

Harbour Towage Services in Australian Ports

Information Paper

This Paper examines the structure and operation of the harbour towage industry in Australia. The results of previous studies are outlined and the characteristics of harbour towage operations are described. Participants affecting the operation of the industry are port authorities, pilots, towage operators, tug crews, shipping lines, shipping agents and shippers.

Subject

Series

Date

A to Z

Search

Results

Print

Exit

bureau of
transport and communications
economics

Information Paper 27

Harbour Towing Services in Australian Ports

© Commonwealth of Australia 1988

ISSN 0158-104X

ISBN 0 644 08266 6

This work is copyright. Apart from any use as permitted under the *Copyright Act 1968*, no part may be reproduced by any process without written permission from the Director Publishing and Marketing AGPS. Inquiries should be directed to the Manager, AGPS Press, Australian Government Publishing Service, G.P.O. Box 84, Canberra, A.C.T. 2601.

CORRIGENDA

BTCE Information Paper 27

HARBOUR TOWAGE SERVICES IN AUSTRALIAN PORTS

p. 57 - Table I.1 (Cont.) Cape Cuvier, crew size
for tugs Boolathana and Leaders Creek
should read:

3 officers, 2 ratings.

FOREWORD

This Paper presents the findings of a Bureau of Transport and Communications Economics (BTCE) study of the structure and operation of the harbour towage industry in Australia. The description of the industry in the Paper provides information for the current consideration of shore-based shipping issues. It also forms the basis for a Paper which will analyse the major factors affecting the performance of the harbour towage industry (BTCE, forthcoming).

This Paper was prepared by a study team led by Mr K. Starr. Members of the team were Mr B. O'Gallagher, Mr T. Winn and Mr N. Wuest.

Many individuals and organisations contacted during the course of the study provided extensive information on the harbour towage industry. I would particularly like to thank the officials from the towage operators, port authorities, trade unions, shipping lines, shippers, shipping agents, industry associations and government departments for their assistance.

W. J. MERRILEES
Research Manager

Bureau of Transport and Communications Economics
Canberra
July 1988

CONTENTS

| | Page |
|--|------|
| ABSTRACT | iii |
| FOREWORD | v |
| EXECUTIVE SUMMARY | xiii |
| CHAPTER 1 INTRODUCTION | 1 |
| Previous studies | 1 |
| Current BTCE work | 2 |
| Outline of Paper | 3 |
| CHAPTER 2 CHARACTERISTICS OF HARBOUR TOWAGE OPERATIONS | 7 |
| Harbour towage services | 7 |
| Size of the towage market | 8 |
| Tug utilisation rates | 10 |
| Harbour towage fleet | 12 |
| CHAPTER 3 PARTICIPANTS IN THE HARBOUR TOWAGE MARKET | 19 |
| Shippers | 19 |
| Shipping lines | 19 |
| Shipping agents | 20 |
| Port authorities | 20 |
| Pilots | 22 |
| Towage operators | 22 |
| Tug crews | 28 |
| CHAPTER 4 TOWAGE OPERATORS' MARGINS AND COSTS | 29 |
| Operators' margins | 29 |
| Cost overview | 31 |
| Depreciation | 31 |
| Crew costs | 33 |
| Other operating costs | 39 |

| | Page |
|--|------|
| CHAPTER 5 | |
| TOWAGE CHARGES | 41 |
| Structure of towage charges | 41 |
| Variations in charges between ports | 44 |
| Trends in towage charges | 46 |
| APPENDIX I | |
| HARBOUR TOWAGE FLEET DATA | 51 |
| APPENDIX II | |
| OWNERSHIP OF TOWAGE OPERATORS | 61 |
| APPENDIX III | |
| CONTROLS OVER TOWAGE OPERATOR ENTRY AND CHARGES | 65 |
| REFERENCES | 69 |
| ABBREVIATIONS | 71 |

TABLES

| | | Page |
|-------|--|------|
| 2.1 | Tug utilisation rates at selected ports, 1985-86 and 1986-87 | 12 |
| 3.1 | Operating arrangements for Australia's harbour towage fleet, 1988 | 24 |
| 4.1 | Structure of costs (excluding operator's gross margin) for selected towage operations | 32 |
| 4.2 | Annual aggregate wages for tug crews at selected Australian ports, June 1988 | 35 |
| 4.3 | Crew levels for tugs at selected Australian ports, June 1988 | 36 |
| 4.4 | Average earnings of tug crews at Westernport as per group certificates, 1985-86 | 39 |
| 5.1 | Towage schedule for the Port of Melbourne, July 1987 | 42 |
| 5.2 | Towage charges per tug for a range of ship sizes at selected Australian ports, 1988 | 45 |
| 5.3 | Comparison of total towage charges for arrivals and departures of selected ships in the Port of Melbourne, 1983-84 and 1987-88 | 50 |
| I.1 | Australian harbour towage fleet characteristics, 1988 | 52 |
| II.1 | Ownership of Australian harbour towage operators, 1988 | 62 |
| III.1 | Controls over towage operator entry and towage charges in individual ports, 1988 | 66 |

FIGURES

| | Page |
|--|------|
| 1.1 Australian ports with harbour towage services, 1988 | 4 |
| 2.1 Ship visits to Australian ports stevedored by waterside labour, 1950-51 to 1983-84 | 9 |
| 2.2 Number of tug jobs at eight Australian ports, 1979-80 to 1986-87 | 11 |
| 2.3 Australian harbour towage fleet by bollard pull, 1988 | 14 |
| 2.4 Australian harbour towage fleet by age, 1988 | 15 |
| 2.5 Australian harbour towage fleet by number of tugs at individual ports, 1988 | 16 |
| 2.6 Harbour towage fleet size and aggregate bollard pull for ports with more than two tugs, 1988 | 17 |
| 3.1 Estimated market shares of Australian harbour towage operators, 1986-87 | 25 |
| 5.1 Trends in towage charges in real terms at selected Australian ports, 1977-78 to 1986-87 | 47 |
| 5.2 Trends in towage charges in real terms at selected Australian ports, 1982-83 to 1986-87 | 48 |

EXECUTIVE SUMMARY

This Paper describes the structure and operation of the harbour towage industry in Australia. It provides factual information for the discussion of issues affecting the industry and also forms the basis for a Paper which will address key issues (BTCE, forthcoming).

Harbour towage services are provided at 49 Australian ports. They account for a significant proportion of the port charges incurred by shipping lines. In addition, the industry exhibits several structural characteristics which are evident in other areas of the waterfront. The participants affecting the operation of harbour towage services are port authorities, pilots, towage operators, tug crews, shipping lines, shipping agents and shippers.

Port authorities indirectly influence towage operations through their service quality stipulations such as hours of tug availability. In order to ensure the safety of ships and port installations, the number of tugs for particular ship movements is essentially determined on the basis of port authority guidelines and the requirements of pilots. A small number of port authorities also specify the number and size of tugs they require in port and various authorities require the provision of fire fighting capacity.

In 21 of the 49 ports covered in the Paper there are formal controls over entry by towage operators and towage charges. Various approaches based on tenders, contracts and licensing are used in these ports. In a further six ports charges are determined by the port authority or major shipper which operates the towage service. In some other cases port authorities may use informal consultative procedures to influence charges.

Towage operators have significant input in several areas of towage operations. They effectively decide most of the physical specifications of tugs, handle negotiations with trade unions, determine the structure of towage schedules and have a major role in setting the levels of charges. Most ports are serviced by a single

towage operator and on a national basis there are three major operators. Howard Smith, Adelaide Steamship and Brambles have interests in around 80 per cent of the harbour tugs in Australia. In many ports towage services are operated by joint ventures.

There are approximately 1300 crew members employed on harbour tugs in Australian ports. They are generally represented by the Merchant Service Guild of Australia, the Australian Institute of Marine and Power Engineers and the Seamen's Union of Australia. Annual aggregate wages of crew members currently range between \$27 600 and \$72 800 across categories and ports on a national basis. These wages include overtime components associated with the provision of towage services on a 24-hour basis. Crew levels vary between four and eight for the larger tugs.

Shippers and shipping lines appear to have limited influence over the operation of the harbour towage industry. Shipping agents generally order the tugs but are effectively required to act in accordance with port authority and pilot requirements.

Charges for towage services are generally based on the recovery of tug acquisition and operating costs plus a gross margin for the operator. The available information suggests that the operator's gross margin represents between 15 per cent and 45 per cent of the towage charge in the majority of Australian ports.

The other major components of towage charges in most ports include crew costs and tug depreciation. The available information for Australian ports suggests that crew earnings and on-costs such as payroll tax account for between 50 per cent and 80 per cent of costs (excluding the operator's gross margin). The range for depreciation is from 6 per cent to 22 per cent. The remaining costs of providing towage services, such as administration and fuel, account for between 11 per cent and 34 per cent of costs (excluding the operator's gross margin) in the ports for which data were obtained.

There is significant variation in towage charges per tug at individual Australian ports. This variation reflects differences in tug utilisation rates, crew costs, tug depreciation charges and other factors. Differences in the profitability of towage operations in individual ports may also affect the relative levels of towage charges.

The harbour towage fleet in Australian ports currently comprises 116 tugs. The introduction of more powerful tugs, a decline in the number of ship calls and technological factors such as bow thrusters have

reportedly resulted in a significant decline in the number of tug jobs at most Australian ports in recent years.

Information on trends in towage charges is limited and hence it is not possible to identify the general trend in real charges at Australian ports. Data for several ports suggest that charges per tug have risen in real terms over the last ten years. However, charges per tug have fallen in real terms in some ports over the last three to four years. There is also some evidence to suggest that increases in charges per tug in the larger ports have been offset to some extent by the introduction of more powerful tugs. This has resulted in fewer tugs being used for particular ship movements.

CHAPTER 1 INTRODUCTION

In recent years the Federal Government has supported a variety of initiatives designed to improve the performance of the shore-based shipping industry. The BTCE has been actively involved in this process through the provision of research support and other activities.

The examination of the shore-based shipping industry has included some references to the operation of towage services in Australian ports. These services account for a significant proportion of port charges incurred by shipping lines. Service quality aspects of towage operations also affect the total costs incurred by the lines. In addition, the harbour towage industry occupies a strategic position in the shore-based shipping industry. Towage operations have therefore been identified as a priority work area by the BTCE.

PREVIOUS STUDIES

A study of tug utilisation at 21 major Australian ports was prepared for the Australian Chamber of Shipping (ACOS) in 1984 (Brady 1984). Considerable over-use of tugs relative to the requirements of ships' masters was identified at 14 ports, with the level of over-servicing ranging from 1 per cent to 26 per cent. It was estimated that a more realistic and responsible approach could reduce towage costs by between 10 per cent and 20 per cent in most major ports. Various recommendations to improve the matching of tugs to ship requirements were made.

Towage operators criticised the methodology and some of the findings of the study. They subsequently indicated that the information collected during the study is not relevant to current harbour towage operations in Australian ports.

In 1986 the Bureau released a Paper which presented a comprehensive description of the shore-based transport and handling system for Australia's non-bulk trades (BTE 1986). This Paper drew upon the work undertaken for the Industry Task Force on Shore-based Shipping Costs

and included a brief discussion of the towage industry. It referred to the earlier study for ACOS and outlined some industry characteristics such as a lack of competition and barriers to entry. Some information on towage charges in major ports was also presented. Estimates prepared by the Bureau indicated that towage services accounted for around 18 per cent of port and related charges and 3 per cent of Australian shore-based charges for full container load (FCL) export cargo (BTE 1986, 195-196).

Towage charges were also included in a survey of port costs which was released by the National Bulk Commodities Group (NBCG) in October 1986 (National Bulk Commodities Group 1986). This survey indicated that there were significant variations in towage charges at 31 Australian ports. The NBCG concluded that the survey revealed high costs for towage services which in turn indicated inefficiency in the industry.

Towage operators disagreed with some of the conclusions reached by the NBCG. In particular, they indicated that the variations in charges between ports reflected differences in costs and tug utilisation rates rather than inefficiency in the towage industry.

The Federal Government's Waterfront Strategy, which was announced in December 1986, was based on four working groups under the umbrella of the Inter-State Commission (ISC). The Importer/Exporter Panel, which was one of the four groups, identified the operation and cost of tugs as one of five key action areas to be investigated by sub-groups of the Panel.

The ISC completed an initial report on the Waterfront Strategy in September 1987. This report outlined the progress being made by the various Waterfront Strategy groups and included a progress report on the consideration of the operation and cost of tugs (Inter-State Commission 1987, 54-55). The Importer/Exporter Panel reported that several major factors leading to an inefficient towage industry had been identified.

The final report of the Importer/Exporter Panel to the ISC in December 1987 again referred to these factors and made several recommendations to improve the efficiency of the towage industry. The Panel's recommendations included an examination of the structure of the industry.

CURRENT BTCE WORK

The relevance of the performance of the towage industry goes beyond its immediate impact on charges incurred by shipping lines and the

effect of service quality factors on shipping costs. The industry exhibits a number of characteristics which are evident in other areas of the shore-based shipping industry. These characteristics include a small number of operators in individual ports, a small group of major national operators and ownership links with other operators of waterfront services. Study of the towage industry may therefore contribute to a better understanding of broader shore-based shipping issues.

In view of these factors, and after discussions with the ISC, it was concluded that the BTCE could make a significant contribution to the Waterfront Strategy by undertaking a two-stage study of towage services in Australian ports. The first stage involves this Information Paper which describes the structure and operation of the industry. A second Paper will address the key issues in the towage industry in terms of current performance and measures to promote improvements. These issues include over-servicing, roster systems and the role of port authorities.

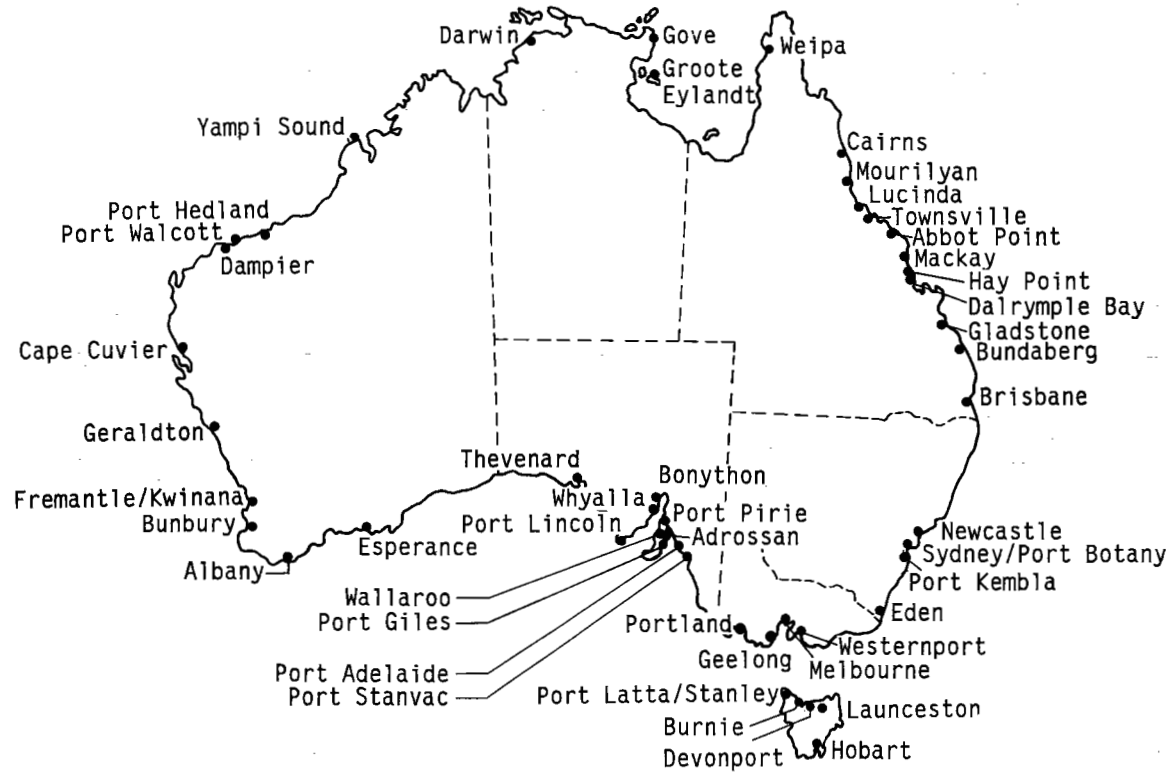
OUTLINE OF PAPER

The following chapters describe the harbour towage industry in Australia. Harbour towage primarily involves assisting ocean-going cargo ships to berth and unberth and excludes related tasks such as deep-sea towage and salvage. The ports with harbour towage services that are covered in this Paper are identified in Figure 1.1.

