

**Mapping Hesquiaht Harbor Fish Weir Stakes with Use of GIS:
The Role of the University Researcher in
Community Based Projects**

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At first, I really enjoyed, but had a hard time with not knowing, why or when we were doing things. When we first arrived in the Hesquiaht Harbor all I knew is we were there at the request of a community member. From what I knew of the request, it had something to do with a fish weir. I wasn't even sure what a fish weir was exactly, but I was hoping to find out. I was also unclear as to why we were helping or what the intentions were, I just had to be patient. As a First Nation elder by the name of Stephen Charleston, led people from our group in pairs, each with a handful of short sticks with fluorescent tape tied to them, I didn't understand what he was leading them to.

It was finally my turn, I took my sticks and followed him, he told me to stand in a specific spot, a couple meters from another classmate. In the ground I could see the tops of several four inch posts sticking out of the sand. I didn't know what these were, but I gathered they were part of the weir. As each of the 15 other people from our group were assigned a position, the shape of the 'weir' was beginning to form. It looked like a large semi circle, which covered a large portion of the beach. I waited patiently for my professors to make there way around the half circle, taking global positioning system (GPS) readings at each of the posts marked with a stick and a member of our group. As I waited my turn to become a data point, I looked around, trying to imagine this place over 100 years ago. Later I hoped I would get a glimpse of what Stephen had to say about the history of his people in the area.

After each person in our group became a data point, Stephen directed us again, this time to make the 'inner' part of the weir. Just as I thought I was seeing a clear representation of the weir's shape, the inner part we were now constructing looked like a jumbled mess. There were several dozen stakes inches apart from each other, making no sense to me. But as I remembered, patience is virtue, especially when being asked to assist in the request of a community member; I enjoyed the moment as I waited to become another GPS data point.

~Excerpt from authors' Field Journal, May 14, 2005 Clayoquot Sound.

Introduction

Objectives

After assisting Hesquiaht elder Stephen Charleston with the location and identification of the stakes on the beach as described above, our group was led to a place higher up on the shore and Stephen described to us what he knew about this weir. Something I recall from memory, as I did not feel it was appropriate to have my field journal out, is that his ancestors last used this weir in 1889, as a primary method to collect fish as a food source. He also stated that although he knew his ancestors used and constructed this weir, he himself had never been taught how to use it or how they used it. He went on to draw a diagram in the sand, representing how he thought the weir may have been used. He described two nearby rivers serving as Coho and

Chum salmon spawning areas, which fed into the ocean. He also described his belief that as the tides rose each day the fish would come with them, swimming directly into the weir. Then as the tide went out, the fish would become trapped in the weir, allowing the Hesquiaht people to collect the fish directly out of the weir. One aspect Stephen clearly stated, about the collection of the fish, is that only what was needed was taken, and the rest were let free. By allowing the fish to be released they could ensure there would be plenty of fish for later harvest. After Stephen explained how he thought the weir may have been used, he said that these are only ideas he has been able to formulate, although, he would like to understand more about weirs and their role in First Nation communities. In order to further understand, he needed a visual representation of the weir remains he had discovered. This is when I learned his reason for inviting us to this site; he wanted a way to visualize the shape of the weir, to further understand its use.

I knew, after gaining a better understanding of why Stephen had requested our group to assist him with the location and mapping of the beach stakes, that this was a project I would be particularly interested in. As a geographer, my passion and interest in the field and experience with geographic information system (GIS) applications could assist in the creation of a documented visual illustration of the stakes that had been located in the Hesquiaht Harbor. In this paper I very briefly introduce the use of fish weirs as a traditional fishing technique and refer the reader to a more detailed report and annotated bibliography on weirs compiled by Alyssum Neilson (2005) as part of this course. I outline methods and applications of GIS to create a visual representation of the fish weir stakes located in the Hesquiaht Harbor through the use of an ArcGIS software package. In the context of community-based research, I discuss how this project seeks to incorporate local knowledge with academic knowledge, and I examine various roles of the university researcher in community based projects. Finally, I describe the benefits and limitations associated with the use of GIS in this project, and suggest that future efforts to understand the weir will benefit from a community-based research approach.

