



ISSN: 0976-3031

Available Online at <http://www.recentscientific.com>

International Journal of Recent Scientific Research
Vol. 6, Issue, 6, pp.4508-4513, June, 2015

**International Journal
of Recent Scientific
Research**

RESEARCH ARTICLE

THE SOCIAL ECOLOGY RESILIENCE OF MUNCAR FISHERMAN, THE REGENCY OF BANYUWANGI, INDONESIA

¹*Kusumah MS, ²Hidayat K, ²Sukeksi K and ³Susilo E

^{1,2}Department of Rural Sociology, Agriculture Faculty, Brawijaya University

³Fishery and Marine Sciences Faculty, Brawijaya University

ARTICLE INFO

Article History:

Received 2nd, May, 2015
Received in revised form 10th,
May, 2015
Accepted 4th, June, 2015
Published online 28th,
June, 2015

ABSTRACT

The construction of fisherman social ecology resilience is the moral order which constructed as a product of fisherman interaction with the environmental change. Based on the result of this research, socio-ecology resilience is a concept that refers to the field of human ecology science. Resilience is defined in the ability of humans to adapt in the environment, especially when the environment changes, this concept is also applied in this paper to explain the ability of the flexibility of the human to face the changing of environmental conditions, especially on the social economy. Socio-ecological resilience of Muncar fisherman featuring three concepts, namely consciousness of environmental degradation; institutionalization of marine environment protection; and social assurance over the marine resources.

Key words:

institutionalization of marine environment protection; the consciousness of environmental degradation; social assurance over the marine resources, and social ecologic resilience.

Copyright © Kusumah MS et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution and reproduction in any medium, provided the original work is properly cited.

INTRODUCTION

Since 2010, there were natural resources scarcity especially sardinella lemuru in fishing ground of Muncar fisherman at Bali Strait. This study refer to fisherman behavior on managing the marine. Illegal fishing and overfishing directly impacted to the natural resources sustainability. The question arises based on those facts, how the socio-ecologic resilience is conducted by Muncar fisherman as the form of social action in relation to the environmental degradation. The aim of this research is analyzing process, behavior, and meaning of socio-ecologic resilience as the form of social cultural values in context of environmental resource degradation. Socio-ecological resilience is the reflection for recovering of social assurance over natural resources.

METHODOLOGY

This research is conducted in Muncar Regency of Banyuwangi, Indonesia. The qualitative approach is applied in this research by using ethno-historical method. In order to find the informant of the data that is used in this research, the researcher used the theoretical sampling. Triangulation technique is applied for the

data validity. Furthermore, thick description (Geertz, 1973) is used for the analysis method.

Resilience In Sociological Perspective

Resilience is the ability of individuals to cope with surprises (Holline, 1976). Ecological definition of resilience is "the amount of interference that can be absorbed before the system changes the structure and change the variables and also processes that are able to control the behavior" (Gunderson, and Holling, eds., 2002, p. 4). Walker and Salt (2006, p. 2) translate resilience as "the capacity of the system in the face of temporary shocks but able to maintain its basic functions and the structure remains the same because it is an identity".

Classic Sociology defines environmental sociology as a field of inquiry (Hannigan, 2006, p. 1). According Darmawan (2007) by quoting Dunlap and Catton (1979), environmental sociology - which is an evolutionary development of human ecology science at the level of social systems - enrich and strengthen human ecology science by examine issues of destruction of nature from the perspective of social conflicts and functional

*Corresponding author: **Kusumah MS**

Department of Rural Sociology, Agriculture Faculty, Brawijaya University

operation of institutional mechanisms in the governance of human relationships to the ecology.

Contemporary sociology defines environmental sociology in two stages of development perspectives. The first perspective aims to identify key factors related to the 'crisis' of environmental degradation and damage. Other one significantly changes to the approach and studies, namely trying to find the most effective mechanisms in environmental reform or improvements that will help the 'mapping process of ecological order socially and sustainability' (Hannigan, 2006, p. 14).

