

2015 California Exports of Recyclable Materials



California Department of Resources Recycling and Recovery

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STATE OF CALIFORNIA

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Executive Summary

California generated an estimated 76 million tons of waste material in 2015. Of that, about 40 million tons were disposed, and about 36 million tons were source reduced, recycled, or composted. The fate of the material disposed is fairly well documented through sources such as CalRecycle's Disposal Reporting System, but the fate of the remaining 36 million tons is not as well known.

This report provides information about recyclables exported from California's ports in 2015 and provides a context for how important the export of recyclables has become. Not all the material exported from California's ports was necessarily generated in California. The report focuses on recyclable seaborne exports because the available data is more reliable and detailed than other types of transportation data. However, limited data on recyclables exported by truck, rail, and air from California was obtained and is included in this year's report.

About 16.4 million tons of recyclables with a vessel value of \$5.4 billion were shipped out of California's ports in 2015. Mixed paper made up nearly 60 percent of the total weight shipped. Ferrous and Non-Ferrous Metals combined made up almost two-thirds of the vessel value. China, Korea, and Taiwan received 81 percent by weight of all recyclables shipped overseas from California ports.

Nine of the 12 material categories detailed in this report saw a decrease in the tonnage exported. This resulted in a 1.7 million ton net reduction of recyclables shipped from California's ports in 2015. This drop in tonnage may be explained by several factors such as a strong U.S. dollar, low commodity prices, and slowdowns from West Coast port contract disputes. Determining what impact these had on California recycling is difficult since we don't have a good handle on how much of the total amount exported was actually generated in California.

2015 key findings:

- Seaborne exports of all commodities (recyclables and other commodities) shipped from California ports totaled 63.8 million tons with a vessel value of \$85 billion.
- Recyclable material made up about 16.4 million tons of California's seaborne exports with a vessel value of about \$5.4 billion.
- The total vessel weight of recyclables exported from California ports dropped about 1.7 million tons (9 percent) in 2015, compared to 2014.
- Mixed paper, cardboard, and paperboard was the largest category, accounting for 59 percent (9.7 million tons) by vessel weight of California recyclables exported.
- Ferrous and Non-Ferrous Metals combined made up about 64 percent of the vessel value of the seaborne recyclable exports from California.
- China received more recyclables from California ports than any other single country, with 10.2 million tons in 2015. This is a drop of about 148,000 tons (1 percent), compared to 2014.
- China, Korea, and Taiwan accounted for 81 percent by vessel weight and 79 percent by vessel value of seaborne recyclable exports.

- California ports accounted for 44 percent of the country's seaborne recyclable exports by weight and 38 percent of the vessel value.
- Truck and rail exports of recyclables to Mexico had a value of at least \$45.6 million.
- Air exports of recyclables to Japan and Germany had a value of about \$20 million.
- Greenhouse gas emissions from the transport of recyclables on ocean-going vessels was about 2.4 million MTCO_{2e} in 2015. These are emissions that could have been avoided if materials had remained in California.

The report's data comes primarily from WISERTrade information unless otherwise noted. WISERTrade is a company that aggregates U.S. Census Bureau and other sources of information into its data systems. For convenience, this report combines recyclables into several groups. These include: High-Grade Paper; Mixed Paper; Plastics (1, 2, and 4); Other Plastics (3, 5, 6, and 7); Glass; Tire and Rubber Scrap; Used Oil and Grease; Batteries; Copper Wire; Ferrous Metals; Non-Ferrous Metals; and new in the 2015 report, Worn Clothing. Information for Aluminum Cans is provided separately, though their weight and vessel value are also included in the data for Non-Ferrous Metals.

Introduction

AB 341 (Chesbro, Chapter 476, Statutes of 2011) established a statewide goal of 75 percent recycling, composting, or source reduction of solid waste by 2020 for California. Recycling will be a key part of our efforts to reach this goal. Measuring recycling in California is currently a challenge because there is no comprehensive means to do this. However, we should have more data in the future due to recycling reporting requirements under AB 901 (Gordon, Chapter 746, Statutes of 2015).

