



Improving Monitoring and Evaluation of Marine Enforcement in Coastal Marine Protected Areas and Fisheries

Proposers

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Objectives

If properly managed and enforced, Marine protected areas (MPAs) are one of the best conservation tools we have to protect our oceans. WildAid developed a framework for effective and sustainable enforcement of MPAs, and a monitoring and evaluation tool, the Marine Protection System (MPS) Tracker to measure impact in their work. Through this project, we aim to:

- ➢ Develop an automated, reproducible workflow for the MPS Tracker
- ➢ Create an interactive data visualization tool that allows WildAid to effectively view and share their results and communicate project progress with donors and partners

Significance

MPAs are areas of the ocean set aside for conservation, including no-take or zones that prohibit specific types of fishing activity. If well-managed, MPAs and fisheries can protect coral reefs, rejuvenate marine wildlife and ecosystems, provide jobs, and feed billions of people (FAO, 2020). Unfortunately, MPAs and fisheries struggle to succeed due to a lack of effective enforcement. Over 60% of MPAs are not well-enforced (Edgar et al., 2014), and $23 billion is lost annually to illegal, unreported, and unregulated fishing (IUU) (Agnew et al., 2009). WildAid Marine responded to this issue by launching a globally scalable and impactful marine enforcement model in 2018 that has expanded by a factor of nine with 75 projects in 14 countries.

According to a study by Gill et al., well-enforced marine areas can increase conservation benefits by nearly 300% (Gill et al., 2017). Currently, WildAid's MPS Tracker is the only known tool to specifically measure marine enforcement capacity and track improvements over time, making it a unique and crucial contribution to the field of MPA management. As described in the client support letter, WildAid has prioritized the further development of the Tracker as they aim to scale their program to 250 sites by 2027 so they can use this tool to communicate the impact of their growth in a quantifiable manner. This project aims to automate the workflow for the Tracker, which has historically been challenging for WildAid, given that its present format lacks version control management, so it is difficult to standardize the process of filling out the spreadsheets. In addition, this project will improve the way WildAid communicates results to donors and in-country partners, and make it easier to share the Tracker with other MPAs and fisheries. As WildAid grows, it is imperative to simplify this process to ensure that project managers fill out the form each year to track improvement over time and address issues in a timely manner, which will ultimately help strengthen marine enforcement around the world.

Background

Monitoring and Evaluation is an important component of WildAid's work. Their MPS Tracker incorporates both qualitative and quantitative metrics to assess progress in establishing a complete marine protection system. During the initial comprehensive assessment of a new site, WildAid conducts a baseline evaluation of a site's enforcement system using the MPS Tracker's 27 categories, examples in Figure 1. These categories cover five key focus areas: surveillance and enforcement, policies, funding, training, and community engagement. This initial evaluation informs the development of the site's MPS Plan and serves as a baseline to track site progress. All sites are then re-evaluated with the MPS Tracker annually and findings inform the creation of strategic annual workplans. Key metrics, such as total patrol hours or observed compliance rate, can be compared both within and across sites to demonstrate measurable improvement over time.

The tool was developed because existing MPA management tools such as those by NOAA (Pomeroy et al., 2004), IUCN (Day et al., 2019), and Marine Conservation Institute (Marine Conservation Institute) have a known weakness in evaluating enforcement capacity at MPAs and fisheries. First developed in 2012, the Tracker is currently in version 4 and has been beta tested by WildAid's project managers in five countries over 1-3 years. The most recent version was modified using findings from a series of focus groups with enforcement, compliance, capacity building, and social science experts. The Tracker is currently in Excel format with two tabs: the Tracker itself (Fig. 1) plus a theory of change tab (Fig. 2), as well as a separate document used as the master data sheet where WildAid has compiled a pivot table to summarize results (Fig. 3). In the current workflow the Tracker is emailed back and forth between project managers and WildAid Marine staff. The current workflow is documented in detail in Figure 5. There are many benefits of transitioning to a more reproducible workflow through automating these steps programmatically.

