



The FOSSIL Project University of Florida Natural History Museum

Final Summative Report

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Executive Summary

The majority of individuals who participated in FOSSIL perceived they benefited from the project. Roughly three quarters of individuals reported some benefit, and one-fifth reported substantial benefit.

The initial model within the FOSSIL Project as it was proposed viewed the clubs as a mediating element between the FOSSIL Project and individuals, and that over time we would see a growth in networking among the clubs. This did not occur in a significant fashion throughout the clubs, though some clubs appeared to strengthen their connections. Instead, connections were made most powerfully at the individual level, and the project saw its greatest impact there. Some of the most powerful testimonials to the project were from rural participants without clubs in their area, with the FOSSIL Project giving them a link to an enlarged world. Participants generally made connections through face-to-face meetings, traveling, and social media, as well as through myFOSSIL. One strength of the FOSSIL Project team was building those connections one-by-one, fostering relationships between the team members and participants, and then between participants.

The overall model of mode of participation within the FOSSIL project is different than initially predicted. In the beginning stages of the project, there was a presumption that individuals would encounter the FOSSIL project through their local fossil club or through social media, join the myFOSSIL online community and have most of their interaction through the myFOSSIL online platform. Early analysis by the FOSSIL project team demonstrated that mode of participating in the project did not hold true. Instead, individuals encountered the project in a variety of ways, and choose to interact with FOSSIL from within specific formats, not necessarily myFOSSIL. For example, some individuals interact with the FOSSIL Project primarily through the project's Facebook page. Others make use of the YouTube channel. Others read the newsletter, or participate in in-person activities, or use myFOSSIL. Instead of a funnel model, where all activities funnel towards myFOSSIL, the team moved to a more distributed approach, meeting participants where they choose to engage, rather than trying to move participants to use a specific platform. This switch in approach meant the project increased their effort towards social media, as for some participants this was the primary format of engagement.

Beyond developing a network, the FOSSIL Project fostered an interest in the larger research process of paleontology. Through the project half of the respondents felt their interest in the larger process had increased, with nearly one-fifth noting it had increased a great deal. Participant understanding of the scientific process of paleontology grew as well, with half

stating their understanding of the process increased. The largest gains in specific skills were in fieldwork and identification.

Individuals who benefited experienced a step-wise progression through different elements of paleontology, from deepening awareness, to access for more resources and community, to an interest in the scientific progress. For those individuals at a basic level -- people who had a baseline curiosity but no indication of developing a practice—the FOSSIL project provided them a broader view of paleontology, and made paleontology and paleontologists more relatable, interesting, and complex. These individuals tended to not be in FOSSIL clubs. For the individuals already at that stage, they moved to what we term Step 2. These participants were regular fossil collectors. For this group, the FOSSIL Project provided access to experts and a broader community of practice. The FOSSIL Project also gave them a deeper awareness and appreciation of the scientific process of paleontology. They understood, often for the first time, why collecting information around the fossil was important. For individuals who already had this highly developed practice of paleontology, the FOSSIL Project made those individuals want to share their knowledge, and engage in other outreach efforts. In our interviews, we saw participants who benefited generally move one step rather than multiple steps.

Key Takeaways:

- Participants benefited from the FOSSIL Project, in terms of knowledge and interest, and also in concrete paleontology skills. Those that participated more, experienced greater benefit.
- The specific type of benefit was linked to participant incoming paleontology level of knowledge and practice.
- Connections within the FOSSIL Project community were made between individuals, including between the project team and participants, and between participants, rather than through clubs.
- This model of individual connections particularly supported rural audiences, who used the FOSSIL Project as an inspiration and as gateway to science.
- The FOSSIL Project also supported a growing educator audience. Teachers from low-income areas described how teaching the scientific process of paleontology gave their students opportunity to see ways they excel in different avenues.
- The FOSSIL Project changed their model of engagement to meet the needs of their participants, who engaged on distributed platforms, rather than funneling to a single platform.

- Meeting the needs of the participants through social media was labor-intensive, and required significant strategic planning and analysis.
- The online myFOSSIL platform served less as a place where “community” takes place, and more as a trusted resource.

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Project Background

Paleontology, like ornithology and astronomy, has a large amount of amateur interest and engagement. In all three disciplines, significant findings and contributions to collections, identification, and research are made by amateurs, and on the whole amateurs often spend more time observing and collecting than professionals within these disciplines. Amateur astronomers are responsible for finding the bulk of the exo-planets documents, and amateur ornithologists have mapped the change in species migration timing and paths through such tools as eBird¹. Yet until The FOSSIL Project, there were no nationwide platforms that worked specifically to increase communications and integrate efforts of amateur and professional paleontologists. Individual fossil clubs supported the interests of their members, but those clubs typically did not communicate with one another.

Nor was there an organized mechanism in which fossil clubs could interact at a national level with professionals, with whom they share a tremendous interest in paleontology.

The team's front-end survey data from prior to the beginning of project indicated a high degree of interest by the fossil clubs in paleontological content, but significantly lower primary knowledge of these topics, as well as the nature of the scientific process. Furthermore, although there was a high degree of interest in access to fossil collections in museums, members of fossil clubs typically had little opportunity to access these resources for their own personal learning.

The FOSSIL team's initial research prior to commencing the grant demonstrated widely varying attitudes of amateurs and professionals towards one another, and a significant lack of trust. At times, amateurs felt a lack of respect towards their work from professionals, despite the deep amount of expertise the amateurs held, and the significant contributions they had made towards finding, collecting, and accessioning fossils. Professionals felt the amateurs sometimes did damage to the field through improper collecting or through selling fossils. Professionals were generally reluctant to undertake outreach. While they felt outreach encouraged a new generation to discover a love of paleontology, it came at the expense of precious time needed to conduct research and publish for advancement in academia. Amateurs were uncertain how to find or connect with professionals to get advice. Members of both communities were concerned about the shrinking number of collecting sites, due to increased insurance around quarries and other likely areas. Some members of the community were reluctant to share favorite collection sites, for fear their site would be depleted by others.²

The FOSSIL project, funded by NSF (DRL-1322725) created a networked community platform

¹ <https://ebird.org/home>

² FOSSIL Project Advisory Committee Review (2014), Internal Report and FOSSIL Project Community Survey (2014), Internal Report

for fossil clubs and professional paleontologists to collaborate in order to address these needs. Based at the Florida Museum of Natural History on the University of Florida campus, the FOSSIL project fosters a networked community of practice³ in which fossil club members and professional paleontologists can collaborate in learning, the practice of science, and outreach. Mediated through online resources and annual meetings, the FOSSIL project aims to enhance communication between fossil club members and professional paleontologists, engage club members in training and development, allow club members to attend meetings and workshops, and to conduct K-12 outreach to underserved audiences. The project also encourages amateur contributions and access to the growing digitized collections in U.S. natural history museums, and aims to help individuals create and share personal digitized fossil collections.

The FOSSIL project has served two primary target audiences: amateur and professional paleontologists.

The main activities of the FOSSIL project to date include:

- myFOSSIL: a networked web-based community including discussion forums, member pages, resources, and more;
- A robust social media presence, including regular content postings and user interactions on Facebook, Instagram, and Twitter;
- The FOSSIL project newsletter;
- Webinars and videos on specific paleontology topics; and
- Face-to-Face meetings, specimen collection trips, and conference gatherings.

A mobile app for the FOSSIL Project is also available, having been launched after the data for the evaluation was gathered.

FOSSIL Project Goals

The FOSSIL project was designed to strengthen and deepen connections, creating new ties between amateur and professional paleontologists, in order to increase knowledge of, interest in, and skills for the research practices of paleontology. Through extensive work with the team, we translated these larger goals into specific outcomes for each of the target audiences. While our

³ A CoP can evolve naturally because of the members' common interest in a particular domain or area, or it can be created deliberately with the goal of gaining knowledge related to a specific field. It is through the process of sharing information and experiences with the group that members learn from each other, and have an opportunity to develop personally and professionally ([Lave & Wenger 1991](#) via Wikipedia)

primary concentration was on the amateur audience, we also wanted to encourage more positive attitudes and collaboration from the professional paleontologists towards amateurs.

Amateur Outcomes

- Amateur paleontologists will increase their connections with other amateur and professional paleontologists from all areas of the United States.
- Amateur paleontologists will have increased positive attitudes towards professional paleontologists.
- Amateur paleontologists will learn about opportunities in paleontology.
- Amateur paleontologists will have enhanced interest in providing outreach to the community.
- Amateur paleontologists will increase their knowledge of the science of paleontology.
- Amateur paleontologists will increase interest in the scientific research process of paleontology.

Professional Outcomes

- Professional paleontologists will have more positive attitudes toward amateur paleontologists and be more welcoming of them.

In a strong Community of Practice (CoP), individuals take agency for their own learning, developing knowledge and skills through interactions with the community. While the outcomes above detail the very specific areas where the FOSSIL project aims to have an impact, the team is aware that creating a CoP can have numerous unexpected outcomes—friendships made, papers written, interests that evolve. The FOSSIL team posited this particular CoP could build knowledge and skills, but also trust and relationships. Thus, our overarching summative evaluation questions reflect that aim.

Overarching Summative Evaluation Questions:

- 1) How do amateurs and professionals learn and share practices and skills in a Community of Practice (CoP), including effective collections and digitization practices?
- 2) Can a CoP effectively bridge the gap between amateur and professional paleontologists?
- 3) How does access to professional paleontologists and digitized collections change the practice of amateurs and of professionals?
- 4) How does networking the clubs improve the outreach, resources and capabilities of the individual clubs?

Summative Methodology

For the summative evaluation focused on community outcomes and impact, there are three different methodologies.

First, throughout the project the team has been tracking analytics for myFOSSIL through Google analytics, as well as monitoring social media usage. Google Analytics for myFOSSIL was set up in September 2017 to be more accurate, removing automatic site visits from web-crawlers and other automated services, and to give unique UserIds to individual visitors, so as to better track recency and stay time. Our brief analysis below shows the scope of the usage of myFOSSIL after those features were incorporated.

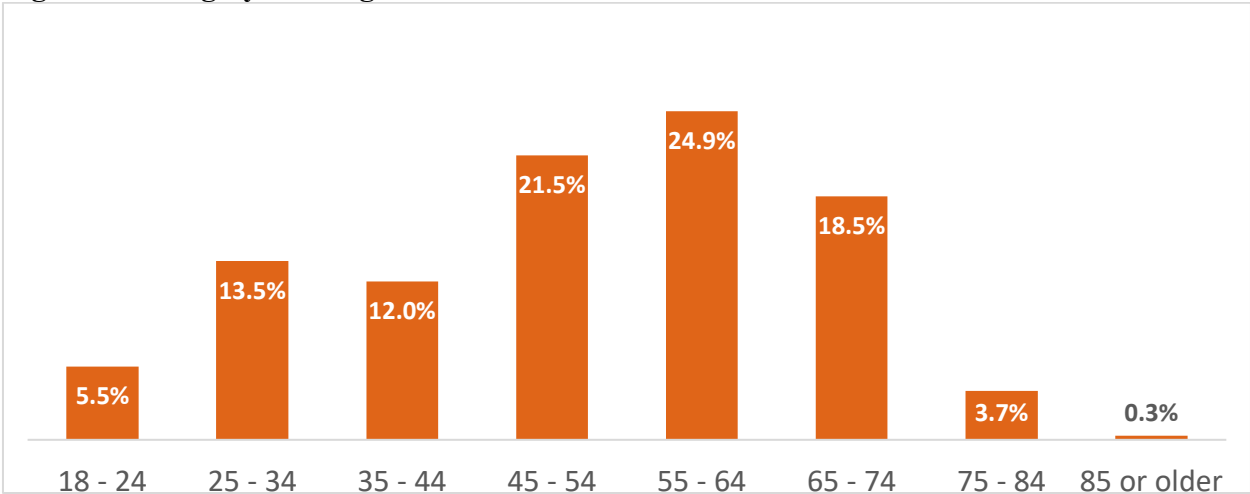
Secondly, a summative survey was conducted in March 2018. This survey was sent to all FOSSIL project participants. Since individuals approach the project from different directions, the team sent out email requests, put items in the newsletter, and conducted a significant social media campaign. As an incentive, survey respondents had the opportunity to be selected to have their travel and lodging paid for a fossil collection trip to Eastern North Carolina.

