WorkCover
NEW SOUTH WALES

MANUAL HANDLING METHODS IN THE RETAIL SEAFOOD INDUSTRY

FINAL REPORT

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WorkCover. **Watching out for you.**

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EXECUTIVE SUMMARY

The WorkCover NSW Retail Industry Reference Group (IRG) formed the Seafood Industry Working Party to develop strategies to improve occupational health and safety (OHS) in the NSW seafood industry. This Working Party identified the need for research into manual handling methods as the first priority, and contracted Fiona Weigall and Katrina Simpson of Health and Safety Matters Pty Ltd to conduct the research.

The aim of the project was to identify and assess the risks relating to manual handling methods used in the seafood industry in NSW, and to provide recommendations to the industry about controlling these risks. The main focus was on field research and consultation with people working in the industry. Input from industry guided both the identification and assessment process, and aimed at ensuring that the approach to the project and the recommendations that stemmed from it were practical, realistic, workable, effective and affordable.

The project used a combination of quantitative data collection methods (eg direct measures, physiological measures, biomechanical measures and anthropometric measures) and qualitative data collection methods (eg face to face interviews, focused discussions, and brief phone surveys) in order to identify, assess, and prioritise the key manual handling issues.

Based on the results of the project, the manual handling tasks identified as posing the most significant risks of work-related musculoskeletal injury (such as back injuries and arm and wrist strains) were:

- Lifting and moving large fish crates and heavy boxes – especially if lifting/lowering from high or low levels, moving them on and off various hand trucks, and pulling stacks over the ground
- Lifting and handling large fish – especially from high or low levels
- Packing and sorting seafood – especially if using bulk bins and/or leaning and twisting and doing rapid work
- Filleting fish – especially at a poorly designed workstation and if not interspersed with other tasks

The specific risks to the back and upper limbs identified in the project were the heavy and forceful movements and awkward postures as well as the long periods performing these tasks and the repetitive nature of some tasks.

The key factors contributing to these risks were identified as the:

- Loads – weights and forces
- Postures and movements – and the impact of workplace and load design
- Duration and frequency of the manual handling tasks
- Work environment
- Lack of OHS systems – for injury prevention and injury management

These risk factors have all been shown to be major contributing factors to work-related musculoskeletal disorders, and a number of tasks exposed workers to several risk factors, such as high forces combined with awkward postures.

The project highlighted that the NSW seafood industry's current management of manual handling issues needs urgent changes and improvements. There was little evidence that the industry used a systematic approach to managing risk, and many of those surveyed had not begun to assess the significant area of manual handling problems and injury risks.

To better manage the risks associated with manual handling and other OHS hazards, a strategic, co-ordinated and national approach is recommended. This should include the following key areas as the foundation for improvements:

- Development and implementation of OHS management systems
- Improved designs and layouts of premises
- Increased awareness of manual handling and other OHS risks
- OHS education and training for all people working in the industry
- Ongoing information dissemination and support for OHS

In addition to these systems and structures, there are also some specific changes that are recommended for the high-risk tasks that the project identified. These include changes to the: designs and dimensions of typical loads; methods of stacking and storing loads; designs of mechanical handling equipment such as hand trucks; methods for loading and unloading bulk bins; methods for handling large fish and other large loads; retail designs; ice use; work environment; filleting areas; and clothing and personal protective equipment.

To achieve the changes, the seafood industry's peak bodies will need to determine who will take the lead role in developing, implementing, monitoring and promoting OHS. Manual handling should be the primary focus of the push in OHS due to the current and very serious problems faced by the workforce, and the high risk of the development of acute and chronic injuries.

CONTENTS

1. INTRODUCTION

1.1 BACKGROUND

The WorkCover NSW Retail Industry Reference Group (IRG) formed a working party to develop strategies to improve manual handling and occupational health and safety (OHS) culture in the NSW seafood industry. The seafood industry is a relatively small sector within the retail industry, and no significant research had been conducted to analyse and improve work practices within the industry. The Seafood Industry Working Party identified the need for research into the manual handling methods in the seafood industry as a priority, and Fiona Weigall and Katrina Simpson of Health and Safety Matters Pty Ltd were contracted to conduct the research.

While the project was primarily a research project it is anticipated that it will be one of the IRG's and the Seafood Working Party's first steps in the process of improving OHS workplace culture in the NSW seafood industry.

1.2 PROJECT AIMS AND OBJECTIVES

The aim of the project was to identify and assess the risks relating to manual handling methods used in the seafood industry in NSW, and to provide recommendations to the industry about controlling these risks. The 'seafood industry' in this project was defined as being 'from the point of landing the product from the vessel until it reaches the retail outlets'.

The specific objectives of the project were to:

- Identify and analyse the major injury patterns in the NSW seafood industry
- Analyse initiatives regarding manual handling in the seafood industry and related industries
- Observe and analyse current seafood industry manual handling practices – specifically by fish processors, workers at fish markets, wholesalers and retail seafood outlets
- Provide recommendations for improved manual handling methods, equipment design/modifications, training requirements, education strategies and future research development

The main focus of the project was on field research and consultation with people working in the industry. The input from industry guided both the identification and assessment process, and aimed at ensuring that the approach to the project and the recommendations that stemmed from it were practical, realistic, workable, effective and affordable.

The project used a combination of quantitative data collection methods (eg direct measures, physiological measures, biomechanical measures and anthropometric measures) and qualitative data collection methods (eg face to face interviews, focused discussions, and brief phone surveys).

The research also took into consideration the concepts, objectives and recommendations from existing seafood industry initiatives, including the Safety Management Plan for NSW Commercial Fishermen; the Seafood Industries National Competencies; and the Major Injury Patterns in the NSW Seafood Industry.

The project was conducted over four months from May to August 2002 and had four distinct stages:

1. Collection of background information from the literature.
2. Consultation with key stakeholders representing the various parts of the industry, and initial observation of worksites and work practices.
3. Data collection and ergonomics analysis of manual handling activities identified as a potential risk.
4. Investigation of controls, including the exploration of strategies, education and training options, workplace design and manual handling equipment.

2. METHODOLOGY

2.1 APPROACHES USED IN THE STUDY

A range of approaches was used to gather sufficient quantitative and qualitative data to meet the project objectives. These included the collection, assessment and analysis of biomechanical, psychophysical, physiological and epidemiological data. The main emphasis was on the biomechanical, psychophysical and epidemiological approaches. The explanations of each of these methods are provided in Table 1.

Table 1 – Approaches to determining risk of a task, and establishing limits

Approach	Methods
Biomechanical	Focuses on the compressive and shear forces, moments and reactions on the joints and body structures at different angles used in manual handling
Physiological	Uses metabolic load limitations such as oxygen consumption, heart rate and fatigue, and can also use the measurement of intra-abdominal pressure
Psychophysical	Based on peoples' advice and opinions regarding how they feel and what they find is acceptable, eg as maximum loads.
Epidemiological	Uses workplace risk factors and injury patterns together with personal risk factors to determine the level of risk

(Adapted from Mital, Nicholson & Ayoub 1993; and Stevenson 1999)

2.2 COLLECTION AND COLLATION OF BACKGROUND INFORMATION

The aim of the first stage of the project was to explore the existing research into manual handling in the seafood industry within Australia and overseas. This was to ensure that the project was properly focused and did not unnecessarily duplicate information. The first step was to review and analyse industry specific injury data including:

- WorkCover NSW Workers Compensation and Accident reports
- Master Fish Merchants' Association of Australia Survey

Following the injury data analysis, a review of the relevant literature was undertaken. The documents selected for evaluation were included according to the integrity of their scientific basis and relevance to the topic. Initially papers were only included if they were found in refereed journals or reputable texts from the past 5 years. Due to the lack of relevant information the scope of the search was then expanded to include selected articles and books from early 1980 and unpublished projects and reports.

The following sources of information were searched:

- CD-ROM search of OSHROM, NIOSH, Medline. A range of key words was used individually and in combination in the CD ROM searches.
- Internet search using keywords
- Secondary sources (ie reference lists from published articles) to locate further literature

To gain further information on the seafood industry and associated manual handling issues the following activities were conducted:

- Consultation with peak bodies in the seafood industry in Australia and overseas. (For example, Seafood Industry Associations, Training Associations and other Fisheries and Seafood Organisations in Australia, New Zealand and Canada were contacted to locate any industry research or projects that had been conducted.)
- Consultation with national and state government authorities responsible for OHS
- Consultation with universities and professional association contacts where ergonomics and safety science topics are being taught or researched

2.3 FIELD RESEARCH – CONSULTATION AND INITIAL OBSERVATION

To complement and supplement the literature review and injury data, initial consultation with people working in the seafood industry and observation of workplaces and work practices was conducted. Most of the worksites used for the initial phase of consultation and observation were identified with advice from the Seafood Industry Working Party.

The researchers were provided with a list of names of premises that would provide a range of different functions including wholesaling, retailing, transport, processing etc. In addition, other sites were sought via phone contact.

The main criteria for the initial selection of sites were:

- management's willingness to be involved in the project
- current involvement with the Sydney Fish Markets and/or Master Fish Merchants' Association
- availability to be interviewed and have their premises visited
- to provide a range of tasks in a range of different settings

The initial period of observation and consultation took place over a four week period in June and July 2002. Additional sites were selected by the researchers to include smaller premises in a wider range of settings, and these visits occurred in July and August. A total of 20 premises were visited, and a total of 35 in-depth interviews were conducted with the owner or manager of the premises and with a sample of staff. In addition more than 50 other people working in the industry were informally interviewed either face to face, by phone or via email. The people interviewed were from fishing co-operatives, wholesalers, retailers, transport, and fish processing.

The interviews were conducted using a semi-structured interview. This included a survey derived from the Nordic Questionnaire (Kourinka, Jonsson, Kilbom, Vinterberg, Biering-Sorensen, Andersson & Jorgensen, 1987), which asks for details on reported musculoskeletal problems over the last year. Other questions regarding injury reporting, advice about any current manual handling hazards, suggestions for improving manual handling, and past exposure to OHS training and OHS information etc were included. (Refer to Appendix 1 for a copy of the interview questionnaire).

Observations of the workplace and work practices were conducted at each business using an observational checklist. The checklist was used by the researchers to identify manual handling activities, to collect information on the work environment and workplace layout, and to review the types of equipment used. Dimensions of equipment and fixtures were collected during this stage of the process where possible. Workplaces and tasks were generally observed over 1 – 2 hours under normal operating conditions. (Refer to Appendix 1 for a copy of the observation checklist).

Both the semi-structured questionnaire and the observation checklist were piloted in two workplaces by both researchers and modifications were made to the questionnaires to enhance usability in the field and improve question design.

2.4 ERGONOMIC ANALYSIS OF SELECTED MANUAL HANDLING ACTIVITIES

The initial observation and consultation phase identified a number of manual handling activities and issues that required further assessment and analysis (see Table 2).

Table 2 – Manual handling activities identified for further assessment and analysis

Issues for further assessment
Handling and Moving Loads Fish Crates: Weighs of the fish crates, repetetive lifting and moving of the fish crates, height of the stacks, awkward to handle due to their size and width Coffins and bulk bins: Awkward to access, heavy loads are lifted from the bins, weight of the coffins Polystyrene Boxes: No handles so it is difficult to get a good grip for the initial lift Handling Large Fish: Heavy loads, awkward to handle, care required when handling so the product is not damaged
Handling ice • Shovelling, storage of ice
Equipment • Use of hand trolleys • Fish crate trolley
Layout and design of premises **Retail issues:** • Design of counters – height, depth and reach distances

2.4.1 Subjects

The data collection and ergonomic analysis was undertaken in two locations; the Sydney Fish Markets and the Newcastle Commercial Fishermen's Co-operative Limited in order to assess the range of manual handling tasks identified above.

At the Sydney Fish Markets seafood is delivered to the premises (eg by truck or directly from the wharf). Fish crates and polystyrene boxes are unloaded by forklift from trucks onto the auction floor and then sorted into location, species and weight. Seafood is also delivered in bulk bins and cardboard 'coffins' and is sorted into fish crates, weighed and iced.

At the Newcastle Co-operative fish are delivered from fishing boats in bulk bins or fish crates, and are weighed, sorted and iced. In the processing area, fish are sorted, weighed, and then packed into polystyrene boxes, coffins or plastic bags.

Two groups of employees participated in the study:

- Eight employees from the Sydney Fish Market Pty Ltd, and
- Four employees from the Newcastle Commercial Fishermen's Co-operative Ltd

2.4.2 Postural load measurement techniques

To analyse and quantify the postural demands of the selected manual handling activities, the Ovako working posture analysis system (OWAS) and the rapid upper limb assessment (RULA) tools were used.

2.4.2.1 Ovako Working Posture Analysis System (OWAS)

Postural load was measured using the basic Ovako working posture analysis system (OWAS). The OWAS, described extensively by Karhu, Harkonen, Sorvali and Vepsalainen (1981) and Karhu, Kansi and Kourinka (1977), provides an observational method of studying musculoskeletal load in different working postures. It is based on definitions relating to the back, upper limbs and lower limbs. The OWAS method is based on work sampling, which provides the frequency of each posture and the time spent in each posture.

Video recordings were made using a Panasonic NV-A5A video camera of each subject performing selected manual handling tasks. The filming angle was selected to give the best clear view of the subject's whole body, unobstructed by other employees, fish crates and equipment. All the OWAS analysis was carried out from videotapes, by one researcher to avoid possible inter-observer variability.

Approximately 5 hours of videotape were analysed. Observations were made at either 3 second or 5 second intervals and postures classified according to the OWAS method. A total of 2371 observations were recorded. A minimum of 100 observations is recommended to provide sufficient analysis for each task or job (Louhevaara & Suurnakki, 1992).

2.4.2.2 Rapid Upper Limb Assessment (RULA)

RULA is a survey method used where work related upper limb disorders are reported. This method assesses the postures of the neck, trunk and upper limbs along with muscle function and the external loads experienced by the body (McAtamney & Corlett, 1993). A coding system is used to generate an action list which indicates the level of intervention required to reduce the risks of injury due to physical loading on the operator.

Sampling was conducted at variable intervals and a number of tasks were identified from the videotapes and from direct observation. All of the RULA analysis was carried out by one researcher to avoid possible inter-observer variability.

2.4.3 National Institute of Occupational Safety and Health (NIOSH) equation

The revised NIOSH equation (Waters, Anderson, Garg & Fine 1993) was used to determine the level of risk associated with the manual handling activities identified. The calculation considers factors including horizontal and vertical distances, frequency of lifting, asymmetry and coupling (grip) to determine a Recommended Weight Limit (RWL) for a particular set of circumstances. A weight load constant of 23kg is used as a standard maximum for ideal conditions, which is then altered by multipliers to the specific lifting condition.

The lifting index (LI) compares the actual weight being handled with the RWL, and provides an estimated level of risk, with probability of low back pain increasing as LI increases (Waters et al 1993). Calculations were made for common manual handling activities performed by workers in the seafood industry using frequently handled products and using known measurements. Variables, and therefore equation multipliers, were altered to estimate effects of different circumstances such as increased distance from the load and twisting of the back.

2.4.4 Measurement of Weight and Forces

Pushing and pulling forces were measured using a Salter (Model 16) tension and compression tester. Weights were measured using individual workplaces' electronic scales.

2.5 INVESTIGATION OF CONTROLS

The final stage of the project involved investigating approaches to reduce the risks from the identified manual handling issues in the seafood industry. This stage included a detailed exploration of potential strategies, education and training options, workplace design models, and specific manual handling equipment. This was done through detailed investigation of the ergonomics and OHS literature, combined with visits to equipment suppliers and further discussion with people in the seafood industry.

As part of this final stage, additional premises were visited to review equipment options and to clarify the issues identified and assessed in the ergonomic analyses. It was also critical to continue the consultation with people in the industry to ensure that the recommendations from this report would be practical and workable.

3. FINDINGS

The first stage of the project included analysing the major injury patterns and cost drivers, reviewing existing research and information regarding manual handling in the industry, consulting with peak bodies and government authorities responsible for OHS, and conducting a review of published literature and unpublished reports and projects.

The analysis of the major injury patterns demonstrated that manual handling injuries were the most common types of injuries in the seafood industry. Data from WorkCover NSW (1999/2000) includes the seafood industry under three different industry groups – Seafood Processing, Fish Wholesaling and Fresh Meat, Fish and Poultry Retailing. The key issues identified from the injury data were:

- The most common injuries (ie nature of injury) in the industry were 'sprains and strains of joints and adjacent muscles' and 'disorders of muscle, tendons, and other soft tissues'. These injury types accounted for between 40 to 73% of all reported injuries over the past 2 years of available data.
- The most common mechanism of injury was muscular stress (including lifting, carrying, putting down, handling objects other than lifting, carrying and putting down, muscular stress with no objects being handled, and repetitive movement with low muscle loading).
- The most common agencies of injury were 'non-living animals' and 'cartons and boxes.'

