National Leadership Grants for Museums

Sample Application MG-40-18-0003-18
Project Category: Advance Digital Assets and Capacity
Funding Level: Non-Research grants $50,000-$1,000,000

Lincoln Park Zoo

Amount awarded by IMLS: $541,815
Amount of cost share: $576,793

Attached are the following components excerpted from the original application.

- Abstract
- Narrative
- Schedule of Completion

Please note that the instructions for preparing narratives for FY2019 National Leadership Grants for Museums differ slightly from those that guided the preparation of FY2018 applications. Most obviously, the names and descriptions of project categories have changed slightly and there is one new project category – Data, Analysis, and Assessment. Be sure to use the narrative instructions in the FY2019 Notice of Funding Opportunity for the grant program and project category to which you are applying.

Evaluating Management of 500 Zoo and Aquarium Animal Populations Using Enhanced Tools and Systematic Analysis

The mission of modern zoos and aquariums is to connect people to nature, educate and inspire visitors, and conserve wild animals and wild places. For the American public to reap these benefits, zoos need to maintain diverse, sustainable living animal collections. Zoos and aquariums accredited by the Association of Zoos and Aquariums (AZA) cooperatively manage their animal populations for sustainability through Species Survival Plan® (SSP) programs. SSPs currently manage ~500 species at more than 230 AZA member institutions and additional non-AZA partners. The AZA Population Management Center (PMC), hosted at Lincoln Park Zoo, provides assistance to zoo professionals across the country by conducting demographic and genetic analyses of SSPs, resulting in Breeding and Transfer Plans (BTPs). BTPs try to create sustainable populations by maintaining demographic stability and genetic diversity via recommendations to individual animals within SSPs, issued every 1-3 years.

In the past decade, concerns have been raised about the effectiveness of this critical system. Under a previous IMLS grant Lincoln Park Zoo developed PMCTrack, a comprehensive monitoring system of BTP recommendations and their impact, to address these concerns. Used by the AZA community since 2011, PMCTrack created a transparent, standardized means of assessing and improving SSP management. PMCTrack has been widely successful, but Lincoln Park Zoo and its partners have identified several ways to enhance its impact within the AZA cooperative management system. In this grant, Lincoln Park Zoo proposes to 1) make key programming enhancements to PMCTrack, building on lessons learned in the six years since its release; 2) conduct comprehensive research on PMCTrack's massive dataset, yielding a better understanding of the drivers behind both fulfilled and unfulfilled BTP recommendations; and 3) conduct additional PMCTrack trainings for the AZA community to reduce barriers to usage.

Lincoln Park Zoo will lead the project with collaboration from AZA, the PMC, the AZA Reproductive Management Center (RMC), and a Stakeholders Advisory Group of AZA community members. Programming will focus on: a) creating a new Reproductive Viability Analysis report to help the RMC identify the correlates of successful reproduction in SSPs; b) user-requested enhancements impacting ~2000 potential users across AZA; and c) changes to PMCTrack reporting to allow all users to more effectively query, analyze, and understand PMCTrack data. Research will examine PMCTrack's massive dataset, which spans 17 years of the formalized SSP management system and contains over 347,000 recommendations from 514 SSPs issued to 688 institutions. Lincoln Park Zoo will hire a post-doctoral fellow to analyze what factors are associated with high rates of recommendation fulfillment. In addition, the team will conduct the first systematic analyses of the reasons that recommendations have *not* been fulfilled across SSPs. Finally, in-person trainings and the development of online learning modules will increase effective usage of PMCTrack throughout the AZA community.

The proposed project will provide the wide network of zoo and aquarium professionals involved in the SSP management system with a more powerful and user-friendly PMCTrack. The project will also train these professionals to better use the system to improve SSP management. Lincoln Park Zoo will track progress by monitoring usage rates of PMCTrack and user feedback on PMCTrack's usability and performance. The research outcomes will inform SSP management as a whole, and will be tracked based on production of scientific publications and recommended policy changes. Overall, this project will result in a more user-friendly PMCTrack, more data-driven decision-making for SSP management, more successful recommendations, and, ultimately, more sustainable zoo populations.

**Evaluating Management of 500 Zoo and Aquarium Animal Populations
Using Enhanced Tools and Systematic Analysis**

1. Project Justification

What need, problem, or challenge will your project address and how was it identified?

The mission of modern zoos and aquariums is to connect people to nature, educate and inspire visitors, and conserve wild animals and wild places. For the American public to reap these benefits, zoos need to maintain diverse, sustainable living animal collections. Zoos and aquariums accredited by the Association of Zoos and Aquariums (AZA) cooperatively manage their animal populations for sustainability through Species Survival Plan® (SSP) programs. Sustainability is achieved if populations are maintained at appropriate sizes, breed at desired levels, remain genetically diverse for the long-term, and can do so with minimal reliance on wild animal imports. Unfortunately, over the last decade serious concerns have been raised about the long-term sustainability of zoo populations[1-7] (for references see _Supporting Document 1_).