Finally, the evaluator suggested adding qualitative telephone interviews for the summative. While telephone interviews were not initially part of the summative plan, the team felt interviews were critical to capture those stories behind the more quantitative data provided by the survey.

Survey Sample

Of the individuals that responded to the survey request, there were 343 individuals who agreed to the consent notice and at least partially completed the survey. Just over half (55%) of those individuals were male. The respondents skewed towards older adults, with nearly half of the respondents over age 55.

Figure 1: Roughly Half Age 55 or Older



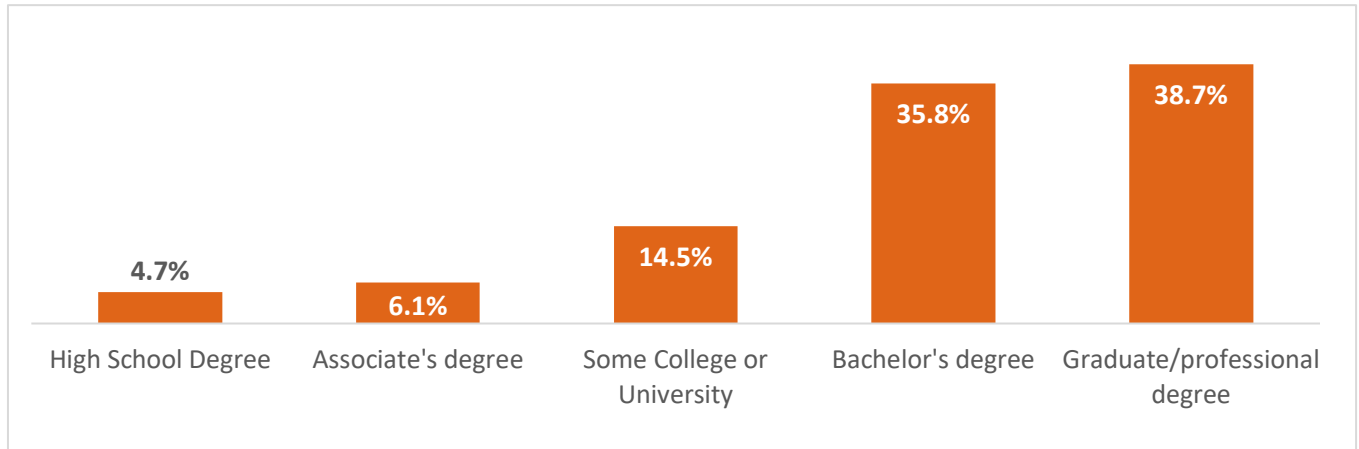
The vast majority of the individuals completing the survey were white.

Table 1: Primarily Caucasian Participants

Ethnicity	Survey %	Survey N	US Census
White	86.3%	297	60.7%
Prefer not to answer	7.3%	25	0.0%
Latino(a) or Hispanic	2.3%	8	18.1%
African American/Black	1.5%	5	13.4%
Asian / Asian American	1.5%	5	5.8%
American Indian/Native Alaskan	1.2%	4	1.3%

Over 75% of the individuals in the survey had a college education or graduate degree.

Figure 2: Highly Educated



There were 204 individuals who were willing to be contacted by phone, out of the 336 respondents. We sampled:

- Those that benefited and showed tangible benefits in the survey
- Those that benefited and did not have increased results
- Those that belonged to clubs and those that didn't

We did not focus on:

- Those that did not know of or benefit from the FOSSIL project

We were able to reach and interview 44 individuals.

Findings

The findings within this report are organized by key question in the following order:

- How do individuals interact with the FOSSIL Project?
- Do participants benefit from the FOSSIL project? If so, how? Who benefits?
- What are the factors that influence project impact?
- What is the composition of the FOSSIL community?
- How has the FOSSIL project community grown and changed?
- Does the FOSSIL project serve as a community?
- How has FOSSIL impacted Amateur/Professional connections?

How Do Individuals Interact with the FOSSIL Project?

Individuals engaged with the FOSSIL Project in their own distinct ways. Nearly half of the survey sample were members of myFOSSIL, one-fifth attended a FOSSIL Project event, and one-fifth read the Project newsletter. Facebook has long been a primary driver of FOSSIL Project participation, and approximately one-third of the respondents followed the FOSSIL

Project on Facebook. Significantly less (under 10%) followed the project on Twitter, perhaps reflecting the older age cohort and reluctance regarding social media.

Figure 3: Online Interaction More Prevalent than In-Person

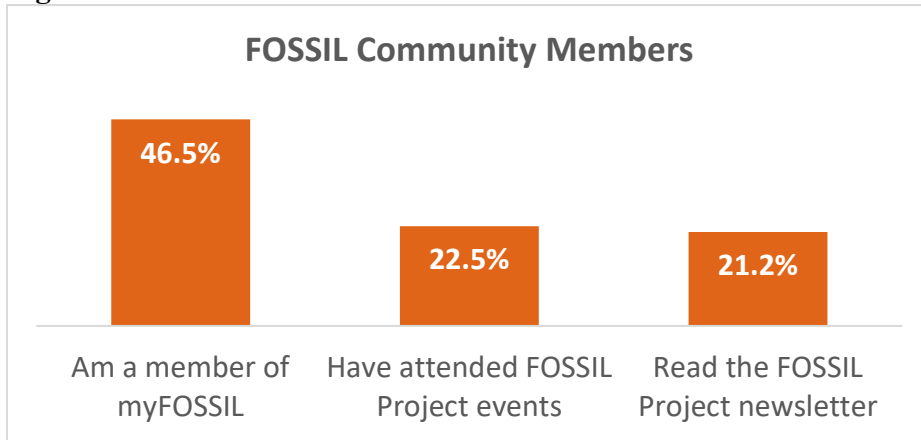
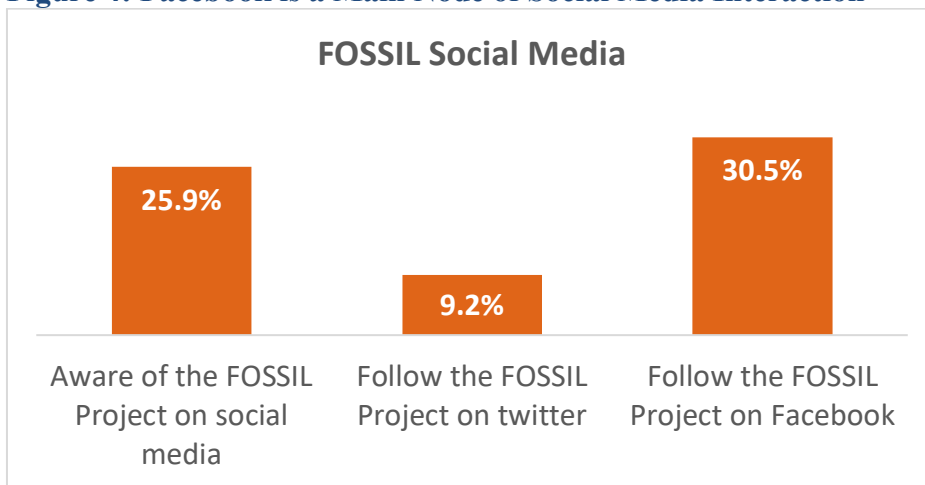


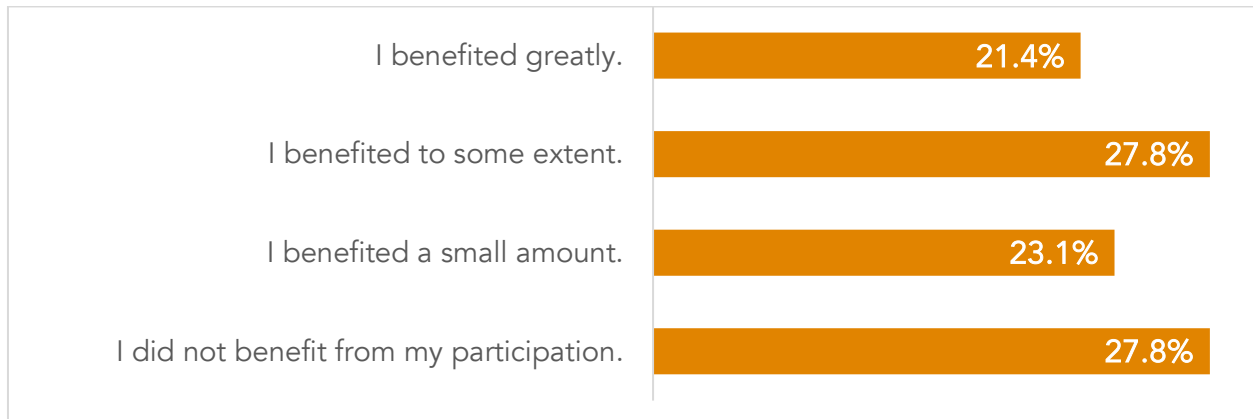
Figure 4: Facebook is a Main Node of Social Media Interaction



Do Individuals Benefit from the FOSSIL Project?

Yes. When asked this question about the FOSSIL project, nearly 75% of the survey respondents felt they benefited to some degree from the FOSSIL project, with nearly one quarter noting they benefited greatly.

Figure 5: More than Three Quarters of Participants Feel They Benefited from FOSSIL



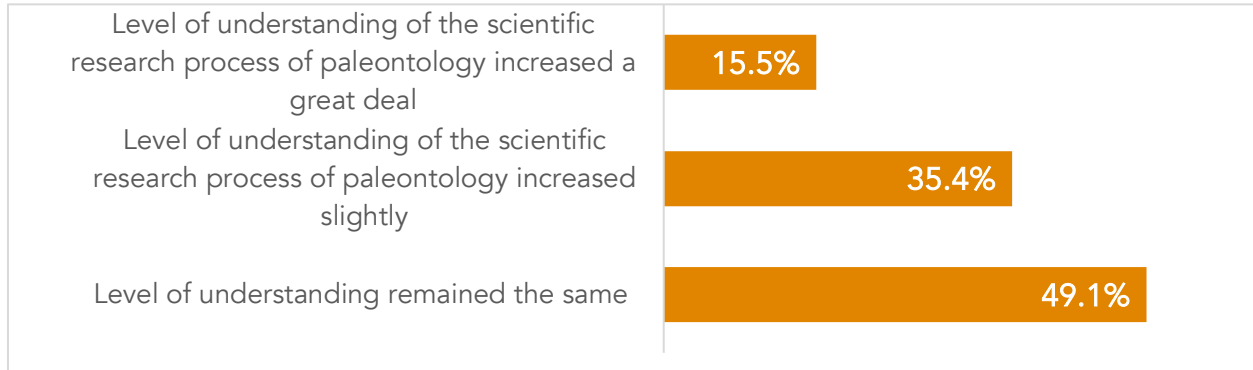
The FOSSIL Project was designed to generate a variety of outcomes, including causing amateur paleontologists to increase their interest in, and knowledge of the science of paleontology and the scientific research process of paleontology. The FOSSIL team was interested in whether individuals would experience a change of interest specifically within the research processes around paleontology. Amateur fossil collectors are obviously already highly interested, but initial project surveys showed they were more interested in and confident of their field collection processes and related knowledge and skills, rather than the larger research process. Through the project 50% of the respondents felt their interest in the larger process had increased, with nearly 20% noting it had increased a great deal.