The injury data from WorkCover NSW Compensation Statistics was consistent with the data obtained in the report 'Major Injury Patterns (Cost Drivers) in the NSW Seafood Industry' 2001 (MFMA 2002). This report provided the results of a survey of staff working in seafood wholesalers, retailers and suppliers. The main findings included:

- The most common injuries were 'sprains and strains of joints and adjacent muscles' and 'disorders of muscle, tendons, and other soft tissues' accounting for 50% of all reported injuries
- The most common injuries were reportedly from 'manual handling' accounting for 64% of all injuries

The literature search revealed that there was a limited amount of research in relation to manual handling in the seafood industry such as in wholesaling and retailing. There were a number of articles related to the fish processing industry, where high volumes of single species fish are processed. These articles predominately focused on investigation of the prevalence of upper limb musculoskeletal injury, but provided minimal information on solutions.

The information that was available was also very general with few solutions to specific problems. In addition, the solutions identified in the literature were rarely tested or evaluated. Due to the lack of seafood industry information, the search was extended to include other industries with similar or related tasks. A summary of the findings of the literature review was provided to the Seafood Industry Working Party (Simpson & Weigall 2002), and the information was considered as background to this project.

In NSW, the hub of the seafood industry is centred around the Sydney Fish Market (SFM) at Pyrmont, with more than 15 million kilograms of seafood traded annually from this site. This equates to 2,700 crates per auction.

Seafood is brought in from local and interstate fishing co-operatives, and is also flown in from overseas. The auctions are attended by more than 170 buyers, and from the auction the seafood is then supplied to more than 250 retailers and thousands of restaurants (SFM 2002).

The results from this report illustrate that each of these crates and other containers of seafood is repeatedly manually handled throughout its movement from the wharf to the auction floor and then to the wholesalers, retailers and restaurateurs.

As the NSW seafood industry provides more than 400 different species (SFM 2002), the use of bulk handling methods is limited and the work tends to be labour intensive. Each species must be carefully sorted, and then different processing and handling methods are used depending on the species, its size, and its market destination. This project identified a large range of manual handling tasks through the supply chain that required assessment.

The NSW Occupational Health and Safety Regulation 2001 states that when conducting a risk assessment in relation to manual handling the following factors must be taken into consideration:

1. Characteristics of loads
2. Location of loads and distances moved
3. Weights and forces
4. Actions and movements and working posture and positions
5. Duration and frequency of manual handling
6. Work environment
7. Workplace and workstation layout
8. Work organisation
9. Skills and experience
10. Age
11. Clothing and personal protective equipment
12. Other factors considered relevant

The findings from the field research and ergonomic analysis have been combined together and each of the risk factors listed above are discussed in further detail.

3.1 CHARACTERISTICS OF LOADS

A wide variety of loads are lifted and moved by people working in the seafood industry. Table 3 provides an overview of the typical loads, their dimensions and weights, together with comments made by workers and managers about the loads during the interviews and observation stages of the project. Table 4 provides information on bulk loads that are moved mechanically within the seafood industry. These bulk loads are filled with loose seafood products, and these products are then removed and sorted into fish crates or other containers.

The most frequent comments and most reported problems were in relation to the size and weight of the large fish crates. As well as being a risk for manual handling, there was concern from many of the people interviewed that the quality of the seafood was compromised. Many of those interviewed reported that the weight of the loads should be reduced and more half-sized crates should be used. One retailer suggested that the full-sized crate should be eliminated altogether.

Team lifting, for example using two staff, was actively encouraged for the large crates at only two businesses surveyed. At only one business were female staff permitted and even required to lift the large crates. In all other businesses the crates were considered to be too heavy for women, and men were expected to do all the heavy lifting.

Some managers reported that they were actively sourcing products that came in lighter and more compact loads, such as requesting 10kg boxes of prawns and oil in smaller containers.

Table 3 – Characteristics of typical loads handled by people working in the seafood industry

Load type	**Description**	**Load dimensions in mm**	**Capacity and/or weight**	**Comments from workers and managers**
Large fish crate	Plastic, stack and nest, with drain holes (Nally IH065)	L 711 W 438 H 316	54.5 litres Empty crate 3.14kg Net and gross weights vary Average gross weights of full crate (including product and ice) 40Kg	• Crates are too large and heavy • Weights in crates vary • Quality of the product is affected by the weight • Some staff reported that crates can occasionally weigh over 50kg
Half fish	Plastic, stack and crate nest, with drain holes (Nally IH036)	L 711 W 438 H 190	32.2 litres Empty crate weight 2kg Net and gross weights vary Average gross weights of a small sample of half crates – 22kg	• Easier to manage than large crate • Preferred by some retailers as they can buy smaller quantities • Cost of washing is same as for large crates
Poly boxes	Polystyrene boxes with lids	Various sizes ranging from: L 570–750 W 310–410 H 210–260	Empty box weights range from 300 – 800 grams Net and gross weights vary Average gross weight 22kg	• Easy to damage • No handles • Some have small 7mm bevel area – too small to grasp • Some covered in plastic making it more difficult to grip the load. • Suitable for small species
Large fish – loose	Eg tuna, shark, broadbill	Various, can be from 1.5–3m long	Weights vary these fish into Gross weights between 100 to 350kg	• Some retailers cut smaller sections before leaving the auction floor • Some retailers cut them at the loading dock at the shopping centre
'Coffins' eg tuna, broadbill	Large, long cardboard boxes with large fish wrapped in plastic	Various eg L 1800 W 470 H 300	Gross weights 45–60kg	• Tuna is expensive and fragile, so care must be taken when handling, to minimize bruising or damaging the product
Boxes of oil	Solid oil in cardboard boxes		15–25kg boxes	• 25kg box is too heavy • 15kg box was reported as being easier to handle

Load type	Description	Load dimensions in mm	Capacity and/or weight	Comments from workers and managers
Pails & Tins of oil	Cooking oil used in takeaway shops		20 litre pails	• Common for female staff to rely on males to lift • Pail is useful for re-using to hold waste oil
Medium to small seafood products	These loads are manually sorted according to species, size etc	Various eg L 100–1000 W 20–300 H 20–150	Includes small prawns to wide range of fish and other products – Weights range from a few grams to 10kg	• Difficult to grip due to size, slipperiness or spikes • Repetitive grasping of small products causes discomfort
Prawn trays	Shallow plastic trays	L 600 W 350 H 100		• No reported problems
Pippi trays	Used to store pippis in their shells when they are immersed into water tanks	L 560 W 380 H 300	Up to 25kg	• 30 to 40 crates can be lifted in and out of the tanks each Day • Team lifting implemented in one co-operative visited
Chicken crates	Used in the poultry industry – and used by one seafood retailer	L 575 W 385 H 165	Basket weight 1.55kg	• Easier size to handle than the large fish crates • Suggested by one retailer as an alternative to fish crates
Ice on a shovel	Ice is provided in a variety of storage systems, and is then shovelled Typical shovels are plastic		A full shovel load weighs up to 10kg Shovel weight = 1.9kg	• Hard to break up old ice – needs to be repetitively chipped • Easier to shovel freshly made ice
Pallets	Full sized timber pallets and half-sized plastic pallets		Timber pallets weigh approximately 25 – 30kg	• Generally moved with a forklift, pallet jack or hand truck • Pallets were also lifted manually
Frying baskets	Baskets to hold chips and seafood for deep frying in retail premises	Various styles, some 600mm long	Eg weight of approximately 3kg with cooked product	• Heavy to lift in and out of the cooking oil • Wrist discomfort from repeated basket tipping was reported by some interviewed
Bulk dry products bins	Plastic bins used to store flour etc in retail stores for cooking			• Reported to be too heavy for females to lift • Hard to remove lid

Table 4 – Characteristics of bulk loads that are moved mechanically but require manual loading and unloading of the seafood product

Load type	Description	Load dimensions in mm	Capacity and weight	Comments From workers and managers
Large ice bins – various styles	Large square bin with lift out panels on one side	L 1300 W 1300 H 610–1550		• Difficult to remove sides of the bin • Sharp metal protrusions and sharp edges on the bin
	Very large bin, without lift-out sections	L 2150 W 1200 H 1030		• Difficult to reach the ice as the level reduces • Reported that it was often easier to climb into the bin to shovel the ice
Bulk bins – plastic, fibreglass and tin. Some are commerc-ially made	Nylex Rotomould blue bin with a lid, with positions for forklift tines	L 1150 W 1150 H 950	700mm deep Lid weighs 19kg	• Lid is heavy when lifted manually • Can be hard to move bin with pallet jacks • Hard to reach product at bottom of the bin
	Plastic bin	L 1470 W 1180 H 890		• Hard to reach product
	Fibreglass Some have a lower area on one side eg 900mm high	L 1230–2700 W 1040–1200 H 750–1050	3 tonne	• Hard to reach product • Better with one side lower
King bins	Large bins, generally cardboard with plastic linings, holding bulk loads of seafood	Variable sizes, eg L 1200 W 1200 H 1000 (Height can range from 700 to 1400)	350 – 400kg	• Deep to lean in and grasp fish • Tiring for the back and hands to repeatedly lean and pick up the fish

3.2 LOCATION OF LOADS AND DISTANCES MOVED

In addition to assessing the typical loads, it is also vital to assess where the loads are moved to and from. Risks for manual handling tasks increase with loads at low levels (eg below thigh level) and at high levels (eg at and above shoulder height). Risks may also increase if the load must be moved over long distances.

3.2.1 Loads at low levels

Tasks identified as requiring a significant amount of lifting to or from low levels are:

- Stacking and unstacking crates and boxes at fishing co-operatives, in trucks, on the auction floor (by staff and wheelers), in coolrooms and freezers and in retail settings
- Filling and emptying bulk bins at fishing co-operatives
- Packing seafood into boxes and coffins
- Unpacking seafood from boxes and coffins
- Packing seafood into coffin freezers

One example of this problem is sorting fish from bulk bins. The assessment showed that bulk bins are typically placed on the floor and staff sort the product from the bins into fish crates where they are weighed and then iced. No bin tippers were available at any of the workplaces visited during the project. Several workplaces reported that they used a forklift to tip the large bins – either onto tables or directly onto the floor. The risk of the bin slipping and falling is increased with this particular work process, and implementing a safer work method is considered a priority.

3.2.2 Loads at high levels

Manual handling tasks requiring working with loads at high levels included:

- Stacking and unstacking crates and boxes at fishing co-operatives, in trucks, on the auction floor by staff and wheelers, in coolrooms and freezers in retail settings
- Unpacking seafood from boxes and coffins stacked high

According to the survey results, the fish crates are typically stacked to 5 high throughout the seafood industry – including in the fishing co-operatives, at wholesalers, and in retail settings in the freezers and coolrooms. During transport, fish crates were often stacked to six, seven and eight crates high to maximize the space within the truck and to minimise freight costs. This means that staff have to lift very heavy fish crates (eg in excess of 40kg) above shoulder and head height. Table 5 provides a summary of the heights of these loads.

Table 5 – Height of common loads handled by staff working in the seafood industry

Load	Height of load (mm)	Comments
Large fish crates, stacked:		
5 high	1330	Staff were observed climbing onto the rim of the bottom fish crate to enable them to reach the top crate when stacked 7 high.
6 high	1590	
7 high	1850	
8 high	2110	
7 high on pallet	1990	Crates were often dropped from 6 – 7 high instead of being lifted down to floor level.
Large fish crates, nested:		
20 high	2100	Heights of nested crates varied slightly according to how tightly nested the crates were, which sometimes made them difficult to separate
Polystyrene boxes		
7 high on pallet	1930	

3.2.3 Moving loads over distances

A variety of equipment is available to move loads over short and long distances. Tables 6 and 7 outline the common types of equipment identified during the project. Information is also provided on the advantages and disadvantages of the equipment with regard to the manual handling tasks, and this was gained through discussion with staff and observation of the equipment being used under normal operating conditions.

Table 6 – Equipment used to move loads (non-powered)

Type	Description	Advantages for manual handling	Disadvantages for manual handling
2 wheeled hand trucks used in the industry	Varying styles – typically with a flat base, upright handles, solid wheels	• Inexpensive • Easy to manoeuvre in small spaces	• Vertical handle design can make it hard to tilt load • Base design can make it difficult to push under crates
Fish crate trolley/ hand truck – various styles	4 or 6 wheeled trolley designed to lift fish crates	• No need to lift and tilt load onto trolley. • Can lift and move 5 crates without effort	• Not suited to uneven surfaces, slopes, or steps. • Any jolting will cause load to drop. • Difficult to push in a straight line.
Newcastle Co-operative's platform trolley (custom made)	Long 4 wheeled trolley (base 1910 x 720) designed to fit a row of 4 crates on the platform base. Pneumatic tyres – 2 fixed rear & 2 swivel front Handle 1140mm Platform height 510mm, with a 15mm lip	• Easy to pull • Large wheels (420mm diameter)	• Pulling with one hand may place strain on the shoulder • Pulling may encourage twisting
Newcastle Co-operative's ice trolley (custom made)	3 wheeled trolley, Pneumatic tyres, 1 front & 2 rear swivel wheels Drop down back. Length 1540mm, width 960mm, height 970mm, base height 450mm. Handle 1180mm long	• Easy to use • Drop down back provides easy access • Base height does not require bending • Easy to use with the ice chute to fill the bin • Much better than shovelling ice into crates • Easy to move large quantity of ice	• When fully loaded top of ice stack is over 1300mm high • Pulling with one hand may place strain on the shoulder • Pulling may encourage twisting
Long handled hooks for pulling single crates and crates in stacks	Hand fashioned steel lengths with a small hook at one end and a T-handle at the other Commonly used in trucks	• Simple to use • Cheap • Works well on smooth, flat surfaces • Saves bending down to reach crates	• Not suited to uneven surfaces or slopes

Type	Description	Advantages for manual handling	Disadvantages for manual handling
Dollies	Low frame or base on wheels, designed to fit a fish crate	• Easy to move • Inexpensive • Can be stacked up with crates	• Need to lift crate on and off
Skids / rollers	Level or sloped surface for sliding crates etc between areas	• Utilises gravity and reduces push/pull forces • Can be portable	• Requires some floor space

Table 7 – Powered equipment used to move loads

Type	Description	Advantages for manual handling	Disadvantages for manual handling
Forklifts	LPG powered forklift trucks – various sizes and types	• Can lift large loads without handling or orienting the crates	• Some trucks cannot use forklifts to load due to the truck's flooring • Need suitable loading dock space • Increased risk when pedestrians are in the vicinity • Repeated twisting of the neck when reversing
Forklifts with specially designed lifting attachment to carry fish crates	One design can carry 30 large crates (footprint of 6, at 5 high), another holds 20 crates (footprint of 4, at 5 high)	• Load does not need to be on a pallet as it is lifted directly off the floor • Works well once crates are correctly aligned	• Loads must be oriented to suit the tines
Pallet jacks		• Easier to manoeuvre in constricted spaces	• Large push/pull forces may be required with heavy loads • Standard pallet jacks rust with salt water
Trucks and vans	Small utilities	• Easy to manoeuvre and park	• Must be loaded and unloaded by hand • Use hooks or crawl in to reach products
	Medium sized trucks Some refrigerated trucks have a single low, narrow doorway (eg 1440mm tall x 780mm wide)	• Keeps products cold so reduces the need for ice	• Small doorways can make handling slow and difficult, palletised loads cannot be used, and need to stoop to walk in and out
	Large Pantecs and semi-trailers	• Large vehicles with large double doors can be loaded by forklift • Easy to load mechanically	• Difficult to manoeuvre in tight spaces • Have to wait for the loading dock and dock leveller at SFM

3.3 WEIGHTS AND FORCES

The weight of the loads handled in this industry was a major risk identified during the research project. The weight of the large fish crates was identified as the most important issue by those interviewed and during discussion with key stakeholders in the seafood industry. These heavy loads are repeatedly lifted, lowered, carried, pulled and pushed.

3.3.1 Weights lifted and lowered

When interviewing staff about the large crates the common perception was that the large crates' gross weights were approximately 25 to 30kg. However on assessment of a sample of crates, heavier gross weights were measured. Table 8 illustrates these findings, and shows that the average weight from a sample of 25 crates was 39.8kg (standard deviation 5.3kg).

The misconceptions regarding the weights are believed to be due to only the net weight being given, with the rest of the load made up by varying amounts of ice as well as the container weight. Table 8 also shows that the gross weight of large crates is typically 1.6 times as much as the product weight for large crates, and the gross weight of small crates and polystyrene boxes may be between 2 and 3 times the net product weight.

