

The Technique Record of Repairing Penghu Stone Tidal Weirs —based on Angnata village Penghu, Taiwan— (澎湖石滬的場域修復與工法記錄) (- 以澎湖紅羅村為例 -)

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ABSTRACT

Our project is based at the location “Xin Hu” in the Angnata village of Huxi township, Penghu. We invite the professional team of stone tidal weirs masters to guide the repair so that our team can practice, learn, do depth interviews, record audio dictations and systematically sort the sets of executable repair methods. Further, to develop the model of experiencing the repairmen for the public. By the experiment, we look forward to achieving the purpose of discussion of stone tidal weirs preservation, ecological preservation, and possibilities of the youth returning which leads to the targets- inherit local experience and sustainable community development.

Chinese Abstract (摘要)

澎湖有90座島嶼，海洋資源豐富、季節風明顯、潮間帶廣闊，因此發展許多特殊的傳統漁法，其中最著名的為石滬。但隨著科技的發展與社會的變遷，傳統漁村的人口逐漸外移，傳統漁法無人傳承，相關技藝漸漸瀕臨消失。離島出走團隊發起「澎湖石滬復興計畫」，以「創新與實驗」的方式，選擇以澎湖紅羅村作為基地，並以「外港口滬」為石滬實驗場域，進行傳統潮間帶漁法的體驗與石滬修復的實驗行動。本計畫邀請紅羅村石滬師傅組成的工班進行指導，而離島出走團隊則透過施作學習、深度訪談、口述記錄，系統性的整理出一套具有規則可循的修復石滬工法，並延伸發展出修復石滬的體驗模式。期望透過實際的測試行動，來探討石滬保存、生態復育與青年返鄉的可能性，以達到在地經驗傳承、社區永續發展的目標。

Keywords: traditional fishing (傳統漁法), depth interviews (深度訪談), stone weir (石滬)

List of Figures and Images

Figure 1: Guidelines to stone weir restoration work.

Figure 2: Experiential Learning for participants in the stone weirs restoration project.

Figure 3: Experiential Models Designed for Different Types of Participants.

1. INTRODUCTION

This study was conducted as part of the '106th-year College Student Rural Migration Second-Phase Action Plan', under the project titled 'Experience of Tidal Fishing Method and Stone Weir Restoration Project.' The actual stone weir restoration activities took place in Hongluo Village, Huxi Township. The entire project was carried out by the 'Isle.travel' team, with Professor Mingru Li, a stone weir scholar, serving as the project advisor. Through Professor Li's recommendation, we collaborated with a master stone weir restorer from Hongluo Village for this project. Each master weir restorer possesses unique professional skills, including the handling and construction of heavy stones, with weights often reaching a hundred kilograms, as well as the ability to withstand ocean currents and trap fish. These skills represent intangible cultural assets within the context of this restoration technique and are one of the main research and documentation objectives of this study.

Each stone weir is akin to a complex family ancestral home with multiple ownerships. In Penghu, a stone weir is usually collectively owned by several families. In the early days, ownership of a stone weir could even serve as a dowry for Penghu daughters, symbolizing a 'sea field.' Hence, the team encountered the first challenge at the beginning of the project. The initially designated 'Gōa-káng-kháu Weir' in Hongluo faced opposition due to safety concerns and continued usage by a family. However, the weir owners recognized and approved of the team's intentions and offered an alternative option—the 'New Weir.' The 'New Weir' had been forgotten for a century by the residents of Hongluo and was in a severely damaged condition. After confirming with the Agriculture and Fisheries Bureau that there was no registered owner, the 'New Weir' became the team's first target for restoration. Situated in the Hongluo, the 'New Weir' is close to the shore,

making it an ideal demonstration site for the team's initial stone weir restoration and methodology documentation.

2. LITERATURE REVIEW

2.1. Stone Weirs in Penghu

Penghu, an island environment surrounded by the sea, possesses abundant intertidal marine resources, which have given rise to various unique local fishing methods. Among them, stone weirs are particularly remarkable as fishing traps in the sea. For centuries, the ancestors of Penghu observed water currents, constructed stone weirs, and utilized the ebb and flow patterns of the tides, combined with the distinctive structures of stone walls, to gather scattered fish catches in one place for easier capture, thereby providing sustenance for their families.

