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Ergonomics and environmental sustainability: a case study of raft fisherman activity at Ponta Negra Beach, Natal-RN

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Abstract: This paper aims to present the significance of methods used by the Ergonomic Analysis of Work for the construction of the scenario of craft fishing with rafts, held by 42 fishermen on the beach of Ponta Negra, Natal - RN; and relate the knowledge in ergonomics to environmental aspects / impacts, aiming the sustainability in this activity. This research is characterized as a case study, of the descriptive and exploratory type and of applied nature. To collect data, we used observational methods, in order to expand information about the activity, and interaction, as conversational action and photographic/videos records to clarify points not covered by observation. It was observed problematic as the reduction of fishing productivity, alterations of the sea, difficulty in docking the rafts, and inadequate waste disposal, noting that this activity needs care regarding the use of the environment. The obtained results contributed to the organization of environmental education workshops, seeking to enhance good individual / collective environmental practices focused on the sustainability of the environment in which they live. Add the need for proposals aimed for managing the activity, involving fishermen, institutions and society, to ensure the improvement of the environment, hence the quality of life of the population.

Keywords: Conversational action; Environment, raft fishermen.

1. Introduction

The craft fishing is one that is possible by manual work of the fisherman, it makes use of appliances that do not reach the same levels of industrial fishing productivity and does not cause the same impact on fish stocks with the same intensity (Silva 2004). This type of fishing when performed with rafts is intrinsic to the Northeast of Brazil and, in Rio Grande do Norte, represents 12% of the annual volume of fish (2175 t), according to statistics of the Superintendency of the Brazilian Institute of Environment and Renewable Natural Resources – IBAMA-RN (2008).

Sustainability has been requested in all areas to achieve environmental and socio economic improvements, for this reason it would not be different in the exercise of craft fishing, so this article presents preliminary data from a research about the raft fisherman activity aimed at identifying the main environmental problems inherent in this activity developed at Ponta Negra Beach, Natal-RN. To this end, we used observational methods such as located observations and open mappings, and interactional, as verbalizations, extended listening, and conversational action. Such methods are widely applied for Ergonomic Analysis of Work (WISNER, 1987; GUÈRIN, 2001; VIDAL, 2003; SALDANHA, 2004; CARVALHO, 2005).

In this context, this study is justified by the pursuit of optimizing the working process of the raft fishermen, through knowledge of environmental problems faced for a better management / balanced / sustainable environment, in which the raft fishermen are inserted, in order to achieve improvements in the quality of life of these fishermen and so as in environmental quality of the area.

2. Theoretical reference

2.1 Craft fishing and raft acticity

Craft fishing is one that is made viable sole and exclusively by manual work of the fisherman, being based on knowledge passed by elders of the community, or acquired through interaction with fellow professionals, and always held in small boats powered by oars or sails, without tools to support navigation and use in their fishing operations only experience and knowledge acquired by fishermen (SILVA, 2004).

Craft Fisherman can be defined as those that, in the capture and landing of all kinds of aquatic species, commonly exploit ecological environments located close to shore, because the boat and equipment used for this end have little autonomy, these fisheries commonly employ relatively simple equipment and the product is commercialized, usually through intermediaries.

Currently, there are 390.761 registered craft fishermen in the country, according to results of the National Fishermen's Reregistration and the National Program for the Enhancement of Artisanal Fishermen, conducted by the Special Secretariat of Aquaculture and Fisheries of the Presidency of the Republic. The data show that the division by states, Pará has the largest population of fishermen, with 77.133 (19,74%). Nevertheless, it is in the Northeast that is majority of these workers. The region has the second state in Brazil in number of fishermen, Maranhão, with 45.726 or 11,7% of the total. The Northern Region is the second largest in number of fishermen (117.200 - 30% of total). The Amazon is the second most important fishing state and fifth in North Brazil, with 22,76 thousand fishermen – 5,82%. In the South, Santa Catarina has 24.9 thousand fishermen and Rio Grande do Sul, 16.497 thousand. In the Southeast, the largest number of fishermen is at São Paulo – 16,167 thousand or 4,14%. Rio de Janeiro is the second most important state, with fishermen 13,305 thousand - 3.04% of total ((SEAP, 2006 *apud* CASTRO *et al*, 2008).

