

Hoppers in Action: A handbook for fishers on the use of hoppers in Australian trawl fisheries.

Anissa Lawrence and Cassandra Rose



Australian Government

**Fisheries Research and
Development Corporation**

Project No. 2003/012

© Fisheries Research and Development Corporation and Ocean Watch Australia Pty Ltd 2004.

ISBN 0-9750797-4-3

This work is copyright. Except as permitted under the Copyright Act 1968 (Cth), no part of this publication may be reproduced by any process, electronic or otherwise, without the specific written permission of the copyright owners. Neither may information be stored electronically in any form whatsoever without such permission.

The Fisheries Research and Development Corporation (FRDC) plans, invests in and manages fisheries research and development throughout Australia. It is a statutory authority within the portfolio of the federal Minister for Agriculture, Fisheries and Forestry, jointly funded by the Australian Government and the fishing industry.

Ocean Watch Australia Ltd is an environmental, non-profit organisation sponsored by the commercial seafood industry in New South Wales, Australia. Ocean Watch represents the environmental interests of industry and provides advice to the industry and government and educates the public on aspects of fisheries sustainability including environmental best practice as it relates to fishing, habitat protection/rehabilitation and water quality.

Table of Contents

Acknowledgments.....	1
Background.....	1
Need.....	1
Objectives.....	2
Methods.....	3
Information gathering.....	3
Information synthesis.....	3
Extension.....	4
Project assessment.....	4
Results/Discussion.....	5
Benefits.....	5
Further Development.....	6
Planned Outcomes.....	6
Conclusion.....	7
APPENDIX 1: Project team.....	8
APPENDIX 2: Literature review.....	9
APPENDIX 3: “Before survey”, results and interview questions.....	20
APPENDIX 4 Follow-up questionnaire and results.....	30

FRDC Project 2003/012 Hoppers in Action: A Handbook for Fishers on the Use of Hoppers in Australian Trawl Fisheries

Acknowledgments

We would like to sincerely thank all commercial fishers, seafood companies, researchers and hopper builders that contributed invaluable information to the hopper handbook by either returning the hopper handbook surveys, participating in face-to-face interviews or by providing photographs. We would also like to thank the Fisheries Research and Development Corporation for their financial assistance in this project.

Background

Australia's prawn trawl fisheries are among our most valuable, representing a production value of \$473 million and contributing around \$291 million in export earnings (ABARE 2002). With the development and implementation of Australia's Oceans Policy and the Commonwealth's environmental legislation *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) fisheries management has shifted its focus from predominantly maximum yield-focused activities to a more ecosystem-based approach, whereby the overall effects of fishing can be managed within a holistic framework.

These changes have seen the development and adoption of new fishing practices and gear technologies that have improved commercial fishing operations and economic efficiencies and reduced impacts on aquatic environments and non-target species. One such innovation has been the hopper, or back deck, in-water sorting device that allows fishers to separate target species from non-target species in sea water and return bycatch species to the marine environment sooner, thereby increasing the likelihood of survival.

To date there has been limited focus given to researching and documenting the use, application and benefits of hoppers in prawn trawl fisheries in both Australian and comparable overseas fisheries. Whilst national agreement has been obtained from industry and researchers to work collaboratively to develop a national strategy for hopper research and development in Australia, there are a number of considerations influencing the appropriateness and effectiveness of hoppers with respect to increasing the sustainability of trawl operations.

This project documented the current use and application of hoppers across Australian prawn trawl fisheries using a mix of literature searches and interviews with fishers. The project aimed to explicitly describe and extend knowledge about the existing and potentially useful application of hoppers, not only amongst commercial fishers, but also between different fisheries and other fishery stakeholders. Within Australia's prawn trawl fisheries this will facilitate the broader adoption of best practice and reduce the duplication of research and education initiatives. With respect to other stakeholders, this project will lead to a better understanding of the actions being taken by industry to improve the sustainability and economic efficiency of Australia's commercial fisheries.

Need

Research undertaken in the Queensland hopper pilot study and South Australia's Spencer Gulf prawn trawl fishery has suggested that the use of hoppers in prawn trawl operations can enhance the survival of bycatch species. There are however, varying opinions from the Australian scientific community as to whether hoppers actually do make a positive contribution towards

FRDC Project 2003/012 Hoppers in Action: A Handbook for Fishers on the Use of Hoppers in Australian Trawl Fisheries

increasing the survival of bycatch species.

Over the last few years, the uptake of hoppers in Australian prawn trawl fisheries has increased, with many vessels in the Northern Prawn, Exmouth Gulf, Spencer Gulf and Gulf St Vincent prawn trawl fisheries now using hoppers. In most of these fisheries the rate of adoption has been driven by the economic benefits relevant to improved product quality and increased operational efficiencies when using hoppers. However, a coordinated and cooperative review to determine and quantify the effects of hoppers has not been undertaken.

The Northern Prawn Fishery Management Advisory Committee (NORMAC) Bycatch Action Plan has identified research into the effects of hoppers on bycatch survival as a “high priority”. The East Coast Trawl Plan also includes the need to reduce bycatch by 40% by 2005 and flags that hoppers could assist this target. NSW estuary prawn trawl operators also support the concept of hoppers with a need for further research into hoppers being identified as a “high priority” at the Estuary Prawn Trawl MAC meeting held at NSW Fisheries in July 2002.

An independently facilitated workshop was held in September 2002 to bring together industry and research stakeholders from both Commonwealth and State prawn trawl fisheries in WA, SA, NSW and Queensland (East Coast Trawl and Torres Strait) to progress the development of a national hopper research and development framework. Outcomes from the workshop supported the need for a coordinated national approach to be developed with respect to future research, education and communication activities relevant to hoppers.

Objectives

The objectives of this project were to:

1. undertake a national and international literature review of existing knowledge and technology relevant to the use/research of hoppers and document and identify research gaps;
2. document, via a technical handbook, the use, designs, practices associated with the existing use of hoppers across Australian prawn trawl fisheries;
3. hold a technical workshop to facilitate the development of a technical handbook which overviews hopper technology, provides advice on improving operational practices, case studies existing developments and includes the results of the literature review;
4. extend the handbook to fishers via a series of key port visits;
5. provide information to fishery and environmental managers and the general community on existing mechanisms used by industry to improve operational practices; and
6. provide guidance and advice to industry and fishery managers about R&D priorities relevant to improving and extending hopper use and technology within Australian prawn trawl fisheries.

FRDC Project 2003/012 Hoppers in Action: A Handbook for Fishers on the Use of Hoppers in Australian Trawl Fisheries

Methods

In the development of the hopper handbook information gathering and synthesis, extension and project assessment tools were used.

Information gathering

Literature review

A literature review on hopper use and design was undertaken. Australian and international (USA, England, Scotland, Norway) scientists involved in hopper research were contacted and CSIRO, Queensland Department of Primary Industries and Bureau of Rural Sciences libraries reviewed. Extensive searches of international fishery websites (including fisheries agencies and NOAA in USA) were performed along with a broad search of the world wide web for any information on hoppers.

Direct discussions

A large number of fishers and researchers were interviewed directly and information on hoppers was collated from a wide range of sources.

To collect detailed information on hoppers, the Project Officer (refer Appendix 1 for project team) conducted a 3 week trip around Australia in September 2003 to key trawl fishery ports to interview fishers, researchers and other industry stakeholders. The interviews were conducted using surveys and a standard list of questions to ensure consistency in questioning. The surveys were completed and hand written notes taken.

