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Reference at a remote field station: a case study of ecology, environmental science and geology fieldwork at an embedded library

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Abstract

Purpose – Field station libraries, particularly those serving biological and marine research stations, represent a unique but understudied class of special libraries. This case study investigates reference services at the remote University of Michigan Biological Station (UMBS) to provide a baseline assessment of how such services support the information needs related to research in ecology, geology and environmental science.

Design/methodology/approach – The study recorded, coded and analyzed 209 reference transactions from the 2022 and 2023 summer sessions, revealing trends in patron inquiries and the role of the reference desk. Further, the case study examined the organizational structure, community interaction and mission of the field station library.

Findings – The study concludes that UMBS's field station library functions as a form of embedded librarianship, characterized by shared administration between the main campus library and the field station, deep integration into the community and subject matter expertise in relevant scientific disciplines. The in-person reference desk is a well-utilized library service that has documented increased use in recent years, contrary to national trends.

Originality/value – This is the first time reference services at a remote field research station have been examined. It will inform field station librarians and administrators, as well as main campus ecology, geology and environmental science subject specialist librarians in working with the needs of their community. This investigation lays the groundwork for a broader survey to enhance understanding and development of field station libraries as a distinct type of special library. Understanding the field station library as a type of embedded library will assist in assessing the library as well as improving services and patron experience.

Keywords Reference services, Special libraries, Ecology, Case study, Embedded librarianship, Field station libraries

Paper type Research article

Introduction

This project presents a case study of reference services at a remote biological field station. The primary research questions guiding this study are:

(1) How does the field station community seek information through the reference desk?

(2) What types of information are being used by the community, as evidenced by their interactions with reference services?

Understanding these questions is essential to the effective operation of a field station library. Moreover, the findings provide insights into the information-seeking behaviors of ecologists, environmental scientists, naturalists and geologists—disciplines that rely heavily on data and

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experiences derived from fieldwork. Consequently, understanding the information needs of the field station community offers broader implications for similar user groups on the main campus.

This study also contributes to ongoing discussions about information behavior in place-based research and instruction. It seeks to fill a gap in the literature by identifying how field-based researchers and learners seek and use information, and by clarifying the librarian's evolving role in such settings, thereby setting up future research into this type of special library and information literacy in place-based research and teaching.

By examining the use of reference services in the context of ecological and geological research, which are fields deeply rooted in fieldwork, this study aims to inform how libraries can support these disciplines more effectively. Although focused on one field station, the findings have wider applicability, particularly as a foundation for understanding how patrons in field-based sciences utilize reference services and information. Further, it represents a potentially common structure for field station libraries and a starting point for research into additional models of field librarianship.

Background and site information

The University of Michigan Biological Station (UMBS) is a former 19th-century lumber camp that was repurposed into a remote field research and education site. The first session was held in the summer of 1909, and the UMBS has provided researchers, instructors and students with a location and facilities to engage with field science research and education ever since. Located 260 miles north of the main campus, the UMBS supports a wide range of research into environmental topics such as human impact on the environment, climate change, invasive species and maintenance of biodiversity (Regents of the University of Michigan, 2024). Researchers come to the UMBS to conduct place-based research in the northern Great Lakes ecoregion. The student population is primarily from the University of Michigan's Ann Arbor campus, but students from across the country are represented in the community as well. Instructors are drawn from across the United States, though the majority of instructors as of 2024 have a primary affiliation with the University of Michigan, Ann Arbor. Instruction at the UMBS occurs in the summer months for intensive two- and four-week academic courses. Undergraduate learners are provided with a comprehensive field research experience, which includes classroom instruction, field work, experiment design, data collection and scientific writing. In contrast to the classroom experience on the main campus, field station courses are characteristically hands-on learning experiences in the field that culminate with an original research project conducted on-site. Course offerings primarily consist of ecology and geology and are designed to satisfy undergraduate major degree requirements and electives; however, in recent years multidisciplinary courses in creative writing and rhetoric with emphasis on the environment have been offered through the English department. Courses meet from 8:30 AM to 5:00 PM for 3 consecutive days—either Monday through Wednesday or Thursday through Saturday. Each student typically takes 2 classes; thus, students are expected to be engaged Monday through Saturday for the four-week duration. This schedule means that downtime is brief, and information needs have a very limited time to be met as compared to a non-field course taught on the main campus. This time can be particularly limiting for students when conducting literature research for the required original research projects. A readily available and responsive reference service is a necessary part of the services offered by the field station.

