibitive.	-	-	-	-	-
6.5.2	Investigate and identify a suitable cloud-based solution that is easy to share, secure, and can handle large data for hosting the handbook, videos, templates etc.	-	-	-	-	-
6.5.3	Identify the repository/institution for any hard copies and tangible tools.	-	-	-	-	-
6.5.4	Develop and deliver webinars, courses, or other in person or virtual training opportunities for practitioners, advisors and other stakeholders.	-	-	-	-	-
6.5.5	Develop programs for the public.	-	-	-	-	-
6.5.6	Market GMI program and goals to stakeholders, and the public with website and social media.	-	-	-	-	-
6.5.7	Engage communication staff of stakeholder institutions to help with messaging.	-	-	-	-	-

Objective 6.6: An effective platform for peer to peer sharing of experiences and innovations in group management is in use.

	ACTION	RESPONSIBLE	COLLABORATING	OUTPUT	OUTCOME	TIMELINE & STATUS
6.6.1	Develop a (secure) mechanism (e.g., Listserv) for advisors to share and discuss experiences with each other and with end users, to facilitate adaptive management of group management.	-	-	-	-	-

	ACTION	RESPONSIBLE	COLLABORATING	OUTPUT	OUTCOME	TIMELINE & STATUS
6.6.2	Develop a list of advisers and resources to help develop program goals and appropriate group management strategies to achieve those goals.	-	-	-	-	-
6.6.3	Develop a list of groups with specialized knowledge that can be available for questions and input for group management strategies.	-	-	-	-	-



Credits: *Eidolon helvum* (Straw-coloured fruit bats), Donna Bear.



Appendices

Appendix 1: Key terms

Ex-situ: The state of a population being outside of a species' natural condition or environment, under intensive human management.

Gap analysis: The process of comparing existing tools, methods, or solutions to needed tools, methods, or solutions to identify where needs are not being met.

Goal: An interim milestone achieved en route to realizing a vision.

Group-based population management (“group management”): the process of manipulating organisms and their interactions to influence population characteristics to achieve defined goals, using data collected at the level of groups of organisms, or manipulations of groups of organisms.

Group Management Initiative (GMI): a collection of people who share the vision that Group-managed species are effectively conserved based on sound science, using the best available global information and tools.

In-situ: The state of a population being in a species' natural condition and environment, with minimal or no human management.

Member: A person who has attended at least one GMI plenary event or has otherwise participated in the past, and currently elects to receive information about future GMI news, events, and activities.

Objective: An intermediate state to be attained on the way to achieving a goal.

Participant: A person who is a GMI member and is presently investing time in the steering committee, a working group, a breakout room, or other GMI activities.

Population: A set of organisms in a defined location or locations, at a defined point in time, usually of the same species, and typically which may interact with each other at least theoretically.

Population management practitioner: A person whose work includes making decisions and/or taking actions to influence a living population's characteristics, to achieve particular goals.

Program: Over a defined period in time, a particular instance of the application of group-based population management, to a particular species, using particular populations to achieve particular goals.

SMART action: Undertaken to achieve a particular objective, an activity that is Specific, Measurable, Assignable, Relevant, and Time-bound.

Stakeholder: A person or entity with an interest in the achievement of the GMI vision, typically who will affect or be affected by it.

Tools and methods: The human organizations, methods, processes and practices, data, analyses, and computer programs and other analytical tools that are collectively used to achieve a particular end.

Appendix 2: GMI Members & Participants 2020-2022

The table below presents all participants in GMI activities to date, in alphabetical order, by first name. Participants are considered to be anyone who has attended any GMI event or meeting; members are furthermore those who have not only attended but have actively contributed by serving on the Steering Committee or a short-term team to accomplish GMI actions.

In the last two columns of the table, SC indicates dates of service on the Steering Committee, if any, while participation in Events is indicated with a number for the first (August 2020), second (October 2020), third (March 2021) or fourth (October 2022) plenary event. An asterisk indicates participation in the GMI wiki platform (Confluence).

Collaboration on one of the short-term teams to accomplish a specific set of tasks is indicated by name. These teams to date have consisted of a first set of teams (February–November 2020): Theory, Data/Standards, Molecular Tools, Software, Process, Focal Species, and Vision; a second set (January–March 2021): Challenges and Goals; and an ongoing third set (April 2021–present): How-to, Records, Simulations, and Strategic Plan.

FIRST NAME	LAST NAME	AFFILIATION AT TIME OF PARTICIPATION	CITY, STATE	COUNTRY	GMI PARTICIPATION	
					SC, EVENTS	WIKI, TEAMS
Abby	Meyer	Botanical Gardens Conservation International U.S.	San Marino, CA	USA	2	*Records
Al	Elliott	Royal Botanic Garden Edinburgh	Edinburgh	UK	-	*Records
Alex	Cliffe	Whipsnade Zoo	Bedfordshire	UK	-	*Records
Aliana	Norris	Beijing Forestry University	Beijing	China	2	-
Amanda	Lawless	AZA Population Management Center at Lincoln Park Zoo	Chicago, IL	USA	2, 4	*Records co-lead
Amélie	Mathieu	Government of British Columbia	Victoria, BC	Canada	2	-
Amy	Chabot	African Lion Safari, Canadian Species Initiative, UICN Conservation Planning Specialist Group (CPSG)	Cambridge, ON	Canada	2	-
Amy	Byrne	Morton Arboretum	Chicago, IL	USA	2	*Records
Ana	Ferreira	Oceanario de Lisboa	Lisbon	Portugal	4	*Records
Andrea	Echeverry-Alcendra	Colombian Association of Zoos, Aquariums and Related (ACOPAZOA), Barranquilla Zoo	Barranquilla, Atlántico	Colombia	2, 3, 4	* Records, Strategic Plan