Equity

WildAid's Marine program is based on strong partnerships with coastal communities, empowering them to act as stewards of their marine resources. WildAid creates a customizable plan to strengthen enforcement, then transfers the knowledge and skills to government officials and community leaders to implement it. The result is dramatically improved, sustainable marine enforcement for developing nations that often lack resources to protect their marine environments from criminal and unsustainable fishing practices. Stronger enforcement leads to greater conservation outcomes for these nations, which in-turn creates long-term economic benefits for artisanal fishers dependent on healthy oceans for their livelihoods. The MPS Tracker is an important component of WildAid's work and demonstrates how WildAid activities directly impact their enforcement capacity and therefore their conservation outcomes. This project would elevate the Tracker's visibility and highlight the importance of effective enforcement in the field of MPA management, as well as allow WildAid to work more effectively and transparently with stakeholders, empowering them in the protection of their natural resources.

Data

The project will utilize data generated by WildAid's marine program over the last three years (including 2022) from up to 75 marine sites. Individual surveys, as well as the current master Excel sheet and summary of results will be sent to the students via email or Google Drive. If time allows, other data sources, including patrol logs will be included to populate the project.

Computational tools & needs

- This will most likely be done in R, although Python could be incorporated.
- Microsoft Excel will be utilized to read the data in its current format
- Data is relatively lightweight, so it would not require any cloud computing or big data manipulations, meaning it would be possible to work on a local machine. This would also be the strategy most manageable for the client.

Possible approaches

WildAid will work closely with the MEDS capstone student group to develop an approach for meeting the deliverables and objectives. We envision the following three steps:

1. Streamline data entry
    a. Create a somewhat automated interface where project managers can enter data online into a quality-controlled spreadsheet or form, which then saves in a machine readable and ideally tidy format.
2. Compile and summarize data programmatically
    a. Read the completed forms into R to be aggregated and summarized.
    b. The workflow within R produces an output summary in whatever format is deemed most useful, which is easily or automatically updated as new forms are submitted.
3. Visualize and share data
    a. The data from step two is then pipelined into an interactive data visualization that is easy, informative, and satisfying to share with audiences.

Deliverables

- ➢ Automated workflow: transition from multiple emailed MPS Tracker Excel spreadsheets to an online form (web-based data collection interface, Google Sheet, etc.) which can be submitted and then analyzed and aggregated in R.
- ➢ Data visualization: create an interface to aggregate and display the data collected in the MPS Tracker utilizing the new workflow. This would be an interactive system where the client, donors or partners can click through and discover what WildAid Marine is doing and tell the story.
- ➢ Stretch goals: MEDs students could develop the following if time allows.
    - ○ Create more in depth interactive maps of MPA sites
    - ○ Incorporate a section to analyze other data to showcase progress in WildAid projects, including patrol logs, marine population monitoring, or completion of annual workplans.
    - ○ Link the MPS Tracker with annual workplans to demonstrate visually how implementation of the plan can create positive changes in Tracker scores over time.
    - ○ Design an intuitive dashboard to visualize MPS Tracker Data

Audience

- ➢ *Donors and partners*: Currently the data from the MPS Tracker is not in a format that can easily be communicated. The visualization would provide WildAid with something to share with donors and partners demonstrating work and highlighting accomplishments. With more efficient dissemination of their positive impact, WildAid can streamline their communication with donors, partners, and MPA stakeholders. Moreover, if our team can improve scientific communication to donors by means of data visualization, interactive graphs and maps, or even (as a stretch goal) an intuitive and accessible dashboard, WildAid could potentially access more funding opportunities.
- ➢ *Individual Project Managers and WildAid staff*: WildAid employs project managers that collect data on the implementation of their MPS plans at various global MPAs. The automated workflow will benefit WildAid, as the current data entry system requires that staff email various spreadsheets to the individual project managers, and then manually aggregate them, which is inefficient and can lead to errors. Automating the workflow would allow WildAid staff to more efficiently assess progress of key metrics at MPA sites and make it easier for project managers to access the Tracker and view historical data.

SUPPORTING MATERIALS:

Citations

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Pomeroy, R.S., Parks, J.E. and Watson, L.M. (2004). How is your MPA doing? A Guidebook of Natural and Social Indicators for Evaluating Marine Protected Area Management Effectiveness. *IUCN*, Gland, Switzerland and Cambridge, UK. xvi + 216 pp. https://nmsmarineprotectedareas.blob.core.windows.net/marineprotectedareas-prod/media/archive/pdf/national-system/mpadoing.pdf

Budget and justification

After brainstorming possible approaches to tackle our goals, we do not anticipate needing any additional funding for this project. We would like to avoid buying any proprietary software and we see this as being very attainable. At this point it does not seem necessary to access any of the allotted budget.