Figure 6: Over Half of Respondents had an Increase in Interest



We asked individuals whether their understanding in that scientific research process had increased along with their interest. Nearly 50% said their understanding of the process increased, one-third of the respondents said their understanding changed slightly, and 15% experienced a great deal of change in their understanding.

Figure 7: Change in Understanding of the Scientific Research Process of Paleontology Due to the FOSSIL Project



How do Individuals Benefit? Details

Digging deeper into exactly how participants had benefited, we asked participants to rate whether the FOSSIL Project increased their interest, knowledge, or skills within a specific domain. In order to force individuals to be precise and consider their response, we had them single-select within the survey.

The largest gains were in fieldwork and identification, with roughly 10% of the respondents gaining new skills, and another 20-25% gaining new knowledge but no new skills. Another 20-25% of respondents experienced a change in interest in these topics due to the FOSSIL Project. Numbers of new skills, knowledge, and interest fell in the accessioning and outreach categories, with an exception of giving a talk to kids about paleontology. Approximately two-thirds of the respondents did not feel they had any change in these categories.

Table 2: Participant Change in Specific Interests, Knowledge, and Skills Due to the FOSSIL Project

	FOSSIL project increased my INTEREST in this topic	FOSSIL project increased my KNOWLEDGE of this topic	FOSSIL project increased my SKILLS in this topic	FOSSIL project had no impact on me in this topic	Sample
Planning (Where to go, When to go, Equipment)	25.6%	19.1%	8.0%	47.3%	262
Prospecting	24.4%	16.4%	8.8%	50.4%	262
Finding	21.8%	18.7%	12.6%	47.0%	262
Documenting	22.1%	19.5%	11.8%	46.6%	262
Identifying	20.2%	23.7%	13.7%	42.4%	262
Knowing who to reach to help identify a fossil	16.4%	25.6%	14.9%	43.1%	262
Jacketing	23.3%	9.5%	6.1%	61.1%	262
Excavating	22.9%	9.9%	9.5%	57.6%	262
Cleaning	22.6%	16.7%	9.0%	51.8%	257
Identifying (What do you use to do that?)	20.6%	23.7%	9.7%	45.9%	257
Sorting	23.7%	14.8%	9.3%	52.1%	257
Photography	27.2%	12.8%	7.8%	52.1%	257
Digitization	29.6%	10.1%	5.5%	54.9%	257
Cataloging (Putting a number on it and putting it within a database)	25.7%	14.4%	6.2%	53.7%	257
Storing	26.1%	13.6%	5.8%	54.5%	257
Accessioning	26.5%	10.1%	2.7%	60.7%	257
Sharing	30.0%	11.7%	4.7%	53.7%	257
Give a talk to kids about paleontology	23.4%	10.5%	9.7%	56.4%	257
How to write an abstract	19.8%	6.6%	3.9%	69.7%	257
Giving a presentation at Fossil Club Meeting	21.4%	10.5%	5.5%	62.7%	257
Giving a presentation at Professional Meeting	19.5%	8.2%	5.1%	67.3%	257
How to make a Poster	19.1%	7.4%	7.0%	66.5%	257

How to give a Poster	19.1%	8.6%	6.2%	66.2%	257
Publications	20.2%	9.7%	3.5%	66.5%	257

How do Individuals Benefit? Step-Wise Progression

Participants who benefited from FOSSIL can be aligned along a step-wise growth process. The FOSSIL project met individuals at their incoming level, and supported them in moving to another level in their paleontology awareness, knowledge, and practice.

During the qualitative telephone interviews, we saw evidence of participants experiencing what we characterize as step-wise growth. Our 44-person interview sample was primarily focused on individuals who felt they had benefited from the FOSSIL project, so Figure 6 below represents potential change, not necessarily the change that every individual within the FOSSIL Project experienced. If they did experience change, it appeared to fall along this progression. Generally speaking, individuals who benefited from the Project moved up one step. For example, during the course of their participation, they might move from **Step 1** to **Step 2**.

Some interviewees had only a cursory prior experience with paleontology, for example they taught it but didn't practice it themselves, their friends were into it but they weren't, or they had children who related to the world through dinosaurs. These individuals might be considered a Step 1 on a scale of amateur paleontological development; they are people who have a baseline curiosity but no indication of developing a practice.

Figure 8: Step-Wise Paleontology Growth Model

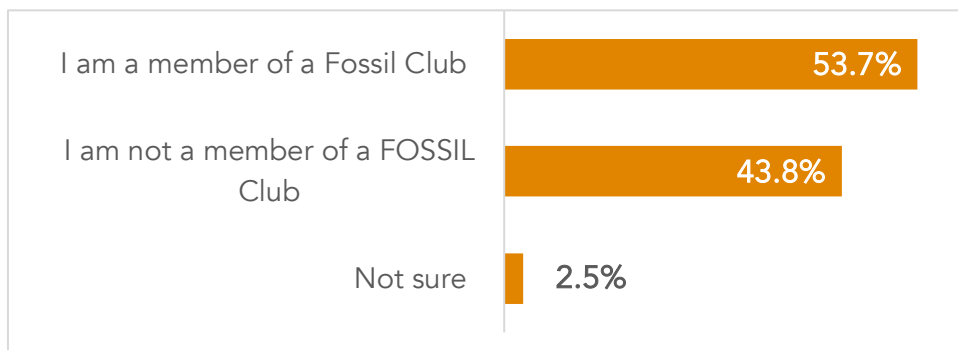


For **Step 1** individuals, the FOSSIL Project provided them a broad view of paleontology that took them “behind the scenes.” As one individual said, “[I realized] you need knowledge to treat what you dig with *respect*.” Another noted “It opened my eyes” to how much work it is, and what goes into the process. “When I look at dinosaurs in the museum, I see them in a different

way now. I think about the whole process - not just the digging- and how we all have bones in our bodies.” **Paleontology and paleontologists become more relatable, interesting, and complex.** Almost none of interviewees at Step 1 were involved in clubs. They primarily learned of the FOSSIL Project through friends, work, or by searching online.

The evaluation team initially felt the survey responses from individuals who did not belong to clubs would bias our results, and were not reflective of the FOSSIL community.⁴ There was a concern that perhaps individuals were “spamming” survey in order to qualify for the incentive, and perhaps not representative of our target population. As word of the survey and the incentive spread through Facebook, individuals who were not engaged with a specific fossil club responded. Through discussion, the team came to the conclusion that while the numbers of amateur paleontologists in a club were higher than expected, this population still represented the FOSSIL community.

Figure 9: Nearly Half of Survey Respondents Were Not Members of a Fossil Club



A second group-- **Step 2**-- of interviewees were regular fossil collectors. The primary interest of these interviews was identifying their finds and learning more about fossiliferous area of interest. For this group, the FOSSIL Project provided **access to experts and a broader community of practice.** Even for long-time Step 2 amateur paleontologists, the FOSSIL Project had impact:

Been collecting for 59 years but myFOSSIL Project opened up different avenues of paleontology I wasn't aware of. Gave me contact with individuals and opened new learning about types of fossils not previously in my area of interest or my geographic home.

The clubs can sometimes get provincial. On myFOSSIL you realize there's a bigger community than Kentucky, Ohio, and Indiana. When you tap in you find

⁴ Nearly half of the survey respondents who were willing to be interviewed were not members of clubs.

other people doing similar research in different areas and it brings you together naturally.

FOSSIL has gotten me in touch with others in nearby states North Carolina, and West Virginia.

FOSSIL Project helps me stay up on the local language. I travel to work in the Hell Creek Formation and most of the people around me don't. Still, if I go to beers with paleontologists in Iowa, I want to be able to talk with them about what's new.

The FOSSIL Project also gave them a deeper awareness and ***appreciation of the scientific process of paleontology***. They understood, often for the first time, ***why collecting information around the fossil was important***.

Without the context a fossil is just a trinket on the shelf.

Most of these interviewees were primed for advancing their hobby; almost all expressed an inherent curiosity that was piqued by paleontology. "I don't just like to find a fossil and put it on a shelf. I want to know more!" The FOSSIL Project whetted their appetite for more, through clear explanations of why scientific process was important, connections with experts, and (occasionally) deeper training within that scientific process.

What excites me about FOSSIL Project is people learn appropriate process of scientific documentation. That turns data into knowledge.

Amateur fossil sites give fossil hunters tips to enhance the look of their fossils. Pretty fossils aren't bad, but we can do more.

For this group, **awareness did not always translate into practice**. However, they expressed interest in learning and developing. **Step 2** interviewees most commonly asked for training to improve their skills in prep and photography. They want to stay abreast of language changes, current findings, and some scholarly discussions. This transformation from causal collectors to amateur paleontologists who recognize the importance of scientific process was not just about "doing it right" but about finding ways to deepen their experience and understanding.

Sunday collectors don't usually do research. Because they are not aware of what's available. With FOSSIL Project, the whole world is available!

FOSSIL Project brings people into the light. It gives them the tools, it helps them learn. If people learn why to note how deep [a fossil] was in the ground, or where

it was, they will want to [document] it because they know it *means* something and they can learn more!

The **Step 3** individuals put their understanding of the scientific process of paleontology into practice. The process of “doing paleontology” becomes self-validating, and they feel that science *belongs to them*. They reported recording metadata, in some cases aligned with their local museum. These individuals were likely to comment on specific, concrete skills they learned:

I learned to jacket fossils.

I learned to remove fossils out of sandy material.

I learned how to put fossils into excel, separate finds, and label specimens.

I learned the importance of a flat background, scale bar, and high-quality images from good angles.

I learned to do prepping with a dremel.

Step 3 interviewees often have existing relationships with the broader paleontology community, particularly museums and universities where they volunteered or submitted their finds. They are very aware of tacit rules around collecting, and voice a respect for professionals and amateurs alike. They feel proud of their knowledge, and want to be useful to professionals, amateurs, and beginners. “Coworkers come into my office and see my fossil display. They get curious and start asking questions. I love to tell them.” This group asked for deeper skill-building videos & webinars to help them with their own fossils, and wanted a *broader* depiction of the scientific research process of paleontology. Several asked for an encyclopedic set of resources. “I want to see a webinar on a dig recovery site to just, like, watch the total process from scouting the location, finding specimens, identifying them, excavating, doing prep, documenting, displaying, and showing what’s been learned.”

Step 3 individuals can also be marked by a critical pivot in their interest: the move from caring to sharing. **Once they understand why the scientific process of paleontology is important, they want to do it and they want to share it.** A big part of that is ensuring that non-experts and newcomers have a solid place to start. “I love to interact with people who get excited when they find a brachiopod. They act like they found a diamond. I want to encourage them, not act like a snob. I want to help the journey of anybody in paleontology.”

Step 3 interviewees recognized the barriers to entry, and the step-wise growth towards their expertise, which they sometimes had surmounted themselves.

I am a late bloomer. I started in my 50s. When I started, I had no clue what they were talking about when they said the so-and-so layer.

This interviewee and others were concerned that the FOSSIL Project starts at a relatively high level, has a specialized lexicon, and might not be thrilling to everybody at first. As another noted:

Sometimes people without confidence, skills, or language to even know what questions to ask don't get invited to the inner circle. But everyone starts somewhere.

To lessen the entry barrier, and get people excited and involved, they evoked people like Drs. Neil DeGrasse Tyson and Carl Sagan who had the ability to translate high level material into palatable segments; they spoke of funny, pithy, or odd takes on paleontology that grabbed their or their students' interest early on. "It's not just amateurs and professionals we're talking about. It's a whole big group who don't know they love it and don't know this is a viable important thing to do."