Interviews were held with fishers from the Northern Prawn, Torres Strait Prawn Trawl and Qld East Coast Trawl fisheries in Cairns. Ports visits were made to Adelaide (Gulf St Vincent Prawn Trawl), Port Lincoln (Spencer Gulf and West Coast Prawn Trawl), Fremantle (Shark Bay Trawl), Exmouth (Exmouth Gulf Prawn Trawl), Tasmania (to interview one of the main hopper builders in Australia who now resides in Tasmania), Hawkesbury River (Estuary Prawn Trawl), Hunter River (Estuary Prawn Trawl), Port Stephens (Ocean Prawn Trawl), Clarence River (Estuary Prawn Trawl), Moreton Bay (Trawl). During port visits fishers were extremely generous with their time, co-operative and interested in the project and the production of a handbook on hoppers.

Information synthesis

Technical workshop and handbook review

A technical workshop was held with the project steering committee to workshop the handbook content, style and layout.

The 1st and 2nd drafts of the handbook were peer reviewed by all nine members of the steering committee with relevant excerpts also reviewed by all persons whose interview information had been directly used in the handbook. After incorporating the comments received the handbook text was also provided to other potential users (including fishers, seafood companies, seafood industry councils, scientists and a conservation group (64 people/organisations)) for comment.

FRDC Project 2003/012 Hoppers in Action: A Handbook for Fishers on the Use of Hoppers in Australian Trawl Fisheries

Extension

The following extension methods were used:

- media releases about the project in two editions (May and October 2003) of the SeaNet newsletter;
- development of an electronic promotional brochure about the handbook for broad distribution and general advertising;
- official launch of the handbook with the Minister (date TBA);
- dissemination of the hopper handbook (as a hard copy and also as a CD Rom) through SeaNet networks, including individual fishers, industry associations, management agencies, research institutes and other interested parties; and
- inclusion of a down-loadable PDF version of the handbook on the FRDC and Ocean Watch websites, as well as links with other relevant sites
- provision of copies at the 2004 Prawn Industry Conference in Cairns in November 2004.

Project assessment

To assess the performance of this hopper handbook project a survey was conducted with industry and other stakeholders to determine the usefulness of the handbook and the level of information uptake prior to the commencement of this project. Those subsequently receiving copies of the handbook have been requested to complete the follow-up survey.

A “Survey and Information Request” was prepared prior to the development of the handbook, with the assistance of FRDC’s communication department (Appendix 3). This survey provided an understanding of attitudes towards hoppers as well as providing a means to collect information on their knowledge and use of hoppers. This was sent to a wide range of stakeholders via email and post and used as the basis for interviews with fishers and researchers.

Around 170 surveys were distributed to individuals and/or organisations from Queensland, New South Wales, Victoria, Tasmania, South Australia, Western Australia, Northern Territory and the ACT. These included fishers, fishing companies, fishing co-operatives, fishers associations, seafood councils, seafood processing companies, hopper designers and builders, researchers and managers and conservation organisations. Some were sent multiple copies of the survey to forward onto others. To encourage returns of the survey and information request, many of them were sent by post with a stamped return self-addressed envelope included.

The November 2003 meeting of the steering committee (at which the FRDC representative was Kylie Paulsen) decided that the follow up questionnaire would be distributed with the handbook so users could then provide comment on the handbook. The follow up questionnaire has been distributed with the handbook with a request to return the questionnaire within one month. At the end of January questionnaires received will be collated and a summary of the results forwarded to FRDC as an Appendix to the Final Report.

FRDC Project 2003/012 Hoppers in Action: A Handbook for Fishers on the Use of Hoppers in Australian Trawl Fisheries

Results/Discussion

Hopper handbook

The hopper handbook itself is the main output from this project. It overviews current hopper technology; describes the environmental and commercial benefits of hoppers; briefly describes the history of Australian hopper development; outlines where hoppers are used; provides a large number of case studies to illustrate hopper use; includes advice on good hopper operational practices; includes a summary of the hopper literature review and provides answers to frequently asked questions about hoppers. Copies of the handbook have been provided to FRDC.

For dissemination of the handbook, 500 hard copies have been printed. The handbook has also been made available through the Ocean Watch website.

Although not a part of the original scope of the project it was decided following discussions with FRDC that a copy of a CD containing FRDC Project 2001/098 Evaluation of Hoppers for reduction of bycatch mortality in the Queensland East Coast Prawn Trawl Fishery final report and instructional videos as well as the complete literature review for this project be included in the handbook so as to ensure benefits from both projects could be shared.

Literature Review

The full literature review is provided in Appendix 2.

Before Survey

With respect to the “before survey”, of the 173 surveys distributed 55 were returned. Sixty percent of these returns were from interviews either conducted face-to-face or by phone.

The results of the responses to each of the questions in the before survey are included in Appendix 3.

Follow-up questionnaire

Results of the follow-up questionnaire are included in Appendix 4.

Benefits

The major beneficiaries of the hopper handbook are commercial trawl fishers from all State and Commonwealth trawl (prawn, fish and scallop) fisheries in Australia. The handbook provides comprehensive information for fishers on how hoppers are being used, the reasoning behind usage and many examples of hoppers in action, hopper practice and their benefits and shortcomings.

The general community and conservation groups will also benefit due to the readily available information in the handbook on trawl fisheries and initiatives taken by the trawl industry to reduce their impacts on the marine environment.

FRDC Project 2003/012 Hoppers in Action: A Handbook for Fishers on the Use of Hoppers in Australian Trawl Fisheries

Further Development

To further develop the use of hoppers and encourage industry take-up of this technology, further research is required on the potential bycatch survival achievable with hopper use and the fate of discards from hoppers. This area needs to be investigated more rigorously, particularly with a number of conservation groups now calling for the mandatory use of hoppers, based on the idea that they improve bycatch survival. There is however very little scientific evidence currently available to support this claim.

Planned Outcomes

The hopper handbook should lead to increased efficiency and improved use of hoppers by providing a comprehensive summary of all current uses of hoppers by different fishers in a variety of Australian trawl fisheries. This knowledge, which is presented in an easy to understand style with many photos can be shared and disseminated across all Australian trawl fisheries.

The handbook will increase the hopper knowledge base and voluntary uptake by industry of available best practice as it provides information on all aspects of hopper use, such as different hopper designs, best practice use and any problems with hoppers and how they can be solved.

The handbook will increase public awareness of industry's commitment to developing and adopting improved practices as the handbook describes and illustrates the trawl industries initiatives to reduce impacts to the aquatic environment in a clear and straightforward manner.

The handbook describes the current limitations to the more widespread adoption of the use of hoppers as identified by industry. It also identifies the need for more research to clarify the improvement in bycatch survival provided by hoppers.

The feedback received from a number of key stakeholders on the draft of the handbook was very positive. Four comments received were:

1. "Very good." Graeme Stewart (EO Shark Bay Prawn Trawler Operators Association, WA)
2. "I have read the draft and I think it is good. It was exactly what many Industry people wanted. You have done a fine job. I am looking forward to see it in print." Ib Svane (SARDI Principal Scientist, SA)
3. "Have gone over draft and it looks fine to me" Michael O'Brien (Raptis, Qld)
4. "Many thanks for sending me the draft of the Hopper Handbook. It is a comprehensive document and represents a lot of painstaking research and writing. Well done." Peter Pownall (NORMAC)

FRDC Project 2003/012 Hoppers in Action: A Handbook for Fishers on the Use of Hoppers in Australian Trawl Fisheries

Conclusion

This project has provided an opportunity to consolidate all literature currently available on existing knowledge and technology relevant to the use/research of hoppers. It has demonstrated that there are clear gaps in the research and that it is imperative further work be undertaken to identify and quantify the environmental benefits of hoppers for bycatch survival.

