

CHAPTER II

SOCIAL ECOLOGY AND DEVELOPMENT: CONCEPTUAL ANALYSIS

Introduction

In this chapter, we analyse the conceptual framework adopted for this study and reviews the literature that examines the relationship between the development pattern and social ecological changes observed in the marine fisheries sector.

In the first part of this chapter, we are trying to understand the concept of social ecology and sustainable development in the marine fisheries development context. In the second part of this chapter, we are exploring how ecosystem approach to fisheries can provide a better understanding in analysing relationship dimensions between the marine and social ecology. The last section deals with the challenges in the ecosystem approach to the fisheries management.

Ecology - Historical Development

It was Ernst Haeckel, in 1866, who applied ecology in its philosophical sense. He defined ecology "as the total relations of the animal to both its organic and its inorganic environment"¹⁷. This definition places ecology close to other disciplines like genetics, evolutionary physiology and psychology. It is Haeckel's definition that is commonly abbreviated in ecology reference and textbooks as the study of the interrelations of plants and animals with their environments.

A more comprehensive view of ecology is given by Hedgpeth (1969), a psychiatrist, in which bio-psycho-social and historical dimensions are emphasised. He defines¹⁸ ecology "as that inter-intra confrontation of biological social and historical; factors that embrace one's family, school, neighbourhood and the communities that teach values, defenses and offenses the meaning of oneself and one's existence". The relationship aspects of ecology is emphasised in different ways in this analysis.

In the 20th century description of ecology, it is described as a natural discipline with its roots in philosophy. Nicolson¹⁹ (1982 a) gives a more detailed analysis in this

¹⁷ Krebs Charles J. (1978) : *Ecology - the Experimental Analysis of Distribution and Abundance* (Second Edition) , New York, Harper and Row Publishers, P.3

¹⁸ Hedgpeth, J.W. (1969) : 'A Fit home for Earth's' Noblest Inhabitant', *Science*, 164, PP 666-8

¹⁹ Nicolson M (1982a) *Was there a Linnean Ecology?* A comment on some recent literature (Personal communication to Mc Intosh as cited Mc Intosh 1987, Op. Cit. P.16

context. According to him ecology as a science refers to three broad fields. They are:

1. The professional science of ecology in a variety of guises - marine, terrestrial etc.,
2. The political movement or philosophy broadly incorporating a variety of environmental concerns,
3. The relation of any organism to the environment (i.e., its ecology).

In the 20th century, there has been a more systematic and comprehensive development in the theoretical framework of ecology.

In the contemporary world, ecology is widely used not just in the biological sense alone. A recent theory is that the earth is not just a dead planet which contains valuable closed system but is itself alive. According to this belief. 'Gaia', the earth has its own serene ecological balance, its own will to live. It is capable of preserving its own will to live. It can shrug off disturbing intrusions, whether from comets or from man. Like any other species, Gaia has its own natural term. It lives and it will die.²⁰

While it is important to recognize the natural balancing act within the ecosystem, it has been already verified that the impact of human actions on the planet will not be rectified by itself, unless actions are taken to address the destructive practices. One of the examples will be the relationship between green house gas emission and climate change.

In the study of ecology, different schools of thoughts have been developed based on the emphasis on the analysis: a. **cultural ecology**-analysis of the influence of culture on human behaviour²¹ with an emphasis on cultural determinism²²; b. **population and human ecology**²³ -analysis of population dynamics²⁴ between multi species communities and its impact on environment²⁵ based on systems theory and analysis²⁶.

²⁰ The Gaia concept was first made explicit in Lovelock J.E. (1979) : *Gaia, A New Look at Earth*, Oxford, Oxford University Press

²¹ Lumsden C and Wilson E (1981) : '*Genes, Mind and Culture*', Cambridge, Harvard University Press, P.370 as cited in Ruse Michael (1986): *Taking Darwin Seriously : A Naturalistic Approach to Philosophy*, Oxford : Blackwell P.143

²² Steward, J.H. (1955) *Theory of Culture Change*, University of Illinois Press, Urbana; Cohen Erik (1973): *Social Ecology: A Multidimensional Approach*, Working Paper No.3, Department of Sociology, University of Singapore, P.2: Also see Steward, J.H. (1955) *Theory of Culture Change*, University of Illinois Press, Urbana

²³ a. Park, T (1945) : 'Ecological Aspects of Population Biology'. *Scientific Monthly*, 60, 311-3

b. Park, T.C. (1946) : 'Some Observations on the History and Scope of Population Ecology', *Ecological Monographs*, 16, 313-20

Social Ecology

Social ecology, as a separate field of ecology, addresses the economic, ethnic, cultural, and gender conflicts, among many others, lie at the core of the most serious ecological imbalances of today's society²⁷. Social ecology as a concept was introduced in 1965. Social ecology, by definition, takes on the responsibility of evoking, elaborating, and giving an ethical content to the natural core of society and humanity.²⁸ The philosophical base of social ecology lies on the idea that the real background on which the ecological future of the planet will be decided is clearly a social one. Social ecology, rests on the awareness of the interdependence of the biophysical and socio-cultural domains²⁹. In addition to the focus on the root cause of ecological pathology, it has given a new interpretation to the spirituality as the ability of an awakened humanity to function as moral agents in diminishing needless suffering, engaging in ecological restoration, and fostering an aesthetic appreciation of natural evolution in all its fecundity and diversity³⁰. This spirituality advocated by social ecology is naturalistic rather than supernaturalistic or pantheistic. The significant position of social ecology lies in the association it establishes between society and ecology, the social conceived as a fulfillment of the latent dimension of freedom in nature, and the ecological conceived as the organising principle of social development-in short, the guidelines for an ecological society humanity³¹. The basic categories of social ecology are; culture, polity, social structure, economy and ecological infrastructure . In studying the reciprocal interactions of the biophysical world and the human social world, social ecology draws upon sociological theories of power, ideology, social organisation, etc. as well as the concepts and findings of scientific ecology³². "The power of social ecology lies in the association it establishes between society and ecology, the social conceived as fulfillment of the latest

²⁴ Elton, C. (1942) : *Voles, Mice and Lemmings: Problems in Population Dynamics*, Oxford : Clarendon Press

²⁵ a. Slobodkin, I.B. (1962) : 'Preliminary ideas for a Predictive theory of ecology'. *American Naturalist*, 95, (147-53)

b. May, R.M. (1974 a) : 'Ecological Simulations'. *Science*, 184, 682-3

²⁶ Wilson, D.C. (1996): *The Critical Human Ecology of the Lake Victoria Fishing Industry*. Ph.D. Dissertation. Dept. of Sociology, Michigan State University, Michigan

²⁷ Bookchin M. (1993) : 'What is Social Ecology?' in *Environmental Philosophy: From Animal Rights to Radical Ecology*, ed. by M.E. Zimmerman, Engelwood Cliffs, New Jersey, Prentice Hall

²⁸ Bookchin, M. (1990, a) : *The Ecology of Freedom*, Montreal, Black Rose Books

²⁹ Guha Ramachandra (Ed.) (1994): 'Introduction' in *Social Ecology*, Delhi, Oxford University Press

³⁰ Bookchin, M. (1993) Op. Cit.

³¹ Bookchin M. (1990, b) : *The Philosophy of Social Ecology. Essays on Dialectical Naturalism*, Montreal, Black Rose Books

³² Guha, Ramachandra (1994) Op. Cit.

dimension of freedom in nature, and the ecological conceived as the organising principle of social development-in short, the guidelines for an ecological society”³³

Dialectical naturalism forms the underpinning of social ecology’s most fundamental message: our basic ecological problems stem from social problems³⁴. Homo sapiens have slowly and painstakingly developed from the natural world into a unique social world of its own. As both world interact with each other through highly complex phases of evolution, it has become as important to speak of social ecology as to speak of a natural ecology³⁵. In the analysis of nature and society, social ecology takes an evolutionary perspective and explain how the human nature and biotic nature are related. But there is a difference in the environmental changes generated due to the actions of human beings and non-human beings, as it is more dominated with technological foresight. At the same, human beings have also got a great role in reshaping the natural environment. The intricate linkages of cause, effect and response in nature- of which even modern science does not have a full understanding – can produce many unintended consequences of human intervention ³⁶. As a result, the social development by which the human beings grade out of their biological development often becomes more problematicai for themselves and non-human life.

Social Ecology and Technology

There are different analysis to understand the development of technology. The comprehensive theory developed by Albert Borgmann³⁷ has been recognised by the contemporary scholars for the theoretical significance. Borgmann’s theory of technology argues that every daily life is characterized by events and activities that are attached with significance³⁸. They provide focal points from which we evaluate and orient rest of our lives. These focal activities, and other activities to varying degrees, are embraced by contexts that include, depending on individual circumstances, social,

³³ Bookchin M (1990, b): Op Cit., P118

³⁴ Bookchin M (1990,b) Op Cit P.47

³⁵ Bookchin, M. (1996) 'The Concept of Social Ecology' in Merchant Carolyn Ed. (1996) *Ecology- Key concepts in Critical Theory*, New Delhi, Rawat Publications

³⁶ Guha, Ramachandra Ed. (1994) Op. Cit.

