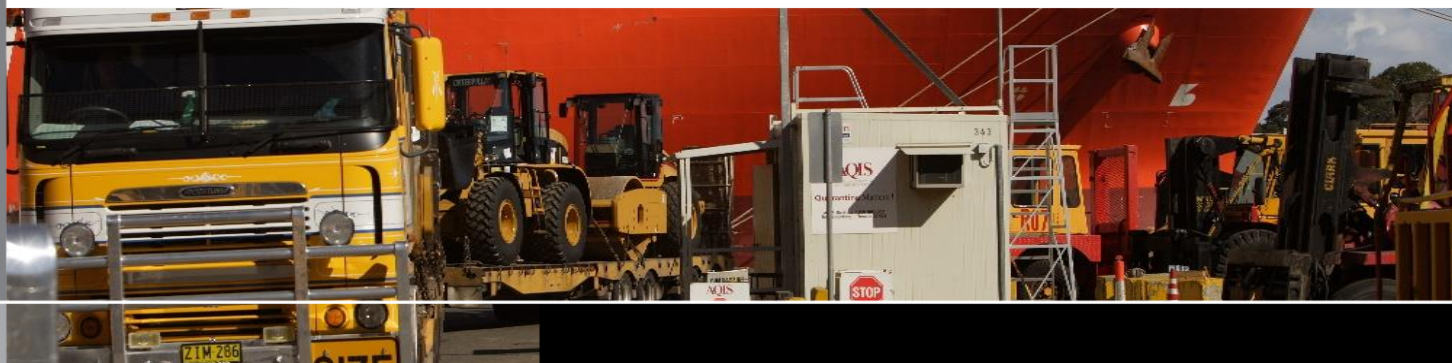**Australian Government**

Department of Infrastructure, Transport, Regional Development and Communications

Bureau of Infrastructure and Transport Research Economics

Regional port catchments for road freight

At a glance

This report uses freight vehicle telematics data to illustrate the freight catchment areas of Australia's five mainland capital city ports. The report includes maps showing a sample of private freight vehicle movements, comprising several hundred thousand journeys, to and from each port, over calendar year 2019. The journeys shown in the maps cover vehicle movements over the 24 hours prior to arriving at the port and 24 hours after stopping at the port, and how that varied over the 12 months.

The results highlight the extensive regional influence of all five capital city ports. The results also reveal significant seasonal variation in the geographic extent of port-related truck movements, with most port catchments expanding during the winter months and contracting during the summer months of 2019.

BITRE's freight telematics data project is utilising telematics data (i.e. regular digital vehicle location records), sourced from participating freight operators, to develop and demonstrate how such data can be used to better understand road freight network use and help inform industry operations and government planning.

Introduction

Australia's capital city ports are the principal ports of entry for over 86 per cent of Australia's nearly $220 billion in annual merchandise imports and account around 22 per cent of Australia's $330 billion of merchandise exports. By mass, approximately 66.0 million tonnes of merchandise freight imports and 44.0 million tonnes of merchandise exports, in 2019–20, passed through Australia's five mainland capital city ports.

Previous studies of Australian port supply chains have highlighted the significant 'geographical catchments' of Australia's capital city ports, particularly servicing agricultural exports from regional hinterlands. These 'catchments' can cover the metropolitan area the port is based in, the larger state and frequently interstate regions. These areas send freight to the port to be exported and receive freight distributed from the port. For example, containerised grains, cotton and horticultural exports are transported from regional areas direct to capital city ports for export. Those studies have used data on specific commodity supply chains to illustrate the port catchment regions—see, for example, BITRE (2018a and 2018b).

In contrast, this report uses freight vehicle telematics data—i.e. sequences of observations of vehicle position and time—to illustrate the catchments of Australia's five major mainland capital city ports: Port Botany, the Port of Melbourne, the Port of Brisbane, the Port of Adelaide and the Port of Fremantle. For each port, maps tracking a sample of private freight vehicles are included, which comprise several hundred thousand journeys across calendar 2019. The vehicle journeys illustrated here, cover the 24 hours prior to arriving at the port, and 24 hours after stopping at the port and how that varied over the 12 months. Darker lines indicate more journeys. Actual travel times for journeys displayed may be longer than 24 hours as a journey is deemed to end only at a stop of at least 1 hour.

The data does not provide any information about the types of goods carried and the trips shown may represent multiple consignments. As it is sourced from only a small sample of operators, it is not necessarily representative of the broader pattern of all port-related freight vehicle journeys. Nonetheless it does show the extensive areas influenced by Australian ports. For most of these ports, the catchment area expanded during the winter of 2019 and contracted during the summer months.

Sydney – Port Botany

Figures 1 and 2 show the geographic extent of a sample of freight vehicles travelling to and from Port Botany within a 24-hour period, respectively. The catchment includes areas as far afield as Melbourne, Brisbane and Adelaide and covers regional centres in New South Wales as far north as Tamworth, Narrabri and Moree, west to Parkes, Wellington, West Wyalong and Wagga Wagga, and south to Eden, Bombala and Jindabyne. Outbound freight vehicle movements include more significant movements to Brisbane, Melbourne and Adelaide and extend as far north as Roma in western Queensland.

Figure 3 breaks down the inbound and outbound freight vehicle movements to and from Port Botany by calendar month – inbound freight vehicle catchments are shown in Panel (a) and outbound freight vehicle catchments in Panel (b). The geographic extent of inbound freight vehicle movements is less extensive in January and February, but expands during autumn and is most extensive during the winter and spring month of the year. For example, vehicle movements from as far west as Mildura (Victoria) in May and June (coincident with the peak of the citrus harvest). So to the geographic extent of outbound freight vehicle movements from Port Botany are far less in January and February in comparison with the rest of the year.

