Francisco Alves dos Reis Junior

THE RISKS OF USING COMPRESSORS IN LOBSTER FISHING

Introduction

Lobster fishing is an important activity and lobsters are a principal export of several Brazilian states, especially in the northeastern region. Although the activity is of great economic and social importance in a number of places, "fishing with compressors", has caused a high number of fatal and incapacitating work accidents among divers.

When traveling through the lobster fishing communities on the coast of Rio Grande do Norte State, it is common to find paraplegic fishermen or to hear about accidents and deaths resulting from diving using compressors. It is worrying that more and more people appear to be getting into this activity after the end of each closed season, (an annual period when lobster fishing is prohibited along the whole Brazilian coastline), despite the high risks and the evident depletion of lobster stocks. The various public agencies involved with this illegal activity do little or nothing to change this reality in spite of widespread public awareness of the problem that has led to articles in the press. Divers continue to be at risk as public officials continue to perpetuate negligence and omission and the public watches on passively. While accidents and deaths in this predominantly craft activity continue to proliferate, the figures are excluded from official statistics.

This chapter aims to show the severity of the problems arising from the use of compressors for lobster fishing. The chapter describes the path taken by the Ministry of Labor and Employment OSH inspectorate after the problem was recognized, revealing a situation where the limits of inspectorate functions are not clear. The main factors that produce accidents are analyzed to encourage debate and recommendations about priorities for the OSH inspectorate.

Information for the analysis was obtained in a number of ways, using a variety of methodologies, over a three-year period of contact and work with communities using compressors when diving for lobster fishing.

Intervention by the OSH inspectorate

In the year 2000, the Regional Work Delegation (DRT) of the Ministry of Labor and Employment, started planning the "National Campaign for the Prevention of Work Accidents", (CANPAT), in the State of Rio Grande do Norte. Their first task was to find statistical data and information about work accidents from official databases and through exchanges of information between inspectors. Official data gave the impression that all was well with a minimal number of fatal or disabling accidents that were not concentrated in any particular activity. However, information obtained informally gave another picture; occasional reports indicated that the use of compressed air in lobster fishing was leading to large number of accidents, including fatal accidents.

A reconnaissance visit to a community using compressors for lobster fishing as their main activity was arranged by the DRT and the local mayor. The fishermen received these visitors with open arms and described their work, its risks and equipment. Victims of accidents that had caused paralysis, (paraplegias), and other irreversible injuries, especially to the nervous
system, were interviewed. The first impressions were: lobster fishing using compressed air was a high risk activity, many people had died or suffered serious irreversible injuries as a consequence, and the fishermen wanted to change the situation. The high price paid to fisherman for a kilogram of lobster tail, R$60.00, (US$20.00), was undoubtedly the reason why the activity attracted so many fishermen. The quantity of lobsters caught had been decreasing over the years. State intervention had no credibility in the eyes of the fishermen as they saw it as playing a purely punitive role so this forced the civil servants participating in the project to show that the state was able to play other roles.

The second step was the identification of the localities and techniques employed for fishing, followed by bibliographical and other relevant research. Five lobster fishing localities were visited and it was decided that medical doctors, who acted as inspectors in the state’s OSH inspectorate, would use questionnaires in three of them. Given the lack of any statistical data about work accidents, a primary goal was to assess the importance of the problem, as well as increasing understanding of the activity through descriptions of accidents and their consequences.

The research process

A total of 125 questionnaires were applied to divers from three different lobster fishing locations in Rio de Fogo, Zumbi and Caiçara do Norte. The localities were chosen because of the interest of local fishermen in the research. In addition to information about the number of accidents, the questionnaires sought to gather data about the causes of accidents, the depth at which they occurred, the age of victims and length of time they had been working in the activity. Completion of the research was difficult for two reasons, the frequency of the fishermen’s voyages and the absence of precise information originally sought (e.g. researchers were unable to precisely calculate the number of divers in each community). In addition, analysis was difficult because of the large number, variety and inaccuracies about the number of accidents reported by the divers. Problems also resulted from confusing descriptions of accidents, due to reliance on people’s memories. It is important to note that 86% of the divers interviewed, (105), reported that they had suffered at least one lost time accident, (and often five, six, or more), and that most of these were due to alterations in pressure during diving.

The search for alternative sources of information proved worthwhile, and revealed two important facts. Firstly, a number of high quality monographic studies and other written work on lobster fishing already existed. A second revelation was the fact that while a large number of government agencies had responsibilities related to this activity they all lacked structure, staff, policy priorities and organized sources of data on the subject. This portrait of disorder, together with the lack of policies and priorities for the whole fishing sector, became clear after consideration of the number of agencies that had been created and disbanded throughout the years. In addition, there had been frequent changes to the government body responsible for control of the sector.