The examination of recyclable exports helps us gain a better understanding of where our recyclables go and which materials require further attention. Recyclable material export information is combined with other recycling data in CalRecycle's State of Recycling reports. Those reports provide an overview of recycling infrastructure in California by providing data on recycling amounts, types, facilities, and material flows.

This report focuses on recyclables exported from California ports by vessel because it is more detailed and readily available than other export information. The information provided represent materials that left California ports but were not necessarily generated in California. Conversely, materials generated in California may have left the United States from other states, and their weights and values would not be captured in this report.

Data in this report comes primarily from WISERTrade unless otherwise noted. WISERTrade does provide some air weight and value data, but not much recyclable material is moved in this manner. "Other Value" categories provide truck, rail, and pipeline value information but does not give weight and separate truck data from rail data. As a result, this report includes the limited data for rail and truck dollar values for Mexico, and air dollar values for Japan and Germany. Exports to Canada are not included in the report at this time due to material not entering Canada directly from California. This report provides some limited information from U.S. Surface Transportation Board and the U.S. Department of Transportation. The amounts of recyclables imported to and exported from California by rail and truck to other states is not directly comparable with the data provided by other sources.

Recyclable commodities were identified in the WISERTrade database by examining each commodity's Harmonized System (HS) code. This system is an international standard that assigns numeric codes to traded commodities. Recyclable commodities were combined into custom groups in this report to represent categories of common recyclables by type or particular interest. Throughout this report, weight is shown in tons, and a conversion factor of 0.00110231 tons per kilogram was used to calculate the totals from WISERTrade database reports.

Two new HS codes were added in the 2015 Exports report. "Worn Clothing" (HS code 6309000000) was added and created a new category, and "Used Iron or Nonalloy Steel Rail Scrap" (HS code 7302101080) was added to the Ferrous Metals category. In 2015, Worn Clothing equaled about 128,000 tons in vessel weight and about \$96 million in

vessel value. Rail Scrap added less than 1 ton to the vessel weight of the Ferrous Metals category and less than \$3,000 in vessel value. The tonnages for both of these additional HS codes are included in prior year trend data as well.

This paper addresses these questions:

- How many tons of recyclable materials were exported by sea in 2015 through California ports?
- What types of recyclable materials were exported by sea in 2015 through California ports?
- What was the vessel value and weight of these exported recyclable materials?
- Where did the exported materials go, and what are their historic export trends?

Results

2015 California Seaborne Exports of All Commodities by Weight (Figures 1a and 1b)

- Approximately 63.8 million tons of materials (recyclables and other commodities) were exported from California ports in 2015, a decrease from 74.2 million tons in 2014.
- Recyclables made up about 16.4 million tons (26 percent) of all California’s seaborne exports in 2015. This is a decrease of about 1.7 million tons compared to 2014.
- The amount of recyclables exported from California ports has decreased annually since the peak of 22 million tons in 2011.

Figure 1a: 2015 Seaborne California Exports by Weight (Total ~ 63.8 Million Tons)