Chapter 2 outlines the characteristics of towage operations. It includes a description of the services provided by harbour tugs and factors affecting the size of the towage market. The characteristics of the current tug fleet are described in terms of power, age and distribution between ports.

The participants in the towage market are identified in Chapter 3. They include shippers, shipping lines, shipping agents, port authorities, pilots, towage operators and crews. The activities of port authorities which affect the environment for towage operations are described. Details of the towage operators such as ownership structures and links between operators are also presented.

Chapter 4 covers towage operators' gross margins and costs. The proportion of charges attributable to the operator's gross margin is broadly identified and the relative importance of the remaining cost components for several towage operations is discussed. The recovery of tug acquisition costs through depreciation charges is also



Source BTCE.

Figure 1.1 Australian ports with harbour towage services, 1988

described. Crew costs are considered in terms of wages, crew levels, leave entitlements, other payments and on-costs.

Towage charges are described in Chapter 5. The major aspects are the structure of charges, variations between ports and trends in the levels of charges over time.

CHAPTER 2 CHARACTERISTICS OF HARBOUR TOWAGE OPERATIONS

The operations undertaken by Australia's harbour towage fleet and the factors that affect the demand for towage services are described in this chapter. An outline of the current fleet and its geographical distribution is also provided.

HARBOUR TOWAGE SERVICES

The operation of harbour towage services contributes to the safe handling of ships in Australian ports. Towage services are an integral component of efficient operations in many ports due to the size and limited manoeuvrability of ocean-going ships and restricted clearances in channels and berth areas. They assist the client ship and also protect other vessels and port facilities from damage.

The major functions undertaken by harbour tugs in port areas include:

- . manoeuvring of ships through navigation channels and turning in swinging basins prior to berthing or sailing; and
- . assisting ships on and off berths including movement between berths.

As a result of Australia's extensive coastline, harbour tugs also undertake other functions such as salvage and deep-sea towage work.

The harbour towage requirements in individual ports reflect the impact of the physical characteristics of the port, weather conditions, the size and design of ships handled and the needs of shipping lines. Certain requirements are imposed by clearances in channels and berths, the need to swing vessels, operational practices (for example, timing of inwards and outwards movements) and tidal patterns. The severity of weather conditions and the speed with which they change also affect the safety margins specified by port authorities and pilots. The dimensions and design characteristics of ships using individual ports interact with these factors and impact on towage requirements. In addition, towage operations are affected by the service quality specifications of shipping lines.

Various shipping lines have claimed that the number of tugs used for particular ship movements in Australian ports is excessive, with the result that total payments for towage services are unnecessarily high. As noted in Chapter 1, considerable over-use of tugs at some ports was identified in a study prepared for ACOS in 1984. The issue of over-servicing, including any impact on aggregate towage charges, will be considered in detail in a Paper on key issues in the towage industry (BTCE, forthcoming).

SIZE OF THE TOWAGE MARKET

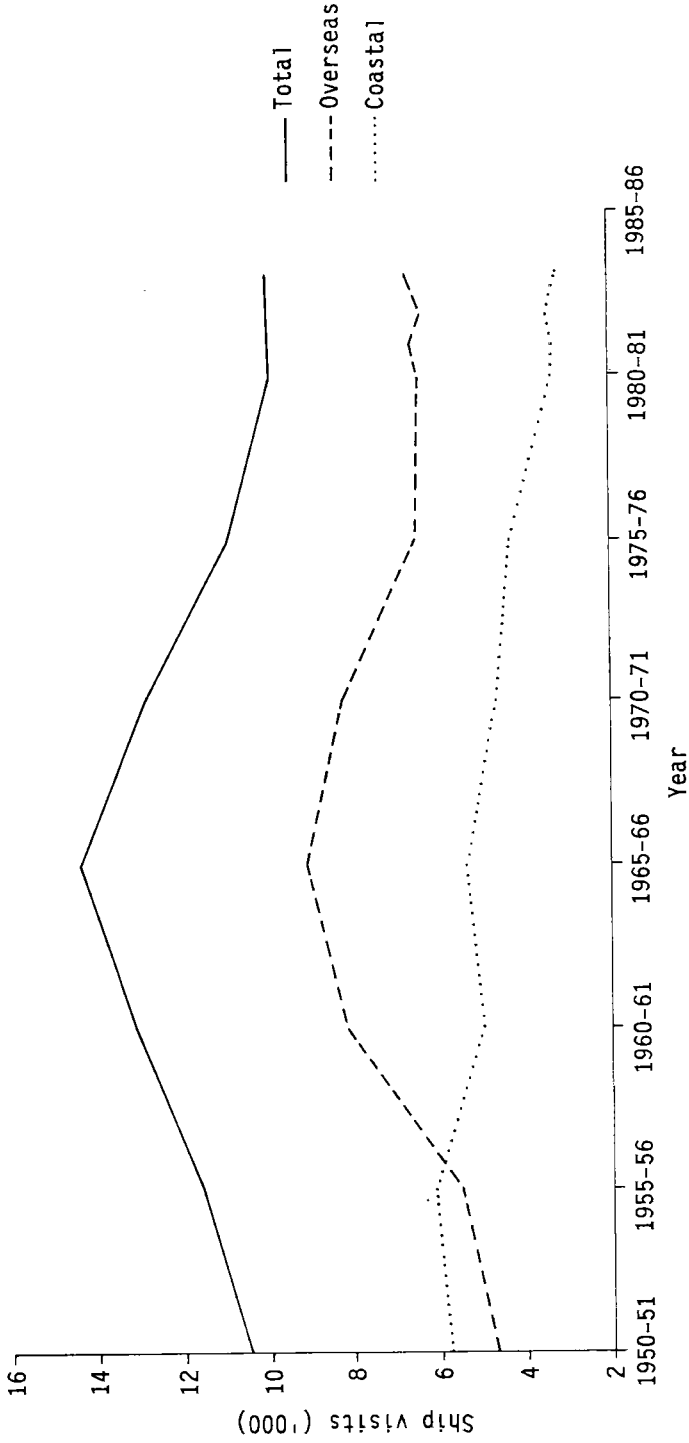
Harbour towage services are currently provided at a total of 49 Australian ports. Details of the towage operations in these ports are provided in Appendix I. A number of ports which handle ocean-going ships do not have towage services as a result of factors such as the small size of ships calling, limited numbers of ship calls, the physical characteristics of the port and geographic isolation. Ports without services include Broome, Wyndham, Trial Bay and Port Alma.

The size of the harbour towage market in Australia has been significantly affected by a variety of developments in shipping and towage practices.

The number of ship calls at Australian ports has generally declined since the 1960s. Figure 2.1 indicates that the number of visits to ports stevedored by waterside labour fell by 31 per cent between 1965-66 and 1983-84.¹ Coastal shipping visits fell by 38 per cent and overseas shipping visits declined by 27 per cent over this period. Information for the period after 1983-84 is only available for overseas ship visits due to discontinuation of the series for coastal ships. These data indicate that there was a partial recovery in the number of visits by overseas ships in the early part of this period, with an increase of 7 per cent between 1983-84 and 1986-87 (Australian Bureau of Statistics 1988).

This overall decline in the number of ship visits partly reflects an increase in the average size of ships in the Australian trades. In addition, the containerisation of general cargo traffic after the late 1960s resulted in a substantial rationalisation of port calls, with

1. Figure 2.1 excludes 15 bulk ports, many of which have been opened since 1965-66. However, inclusion of traffic at these ports would not reverse the downward trend in the total number of ship visits.



Sources Department of Transport, 1985. Department of Transport and Construction, 1982.

Figure 2.1 Ship visits to Australian ports stevedored by waterside labour, 1950-51 to 1983-84

the specialist container ships in the overseas trades serving a smaller number of ports than the earlier conventional vessels. The decline in coastal shipping activity reflects both a loss of market share to competing modes and increases in average ship size.

The size of the towage market has also been affected by technological developments in ship design. In particular, towage requirements have been reduced by the fitting of bow thrusters which increase the manoeuvrability of ships in port areas and therefore reduce the need for assistance from tugs. Towage requirements have also been affected by other factors such as increased ship dimensions and changes in ship design.

Increases in ship dimensions and strategies by towage operators to contain or reduce costs have resulted in the introduction of more powerful tugs with improved propulsion systems. These technological advances in tug design have enabled various towage operations in some of the major ports to be undertaken with fewer tugs.

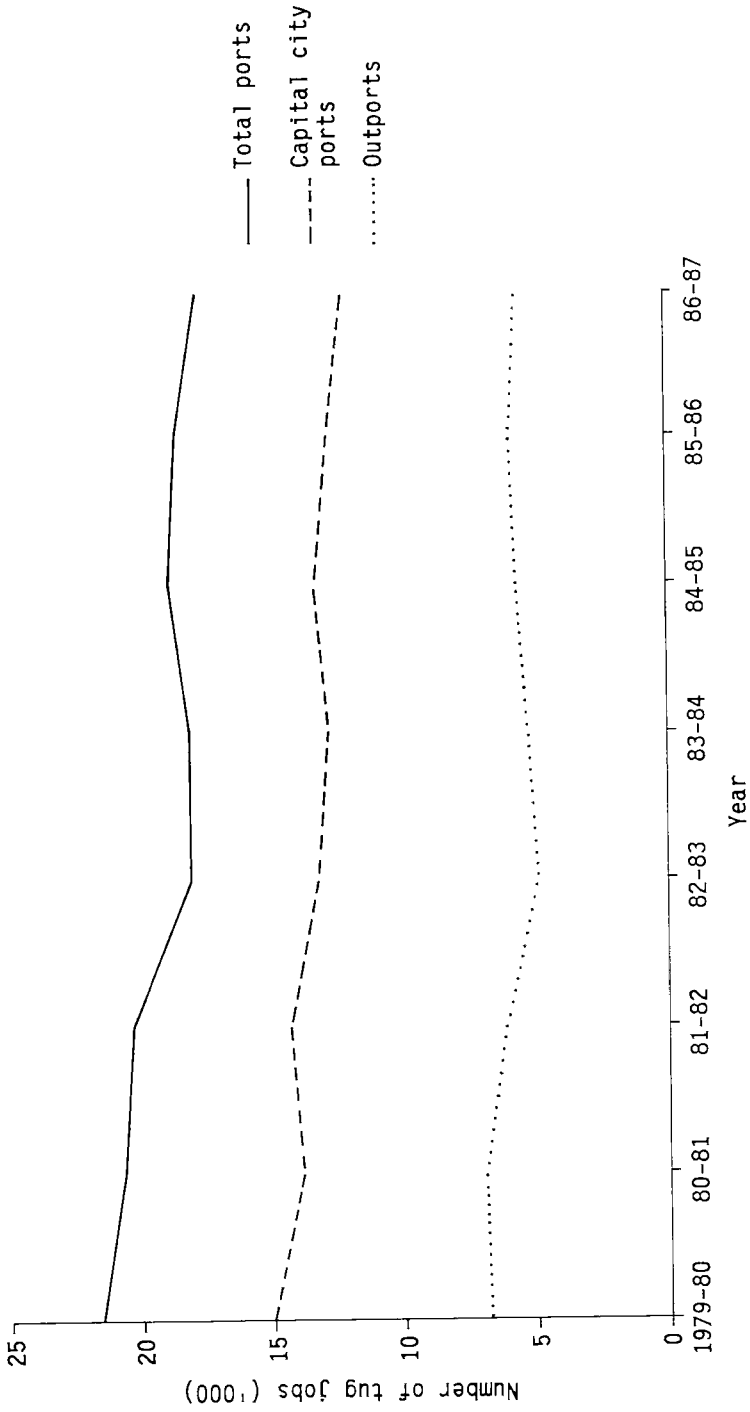
The usual indicator of the size of the towage market is the number of tug jobs. Information on the aggregate number of tug jobs undertaken in Australian ports is not readily available but there are some data for a limited number of ports.

Figure 2.2 indicates the trend in the number of tug jobs at four capital city ports and four outports over the eight years to 1986-87. There was an overall decline of 18 per cent in the number of tug jobs, although the figures vary significantly on an annual basis due to changes in levels of port activity. The partial recovery in tug jobs at the outports after 1982-83 mainly reflects developments at the largest port in this group.

Figure 2.2 does not necessarily indicate the overall trend in tug jobs in Australian ports as the sample of ports is relatively small. The opening of new iron ore and coal ports until the early 1980s would have at least partly offset declines in existing ports. However, advice from the major towage operators indicates that the number of tug jobs has generally been declining in most Australian ports.

TUG UTILISATION RATES

The number of tugs in a particular port reflects the requirement for an adequate service to meet peak traffic demands over a 24-hour port operation. However, in the busier Australian ports there are significant periods during the day when the frequency of ship movements is low. In many other ports there are frequent periods of



Source Industry sources.

Figure 2.2 Number of tug jobs at eight Australian ports, 1979-80 to 1986-87

one day or more when no ships move in the port. These factors have contributed to relatively low utilisation rates for tugs.

Table 2.1 indicates that even in some of the larger Australian ports the average utilisation rate rarely exceeds three jobs per day. Utilisation rates are much lower in many of the small outports. The variation between the figures for 1985-86 and 1986-87 primarily reflects changes in port traffic levels.

Industry sources indicate that in most Australian ports the time required for a single tug job rarely exceeds two hours from engine start-up to return to base. A substantially longer period may be involved in ports which are serviced by tugs based in adjacent ports.

HARBOUR TOWAGE FLEET

As at June 1988, harbour towage operations in Australian ports were undertaken by a fleet of 116 tugs. There were also a variety of other tugs involved in towage activities such as the movement of lighters, barges and other small vessels or the provision of specialist fire fighting services. Although the latter tugs may also have intermittent involvement in limited harbour towage activities, they

TABLE 2.1 TUG UTILISATION RATES AT SELECTED PORTS, 1985-86 AND 1986-87

(tug jobs^a per day)

| Ports | Tug utilisation | |
|--------------------|-----------------|---------|
| | 1985-86 | 1986-87 |
| Newcastle | 3.9 | 3.9 |
| Sydney/Port Botany | 2.6 | 2.4 |
| Melbourne | 2.7 | 2.3 |
| Brisbane | 1.7 | 1.7 |
| Fremantle | 1.3 | 1.4 |
| Portland | 0.5 | 0.6 |
| Devonport | 0.7 | 0.6 |
| Esperance | 0.4 | 0.3 |

a. The number of tug jobs indicates the average number of times each tug provides towage services.

Sources Industry sources.

are not included in this study. Detailed information on the current harbour towage fleet is presented in Appendix I.

The power of individual harbour tugs, which is measured in terms of bollard pull, ranges from 6 tonnes to 75 tonnes.² Figure 2.3 indicates that 60 tugs have a bollard pull in excess of 40 tonnes. These tugs account for around 68 per cent of aggregate bollard pull. The prominent position of the larger tugs in the Australian fleet is the result of the trend to substantially more powerful units since the late 1970s.