³⁷ Borgman Albert (1984): *Technology and the Character of Contemporary Live*, Chicago: University of Chicago Press: 1984

³⁸ Higgs Eric Stowe (1998): “ ‘Small’ Is Neither Beautiful no Ugly; It is Merely Small” *Technology and the Future of Social Ecology* pp 240-261 in Andrew Light (ed) (1998): Op. Cit

cultural, political, economic and spiritual, and ecological factors, This is explained by Borgmann in the following way: “This pattern is visible first and most all in the countless inconspicuous objects and procedures of daily life in a technological society. It is concrete in its manifestations, closest to our existence, and pervasive in its extent. The rise and the rule of this pattern I consider the most consequential event of the modern period. Once the pattern is explicated and seen, it sheds light on the hopes that have shaped our times, on the confusions and frustrations that we have suffered in our attempts to realize those hopes, and ...of acting constructively on our best insights”³⁹. In Borgmann’s view the contemporary pattern, namely, technology, threatens the stability and viability of these practices and contexts.

Some of the social ecologists view technology as a force that determines human relationship, ways of life and all the more it is the liberation from technological over-influence that would ensure freedom. “The development of the machine tend to rupture the intimate relationship between man and the means of production.....Although, initially an “extension of man”, technology is transformed into a force above man, orchestrating his life according to a score contrived by an industrial bureaucracy; not men, I repeat, but a bureaucracy, a social machine. With the arrival of mass production as the predominant mode of production, man became an extension of the machine, and only of mechanical devices in the productive process but also of social devices in the social processes. When he becomes an extension of a machine, man ceases to exist for his sake. Society is ruled by the harsh maximum; “production for the sake of production”⁴⁰.

It is important to come out of the clutches of the influence of technology. “An ecological ethics of freedom cannot be divorced from a technics that harmonises our relationship with a nature- a creative, not destructive, “metabolism” with a nature. Our consumption pattern should be in such a way that it is providing opportunity to generate life, than destruction”⁴¹.

In order to liberate human being from the technological influence, both Borgmann and Bookchin have provided certain measures. Borgmann suggests to have a reform

³⁹ Borgmann Albert (1984): Op. Cit., p3

⁴⁰ Bookchin Murray (2004): Op. Cit p 78-79

⁴¹ Bookchin Murray (1990,b): Op. Cit p124

strategy with a two-sector economy. In this, local community based economy is elevated to a point where large-scale industrial activity serves the interests of local economies. Bookchin suggests 'proposal of flourishing alternative technologies' to overcome this influence and should ensure that any social function should be considered as part of the ecological processes.

Critique of Social Ecology

The theoretical analysis of 'social ecology', based on the social anarchism, primarily developed by Murray Bookchin has been severely criticised, especially due to its 'too rigid dogmatic approach' to the Marxian ideology⁴². Attempts have been made to give a generalistic view of social ecology, though not identical with the views of Bookchin. John Clark, who had been associated with Bookchin, whose views were later rejected by Bookchin, defines "as a philosophical approach, social ecology, investigates the ontological, epistemological, ethical and political dimensions of the relationship between the social and the ecological and seeks the practical wisdom that results from such reflections"⁴³. In this, broader analysis of social ecology, author also traces the history of social ecology as early as 19th century, with Peter Kropotkin, Elisee Reclus and continuing in the twentieth century with Patrick Geddes, Lewis Mumford and Bookchin⁴⁴. In this definition, other thinkers are also attributed, which might not be widely known or could be difficult to accept. The responsibility for this decreased appeal of social ecology, in the view of Clark, mainly lies with Bookchin.

"Although Bookchin develops and expands the tradition of social ecology in important ways, he has at the same time also narrowed it through dogmatic and non-dialectical attempts..... and divisive attacks on "competing" ecophilosophies and on diverse expressions of his own tradition"⁴⁵. Due to this, in the academic world, social ecology has got a negative connotation with Bokchinist sectarianism.

⁴² Light Andrew ed (1998): *Social Ecology* after Bookchin, New York, The Guildford Press. See also the chapters in the book.

⁴³ Clark John (1997: 'A Social Ecology', *Capitalism, Nature, Socialism*, Vol No.8, No.3 September, p.3

⁴⁴ Ibid

⁴⁵ Ibid p.9

In one another critique of Bookchin's social ecology, his position has been classified in similar way to that of 'political ecologists'⁴⁶, similar to the issues raised by some of the deep ecologists. Light also attributes Bookchin as a an 'enviornmental materialist'- "political ecologist who begin their description and prescription of environmental problems in social, institutional, or material terms"⁴⁷.

As the later contemporary (young) social ecologists, who are not so dogmatic, still influenced by the relationship aspects within the social and natural systems, try to adopt a less dogmatic approach towards social ecology. Unhappy with this development, Murray Bookchin himself writes in the introduction of the third edition of the 'Post Scarcity Anarchism': "Social ecology, it should be emphasized, is not anarchism any more than it is individualism. It is decidedly a new form of libertarian socialism: libertarian in its concept of an organic and "form-the ground-up" mode of praxims; socialist in this belief that power must be conceived as conidial communities"⁴⁸.

Social Ecological Changes and Development Pattern

There is greater relevance in applying the theory of social ecology to understand the modern development pattern. Most of the development interventions ideally aim at ensuring a good quality of life for the human beings. It is also thrived to meet the ever increasing consumption needs. In this process, the technology driven development pattern, tend to impact on the relationship dimensions of the human beings to the ecology and also generating a different relationship pattern between those who own the technology and use or consume the technology.

Any impact on the ecology is reflected on the social world. This may generate two simultaneous phenomena extreme deprivation on the one hand, and of irrational excess on the other. "The deprivation is that of essentials, such as food, clean and adequate water, air, health care, and safe living and working conditions. The excess consists of bombarding our beings, our lives, and our environment with hazardous gases, chemicals and biological contamination, i.e., irrational and inessential

⁴⁶ Light Andrew ed (1998) Op Cit. p19

⁴⁷ Ibid

⁴⁸ Bookchin Murray (2004): 'Introduction to the third edition' of Post Scarcity Anarchims, Edinburgh, AK Press, P. xl.

intoxication"⁴⁹. In the same way any technology induced change on the ecology is resulted in the social relations⁵⁰. Any discussion on technology and development should focus on the 'social, political and economic basis of environmental problems'⁵¹.

These development interventions, ultimately, goes against the very purpose of the development, as it results in destruction than 'conservation' or generating life for those who is dependent on this. In the following chapters, we will try to analyse these changes in the marine fisheries development context. Before analysiing this, in the following section an analysis is given on the concept of sustainable development and its relationship with social ecology.

Understanding Development

"Development 'is a process through which the potentialities of an object or organise are released until it reaches its natural, complete, full-fledged form"⁵². The term development had its roots in the period of early Greek philosophers, Plato (427-347 BC), and Aristotle (384-322 BC) whose contributions to economic thinking became the basis for later ideological discourse⁵³. Later a connotation in terms of economic development was also associated with this. With the advent of mercantilism, main emphasis was given to economic growth in terms of wealth from the new found lands and international trade.⁵⁴

In the age of revolution (1600-1800) though many great thinkers were of the opinion that economic growth is the principle criterion of development, there were differences in their view on the forces determining economic growth. Following this, classical economists advocated for a 'profit' led economic development pattern which Marxists emphasized on ensuring distributing the income equally to every one whoever is

⁴⁹ Shiva Mira (1993) Environmental Degradation and Subversion of Health in *Minding Our Lives*, Ed. by Vandana Shiva, New Delhi, Kali for Women

⁵⁰ Gorz Andre' (1996) The Political Ecology of Capitalism in *Social Theory and the Environment*, ed. by Goldblatt David (1996), Polity Press, Cambridge, UK

⁵¹ Nayar K.R., (1990): Environment and International World Views Two Steps Backward', *Economic and Political Weekly*, March 3, 1990 pp 457-62

⁵² Esta Gustavo (1997): 'Development' in Wolfgang Sachs (ed.) *The Development Dictionary*, New Delhi Orient Longman Limited

⁵³ Landerfth H and Davind C.C. (1989) *History of Economic Theory* (2nd Edition), Boston, Mifflin Company, PP. 21-23

⁵⁴ Jumper S.R. et al (1980) : *Economic Growth and Disparities, A World View*, New Jersey, Prentice hall Inc., , PP 45-47

involved in the production process. In general, in the race of economic development, environmental concerns were out of place.