					GMI PARTICIPATION	
FIRST NAME	LAST NAME	AFFILIATION AT TIME OF PARTICIPATION	CITY, STATE	COUNTRY	SC, EVENTS	WIKI, TEAMS
Andrea	Putnam	San Diego Zoo Wildlife Alliance	Boise, ID	USA	1, 2, 3	*Molecular Tools, Records
Andrea	Worley	San Diego Zoo Wildlife Alliance	San Diego, CA	USA	1, 2	Data/Standards
Arlene	Cardozo	Provita	Caracas	Venezuela	-	Focal species
Asako	Chaille	San Diego Zoo Wildlife Alliance	San Diego, CA	USA	June 2020 - June 2022, 1, 2, 3, 4	*Steering Committee, Molecular Tools co-lead, How-To
Ashley	Franklin	AZA Reproductive Management Center at the Saint Louis Zoo	St Louis, MO	USA	2	-
Bart	Shepherd	California Academy of Science	San Francisco, CA	USA	-	*Records
Belen	Jimenez	Technical University of Denmark	Kongens Lyngby	Denmark	2, 3	*Simulations
Benjamin	Tapley	Zoological Society of London	London	UK	2	-
Betsy	Herrelko	Smithsonian's National Zoo & Conservation Biology Institute	Washington, DC	USA	2	-
Borja	Reh	Allies For Wildlife	Madrid	Spain	2	-
Brandie	Smith	Smithsonian's National Zoo & Conservation Biology Institute	Washington, DC	USA	1, 2	*Theory
Brian	Chouinard	SeaWorld Parks and Entertainment	San Diego, CA	USA	1	Data/Standards
Brian	Coyle	Smithsonian's National Zoo & Conservation Biology Institute	Washington, DC	USA	1, 2	*Focal species, Strategic Plan
Brian	Zimmerman	Bristol Zoological Society	Bristol	UK	1, 2, 3	Focal species
Candice	Dorsey	Association of Zoos and Aquariums (AZA)	Washington, DC	USA	2	-
Carolina	Ortiz	Wildlife Ecology, Management and Conservation Lab (LEMaC) /University of São Paulo	São Paulo	Brazil	2	-
Caroline	Lees	IUCN Conservation Planning Specialist Group (CPSG)	Auckland	New Zealand	1	Process
Carolyn	Hogg	University of Sydney	Sydney	Australia	1, 3	*Molecular tools
Catherine	Grueber	University of Sydney	Sydney	Australia	1, 2, 3	*Theory, Simulations
Cheryl	Asa	St Louis Zoo	St Louis, MO	United States	2	-
Christina	Hvilsom	Copenhagen Zoo	Copenhagen	Denmark	2	-
Christopher	Michaels	Zoological Society of London	London	UK	2	-
Claire	Ford	Taronga Conservation Society	Mosman	Australia	-	-
Danny	de Man	European Association of Zoos and Aquaria (EAZA)	Amsterdam	Netherlands	2	-
David	Powell	Saint Louis Zoo	St Louis, MO	USA	2	-
David	Tonkyn	Independent scholar	Clemson, SC	USA	2, 3	*Simulations
David	Bennett	Universidade Federal do Rio Grande do Sul	London	UK	2	-
Deon	Gilbert	Zoos Victoria	Victoria	Australia	-	*Records
Donna	Bear	Jacksonville Zoo and Gardens-Bat TAG Vice-Chair	Jacksonville, FL	USA	2	-
Dustin	Wolkis	National Tropical Botanical Garden	Kalāheo, HI	USA	-	*Records