SSPs currently manage more than 500 species, including tens of thousands of individual animals spread across 230 AZA member institutions and additional non-AZA partners. Many of these SSPs focus on imperiled wildlife. Forty-six percent of the species in SSPs are listed as vulnerable, endangered, critically endangered, or extinct in the wild by the International Union for the Conservation of Nature (IUCN), highlighting the importance of maintaining sustainable zoo populations. AZA has two centers focused on supporting SSP sustainability: the Population Management Center (PMC) at Lincoln Park Zoo (LPZ) and the Reproductive Management Center (RMC) at Saint Louis Zoo. The PMC conducts demographic and genetic analyses and produces Breeding and Transfer Plans (BTPs) in collaboration with the program leaders and institutions involved in each SSP. BTPs include short-term (1-3 year) recommendations based on the PMC's analyses of the number of births needed, the most appropriate genetic pairings to make, and the inter-institutional transfers required to set up these pairs. All institutions have an opportunity to give feedback before a BTP is finalized and thus, in theory, the BTP should reflect the collective intent of SSP members to attempt the proposed recommendations. The RMC supports the BTP recommendations and general SSP sustainability by providing advice on breeding management (both prevention and promotion of breeding) and conducting research to identify the correlates of successful reproduction in a variety of species. Both Centers are focused on improving SSP management using data-driven decision making.

An essential step in assessing SSP sustainability is evaluating whether BTP recommendations are occurring as requested and, if not, the possible reasons for failure**.** In 2008, LPZ received a National Leadership Grant (LG-25-08-0063-08) to develop PMCTrack, a comprehensive monitoring system of BTP recommendations and their impact (www.PMCTrack.org); it was released to the AZA community in 2011. PMCTrack's core data are 1) BTP recommendations for each SSP animal to move, stay, breed, or not breed, 2) whether those recommendations were fulfilled (occurred as requested) before the next BTP was issued, and 3) the reasons why recommendations went unfulfilled, collected via surveys of each institution. As of November 2017, the PMCTrack dataset includes more than 347,000 recommendations issued by 514 SSPs to 688 institutions, spanning 17 years of SSP management. With these data, we now know that 23.4% of Breed (out of N = 19,205 recommendations), 94.9% of Do Not Breed (N = 63,932), 58.8% of Transfer (N = 10,666), and 92.8% of Hold (N = 91,398) recommendations are typically fulfilled before the next BTP is issued[8,9].

Understanding these fulfillment rates from 2000-2017 is important, but the true power of 347,000 recommendations lies in using them to identify what variables are associated with high fulfillment rates. For example, the low (23.4%) fulfillment rate for breeding recommendations threatens SSP sustainability and has been alarming to the community. Following through with breeding recommendations is essential to SSPs being able to produce enough births, produce the "right" births to maintain the population's genetic health, and meet target sizes and exhibit needs of institutions. It is crucial that we gain a better understanding of the reasons why BTP recommendations go unfulfilled so we can address them. PMCTrack was designed to do this. Both its users and those who guide policy within AZA regard PMCTrack as an essential system for data-driven SSP management (_Supporting Doc. 2_). It provides critical data on fulfillment rates, helps us monitor the impact of

changes made to SSP programs, and creates transparency so individual institutions better understand their participation in the SSP system, which the community has long called for. However, we have not yet harnessed PMCTrack's full potential.

What do you propose to do?

In this proposal we build off lessons learned in the six years since PMCTrack's release to pursue three key initiatives: **1) database enhancements** to meet the needs of both AZA science centers and create a more powerful and effective tool for the entire AZA community; **2) analyses of its comprehensive dataset** to provide system-wide understanding of the drivers behind both fulfilled and unfulfilled recommendations; and **3) training for the AZA community** to reduce barriers to usage. We are confident that collectively these initiatives will maximize PMCTrack's effectiveness as a tool for data-driven decision-making for SSPs.

First, we will make key enhancements to PMCTrack to create new analytical tools and improve user experience. Working collaboratively with the RMC, we will integrate data collection for Reproductive Viability Analyses into PMCTrack. The RMC has developed this analytical tool to identify key factors that may affect reproductive success in individual SSPs[10]. They are piloting this approach with four species, but currently data are manually collected in a time-intensive process. PMCTrack currently collects ~60% of the relevant data and could easily collect ~85% with new data extraction routines. Automation and integration into PMCTrack will enable the RMC to drastically reduce data collection time, enabling them to assist more SSPs. Second, we have identified improvements to PMCTrack user interfaces and survey routines, gathered through six years of experience integrating PMCTrack into management and through direct requests from users across the community (*Supporting Doc. 2)*. We will solicit additional feedback on desired changes and then prioritize the requests that will be most impactful to the AZA community. Finally, leveraging nine years of experience in developing PMCTrack, we will modify the reporting tools to improve the user's ability to query, analyze, and apply PMCTrack data to SSP management. These enhancements include: simplifying the reports, providing more visualizations of the data, creating automated exports that are emailed to users rather than requiring logins, and streamlining reporting functionality. We will also tailor key PMCTrack data for zoo and aquarium directors who do not currently have direct access to the information.