It was after Second World War the term development assumed a new connotation. When Harry S. Truman declared for the first time in his inauguration speech in 1949, the southern hemisphere as 'underdeveloped areas' and considered United States at the top of the social evolutionary scale with other industrialised countries⁵⁵. From then onwards the main thrust of development connotated to escape from the negative condition called 'underdevelopment'. In the view of the Latin American Theorists and other leftists intellectuals "Truman had simply substituted a new world for (what had already been there) the background of poor countries where in that condition due to past looting in the process of colonisation and capitalist exploitation. Underdevelopment was the creation of development"⁵⁶.

This period is also characterised by the involvement of the United Nations in the development issues of the developing countries. The three UN reports verify this fact. They are: 1. The national and international measures for full employment (1949) which advocated international measures for development purposes, 2. Measures for economic development of underdeveloped countries (1951) which put accumulation of physical capital as its prime objective and 3. Measures for international economic stability (1951) which aimed at promoting larger flow of international capital and reducing fluctuations in the prices of primary products⁵⁷. Together with this there was also an emphasis on social development. It is expressed in the Proposals for Action of the First UN Development Decade (1960-70) that "the problem of the underdeveloped countries is not just growth, but development...Development is growth plus change. Change in turn, social and cultural as well as economic and qualitative as well as quantitative.... The key concept must be improved quality of people's life (United Nations, 1962)"⁵⁸. It was for this purpose the United Nations Research Institute For Social Development was established in 1963.

⁵⁵ Sachs Wolfgang (1997) 'Introduction' in Wolfgang Sachs (ed.) Op. Cit. PP 1-2

⁵⁶ Esteva Gustavo (1997) Op. Cit. 15

⁵⁷ Gerald M and D. Seers (1984) 'Pioneers in Development' New York, Oxford University Press as cited in S. Peppin (1993) Op. Cit. PP 16-17

⁵⁸ UN (1962) The UN Development Decade: Proposals for Action, New York, UN



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Though there was a conceptual shift, development was still considered to a definable path of economic growth by the UN. In the 1960s, as UNRISD acknowledged later, 'social development was seen partly as a precondition for economic growth and partly as a moral justification for it and the sacrifices it implied'⁵⁹. Later it was perceived that growth was accompanied by inequality and social aspects were acknowledged as the 'social obstacles in the United Nations Report of the 109 meeting of Experts on Social Policy on Planning'⁶⁰. As a result, internationally a new approach based on the principles of growth with justice or redistribution with growth was initiated. This approach emphasised that the augmentation of incomes depends more on the availability of land and capital access to public facilities. This new approach also laid emphasis on the distribution of basic needs such as education, health and other public services as necessary to raise productivity and to alleviate poverty⁶¹. There was also an emphasis on identifying a unified approach to development and planning that would fully integrate the economic and social components which was initiated by the UN. This would include components designed.:

1. To leave no sector of the population outside the scope of change and development
2. To effect structural change which favour national development and to activate all sectors of the population to participate in the development process
3. To aim at social equity including the achievement of equitable distribution of income and wealth in the nation
4. To give high priority to the development of human potentials... the provision of employment opportunities and meeting the needs of children (UNRISD, 1980)⁶².

This unified approach and the growth with justice approach did not last long, as it was not profitable, where development was equated with growth.

⁵⁹ UNRISD (1979) *An Approach to Development Research*, Geneva, UNRISD

⁶⁰ Esteva Gustavo (1997) *Op. Cit.*

⁶¹ Chenery, H., (1984) *Poverty and Progress, Choices for the Developing World* in P.K. Ghosh (ed.) *third World Development : A Basic Needs Approach*, Connecticut, Green Wood Press, P. 75 as cited in S. Peppin (1993) *Opp. Cit.*

⁶² UNRISD (1980) *The Quest for a Unified approach to Development*, Geneva, UNRISD

In 1974 the Declaration of Cocoyoc emphasised that men should be the centre of development, as the declaration says the purpose of development should not be to develop things, but to develop men. This view was complemented by another approach, Basic-Needs approach, which was first proposed in the Conference on Employment, Income Distribution and Social Progress organised by ILO in June 1978. The spectrum of the scope of development also narrowed down in the later years. The Basic-Need oriented approach was a signal strategy. The World Bank found it particularly attractive since it appeared as the natural sequel to its experiments with target groups, which was concentrated on the rural poor and small farmers⁶³.

Sustainable Development

As the exploitative pattern of development was the dictum of the early decades, there was a growing concern about the various environmental changes in many parts of the globe. This led to the idea of sustainable development as an attractive development paradigm. The term sustainable development entered the environmental debate in 1980 when the International Union for conservation of Nature and Natural Resources (IUCN) launched the World Conservation Strategy⁶⁴. Sustainable development is conceptualised as that development which meets the needs of the present generation without compromising the needs of the future generations⁶⁵.

Sustainable development refers to qualitative change of a physically non-growing economic system in a stage of dynamic equilibrium maintained by its environment. It implies a different direction of technical progress: one that squeezes more service per unit of resource, rather than one that just runs more resources through the system: one that does not sacrifice natural resource productivity⁶⁶. It also focuses that resources should be exploited on a sustained yield basis and a stationary population.

Sustainable development articulates a sane strategy of conservation of natural resources with an emphasis on the optimal utilization of resources freely available in

⁶³ Esteva Gustavo (1997) Op. Cit., P. 20

⁶⁴ IUCN (1980) *World Conservation Strategy Living Resource Conservation for Sustainable Development* Gland: IUCN, UNEP and WWF, Switzerland

⁶⁵ WCED (1980) *Our Common Future: Report of the World Commission on Environment and Development*, New Delhi, Oxford University Press

⁶⁶ Daly Herman (1991) 'Sustainable Development: From Concept and Theory to Operational Principles' in Kingsley Davis and Branstam Mikhail S (eds) *Resources, Environment and Population- Present Knowledge, Future Options*, Oxford University Press, New York, p 33-47.

nature and to prioritise resource use flowing from the expendability of the resource⁶⁷. In this context, it is important to stress the importance of 'environmentally significant behaviour' to achieve sustainable development⁶⁸.

In 1992, after 20 years of the Stockholm conference, a second UN conference on the environment was held in Rio de Janeiro, Brazil. The Rio Summit, formally known as the United Nations Conference on Environment and Development (UNCED) and popularly known as the Earth Summit was another significant development in the pursuit for sustainable development. Greater recognition of the fact that the developed countries economic advancement had affected the environment and if the developing countries follow the same path, it might generate further environmental deterioration. This led to the adoption of Agenda 21, a blue print for sustainable development, with a common vision for growth, equity and nature conservation for future generations. Agenda 21 highlighted the importance of North and South to work together for the sustainable development and the summit created a new agency, the UN Commission on Sustainable Development to monitor and collect data on environmental and development activities. Irrespective of the efforts for the opportunities for the South to collaborate with the North, there were problems between the North and the South, especially in terms of the actual commitment to Agenda 21 as the Southern countries realised that the trade policies were in favour of the North countries to meet their consumption patterns and it limited their ability to fund its own needs⁶⁹. In 2002, at the World Summit on Sustainable Development (WSSD) in Johannesburg, three main issues related to the sustainable development were highlighted: environmental protection, social development and economic prosperity. In the WSSD, five specific areas related to the sustainable development were discussed. They are: water, and sanitation, emergency, health, agricultural productivity, and biodiversity protection and ecosystem management⁷⁰. The WSSD came out with a Plan of Implementation for the following prioritized actions: poverty eradication, changing unsustainable patterns

⁶⁷ Raza Moonis (1992) 'Some Reflections on the Concept of Sustainability in Development' in Mehdi Raza (ed.) *Development and Ecology*, Jaipur, Rwa Publications

⁶⁸ Stern Paul C (2000) 'Toward a Coherent Theory of Environmentally significant Behaviour', *Journal of Social issues*, Vol. 56, No.3 PP 407-424

⁶⁹ Dwivedi O.P. and Renu Khator (2006): *Sustaining Development: The Road from Stockholm to Johannesburg* in 'Sustainable Development Policy and Administration Gedeon M. Mudacumura, Desta Mebratu and M. Shamsul Haque, (eds) Boca Raton, CRC Press Taylor and Francis pp. 113-134

⁷⁰ United Nations (2002): *Report of the World Summit on Sustainable Development*. Document A/CONF. 199/20. New York: United Nations

of consumption and production, protecting and managing the natural resource of economic and social development, globalization and sustainable development, health and sustainable development, sustainable development of island states, development plans of Africa and other regions and an institutional framework and methods of implementation⁷¹. The World Summit also came out with a new understanding on the role of the civil society organizations for the environmental protection and the realization that the poverty and environmental quality are interlinked, that the poor should not be accounted for deteriorating the environment, and that they should not be on trial, as was the argument at the Earth Summit⁷². The influence of the developed nations was clear as they did not want to make any concrete commitment that would undermine their privileged position and that would harm the multinational corporations who benefit from the existing governing models⁷³.