					GMI PARTICIPATION	
FIRST NAME	LAST NAME	AFFILIATION AT TIME OF PARTICIPATION	CITY, STATE	COUNTRY	SC, EVENTS	WIKI, TEAMS
Edward	Spevak	Saint Louis Zoo	St Louis, MO	USA	2	-
Elmar	Fienieg	European Association of Zoos and Aquaria (EAZA)	Amsterdam	Netherlands	June 2020 - present, 1, 2, 3, 4	*Steering Committee, Theory co-lead, Simulations co-lead, Challenges lead.
Emily	Coffey	Atlanta Botanical Garden	Atlanta, GA	USA	2	*Records
Eric	Tsao	Taipei Zoo	Taipei	Taiwan	2	-
Erica	Royer	Smithsonian's National Zoo & Conservation Biology Institute	Front Royal, VA	USA	1, 2, 3	Focal species
Erin	Sullivan	Woodland Park Zoo	Seattle, WA	USA	1, 2, 3	*Software, Strategic Plan
Fabio	Vannucchi	Sao Paulo State University	São Paulo	Brazil	2	-
Filip	Vandelook	Meise Botanic Garden	Meise	Belgium	-	*Records
Francesc	Carbonell Buira	Torreferrussa Wildlife Recovery Center. Forestal Catalana. Generalitat de Catalunya	Barcelona	Spain	1, 2	Focal species
Frank	Princée	Population Management and Wildlife Conservation	Norfolk	UK	2, 3, 4	*Simulations
Fujun	Shen	Chengdu Research Base of Giant Panda Breeding	Chengdu	China	1, 2	Process
Gerardo	Garcia	Chester Zoo	Chester	UK	2	Focal species
Gina	Ferrie	Disney's Animal Kingdom	Orlando, FL	USA	June 2020 - present, 1, 2, 3, 4	*Steering Committee, Process co-lead, Goals lead, How-to co-lead, Vision.
Glennon	Frei	Saint Louis Zoo	St Louis, MO	USA	2	-
Gloria	Svampa	La Torbiera Zoological Park & Italian Association of Zoos and Aquaria	Agrate Conturbia	Italy	2	-
Gowri	Mallapur	Central Zoo Authority (CZA)	New Delhi	India	2	-
Grant	Abel	Seattle Aquarium	Seattle, WA	USA	2	-
Gwen	Maggs	Durrell Wildlife Conservation Trust	Jersey	UK	2	-
Haley	Blackwell	AZA Population Management Center	Chicago, IL	USA	2	-
Hana	Johnstone	AZA Population Management Center at Lincoln Park Zoo	Chicago, IL	USA	2	-
Hannah	Jenkins	Species360	London	UK	1, 2, 3	Data/Standards
Heather	Pong	Wildlife Reserves Singapore	Mandai	Singapore	2	-
Iliana	Baums	Helmholtz Institute for Functional Marine Biodiversity	Oldenburg	Germany	2	*Simulations, Focal species
Jack	Windig	Wageningen University	Wageningen	Netherlands	1, 2	Theory, Simulations
James	Biggs	Zoo and Aquarium Association of Australasia (ZAA)	Mosman	Australia	1, 2, 3	*Data, Process
Jamie	Ivy	San Diego Zoo Global	San Diego, CA	USA	1, 2, 3	*Software, Simulations

					GMI PARTICIPATION	
FIRST NAME	LAST NAME	AFFILIATION AT TIME OF PARTICIPATION	CITY, STATE	COUNTRY	SC, EVENTS	WIKI, TEAMS
Jay	Hemdal	The Toledo Zoo and Aquarium	Toledo, OH	USA	2, 4	*Records
Jean	Miller	AZA's Institutional Data Management Scientific Advisory Group (IDMAG)	Buffalo, NY	USA	1, 2, 4	*Records
Jean	Linsky	Atlanta Botanical Garden/Global Conservation Consortium for Magnolia	Atlanta, GA	USA	2	*Records
Jennifer	Moore	NOAA Fisheries	St Petersburg, FL	USA	1, 2	*Focal Species, Records
Jeremie	Fant	Chicago Botanic Garden	Chicago, IL	USA	June 2020 - present, 1, 2, 3	*Steering Committee, Molecular tools, Focal species, Goals, How-to
Jessica	Steiner	Wildlife Preservation Canada	Guelph, ON	Canada	2	-
Jinliang	Wang	London Institute of Zoology	London	UK	1	*Theory
Jim	Guenter	Species 360	Bloomington, MN	USA	4	-
Jo Anne	Smith Flueck	Universidad Nacional del Comahue, Fundación Shoonem	Neuquen	Argentina	2	-
John	Andrews	AZA Population management Center, Lincoln Park Zoo	Chicago, IL	USA	2, 3	-
Jorge	Rodriguez	IUCN Conservation Planning Specialist Group Mesoamerica (CPSG)	San Jose	Costa Rica	4	-
Judy	Che-Castaldo	Lincoln Park Zoo	Chicago, IL	USA	1, 2	Focal species
Karen	Bauman	Saint Louis Zoo	St Louis, MO	USA	1, 2	Process
Kate	Pearce	Zoos Victoria	Melbourne	Australia	1, 2	Focal species
Katelyn	Mucha	Species360	Bloomington, MN	USA	June 2020 - present, 1, 2	*Steering Committee, Software co-lead, Records, How-to
Kathryn	Rodriguez-Clark	Smithsonian's National Zoo & Conservation Biology Institute	Washington, DC/ Boston, MA	USA	June 2020 - present, 1, 2, 3, 4	*Director, Steering Committee, How-to co-lead, Simulations, Strategic Plan co-lead, Theory, Data/Standards, Software, Focal Species co-lead, Process co-lead, Goals
Kathy	Traylor-Holzer	IUCN Conservation Planning Specialist Group (CPSG)	Apple Valley, MN	USA	June 2020 - December 2021, 1, 2, 3	*Software, Simulations
Katie	Heinemann	Center for Plant Conservation	Escondido, CA	USA	-	*Records
Kay	Havens	Chicago Botanic Garden	Chicago, IL	USA	June 2020 - October 2020, 1, 2, 3	Steering Committee, Focal species