The handbook provided is a useful resource for fishers, researchers, managers and conservationists on the use, designs and practices associated with the existing use of hoppers across Australian prawn trawl fisheries. It offers a simple and yet effective presentation of the existing mechanisms used by industry to improve operational practices and reduce environmental impacts

FRDC Project 2003/012 Hoppers in Action: A Handbook for Fishers on the Use of Hoppers in Australian Trawl Fisheries

APPENDIX 1: Project team

Principal Investigator

Anissa Lawrence, Executive Officer, Ocean Watch Australia Ltd (January 2004 – November 2004).

Christine Soul, Executive Officer, Ocean Watch Australia Ltd (until January 2004).

Project Officer

Cassandra Rose, Ocean Watch Australia Ltd.

Administrative Contact

Emma Brunson, Administration Officer, Ocean Watch Australia Ltd.

Co-Investigators

Emma Bradshaw, National Co-ordinator, SeaNet Fisheries Extension Service

Denis Ballam, Queensland SeaNet Extension Officer

Neil Gribble, Fisheries Biologist, Department of Primary Industries, Queensland

Dave Brewer, Research Scientist, CSIRO Division of Marine Research, Queensland

Mervi Kangas, Research Scientist, Department of Fisheries, Western Australia

Neil Carrick, Research Scientist, South Australian Research and Development Institute

Crispian Ashby, Fisheries Research and Development Corporation

Kylie Paulsen, Fisheries Research and Development Corporation

APPENDIX 2: Literature review

Introduction

There is little published literature on hoppers, both within Australia and overseas. This is not surprising given that the development and uptake of hoppers on trawlers has been, at least in Australia, entirely an industry initiative, driven by economics given the improved target product quality and processing efficiency derived from using hoppers.

The use of large hoppers in Australia has been a relatively recent development beginning in 1982 on large (approximately 20 metres in length) trawlers targeting scampi off northwest Australia and banana prawns in the Gulf of Carpentaria (pers comm. Rod Tedman, FISHQUIP, 2003). Uptake within this and other trawl fisheries occurred gradually over the next decade.

Hoppers are currently used by varying numbers of trawlers in the Northern Prawn, Torres Strait Prawn Trawl, Queensland East Coast Trawl (including the Stout Whiting Fishery in southeast Queensland), NSW Estuary Prawn Trawl, NSW Ocean Prawn Trawl, Spencer Gulf, West Coast Prawn, Gulf St Vincent Prawn, Western Australian Shark Bay Trawl, Exmouth Gulf Prawn, Broome Prawn, Kimberley Prawn, Pilbara Demersal Finfish, Northern Finfish Trawl and the Northwest Slope Trawl fisheries.

In recent years, with attention focused on the need to manage fisheries by the principles of Ecological Sustainable Development, the value of hoppers as having the potential to increase bycatch survival when used in conjunction with gear technology improvements and other operational procedures, has been recognised by the scientific and conservation community. To date however, there has been very little research published in relation to hoppers.

Australian literature

Heales *et al.* (2000) and Heales *et al.* (2003) examine the accuracy of sub-sampling from trawlers in tropical northern Australia to represent the total catch. Heales *et al.* (2000) examines sub-sampling from conventional sorting trays and comments on the increasing uptake of hoppers in the Northern Prawn Fishery and the need to assess how best to accurately sub-sample from a hopper and conveyor, given the differences in catch handling when using a hopper to a conventional sorting tray.

Heales *et al.* (2000) reported that sub-sampling from the hopper caused a bias in catch composition estimates. This was due to the uneven distribution of species as they left the hopper and moved onto the sorting conveyor. Heales *et al.* (2003) recommends that for unbiased sub-sampling, samples must be taken from a temporary tray placed over the hopper. The uneven species distribution is considered most likely due to the differing buoyancies of the individual species, variations in catch size and hopper operations as sea water levels change in the hopper as the catch is sorted (Heales *et al.* 2003).

Most prawns, other crustaceans and bivalves sink to the bottom and are the first animals to be removed from the hopper by the conveyor. Heales (pers comm. 2003) commented that scallops (*Amusium pleuronectes*) were removed from the hopper near the beginning of sorting, with all removed by the time approximately 50% of the catch was sorted. Many fish species float and

FRDC Project 2003/012 Hoppers in Action: A Handbook for Fishers on the Use of Hoppers in Australian Trawl Fisheries

tend to remain in the hopper until most prawns are removed. As the crew drops the water level, the remaining fish drop down onto the conveyor and are removed from the hopper. Heales (pers comm. 2003) commented that some fish species did come out of the hopper near the beginning of sorting, such as lizard fish (*Saurida undosquamis*) and flathead (*Inegocia japonica*), both long shallow bodied fish that live on the seabed. Others such as ponyfish (*Leiognathus moretonensis*) and silver biddy (*Gerres subfasciatus*), both small fish that live in the water column did not leave the hopper until after 60-70% of the catch was sorted

Heales *et al.* (2003) described the hopper system used by Northern Prawn Fishery vessels. Vessels in this fishery are mostly 18-22 metres in length targeting banana prawns (*Peneaus merguensis*) during the day and night with less than one hour shots, and tiger prawns (*P. semisulcatus* and *P. esculentus*) and endeavour prawns (*Metapeneaus endeavouri* and *M. ensis*) during the night with 3-4 hour shots (Stobutzki *et al.* 2000). The hopper is described as a tank on the deck filled with sea water into which each catch is spilled at the end of a trawl. The catch is removed from the bottom of the hopper by way of a sorting conveyor that moves past the crew. This allows the crew to remove target species and byproduct, with bycatch being returned to the sea via a discard chute, usually within 1 minute of being removed from the hopper (Heales *et al.* 2003).

Two types of hoppers used in NSW prawn trawl fisheries are described by Broadhurst (1999). In the Hawkesbury River Estuary Prawn Trawl Fishery, nearly all vessels are less than 10 metres in length and target school prawns (*Metapeneaus macleayi*) during the day using short shots of 10-90 minutes. A large component of the bycatch is catfish with venomous spines. To avoid direct contact with the catfish, since the 1990s these fishers have been using a small water container into which the catch is emptied. It is a 50-100 litre plastic container filled with sea water, either sitting on the back deck or attached to a steel frame which is bolted to the bulwarks and hinged so that the container can be tilted over the side of the vessel. The fisher stirs the emptied catch so the prawns float to the surface where they are scooped out with a sieve or retrieved by their antenna using a custom made tool. After all the prawns are removed, the fish are released back into the river. Most of the catch is sorted within 20 minutes of retrieval and anecdotal information from fishers and researchers suggests that most fish appear to be alive when released.

Some vessels operating out of Port Stephens in the NSW Ocean Prawn Trawl Fishery use a different style of hopper. These vessels range from 9-18 metres in length and operate mostly at night targeting eastern king prawn (*Peneaus plebejus*) with 1.5-2 hour shots. The hopper is a 300-400 litre container on the back deck that is filled with sea water and into which the catch is emptied. The catch is stirred and a sieved scoop used to remove and sort prawns from bycatch. Bycatch is returned to the sea (Broadhurst 1999).