The researcher community at the UMBS draws on field scientists from around the world. Research tends to be team-driven and is performed by both visiting and resident researchers on topics across ecology, environmental science, evolutionary biology and geology. Field research primarily occurs in the summer months but occurs year-round to varying degrees. There are multiple long-term research projects in process at the station with the associated personnel who are on-site either part-time or year-round. In recent years, there has been a move to partner the station with local Native American tribes to support education, ecology, conservation and management of their lands. From the perspective of the library, the summer months are the busiest, with demand trailing off during the rest of the year.

The UMBS Library is a non-circulating collection that consists of over 10,000 print volumes primarily in the areas of natural history, ecology, geology and environmental science. The UMBS community members and guests have access to all electronically available journal articles, books and other materials at the field station that they would have on the main campus. The UMBS Library provides 2 floors as a 24-h space for the field station community to work. Since returning to normal operations following the COVID-19 pandemic, students have increasingly used the space for group work, meetings and socializing rather than exclusively as an individual quiet-space reading room. The reference desk is centrally located near the back of the library with clear sightlines to most of the lower floor. Reference desk operational hours are 9 AM to 5 PM Monday through Friday, 6 PM–8 PM Monday, Wednesday and Thursday, and 6 PM–9 PM on Sunday evenings. However, in practice, the short summer sessions and the residential nature of the location mean that reference questions can arrive at any time. The UMBS community members have access to both the in-person field station librarian and the online chat service that is provided by the main campus library for the entire university community. The field station library is jointly administered by the field station administration and the main campus library. The field station administers and maintains the physical space as well as the building itself. The main campus library is responsible for the librarian and the physical collection within the space.

Scope of the reference desk

The field station reference desk is the contact point for patrons seeking help using or accessing library resources at the field station. In general, the reference desk provides the following support to the research community:

(1) Reference services to the field station community, including literature searches, including identifying databases, keyword generation, search strategies and information assessment, etc.

(2) Assistance locating specific physical and electronic materials on-site and requesting physical items from the main campus

(3) Individual and group library instruction tailored to the information needs of the individuals, courses and the field station community

(4) Promote library resources and services

(5) Support the field station community through library services such as interlibrary loan, research data, copyright, etc.

Field station reference desk outcomes

It is useful to think about functional outcomes for the field station reference desk as a service. Similar to learning outcomes in course design, these outcomes can be used to assess existing services, guide the implementation of new services and benchmark the scope of existing functions.

(1) Support the field station community's access to and use of information, particularly place-based information.

(2) Contribute to, support and improve the research and scholarly communication at the field station.

(3) Foster the growth of the community's information literacy, particularly within the context of ecology and geology field work.

(4) Develop and maintain subject liaison relationships between the library and the field station community.

Organization of the service

The on-site field station librarian is a temporary position administered by the library on the main campus with input from the field station administration. This summer-only temporary position is employed on-site for approximately 9.5 weeks, which covers the duration of two four-week summer sessions plus intersession time for set-up and maintenance. The field station librarian is a subject specialist in ecology and more broadly in geology, evolutionary biology and other related fields. The field station provides the librarian on-site housing, with the librarian living, eating and working among the field station's summer researchers, students and instructors. Given the remoteness of the position, the involved needs of the community, as well as the time needed to meet those needs, it has been historically necessary to hire a temporary librarian for the summer months rather than pull a main campus librarian away from their existing responsibilities. The temporary nature of the position meant that the job historically drew librarians from K-12 library positions, 9-month academic jobs and graduate students. The administration of the field station librarian and the on-site physical collection is overseen by the main library, while the physical space and building are administered by the field station.

The field station librarian oversees the reference desk as well as the library's physical space and collections during the summer class sessions. The librarian is physically available at this location 40 h per week, though in principle library assistance can occur at any time at the field station given the field station's close living and working conditions. Reference questions can be asked in-person and by email. Chat reference is available, and reference questions requiring specific knowledge of the field station librarian can be escalated from the main campus chat reference service if necessary. The summer librarian also provides library instruction, which includes search strategies, databases such as Web of Science Core Collection, Scopus and the institutional repository, citations and citation management tools, locating place-based information and how to use AI in literature searching. The reference desk also provides a point of contact for interlibrary loan, including physical and scanned materials from main campus holdings. Because of time considerations for the relatively short summer term and the fact that many community members work in remote field sites during the day, the reference desk acts as a go-between for the community and interlibrary loan. Likewise, the reference desk can provide very basic circulation services such as returning books and receiving physical materials from the main campus. The field station librarian also oversees the field station's physical course reserves, which supplement in-class instruction.