					GMI PARTICIPATION	
FIRST NAME	LAST NAME	AFFILIATION AT TIME OF PARTICIPATION	CITY, STATE	COUNTRY	SC, EVENTS	WIKI, TEAMS
Kazutoshi	Takami	Toyohashi Zoo and Botanical Park/Japanese Association of Zoos and Aquariums (JAZA)	Toyohashi	Japan	2	-
Kendra	Strohmayr	AZA Population Management Center at Lincoln Park Zoo	Chicago, IL	USA	2	-
Kevin	Willis	Florida Fish and Wildlife	Minneapolis, MN	USA	-	Advisor to KRC
Klaus-Peter	Koepfli	Smithsonian's National Zoo & Conservation Biology Institute	Washington, DC	USA	1	Molecular tools
Kristin	Leus	European Association of Zoos and Aquaria (EAZA), IUCN Conservation Planning Specialist Group (CPSG) Europe/Copenhagen Zoo	Merksem	Belgium	June 2020 - January 2023, 1, 2, 3	*Steering Committee, Process co-lead, Challenges, Strategic Plan co-lead
Kristine	Schad Eebes	AZA Population Management Center at Lincoln Park Zoo	Chicago, IL	USA	June 2020 - present, 1, 2, 3, 4	*Steering Committee, Data/Standards lead, Records co-lead
Kushaal	Selvarajah	Malaysian Conservation Alliance for Tigers (MYCAT)	Kuala Lumpur	Malaysia	2	-
Laura	Gruber	White Oak Conservation	Yulee, FL	USA	2	-
Liang	Zhang	Chengdu Research Base of Giant Panda Breeding	Chengdu	China	2	-
Linda	Penfold	South-East Zoo Alliance for Reproduction & Conservation (SEZARC)	Yulee, FL	USA	1, 2, 3, 4	*Data/Standards, Vision, Strategic Plan
Lucy	Kemp	Mabula Ground Hornbill Project/IUCN SSC Hornbill Specialist Group	Limpopo	South Africa	2	-
Luis	Carrillo	Amphibian Ark	Amacuzac	Mexico	2	-
Mandi	Schook	Disney's Animals, Science and Environment	Orlando, FL	USA	2	-
Mara Cristina	Marques	Fundação Parque Zoológico de São Paulo	São Paulo	Brazil	2	-
Maria	Balcazar	European Association of Zoos and Aquaria (EAZA)	Amsterdam	Netherlands	2	-
Mary	Hagedorn	Smithsonian's National Zoo & Conservation Biology Institute	Honolulu, HI	USA	1	Molecular Tools, Focal Species, Vision
Megan	Brown	Association of Zoos and Aquariums (AZA)	Washington, DC	USA	2, 4	*Strategic Plan
Michael	Meyerhoff	Angkor Centre for Conservation of Biodiversity (ACCB)	Siem Reap	Cambodia	2	-
Michael	O'Neill	New England Aquarium	Boston, MA	USA	-	*Records
Michael	Pirie	University of Bergen, University Gardens	Bergen	Norway	-	*Records
Michelle	Hatwood	Freeport McMoRan Audubon Species Survival Center	New Orleans, LA	USA	2	-
Michelle	Smurl	Brevard Zoo	Melbourne, FL	USA	2	-
Monicque	Silva Pereira	Secretaria de Infraestrutura e Meio Ambiente	São Paulo	Brazil	2	-

					GMI PARTICIPATION	
FIRST NAME	LAST NAME	AFFILIATION AT TIME OF PARTICIPATION	CITY, STATE	COUNTRY	SC, EVENTS	WIKI, TEAMS
Monique	Pool	Green Heritage Fund Suriname	Paramaribo	Suriname	2	-
Muhammad	Firdhaus	SMK Peternakan Juara Subang	Kasomalang, Subang	Indonesia	2	-
Murphy	Westwood	The Morton Arboretum	Lisle, IL	USA	2	-
Myfanwy	Griffith	European Association of Zoos and Aquaria (EAZA)	Amsterdam	Netherlands	2	-
Nathan	Wilke	US Fish and Wildlife National Hatchery System	Fairfax, VA	USA	1, 2, 3	*Process, How-to
Nicole	Duplaix	Oregon State University	Corvallis, OR	USA	2	-
Nicole	Errante	Species360	Bloomington, MN	USA	1, 2, 3	*Software, Data/Standards, Records
Nina	Trontti	Helsinki Zoo	Helsinki	Finland	2	-
Paige	Howarth	San Diego Zoo Global	San Diego, CA	USA	1, 2	Focal species
Patrick	Griffith	Montgomery Botanical Center	Coral Gables, FL	USA	-	*Records
Paul	Senner	AZA Population Management Center at Lincoln Park Zoo	Chicago, IL	United States	2	-
Paul	Pearce-Kelly	Zoological Society of London	London	UK	1, 2, 3	*Focal species, Records, Vision
Paula	Cerdán	World Association of Zoos and Aquariums (WAZA)	Barcelona	Spain	2	-
Phil	Miller	IUCN Conservation Planning Specialist Group (CPSG)	Apple Valley, MN	USA	1, 2, 3	*Theory, Simulations
Philippe	Helsen	Centre for Research and Conservation - Antwerp Zoo	Antwerp	Belgium	June 2020 - present, 1, 2, 3, 4	*Steering Committee, Theory co-lead, Molecular tools, Simulations co-lead, Goals
Rachel	Bladow	AZA Population Management Center at Lincoln Park Zoo	Chicago, IL	United States	2	-
Ramesh Kumar	Pandey	National Zoological Park New Delhi	New Delhi	India	2	-
Raymond	Van der Meer	European Association of Zoos and Aquaria (EAZA)	Amsterdam	Netherlands	2	-
Richard	Emslie	Ecoscot CS and IUCN SSC AfRSG	Durban	South Africa	2	-
Rob	Ogden	University of Edinburgh	Edinburgh, Scotland	UK	June 2020 - October 2022, 1, 2, 3	*Steering Committee, Molecular Tools co-lead, Challenges, Simulations
Robert	Lacy	Species Conservation Toolkit Initiative (SCTI)	Bangor, ME	USA	1, 2, 3, 4	*Software, Theory, Simulations
Roopali	Raghavan	Wildlife Reserves Singapore	Singapore	Singapore	2	-
Samantha	Guillaume	Zoological Society of London	London, England	UK	-	*Records
Sandy	Trautwein	Species 360	Bloomington, MN	USA	-	*Records
Skalalis	Diana	Universitas Padjadjaran	Bandung	Indonesia	2	-
Sonja	Luz	Wildlife Reserves Singapore	Mandai	Singapore	2	-