As the very definition of sustainable development does not indicate the actual factors for achieving sustainable development, it has led to divergent approaches. Administrators, scientists and activists use the terminology of sustainable development without considering the social structures necessary to realise sustainability⁷⁴. "Sustainable development has been explicitly conceived as a strategy for sustaining development. not for supporting the flourishing and enduring of an infinitely diverse natural and social life⁷⁵. Sharadchandra Lele⁷⁶ considers it as a fuzzy and politically expedient 'catch phrase' for planners and activists and points out "the proponents of sustainable development are faced with a dilemma between the urge to take strong stands on fundamental concerns and the need to gain wide political acceptance and support.

As an economic concept, most of its proponents accept the analysis in the following: 'development is defined here to be *sustainable if it does not decrease the capacity to*

⁷¹ Ibid

⁷² Verolme, Hans J.H. (2002): From Rio to Johannesburg: A European perspective. In: Environmental Change and Security Project Report. Washington, DC: Woodrow Wilson International Centre for Scholars, pp. 5-7

⁷³ Dwivedi O.P. and Renu Khator (2006) Op. Cit

⁷⁴ Krishna Sumi (1996) *Environmental Politics - People's Lives and Development Choices*, New Delhi, Sage Publications

⁷⁵ Esteve Gustavo (1997) Op. Cit. P. 22

⁷⁶ Lele Saradchandra M (1991) *Sustainable Development : A Critical Review*, world Development Vol. 19 No. 6, PP 607-21

*provide non-declining per capita utility for infinity*⁷⁷. In this analysis, items that form the capacity to provide utility are called capital. Hence, Nature is a totality of the Nature capital like the resources, flora and fauna and the larger ecosystems that could provide material and non-material satisfaction value. For these economists, those items of nature that would not provide any utility to the humans are not natural capital. For example, a biological agent that causes a communicable disease, is not a natural capital. There are also human-made capital and human capital like education and special skills. In this whole analysis, human valuation of the resources is the central point in the definition of sustainability⁷⁸.

Emphasising the neoclassical approach, Neumayer defines SD as 'maintaining the capacity to provide per capita utility non-declining for infinity' irrespective of the available social decision criterion⁷⁹. In this approach, it is not clearly analysed who control these natural capitals and how disutility natural capital arises. It does not focus on the social aspects neither.

When we analyse 'present' and 'future' generations, it is of course a factious simplification. There is a permanent flow of people into and out of the present generations while 'future' generations are not a given but are contingent on the 'present' generation's actions⁸⁰.

Reasons for committing to sustainable development is also based on the moral philosophical arguments⁸¹. Commitment to sustainable development does not mean that it might lock society into eternal poverty⁸² or it might result into the choice of greatly inferior utility paths.

Sustainability is basically seen by the neoclassical economists as a problem of managing a nation's portfolio of capital to maintain it at a constant level, either *in toto*

⁷⁷ Neumayer Eric (2003): *Weak versus Strong Sustainability: Exploring the Limits of Two Opposing Paradigms* (second ed) Cheltenham, UK, Edward Elgar, p.7.

⁷⁸ Ibid; P.8

⁷⁹ Ibid; P9

⁸⁰ Ibid; P11

⁸¹ Ibid; p16

⁸² Dasgupta, Partha (1994): 'Optimal versus Sustainable Development' in I. Serageldin and A. Steer (eds), *Valuing the Environment, Proceedings of the First Annual International Conference on Environmentally Sustainable Development*, Washington DC: World Bank pp 35-36 (Reference p.35)

or per capita.⁸³ This includes natural capital, in principle, but it also allows for virtually unlimited substitution between human-made and natural capital.⁸⁴

Sustainability is also classified into two: weak sustainability and strong sustainability. According to Brekke⁸⁵(1997) "a development is said to be *weakly* sustainable if the development is non-diminishing from generation to generation" which is more dominant among economists and not among ecologists and natural scientists. *Strong* sustainability views sustainability as non-diminishing life opportunities....This should be achieved by conserving the stock of human capital, technological capability, natural resources and environmental quality.⁸⁶ Under the strong sustainability criteria, minimum amounts of different types of capital (economic, ecological, social) should be independently maintained, in real physical/biological terms.

The major motivation for sustainability is based on the fact that the natural resources can not be substituted for by manufactured or human capital, but is based on quasi-moral perspective. The strong sustainability factors also would ensure that the agreed principles and policies of sustainable development would ensure that the agreed principles and policies of sustainable development would be implemented in the process of achieving sustainability⁸⁷ and it calls for appropriate governing systems⁸⁸.

While earlier analysis of sustainable development focused the debate stayed close to the realm of the growth debate, the later analysis emphasizes the concept of 'ecological sustainability' which is considered to be more clear with less room for contradiction⁸⁹. The new perspectives of sustainable development analyses, in addition

⁸³ Ayres Robert, U, et al, (2001) 'Strong versus Weak Sustainability: Economics, Natural Sciences, and "Consilience"' *Environmental Ethics*, Vol. 23, No. 2

⁸⁴ Pearce David et al (1990) *Sustainable Development Concepts: Economics and Environment in the Third World*, Cheltenham: Edward Elgar

⁸⁵ Brekke Kjell Arne (1977) *Economic Growth and the Environment: On the Measurement of Income and Welfare*, Cheltenham, Edward Elgar

⁸⁶ Ibid

⁸⁷ Bressers Hans Th A and Walter A. Rosenbaum (2003): 'Social Scales, Sustainability, and Governance: An Introduction in Hans Th A Bressers and Walter A. Rosenbaum (ed) in *Achieving Sustainable Development: The Challenge of Governance Across Social Scales*, London, Praeger pp 3-24

⁸⁸ Schmand Jurgen and C.H. Ward (2000): *Challenge and Response* in Jurgen Schmandt and C.H. Ward (ed): *Sustainable Development: The Challenge of Transition*; Cambridge, Cambridge University Press pp 1-11

⁸⁹ Bergh Jeroen C.J.M. Van den and Jan van der Straaten (1994): 'Introduction' in Jeroen C.J.M. Van den Bergh and Jan van der Straaten (ed) in *Toward Sustainable Development: Concepts, Methods and Policy*, International Society for Ecological Economics and Island Press, Washington DC p6.

to the ecological dimension, physical economic psychological, sociological and historical elements associated with sustainable development.

But there is a strong view that the concept 'sustainable' can not fully address the issues with regard to the sustenance of natural resources, as it is more concerned with sustenance of consumption needs. Hence the term 'reproducibility' is suggested. "*Reproducibility or conservation* are directly related to the notion of carrying capacity: a level of production making use of a natural resource is reproducible if it lies within the upper limit set by the carrying capacity of the ecosystem within which it takes place. In other words reproducibility refers to the ability of a system to maintain its productivity when subject to stress and shock.... This concept of reproducibility or conservation should be carefully distinguished from the concept of sustainability... Sustainability (of a consumption level, or of a development process) may require the ultimate destruction of a resource or a change in the ecosystem. Reproducibility is a more stringent criterion in that it requires the resource base to be preserved. When using the concept of sustainability, we are concerned about whether a level of well-being (or of production, or of consumption) can be maintained over an infinite horizon, where as, when referring to reproducibility, we are not only concerned with the possibility of sustaining a level of well-being but also with the way this can be done since we require the stability of the ecosystem within which human intervention takes place"⁹⁰. Though the concept of reproducibility helps to characterise human intervention in an ecosystem, it says nothing about its desirability (or optimality), except under ultraconservationist views considering the current *status quo* as preferable to anything else. .

Social Ecology and Development Dimensions in the Marine Ecology

Application of social ecology in the fisheries sector helps us to focus on the relationship pattern between the human subsystems in the marine ecology and fisheries development pattern and technological advancement. The particular way of the extraction process of marine resources is shaped by the social, cultural and economic and technological conditions existing in the given society⁹¹.

⁹⁰ Baland Jean-Marie and Jean-Philippe Platteau (1996) *Halting Degradation of Natural Resources, Is there a Role for Rural Communities?* Oxford, Food and Agricultural Organisation of the United Nations and Clarendon Press PP 15-16

⁹¹ Thorpe Andy et al., (2005): Op Cit., p43

There are mainly two different type of fish capturing system: Small Scale and Industrial. It has been analysed that diversity in the fish catching is based on the following characteristics and historical origins: social organisation of production, the technological intensity of fishing and the closely related attributes of space and time⁹². Though traditionally this two classification has been very prominent, it is important to observe that the small scale fishworker using the industrial techniques to increase their fish capture, which has now led to a new classification of semi-industrial fishing, though this group still has got the non-capitalist mode of production⁹³. There are different attributes given to these three different groups of fish workers based on the following factors: social-institutional, technology factor and space and time factor⁹⁴.

The traditional classification has been small scale versus large scale. Charles A observes⁹⁵ this fundamental distinction in fishery debates are based on organisational and structural factors and he defines this distinction as follows: “based on the size of a typical fisher’s operation (e.g. vessel size), so that a small-scale fishery is one with a fleet of small boats:

based on the size of a typical fisher’s operation, (e.g. vessel size), so that a small-scale fishery is one with a fleet of small boats:

based on an ‘inshore’ versus ‘offshore’ split, related both to the distance from shore that the fishery can operate and the extent to which the fishery is tied to coastal communities; based (in developing countries, and in the social science literature) on what is referred to as ‘mode of production’ (artisanal versus industrial), which depends both on actual activity, and on fisher self-perception, i.e., whether fishers views themselves as ‘artisans’.