Step 3 people want to teach, share, and help spread the science and hobby of paleontology, especially with younger generations. In almost all cases, interviewees in this group spend their free time visiting schools, developing small exhibits for neighbors, or donating their finds and their expertise to local museums and, when possible, youth groups. Their language was emotive and emphatic. This group **believes in paleontology and believes a common scientific process is paleontology's route to furthering a world of knowledge**. However, they also understand the power in hobbyist paleontology, and do not believe that everyone has to 'do it right.' They believe **paleontology's greater benefit to humanity is the critical perpetuation of curiosity and a deepening perspective of Earth's long history**. This belief in paleontology supported their larger worldview, such as the individual who commented, "The more we learn about the past the more we can do the future better."

Future Considerations: The team may want to consider how to develop targeted messages for their programs and efforts that resonate with each of these audiences. For instance, a program designed to show how to connect with others beyond your local area is aimed at a different audience than those who are trying to find effective outreach materials. Would it benefit others to make the progression explicit?

The FOSSIL Project team hypothesizes that there is an additional smaller number of individuals who reach **Step 4**. We did not directly see evidence within the qualitative interviews, likely due to sample size. In the Project team's experience, some individuals who were already highly motivated and deeply engaged within the amateur paleontology community increased engagement through a growth of skills, primarily in outreach and leadership.

Who Benefits from FOSSIL?

Impact in Rural and Underserved Audiences and with Teachers

Within the original grant conceptualization and first implementation of the FOSSIL Project, neither rural audiences or educators were explicitly a primary target audience, though structures were embedded within the project to support both. As the FOSSIL Project was designed to provide access, information, resources, and a network for individuals across the United States, it was (and is) ideally suited for teachers and for individuals in rural environs.

One traditional underserved audience engaged in the FOSSIL Project is rural. Several telephone interviewees said they would like to see the FOSSIL Project serve as an introduction to STEM in their rural areas and small towns. From New Mexico to Massachusetts, Shenandoah Valley to South Carolina, interviewees who identified as “poor” spoke of the importance of paleontology to their own lives and the potential for paleontology to lift up their community.

How did I get into it? I was poor, isolated, and bored. Nature was free and right there.

In my town, education is not valued or prioritized. Kids have drug addicted parents. Basic survival is a priority. Museums are not a part of life. Giving students a fossil to hold in their hand, it opens up their eyes and hearts to something larger.

One interviewee said he lives in “coal country.” He said that companies are retreating from his area, leaving citizens frantic to find ways to fill this gap in livelihood and identity. He organizes fossil events to help reconnect people to their community and own backyards. In his words:

Fossils can help transition my community off coal, culturally and ecologically. I’m proposing beachcombing days, and people look at me like I’m crazy [because we live in the desert], but I tell them we live on the western edge of the interstitial sea.

Across the land, interviewees gave examples of ways paleontology gets local people aware of what is already around them and engenders a different type of pride in their hometown/area, “beyond athletics.” One interviewee exclaimed, “Mom, there were rhinos here!” Of the teacher interviewees who identified themselves as living in impoverished areas, each spoke of at least one student who was now pursuing a career in paleontology. “Her mom said her interest is real and it’s not just a fad.”

In areas where paleontology is not widely known, paleontologists can look like heroes, albeit distant ones. A teacher commented “They see photos of me from the field and they think I am a rock star!” Teachers from poor areas described how teaching the scientific process of paleontology gave their students opportunity to see ways they excel in different avenues.

We show students paleontology isn’t just digging in the dirt. That’s a small part of it. You clean, describe, photograph, label, analyze data, compare it to other things. Sharing all of this with them gives them a realistic view. They can see different career opportunities, not just ones in the field, if they are good with numbers, like to draw, or use their hands.

While having “heroes” can be helpful, it may not surmount issues of diversity and inclusion. Parents and teachers were clear; it’s not just information they want: they want to show diverse representation. “I would love to show something like ‘a day in the life’ of a paleontologist, but *not just dusty old white men.*” As one parent said, “nobody looks like my kids in the field.”

Another teacher gave an example:

Before the earth science lesson, I have them draw a picture of a scientist. They almost always draw a man in a white coat. Then we talk about paleontology, the process, the science. Afterwards, I have them draw a scientist... and they draw themselves.

Students could imagine paleontology as a reachable goal, and they were especially grateful for representation by the FOSSIL Project graduate students who visited.

Teachers specifically requested materials that would bring their existing curriculum up to date, and (short, ‘cool’) videos to keep it interesting. Teachers noted the lack of up-to-date resources:

My textbook was published in 2001. Pluto is still a planet. I follow the FOSSIL Project Facebook page to stay up on what’s new.

The impact of the FOSSIL Project on educators and rural individuals has led the team to increase their focus on these two audiences. The team has evolved to conceive of their audiences as fitting into three primary categories: amateurs, professionals, and educators, who have both distinct and overlapping resource needs. As seen in the next section, the team also began conceiving of the project as directly serving individuals rather than primarily through clubs. This shift allows the team to better support rural individuals, who may not have a club nearby to meet their needs.

What are the factors that influence Project Impact?

Connections are Made Individually



The connections made in FOSSIL are primarily individual to individual, rather than mediated through the clubs. In at least a handful of clubs, a club leader regularly sends out email blasts about FOSSIL webinars, and encourages club members to participate in myFOSSIL. In other instances, members were energized by visiting speakers like PI Bruce MacFadden or FOSSIL team member Jeanette Pirlo. Some clubs say they struggle to find relevant, interesting, and affordable speakers, and interviewees raved about getting time to spend with any FOSSIL Project staff who came to their club.

If you had asked me before, I would have thought the FOSSIL Project wasn't so great. Then a FOSSIL speaker came to speak at my club! The way she spoke with respect about amateurs was like a light went on.

I saw myself in Bruce's Powerpoint, and it felt good. They know my name!

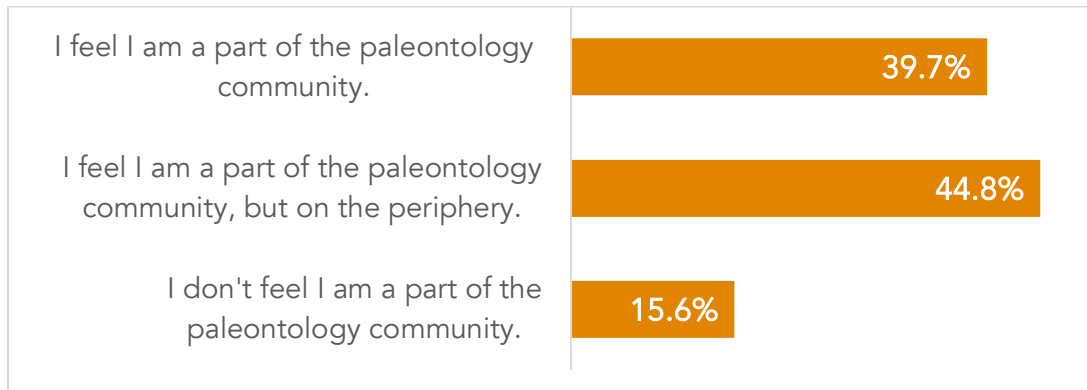
Dr. MacFadden came to look at my fossil collection personally!

However, despite some crossover, fossil clubs and the FOSSIL Project are relatively mutually exclusive experiences in the lives of the amateur paleontologists interviewed. Clubs function as organizers for trips, and places to share a passion with like-minded individuals, but they also carry the social burdens of any small group: dominant personalities, antiquated cultures, and (in some cases) winter hibernation.

Clubs perpetuate the historic attitude that it's difficult to connect with professionals. Views are changing, but members are still a little shy or scared to ask 'What can I offer?' because in the past they felt looked down upon. Just being in a workshop with Bruce I saw this wasn't the case. I'm trying to change the culture of our club.

In our quantitative survey, we asked community members to reflect beyond the FOSSIL Project, to the larger community of individuals nationwide who are actively engaged within paleontology, whether professionally, through a club, or on their own. We were interested in determining to what degree did they feel a part of that larger paleontology community. Nearly 40% of our respondents did feel they were part of that larger community, and another 45% commented they felt as if they were part of the larger paleo community but on the periphery. It is interesting to note that the bulk of the respondents to this survey felt they were not as directly involved within the larger paleontology community. It is unclear whether this is by choice, if they continued to feel marginalized within the larger paleontology community, or they simply do not have the knowledge how to or interest in connecting with others nationwide.

Figure 10: Most Individuals Feel They Are Within the Community or On the Periphery



We didn't ask if to what degree the FOSSIL Project had influenced their sense of belonging within the quantitative survey, though we did probe on this issue in our follow-up telephone interviews. We found interviewees essentially have separate communities and relationships in FOSSIL from their local clubs. **Interviewees who saw themselves on the geographic periphery, in areas where there are limited or no fossil clubs, found they benefited most from the FOSSIL Project because it gave them an expansive sense of belonging.** Due to that, interviewees petitioned the FOSSIL Project to do more regional engagement.

I never thought there was a place *to belong*, period. But when you get on FOSSIL Project you feel like you're part of a team, I'm not going to lie.

I love the FOSSIL Project, but Gainesville is a long way away from Upstate New York.

FOSSIL should have weekend workshops in other parts of the country, like Southern California, to develop lesson plans.

I feel far away out here in Seattle. It's great when Bruce comes to visit us. Remind them we are out here.

This sense of being on the periphery was echoed by many interviewees, from Minnesota to Maine. Although the FOSSIL Project exists as an online community, **most people felt strongly that Florida was at the FOSSIL Project center, with Southern Florida the epicenter of amateur activity..**

Community is forged through Traveling

One form of community within the FOSSIL Project occurs in traveling-- collaborative, "helpful" travel. In at least four reported instances, interviewees connected with other amateurs through myFOSSIL, and went on trips to meet them. In one of those cases, the two former strangers are

now conducting research together. There is a clear sense that the FOSSIL Project community is broad, with many regional experts. **Because FOSSIL Project participants travel regularly for their passion, they wish the FOSSIL Project provided greater resources for this type of travel.** Interviewees specifically asked for items such as topographic maps and field keys to identify fossils. They'd like to know who the local experts are, what those experts recommend, where to go *safely* and *legally*, and what the area is known for. Many interviewees travel with their families, specifically to fossiliferous areas. Because they are out of their local knowledge-zone, they need extra help seeing what they are looking for, especially when guiding their kids. Many interviewees expressed interest in being helpful to existing projects or research on these trips. Comments included:

Some people say you'll know it when you see it, but I won't. If it's not in my area, I need some help.

As the parent, I have to stay one step ahead. If I had a sheet that I could print out to take with us that showed maybe 10 different types of brachiopods, I would know what to look for.

If I know they are looking for fossils in this criteria or this age group, I could try to find and collect those fossils. Then I could send them in.

In this regard, cross-country community is developed beyond just meeting others; it thrives in being useful to them and able to share finds with those who will benefit.

The strongest (most outspoken) impact we saw in interviewees was when they had direct interaction with the FOSSIL Project staff and graduate students. The biggest change in confidence and attitude about 'belonging' came from people who attended sponsored digs, talks, and workshops. One interviewee said:

I would have said the FOSSIL Project was 'meh.' Then I got picked to go on a dig. Now? It's TREMENDOUS. Prior to the trip I saw no community, Afterward, YES, Really. I can't tell you how much I appreciate it!

I thought paleontology was a dead subject because all the books I could find were old textbooks from the 60s. Belgrade was like an *awakening*. It brought all these isolated people together!