Other unpublished information includes:

- a report from a regional workshop which describes two small boat hoppers used in NSW (referred to in Broadhurst 1999);
- a CD Rom on best practice hopper operation produced by SeaNet (2002a);

FRDC Project 2003/012 Hoppers in Action: A Handbook for Fishers on the Use of Hoppers in Australian Trawl Fisheries

- a Fisheries Research and Development Corporation (FRDC) project report on the preliminary assessment of bycatch survival of hoppers compared to conventional sorting trays (Dell *et al.* 2003);
- preliminary research in South Australia on survival of bycatch discarded from hoppers (pers comm. N.Carrick 2003);
- reference to hoppers by conservation groups in comments on trawl fishery management plans and in a manual for processing wild caught prawns (WWF 2000, 2001a, 2001b); and
- a short article on hoppers included in an electronic newsletter circulated by the Australian Fisheries Management Authority (AFMA 2003).

SeaNet Fisheries Extension Service (an environmental extension service to the Australian seafood industry) and Ocean Watch Australia have been working for a number of years with industry on good practices when using hoppers, particularly as it relates to potential improvements to bycatch survival. In co-operation with Queensland Department of Primary Industries, the Queensland Government and funded by FRDC, SeaNet has produced a CDROM “Recommended Practices for Hopper Operation” (SeaNet 2002a). It includes a short video of a hopper in operation as a practical demonstration highlighting the best practices for hopper use to maximise bycatch survival and enhance product quality. It addresses factors such as shot duration (a critical factor influencing both product quality and bycatch survival), hopper preparation (ensuring the hopper is full of sea water), spilling the bags and catch processing (the co-ordination of conveyor belts and the water level in the hopper for the most efficient sorting). This CDROM also includes a video of the operation of a small boat hopper prototype developed in Queensland.

SeaNet has also developed an information sheet on “Procedures to enhance the survival of discards using hoppers during sorting of prawn trawl catch.” (SeaNet 2002b) This sheet provides practical technical information to enable crews to operate the hopper most efficiently and to maximise its benefits associated with improvements in product quality and potential bycatch survival.

Ocean Watch has previously described the use of hoppers as a post harvest solution to bycatch and provided two examples: a small vessel hopper used in the Hawkesbury River Estuary Prawn Trawl Fishery (NSW) and a larger type of hopper commonly used in tropical Australian prawn fisheries (Leadbitter 1999)

FRDC Project 2003/012 Hoppers in Action: A Handbook for Fishers on the Use of Hoppers in Australian Trawl Fisheries

Bycatch survival with conventional sorting trays

The use of a hopper has the potential to increase the survival of bycatch, although very little scientific research has been conducted to test this hypothesis. Theoretically, emptying the catch from a trawl into a container full of sea water where it remains until it is removed via a conveyor and returned to the sea (usually within a minute), should provide bycatch species with a better chance of survival. That is, when compared to the use of a conventional sorting tray where the bycatch is exposed to the air until sorting is completed before being returned to the sea (this can take on average up to 20 minutes).

Extensive research has occurred to generally examine the fate of bycatch from trawlers, with some of this work also assessing survival. However, this research has been undertaken on trawlers using conventional sorting trays. During these studies the majority of fish bycatch (80-90%) were found to be dead by the time they were discarded from trawlers using conventional sorting trays (Hill and Wassenberg 1990, Wassenberg and Hill 1989, 1993). Care should however, be taken in generalising as differences in fish survival rates can be large, even within the same family/genera and between fish sizes. In a Torres Strait bycatch survival study, survival rates among 13 fish species ranged from 0% to 97%. All dollarfish (*Leiognathus splendens*) and all individuals of two goatfish (*Upeneus*) species died. Two species of grunter (*Teraponidae*) had 50% and 97% survival rates, while three trevally (*Carangidae*) species had 13%, 29% and 66% survival rates (Hill and Wassenberg 1990). In a Moreton Bay bycatch survival study 75% of adult small-toothed flounder (*Pseudorhombus jenynsii*) survived, while less than 20% large-toothed flounder (*P. arsius*) survived. All juvenile flounder (pseudorhombids) died (Wassenberg and Hill 1989).

Invertebrates generally have higher survival rates than fish, although this also varies with species and between studies. Crustaceans were found to generally survive trawling and exposure on conventional sorting trays. Crabs, being more robust were found to have 100% and 86% survival rates in the Torres Strait and Moreton Bay respectively, although soft, newly moulted crabs died. In the Torres Strait study, 50% of mantis shrimps (stomatopods) survived, while the majority of small non-commercial species of prawns (penaids) died (Wassenberg and Hill 1989, Hill and Wassenberg 1990). Nearly all cuttlefish and squid (cephalopods) were dead when discarded from the sorting tray (Wassenberg and Hill 1989). Shells (bivalve molluscs) were found to be the most resistant to trawling and most snails (gastropods) and robust echinoderms, such as some sea cucumbers (holothurians) and sea stars (asteroids) also survived capture in trawl nets (Hill and Wassenberg 1992, Wassenberg and Hill 1993). Some of the more delicate echinoids, feather star (crinoids) and soft corals did not survive (Stobutzki *et al.* 2000).

The survival of bycatch from trawling is dependent on a range of fishery specific modes of operation (Wassenberg and Hill 1989, Harris and Poiner 1990, Hill and Wassenberg 1992, Andrew and Pepperell 1992, Wassenberg and Hill 1993, Kennelly 1995, Blaber *et al.* 1997, Farmer *et al.* 1998, pers comm. Don Heales CSIRO, 2003).

These include:

- **Trawl duration:** The longer the trawl, the greater the weight of the catch and consequently the greater the degree of compression and potential physical damage to animals in the codend. The longer bycatch animals are in the codend the greater their fatigue and stress.

FRDC Project 2003/012 Hoppers in Action: A Handbook for Fishers on the Use of Hoppers in Australian Trawl Fisheries

- **Trawl depth and the rate at which a net is hauled at the end of a shot:** A reduction in pressure as the catch is brought to the surface can distend or rupture the swim-bladders of fish, preventing them from sinking. These animals are vulnerable to predation by surface scavengers such as dolphins, seabirds and sharks. Those species that return to the seabed may survive unless they are fatally damaged (Stobutzki *et al.* 2000).
- **Time spent on a sorting tray exposed to the air:** The longer that marine animals are exposed on the sorting tray, the lower their chance of survival. This can be influenced by the amount of catch to be sorted, the number of crew sorting and sea conditions.
- **Size and composition of the catch:** The variety of species in the codend influences the potential damage to bycatch species from spines, teeth, venom, crushing and abrasion in the codend and on the tray or in the hopper.
- **Gear type:** Different net and codend mesh types and sizes can result in physical trauma and cause scale loss in fish. For example, in one study (Farmer *et al.* 1998) larger size square mesh was found to damage fish less than same size diamond mesh or smaller square mesh.
- **Trawl speed:** The speed at which a vessel travels while trawling can affect fatigue and the physiological stress of bycatch species.
- **Size of individual animals:** Smaller members of some species are less likely to survive than larger individuals.
- **Shot time:** Day versus night trawling and seasonal variations can affect bycatch species composition.
- **Ratio of catch size to hopper volume:** The ratio of catch size to water volume in the hopper can affect the availability of oxygen. A high ratio results in rapid oxygen depletion. A small amount of catch to high volume of water improves oxygen concentrations and the environment for bycatch survival.

Bycatch survival with hoppers

Hoppers have been evaluated for their potential to improve bycatch survival in the Queensland East Coast Prawn Trawl Fishery (Dell *et al.* 2003). Comparative potential bycatch survival was examined between boats with and without hoppers over two and four hour periods.