The state’s Health Secretariat was approached in an attempt to find better quality data. It was thought that examination of the causes of death of fishermen, as recorded on death certificates, would make it possible to calculate their fatal accident rates. Death certificate

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7 The questionnaires were administered with by Maria José Alves and Lis B. Cunha Coutinho.
data has been computerized since 1985, however, in spite of the importance of fishing, fishermen were only included as an occupational category for the registration of fatal work accidents from 1999 onwards. In the two years (1999 and 2000), for which statistics for “frequency by occupation and year of death” and “death from drowning” included fishermen, the numbers of “deaths from drowning and from accidental submersion” were 2 and 10 cases respectively. There is no precise calculation of the number of lobster divers in Rio Grande do Norte, and we know that not every death from lobster fishing with compressors is registered as a “death from drowning and accidental submersion.” As a result of conversations with leaders from the lobster fishing communities, we estimated that about 700 divers worked over the 1999-2000 period, which would mean a mortality rate of at least 3 and 13 per 1000 divers, per year, in those two years. In comparison, the work accident mortality rate in the construction sector in the state was 0.4 per thousand in 2002, one of the highest mortality rates in the last 10 years (AEPS, 2002).

Based on the memory of interviewees, communities in Zumbi and Rio de Fogo supplied the names and year of death for those who had perished diving for lobsters. Between 1975 and 2000, 9 people had died in each of these communities. In the Zumbi community, researchers were also informed of the names and addresses of another 46 individuals who, over the same period, suffered disabling injuries of such severity that they were forced to abandon diving. When we examine data related to these two communities alone, (there are thirty two such communities in the state), and consider that twelve fishermen’s deaths had been officially defined as due to “drowning and accidental submersions” over a two year period, the probable size of the problem come into focus. (N.B. the cause of death does not appear to have been precisely defined, however.) It should also be noted that lobster fishing, particularly diving using compressors, occurs along much of Brazil’s 8,000 kilometer long coastline, principally in the northeastern region.

Recognizing that this is a very serious problem, what can be done about it? Given the size of the problem and the social repercussions of any possible intervention, it was understood that no measures could be taken without the participation of the fishermen and their communities. Two strategies for action were defined: the development of a “collective work analysis” (CWA) with the fishermen, and a wide-ranging discussion of the problem with all the institutions and actors involved.

CWA is a research technique which seeks to understand work from the worker's perspective, or more precisely, on the basis of the worker's perspective. A group of workers is invited to participate spontaneously in a meeting, (that may be recorded with the consent of the group), where participants talk about what they do when they work so that researchers can better understand the situation through the collective experience and knowledge of workers. This process also allows workers to be ‘owners’ of knowledge and speech and to have a possibility to externalize their knowledge and to develop a better understanding of their activity and what it represents for their lives - they can transform and can be transformed at the same time. This exchange is important because workers start to develop and cement new ideas, question deeply held beliefs, and consequently change behavior and actions.

The project was elaborated and developed by myself (author of this article), together with two researchers from FUNDACENTRO, Leda Leal Ferreira and Sandra Donatelli and results will be published as a book. Research also relied upon the support and involvement of fishermen from Zumbi and Rio de Fogo. A total of five meetings were held, all audio taped. Three initial meetings were held with about twenty five lobster fishermen and boat owners, followed by
two meetings where the ideas were returned to the participants (an important component of the research technique). Overall, about eighty people participated, and the material that had been developed was presented to the participants before writing the final version of the report. The aim was not only to discuss and clarify the draft, but also to seek suggestions and agreement for the final report, and to ensure that the participant’s history and work were adequately represented.

The focus of discussion widened as CWA began. The main government bodies involved in the activity was identified and, after initial contact with the body that oversees harbors (‘Capitania dos Portos’, part of the Brazilian Navy), a first meeting was scheduled to discuss the problem. The Public Prosecutor’s Office for Work-related Issues, the Federal Government’s Nature Conservation Agency (IBAMA), the Federal University of Rio Grande do Norte (UFRN) and the Agriculture Ministry also attended. Later, the fishing communities, represented by the Rio Grande do Norte Fishermen’s Federation, were included. The State Fisheries Committee was resuscitated, coordinated by the state government’s Agriculture Department, in order to study proposals and discuss solutions. New partners were invited including the Association of Fishing Enterprises in the State of Rio Grande do Norte; the Rio Grande do Norte Association of Fisheries Engineers, the State Legislative Assembly and, occasionally, other public agencies or civil entities. The regular schedule of meetings was occasionally interrupted. A government agency interrupted the process by engaging in a highly visible action, seizing compressors and illegal equipment. While this was ineffective and only had a short-term effect, it triggered actions and political pressure from fishermen. Since then discussions have stopped and there is little chance of progress.