One interviewee said she made her best friends through PaleoBlitz. "I feel a sense of belonging with the people I met on PaleoBlitz. It was incredibly meaningful." Interviewees who once described themselves "lone wolf" or "isolated paleo nerds" found there were others like themselves. Finding citizens who are 'fossil people' is an important validation of several

interviewees' identity. "We are like a tribe, a specialized tenant of people, who speak a different language and don't get bored when talking about echinoids." "I feel connected to all fossil people," said one.

The impact of bringing people together cannot be underestimated. *Every person* who engaged with FOSSIL personnel said staff explained things clearly, they felt validated, and they wanted to deepen their learning.

Going to the dig, I got to appreciate the *process of paleontology*, procedures and justifications. Bruce was clear and it made sense.

Before [the dig], I didn't have confidence. But FOSSIL Project people are so generous about sharing knowledge or information.

FOSSIL is a place where you're not afraid of looking undignified, not afraid to look like you don't know anything. Everybody, even the professionals, rely on someone else knowing more than they do.

myFOSSIL

While the FOSSIL Project has deepened people's understanding of paleontology, fostered new in-person connections, and expanded their awareness of paleontologists around the country, it has not reached the critical threshold of "being an online community." Users notice the low flow of traffic on myFOSSIL. As one says, "there is not a lot of people there, so no I don't think of it as a community." For some, their time does not afford them technical barriers. "This is not the only thing in my life."

The logging-in process feels burdensome and means some individuals are less likely to use it. They don't want to remember another password, and then have to wait to log in. Others who wanted to use myFOSSIL for their collections were frustrated by the number of fields they had to enter for each item. If they didn't know all the information, they felt both slowed and embarrassed by the holes in their knowledge. Other users want to upload all the photos in a separate "holding area," and then slowly fill out data for them. If they could look through other people's photos, perhaps they could help one another, simulating a crowd-sourced piece for these elements. One interviewee logged in to myFOSSIL during the interview and commented that there were only seven people online, and most were administrators. Other myFOSSIL quotes included:

I only posted on myFOSSIL because of the sponsored trip I attended.

It's much easier to send a message on Facebook.

I would use myFOSSIL if they had a more user-friendly platform like Facebook.

It's fairly straightforward but clunky.

The technical barriers and lack of active community on myFOSSIL do not deter interviewees from asking specific questions in service to pointed research, but it does deter them from starting 'conversations' online (and in some cases logging in at all). For that purpose, many spent time on other forums and Facebook pages related to their particular paleontological interest.

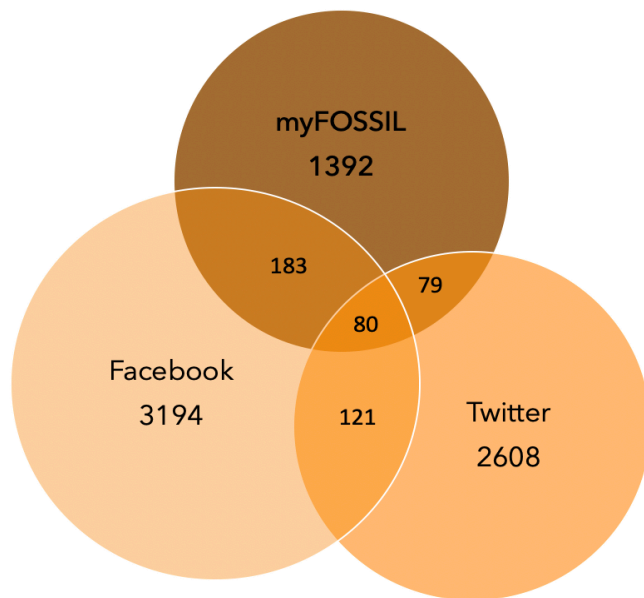
Future Recommendation for the team: Make a "Read-only" status for myFOSSIL that does not require logging in. Individuals would have to log in to make comments, post resources or fossils.

The FOSSIL team evolved their strategy over time to meet the needs of the community. Initially seeing myFOSSIL as the primary participant conduit of engagement, the team pivoted to a multi-platform strategy to meet the community preference for different modes of engagement. This strategy, while resulting in less concentration and effort within myFOSSIL, is clearly successful in engaging individuals on different platforms, as demonstrated by Figure 9 below. The team also was judicious with the project resources, electing in the later years of the project to put money towards the development of a FOSSIL Project mobile app, as well as the social media efforts. Some of the elements of the development of the app were influenced by the FOSSIL Project's Instagram content stream, demonstrating the mutually reinforcing nature of the multi-platform approach. While the mobile app is outside of the scope for this evaluation, features developed for the app have gone on to be incorporated within myFOSSIL, enhancing the experience in another format.

Growth in the myFOSSIL Community Over Time

As of December 2018, myFOSSIL has 1,640 members. As mentioned above, myFOSSIL is a significant connection and resource for amateur and professional paleontologists, but far from the only connection within the FOSSIL Project. The FOSSIL Project Facebook page has roughly double the number of followers than myFOSSIL has members, and there is little overlap between those that use Facebook and also use myFOSSIL—just under 11% are on both platforms.

Figure 11: The FOSSIL Project Community Has Distinct Different Platforms of Use



The numbers in each section represent the number of individuals within that bubble. The numbers where two sections overlap represent people who use both or all three platforms. Approximately 20% of the FOSSIL Project Facebook followers are unidentified, meaning we do not know if they use other platforms to access the FOSSIL Project.

Data from myFOSSIL Social Media Analysis December 2018. Compiled by Fossil Project team.

Change in the myFOSSIL Community Use Over Time

We completed an in-depth analysis of myFOSSIL usage during two four-month time periods, the first from September 15, 2017 to January 15, 2018, and the second from July 14, 2018 to November 15, 2018. During this time period, myFOSSIL gained over 400 users, up 38%. The number of sessions went up, but the number of unique users went down. This means while there were fewer individuals online, a small portion of those were signing in significantly more often. The median number of sessions per user remained at 2, so overall most users did not increase their number of sessions. There was also a slight rise in average number of users per day, moving from 6-7 users a day to 10. Average stay time remained the same, just over 8 minutes, which is quite high.

Table 3: Comparative myFOSSIL Statistics Over Time

	Sept 15 2017 - Jan 15 2018	Jul 14 2018- Nov 15 2018	Change Over Time
Total myFOSSIL Community, not including staff	1214	1640	Community has grown by over 400 users
Number of Days	122 days	122 days	--
Number of Unique Users Who Signed-in	227	181	Decrease of 46 unique sign-ins

Percentage of non-staff myFOSSIL Population	19%	11%	
Number of Sessions	829	1183	
Number of Average Users per Day	6-7	10	Slight rise of 3-4 more users per day
Median Number of Sessions per User	2	2	Overall same median number of sign-ins
Average Session Time	8.5 minutes	8.36 minutes	None
High Number of Sessions for non-staff member	45	52	

As documented in the in-depth comparison above (Table 2) and from the monthly analytics reports, the myFOSSIL overall community is growing, currently at a rate of 3% each month. There has also been a slight rise in the number of average users per day from 6-7 users to an average of 10 users per day. These are both positive statistics, the community is growing. Another positive statistic is that the community is maintaining a high average session time.

However, the community is not showing overall increased “stickiness”; individuals are not more likely to come back than they were before. The majority of users only sign on to myFOSSIL twice, and only 11% of the myFOSSIL community (not including staff and team members) signed in during the most recent 4-month in-depth exploration. In Table 3 below, during the Fall-Winter of 2017, 8 users had more than 10 sessions (roughly 2-3 sessions a month). Nine months later, the community has grown by 38%, yet still only 9 users have 2-3 sessions per month. In the earlier period, 49 users had 4 or more sessions, nine months later 56 users have more than 4 sessions.

Table 4: Users by Total Number of Sessions

	<i>Fall - Winter 2017</i>	<i>Summer - Fall 2018</i>
1 session	78	71
2-3 sessions	90	54
4-9 sessions	45	35
10-19 sessions	8	9
20 or more sessions	6	12

In sum, the myFOSSIL community is growing and slightly more users sign-in in a given day. Users are still not strongly adopting the platform. Currently we are not seeing growth of regular use or “super users.”

Growth in FOSSIL Project Social Media Participation Over Time

Furthering the adoption of a multi-channel approach, the FOSSIL Project steadily increased their social media presence over time, launching Facebook and Twitter presences at the beginning of the project, myFOSSIL in September 2015, Instagram in October 2017, and YouTube in December 2017, and the myFOSSIL mobile app in fall of 2018.

The amount of human day-to-day effort in crafting and maintaining FOSSIL’s social media presence should not be underestimated. The team had several members working continually on writing and responding to posts, gathering images, and coordinating an overall strategy to increase engagement. This intentional effort to monitor what types of content, the timing of that content, and how to coordinate content across platforms was time-consuming and can not be automated. The FOSSIL Project social media team was intentionally user-centered, focusing their efforts on who was participating on different platforms, and endeavoring to craft a process that provides rich content to the users—items to react to, comment about, agree or disagree with, and engage emotionally.

This effort to invest in participants through the way they preferred to engaged seemed to pay off. No one path was a clear route to engagement or benefit, but those that participated in some way, be it by social media, myFOSSIL or through reading the newsletter were more likely to see benefit than those that did not.

Table 5: Those that Participated More Benefited More

	Benefited greatly from FOSSIL	Benefited to some extent	Benefited a small amount	Did not Perceive Benefit	Blank
Twitter					
FOSSIL Twitter Followers	30.0%	26.7%	20.0%	10.0%	13.3%
Did not follow FOSSIL on Twitter	17.1%	25.0%	19.5%	27.4%	11.0%
Facebook					
FOSSIL Facebook Followers	30.6%	31.6%	23.5%	8.2%	6.1%
Did not follow FOSSIL on Facebook	13.5%	22.7%	18.1%	32.7%	13.1%
myFOSSIL					
myFOSSIL users	30.9%	27.6%	22.4%	13.2%	5.9%
Did not use myFOSSIL	8.7%	23.3%	17.5%	35.4%	15.0%
Newsletter					
FOSSIL Newsletter Readers	31.0%	38.0%	16.9%	7.0%	7.0%
Non-newsletter Readers	15.0%	22.0%	20.2%	30.7%	12.2%

As noted above, crafting content for participants to engage in was highly time-consuming, yet brought the project alive and made it personal for those that took part. Below, an example Facebook post and the comments.

Figure 12: Example Facebook Post

The FOSSIL Project
March 2 at 11:20 AM · 🌐

Geologic Time Scale: a chronological sequence of #geologic events, used as a measure of the age of any part of geologic time. This is usually presented in the form of a chart showing the names of the various rock-stratigraphic, time-stratigraphic, or geologic-time units.

Do you have a favorite Era, Period or Epoch?

116 15 Comments 41 Shares

Like Comment Share

All Comments ▾

Write a comment...

Lee Higginbotham Ray Troll, artist for this time scale, truly rocks.
Like · Reply · 2d 1

Tiffani Snider Kaleb Snider 1
Like · Reply · 2d

Thomas Nolan Pennsylvanian of course I am from Pennsylvania, but that is just a coincidence.
Like · Reply · 2d 1

Bill Heimbrock I like the late Ordovician, because I can reach down to the ground at any time in the present, and pick up a souvenir of life nearly a half billion years ago. Looking down is awesome in Cincinnati, Ohio!
Like · Reply · 2d 2

Anne Drake Look it's Kirk Johnson and Ray Troll!
Like · Reply · 3d 2

Kate Barnash Triassic thru Cretaceous for Dinosaurs. and is it Cambrian or Ordovician for Trilobites?
Like · Reply · 2d 1

2 Replies

Francesca Geoductor Paleo-proterozoic 1
Like · Reply · 2d

Walter W. Stein Bill Late Cretaceous from about 90 mya to 66, right before the proverbial coprolite hit the fan. Of course just afterword is interesting too.

Facebook was the dominant platform with more followers there than in other channels.