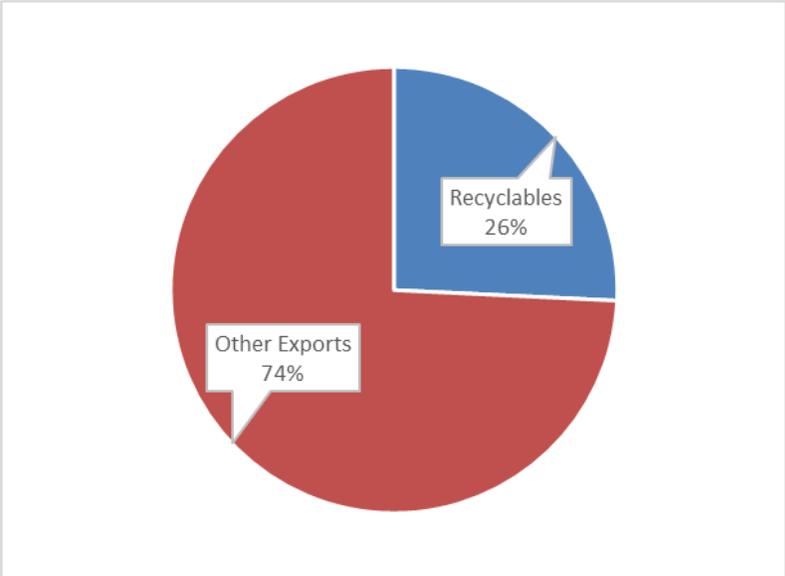
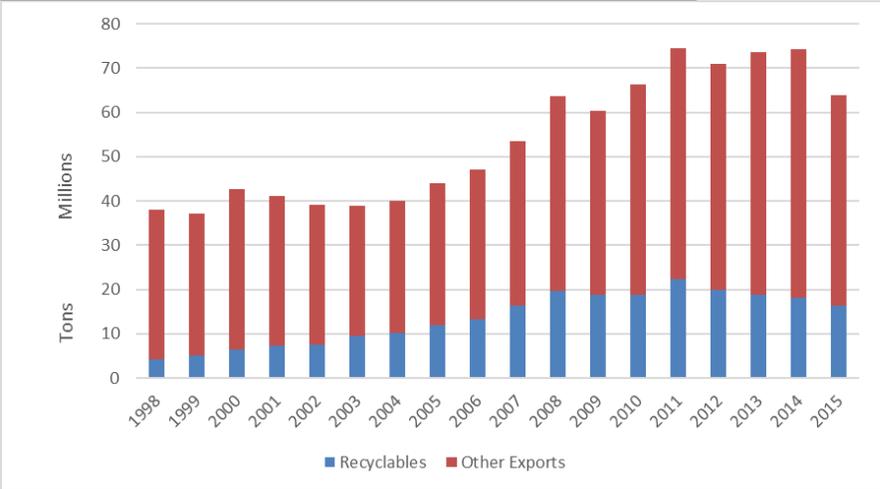


Figure 1b: California Seaborne Exports Trends (Tons)



2015 California Seaborne Exports of All Commodities by Vessel Value (Figures 1c and 1d)

- Exports of all materials (recyclables and other commodities) from California ports had a vessel value of \$85 billion in 2015.
- Recyclables made up about \$5.4 billion (6 percent) of all California's seaborne exports in 2015. This is down from \$7 billion in 2014.

Figure 1c: 2015 Seaborne California Exports by Vessel Value (Total Value: ~\$85 Billion)