Literature review

Field research stations are commonly associated with universities, though they can be administered by governments, non-profits, or private organizations. Field stations as a movement have a history going back to the late 19th century with examples of both terrestrial and aquatic locations (Jack, 1946; Cain, 1959; Swain, 1998; Nadelhoffer *et al.*, 2010; Vetter, 2012; Inaba, 2015; Canadelli, 2016; De Bont, 2019). The individual missions of field stations vary; however, the three primary areas are research, education and public outreach (Stepien *et al.*, 2017). Field stations have been defined in the literature depending on the ecosystems involved, the types of research, the amount of education and research, as well as specific local history (Cain, 1959; Whitesell *et al.*, 2002; Wyman *et al.*, 2009; Tydecks *et al.*, 2016; Zarestky *et al.*, 2022, McDermott *et al.*, 2022). These definitions of field stations agree that field stations typically include an outdoor location that is characteristically remote, and the field station provides access to on-site facilities to enable research and everyday life. Further, the research and teaching conducted at a field station can be characterized as place-based (Cain, 1959; Kingsland, 2010). A defining characteristic of field research stations is the presence of long-term infrastructure to assist in the residential research process, including housing, meal services, laundry, Internet, laboratory, educational facilities and, of course, libraries. Field research stations can also facilitate public engagement by putting researchers into direct

contact with the public, outward-facing citizen science projects and disseminating research, results and expert recommendations (Tydecks *et al.*, 2016; Busch, 2022).

While libraries can be found within field stations, they are not universally available across all such stations. Field stations that provide on-site libraries typically manage the library as part of the field station or through an affiliated university library. Whitesell *et al.* (2002) surveyed 179 tropical field stations and found that 73 (40.8%) provided some form of library service or facility to researchers. Tydecks *et al.* (2016) conducted a survey of 138 freshwater field stations and found that 30 (21.7%) offered on-site library facilities. A 2012 joint survey by the National Association of Marine Laboratories and the Organization of Biological Field Stations found that 12.1% of responding field stations reported that their paid staff included at least one librarian (NAML and OBFS, 2013).

Field station libraries are less well represented in the literature. Gilmont (2014) provides an account of field station reference from the perspective of a paraprofessional. Carlson and Stowell-Bracke (2013) characterized graduate student attitude to data management and sharing at a water quality field station in northwestern Indiana. Gerrish and Martin (2024) used qualitative interviews and informed learning to investigate the information needs that characterize work at a field station in northern Michigan. Gerrish and Martin (2023) investigated field station student preferences for in-person and virtual interaction with the station library's on-site reference desk.

Organizational models of field stations (i.e. in-person, embedded and fully virtual) are not discussed in the literature. Dewey (2004) initially defined embedded librarianship as an enhanced online relationship with a community often mediated through learning management systems (LMS). This model emphasized increasing contact between the library and specific university communities. Since then, the definition has expanded to include both an in-person and virtual presence by the librarian. Wu and Mi (2013) expand the definition to include integration of the library and librarian into multiple aspects of a student's education. Ma *et al.* (2018) found that embedded librarians were moving away from passive roles in the LMS into areas of active collaboration, information experts and subject matter liaisons while maintaining a physical presence external to the library. Shumaker and Talley (2009) defined the embedded libraries as co-located with the community, shared funding by the library and the customer group, and shared management for the service by the library and the customer group.

The read scale

The Reference Effort Assessment Data (READ), introduced by Gerlich and Berard (2010), evaluates qualitative aspects of academic library reference transactions. It was developed because of the need for deeper assessments following the rise of virtual chat reference (Neville and Henry, 2009). The six-point scale takes into consideration effort, training, knowledge, skills and instructional methods used by reference staff. It primarily assesses the skill, time and effort required to answer different types of reference questions.

More recently, the READ Scale has been used to study the impact of COVID-19 on reference services. Hervieux (2021) used it to evaluate question difficulty as services shifted fully online due to social distancing. Anderson *et al.* (2021) similarly used the scale to assess changes in the perceived difficulty of reference queries during the pandemic. Stieve and Wallace (2018) applied the READ Scale to compare the difficulty of chat questions based on whether they came from the library website or a course learning management system. Their findings informed staffing and expertise decisions for chat services. Warner and Hurley (2021) conducted a systematic review and found the scale was frequently used to guide staffing levels and the assignment of staff based on expertise.