Figure 13: Number of Followers/Members as of January 2019

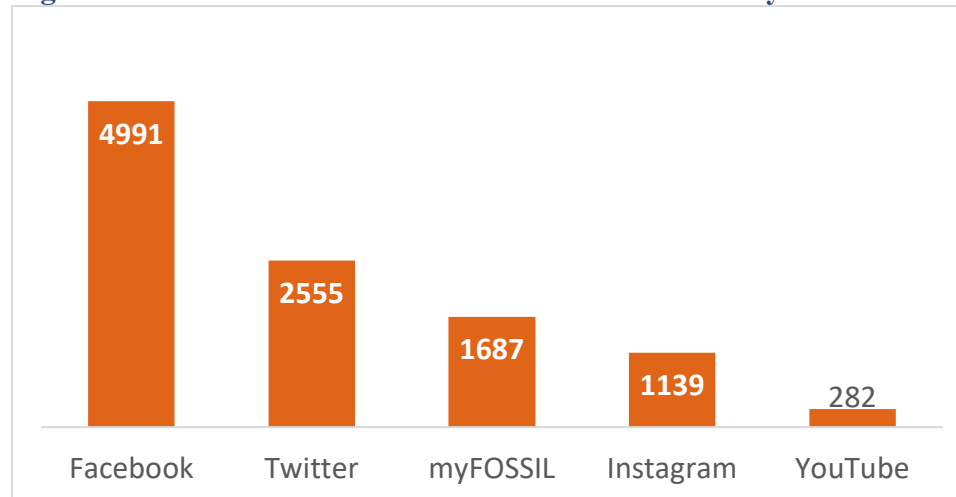


Table 6: Growth and Followers by Social Media Channel

	Jan 2019 Followers	2018 Growth*	2018 Average Monthly Impressions	2018 Average Monthly Engagement
Facebook	4991	23%		4035
Twitter	2555	36%	58,036	
myFOSSIL	1687	44%		
Instagram	1139	686%	22,338	
YouTube	282	231%		

*Both Instagram and YouTube Channels began in 2017 and experienced strong growth in their first years, which is slowing down as the community grows.

Other social media channels show high levels of impressions. The terms ‘Impressions’ on Twitter refers a total tally of all the times the tweet has appeared within in a followers’ timeline as well as the times it has appeared in search or as a result of someone liking the Tweet. Engagement includes any way someone interacts with a Tweet, including but not limited to, Retweets, clicks and Likes. The Engagement Rate is calculated by dividing the number of engagements by the number of impressions.

For the 2018 FOSSIL Project Twitter feed, one of the most successful tweets was posted in July:

Figure 14: Example Successful Twitter Post



This tweet had 1,959 impressions and 213 engagements, for a total engagement rate of 10.9%.

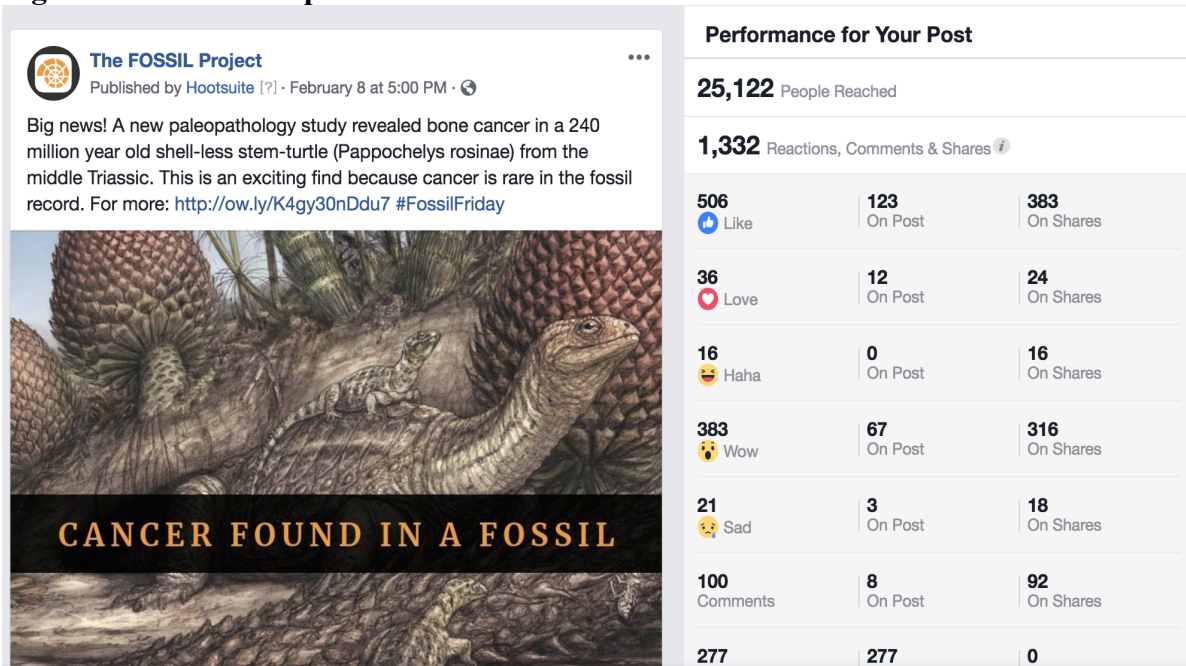
In Facebook, the metrics are calculated differently. According to Sprout Social, a leading social media metrics service, “Reach is the total number of people who see your content. Impressions are the number of times your content is displayed, no matter if it was clicked or not. Think of reach as the number of unique people who see your content. In a perfect world, every one of your followers would see every piece of content you posted.”

Figure 15: 2018 Facebook Engagement Rate Example



This Facebook post above in February of 2018 had a reach 2,549 and a total engagement of 485, for a 19% engagement rate, which is extremely high. Including to the M+R Social Media Benchmarks Study of 2018⁵, the Engagement Score for an average Facebook post across all non-profits was 0.44%, meaning 0.44% of people who like the page engaged with the post. Facebook engagement is still growing extensively, as shown by this 2019 post below which more than doubles the number of engagements.

Figure 16: 2019 Example Metrics for Facebook Post



Within their poster for the Southeastern Geological Society of America meeting, the team⁶ demonstrated how detailed and rigorous their social media approach is.

The team was very specific in their construction and timing for each media. Figure 18 below represents an example of the components of one of the team’s Instagram posts.

⁵ <https://www.mrss.com/lab/social-media-directors-guide-to-2018-benchmarks/>

⁶ The authors for this poster were Mary Jane Hughes, Samantha Ocon, Sadie Mills, Jennifer Bauer, Kent Crippen, Lisa Lundgren, Richard Bex II, and Bruce MacFadden. All credit goes to this team for their rich visuals and explanation.

Figure 17: Deconstructing an Instagram Post

Instagram Post



- ← **Eye-Catching Graphic**
Includes some connection to paleontology such as fossils, museums or fieldwork.
- ← **Engaging Content**
Includes information in connection with the FOSSIL Project, news or information related to paleontology.
- ← **#Hashtags and @Mentions**
A hashtag is an engagement tool that is used to identify a keyword or topic of interest and facilitate a search for it. A mention allows you to connect with another individuals profile.
- ← **Links to outside materials**
Usually will include some connection to paleontology such as fossils, museums or fieldwork.

*Source: Hughes, M.J. et al, Southeastern Geological Society of America FOSSIL Project Poster 2019

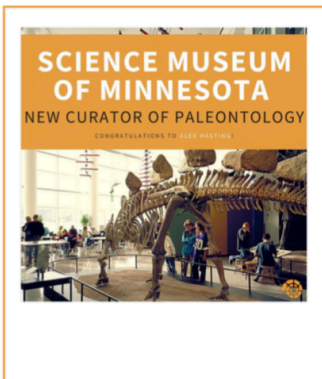
The team studied the differing amount of engagement they receive on posts, allowing them to analyze engagement rates over time. For Instagram, they have developed a typology of posts, concluding through examining the data Information posts garner the highest engagement rates.

Figure 18: Taxonomy of Instagram Post Types

Post Types Taxonomy

Opportunity

Post about something that CoP members or broader society can participate in such as field trip, talk, citizen science or job within the related field.



Example: Science Museum of Minnesota!
The @sciencemuseum named Alex Hastings as its new curator of #paleontology this Thursday and he is set to join the team during the fall!

News

Post about a media outlet story about paleontology (e.g. ScienceDaily) description of current research in the field but for a lay audience.



Example: Hemet museum new fossil!
Article from the @presenterprise report on the first new dinosaur named at the Hemet Museum in California!

Information

Post about general resources for paleontology, such as geologic map or dissemination of recent organization activity, education materials and definitions of paleontological terms.



Example: Shark Week: Great White!
This #marine predator can be found throughout the world's oceans. The #GreatWhite is equipped with a set of 300 sharp, triangular teeth arranged in up to seven rows!

Promotion

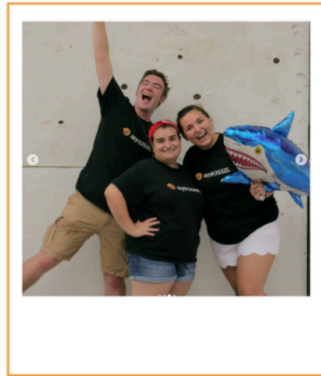
Post about the FOSSIL Project or any of the activities that are associated with the project. This includes promotions about the mobile app or information directing back to the website.



Example: 500 followers!
We did it!! Thank you to everyone for helping us reach 500 followers this past week! #Paleontology

Activity Updates

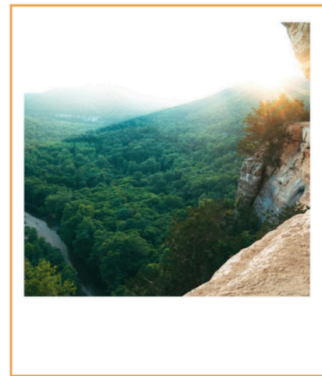
Post about conducting fieldwork or visiting a museum that contains materials associated with paleontology.



Example: Meg Outreach!
Yesterday was JAWSOME! Thank you to everyone who visited our pop-up #megalodon #museum in honor of @megmovie!

Other

Post about a topic related to paleontology that does not include specific information, news or an opportunity attached to the subject.



Example: Go take a hike!
Go take a hike! Enjoy the last few days of summer and visit your local #StateParks or #NationalParks!