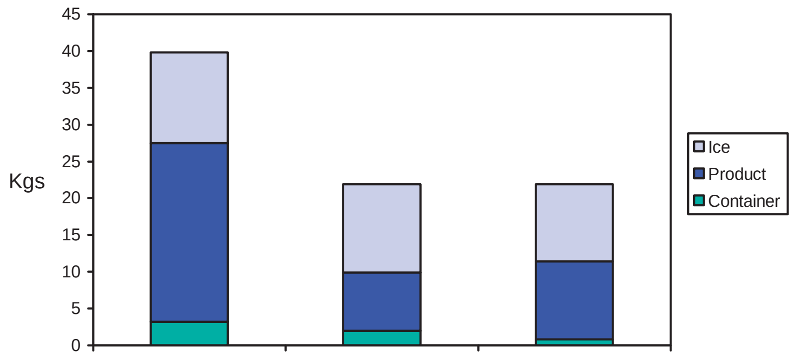
Table 8 – Weight of typical loads

	PRODUCT WEIGHTS (kg)		GROSS WEIGHTS (kg) (Product, ice and container)			RATIO OF NET WEIGHT TO GROSS WEIGHT		
	Mean	**Median**	**Mean**	**Median**	**Standard deviation**	**Mean**	**Median**	**Standard deviation**
Large crates	24.3	25	39.8	39.5	5.2	1.6	1.6	0.64
Small crates	7.9	8.5	21.9	22.9	2.8	3.3	2.8	1.68
Poly-styrene boxes	10.6	10	21.9	21.7	3.1	2.1	2	0.23

Note: The sample sizes for the above survey were only small ie 25 large crates, 5 small crates and 4 polystyrene boxes. In another sample of polystyrene boxes from three different sources the net loads were much heavier with a mean of 18kg and a median of 18.25, but gross weights were not measured.

The composition of the gross loads of the crates and polystyrene boxes as measured in the survey is illustrated in the Figure 1.

Figure 1: The composition of mean gross weight of a sample of fish crates and polystyrene boxes



In a survey to eight staff from one premises who regularly have to manually handle seafood products in their work, they were asked to suggest a possible maximum gross weight for the large fish crates and the polystyrene boxes. Six respondents believed fish crates should be a maximum of 30kg, with one nominating 35kg and the other nominating 30–40kg. In contrast, for the polystyrene boxes five recommended a maximum gross weight of 15kg, two recommended 20kg and one recommended 25kg.

3.3.2 Forces to pull and push loads

People working in the industry also identified moving loads as a manual handling risk due to the high forces required. Table 9 provides a summary of the typical pull forces exerted when moving fish crates using a variety of techniques and equipment.

Table 9 – Pull forces exerted when moving loads

Load	**Initial Force (kg)**	**Sustained force (kg)**
Fish crates, pulling crates over the floor		
3 high – with net load 60 – 86kg	26 – 37kg	22 – 24kg
4 high – with net load 80kg	> 40kg*	35 – > 40kg*
5 high – with net load 100 – 125kg	> 40kg*	35 – > 40kg*
Floor surface: Epoxy coating		
Fish crate pulled over floor – 33kg net load	20kg	15kg
Fish crate in dolly pulled over floor – 33kg net load	4kg	1kg
Floor Surface: concrete		
Ice trolley, Newcastle		
Fully loaded	11kg	7kg
Floor Surface: concrete		
Fish crate trolley, Newcastle		
Stack of 5 x 35kg gross crates	9kg	6 – 9kg
Floor Surface: concrete		
Fish crate trolley, SFM (poor condition trolley)	13 – 17kg	11 – 14kg

[*Note: The force gauge used in the survey could measure up to a maximum of 40kg, and the loads in this example were well beyond this figure and could not be recorded.]

As the table illustrates, the heaviest forces in the survey were moving fish crates over the ground without any assistive devices. The lowest forces were with using the dolly, fish crate trolleys and the Newcastle ice trolley.

3.4 ACTIONS & MOVEMENTS and WORKING POSTURE & POSITIONS

The project also identified that many workers involved in manual handling tasks used awkward postures such as bending, stooping, twisting and over-reaching. Some postures and muscle groups were held in static (or still) positions for long periods, while others were dynamic, with frequent movements and actions involving numerous muscle groups.

These postures and positions and the typical movement patterns were analysed using the Ovako Working Posture Analysis System (OWAS) (Karhu et al 1977 & 1981) and the Rapid Upper Limb Assessment (RULA) (McAtamney & Corlett 1993).

3.4.1 Ovako Working Posture Analysis System (OWAS)

The distribution of the pooled OWAS postures for the common manual handling tasks performed by people working in the seafood industry is shown in Table 10. The most typical OWAS postures adopted were walking or standing on one straight leg, back postures were often bent, twisted or a combination of both, arms were predominantly below shoulder level.

Sorting fish from bulk bins and sorting fish from coffins had the highest proportion of time spent with the back bent and twisted. The back was twisted for 72% of the time while shovelling ice.

The raised arm postures (ie one or both arms above the shoulder) were adopted more often when moving and sorting crates stacked 7 high (14.5%), sorting fish from coffins into crates (13%) and when unloading fish from coffins (8.8%). The proportion of time spent walking was highest when moving and sorting crates (35 – 43%) and polystyrene boxes (44%).

Figure 2 shows the percentages of back postures during commonly performed manual handling activities. Certain activities showed higher proportions of harmful postures, including sorting fish from bulk bins and coffins and shovelling ice. However, all the manual handling activities analysed demonstrated a high proportion of time spent in harmful back postures.

Although OWAS is useful for analysing the proportion of time spent in certain postures it is not sensitive enough to identify risks associated with wrist, hand and head and neck postures. An assessment of the upper limb and head and neck was also conducted using the Rapid Upper Limb Assessment tool to complement the OWAS data.

Figure 2. OWAS back postures during common manual handling tasks performed in the seafood industry

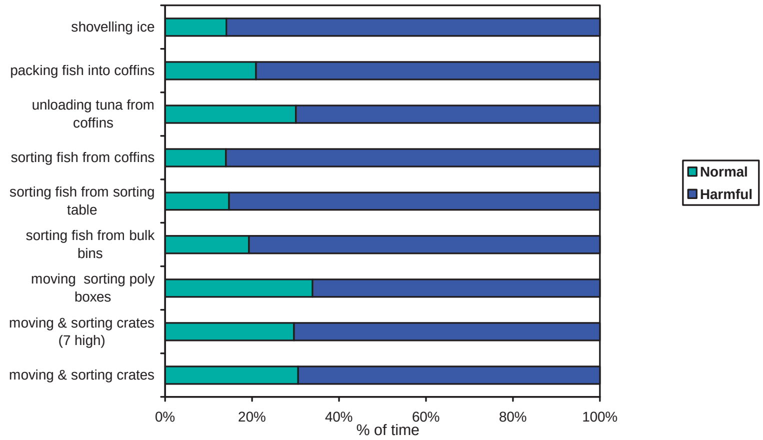


Table 10 – Percentage of time spent in postures according to OWAS variables for common manual handling tasks

	Posture	Moving & Sorting Crates	Moving & Sorting Crates (7 high)	Moving & Sorting Poly Boxes	Sorting Fish from bulk bins	Sorting Fish from sorting table	Sorting Fish from coffins into crates	Unloading tuna from coffins	Packing Fish into coffins	Shovelling ice
Back	Straight	31.5	29.5	33.8	20	14.5	14	30.5	21	14.2
	Bent	9.4	10.0	6.0	1.7	28.9	25	20.7	14.5	0
	Twisted	35.8	33.3	35.1	28	31.9	18	21.1	23.5	72.5
	Bent & twisted	26.2	26.7	24.9	54	23.4	43	29.1	41.5	14.2
Arms	Both arms below shoulder level	63.4	83.5	96.7	99.3	99.5	7	91.1	98	76.9
	One arm below shoulder level	1.1	6.1	3.3	1	0	7	6.1	2	24.1
	Both arms at or above shoulder level	1.0	8.4	0	0	1	6	2.75	0	0
Legs	Standing	13.6	11.1	9.3	10.3	55.1	55	33.9	15	3.2
	Standing on 1 leg straight	34.1	23.2	38.2	43.3	18.3	44	39.9	48	64.8
	Standing both legs bent	4.9	2	1.6	3.7	4.1	7	2.75	2	0
	Standing one leg bent	12.1	10.7	7.9	20.7	2.75	16	9.95	12	7.6
	Kneeling on one knee	0	0	0	0	0	0	0	0	0
	Walking	35.4	43.1	44.3	19.3	7.6	18	8.25	23	24.2

3.4.2 Rapid Upper Limb Assessment (RULA)

Analysis of the workers' upper limb postures and movements was undertaken using the Rapid Upper Limb Assessment (RULA).

A large range of tasks at fishing co-operatives, on the auction floor and at retailers was assessed using this tool. These included: lifting and handling fish crates and boxes, lifting and handling fish, moving loads with hand trucks, moving loads by pushing them over the ground, moving loads with hooks, shovelling ice, unpacking and sorting seafood products, serving at retail counters and filleting seafood.

Of the tasks analysed, the tasks in Table 11 were rated as posing the highest risks due to a combination of the postures and movements in the upper limbs, neck and back, and the loads and forces. The RULA scoring criteria found that each of these tasks significantly exceeds acceptable limits and "investigation and changes are required immediately to reduce excessive loading of the musculoskeletal system and the risk of injury" (McAtamney & Corlett, 1993).

Table 11 – High risk tasks as identified using the 'Rapid Upper Limb Assessment'

Task	Main musculoskeletal risks identified
Lifting crates from stacks over worker's chest height eg from 5 or 6 high and over	• Upper arms raised and abducted, neck extended • Legs not well-balanced (eg standing on tip-toes or standing on the edge of the lower crates to reach the 6th and 7th crates) • Very heavy loads (ie 20 – 50kg) • Task done repeatedly
Pushing some hand trucks under stacks of crates (eg 4 crates using SFM hand truck)	• Explosive jarring movement with wrists in deviated and flexed posture to hold the almost vertical truck handles • Balancing with one foot on the truck to try to push it into place under the load • Arms raised and shoulders hitched, then applying sudden force to lever the load back • Repetitive
Lowering a stack of crates (eg 4 crates arms at shoulder height	• Awkward wrist positions with shoulders hitched and using SFM hand truck) • Balancing with one foot on the truck and one extended out the back • Often uncontrolled movement • Repetitive
Lifting and handling large fish between containers or tables at low levels eg lifting fish in or out of crates or coffins at low levels	• Leaning down and twisting around to different containers • Leaning with both hands holding a load, and sometimes using both hands to arrange fish in a crate or coffin or onto a table • Awkward wrist posture to hold and grasp fish • Can be a repetitive task
Lifting and handling large fish (eg yellow fin tuna) from stack of coffins positioned over shoulder height	• Lifting heavy load at over shoulder height, so often shoulder hitching and abducting the arms • Awkward to grip load (eg through the gill) causing a twisting motion for the wrist
Throwing fish crates (eg a distance of approximately 5m while sorting them on the auction floor)	• Twisting and flexing the back and the neck • Working with arms at shoulder height and across the body • An explosive and repetitive movement (eg 7 crates in 30 seconds) • Loads in excess of 16–20kg
Lowering crate to floor level and twisting the crate (eg at the SFM the crates are oriented length-ways with the label facing the aisle)	• Leaning down, often with a twisted back in order to orient the crate • Often a rapid and repetitive movement
Shovelling ice from high levels and from low levels (such as from a large or deep bin)	• Posture is typically bending and twisting to reach the ice then bending and twisting to place the ice into a container • The load is held away from the body • Can be performed over shoulder height and at low levels • May be done for long periods
Filleting fish and associated tasks (eg steeling) Oyster shucking was not assessed but is considered likely to have similar characteristics	• Elevated and abducted arms if at high work surfaces • Very repetitive work • Forceful work • Some extreme wrist, finger and thumb postures (eg both hyper-extended and very flexed positions) eg to grip small fins and to hold the head still as flesh is cut away • Very rapid wrist movements

In contrast, other manual handling tasks where similar loads were handled could be performed in much safer and more efficient postures. These tasks were:

- Using the specially designed fish crate trolley that does not require the load to be levered on and off a base
- Getting ice from a chute directly into bins to reduce shovelling
- Using a platform trolley with loads kept between thigh and chest height
- Using hand trucks with wheels closer to the centre of gravity of the load and with a base that slides under crates more easily
- Using dollies to move loads rather than lifting them
- Having loads positioned on benches or tables or other supports

The key factors that make these tasks safer from a postural perspective are:

- More upright postures
- Symmetrical postures (not leaning to one side)
- Forward facing postures
- Controlled and even movements (rather than explosive or jerky)
- Not reaching beyond shoulder height except for occasional and light loads
- Less force required
- Wrists and elbows working in their middle range in stronger and more efficient postures (ie not excessively bent, extended or twisted)

3.4.3 NIOSH Calculations

The NIOSH calculations provide trends in estimated risk, with the potential for increased risk where the worker is not close to the load. This can be due to individual methods (such as standing at a distance from the load), the size and shape of the load and the positioning of the load.

The calculations in Table 12 show that the recommended weight limit (RWL) for moving and sorting large fish crates was between 7.1kg and 11.3kg and the RWL for lifting large fish such as tuna was 6.45kg to 8.1kg. This is assuming that the lifting conditions were optimal ie close to the load, good grip, minimal twisting. As the mean weight of the large fish crates was 40kg and large fish vary in weight from 25 to 60kg it is evident that risks will be present with these lifting tasks.

The NIOSH equation recognises that there is an ‘excessive risk of injury’ with a lifting index over 3.0 (Waters et al, 1994). Tasks that were found to have a lifting index (LI) above ‘3.0’ were lifting and moving large fish crates and lifting large fish such as tuna and broadbill from coffins and bulk bins.

The RWL for lifting and sorting fish from bulk bins was 4.4kg. The lifting index for sorting fish from bulk bins for fish under 10kg was below 3.0 if the task is performed under optimum conditions. Even thought the lifting index is < 3.0, Waters et al (1993) reported that lifting tasks with a lifting index of >1 pose an increased risk of lifting related low back pain for some fraction of the workforce.

Table 12 – NIOSH calculations: examples of manual handling tasks in the seafood industry.

Origin of lift: Lifting large fish crates from floor Destination: onto one fish crate (stack of 2)	RWL = 11.3 Actual weight of fish crate = 40kg Lifting Index = 3.5
Origin of lift: Lifting large fish crates from floor Destination: onto four crates (stack of 5)	RWL = 9.85 Actual weight of fish crate = 40kg Lifting Index = 4.06
Origin of lift: Lifting large fish crates from stack of 5 high Destination: to the floor	RWL = 7.1 Actual weight of fish crate = 40kg Lifting Index = 5.6
Origin of lift: Lifting large fish crates from stack 5 high Destination: to 3 crates (stack of 4)	RWL = 8.3 Actual weight of fish crate = 40kg Lifting Index = 4.8
Origin of lift: Lifting and sorting fish from bottom of bulk bin Destination: to the top of the bulk bin (900mm high)	RWL = 4.53 Actual weight fish = <1 to 10kg Lifting Index = <1 to 2.2
Origin of lift: Lifting fish from middle of a bulk bin Destination: to the top of the bulk bin (900mm high)	RWL = 4.4 Actual weight of fish = <1 to 10kg Lifting Index = <1 to 2.2
Origin of lift: lifting large fish into bulk bins (1050mm high side) Destination: bottom of the bulk bin	RWL = 8.1 Actual weight fish = 25 to 60kg Lifting Index = 3.0 to 7.4
Origin of lift: lifting large fish from coffins (2 coffins stacked on pallet) Destination: display table (390mm high)	RWL = 6.45 Actual weight fish = 25 to 60kg Lifting Index = 3.8 to 9.3

3.5 DURATION & FREQUENCY OF MANUAL HANDLING

In many areas within the seafood industry, manual handling tasks were performed for long periods, and required frequent, repetitive movements. Table 13 provides a summary of the duration and frequency of typical manual handling tasks observed in the industry that involve either heavy or repetitive tasks.