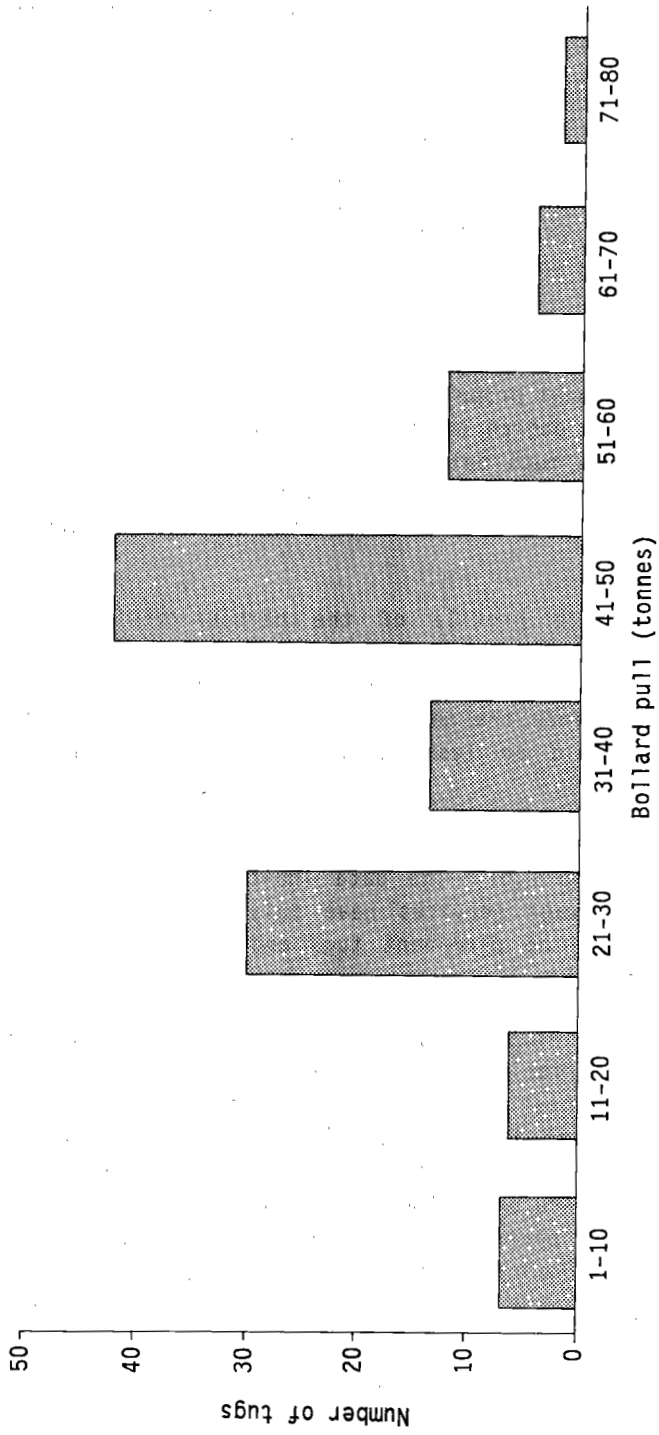
Australian operators were among the first companies in the world to introduce omni-directional propulsion systems on a large scale. These systems provide a high degree of manoeuvrability and also enable the tug to exert almost as much pull astern as it can when going ahead. Around 36 per cent of Australian harbour tugs, accounting for 46 per cent of aggregate bollard pull, have omni-directional propulsion systems.

Information on the age profile of the harbour towage fleet is presented in Figure 2.4. As a result of the major construction program since the late 1970s, around 40 per cent of the fleet is ten years old or less. Since the newer tugs are generally larger, tugs that are ten years old or less account for 48 per cent of the aggregate bollard pull.

The distribution of the harbour towage fleet between individual ports is summarised in Figure 2.5. The data indicate that 31 of the 49 ports with harbour towage services have only one or two tugs. A further six ports have no permanent tugs and are served by units stationed in nearby ports.

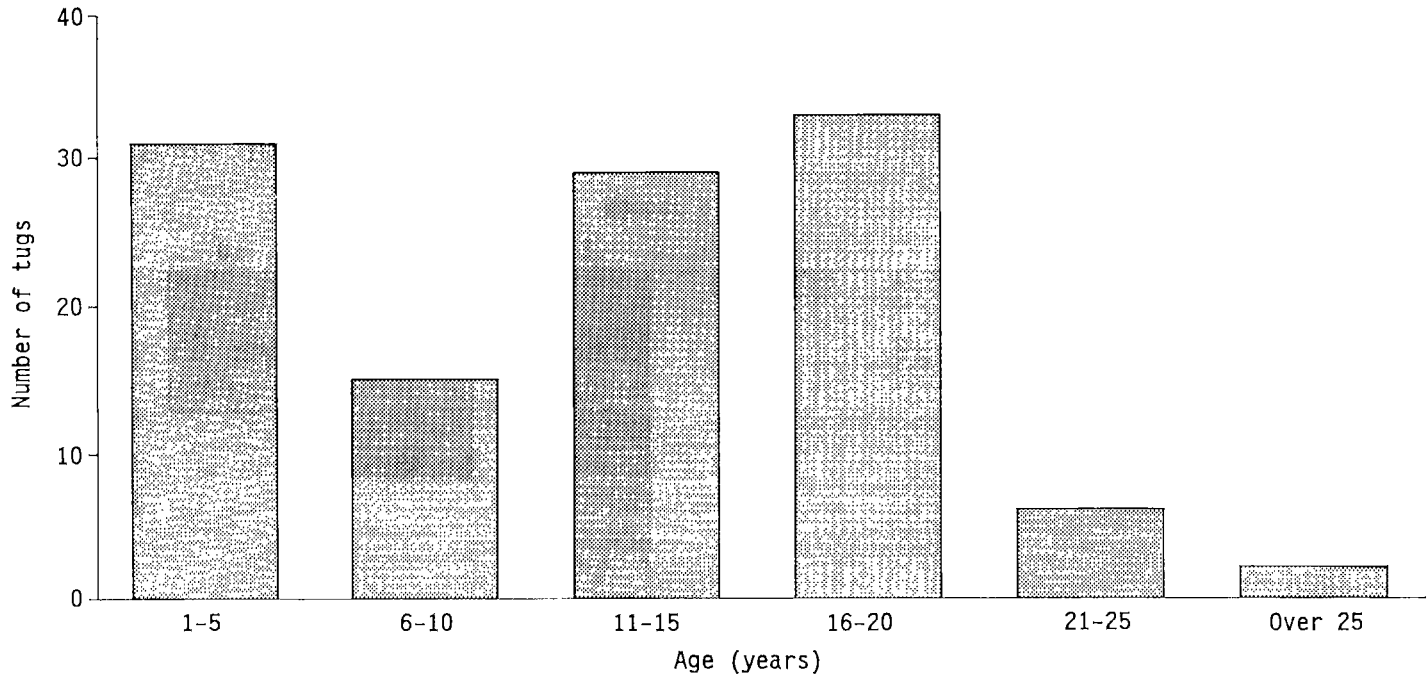
The 12 ports with more than two tugs account for 54 per cent of the national fleet. Information on the number of tugs and aggregate bollard pull of the fleet at each of these ports is presented in Figure 2.6. The largest fleet in terms of both number and bollard pull is in Sydney/Port Botany. This is followed by the fleets in Port Hedland, Dampier, Brisbane and Melbourne which are of similar size and power. The remaining ports comprise the other capital cities and several ports which predominantly handle bulk cargoes.³

-
2. Bollard pull represents the force that can be exerted on a static object (that is, a bollard) by a tug.
 3. Several other ports have only two tugs but their aggregate bollard pull is similar to that of the third group of ports with three or more tugs.



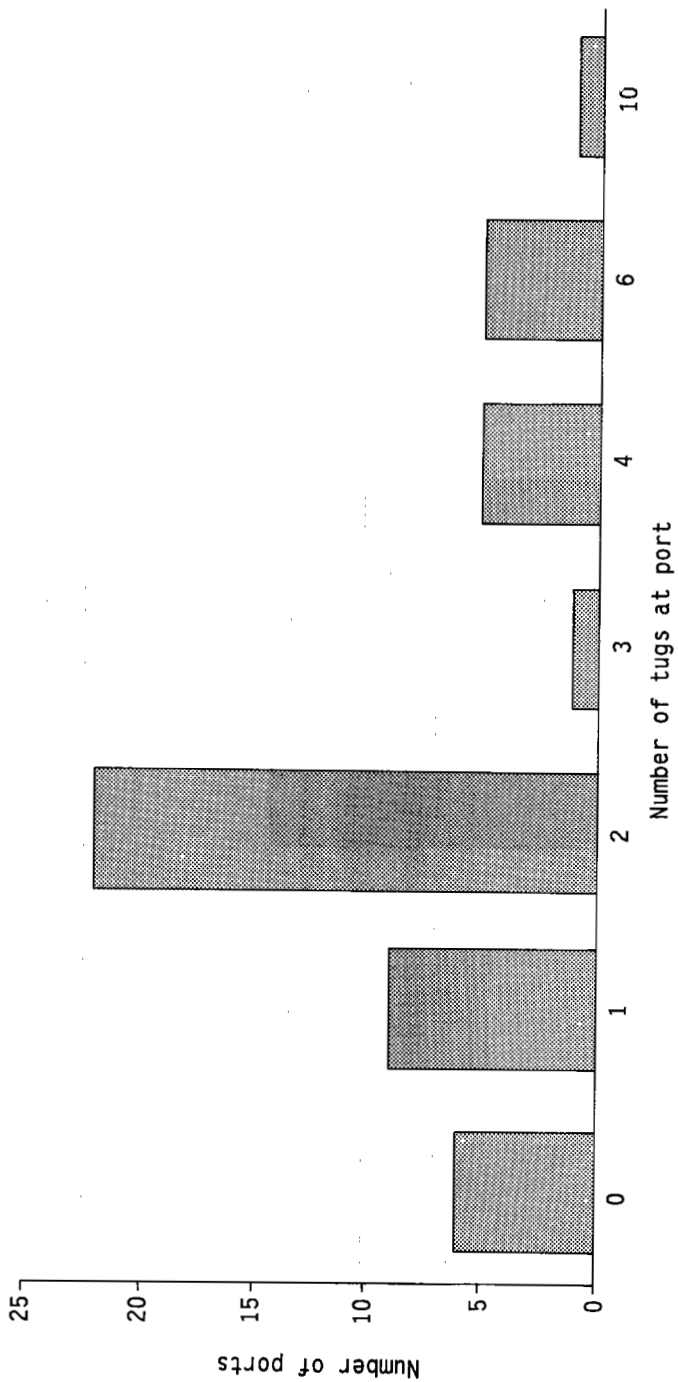
Source: Industry sources.

Figure 2.3 Australian harbour towage fleet by bollard pull, 1988



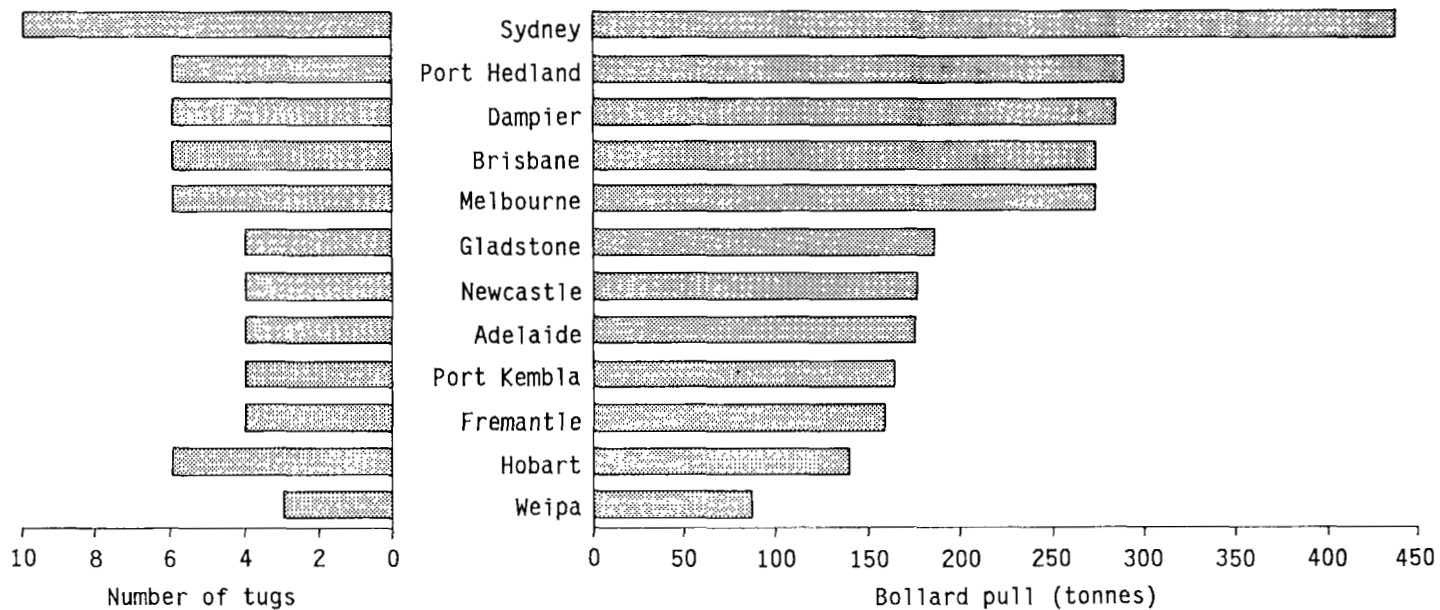
Source Industry sources.

Figure 2.4 Australian harbour towage fleet by age, 1988



Source Industry sources.

Figure 2.5 Australian harbour towage fleet by number of tugs at individual ports, 1988



Source Industry sources.

Figure 2.6 Harbour towage fleet size and aggregate bollard pull for ports with more than two tugs, 1988

On a State basis the largest tug fleets are concentrated in Western Australia and Queensland. These States have 30 and 27 tugs respectively. They are followed by New South Wales (20 tugs), Victoria (12), South Australia (11), Tasmania (11) and the Northern Territory (5).

The new more powerful tugs have generally been placed in the large capital city ports, where acquisition costs can be spread over a large number of tug jobs, and in major bulk ports which handle large ships. The smaller tugs, which are often displaced from these ports, have relatively low capital costs due to their size and age. These tugs are therefore stationed in the smaller capital city ports and outports where numbers of ship calls, and hence the ability to spread tug capital costs, are lower.

Tug fleets in the larger ports generally include a mix of tugs with varying capabilities. This reflects factors such as the towage requirements in each port and the impact of tug acquisition costs on towage charges.

CHAPTER 3 PARTICIPANTS IN THE HARBOUR TOWAGE MARKET

An understanding of the functions of the participants in the harbour towage industry and their respective roles is central to any study of the industry. The participants are shippers, shipping lines, shipping agents, port authorities, pilots, towage operators and tug crews. They affect the operation of the towage industry both on an individual basis and through the activities of relevant associations.

There are some ownership links between shipping lines, shipping agents and towage operators. In addition, several companies with interests in these areas have significant involvement in other waterfront areas such as stevedoring and container terminals. Vertical integration on the waterfront is described in Coopers and Lybrand W. D. Scott (1988).

SHIPPERS

Towage costs are ultimately borne by shippers. In non-bulk cargo ports and many bulk cargo ports, shippers have little direct influence on the operation of towage services. However, in some bulk cargo ports mining company shippers either operate the towage services or determine the conditions of operation by private towage companies.

Shippers are represented by a variety of associations such as the Australian Shippers' Council, the Australian Mining Industry Council and the NBCG. As noted in Chapter 1, the NBCG has commented on the operation of the harbour towage industry.

SHIPPING LINES

Shipping lines are the direct users of harbour towage services. There are over 90 different lines regularly calling at Australian ports. They have limited influence over the operation of towage services due to:

- . the fragmented nature of the shipping industry;
- . the lack of effective competition between towage operators in individual ports; and

- . the powers of port authorities and pilots.

However, in some cases the lines' decisions on factors such as ship design and their requirements for hours of port operation impact on towage requirements.

The interests of shipping lines are mainly represented by ACOS and the Australian National Maritime Association (ANMA). Shipping lines have attempted to influence the operation of the harbour towage industry through these associations. For example, ACOS commissioned a study on levels of service as noted in Chapter 1 and has expressed concerns about increases in towage charges on a number of occasions.

SHIPPING AGENTS

The functions of shipping agents include the ordering of tugs on behalf of shipping lines. On receipt of advice of a ship arrival or departure, the shipping agent generally contacts the towage operator to arrange the required number of tugs.¹ The number of tugs required is generally based on port authority guidelines or pilot requirements.

There are more than 65 companies providing shipping agency services in Australian ports. Many of these companies are affiliated with the major shipping lines and there are also some ownership links with major towage operators.

PORT AUTHORITIES

As noted in Chapter 2, harbour towage services are provided in 49 Australian ports. In general, port authorities are responsible for the development of ports, the control of shipping movements and the safe manoeuvring of ships within the ports. Although a number of port authorities operated towage services until the 1970s, the Port of Portland Authority is the only remaining public sector operator of harbour towage services.

The degree of regulation or control of towage operations by port authorities (or relevant State government departments) varies from port to port. Port authorities indirectly influence towage services through their service quality stipulations such as hours of tug availability. In the larger ports there are guidelines on numbers of

1. In a small number of ports such as Melbourne and Fremantle, the shipping agent contacts the port authority which in turn contacts the towage operator.

tugs required for individual ship movements in order to ensure the safety of ships and port installations. In a small number of cases, port authorities have specified the number and size of tugs they require in the port. Various port authorities also specify the provision of fire fighting capacity on tugs.

