



Ergonomics applied to aquaculture: A case study of postural risk analysis in the manual harvesting of cultivated mussels



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ABSTRACT

The aim of this study was to evaluate the risk of Work-related Musculoskeletal Disorders (WRMD) in the manual harvesting of cultivated mussels. The Ovako Working Posture Analysis System (OWAS) was applied during operations of sea withdrawal and disaggregation of mussels, which are considered as the most difficult ones of the harvest process adopted in the State of Santa Catarina, southern Brazil. On average, 35 work positions were identified during the removal of mussels from the sea and 28 postures during mussels' disaggregation. During sea withdrawal, 74.4% of the positions were classified as harmful to the workers' musculoskeletal system, requiring immediate or short-term interventions in the workplace. During mussels' disaggregation, the percentage was of 69%. Besides pointing out the risks of musculoskeletal injuries to which workers are subject, the research allowed identifying which labor positions should be avoided and how avoiding them to eliminate such risks.

1. Introduction

Aquaculture has undergone significant development in the last decades (FAO, 2016). However, the sector has received little attention about workers' health and safety (Cole et al., 2009; Myers, 2010). Drowning, electrocution, crushing, poisoning, head injuries, traumas caused by stumbling, slipping and falling, strains, twists, burns, chemical intoxication, cuts and perforations, exposure to low temperatures, noise and solar radiation, bacterial and parasitic infections, and musculoskeletal disorders are examples of fatal and nonfatal occurrences reported in aquaculture (Cole et al., 2009; Guertler et al., 2016; Mitchell, 2002; Moreau and Neis, 2009; Myers, 2010).

Work-related musculoskeletal disorders (WRMD) are the largest occupational risk factors worldwide (Lee and Han, 2013). It is one of the most dangerous consequences of musculoskeletal system overload caused by improper work postures (Bosch et al., 2007; Roman-Liu, 2014; Van Nieuwenhuysse et al., 2006). Direct and indirect costs of occupational injuries and WRMD correspond to 4% of the world's Gross Domestic Product (GDP) (ILO, 2013). In the European Union, these costs are of 145 billion euros per year (ILO, 2013). In the United States,

workers' compensation for WRMD varies from 15 to 20 billion dollars a year (Otto and Scholl, 2011). Such disorders accounted for one-third of all work leaves caused by registered non-fatal occupational diseases. Then, agricultural, forestry, fishing and hunting workers accounted for 41.9% of reported cases (Bureau of Labor Statistics, 2013). It is still difficult to obtain systematic data records regarding WRMD in Brazil and other Latin American countries (Coury, 2005; Piedrahita, 2006). In general, these disorders are recorded as work-related injuries or occupational diseases (Coury, 1999). According to the Brazilian Ministry of Social Security, work-related injuries costs totaled R\$ 70 billion in 2012 (equivalent to US\$ 36.8 billion), and in this context, WRMD and repetitive strain injuries (RSI) were reported as the second leading cause of such incidents (Brazil, 2012).

WRMD is a set of diseases that affect muscles, tendons, nerves and vessels of upper and lower limbs, and it is characterized by the occurrence of symptoms such as pain, paresthesia, sensation of weight and fatigue, insidious appearance, concomitant or not, that have direct relation to the demands of tasks, physical environments and work organization (Chiavegato Filho and Pereira, 2004; Maeno et al., 2006). Poorly designed workplaces that provoke workers' exposure to minor

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