Resilience concept was first introduced by [Holling \(1973\)](#), this concept relates to "the behavior of the ecological system of the possibility of the destruction of their elements, and by replacing parts of the wake that is equilibrium towards more persistence" (Holling, 1973, p. 2). In the perspective of ecology, Holling defined resilience "is a tool for measuring persistence systems and their ability to absorb change and disturbance and still maintain the same relationship between waking populations or variables" (Holling, 1973, p. 14). In this definition, seen as the system's resilience and persistence, or the possibility of extinction, is seen as the result of ([Holling, 1973](#)). Changes and disturbances are the result of factors that need to be underlined ([Holling, 1973](#)).

Variability in ecological systems in some predictable things very deeply, but sometimes always surprising (Holling, 1986). Holling offer a 'theory of surprise' that is based on the idea of discontinuity and on the nature of ecological systems (Holling, 1986). Folke, Carpenter, Elmqvist, Gunderson, Holling and [Walker \(2002, p. 438\)](#) states that: the resilience associated with (i) the amount of shock; (ii) the degree to which the system is able to organize itself; and (iii) the level in developing the capacity to learn and adapt.

[Adger \(2000: p.347\)](#) in ([Brand and Jax \(2007\)](#)) defines resilience sociologically, he looked at resilience as the ability of community groups or communities to take over the pressure and external interference as a result of changes in social, political and environmental. [Adger \(2000: p. 350\)](#) states that the resilience of social systems associated with the resilience of the ecological system in which the social system depends. [Adger \(2000: p. 352\)](#) states that in order to test the resilience is through the assessment of the positive and negative aspects of social segregation, marginalization and social capital.

[Brown \(2014: p. 108\)](#) concluded that the use of the concept of resilience is by looking at the field of the use, application and concept developed. Brown formulate that the study of resilience can be used in the field of social and ecological system (SES), human development and the science of organization and social innovations. In the field of study SES, resilience is applied to assess the management of complex systems as a result of changes in the management of adaptation strategies. This study uses many concepts of adaptation cycle, adaptability, transformation and the relationship between the social dimension and the ecological dimension of resilience. While in the field of human development studies, resilience is

applied to capture and organize individual response to the crisis. This field is developing the concept of individual resilience, human and institutional capacity.

Social structure cannot be separated from the structure of the environment. As the wake of social relations with the environment, there is a relationship of mutual exchange and energy behavior. Social behavior on the environment is a human action in treating nature. The concept that refers to the social behavior is environmental governance. On the other hand, energy is referring to the ecological dimension of social resilience in anticipation of changes in the environment.

RESULT AND DISCUSSION

Émile Durkheim, Karl Marx and Max Weber are assumed by many sociologists that they put a social structures beyond the physical structure or environment ([Buttel, 1986, p. 337-56](#)). On the other hand, the study of resilience is a study about process that can be considered as a positive adaptation and development in the context of the damage and the challenges ([Crawford, Wright, and Masten, 2005, p. 355](#)).

When there is a scarcity on the source of the fishing production (ie the disappearance of fish catches), then the initial consciousness that is present (in the minds of the fishermen) is a natural occurrence that is commonly experienced. This condition is culturally often called the "laep (madures)" or no harvesting. But, when it became a long period exceed ecological reality that become part of the lives of fishermen, then raised the question in the framework of fishermen, which is why such a long drought and how to restore natural conditions in order to be able to restore the availability of marine fish were abundant back. Cultural efforts through ritual is not able to give an answer for fishermen Muncar to be able to restore fish that have high economic value.

The presence of ecological consciousness manifested in the understanding of the causes of scarcity becomes the basis of the actions of the fishermen build social-ecological. Muncar fishermen raise the collective consciousness of impending environmental damage as a result of a wrong practice of fishing and excess. Referring to the opinion [Bergami and Bagozzi \(2000\)](#) that the concept can be used to understand the reality of this is the identification and categorization of society to understand their environment. Ecological awareness as a result of the growth of the knowledge derived from the experience of the lives of fishermen, brought fishermen to institutionalize environmental protection. Chronology of relations social structure with the structure of the environment resulted in the ability of human beings to be able to build social resilience values - ecological. The concept of resilience is if revealed in the process of establishing the resilience of fishermen then illustrated in figure 1.