The major forms of direct regulation of towage operations by port authorities (or relevant State government departments) are controls over entry by operators into individual ports and procedures for review or approval of towage charges. Information on practices in individual ports is presented in Appendix III.

Mechanisms used to control entry by towage operators include tenders, contractual arrangements and licensing. Practices in individual ports reflect both the attitudes and legislative powers of the relevant authorities. There are no controls over entry in the capital city ports and regulation is generally limited to outports in Queensland, Western Australia and Tasmania.

The tender process is used in nine ports. Due to the significant capital costs involved in towage operations, a contractual arrangement is always used in conjunction with the tender process. Long-term contracts assist the operator to amortise tug acquisition costs without undue effects on towage charges. Contracts also enable port authorities to specify levels of service and towage charges. For example, the Geraldton Port Authority sets and collects towage charges, with the towage operator receiving stipulated payments over a ten-year period. Contracts are also used in five ports where there is no tender process.

Licensing of towage operators is used in 13 ports. Where port authority legislation provides for licensing a towage operator can legally be denied the right to provide towage services in the port. Licensing is sometimes used in conjunction with contracts and tenders.

In the majority of ports there are no tenders, contractual arrangements or licensing activities. A total of 28 ports have no formal controls over entry by towage operators. In six of these ports towage services are operated by the port authority or the major shipper using the port.

There are formal procedures for the review or approval of variations in towage charges in 21 outports in four States. These arrangements assist the port authorities to consider whether proposed increases in charges are justified by movements in costs. In a further six ports

charges are determined by the port authority or major shipper which operates the towage service.

There are no formal controls over towage charges in the remaining 22 ports which include all of the capital city ports. However, in some of these cases port authorities rely on informal consultative procedures to exert some influence on towage charges.

The interests of port authorities are represented by the Association of Australian Port and Marine Authorities (AAPMA).

PILOTS

Pilots assist the movement of ships in Australian ports as required by port regulations, although some ships' masters have exemptions from the requirements in individual ports. The function of a pilot is to ensure the safe passage and manoeuvring of ships within the confines of the port and associated navigation channels. Tugs assist the pilot in undertaking this function. The pilot essentially determines the number and usage of tugs for any particular manoeuvre.

The number of tugs required by the pilot partly reflects physical and environmental factors that were discussed in Chapter 2. Institutional constraints, such as tug rostering systems and advance booking requirements, also impact on the number of tugs used.

Where port authority guidelines for tug usage are issued, they are generally based on the pilots' recommendations. Pilots are usually port authority or State government employees, although there are also some private operations such as the Port Phillip Sea Pilots Association.

TOWAGE OPERATORS

Towage operators have a significant input in several areas of towage operations. They effectively decide the power, propulsion systems and most other basic physical specifications of tugs, although there is some consultation with other participants such as port authorities. Negotiations with trade unions over crew sizes, wages and conditions are handled by the towage operators. They also determine the structures of towage schedules and make decisions on levels of charges, although as noted earlier there are various procedures for review or approval of charges by port authorities.

The major towage operators are represented by the ANMA Towage Sub-Committee. Under a separate arrangement, the Tug Operators Committee co-ordinates their approach to industrial issues.

Harbour towage services at individual ports are generally provided by a single operator as a result of limited market size and economies of scale. The major exceptions to this pattern are the ports of Sydney/Port Botany and Newcastle where towage services are provided by two operators.

Table 3.1 indicates that three companies are prominent in the provision of harbour towage services. Howard Smith Ltd, The Adelaide Steamship Company Ltd and Brambles Industries Ltd have interests in around 80 per cent of the harbour tugs in Australian ports. Other operators include McIlwraith McEacharn Ltd, P&O Australia Ltd, five mining companies, the Port of Portland Authority and two family companies. More detailed information on the ownership structure and fleet characteristics is presented in Appendixes I and II.

Table 3.1 indicates that 54 per cent of the harbour towage fleet is operated through joint ventures. These arrangements usually incorporate joint venture ownership of the tugs, although tugs wholly owned by individual partners are also included in some cases. One of the partners has management responsibility in each joint venture.

Approximate market shares of the harbour towage operators are presented in Figure 3.1. The figures are based on the estimated numbers of ships assisted by tugs at individual ports rather than the numbers of tug jobs. For joint venture operations, traffic is allocated to the partners in proportion to their shareholdings.

Figure 3.1 indicates that Howard Smith and Adelaide Steamship have the largest market shares, with Brambles being the third largest operator. These companies account for approximately 81 per cent of the harbour towage market. Inclusion of McIlwraith McEacharn results in a market share of 89 per cent for the four largest towage operators.

The market share estimates are affected by the assumptions used and different figures would be obtained if the basis was the number of tugs or bollard pull or if the criterion was tug ownership or management. However, the alternative approaches would still indicate large market shares for the major towage operators, the most significant difference being changes in the ranking of Howard Smith and Adelaide Steamship.

Howard Smith Ltd

Howard Smith's involvement in towage services dates from 1875 when it commenced operating services in competition with three other operators

TABLE 3.1 OPERATING ARRANGEMENTS FOR AUSTRALIA'S HARBOUR TOWAGE FLEET, 1988

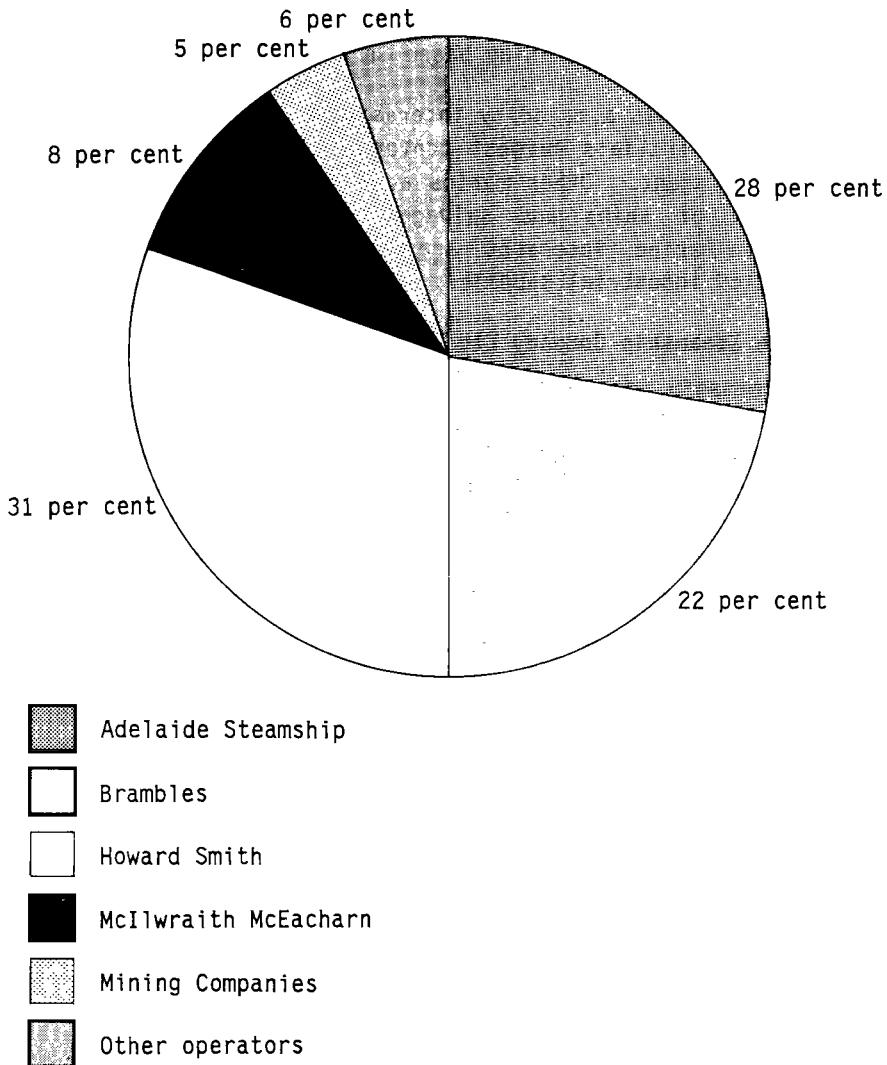
| <i>Parent companies</i> | <i>Number of tugs</i> |
|---|-----------------------|
| Fully owned associates ^a | |
| Howard Smith | 3 |
| Adelaide Steamship | 7 |
| Brambles | 20 |
| McIlwraith McEacharn | 2 |
| P&O Australia | 4 |
| Mining companies | 14 |
| Port of Portland Authority | 2 |
| McKenzie's Tug Service | 1 |
| Joint ventures ^b | |
| Howard Smith and Adelaide Steamship | 41 |
| Howard Smith and McIlwraith McEacharn | 11 |
| Adelaide Steamship and Brambles | 4 |
| Adelaide Steamship and Stannard Bros | 5 |
| P&O Australia, Adelaide Steamship and Howard Smith ^c | 2 |
| Total | 116 |

- a. Tug operating company wholly owned by, or the same as, the parent company.
- b. In joint ventures, parent companies each have a 50 per cent holding in the operating company unless otherwise indicated. This does not necessarily reflect ownership of the tugs. For example, Howard Smith has three fully owned tugs operated by joint ventures.
- c. P&O Australia has a 50 per cent holding in the operating company and the remaining shareholders each have 25 per cent.

Sources Industry sources.

in Port Phillip Bay. Most of the company's towage interests now involve joint ventures which operate a total of 54 tugs. An additional three tugs are operated through wholly owned subsidiaries.

Howard Smith's towage operations cover ports in Queensland, New South Wales, Victoria and Western Australia. The company also operates in the related field of offshore oil and gas services through a joint



Source Industry sources.

Figure 3.1 Estimated market shares of Australian harbour towage operators, 1986-87

venture with P&O Australia. In 1987 it acquired a 75 per cent holding in a towage and marine operation based in the United Kingdom.

Howard Smith also has a majority interest in James Patrick and Co Pty Ltd which is Australia's largest conventional stevedoring contractor and a shipping agent. Other marine activities include the ownership and operation of ships and salvage activities. Howard Smith's principal non-marine interests are coal mining, engineering and distribution of industrial supplies.

The Adelaide Steamship Company Ltd

Adelaide Steamship was initially formed in 1875 to provide coastal shipping services but it soon became involved in the harbour towage industry. The company currently operates seven tugs through wholly owned associates and is involved in joint ventures which operate an additional 52 tugs. It provides harbour towage services in Western Australia, New South Wales, Queensland and the Northern Territory and is the dominant operator in South Australian ports.

Adelaide Steamship's early involvement in the shipping industry is still reflected in its other marine interests. These activities include shipping agencies and port services. However, a program of diversification was commenced in the 1970s and the company's major sources of revenue now involve non-marine activities such as retailing, manufacturing and merchandising.

Brambles Industries Ltd

Brambles entered the harbour towage industry in 1970 when it acquired the Sydney operator J. Fenwick. This was followed by further expansion, particularly in Tasmania where various port authority operations were acquired. The company's wholly owned subsidiaries currently operate 20 tugs and it has interests in an additional four tugs through a joint venture.

Brambles operates towage services in the New South Wales ports of Sydney/Port Botany and Newcastle and at the coal export facility at Hay Point in Queensland. It also controls the towage services in the ports of Tasmania and has joint ownership of a smaller New South Wales towage operator which provides services at Port Kembla.

The company's other marine interests include Bass Strait shipping services and shipping agency activities. Brambles' non-marine activities cover areas such as materials handling, waste management, security services and freight forwarding.

McIlwraith McEacharn Ltd

McIlwraith McEacharn's involvement in harbour towage operations began in 1961 when it acquired the towage interests of two operators in Melbourne. The company currently operates two tugs through a wholly owned subsidiary and a further 11 harbour tugs are operated through joint venture arrangements with Howard Smith.

McIlwraith McEacharn's joint venture operations involve the ports of Melbourne and Westernport in Victoria and Weipa in Queensland. It has contracted in its own right to provide towage services to the coal export facility at Dalrymple Bay in Queensland.

The company's other marine activities include ship management, shipping agencies and ship repair. Major non-marine interests are coal mining and oil field and mining services. Around 46 per cent of McIlwraith McEacharn's shares are directly held by TNT Ltd.

P&O Australia Ltd

P&O Australia entered the harbour towage industry in 1975 when it contracted to supply towage services to the BP Kwinana refinery. The company currently operates two tugs at Geraldton through a wholly owned associate and manages two tugs which operate at Cape Cuvier. A further two tugs are operated at Kwinana in a joint venture with Howard Smith and Adelaide Steamship.

P&O Australia has substantial other marine interests in Australia. The company is a major operator of container terminals, stevedoring services, offshore supply services for the oil and gas industry and shipping agencies. Its parent company is a major shipowner. Other activities of P&O Australia include cold storage, distribution and tourist services.

Mining companies

Five mining companies operate harbour towage services at specialised bulk cargo ports. The companies are Cape Lambert Services (Port Walcott), Pilbara Harbour Services (Dampier), Woodside Offshore Petroleum (Dampier), BHP-Utah (Yampi Sound, Groote Eylandt) and Nabalco Shipping (Gove).

These companies operate 14 tugs, two of which are chartered from Howard Smith and McIlwraith McEacharn. At several other specialised bulk cargo ports, mining companies have contracted with private operators to provide towage services.

Port authorities

As noted earlier, the Port of Portland Authority is the only port authority that continues to operate harbour towage services in Australia. The Authority has two tugs.

Tugs are operated by some other port authorities but they are limited to functions such as movement of port authority equipment or fire fighting. They do not handle commercial trading ships under normal circumstances.

Other operators

Stannard Bros is the largest of the two remaining family companies that operate harbour towage services in Australia. The company has an association with Adelaide Steamship through two joint ventures which operate five harbour tugs in South Australia and the Northern Territory.

McKenzie's Tug Service is the other family company which provides harbour towage services. It operates one tug at Esperance in Western Australia.

Several other companies provide towage services for lighters, barges and other small vessels in some Australian ports. On occasions the small tugs used by these operators may assist in the movement of larger trading ships. However, as the involvement by these operators in harbour towage is a small part of their overall activities, these companies and their tugs are not included in this Paper.

The foregoing discussion of towage operators also excludes the Geraldton Tug Company which provided towage services in Geraldton until late 1987.

TUG CREWS

As at June 1988, total employment on harbour tugs in Australian ports was approximately 1300 people. The composition of tug crews varies between ports but they generally include several officers (master, engineer and sometimes a mate) and ratings (greaser and deckhands).

In ports where the national Tugboat Industry Award applies, members of the tug crews are generally represented by the Merchant Service Guild of Australia, the Australian Institute of Marine and Power Engineers and the Seamen's Union of Australia.

CHAPTER 4 TOWAGE OPERATORS' MARGINS AND COSTS

Charges for towage services are based on recovery of tug acquisition and operating costs plus a gross margin for the operator. Towage operators generally treat individual ports as separate cost centres.

In the first part of this chapter the impact of the operator's gross margin on towage charges is considered, although the discussion is limited by the lack of data and apparent variability in gross margins. The following sections contain an overview of the structure of costs (excluding the operator's margin) and a detailed description of the major components.

The discussion in this chapter is based on the approach used in towage operators' financial accounts as this is the basis for the setting of towage charges. The data are not adjusted to incorporate economic concepts such as the opportunity cost of capital or appropriate depreciation charges in an environment of inflation.

OPERATORS' MARGINS

Where port authority review or approval of charges is required, towage operators reportedly incorporate an after tax return of around 14 per cent per annum based on the undepreciated, historic cost of assets. The operator's gross margin, which is calculated before interest and income tax but after depreciation, is therefore typically set at around 27.5 per cent of assets.

A more useful concept for the analysis of the components of towage charges is the operator's gross margin as a proportion of total revenue. This indicates the proportion of the towage charge which accrues to the operator. It does not show the operator's net earnings as there are additional outflows for income tax and interest payments associated with the use of borrowed funds. In addition, the use of historic cost based depreciation charges in an environment of inflation may result in some of the gross margin being used to fund the replacement of capital equipment.