The form of this paper is based on a standard Geography report. It includes enough technical detail for the data to be accurately conveyed to someone who might want to repeat the mapping exercise or use the information as a basis for further study. At the same time, I have attempted to minimize technical language and jargon in my discussion of the data to ensure the results are accessible to a wide readership.

Fish Weirs

Weirs are fence like structures, constructed from locally extracted natural resources, which allow water to pass freely, but trap fish swimming through the structure. Fish weirs are a traditional fishing technique used within many First Nation cultures. Weir types vary depending on their target fish species; however, there are generally two main types of weirs which include river weirs and ocean/tidal weirs. Ocean or tidal weirs, the type of weir possibly used in the Hesquiaht Harbor, depend on the change in ocean tides for their success. As the tide rises, fish approach the weir located in the upper tidal zone, and as the tide recedes the fish become trapped in the weir. These structures are typically made of wood or rocks in the form of a tall crescent shape. Weirs can also be combined with a trap, which acts as a holding cell for future harvesting (Neilson 2005). Fish weirs were a very popular means catching fish among First Nations people, as they provided a system to catch many fish at one time.

Methods

Acquiring Field Data

On May 13, 2005 at approximately 10 am a group of sixteen University students and two instructors arrived at the shore of Hesquiaht Harbor, located in the Northwestern region of Clayoquot Sound, on the mid-west coast of Vancouver Island. At this time the tide was low and the weather was cloudy, with slight precipitation occurring intermittently.

The weir stakes were visible as small vertical sticks, presumably Cedar, sticking up approximately 1-10 inches above the sand. Ends of the stakes were generally pointed and diameters ranged between approximately 1-4 inches. Some stakes were covered in barnacles and/or seaweed making them difficult to recognize. The total length of the stakes (i.e., how far beneath the ground they extended) was not known, but is estimated to be several feet. A close-up of the weir stakes is shown in Image 1 below.

**Image 1: Close up of Traditional Hesquiaht Fishing Weir Stakes
Hesquiaht Harbor, 2005 (photo by K. Bannister)**



All official weir stake positions as well as speculated stake locations were located by Stephen Charleston, a local Hesquiaht elder. Each stake location was marked by one of the sixteen group members with fluorescent marking tape attached to the tip of a short stick. GPS readings were then taken at 29 official stake locations, 4 possible stake locations, and one photo point location by Barb Beasley and Kelly Bannister using a handheld GPS unit. A panorama view of the field site and stake locations marked by group members is shown in Image 2 below.

Image 2: Panoramic View of Traditional Hesquiaht Fishing Weir Stake Locations, Hesquiaht Harbor, 2005 (original photos by B. Beasley)



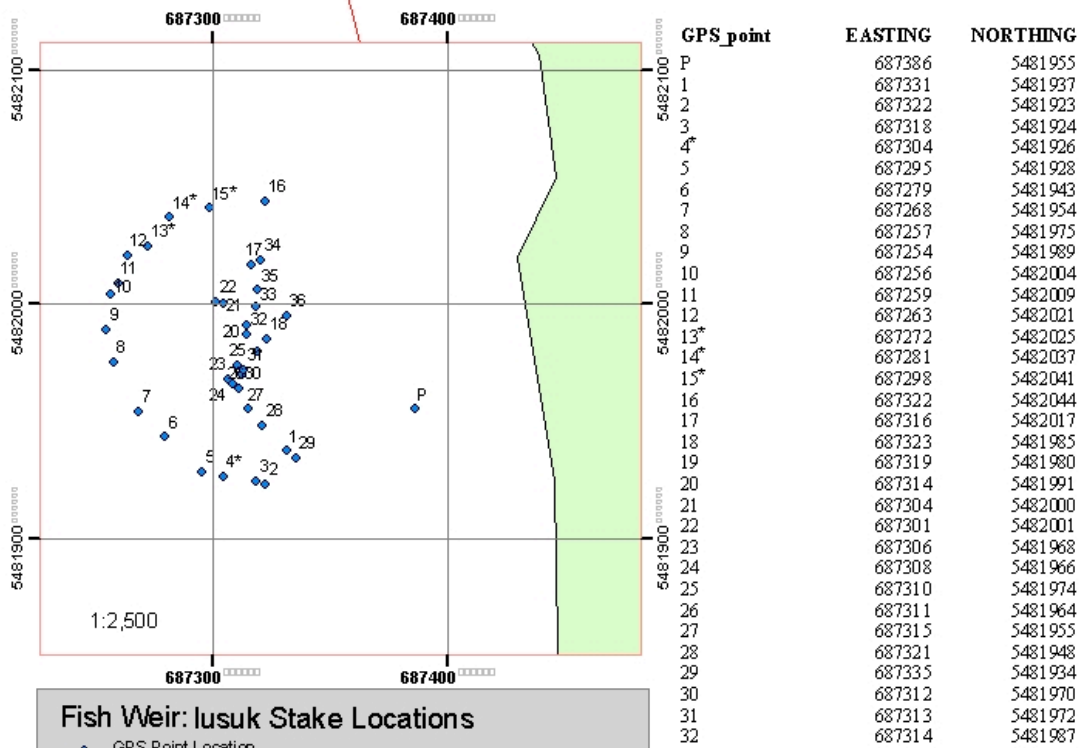
Geographic Information Systems Methodology and Applications