Bali Strait known for its wealth of natural resources and fish resources. Human nature is anthropocentric treat nature becomes fulfillment of basic human needs. The same thing is done by fishermen Muncar. Fishermen Muncar treat Bali strait to fulfill the needs of the fish. Pressure industrial and economic

demands lead fishermen to act do overfishing even destructive fishing, namely fishing immature and fishing gears which damage the environment. As a result there is a decrease or degradation in environmental conditions, which damage the marine environment and fish stocks are dwindling because the cycle was interrupted. At this point, the growing social and ecological awareness of fishing on the marine environment. Value of consciousness is manifested in the form of social ecological resilience behavior to environmental change.

Social action fishers through the development of social groups into the manifestation of awareness among fishermen on the environment. Ecological awareness is fostered by fishermen, basically a fishing effort to restore the function of the natural environment in its original state. The most fundamental values of the growth of social-ecological consciousness is a normative impetus fishermen in restoring function to be able to provide the right environment on social jaminas of the environment.

Social action of fisherman through the development of social groups into the manifestation of awareness among fishermen on the environment. Ecological awareness grown fisherman, essentially a fishing effort to restore the function of the natural environment in its original state.

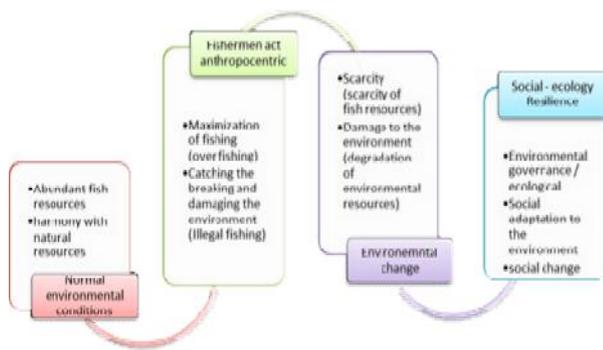


Figure 1 Revolutionary process of the fisherman social-ecology resilience

The most fundamental values of the growth of social-ecological consciousness is a normative impetus of fishermen in restoring function to be able to provide the right environment on social jaminas of the environment. Based on the discussion of the resilience of Social Ecology at the top of the groove constructed proposition scheme as illustrated in Figure 2 below:

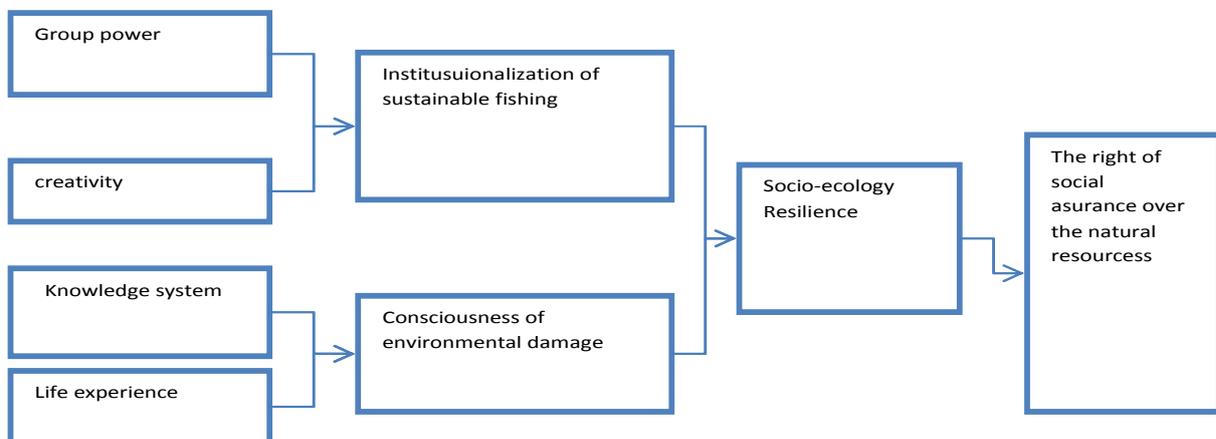


Figure 2 The construction of social-ecology resilience

Socio-ecological resilience fishermen based on the findings and analysis can be compared with the construction of socio-ecological resilience kosep fishermen normative-theoretical. Humans are always make adjustments in the social structure as a form of social structure adjustment to ecological changes. This adjustment constructed in the social construction in the form of a cycle of adaptation, adaptability, social change, the relationship between the dimensions of social and ecological resilience.