					GMI PARTICIPATION	
FIRST NAME	LAST NAME	AFFILIATION AT TIME OF PARTICIPATION	CITY, STATE	COUNTRY	SC, EVENTS	WIKI, TEAMS
Stephanie	Allard	National Aquarium	Baltimore, MD	USA	2	-
Steve	Metzler	San Diego Zoo Safari Park	San Diego, CA	USA	1, 2	Focal species
Steven	Gray	Lincoln Park Zoo	Chicago, IL	USA	2	-
Steven	Yong	Steinhart Aquarium at the California Academy of Sciences	San Francisco, CA	USA	2, 3	*Records
Susi	Ngoi	San Diego Zoo	San Diego, CA	USA	-	*Records
Taylor	Callicrate	Species Conservation Toolkit Initiative (SCTI)	Columbia, MD	USA	1, 2	Software, Data/Standards
Tracy	Rehse	SANBI: National Zoological Garden of South Africa	Pretoria	South Africa	4	-
Tony	Niemann	Tracks Software	Salida, CO	USA	1	*Software, Records
Valentina	Cedeno	Provita	Caracas	Venezuela	1, 2	Focal species
Vanessa	Handley	Montgomery Botanical Center	Coral Gables, FL	USA	-	*Records
Wendy	Chua	Southeast Asian Zoos & Aquariums Association (SEAZA), Wildlife Reserves Singapore	Mandai	Singapore	2	-
Yolanda	Matamoros	IUCN Conservation Planning Specialist Group (CPSG)	San Jose	Costa Rica	4	-
Yvonne	Strode	Peoria Zoo	Peoria, IL	USA	2	-
Zjef	Pereboom	Antwerp Zoo	Antwerp	Belgium	June 2020 - October 2022, 1, 2, 3	*Steering Committee, Process

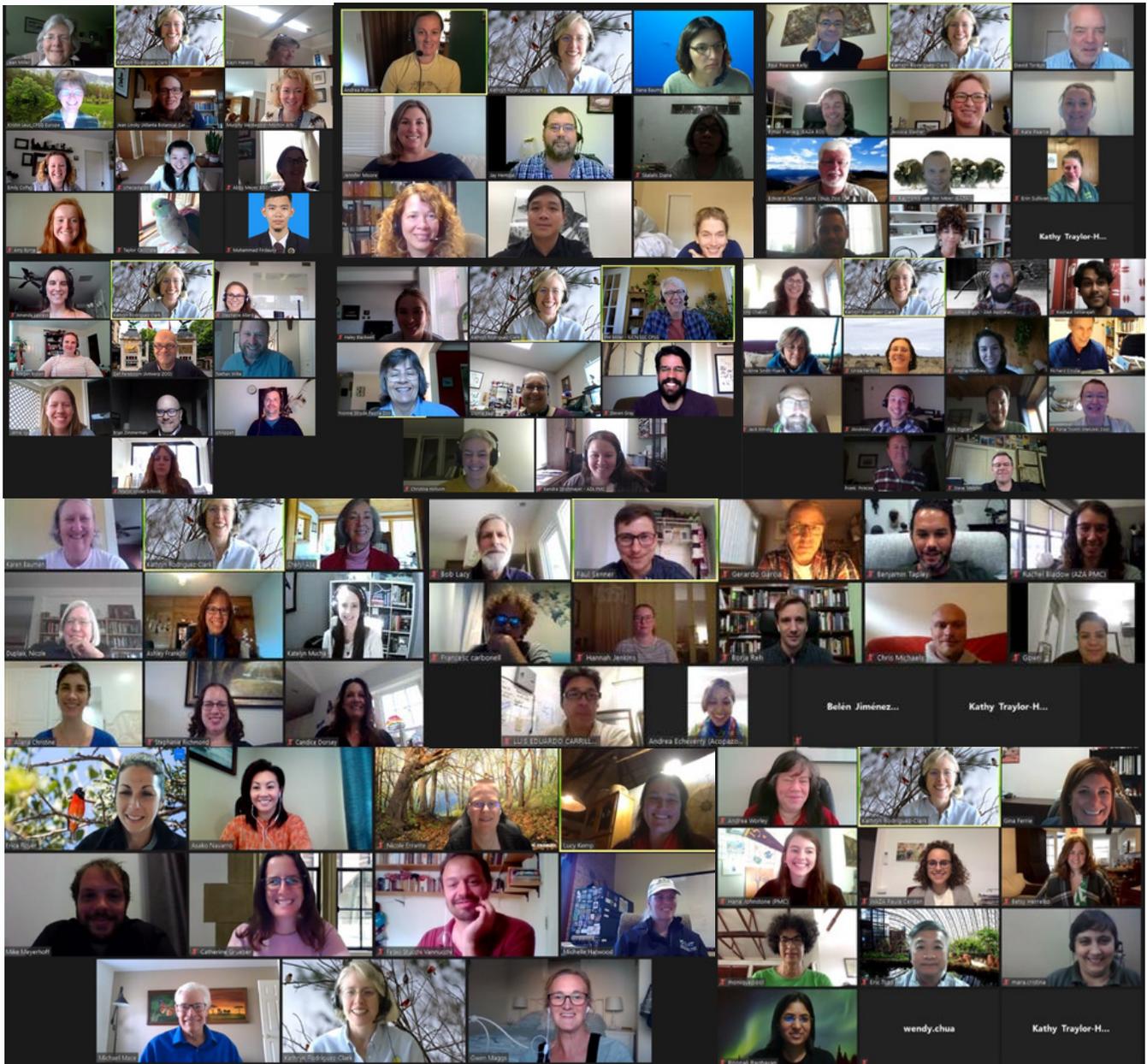
Appendix 3: Abbreviations of names used in the document