Table 13 – Duration and frequency of typical manual handling jobs

Task	Typical job	Duration & frequency
Heavy lifting and handling – including handling loads between floor and	Processing seafood in co-operatives	• Variable shifts, dependent on boat deliveries
	Setting up the auction floor	• Variable – up to 8 hours, with long overhead periods of constant work with repetitive handling
	Stock control in warehousing and retailing	• Constant throughout shift • Small – medium sized retailers may buy 120 to 250 crates per week in summer and these all need loading into the freezer or coolroom until required
	Shovelling ice, occurs throughout the industry	• Some premises required frequent and repeated shovelling, while others had augers and ice chutes for easier retrieval of ice • In 2 x 5 minute periods of one observation it was noted that for every one shovel-load of ice, an average of 1.5 strikes with the shovel were required. So to achieve 30 scoops or shovel loads of ice, the worker used approximately 45 striking and lifting movements, adding to the workload of this task.
	Wheeling product from the auction floor Loading and unloading vehicles	• 4 – 5 hours per auction, and may be followed by retail or other work • Variable – after a short and intense period of loading, the drivers may then sit and drive for periods of more than 5 hours, and then do another period of intense physical work. • Most loading is done mechanically but loads from small suppliers is manually loaded • Trucks with narrow doorways cannot be loaded by forklift so must be manually loaded. For example, one driver reported regularly having to load 115 x 15kg boxes on one day each week, and then unload them at the customer's premises
Repetitive and forceful upper limb work, done while standing	Filleting fish and steeling the knives	• Constant throughout the shift • Typical rates of filleting for one species was to fillet at a rate of one medium-sized fish each 10 seconds, including 8 cuts with the knife • Steeling, involving rapidly pushing the side of the knife along a long steel held in the other hand, to keep the knife blade straight and sharp, was performed by filleters at a rate of once every 1 – 3 minutes, depending on the filleting task.
	Packaging and processing small seafood products	• Constant throughout the shift
	Cooking seafood in takeaway shops	• Variable – can be very constant at mealtimes at in busy periods

Task	Typical job	Duration & frequency
Repetitive upper limb work with repeated bending	Packing seafood into boxes or coffins positioned at low levels at co-operatives and wholesalers	• Variable – can be 1–2 days constant work when a boat arrives. May be more constant in wholesalers.
	Unpacking fish from coffins and boxes positioned at low levels Unpacking and sorting fish from bulk bins on the auction floor	• Short periods interspersed with other tasks • Relatively short periods (eg 15 to 30 minutes) interspersed with other tasks • The SFM reportedly receives an average of 5 to 6 bulk bins each night and 8 to 10 bins on busy nights. • At the SFM the frequency and duration of this task varies, but it is typically performed over one long period after the fish crates and other loads are sorted. • Depending on the contents of the bulk bins it can take 15 – 30 minutes for one person to empty a bulk bin if the bin contains only one species, and 3–4 people if the bulk bin contains mixed species (eg may contain15 different species) • The sorting was assessed as being as rapid as one fish per second (when grasping one fish in each hand) and one fish every two seconds for larger fish where two hands were needed • The variables affecting the speed of the sorting were the position of the fish (eg on top of the load or deep in the bin), the difficulty in grasping certain species, and the position of the crates

The findings from the project demonstrated that crates were repetitively lifted, lowered, pushed and pulled, and often for long periods before a rest break. Table 14 provides a summary of these repetitive movements. Four staff were observed over twenty-five, one minute work samples.

Table 14 – Handling tasks observed in one minute periods

Number of movements performed*	Lift/lower crates (1 crate at a time)	Push/pull crate/s (stack of 1 – 5 crates)
Minimum number in 1 minute	1 lift/lowers	1.6 push/pulls
Maximum number in 1 minute	4 lift/lowers	5 push/pulls
Average number in 1 minute	2.89 lift/lowers	3.4 push/pulls

*In each minute the subjects were both lifting/lowering and pushing/pulling, however the number of crates pushed/pulled varied, and was either pushed/pulled without aids (ie being pushed directly over the floor) or were pushed using a hand trolley. Pushing directly over the floor was the most common technique.

From these results it is evident that many tasks are performed for long periods and also involve very repetitive manual handling utilising the whole body and/or the upper limbs.

3.6 WORK ENVIRONMENT

The following environmental factors were identified as increasing the risk of staff developing injuries from manual handling tasks at work:

- Floor surfaces
- Cold temperatures
- Poor lighting

Each of these factors is described below.

3.6.1 Floor Surfaces

The main issues identified with floor surfaces in the seafood industry were the constantly wet floor, ice and seafood on the floors, hard floors and uneven floor surfaces.

3.6.1.1 Wet and icy floors

Freezers often have problems with a build up of ice, and coolrooms typically have ice and water on the floor, especially if the icemaker is located in the coolroom. These conditions can increase the risk of slips when staff are pushing or handling loads.

The customer areas were also wet in a number of retail premises surveyed. Some floors were slippery with ice and water and posed a risk to customers and staff. One retailer commented that his shop was redesigned following an incident when an elderly woman on crutches slipped on his floor. In this store the customer area is now separate from where crates and ice are carried, and the flooring has been upgraded to be more slip resistant.

Non-slip surfaces had been installed in a number of retail premises and these varied in type and quality, with some previously non-slip surfaces showing signs of wear and requiring re-surfacing or replacement.

3.6.1.2 Hard surfaces

Staff in most parts of the seafood industry are either standing and/or walking on hard concrete or tiled surfaces all day. Only one of the premises visited in the survey had an area with matting designed to provide cushioning, but this was restricted to one worker who had an injury.

Filleters generally stood on slightly raised platforms, but these were typically crude timber boxes or upturned polystyrene lids. Staff reported that these methods provided some insulation from the cold floor and were also used to raise their height to better suit the high filleting boards.

3.6.1.3 Uneven floors

Many premises, particularly in older buildings, had uneven floors, deep open drains (often covered with uneven or unstable drain covers), and various steps and ramps within the building. Many floors also had hoses stretched across them that created trip hazards and restricted the use of hand trucks and other wheeled aids. Steps into coolrooms and freezers were also common and so restricted the use of hand trucks and other mechanical equipment.

3.6.2 Temperatures

Seafood products are required to be kept at certain temperatures to maintain quality and to comply with food safety requirements. Working in freezers, coolrooms, and using ice and cold running water are part of the normal work environment for staff in most areas within seafood processing, wholesaling and retailing. Most staff are constantly in contact with cold product, cold equipment and ice, and filleters and oyster shuckers have the additional issue of having their hands almost constantly immersed in cold water.

Staff who constantly worked with their hands in cold water reported becoming de-sensitised to the cold water, but also found that over time their hands became stiff and lost mobility. Two filleters described how they could no longer pick up and grip small items such as screws and nails after having worked as filleters for many years. One filleter could no longer open his hands due to the stiffness and lack of movement.

The room temperatures were also reported as a problem by some staff. People working in fishing co-operatives and on loading docks are often exposed to the elements, and the work areas in the building may also be open to the weather due to large roller doors for vehicle access. These environments can be hot in summer and cold in winter.

3.6.3 Lighting

Lighting was often poor in freezers and coolrooms, making it difficult to read labels and to see ice, water and other hazards. Lighting was also noted to be dim over some filleting areas, and this may contribute to the forward flexed posture adopted by some staff to enable them to see the product.

3.7 WORKPLACE & WORKSTATION LAYOUT

Many of the retail premises surveyed (70%) were leased by the business from a shopping centre or building owner. This means that the business has limited control over the design and layout of the interior, storage areas, loading area etc. Opportunities to change the workplace layout to improve manual handling are likely to be limited when leasing a property.

The project identified that the main workplace design and layout issues that impacted on manual handling were in the following areas:

- loading areas
- general design of the front of retail premises
- display case design
- filleting areas
- access to and within coolrooms and freezers
- heights and design of tables, benches and scales

A brief description of how these designs and layouts affect safe manual handling is provided below.

3.7.1 Loading areas

The design and availability of a loading dock area varied greatly between premises. Most retail premises did not have access to a loading dock and used the car park or private rear access to unload their vehicles. Products were generally lifted off the back of trucks, carried up a few steps, then down narrow corridors into coolrooms.

Even in a large shopping centre the seafood retailer had to unload the product onto the ground as no dock was provided. The product was placed onto hand trolleys, taken to a goods lift and then through corridors to the back of the premises.

The only premises that had loading docks were large venues (such as the SFM, large co-operatives and wholesalers), and these varied in design with many lacking cover from the weather. The main complaint made by transport companies and seafood buyers is the lack of suitable dock areas at the SFM. For example with only one dock area and only 3 dock levellers, trucks are forced to queue up to unload and to load their products. After the auction has finished it is common practice to have buyers pushing their hand trolleys through the car park and then to manually load their crates and boxes into the back of their vehicles.

Drivers who deliver products to retailers and restaurants also raised the issue of loading areas. For example, one driver who had 20 regular 'drops' claimed that only two of the premises had loading dock areas, and most had poor access to the premises. Access to most premises was through narrow rear doorways, and some premises required loads to be taken up external stairs that were exposed to the weather.

3.7.2 Retail premises' designs

The design and layout of the retail premises that were surveyed varied considerably depending on the age of the premises, its location and the available space.

In some of the premises the filleting is performed in the main retailing room, and in others it is done in a side or rear room. In many retail premises the display cases were situated in the middle of the shop and the layout and positioning of coolrooms and the filleting areas meant that product was constantly being moved through the customer area. This increases the risk of customers slipping on spilled water, ice or seafood.

A number of retail outlets had designed their layout to separate the customer area from the work area, with U-shaped and L-shaped display cases and barriers such as gates to prevent customer access behind the counters. Specific observations and issues with display cases and filleting areas are discussed below.

3.7.3 Display cases

A wide variety of display case designs were also identified during the project. Table 15 provides information on the different types of display cases and their potential advantages and disadvantages for manual handling. When selecting display case designs retailers need to consider the impact the design has on manual handling tasks. Retailers also need to consider other factors such as the food safety requirements, cleaning, temperature control and the quality and appearance of the product. These other factors are not described in the table.

Table 15 – Features of display case design

Feature	Observations	Potential advantages & disadvantages for manual handling
Display case depth	Deep counters eg up to 1200mm deep from front to back	Disadvantage: • Deep counters require staff to lean into the counter to reach the product
Countertop height	High counter tops were noted in many retail outlets – some over 1450mm high	Disadvantage: • Staff and customers are lifting loads at above shoulder height to reach to the counter top.
Display case height – height at staff side	Display case heights varied – typically 850 to 950mm, sloping down towards the customer side	Disadvantages: • With cabinets packed with ice – the working height will be too high for the majority of staff • The sloped angle can make it hard to reach products in the front of the display case Advantage: • 850 to 950mm is a good working height for most people
Height of product, sitting on ice	Some ice beds were more than 300mm high, and the least amount of ice observed was 30mm With the product sitting on ice the working height varied from 900mm to more than 1100mm	Disadvantages: • High beds of ice require a larger quantity of ice be shovelled and also cleared out • Reaching at chest height or above is more tiring
Spit guards	The use of guards varies, but were most commonly seen over filleted fish.	Disadvantage: • High spit guards can provide an obstruction to passing goods to customers Advantage: • A spit guard with a horizontal surface provides a space for placing goods, and reduces the need for staff to hold a load suspended while waiting for the customer to take it
Refrigeration methods	Most retailers rely on iced cabinets to keep the product chilled. The average number of crates of ice used to fill an average sized display case was 20 to 25 large crates, and 15 crates for a small store. Only 2 stores used refrigerated cabinets in preference to ice. Both of these cabinets were front opening.	Disadvantages: • Repetitive shovelling and tipping crates of ice to fill the cabinets and continually topping up • Water and ice can spill if product is handled in the front of the counter, creating a slip hazard for customers Advantages • Refrigerated cabinets do not require ice • Front opening cabinets are easier to clean • Front opening cabinets can have product loaded from the front

Feature	Observations	Potential advantages & disadvantages for manual handling
Scale placement	Scales placement varied, with the scale base between 1100mm to 1400mm high	Disadvantages: • Scales positioned at or above shoulder height requires the employee to frequently reach above shoulder height to reach the scales and tilt their head to read the display increasing the risk of shoulder and neck injury
Design of corner units	Corners of many display cabinets were very deep and some had product positioned around cabinet supports	Disadvantages: • The support structures made access to the product very difficult • Deep corners required overreaching and forward bending of the back
Wrapping table	Table typically positioned behind the main counter at about 900mm high These areas generally provided a good work surface area	Disadvantages: • If the area is too close to the counter it may encourage staff to twist rather than step and walk
Space between the cabinets to pass items to customers	Some retailers had a lower area between the display cabinets where they could pass the goods and take payment	Advantage: • This space between the cabinets makes it easier to pass purchases to customers without lifting loads over the counter top.
Shelves on either side of cabinet	Some designs incorporated a shelf for customers to place their shopping or other bags, typically between 200 to 300mm deep. Other designs have a shelf on the staff side	Disadvantage: • The positioning of shelves increases the reach distance between staff and customers. Advantage: • A shelf is convenient for customer's bags, and can provide a useful work area for wrapping in some areas.
Fish crates stacked against the cabinets	Many premises stacked crates in front of counters on the customer side to display product	Disadvantage: • This increases the reach distance between staff and customers • Increases the likelihood of ice, water and seafood products falling onto the floor in the customer area

3.7.4 Filleting areas

Fish filleters are employed in processing, wholesaling and retailing operations to clean, scale, fillet and dress seafood. Table 16 provides a summary of the main features of filleting areas noted in the surveys, with comments on the potential advantages and disadvantages of each feature with regards to safe manual handling. Again the emphasis of this information is on manual handling.

Table 16 – features of filleting areas

Feature	Observations	Potential advantages & disadvantages for manual handling
Filleting benches	Benches were often too high for the filleters eg between 1000 to 1050mm high for filleters of relatively short stature (eg males below 1650mm tall)	Disadvantages: • If the bench is too high for the filleter they are working with shoulders hitched and in awkward postures Advantage: • Higher benches can be made to suit a range of sizes through the provision of standing platforms
Sinks: Deep, large sinks with straight sides	Long reach into sink to access products eg to a depth of between 350 to 400mm	Disadvantages: • Reaching down into a sink for the seafood requires repetitive forward bending
Sinks: Semi-circular shaped sink in cross-section from the end view	Shallower sink with curved sides at the front and rear of the sink – 250mm deep in the middle	Advantage: • Less reaching required so a more upright posture can be maintained
Filleting bench with no sink	Cutting board with a shallow depression (25mm) behind it for holding fish A hose runs water over the product rather then having it fully immersed in water	Advantages: • Repetitive forward bending and reaching into sinks is eliminated
Cutting boards	Cutting boards were positioned over at least half the sink in many premises surveyed	Disadvantage: • Reaching down and under the cutting board to reach the product requires forward bending and twisting of the back
Footstools, boxes and lids	Various items are used by filleters to stand on to get them off the hard, wet, cold floor – eg foam lids or a 150mm high timber box	Disadvantage: • The use of lids and old boxes is an inappropriate method of achieving a comfortable and safe working posture and may not provide adequate support to reduce postural stress
Filleting area – space	Many filleting areas were in restricted, narrow areas with crates and boxes stacked around them on the floor	Disadvantage: • Working in restricted areas with minimal space may require staff to compromise safe working postures
Lighting	Some filleting areas were poorly lit	Disadvantage: • With poor lighting, filleters may need to lean forward, closer to the product to enable them to see the product – particularly when working on small products or doing detailed work
Band saws	Band saws were noted in many premises in the survey and are used to slice fish into portions.	Comments: • Band saws were often placed where there was limited circulation space around the band saw, with other staff walking directly behind the operator • Many of the blades did not have any guarding and emergency stop buttons were not easily reached.

3.7.5 Access to and within coolrooms and freezers

Many of the coolrooms and freezers had access from one small doorway, and this was often up a step. One purpose-built facility, the Newcastle Fishing Co-operative, had access from two sides and provided an easier method of loading and unloading products.

Restricted space was also an issue in many premises, and this meant staff were reaching and lifting product that was stacked behind other items. Restricted space also limited the use of hand trucks and other mechanical equipment.

3.7.6 Heights and design of tables, benches and scales

Staff in many areas of the industry were lifting items on and off tables and benches that were not the best height for the load or for the tasks. For example, low tables that require forward leaning to reach the product (eg tables 400 to 600mm high were observed), and high benches that require elevating the shoulders.

Some tasks required loads to be frequently lifted between surfaces, and the workplace layout did not allow for the load to be slid or moved easily between benches or tables.

The placement and height of scales was also identified as a common problem in most premises. Often very heavy loads (such as crates of fish and large fish) had to be lifted off one surface, carried to a scale, and lifted onto the scale (eg in fishing co-operatives and at the auction floor).

Scales in retail premises were often poorly located with the platform of the scale often at or above the shoulder height of staff (eg to 1400mm) requiring loads to be lifted to and from this height.

All of the above design factors can create additional hazards for staff and increase the risks of musculoskeletal disorders when they are handling loads.

3.8 WORK ORGANISATION

The main organisational issues impacting on workload and manual handling tasks related to the:

- very variable and unpredictable work flow
- frequent double handling of loads
- long and/or intense work periods

Each of these factors is described below, together with a description of their impact on manual handling tasks.

3.8.1 Variable and unpredictable workload

In many areas of the seafood industry the organisation of manual handling tasks is dependent on the amount of fresh seafood product available, and this is dependent on the weather and the season. At fishing co-operatives the workload is generally unknown until the arrival of the fishing boats. The size and variety of the fishers' catches then determines the tasks performed at the co-operative. The co-operatives' busy periods are usually when the local seafood products provide the largest catches.

The unpredictable and variable workload was also a problem highlighted at the SFM auction floor. The auction area receives goods from up to 20 trucks through the night prior to the auction the following morning. In addition, the local fishing fleet delivers their load directly from the wharf. While some fishing co-operatives and transport companies provide an indication via fax or phone regarding the amount and type of product to be delivered and their estimated time of arrival, many do not. This makes it difficult for managers and supervisors at the SFM to ensure that they have sufficient staff to perform the work.

The total load on the auction floor is also variable, as they can receive anywhere from 2000 – 6500 items (crates, boxes) and these have to be sorted and positioned for each auction. The timing of delivery of the loads may mean that there are quiet and very busy times throughout the shift.

Another issue impacting on the work organisation for SFM staff was the problem with buyers viewing the product while they were trying to sort and position the load. Buyers were observed to arrive at the fish markets from as early as 3.30am for the 5.30am auction. The impact of this is that the product (crates, boxes and bulk bins etc) are still being unloaded and sorted, with forklifts in use. The buyers act as obstacles for staff and disrupt the flow of work, and are also at risk of being injured by trolleys, forklifts and crates.