(1) Uniqueness and Importance of Stone Weirs

The primary materials used in Penghu's stone weirs are basalt and coral stone. Basalt, also known as black stone, has angular shapes that allow for interlocking arrangements of each stone without the need for cement or other artificial means of fixation. Furthermore, the porous nature and crevices of stone weirs provide hiding places for fish fry, as well as support the growth of shellfish and algae, exemplifying ecological sustainability. In different regions of Penghu, tidal basins, targeted fish species, and the utilization of local materials have led to diverse methods of constructing stone weirs, making the underlying fishing culture and values worthy of exploration, investigation, and preservation.

(2) Conservation Crisis Faced by Stone Weirs

Since the 1960s, with the rise of mechanized vessels and new fishing techniques, coupled with environmental changes and the depletion of marine resources, traditional stone weir fishing methods, which offer lower yields but are relatively environmentally friendly, have gradually become powerless. In recent years, they have been rarely used and left unrepaired. Currently, only about 20% of stone weirs in Penghu are still in use and possess complete fishing functionality, while most other stone weirs face the risk of collapse or burial.

2.2 Challenges in Restoring Stone Weirs

Penghu's geographical environment is uniquely advantageous, with intertidal zones surrounding the islands. This has led to the presence of stone weirs throughout Penghu's coastal villages. The construction techniques of stone weirs were naturally acquired and passed down as essential skills by families who owned them in earlier times. However, in the present era of change, stone weirs that no longer yield fish gradually lose maintenance, rendering the subsequent generations unfamiliar with the techniques required to maintain them. The dwindling knowledge of restoring stone weirs has become an increasingly vanishing experiential wisdom, preserved only through oral accounts passed down by the elderly.

(1) Fading Techniques

The restoration techniques for stone weirs vary depending on factors such as the stone material, regional environment, water flow changes, targeted fish species, and the work habits of the master craftsmen. Currently, there are only around four organized stone weir restoration teams actively involved in Penghu, based on the accounts of local elderly individuals. Among them, there are fewer than five master craftsmen with specialized skills and leadership. In other words, when the older master craftsmen retire, there will likely be a crisis in the continuity of restoration techniques within this generation, creating a gap in the transmission of this knowledge related to marine culture.

(2) Exclusivity of Stone Weirs

The construction of stone weirs is time-consuming and labor-intensive, requiring the involvement of not just

a few individuals. It often takes several years and requires the collective efforts of an entire family, village, or even different clans. Consequently, the ownership of a stone weir is a complex matter. It is closely related to the contributions of labor and resources from each family involved in its construction. The time and location of its usage need to be discussed and coordinated among the weir owners. Outsiders or those not assigned to a particular day are not permitted to use the stone weir, and unauthorized entry may lead to disputes. The traditional system of weir ownership, deeply ingrained in the culture, has evolved into established customs. Although it has diminished, it has not completely dissolved. Most stone weirs that still possess fishing functionality have intricate ownership arrangements, making it difficult for outsiders to approach or access them.

3. RESEARCH METHODS

This study utilized the opportunity provided by the '106th-year Rural Migration Second-Phase Action Plan' of the Water Resources Agency to investigate and document the "Experience of Tidal Fishing Method and Stone Weir Restoration." During the research process, collaboration was established with Master Hong Zhenkun and his stone weir restoration team from Hongluo Village in Huxi Township, Penghu. The research was conducted at the site of the "New Weir" in Hongluo Village, integrating traditional techniques with innovative experiential program design. The goals of the research included local knowledge transfer and community sustainable development, with the incorporation of an experiential operational model. Seven rounds of experiential activities were organized from July to August of the 106th year to assess the impact and benefits of the experimental operational model. The research project spanned from March of the 106th year to October of the 107th year and consisted of two phases:

3.1 Participant Observation

The participant observation method involved the research team actively participating in the stone weir restoration operations. By becoming members of the observed group, the team played the role of both participant and observer. This method allowed for data collection through participation in group activities and provided direct and authentic information due to the team being seen as part of the group and eliciting natural responses from the observed group (Huang 2000). In this project, the team actively engaged in the restoration of stone weirs and experienced a twenty-day restoration project alongside the master craftsmen. The team both learned the techniques through participation and observed and recorded the process.

3.2 In-depth Interviewing

The in-depth interview method is a qualitative research approach that involves face-to-face interviews. It emphasizes the collaborative construction of meaning between the interviewer and the interviewee to reveal explanations or data related to a specific question. Generally, it can be categorized into structured, unstructured, and semi-structured interviews (Guan 2010). This project utilized a semi-structured in-depth interview approach. Prior to interviewing the master craftsmen, data was compiled, and a set of predetermined questions was prepared to guide the craftsmen in providing more in-depth descriptions of stone weir restoration techniques.