This preliminary work by Dell *et al.* (2003) indicates that hoppers do increase bycatch survival. The use of hoppers almost doubled the average number of bycatch surviving, that is, from 8.5% with a sorting tray compared to 16.1% with a hopper. The number of surviving species varied from 1.2%-17.1% with a conventional sorting tray and 4.6%-37.4% with a hopper. The number of species, weight of species and diversity of species that survived were all significantly higher from vessels with hoppers. A total of 151 species were sampled in the survival studies. Eighty-eight species survived processing from a hopper, 53 species survived processing from a conventional sorting tray and 58 species did not survive either hopper or tray processing.

The time taken to sort the catch was almost twice as fast when using a hopper, another factor that should assist bycatch survival (Dell *et al.* 2003). The shorter the time some bycatch spends

FRDC Project 2003/012 Hoppers in Action: A Handbook for Fishers on the Use of Hoppers in Australian Trawl Fisheries

on board the vessel, the greater the potential for survival. In this project fish were the main group studied, with some mantis shrimp, cuttlefish, octopus, non-commercial prawns and bugs also included. Crabs, sharks, echinoderms and shells (bivalves) were not examined.

Trawl duration and depth were also found to influence bycatch survival, regardless of whether the catch was processed with a hopper or tray. For every 10 metre increase in trawl depth, the percentage of animals that survived decreased by 3.8%. For each half hour increase in trawl time, the percentage of animals that survived decreased by 1.45%. The set up and operation of the hopper was also observed to affect bycatch survival. The more efficiently the hopper operated, the better the survival rate. The survival trials were of a short duration and as such, this was considered a preliminary study that provided indications of potential survival. Longer duration survival trials would be necessary to fully assess bycatch survival rates.

The majority of hoppers currently used in Australian trawl fisheries have been designed for use on large trawlers and are expensive and unsuitable for small vessels. There are some cheap small vessel hoppers currently in use, but generally these are more suitable for the very small trawlers (of 10 metres in length). Dell *et al.* (2003) investigated the potential of a prototype small hopper for use on a smaller prawn trawl vessel (less than 14 metres in length). This prototype is a small, cheap and lightweight device that runs entirely off the deckhose. Initial trials have suggested this hopper design also has good potential for bycatch survival and a demonstration of its operation has been included in the SeaNet (2002a) CD Rom discussed previously.

Preliminary ongoing bycatch survival research is also being conducted in South Australia (N Carrick pers comm. 2003). In this unpublished research, the survival of bycatch from vessels with hoppers is being compared to survival from vessels with sorting trays. Compared with a conventional sorting tray, hoppers have been found to improve the survival of some species of trevally and rock flatheads. The loss of scales on some fish has also reduced with the use of a hopper. This research also supports Dell *et al.* (2003) findings as the time taken to sort the catch was found to be three times faster with the use of a hopper, demonstrating the improved processing efficiency that can be achieved with a hopper.

A preliminary assessment of the survival of shark, skate and ray bycatch from South Australian vessels with hoppers over a 6-8 hour period is also being conducted (pers comm. N Carrick 2003). Findings suggest that again survival rates are species dependent: a 7-gill shark (*Notorynchus cepedianus*) was very lively after 8 hours in sea water tanks on board the vessel, while elephant sharks (*Callorhinchus milii*) were the most sensitive species to trawling.

The use of hoppers in South Australia has also been referred to in a number of information sheets produced by SeaNet (SeaNet 2002b). There has been an uptake of hoppers in approximately 98% of the Spencer Gulf Prawn Trawl Fishery fleet. All but one are locally designed (A Haldane pers comm. 2003). It has also been stated in the information sheets that by replacing the conventional sorting tray with a hopper, incidental species are given a much greater opportunity for survival. A general description of the Spencer Gulf hopper operation is also provided by Palmer (2003).

FRDC Project 2003/012 Hoppers in Action: A Handbook for Fishers on the Use of Hoppers in Australian Trawl Fisheries

Unpublished literature

The conservation group World Wildlife Fund for Nature has made a number of comments regarding hoppers. In their submission on the East Coast Trawl Fishery (ECTF) Management Plan 1999 (WWF Australia (2001a)). It stated that “*The World Wide Fund for Nature Australia (WWF) believes that every effort should be made to reduce the catch of non-principal species until otter trawling is phased out, for example, through the compulsory use of hoppers*”. Their position statement on Demersal Otter Trawling in the Great Barrier Reef World Heritage Area stated that “*the ECTF Management Plan should be amended to ensure industry wide adoption of wet hoppers for the immediate sorting of bycatch, in order to reduce the extent of bycatch mortality*” (WWF Australia 2001b) and that “*there should be rapid industry wide adoption of wet hoppers*” (WWF Australia 2000).

The Convention on International Trade to discuss the Conservation of Seahorses and other members of the Family Sygnathidae (CITES 2002) stated that “*managing bycatch of sygnathids will be problematic*” and “*innovative management options of particular utility to bycatch fisheries, such as mandatory use of sorting hoppers, will need to be considered*”. It is not clear if the definition of hoppers referred to is the same as that used in Australia.

Conservation, scientific and fisheries management groups have called for more research into the effectiveness of hoppers in improving bycatch survival. The Great Barrier Reef Marine Park Authority Audit of the Queensland ECTF (Huber 2003) recommended that the development and adoption of hopper technology be encouraged. The Australian Coral Reef Society commented on the Ecological Assessment of the Queensland ECTF (ACRS 2003) and also recommended that research and assessment of hoppers be encouraged.

The Northern Prawn Fishery (NPF) Bycatch Action Plan 2002 states that “*hoppers are being increasingly adopted throughout the fleet*” and “*that a more quantitative assessment of their effectiveness at increasing the survival of unwanted species is needed. NORMAC (Northern Prawn Fishery Management Advisory Committee) will seek the support of other fisheries using hoppers to encourage more quantitative research into their effectiveness at increasing survival of bycatch*”. The uptake of hoppers to improve product quality and increase the survival of bycatch after capture is cited as an achievement of the NPF to address bycatch issues.

The Torres Strait Prawn Fishery (TSPF) Draft Bycatch Action Plan 2003 states as part of its actions that “*AFMA and TSPF Working Group will engage research to adapt and adopt systems to reduce mortality of bycatch species on deck using hoppers by reducing sorting time or similar devices*” and that “*trials into the use of different hopper designs as a device to increase the chances of recovery and survival of bycatch from trawling could be investigated, as the influence of sorting time may affect the recovery and survival of bycatch.*”

As an indication of the commercial acceptance of hoppers, their use is recommended in the 1997 Queensland Seafood Industry Association sponsored Best Practice Manual for Catching and Processing of Wild-caught Prawns (Anon 1997).

AFMA Research News (May 2003) includes an article on the use of hoppers in the NPF (AFMA 2003). It states “*anecdotal reports have indicated that hoppers have reduced mortality of bycatch by between 40 and 70 percent*”. The reference for this high reduction in bycatch

FRDC Project 2003/012 Hoppers in Action: A Handbook for Fishers on the Use of Hoppers in Australian Trawl Fisheries

mortality remains unconfirmed. There have been no published scientific studies identified to suggest such high reductions in mortality and great care should be taken when quoting such figures.

International literature

The use of hoppers in international fisheries appears to be extremely limited. Some Australian vessels fishing in Indonesian waters use the same type of large hopper as used in Australia. Hoppers are reported as being used in the United States Dogfish Fishery in Massachusetts and the Northeastern Offshore Squid Fishery and in some pelagic fisheries in Scotland, Ireland and Norway (Heales *et al.* 2003).