It is also worthwhile to note that expressions might vary in place to place and it is also relative. For example, what is considered as a small scale might be of large scale in another country or vice versa. Over all, small scale fisheries is rooted on the relationship aspect of the production system, with strong institutional cohesion with the advantage of community based fishing practices.

⁹² Johnson Derek et al (2005): Fish Capture In Kooiman et al (eds): Op Cit., p 173

⁹³ Ibid, p 75

⁹⁴ Ibid, p. 76 Charles A (2001): Sustainable Fishery Systems, Blackwell Science, Oxford p.3

⁹⁵ Charles A (2001): Sustainable Fishery Systems, Blackwell Science, Oxford p.3

Johnson et al argues⁹⁶ that the social relations that exist in the fishing pattern determine the social institutional scale of fish capture. In their view, the small scale fisheries are organised on the basis of affective relations, participation and all the more without factoring the labour costs, as the social contracts and community and institutional bonds are very strong. The industrial fishing sector is organised on community basis, which is dominated by the market based logic.

Industrial Fish Capture

It is the market based rationale that is the basis of the industrial fish capture system and everything in the fishing is organised around profitability. In the industrial sector, relations among the labourers exist like that of a firm. Share based system of remuneration is the main prevalent factor in this sector. In industrial capture fishing, technological interventions have generated challenges for the local systems, especially in terms of access rights of the traditional fishworkers. It is also observed that in most of the developing country context, industrial technology, including the mechanised boats, were new and was introduced with the support of the international development agencies, the government and even the multinational companies. The main purpose of the introduction of new technology, along with packages and incentives was to intensify marine fish production⁹⁷ and to increase the profit. Labourers in the industrial fleets are inputs into the production process and systems of remuneration are chosen to maximise productivity.

There is another category called intermediate or semi-industrial, which has got the mix of community and industrial characteristics and ownership of the fishing boats and gears and the relations between the owners and labourers make the distinctive attribute of this group⁹⁸. In the mechanised boats or trawlers in India, one could easily observe these attributes.

There has been different attempts to classify the technological scale in fishing. One of the forms of the classification is based on the distinction between active gears-those that target species moves into itself- and passive gears- those that purse fish in order to entrap them. In the same way, on the basis of the spatial dimensions another

⁹⁶ Johnson Drek, Maarten Bavinck and Joeli Veitayaki (2005): Op. Cit p.79

⁹⁷ Ibid p. 81

⁹⁸ Ibid p.78

classification has been made, as mid-shore and offshore fisheries, on the basis of the relative distances beyond the inshore area. The introduction of advanced technology, both high powered motor boats and inboard storage facilities and financial packages and development assistance have enabled small-scale fishers to get into the mid-shore areas. Distant water fishing is still in the hands of large vessels that are owned by the multinational companies or national level large scale corporations. In the Indian context, deep sea fishing is an area that is yet to be fully exploited.

While technology plays a critical role in the fisheries development, technology is one of the main contributing factors behind the social unrest in the fisheries sector. Technology is also an important variable in human niches. In the marine fisheries, as argued by Tuomi-Nikula, “human niches” are formed around the capture of different species of fish⁹⁹. As fish workers follow seasonal cycles in targeting particular varieties, they are sequentially and almost simultaneously involved in a variety of niches¹⁰⁰. When fishworkers participate in identical niches and thereby target the same species at the same time, competition arises¹⁰¹. According to Tuomi-Nikula, technology is a factor in fisheries conflict, as when “a natural resource is exploited by different technical resources”¹⁰².

According to Maarten Bavinck, while Tuomi-Nikula recognises issue of fishing competition, on the basis of fishing grounds,” she fails to elaborate on the term ‘grounds’ or to integrate the territorial component in the argument¹⁰³. Fishing activities take place in a spatial setting, and for him physical space is the realm for the application of fishing gears but also for the possible interference of one gear with another¹⁰⁴. This has been very often reported in the Indian waters, especially the damages done by the trawling gear on the standing nets of other fishworkers in certain

⁹⁹ Tuomi-Nikula, O. (1985): The cultural-ecological aspect of culture change. *Stud. Fen.* 30 147-163 quoted in Maarten Bavinck (2005): *Understanding Fisheries Conflicts in the South- A Legal Pluralist Perspective, Society and Natural Resources*, 18: 805-820

¹⁰⁰ *Ibid* p149-150

¹⁰¹ *Ibid* p. 155-156

¹⁰² *Ibid* p155.

¹⁰³ Bavinck Maarten (2005): *Understanding Fisheries Conflicts in the South- A Legal Pluralist Perspective, Society and Natural Resources*, 18: 805-820

¹⁰⁴ *Ibid* p 809

area. This possible fishing gear interferes with each other has been called as 'technological externalities' by Schalger and Ostrom¹⁰⁵.

In the above two analysis of fisheries conflict, impact of the market on competition patterns is not analysed. But it is a real factor in the lives of fish workers¹⁰⁶. Competition in the seas arise due to the high market value of a particular species and on the spaces in which these species are predominantly located¹⁰⁷. Here, it is important to note that there could be competition between the operators of different gears who might target different species. It is also interesting to note that the traditional or small scale fish workers have been also forced to compete with the large scale sector operators. This competition for space, species and market values have resulted into different conflicts between the small scale and large scale fish workers in India and other parts of the world¹⁰⁸. There are also evidences of increasing conflicts within the small scale fish workers amongst different gear groups due to 'increased mobility of fishing vessels', 'capacity expansion' and excessive 'fishing pressure'¹⁰⁹. Is this competition likely to become severe? According to Platteau, this is likely to become severe if there is a drastic resource deterioration or market fluctuations¹¹⁰.

In the context of Kerala, the steady growth of trawler fleet led to competition for fishing space since they too began fishing in the same fishing space where the traditional fishers used to fish. The consequent space congestion gave rise to direct technological externalities like gear entanglement and gear destruction. The manually propelled traditional crafts used to fish in the 0-20 mt depth area of Kerala

¹⁰⁵ Schlager, E and E Ostrom (1993): Property Rights regimes and coastal fisheries: An empirical analysis. In *The Political Economy of customs and culture: Informal solutions to the commons problem*, eds. T.L. Anderson and R.T. Simmons, 13-41, Lanham, MD: Rowman & Littlefield.

¹⁰⁶ Ginkel (1998):

¹⁰⁷ Bavinck Marten (2005): Op Cit., p 809

¹⁰⁸ For details please see, Bavinck, M (2001) : *Marine resource management-conflict and regulation in the fisheries of the Coromandel Coast*. New Dehi, India: Sage; Berkes, R., R. Mahon, P. McConney, R. Pollnac, and R. Pomeroy eds (2001): *Managing Small Scale Fisheries: Alternative directions and methods*. Ottawa: International Development Research Centre; Jayapathy, J. (1999): *Mukkuvar Catholicism*. In *Popular Catholicism in a world church*, eds. T. Bannat and J.P. Wiest, 183-214. Mary Knoll, NY: Orbis Books; Kurien J (1985) Op Cit., Kurien J and Achari (1988) Op. Cit., and 1994 Op Cit.

¹⁰⁹ Mathew Sebastian (2001): *Small-scale fisheries perspectives on an eco-system based approach to fisheries management*, Reykjavic Conference on Responsible Fisheries in the Marine Eco System, Reykjavic, Iceland, 1-4 October. P10

¹¹⁰ Platteau Jean-Philippe (1989): Op.Cit

coast which comprised of 4473 sq.km¹¹¹. Interestingly, in the absence of any space regulations, the mechanised boats were also crowding in this space, attracted by its high productivity. This has further reduced the (already miniscule) fishing space of traditional crafts. In principle, the fishing space allotted to mechanized boats has also fallen since 1980, with the introduction of regulation of their fishing space. Very recently, conflicts have been reported among the inland fishworkers of Kerala, especially between the traditional groups and the newly arrived group with the support of local governing bodies (panchayats)¹¹².

The dynamism between technology, marine species and spatial factors and the troubled social relationship pattern of the fish workers can be attributed to the 'social ecological' changes in the marine fisheries. An ecosystem approach to marine fisheries management helps to manage the relationship dimensions between the natural and human subsystems there by ensuring sustainable fisheries livelihood.

Ecosystem Approach for Sustainable Fisheries Livelihood

Food and Agriculture (FAO) defines an eco system as a 'functioning, interacting system composed of living organisms and their environment' and the concept is applicable at any scale, from the planet as an ecosystem to a microscopic colony of organisms and its immediate surroundings¹¹³. The over all objective of an ecosystem approach to fisheries is to plan, develop and manage fisheries in a manner that 'addresses the multiplicity of societal needs and desires,' without affecting those needs of the future generations that could be addressed by the marine ecosystems¹¹⁴.