4. RESULTS

The stone weir that was restored in this project is located in Hongluo Village, Huxi Township, Penghu County, known as the "New Weir." According to local residents' oral accounts, the stone weir had collapsed over 40 to 50 years ago, with no identifiable weir owners or related historical records. Subsequently, through site inspections with Master Hong Zhenkun and his stone weir restoration team from Hongluo Village, it was found that the base stones of the stone weir were scattered but still showed signs of the original layout. Master Hong Zhenkun determined that the stone weir could be restored and initiated the restoration work.

The restoration project lasted approximately three months and included the restoration of the weir structure, the pool, dike and the weir tail. Although the restoration was not yet complete, during the restoration process, it was observed that each master craftsman had their own expertise and responsibilities in specific restoration

areas and techniques. Therefore, the techniques, tools, target stones, and optimal tidal times for operation were recorded and documented based on the craftsmen's oral memories, and a systematic compilation of stone weir restoration techniques was created. This compilation became a concise and easily understandable set of guidelines, incorporating easy-to-follow steps.

4.1 Stone Weir Restoration Technique Guidelines Database

Throughout this project, active participation in the stone weir restoration work was undertaken, employing participant observation and in-depth interviews. The documentation focused on Master Hong Zhenkun and his team from Hongluo Village, Penghu County, as the subjects of the record. However, the documentation had to proceed in sync with the restoration work, and the current database represents only the initial stage of the project. The guidelines are presented in a simple and understandable manner as an initial integration of the information gathered. There are plans to continue the documentation and expand the results obtained in the current stage in the future.

 離島出走 island travel 1 澎湖石堰工法簡介	順風礁之石堰：北港與南港	工法步驟一 Step 1 運——Delivery  為節省人力，搬運要挑在漲潮時，利用海水浮力進行，早期載具使用木筏、船板，甚至是船材板等，現代則使用浮力大的泡棉墊，船身大小依需求打造，修復者合力將所需石料搬運上船，再以一至兩人於海中撐浮、划水前進，來到現場。 文字編輯：離島出走 island travel	工法步驟二 Step 2 撬——Prying  在清理石堰堆存的基礎時使用，會先將挖洞插入石塊與泥沙之間的縫隙，再配合使用槓桿原理，鬆動無法靠人力搬運的大型石塊，將其鬆動，再搬運成適合疊砌的角度。 文字編輯：離島出走 island travel
工法步驟三 Step 3 掘——Digging  利用兩端釘死的柵力，插入長期沉積於沙的石堰底部，將底部堆積的舊有基礎石面清理出來，將其挖出，再搬運成合適的角度，而取出的石料通常體型較大，除了適合疊砌基礎外，也可以使用在外圍的圍堤上。 文字編輯：離島出走 island travel	工法步驟四 Step 4 轉——Turning  修復者一開始挑取半乾好且較容易操作的角度將石塊擺放到位，再透過不斷轉動的方式，考量與其他石塊的對應位置與整體結構是否能達到預設效果，去試著找到每一塊石塊最適合的角度。 文字編輯：離島出走 island travel	工法步驟五 Step 5 綁結——Knotting  以兩條繩子互相交叉綁出四個繩結成一個可以自由調整大小的方型，中間繩空能圍適合卡住有稜角的水式石，再拉往兩端綁結的繩結，由多人合力一起進行石塊的移動，包括短距離的搬運與將石塊搬離水中堆至圍堤上的輔助動作。 文字編輯：離島出走 island travel	工法步驟六 Step 6 敲——Knocking  在進行疊砌時，會盡量試著找到石塊間相互契合的角度，但還是可能因為大小差異或形狀多種等問題，而找不到合適的角度，為省去挑選石料的時間與麻煩，修復者會手持握有中小型石塊來敲打凸出的石塊，使其跟緊密合與平整。 文字編輯：離島出走 island travel
		工法步驟七 Step 7 填樁——Stuffing  石堰基礎與外圍以大理石塊排列完成後，中間空下部分填之為內樁，會以中小型、細碎的石塊來進行填砌，若石塊位於水流較強處，小石塊以垂直方式插入內樁，若在水流較弱處，小石塊以斜向方式插入，彼此緊密咬合不鬆動即可，還有在填滿石塊後有透水性。 文字編輯：離島出走 island travel	工法步驟八 Step 8 修面——Shaving  在圍堤接近完工時，發現最上層的石塊高度可能不一致，由修復者會重新堆疊表面石塊的排列組合，使其能夠盡量呈一半坦的面，形成方便船隻人在石堰上行走的腳堤。 文字編輯：離島出走 island travel

Figure 1: Guidelines to stone weir restoration work.

