

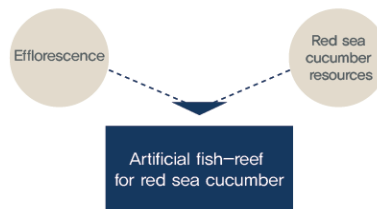
Design development of artificial fish-reef for red sea cucumber to apply the service design process for relaxation of efflorescence

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1. Purpose & background of study

In our country, Jeju island as a volcanic one was recorded in the three fields of UNESCO Nature Environment by being designated as the Global Geopark after being placed in the lists of biosphere zone in 2002 and the World Nature Heritage in 2007. Among them, blue sea of Jeju island provides only its beautiful scenery for visitors and is also a livelihood to provide the inhabitants of Jeju province with income from fishery resources. But, as algae melt away and solidify as stones in this Jeju sea, efflorescence called desertification of sea has become more serious. In this efflorescence, red sea cucumber is offering a great help to recovery of the ocean environment as it can inhabit the sea. As its numbers are not many, Jeju province is maintaining the numbers by seeding.

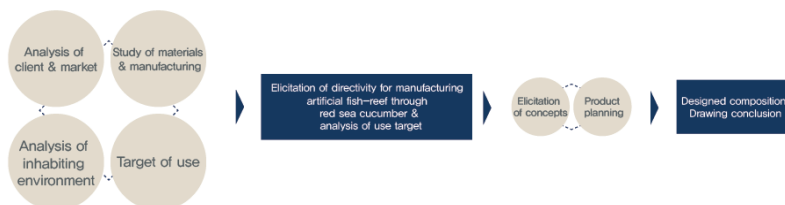
[Table 1] Background of study



This design contributes to relaxation of efflorescence called desertification of sea among problems in Jeju marine ecosystem, and tries to enhance availability of efficient production and marine resources management.

2. Design process

[Table 2] Process in progress of design study of artificial fish-reef for red sea cucumber



3. Study of manufacturing

To design artificial fish-reef, at first study on inhabiting environment of red sea cucumber is performed, materials required in manufacturing is examined and analyzed, the general process are done by studying a way to mass-produce in the manufacturing way, and a convenient way is studied while working in sea for more efficient accessibility of users.

3.1. Elicitation of manufacturing way through analysis of red sea cucumber and target of use

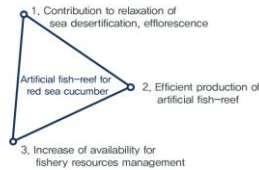
Red sea cucumber(subject) : Red sea cucumber is living at the bottom of the sea(10-20m), It prefer a place where the water temperature is low, 8-9 degree and is inhabiting under shady stones.

Female diver(user) : As red sea cucumber is mainly collected by female divers' hands, the design is required so that divers can work in the water without any difficulty.

Manufacturing method : Productivity should be increased with a type of module to be assembled, and the design should be set up so that red sea cucumber can be easily collected in a way of using drawers.

Materials : 1.As sea cucumber is a plankton state in seeding, its floating larval plankton should be easily bottomed through concrete having a characteristic of porosity. 2. If drawers are placed in the sea for a long time, seaweeds get jammed among them. So, they should be made of acrylic panels on which seaweeds stick to prepare loss of their function.

[Table 3] Analyzed result of manufacturing



Considering the efficient production of artificial fish-reef and the inhabited environment of red sea cucumber, design of artificial fish-reef should be required and provided for female divers as users in accordance with their working environment.

3.2. Elicitation concepts & product planning

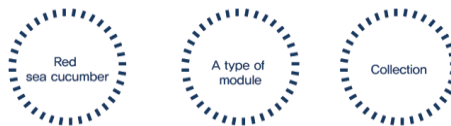


Figure 1. Concept of artificial fish-reef for red sea cucumber

By drawing three key words such as inhabited environment of red sea cucumber, a type of module and collection as concept key words of artificial fish-reef, the whole design is considered on the basis of study on the inhabited environment of red sea cucumber with the concept as 'artificial fish-reef for red sea cucumber'. In addition, as each part can be assembled in a type of module in manufacturing, efficiency is enhanced and increase of availability for fishery resources management is promoted in consideration of convenience in collecting after selecting female divers who collect red sea cucumber as target of users.

4. Design composition



Figure 2. Design of artificial fish-reef for red sea cucumber

The composition of artificial fish-reef for red sea cucumber is made in a type of module using E-basalt having a characteristic of basalt. Mobility & plant equipment as problems of artificial fish-reef through modularization can be minimized. Also, considering different sizes of red sea cucumber in accordance with characteristics and growth of movable sea cucumber simultaneously with using concrete having a characteristic of porosity, it's designed with additional holes of various sizes. The bottom was manufactured with the structure in a way with drawers in consideration of collection convenience of female divers.

5. Drawing conclusion

The design of artificial fish-reef for red sea cucumber contributes to solution of marine ecosystem problem called desertification, efflorescence and enhances efficiency in the process of manufacturing artificial fish-reef with production method in a type of module. And income of fishermen can be increased and fishery resources can be easily managed by enhancing efficiency while female divers as target of use are working in the sea after borrowing a way as a way with drawer.