An ecosystem approach to fisheries (EAF) strives to balance diverse societal objectives, by taking into account the knowledge and uncertainties about biotic, abiotic and human components of ecosystems and their interaction and applying an integrated approach to fisheries within ecological meaningful boundaries¹¹⁵.

¹¹¹ Area of territorial waters of Kerala with respect to the depth ranges 0-20 mt, 0-50 mt, and 20-50 mt are respectively 4472.76, 15992.76, and 11520.00 sq. kms (Kalawar et al; (1985) p 381.

¹¹² Santha Sunil D (2007): State Interventions and natural resource management: A study on social interfaces in a reverie fisheries setting in Kerala, India. *Natural Resources Forum* 31 (2007) PP 61-70

¹¹³ FAO (1999a): FAO Glossary: Fisheries Department, FAO, Rome
(www.fao.org/fi/glossary/glossary.asp)

¹¹⁴ FAO (2203): The Ecosystem approach to marine capture fisheries. FAO Technical Guidelines for Responsible Fisheries, No. 4 (Suppl.2): pp 112

¹¹⁵ FAO (2002a): Guidelines on the Ecosystem Approach to 'Fisheries: FAO Technical Guidelines for Responsible Fishing 9. Rome. FAO

EAF give consideration to four common components. They are¹¹⁶:

‘Consider more fully the ways that the biotic and abiotic marine environment affects exploited resource

Consider more fully the ways that fisheries affect the structure and function of marine ecosystems (fisheries outputs)

Apply inclusive government approaches which bring all users of the marine ecosystem together at meaningful geographic scales....’

In the ecosystem approach to fisheries, we need to understand the interrelationships of all the subsystems involved, namely, biological structure of the marine ecosystem, fishworkers and fishing process, external environment and governing systems.

It has been observed that underlying concepts of ecosystem management and fisheries management remain still ‘fuzzy and tend to overlap’ ‘as the various expressions refer to what appear to be in practice very converging processes, aiming at largely overlapping sets of objectives’¹¹⁷.

The following section analyses the interaction between the different subsystems in the social and natural ecology of the marine ecosystems.

Biological Organisation and Structure

Living organisms of all types- whether freely moving or captive- are a product of, and interact with, their natural environment. These resources are taken into the human domain or ecology, either by extracting the resource from its original source or by exploiting the resource within the context of its natural environment¹¹⁸. In the case of fishes, they are part of the marine ecosystem and its abstraction would impact on the marine environment. The over extraction of certain species could adversely affect the harmony of the marine ecosystem. This is all the more manifested in the bottom

¹¹⁶ Rice Jake (2005): Will an Eco System approach mitigate the factors of unsustainability? Discussion paper 10 in *Overcoming Factors of Unsustainability and Overexploitation in Fisheries: Selected Papers on Issues and Approaches*, FAO Fisheries Report No. 782, FAO, Rome pp 191-219

¹¹⁷ Garcia S.M. et al (2003): *The Ecosystem approach to Fisheries, - Issues, terminology, principles, institutional foundations, implementation and outlook*, FAO Technical Paper 443, Food and Agriculture Organization of the UN, Rome p 6

¹¹⁸ Thorpe Andy et al., (2005): Introduction in Jan Kooiman et al., (ed) *Fish for Life- Interactive Governance for Fisheries*, Amsterdam University Press, Amsterdam pp 41-44.

trawling, that severely damages the structure of the seabed and there by the entire marine ecosystem¹¹⁹. In this process, it is also important to analyse how this process affects other subsystems that are dependent on the marine ecosystem, especially the human ecology, other species like the sea birds and other dependent organism. Other actions, like the oil exploration and other actors contributing to the marine pollution also affect the harmony of the marine ecosystem.

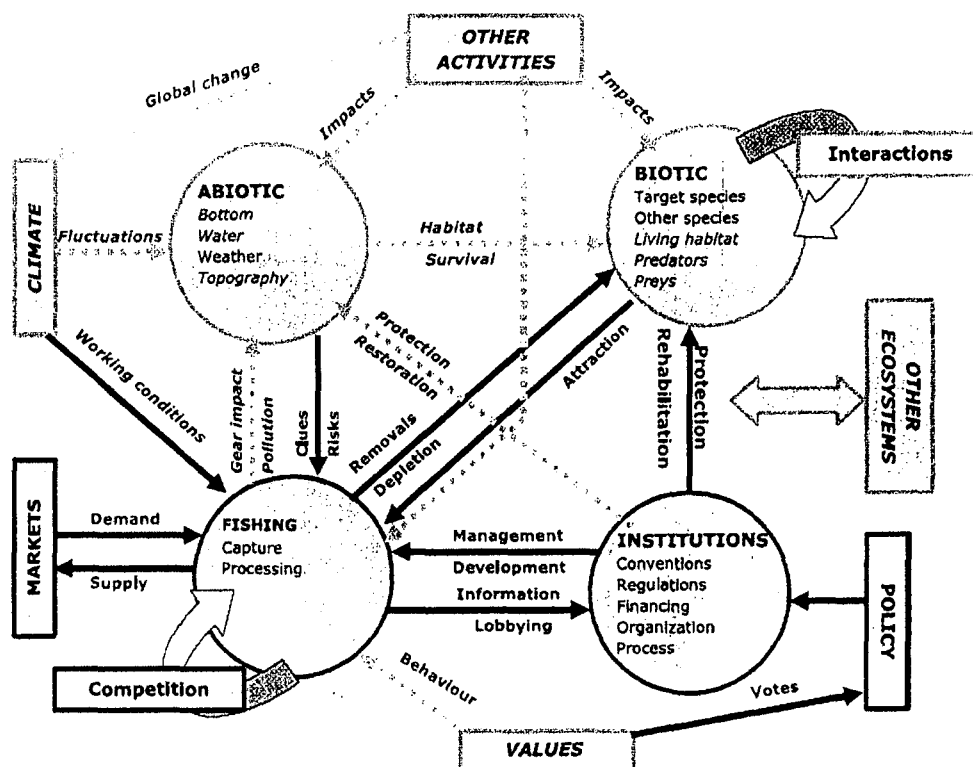
The ecology of marine resources are linked to different factors are linked to one another, which Michel Kulbicki calls as the 'fish chain'¹²⁰. The description of the fishers' interaction within the ecosystem requires identification of four main ecosystem compartments¹²¹: (1) a biotic compartment, including target fish resources, associated and dependent species and living habitats (sea grass, algal beds, corals); (2) an abiotic compartment, characterised by its topography, bottom types, water quality and local weather/climate; (3) a fishery compartment, in which harvesting and processing activities take place, with a strong technological character, and a (4) an institutional compartment, comprising, in which harvesting and processing activities take place, with a strong technological character, and (4) an institutional compartment, comprising laws, regulations and organisations needed for fisheries government. What does constitute biotic component of the ecosystem? Human beings, who draw resources, food and other sources of livelihood as well as the part of the fishery component which they drive. These components interact and are affected by the following factors¹²²: (i) non-fishing activities; (ii) the global climate, (iii) other ecosystems, usually adjacent, with which they exchange matter and information; and (iv) the socio-economic environment as reflected in the market, relevant policies and societal values. These interactions can be understood from the following diagram.

¹¹⁹ Ibid p. 43

¹²⁰ Kulbicki Michel (2005): Aquatic Ecologies in Jan Kooiman et al., (eds) Op Cit. p 45-69.

¹²¹ Garcia, S.M. (2003): Op. Cit. p9

¹²² Ibid



Source: Garcia, S. M. et al. 2005 (Ecosystem Approach to Fisheries: a review of implementation guidelines, ICES Journal of Marine Sciences 62(3) p 311-18

Figure1- Ecosystem Components and Interactions addressed by EAF

Diversity forms the basis of ecological processes with different type of environmental resource. Any changes in this could result in the larger natural and social ecological changes.¹²³ Diversity in the marine ecology can be explained as a continuum of organisation levels starting from genetic diversity to ecosystem and landscape diversity that are linked to each other¹²⁴. Marine aquatic diversity can be understood mainly in the following way: 1. regional aquatic diversity (number of species existing in a region; 2 island or province diversity (the number of taxa known for a sub

¹²³ Chapin, F.S., E.S. Zavaleta, V.T. Eviner, R.L. Naylor, P.M. Vitousek., H.L. Reynolds, D.U. Hooper., S. Lavorel., O.E. Sala., S.E. Hobbie, M.C. Mack and S. Diaz (2000): Consequences of Changing Biodiversity. Nature 405: 234-242

¹²⁴ Kulbicki Michel (2006): Op. Cit

region, often called a province in ecology); local diversity (the number of taxa (or functional groups or genetic varieties) in a specific habitat like reef or mangrove area or trawling ground: 4 species density or richness (the number of taxa in each standard sampling unit- eg., transect or trawl)¹²⁵. Diversity is affected by different factors, mainly: 'large scale spatial factors that are linked to physical phenomena such as regional up dwellings, island size, island type etc and local-scale spatial factors like the physical factors like (e.g., depth, coastal configuration) as well as ecological factors such as biotope type (eg., mangrove, reef etc), habitat (eg., reef flat, reef back), components of the habitat (like size of the mangrove, coral cover and sea weed density), and the outcome of the human actions like fishing level and pollution¹²⁶.