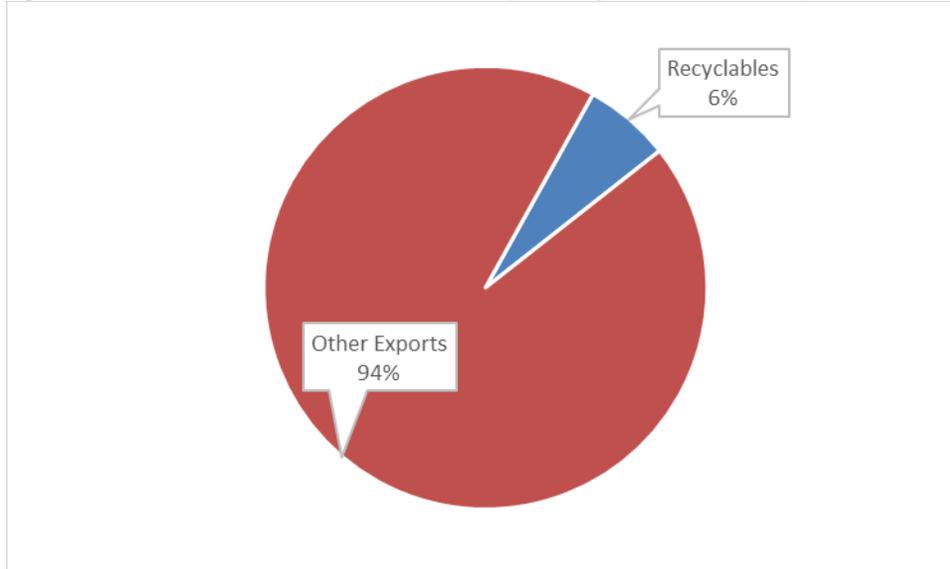
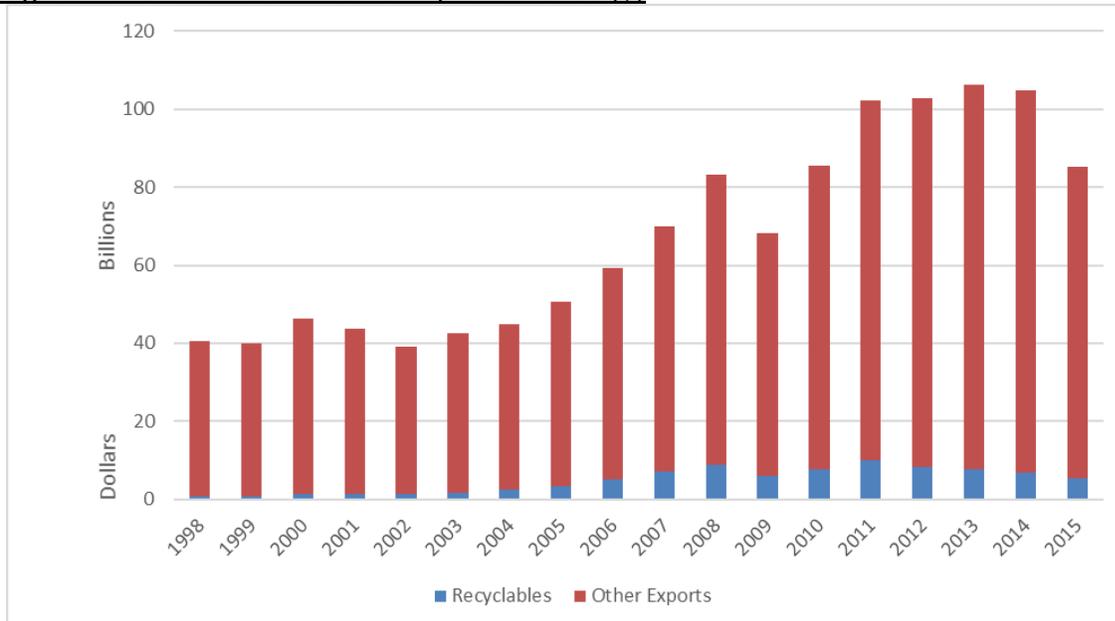


Figure 1d: California Seaborne Exports Trends (\$)



2015 California Seaborne Exports of Recyclables by Category (Figures 1e and 1f)

- The single largest category by weight was Mixed Paper, which accounted for 59 percent by weight of recyclable exports from California ports.
- Non-Ferrous Metals, though only 7 percent of recyclable exports by weight, made up 39 percent of the recyclables export vessel value.
- Ferrous Metals made up 25 percent of the vessel value, and combined with Non-Ferrous Metals accounted for 64 percent of the vessel value of exported recyclables by sea.

Figure 1e: 2015 California Seaborne Exported Recyclables by Weight (Total: ~16.4 Million Tons)