The operator's gross margin appears to be a significant component of towage charges. In terms of the operators' systems for setting of charges, the gross margin would account for around 27 per cent of the charges in a port where depreciation represented say 10 per cent of costs (excluding the operator's gross margin) on the basis of a 7.5 per cent annual rate for depreciation.¹ If depreciation accounted for 20 per cent of costs (excluding the operator's gross margin), the expected return would represent 42 per cent of charges. The extreme upper end of the range increases to 52 per cent if the more commonly used 5 per cent and 6.7 per cent depreciation rates are incorporated in the calculations.

The proportion of costs (excluding the operator's gross margin) attributable to depreciation charges probably varies from 5 per cent to 15 per cent in most Australian ports, resulting in a range between 15 per cent and 45 per cent for the gross margin as a proportion of towage charges. Limited information on operator costings for individual ports obtained during the study indicated figures in this range.

In practice, the towage operator's gross margin may vary over time as a result of factors such as unforeseen changes in port traffic which affect revenue. Comprehensive data on the actual margins of towage operators are not readily available but some information can be obtained from financial statements lodged with Corporate Affairs Commissions. Data obtained during the study indicate that earnings before interest and tax as a proportion of sales for several operators have been in the range of 15 per cent to 45 per cent in recent years. The proposed reduction in the corporate tax rate from 49 per cent to 39 per cent would provide some scope to reduce future gross margins.

Gross margin as a proportion of revenue does not provide a measure of the rate of return achieved by the towage operator as it does not relate earnings to equity or assets. Rates of return in the towage industry are not addressed in this Paper.

1. If total costs (excluding the operator's gross margin) equal 100 units, the pre-tax rate of return of 27.5 per cent equals (27.5 divided by 7.5) times the depreciation charge of 10 units. This equals 36.7 units. The proportion of charges attributable to the operator's gross margin would therefore be (36.7 divided by 136.7) which equals 27 per cent. Depreciation charges are discussed in greater detail in a later section of this chapter.

COST OVERVIEW

Information on the structure of costs (excluding the operator's gross margin) for towage operations in three Australian ports is presented in Table 4.1. The data indicate that crew wages and allowances are the major component, with depreciation generally being the next largest cost category.

Table 4.1 also indicates that there is significant variation between cost structures in the capital city port, the large bulk port and the small outpost. The ports included in the table are not necessarily representative of all Australian ports in each group. In particular, the proportion of costs attributable to depreciation charges in the major capital city port is very low due to relatively high crew costs in this port. Approximate estimates for another port in this group suggest that depreciation would be around 10 per cent of costs (excluding the operator's gross margin) while wages and allowances would account for around 50 per cent. However, Table 4.1 probably captures the range of cost structures for the majority of harbour towage operations in Australian ports.

The variations in cost structures reflect the impact of factors such as tug characteristics and crew wages. The components of these costs are discussed in detail in the following sections.

DEPRECIATION

Table 4.1 indicates that tug depreciation charges may comprise up to 22 per cent of the costs (excluding the operator's gross margin) of providing towage services.

While there are no restrictions on the importation of new tugs into Australia, towage operators have relied on local shipyards for new buildings since the 1950s. The importation of second-hand tugs is restricted by import controls designed to assist the local shipbuilding industry. The major tug construction companies in Australia are Carrington Slipways Pty Ltd, Tamar Marine Pty Ltd, Australian Shipbuilding Industries (WA) Pty Ltd and Ocean Shipyards (WA) Pty Ltd.

Industry sources indicate that tug construction costs are currently around \$3 million for a 30 tonne bollard pull tug and \$6 million for a 50 tonne bollard pull tug typical of the size and design of those recently introduced in the major ports. The major towage operators have reportedly obtained discounts of 10 per cent or more on machinery, propulsion systems and building costs.

TABLE 4.1 STRUCTURE OF COSTS (EXCLUDING OPERATOR'S GROSS MARGIN)
FOR SELECTED TOWAGE OPERATIONS
(per cent)

| Cost components | Major capital city port | Large bulk port | Small outport | |
|-------------------------|-------------------------|-----------------|-------------------------|------------------------|
| | | | Modern medium-sized tug | Older medium-sized tug |
| Depreciation | 6.1 | 17.0 | 21.6 | 6.8 |
| Crew | | | | |
| Wages and allowances | 63.2 | 43.0 | 55.8 | 67.9 |
| Wage on-costs | | | | |
| Payroll tax | 3.8 | 2.0 | 3.2 | 3.9 |
| Superannuation | 5.7 | 2.0 | 4.2 | 5.1 |
| Workers' compensation | 1.4 | 1.0 | 3.9 | 4.7 |
| Long service leave | 1.8 | 1.0 | a | a |
| Other operating costs | | | | |
| Administration | 4.1 | 6.0 | 1.2 | 1.4 |
| Repairs and maintenance | 4.3 | 20.0 | 5.2 | 5.7 |
| Fuel and oil | 4.0 | 5.0 | 1.4 | 1.7 |
| Insurance | 2.3 | 3.0 | 1.9 | 0.8 |
| Others ^b | 3.3 | a | 1.6 | 2.0 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 |

a. Included in other cost categories.

b. Includes items such as victualling and stores.

Sources Industry sources.

The cost of tugs constructed in Australia is also affected by a government bounty. The *Bounty Ships Act 1980* provides for a 20 per cent bounty on the construction cost of tugs built in Australia. For the purchaser of a 50 tonne bollard pull tug, this would represent a saving of \$1.2 million.²

2. As at June 1988, the total amount of bounty available had been fully reserved.

Around 40 per cent of tug construction costs are attributable to the purchase of imported components such as marine engines and propulsion systems. Price increases for these components resulting from changes in the value of the Australian dollar have reportedly contributed to a significant increase in tug construction costs in recent years.

As noted earlier, the recovery of tug acquisition costs from users of towage services is based on depreciation charges. Industry sources indicate that this involves an annual depreciation rate of between 5 per cent and 7.5 per cent based on historic purchase cost and the straight-line depreciation method. In an environment of general price inflation this results in relatively high depreciation charges for new, large tugs and lower charges for older tugs.

This approach to the recovery of tug acquisition costs has encouraged the use of smaller, older tugs in many outports with relatively low traffic levels. The large modern tugs have high depreciation charges which can be spread over a relatively large number of jobs in the major ports. The older tugs have much lower depreciation charges which can be absorbed by the relatively small numbers of users in many outports. Large tugs are also used at some specialised bulk ports such as Abbot Point where traffic levels are low but the large size of ships using the port requires powerful tugs.

CREW COSTS

Many aspects of wages and working conditions for tug crew members are specified in the *Tugboat Industry Award 1982*. This Federal award was established in 1974 and superseded various State awards. It was subject to renegotiation every two years until 1982 but has not been renegotiated since that time. Separate schedules within the Tugboat Industry Award specify wages and working conditions applicable to individual ports or groups of ports.

Crew wages

The Tugboat Industry Award specifies an aggregate wage system. This provides an all-inclusive wage which incorporates a base rate for work performed during ordinary working hours and an additional amount for work outside ordinary hours.

The base rate for officers can vary depending on the category of tug worked.³ As of February 1988, the base rate under the award ranged from \$20 025 per annum for a deckhand to \$33 556 per annum for a tug master.

The additional amount for work outside ordinary hours is based on the pattern of hours worked by crews in individual ports in previous years. It is calculated as a percentage of the base rate and varies between ports from 27.5 per cent in Geraldton to 117 per cent in Melbourne.

This variation results in significant differences between ports in aggregate wages for individual crew members. For example, a tug master in Melbourne receives an annual aggregate wage of \$72 817 (\$33 556 plus 117 per cent) whereas a tug master in Whyalla receives \$46 308 (\$33 556 plus 38 per cent).

Table 4.2 shows the annual aggregate wages received by crew members for a sample of Australian ports. Annual aggregate wages range from \$27 635 for a deckhand in Whyalla to \$72 817 for a tug master in Melbourne.

Crew levels

One aspect of working conditions which is not specified in the Tugboat Industry Award is crew levels. In practice, crew levels vary between ports. These variations are reportedly the result of historic custom and practice at individual ports rather than obvious differences in operational requirements.

Table 4.3 indicates the size and composition of tug crews for a sample of Australian ports. Crew levels range from four to eight at the ports covered in the table.⁴ There are major differences in crew levels at Sydney and Melbourne which are the largest non-bulk cargo ports in Australia.

-
3. Under the Tugboat Industry Award, tugs are categorised using tonnage/power units which are the sum of the gross registered tonnage and main engine(s) brake horsepower figures for each tug. Category 1 tugs have less than 1851 tonnage/power units and Category 2 tugs have 1851 units or more. For the purposes of this Paper, wage estimates are based on those rates applicable to Category 2 tugs.
 4. At several Australian ports where very small tugs provide harbour towage services, crews of two and three are used (see Appendix I).

TABLE 4.2 ANNUAL AGGREGATE WAGES^a FOR TUG CREWS AT SELECTED AUSTRALIAN PORTS, JUNE 1988
(\$)

| State and port of operation | Officers | | | Ratings | | |
|-----------------------------|----------|----------|--------|------------------|---------|----------------|
| | Master | Engineer | Mate | Leading Deckhand | Greaser | Deckhand, Cook |
| New South Wales | | | | | | |
| Sydney | 57 045 | 57 045 | .. | .. | 34 352 | 34 042 |
| Newcastle | 55 368 | 55 368 | .. | .. | 33 342 | 33 041 |
| Port Kembla | 56 374 | 56 374 | .. | .. | 33 948 | 33 642 |
| Victoria | | | | | | |
| Melbourne | 72 817 | 72 817 | 55 990 | .. | 43 849 | 43 454 |
| Geelong | 69 125 | 69 125 | 53 152 | .. | 41 626 | 41 252 |
| Portland | 48 320 | 48 320 | .. | .. | 29 098 | 28 836 |
| Queensland | | | | | | |
| Brisbane | 56 804 | 56 804 | .. | 37 920 | 37 720 | 37 464 |
| Gladstone | 62 073 | 62 073 | .. | 37 603 | 37 402 | 37 037 |
| Hay Point | 64 504 | 64 504 | 48 767 | 37 013 | 36 777 | 36 445 |
| South Australia | | | | | | |
| Adelaide | 54 360 | 54 360 | 41 799 | .. | 32 735 | 32 440 |
| Whyalla | 46 308 | 46 308 | 35 607 | .. | 27 887 | 27 635 |
| Port Pirie | 48 320 | 48 320 | 37 155 | .. | 29 098 | 28 836 |
| Western Australia | | | | | | |
| Fremantle | 57 717 | 57 717 | .. | 34 980 | 34 756 | 34 443 |
| Kwinana | 68 232 | 68 232 | .. | 41 353 | 41 088 | 40 718 |
| Albany | 56 374 | 56 374 | .. | .. | .. | 33 642 |
| Tasmania | | | | | | |
| Hobart | 46 123 | 46 123 | .. | .. | .. | 28 103 |

a. For Category 2 tugs as specified in the Tugboat Industry Award.
.. Not applicable.

Sources Based on the 5 February 1988 schedule of variations to the Tugboat Industry Award 1982. Includes the Second Tier Wage adjustment.

TABLE 4.3 CREW LEVELS FOR TUGS AT SELECTED AUSTRALIAN PORTS,
JUNE 1988

(number)

| State and port of operation | Officers | | | Ratings | | | Total crew |
|-----------------------------------|----------|----------|------|---------------------|---------|-------------------|---------------|
| | Master | Engineer | Mate | Leading Deckhand | Greaser | Deckhand, Cook | |
| New South Wales | | | | | | | |
| Sydney | 1 | 1 | .. | .. | 1 | 2 | 5 |
| Newcastle | 1 | 1 | .. | .. | 1 | 2 | 5 |
| Port Kembla | 1 | 1 | .. | .. | 1 | 2 | 5 |
| Victoria | | | | | | | |
| Melbourne | 1 | 1 | 1 | .. | 1 | 4 | 8 |
| Geelong | 1 | 1 | 1 | .. | 1 | 3 | 7 |
| Portland | 1 | 1 | .. | .. | 1 | 2 | 5 |
| Queensland | | | | | | | |
| Brisbane | 1 | 1 | .. | 1 | 1 | 2 | 6 |
| Gladstone | 1 | 1 | .. | 1 | 1 | 2 | 6 |
| Hay Point | 1 | 1 | 1 | 1 | 1 | 3 | 8 |
| South Australia | | | | | | | |
| Adelaide | 1 | 1 | 1 | .. | 1 | 1 | 5 |
| Whyalla | 1 | 1 | 1 | .. | 1 | 1 | 5 |
| Port Pirie ^a | 1 | 1 | 1 | .. | 1 | 1 | 5 |
| Western Australia | | | | | | | |
| Fremantle ^b | 1 | 1 | .. | 1 | 1 | 2 | 6 |
| Kwinana | 1 | 1 | .. | 1 | 1 | 2 | 6 |
| Albany | 1 | 1 | .. | .. | .. | 2 | 4 |
| Tasmania | | | | | | | |
| Hobart | 1 | 1 | .. | .. | .. | 2 | 4 |

a. Crew level applies to the large tug.

b. Crew arrangements applicable to three of the four tugs in the port.

.. Not applicable.

Sources Industry sources.

The differences in crew levels mainly reflect employment practices with respect to mates and variations in the number of ratings. Melbourne and Westernport are the only Australian ports where a cook is required to be engaged on harbour tugs. There is significant variation in crewing levels within States as shown in Table 4.3 and Appendix I.

Leave entitlements

Most Australian ports offer a 24-hour towage service all year round. In providing this service, individual tug crews are generally required to be available for duty for some 18 to 20 hours per day. A roster system is used to allocate work amongst crew members. Hours actually worked on the tugs are dependent on numbers of ship movements.

The most common roster systems found in Australian ports are one week on duty/one week off, two weeks on duty/two weeks off and two weeks on duty/one week off. According to the Tugboat Industry Award, crew members generally accumulate paid leave at the rate of 0.857 of a day for every day rostered on duty which equates to 168 days (24 weeks) per annum. These leave provisions are based on similar principles to those found in the maritime industry. The basis for the 168 days is that:

- . 104 days represent weekends
- . 20 days represent four weeks' annual leave
- . 10 days represent public holidays
- . 28 days represent leave in lieu of working a 35-hour week
- . 6 days represent additional leave.

In maintaining a year round operation and adhering to the leave provisions of the Tugboat Industry Award, towage operators at the busier ports generally employ around 2.0 crews per tug. Towage operators in some of the less busy ports, such as Port Pirie, are able to maintain operations with only a single crew being employed for each tug. In addition, Kwinana has a ratio of 3.0 as a result of local factors which are discussed in a later section.

The combined effect of variations in crew levels and aggregate wages at different ports results in significant differences in total crew wages. For example, assuming a crew to tug ratio of 2.0 and using data from Tables 4.2 and 4.3, the current cost of wages (excluding the on-costs discussed later) is estimated to be:

- . \$433 000 per annum for a tug in Sydney; and
- . \$839 000 per annum for a tug in Melbourne.

Additional payments

Crew members may receive significant additional payments for performing firewatch duties or work outside the harbour. Other payments are received in the form of allowances for items such as travelling, meals and clothing.

Firewatch

Firewatch is the practice of maintaining a full crew aboard a tug in readiness to proceed to any fire emergency in the port. The only ports in Australia that have a firewatch service are Kwinana, where it is provided continuously, and Westernport, where it is only provided when a tanker is in port.

At Westernport, crew members receive an extra payment for performing firewatch duties. It is calculated as 55 per cent of their base rate. Table 4.4 indicates that payments for firewatch represent around 20 per cent of a crew member's gross annual earnings at Westernport.

At Kwinana there is a continuous shift system rather than the roster system used in other ports. This results in the employment of six crews to operate the two tugs, giving the crew to tug ratio of 3.0 noted earlier.

Outside work

Towage operations performed outside the normal harbour limits are commonly referred to as outside work. Crewing levels for this work are usually at least double the complement for normal harbour towage.

Crew members are paid under a separate schedule of the Tugboat Industry Award for outside work. This schedule specifies a daily rate which varies according to the nature of the towage operation. The lowest rate is for a free running voyage between two ports where no towage work is performed. The daily rate for this work as at 5 February 1988 ranged from \$286 for a deckhand to \$454 for a tug master. The highest rate for outside work involves emergency towage where the daily rate ranged from \$504 for a deckhand to \$684 for a tug master.

Wage on-costs

As previously indicated in Table 4.1, wage on-costs such as payroll tax, superannuation, long service leave and workers' compensation can represent up to 14 per cent of costs (excluding the operator's gross margin). This percentage may vary in line with the variations in crew wages and differences in the structures of individual towage operations.