However, the READ Scale has limitations. Warner and Hurley (2021) noted that transactions were often scored too low, potentially undervaluing reference work. Some institutions adopted modified versions to better suit specialized services (Sheehan, 2011; Stieve and Wallace, 2018), which can affect consistency, particularly in highly specialized

work. Accurate interpretation also requires uniform application, which depends on proper training and resource investment (Bowron and Weber, 2019).

Methods

This study characterizes the reference services at a remote field station engaged in research and education. Reference transactions were recorded and analyzed during the 2022 and 2023 summer sessions. These reference transactions occurred at the field research station during the 9.5 operation weeks and included both in-person transactions and email. At the end of each reference interaction, the original question was recorded along with notes on the transaction and ultimate information request. A record of each classroom instruction session was kept and annotated as necessary. Online reference questions are directed to the chat reference service on the main campus and not recorded in this list unless the question escalated beyond the reference staff's ability to answer, in which case they were most likely part of the email section of the data. Reference transactions from 2020 to 2021 were heavily impacted by social distancing measures and COVID-19 and not included as part of the analysis, though the transaction numbers are available; see Gerrish and Martin (2023). Reference questions in the data set were subsequently scored on the READ Scale (Gerlich and Berard, 2010). The READ scale is a tool used in libraries to evaluate and analyze reference services. It helps librarians assess the complexity and effort involved in responding to reference inquiries, with higher scores requiring more time and expertise. For a detailed explanation of the scale and examples, see Table 1 below. Each question then was coded using a multi-round attribute coding system (Saldaña, 2021) based on the type of question or information sought. This process involved categorizing the data over multiple iterative readings, where each round of coding refined and added new codes to the existing coding framework. The first round involved generating possible categories present in the data. The second round involved refining and merging those categories to best describe the data and reflect the assessment in progress. The third round involved another reading of the data, where the data were coded based on the refined codes that emerged from the second round of coding. This methodology allowed for a more nuanced understanding and classification of the complex reference transaction data set while also allowing the coding system to evolve as new categories become apparent. Access to the data was restricted to the primary investigator (PI), and the data were de-identified with no identifying information kept in the final data set.

Results

A total of 209 questions were asked in-person and email—88 questions in 2022 and 125 in 2023. Of these, 184 in-person reference questions were asked—81 in 2022 and 103 in 2023. Reference questions were generally asked at the physical reference desk in the library, but 7.06% (13 questions in total) were asked elsewhere in camp—most often in the dining hall. A total of 25 questions were asked via email—7 in 2022 and 18 in 2023. Data from 2017 to 2019 were collected when courses ran under an eight-week model when students took 2 courses that met 6 days per week for fewer daily hours. Data from 2020 to 2021 were collected during virtual field instruction due to COVID-19 social distancing and do not represent a normally functioning field station. For the years 2020 and 2021, students were able to take classes at the field station virtually but were not on-site. Similarly, researchers were able to gather data but were not housed on-site. See Gerrish and Martin (2023) for a discussion of the field station's response to COVID-19. Data collected from 2022 to 2023 were collected during the current four-week accelerated in-person field course schedule. A summary of the total questions asked for 2017 and 2023 is listed below in Table 2.

Reference questions from 2022 to 2023 were scored on the READ Scale (Gerlich and Berard, 2010). READ Scale numbers ranged from 1 to 4 with no 5s or 6s in either year. Summer 2022 had an average READ score of 2.01, and Summer 2023 averaged 2.00. READ

Table 1. Detailed explanation of the six-point READ Scale as well as examples based on those observed at the field station reference desk