To demonstrate the significance of craft fishing carried out whit rafts in Rio Grande do Norte, presents statistical data from the IBAMA-RN, responsible for monitoring of artisanal fisheries in the state. In 1995 fish production coming from rafts was 2958,1 t, 28,86% of the total catch. In 2000 there was a decrease to 1808,6 t (15,46%) and in 2007, the number of fishing rafts was 2175 t, representing 12.09% of total production. These data show that despite a relative decrease between 1995 and 2007, raft fishing production is still quite significant compared to other types of fishing also developed in at RN. It appears that the increase in the total fisheries production of the RN occurred due to the increase in watercrafts of the motor "boat" type, as the statistical bulletins of marine fisheries and estuarine of the RN in the cited years.

Nevertheless, the available data on fisheries in Brazil are usually incomplete and intermittent, as it has been obtained through various methodologies and sometimes without due rigor, most by sampling. This short and / or inconsistent data on fishing at Brazilian reservoirs comes from a culture of non-monitoring, traditional in the country, in addition to errors in obtaining resources and efforts that are repelled from this activity for actions such as storage, control of fishing , among others (AGOSTINHO *et al*, 2007 *apud* CASTRO *et al*, 2008)).

Thus a consistent assessment of the actual situation of fishery resources and achieving a more accurate diagnosis of fishing are impeded, compromising planning and decision-making on the management measures ((AGOSTINHO *et al*, 2007 *apud* CASTRO *et al*, 2008).).

Currently, IBAMA is responsible for the ordering of the fisheries with overexploited resource or threatened by overexploitation (UNIVALI, 2001 *apud* Castro *et al*, 2008), while the species considered not exploited, underexploited and highly migratory are under the responsibility of SEAP, now the Ministry of Fisheries and Aquaculture, for example, the group of tunas and related (CASTRO *et al* 2008).

In the context of artisanal fishery, the rafts activity is inserted. The Brazilian Agricultural Encyclopedia (2004) argues that there are records of rafts in Brazil since the period of colonization, when the native used them for transportation and fishing. The first rafts were made of wooden rollers. From 1940 began to emerge rafts of boards, built in plywood and / or wood. To Cascudo (2002), the raft crew consists of Master, bowman, bow and Counter nozzle tip. The Master is considered the pilot of the raft, for he is responsible for navigation and selection of fishing (fishing spots). The others aid in the fishing activity (CELESTINO *et al* 2009).

According to Oliveira *et al* (2009), this activity demands mental overload, because the fishermen need to have the domain of marine territory and the natural elements that compose it, so that the arrival at the fishing spot is successful.

Note also high physical load, by virtue of performing the activity itself, such as loading and unloading the

boat from the sea and collect and disposal of the networks.

Moreover, the raft activity is affected by the advancement of urbanization, especially that undertaken on beaches, in which the housing boom and the rise of tourism triggered the gradual occupation of floor space used by fishermen to carry out part of their work and the parking of the rafts. A research by Monteiro (2007) calls attention to this problematic. According to him, it is common the struggle for the beach sand space between the fishermen, who keep their rafts there, and koiks owners, street vendors and bathers.

Stori (2000), Repinaldo and Tonini (2007), point out that the waste can cause other damage to fishing as aggressive destination to the environment, beyond the wears of the stock of fishery resources due to problems like overfishing and poor environmental awareness, focused on the importance of the biological cycles of organisms in marine or estuarine ecosystems in the communities dependent on fishing.

E Nevis; Muehe (2008) verify in his research that the coastal area is influenced by oceanic, atmospheric and continental agents, reason why it is particularly sensitive to climate change. Changes in the intensity, spatial distribution or the climatology of winds affect the oceans and coastal water bodies, producing the most significant effects. However there are other forms of interaction between ocean and atmosphere that bring consequences for the biota and some human activities, such as Current vortices of the Brazil influences locally the generation and propagation of waves, as the quality of the masses of water on the continental plataform; temperature differences of air-sea, forming fog, with losses to the operation of airports and coastal shipping; penetration of sea breeze affect materials and structures in the coastal zone.