Upon collection of GPS point readings and return to the University of Victoria, the raw data, taken in the field, was compiled into an excel spreadsheet. In order to use the Easting and Northing information recorded with the GPS unit, to create a digitized representation of the stake positions, an application in ArcGIS software was used. In the following I outline the procedures used to produce a spatially referenced map in ArcMap.

Initially, ArcMap software was used to import the excel file containing the raw data collected on May 13, 2005, converting it into a shape file. Next, a file transfer protocol (ftp) website provided by the Ministries of Sustainable Resource Management (MSRM) sector was accessed to obtain a base map of the Clayoquot sound region. After converting the original datum from Albers equal area projection to NAD 83 Zone 9, I imported the coastline vector file to spatially reference the GPS data points. The vector base map obtained from MSRM contained information that was not pertinent to this project, thus a filter was used to eliminate unnecessary information. Also, because the base map was projected at a 1:50,000 scale, adjustments were made. By adjusting the scale of the map to a 1:275,000 scale, a better reference to the location of the Hesquiaht Harbor is shown. However, this projection still did not show a close enough view of the exact area of the fish weir stakes, so an inset was produced to show greater detail at the 1:2,500 scale. Finally, I overlaid a coordinate system on the inset map, creating a cartographic output of the coastline and GPS points, labeling all pertinent information.

Each stake location, as noted by Easting and Northing readings is delineated by an identification number in the inset map. Each potential stake, where no actual stake was present but one was thought to originally exists, is marked with an identification number as well as a small star. The one photo-point, marked with a 'P' is where Image 2 (shown above) was taken. After the completion of importing raw data into ArcMap, and the manipulation of the obtained base map, a final projection containing the exact location of each weir stake documented was produced. Figure 1 represents the final document created using the GPS data collected, in a spatially referenced image of the Hesquiaht Harbor weir stakes. Included in this map are relevant land masses, coastal features, and appropriate metadata.

Figure 1: Hesquiaht Harbour, Vancouver Island, B.C. 2005- Fish Weir Stake Locations



Created by: Marin Ripsam- June 2005

Results

The completion of the data manipulation using ArcGIS software allowed me to produce a spatially referenced image of the location of each stake position within Hesquiaht Harbor (see Figure 1). With the use of an inset 1:2,500 projection, the exact location of each stake is shown according to data acquired from the field. Identified by numbers, each stake, as well as one photo point are listed in columns in accordance with their Easting and Northing reading.

Due to insufficient data, and imprecise data collection methods I am unable to make definitive conclusions regarding the type of fish weir located in the Hesquiaht harbor; however, I am able to make speculations based on findings compiled by Alyssum Neilson (Neilson 2005) in conjunction with the ideas presented by Stephen Charleston. As investigated by Nielson, and as discussed with Stephen Charleston at the site of the weir, the weir resembles that of an ocean or tidal weir, which takes advantage of incoming and receding tide patterns to trap the fish. The clustering of the inner portion of the semi-circle suggests the weir was possibly used in conjunction with a trap (Nielson 2005). Although I am unable to make precise conclusions, I have been able to contribute to the composition of a visual representation through the documentation of stake positions. This will assist with further efforts in documentation, analysis and understanding of the weir used by the Hesquiaht First Nation communities.