Read score summary Score	Description	Example
1	Answers that require the least amount of effort No specialized knowledge skills or expertise; anyone in the library could answer No consultation of library resources Typically, less than 5 min Mostly questions you can answer by pointing or with a few words	Directional: Where is Hungerford teaching lab? Library or station hours: What time does the administration office open? Service point location: How do I complete a maintenance request? Where are the print course reserves? Rudimentary assistance: Do you have a pen? Can you refill the paper in the printer?
2	Answers given which require more effort than a 1 Require only minimal specific knowledge skills or expertise Answers may need nominal resource consultation (e.g. consult the catalog)	Call number/book inquiries: Do you have Ecology in Action by Fred D. Singer? Item Location: How do I locate a book in the Library of Congress (LC) or Dewey collections? Do we have a subscription to the journal *Michigan Botanist*? How do I map my computer to the printer?
3	Answers in this category require some effort and time (5 or more minutes) Consultation of library resources is needed Instruction in some form is required Subject based questions where 1 source is consulted or searched Reference knowledge, skills, and training come into play	How do I search for articles on Kirtland's Warbler conservation projects? Where can I find texts that discuss Native American wild rice production? Can you show me where to locate census population data that I can use in GIS? What databases cover the atmospheric physics of climate change?
4	Answers or research requests require the consultation of multiple resources Patrons require multiple sources for research Subject specialists may need to be consulted and more thorough instruction and assistance occurs Reference knowledge and skills needed Efforts can be more supportive in nature for the user, or if searching for a finite answer, difficult to find Exchanges can be more instruction based as staff teach users more in-depth research skills	Can you help me find articles on *in situ* springtime methane flux from an oligotrophic lakebed? I am looking for peer reviewed articles, print manuscripts, and information in the institutional repository I am conducting comparative literature research. Can you help me search for references across multiple literary databases and improve my search strategy? I am looking for any studies that have been done on *Enallagma aspersum* near the research station. I want to expand my initial search into related subject areas. Can you help me redefine my topic and suggest additional relevant resources? I want literature that takes place in Northern Michigan like *Nick Adams Stories*. Can you show me how to use the library's advanced filters and citation tools across different platforms and databases?
5[a]	Does not normally resolve at the reference desk; typically by email, consultation, etc. More substantial effort and time spent assisting with research and finding information On the high end of the scale, subject specialists need to be consulted Consultation appointments with individuals might be scheduled Efforts are cooperative in nature, between the user and librarian and or working with colleagues Multiple resources used May include primary sources as well as secondary sources Dialogue between the user and librarian may take on a "back and forth question" dimension	I am doing a systematic review on CO_2 flux in boreal forest vernal pools. Can you help me develop a comprehensive search strategy using multiple databases, and guide me on inclusion/exclusion criteria and citation management? I need to find US federal court cases and legislative history related to water rights law in the Laurentian Great Lakes region from the early 20th century I am producing a documentary on Indigenous land rights and need primary source materials, including treaties, maps, photographs, and oral histories from various repositories I am applying for a National Science Foundation (NSF) grant. Can you help me create a Data Management Plan that complies with both federal and institutional policies, including data sharing and preservation strategies that are specific to my data?

(*continued*)

Table 1. Continued

Read score summary Score	Description	Example
6[a]	Research consultancy rather than standard reference help The most effort and time expended; involves multiple days Does not normally resolve at the reference desk; typically by email, consultation, etc. Inquiries or requests for information can't be answered on the spot At this level, staff may be providing in-depth research and services for specific needs of the clients This category covers some 'special library' type research services Primary (original documents) and secondary resource materials may be used	What are the curriculum models for teaching environmental ethics to undergraduate students? How has this been done in field science courses? I want to create an interactive map that visualizes methane flux shifts in the Great Lakes Staits region using data from 1999 to 2020. I need help finding, cleaning, and structuring the data, and choosing appropriate tools I need a full policy history and comparative legal analysis of Public Trust from the United States and Canada with emphasis on changes since 2015 We are researching the feasibility of an oil pipeline through the Great Lakes Staits region. Can you find proprietary market reports, trade publications, patents and import/export data the US and Canada?

Note(s): [a]No examples of a READ score of 5 or 6 were observed in the data and they are included in this table for completeness.

Source(s): Table by the author

Table 2. The number of reference interactions per summer

	Total students	Semester structure	Email	Walk-in/in-person/	Total	Questions per student
2017	213	8-week	7	106	113	0.53
2018	187	8-week	9	105	114	0.61
2019	196	8-week	0	46	46	0.23
2020[a]	171	8-week virtual	0	0	0	0
2021[a]	167	8-week virtual	0	4	4	0.02
2022	60	4-week	7	81	88	1.22
2023	131	4-week	18	107	125	0.93

Note(s): [a]These in-person reference transactions occurred over Zoom due to COVID-19 social distancing measures. They are included for completeness but are not representative of present conditions.

Source(s): Table by the author

scores for the combined years averaged 2.01. A READ score of 2 was the most common score for both summer semesters. A record of the questions asked was not kept until summer 2022, and READ scores from 2017 to 2021 are not available. See Table 3 below for a distribution and summary of the READ scores.

Questions were coded based on the type of question and the information sought. A total of 14 categories were identified. Most questions were only assigned a single category, though there were exceptions with questions with more complex information requests—typically involving READ scores of 3 or 4. For example, a question seeking a particular book in the collection was assigned a single category; however, a question broadly seeking information on a particular phenomenon under specific environmental conditions could consult multiple areas, including databases, monographs and the institutional repository (IR). See Table 4 below for a list of the categories as well as a description and examples.