Second, we will conduct analyses of the 17 year longitudinal PMCTrack dataset to assess what institutional, programmatic, and individual animal factors correlate with high rates of recommendation fulfillment. In addition, we will conduct the first systematic analyses of the reasons that recommendations have *not* been fulfilled across SSPs, which are collected in PMCTrack's Outcomes Survey (*Supporting Document 3A*). At the AZA-wide level, a preliminary analysis of these data suggest that higher fulfillment rates were impacted by a variety of species biology and program management factors as well as temporal trends, generally increasing over time and as SSPs become more established[8]. In this project, we will hire a post-doctoral fellow to focus on high priority analyses of this massive dataset that will deepen our understanding. In addition, we will work with individual SSP Coordinators to interpret their historical fulfillment rates and the results of Outcomes Surveys. Through analysis of these datasets, we will identify approaches that SSPs can adopt to increase fulfillment rates, and determine if policies surrounding SSPs can be adapted to improve outcomes, or if particular taxa need further research into their husbandry or reproductive challenges.

Third, we will enhance PMCTrack training for AZA professionals to improve its adoption by the zoo community. We will conduct regular in–person group trainings, develop online learning modules (in a recent AZA survey, 59% of zoo and aquarium staff preferred these types of modules for training), and offer one-on-one training to ensure effective and widespread use of the system. Adoption by additional users will increase the size of the overall PMCTrack dataset, making it a more comprehensive and powerful tool.

Who or what will benefit from your project?

The project will provide professionals involved in SSP management with a more powerful and user-friendly PMCTrack and train them to better use the system to improve SSP management. This includes

Coordinators who manage individual SSPs (N = 400 users), Taxon Advisory Group (TAG) Chairs (N = 43 users) who oversee the SSPs for groups of similar species, and users representing individual institutions, including Institutional Liaisons (ILs), Institutional Representatives (IRs), and zoo and aquarium directors (N = ~2000 users; *see Supporting Doc. 3B for role descriptions*). All of these people play a pivotal role within the SSP management system (many as volunteers), and improvements will mean their time is used efficiently.

In addition, the project will create a better tool for PMC and RMC scientists to provide data-based advising for SSPs. Incorporating the Reproductive Viability Analysis data extraction and reporting will facilitate the work of and enhance collaboration among the RMC and PMC. By significantly reducing data collection time, RMC scientists will be able to complete analyses on SSPs more rapidly, identifying key factors that are correlated with successful breeding. Those findings will then be directly applied by PMC and SSP Coordinators to develop BTPs, resulting in breeding recommendations that are more likely to be fulfilled.

As a result, this project will enhance the sustainability of the over 500 species managed as SSPs. This will ultimately enable AZA institutions to fulfill their missions to connect people to nature, educate and inspire 186 million annual visitors of all ages, and conserve wild animals and wild places.

How will your project address the goals of this program?
This project enhances a critical tool for SSP management using an approach prioritized by IMLS in 2017: "implementing approaches to continuously evolve…using data-based information gathering and decision-making strategies." As SSPs are the core of zoo and aquarium collections, this work directly support's IMLS's goal of exemplary management, care, and conservation of museum collections. Through additional capacity-building, the project also involves training and development for zoo and aquarium staff on using this important tool and participating in the SSP management system.

2. Project Work Plan
Project Activities: Over the three year grant period, we will:
1. **Enhance the PMCTrack database and website** by working with our programmers to:
    a. **Create new functionality to support the RMC's Reproductive Viability Analyses**
        i. Extract and store essential data from each SSP's studbook database (e.g. reproductive history of an individual involved in a breeding recommendation, institutional history of breeding the species). The RMC has already identified the most essential variables for analysis when piloting this approach.
        ii. Create a new Reproductive Viability Analysis report that the RMC can access which aggregates all of the relevant breeding recommendations, birth events, and studbook data for each SSP. This report will form the starting point for their Reproductive Viability Analysis process, in which they augment these data with additional information relevant to predicting breeding success rates in collaboration with SSP coordinators.
    b. **Improve PMCTrack user experience based on community feedback:** We will create a Programming Plan based on feedback collected via: (1) informal communications and requests from users since the application's launch; (2) a user's survey we will launch in the first months of the grant; (3) ideas generated at a users' focus group that we will hold at the AZA Meeting in March 2019; and (4) advice from a virtual Stakeholders Advisory Group (see *Supporting Document 3B).* We will work with the Advisory Group to prioritize the most important PMCTrack enhancements that will benefit users. A few examples of likely priorities include:
        i. Improvements to how surveys are presented and administered to create a more modern, streamlined, and satisfactory user experience;
        ii. Flexibility in survey response deadlines to allow additional IRs to respond; and
        iii. Enhanced ability for additional users (Species Coordinators, PMC) to record reasons that recommendations weren't fulfilled rather than only IRs having that capability.