Data

As described in the proposal body, the project will draw on data generated by WildAid's Marine Program, which will be emailed to or shared via Google-Drive with students. Figures below include

examples of spreadsheets and data that will be included. WildAid will not require an NDA to provide access to the data, but request that they are given the opportunity to review and approve any publications beforehand. The images below show what the data currently looks like.

WILDAID MARINE PROGRAM

Country:	
Site:	
Date:	
Site Evaluators:	

Category	Status 1-5	Status Scoring Criteria
		PROCESS INDICATORS
		Surveillance and Enforcement
Vessel Availability		1 = Vessels are in poor shape. Vessel availability is low. 3 = Vessels are in good condition. Vessel availability is average (approximately 50% or more). 5 = Vessels are in good condition. Vessel availability is higher than 75%.
Fleet Adequacy		1 = There are not enough vessels to patrol the MPA and/ or they are not the right kinds of vessels. 3 = There are enough vessels to patrol the MPA, but they are not the right kind of vessels (e.g. coastal vessels only when the MPA needs oceanic). 5 = There are enough vessels to patrol the MPA. The MPA has the right types of vessels for their needs.
Patrol Planning		1 = The MPA agency does not engage in a formal patrol planning process. 3 = The MPA agency has a patrol plan but it is not implemented consistently. 5 = The MPA agency follows a strategic, data-driven patrol plan.
Patrol Execution		1 = The MPA agency does not conduct patrols. 3 = The MPA agency conduct some patrols but they are infrequent, inconsistent, and not targeted for high-risk areas. 5 = The MPA agency conducts frequent, consistent, strategic, data-driven patrols.
Patrol Equipment		1 = Patrol vessels lack essential safety equipment and boarding kits. * 3 = Patrols vessels are equipped with essential safety equipment, but lack adequate boarding kits, or vice versa. 5 = Patols vessels are equipped with both essential safety equipment and boarding kits.
Intelligence Sources		1 = Intelligence information is limited to what is gathered from patrols. 3 = The MPA has some access to external intelligence (e.g. informants or surveillance technology). 5 = The MPA uses multiple channels to gather intelligence information, including but not limited to: surveillance technology to track infractions as they occur, an informant hotline, and other outside sources.
Investigation Procedures		1 = There are no boarding or chain of custody procedures in place. 3 = There are some investigation procedures in place, but they have not have been reviewed or approved by legal teams. 5 = There are boarding and chain of custody procedures in place. These have been reviewed and approved by legal teams.
Institutional Collaboration		1 = Overlapping jurisdictions, unclear lines of authority, and / or competing interests lead to limited or no focus on enforcement. 3 = Overlapping jurisdictions, unclear lines of authority, and / or competing interests lead to inefficient, ineffective, or minimal enforcement. 5 = Institutions have clearly defined responsibilities and collaborate effectively on enforcement efforts.
Staff Numbers		1 = There are no MPA staff for enforcement operations (e.g. surveillance such as patrols and community engagement). 3 = MPA staff numbers are insufficient for enforcement operations and/ or staff retention is low. 5 = MPA staff numbers are sufficient for enforcement operations. Staff retention and/ or morale are high.
Surveillance Prioritization		1 = No priority areas* are defined or priority areas are not under surveillance. 3 = Some of the MPA's priority areas are under constant surveillance via regular patrols and surveillance equipment or all priority areas are monitored, but not continuously. 5 = 100% of the MPA's priority areas are monitored continuously via regular patrols and surveillance equipment.
		Policies and Consequences