Figure 1 – Port Botany inbound freight vehicle movement catchment areas
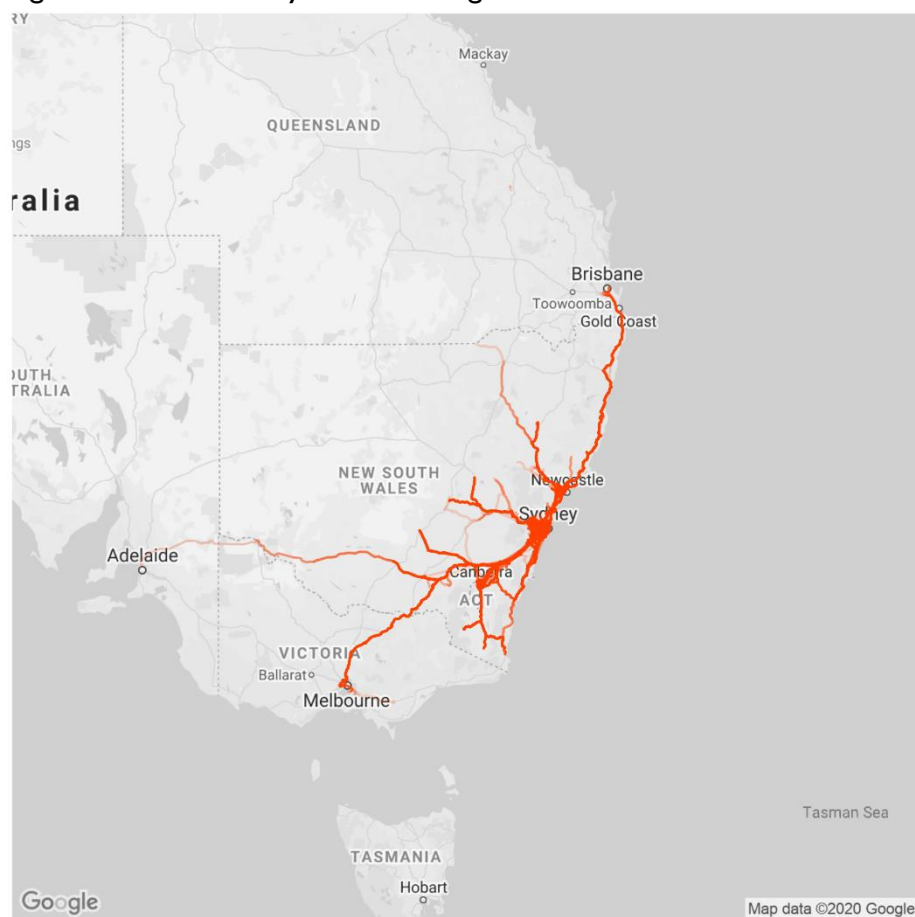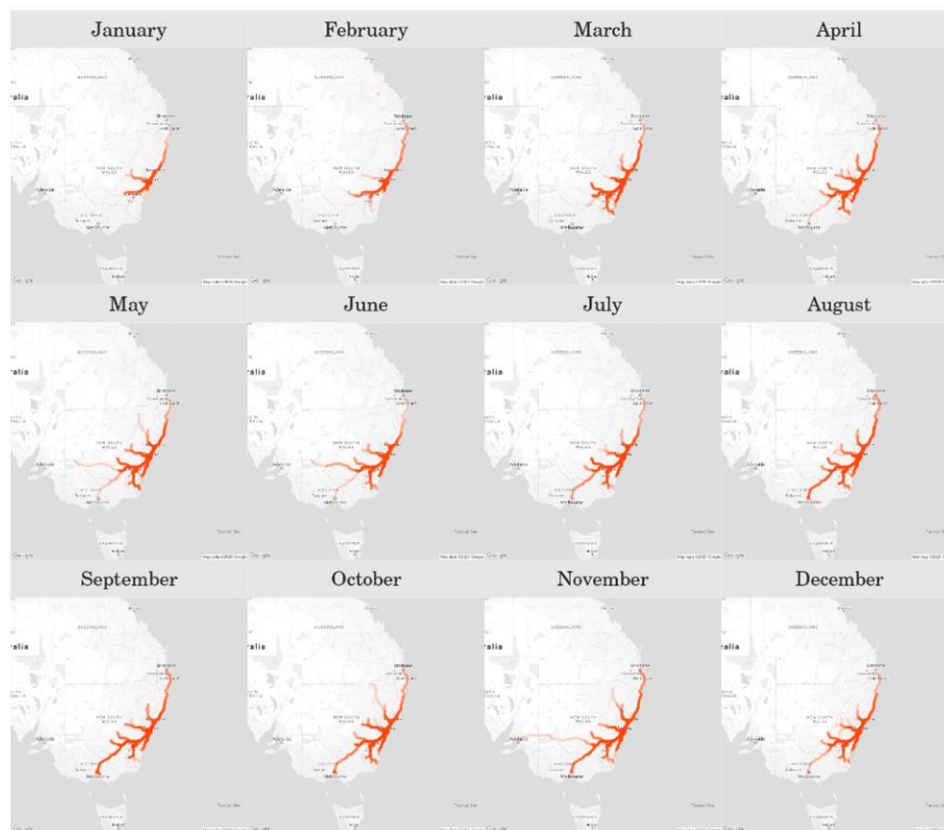

Source: BITRE estimates.

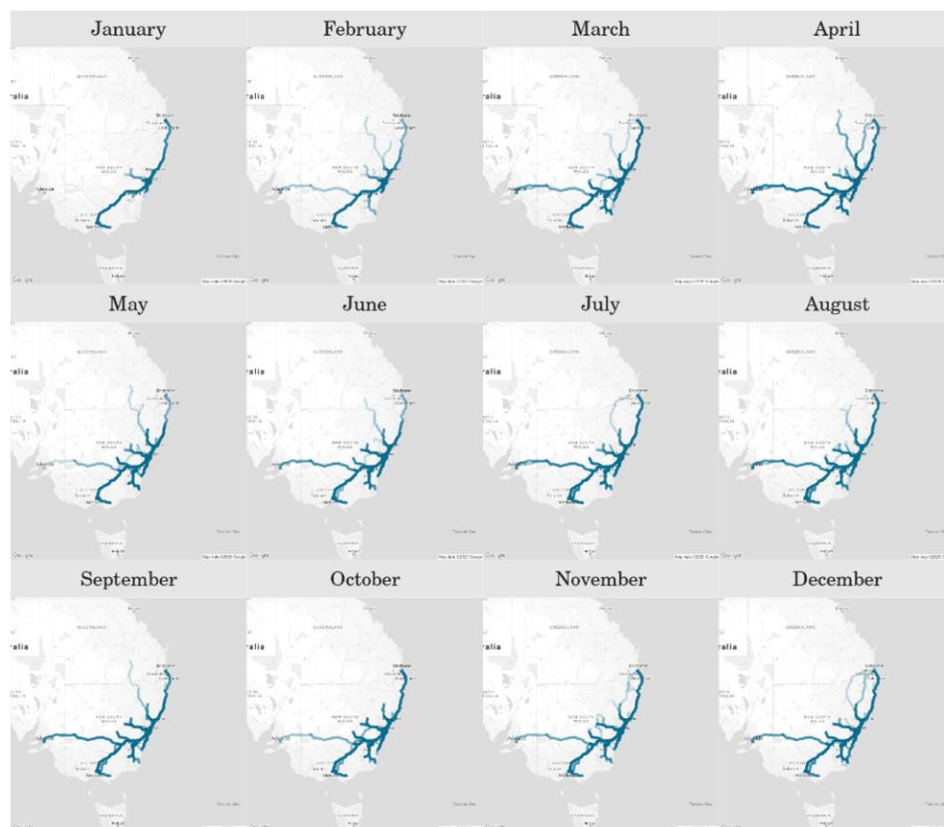Figure 2 – Port Botany outbound freight vehicle movement catchment areas

Source: BITRE estimates.

Figure 3 – Port Botany catchments by month

(a) Inbound freight vehicle movement catchments

(b) Outbound freight vehicle movement catchments
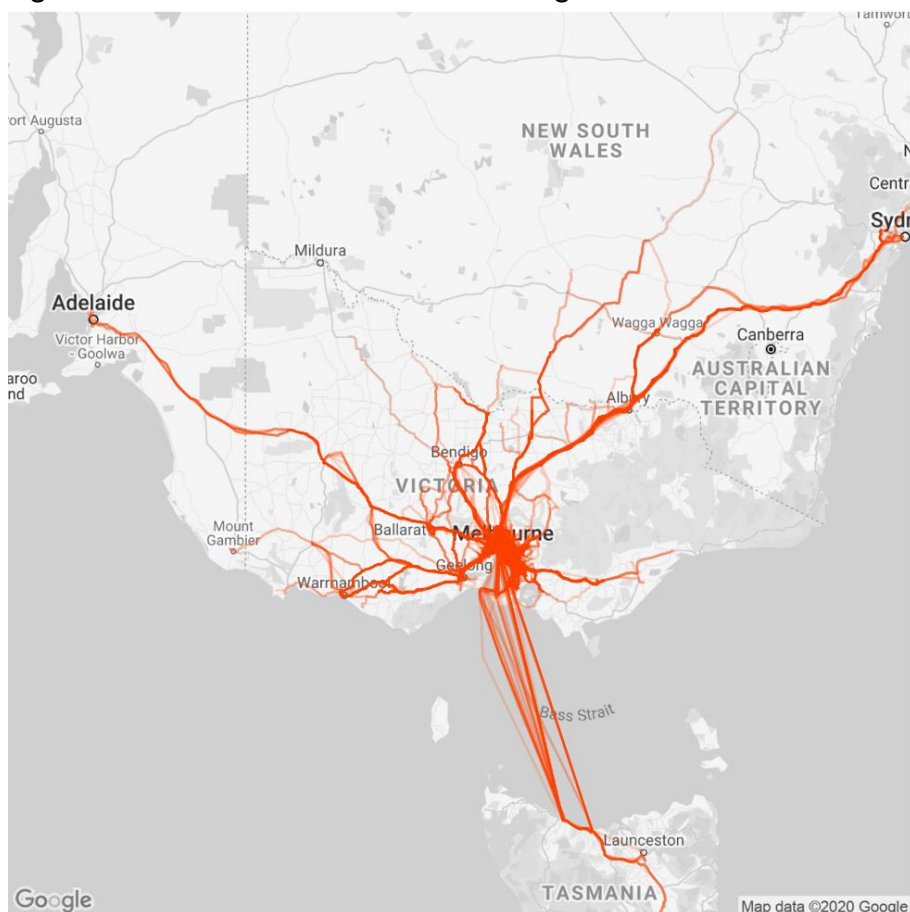
Source: BITRE estimates.