ABBREVIATION	FULL NAME
AEA	Andrea Echeverry-Alcendra
AL	Amanda Lawless
AC	Asako Chaille
BL	Bob Lacy
BS	Brandie Smith
EF	Elmar Fienieg
JF	Jeremie Fant
JM	Jean Miller
GF	Gina Ferrie
KL	Kristin Leus
KM	Katelyn Mucha
KRC	Kate Rodriguez-Clark
KSE	Kristine Schad Eebes
KTH	Kathy Traylor-Holzer
LP	Linda Penfold
PH	Philippe Helsen
RO	Rob Ogden

Appendix 4: Images of working groups during virtual meetings or plenary events



Event 1: First GMI meeting, August 2020.



Event 2: CPSG Annual Meeting, October 2020.

Appendix 5: Actions in 2023, by leader

Amanda Lawless

	ACTION	RESPONSIBLE	COLLABORATING	OUTPUT	OUTCOME	TIMELINE & STATUS
1.4.5	Identify the minimum taxon-specific data needed to be collected in order to group manage a population.	KSE, AL, and Records Team.	Records team.	Seven taxonomic sub-teams formed within the Records team; lists of minimum taxon-specific data prepared.	Future teams developing tools and methods understand the minimum data their tools must be able to store and analyze.	Target January 2023.
1.4.6	Identify the ideal taxon-specific data to collect to group manage a population.	KSE, AL and Records Team.	Records team.	Lists of ideal taxon-specific data are prepared.	Future teams developing tools and methods understand the range of data their tools will ideally be able to store and analyze.	Target January 2023.
1.4.7	Organize and present existing record-keeping tools (data templates, software, etc.) as examples for others to learn from and use as they collect data to inform group management.	KSE and AL.	Records team.	Appendices of record-keeping tools are prepared for the How-to group management guidelines.	Guidelines users will be able to easily find examples of existing tools for keeping records for group management.	Target January 2023.

Andrea Echeverry-Alcendra

	ACTION	RESPONSIBLE	COLLABORATING	OUTPUT	OUTCOME	TIMELINE & STATUS
2.2.8	Produce final GMI Strategic Framework and 2023-2024 Strategic Plan.	KRC, LP, AEA.	Strategic Plan team members, Steering Committee members, other short-term team members.	Meeting inputs incorporated. Steering Committee, short-term team members review draft. Text finalized.	Final GMI Strategic Framework and 2023-4 Plan is ready to be designed and shared (Obj. 6.2.6).	Target January 2023.

	ACTION	RESPONSIBLE	COLLABORATING	OUTPUT	OUTCOME	TIMELINE & STATUS
6.2.1	Share Strategic Framework & 2023-4 Plan (Goal 2).	KRC, LP, AEA.	CPSG publications staff.	Document published by CPSG and available on their website.	All GMI participants have an effective tool to explain their joint efforts, inspire trust, raise funds, and guide efforts.	Target March 2023.
6.2.4	Publish & post paper reviewing current group management methods & practice (Goal 1).	KRC.	Manuscript co-authors. AEA.	Scientific publication reviewing current methods and practice in group management prepared from materials produced in Obj. 1.3.	Scientific community is aware that group management is an important challenge, additional research is spurred, new collaborators and funding are identified.	Target December 2023.