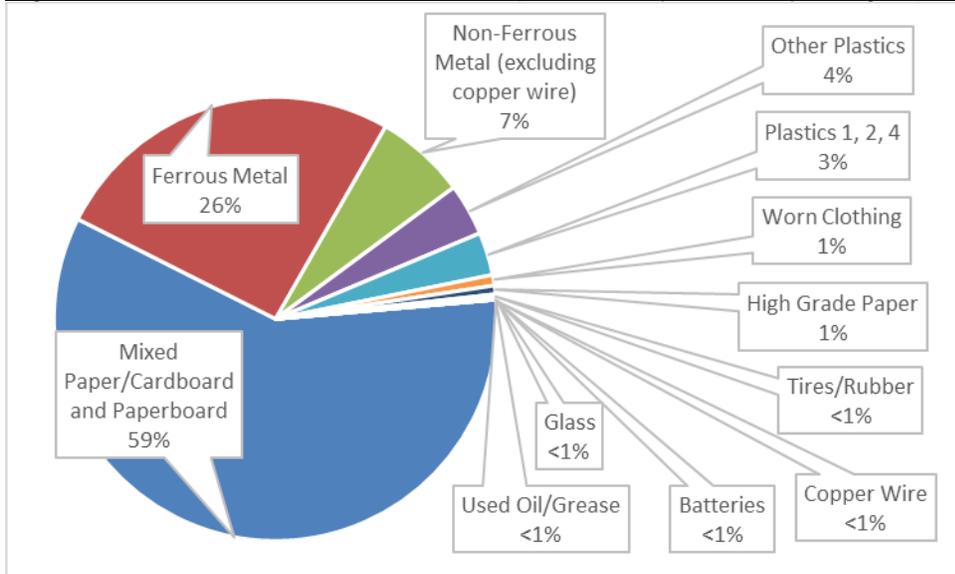
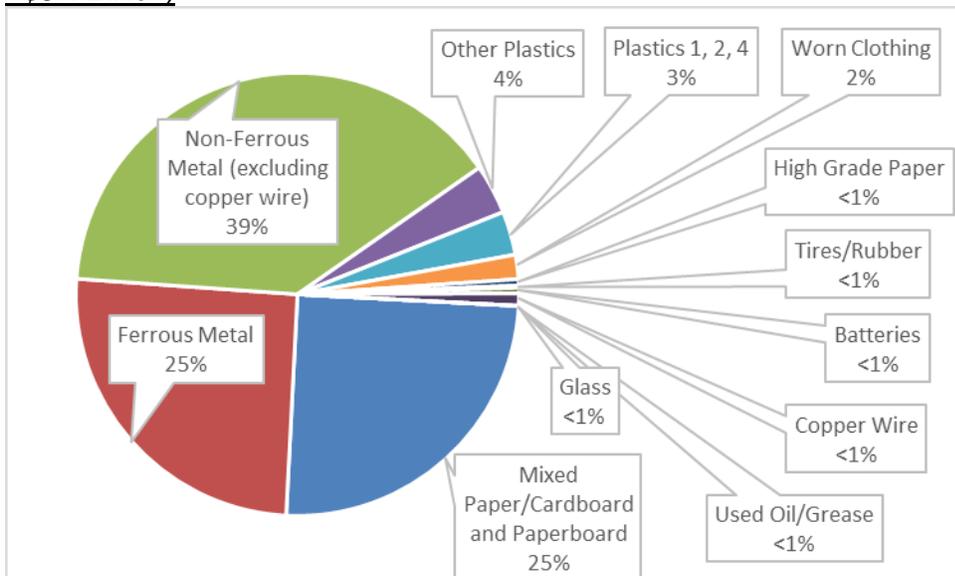


Figure 1f: 2015 California Seaborne Exported Recyclables by Vessel Value (Total Vessel Value: ~\$5.4 Billion)



2015 California Seaborne Exports of Recyclables by Destination Country (Vessel Weight) (Figures 2a through 2c)

- The following three countries received 81 percent of the 16.4 million tons of recyclables exported from California ports:
 - China: 62 percent (10.2 million tons)
 - Korea: 10 percent (1.7 million tons)
 - Taiwan: 9 percent (1.5 million tons)
- Compared to 2014, exports of recyclables were down about 9 percent by weight.

Figure 2a: Recyclable Exports by Sea from California by Country in 2015 (Total: ~16.4 Million Tons)