Melbourne – Port of Melbourne

Figures 4 and 5 show the geographic extent of a sample of freight vehicles travelling to and from the Port of Melbourne within a 24-hour period, respectively. The catchment area, like that of Port Botany, extends along the whole Hume Highway between Sydney and Melbourne and also to Adelaide and into Tasmania. It also encompasses regional centres in Victoria including Geelong, Warrnambool, Horsham, Echuca, Wodonga, Bairnsdale, and in New South Wales such as Deniliquin, Griffith, Wagga Wagga, West Wyalong and as far north as Dubbo, and Mount Gambier in South Australia.

Freight vehicle movements to and from Tasmania extend from Burnie or Devonport, through Launceston, to Hobart. The multiple apparent vehicle movement 'paths' across Bass Strait are an artefact of there being fewer recorded vehicle position observations, which is due to the less frequent polling of vehicle position when vehicles are not in operation.

Figure 6 breaks down the inbound and outbound freight vehicle movements to and from the Port of Melbourne by calendar month – inbound freight vehicle catchments are shown in Panel (a) and outbound freight vehicle catchments in Panel (b). Again, like Port Botany, the geographic extent of inbound freight vehicle movements is less extensive in January and February, but expands during autumn and is most extensive during the winter and spring month of the year, particularly to and from regional Victoria and New South Wales.

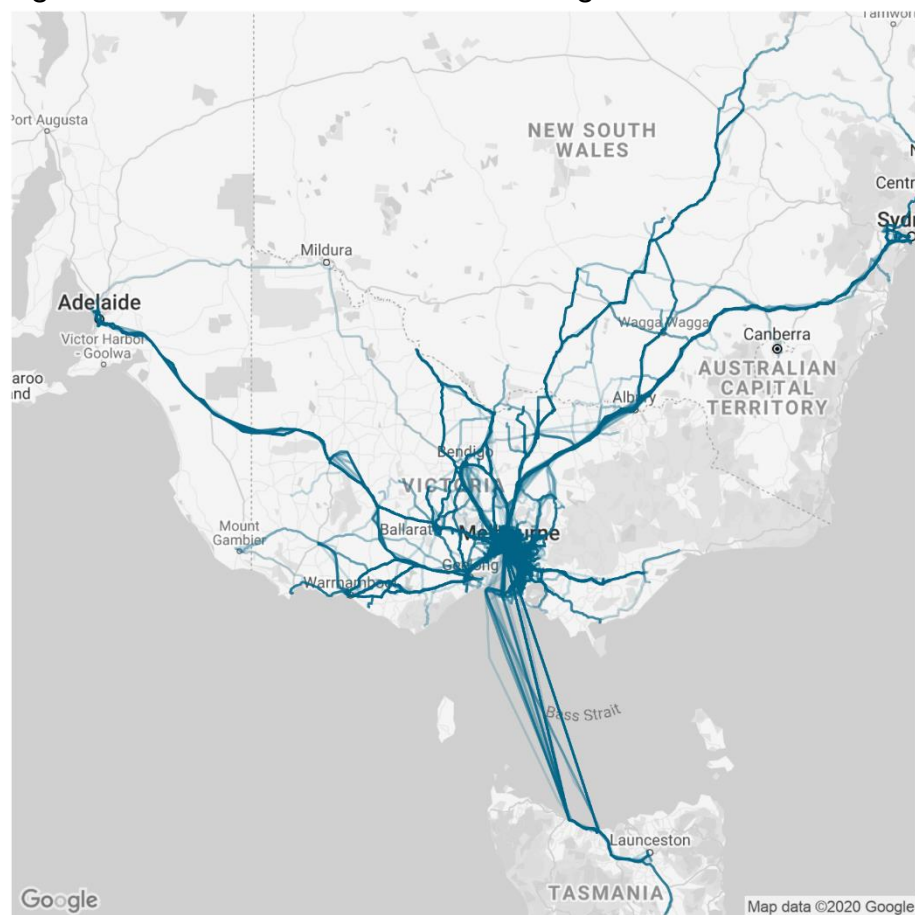**Figure 4 – Port of Melbourne inbound freight vehicle movement catchment areas**

Note: Multiple apparent vehicle movement 'paths' across Bass Strait are an artefact of there being fewer
        recorded vehicle position observations when the vehicle is not in operation.
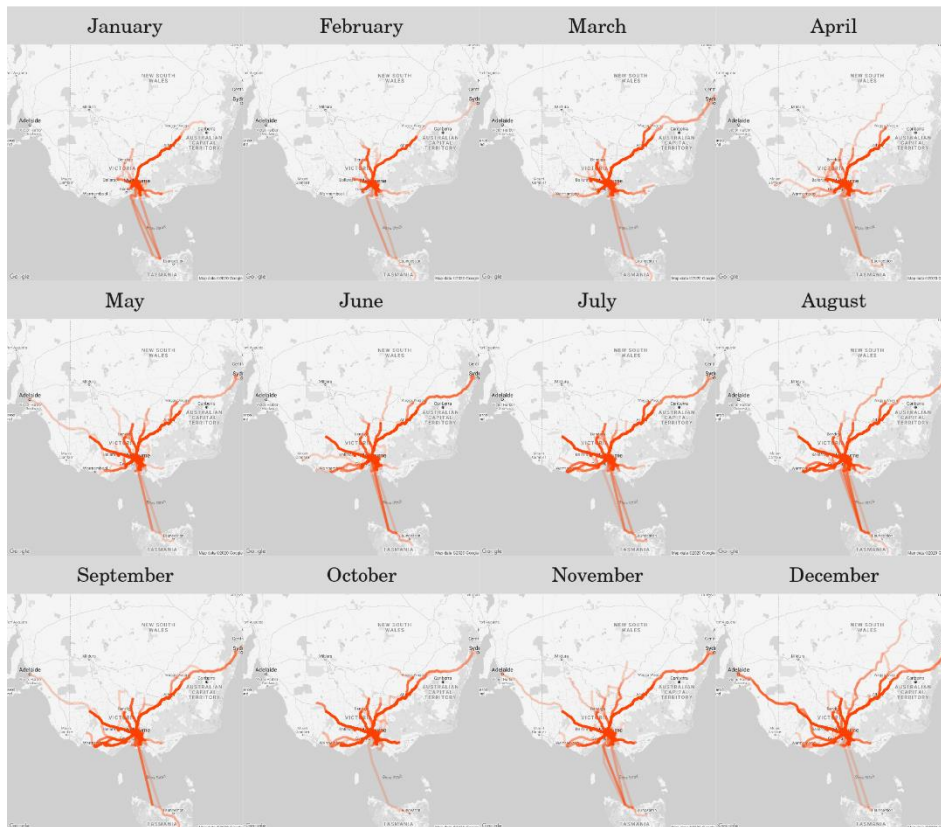
Source: BITRE estimates.