Elmar Fienieg

	ACTION	RESPONSIBLE	COLLABORATING	OUTPUT	OUTCOME	TIMELINE & STATUS
3.3.1	Form and engage short term "Simulations" team.	PH, EF.	Simulation team members.	Simulation team is organized, has a workspace within the GMI online wiki, and is working.	Organizational structure and technical capacity are in place to accomplish Actions 3.3.2 & 3.3.3.	Formed May 2021, team engagement postponed until Act. 3.3.2 completed. Target 2023.
3.3.4.	Hold a 2-day workshop/course for the Freshwater teleost TAG to develop and select group management strategies for their species (See also 4.2.1).	EF.	PH, other willing GMI collaborators.	Potentially novel strategies for selecting management approaches for the 9 Freshwater fish EEPs. A short report to share results.	Experience is gained in training managers to select group management strategies. A better understanding of practical limitations is gained.	Target March 2023.

	ACTION	RESPONSIBLE	COLLABORATING	OUTPUT	OUTCOME	TIMELINE & STATUS
4.2.1	Hold a 2-day workshop/course for the Freshwater teleost TAG to develop and select group management strategies for their species (see also 3.3.4).	EF.	PH, other willing GMI collaborators.	Potentially novel strategies for applying group management for the 9 Freshwater fish EEPs. A short report to share results.	Experience is gained in training managers to apply group management strategies. A better understanding of practical limitations is gained.	Target March 2023.

Gina Ferrie

	ACTION	RESPONSIBLE	COLLABORATING	OUTPUT	OUTCOME	TIMELINE & STATUS
1.4.8	Produce first draft of guidelines for group-based population management.	KRC, GF, and How-to Team.	AL, BL, EF, JF, KSE, PH and all other identified contributors.	All outline sections will have draft content with appropriate references.	Editors will have initial content to modify, request that authors build on, and find additional authors to complement.	Target May 2023.
1.4.9	Edit draft guidelines.	KRC and GF.	AL, BL, EF, JF, KSE, PH and all other identified contributors.	Manuscript edited for consistent language, with overlaps, gaps and other problems identified. Editorial requests made to contributors.	Contributors have consistent, useful feedback on how to ensure their sections advance the overall aims of the guidelines.	Target June 2023.
1.4.10	Create final v1.0 guidelines with last author contributions and editing.	KRC, GF, and How-to Team.	AL, BL, EF, JF, KSE, PH and all other identified contributors.	Manuscript is complete and consistent with gaps filled.	Guideline content is complete and ready to be shared (Objective 6.2.3).	Target December 2023.

Kristine Schad-Eebes

	ACTION	RESPONSIBLE	COLLABORATING	OUTPUT	OUTCOME	TIMELINE & STATUS
1.4.5	Identify the minimum taxon-specific data needed to be collected in order to group manage a population.	KSE, AL, and Records Team.	Records team.	Seven taxonomic sub-teams formed within the Records team; lists of minimum taxon-specific data prepared.	Future teams developing tools and methods understand the minimum data their tools must be able to store and analyze.	Target January 2023.
1.4.6	Identify the ideal taxon-specific data to collect to group manage a population.	KSE, AL and Records Team.	Records team.	Lists of ideal taxon-specific data are prepared.	Future teams developing tools and methods understand the range of data their tools will ideally be able to store and analyze.	Target January 2023.
1.4.7	Organize and present existing record-keeping tools (data templates, software, etc) as examples for others to learn from and use as they collect data to inform group management.	KSE and AL.	Records team.	Appendices of record-keeping tools are prepared for the How-to group management guidelines.	Guidelines users will be able to easily find examples of existing tools for keeping records for group management.	Target February 2023.

Kathryn Rodriguez-Clark

	ACTION	RESPONSIBLE	COLLABORATING	OUTPUT	OUTCOME	TIMELINE & STATUS
2.2.8	Produce final GMI Strategic Framework and 2023-2024 Strategic Plan.	KRC, LP, AEA.	Strategic Plan team members, Steering Committee members, other short-term team members.	Meeting inputs incorporated. Steering Committee, short-term team members review draft. Text finalized.	Final GMI Strategic Framework and 2023-4 Plan is ready to be designed and shared (Obj. 6.2.6).	Target January 2023.

	ACTION	RESPONSIBLE	COLLABORATING	OUTPUT	OUTCOME	TIMELINE & STATUS
6.2.1	Share Strategic Framework & 2023-4 Plan (Goal 2).	KRC, LP, AEA.	CPSG publications staff.	Document published by CPSG and available on their website.	All GMI participants have an effective tool to explain their joint efforts, inspire trust, raise funds, and guide efforts.	Target March 2023.
1.4.8	Produce first draft of guidelines for group-based population management.	KRC, GF, and How-to Team.	AL, BL, EF, JF, KSE, PH and all other identified contributors.	All outline sections will have draft content with appropriate references.	Editors will have initial content to modify, request that authors build on, and find additional authors to complement.	Target May 2023.
3.1.1	Conduct and prepare a literature review on approaches to group management, clearly stating research questions (see Action 6.2.3).	KRC.	Manuscript co-authors.	Scientific publication reviewing current methods and practice in group management prepared from Obj. 1.3.	Initial set of factors relevant to deciding which strategies to apply have been identified and compiled.	Target June 2023.
1.4.9	Edit draft guidelines.	KRC and GF.	AL, BL, EF, JF, KSE, PH and all other identified contributors.	Manuscript edited for consistent language, with overlaps, gaps and other problems identified. Editorial requests made to contributors.	Contributors have consistent, useful feedback on how to ensure their sections advance the overall aims of the guidelines.	Target June 2023.
2.2.9	GMI Director and Steering Committee meets regularly to review and guide 2023-2024 actions.	KRC.	Steering Committee members.	Strategic plan updated and shared.	Director, Steering committee, members, participants and funders are aware of ongoing efforts.	Target June and November, 2023.