Retailers appear to be slightly less influenced by the season and the catch, but the busiest periods are reportedly the Christmas period, summer months and Easter. The workload is also affected by the public's shopping patterns and meal times (eg for takeaway foods).

3.8.2 Double handling

At many stages of the movement from the wharf to the retail premises and to restaurants the loads are repeatedly manually handled, and are often unstacked and restacked by the same workers over a short period.

Multiple handling of crates and boxes was a feature of work at fishing co-operatives, at the SFM auction floor, and in wholesalers and retail premises. At a co-operative, the process of sorting, filling, weighing and icing both fish crates and bulk bins required a considerable amount of double handling of loads. When filling the bulk bins during busy season (eg 'mullet runs') the product is placed in a fish crate, weighed and then lifted and tipped into the bulk bin and iced. Fish crates are also filled with fish, lifted onto the scales with fish added or removed, and then lifted to the floor and iced.

Throughout the industry most of the product is stored in tall stacks, so to access the bottom crate or box all of the other loads must be lifted off and then re-stacked. In this case if a wheeler needs just 20 crates that are each at the bottom of a stack of 5, he may have to perform 9 lifts per stack (so 180 lifts in total) to collect only 20 crates.

This double handling was also observed at a wholesaler, when loads arrived on pallets stacked very high (beyond 2m). As this load was too tall for the freezer, the top level had to be unpacked. This process involved removing the plastic wrapping from the load, lifting off the top layers, stacking these onto another pallet, and then re-wrapping the new load.

3.8.3 Hours of work and job design

Staff in the seafood industry work various hours through the week, with shifts including night work, very early morning work, and weekend work. The survey of 35 people in the industry revealed that the average hours worked per week were more than 52 hours, with 10 of the respondents working in excess of 70 hours a week. Staff who worked the longest hours tended to be business owners, managers or in other senior roles. Truck drivers also worked long hours when the work was available.

Table 17 – Hours worked

Range of hours worked	16 to 84 hours
Average hours per week	52.4 hours
Median hours per week	47 hours
Standard deviation	16.7 hours

In depots and fish co-operatives the hours are less fixed and are dependent on the fishing fleet, weather and season. The typical hours of operation reported were 8 – 12 hours per day. In addition, in the busy periods when certain fish are 'running' the staff may work 18 hours a day and may also be on call if a boat arrives.

Staff at the SFM auction floor are mostly employed to work a 38 hour week and they work day, afternoon or night shift with staggered start and finish times. Most manual handling activities are performed on the afternoon and night shifts when the product arrives for the weekday auctions. The data entry staff may supplement the usual afternoon and evening shift staff if required.

The retailer managers/owners interviewed typically started their day with a trip to the markets, and arrived at least 30 minutes before the auction started at 5.30am. They report typically ending their day at about 6.30pm to 7pm, depending on the day and time of year. Many of the retail premises surveyed opened 7 days a week, particularly if located in a large shopping centre, the fish markets or a tourist area. Retail shops in suburban Sydney tend to open 6 days a week.

Truck drivers had a very different workload from others in the industry, with the periods of intense activity when they are loading their trucks, followed by sitting in a fixed and static posture for very long periods, then further intense activity to unload the truck. The amount of manual handling varies according to the load and the delivery site.

While most permanent staff in the seafood industry are paid a weekly wage, casual staff are paid for hours worked or on a piece rate. Examples include workers who process seafood who are paid per kilo of product, and some wheelers (who lift and wheel the crates and boxes from the auction floor to the trucks) who are paid by the crate or on a unit rate. One manager observed that staff paid by piece or unit rates " don't tend to take breaks – they just keep working!"

3.9 SKILLS AND EXPERIENCE

3.9.1 Job Skills

The skills and experience of the managers and staff interviewed varied, with many having working solely in the seafood industry, and others with some experience in other industries. The specific educational and training backgrounds were not assessed in this project, however informal conversations revealed that most had learnt their skills on the job in the seafood industry.

The work roles and duties also varied, with some staff working across a number of areas, and others specialising in one function. For example, in retail premises, staff often worked between the coolroom, sales and cooking areas, however filleting and oyster shucking were often more specialist positions.

Owners and managers appear to be the most multi-skilled, and have often been in the industry for many years with some experience and training in each area. Most of the managers were 'hands-on', participating in filleting, sales or coolroom activities as required. Several managers/owners commented, "you have to be able to do everything!"

3.9.2 Employment patterns

The interviews with people working in the industry revealed that staff tend to stay with one company for a long time, and it is not uncommon for staff to have in excess of 20 years in one company. In the survey, the median length of employment was 8 years, with the longest being 42 years. Staff frequently described the issue of loyalty towards the company during interviews and informal discussions.

Table 18 – Employment duration

Range	0.5 – 42 years
Standard deviation	10.9 years
Mean	11.8 years
Median	8 years

The other factor with employment in this industry is the large number of casual staff. Most employers seem to operate with a core of permanent staff that is supplemented with an equal number of casuals. Tasks such as fish processing (eg shelling and freezing prawns and packing seafood), serving in retail premises, cooking fish and chips and filleting, all used casual staff to cover workload peaks.

Consistent with other industries in Sydney and regional areas, there is a wide ethnic mix of people working in the seafood industry, including many from non-English speaking backgrounds. According to people interviewed for this project, the businesses located within the Sydney Fish Markets are changing from being dominated by people from Greek backgrounds to having an increasing amount of people from Asian backgrounds.

Being from a variety of ethnic backgrounds means that the population has a great range of statures and a range of communication requirements that must be considered when designing manual handling tasks to be safe.

3.9.3 OHS knowledge

Staff working in the seafood industry who have a role in OHS described a general lack of understanding and appreciation of OHS throughout the industry. While food safety has gained recognition and some premises were in the process of implementing food safety systems, the area of OHS was not considered as important or as relevant.

When interviewing managers and owners, OHS was seen as being "common sense", and not requiring special skills or knowledge. Experience in the industry was considered to be most important. Younger workers were considered by some managers to be most at risk of injury as they "don't know their limitations". Those managers who had come from outside the industry appeared to be more aware of OHS and were trying to improve safety within their businesses. Those businesses that were implementing food safety systems also had a better understanding of OHS and risk management than other businesses.

According to the staff surveyed as part of this project, only 18 (or 50%) had received any training in OHS, and of these most had received the training when they were working in other unrelated industries. Only 4 respondents (or 11% of the total) reported having received training in manual handling issues related to their job in the seafood industry.

In the survey staff and managers were also asked about access to OHS information. Their responses are summarised in Table 19.

Table 19 – Responses regarding gaining OHS information and advice

Responses to "If you want occupational health and safety information or advice, what do you do?"	**Number of responses (Respondents may have more than one response)**
From managers:	
• Contact WorkCover	2
• Ask the Master Fish Merchants Association	2
• Contact Sydney Fish Market	1
• Don't know	1
• Why would I need information?	1
From staff:	
• Ask the boss/supervisor	13
• Not sure/don't know	4
• ask a Health Inspector	1
• ask the chair of the OH&S committee	1
• look in the Yellow Pages	1
• ask the Seafood School at the SFM	1
• ask at the SFM First Aid Room	1
• refer to the SFM OHS booklets	1

Another question in the survey asked how people in the industry would like to receive information about OHS (such as advice from this project) and the responses are summarised in Table 20.

Table 20 – Provision of information to managers and employees

How managers would like to receive OHS information for themselves and/or for their staff	How staff would like to receive OHS information
• Newsletter • Flyer to place in pay packets (simple information eg 5 words maximum) • Verbal – get too much junk mail over my desk • Something with illustrations • Something faxed that I can pin up so all staff can read it • A written summary of the key issues, written with dot points for the manager, then for the staff a poster with pictorial information clearly showing the right or wrong methods etc • A letter • A poster or a video	• Newsletter • Face to face • From the supervisor, together with facts and figures • Tool box meeting and from the OH&S committee • A brief note – not too lengthy that takes too long to read • Informal meeting with manager • Something with clear illustrations • Posters

3.10 AGE

The age range of staff interviewed in the survey was 18 to 61 years old (median = 37 years). As was seen in the previous information regarding length of employment (see Table 18), many of these people have worked in the seafood industry from a young age. According to the managers interviewed, young students and other casual staff may be employed in busy times, so this may lower the average age of workers.

Table 21 – Reported ages of staff interviewed

	Reported ages
Range	18 – 61 years
Standard deviation	12.4 years
Mean	37.4 years
Median	37 years

3.11 CLOTHING AND PERSONAL PROTECTIVE EQUIPMENT

The most typical clothing worn in processing and retail premises during the project (conducted in a Sydney winter) was casual long pants and shirts and warm tops. People interviewed reported a number of problems with clothing and footwear, and additional issues were also noted during the project that affected workers' abilities to perform manual handling tasks. These comments and observations are summarised below.

3.11.1 Footwear

Most staff wore gumboots, but made the following complaints about this footwear: gumboots did not keep the feet warm; tended to rub and cut into the flesh on the calf area; and were not comfortable when worn for long periods. Some staff had tried to remedy the warmth problem by wearing plastic bags over their socks. One brand, 'Blundstone', was reportedly more padded than some other brands.

Some staff wore slip-on boots, reporting these to be more comfortable than gumboots.

In some settings protective steel caps were a requirement, and these were available in both the gumboot and shorter boot style.

3.11.2 Aprons

For protection from the water and ice most staff wore long plastic aprons fastened around their neck and covering from the chest to below the knees. Staff reported the following problems: they created a dragging and heavy feeling, tending to pull on the neck; and were too stiff to be able to crouch down to lift things from low levels and position the load between the legs.

3.11.3 Gloves

Rubber gloves were typically worn by staff sorting fish to protect them from the spikes and from the cold. However staff reported that the gloves made it more difficult to grasp some fish due to their slipperiness, as the thick rubber significantly reduced their sensation. The thinner rubber or latex gloves were also unsuitable as the spikes could easily penetrate them.

In only one site the newer, trainee filleters wore slash proof gloves, and this was required by management. While these filleters had learnt to fillet using the gloves, the senior filleters found gloves too cumbersome and filleted without the gloves.

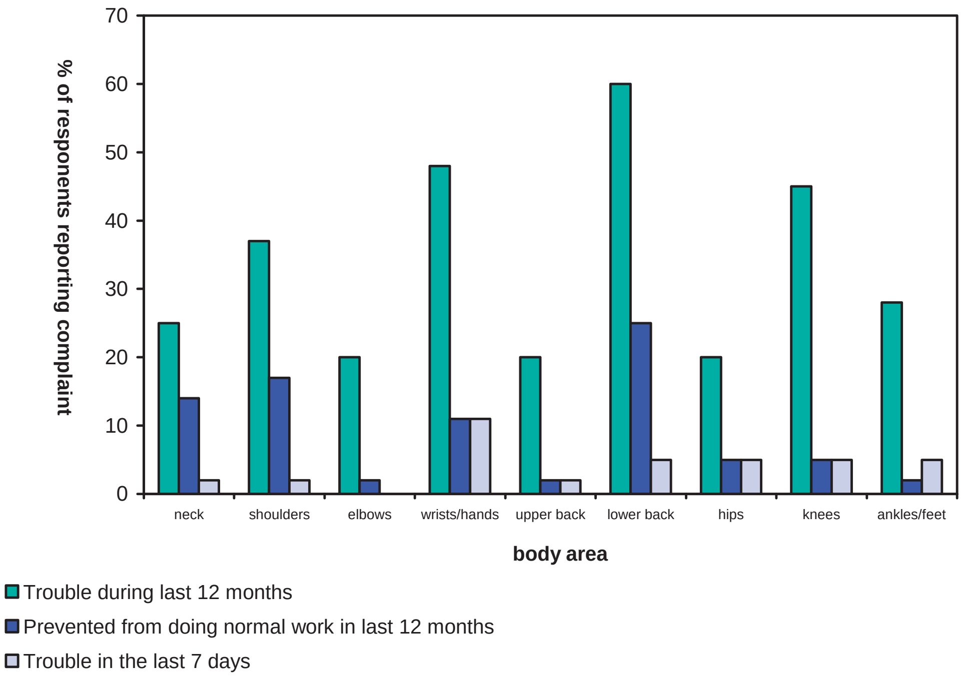
3.12 OTHER FACTORS

3.12.1 Injuries and injury reporting

A questionnaire regarding musculoskeletal health was used to determine if staff had past and/or current episodes of 'trouble' (defined as an ache, pain or discomfort) in their neck, arms, hands, back, and legs (see Appendix). The questions asked if they had experienced trouble at any time in the past 12 months, and at any time in the past 7 days. They were also asked if this trouble had prevented them from doing their normal work at home or at work.

A summary of the results are provide in Figure 3.

Figure 3. Reported musculoskeletal complaints for people working in the seafood industry



After asking about their health, the staff participating in the semi-structured interviews were then asked about injury reporting, and asked if they would report a work injury. The interviews revealed that there was a varied response, with many of the staff (26%) reporting that they would not inform anyone of their injury and may even keep working. Of the staff who stated that they would report the injury, all were working at larger premises.

Table 22 – Responses regarding injury reporting

Responses to the question "If you were injured at work, what would you do?"	Number of responses from 30 staff (Respondents may have more than one response)
Tell the boss	15
Complete an incident report form	5
Don't report it at work	5
Keep working then go to the doctor	5

Staff were also consulted about any suggestions they had to prevent manual handling injury that were in addition to design and layout features they had already provided. The following health strategies were suggested: warm up and stretch before work each day, especially if doing heavy work eg loading crates in the morning; wear lumbar belts for support; avoid lifting loads heavier than you can manage; don't lift crates on your own; practice yoga.

3.12.2 Industry associations and stakeholders and their role in manual handling

Each of the 5 managers interviewed were members of an employer association – the Master Fish Merchants' Association (MFMA). On the contrary, only 2 staff reported being members of unions – the Shop Distributive and Allied Employees Association and the Transport Workers Union.

Employer associations and unions can be one source of information, advice or support regarding manual handling and other OHS issues. However neither the MFMA or the reported unions appeared to have had much past influence or involvement in the seafood industry on the manual handling issues identified in this project.

Many other associations and organisations were contacted as part of this project including various Fishing Industry Councils and Seafood Councils, Fishing Co-operatives Association, Seafood Services Australia, Seafood Training Australia, TAFE's NatFish, the Australian Maritime College etc. All have different roles within the fishing and/or seafood industries. Of these bodies, the one that appears to have the greatest role in or knowledge of OHS and manual handling issues is Seafood Training Australia, as they include OHS subjects (and manual handling) as part of the Seafood Industry Certificates.

3.13 SUMMARY OF FINDINGS

Based on the results of the detailed analyses, the tasks identified as posing the most significant risks of injury from manual handling are:

- Lifting and moving large fish crates and heavy boxes – especially if lifting/lowering from high or low levels, moving them on and off various hand trucks, and pulling stacks over the ground
- Lifting and handling large fish – especially from high or low levels
- Packing and sorting seafood – especially if using bulk bins and/or leaning and twisting and doing rapid work
- Filleting fish – especially at a poorly designed workstation and if not interspersed with other tasks

4. DISCUSSION

The results of the project show that many of the manual handling tasks currently performed in the seafood industry place workers at high risk of developing work-related musculoskeletal disorders. The specific risks to the back and upper limbs identified were the heavy and forceful movements and awkward postures as well as the long periods performing these tasks and the repetitive nature of some tasks.

The key factors contributing to these risks are the:

1. Loads – weights and forces
2. Postures and movements – and the impact of workplace and load design
3. Duration and frequency of the manual handling tasks
4. Work environment
5. Lack of OHS systems – for injury prevention and injury management

These risk factors have been shown to be major contributing factors to work-related musculoskeletal disorders (OSHA 1999). Other evidence shows that these disorders are often related to more than one risk factor and are "multifactorial" in origin. This term is described as the "simultaneous exposure to and often synergy among, several risk factors, eg high force requirements and awkward postures" (OSHA 1999).

Many of the manual handling tasks assessed during this project included a range of risk factors. Each of these factors will be discussed below considering both the individual risk factors and also their relative impact when they are combined with other risk factors.

4.1 LOADS – WEIGHTS AND FORCES

4.1.1 Load weights

The manual handling task that posed the highest risk in the seafood industry was handling large fish crates. As the project showed, loads are often in excess of 40kg and can be over 50kg and are generally handled by one worker. The results of the NIOSH calculations illustrate that these weights are well in excess of the 'recommended weight limit'. Other heavy and awkward loads such as the coffins, large fish and heavy polystyrene boxes were also found to exceed the recommended weight limits.

While people working in the seafood industry routinely lift and handle these heavy loads, the ability to lift does not indicate that the load is safe to lift. Research shows that what people feel is acceptable to them is often placing high compression and shear forces on the structures of their back, and may also be placing them at risk due to their personal physiological characteristics and limitations (Mital, Nicholson & Ayoub 1993; Stevenson 1999).