Figure 5 – Port of Melbourne outbound freight vehicle movement catchment areas

Note: Multiple apparent vehicle movement 'paths' across Bass Strait are an artefact of there being fewer recorded vehicle position observations when the vehicle is not in operation.

Source: BITRE estimates.

Figure 6 – Port of Melbourne catchments by month

(a) Inbound freight vehicle movement catchments
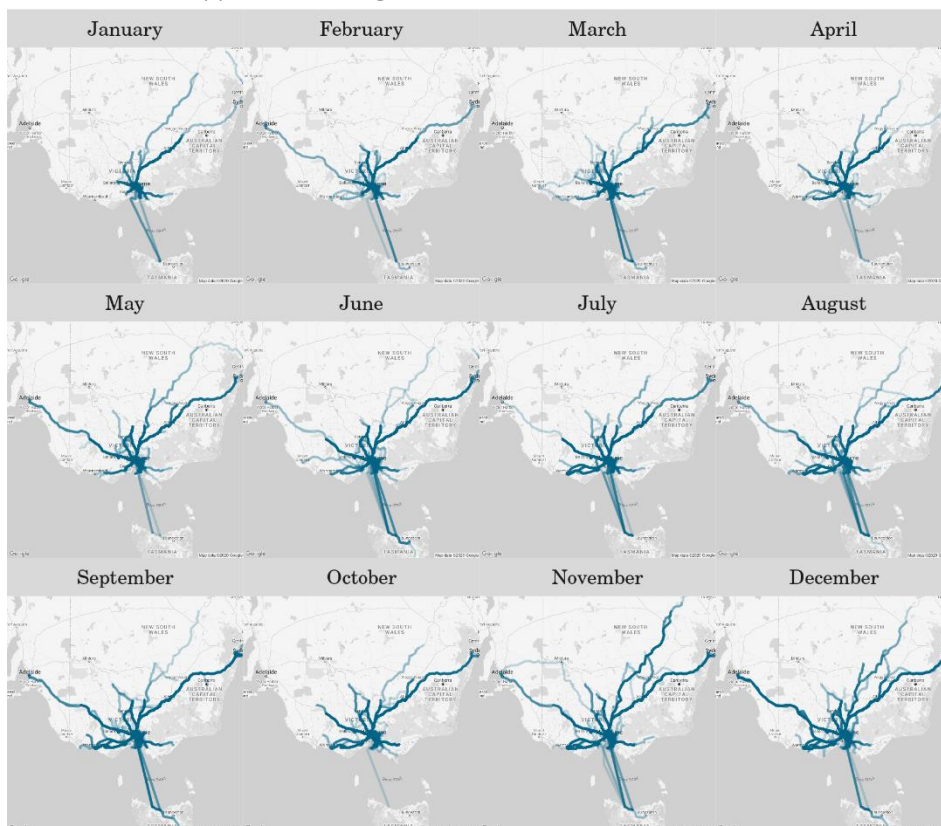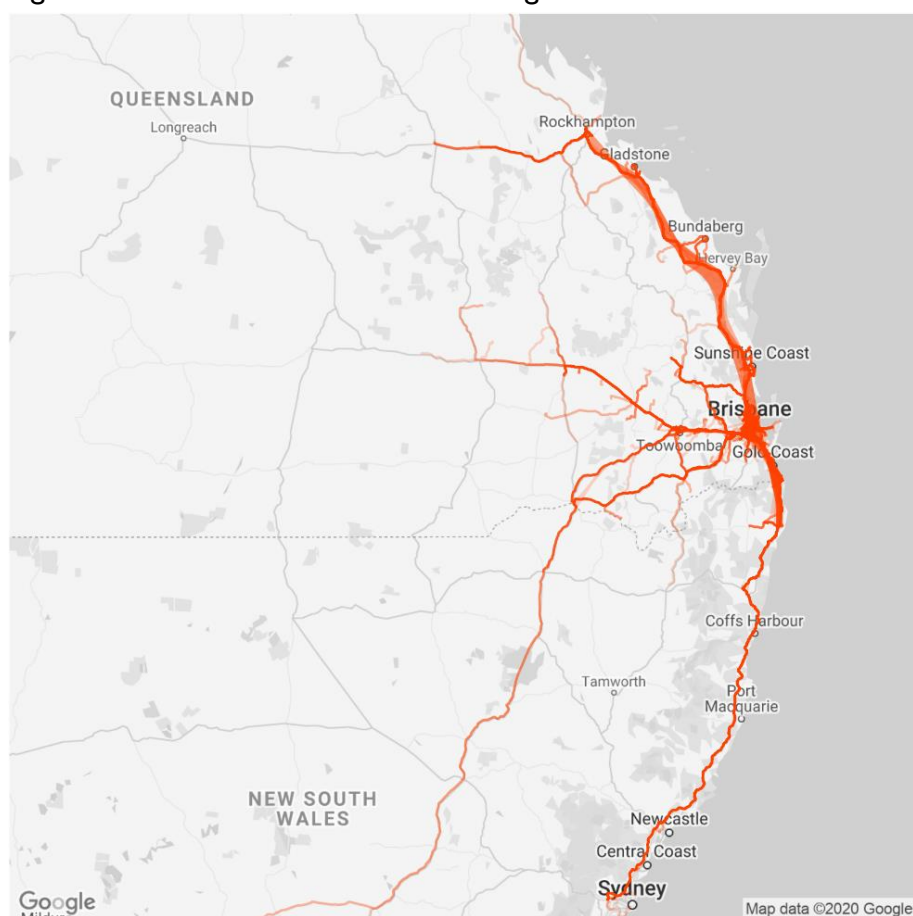

(b) Outbound freight vehicle movement catchments

Source: BITRE estimates.

Brisbane – Port of Brisbane

Figures 7 and 8 show the geographic extent of a sample of freight vehicles travelling to and from the Port of Brisbane within a 24-hour period, respectively. The inbound catchment is less extensive and is dominated by coastal routes from Rockhampton and Bundaberg in the North to Sydney in the South, and areas surrounding Toowoomba. These areas include major meat processing facilities that serve export markets. The outbound catchment also services major inland centres as far as Mackay, Roma and Emerald in Queensland, and Moree, Armidale and Dubbo in Northern and Central New South Wales.

Figure 9 breaks down the inbound and outbound freight vehicle movements to and from the Port of Brisbane by calendar month – inbound freight vehicle catchments are shown in Panel (a) and outbound freight vehicle catchments in Panel (b). Again, like Port Botany and the Port of Melbourne, the geographic extent of inbound and outbound freight vehicle movements are less extensive in January than during the remaining months of the year. Outbound vehicle movements appear to extend to all major Queensland regional centres across all months of the year.