Figure 1. MPS Tracker key with 27 total categories for scoring

CATEGORY	STATUS	INDICATOR specific, observable & measurable characteristics, actions, or conditions that show whether or not the desired change has happened	ACTIVITIES actions (to be conducted by WA Marine or partners) associated with delivering project goals	OUTPUTS direct, immediate & measureable short-term results associated with the project	OUTCOMES medium-term consequences that relate directly to project goals (i.e. anticipated changes in knowledge, skills, attitudes, behavior, condition, or status)	IMPACT long-term & indirect consequences influenced by the project
			Surveillance & Enforcement			
Vessel Availabilit	1 = Vessels are in poor shape. Vessel availability is low. 3 = Vessels are in good condition. Vessel availability is average (approximately 50% or more). 5 = Vessels are in good condition. Vessel availability is higher than 75%.	Vessel availability %	Conduct baseline vessel availability assessment Repair existing vessels Institute ongoing repair protocols Design comprehensive fleet renewal plan	Vessel availability assessment completed. # of vessels repaired. Fleet renewal plan drafted and accepted.	Vessel availability is higher than 75% and enables improved surveillance and enforcement of the MPA.	Improved compliance with MPA regulations Improved conservation outcomes
Fleet Adequacy	1 = There are not enough vessels to patrol the MPA and/ or they are not the right kinds of vessels. 3 = There are enough vessels to patrol the MPA, but they are not the right kind of vessels (e.g. coastal vessels only when the MPA needs oceanic). 5 = There are enough vessels to patrol the MPA. The MPA has the right types of vessels for their needs.	% of total adequate vessels needed	Conduct baseline fleet adequacy assessment Purchase new vessels Design comprehensive fleet renewal plan	Fleet adequacy assessment completed. # of new vessels purchased Fleet renewal plan drafted and accepted.	Fleet is adequate to meet the enforcement and surveillance needs of the MPA.	Improved compliance with MPA regulations Improved conservation outcomes
Patrol Planning	1 = The MPA agency does not engage in a formal patrol planning process. 3 = The MPA agency has a patrol plan but it is not implemented consistently. 5 = The MPA agency follows a strategic, data-driven patrol plan.	(y/n) The marine area follows a formal, strategic, data-driven patrol plan.	Develop a patrol plan Implement patrol plan Collect and analyze patrol data Revise patrol plan	A patrol planning process and patrol plan have been developed and implemented.	Strategic patrol planning enables improved surveillance and enforcement of the MPA.	Improved compliance with MPA regulations Observable fisher behavior change Improved conservation outcomes

Figure 2. Theory of change metadata for the MPS Tracker for 3 of 27 categories

Average of Score	Column Labels					
	Community Engagement	Consistent Funding	Policies and Consequences	Surveillance and Enforcement	Training and Mentorship	Grand Total
Row Labels						
Bahamas	**3.20**	**1.80**	**2.75**	**2.75**	**2.13**	**2.65**
2020	2.83	2.00	3.00	2.80	2.25	2.71
2021	3.75	1.67	2.50	2.70	2.00	2.59
Coastal Ecuador	**3.00**	**2.86**	**2.28**	**3.43**	**2.75**	**2.95**
2019	3.50	3.00	2.67	3.80	2.75	3.29
2020	3.00	3.50	2.50	2.90	3.25	2.93
2021	2.25	2.33	1.67	3.60	2.25	2.63
Gabon	**2.73**	**2.00**	**3.17**	**2.29**	**2.78**	**2.64**
2019	2.50	2.00	3.33	2.00	2.50	2.46
2020	2.83	2.00	3.50	2.60	3.00	2.86
2021	3.00	2.00	2.67	2.00	3.00	2.57
Galapagos	**4.38**	**4.20**	**3.72**	**4.23**	**3.50**	**4.04**
2019	4.83	3.00	4.00	4.20	4.00	4.22
2020	4.33	5.00	4.00	4.10	3.00	4.04
2021	3.75	4.00	3.17	4.40	3.50	3.85
Tanzania (PECCA)	**2.88**	**1.43**	**2.61**	**2.20**	**1.92**	**2.31**
2019	2.50	1.00	3.00	2.20	1.25	2.21
2020	2.67	1.00	2.67	1.90	1.75	2.14
2021	3.75	2.00	2.17	2.50	2.75	2.59
Mexico	**2.75**	**1.33**	**2.33**	**1.70**	**2.25**	**2.04**
2021	2.75	1.33	2.33	1.70	2.25	2.04
Grand Total	**3.22**	**2.29**	**2.88**	**2.95**	**2.61**	**2.88**

Figure 3. Master spreadsheet pivot table summary of results

WILDAID MARINE PROGRAM	Country:	Tanzania/Zanzibar	
	Site:	Pemba Channel Conservation Area (PECCA)	
	Date:	Dec-20	
	Site Evaluators:	Jay Udelhoven; Gregg Casad	