TABLE 4.4 AVERAGE EARNINGS OF TUG CREWS AT WESTERNPORT AS PER GROUP CERTIFICATES, 1985-86

| <i>Classification</i> | <i>Gross earnings (\$)</i> | <i>Earnings for firewatch (\$)</i> | <i>Firewatch earnings as a percentage of gross earnings (per cent)</i> |
|-----------------------|----------------------------|------------------------------------|--|
| Master | 84 092 | 16 432 | 19.5 |
| Engineer | 85 237 | 16 598 | 19.5 |
| Mate | 58 574 | 12 191 | 20.8 |
| Greaser | 51 715 | 9 911 | 19.2 |
| Cook | 52 285 | 9 792 | 18.7 |
| Deckhand | 48 178 | 9 637 | 20.0 |

Source Industry source.

OTHER OPERATING COSTS

The other components of towage operators' costs account for between 11 per cent and 34 per cent of costs (excluding the operator's gross margin).

Administration costs include the general overheads of the towage operators and costs for tug control offices.

There have been significant changes in tug maintenance practices in recent years with major operators moving to a five-year cycle for slipping. The lack of adequate slipping facilities at certain outports necessitates the movement of some tugs between ports for repair and maintenance work. Table 4.1 indicates that maintenance and repairs is a relatively high proportion of costs at the large bulk port. This reportedly reflects the additional costs associated with the operation of large tugs at an isolated location.

In contrast to many other transport activities, fuel is a relatively small proportion of tug operating costs. This reflects the limited numbers of hours that tugs are involved in working ships.

BTCE Information Paper 27

Towage operators carry Protection and Indemnity Club and hull insurance. The annual insurance premium for a major operator is reportedly around 1.3 per cent of the insured value of the tug but higher rates are incurred by small operators.

The remaining operating costs include victualling and provision of stores.

CHAPTER 5 TOWAGE CHARGES

The schedule of charges for individual towage services is determined after considering total revenue requirements and the forecast number of tug jobs in each port. In this chapter towage charges are considered in terms of their structure, variations between ports and trends over time.

STRUCTURE OF TOWAGE CHARGES

Charges for services provided by towage operators are specified in published schedules. There does not appear to be any discounting of scheduled charges, although at least one shipping line has reportedly attempted to negotiate discounts in recent years.

Towage schedules vary between ports but there is a group of standard components in the majority of cases. Table 5.1 presents a representative towage schedule for an Australian port. The structure can be considered in terms of the basic towage charge and additional charges.

Basic towage charge

Basic towage services involve the provision of assistance for ship movements in navigation channels and berthing and unberthing under specified conditions. The schedules of charges for these services apply to ships using their own power and are predominantly based upon a ship's gross registered tonnage (GRT) as recorded in the current volume of Lloyd's Register of Shipping. In some cases the basis of charging is summer deadweight tonnage (DWT). At several ports the basic towage charge is constant for all ship sizes.

The data in Table 5.1 indicate the charges for one tug to attend ships in the various size ranges. The total charge for assisting a particular ship reflects both the charge per tug and the number of tugs used. The factors affecting the number of tugs required were discussed in Chapter 2. Where multiple tugs are used the total towage charge is generally equal to the number of tugs multiplied by the

TABLE 5.1 TOWAGE SCHEDULE^a FOR THE PORT OF MELBOURNE, JULY 1987

| <i>Ship size and service</i> | <i>Charge per tug service</i> |
|--|---|
| | Basic towage services ^b |
| | \$ |
| Up to 5 000 GRT | 2 130 |
| 5 001 - 7 500 GRT | 2 180 |
| 7 501 - 10 000 GRT | 2 260 |
| 10 001 - 12 500 GRT | 2 290 |
| 12 501 - 15 000 GRT | 2 350 |
| 15 001 - 17 500 GRT | 2 440 |
| 17 501 - 20 000 GRT | 2 470 |
| 20 001 - 30 000 GRT | 2 550 |
| 30 001 - 40 000 GRT | 2 610 |
| 40 001 - 50 000 GRT | 2 680 |
| 50 001 - 60 000 GRT | 2 750 |
| 60 001 - 70 000 GRT | 2 800 |
| 70 001 - 80 000 GRT | 2 860 |
| 80 001 - 90 000 GRT | 2 940 |
| 90 001 - 100 000 GRT | 3 010 |
| 100 001 - 120 000 GRT | 3 110 |
| 120 001 GRT and over | 3 160 |
| | Additional components of basic services |
| | \$ |
| Waiting time per hour or part thereof | 790 |
| Tug tow lines | 60 |
| Work not elsewhere specified | 5 160 ^c |
| | Cancellations and deferrals |
| | per cent |
| Tugs cancelled | 100 |
| Tugs provided but not used | 100 |
| Tugs cancelled but subsequently re-ordered | 50 |

TABLE 5.1 (Cont.) TOWAGE SCHEDULE^a FOR THE PORT OF MELBOURNE, JULY 1987

| <i>Ship size and service</i> | <i>Charge per tug service</i> |
|---|-------------------------------|
| Services attracting a surcharge ^d | per cent |
| Removals between berths ^f | 25 |
| Thruster-equipped ship not normally assisted ^g | 50 |
| Ship not using own main engines | 50 |
| Special services | |
| Salvage work ^h | Contract rates |

- a. All rates are nett and towage is undertaken in accordance with United Kingdom Standard Conditions for Towage and Other Services (Revised 1974).
- b. Berthing, mooring and unmooring, assistance on and off wharves.
- c. Rate of \$1290 per hour or part thereof for a minimum of four hours per tug.
- d. Additional charge on scheduled rates.
- f. Unberthing, berthing and attendance during movement between berths.
- g. For thruster-equipped ships which do not normally engage tugs but unexpectedly require tug assistance as a consequence of weather or mechanical failure.
- h. Carried out both within and outside ports. Minimum charge one-half day.

Source Melbourne Tug Services (1987).

charge per tug. The total charge would therefore be higher than the figures in Table 5.1 in these cases.

In some Australian ports a single schedule of charges for basic towage services applies over a 24-hour period on any day. In other ports charges vary according to whether a ship requires assistance during weekdays, weekends or public holidays. In addition, weekdays are divided into periods that attract ordinary time and overtime rates. Analysis of towage schedules for a group of 43 ports indicates that basic service charges vary according to the time of day and time of week in 23 ports. In the remaining 20 ports a single schedule applies.

Additional charges

Shipping lines may incur a variety of charges in addition to the basic service charges specified in the schedules. The services and

components for which additional charges are made vary between ports. Some of the more common charges are discussed in this section.

Basic service charges generally cover between the first half-hour and two hours of attendance by the tug as calculated from the starting time specified in the original booking. An hourly rate is charged after the initial period. In the event that a ship is not ready for departure or arrival at the appointed time, an hourly rate may be levied. If a ship is not using its own main engines there is a surcharge of 50 per cent on the basic service charge.

Where a tug in attendance is not used or a tug booking is cancelled, a charge of up to 100 per cent of the scheduled charge may be applied. If a tug booking is deferred or tugs are re-ordered after cancellation, a charge of up to 50 per cent of the scheduled rate may apply for each cancellation.

Where a thruster-equipped ship that does not normally engage a tug requires assistance, as a result of mechanical failure or adverse weather conditions, there is a 50 per cent surcharge on scheduled rates in many cases. A surcharge of between 25 and 50 per cent of the scheduled rate may be charged to ships requiring assistance in moving between berths. There are also additional charges for the supply of tug tow lines and the delivery of water.

When a tug is required for other normal port services charges are levied on an hourly basis with a specified minimum period. Special services such as salvage or refloating of disabled vessels are charged at contract rates.

VARIATIONS IN CHARGES BETWEEN PORTS

There are significant variations between ports in the towage charges for individual ships. Table 5.2 presents data on charges per tug for a range of ship sizes in the capital city ports and selected bulk ports and outports. The figures represent the most common charge per tug for a berthing or unberthing operation.

Table 5.2 indicates that there is significant variation in the charge per tug. For example, the scheduled charge for a 30 000 GRT ship ranges from \$1450 at Groote Eylandt to \$8250 at Abbot Point. With a 90 000 GRT ship, charges at the eight ports covered in the table vary from \$2709 at Sydney to \$16 250 at Abbot Point.

Table 5.2 cannot be used to draw inferences about the relative efficiency of the towage services in the specific ports. Rather, it

TABLE 5.2 TOWAGE CHARGES PER TUG FOR A RANGE OF SHIP SIZES AT
SELECTED AUSTRALIAN PORTS^a, 1988
(\$)

| Ports | Vessel size ('000 GRT) | | | | |
|-------------------------------|-----------------------------|-------|--------------------|--------------------|--------------------|
| | 10 | 20 | 30 | 60 | 90 |
| Capital city ports | | | | | |
| Sydney | 1 267 | 1 551 | 1 795 | 2 371 | 2 709 ^b |
| Melbourne | 2 260 | 2 470 | 2 550 | 2 750 | 2 940 |
| Brisbane | 1 780 | 2 600 | 2 970 | 3 820 | 4 240 |
| Adelaide ^{cd} | 2 202 | 2 939 | 3 113 | 3 338 ^b | f |
| Fremantle ^c | 1 500 | 1 960 | 2 440 | 3 160 | 3 500 |
| Hobart ^d | 1 458 | 2 439 | 3 419 | f | f |
| Darwin ^d | 3 711 | 5 182 | 5 493 ^b | f | f |
| Specialised bulk ports | | | | | |
| Abbot Point ^{gh} | 5 000 | 6 250 | 8 250 | 13 750 | 16 250 |
| Dampier ^h | 2 203 | 2 938 | 3 909 | 5 407 | f |
| Groote Eylandt ⁱ | 1 450 | 1 450 | 1 450 | 1 450 | f |
| Hay Point ^j | 6 000 | 6 000 | 6 000 | 6 000 | 6 000 |
| Port Hedland ^h | 2 158 | 2 900 | 3 955 | 5 313 | f |
| Outports | | | | | |
| Bunbury | 2 069 | 3 350 | 3 782 | 4 891 ^b | f |
| Launceston | 1 430 | 2 383 | 3 085 ^k | f | f |
| Port Kembla | 1 049 | 1 688 | 2 516 | 3 758 | 5 000 ^b |
| Portland | 2 057 | 2 152 | 2 258 | f | f |
| Whyalla ^c | 2 294 | 3 041 | 3 441 | 3 441 | f |
| Westernport | 3 580 | 3 870 | 4 150 | 5 230 | 5 860 ^b |

- a. Charges are for each tug employed and for one-way movement.
b. Charge applies to all ships above a specified size.
c. Rates are for inner harbour berths.
d. Overtime rates are used in ports where time-based schedules apply and most towage operations are undertaken during overtime hours.
f. Charge for ship size is not specified in towage schedule or ships of this size are not normally handled in the port.
g. Includes five hours steaming time to and from Bowen.
h. Towage schedule is based on deadweight tonnes. Categories corresponding to GRT were derived using standard conversion table.
i. Standard charge per hour for the large tug. Tug jobs in this port generally take less than one hour.
j. Standard charge for all ships.
k. Maximum charge for one hour.

Sources Towage schedules. Industry sources.

reflects the impact of the factors which affect operators' margins and costs in ports throughout Australia. As indicated in Chapter 4, differences in levels of towage costs result from variations in tug utilisation, crew levels, aggregate wages, towage fleet characteristics and other factors. Differences in profitability may also contribute to the variations in towage charges in Table 5.2.

TRENDS IN TOWAGE CHARGES

Comprehensive time series data on Australian harbour towage charges are not readily available. The records maintained by most industry participants are generally limited to recent towage schedules. In addition, changes in the format of schedules for individual ports mean that in many cases directly comparable charges are not available over significant periods. However, some information on charges per tug and total payments by lines for the handling of specific ships was obtained from industry sources.

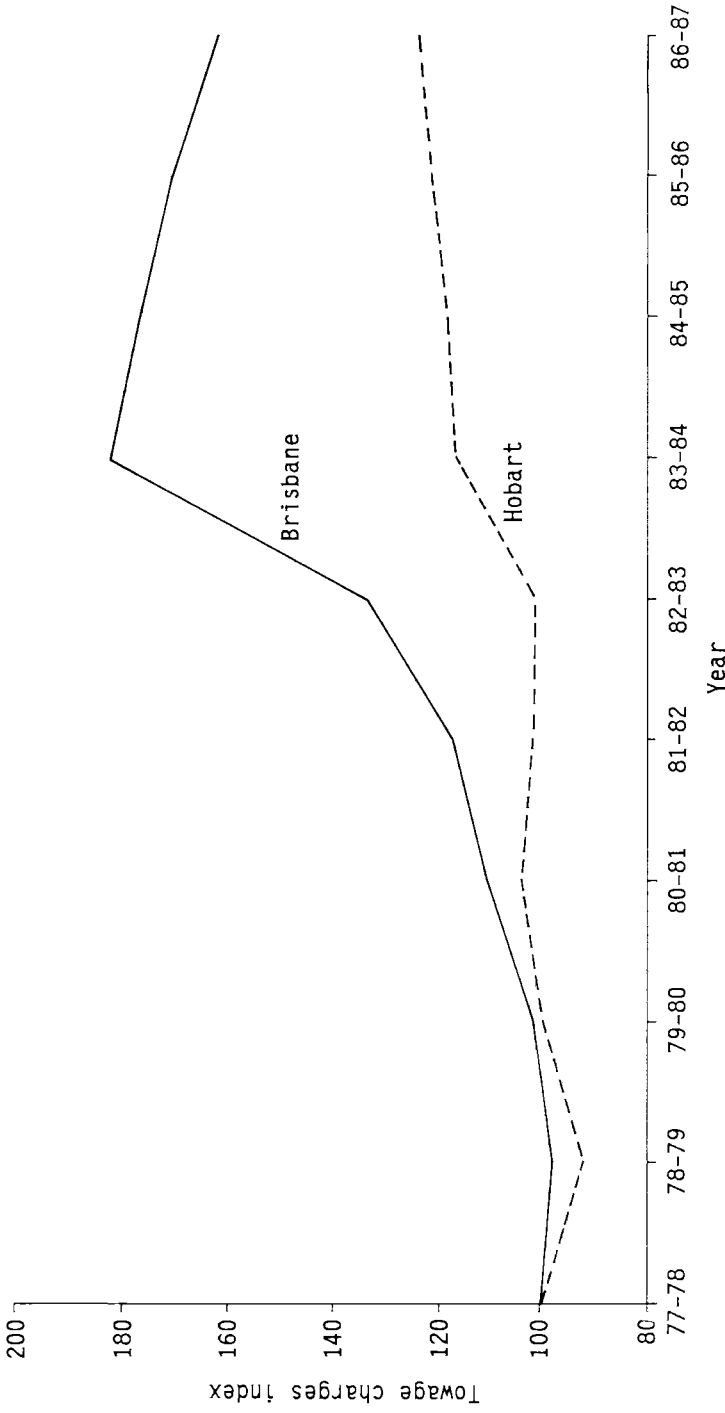
Charge per tug

Figure 5.1 illustrates the trends in the charge per tug in real terms for a ship of 25 000 GRT at two Australian ports between 1977-78 and 1986-87. The time series for Brisbane and Hobart show significant variations in rates of increase in individual years. In addition, there were differences in average rates of increase in the two ports over the period. The scheduled charges in Brisbane increased at an average annual rate of around 5 per cent in real terms up to the end of 1986-87. The towage operator indicated that a subsequent change in the basis of the towage schedule from ship length to GRT resulted in lower charges in nominal terms for many ships after this period. The rate of increase in Hobart averaged 2 per cent per annum in real terms between 1977-78 and 1986-87.

Figure 5.2 illustrates the trends in towage charges in two other ports over the five years to 1986-87. The average annual rate of change in real terms at Geelong was 8 per cent, the major factor being a large increase in charges during 1983-84. At Fremantle the average rate of increase up to the end of 1986-87 was 6 per cent per annum in real terms.