The total number of questions for each category was tallied along with a percentage for the year. An overall percentage for the 2 years was also calculated. See Table 5 below for a summary of the data.

Table 3. The distribution of READ scores based and the average READ score by year

Summary of READ scores by year			
Year	READ Score Class	Count	Percentage
2022	1	26	29.89%
	2	39	44.83%
	3	17	19.54%
	4	5	3.83%
	Average	2.01	
2023	1	29	23.77%
	2	66	54.10%
	3	24	19.67%
	4	3	2.46%
	Average	2.00	
Total	1	55	26.32%
	2	105	50.24%
	3	41	19.62%
	4	8	3.83%
	Average	2.01	
Average overall		2.01	

Source(s): Table by the author

Discussion

The field station library is the point of contact between the field station and the main campus library. As such, it serves to meet the information needs of the community in a manner suitable for the environment. In terms of access to the library, the reference desk provides the community with access to reference services, circulation with the main campus, course reserves, as well as miscellaneous services like GIS, data management and scholarly communication. The overall structure of services and presentation of the reference desk matches libraries of equivalent size (Dawson, 2011; Miles, 2013; Bowron and Weber, 2019), with the exception that the field station library does not offer a dedicated chat reference option beyond the one available to all university community members.

The usage numbers (Table 2) point to a highly utilized library resource at the field station with the exclusion of years 2020 and 2021, which were highly impacted by COVID-19 and a temporary move to virtual instruction. In fact, since 2021, the number of questions per student has increased. Between 2017 and 2019, the total number of reference interactions per student peaked at 0.61 questions in 2018 and decreased to 0.23 in 2019. For the period of 2017–2019 under the eight-week model, there was an average of 0.43 questions per student. However, after a return to an in-person field station in summers 2022 and 2023, the reference desk average increased to 0.98 questions per student. The total number of students attending the field station per term has decreased since the move from an eight-week model to a four-week model; however, the total number of questions per student has increased. That is, individual students from 2022 to 2023 were more likely to use the reference desk than students from prior to 2020. This observation goes against the national trend seen in most libraries, where the in-person reference model has largely been replaced by synchronous chat reference. McClure and Bravender (2013) and Stevens (2013) report that the in-person and desk-centric model of reference was showing a decrease in use numbers more than a decade ago as users began to favor chat reference and LibGuides. Likewise, there are reports of a decrease in the total number of reference transactions in general. Saunders *et al.* (2023), Bandyopadhyay and Boyd-Byrnes (2016), and Johnson (2019) noted the trend for a decreasing number of total reference transactions overall and the in-person reference desk in particular. Based on the reference transaction numbers, the field station library and community are not following the trend of decreased reference interactions. While there is a decrease in the number of

Table 4. Summary of all categories found during coding, a description of the category and example questions

Category	Description	Examples
General questions about the library or services	Questions about the library use including services, space, and materials	Do you have a mask? How late is the library open? Can I schedule a guest lecture from the library?
Research Site Information	General information about a site or location in the region including accessing, navigating, site rules, etc.	Is there a map of the lumber roads in the Kingston Plains? Does French Lake have public boat access? Where is parking at Grass Bay?
Place-Based Literature	The request is seeking research literature related information specific to a northern Michigan location, site, or specific region	Are there any data sets on dragonflies at Lark's Lake? What research has been done on water turbidity below the Lake Catherine Dam? What research methods have been used to study *Bufo fowleri* in Wilderness State Park?
IR (Deep Blue)	A request for data sets or papers located exclusively in the institutional repository	I need a specific unpublished paper from 1971. What student research projects have examined Trichoptera in the Maple River? What research methods have students used to study *Peromyscus maniculatus*? Is there a recent macrophyte species list for North Fishtail Bay?
GIS (Geographic Information System)	A request for help with a GIS process or locating data	How do I join a.csv file to a shapefile? I need a historic orthographic photo showing shoreline change for Wycamp Lake. Can you help me find census tract data for the eastern Upper Peninsula?
Tech Support	Assistance with technology or accessing online resources	How do I connect to the printer? My login isn't working. How do I insert a table into Google Docs?
Field Station General Information, Policy	Information about field station policies, procedures, and field station directional	What time does the admin office open? Where is the laundry? How do I request maintenance in my cabin? Can I check into my cabin if the admin is closed?
Reference, Non-specific	Catch all for any other reference question. Generally, not related to research or coursework	Where are the current wildfires in Canada? What are the nearest grocery stores? What is another name for the ovenbird?
Literature Searching	Searching the literature for a specific topic or question	I need articles on mercury deposition in freshwater lakes relating to forest fires. Can you help me find articles that discuss the implementation of the floristic quality metric?
Title Search	Searching for a specific book or article title	I need a copy of *How to do Ecology.* Do we have access to Phillips and Miroslav (2008)?
Book Search, non-specific	Searching for books in the collection, but not a specific title	Where are the bird books? Do we have anything on native American uses of natural dyes? I need books about pitcher plants and the environments where they live
Library Policy	Questions about policies or practices in the field station or main campus libraries	Does Inter Library Loan (ILL) deliver to the field station? Can I check out a book to use in the lab? Does the library have individual workspaces?
Citation help	Question about citation format or use	How do I do in-text citation for American Psychological Association (APA) style? How do I cite unpublished works from the IR? What citation management tools are there?
Copyright	Questions about copyright library policy	Is my laboratory procedure protected by copyright? Can I give everyone in my ecology class a copy of a book chapter?