Consciousness of environmental degradation

Muncar fishermen have started to raise awareness of environmental damage as a result of the fishing action itself. Sardinella lemuru conditions in the waters of the Strait of Bali, "Ngalih, Ngadoh, Ngilang" means to move, move away and disappear. In a meeting between fishermen, a 5th grade elementary school student read a poem. Here is the poem:

My Sea My Future
 My sea my future
 The wealth of marine resources
 Not the legacy from grandparent
 But surrogate children and grandchildren to be processed
 With skilled hands
 What are you waiting for?
 Let's preserve the sea from this moment
 Do not fishing with bombs, potassium
 And a tool that is environmentally illegal
 So that we avoid environmental damage of the sea
 For the sake of our children and grandchildren in the future

This meeting is the entry key that awakened awareness of the environmental damage as a result of the action of fishing that does not heed the sustainability of fish resources and damaging ecologically.

The influence of overfishing on the increasing distance fishing ground in the Strait of Bali, namely: '80s sardinella lemuru position is in the area of 1-2 nautical miles (<4km), 90s sardinella lemuru position is in the area of 3-4 nautical miles (< 8km), 2000s sardinella lemuru position is in the 4-6 nautical miles (<12km), 2010s sardinella lemuru position is in the 6-12 nautical miles (<24km) "

Causes of this condition in addition to overfishing, as well as fisherman catch small fish (because mesh is less than 1 inch), so that the life cycle of sardinella lemuru disconnected because life cycle of sardinella lemuru were disconnected, Industrial and domestic waste, damage of environmental resources, global warming and climate change.

After 4 years, finally, Muncar fisherman began to realize the environmental damage, which makes sardinella lemuru disappear from the Strait of Bali. Demersal and pelagic fish are surplus in the Strait of Bali. However, this does not guarantee the availability of fishing satisfied when changing the type of fish catches. Famine makes a lot of land skipper went bankrupt and abandoned by ship crew (pandhiga- Madurese). According to the informant, from 178 ships (sleret – type of traditional ship), vessels are still operating only 90 ships, and only 33 ships got the fish catch.

Disappearance of sardinella lemuru makes skipper (Juragan Darat – Indonesian) change the system of fish catching from two boat into one boat system. First, this strategy is used is to reduce the huge of operating costs, although there is no certainty sardinella lemuru will reappear. Second, to reduce the ever-increasing loan even exist skipper who admitted in 4 years this loss has reached 800 million rupiahs.

The consciousness of elites of sleret fisherman emerge through narrative statement that the fishing gear which has been used was very detrimental.

Agreement to begin using fishing gear, especially about on mesh size, size of ship and engine size strived to maintain and restore fish stocks. As the consciousness of fisherman still expect the regulation and supervision of the state.

Consciousness about the impact of fish catching to over-fishing has always been the dilemma of the fisherman. This phrase became frightened fisherman sleret to the fact that the other fisherman (traditional or semi-traditional) always act precedes fishing gonat immature because they use fishing gear with a small mesh.

Institutionalization of marine environment protection

Institutionalization is a sociological concept to explain that the natural environment has become part of the social world. Due to damage and the number of marine production dropped drastically, so fish catching as naturally attempt to follow the changes.

The revenue of ship crews (in sleret) decreased significantly. This condition would bring burden to the lives of the fisherman. The erratic income of the fisherman due to the disappearances of sardinella lemuru continuously for 4 years which makes fisherman dragged into misery and poverty. Fish harvesting season is lost, fisherman difficult to live. Fishermen are faced with the fulfillment of daily needs of their households, respectively. It is indeed a heavy burden for the fisherman in their daily lives during no harvesting fish.