According to Abdallah Bacha (1999) the variation in the productivity of artisanal fishing grounds in the overexploitation of marine fisheries resource. By studying this exploration, Paez (1993 *apud* ABDALLAH, BACHA 1999) highlights the situation of overfishing for most species of commercial value caught along the Brazilian coast.

2.2 Environmental sustainability in artisanal fisheries

The Organization of the United Nations defines and completes properly Sustainable Development with regard to agriculture and fishing activity, as the management and conservation of the natural resource base, and the orientation of technological and institutional change in order to ensure the continued achievement and satisfaction human needs for the present and future generations. This sustainable development (in agriculture and forestry sectors and cultivation and catching of fish) conserves land, water, plants and animal genetic resources, not degrading the environment, technically appropriate, economically viable and socially acceptable (FAO Fishiers Departament *apud* GESAMP, 2001, p. 04)

Sustainability in the fishing sector requires first that its contents may be broadcast, so we can have an awareness of both the industry and fishing communities that survive from this activity. Incentive policies have been developed in the country with the objective of transferring knowledge to fishermen about sustainable exploitation of fish stocks on the Brazilian coast, as the depletion of those compromise the fishing (CELESTINO *et al*, 2009).

Brazil, a country of continental dimensions, has great wealth in relation to coastal ecosystems, which represents an enormous fishery potential. The vast biodiversity found in the coastal area of Brazil is of utmost importance for the artisanal fishing communities, setting up a dependency relationship, for is the sea that supports the families. However, such communities have been jeopardized by strong pressures mainly related to urban growth and unsustainable industrial fishing. In addition to the pressures, the fisherman himself behaves, even if unconsciously, in order to degrade the work environment, through the capture of rare species or inadequate disposal of solid waste, not realizing that these actions contribute to the eradication of such traditional fishing.

So the idea of sustainability implies the prevalence of the premise that you must set limits to the possibilities of growth and outline a set of initiatives that take into account the existence of relevant social partners and participants and assets through educational practices and a process of informed dialogue, which reinforces a sense of co-responsibility and the formation of ethical values. Thus, the concern for sustainability is the ability to ensure socio-political changes that do not compromise the ecological and social systems that sustain communities (JACOBI, 2003).

2.3 Ergonomics

Ergonomics is a science which focus is the activity of people's work, it presents as object the situation where this occurs and as finality the positive transformation

of the labor system (VIDAL, 2008). Ergonomic Work Analysis (EWA), a methodology widely used for the development of ergonomic studies, set up a structured set of mutually complementary analysis of the determinants of people's activities in an organization. Are quantitative and qualitative analysis that allows description and interpretation of what happens in reality of focused activity. These are engendered by selected demand that originate ergonomic actions and allow, right from the initial clarification of demands, to define the nature of the problem (VIDAL, 2002, p.145).

The EWA discussed by Wisner (1987), Guèrin (2001), Vidal (2008), Saldanha (2004) and Carvalho (2005) makes it possible to analyze a given work activity, more closely, the scenario in which it performs as well the actors involved, offering understanding of the real activity, as indeed it is. In this context, ergonomics emerged as a transforming agent in order to promote adjustments in the raft fisherman activity, contributing to quality of life of fishermen and fish productivity.

For the efficient application of methods in ergonomics it is essential to build a social device (Vidal, 2008), which consists of a participatory action framework, technical and management. According to Saldanha (2004), the Social Construction is made up of individuals that participate in the gathering of information, which allows the knowledge about the activity, ensuring the success of ergonomics action.

3 Methodology

This paper is characterized as a case study, a descriptive and exploratory type (Gil, 1991) and applied nature (Silva and Menezes, 2001), in which artisanal fishing with rafts has been described according to the investigated reality, and its set of features widely exploited in order to identify their problematic and then suggest actions for improvement.