    c. **Enhance reporting features to improve ease of access and usage of PMCTrack data:**
       i. Improve report functionality, including making reporting easier, faster, and more flexible;
      ii. Simplify reports, creating more actionable output including more visualizations of the data; and
     iii. Create new functionality that will automatically email key PMCTrack metrics to specific user groups on user-defined frequencies (annual, quarterly, monthly), rather than requiring users to login and access information. Pushing the PMCTrack information out to the users will keep the tasks they need to complete for the SSP management system top of mind.

2. **Analyze the rich PMCTrack dataset to better understand AZA-wide and SSP-specific challenges:**
    a. **Evaluate what institutional, programmatic, and individual animal factors correlate with high rates of recommendation fulfillment over the past 17 years within and across SSPs.** Specifically, we will examine how fulfillment rates are impacted by:
       i. Individual animal factors such as age, reproductive history, genetic status. We predict that lower fulfillment rates may be associated with increasing female age, past history of unfulfilled recommendations, and past breeding history, based on evidence in select taxa that are beginning to accumulate[12]. This analysis will be further enhanced by the additional data collected for the Reproductive Viability Analyses. The RMC analyzes these data on an SSP-by-SSP approach, but the Post-Doctoral Fellow will also analyze across SSPs to yield AZA-wide patterns;
      ii. Population size and number of participating institutions. We predict that larger populations and/or those spread across more institutions will have lower fulfillment rates, due to the challenges of communicating with and organizing larger groups of IRs; and
     iii. Institution and institution type (i.e., collection size, staff size, budget size, location). We make no *a priori* hypotheses.
To analyze the above relationships, we will use random forest statistical analysis, a type of classification and regression tree analysis that is especially useful for exploring large datasets that contain complex interactions between combinations of continuous, ordinal, and categorical variables[13,14]. This approach is also appropriate based on the correlative rather than causal nature of our analysis. We will use the randomForest package[15] in R[16] to run this analysis.
    b. **Analyze PMCTrack Outcomes Survey data within and across SSPs to assess why recommendations are unfulfilled.** PMCTrack Outcomes Surveys were released in 2014, and can be sent by an SSP Coordinator as they prepare to create a BTP. The survey asks respondents to select a primary and secondary reason that the recommendation in question did not occur from a closed-ended, pre-determined list of categories (e.g., *Supporting Document 3A*). The answer choices are deductive (derived before the empirical data were collected[17]), developed from anecdotal reasons the PMC has heard for why each recommendation type might not occur. Users also have the option to provide open-ended text responses in either an "Other Reasons" or "Comments" field. Preliminary analyses of data from 51 SSPs that had used the surveys as of November 2017 (N = 1,406 individual IR survey responses), showed that 43% of IRs used the "Other Reasons" or "Comments" fields yielding 633 individual text-based responses. Thus the survey data will yield both closed- and open-ended responses, which will require qualitative data analysis approaches[18,19] to yield useful insights. Because these data are entirely new and will accumulate slowly as SSPs work with the PMC, we will develop a standardized, repeatable analytical approach during the grant period so we can continue to re-analyze the data as it accumulates, including after grant completion. We will:
       i. Develop a framework and approach for extracting, cleaning, and coding open-ended Outcomes Survey data, including a process for assessing whether existing comments can be coded into

> pre-existing categories, identifying whether deductive categories need to be modified, and identifying whether new categories will be added;
> ii. Investigate and select an appropriate Qualitative Data Analysis software package to facilitate coding, retrieval of comments by category, data visualization, and export of tabulated data for further statistical analysis in R;
> iii. Hire and train a research assistant to code open-ended survey data. Coding will primarily be conducted by the research assistant, but the team will also establish inter-rater reliability standards so that coding consistency continues after the grant period. Instances in which responses cannot be clearly coded will be reviewed by the group in weekly meetings, thereby using "consensual coding"[16], which will improve all coders' understanding of how to consistently code responses;
> iv. Use an extraction of the data accumulated thus far to test the methodology outlined above;
> v. Prepare a comprehensive analysis protocol of the preliminary data in R to summarize and highlight key patterns in the reasons that recommendations don't occur. Analysis will be based on frequency of responses cross-tabulated by categories such as recommendation type, species, SSP, and institution. We will develop an R-package for the analysis that can be reused in the future as more data accumulate; and
> vi. If changes to deductive categories in the Survey are needed, release a second version of the Outcomes Survey for use in future data collection.