Category	Score 1-5		Scoring Criteria	Scoring Notes
PROCESS INDICATORS				
Community Engagement				
Education and outreach efforts are part of MPA management and take place regularly.	2		Education/ Outreach not included in management plan and little or no efforts being made	**2020:** E&O is in GMP, but barely and there is likely some E&O happening on the ground, but barely.
		3	Education/ Outreach not included in management plan. Some efforts have been made to conduct education/ outreach. Content may or may not be relevant to the public, but reaching a large subset of the population.	
		5	Education/ outreach included in the management plan. Regular communications/ outreach is reaching most of the stakeholders. Content is relevant to MPA goals and the public.	
Public is well-informed about MPA regulations and sanctions levied against illegal fishing cases via regular commuications.	3	1	Public is largely uninformed about MPA regulations and sanctions levied.	**2020:** While hard to gauge, it appears that the public is either uniformed or not concerned with regulations given the fact they are not enforced by the DFD. SFCs, on the other hand, tend to be effective in communicating closures and openings. No significant changes occurred from 2019 to 2020.
		3	Attempts have been made at communicating MPA regulations, but some of the public is still uninformed. Or public is unaware of sanctions levied against infractors.	
		5	Public is well-informed about MPA regulations and sanctions levied against illegal fishing cases via regular communications.	
The community is fundamentally involved in MPA management.	3	1	Little or no involvement from the community in the MPA management.	**2020**: Community involvement via SFCs. **2018-2019**: Eight communities to the South of Pemba and two in the North (Fundo & Uvinje are engaged via the outreach work carried out by Mwambao. Manta Resort has also engaged two communities in the North. Manta Reef is currently working with one village closure, but has no by-laws. PECCA engagement of SFCs is limited, though there are reports that PECCA does help in the resolution of conflicts among communities and carries out the occasional patrol throughout the MCA (3-4 per month).
		3	Some involvement by the community in MPA management.	
		5	The community is highly involved in all aspects of MPA management. e.g. community members participate in town hall meetings, management processes, call in tips, etc. These could be informal processes or more formal governance structures.	
High support for MPA from fishing sector and awareness of MPA regulations. Volume of catch and equipment used is sustainable and measured.	2	1	Little or no support for MPA from artisanal, commercial, and recreational fishing sectors OR no awareness of MPA regulations. Volume of catch and equipment used is unsustainable or not measured.	Some communities see the value of MPAs to increase catch yield. Those SFCs are taking action to protect time/area closures through partnerships with KMKM.
		3	Some support for MPA from fishing sector and awareness of MPA regulations. Volume of catch and equipment used is unsustainable or not measured.	
		5	High support for MPA from fishing sector and awareness of MPA regulations. Volume of catch and equipment used is sustainable and measured.	
Tourism industry and private sector (Businesses, NGOs, Universities, other) support management and are not seen as a threat to conservation objectives.	4	1	Tourism industry and private sector do not support management and are seen as a threat to conservation objectives (sector is growing too fast, sacrificing user experience and/ or health to the ecosystem, competing interests with management).	**2020:** Tourist operators support the MPA management because they realise the value of the marine resources to the industry. Also, that tourism levels are such that they are not a primary threat at this point. The logistical challenges and high cost of getting to Pemba creates a barrier to growth in the industry.
		3	Tourism industry and private sector support management, but are seen as a threat to conservation objectives (sector is growing too fast, sacrificing user experience and/ or health to the ecosystem).	
		5	Tourism industry and private sector support management (through project implementation, funding, other) and are not seen as a threat to conservation objectives.	
Number of aerial and maritime vessels		1	Number of vessels and people/ common routes and destinations are growing and unsustainable.	**2020**: It's unclear if the numbers are growing this year. From 2007 to 2016, the fisher community grew by 15% and most of the new entrants were below 20 years of age. The combination of considerable population momentum and