While the fishermen from poorly resourced fishing communities are organized, they work in fragmented groups, have no leadership training and have "questionable” representatives. There are ‘lifetime leaders’ in almost all the State Fishing Federations. (Federations charged with organizing different professions at the State level were institutionalized as a part of the official corporatist union structure set up by President Getúlio Vargas.) These lifetime leaders were not originally involved with fishing activity, and seem to be more worried about their personal agendas and keeping their jobs than about organizing and contributing positively to the structure of the fishing sector. Although the fishing companies talk about good intentions, they continue to make money from the disorganization and undercapitalization of the fishermen. They determine prices through buyer networks, purchase lobsters when the season is closed and buy under-sized lobsters which increases competitiveness and rivalry among fishermen and make little or no contribution to the preservation of lobster stocks. The government is generally represented in the State Fisheries Committee by agencies that lack adequate staffing, are poorly structured, have no decision-making power and which continue to operate without a policy for craft fishing. The consequences from this state of affairs are worsened by the fact that the fishermen lack political representation.

**The activity of lobster fishing**

**History**

Between 1967 and 1977, important developments occurred in companies and industrial activities involving fishing, thanks to a policy based mainly on tax exemptions for the whole fishing industry. While these measures accelerated the development of industrial fishing, craft fishing – which occurs where fishing activity is not carried out by capitalist companies -
continued to survive without benefits or policies to help it develop and grow. The policy aimed to increase production and productivity, but neither research nor planning to determine sustainable maximum fishing levels for various species was carried out prior to implementation. In many cases, this led to over fishing and biological implications for fishing resources.

The process was no different in the case of the lobster. Industrial scale fishing began in the 1950s, albeit in a modest way, and gradual growth began only in the second half of the 1960s, caused mainly by the structuring of the sector, the introduction of a range of fishing methods and growth itself. A gradual decline in stocks and decreased productivity resulted. This fact, associated with the end of tax incentives to industrial fishing activities in 1977, led to rising production costs and resulted in several companies closing and withdrawing from fishing activity. These companies went from being producers to buyers, maintaining their processing and commercialization activities, principally aimed at overseas markets. They stimulated and financed lobster fishing by the craft sector. This period coincided with increasing activity involving diving and the use of compressors, especially in Rio Grande do Norte, that resulted in greater productivity and lower costs than the more traditional use of lobster pots and related methods. From this point onwards there was continual growth in lobster fishing using compressors.

The workgroup

The workgroup is generally made up of five people: two divers, two hose handlers and a master. The master’s job is to sail the vessel to places where lobsters are to be found. He is also responsible for the boat and coordinates the crew’s work so is in fact in charge of the boat’s operation. He must also ensure that the boat motor is always running for should it stop during a dive, the lives of divers will be endangered due to lack of air supply.

Hose handlers look after the hoses and the divers’ air supply. Incidents such as those caused by hose blowout, breaking of a transmission belt, a hose being cut by their boat’s propeller (or by that of another boat), all require urgent reactions by hose handlers. If hose handlers do not rapidly correct problems caused by accidents such as those described above, the quantity of air contained in the reservoir is usually insufficient to continue a dive forcing divers to return to the surface without adequate decompression. This results in the high morbidity and mortality rates found among divers.

The equipment

There must be a supply of compressed air for a diver. The compressor is hooked up to the boat’s motor by a transmission belt. A small hose carries the compressed air to a cylinder, (like those used for gas cooking), that acts as a holding tank. Although the cylinder is small, it stores the air, plays a role in separating out impurities, and helps stabilize the gusts of air that the compressor produces. A reserve supply should be sufficient to guarantee the diver’s safe return to the surface in cases of emergency. The cylinder’s small size, however, means that supply of reserve air is insufficient to permit the necessary time for decompression. The cylinder’s original valve is adapted so the air goes through a filter to reach a bifurcated nylon hose through which the air flows to the divers. The divers breathe through a mouthpiece connected to a valve, and this is used to regulate the air pressure necessary for breathing. In general, the capacity of the compressors is insufficient to maintain two divers working
simultaneously at greater depths. Other equipment includes fins, masks, weight belts and sometimes gloves to protect hands from lobster thorns.