Internationally however, the term “hopper” on a trawler refers to large empty metal containers into which the catch is dumped and the target species (often fish) then removed via a conveyor. These containers **are not filled with sea water**, as with hoppers in Australia.

In 2001 a USA shrimp fisher designed and tested his own version of a small water filled hopper with a conveyor to lift out the catch (Lewis 2001). Similarly to that found in Australia, this fisher found that with his prototype hopper sorting time was faster, bycatch mortality appeared to be reduced and profitability increased through requiring one less crew member.

Water filled hoppers have been developed in Australia in relatively recent times. FISHQUIP (Rod Tedman pers comm.2003) developed and built the first large hoppers in Australia. They also build many of the large hoppers in use today as well as conveyors and other processing equipment for overseas fisheries. Mr Tedman is not aware of the use of hoppers (with recirculating sea water) in any overseas fisheries, except in Indonesia where Australian vessels fishing in their waters use them. In Australia, the main uptake of large hoppers is in high value prawn fisheries, especially in the tropics. There are few other industrialised countries that have high value prawn trawl fisheries in the tropics where money can be invested on upgrading processing equipment.

An international literature and World Wide Web search and questioning of leading Australian and international scientists and researchers has not identified any other literature, published or unpublished relating to the use of hoppers with recirculating sea water.

Gaps in the research

Without a doubt thorough scientific research on the effects of hoppers on bycatch survival and the fate of discards from hoppers is lacking. This area needs to be investigated more rigorously, particularly with conservation groups now calling for the mandatory use of hoppers based on the premise that they improve bycatch survival with little scientific evidence to support this claim. The limited research available suggests that hoppers do improve bycatch survival, although the response by different taxonomic groups and species appears to be highly variable and bycatch survival improvement may only occur with hoppers being used in conjunction with other bycatch reduction gear technologies and operational practices.

The available literature also provides limited detailed descriptions of the use and design of the different types of hoppers currently used in Australia. This is primarily the result of these descriptions not being the main focus of the research article. Nevertheless, given the lack of

FRDC Project 2003/012 Hoppers in Action: A Handbook for Fishers on the Use of Hoppers in Australian Trawl Fisheries

information available, it is difficult for those stakeholders interested in the actual operation of different types of hoppers to easily access this type of information.

Conclusion

A great deal of research has focussed on removing the animals from the trawl net before it is brought to the surface and this has led to the successful introduction of a range of Bycatch Reduction Devices in trawl fisheries around Australia. Although the success of these devices in reducing bycatch has varied, it is unlikely that the bycatch from prawn trawlers will be completely eliminated by present designs, which have achieved up to around a 30-60 % reduction in bycatch for nighttime prawn trawl fisheries (Stobutzki *et al.* 2000, Broadhurst *et al.* 2002).

As such, despite the use of bycatch reduction devices, the level of bycatch from trawling is still considered an issue. Preliminary research has shown that hoppers are a tool which, when used in conjunction with other operational practices and gear technologies to reduce bycatch mortality, can improve the survival of bycatch after it is brought on board a trawler.

However, there currently exists a lack of detailed research on the potential bycatch survival that can be achieved from hoppers. In addition, little documented information is available on the use and design of hoppers in Australian trawl fisheries. This latter point has been addressed by this FRDC sponsored project to develop the handbook.

References

ACRS (2003) *Comments by the ACRS (Australian Coral Reef Society and AMSA (Australian Marine Sciences Association) on the Ecological Assessment of the Queensland East Coast Otter Trawl Fishery*. January 2003 available from www.australiancoralreefsociety.org

Australian Fisheries Management Authority (2003) *Fishing Future. Newsletter of the Australian Fisheries Management Authority*. Vol 1, 3, May 2003. available from www.afma.gov.au

Anon (1997) *ISO Best practice manual for catching and processing of wild-caught prawns*. Commonwealth of Australia.

Andrew, N.L. and Pepperell, J.G. (1992) *The by-catch of shrimp trawl fisheries*. *Oceanogr. Mar. Biol. Ann. Rev.* 30, 527–565.

Blaber, S., Brewer, D., Buckworth, R., Burrige C., Farmer, M., Milton, D., Salini, J., Wang, Y., Wassenberg, T., Buxton, C., Cartwright, I., Eayrs, S., Rawlinson, N., Gill, N., Mounsey, R., Ramm, D. and MacCartie, J. (1997) *Effects of trawl design on bycatch and benthos in prawn and finfish fisheries*. FRDC Project No 93/179 p199.

Broadhurst, M.K. (1999) *Separating prawns and bycatch using on board sorting containers filled with water: examples from New South Wales, Australia. Report for GEF/UNEP/FAO Project on reduction of the impact of shrimp fisheries Regional Workshop for Africa, Lagos, Nigeria 13-15th December 1999*. p9.

**FRDC Project 2003/012 Hoppers in Action: A Handbook for Fishers on the Use of
Hoppers in Australian Trawl Fisheries**

Broadhurst MK, Kangas MI, Damiano C, Bickford SA, Kennelly SJ (2002) *Using composite square-mesh panels and the Nordmore-grid to reduce bycatch in the Shark Bay prawn-trawl fishery Western Australia*. Fisheries Research 58 (2002) pp 349-365

CITES (2002) *Conservation of Seahorses and Other Members of the Family Syngnathidae*. Twelfth Meeting of the Conference of the Parties Santiago (Chile), 3-15 November 2002.

Dell, Q., Gribble, N., Foster, S. and Ballam, D. (2003) *Evaluation of "Hoppers" for reduction of bycatch mortality in the Queensland East Coast Prawn Trawl Fishery*" FRDC 2001/098 p 68.

Farmer, M.J., Brewer, D.T. and Blaber, S.J.M. (1998) *Damage to selected fish species escaping from prawn trawl codends: a comparison between square mesh and diamond mesh*. Fisheries Research. 38, 73-81

Huber D (2003) *Audit of the Management of the Queensland East Coast Trawl Fishery in the Great Barrier Reef Marine Park Authority May 2003*. www.gbrmpa.gov.au

Harris, A.N and Poiner, I.R. (1990) *By-catch of the prawn fishery of Torres Strait: composition and partitioning of the discards into components that float or sink*. Aust. J. Mar. Freshw. Res. 41, 37-52.

Heales, D.S., Brewer, D.T and Wang, Y. G (2000) *Subsampling multi-species trawl catches from tropical northern Australia: does it matter which part of the catch is sampled?* Fisheries Research. 48, 117-126.

Heales D.S., Brewer D.T., and Jones, P.N (2003) *Subsampling trawl catches from vessels using seawater hoppers: are catch composition estimates biased?* Fisheries Research, pp 113-120.

Hill, B.J. and Wassenberg, T.J. (1990) *Fate of discards from Prawn Trawlers in Torres Strait*. Aust. J. Mar. Freshwater Res. 41 53-64

Hill, B.J. and Wassenberg, T.J. (1992) *The fate of materials discarded from shrimp trawlers*. International conference on shrimp bycatch Lake Buena Vista, Florida. 115-123

Kennelly. S.J. (1995) *The issue of bycatch in Australia's demersal trawl fisheries*. Reviews in Fish Biology and Fisheries. 5, 213-234.

Leadbitter, D. (1999) *Bycatch solutions: A handbook for fishers in non-trawl fisheries*. FRDC Project No 1998/201. Ocean Watch Australia Ltd., New South Wales.

Lewis J.K. (2001) *Bycatch mortality reduction in a shrimping operation*. North Carolina Sea Grant Program. Final Report. Project No. 00-FEG-18.
<http://www.ncsu.edu/seagrant/FRG/00FEG-18.html>

Northern Prawn Fishery Bycatch Action Plan 2002. www.afma.com.au

Personal communication with Carrick N. SARDI, SA 2003.