Discussion

Before discussing the fish weir mapping exercise itself, in this section I first contextualize this project as a form of community based research and evaluate different aspects of the project in this light.

Characteristics of Community Based Research

Community based research can be broadly described as research that is done in collaboration with people from a community, with the term “community” encompassing a wide range of possibilities based on geography, interest or circumstance (Bannister 2005). Despite a lack of agreed definition of community based research, there are some fundamental characteristics that are described for research associated with collaboration between a university researcher(s) and a geographic community. For example, as described by Green and others, “participatory research” is the integration of research, education and action (Green *et al.* 1995). Green and others further state that participatory research seeks to link systematically collected and analyzed research processes with the aim of taking action (Green *et al.* 1995). Some key characteristics included in their definition of participatory research as a methodology include a reciprocal educational process between the community and researchers, an emphasis on taking action on the issue under study, and extensive collaboration between academically-trained researchers and the community in each stage of the problem (Green *et al.* 1995). Another defining characteristic of participation as outlined by Randy Stoecker in his article “Are Academics Irrelevant?” is that participation requires dialogue where the researcher’s knowledge, drawing and abstracting from many contexts is combined with local knowledge, which is rich in experience and understanding (Stoecker 1999). Lastly, an important point as laid out by Green and others is that sometimes a community does not have sufficient opportunity to develop skills needed to address their issue or problem, thus, community based research aims to pool the researchers’ resources as well as the communities’ resources to embrace strengths and share responsibilities (Green *et al.* 1995).

In the following sections, I address how my involvement in the project based on the Hesquiaht Harbor fish weir embraces a combination of local knowledge and academic knowledge, in response to a community request. I also discuss the varying roles of the university researcher in community based projects in general. Finally, I address the benefits and limitations of using GIS in this project, concluding with suggestions for future to further enhance the understanding of the traditional fish weir.

Collaboration between University-based and Local Knowledge

When I first arrived at the site of the fish weir in the Hesquiaht harbor, I was uncertain about the history of the area. Not only was I uncertain about the area as a whole, but I was also uncertain as to what a traditional fish weir was. As I patiently allowed the process to unfold, from the initial stages of a local Hesquiaht elder leading each member of the University based group to a specified location, which I eventually understood to be a stake that composed the outline of the weir, to the final composition of a spatially referenced visual image I created; I was able to realize that understanding of the history of the area was no small task. Later, through discussions with the same Hesquiaht elder I was able to hear his thoughts regarding how he believed the fish weir was used, based on his understanding of his ancestor's way of life. Since he was still uncertain about the basic overall shape of the weir itself, and thus questions regarding its exact use remained unanswered, he asked our group to help him visually see the shape through the use of our bodies and small wood sticks with flags.

As indicated previously, as a geographer I wanted to contribute by creating something empirically based for the community to use in the further understanding of the weir. Community-university collaborative initiatives, such as this, combine research, teaching, and professional service to address a community defined issue (Marullo and Edwards 2000). This combination of an empirically based knowledge, such as the production of a spatially referenced map of the weir using GPS data, and the local understanding of the weir is seen as 'collaborative research' as defined by Frank Fischer in his book "Citizen, Experts and the Environment: The Politics of Local Knowledge" (Fischer 2000). This type of collaborative research seeks the knowledge from conventional scientific methods, as well as information that is specific to real-life situations (Fischer 2000). A definition of collaborative research, as employed by Frank Fischer, is "a deliberative process in which practitioners and a client system are brought together to solve a problem or to plan a course of action through the process of collective learning" (Fischer 2000:176). By bringing together experts from a specified area, as relevant to the problem or question being addressed in the community, a mutually beneficial outcome can be achieved (Fischer, 2000). However, often in order to analyze data obtained by a researcher, local knowledge is seen as beneficial in understanding linkages to the larger social structure (Fischer 2000).