There are various methods to determine the maximum and optimum loads for manual handling for a working population. The guidelines developed by Snook and Ciriello (1991) are based on psychophysical research and a summary of these is provided in Table 23. However with any guidelines it is critical to consider all of the variables impacting on the task, for example the number of times the load is handled in a typical day.

Table 23 – Recommended maximum acceptable loads for lifting and lowering (based on a load with handles, width 490mm, for a lift or lower of a height of 760mm)

Males	Acceptable Weight (kg)	Between floor level and knuckle height Lift / Lower	Between knuckle and shoulder Lift / Lower	Between shoulder height and arm reach Lift / Lower
Loads lifted/ lowered once every 8 hours	Optimum* Maximum*	20 / 24 28 / 34	17 / 19 23 / 26	16 / 15 21 / 21
Loads lifted/ lowered once every 30 minutes	Optimum Maximum	17 / 19 23 / 26	16 / 16 26 / 21	14 / 12 24 / 17
Loads lifted/ lowered once every 5 minutes	Optimum Maximum	16 / 18 19 / 21	24 / 26 13 / 12	14 / 15 17 / 17
Loads lifted/ lowered once every 14 seconds	Optimum Maximum	10 / 11 14 / 16	12 / 14 16 / 18	10 / 10 13 / 14

Females	Acceptable Weight (kg)	Floor level to knuckle Lift / Lower	Knuckle height to shoulder Lift / Lower	Shoulder height to arm reach Lift / Lower
Loads lifted/ lowered once every 8 hours	Optimum* Maximum*	13 / 13 16 / 16	12 /13 14 /15	9 / 10 11 / 12
Loads lifted/ lowered once every 30 minutes	Optimum Maximum	9 /10 12 /12	10 / 10 12 / 12	8 / 8 9 / 9
Loads lifted/ lowered once every 5 minutes	Optimum Maximum	8 / 9 10 / 11	9 / 9 11 / 11	7 / 8 8 / 9
Loads lifted/ lowered once every 14 seconds	Optimum Maximum	7 / 7 9 / 8	7 / 7 8 / 8	5 / 5 6 / 6

(Tables adapted from Snook & Ciriello, 1991)

* Optimum refers to loads that can be handled by 90% of workers, and can be used to plan routine and repetitive manual handling tasks

* Maximum permissible weights are those that 75% of healthy workers aged between 18 – 60 years can be expected to lift (Stevenson, 1999).

Applying these guidelines to the results, it is then possible to determine the safety of the current load weights that were observed. For example, the results showed that lifting and handling of crates with male workers was performed at a rate of an average of 3 lift/lowers between floor and above shoulder height every minute. Using the above table as a guide, the recommended optimum load for this task would be between 10kg to 13kg.

However for less frequent handling, such as taking a crate to the filleting bench, the rate is approximately once every 5 minutes. If the crate could be lifted from a height of between knuckle and shoulder and was placed between knuckle and shoulder height, the optimum load would be 14kg to 15kg. A task performed less frequently but also from a mid-position (knuckle to shoulder) may be safe with a heavier load, eg up to 16kg.

The NIOSH calculations also demonstrated that lifting large fish crates and other heavy and awkward loads exceeded recommended weight limits for these tasks. The NIOSH calculation is based on three sets of criteria, from the fields of biomechanics, psychophysics and physiology.

The recommended weight limit for a task represents a load value that nearly all healthy male and 75 percent of females could perform. The NIOSH recommended weight limits, calculated using a 23kg load constant, could be regarded as conservative for a population of males. However, the Lifting Index provides an alternative means of interpreting the NIOSH equation results, with values exceeding 3.0 considered as placing most employees at risk (Waters et al 1993). Lifting index values greater than 3.0 were found in manual handling tasks commonly performed in the seafood industry.

The 1992 NIOSH lifting equation has a number of limitations, with the main being that it is only applicable to analysing two-handed lifting and lowering tasks. The NIOSH equation is also based on the assumption that other manual handling activities such as pushing, pulling, carrying and holding are minimal and do not require significant energy expenditure. The equation does not include unpredicted conditions such as unexpected heavy loads, slip or falls. It assumes that the work environment provides a firm footing and does not account for added environmental stresses such as high temperatures and or humidity. As many of the above conditions occur during manual handling tasks in the seafood industry the recommended weight limits may still be too high.

Given the seafood industry’s current load weights, positions of the loads and the rate of work, the industry will need to carefully consider how to improve the methods for handling these loads. The aim for controlling the major risks with this heavy manual handling is to eliminate the need to handle the loads by using a more automated system of bulk handling. The forklift tines designed specifically to lift and move the crates were good examples of this approach (for example at the SFM and at the Newcastle Commercial Fishermen’s Co-operative).

4.1.2 Forces to move loads

Using two-wheeled hand trucks to move heavy loads and sliding stacks of fish crates across the floor were also tasks that posed significant risks to people working in the seafood industry.

The postural analyses (OWAS and RULA) demonstrated that the hand trucks currently in use in the industry require very awkward postures and extreme ranges of movement in the upper limbs in order to load and unload them. The exceptions to this were two specially designed trolleys that do not require the load to be tilted, and can be used in more controlled and upright postures as well as requiring significantly less force.

The forces used to pull stacks of fish crates over the floor exceeded recommended guidelines for push/pull forces. Workers also adopted awkward postures while performing this task. The combination of the large forces with awkward postures increases the risk of injury. Table 24 outlines the acceptable pulling forces for men and women.

Table 24 – Acceptable pulling forces

Males: pulling a load at height 950mm		**Distance**					
Frequency of pull/push	Males Acceptable force (kg)	2.1 metres		7.6 metres		15.2 metres	
		Initial force**	Sus. force**	Initial force	Sus. force	Initial force	Sus. force
Every 12 seconds	Optimum* Maximum*	22 27	13 17	–	–	–	–
Every 1 minute	Optimum Maximum	25 31	16 21	23 28	13 17	21 12	26 15
Every 30 minutes	Optimum Maximum	27 33	20 26	24 30	16 21	23 28	14 18

Females: pulling a load at height 890mm		**Distance**					
Frequency of pull/push	Females Acceptable force (kg)	2.1 metres		7.6 metres		15.2 metres	
		Initial force**	Sus. force**	Initial force	Sus. force	Initial force	Sus. force
Every 12 seconds	Optimum* Maximum*	16 19	_9*_ 12	–	–	–	–
Every 1 minute	Optimum Maximum	18 21	10 13	16 19	9 11	14 17	_7_ _10_
Every 30 minutes	Optimum Maximum	22 26	12 16	20 23	10 14	17 20	9 21

(Table adapted from Snook & Ciriello, 1991)

* Optimum refers to loads that can be handled by 90% of workers, and can be used to plan routine and repetitive manual handling tasks (Stevenson, 1999).

* Maximum permissible loads are those that 75% of healthy workers aged between 18 – 60 years can be expected to manage (Stevenson, 1999).

** 'Initial' refers to the force required to initiate the movement, while 'Sus' refers to the force required to sustain the movement.

Numbers in italics refers to forces that would exceed physiological limits if the pulling/pushing task were performed continuously over an 8 hour shift.

One co-operative that participated in the project had been working in a systematic way to identify and assess manual handling risks, and the new and innovative trolley designs are examples of what they had achieved. These designs eliminated the need to slide crates on the floor and minimised the use of the two-wheeled hand trucks. These serve as examples of the value of investigating problems, considering various options for controlling the risks, and involving the workers who perform the tasks in developing solutions.

4.2 POSTURES AND MOVEMENTS

4.2.1 Tasks requiring awkward postures

The second most significant risk factor identified in this study were the awkward postures workers adopted while performing manual handling tasks. The results of the posture analyses (OWAS and RULA) demonstrated that forward bending, twisting, reaching, and performing tasks over shoulder height were all common postures, and each of these postures increases the risk of musculoskeletal disorders. The combination of any of these postures further increases the risks associated with manual handling.

The tasks identified with the most awkward postures were:

- reaching to crates and other loads (eg fish) stacked high (ie over 1400mm)
- pushing hand trucks under loads
- reaching and leaning into large bulk bins when processing or sorting fish
- bending and twisting to lift and move loads from low levels
- shovelling ice from various styles of ice bins
- filleting fish

The results from the project illustrate how most forward bending, twisting and over-reaching postures are influenced by the size and dimensions of the loads, the workplace layout, access to the loads and the availability of suitable equipment. The design of many of the manual handling tasks assessed did not allow workers to use symmetrical or upright postures, so in many cases workers adopted 'unsafe postures' such as forward bending and twisting to perform the tasks.

The start and finish positions of a load are important factors to consider when determining the relative safety of a task. It was common to lift crates and other heavy loads on and off the floor, and to lift and lower loads from above shoulder height. Even with much lighter loads, the risk of injury is still significant if the task is done in a forward leaning, twisted or over-reaching posture.

In two studies comparing the back at different postures while moving boxes stacked on pallets, the highest risk task was lifting loads from the base of the pallet (Marras, Granata, Davis, Allread, Jorgensen 1996, and Allread, Marras, Granata, Davis & Jorgensen 1996). One of the studies found that at the bottom pallet layers, the risk of low back injury was the same regardless of the weight or the size of the box (Allread et al 1996).

Another factor affecting the risk of using twisted or stooped postures is the time that the worker maintains this posture, with risk increasing with duration. Studies have found that workers doing tasks requiring long periods of forward leaning (such as bending into deep bins or over a low table) are at an increased risk. Prolonged full flexion causes the spinal ligaments to 'creep' and for the disc annulus (situated in the spinal discs) to be forced posteriorly (or backwards). This change to the spinal structures lasts for between 2 and 30 minutes following a period of 20 minutes in flexion, and so places workers at a greatly increased risk of injury from heavy manual handling tasks during this flexion recovery period (McGill 1997).

This scenario of working in a flexed posture and then performing strenuous work is common in a few areas within this industry. For example, fish processing and sorting from bulk bins can involve long periods of forward bending (eg 20 minutes or more) followed by episodes of heavy lifting and handling.

4.2.2 Compensating for tasks requiring forward bending and twisting

The reasons that bending and twisting postures pose additional risks are related to a range of biomechanical and physiological factors such as the compressive and shear forces on the discs and stretching of various musculoligamentous structures. The ergonomics literature suggests that the weights of loads should be reduced where bending or twisting is involved.

The United Kingdom Health and Safety Commission recommend that industry be guided by the following 'Correction Factors' on the weights people handle while stooping or bending (Pheasant & Stubbs 1991). These factors are provided in Table 25.

Table 25 – Correction Factors – Reduce guideline weights by the percentages shown

Stooping	20 degree stoop	25%
	45 degree stoop	35%
	90 degree stoop	50%
Twisting	30 degree twist	10%
	60 degree twist	15%
	90 degree twist	20%

Using the data from Table 23, a 16kg load at waist height may be considered an optimum load if the load is lifted every 30 minutes in an upright posture (eg lifting a polystyrene box from a shelf). However, using the Correction Factors in Table 25, if the load was on the floor and could only be lifted while bending at 90 degrees (such as a box in a coolroom positioned behind other boxes), the safe load would be 50% less or 8kg.

4.2.3 Impact of the overall design and layout of premises

The project identified a variety of designs across the different sectors of the seafood industry (from fishing co-operatives to retail premises) that are likely to be contributing to many of the postural problems described above. While some of the newer premises had carefully incorporated features that made manual handling easier and safer, many premises had not.

Many of the older premises appeared to have developed in an ad hoc way and did not provide a good flow of materials between the loading area and the main work areas. Some of the designs and layouts suited the staff and tasks within the premises, but they were not always well designed for other businesses or individuals that routinely visited to supply or collect product from them or to perform other manual handling tasks.

The issue of site safety and the responsibility of site owners for others visiting their premises to perform manual tasks was explored in a WorkCover NSW working party (Weigall & Hely 1998). The working party found that there was significant confusion about responsibility for manual handling and other OHS issues when workers visited or attended others' premises. Workers were often provided with inadequate or unsafe facilities, and were not given safety information regarding the worksite they were visiting.

Given the close business relationships between the different parts of the seafood industry, the flow of goods within the industry needs to be reviewed to ensure that manual handling is safer for all parts of the industry, and that there are systems and structures to facilitate this. OHS should be incorporated into all workplace design, equipment and work production schedules and strategies, rather than be seen as a separate issue (eg NOHSC 2000), and should include consideration for other workers and people visiting the site.

4.2.4 Load sizes affecting manual handling

As the results of the survey indicated, the typical loads handled in the seafood industry are long (fish crates >700mm, coffins >1800mm, and large fish >1000mm) and often bulky (eg large boxes without handles, and large seafood products). The Australian National Standard and Code of Practice for Manual Handling (NOHSC 1990) states that there is an increased risk of manual handling injuries where loads exceed the following dimensions: length – 500mm; width – 300mm. Many loads handled in the seafood industry exceed these dimensions.

Ergonomics and safety literature recommend that loads and containers that are to be manually lifted and carried should be as compact as possible to permit the centre of gravity to be close to the body. With the centre of gravity of the container close to the spinal column, the disc pressure on lumbo-sacral disc (L5/S1) is minimised (Chaffin & Anderson 1984). In addition, if the load is to be lifted from the ground the load should be able to pass between the knees, so a width of less than 300mm is optimal (Pheasant 1988).

Clearly few of the loads handled in the seafood industry are in line with these guidelines, and this increases the difficulty with manual handling tasks and increases the associated risks.

4.2.5 Handles on loads

Despite the difficulty with some loads in the industry due to their size and weight, workers interviewed reported that the handles on the crates made them easier to lift and move than other similar sized loads that lacked handles.

This view is supported by a number of biomechanical studies that show how a handle on a load can make the load safer to lift as it significantly reduces the loading on the spine. In one study on lifting boxes weighing from 18 to 27kg, the use of a handle reduced spinal compression by an amount that was equivalent to removing almost 5kg from the box weight (Marras et al 1996).

Drury (1980) suggests that handles should be placed on all containers that are to be carried. According to Drury (1980), an optimal handhold cut-out has the following characteristics: 115mm long, 25 to 38mm diameter bearing surface, hand clearance of 30 to 50mm clearance. These handhold specifications are similar to the current fish crate (108mm long, clearance of 35mm, 18mm diameter bearing surface).

Given workers' preference for handholds and their value from an ergonomics perspective, the handles on fish crates should clearly be continued and perhaps extended to all sides, and other loads that lack handles or handholds should be redesigned.

4.2.6 Other load design issues

Other factors that increase the manual handling risks of loads are described by the NOHSC (1990) and these include loads that:

- are smooth, slippery, greasy or wet
- have sharp edges or protrusion
- are very hot or cold
- need to be moved in a special way to ensure it is not damaged
- are an awkward shape to carry in a balanced posture

Many of these factors are present in the loads handled within the seafood industry – such as with sashimi, live lobsters, and icy boxes – and pose additional risks to manual handling.

As with other OHS issues related to loads and their packaging options, the problems need to be managed through a systematic process of assessing the risks with the load, and then developing, prototyping and trialling new methods to eliminate or reduce the risks. These changes to the loads and their packaging should also be designed to suit each product and its movements through the supply chain (Hely & Weigall 1998; Hely & Weigall 1999).

4.3 DURATION AND FREQUENCY OF MANUAL HANDLING TASKS

4.3.1 Prolonged periods of manual handling

A common issue identified during the project was the prolonged periods that some staff performed heavy and intensive manual handling tasks. For example there were periods of intense work in fishing co-operatives when boats were unloading their catch, at the SFM when trucks made deliveries for the auction floor, at depots where trucks were manually loaded, in stores areas, and in some seafood processing jobs such as filleting.

The duration of the task affects fatigue and muscle recovery, and long periods of either static or dynamic muscle effort need to be interspersed with frequent rest breaks or with other less physically demanding activities (OSHA 1999; NOHSC 1990).

Even low magnitude loading – such as handling light loads – can cause low back injuries (McGill 1997) and other musculoskeletal injuries if it is applied over a long duration. For example, while fish filleters may not always be required to handle large crates, by filleting they are performing demanding physical work based on the high static loading required in their shoulder and neck muscles. In addition, they are using the muscles in their forearms, wrists and fingers to repetitively grasp the fish and to use the knives for long periods.

Some activities in this industry could be described as having only short periods where they are exposed to musculoskeletal risk factors – such as working in retail sales at a very busy time but at a well designed counter. Other tasks such as the filleting, processing and sorting crates appear to have more constant physical demands. It is these long periods of physically demanding work through the shift and through the working week that place people at most risk.

As described earlier and outlined in Table 23, the safe loads that can be lifted and lowered repeatedly and for a long period are less than loads that are infrequently handled or handled for short periods.

However the difficulty with many of the jobs in this industry is the unpredictability of workloads and the lack of ability to properly plan work schedules. For many sections of this industry, peoples' workload during the shift and during the week is largely or totally dependent on businesses further up the chain. While some of these issues can be addressed in part through earlier notification of estimated time of arrivals and estimated loads being delivered, a large casual or flexible workforce will always be required to cope with peak times in order to avoid placing excessive strain on permanent staff.