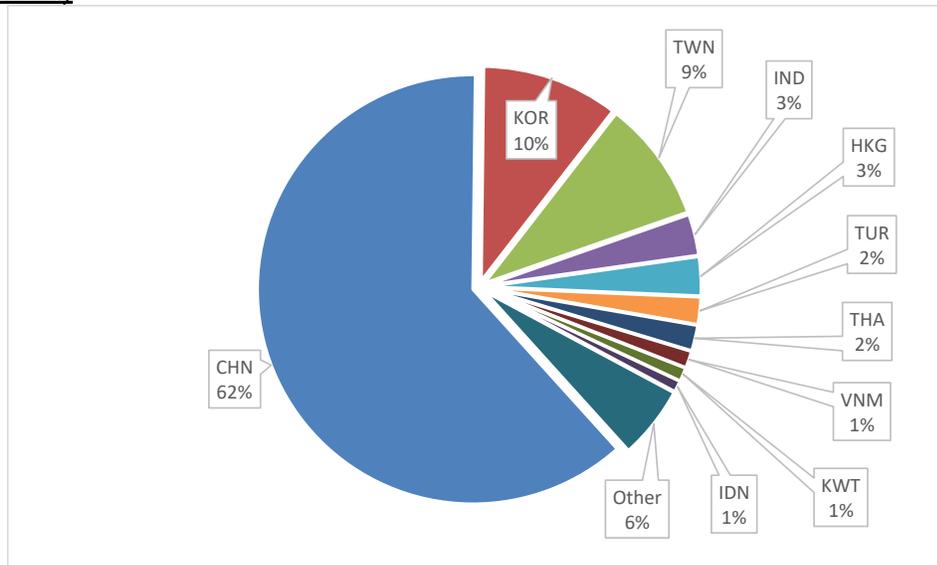


Figure 2b: Recyclable Exports by Sea from California by Country (Tons)

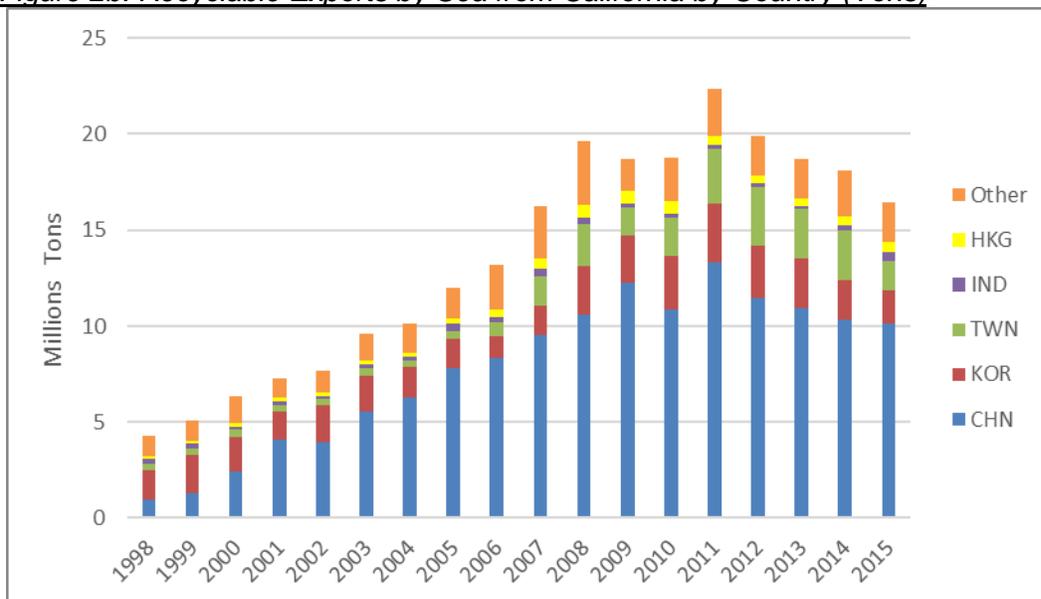


Figure 2c: Changes in Recyclable Exports from California Ports (by Country)

Country	Percent Change Annual Total 2014 to 2015	Tonnage Change 2014 to 2015
Total All Countries (includes all trade partners)	-9	-1,665,000
China	-1	-148,000
Korea, Republic of	-20	-416,000
Taiwan	-42	-1,077,000
India	89	240,000
Hong Kong	11	46,000
Turkey	409	272,000
Thailand	1	3,000
Vietnam	-33	-101,000
Kuwait	-32	-82,000
Indonesia	-55	-171,000

2015 California Seaborne Exports of Recyclables by Destination Country (Vessel Value) (Figures 2d and 2e)

- The following three countries received 79 percent of the \$5.4 billion worth of recyclables by vessel value exported from California ports.
 - China: 58 percent (\$3.1 billion)
 - Korea: 12 percent (\$628 million)
 - Taiwan: 9 percent (\$ 476 million)
- Compared to 2014, vessel value of recyclables exported from California ports was down about 23 percent (vessel value of all commodity exports were down about 19 percent compared to 2014).