Personal communication with Haldane, A. Haldane Enterprise 2003.

**FRDC Project 2003/012 Hoppers in Action: A Handbook for Fishers on the Use of
Hoppers in Australian Trawl Fisheries**

Personal communication with Heales D.S. CSIRO Cleveland, Queensland 2003.

Personal communication with Tedman, R FISHQUIP 2003.

Palmer, G. (Ed) (2003) *Prawn fishing in Spencer Gulf and the West Coast. Harvesting with care in the State of South Australia*. Spencer Gulf and West Coast Prawn Fishermen's Association. Inc. p10

Stobutzki, I., Blaber, S., Brewer, D., Fry, G., Heales, D., Miller, Milton, D., Salini, J., Van der Velde, T., Wassenberg, T., Jones, P., Wang, Y.G., Dredge, M., Courtney, T., Chilcott, K., Eayrs, S. (2000) *Ecological Sustainability of Bycatch and Biodiversity in Prawn Trawl Fisheries*. FRDC Project No. 96/257 pp 512.

SeaNet Fisheries Extension Service (2002) *Recommended Practices for Hopper Operation*. Ocean Watch Australia Ltd CDROM.

SeaNet Fisheries Extension Service (2002) *Information Sheets: "Procedures to enhance the survival of discards using hoppers during the sorting of prawn trawl catch"; "Prawn Fishing and Good Practices in Spencer Gulf Prawn Fleet"; "South Australian prawn trawling"; "The South Australian prawn fishery"* Ocean Watch Australia Ltd

Torres Strait Prawn Fishery Draft Bycatch Action Plan 2003 www.afma.com.au

Wassenberg, T.J. and Hill, B.J. (1989) *The effect of trawling and subsequent handling on the survival rates of the bycatch of prawn trawlers in Morton Bay Australia*. Fisheries Research. 7 99-110.

Wassenberg, T.J. and Hill, B.J. (1993) *Selection of the appropriate duration of experiments to measure the survival of animals discarded from trawlers*. Fisheries Research. 17, 343-352

WWF Australia (2001a) *Fisheries (East Coast Trawl) Management Plan 1999 Plan Review Paper Permitted Fish (other than principal fish) Review Submission by the WWF Australia August 2001*. Sydney, NSW WWF Australia

WWF Australia (2001b) *Demersal Otter Trawling (bottom trawling) in the Great Barrier Reef World Heritage Area. WWF Australia Position Statement November 2001*. Sydney, NSW WWF Australia

WWF Australia (2000) *Demersal Otter Trawling (bottom trawling) in the Great Barrier Reef World Heritage Area. WWF Australia Position Statement August 2000*. Sydney, NSW WWF Australia

**FRDC Project 2003/012 Hoppers in Action: A Handbook for Fishers on the Use of
Hoppers in Australian Trawl Fisheries**

APPENDIX 3: “Before survey”, results and interview questions

Before Survey

This survey and request for information is being undertaken to determine what is currently known about hoppers among industry. This information will assist in the development of a “Hopper Handbook” which is being produced to document the use, design and practices associated with the use of hoppers across Australian trawl fisheries.

For further information about the production of this handbook, an overview of the project is attached.

Your participation in this survey is appreciated. If you would like to participate, please mark your answer to the following questions and return the form, either by email, fax or post to Cassandra Rose or phone them through on the number below.

If you have experience with hoppers and would like to contribute more detailed information, it would be greatly appreciated. We are looking for more detail on the types of hopper you are familiar with, any operational problems, benefits, when and why hopper was installed, industry contacts etc, any photos or drawings of hoppers, and points regarding hoppers that you feel should be included in the handbook to make it more useful to fishers. We greatly value your input, so please call Cassandra to discuss your experience/knowledge of hoppers.

A first draft of the handbook will be prepared by December, therefore, all surveys and contributions will need to be received before this time. All information provided is strictly confidential and will only be used in the handbook with your permission. All contributions included in the handbook will also receive full acknowledgement in the publication.

Cassandra will be visiting fishers, gear specialists and designers, managers, researchers and other stakeholders during September (8-30th) for direct discussions about hoppers. Cassandra will visit SA (Adelaide and Port Lincoln), WA (Perth and Exmouth), NSW (ports from Sydney north to the border), Qld (Brisbane, Mooloolooba, Cairns). If you are interested, available and could make time to speak with her during these visits, please contact Cassandra.

Thank you for your time and please don't hesitate to contact if you have any additional queries or comments.

**FRDC Project 2003/012 Hoppers in Action: A Handbook for Fishers on the Use of
Hoppers in Australian Trawl Fisheries**

Survey Questions

If you receive this electronically, please place an X next to your answer and return by email. If you prefer to reply by post, please print the survey page and place an X next to your answer and return to Cassandra Rose. If you receive by post, please place an X next to your answer and return in the enclosed prepaid envelope. Alternatively, phone and give your answers.

1. What is your involvement in the fishing industry?

Skipper

Owner

Deckhand

Other

2. Which fishery are you currently involved in?

East Coast Trawl – Prawn

Stout Whiting

East Coast – Scallop

Torres Straight

NSW trawl

Exmouth WA

Shark Bay, WA

Spencer Gulf SA

Gulf St Vincent SA

Northern Prawn Fishery

Deep water

Other

3. What size vessel do you operate?

0 – 5 m

5 – 10

10 – 15

15 – 20

FRDC Project 2003/012 Hoppers in Action: A Handbook for Fishers on the Use of Hoppers in Australian Trawl Fisheries

20 +

4. Have you heard about hoppers?

Yes (go to question 5) No

If no: Would you like to find out more about hoppers and how they operate?

Yes No

5. Are you aware that there are different types of hoppers in use in Australian fisheries?

Yes No

6. Do you have a hopper on your boat?

Yes No

6a. If yes: Why did you put a hopper on your boat(s)? :

Place an X next to the letter of as many of the following reasons as you wish.

You may rank the reasons 1 (highest)-4 (lowest) if you wish.

- a. Improved product quality
- b. Faster sorting time
- c. Occupational Health and Safety
- d. Other

Other (or any other comments)

.....

.....

6b. If no: Have you considered putting a hopper on your boat(s)?

Yes No

6bi. If yes: Why have you not installed a hopper ?

Place an X next to the letter of as many of the following reasons as you wish.

FRDC Project 2003/012 Hoppers in Action: A Handbook for Fishers on the Use of Hoppers in Australian Trawl Fisheries

You may rank the reasons 1 (highest)-7 (lowest) if you wish.

- a. Cost
- b. Not compatible with other fisheries i.e. scalloping
- c. Don't think a hopper will benefit my fishing operation
- d. Don't think that it will save any sorting time
- e. Don't know whether there is a suitable type of hopper for the boat(s)
- f. No room on the back deck to put a hopper on
- g. Other (or any other comments)

.....

.....

7. What do you think improves the use of a hopper?

Place an X next to the letter of as many of the following reasons as you wish.

You may rank the reasons 1 (highest)-8 (lowest) if you wish.

- a. short shot times
- b. shallow water trawls
- c. hopper as full of seawater as possible (for the weather conditions)
- d. do not overload hopper with catch
- e. use of baffles in hopper in rough weather
- f. regulation of hopper water level during sorting
- g. use of sprays
- h. other

Other (or any other comments)

.....

Thank you very much for your time.