Figure 4. Completed MPS Tracker for Pemba Channel Conservation Area for 2020

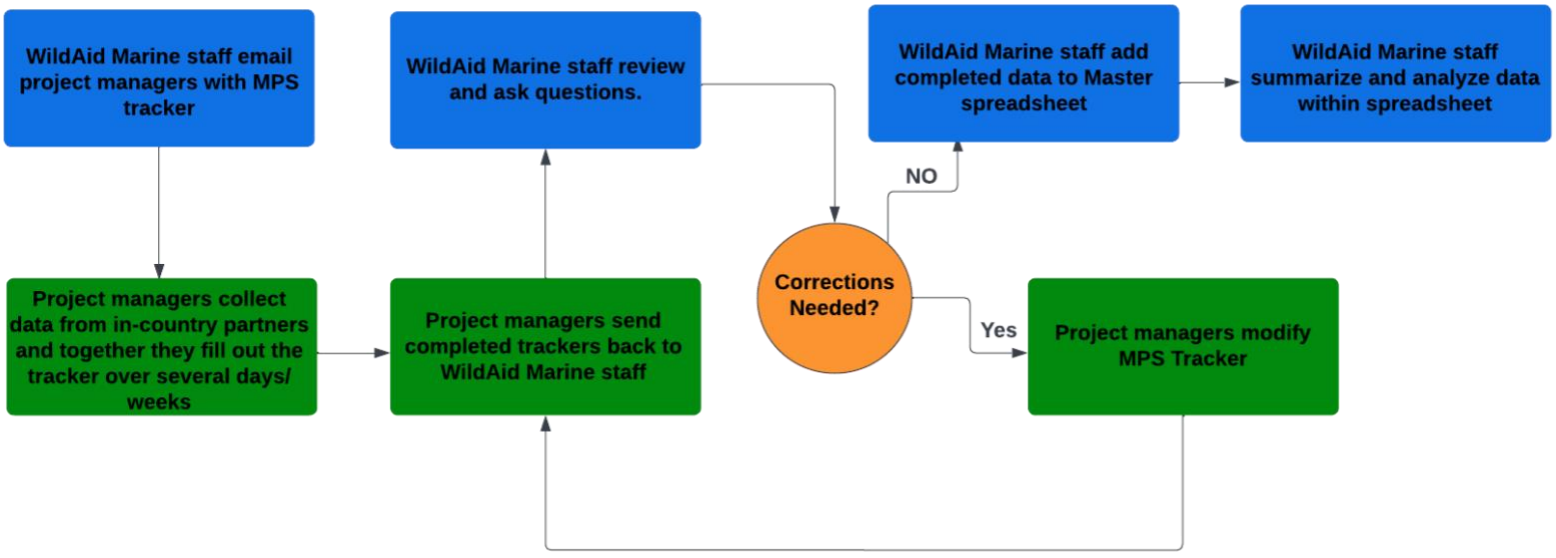

Figure 5. Current Workflow utilized for MPS Tracker



October 12, 2022

Group Project Committee
Bren School of Environmental Science & Management
2400 Bren Hall
UC Santa Barbara, CA 93106

Dear Group Project Committee:

WildAid enthusiastically supports the MEDS Group Project proposal, "Improving monitoring and evaluation of marine enforcement capacity in coastal MPAs and Fisheries" The proposal was written in partnership with Jared Petry, Adelaide Robinson, and Elke Windschitl, students in the MEDS program. I am writing this letter on behalf of the entire client team, which includes myself and WildAid's Marine Program Manager, as well as a group of project managers.

This project will leverage the use of three years' worth of data collected to measure enforcement capacity at up to 75 of WildAid's marine program sites using 27 categories in our unique Marine Protection System (MPS) Tracker (Data for 2021 will be available by the end of January 2023). Currently, the Tracker is used to measure our programmatic impact at each site year-over-year and across sites. Our team of project managers fills out the Tracker annually and our Marine Program staff synthesize and use the Tracker to report back to donors and partners. The student project will first improve our current workflow by automating it, thus reducing user error, inefficiencies from version control, and simplifying the process from getting the current Tracker to the project managers and sending the completed Trackers back to marine staff. Secondly, the project will improve upon the visualization of the synthesized results to create a more beautiful and user-friendly dashboard that our team can showcase to donors to better explain programmatic accomplishments each year. This will simplify our monitoring and evaluation process and improve impact reporting to make our work more transparent and demonstrate the importance of effective enforcement to marine conservation.

WildAid commits to regular consultation and supervision throughout the duration of the project with a minimum of bi-weekly meetings until June 2023 to ensure consistent communication and collaboration. We will provide access to all data collected and answer any relevant questions, as well as send additional metrics as needed, such as patrol logs, annual planning

spreadsheets, MPS plans, and other data we have access to as part of our individual projects. There will be no need for a non-disclosure agreement for access to this data. However, we would prefer that any publication of the data is approved by WildAid first. As the MPS Tracker is an important part of our programmatic monitoring, we also commit to funding the future maintenance of the final project and will consider hiring a data science fellow as needed to maintain the final project.

Thank you for your consideration of our proposal and please do let us know if there is any additional information that we can provide. We are very interested in pursuing this collaboration with the Bren School.

Best wishes,

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