3. **Conduct trainings on PMCTrack and new program enhancements to reduce barriers to use within the community.** Although there is significant support within the AZA community for PMCTrack (see *Supporting Doc. 2)*, we know that the busy volunteers involved in SSP programs can find it challenging to adopt new tools. In 2015-7, 30% of eligible SSPs used Outcomes Surveys and 48% of eligible SSPs used Wants/Needs Surveys. Both surveys' usage rates show increasing trends over time, but improved functionality will improve usage. We will expand usage within the grant timeframe by:
   a. Developing additional online help modules that will be hosted on AZA's Online Training Modules portal. Modules will be role-specific and focused on a single aspect of working within PMCTrack;
   b. Using short-courses, help desks, and one-on-one trainings at AZA conferences (two each year) to train all user groups, providing them a range of more and less formal ways to familiarize themselves with PMCTrack and how it may apply to their programs; and
   c. Working one-on-one with SSP Coordinators as they're preparing for their BTP meetings to assist with survey setup and interpretation of baseline fulfillment rates and survey results.

Who will plan, implement, and manage your project?

The assembled project team combines the talents and perspectives of LPZ, the PMC, the RMC, and AZA; it is uniquely positioned to complete the programming, research, and training aspects of the project with the highest level of success. LPZ hosts the largest concentration of population-biology-focused staff in AZA, including the PMC (7 staff) and the Alexander Center for Applied Population Biology (5 staff). For the past 17 years, the PMC has advised AZA SSPs on population management and development of BTPs. The Alexander Center focuses on conducting research and developing software tools to improve scientific management of animal populations. The AZA RMC at Saint Louis Zoo and its international advisory board have been providing the AZA community with advice on breeding management for 26 years. This expert team will coordinate closely with the team member based at AZA, who will ensure strong collaboration and communication with the AZA Board of Directors, Board-level animal management committees, and the Association as a whole. We will also form a **Stakeholder's Advisory Group** for AZA community feedback (see *Supporting Doc 3b).*

Personnel – Permanent Staff

These personnel all have positions that include time to either lead or collaborate on projects focused on improving understanding of small population biology and the AZA cooperative management system.

Lisa Faust, Ph.D. (LPZ), Principal Investigator (PI): Faust is the Vice President of Conservation and Science and the Director of the Alexander Center. She specializes in demography, including 20 years of experience in population biology research. She has been a PI or co-PI on five IMLS population biology and software development projects, including the 2008 grant to develop PMCTrack. She will oversee the project through all stages of programming, research, and development of policy and management recommendations. She will manage budget expenditures, reporting, and share results with key stakeholders.

Judy Che-Castaldo, Ph.D. (LPZ), Co-PI: Che-Castaldo is a Research Scientist in the Alexander Center, with ten years of experience working on population biology research. She will lead the research portion of the project, guiding project design and statistical analyses and supervising the Post-Doctoral Fellow.

Kaitlyn Perišin (LPZ), Project Coordinator: Perišin is a Research Biologist in the Alexander Center, with 8 years of experience working with the participants of SSPs, including serving as the point person on PMCTrack software testing, customer service, and training. Perišin will coordinate with the programmers and will oversee the programming, testing beta releases, and any testing conducted by the Research Assistant. She will also take the lead on designing and delivering training for PMCTrack users.

Kristine Schad, M.S. (PMC), Project Team: Schad is Director of the PMC. She has 12 years of experience in small population biology and zoo population management. She will attend team meetings to advise on the programming, research, and training aspects of the project. She will also collaborate on development of policy changes and ensure smooth adoption of results into PMC management process.

Monica McDonald, Ph.D., Ashley Franklin, Ph.D. (RMC), Project Team: McDonald is Program Coordinator of the RMC. She has 8+ years of experience designing research projects and collecting and analyzing behavioral and genetic data from wild animal populations. Franklin is Program Analyst of the RMC. She has 11 years of experience conducting research to inform management strategies of zoo populations, with high proficiency in statistical analyses. Both RMC scientists will collaborate on the design and programming of the Reproductive Viability Analysis tool, including attending relevant team meetings and conducting software testing during tool development. They will also collaborate on relevant research analyses completed by the Post-Doctoral Fellow that build off the single-SSP Reproductive Viability Analysis approach.

Candice Dorsey, Ph.D. (AZA), Project Team: Dorsey is the Senior Vice President of Conservation, Management, and Welfare Sciences at AZA. She has 18 years of experience designing and executing zoo-based research. She will collaborate on analyses, coordinate any recommended changes to AZA policy, and collaborate with the appropriate AZA committees to implement these recommendations.

John Andrews, M.S., Amanda Lawless, M.S., Nicolette Sra, M.S., and Paul Senner, M.S. (PMC), Project Team: These Population Biologists collectively have 6 years of experience assisting SSPs with population analysis to produce BTPs. They will advise the project during all stages. They will assist with training SSP Coordinators in better using PMCTrack's tools and data as they develop BTPs and collect prospective data to be uploaded to PMCTrack as part of ongoing PMC duties.