FRDC Project 2003/012 Hoppers in Action: A Handbook for Fishers on the Use of Hoppers in Australian Trawl Fisheries

Before Survey Results

There were 55 responses to the survey. The percent responses to each of the questions are described below.

The mode of survey:

Face to face interviews	60%
Postal returns	31%
Phone interviews	7%
Email	2%.

1. Involvement in fishing industry:

Owner/skipper	36%
Skippers	31%
Owners:	20%
Operations manager	7 %
Deckhand	2%
Engineer	2%
Seafood Marketer	2%

2. Fishery that survey returns from: in some cases the fisher/owner operated in more than one fishery

Northern Prawn Fishery	18%
Torres Strait Prawn Fishery	18%
Qld East Coast Prawn Trawl	16%
East Coast Prawn	73%
Stout Whiting Trawl	9%
Moreton Bay Otter Trawl	18%
NSW Trawl Fisheries	13%

**FRDC Project 2003/012 Hoppers in Action: A Handbook for Fishers on the
Use of Hoppers in Australian Trawl Fisheries**

Clarence Estuary Trawl	22%
Hunter Estuary Trawl	11%
Hawkesbury Estuary Trawl	11%
Ocean Prawn Trawl	56%
Exmouth Gulf Prawn Fishery	12%
Spencer Gulf & West Coast Prawn Fishery	9%
Shark Bay Trawl Fisheries	6%
Gulf St Vincent Prawn Fishery	4%
South East Trawl	3%
Victorian Inshore Trawl	50%
Royal Red Prawn	50%
Pilbara Fish Trawl	1%

3. What size vessel do you operate?

20+ m	39%
15-20m	41%
10-15m	11%
5-10m	9%

4. Have you heard about hoppers?

Yes	96%
No	4%

4a. If no: Would you like to find out more about hoppers and how they operate?

Of those that had not heard about hoppers 100% answered they would like to find out more about hoppers and how they operate

**FRDC Project 2003/012 Hoppers in Action: A Handbook for Fishers on the
Use of Hoppers in Australian Trawl Fisheries**

5. Are you aware that there are different types of hoppers in use in Australian fisheries?

Yes **95%**

No **5%**

6. Do you have a hopper on your boat?

Yes **80%**

No **20%**

6a. If yes: Why did you put a hopper on your boat? (not all answers were ranked but some were)

Improved product quality **37%**

Faster sorting time **29%**

Occupational Health and Safety **24%**

Other **10%**

There were 9 responses for ‘Other’. Of these, all were mentioned once except for “reduce bycatch mortality” for which there were 3 responses:

- keeping live prawn
- company decision
- reduce bycatch mortality
- reduce fish scaling
- reduce crew member rest get better pay.
- more time to make decisions

FRDC Project 2003/012 Hoppers in Action: A Handbook for Fishers on the Use of Hoppers in Australian Trawl Fisheries

- good for stout whiting

8 surveys ranked their answer to this question.

Half of these ranked improved product quality as the main reason followed by faster sorting time and then OH&S.

Of the other half, 3 of the responses ranked faster sorting time as the main reason followed by improved product quality and then OH&S

One respondent ranked OH&S the main reason, followed by faster sorting time and then improved product quality.

6b. If no: Have you considered putting a hopper on your boat(s)?

Of the 11 “no” answers to “do you have a hopper” only 6 responded to this question

Yes **50%**

No **50%**

6bi. If yes: Why have you not installed a hopper ?

Cost	31%
No room on the back deck to put a hopper on	27%
Other	23%
Don't know wether there is a suitable type of hopper for the boat	12%
Don't; think hopper will benefit fishing operation	4%
Don't think it will save any sorting time	4%
Other:	
Future of fishery unsure	67%
Stability issue	33%
No responses ranked these answers	

**FRDC Project 2003/012 Hoppers in Action: A Handbook for Fishers on the
Use of Hoppers in Australian Trawl Fisheries**

7. What do you think improves the use of a hopper?

Hopper as full of seawater as possible	18%
Do not overload hopper with catch	18%
Use of baffles in hopper in rough weather	17%
Regulation of water level in hopper during sorting	17%
Short shot times	12%
Use of sprays	8%
Shallow water trawls	6%
Other	4%
Water chilled	67%
Co-ordination of 2 conveyer belts to maximise product flow	33%

7 responses ranked these answers though no clear pattern emerged except that the 1st two reasons were ranked the highest the most often.

**FRDC Project 2003/012 Hoppers in Action: A Handbook for Fishers on the
Use of Hoppers in Australian Trawl Fisheries**

Interview questions (used when interviewing hopper users face to face)

For those who have hoppers on their vessels or have used them

- Size/ type of vessel with hopper and fishery
- Number of nets/ gear type
- Target species, time of fishing (day/night), shot duration, average depth trawled
- Design /Type/Size or volume of hopper (Materials, layout how it fits into boat etc).
- How they operate (type of water sprays, position, intake drainage, outlet, pros and cons, problems.)
- Number of crew vessel surveyed for
- When was hopper installed?
- Cost of hopper and conveyer/cost of installation?
- Was it a major job to modify the vessel for the hopper?
- Have there been any stability issues with the hopper?
- Do you have to operate any differently to account for hopper-eg move fuel between tanks?
- Have you noticed, or your buyer commented, on improved product quality since you began using hoppers?
- Can you make any estimate of the average gain in price per kg for your product since you began using hoppers?
- Is it possible to estimate the time it took to recoup the costs of buying and installing the hopper?
- What are the benefits of hoppers? (eg Processing time, product quality)
- What are the disadvantages of hoppers?
- Identified best practice to maximise the benefits of using a hopper
- Any points regarding hoppers that you feel should be included in the handbook to make it more useful?

Do you have any photos of hoppers on your vessels that you would not mind be used in the handbook?

**FRDC Project 2003/012 Hoppers in Action: A Handbook for Fishers on the
Use of Hoppers in Australian Trawl Fisheries**

APPENDIX 4 Follow-up questionnaire and results

Follow-up Questionnaire

This hopper project aimed to explicitly describe and extend knowledge about existing and potentially useful application of hoppers in Australian trawl fisheries.

You have now received a copy of the Hoppers in Action handbook and we would appreciate you taking a few minutes to complete this follow-up questionnaire to tell us what you think about this handbook

If you receive this electronically, please place an X next to your answer and return by email. If you prefer to reply by post, please print the survey page and place an X next to your answer and return to Ocean Watch. If you receive by post, please place an X next to your answer and return in the enclosed prepaid envelope. Alternatively, phone and give your answers.

1. What is your involvement in the fishing industry?

Skipper

Owner

Deckhand

Other

2. Which fishery are you currently involved in?

Northern Prawn Fishery

Torres Straight Prawn Fishery

Exmouth Prawn Fishery WA

Shark Bay Fishery WA

Spencer Gulf and West Coast Prawn Fishery SA

Gulf St Vincent Prawn Fishery SA

Qld East Coast Trawl

Qld Stout Whiting Trawl

NSW Estuary Trawl

**FRDC Project 2003/012 Hoppers in Action: A Handbook for Fishers on the
Use of Hoppers in Australian Trawl Fisheries**

NSW Ocean Trawl

Pilbara Fish Trawl

South East Trawl

Victorian Inshore Trawl

Royal Red Prawn

Other

3. What size vessel do you operate?

0 – 5 m

5 – 10m

10 – 15m

15 – 20m

20 +m

4. Do you have a hopper on your boat?

Yes (go to question 6) No

5. Does this hopper handbook increase your understanding of hoppers and how they operate?

Yes No

5a. Would you now consider putting a hopper on your boat(s)?

Yes No