*Source: Hughes, M.J. et al, South Eastern Geological Society of America FOSSIL Project Poster 2019

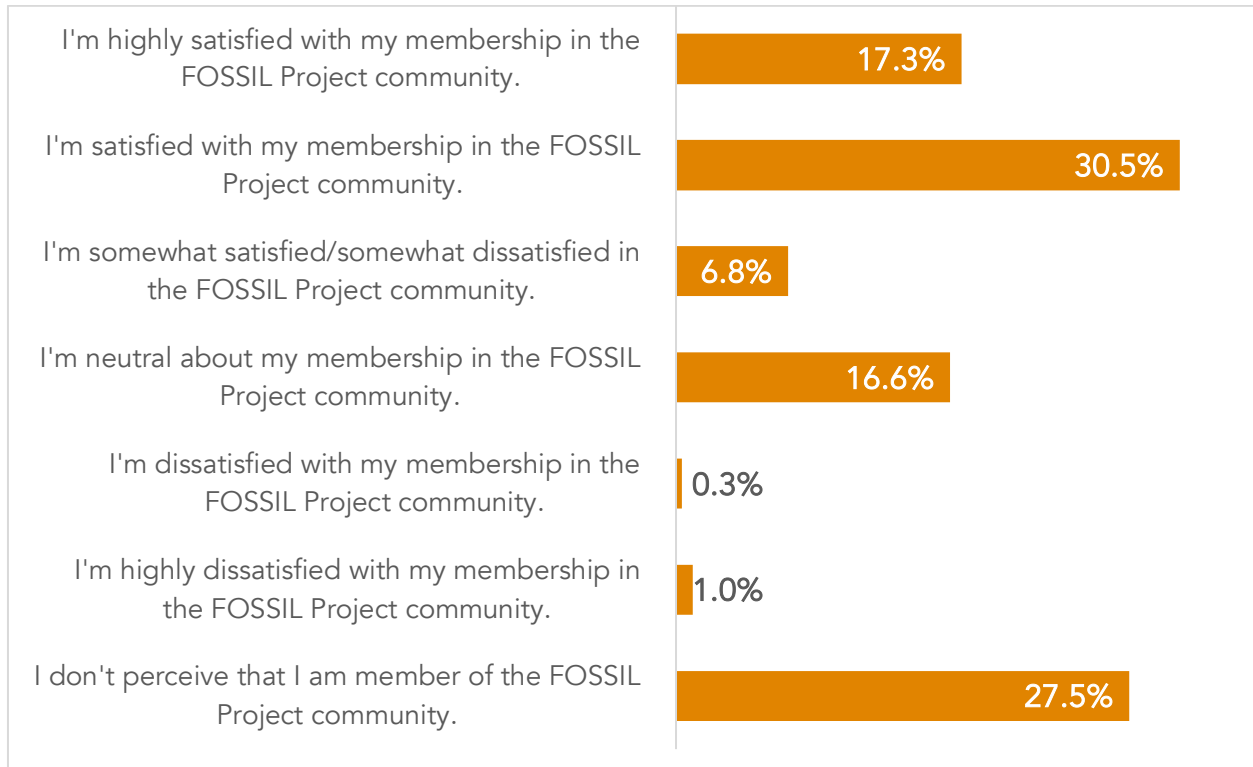
Does the FOSSIL Project Serve as a Community, and If So, In What Ways?

Our analysis of the health of the community has been partially based on Malinen's 2015 article⁷ on measuring user participation in online communities. That literature review has shown that member satisfaction, belonging to the community, quality of relationships between members, high member satisfaction, and friendships formed in the community are measures used to gauge online community strength. Intentions to contribute and the usefulness of contributions made in the community have been used to test the impact of active participation in the success of the community.

To that end, we asked community members how satisfied they were with their membership within this community. Nearly half of the respondents were satisfied or highly satisfied with their membership within the FOSSIL Project community. Less than two percent were dissatisfied with their membership within the community. Interesting, more than one quarter did not feel they were a member of the community. It is not clear whether they wished to be a member of the community and did not feel accepted, or were not interested in being within the community. This perception may be due to the relatively low Fossil Club membership within the sample.

⁷ Malinen, Sanna. (2015). Understanding user participation in online communities: A systematic literature review of empirical studies. *Computers in Human Behavior*. 46. 228-238.

Figure 19: Satisfaction with Membership in the FOSSIL Project Community



myFOSSIL is not where “community” takes place. Community may occur more naturally on the faster-moving social media channels. **myFOSSIL is a highly-trusted resource where one can look up information.** Many interviewees said they visited the Fossil Forum to discuss their finds and see what others were doing. A quarter of all interviewees mentioned that they use the Fossil Forum for its ease and “real community” and several suggested linking up with the people who are there. **Yet, when it came to finding answers to specific questions, myFOSSIL was where they would go.**

I primarily use the Fossil Forum because it’s just easier. It’s a place I can search through to read what people are discussing. But I use FOSSIL Project to ID things my students find on a creek trip. To identify, compare, and ask questions. *More importantly, to learn the reasons behind the ID.*

There’s not a lot of people, so I don’t feel like there is an online community for the FOSSIL Project, but I trust what I learn on myFOSSIL. I have 100% faith in what happens there.

I asked a question on myFOSSIL: 'How do the pros identify brachiopods?' They all look like shells to me. And a *real* paleontologist responded and said what they use. They recommended books, websites, tips, papers, and scientific examples!"

A useful analogy might be that myFOSSIL serves as the "MayoClinic.org" for the community, as a trusted resource. Whereas the Fossil Forum (where community occurs, there is more traffic, and users are more likely to debate) is more like a health-wiki for discussing and debating symptoms.

When you post something for identification on Fossil Forum or another fossil site, someone always has an opinion on what it is. But then someone else will have a different opinion. This back and forth is natural and it's actually interesting, but it doesn't help me when I really need to know.

Other benefits of myFOSSIL include erasing physical barriers and solidifying healthy social boundaries. Amateurs understand the daily pressures and time constraints put on professionals. Prior to the FOSSIL Project, they did not have any other way to get their specific questions answered. They were used to having to "track down" experts on the phone or by showing up at their office, and they felt like a burden. Having access to experts through the FOSSIL Project gave them peace of mind that they were getting a good answer in a scenario that was comfortable to the professionals' boundaries.

Physical boundaries aren't an issue online. Before the FOSSIL Project you needed to live near a museum or university, which I don't. It's intimidating to go in with a box of rocks. You feel like you are wasting their time. Now you just throw it out on the forum and they answer when they are free.

Because of FOSSIL Project, I can connect to real people. I used to use just books, but I found I needed more specific resources as my questions got more advanced.

I know a lot. But I can contact people if I run into something. It's like having a good backup system.

How Has the FOSSIL Project Impacted Amateur/Professional Paleontologist Connections?

This accessibility to 'real experts,' and the consistently positive encounters with FOSSIL Project staff changed some amateurs' perception of professional paleontologists. Above all, the FOSSIL Project showed that professionals view amateurs as valuable and important. Since many of the interviewees had no experience with paleontologists prior to the FOSSIL Project, those individuals had positive impressions about 90% of the time. The few who didn't have positive experiences spoke of professionals "not sending fossils back," "not putting my name on authorship," and "not caring about my feedback at the inception of the FOSSIL Project." **It was**

the interviewees who had never interacted with a professional who were more impressed by the openness and warmth of professionals. Their feedback was less about attitude change and more about developing relationships. When they spoke further, most said they had heard rumors of ‘bad blood’ between professionals and amateurs but they were now able to recognize these as isolated events.

Before FOSSIL Project I heard some bad things about professionals, how they see us, but I honestly didn’t know what to think. I didn’t have any access to make my own mind up. Once I was able to get involved in FOSSIL, I see how hard they truly work to reach out. Now I tell everybody: professionals are helpful. They want to make it work!

For interviewees who have a curiosity but don’t necessarily want to make paleontology their full-time hobby, personal interactions are often most helpful. “Sometimes it’s actually a little intimidating. How am I going to figure all this stuff out without putting my life into it?” FOSSIL Project is capable of providing varying levels of knowledge/explanation simply because it’s *made up of people* whose goal is to make the science of paleontology palatable. That comes across to users.

Facebook, Webinars, and ‘Proper’ Resources

The Facebook feed, for those who followed it, was a unilaterally positive experience. Interviewees thought it was well updated, gave them information about events, and helped them stay abreast of new discoveries. Almost a quarter of the interviewees specifically mentioned the webinars.

I’ve never met anyone from FOSSIL Project in person. But I’ve watched all the webinars.

Here in Maine, people are so spread out, so when you get a chance, you talk fossils with anyone, despite rank. With regard to the FOSSIL Project, I mostly watch webinars and pay attention to the online conversations.

Additionally, the webinars sent in advance of the digs helped set the stage and make attendees comfortable with what they would be doing and looking for. Interviewees occasionally commented on poor sound quality and production value of the webinars, but nonetheless got a lot out of them. They asked for the webinars to be archived, perhaps unaware of those resources. All individuals remarked would like short produced videos in addition to archived webinars.

Some individuals are looking for “**hard core proper resources,**” such as scientific papers, older out of print (or expensive) books. Individuals do not want to necessarily have constant access,

but would like to connect with someone online like a reference librarian who can understand their question and provide them access to the papers they need. As they noted:

I want to read the scholarly articles, but I can't pay fifty bucks a pop for those PDFs. If through membership in the FOSSIL Project, we could get access to the scholarly journals. That would be worthwhile!

Individuals would like to be able to contribute to the FOSSIL Project, but often feel their offers to contribute are not followed up on or valued. Some have full curriculums they would like to post, and their own videos or resources.

The Future

Interviewees are noticing a decline in club membership over the past years. This anxiety about bringing up a new generation of paleontologists was pervasive.

We've got to foster interest. Maybe the FOSSIL Project can be a good way to foster new involvement, and to get existing club members to think more than just go to the creek.

I would say most people *I know* are aware of the FOSSIL Project. Clubs know about it. But FOSSIL helps only people collecting fossils to start with. It's not put out to the general public, so you can't get new collectors started.

Why did some individuals say they gained knowledge and skills, but didn't benefit?

While we did not focus our qualitative interviews on those that did not benefit, we did conduct some interviews specifically of individuals who noted change in knowledge, interest or skills but who did not feel they benefited from the FOSSIL Project. We spoke with them about their reactions and why they felt the FOSSIL Project did not meet their needs. These interviews can be categorized as individuals with a bit more chagrin. They definitely cared about paleontology, and the potential of the FOSSIL Project, because they have given significant amount of thought to how they wished the FOSSIL Project had served their needs. They included a fresh new teacher eager to use resources in his classroom but having trouble locating them; a retired amateur who was annoyed by the insider politics of his local club, has a giant collection, and wishes desperately to connect with experts; a couple who attended a sponsored dig and offered to stay involved afterwards but "haven't heard a peep." What united these participants was their lack of the big picture of the FOSSIL Project. They simply didn't know that what they want is already out there, or they weren't getting the follow-through they desire. They felt that they fell through cracks in the project reach, and hadn't had a face-to-face interaction that brought them back in to the project. When they felt they can not find what they need from myFOSSIL or the other FOSSIL Project attributes, they express that most of the FOSSIL content they saw on

myFOSSIL were self-promotions for the FOSSIL Project, rather than ‘actual’ content. This finding underscored the human interaction needed to foster participation.

Conclusion

This evaluation demonstrates individuals benefited from the FOSSIL Project benefited participant knowledge and interest in paleontology, and also in concrete paleontology skills such as fieldwork and identification. In addition to developing a network of interested amateurs, the FOSSIL Project fostered an interest in the larger research process of paleontology. Connections were made most powerfully at the individual level, and the project saw its greatest impact there. Participants generally made connections through face-to-face meetings, traveling, and social media, as well as through myFOSSIL.

The FOSSIL Project changed their model of engagement to meet the needs of their participants, who engaged on distributed platforms, rather than funneling to a single platform. One strength of the FOSSIL Project team was adapting to the needs of the participants, and building those connections one-by-one, often through social media or in-person visits. Meeting the needs of the participants through social media was labor-intensive, and required significant strategic planning and analysis.

The model of individual connections particularly supported rural audiences, who used the FOSSIL Project as an inspiration and as gateway to science. The FOSSIL Project also supported a growing educator audience. Teachers from low-income areas described how teaching the scientific process of paleontology gave their students opportunity to see ways they excel in different avenues. This active evolution and adaption of the project, particularly towards a distributed set of platforms and individual connections, could be useful for other amateur communities to consider.