Kelvin Limbrick, Kayla Melton M.A. (PMC), Project Team: Limbrick is the Studbook Analyst and Melton is the Research Assistant in the PMC; they assist SSPs with data cleanup and preparation for the BTP process, and are responsible for uploading key data to PMCTrack as they coordinate the planning process. They will provide feedback on the programming plan, liaise with SSP coordinators who are using PMCTrack, and ensure that programming changes are seamlessly integrated into the PMC's administrative processes.

Personnel - Grant-funded positions

Funding is requested for positions that will work at Lincoln Park Zoo as part of the project team:

Post-Doctoral Fellow: Ideal candidate has a Ph.D. in ecology, focused on population dynamics and population biology. S/he will have strong statistical skills, experience working with large datasets and qualitative data

analysis, and an interest in addressing applied population biology questions. This position will assist the PI, co-PI, and project team in executing the Research Plan. This is a full-time position for years 1-3.

Research Assistant: Ideal candidate has a B.S. in biology or the sciences, strong computer skills, and an interest in population biology and zoos. This position will assist Perišin with software testing and debugging. S/he will also assist the Post-Doctoral Fellow with data entry and data cleaning, especially in the coding and analysis of the Outcomes Survey data. This is a full-time position for years 1-3.

Personnel – Consultant Partners

Tony Neimann (ZierNiemann Consultants): Niemann and his company's programmers have been assisting with PMCTrack development since fall 2015. They also developed additional record keeping software utilized by zoos and aquariums, and thus have a strong understanding of the PMCTrack user group. The group has 20 years of experience writing software for the zoo and aquarium community.

What are the risks to the project and are they accounted for in the work plan?
This is a low-risk project with a high chance of success given that PMCTrack is already operating as a key part of the AZA cooperative management system, has a substantial historical dataset that can yield important research findings, and has strong support from the AZA community (*Supporting Doc. 2)*. In addition, bringing new functionality of the Reproductive Viability Analyses into PMCTrack will ensure that both AZA Centers have the best tools for advising SSPs. For the programming, we are working with a trusted consultant partner who has been developing PMCTrack for the past three years, and understands both the application and the zoo community users well. Although unanticipated delays are common with software development projects, both the LPZ project team and ZierNiemann have had extensive experience in planning and executing these types of projects and are confident that the proposed Project Plan is feasible within the grant period. Because the historical dataset is already collected, we will immediately pursue the research portion of the project with an analysis of which institutional, programmatic, and individual animal factors correlate with high rates of recommendation fulfillment. We recognize that analysis of the Outcomes Survey data will take more clean-up and coding, which is why we have built in Research Assistant time to assist so that the Post-Doctoral Fellow can remain focused on higher level analyses. Ultimately, we feel confident that the risks in this project are acceptably low and are well accounted for in the work plan.

When and in what sequence will your activities occur?
Project Year 1 (December 2018 – November 2019):
1. Hire and train project staff, form Stakeholders Advisory Group (December 2018 – February 2019)
2. Programming:
    a. Conduct electronic survey to query all current PMCTrack users on prioritization of identified design changes and to gather additional requested design changes (January 2019)
    b. Develop draft Programming Design Proposal (December 2018-February 2019)
    c. Convene meeting with LPZ, AZA, RMC, and programmers to review Programming Design Proposal (February 2019)
    d. Convene PMCTrack users' focus group for members of the Stakeholders Advisory Group and general users at AZA Meeting to gather final feedback on proposed improvements and prioritize changes (March 2019); Develop final Programming Design Plan (April 2019)
    e. Begin programming (May 2019); Utilize Stakeholders Advisory Group and Project Team staff as testers throughout programming
3. Research:
    a. Develop Research Plan, prioritizing analyses focused on the institutional, programmatic, and individual animal factors correlated with high rates of recommendation fulfillment as well as those focused on the reasons for unfulfilled outcomes (January-Mar 2019); initiate research
    b. Report findings at AZA Conference (September 2019)

      c. Produce draft of manuscript on factors related to high fulfillment rates (December 2019)
4. Training:
      a. Develop Training Plan, including identifying needed help modules, incorporating feedback from the user's focus group at AZA meeting (March 2019)
      b. Hold PMCTrack trainings and help desk at AZA Conferences (March 2019, September 2019)

<u>Project Years 2-3 (December 2019 – November 2021):</u>
1. Continue programming, gathering feedback and testing with Stakeholders Advisory Group;
2. Continue research, including developing the qualitative data analysis approach for Outcomes Survey data and the R package for analysis; report findings at AZA National (September 2020, 2021) and an appropriate scientific conference (October 2020, 2021); Produce draft of manuscript on the reasons for unfulfilled outcomes (March 2021);
3. Continue training plan, including conducting PMCTrack trainings and help desk assistance at AZA Conferences (March 2020, September 2020, March 2021, September 2021)
4. Conduct final user survey to gauge impact of programmatic changes for PMCTrack users (October 2021)