Figure 7 – Port of Brisbane inbound freight vehicle movement catchment areas
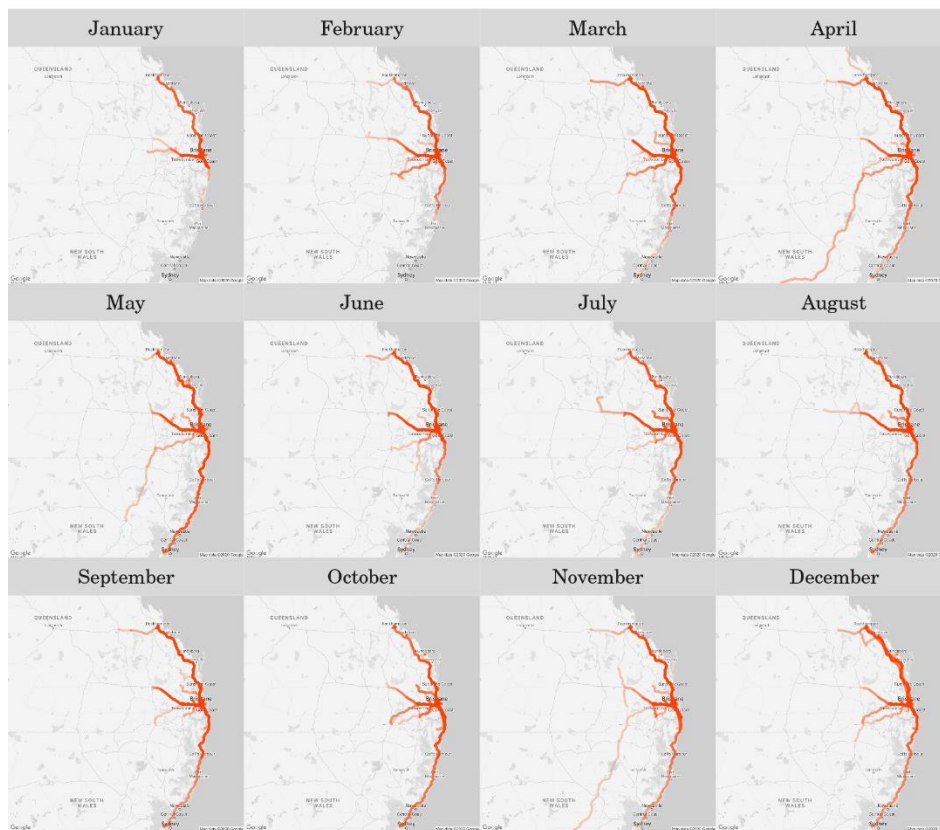

Source: BITRE estimates.

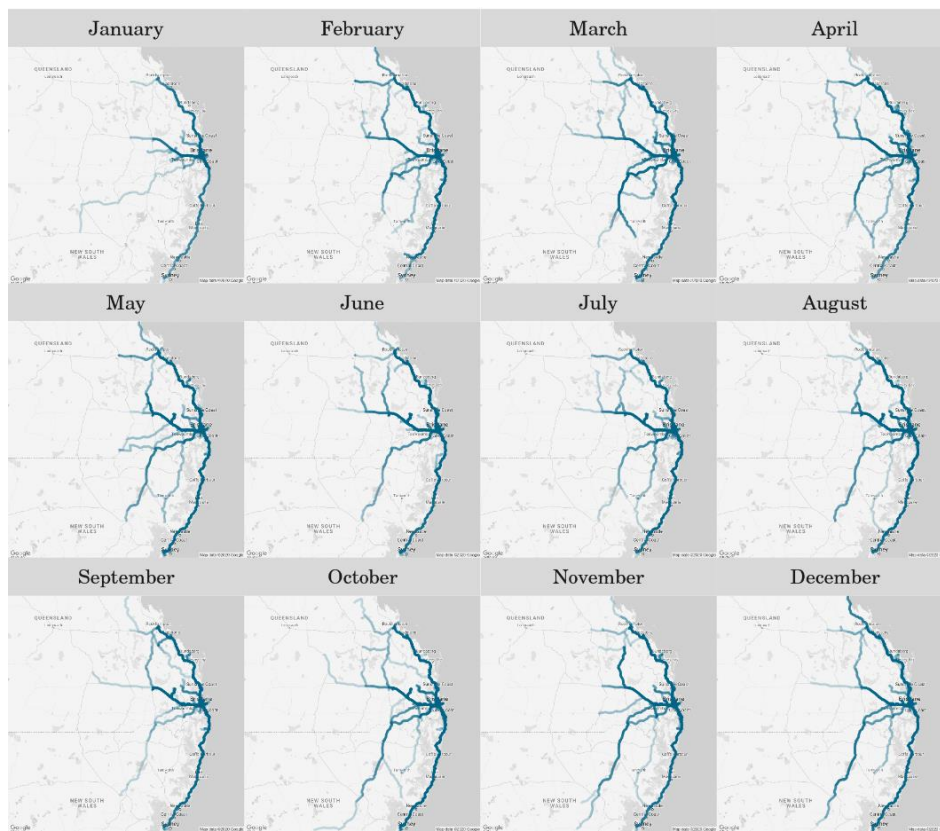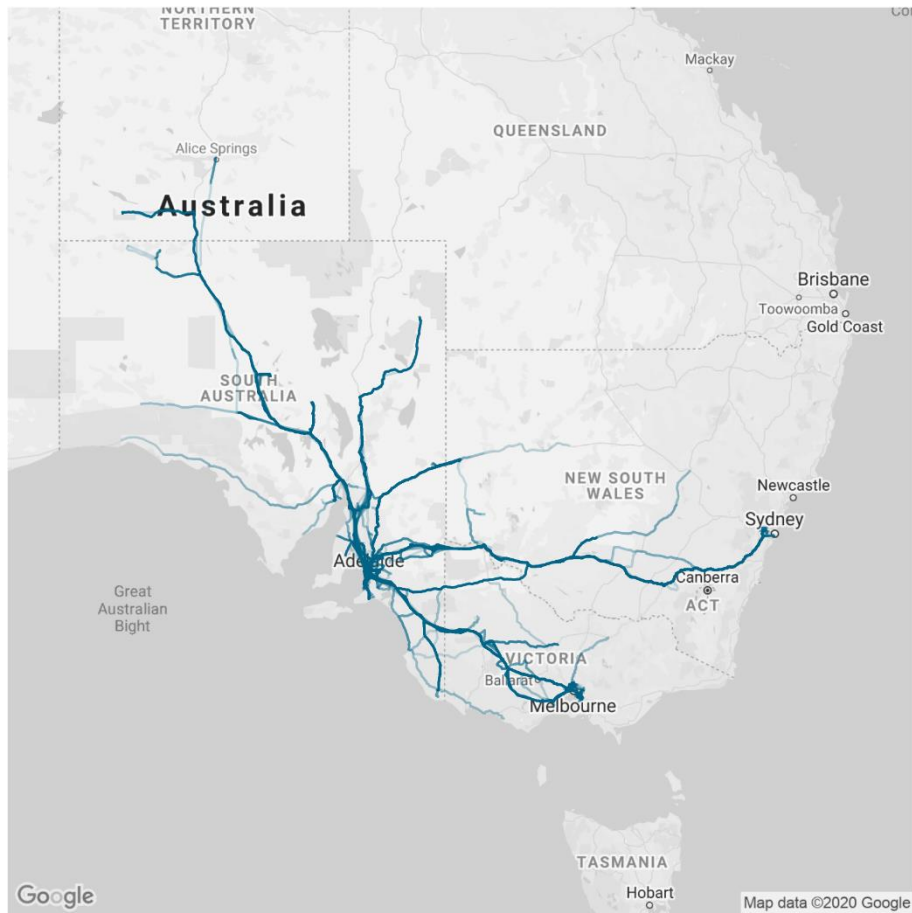Figure 8 – Port of Brisbane outbound freight vehicle movement catchment areas
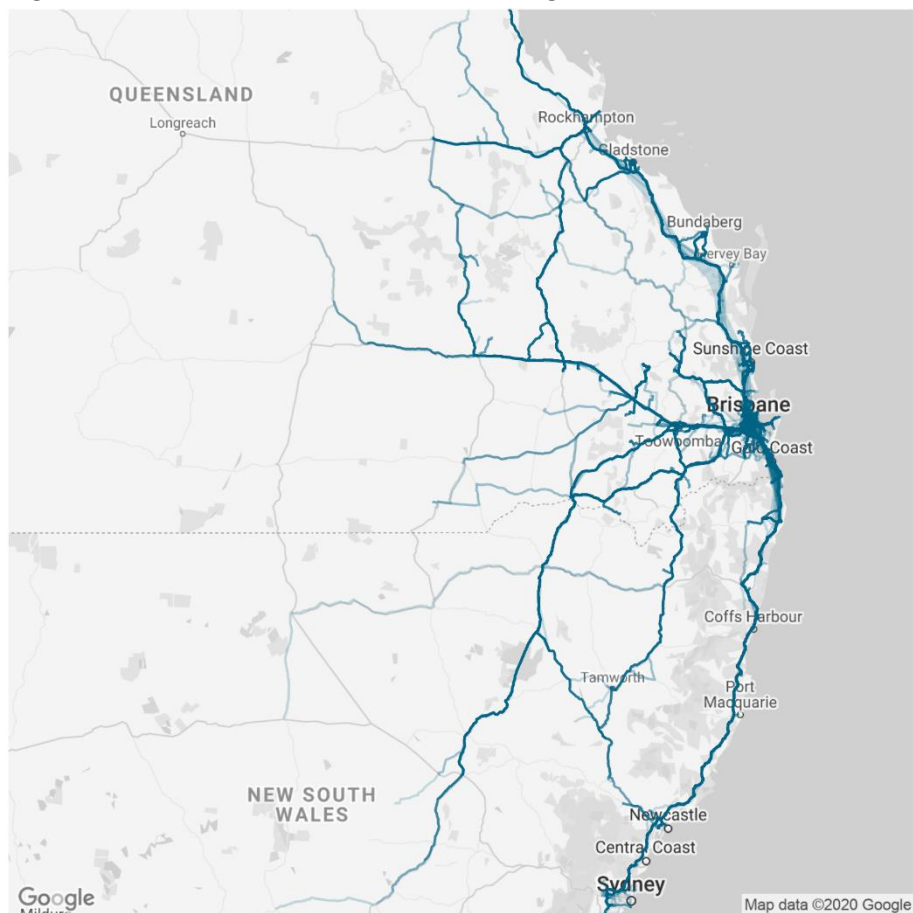
Source: BITRE estimates.