Appendix A: What FOSSIL Participants Would Like More Of

Regionally-Specific Information on:

- Whom to contact re: boats, access to private land
- Permits, laws, regulations
- Where to go, and areas to avoid (up to date)
- How to find fossiliferous areas
- What studies are going on (what do people need)
- Who to contact to go hunting with (other amateurs, clubs)
- What events (hosted by clubs or FOSSIL) listed by county
- Existing research, organized by area and time period
- Geological contexts
- Maps (not too location-specific or sensitive)
- Local language and site descriptions (“grassy field next to the gas station parking lot”)

Videos and Webinars

- New terminology (not advanced, also intro to language for total beginners)
- Bite-sized (3-5 minutes)
- Rules and best practices (for beginners, parents, teachers)
- “How to’s” Encyclopedic A-Z of the process of paleontology
- Lots more different prep
- A day in the life of (20) paleontologists
- How people determine/distinguish matrix from what they are looking for
- Funny, weird, interesting takes on paleontology (ex. person who brewed beer from yeast of whale fossil)
- Interviews: how did you get into paleo?
- Stories about paleontology, for kids (dinos and more!)
- Image-rich videos to play at paleo holiday parties behind the buffet table
- More ‘Women in paleontology’

General Resources

- PDFs of scholarly articles
- Digitized old ‘important’ books
- Access to online full-text search databases
- Latest finds
- Up-to date terminology
- “Follow up” material after visiting sites (and a checklist of what to do next)
- ID sheets based on area, type, age. (visuals with text descriptions)
- Printable image sheets based on location-specific fossil groups
- Kits for parents (especially home school) to support kids learning

- Kits for clubs to run events
- General contextual Info: “If you want to know more about North America in this time period...” with visuals

School-specific requests

- More social support for girls in STEM
- Places teachers can write to be sent fossil kits with posters, videos, maps, reports, to adapt for lesson plans (that are vetted by professionals)
- Reach out to teachers across the US to come to local universities for a week in summer to develop lesson plans
- Write up for/by teachers about what they are ‘actually’ doing in the classroom with fossils, how to solve real problems (with admin, parents, technology) implementing paleo lessons.

Appendix B: Summative Survey Instrument



FOSSIL Club Member Summative Survey 2018

This survey was deployed via web-based survey questionnaire.

The assumption is that all individuals receiving this survey either follow the FOSSIL Project on social media, belong to myFOSSIL, attended a FOSSIL webinar or presentation, or some combination of the three.

---INFORMED CONSENT PAGE---

1. Are you a member of any paleontology clubs? Yes No
 - a. If yes, please choose the club(s). [A list of all known clubs will be provided from the prior survey, with an option for write-ins.]

2. When did you first have your initial interest in Paleontology? (Childhood, Early adolescence, Adolescence, Adulthood)

3. What year were you born? (e.g., 1970) _____

4. Gender: Female Male

5. What race/ethnicity do you consider yourself? (More than one answer is fine!)
 African American/Black American Indian/Native Alaskan
 Asian / Asian American Latino(a) or Hispanic
 Native Hawaiian/Pacific Islander White Prefer not to answer

6. What is the highest level of education that you have completed? (mark one)
 High school or less Bachelor's degree
 1-2 years of college or no degree Graduate/professional degree
 Associate's degree Prefer not to answer

7. How familiar are you with the FOSSIL Project? (Check all that apply)
 Have not heard of the FOSSIL Project
 Heard of it, but haven't engaged with it at this point
 Aware of the FOSSIL Project on social media

- Follow the FOSSIL Project on twitter
- Follow the FOSSIL Project on Facebook
- Receive the FOSSIL Project newsletter
- Read the FOSSIL Project newsletter
- Aware of myFOSSIL (online resource for amateur and professional paleontologists)
- Am a member of myFOSSIL
- Have attended FOSSIL Project events

8. Are you an active participant in the FOSSIL Project? In what ways?

9. Has participating in the FOSSIL Project benefited you in any way?

- Yes, I benefited greatly.
- Yes, I benefited to some extent.
- I benefited a small amount.
- No, I did not benefit from my participation.

If yes, how so? If no, Why not?

10. How useful have the information and resources provided by the FOSSIL team or FOSSIL Project community members (either on myFOSSIL, or social media, or webinars, or other activities) been for you?

- I haven't used FOSSIL Project information or resources.
- The information and resources have been minimally useful.
- The information and resources have been somewhat useful.
- The information and resources have been useful.
- The information and resources have been highly useful.

11. How satisfied are you with being a member of the FOSSIL Project community?

- I don't perceive that I am member of the FOSSIL Project community.
- I'm highly dissatisfied with my membership in the FOSSIL Project community.
- I'm dissatisfied with my membership in the FOSSIL Project community.
- I'm neutral about my membership in the FOSSIL Project community.
- I'm somewhat satisfied/somewhat dissatisfied in the FOSSIL Project community.
- I'm satisfied with my membership in the FOSSIL Project community.
- I'm highly satisfied with my membership in the FOSSIL Project community.

12. Beyond the FOSSIL Project, to what degree do you feel you are a part of the larger community of individuals active in paleontology?

- a. I feel I am a part of the paleontology community.
- b. I feel I am a part of the paleontology community, but on the periphery.
- c. I don't feel I am a part of the paleontology community.

13. Reflect for a moment on how connected you feel to paleontology, to other colleagues and to friends within the paleontology community. Has your sense of being a part of the paleontology community increased, decreased, or remained the same DUE to your participation in the FOSSIL Project?

- a. I haven't really been a part of FOSSIL Project.
- b. My sense of connectedness to the larger paleontology community has decreased due to the FOSSIL Project.
- c. My sense of connectedness to the larger paleontology community remains about the same as it was without the FOSSIL Project.
- d. My sense of connectedness to the larger paleontology community has increased somewhat due to the FOSSIL Project.
- e. My sense of connectedness to the larger paleontology community has increased greatly due to the FOSSIL Project.

14. Have you formed new connections or friendships due to your participation within the FOSSIL Project? If so, please describe.

15. Do you intend to contribute to the FOSSIL Project going forward in the future?

- I'm not really interested in contributing to the FOSSIL Project.
- I intend to contribute, but I know realistically I won't likely have time.
- I do intend to make time to contribute to the FOSSIL Project going forward.
- I plan to continue contributing to the FOSSIL Project.

16. In your perception, has the FOSSIL Project broken down barriers within and between the amateur and professional paleontology communities?

1- No, the FOSSIL Project has not broken down barriers within & between groups at all	2	3	4	5	6	7 – Yes, the FOSSIL Project has significantly broken down barriers within & between groups
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[For all]

17. How often do you communicate directly with other members of your fossil club?
(Through emailing/calling/seeing in person, **not** including interactions in myFOSSIL or other online forums)
- Daily
 - Weekly
 - Monthly
 - Several times a year
 - Once a year
 - Once every few years
 - Not in a long time, if ever
18. How often do you communicate with members of other clubs? (Through emailing/calling/seeing in person, **not** including interactions in myFOSSIL or other online forums)
- Daily
 - Weekly
 - Monthly
 - Several times a year
 - Once a year
 - Once every few years
 - Not in a long time, if ever
19. How many professional paleontologists do you know personally?
- None
 - 1-2
 - 3-5
 - 6-10
 - 11-15
 - More than 15
20. Please estimate how many professional paleontologists you directly email/call/see in person on a yearly basis. (This **does not** include interactions in online forums or list-serves) (numerical open-ended answer)
21. Has the FOSSIL Project changed your attitudes toward professional paleontologists in any way? How so? (open-ended answer)

22. Please rate your interest in the scientific research process of paleontology.

1- Not at all interested	2	3	4	5	6	7 – Extremely Interested
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23. Please rate your understanding of the scientific research process of paleontology.

1- Not Knowledgeable	2	3	4	5	6	7 – I’m an Expert
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24. Has the FOSSIL Project changed your interest in the scientific research process of paleontology?

- No, my level of interest remains the same
- Yes, my level of interest in the scientific research process of paleontology has increased slightly
- Yes, my level of interest in the scientific research process of paleontology has increased a great deal

25. Has the FOSSIL Project changed your understanding of the scientific research process of paleontology?

- No, my level of understanding remains the same
- Yes, my level of understanding of the scientific research process of paleontology has increased slightly
- Yes, my level of understanding of the scientific research process of paleontology has increased a great deal

26. In order to understand better how the FOSSIL Project can provide support in paleontology skills, please rate your skill level on the following items: [1-7 rating scale, 1 is I don’t know how to do this, to 7 I’m an expert. 4 is I can do this, but I’m not fully confident in my skills.]

	1-7 rating scale
Access and Comfort level with Finding Research Resources (Online & Offline resources)	
Field Collection Process	
Planning (Where to go, When to go, Equipment)	
Prospecting	
Finding	
Documenting	
Identifying	
Knowing who to reach to help identify a fossil	
Jacketing	
Excavating	

In the Lab/Home Lab	
Cleaning	
Identifying (What do you use to do that?)	
Sorting	
Photography	
Digitization	
Cataloging (Putting a number on it and putting it within a database)	
Storing	
In the Museum/National Park/Other Collecting Institution	
Accessioning	
Sharing	
Outreach	
Give a talk to kids about paleontology	
How to write an abstract	
Giving a presentation at Fossil Club Meeting	
Giving a presentation at Professional Meeting	
How to make a Poster	
How to give a poster	
Publications	

27. Has participating in the FOSSIL project helped you in any way?

	FOSSIL project increased my INTEREST in this topic	FOSSIL project increased my KNOWLEDGE of this topic	FOSSIL project increased my SKILLS in this topic	FOSSIL project had no impact on me in this topic
Access and Comfort level with Finding Research Resources (Online & Offline resources)				
Field Collection Process				
Planning (Where to go, When to go, Equipment)				
Prospecting				
Finding				
Documenting				
Identifying				

Knowing who to reach to help identify a fossil				
Jacketing				
Excavating				
In the Lab/Home Lab				
Cleaning				
Identifying (What do you use to do that ?)				
Sorting				
Photography				
Digitization				
Cataloging (Putting a number on it and putting it within a database)				
Storing				
In the Museum/National Park/Other Collecting Institution				
Accessioning				
Sharing				
Outreach				
Give a talk to kids about paleontology				
How to write an abstract				
Giving a presentation at Fossil Club Meeting				
Giving a presentation at Professional Meeting				
How to make a Poster				
How to give a poster				
Publications				

We'd like to know more about how we can better support the paleontology community members, including both amateurs and professionals.

28. What else would you like the FOSSIL Project team to know?

Appendix C: Summative Telephone Interview Instrument



FOSSIL Club Member Telephone Interview 2018

I see you are a member of [Name of Club or Clubs].

Let's start with your interactions with the paleontology community at large.

1. Prior to the FOSSIL Project, would you say that you were connected to the larger paleontology community, either regionally or nationally?
2. Has that perception of that connectedness to the larger paleontology community, either regionally or nationally changed due to your participation in the FOSSIL Project?
3. Have you participated in different ways over the last few years in the larger paleontology community, either regionally or nationally?

And now focusing your interactions specifically with the FOSSIL Project.

4. Are you an active participant within the FOSSIL PROJECT community? In what ways?
5. The FOSSIL Project contains elements that are both online, such as myFOSSIL forums and resources, as well as elements that are in-person, such as guest speakers, outreach, workshops and trips. Can you tell me whether you've participated primarily online, in-person, or both? Has the existence of online elements supported the in-person components and vice versa? In what ways?
6. You mentioned within your survey that participating in the FOSSIL Project [had/hadn't] benefited you. Can you tell me more about your answer? [If yes, how so? If no, Why not?]
7. [If appropriate] Tell me about a specific incident or event where you felt you really benefited from the FOSSIL project.
8. Have you experienced a sense of belonging within the FOSSIL Project community?

9. Has the FOSSIL Project changed your attitudes toward professional paleontologists in any way? How so?
10. Within your survey, you mentioned you felt the FOSSIL Project had/hadn't broken down barriers within and between the amateur and professional paleontology communities. Can you expand on that answer more? Where has the FOSSIL Project helped the most? What barriers remain?
11. You described [intentions towards future participation]. Can you tell me more about why or why not you'll be participating within the FOSSIL Project going forward?
12. What else would you like the FOSSIL Project team to know?