Figure 2d: Recyclable Exports by Sea from California to Countries in 2015 (Vessel Value)

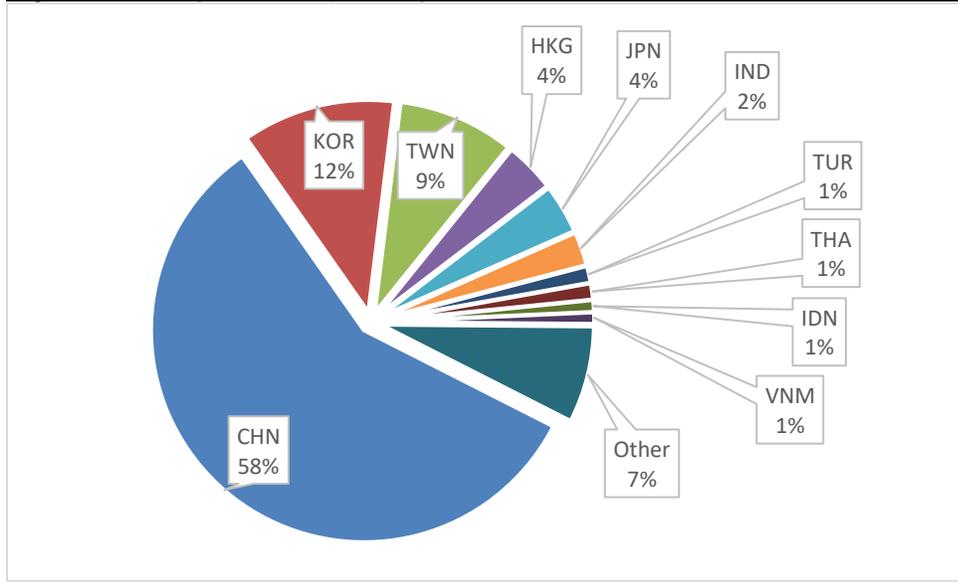
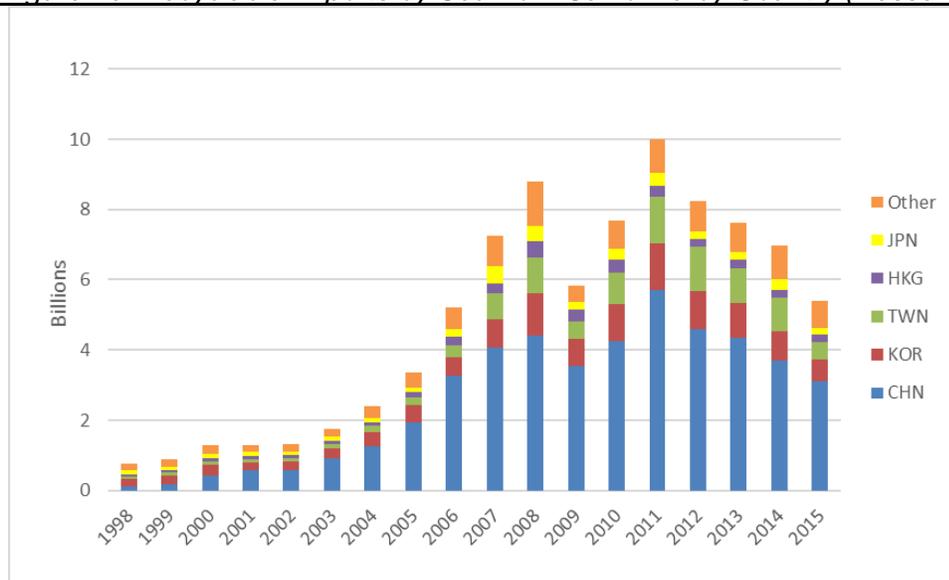


Figure 2e: Recyclable Exports by Sea from California by Country (Vessel Value)



2015 U.S. Seaborne Exports of Recyclables (Vessel Weight) (Figures 2f and 2g)

- About 37.4 million tons of recyclables were exported by sea from all U.S. ports in 2015.
- The top three destination countries made up 70 percent by vessel weight of those exports:
 - China: 49 percent (18.2 million tons)
 - Turkey: 12 percent (4.4 million tons)
 - India: 9 percent (3.2 million tons)
- Compared to 2014, exports of recyclables from all U.S. ports were down nearly 8 percent by weight.
- The United States as a whole exports more seaborne recyclables to China than to any other country. However, non-Asian countries play a larger role in U.S. seaborne recyclable exports compared to California.
- U.S. seaborne recyclable export tonnages have been decreasing since 2011.