Figure 9 – Port of Brisbane catchments by month

(a) Inbound freight vehicle movement catchments

(b) Outbound freight vehicle movement catchments

Source: BITRE estimates.

Adelaide – Port Adelaide

Figures 10 and 11 show the geographic extent of a sample of freight vehicles travelling to and from Port Adelaide within a 24-hour period, respectively. The inbound catchment areas include all five Eastern States and the Northern Territory, including vehicle movements trips from Brisbane, Sydney and Melbourne, as well movements from regional centres in South Australia, New South Wales and Victoria, extending as far as Alice Springs (en route to Darwin), Mackay and even Hobart. Outbound vehicle movements from Port Adelaide extend to Sydney and Melbourne and regional centres in South Australia, Victoria and New South Wales.

Figure 12 breaks down the inbound and outbound freight vehicle movements to and from Port Adelaide by calendar month – inbound freight vehicle catchments are shown in Panel (a) and outbound freight vehicle catchments in Panel (b). Again, like other ports, the geographic extent of both inbound and outbound freight vehicle movements is less extensive in January and February than during most other months of the year. For Port Adelaide, Sydney and Melbourne are major origins and destinations in all months of the year. It is to and from regional centres where freight vehicle movements vary most across the year.

Figure 10 – Port Adelaide inbound freight vehicle movement catchment areas
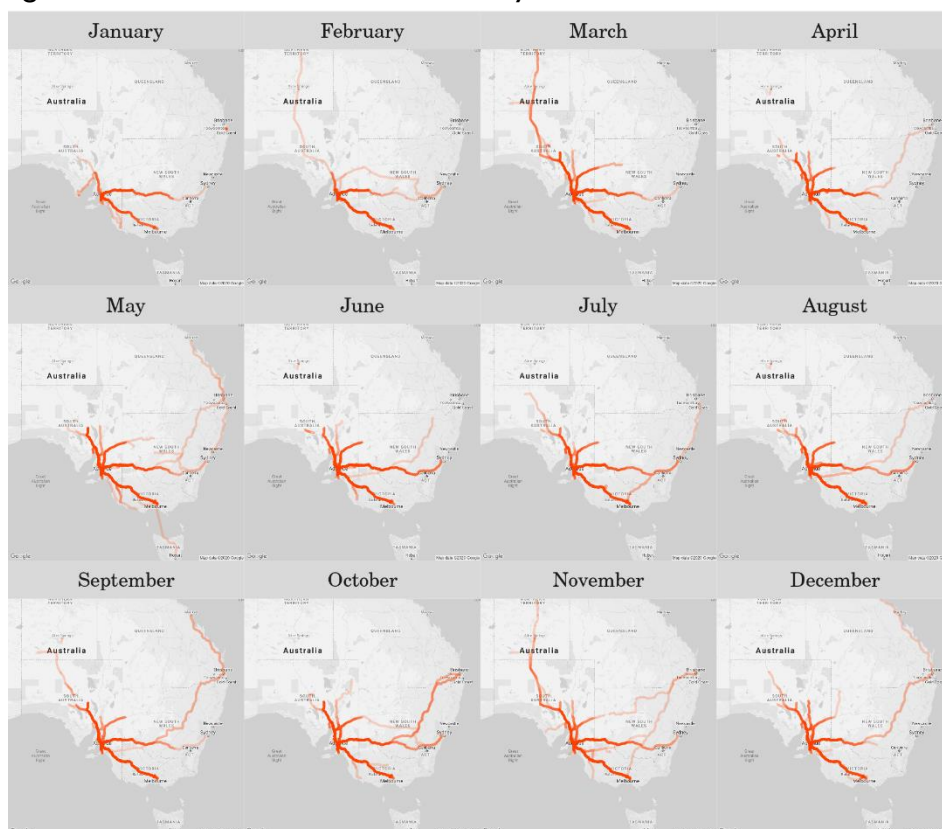

Source: BITRE estimates.