Implication of no priority government policy for controlling fisheries modernization, destruction of the marine ecosystem and coral reefs, and mangrove forests are diminishing their area. Mangrove forests as vital spawning grounds for fish. Observing this HNSI (Indonesian Fisherman Association) of Banyuwangi cooperate with the local government department of marine initiated to replant mangrove forests. On the basis that most of the fishermen still have motivation to maintain habitats (coral reefs and mangroves). HNSI who also participated in a pioneer in the institutionalization of environmentally sustainable fishing.

Fisherman developed 3 efforts of behaviors on facing the environmental change, in order to restore the fishery resources and marine natural resources, namely mangrove planting; the transfer of fishing ground, and economic diversification. Those three activities are carried out jointly and agreed that they apply to all fisherman.

HNSI of Banyuwangi in cooperation with the local government replanting mangrove forests. Muncar fisherman agreed that the spawning area is the area of Kayu Aking. This area is not to be used for fishing ground. The agreement is also presented as an effort to improve the marine environment associated with the production control by shifting fishing ground out off 4th zone. Diversification of fishing effort shifted from fish catching into aquaculture.

The power of social resilience on fishing activities is not in the practice but on fishing effort to realize the activity in groups. Muncar fisherman form groups of KUB (Joint Business Group), which was initially only serves to build economic strength fisherman. and into the path channeling government assistance, both grants and loans. KUB presence is construction of new economic strategy. Fisherman and aquaculture create groups. The KUB can be grouped into three types of activity, namely the strengthening of the economy of small groups of fisherman (traditional), environmental protection and business development.

Social assurance of marine resources

Social assurance over marine resources is a assurance that could be granted by the marine resources to the users of these resources. In other words, natural resources remain able to meet all the needs of marine resources for the fisherman. Social assurance protection on marine resources is a concept for understanding action in relation fishing action; conflict and conflict resolution were carried out as well as the protection of marine resources and fish resources. Marine resources as open access and common property became the legal basis of the claims management and mastery of the sea. When discussion of the relation of fisherman, the conflict and the management of marine, then at the same time must also be understood about the communal rights of fisherman

Reality of social assurance protection for natural resources is actualized in a normative legitimacy. This normative legitimacy can be mores, norms, values or positive law. Muncar fisherman attaches social assurance over natural

resources in the rights to manage natural resources. Two entities norms then built by fisherman Muncar, namely cultural norms and positive law. These norms directly regulate social transactions and access to and control of ecological protection. Cultural norms developed through a form of ritual as a symbol of recognition of the rights owner of the management of marine resources, namely through the ritual of picking sea. While the positive legal norms are built on strengthening the rule of the country (in this case SKB – Joint Decision Letter -- East Java Governor and Governor of Bali) are also arranged in a formal legal transactions and control access and ecological protection.

Symbol of the Right to Manage Marine Resources

For Muncar fisherman communities, the recognition of the right to the management of marine resources is shown in the form of cultural recognition. Rights for the management of marine resources for the fisherman are a norm which gives legitimacy to manage marine tenure. When the sea is considered as common property, the sea belongs to all people. Sea can be explored by every fisherman from everywhere.

The marine tenure rights embedded in the framework Muncar fisherman mindsets and cultural construction framed governing the ownership and management rights of the marine. Within the culture framework of marine management, the rights are embodied in ritual offerings to the sea. Ritual quotation sea not only be understood as a form of praise in the ruling party and the sea on the abundance of marine resources which can be unexplored but also a form of cultural expression that the sea is the property of the fishing communities.

Petik Laut (tradisional ritus of sea picking ritual) held every Muharram or Shura (in the Javanese calendar). According to local legend, this ritual begins with the arrival of Syed Yusuf when entering into Muncar together with the spread of Islam in Blambangan . Once when the fish are in disappear so that the fishermen have difficulties ensuing . Many fishermen died, swallowed by waves. To expel the disaster, Sayid Muncar invites people to make ceremonial offerings consisting of goat's head gird, golden rod and unripe bananas. Then , after the ceremony was done , bala ' that hit the area Muncar vanished. The fish reappeared so that fishermen can catch. Since then the Sea Pick ceremony is held every year.