In reference to this project, the background I have in geography and experience with manipulation of GPS data enabled me to access the technology and resources to produce a useful image from the data. However, the value of this report represents not only the image but an integration of different forms of knowledge about the weir (i.e., local, practical scientific, technical) that can be used as a basis for further research and analysis, and may positively influence the kinds of long term outcomes and collaborative partnerships that can occur in the future. Overall, through collaboration and the combination of local and scientific knowledges, expertise and access to technology, a greater understanding of a community request or problem was achieved.

Roles of the Researcher

In collaborative work such as community based research there are various roles that a non-community member, such as a university researcher can take on. Randy Stoecker believes there are three primary approaches academics adopt in participatory research, which include: the initiator, the consultant, and the collaborator (Stoecker 1999). I discuss where my course project can be situated based on this framework.

Stoecker states that one commonly held belief about participatory research is that the research question should be initiated by the community; however, he goes on to discuss that without the initiative of a person with specific skills, time and commitment many projects would not occur (Stoecker 1999). My project on the Hesquiaht Harbor weir was initiated by the community. Although I was not personally asked to compose a spatially referenced image, a question raised during our field course was how the weir was previously used by Hesquiaht people residing in the area. I reasoned that in order to address this question, the shape of the weir must first be determined, and I applied my geography background to answer this question. Producing an image that illustrates the current location of the stakes that compose the weir will enable further analysis that can lead to a better understanding of the community's question of how the weir was previously used.

The consultant as outlined by Stoecker, is usually the position academics find themselves in when collaborating with a community, contrary to the traditional definition of community based research (Stoecker 1999). In a traditional definition of 'public research' used by Stoecker, it is stated that community members should do the research themselves (Stoecker 1999). However, as in the case of my project I was a consultant, by creating something for the community after initial collaboration with Stephen Charleston, who stimulated my interest as a geographer.

In contrast to the consultant role, Stoecker sees the collaborator as a researcher with specific technical expertise, whereas a community member may hold the knowledge of the communities needs and desires (Stoecker 1999). The role of the collaborator aims to bring these two types of knowledge together. In the case of my course project on the weir, I see my role as closer to collaborator than consultant as I was able to contribute my knowledge in the field of geography in conjunction with my access to the resources available at the University in order to combine local knowledge and the desire to learn more about the context of the weir.

Another issue brought up by Stoecker is the question of whether or not collaboration is needed throughout the whole process (Stoecker 1999). In the context of my course project, developing my initial understanding of the weir and the inspiration and objectives for the project required me to learn from a community member and be part of a collaborative exercise so collaboration was necessary; however, in the construction of the visual representation using GPS data, collaboration was not necessary. Conversely, if further analysis is undertaken in the future, more collaboration would likely be necessary for a complete understanding of the weirs uses, as well as determining the overall shape. Fundamental to enabling further research on the weir is making sure the results of this project are returned to the community in a meaningful and accessible form. This is my rationale for using the form of a Geography report and returning a copy of this report to Steve Charleston. By returning this project to the community the reciprocal education process can occur, which is seen as a crucial aspect of community based research as noted above in reference to Green and others (1995) defining characteristics of participatory research. Green and others (1995) also state that the community should expect to benefit through all stages of the research, which includes education, thus by returning what I have produced I can share my knowledge and background as a university geography student

Although Stoecker outlines three primary roles academics play in participatory research, there are several other roles outlined by various authors. Some of these key terms include the facilitator, the professional, and the leader. Collaborative research involving communities is not limited to conducting research and/or being technically skilled, but it also focuses on learning new skills, developing relationships, transformation of social relations and democratic participation, where the research is only seen as a part in the methods to achieve these objectives. (Stoecker 1999).

Benefits and Limitations of GIS

GIS software offers a way of managing, visualizing and analyzing spatial data within the boundaries of spatial relations and data structures. The use of GIS for the documentation of a historical site, such as a fish weir is an extremely beneficial tool (Guney and Celik n.d.). GIS is a cross disciplinary approach that integrates information from a variety of fields, which is apparent in its precision and accuracy (Guney and Celik n.d.). Since GIS is a spatially referenced coordinate system it has the inherent ability to consistently produce accurate representation of an area. With such accurate and precise information, and the incorporation of local knowledge the result can be enhanced. For example, upon the completion of Figure 1, in conjunction with the knowledge shared by Stephen Charleston the understanding of the shape and context of the fish weir was made clearer. Thus it is possible with the future analysis and further integration of GIS spatial information about the weir, the production of spatial information that has not previously been available may be made possible (Guney and Celik n.d.).