Usually the equipment used is not adequate for the task; equipment is mainly improvised and most often used for much longer periods than is desirable to guarantee their quality. For the reasons previously outlined, hoses are probably the biggest cause of equipment accidents but, the lack of maintenance of motors, cylinders and compressors, as well as the time required to change filters, are also factors which contribute to increased risks. Due to its proximity to the compressor, there is a risk that carbon monoxide emitted by the boat’s motor through the exhaust pipe can enter into the air supply causing intoxication.

**Working hours**

The length of the fishing day varies according to the size of the boat. In general, the working week starts on Monday or Tuesday at 5-7am and finishes at 4-5pm each day. When news spreads that there are lobsters in other regions, it is common for the boats to travel for longer periods, which generally results in 5-7 days being spent at sea. Fishing always takes place during daytime.

**Working schedules, compression and decompressions**

One of the greatest risks for divers is accidents caused by direct and indirect effects of pressure. Barotraumas, traumatic clots caused by air, narcosis, CO and CO₂ intoxications and, loss of consciousness are the main decompression illnesses. Divers talk about decompression illnesses with the clarity of those who recognize such events as part of their day-to-day lives. They also point out the negative consequences of the excessive effort that occurs during diving and are very familiar with the effects of rapid returns to the surface without the necessary decompression. However, there are more urgent items on their agenda, namely competition for lobsters and the search for profit. Whenever a colony of lobsters is discovered, people fish until they are totally depleted. Faced with such powerful forces, fishermen do not even remotely consider safety awareness and common sense as goals.

The shortage of lobsters has contributed to pushing divers to go to ever greater depths. Even though the vast majority of them descend no further than 30-35 meters, it is becoming increasingly common to hear reports of dives of up to 80 meters, where only nitrogen is used. When diving with compressed air, the maximum depth should be around 30 meters. Because of the effects of narcosis, nitrogen should be substituted by helium mixed with oxygen (heliox) for dives of 50 meters or more.

The schedule of dives can increase the seriousness of the situation. Each diver should not go down more than once or twice a day, and all dives should be followed by adequate rest periods. In reality, we found that divers are doing more than 10 dives daily, driven by the need to catch lobsters, not by safety concerns. The ideal period for each dive is also exceeded. Time should be inversely proportional to depth, in other words, the higher the pressure at a particular depth the shorter the dive should last but, once again, the determining factor is the discovery of lobster populations and the glimmer of profit.
When a diver shows symptoms of the bends, he frequently returns to the depth he was at on an earlier dive and rises slowly, taking rest spells, to guarantee decompression. Sometimes, the diver is accompanied for part of the time by a second diver. The time spent to surface appears to be random and based upon notions acquired from decompression tables and individual experience. Various cases were described where such a procedure lasted into the night because an accident occurred in the late afternoon. All the divers who have gone through such an ordeal, talk of the fear they experienced when they were alone in the dark sea, lacking resources to protect themselves and with little notion of time. Communities respect this experience. While the technique described above has not been scientifically validated, it sometimes results in a reduction of the symptoms; however, it possibly does not reduce the cause of the symptoms.

Work relations and competition between divers

The day-to-day lives of fishermen are made up of comradeship, friendship and loyalty as well as lack of unity, disagreements and competition. The communities and other institutions that represent their interests, provide a portrait of the organizational difficulties and distrust that predominates.

Once at sea the situation worsens because the lobster fishing regions are well known and are public places so several boats frequently fish in the same area. Each boat observes the others and when signs suggest that lobsters have been found nearby, boats move to the same area, and their divers compete. On such occasions accidents can be caused by the knotting of air-hoses, by propellers cutting through hoses or through misunderstandings. The dynamics set into motion by the mere discovery of lobsters leads to the need for faster action and greater efforts by those who have made the discovery. In other words, the faster fishermen work to catch the lobsters, the less they leave for their competitors and the greater their total catch. The consequence of excessive effort over a short period of time, sometimes accompanied by the need for repeated dives, increases the risks, particularly due to the bends, (when divers return rapidly to the surface without respecting time limits), and exhaustion. In such circumstances, fatigue, respiratory difficulties and mental confusion occur. Fatalities also occur.

The combination of reduced stocks and increased fishing has led to more intense competition. New workers are motivated to become lobster fishermen because of the high market value of the product and because of the lack of work opportunities in these locations. It is a game of good luck, bad luck and illusion. Fifteen or twenty years ago a good catch could yield up to 300 or 400 kilograms of lobster. Today there are periods when a whole month is spent without catching anything or just 3-4 kilograms. "Good" catches, of 70-80 kilograms, are increasingly rare, but the fishermen continue to live for these times, spending the rest of the year in debt, without a stable income.