The global methods of analysis used by the EWA are divided into observational and interactional. The observational studies are intended to know a little more the work situation by lifting techniques and on-site observation - expansion of the information about a particular activity (VIDAL, 2008). The observational methods are subdivided further into global assessment (indicates situations in which demand on ergonomic is fit to instruct) and preliminary studies, both provide the structuring of the data collected on the activity in the studied area, allowing a better view of the possible demands.

Because observational methods do not allow interaction with the subject under review, the interactional methods are applicable, which consist of interactions directed by the researcher with the workers. This sets up a series of questions (closed structures) which are added to the collection of verbalized purposes considered relevant (open structures), as discussed by Vidal (2002). These methods are commonly applied in order to clarify points not covered by observation, or which, the record has left margins of quês

The conversational action consists of a interactions-oriented device, built in a methodical and systematic way in order to assist in gathering information on the work activity which is being studied (VIDAL, BONFATTI and CARVÃO, 2002).

Vidal (2008) argues that one of the interactional methods more used in ergonomic studies are conversational actions in order to investigate what problems are inherent to a particular activity based on the worker's own vision, and you can bring out a set of information that can not be observed, at the same time is possible to discuss issues not previously observed by him. In conversational action, the researcher may ask certain questions deepening details that seem to the worker with little or no importance, but which may be critical to the understanding of the facts and the context in which they operate.

As advocates Saldanha (2004) the technique of conversational action, does not have the purpose of the interview (in the sense of questions and answers), following an order, but has the intention to allow the interviewee to speak with some freedom, being buoyed by the interviewer in one direction. Are the subjective aspects involved in the activity that this technique allows to make explicit, it is possible to construct scenarios of the activity of interest.

The direction of the respondent can be guided with the development of the dynamic script, also called chat script, as recommended Vidal (2001) *apud* Saldanha (2004) highlights that it is one instrument used in the sense to engage in a "conversation with purpose", allowing to expand and deepen communication.

3.1 Application of the methodology in case study

In this research, an analysis of the work activity of artisanal fishing with rafts on the beach of Ponta Negra developed, together with identifying environmental

problems faced by this activity. It began in December 2008 with a sample of 42 raft fishermen. To collect data we used observational methods (open mappings, observations located) and interactive (conversational action) as well as photographic and video records.

The observational methods were used mainly to analyze the site with a gaze focused on the development of activity and the problems encountered regarding the environment. However, with the application of conversational action (figure 01) was made possible a better understanding of the reality experienced by these workers, since they were heard about the performance of their activity and ordinary environmental problems their everyday. And, as recommended by Bonfatti (2004), from conversations with members of a natural formation will emerge the meanings of their routines.

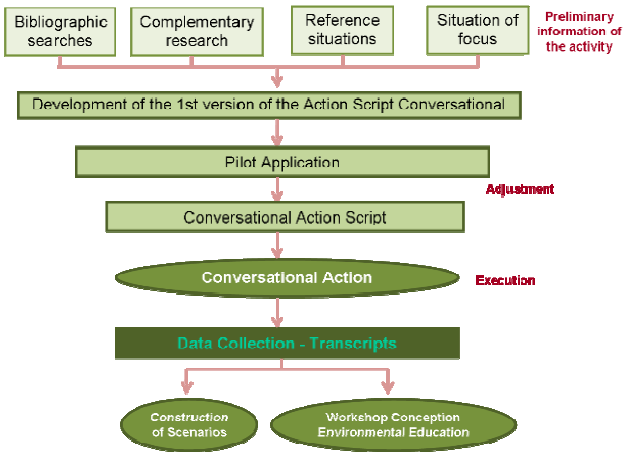

Figure 1: Steps of Conversational Action adapted from Saldanha (2004, p. 155).

According Bonfatti (2003, seminar notes *apud* SALDANHA, 2004, p. 154), so that a conversation between two or more people can sustain is needed: to share a common minimum base of knowledge, management of language; cultural engagement; domain of social situations, creating emotional bonds and even the use of expedients of humor.