Implementation of the tradisional ceremony "petik laut" every full moon in every year according Qamariah calendar and the agreement of fishermen, because the fishermen not to fish because at the time it happened tides. This ritual displays of cultural meetings and Osing Madura. Madura culture shown by the appearance of a typical Madura clothes while carrying traditional weapons "clurit". While Osing culture appears in the form of offerings that use carts paraded towards the beach and accompaniment, two "gandrung" dancers and gamelan.

This ritual can be assumed in recognition of management rights can be seen from the efforts of the community through the offerings prepared by informal leader of fishermen who will be floated in a small boat (gitek). This construction appears first in prayer when placing in gitek.

“Bismillahirrahmanirrahim Ya Rahmanu, Ya Rohimu, Waliukik peneriabin, Peneriabin waliukik”.

Means

“Bismillahirrahmanirrahim, (In the name of Allah, Most Gracious, Most Merciful)
Ya Rahmanu, (dear father)
Ya Rohimu, (dear mother)
Waliukik peneriabin, (bring us fish)
Peneriabin waliukik” (fish bring to us)

Semiotically, the social meanings that can be drawn from that prayer is an acknowledgment that the sea is as parents. In addition to prayer, the meaning of the ritual activity appears from this statement that shows the efforts of local communities as the assertion that the ocean is owned by fishermen Muncar is “idher bumi” (walking around the village. “Idher bumi” is the emergence of young and well-built and handsome men with clothing “sakera” (tradisional madurese clothe collar black), Madura typical complete with arms (clurit) and head cover (odeng) who helped escort offerings. From this ceremony can be interpreted that the youth or the man is a bodyguard Muncar marine waters.

Cultural statement that can be assumed as the recognition of the right of management of the sea is a symbol installation boundaries. This boundary is marked by the laying of offerings in 25 pelawangan. Pelawangan is a meeting place of river water with sea water or more familiar with the estuary. Each "Pelawangan" given two offerings, the offerings placed in Tompo. Tompo is a traditional house appliances made of bamboo is shaped like a basket.

The legitimation of rights on marine resources management in access and control of ecological protection

Muncar fishermen claimed that the Strait of Bali is owned by Muncar Fishermen and Bali Fishermen (Pengambangan Jembrana). Recognition of the two sides is increasingly believed by fishermen because of SKB (Joint Decrees) of the Governor of East Java Province and Bali after conflict of fisherman at 1992. It can be seen from the collective agreements in the presence of fishermen andun (outsider fisherman) rejection, local fishermen always make the decree as a major consideration. Even specifically, Muncar and Pengambangan fishermen never made a deal to keep the management rights over the straits of Bali.

Fisherman as owner communal rights over the straits of Bali, it is proper to be trying to keep their marine management rights are not violated. This was confirmed by the state policy in setting boundaries primarily related to regional autonomy which then reinforces the logic of fisherman on the basis of the value of the management of the sea. On the other hand, the cultural construction of fisherman who have a habit of doing "expansion" into a limited fishing ground movement. The consequences of the limited space for expansion is diminishing territory fisherman catching fish resources to be explored. All informants always declared that "the Bali Strait is the property of the Muncar and the Pengambangan".

"Presence" of outsider fisherman (andun –Maduresse) assessed will greatly affect the fish catching. This means that the presence of andun assumed by local fisherman as the cause of scarcity. Assuming the use of modern technology that create inequality in income catch, but the most fundamental is to describe the fear of the occurrence of over-fishing by outsiders. Muncar fisherman currently considers the use of destructive fishing gear such as potassium, sea bomb or compressor also affected to degradation of the condition of the natural resources of the sea. Consciousness of the illegal fishing can be studied from the involvement of fisherman in guarding the sea. The local fishermen assume that marine resources in the Bali Strait need to be preserved.

Protection of rights is not only to the presence of andun and illegal fishing but also the potential for large-scale damage of the sea. The fear of the destruction of nature on mining and hamper access triggers Muncar fisherman to react to the presence of the mining company.