Risk perception

We interviewed a boat’s crew two days after a fatal accident, which occurred during a dive. All four remaining crew members were relatives of the victim but when asked about the accident and the risks of their work they said that car accidents kill many more people than diving accidents. They said they were aware of the risks but did not consider that these were very different to those of other jobs.
Through discussions with other divers we realized that risks are well known, but are minimized both individually and collectively. Divers also expressed no intention of delaying their return to the surface or of reducing the number of dives per day although such actions would serve as important safety measures. While they recognize the foolhardiness of deep dives, of rapid decompression, of excessive work and of daily diving, they see themselves as being protected because of their experience and their familiarity with the activity, factors considered more important than the risks. Divers also believe that serious accidents are never going to happen to them. During interviews, several former divers, no longer able to work because of irreversible injuries, spoke of how they were once impetuous and efficient divers.

Work and the worker: The focus of the OSH inspectorate

A major doubt that permeated the development of our preventive actions concerned the responsibilities of the Ministry of Labor’s OSH Inspectorate. Is it the responsibility of the OSH Inspectorate to intervene in a sector where craft and informal work predominate? Should this sector be a priority?

The line between formal and informal work appears to be tenuous in this activity so, questions arise as to whether incorporation of lobster fishermen into the formal sector should be a possibility worthy of discussion. Would incorporation solve or reduce the problems observed in this dangerous and illegal activity?

The OSH Inspectorate represents the state. The world is changing, and so are all types of workers and work. It is evident that the Ministry of Labor has been keeping up with these changes, for example, by proposals for new, innovative regulations for rural work which includes specific responsibilities for family-based agriculture. Brazilian society appears to favor this commitment and direction. During the CANPAT ("National Campaign for the Prevention of Work Accidents"), both formal and informal workers, particularly in rural areas, participated in activities and education. Recently settled rural workers as well as registered urban workers, have participated in campaign activities in Rio Grande do Norte with encouraging results. There is a direction which is becoming a priority, i.e. one which views the worker and their work as inseparable. This direction has been supported by leaders from a range of organizations and agencies, at various levels, throughout the period of interaction with the fishermen. Any actions and interventions conducted by the OSH Inspectorate should be analyzed within a specific context and social reality as certain realities cannot be excluded from planning and decision-making processes. The primary objective is to prevent death and accidents in all kinds of work, in both the formal and informal labor markets. The principal question is the establishment of priorities for safety and health.

Conclusions

At the beginning of 2001, during a meeting of the Rio Grande do Norte OSH Inspectorate, the fishermen, represented by the presidents of the communities, agreed to stop diving for lobsters using compressors. However, they wanted to have options for alternative sources of work and income. They suggested retraining and qualification programs and the development of finance programs to permit the purchase of larger boats and new equipment. In June 2002, during the
State Fisheries Committee meeting, the state’s Fishermen's Federation presented a list of demands that included the banning of lobster fishing with the compressors from December 2002 onwards. Their one condition was that special finance credits were to be made available. As an exceptional measure, they also suggested a year long ban on lobster fishing to allowing stocks to rebuild but wanted to receive unemployment insurance over the period as compensation.

A proposal was made to the fishing committee, principally by the state OSH Inspectorate and the Federal University (UFRN). The proposal included retraining and qualifying the fishermen, a policy for financing the purchase of new boats and equipment, and modification of the illegal techniques used currently. Initiatives such as these would have to be accompanied by the adoption of measures already being contemplated by the fishermen, i.e. limitation of the lobster fishing fleet, a temporary increase in the period during which fishing is prohibited, and a transfer of some fishermen to other activities.

Developing a solution for the problem is difficult and there are no quick and ready-made solutions. In Rio Grande do Norte state over 20,000 people and many communities are directly or indirectly involved. Any decisions must rely on both the participation of the diverse actors involved, and on the mobilization of civil society; a solution would also require the support of several public agencies. In addition, the rapid decline in lobster stocks over the last few years must be taken into account as this depletion has been caused by over-fishing. Presently the lobster boat fleet is larger than is necessary to ensure sustainable fishing which currently makes legally permitted fishing activities financially ruinous. The only certainty that exists is that something must be done as the fishing communities cannot continue to pay the price of divers' lives and health because of the omission of public authorities and wider society. The Labor Ministry's OSH Inspectorate is not the main protagonist in this story but it can have a role in revealing the seriousness of the situation, and can bring together all the actors involved in an effort to transform reality and prevent accidents and death at work.