Source(s): Table by the author

Table 5. Number of questions per category for each year with percentage composition

Total questions by type and year with percentage

	2022	Percent year	2023	Percent year	2 Year total	Percent total
Specific Title Search	14	16.09%	23	18.85%	37	20.11%
Book, non-specific	12	13.79%	20	16.39%	32	17.39%
Place-base Literature	12	13.79%	17	13.93%	29	15.76%
General questions about the library	8	9.20%	19	15.57%	27	14.67%
Article Search	10	11.49%	16	13.11%	26	14.13%
IR (Deep Blue)	8	9.20%	15	12.30%	23	12.50%
Library Policy	9	10.34%	11	9.02%	20	10.87%
UMBS General Information, Policy	8	9.20%	8	6.56%	16	8.70%
Reference Non-specific	5	5.75%	10	8.20%	15	8.15%
Tech Support	4	4.60%	4	3.28%	8	4.35%
Location Information	3	3.45%	4	3.28%	7	3.80%
Citation help	4	4.60%	3	2.46%	7	3.80%
GIS	4	4.60%	2	1.64%	6	3.26%
Copyright	1	1.15%	1	0.82%	2	1.09%

Source(s): Table by the author

transactions per student between 2022 and 2023, it remains to be seen if this is a continuing trend or not. Importantly, this trend could be influenced by a range of factors, including changes in instructional design, staffing, or student expectations post-pandemic. Further qualitative study will be needed to examine the long-term trends at the field station under the shorter four-week session model.

The READ score averaged 2.01 for the 2 years of data. Questions with a READ score of 2 make up 50.24% of the reference questions asked for 2022 and 2023. This is likely due to the number of patrons asking for specific titles of books or journals because they are unfamiliar with how to look up a book in the catalog, are unsure about the library's layout, or are unaccustomed to locating a physical book in a library. Patrons may be familiar and comfortable with using the chat reference service maintained on the main campus, but the chat reference staff are well removed from the field station and unlikely to be of assistance locating a physical item. This could help account for the field station's preference for an in-person reference desk over the virtual. Still, 19.62% of reference questions were scored a 3 and 3.83% were scored a 4, which indicates that the population at the field station is using the reference desk for more complex reference assistance. The scores of 3 and 4 indicate that the community is consulting the field station librarian for more involved information needs, more like a subject matter specialist on the main campus. In this case, the deeper reference interactions can be understood as delving more deeply into ecology, environmental science and geology.

From an administrative perspective, the average reference score of 2.01 over the two-year period might suggest that demand at the field station's reference desk does not justify a full-time, in-person librarian. However, the library plays a dual role: providing both basic library services and more advanced, place- and subject-specific support specific to the information needs of the community. The latter requires specialized librarian expertise, including advanced information skills and familiarity with place-based resources. Maintaining a librarian with expertise in relevant scientific fields and local knowledge is likely essential to effectively support users at the site.

When the reference interactions were keyed, the most common theme was the title search, which occurred 37 times, followed by non-specific book searches, which occurred 32 times in the data set. Place-based literature, GIS and locating data sets were represented, which agrees with Gerrish and Martin (2024) that these are key information needs of the field station

community. Questions about field station policy, procedures, locations outside the library and readers advisory were well-represented in the data. The reference desk at the field station serves as an information center for life at the field station rather than restricting itself to just teaching and research. This broader role means the field station librarian supports learning, teaching, research and everyday life in ways that go beyond the traditional campus librarian's role. Rather than operating as a distant branch of the main-campus library, the field station library is deeply integrated into the information needs of the station's community and daily operations.