Fish capture is one of the expressive links of the fish chain, linking the consumer demand to ecosystem that impact through the social organisation and technologies of resource extraction¹²⁷.

There are different studies that analyse the ecological changes in the marine ecology. Climatic changes impact on the marine ecology without reference to human activity and it is observed that fishes and other water born species are more sensitive to such changes¹²⁸. Fishing is the single largest activity that leads to the significant changes in the marine ecology.

Impact from the fisheries on the environment has been well researched¹²⁹. Most of the fishing gear, especially trawl nets and dredges, the most commonly studied gear,

¹²⁵ Ibid P.46-47

¹²⁶ Ibid p. 47

¹²⁷ Johnson Derek, Maarten Bavinck, and Joeli Veitayaki (2005): Fish Capture in Jan Kooiman et al., (ed) Op Cit P 71

¹²⁸ McEvoy Arthur F (1986): The Fisherman's Problem-Ecology and Law in the California Fisheries, 1850-1980, Cambridge University Press, Cambridge p10; Also see the detailed analysis in Nellemann Christian et all (2008): In Dead Water: Merging of Climate Change with Pollution, Over harvest and Infestations in the World's Fishing Grounds- A Rapid response Assessment, UNEP, GRID-Arendal, Norway

¹²⁹ The following studies give an overview of the impact of fisheries on the marine ecology: 1. Dayton, P.K., Thursh, S.F., Agardy, T. and Hofman, R.J. (1995): View Point: Environmental effects of marine fishing. Aquatic conservation. Marine and Freshwater Ecosystems, 5: 205-232; 2. Agardy, T. (2000) Effects of fisheries on marine ecosystems: a conservationist's perspective. ICES Journal of Marine Sciences, 57 (3): 761-765; 3. Kaiser, M.J., Collie, J.S., Jennings, S and Poiner, I.R. (2003): Impacts of fishing gear on marine benthic habits. In M. Sinclair and G. Valdimarsson, eds. Responsible Fisheries in eh marine ecosystem, pp 197-216.. Rome, Italy and Wallingford, UK., FAO and CABI Publishing

'destroy most of the epifauna and kills invertebrates (echinoderms, molluscs, worms, crustaceans etc.) that are food for fish¹³⁰.

Capture fisheries reduce abundance, spawning potential and possibly, population parameters (growth, malnutrition etc) of the different target fish species in the ecosystem. They modify age and size structure, sex ration, genetics and species composition of the target resources, as well as of their associated and dependent species¹³¹. Fishing and pollution are the major contributory factors for fish diversity change¹³². Over fishing affects the original stability, maturity and efficiency of the ecosystem. The empirical study using the 50- year long larval fish surveys from the California Co-operative Oceanic Fisheries Investigations, shows that fishing increases variability in the abundance of exploited populations (even after accounting for life-history effects, ecological traits, phylogeny and a changing environment)¹³³. The study also warns that in addition to causing a decline in abundance, fishing can provoke greater variability in exploited populations (and therefore reduced resilience) and thereby increase the risk of collapse of a fishery from stochastic environmental effects¹³⁴. The changes in the fish habitat by various human activities may be physical (e.g. by adding artificial reefs, oils rigs, aquaculture installations), mechanical (e.g. through the 'ploughing' effect of dredges and trawls), or chemical (e.g. through injection of nutrients, pesticides, heavy metals, drugs, hormones). Fishing gear and the very nature of fishing technology like (use of dynamite or poison) or inappropriate use of another wise acceptable gear (e.g. using trawls in coral reefs or seagrass beds) can change the living and non-living marine environment with the long term impact on the future fish stock. It has been observed that small mesh (8-10 mm) used in the Indian waters targeting juvenile prawns leads depletion of the stock and also traps non targeted species leading to significant discards. A particular species of catfishes is

¹³⁰ Kulbicki Michel (2005): Aquatic Ecologies. In Kooiman et al (eds): Op Cit., pp 58

¹³¹ Garcia, S.M., et al., (2003) Op Cit p10

¹³² Jennings, S. and M.J. Kaiser (1998): The effects of fishing on marine ecosystems. *Advances in Marine Biology* 34: 2-27.

¹³³ Hsieh Chih-hao, et al., (2006) : Fishing elevates variability in the abundance of exploited species, *Nature*, Vol 443 19th October pp 859-862 (Co-authors- Christian S. Reiss, John R. Hunter, John R. Beddington, Robert M. May, George Sugilhara)

¹³⁴ Ibid

extinct in India, due to excessive trawling that have destroyed the entire sea bottom of coastal waters where several of the demersal species inhabit¹³⁵.

Land based sources of pollution and activities are also impacted on the marine ecology. One of the endangered marine ecosystem is the mangroves. Mangroves consist of a number of species of trees and shrubs that have the adaptive capacity to survival in the inter-tidal zone. Mangroves are under the threat of degradation in India. An estimated mangrove spread in India was of 6740 Sq km in the late eighties. This has been further reduced in the last two decades and the present estimate is 4120 sq. km¹³⁶. Mangroves protect against the tidal waves and minimise the impact of natural disasters like Cyclones and Tsunami, in addition to provide a safe and favourable environment for breeding, spawning, rearing of several fish, shell fish, reptiles and mammals.

Coral reefs of India, comprising of fringing reefs and coral patches are severely degraded by siltation, industrial wastes, sewerage from settlement shipping, thermal plans, tourism and mining and collection and fishing¹³⁷.

Another major phenomenon that destroy the marine ecosystem is the pollution. Following are the major activities that are responsible for coastal pollution in India: discharge and disposal of untreated domestic and industrial wastes, discharges of coolant waters, harbour activities such as dredging, cargo handling, dumping of ship wastes, spilling of cargo's chemicals and metal ores, oil transport, fishing activities etc. The mechanised fishing activities such as draining of waste oil, painting of fishing vessels, crapping of metal linings of fishing boats, dumping of waste and rash fishes, etc. It is estimated that more than 90% of pollutants generated in India are released into the coastal zone¹³⁸

Due to the dearth of treatment facilities, domestic wastes are discharged mostly in untreated conditions. It has been estimated that approximately, 5060 km mld reach the

¹³⁵ Swaminathan M. S. (2005): Report of the Committee to review the coastal regulation zone notification 1991, Ministry of Environment and Forests, New Delhi p 36

¹³⁶ Ibid p 38

¹³⁷ Ibid p 41

¹³⁸ India Country Profile. Integrated Coastal Management: an international priority. <http://icm.noaa.gov/country/india/india.html> accessed on 23/Aug/2007

coastal waters of the India¹³⁹. Another estimate shows that untreated domestic sewage, contributes the largest volume of waste with 4 billion m³ reaching the coastal environment every year¹⁴⁰. The quantity of waste water discharged by aquaculture farms is 10-12 MLD. In addition to this, pesticides and fertilizers used in agriculture also find its way into the coastal waters. As a result around about 50 million m³ of river- borne effluents, 33 million tonne of land wastes and 5 million tonne of fertiliser residue are discharged into the coastal and marine environment every year¹⁴¹.

While nutrients flow from the rivers into the ocean can contribute to the increase in the over all biomass of fish in the sea (e.g. Mediterranean region and Baltic Sea)¹⁴². As against this, in the Black Sea, where the deep anoxic salt water with a high methane and hydrogen sulphide content, it is destroying the entire marine ecosystem¹⁴³. In the Indian context, we do not have much data to show the biomass differences of fish in the sea due to pollution.

One important observation that is coming out of the above analysis is the relationship dimension that is generated between the marine ecology and the key` stakeholders, who are involved in the technological scale and the spatial dimension of the fishing. It is also important to analyse how these relationship patterns can ensure a sustainable livelihood. The livelihoods approach has been widely used as a tool in interventions aimed at poverty alleviation for communities that are dependent on natural resources¹⁴⁴. When applied in the marine fisheries context, it ensures to build up assets/resources, activities and access conditions and governing systems that shape fishing communities to have sustainable livelihood options¹⁴⁵. But small scale fishing communities are often forced out of their habitats and displaced from coastal areas due to industrial development, tourisms, pollution, environmental degradation and conflicts with large commercial fishing operations. Different anthropological studies

¹³⁹ Swaminathan M. S. (2005): Op Cit., p71

¹⁴⁰ India Country Profile. Integrated Coastal Management: an international priority. <http://icm.noaa.gov/country/india/india.html> accessed on 23/Aug/2007

¹⁴¹ Ibid

¹⁴² Caddy J.F. and R Mahon (2000): Marine catchment basin effects versus impacts of fisheries on semi-enclosed seas. ICES Journal of Marine Science 57: 628-640

¹⁴³ Garcia, S.M., et al., (2003) : Op. Cit., pp 13-14

¹⁴⁴ For details, please see FAO/DFID (2004): Sustainable Fisheries livelihood programme. Rome: Food and Agriculture Organisation. London: Department For International Development. <http://www.sflp.org/> accessed August 18, 2006.