In addition to serving as a reference for research on stone weir techniques, the guidelines can also provide a basic understanding for individuals or participants who are interested in the topic of stone weirs but lack prior knowledge. In the past, the lack of systematically organized samples often led to difficulties in explanations provided by the master craftsmen and resulted in misconceptions. It also failed to demonstrate the various variations and complexities of stone weir techniques. With the establishment of the guidelines database, it can serve as a support tool for the development of subsequent experiential models, training materials for stone weir restoration teams, and even promotional materials or cultural products. Through these means, stone weir techniques can be promoted, and awareness on marine conservation and ecological environment issues can be raised.

4.2 Experiential Model for Stone Weir Restoration

Under the existing fisheries management plans of the Agriculture and Fisheries Bureau, the operation of stone weirs still requires the weir owners to submit applications every five years. As a result, stone weirs are conceptually classified as private properties with exclusivity. Weir owners may have concerns about the potential damage to the weirs and the depletion of fishery resources. This requires coordination and communication with individual weir owners. In practical terms, it may be challenging to enter and

experience the stone weir sites due to the presence of weir owners or restrictions on access. Taking all these factors into consideration, this project prioritizes sustainable management. It first sought out stone weirs that had long been in a state of disrepair and had no identifiable owners to assess their restoration feasibility. Subsequently, restoration work was initiated. Once the restoration is completed, an application will be submitted to the Agriculture and Fisheries Bureau to certify the restored stone weir as a registered fishery, and it will be jointly owned and maintained by the community. If successful, this case can serve as a model that other areas in Penghu can follow, creating a replicable pattern implemented in different regions. By cultivating community talents through experiential programs and creating a mutually beneficial feedback loop, the government should also take a supportive stance in encouraging the preservation of local culture by providing relevant guidance and subsidies.

(1) Experiential Content



Figure 2: Experiential Learning for participants in the stone weirs restoration project.

The techniques for restoring stone weirs vary depending on the local conditions and the expertise accumulated by the master craftsmen over the years. The techniques involve specific skills and challenges. Therefore, in order to develop an experiential program, the initial focus is on areas with lower technical requirements. In this project, the main experiential activities revolve around the techniques of "delivery", "knotting" and "stuffing" as outlined in the methodology guidelines. "Delivery" and "knotting" both allow participants to experience the difference in difficulty between ancient and modern methods of moving stones and gain an understanding of the immense time and manpower required to construct a stone weir. "Filling" primarily aims to familiarize participants with the internal and external structure of the stone weir and the impact of ocean currents on the weir. Unlike the Double-Heart Stone Weir in Qimei, which mainly serves as a tourist attraction, actively involving participants in the stone weir site allows them to directly experience the function and composition of stone weirs and gain a deeper understanding and record of the restoration techniques.



Figure 3: Experiential Models Designed for Different Types of Participants

5. CONCLUSION

The restoration of stone weirs is not solely about reviving their functional aspects but primarily aims to preserve a cultural heritage that is on the verge of extinction and promote its significance. However, during the two-month restoration period of this project, with the collective efforts of the master craftsmen, the Isle.travel team, and the experiential participants, fishing yields gradually appeared from August 5th, demonstrating the original fish aggregating function of the stone weir. In light of this, the project initiated the development of a preliminary sustainable management model, allocating a portion of the fees collected from the experiential activities as a sustainable fund for stone weir restoration. It is hoped that through this process, the active involvement and attention of local residents can be successfully stimulated. Subsequently, by utilizing the recorded data and systematically organizing and visualizing it through research methods, the project contributes to the preservation of the historical and cultural significance of Penghu stone weirs. It also facilitates coordination with weir owners and communities to establish a symbiotic model and provides a reference for the restoration of other dilapidated stone weirs in different areas of Penghu. The restoration and transformation project of stone weirs not only holds experimental significance in the development of experiential tourism related to stone weir restoration, but also contributes to the win-win strategy of enhancing the visibility of in-depth tourism in the Hongluo community.

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