Thus, with a view to implementing the dynamic script for conversational action literature searches were carried out on the artisanal fishing, environmental pressures exerted by society and those caused by this activity, additional research in the institutions related to fishing activity, global analysis of two reference situations and global analysis of the situation in focus. The overall analysis corresponds to a macro examination of the work activity, essential to clarify the issues, as discussed by Vidal (2008). The reference situation consists in work situations that present characteristics similar to those of the location set for in them to observe the actual variability and strategies employed to address them DANIELLOU (2002). Thus, the global analysis, allowed us to know the problems faced by workers in this activity, both in reference situations in urban beaches as in the situation of focus, which allows the reality to get closer to the real problems existing in the activity studied.

From the preliminary information of the activity we elaborated the first version of the script of conversational action, which had its pilot application on July 17, 2009. This required adjustments, because in the course of its implementation were other points that could also be addressed to strengthen the environmental pressures experienced in the development of the activity.

After the necessary adjustments, began the implementation of conversational actions with the raft fishermen in August 2009, which extended to March 2010. In this case, the sample was restricted to 50% (21 raft fishermen), and 13 of these consultations undertaken in the homes of fishermen and 8 in the workplace. These were recorded with the aid of a MP4 brand Player Mobile, as well as the speeches were written and the meanings of intonations and facial expressions. After completion of each conversational action applied to the workers, we developed a transcript of the audio, allowing you to reach important information for the construction of knowledge about the activity under review.

The transcripts and tabulation of data, through the inclusion of comments matrices, allowed the construction of scenarios, both activity raft fisherman, and the environmental reality as experienced by its workers. In addition to the design of an environmental education workshop, from the information from the transcripts.

4 Results and discussion

4.1 Construction of the activity raft fisherman scenario in Ponta Negra

The raft fisherman activity on the beach of Ponta Negra is developed by 42 males fishermen, predominant age group from 41 to 50 years incomplete primary education and family setting from 3 to 7 children. Of the total sample, 69% said they do or ever have had any activity alongside fishing in order to

supplement their income, since the vast majority (60%) have family income below the poverty.

Some local fishermen have a license for fishing lobster and receive a minimum wage during the closed season (December to May). For licensed raft fishermen, the amount received during this period supplements the family income, which is used not only the survival of the fishermen, but also for the purchase of necessary equipment and maintenance of fishing raft.

All the raft fishermen surveyed reside in the village of Ponta Negra located approximately 1,500 meters from the beach studied. Of these, 92.9% own their homes of masonry with access to electricity.

The rafts used on the beach in the study are a kind of craft boat built in plywood and wood-powered candle and/or motor, measuring 3 to 5 m long by 1,4 to 1,7 m wide. Usually this boat accommodates two to three crew members (teacher and helpers) that perform different functions.

The process of commercialization of the fish can be made directly to the consumer or indirectly, transferring the fish to the middleman or dealer, which sells and only pay the raft fishermen on weekends. According to the fishermen, the amount of monthly income varies with the volume of fish, number of raft fishermen, type of fish caught and climatic conditions, as the fisherman says: *"The fishing harder every day, there are differences from de fishing of the old days to today", "the fish is deducted".*

4.2 Construction of the raft fisherman activity in the environmental scenario at Ponta Negra Beach

The device of conversational action, in addition to observational methods, enabled a greater interaction with raft fishermen at the beach of Ponta Negra. During the conversational action, most raft fishermen felt confident to discuss the various aspects of their work activity, and their views respected unconditionally, due to the process of building reputation and trust developed during the technical visits to the study area . Thus, from the application of techniques, the work done with the raft fishermen brought important information about real activity and the natural and built environment, in which they are inserted.

Thus, it was established problems in the activity, some of them identified in the global analysis performed both in reference situations, such as in focus, and others have arisen in the development of conversational actions, and the main are: reduction in fishing productivity, supported by discussions Abdallah and Bacha (1999), and Stori (2000), Repinaldo and Tonini (2007) that advocate that the damage of the stock of fishery resources, changes in the sea, as studies Nevis Muehe (2007); difficulty for the docking of the rafts (bars and restaurants that dispose their chairs and parasols) recommended by Monteiro (2007), pollution in the workplace (improper disposal of waste at sea and onshore - sewage *in natura*), also verified by Stori (2000), Repinaldo and Tonini (2007). Such problems were found, through the transcripts of the audios of conversational actions applied. The diagram (Figure 04) below shows a few lines of raft fishermen, which denote the problems mentioned above.