The issue of job design must also be considered to ensure that staff who work on piece or unit rates do not work beyond the point of fatigue and place themselves at increased risk of musculoskeletal injury.

4.3.2 Repetitive tasks

While there is no one specific definition of repetitive, Kilbom (1994) suggests the following definition:

- Cycle time is less than 30 seconds
- Fundamental cycle is more than 50% of the total cycle
- Task is performed for more than 1 hour

Combining the project findings and the above definition, the following tasks are considered to be repetitive:

- Filleting and scaling fish
- Sorting fish from bulk bins
- Moving and sorting fish crates
- Filling and emptying bulk bins
- Processing seafood
- Oyster shucking

Fish filleting and oyster shucking were perhaps the most repetitive tasks identified during the project. These tasks have very short cycles with the cycles continuing throughout the shift. The analyses of filleting identified the speed of the filleters' wrist and finger movements, the extreme joint positions, the force required, and the impact of the constant immersion of hands in cold water which all combine to make this a demanding job.

The findings regarding filleting from this project are consistent with the published literature that identified that people working in fish processing (eg gutting, filleting) were at high risk of sustaining upper limb musculoskeletal injuries.

Fish sorting from bulk bins is another example of a very repetitive task for the upper limb as it requires reach, grasp, and release movements to sort the products, some of which are very small and difficult to grasp.

These tasks are also considered to be 'high risk' due to the repetitive nature of the work, the awkward upper limb postures, and the speed and forces required. Jobs that require constant motion without adequate breaks do not provide for muscle recovery, and so place muscles at risk of fatigue and strain. Repetitive tasks that also require significant force, awkward postures or static postures further increase the risk of musculoskeletal injury (OSHA, 1999; NOHSC 1994). The features of 'high risk' tasks are defined in Table 26.

Table 26 – Rate of work causing high risks for musculoskeletal disorders

Body area	Frequency of movement/ contraction per minute (dynamic or static)	Risk modification – very high risk if modified by either:
Shoulder	More than 2.5	High external force, speed, high static load, extreme posture, lack of training, high demands on output, monotony, lack of control, long duration of repetitive work
Upper arm/elbow	More than 10	
Forearm/wrist	More than 10	
Finger	More than 200?	

(**Kilbom 1994**)

4.4 WORK ENVIRONMENT

The two main environmental issues that arose through the study were issues with flooring and with the cold.

4.4.1 Flooring

Staff were expected to stand on hard concrete or tiled floor surfaces. Where staff were standing in one place for long periods (eg filleters) they were often standing on foam lids and wooden boxes.

When standing on hard surfaces for long periods, people typically develop discomfort in the back and in the legs (Kim, Stuart-Buttle & Marras 1994; Madeline, Voigt & Arendt-Nielsen 1998; Rowntree 1992). The reason for this discomfort is believed to be due to the lack of postural sway and so lack of agonist and antagonist muscle movements and the subsequent reduced blood circulation. To counter these problems the provision of cushioned matting and/or suitably cushioned footwear is recommended (Kim, Stuart-Buttle & Marras 1994).

4.4.2 Working with ice and cold water

Cold temperatures have been found to reduce the dexterity and sensitivity of the hands, and this results in people exerting increased force to grip items. If workers are exposed to long periods of handling cold items or touching cold surfaces their hands become numb and dexterity is increasingly impaired (ILO 1998; OHSC 1999).

4.5 OHS SYSTEMS – for injury prevention and injury management

4.5.1 OHS education and training

One of the main findings of the project was the lack of OHS training and information that had been provided to workers. Even workers who had been with the same employer for a long time appeared to have a lack of knowledge regarding the OHS legislation and the manual handling issues relevant to their roles.

There was an attitude amongst some owners and managers that OHS was “just common sense”, and a belief that experience in the seafood industry would reduce their likelihood of having problems with manual handling. However people who have been in one industry for a long time may be at greater risk as they have no benchmark or experience in other industries, and so may be more accepting of the inherent risks within the industry. People working in the seafood industry who had come from other industries appeared to be more proactive and accepted the need for changes to work practices to make them safer.

Business owners and managers in the seafood industry need to be aware of their responsibilities and ‘duty of care’ with regard to their employees and others on their premises in terms of manual handling and other OHS issues. They also need to ensure that they provide their staff with the appropriate training, instruction and supervision, and that they consult with their staff regarding work systems, equipment and issues impacting on OHS. As manual handling tasks make up the bulk of tasks in this industry, specific training in manual handling must form part of this training.

4.5.2 Use of OHS management systems

Only three organisations were identified during the project that had various aspects of an OHS management system in place. For example they each had methods for OHS consultation (such as OHS committees) and had systems for reporting hazards, incidents and injuries, and systems for selecting and/or developing equipment for manual handling tasks.

However, many of the staff surveyed reported that they were not familiar with or did not know about injury and incident reporting. The implications of this are that potential hazards may not be identified, injuries are not being reported and employees are continuing to work with injuries.

Although OHS management systems were not directly assessed or audited during the project, the information collected suggests that many businesses lack systematic approaches to OHS. Despite the large amount of information available from WorkCover NSW on OHS systems and injury management, businesses in the seafood industry appeared to rely on colleagues rather than formal channels for their information, and this is consistent with other research into small businesses (Caple, Hodgson, Greig & Herbstreit 1996). As with other private sector industries, the seafood industry appears to have a less well developed infrastructure for information dissemination than in the public sector.

In order to motivate the seafood industry to take responsibility for OHS and to develop a systematic approach for its management, a number of strategies that were recently recommended for CEOs and business owners of small and medium sized enterprises may also be appropriate for this industry. However this will be best determined by the peak bodies and industry associations. The study by Gunningham (1999) recommended the following strategies:

- Legitimising regulation
- Enforcing regulation
- Applying pressure from the supply chain
- Providing clear and easy to understand information
- Providing leverage through other third parties

4.5.3 Personal factors

This study interviewed a sample of 35 people who ranged in height, weight, body shape, age, and experience in the seafood industry. While some of these personal attributes may appear to either increase of decrease their risk of musculoskeletal injury in certain tasks, the epidemiological literature is not definitive, and is an unreliable method of both assessing risk and selecting staff.

The risk management approach requires that jobs be carefully designed to suit all workers, and that any risks are controlled. For example workstations originally designed for tall people should be altered if the current staff are of a smaller stature. This approach involves designing the job to suit the worker rather than vice versa, and this is a fundamental aspect of the risk management approach.

4.5.4 Women and manual handling

There are however two personal factors that should be considered when designing manual handling jobs – and one is gender. A number of studies have demonstrated that most females cannot safely handle the same loads as most males due to their different anatomy, physiology and anthropometry (eg Lu & Aghazadeh 1994). Studies suggest that this reduction varies, but that females have an average of 60–76% of a male's lifting strength (Mital, Nicholson & Ayoub 1993).

Interestingly, the findings from this project showed that in the seafood industry there is a demarcation with heavy tasks, with women in most cases not being permitted to lift or carry heavy loads such as the large fish crates. There are many women employed in sales roles, but there were no women observed working in storerooms, on the auction floor or as wheelers. Heavy lifting was generally considered the responsibility of the men in the industry.

While this approach could be argued to be one method of managing risk, the aim of the occupational health and safety legislation is to design jobs that are safe for both men and women. The current method of managing risk only serves to transfer high risk tasks to one gender, rather then changing the tasks to suit both genders. By designing tasks that are suitable for both males and females the opportunities for job rotation to minimise risk and multi-skilling of the workforce are increased.

Females who are pregnant also require special consideration when designing manual handling tasks. Pregnant women have increased risk factors for lifting and handling tasks due to increases in basal metabolism together with abdominal and pectoral girth (Troup and Edwards 1985, cited in Mital, Nicholson & Ayoub 1993). Stevenson (1999) also agrees with the need for handling reduced loads, suggesting pregnant women should work with the 'optimum' and not the maximum load, taking note of the recommended frequency.

4.5.5 History of back pain and other injuries

As well as gender, the other key factor impacting on the manual handling risk is history of injury or pain and discomfort. For example studies show that people who have had a previous back pain and those with existing back pain are more likely to suffer back pain in future, so require well designed jobs suited to their needs (Mital, Nicholson & Ayoub 1993).

Those interviewed describing existing musculoskeletal problems with 60% of people interviewed reporting low back problems, 48% reporting hand/wrist pain and 48% reporting knee pain. These employees with a history of existing back pain will be at greater risk of future back pain.

5. RECOMMENDATIONS

This project has highlighted that the NSW seafood industry's approach to dealing with manual handling issues needs urgent action. In order to improve the manual handling methods and other occupational health and safety (OHS) issues in the industry, a strategic, co-ordinated, and national approach is recommended.

The strategy should include:

1. Systems for managing OHS (including manual handling)
2. Specific changes to manage the high risk tasks
3. Further research into identified manual handling issues

Each of these recommendations is outlined below.

5.1 SYSTEMS FOR MANAGING OHS (INCLUDING MANUAL HANDLING)

The foundations for managing manual handling risks in this industry are:

- Development and implementation of OHS management systems
- Improved designs and layouts of premises
- Increased awareness of manual handling and other OHS risks
- OHS education and training for all staff
- Ongoing information dissemination and support for OHS

5.1.1 Develop OHS management systems for the seafood industry

- The peak bodies should drive the development of OHS management systems for the seafood industry.
- These bodies also need to work with their members to facilitate the development of specific strategies for improving manual handling and other OHS problems.
- Personnel with expertise in OHS and manual handling will be required to facilitate this initiative and to continue the momentum generated from this project.

5.1.2 Implement OHS management systems

- Individual businesses in the seafood industry should be encouraged to implement the OHS management systems to meet minimum legislative requirements.
- Peak bodies could provide assistance to their members in the implementation of the OHS systems.
- The OHS management system should suit the size and nature of the business. An integrated management system that incorporates food safety, OHS and environmental systems is also recommended.

- Businesses should consider participation in WorkCover's Premium Discount Scheme as the benchmarks provide the basis of an OHS management system. Participation in the scheme may also lead to a reduction in the Workers Compensation premium if the business meets the benchmarks.

5.1.3 Improve designs and layouts of premises

- The proposed re-development of the SFM site (Nicholls 2002) provides an opportunity for improving the flow of products in and out of the market, particularly with regards to the auction floor and road transport. It is also a time to review the design of the retail and wholesale outlets, ensuring the incorporation of suitable space for product movement (manually and by mechanical means) and for storage.
- The industry should share and promote the good designs that have been incorporated into some of the new premises (such as at the Newcastle Co-operative), while also alerting others to designs that have been found to increase risks for manual handling.
- One way of promoting good practices is to write them up as case studies that can be disseminated and promoted within the industry, and/or having representatives from organisations presenting their design ideas at forums.
- Consider the impact of the design and layout on all people who come to the premises – including staff, customers, suppliers, and contractors.

5.1.4 Increase awareness of OHS and manual handling

- A system for the preparation and promotion of OHS and manual handling information relevant to the industry should be developed. This would require consultation between the key industry players such as Master Fish Merchants' Association, Sydney Fish Markets, NSW Fish Co-operatives Association, Seafood Training Australia etc to determine the most appropriate method, and to determine responsibility for the task. The body disseminating this information should be respected and trusted to achieve the best results.
- OHS and manual handling information needs to be widely promoted, and the promotion should be ongoing.
- The findings and recommendations from this research project should be disseminated to the seafood industry. A summary report written in plain English that can be disseminated throughout the industry by existing networks and incorporated into existing publications is recommended.
- The good practices identified through this research project should be promoted throughout the industry to give recognition to businesses and organisations that have made improvements in OHS and manual handling. This information could be presented in a case study format with practical, clear, concise information.
- The seafood industry should consider incorporating an OHS award for achievements in improving OHS within either a business or throughout the industry, similar to the awards for best small retailer etc.

5.1.5 OHS education and training

- The findings from this research clearly indicate the need for OHS and manual handling training for a number of key groups – for example owners of businesses, managers and supervisors, and employees.

- Topics for staff must include the OHS issues relating to their specific jobs, methods of consulting and communicating OHS issues, staff's rights and responsibilities in OHS, and the reporting systems for hazards, incidents and injuries at work.
- As manual handling tasks make up the bulk of tasks in this industry, specific training in manual handling is essential. The subjects required for manual handing training should include: using a risk management process in managing manual handling issues; and using the equipment and methods best suited to the jobs and the loads handled.
- People in the industry should also be more actively working towards gaining their nationally recognised competencies under the Seafood Industry Training Package.
- The benefits of education and training and the development of competencies in the seafood industry appear to require more promotion within this industry so that more management and staff actively participate in the program.

5.1.6 Ongoing information dissemination and support for OHS

- The seafood industry's peak bodies need to determine who is best placed to provide an ongoing service of information dissemination and support for OHS within the industry
- OHS should be a regular item on the agenda of all peak body meetings and conferences, with information about new initiatives distributed to members or otherwise promoted.

5.2 SPECIFIC RECOMMENDATIONS FOR HIGH RISK MANUAL HANDLING TASKS

In addition to the development of systems for managing and integrating OHS and manual handling into the seafood industry, there are specific changes that are recommended for the high-risk tasks that the project identified. While some short term recommendations are provided, most of the recommendations form part of a longer term plan for improvements and should be considered in the context of the other systems and structures that are recommended.

A combination of each of the following strategies will be needed to achieve change and improvements for manual handling:

- reviewing and updating workplace design and layout
- reviewing and changing the organisation of tasks
- increasing the use of mechanical equipment, and
- training staff in manual handling techniques that are specific to their jobs

As the heaviest and most awkward loads are the fish crates, large coffins/boxes and whole fish, these are a top priority. There should be a reduction in the need for so much manual handling, and an increase in the use of appropriate bulk handling equipment or other mechanical methods. A range of recommendations for these loads and suggestions for other high-risk areas are provided below.

5.2.1 Handling large fish crates

The advice regarding fish crates applies to all parts of the supply chain including fishing co-operatives, the SFM auction floor, transport companies, fish processors, wholesalers and retailers.

Weights

- The gross weight of the fish crates should be reduced and phased in as an urgent priority, in line with the guidelines in this report. This maximum gross weight should be developed in consultation with the industry.
- The industry is currently developing a prototype fish crate that is two-thirds the size of the large fish crate. Having a smaller crate is recommended, as this should reduce the amount of product and therefore weight that can be placed in the crates. The gross weight should again be in line with the guidelines in this report.
- Once the industry has agreed on a maximum weight of the fish crates and other packaged loads, this needs to be promoted, encouraged and enforced. The Sydney Fish Markets was considered by many during the study as having the respect and power to make changes in the NSW seafood industry and it is strongly recommended that the SFM take the lead in reducing the weights of these products.
- Team lifting should also be implemented as a short-term measure when lifting and moving large fish crates due to their dimensions and current weight.
- The current practice of moving large volumes of fish crates by forklift with specially designed tines that suit fish crates should be encouraged and promoted throughout the industry.
- Reduce the need to lift and handle crates through the use of mechanical aids such as skids, roller conveyors, and dollies. For example use a skid to take product between a scale and a pallet, and a dollie to move a crate of ice in a store for icing products.

Stack Heights

- The height of the stacks of fish crates requires attention. It is recommended that the stack heights are restricted to a maximum of 5 large fish crates.
- Where stack heights cannot be reduced (eg where trucks are loaded to 6,7, or 8 high due to freight costs) then mechanical equipment should be used to remove the top crates. This should be enforced to ensure that staff follow safe work practices.
- Review the storage height of empty crates (20 high large nested fish crates). The heights of the stacks should be reduced to ensure that staff are not lifting empty crates above shoulder level. Reducing the stack heights of empty nested crates will be dependent on the amount of storage space available, and storage space will need to be reviewed to ensure that there is sufficient space for empty crates.
- The amount of double-handling of fish crates and other loads also requires further investigation. One method to reduce handling is to have more agreed systems throughout the seafood industry sectors where products are stacked in like stacks, and kept in these stacks as much as possible.

Crate Design and Dimensions

- A longer term recommendation is to review and redesign the fish crates (large and small). As an alternative to the typical tapered design, the seafood industry could investigate the newer straight-walled, collapsible crates that are now common in Europe (Peggie 2000), or assess other existing designs.
- If the current fish crate design is to be modified to suit the current work conditions, the following characteristics should be considered:
  - Higher base support to allow trolley to push plate under load without effort (eg 20mm base height instead of current 9mm base on new crates)

- – Smaller capacity crate
- – More compact size, eg a maximum of between 400–500mm long rather than the current length of 711mm
- – Handles on each side of the crate
- – Crate sizes to have same footprint to make stacking easier and more stable (the current footprint is approximately 5mm different between large and small crates)
- – Have larger area for contents label

- The dimensions of crates and other loads should also take into account the footprints for transportation and packaging.

Labelling of Crates

- Consider placing labels at both ends of the crates to minimise the need to twist the crates when identifying and positioning the crates.
- Use larger, easier to read labels (larger font) on crates to reduce the bending and twisting required to read the labels when sorting crates on the SFM auction floor.