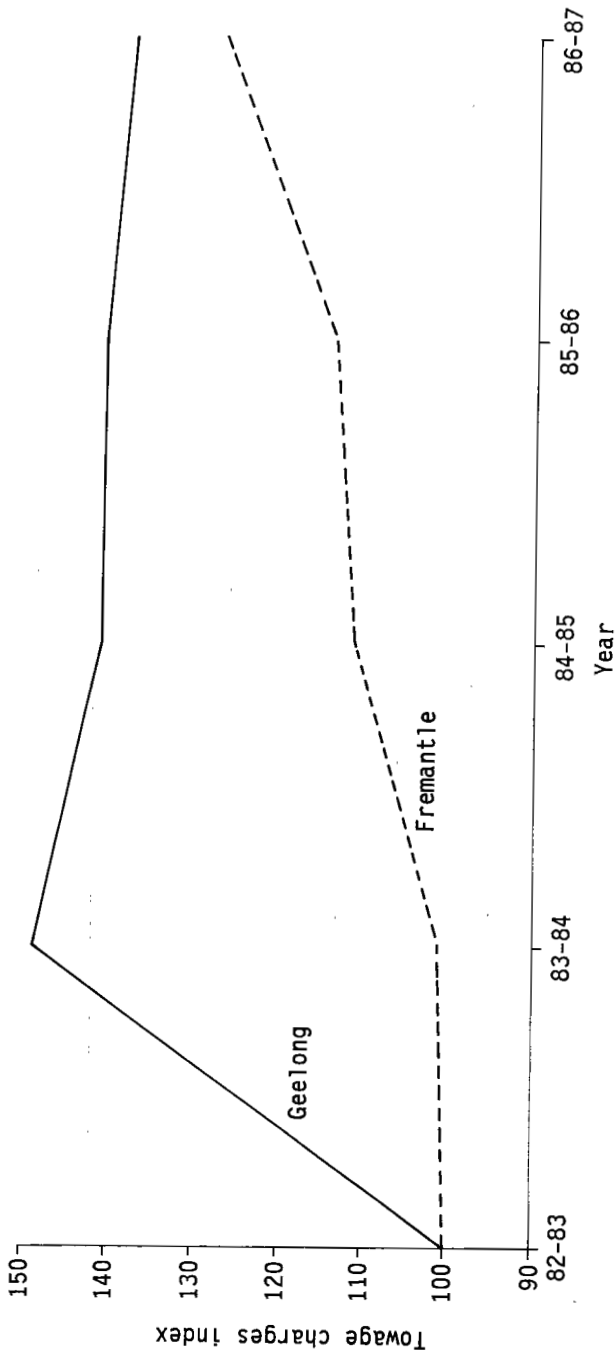
Discontinuous data on charges per tug were obtained for another four ports. The following average rates of change in real terms were estimated from the data:

- an increase of 5 per cent per annum in Esperance between 1977 and 1987;



Sources: Towage schedules. Industry sources.

Figure 5.1 Trends in towage charges in real terms at selected Australian ports, 1977-78 to 1986-87



Sources Towage schedules. Industry sources.

Figure 5.2 Trends in towage charges in real terms at selected Australian ports, 1982-83 to 1986-87

- . an increase of 4 per cent per annum in Bunbury between 1979 and 1988;
- . a decline of 2 per cent per annum in Darwin between 1983 and 1987; and
- . a decline of 1 per cent per annum in Sydney between 1984 and 1987.

One towage operator also commented on the recent trend in towage charges at Gladstone. Charges at this port have reportedly remained constant in nominal terms for more than three years and will be reduced in 1988-89. These developments reflect increasing numbers of ship visits and improvements to the towage fleet at the port.

The available data therefore suggest that charges per tug have increased in real terms over the last ten years in several ports but more recently there have been declines in some ports.

Charge per ship movement

The information on the charge per tug does not reflect the impact of changes in tug requirements on total towage payments for individual ships. Towage operators claim that the trend in towage payments by the lines has been much more favourable than the changes in the charge per tug due to reduced tug requirements resulting from the introduction of more powerful tugs. It appears that reductions in tug requirements would mainly occur in the larger ports. Trends in charges per tug and total charges would be closely linked in the smaller ports which have only one or two tugs.

Table 5.3 presents information on total towage charges for eight ships in Melbourne in 1983-84 and 1987-88. The data in the table have not been adjusted for inflation and indicate significant declines in total charges in four cases. There was a decline in real terms for seven ships. The operator indicated that the major factor in these declines was the reduction in the number of tugs required as a result of the introduction of more powerful and manoeuvrable units.

The NBCG has also collected some data on total towage charges for individual ships. An update of its port cost survey includes the charges for a sample of ships at 15 ports in 1985 and 1987. Changes in reported towage charges for individual ships over the two years range from a decline of 23 per cent in real terms for a specific commodity in one port to an increase of 28 per cent in real terms. The average change for the sample of ship calls and ports in the survey is a decline of 3 per cent in real terms. However, the changes identified in the survey could be affected by the non-continuous

TABLE 5.3 COMPARISON OF TOTAL TOWAGE CHARGES^a FOR ARRIVALS AND DEPARTURES OF SELECTED SHIPS IN THE PORT OF MELBOURNE, 1983-84 AND 1987-88

| Vessel size (GRT) | 1983-84 | | 1987-88 | |
|----------------------|----------------|----------------|----------------|----------------|
| | Charge (\$) | No. of tugs | Charge (\$) | No. of tugs |
| 7 800 | 4 880 | 3 | 4 520 | 2 |
| 18 200 | 8 900 | 5 | 9 880 | 4 |
| 23 700 | 6 240 | 4 | 7 650 | 3 |
| 26 900 | 12 040 | 6 | 12 750 | 5 |
| 27 800 | 17 220 | 8 | 12 750 | 5 |
| 31 000 | 6 320 | 3 | 2 610 | 1 |
| 31 600 | 5 190 | 3 | 7 830 | 3 |
| 44 200 | 11 050 | 7 | 10 720 | 4 |

a. Costs do not include tow lines or attendance charge.

Source Industry source.

nature of adjustments to towage schedules. The NBCG data also indicate significant variations in the changes in towage charges in several ports, presumably as a result of factors such as differences in weather conditions for individual port calls.

The foregoing discussion indicates that the coverage of the available data on towage charges is limited. The information is therefore insufficient to indicate the overall trend in the level of payments for towage services in Australian ports.

Factors which impact on towage charges will be considered in greater detail in a Paper on issues in the towage industry (BTCE, forthcoming).

APPENDIX I HARBOUR TOWAGE FLEET DATA

This appendix contains detailed data on the Australian harbour towage fleet. For each tug it presents the location, date of construction, bollard pull, crew size, propulsion system and operating company. This information is the basis for many of the tables and figures presented in Chapters 2 and 3.

TABLE I.1 AUSTRALIAN HARBOUR TOWAGE FLEET CHARACTERISTICS, 1988

| <i>Tug characteristics</i> | | | | | | | |
|--|----------------|-----------------------|--------------------------------------|------------------|----------------|-------------------------------|--------------------------|
| <i>State and port of operation</i> | <i>Name</i> | <i>Date built</i> | <i>Bollard pull (tonnes)</i> | <i>Crew size</i> | | <i>Propulsion^a</i> | <i>Operating company</i> |
| | | | | <i>Officers</i> | <i>Ratings</i> | | |
| New South Wales | | | | | | | |
| Sydney/Port | Careening Cove | 1970 | 26 | 2 | 3 | DP | J. Fenwick |
| Botany | Sirius Cove | 1975 | 43 | 2 | 3 | TS SN | J. Fenwick |
| | Manly Cove | 1982 | 45 | 2 | 3 | ZP | J. Fenwick |
| | Blackburn Cove | 1983 | 45 | 2 | 3 | ZP | J. Fenwick |
| | Shell Cove | 1986 | 45 | 2 | 3 | ZP | J. Fenwick |
| | Warringa | 1976 | 41 | 2 | 3 | TS | Waratah Towage |
| | Wyambi | 1977 | 41 | 2 | 3 | TS SN | Waratah Towage |
| | Wonga | 1983 | 50 | 2 | 3 | ZP | Waratah Towage |
| | Woonah | 1984 | 50 | 2 | 3 | ZP | Waratah Towage |
| | Walana | 1986 | 50 | 2 | 3 | ZP | Waratah Towage |
| Eden | Greshanne | 1964 | 23 | 2 | 3 | SS | Chartercraft Marine |
| | Weela | 1968 | 25 | 2 | 3 | SS | Services |
| Newcastle | Botany Cove | 1976 | 41 | 2 | 3 | TS SN | J. Fenwick |
| | Iron Cove | 1982 | 45 | 2 | 3 | ZP | J. Fenwick |
| | Wombi | 1978 | 41 | 2 | 3 | TS SN | Waratah Towage |
| | Warrawee | 1985 | 50 | 2 | 3 | ZP | Waratah Towage |
| Port Kembla | Keira | 1973 | 40 | 2 | 3 | TS | Wallace Tugs |
| | Kembla II | 1975 | 40 | 2 | 3 | TS SN | Wallace Tugs |

TABLE I.1 (Cont.) AUSTRALIAN HARBOUR TOWAGE FLEET CHARACTERISTICS, 1988

| <i>Tug characteristics</i> | | | | | | | |
|--|---------------|-----------------------|--------------------------------------|------------------|----------------|-------------------------------|----------------------------|
| <i>State and port of operation</i> | <i>Name</i> | <i>Date built</i> | <i>Bollard pull (tonnes)</i> | <i>Crew size</i> | | <i>Propulsion^a</i> | <i>Operating company</i> |
| | | | | <i>Officers</i> | <i>Ratings</i> | | |
| | Kioloa | 1976 | 40 | 2 | 3 | TS | Wallace Tugs |
| | Korimul | 1982 | 45 | 2 | 3 | ZP | Wallace Tugs |
| Victoria | | | | | | | |
| Melbourne | Buccaneer | 1975 | 41 | 3 | 5 | TS SN | Melbourne Tug Services |
| | Thomas Webb | 1975 | 36 | 3 | 5 | TS SN | Melbourne Tug Services |
| | Corsair | 1976 | 42 | 3 | 5 | TS SN | Melbourne Tug Services |
| | Charles Waugh | 1977 | 44 | 3 | 5 | TS SN | Melbourne Tug Services |
| | Gabo | 1982 | 48 | 3 | 5 | ZP | Melbourne Tug Services |
| | Keera | 1986 | 62 | 3 | 5 | DP | Melbourne Tug Services |
| Geelong | Edina | 1974 | 41 | 3 | 4 | TS SN | Geelong Port Services |
| | Macedon | 1976 | 41 | 3 | 4 | TS SN | Geelong Port Services |
| Portland | Tarragal | 1969 | 28 | 2 | 3 ^b | TS | Port of Portland Authority |
| | Allan Guthrie | 1970 | 30 | 2 | 3 ^b | SS | Port of Portland Authority |
| Westernport | Hastings | 1983 | 52 | 3 | 5 | ZP | Westernport Tug Services |
| | Cooma | 1983 | 52 | 3 | 5 | ZP | Westernport Tug Services |
| Queensland | | | | | | | |
| Brisbane | Thorntwaite | 1971 | 34 | 2 | 4 | TS | Queensland Tug & Salvage |
| | Crowther | 1972 | 34 | 2 | 4 | TS | Queensland Tug & Salvage |

TABLE I.1 (Cont.) AUSTRALIAN HARBOUR TOWAGE FLEET CHARACTERISTICS, 1988

| <i>Tug characteristics</i> | | | | | | | |
|--|-----------------|-----------------------|--------------------------------------|------------------|----------------|-------------------------------|--------------------------|
| <i>State and port of operation</i> | <i>Name</i> | <i>Date built</i> | <i>Bollard pull (tonnes)</i> | <i>Crew size</i> | | <i>Propulsion^a</i> | <i>Operating company</i> |
| | | | | <i>Officers</i> | <i>Ratings</i> | | |
| | Brigand | 1975 | 41 | 2 | 4 | TS SN | Queensland Tug & Salvage |
| | Barbary | 1979 | 41 | 2 | 4 | TS SN | Queensland Tug & Salvage |
| | Austral Salvor | 1986 | 62 | 2 | 4 | DP | Queensland Tug & Salvage |
| | W J Trotter | 1986 | 62 | 2 | 4 | DP | Queensland Tug & Salvage |
| Abbot Point | Denison | 1983 | 55 | 2 | 5 | ZP | Bowen Towage Services |
| | Gloucester | 1983 | 55 | 2 | 5 | ZP | Bowen Towage Services |
| Bundaberg | Robert C Gibson | 1969 | 22 | 2 | 3 | TS | Howard Smith |
| Cairns | Milton | 1965 | 10 | 2 | 2 | TS | North Queensland Marine |
| | Babinda | 1979 | 10 | 2 | 2 | TS SN | Towage |
| Dalrymple Bay | Koumala | 1983 | 55 | 3 | 5 | ZP | McIlwraith McEacharn |
| | Kungurri | 1983 | 55 | 3 | 5 | ZP | McIlwraith McEacharn |
| Gladstone | Wistari | 1974 | 46 | 2 | 4 | ZP | Gladstone Tug Services |
| | Biloela | 1975 | 43 | 2 | 4 | TS SN | Gladstone Tug Services |
| | Tom Tough | 1982 | 46 | 2 | 4 | ZP | Gladstone Tug Services |
| | Kuttabal | 1984 | 50 | 2 | 4 | ZP | Gladstone Tug Services |
| Hay Point | Broadsound | 1977 | 75 | 3 | 5 | TS | J. Fenwick |
| | Belyando | 1977 | 75 | 3 | 5 | TS | J. Fenwick |

TABLE I.1 (Cont.) AUSTRALIAN HARBOUR TOWAGE FLEET CHARACTERISTICS, 1988

| <i>Tug characteristics</i> | | | | | | | |
|--|--|-----------------------|--------------------------------------|------------------|----------------|-------------------------------|-----------------------------------|
| <i>State and port of operation</i> | <i>Name</i> | <i>Date built</i> | <i>Bollard pull (tonnes)</i> | <i>Crew size</i> | | <i>Propulsion^a</i> | <i>Operating company</i> |
| | | | | <i>Officers</i> | <i>Ratings</i> | | |
| Lucinda | Tugs dispatched from Cairns, Mourilyan or Townsville | | | | | | |
| Mackay | Kuranda | 1968 | 10 | 2 | 1 | TS | North Queensland Marine |
| | Nelia | 1974 | 27 | 2 | 3 | TS SN | Towage |
| Mourilyan | Otto Assman | 1971 | 30 | 2 | 3 | TS | North Queensland Marine Towage |
| Townsville | Lucinda | 1974 | 27 | 2 | 3 | TS SN | North Queensland Marine |
| | Burdekin | 1979 | 33 | 2 | 3 | TS SN | Towage |
| Weipa | Comalco | | | | | | |
| | Investigator | 1970 | 23 | 2 | 2 | TS | Weipa Tug Services |
| | Comalco Beagle | 1971 | 23 | 2 | 2 | TS | Weipa Tug Services |
| | Bellarine | 1975 | 41 | 2 | 4 | TS SN | Weipa Tug Services |
| South Australia | | | | | | | |
| Adelaide | Tanunda | 1971 | 33 | 3 | 2 | TS | Ritch & Smith |
| | Tapir | 1976 | 43 | 3 | 2 | TS SN | Ritch & Smith |
| | Tusker | 1983 | 50 | 3 | 2 | ZP | Ritch & Smith |
| | Tarpan | 1984 | 50 | 3 | 2 | ZP | Ritch & Smith |
| Ardrossan | Tugs dispatched from Adelaide | | | | | | |

TABLE I.1 (Cont.) AUSTRALIAN HARBOUR TOWAGE FLEET CHARACTERISTICS, 1988

| | | <i>Tug characteristics</i> | | | | | |
|--|-------------------------------|----------------------------|--------------------------------------|------------------|----------------|-------------------------------|--------------------------|
| <i>State and port of operation</i> | <i>Name</i> | <i>Date built</i> | <i>Bollard pull (tonnes)</i> | <i>Crew size</i> | | <i>Propulsion^a</i> | <i>Operating company</i> |
| | | | | <i>Officers</i> | <i>Ratings</i> | | |
| Port Bonython | Tugs dispatched from Whyalla | | | | | | |
| Port Giles | Tugs dispatched from Adelaide | | | | | | |
| Port Lincoln | Yarwun | 1969 | 22 | 3 | 2 | TS | Port Lincoln Tugs |
| Port Pirie | Tempest | 1965 | 22 | 3 | 2 | SS | Ritch & Smith |
| | Ungarra | 1968 | 12 | 2 | 2 | TS | Port Lincoln Tugs |
| Port Stanvac | Tugs dispatched from Adelaide | | | | | | |
| Thevenard | Wandana | 1980 | 10 | 2 | 2 | TS | Port Lincoln Tugs |
| Wallaroo | Kalanbi | 1981 | 10 | 2 | 2 | TS | Port Lincoln Tugs |
| Whyalla | Turmoil | 1971 | 30 | 3 | 2 | SS | Ritch & Smith |
| | Taminga | 1983 | 50 | 3 | 2 | ZP | Ritch & Smith |
| Western Australia | | | | | | | |
| Fremantle | Wandilla | 1970 | 28 | 2 | 4 | DP | Fremantle Tug Operators |
| | Hamilton | 1972 | 27 | 2 | 4 | TS | Fremantle Tug Operators |
| | Wyola | 1975 | 42 | 2 | 4 | TS SN | Fremantle Tug Operators |
| | Wambiri | 1986 | 62 | 3 | 3 | ZP | Fremantle Tug Operators |