The library reference desk in this regard acts as an information desk for the entire station community and not just the students and instructors; thus, the field station librarian's skillset goes beyond the traditional role of librarian on the main campus as it pertains to the community's learning, teaching, research and daily lives. The community at the field station uses the library and its librarian as an integrated service of the field station rather than an isolated outpost of the main-campus library.

The reference desk is located at the field station, and the librarian lives close among the students, instructors and researchers through the two four-week summer sessions and the previous eight-week sessions. This arrangement allows for direct community building and interaction between the library and the field station community more than would be experienced on the main campus during a similar timeframe. The administration of the library, both as a space and a service, is a shared enterprise between the library on the main campus and the field station. The field station community uses the reference desk and librarian as a subject matter specialist for multiple areas, including ecology, environmental science and geology, in addition to traditional areas such as general reference and readers' advisory. The community's use of the reference desk extends to areas such as GIS, research data management and scholarly communication. This all contributes to the unique identity of the field station reference desk as the community uses it.

In terms of the organization of the library as a type of special library, it became apparent through this assessment that the field station library is a type of embedded library. This was an unanticipated finding based on the organization of the service and the analysis of the reference transaction data. Based on the Shumaker and Talley (2009) definition of embedded libraries, we arrive at the below criteria for an embedded library:

(1) Embedded librarians can be located within or near their communities

(2) There is shared responsibility in administering the embedded library/librarian including funding

(3) They engage in relationship building with their communities, and this process is aided by co-location

(4) The embedded librarian possesses subject matter expertise relevant to the community

(5) The embedded librarian provides complex services while also maintain basic library services

Based on the above criteria, it is reasonable to classify the field station reference desk and library as a type of embedded library because the field station reference desk covers (1) through (4), with the field station library as a whole fulfilling (5). The data in this study show direct evidence of specialized subject matter expertise and the implementation of complex and basic library services such as interlibrary loan, course reserves, Geographic Information System (GIS) support and research data management. Indirectly, the results demonstrate the relationship building between the library and the field station community, where for 2022 and 2023 the number of reference questions per student likely exceeds a similar metric for the main campus. These usage numbers show that the field station reference desk is a well-utilized service at the field station.

The embedded model was not an intentional design choice but instead a convergent evolution of the needs of the field station community, the remoteness of the main campus and the resources available to the university. From the standpoint of structure and services provided, the field station library in its current state has most in common with an in-house medical library as described in Ma *et al*. (2018) and Wu and Mi (2013). Going forward, it may be helpful to assess the field station library as a type of embedded library when considering how to improve or expand the library's services and facilities. Further, in assessing the types of field station libraries in use, it may be good to remember that the embedded library is not the only possible model. Other operation models exist; for example, distance learning models that rely on a librarian on the main campus who connects via Zoom are another viable arrangement. In considering how field station libraries operate, the model likely is determined by a combination of the distance to campus or the main library, funding, staffing levels, information needs and the field station community's expectations. A future survey of field libraries should examine which models are used and why.

The original purpose of this case study was to perform a deep survey of the operations of the reference desk at the field station library in order to create a baseline for further work in this area. If the goal is to further define the field station library as a type of special library, the next step will be to survey field stations and their libraries using this study to inform the process. This future survey will help further define the field station library as a type of special library with specific circumstances as well as information needs and literacies for field stations as well as the ecology, environmental science and geology disciplines. It will also need to define the model of service and how the community interacts with the reference desk, the library's physical collection and the library as a community space. This will ultimately inform librarians working at field stations and administrators on the main campus but also subject specialist liaison librarians who work with ecology and geology communities on the main campus.

Conclusion

The results show that the field station reference desk shares many characteristics with reference desks from small and medium-sized libraries. The similarities include reference services, technical support and access to library services such as interlibrary loan and reserves. The primary difference is the field station's lack of a dedicated synchronous chat reference portal. Despite the trend of decreasing reference interactions, this reference desk is maintaining use within its user community. The community uses the field station reference desk as a subject matter specialist and for broad reference services but also for other areas such as circulation, interlibrary loan, research data management, scholarly communication and GIS. Based on the community's use and how the library is administered, this field station reference desk should be considered a type of embedded library. A further survey of field and marine stations should be conducted to document other possible models and how closely other locations match the characteristics observed in this case study. As such, this case study should be used as a starting point in a further investigation of field station libraries and information literacy in the field station context. Lastly, the data here suggests that there may be an interaction between reference services, place-based information and information literacy, which is another potential direction of future research.

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