¹⁴⁵ Ellis, F. (2000): Rural livelihoods and diversity in developing countries. Oxford: Oxford University Press

and other research show that the 'maintenance of livelihoods in fisheries sector involves recourse to a wide range of interrelated activities' of which the fishing is just one activity¹⁴⁶.

Development Versus Growth and Consumption Versus Conservation Challenges to Ecosystem Approach

Any environmental feature can be looked up on in a variety of ways. The differences in which people view their environment could be named 'environmental orientations'¹⁴⁷. For fishworkers, marine resources will be a source of life and livelihood, while, for other stakeholders, it could be source of seafood, and for other groups, it could be a potential for 'profit'.

The production system in marine fisheries sector is primarily based on the natural capital (marine resources and human resources). Unlike many other production system, these natural resources are open and they have the characteristics of common property. There arises a problem in the open access situation when the agents have to decide whether or not they should 'enter' and start exploiting the resource¹⁴⁸. But the general trend across the globe is that there is no regulatory mechanism to control the entry of the agents of the resource exploitation. But common property and open access are essentially different, though it is often used simultaneously. When used synonymously, these terms imply that marine resources by nature are not subject to exclusive property rights and are thus freely accessible¹⁴⁹. In a common property the community is with the power to exclude non-members from appropriation of the resource base. This is a situation in which there are specified legal or customary rights of joint use over a particular territory which are 'conclusive to a defined group of

¹⁴⁶ Johnson Derek, Maarten Bavinck and Joeli Veitayaki (2005): Op. Cit p. 84

¹⁴⁷ Cohen Erik (1973): *Social Ecology: A multidimensional Approach*, Working Paper No.3, Department of Sociology, University of Singapore, p.3

¹⁴⁸ Baland Jean-Marie and Jean-Philippe Platteau (1996) *Halting Degradation of Natural Resources, Is there a Role for Rural Communities?* Oxford, Food and Agricultural Organisation of the United Nations and Clarendon Press PP 26

¹⁴⁹ Meynen Wicky (1989) 'Fisheries Development, Resources Depletion and Political Mobilisation in Kerala: The Problem of Alternatives', *Development and Change* Vol. 20, No. 4 PP735-770

people¹⁵⁰. The right of exclusion is assigned to a well-defined group in common property while in open access a right of inclusion is granted to any one who wants to use the resource¹⁵¹. Traditionally there has been different social common means of exclusion in the utilisation of common property resources. The very concept of common property presupposes the existence of a well-defined group and the agents do not any more think that the final outcome is independent of their own individual decisions, as was the case under the open access.

Modern marine fisheries development programmes have been carried out by the emphasis on increasing fish catch based on the philosophy of open access of the marine resources in the sense of unrestricted entry. In this approach no serious attention was given to the voices of the traditional wisdom of fishing sustaining the common property resources in the sea. For the fishworkers sea is not mere water and fishes, but it is the 'mother'. That is why in Kerala fishworkers call sea as the mothersea (*Kadalamma*). It is against the conscience of any fishworker to do any harmful practice to this mother. The implication of this belief is that fishworkers do have their own way of sustaining the marine resources.

The main thrust of the modern marine fisheries development approach has been to sustain the rising consumption needs, both direct and indirect, of the market forgetting the reproducibility of the marine resources. "Rising standards of food consumption consequent up on income increases can affect the demand for fish directly, as when the improvement of the food diet takes the form of a greater demand for high-quality fish species which can be sold in a fresh, canned or frozen state. The effect is indirect when as a result of enhanced consumption of meat, demand rises for fishmeal to be used for animal feed"¹⁵². In the middle of the 1980s, around 70 per cent of the total world catch was used for immediate human consumption while the remainder was mostly reduced for fishmeal, oil or fertilizers.¹⁵³

¹⁵⁰ For details, please see: a. McCay, B.J and Acheson, J.M. (1987) 'Human Ecology of the Commons', in B.J. McCay and J.M. Acheson (eds) *The Question of the Commons*, PP. 1-36. Tucson: University of Arizona Press

b. Runge, C.F. (1986) 'Common Property and Collective Action in Economic Development', *World Development* 14(5): 623-35

¹⁵¹ Baland and Jean-Philippe, (1996): Op. Cit.P.29

¹⁵² Platteau Jean-Philippe (1989) 'The Dynamics of Fisheries Development in Developing Countries: A General Overview', *Development and Change*, Vol.20, No.4, 1989. PP 565-597

¹⁵³ FAO (1987) *Year Book of Fishery Statistics - 1985*, vol.61. Rome: FAO, A-1

But who are the actual producers and consumers? Developing countries produce most of the fish products. A recent analysis shows that eight developing countries, Bangladesh, India, Indonesia, Malaysia, the Philippines, Thailand, Sri Lanka and Vietnam account for 60% of marine capture fisheries (23 million tones of fish)¹⁵⁴. Total world fish production increased from 19.3 million tones in 1950 to more than 100 million tones in 1989 and 134 million tones in 2002¹⁵⁵. Marine capture fisheries contribute largest share in the total world fish production. While Indian fish production has increased steadily in the last two decades, the same is with regard to the export of fish and fish products. In 1998 India was the 20th-largest exporter of fish and fish products¹⁵⁶. In 2002-03, marine product exports increased to all time highs in volume as value, with actual export of 467,297 metric tons valued at Rs. 68,810 million or US\$1.43 billion¹⁵⁷. The US emerged as the largest market for Indian marine products and Japan as the second¹⁵⁸. While developed countries still have the highest fish consumption rate, emerging economies like China has got an increasing fish consumption trend accounting for 36 per cent of global consumption in 1997¹⁵⁹. India and South East Asia accounted only for 11% of the total global consumption¹⁶⁰. The larger questions emerging out are: how far this model could sustain the local fish consumption? What is the guarantee that the fish producers have got adequate fish to consume above all other products? We would be exploring some of these questions in the following chapters.

Most of the developing countries continue to focus on increasing the fish production to increase the export value to meet the consumption needs of the developed countries. Open access to the fishing industry has led to larger scale fishing operations and over fishing. International development efforts have contributed to over capacity of

¹⁵⁴ Stobutzki I.C. et al. (2006): 'Key Issues in Coastal Fisheries in South and South East Asia, outcomes of a regional initiative', Fisheries Research, 78, pp 109-118,

¹⁵⁵ FAO (2005): Review of the State of World Marine Fishery Resources, FAO Fisheries Technical Paper 457, p2, FAO, Rome

¹⁵⁶ Trollvik Trine (2002): The Impact of World Trade Organisation Agreements on Fish Trade, FAO Fisheries Circular No. 977, FAO, Rome p13

¹⁵⁷ Kulkarni Parashar (2005): The Marine Seafood Export Supply Chain in India, International Institute for Sustainable Development, Manitoba, Canada p4

¹⁵⁸ Ibid, p5

¹⁵⁹ International Food Policy Research Institute and World Fish (2003): The Future of Fish- Issues and Trends to 2020 Washington, p2,

¹⁶⁰ Ibid

commercial fisheries and undermining of traditional fishers and, sometimes, to over fishing by small fishers¹⁶¹.

Sustainable development in fisheries is 'protecting all aspects related to fishing' and not just protecting fish-stocks'¹⁶². Given the rising demand for fish products in the developed countries was simultaneously felt with the inability of majority of the oceans of developed countries to have adequate supply, especially of the quality species. This situation encouraged the developing countries to expand their production capacity of their fisheries. The mechanism adopted to increase the fish catch has completely denied the status of marine resources as common property resources and there has been open access for every one who was interested in fishing. In the growth and consumption focused model, conservation of marine resources has never been given due attention. This has considerably affected the marine ecology and there by the social ecology of the fisheries systems¹⁶³.

Conclusion

The studies we reviewed have attempted to understand the relationship between marine ecology and social ecology. Our analysis still raises certain questions: how the ecological changes affect the life and social pattern of the fishing communities? To what extent an ecosystem approach has been adopted in the fisheries context of Kerala. In the following chapters, we try to analyse different dimensions of social ecological changes and the relevance of ecosystem approach to fisheries in the context of Kerala, India

¹⁶¹ . Brown Lester R, et al., Protecting Oceanic Fisheries and Jobs in State of The World, 1995: A World watch Institute report on progress toward a sustainable society, New York, W.W. Norton, PP 21-37.

¹⁶² Charles A (2001): Op Cit p 3

¹⁶³ (Larkin): 1978; Op. Cit