5.2.2 Mechanical equipment to used to move fish crates

- Review the current practice of sliding stacks of crates on the floor and implement safer methods to reduce the pushing and pulling forces and poor working postures.
- Consider using a hand truck that does not need to be tilted back, but has 4 or 6 wheels and drives in on either side of the load then lifts the sides of the base crate. One trolley used in some premises has small wheels but is not suited to rough ground and slopes and can be hard to manoeuvre in tight spaces. It is recommended that the following features be modified: the lifting mechanism to lock the load into place; the handle design; wheel size; and wheel configuration.
- Another alternative may be hand trucks with a tilting base plate for easier unloading that are commercially available.
- The use of two-wheeled hand trucks should also be reviewed and alternative methods of moving stacks of crates investigated to reduce the forces exerted and poor working postures that are adopted when using these trolleys.
- The use and design of the two wheel hand trucks should also be reviewed to ensure they are best suited to the user, load, and environment. One business is likely to require a range of different hand trucks to suit the various tasks and staff. For example special stair-climbing hand trucks may be required if staff need to do deliveries up steps or stairs.

The design features that should be considered for hand trucks include:

Base plate (or shoe) design

- Base plates with a tapered and sharp edge are more likely to fit under the current crates (eg Newcastle Co-operative have custom made a V-shaped plate of 6mm steel that has been hot dip galvanised for use with fish crates)
- The base plate needs to be long enough to support the load as it is being picked up and transported

Handle design

- Handles with a curved top (rather than being vertical) place the hand and wrist in a stronger position for tilting the load
- A pram handle (ie a horizontal or inverted U shaped handle) provides a good surface to grasp and to push, especially where only one hand is used (such as for wheelers when they are checking their order forms and locating identification etc). A pram handle also provides a bar that can be pulled down when tilting a hand truck
- A combination handle allows for a greater range of grips and suits more users (Wissenden & Evans 2000)
- Handle diameter should be between 25 to 40mm, with a cylindrical and smooth with no seams or sharp edges (Lawson & Potiki, 1994)

Wheels/Castors

- Hand truck with additional jockey wheels should improve leverage. For example one manufacturer claims a 60% reduction in leverage effort with these additional wheels
- Large diameter wheels reduce the forces required for pushing and manoeuvring, especially over uneven surfaces
- Minimum wheel diameter of 125mm is recommended for indoor use and 200mm for loads over 200kg and for outdoor use (Lawson & Potiki, 1994)
- Softer tyre materials are good for absorbing shock but require more force to move.
- Pneumatic tyres are recommended for gravel surfaces and roads (Lawson & Potiki, 1994). However, if tyres are not even due to unequal amounts of air, heavy and tall loads may be unstable

- When assessing the suitability of the hand truck or trolley, the other factors to consider include: force required; stability; steerability; interface with the user (eg handle height and shape); starting and stopping ability; field of view; loading and unloading method; and the security of the load (Mack, Haselgrave & Gray 1995).
- The hand truck must also suit the environment, so further issues to consider are: floor surfaces; restricted space; corners or turning; steps or lift doors; and slopes and ramps (Mack, Haselgrave & Gray 1995).
- All equipment requires a routine program of maintenance to check wheels, bases, handgrips etc

5.2.3 Filling and Emptying Bulk Bins

To minimise the repetitive lifting, bending and twisting when filling and emptying bulk bins the following are recommended:

- Redesign bin to have drop down sides or lift off side or chute for easier product access.
- Place the bin on a height adjustable platform (commercially available) so that product can be sorted at waist height to minimize bending.
- Investigate using bins with internally sprung base platforms so that as the fish or other product are lifted out of the top of the bin the base of the bin rises, keeping the load at a more comfortable and accessible level.

- Use mechanical equipment to tip the bins onto sorting tables that are approximately 900mm high. When selecting a bin tipper, consider those that can be adjusted to accommodate a variety of bin sizes as there is no standard bin used throughout the industry.
- Consider using smaller commercially available bins that can be manually tipped.
- Minimise the need to double handle fish crates when filling bulk bins in depots and co-operatives by placing the bulk bin on either a pallet jack with an electronic scale or onto a platform scale.

5.2.4 Handling Large Fish

- Utilise chutes and gravity – pushing fish between areas in elevated gutters (eg at waist height), rather than lifting and carrying (eg at the SFM Sashimi room and when loading and unloading boxes of tuna).
- Consider using forklift jib attachments to lift and lower heavy fish in and out of bulk bins and coffins. Investigate the safest way to lift the fish to minimize damage to the product (eg hooks and slings).
- Review the heights of tables and benches in premises to ensure forward bending and leaning is not required to reach the loads. The height of the tables should hold the load at approximately waist height.
- Consider using a long-handled tool to slide large fish into place if there are places where low surfaces must be used.
- Use platform trolleys to move fish from the auction floor so that fish can be slid on and off at a comfortable height. The trolley could have an edge surround or could be a hand truck that converts into a platform trolley (both are commercially available).

5.2.5 Handling other loads (coffins, polystyrene boxes)

Polystyrene boxes

- Reduce the gross weight of the polystyrene boxes in line with the weights for the fish crates.
- Review the design of the polystyrene boxes to include handholds.

Large coffins

- Use mechanical aids to handle the coffins where possible. For example, push coffins on a roller conveyor, skids, or platform trolleys rather than lifting them, and place the coffins on height adjustable platforms so that coffins can be unloaded at waist height to minimise bending down to loads placed on the floor or pallet.

Packing fish into boxes or coffins

- Redesign layouts to have boxes on a raised and tilted/angled table tilted towards the worker and at waist height, so the worker can use an upright posture while packing.
- Ensure the cardboard box lid does not prevent the worker from standing close to the box. The box design may need modifying or clamps may be required to hold the lid out of the way.
- Provide automatic staple guns rather than manual staplers when sealing boxes to minimise the repetitive forceful actions required when using manual stapler. Tape dispensers should also be provided if boxes are to be taped as this will minimize bending and twisting when cutting the tape.

5.2.6 Retail Areas

To minimize the over-reaching into deep retail cabinets (to display seafood, access product and when cleaning display cabinets), the following should be considered:

- Redesign display cases to a maximum depth of about 750–800mm rather than the more typical 900 to 1200mm.
- Display case height should be 900mm (but consider the level of ice used and adjust the height to allow for the level of ice).
- If there is no area to pass through purchases, the counter tops should be a maximum of approximately 1300mm to reduce the amount of lifting and over-reaching to hand items to customers. (However this height will vary according to staff heights and typical products in the cabinets).
- Install front-opening refrigerated cabinets, as these cabinets do not require icing, although some retailers used a small layer of ice to keep the fish moist and to improve presentation. Front-opening cabinets reduce over-reaching when cleaning and can be filled from the front. Some retailers reported that refrigerated cabinets dried out the product and affected quality and this may need further investigation.
- Use slide-out trays in displays to reduce over-reaching and forward bending to access products.
- Consider the placement of scales so that staff do not have to lift fish above shoulder height. Scales that are the same height as the work surface (eg 900–950mm) are recommended. The read-out display can be separate from the scale and placed on the counter top for customers to see or a longer display can be attached.
- Use long-handled tools where possible for reaching the product and to clean the display cabinets.

5.2.7 Handling loads in freezers and coolrooms

- Design coolrooms and freezers to provide easy access – ideally with a loading and unloading end to improve flow of products, and with a doorway suited to wheeling in loads. Consider the width of the doorway, avoid steps, and have ramps that are not too steep.
- Design freezers and coolrooms with good lighting for seeing ice and reading labels.
- Provide sufficient space for lifting and handling without the need to lift in a flexed position or twisting the spine.
- Ensure through regular housekeeping inspections and cleaning procedures that floors are kept free of ice, slip and trip hazards.

5.2.8 Shovelling ice

- Reduce the amount of ice used with the aim of reducing the amount of manual handling required, while not affecting food quality and safety. For example use refrigerated cabinets and/or use less ice in the displays – only 50mm thick bed of ice rather than 300mm.
- Reduce the need to manually shovel ice through the use of ice chutes and augers (eg Newcastle Co-operative method).
- Use fresh ice where possible to reduce the need to chip the ice repetitively before shovelling.

- Store ice in containers that provide easy access with doors, drop down sides etc and do not require leaning or climbing in to reach the ice.
- For small loads of ice for display case icing in retail shops use a crate with ice and a scoop, and place the crate on a dollie or platform trolley for moving within the retail shop.

5.2.9 Work Environment

- Ensure the layout and environment of the premises facilitates the easy handling and movement of products. For example, premises should aim for even flooring without large drains, and without hoses across walkways or steps and other barriers to restrict the safe pushing or carrying of a load.
- Improve the floor drainage and the drainage of display cabinets in retail premises to minimize the amount of water on the floor and so reduce the risk of slips to both customers and staff.
- Change the layout of premises to minimize product and ice being moved through customer areas.
- Review the positioning of band saws to ensure that there is adequate circulation space around the equipment to reduce the risk of the operator being bumped or distracted by other staff.
- Review the initiatives regarding band saws developed by the WorkCover Retail Industry Reference Group and promote these within the seafood industry.

5.2.10 Loading docks

- As part of a total traffic management plan, review the design and layout of loading areas, and ensure they facilitate safe manual handling. For example assess the risk of people or forklifts falling over the edge of the dock, and develop strategies to reduce these risks. Also assess the risk of forklifts striking pedestrians.
- Review the aids currently in use at dock areas, such as ramps or bridges between the dock and the inside of the truck, and ensure they are appropriate to reduce risks of people or loads falling between them.

5.2.11 Filleting Areas

Filleting sinks and work benches

- Redesign or modify sinks to reduce depth and reach distances. Some examples are:
  - Having a filleting area without a sink, but a slight depression behind the cutting board for off cuts
  - Using a sink that is semi-circular in cross-section and shallow, or
  - Providing a false base for the sink that can be removed for cleaning
- Provide sufficient space around each filleter for free arm movement and posture changes.
- Bench heights should ideally be adjustable to allow each filleter to adjust the height to suit them. Where this is not possible, filleting benches should be between 850–950mm high, depending on the heights of the filleters. Shorter employees may need to raise their height by standing on a platform, and this should be stable, large enough to provide a safe working area, and be non-slip.
- Investigate suitable anti-fatigue matting and/or special footwear inserts for filleters that provides cushioning and insulation from the cold and hard floors.

Filleting knife design

- Ensure there is a variety of knife handles to suit each filleter's hand size. Select handles that allow the wrist and hand to work without excessive bending and without pressure on one joint (eg the thumb or index finger).

5.2.12 Clothing and personal protective equipment

- Replace gumboots with more supportive and comfortable footwear (ie with an arch support, well-fitting, and with cushioning). Some options are given below:
  - Water proof boot – PVC water proof, lace-up boots with safety cap and bellows tongue
  - Overshoe – Rubber galoshes that are worn over existing footwear
  - Gaiter/sleeve – Use water resistant leather shoes with a plastic gaiter/sleeve over the lower leg and covering the top of the shoe
  - Freezer boots – Warm, supportive and water repellant footwear
- Investigate and trial alternative apron types that are lighter, less restrictive and have a cross-over style back to replace the typical long and heavy aprons currently used in the industry.
- Ensure staff handling wet items are wearing waterproof clothing that best suits their specific work tasks (eg to cover the waist, chest and thigh area if handling large crates) so they can hold the loads against their body.
- Encourage the use of slash-proof or other protective gloves for filleters to reduce the risk of cuts and lacerations.

5.3 FURTHER RESEARCH

Many of the issues that arose through the project warrant further investigation, as each have a role in improving manual handling and reducing risk of work-related musculoskeletal disorders. The following topics are recommended for further research:

- Packaging and container design – exploring and trialling new designs to better suit their ability to be manually handled (for loads that must be manually handled)
- Hand truck/trolley and mechanical aids – a more detailed investigation and trial of aids to address the issues identified in this project, with the aim of better suiting the user and the environment
- The design and layout of the auction floor – investigating alternate methods of displaying the product with the view to reducing the need for staff and buyers to manually handle the loads. For example using more automated or bulk movement systems such as palletising loads, using roller or belt conveyors, skids and other systems.
- Education and training in OHS and manual handling – investigating the current access to and suitability of educational material and training methods, with consideration for the workers' hours and their language needs. This would include a detailed review of the relevant subjects in the Seafood Industry Certificates, and a review of the availability and location of Training Organisations and of the number and location of qualified subject trainers.

- Physiological workload in manual handling tasks – further investigating the loads placed on the cardiac and respiratory systems during handling. While the NIOSH calculations take into account some physiological criteria, they do not address the potential risk associated with the cumulative effects of repetitive lifting. Only limited heart rate measurements and personal ratings of perceived exertion were made during this project.
- Filleting and oyster shucking – a more detailed investigation into the variety of work methods, tools and equipment that are currently in use and their impact on upper limb postures and forces. This information would assist in determining the best practices that reduce injury risk.
- Personal protective equipment – evaluating, comparing and conducting user trials with a range of footwear, aprons and gloves to determine the most suitable styles and designs for specific tasks and in different settings.
- Bulk bins – investigating and trialling a range of options for their emptying and filling, with regard to the recommendations from this project.
- Prolonged standing – investigating and comparing various flooring systems for staff who stand for long periods, and investigate the option of footwear inserts for cushioning
- Knee strains – assess the demands on the knees with heavy manual handling tasks and with walking on hard surfaces.

Through the implementation of the proposed recommendations and with further investigation of the above areas, the seafood industry and its various members will be adopting a risk management approach to OHS and manual handling. With this approach, the industry will be better equipped to reduce the risk of their workforce developing painful and debilitating work-related musculoskeletal disorders, and will be working towards meeting their legislative requirements for safer workplaces.

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APPENDIX 1

Part 1 – Nordic Questionnaire

Date _______/______/_______

Sex ☐ Female ☐ Male

What year were you born?

How many years/ months have you been doing your present type of work? ______yrs _______mths

On average, how many hours a week do you work? ____________________

How much do you weigh? _________________ kg

How tall are you? ________________ cm

Are you right handed or left-handed? ☐ Left ☐ Right

Trouble with locomotive organs		
To be answered only by those who have had trouble		
Have you at any time during the last 12 months had trouble (pain, discomfort) in:	Have you at any time during the last 12 months been prevented from doing your normal work (at home or away from home) because of the trouble	Have you had trouble at any time during the last 7 days
Neck ☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes
Shoulders ☐ No ☐ Yes, in the right shoulder ☐ Yes, in the left shoulder ☐ Yes, in both shoulders	☐ No ☐ Yes	☐ No ☐ Yes
Elbows ☐ No ☐ Yes, in the right elbow ☐ Yes, in the left elbow ☐ Yes, in both elbow	☐ No ☐ Yes	☐ No ☐ Yes
Wrists/hands ☐ No ☐ Yes, in the right wrist/hand ☐ Yes, in the left wrist/hand ☐ Yes, in both wrists/hands	☐ No ☐ Yes	☐ No ☐ Yes
Upper Back ☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes
Lower back (small of the back) ☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes
One or both hips/thighs ☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes
One or both knees ☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes
One or both ankles/feet ☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes

Part 2 – Manual handling tasks

1. Which area do you mainly work in? (eg filleting, counter sales, coolroom, loading dock)

2. What jobs or tasks do you find the hardest (physically)?

3. How could/do you make them easier?
(Prompts: using equipment, the workplace design, workplace layout, work method etc)

4. If you notice an OH&S problem at work, what would you do?

5. Have you ever had any health & safety training? ☐ Yes ☐ No
If Yes, when was the training and what was the training about?

6. If you want OH&S information or advice, what do you do?

7. Which way would you like OH&S information or advice to be provided to you?

8. If you were injured at work, what would you do?

9. Do you belong to an employer or union organisation?

Seafood Industry Manual Handling Project

Premises:____________________________ **Building: Leased/ Owned** **Business: Owner Run/ Managed/ Other** __________

Date of Review: __________________ **Time:** ____________ **Workforce**:_____ F/T_____ P/T____ Casual/Temp.

Operating hours/days: ________________________________ Shifts Worked: _______________________ Breaks:__________________

Recent injuries/claims: ____

Area	Description	Issues	Measurements
Dock/Delivery	Floor surface Weather Protection Truck Types		
Coolroom/Freezer	Floor surface Ice Shoots/storage Shelving Lighting Doors (plastic strips, plastic)		Shelving heights:
Display and Sales	Display Cases: Wrapping benches: Scales:Platforms/steps Freezer: Upright/Coffin Floors/Ramps Tongs/Scoops		Display Cases: Height: Depth: Height of glass: Height of Scales:

Area	Description	Issues	Measurements
Filleting Area	Floor surface Drainage No of benches Knives:		
Cooking/Preparation			Counter:
Cashier/ Cash Handling			Counter: Depth: Height: Floor surface: Lighting:
PPE	Gloves Footwear Aprons Slash Proof Gloves/gauntlets Clothing Thermals		
Equipment/ Loads	Hand trolley Platform Trolley Forklifts Pallet Jacks Shovels (plastic, Aluminum) Ice Scoops Crates, Boxes Bulk bins Coffins Knives Pallets		

Ordering Hotline **1300 799 003**

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