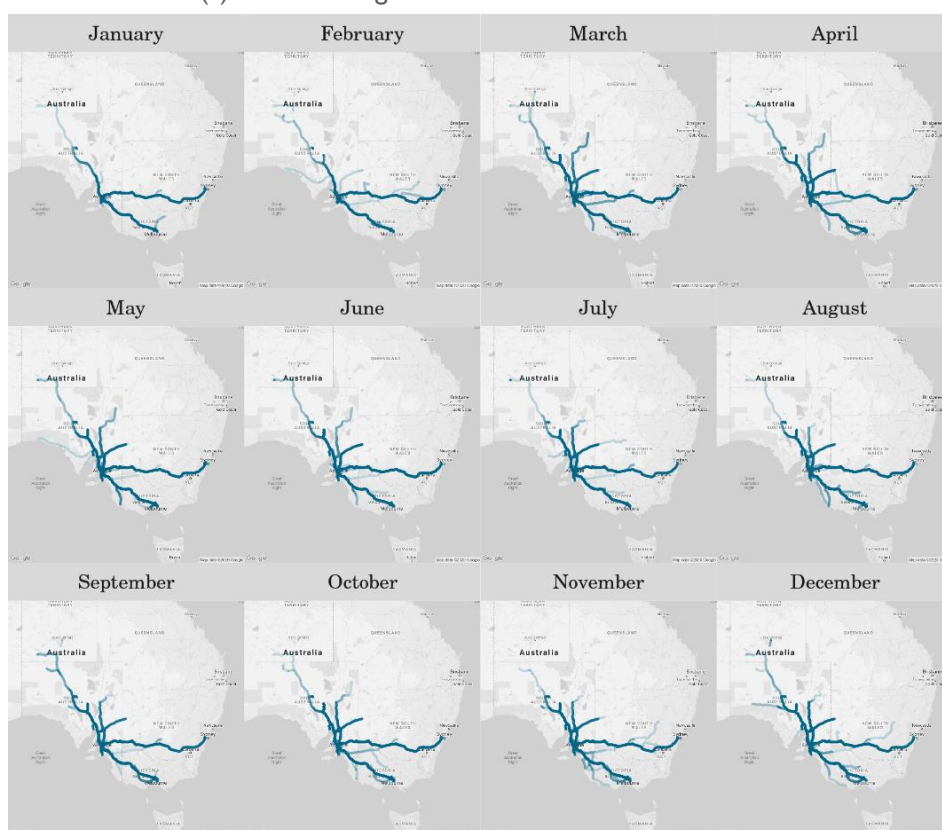Figure 11 – Port Adelaide outbound freight vehicle movement catchment areas

Source: BITRE estimates.

Figure 12 – Port Adelaide catchments by month

(a) Inbound freight vehicle movement catchments

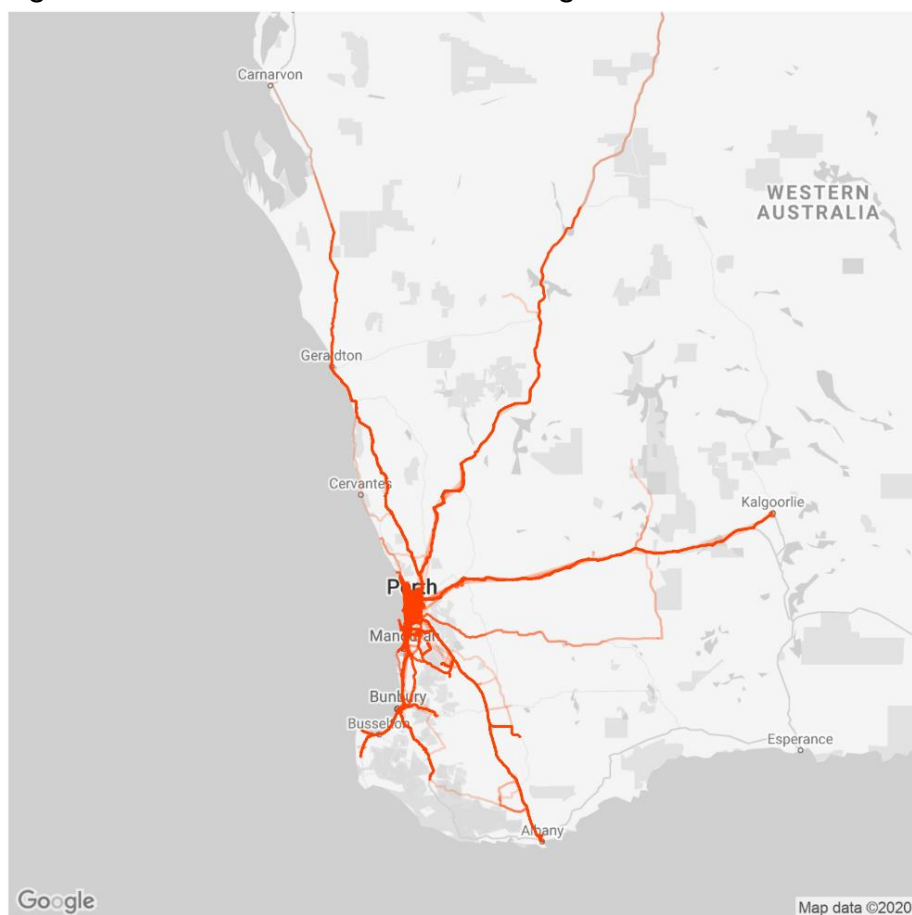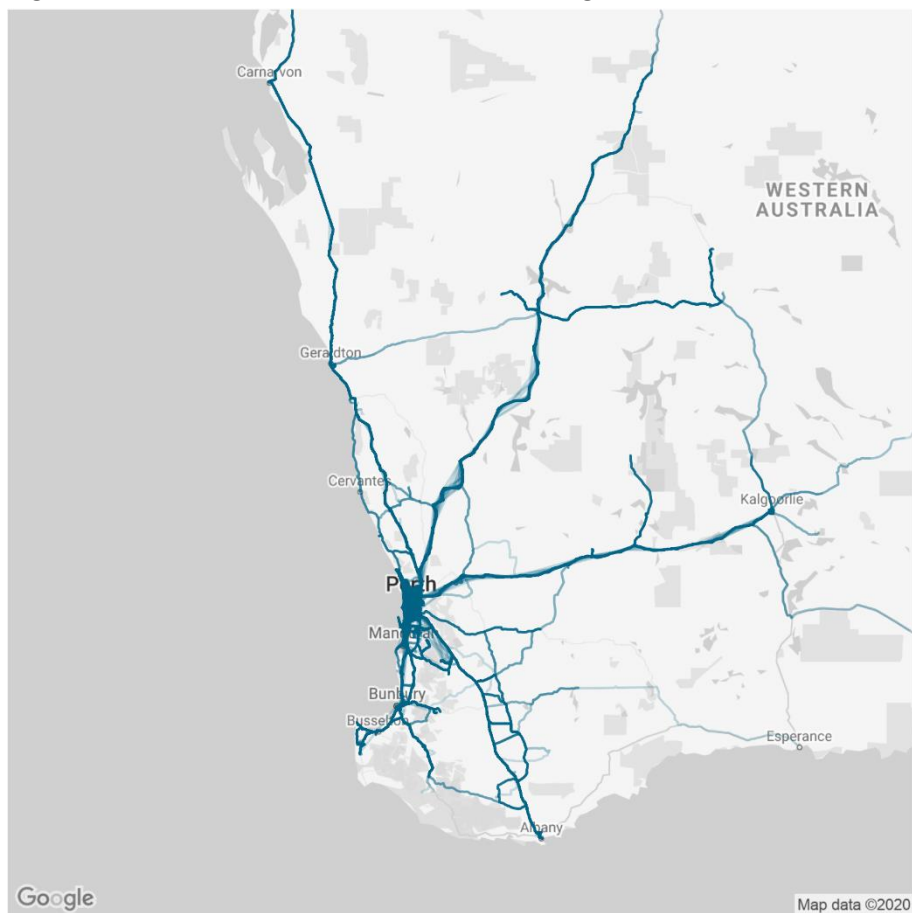(b) Outbound freight vehicle movement catchments

Source: BITRE estimates.

Perth – Port of Fremantle

Figures 13 and 14 show the geographic extent of a sample of freight vehicles travelling to and from the Port of Fremantle (both Inner and Outer Harbours) within a 24-hour period, respectively. The inbound catchment encompasses the more densely populated southwest of Western Australia bounded by important regional centres Albany, Bunbury, Geraldton and Kalgoorlie and along the Great Northern Highway and Brand Highway. The outbound catchment extends further and covers the towns of the wheat-growing region more extensively.