Although GIS applications are capable of producing precise and accurate representations it is important that theoretical developments occur at the level of the data, not at the level of the technology (Rivett 1997). Since technological tools such as GIS allow for the composition of elaborate spatial referencing it is essential that the data being used is appropriate for the type of representation created. Another consideration when using GIS within a context such as my course project is to not make interpretations based solely on mapped data, as it may be restrictive in providing explanations (Rivett 1997). Thus, as outline previously, by incorporating local knowledge with technological tools such as GIS a better understanding of an issue or situation can be obtained.

Some limiting factors to consider in the composition of the spatially referenced image (see Figure 1) include the inadequate time spent on data collection, imprecision of data collection, terrain, and change over time. The one day spent at the site of the fish weir for the collection of data was not sufficient to collect a full spectrum of stake positions due to ocean tides, time of year and variance in stake presence. Collection of GPS points were not extremely precise in their measurement, as some stakes were only centimeters apart, which could not be accurately documented. Last but not least, the change in terrain over time was a factor that was not considered in the construction of the visual representation of the weir. Due to the high variability in the shape of the beach caused by changing weather patterns, tides and land use, the remaining stakes that once composed the fish weir may have been altered from their original state. Though there are some functional limitations inherent in this project regarding GIS and logistical issues, the overall intent to respond to a community member's request to better understand the weirs use was achieved through the production of a visual representation of the weir as it remains today. The image created will serve as a base for future analysis and understanding of the weirs use in the past.

Suggestions for Future Assessment of the Weir

Clearly, further study is required to fully understand this weir and its traditional uses. The use of aerial photos may provide another form of visual representation that would also encompass the surrounding environment. By incorporating surrounding environmental features, such as fish spawning rivers, a more in depth understanding could be reached. Other land surveying techniques could be employed to integrate accurate measurements between stakes and their reference to other land based objects. Ongoing data collection times would further in the understanding of the dynamic environment, which may assist in the understanding of the previous nature of the area, such as seasonal and annual variations in the environment. By understanding the previous nature of the environment clues regarding the history of the weir's use may be discovered. In addition to ongoing scientific data collection more local knowledge regarding the traditional use of the weir would add significant clues and understanding of the weirs use. Local knowledge, such as the knowledge held by Hesquiaht elders, other Nuuchahnulth groups or other coastal First Nation groups who may have used or constructed fish weirs in the past could possibly assist in the further understanding of fish weirs. Community based research is perhaps a way to address gaps in local knowledge that is no longer accessible and academic research that has not been conducted. In order to build upon the visual base I have created using GPS points gathered on May 13, 2005, a standard method of data storage should be created. By creating a way to store the current GPS points, updates could be made as more information is gathered about stake locations or information significant to the weirs history.

In summary, my course project has made a small but hopefully significant contribution to the understanding of this traditional fish weir. It is clear that more research needs to be conducted. After being exposed to community based research experiencing the benefits of a collaborative approach, I see collaboration among community members and outside experts as the key in unlocking the history of this fish weir.

I can't believe how a place like this can have such a spirit, a presence that is indescribable. The sensation that there is still a feeling of the original inhabitants of the area, and from what I've gathered, it is the Hesquiaht people who have lived here for many many generations. The use of the land for all their daily needs still shows through. This weir is incredible to me; I can't believe the stakes from hundreds of years ago still poke out of the sand today. What impresses me even more is the fact that someone here is still able to recognize their original purpose, even though he never used it or ever really knew much about it.

I, as a University student, would never have been aware of these seemingly random sticks poking out of the ground, would make up such a shape to create a traditional means of catching fish. I guess maybe that is why I am here, to learn about things such as this that I can not grasp in a classroom.

~Excerpt from author's Field Journal, May 13, 2005 Clayoquot Sound.

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