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Shapes of fishing gears in relation to the tidal flat bio-organisms and habitat types in Daebu Island region, Gyeonggi Bay

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Abstract This is a base research to analyze the evolution of fishing gear shapes in response to the types of marine benthic organisms and 'getbatang-harvesting tidal flat' in Daebu Island in Gyeonggi Bay. Daebu Island has variety of relatively well preserved natural coast lines and fishing gears. Hand hoes were divided into two categories, one for manila clam collecting and the other for mud octopus collecting. The ones used to catch mud octopuses are much larger and heavier. Clear distinction of shapes and forms were found even among the hand hoes used for collecting the similar types of catch, depending on the getbatang that they were used on. Also, mud octopus hand hoes varied in shapes and forms depending on the region that they were found in and the sex of the user. Fishing gears of other islands in Gyeonggi Bay, Oi Island, Jangbong Island and Ganghwa–Donggum Island, showed differences as getbatang varies, and each region sometimes had different uses of the same tool from each other. It is necessary that we continue the investigation and analysis on the relationship between the shape of fishing gears, organisms, and getbatang sediment conditions before the traditional fishing gears disappear any further.

Introduction

Culture, more specifically the life history and relationship history, of regional communities can vary based on the surrounding environment; in case of fishing villages, differences in the marine and coastal environments can be associated with distinction of marine culture (Ko, 2004; Cho, 2009; Kim, 2010; Je, 2012). There are some cases in which all villages along one coast share the same culture, but one can also find cases where two adjacent villages have completely different, employing

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completely different sets of fishing gears. This is mainly because they have different '*Getbatang* (a people of Gyeonggi Bay region call tidal flats as *getbatang*. It not only means 'tidal flat' itself, but also includes various characteristics of tidal flats as well)' where tidal flat is been using by fishermen as harvest area. Because getbatang are different, the marine lives are different, which means that the characteristics of ecosystem (and biodiversity) may also vary, resulting in the evolution of the shapes of fishing gears, and therefore the culture (Ministry of Oceans and Fisheries, 2002a,b; Kim, 2010).

Traditionally, biodiversity and cultural diversity have been considered as deeply related (Ramsar Regional Center-East Asia, 2012). Like biodiversity, cultural diversity is systematic (Je, 2012). An island's landscape possesses variety of cultural resources created by the interactions of organism, nature, and humanity (Hong, 2011). Therefore, numerous tangible and intangible resources that residents of insular regions have created, utilized, and maintained would be great ingredients of cultural diversity (Hong, 2008; Hong et al., 2014).

Such culture is also useful in nature conservation, it contains insightful ecological knowledge passed down for generations. Japanese call traditional marine ecological knowledge '*satoumi*,' and are putting great efforts into proper organization and handing down of the knowledge (Tsujii and Sasagawa, 2012). This is an effort to not only utilize traditional knowledge and skills of fishing villages in marine management to overcome serious problems in coastal environment of Japan, but also is an attempt to introduce Japanese traditional knowledge to international arena as a new marine management technique. Right now, they are gathering and organizing traditional marine management techniques and culture in regional unit. Japanese government hosted independent seminars and meetings about '*satoumi*' (Japanese word regarding coastal village) at the 10th Conference of the Parties (COP 10, 2010) to the Convention on Biological Diversity, which was held in Nagoya, Japan.

To humanity, ocean is environment and a culture. People who live in the oceanic environment have lived a life associated with ocean, adapting to the marine environment, as well as creating a resulting culture (Yoon, 2001). Fishermen, whose livelihood is totally dependent upon the tidal ebbs and flows, have extensive and systematic knowledge on tidal flats and marine ecosystem. Their folk knowledge is based on experiences that were accumulated and passed down for generation after a generation. Fishermen's understanding on tide can be seen on the symbolic representation system of 'high tide' (Ju, 2006). Tidal flats of south and west coast of Korea have always been something more than a mere natural environment or a place to earn a living (Ko, 2004). They have been the place of living, sphere of living, and religious and ideological tool used toward fulfillment of the world views that its inhabitants aspire. People formed the property of tidal flats by assigning the concept of their lives and the surrounding environment to them (Cho, 2009). This is a work designed to shed a light to the life and relationship history between people, tidal flats, and organisms that live within tidal flats. We have chosen to study fishing gears as the first step to gathering, organizing, analyzing, preserving, and managing the valuable traditional knowledge about the marine cultural heritages that fishermen have.

Study area and methods

This research study was conducted in the Gyeonggi Bay area, focusing on the relationship between the benthic organisms living in tidal flats and the culture of the region by collecting the fishing gears and conducting investigations on the fishing gears (Ministry of Oceans and Fisheries, 2002b). More specifically, the study had been concentrated upon the hand hoes and fishing gears used in digging and turning the sediments.

This study was conducted by visiting the fishing villages in Gyeonggi Bay area that are engaged in tidal flat fishing, concentrating mostly on Daebu Island, Ansan City in Gyeonggi Province (Fig. 1). Daebu Island still possesses extensive and rias coastal line, and though it is only a single island, it contains variety of marine environment, which makes it easier to collect multitude of data in one region. In addition, the fishing gears of Oi Island of Gyeonggi Province and Ganghwa-Donggum Island and Jangbong Island of Incheon Metropolitan City in the bay were included.

As for the shapes and forms of the hand hoes, the dimensions of blade, neck, and grip (Fig. 2) were measured to analyze the relationship between its form and the getbatang. For the investigation on fishing methods, the sites and/or interviewed the regional resident representatives (2 in Daebu Island, 1 in Ganghwa-Donggum Island) and cultural experts (1 from Gyeonggi Cultural Foundation) had been either visited to gather data. Analysis on getbatang sedimentary environment is not included in this paper.

Results and discussions

In Korea, harvesting activities on tidal flat are handed down among people as marine culture (Ministry of Oceans and Fisheries, 2002a). Fishing gears used in tidal flats are divided into four different categories: (1) collection tools, (2) de-shelling tools, (3) containers, and (4) carrying tools (Fig. 3). As of oyster collection, there is one more category of tools used for water draining after de-shelling.

Collection tools vary by the getbatang and the object of collection, such as manila clam (*Ruditapes philippinarum*), venus clam (*Cyclinasinensis*), surf clam (*Mactrachinensis*), hard clam (*Meretrix* spp.), and mud octopus (*Octopus minor*). In Daebu Island, it was found that different types of collection tool were used for different getbatang. These fishing gears have evolved and developed to optimize the collecting, using the materials that were available at the time of their development. Hand hoes used in tidal flats (for collection of shellfish) differed from the ones used on field. Collection gears were paired with containers (Fig. 4).

Collection fishing tools

Fishing gears for tidal shell fishes differ by the type of collection species, because the characteristics of getbatang vary by species. Also, some variations are found by the individual users, the blacksmith shop where the gear was made, and the sex of the user. When and if a specific shape of a tool is found to be more effective in collection, it eventually becomes the uniform standard of that region. There are cases where people did not employ any collection tools in gathering clams in