The inbound catchment in 2019 was strikingly smaller than in other months.

Figure 15 breaks down the inbound and outbound freight vehicle movements to and from Port of Fremantle by calendar month – inbound freight vehicle catchments are shown in Panel (a) and outbound freight vehicle catchments in Panel (b). Again, like other capital city ports, the geographic extent of both inbound and outbound freight vehicle movements is less extensive in January and to a lesser extent February than during other months of the year. And like Port Adelaide, it is to and from smaller regional centres where freight vehicle movements vary most across the year.

Figure 13 – Port of Fremantle inbound freight vehicle movement catchment areas
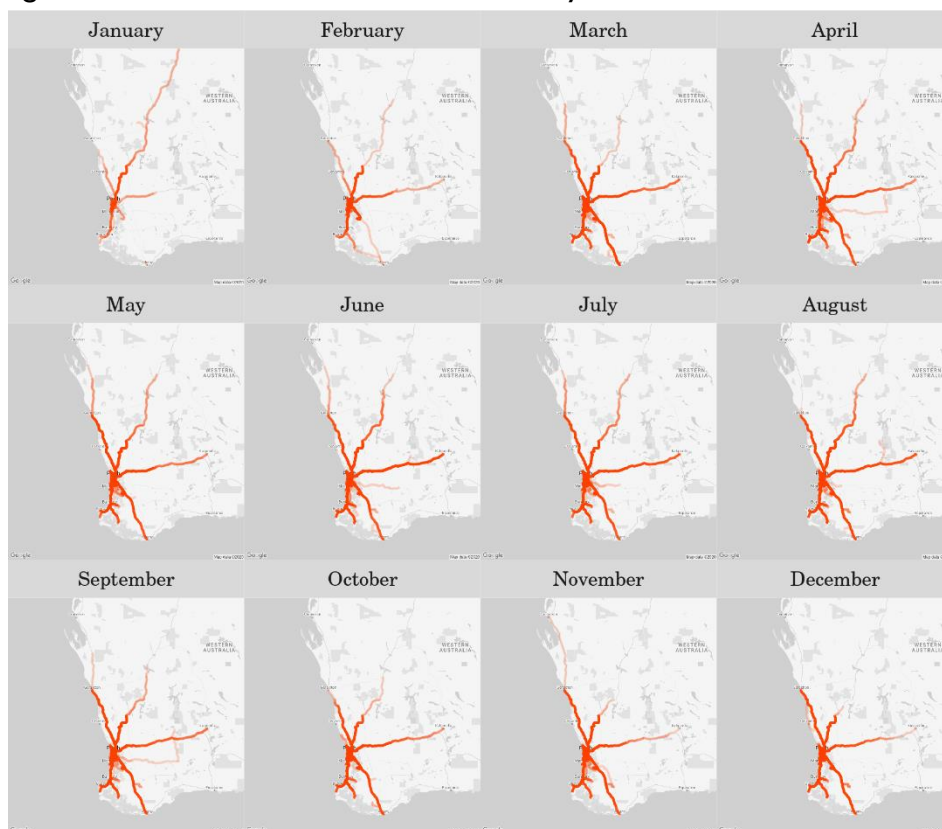

Source: BITRE estimates.

Figure 14 – Port of Fremantle outbound freight vehicle movement catchment areas
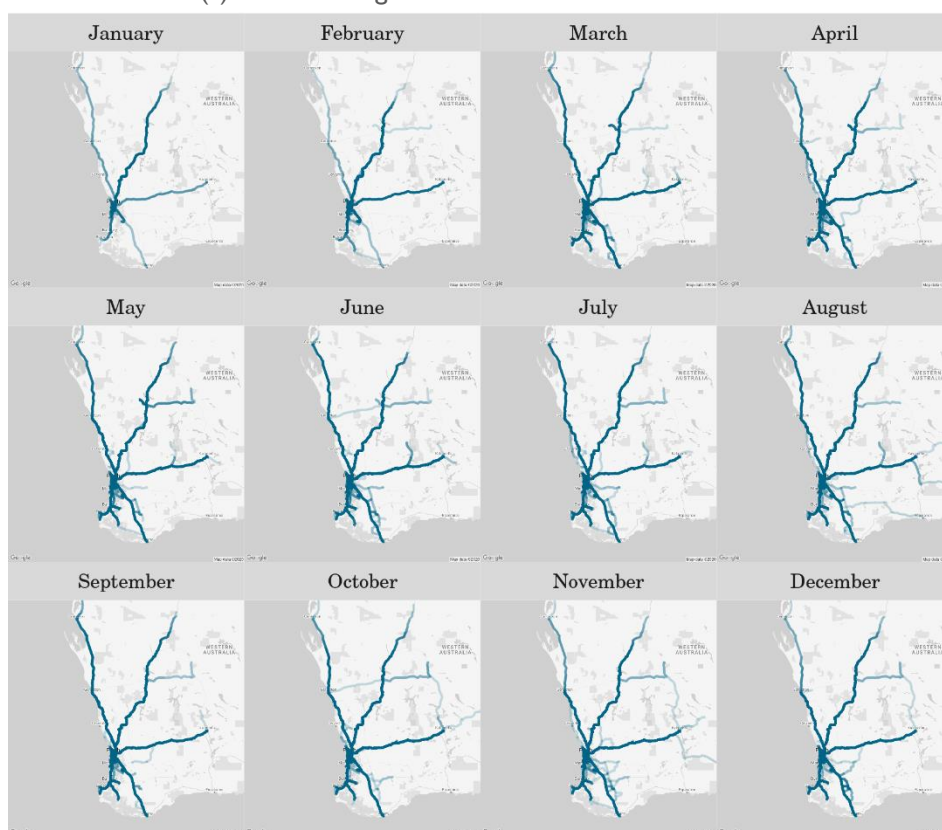

Source: BITRE estimates.

Figure 15 – Port of Fremantle catchments by month

(a) Inbound freight vehicle movement catchments

(b) Outbound freight vehicle movement catchments

Source: BITRE estimates.

About the BITRE freight telematics program

The results presented in this paper are based on data from the BITRE telematics program. This program transforms GPS traces from private road freight firms into data about Australia's road freight industry and road freight network to help government, the industry and other interested parties. This data covers levels of activity, performance of the network including congestion, speeds and travel times, and use of rest areas among other things. The project uses BITRE's independently developed Yulo framework (Green and Mitchell, 2018). By tracking the entirety of vehicles' journeys it can generate data on more parts of the road network than is practical using conventional means such as fixed cameras or pneumatic tubes.

The program has previously demonstrated the effect of COVID-19 related restrictions in the first 4 months of 2020 (BITRE 2020).

All maps appearing in this report were prepared with the ggmap package for R (Kahle & Wickham 2013).

References

Bureau of Infrastructure, Transport and Regional Economics (BITRE) 2020, *Freight route performance under COVID-19*, Information Sheet 110, BITRE, Canberra.

—— 2018a, *Freightline 5–Australian cotton freight transport*, Freightline 5, BITRE, Canberra.

—— 2018b, *Freightline 6–Australian rice freight transport*, Freightline 6, BITRE, Canberra.

Green, R and Mitchell, D, 2018, 'Adapting truck GPS data for freight metrics', Presented at the Australian Transport Research Forum, Darwin, ATRF 2018 Paper 18.

Kahle D. and H. Wickham, 'ggmap: Spatial Visualization with ggplot2', *The R Journal*, 5(1), 144-161. URL: journal.r-project.org/archive/2013-1/kahle-wickham.pdf.