Environmental Issues / Impacts
Reduction of fishing productivity
"It's his fault" (the fisherman reporting that fisherman is also blamed for the reduction in productivity). *"When fish die in the network, they get rotten and push away the rest" "The fisherman is poorer because he wants to" "The fisherman puts the network at nine hours, has to pick it up at midnight, otherwise it (the fish) spoils "*(J12 - master). *"In the old days you fish with a fish net, with ideal mesh, today, everyone is catching the small fish, how will the fish grow, right? I put today, I'm taking already these networks because I'm realizing they're getting a huge embezzlement "*(J22 - master).
Changes at sea
"What I see a lot these days e the sea tide. In the old days the sea was good to. Now a days, if you catch bad weather, you see a bad week, good week" (J3 – master). *"There is a lot of difference, because in the old days, the sea was gentle, we could see. December, January and February were the months of angry sea. But not today, now it's angry sea almost every month, understand?"* (J22 – master).
Difficulty for the docking of the rafts
"Yeah, were splitting our space with, not much the owner of the kiosks because he doesn't affect us with nothing, because it's on top of the boardwalk; it's those people that come with the cart selling bear, soda... Then the space of the fisherman's being taken over by street vendor." (J1 – master). *"That's it, don't even say that we don't have, if you were here in January, December you will see what is destruction on this shore, see? By the tide that comes, there will be destruction. Nobody has, no spot. The hotels, the kiosk man don't let, they've taken over, and it was a fishmen area.* (J22 – master).

Pollution in the work environment
"We through the paper out there, bring it back for what?" "We through the paper out there, the tide take it away" (J12 – master).
"The pollution in the sea is like I'm telling you. I see it. We see many plastic bags, margarine cover, styrofoam, we see a lot of stuff in the water. " (J10 –master).

Figure 04: Diagram of a few lines about the raft fishermen during the conversational actions on environmental issues.

When you engage in conversational action on such issues there is the fact that the raft fisherman activity needs care regarding the use of the environment, as according to the speeches of raft fishermen, it was found that, as they pressure on the environment in which they carry out their labor as they are under pressure in the activity due to of urban growth, tourism, or society itself.

The said speeches of raft fishermen, obtained through the transcripts of conversational actions contributed to the organization of future environmental education workshops in order to clarify about the environmental balance, indispensable for the proper conduct of this activity, highlighting good collective and individual environmental practices focused on the sustainability of the environment in which they are inserted, so as to draw together the guidelines that are necessary to improve the activity raft fisherman quite fragile today.

5. Concluding remarks

The methodology used in this study contributed to the construction of the raft fisherman activity and environmental situation scenario, highlighting some environmental problems caused by the fishermen as well as those exercised by society. Contact with the raft fishermen, reached through the observational and the interactional methods used by the EWA, effectively allowed to know the reality experienced in daily life of workers, which promoted discussion according to Bonfatti (2003) *apud* Saldanha (2004) the management of language, cultural involvement; domain of social situations, creating emotional bonds and therefore the approach and understanding of the experiences of the raft fisherman population.

From this research, we conclude that the main environmental problems of the raft fishrman activity on the beach of Ponta Negra are related to reduction of fishing productivity; the changes in the sea, the difficulties in carrying out the parking of the rafts, in addition, pollution in the work environment, which were confirmed by discussions of literature searches.

Thus, we concluded the need of development of proposals for actions aimed on reducing the problems encountered, in this case, such information enables the design of environmental education workshops to seek alternatives that apply to the problems faced by raft fishermen, so these are the agents modifying their environment, seeking to ensure the improvement in their life quality and preservation of its characteristics, in pursuit of sustainable activity.

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