TABLE I.1 (Cont.) AUSTRALIAN HARBOUR TOWAGE FLEET CHARACTERISTICS, 1988

| <i>Tug characteristics</i> | | | | | | | |
|--|---------------------------|-----------------------|--------------------------------------|------------------|----------------|-------------------------------|-----------------------------|
| <i>State and port of operation</i> | <i>Name</i> | <i>Date built</i> | <i>Bollard pull (tonnes)</i> | <i>Crew size</i> | | <i>Propulsion^a</i> | <i>Operating company</i> |
| | | | | <i>Officers</i> | <i>Ratings</i> | | |
| Albany | Warren | 1971 | 25 | 2 | 2 | TS | Fremantle Tug Operators |
| Bunbury | Capel | 1976 | 43 | 2 | 3 | TS | Elder Prince Marine |
| | Elgin | 1985 | 39 | 2 | 3 | AM | Services |
| Cape Cuvier ^c | Boolathana | 1972 | 24 | 2 | 2 | TS | P&O Towage Services |
| | Leaders Creek | 1981 | 14 | 1 | 2 | TS | P&O Towage Services |
| Dampier | Pilbara Neptune | 1971 | 28 | 2 | 4 | DP | Pilbara Harbour Services |
| | Pilbara Jupiter | 1976 | 46 | 2 | 4 | TS SN | Pilbara Harbour Services |
| | Pilbara Saturn | 1984 | 55 | 2 | 4 | DP | Pilbara Harbour Services |
| | Pilbara Star | 1984 | 55 | 2 | 4 | DP | Pilbara Harbour Services |
| | King Bay | 1985 | 50 | 2 | 4 | ZP | Woodside Offshore Petroleum |
| | Withnell Bay | 1985 | 50 | 2 | 4 | ZP | Woodside Offshore Petroleum |
| Esperance | Cape Le Grand Grand II | 1984 | 28 | 2 | 1 | TS | McKenzie's Tug Service |
| Geraldton | Pelsaert | 1987 | 30 | 2 | 2 | ZP | P&O Towage Services |
| | Beacon | 1987 | 30 | 2 | 2 | ZP | P&O Towage Services |
| Kwinana | Challenger | 1980 | 45 | 2 | 4 | TS | Medina Maritime Services |
| | Champion | 1985 | 51 | 2 | 4 | ZP | Medina Maritime Services |

TABLE I.1 (Cont.) AUSTRALIAN HARBOUR TOWAGE FLEET CHARACTERISTICS, 1988

| <i>Tug characteristics</i> | | | | | | | |
|--|----------------------|-----------------------|--------------------------------------|------------------|----------------|-------------------------------|------------------------------------|
| <i>State and port of operation</i> | <i>Name</i> | <i>Date built</i> | <i>Bollard pull (tonnes)</i> | <i>Crew size</i> | | <i>Propulsion^a</i> | <i>Operating company</i> |
| | | | | <i>Officers</i> | <i>Ratings</i> | | |
| Port Hedland | Talga | 1971 | 36 | 2 | 4 | SS | Hedland Marine Services |
| | De Grey | 1975 | 53 | 2 | 4 | TS | Hedland Marine Services |
| | Warang | 1982 | 50 | 2 | 4 | ZP | Hedland Marine Services |
| | Warilla | 1982 | 50 | 2 | 4 | ZP | Hedland Marine Services |
| | Coongan | 1986 | 50 | 2 | 4 | ZP | Hedland Marine Services |
| | Corunna | 1986 | 50 | 2 | 4 | ZP | Hedland Marine Services |
| Port Walcott | Roebourne | 1972 | 52 | 2 | 3 | TS | Cape Lambert Services |
| | Wickham | 1972 | 52 | 2 | 4 | TS | Cape Lambert Services |
| Yampi Sound | Latrobe ^d | 1972 | 33 | 2 | 4 | TS | BHP - Utah Minerals |
| | Fullerton Cove | 1975 | 40 | 2 | 4 | TS SN | BHP - Utah Minerals |
| Tasmania Hobart | Cape Bruny | 1949 | 25 | 2 | 2 | SS | North Western Shipping & Towage |
| | Cape Raoul | 1958 | 25 | 2 | 2 | TS | North Western Shipping & Towage |
| | Wybia | 1965 | 19 | 2 | 2 | SS | North Western Shipping & Towage |
| | Myalla | 1965 | 15 | 2 | 2 | TS | North Western Shipping & Towage |

TABLE I.1 (Cont.) AUSTRALIAN HARBOUR TOWAGE FLEET CHARACTERISTICS, 1988

| State and port of operation | Tug characteristics | | | | | | |
|--------------------------------|-----------------------------|---------------|-----------------------------|-----------|---------|-------------------------|------------------------------------|
| | Name | Date built | Bollard pull (tonnes) | Crew size | | Propulsion ^a | Operating company |
| | | | | Officers | Ratings | | |
| | Storm Cove | 1970 | 26 | 2 | 2 | DP | North Western Shipping & Towage |
| | Sydney Cove | 1971 | 30 | 2 | 2 | TS | North Western Shipping & Towage |
| Burnie | Spring Cove | 1968 | 26 | 2 | 3 | SS | North Western Shipping & Towage |
| | Campbell Cove | 1976 | 41 | 2 | 3 | TS SN | North Western Shipping & Towage |
| Devonport | Gawler | 1967 | 21 | 2 | 2 | SS | North Western Shipping & Towage |
| Launceston/ Bell Bay | Farm Cove | 1971 | 30 | 2 | 3 | TS | North Western Shipping & Towage |
| | Yorktown | 1972 | 32 | 2 | 3 | TS | North Western Shipping & Towage |
| Port Latta/ Stanley | Tugs dispatched from Burnie | | | | | | |
| Northern Territory Darwin | Goyder | 1970 | 13 | 2 | 3 | TS | Coastal Tug & Barge |

TABLE I.1 (Cont.) AUSTRALIAN HARBOUR TOWAGE FLEET CHARACTERISTICS, 1988

| State and port of operation | Name | Date built | Tug characteristics | | | | Operating company |
|--------------------------------|----------------------------|---------------|-----------------------------|-----------|---------|-------------------------|-----------------------|
| | | | Bollard pull (tonnes) | Crew size | | Propulsion ^a | |
| | | | | Officers | Ratings | | |
| Gove | Gulf | | | | | | |
| | Investigator | 1969 | 10 | 2 | 3 | TS | Nabalco Shipping |
| | Gulf Explorer ^d | 1972 | 30 | 2 | 3 | TS | Nabalco Shipping |
| Groote Eylandt | Tasman | 1968 | 6 | 1 | 1 | SS SN | Groote Eylandt Mining |
| | Makada | 1975 | 15 | 1 | 2 | SS SN | Groote Eylandt Mining |

- a. AM = Aqua Master (omni-directional)
 DP = Duck-peller (omni-directional)
 SN = Steerable nozzle
 SS = Single screw
 TS = Twin screw
 ZP = Z-peller (omni-directional)

b. When a towing operation is necessary an extra deckhand is employed.

c. Tug pens are at Carnarvon.

d. Tug chartered by mining company from the joint owners, Howard Smith and McIlwraith McEacharn.

Sources Industry sources.

APPENDIX II OWNERSHIP OF TOWAGE OPERATORS

This appendix presents information on the ownership of towage operators in Australian ports. The data do not always reflect ownership arrangements for the tugs, as joint ventures include both tugs owned by the operating companies and tugs owned directly by the parent companies which participate in the joint ventures.

TABLE II.1 OWNERSHIP OF AUSTRALIAN HARBOUR TOWAGE OPERATORS, 1988

| <i>Parent companies</i> | <i>Operating companies</i> |
|--|--|
| Fully owned associates ^a | |
| Howard Smith Ltd | Howard Smith Industries Pty Ltd Geelong Port Services Pty Ltd |
| The Adelaide Steamship Co Ltd | Ritch and Smith |
| Brambles Industries Ltd | J. Fenwick and Co Pty Ltd North Western Shipping and Towage Co Pty Ltd |
| McIlwraith McEacharn Ltd | McIlwraith McEacharn Operations Ltd |
| P&O Australia Ltd | P&O Towage Services |
| Robe River Iron Associates Ltd | Cape Lambert Services Pty Ltd |
| Woodside Petroleum Ltd | Woodside Offshore Petroleum Pty Ltd |
| Hamersley Holdings Ltd | Pilbara Harbour Services Pty Ltd |
| BHP-Utah Minerals International Pty Ltd | BHP-Utah Minerals International Pty Ltd Groote Eylandt Mining Co Pty Ltd |
| Swiss Aluminium Australia Ltd | Nabalco Shipping Pty Ltd |
| Port of Portland Authority | Port of Portland Authority |
| McKenzie's Tug Service | McKenzie's Tug Service |
| Joint ventures ^b | |
| Howard Smith Ltd | Waratah Towage Pty Ltd |
| The Adelaide Steamship Co Ltd | Queensland Tug and Salvage Co Pty Ltd North Queensland Marine Towage Pty Ltd Bowen Towage Services Pty Ltd Gladstone Tug Services Pty Ltd |

TABLE II.1 (Cont.) OWNERSHIP OF AUSTRALIAN HARBOUR TOWAGE OPERATORS, 1988

| <i>Parent companies</i> | <i>Operating companies</i> |
|--------------------------------|--------------------------------------|
| | Chartercraft Marine Services Pty Ltd |
| | Fremantle Tug Operators |
| | Elder Prince Marine Services Pty Ltd |
| | Hedland Marine Services Pty Ltd |
| Howard Smith Ltd | Melbourne Tug Services |
| McIlwraith McEacharn Ltd | Westernport Tug Services |
| | Weipa Tug Services |
| The Adelaide Steamship Co Ltd | Wallace Tugs Pty Ltd |
| Brambles Industries Ltd | |
| The Adelaide Steamship Co Ltd | Port Lincoln Tugs Pty Ltd |
| Stannard Bros Holdings Pty Ltd | Coastal Tug and Barge Pty Ltd |
| P&O Australia Ltd ^C | Medina Maritime Services Pty Ltd |
| Howard Smith Industries Ltd | |
| The Adelaide Steamship Co Ltd | |

- a. Tug operating company wholly owned by, or the same as, the parent company.
- b. In joint ventures, parent companies each have a 50 per cent holding in the operating company unless otherwise indicated.
- c. P&O Australia has a 50 per cent holding in the operating company and the remaining shareholders each have 25 per cent.

Sources Industry sources.

APPENDIX III CONTROLS OVER TOWAGE OPERATOR ENTRY AND CHARGES

This appendix presents information on controls over towage operator entry and formal procedures for review or approval of towage charges in individual ports. The data are summarised in Chapter 3.

TABLE III.1 CONTROLS OVER TOWAGE OPERATOR ENTRY AND TOWAGE CHARGES IN INDIVIDUAL PORTS, 1988

| State and port of operation | Operation in port | | | Towage charges | | |
|-----------------------------|-------------------|----------|---------|----------------|------------------|-------------|
| | Tender | Contract | Licence | No controls | Review/ approval | No controls |
| New South Wales | | | | | | |
| Sydney/Port | | | | | | |
| Botany | | | | X | | X |
| Eden | | | | X | | X |
| Newcastle | | | | X | | X |
| Port Kembla | | | | X | | X |
| Victoria | | | | | | |
| Melbourne | | | | X | | X |
| Geelong | | | | X | | X |
| Portland | | | | a | | a |
| Westernport | X | X | X | | X | |
| Queensland | | | | | | |
| Brisbane | | | | X | | X |
| Abbot Point | X | X | | | X | |
| Bundaberg | | | X | | X | |
| Cairns | | X | X | | X | |
| Dalrymple Bay | X | X | | | X | |
| Gladstone | | | X | | X | |
| Hay Point | X | X | | | X | |
| Lucinda | | | X | | X | |
| Mackay | | X | X | | X | |
| Mourilyan | | | X | | X | |
| Townsville | X | X | X | | X | |
| Weipa | | X | | | X | |
| South Australia | | | | | | |
| Adelaide | | | | X | | X |
| Ardrossan | | | | X | | X |
| Port Bonython | | | | X | | X |
| Port Giles | | | | X | | X |
| Port Lincoln | | | | X | | X |
| Port Pirie | | | | X | | X |
| Port Stanvac | | | | X | | X |
| Thevenard | | | | X | | X |
| Wallaroo | | | | X | | X |
| Whyalla | | | | X | | X |

TABLE III.1 (Cont.) CONTROLS OVER TOWAGE OPERATOR ENTRY AND TOWAGE CHARGES IN INDIVIDUAL PORTS, 1988

| State and port of operation | Operation in port | | | Towage charges | | |
|-----------------------------------|-------------------|----------|---------|----------------|---------------------|----------------|
| | Tender | Contract | Licence | No controls | Review/ approval | No controls |
| Western Australia | | | | | | |
| Fremantle | | | | x | | x |
| Albany | x | x | | | x | |
| Bunbury | x | x | | | x | |
| Cape Cuvier | | | | x | | x |
| Dampier | | | | a | | a |
| Esperance | x | x | x | | x | |
| Geraldton | x | x | | | x | |
| Kwinana | | | | x | | x |
| Port Hedland | | x | x | | x | |
| Port Walcott | | | | a | | a |
| Yampi Sound | | | | a | | a |
| Tasmania | | | | | | |
| Hobart | | | | x | | x |
| Burnie | | | x | | x | |
| Devonport | | | x | | x | |
| Launceston/ Bell Bay | | | x | | x | |
| Port Latta/ Stanley | | x | | | x | |
| Northern Territory | | | | | | |
| Darwin | | | | x | | x |
| Gove | | | | a | | a |
| Groote Eylandt | | | | a | | a |

a. Tugs operated by the port authority or major shipper using the port.

Sources Industry sources.

REFERENCES

- Australian Bureau of Statistics (1988), *Shipping and Cargo Australia, June Quarter 1987* and earlier issues, Canberra.
- Brady, P. J. E. (1984), *Tug Utilisation: A Survey of Tug Utilisation in Major Australian Ports*, Australian Chamber of Shipping, Sydney.
- Bureau of Transport and Communications Economics (forthcoming), *Efficiency of Towage Services in Australian Ports*, Occasional Paper.
- Bureau of Transport Economics (1986), *Shore-based Shipping Costs, Non-bulk Cargo*, Occasional Paper 80, AGPS, Canberra.
- Coopers and Lybrand W. D. Scott (1988), *Waterfront Strategy: Australian Industry Structures*, Paper for the Inter-State Commission.
- Department of Transport (1985), *Sea Transport Statistics, Trade and Cargo Review, June Quarter 1984*, AGPS, Canberra.
- Department of Transport and Construction (1982), *Sea Transport Statistics 1980-81*, AGPS, Canberra.
- Inter-State Commission (1987), *Waterfront Strategy: Initial Report*, AGPS, Canberra.
- Melbourne Tug Services (1987), *Schedule of Charges for the Port of Melbourne, July 1987*, Melbourne.
- National Bulk Commodities Group (1986), *Port Cost Survey*, Melbourne.

ABBREVIATIONS

| | |
|-------|---|
| AAPMA | Association of Australian Port and Marine Authorities |
| ACOS | Australian Chamber of Shipping |
| ANMA | Australian National Maritime Association |
| BTCE | Bureau of Transport and Communications Economics |
| DWT | Deadweight tonnes |
| FCL | Full container load |
| GRT | Gross registered tonnes |
| ISC | Inter-State Commission |
| NBCG | National Bulk Commodities Group |