	ACTION	RESPONSIBLE	COLLABORATING	OUTPUT	OUTCOME	TIMELINE & STATUS
6.2.4	Publish & post paper reviewing current group management methods & practice (Goal 1).	KRC.	Manuscript co-authors. AEA.	Scientific publication reviewing current methods and practice in group management prepared from materials produced in Obj. 1.3.	Scientific community is aware that group management is an important challenge, additional research is spurred, new collaborators and funding are identified.	Target December 2023.
1.4.10	Create final v 1.0 guidelines with final author contributions and editing.	KRC, GF, and How-to Team.	AL, BL, EF, JF, KSE, PH and all other identified contributors.	Manuscript is complete and consistent with gaps filled.	Guideline content is complete and ready to be shared (Objective 6.2.3).	Target December 2023.
2.3.1	Solicit representatives of key stakeholder groups and experts to serve on the Steering Committee, replace past members as they step off.	KRC.	SC members.	SC of ~7-10 people actively engaged in GMI work.	Director has expert advice and collaboration to accomplish actions and achieve vision.	Completed June 2020, ongoing.
2.3.2	Hold regular virtual Steering Committee Meetings to review, coordinate and implement actions, evaluate against key performance categories, adapt Strategic Plan, and adapt processes.	KRC.	SC members.	SC meeting minutes, other management documents, shared among SC.	Strategic Framework and Plans are used effectively to achieve vision.	2020-2022, ongoing.
2.3.3	Solicit leaders for short-term teams, support them in forming teams and achieving objectives via virtual meetings and other methods, wind down teams when objectives complete.	KRC.	SC members.	Short term team meeting minutes, documents, products shared among active participants on GMI platform.	Strategic Framework and Plans are used effectively to achieve vision.	2020-2022, ongoing.

	ACTION	RESPONSIBLE	COLLABORATING	OUTPUT	OUTCOME	TIMELINE & STATUS
2.3.4	Maintain GMI online wiki collaboration platform using Confluence.	KRC.	SI information technology staff.	Online platform accessible to all active GMI participants. Logical file structure containing all documents & videos. Streamlined commenting, communication and feedback.	GMI participants are aware of what other participants are doing, can find information when they need it, and can contribute effectively without being hampered by technology.	Completed August 2021, ongoing.
2.3.5	Maintain regular communication via electronic methods and in-person meetings throughout GMI.	KRC, Short-term team leaders.	SC members, GMI participants.	E-mails, telephone calls, texts, videoconferences, transcripts, minutes between communication participants.	GMI participants are aware of what other participants are doing, can find information when they need it, and can contribute effectively without being hampered by technology.	2019-2022, ongoing.

Linda Penfold

	ACTION	RESPONSIBLE	COLLABORATING	OUTPUT	OUTCOME	TIMELINE & STATUS
2.2.8	Produce final GMI Strategic Framework and 2023-2024 Strategic Plan.	KRC, LP, AEA.	Strategic Plan team members, Steering Committee members, other short-term team members.	Meeting inputs incorporated. Steering Committee, short-term team members review draft. Text finalized.	Final GMI Strategic Framework and 2023-4 Plan is ready to be designed and shared (Obj. 6.2.6).	Target January 2023.

	ACTION	RESPONSIBLE	COLLABORATING	OUTPUT	OUTCOME	TIMELINE & STATUS
6.2.1	Share Strategic Framework & 2023-4 Plan (Goal 2).	KRC, LP, AEA.	CPSG publications staff.	Document published by CPSG and available on their website.	All GMI participants have an effective tool to explain their joint efforts, inspire trust, raise funds, and guide efforts.	Target March 2023.

Philippe Helsen

	ACTION	RESPONSIBLE	COLLABORATING	OUTPUT	OUTCOME	TIMELINE & STATUS
3.3.1	Form and engage short term "Simulations" team.	PH, EF.	Simulation team members.	Simulation team is organized, has a workspace within the GMI online wiki, and is working.	Organizational structure and technical capacity are in place to accomplish Actions 3.3.2 & 3.3.3.	Formed May 2021, team engagement postponed until Act. 3.3.2 completed. Target 2023.
3.3.3	Build a research tool to simulate the consequences of the suite of available management approaches.	PH.	BL, SCTI, KRC.	Extension of Vortex (or other tool), with template projects implementing group management approaches.	Simulation team has a means of identifying key factors that influence optimality of alternative management approaches.	Target 2023.

Appendix 6: Bibliography

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