<u>What financial, personnel, and other resources will you need to carry out the activities?</u>

    The resources provided by LPZ, RMC, and AZA and those requested from IMLS will enable project completion in an efficient, cost-effective manner (see budget, budget justification, schedule of completion, and resumes for more details). The total budgetary request from IMLS for this Project is $541,815, which includes $250,363 for personnel salary costs, $55,080 for fringe, $35,845 for travel, $13,856 for supplies and equipment, $110,000 for programming, and $6,000 for other costs. As demonstration of our commitment to this project, LPZ requests only 15% ($70,671) of its eligible 41.60% of indirect costs, using the rest as match ($125,325). In addition, we pledge $452,920 of staff time (salary plus fringe benefits) towards completion of the project, for a total cost share of $578,245. The Total Project Costs are $1,120,060.

<u>How will you track your progress toward achieving intended results?</u>

    Progress on programming will be tracked in bi-weekly meetings with ZierNiemann Consultants and LPZ team members. When the RMC-related analyses are being developed, these bi-weekly meetings will include RMC staff. During these meetings, progress will be tracked against the following milestones: 1) production of the initial Programming Design Proposal; 2) completion of different components of the design and debugging of those components; and 3) regular releases of the PMCTrack improvements to PMCTrack users as programming progress is made.

    Progress on research will be tracked in monthly meetings of LPZ team members, with RMC and AZA team members brought in as appropriate. After the Research Plan has been developed and its' projects prioritized, we will use these monthly meetings to track the stage each project is in, discuss challenges uncovered in the course of the research, and draft conclusions from research results. As necessary, we will meet more frequently to address problems that arise between meetings.

    Progress on training will be tracked by development of online help modules that reflect the updated design of PMCTrack, and holding regular training sessions at the six AZA conferences that fall within the grant period.

<u>How and with whom will you share your project's results?</u>

    The programming improvements will be available to PMCTrack's community of users within the grant period. They will be shared with the user community via PMCTrack trainings and help desk assistance at AZA Conferences, as well as via the online training modules. The products of the research initiatives will be shared with key stakeholder groups via presentations at AZA Annual Conference, including highlighting progress with AZA's Wildlife Conservation Management Committee, AZA's Small Population Management Advisory Group, and the general AZA membership, as well as with the wider community at scientific conferences. As research

projects are completed, they will be submitted for scientific publication in appropriate peer-reviewed journals during or directly after the grant period. We will publish in open access so all can benefit from the results.

3. Project Results

What is the performance goal, and how will corresponding data be collected and reported?

The primary performance goal for this project is to *improve management of the Nation's content and collections*. We will measure performance against this goal using these metrics: (1) production of the tangible products of the proposed work, including a fully functional, improved version of PMCTrack released to AZA users; (2) analyses that improve understanding of the SSP system reported to the AZA community at conferences and resulting in at least two scientific publications; (3) increased usage of PMCTrack, measured by more potential users logging in over the course of the grant period, more SSP Coordinators choosing to use PMCTrack surveys, and increased response rates by IRs to those surveys (response rates to surveys issued in 2017 has been 79%); and (4) improved user satisfaction with PMCTrack as indicated by satisfaction ratings on user surveys administered at the beginning and end of the grant period. Progress will be reported annually to the Stakeholders Advisory Group and other key AZA groups to identify opportunities for data-driven changes to the project and/or SSP management.

A secondary performance goal is *to improve preservation, conservation, and care of the Nation's content and collections*, as the long-term outcomes of this work will be enhanced viability of the SSPs themselves, which form a large proportion of the Nation's zoological/aquarium collections. The ultimate improvements to the SSP process, recommendation fulfillment rates, and SSP sustainability as a whole will require long-term measurement given the realities of animal reproductive rates and the timeframe of recommendations (i.e., recommendations issued during the grant period for SSPs on 3-year planning cycles will not be "scorable" as fulfilled/unfulfilled until after the grant closes). The design of PMCTrack allows us to track these long-term impacts over time, and the PIs commit to continued post-grant analysis to inform this goal.

Finally, as this project involves *training and developing museum and library professionals*, we will utilize IMLS's Performance Measure Statements to evaluate the impact of our professional development for zoo and aquarium professionals. At each of the three group training sessions, we will track attendance and conduct post-training evaluative surveys using IMLS's recommended Performance Measure Statements (e.g., "My understanding has increased as a result of this training").

What are your project's intended results that will address the need, problem, or challenge you have identified?