CONCLUSION

The scarcity on fisherman source of production, -namely, disappearance of fish), then the initial consciousness that is present (in the minds of the fisherman) as a natural occurrence that is commonly experienced. But, when it became a long period exceed ecological reality that become part of the life of fisherman, then raised the question in the mindsets of fisherman, why such a long drought and how to restore natural conditions in order to be able to restore the availability of marine fish were abundant back. Cultural efforts through ritual are not able to give an answer for Muncar fisherman to be able to restore fish that have high economic value.

Appearance of ecological consciousness manifested in the understanding of the causes of scarcity becomes the basis of fisherman to build social ecological actions. Muncar fisherman shows a collective consciousness of impending environmental damage as a result of a practice of illegal and over fishing. The ecological consciousness as a result of the growth of knowledge derived from the experience of the life of fisherman, brought fisherman to institutionalize environmental protection.

Social actions of fisherman through the development of social groups become manifestation of fisherman environmental consciousness. Ecological consciousness which is grown by fisherman essentially is a fishing effort to restore the function of the natural environment in its original state. The most fundamental values of the growth of social-ecological consciousness is a normative impetus of fisherman in restoring function to be able to provide the right environment on social assurance from the environment.

How to cite this article:

Kusumah MS *et al.*, The Social Ecology Resilience Of Muncar Fisherman, The Regency Of Banyuwangi, Indonesia. *International Journal of Recent Scientific Research* Vol. 6, Issue, 6, pp.4508-4513, June, 2015

References

- Adger, W. N. (2000). Social and ecological resilience: are they related. *Progress in Human Geography*, Vol. 24 (3), 352.
- Brand, F. S., and Jax, K., (2007). Focusing the Meaning(s) of Resilience: Resilience as a Descriptive Concept and a Boundary Object. *Ecology and Society*, 12(1): 23.
- Brown, K. (2014). Global environmental change I: A social turn for resilience? *Progress in Human Geography*, Vol. 38(1), 107–117.
- Buttel, F. H. (1986). Sociology and the environment: the winding road toward human ecology. *International Social Science Journal* , 38(3), 337–56.
- Buttel, F. H. (2000). Ecological modernization as social theory. *Geoforum*, 57-65.
- Crawford, E., Wright, M. O., & Masten, A. (2005). Resilience and spirituality in youth. Dalam P. E. E. C. Roehlkepartain, *The handbook of spiritual development in childhood and adolescence* (hal. 355-70). Thousand Oaks, CA: Sage.
- Darmawan, A. H. (2007). *Dinamika Sosio-Ekologi Pedesaan: Perspektif dan Pertautan Keilmuan Ekologi Manusia, Sosiologi Lingkungan dan Ekologi Politik* . Sadality: *Jurnal Transdisiplin Sosiologi, Komunikasi dan Ekologi Manusia*, 1 - 40.
- Folke C., Carpenter S., Elmqvist T., Gunderson L., Holling C.S., and Walker B. (2002, Agustus). Resilience and Sustainable Development: Building Adaptive Capacity in a World of Transformations. *Ambio*, Vol. 31 No. 5,, 437-440
- Geertz, C. (1973). Thick Description: Toward an Interpretative Theory of Culture." In *The Interpretation of Cultures*. . New York: Basic Books,
- Gunderson, L. H. and C. S. Holling, eds. (2002). *Panarchy: Understanding Transformations in Human and Natural Systems*. Washington, D.C.: Island Press.
- Hannigan, J. (2006). *Environmental Sociology* 2nd edition. Dalam J. Hannigan, *Environmental sociology as a field* (hal. 1 -16). Madison Avenue 270 , New York, NY 10016: Routledge.
- Holling C. S. (1973),. Resilience and stability of ecological systems. 1–23., 4, 1–23.
- Holling C.S. (1986). The Resilience of Terrestrial Ecosystems: Local Surprise and Global Change. Dalam a. R. W. C. Clark, *Sustainable Development of the Biosphere* (hal. 292-320). Cambridge: Cambridge University Press.
- Walker, B. and Salt, D. (2006). *Resilient thinking. Sustaining Ecosystems and people in a changing world*. Washington, DC: Island Press.