Currently, the biggest challenge in managing sustainable SSPs is our failure to understand why BTPs, especially breeding recommendations, go unfulfilled. The proposed work will meet this challenge by enhancing PMCTrack, the tool designed to collect those data for all SSPs for the first time. Programming enhancements and increased training opportunities will result in an improved tool that is more widely used throughout the AZA community. In-depth data analyses will illuminate factors correlated with low and high rates of BTP recommendation fulfillment, and categorize – for the first time – the most common reasons that recommendations are not fulfilled. These results will help identify challenges to fulfilling recommendations, including which species or taxonomic groups may need additional research into the behavioral, nutritional, physiological, or husbandry challenges preventing fulfilled recommendations. The new analysis to support the RMC's work will enhance their ability to work intensively with individual SSPs to pinpoint factors that threaten sustainability. Thus, this project will allow the AZA community to more fully understand strengths and weaknesses of the BTP system and guide critical improvements to SSP management.

How will the knowledge, skills, behaviors, and/or attitudes of the intended audience change as a result of your project? What tangible products will result from your project?

The proposed work will facilitate and greatly increase the application of science-based decision-making for SSP management. A deeper understanding of why BTP recommendations go unfulfilled will allow the AZA

community to improve recommendation fulfillment rates by adapting management practices. For example, if our analysis shows that a particular institution is struggling to fulfill an SSP's breeding recommendations, the SSP Coordinator may work with that zoo to provide information about best practices in breeding husbandry. If data reveal that multiple institutions are placing animals together to breed without resulting in pregnancy, it may suggest a need for multi-institutional research into the reproductive physiology or behavior of that species or taxon. Analysis of, and easier access to, these data and findings will help individual SSPs and the AZA community enhance their management of SSP populations. In addition, because PMCTrack will be an ongoing monitoring system, the AZA, PMC, RMC, and SSP Coordinators will be able to track progress on management changes against the substantial baseline data already accumulated. PMCTrack will therefore be a long-term resource to help understand if the SSP system as a whole is increasing in effectiveness.

ILs and directors will be able to use the improved software and reporting tools to view their institution's data within PMCTrack and, in a new PMCTrack feature, receive automatic reports via email on a regular basis without logging in to the system. Currently, ILs have access to these data in PMCTrack but usage is not as wide-spread as for SSP Coordinators and IRs. By making PMCTrack data more accessible to directors, this project will enable them to easily understand their institution's performance within the greater SSP system. This transparency has long been called for in the AZA and its members (*Supporting Document 2*), and will enable each zoo to clearly track their responsiveness to surveys and success in fulfilling recommendations, as compared to AZA-wide averages. Finally, it is likely that simply by transparent monitoring and benchmarking of historical rates, fulfillment rates across the board may begin to improve. When a similar system was set in place in the Zoo and Aquarium Association (ZAA) in Australasia, friendly competition increased rates over time as each institution worked to beat the Association-wide average (and perhaps their fellow directors)[11].

How will you sustain the benefit(s) of your project?

LPZ and AZA are committed to sustaining PMCTrack and its ongoing development. Since the 2008 grant was completed, LPZ has invested programming funds for ongoing maintenance and a full-time position (Perišin) to manage the database and assist the AZA community with interpreting its results. The proposed database enhancements will result in a substantial improvement, creating a second generation product that meets user demands. LPZ is committed to sustaining PMCTrack after completion of the grant, including supporting the hosting and cloud storage fees and performing necessary maintenance to address defects. LPZ is also committed to providing ongoing user support and training after the grant period ends.

In addition, PMCTrack only becomes richer as more data accumulate during and after the grant period. The research conducted by the Post-Doctoral Fellow during the grant will be critical to our initial understanding of the system but will also lay the framework for periodic re-analyses after the grant. LPZ has a substantial research program, and after the post-doctoral position has ended, Che-Castaldo and Faust will continue to analyze, report to the AZA community, and publish key findings from the dataset as data continue to accumulate.

Ultimately, this project will provide an essential evolutionary leap forward for PMCTrack functionality and harness the rich dataset for a deeper understanding of the challenges to SSP sustainability. Successful completion of the grant will create a tool that can be easily sustained going forward.

GRANT ACTIVITY	GRANT YEAR 1												GRANT YEAR 2												GRANT YEAR 3											
	2018	2019												2020												2021										
	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N
Hire and Train Project Staff; Form Stakeholders Advisory Group	■	■	■																																	
Collect User Input Via Survey		■																																		
Programming Planning Meeting @ LPZ				■																																
Develop Programming Design Plan	■	■	■	■	■																															
Programming - PMCTrack Database Enhancements					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
Develop Research Plan		■	■																																	
Research Analysis of PMCTrack Data					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Develop Training Plan				■																																
AZA Mid-Year Conference (Training, Feedback, Progress Reporting)				■														■										■								
AZA National Conference (Training, Feedback, Progress Reporting)										■												■												■		
Scientific Conference (Presentation of Results)																								■												■