Figure 2f: Recyclable Exports by Sea from U.S. to Countries in 2015 (Vessel Weight)

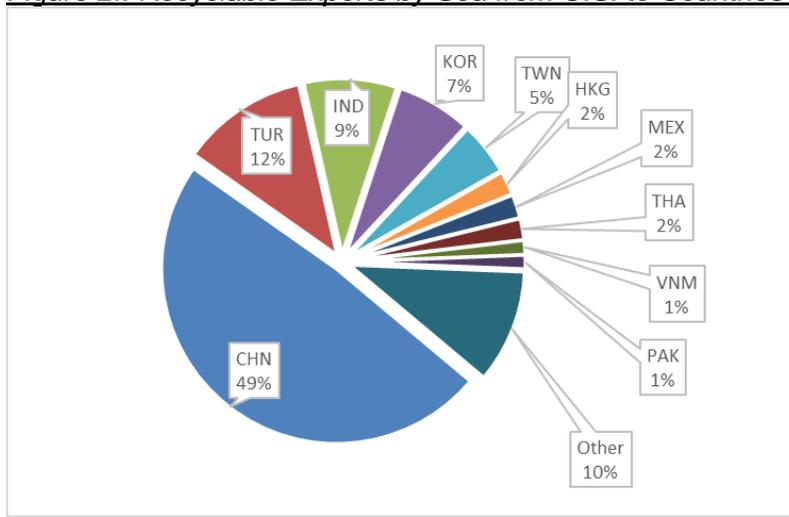
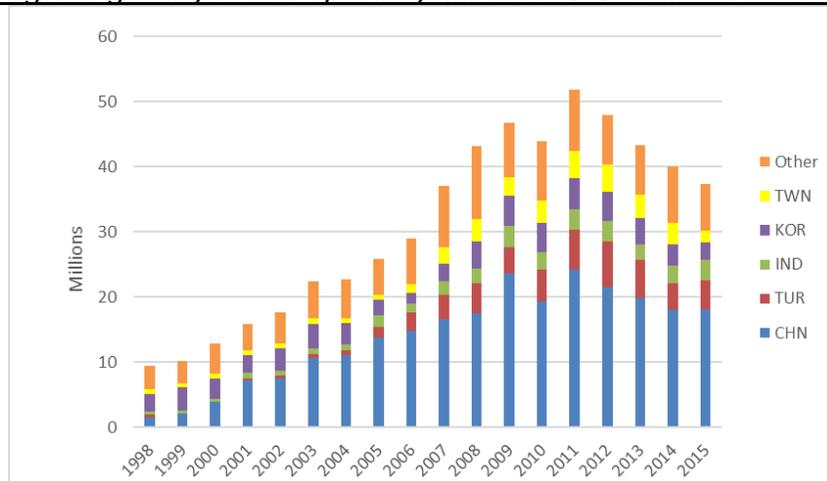


Figure 2g: Recyclable Exports by Sea from U.S. to Countries in 2015 (Tons)



2015 U.S. Seaborne Exports of Recyclables (Vessel Value) (Figures 2h and 2i)

- About \$14 billion of recyclables were exported from all U.S. ports in 2015.
- The top three destination countries made up 57 percent by vessel value of those exports:
 - China – 43 percent (\$6 billion)
 - Korea – 7 percent (\$954 million)
 - Turkey – 7 percent (\$931 million)
- Compared to 2014, vessel value of recyclables exported from all U.S. ports was down almost 21 percent.
- Some European countries appear on the value pie chart below but not on the weight pie chart above. This is due to the higher value of metals exported to those countries.
- Vessel value totals have been decreasing since 2011.

Figure 2h: Recyclable Exports by Sea from U.S. to Countries in 2015 (Vessel Value)

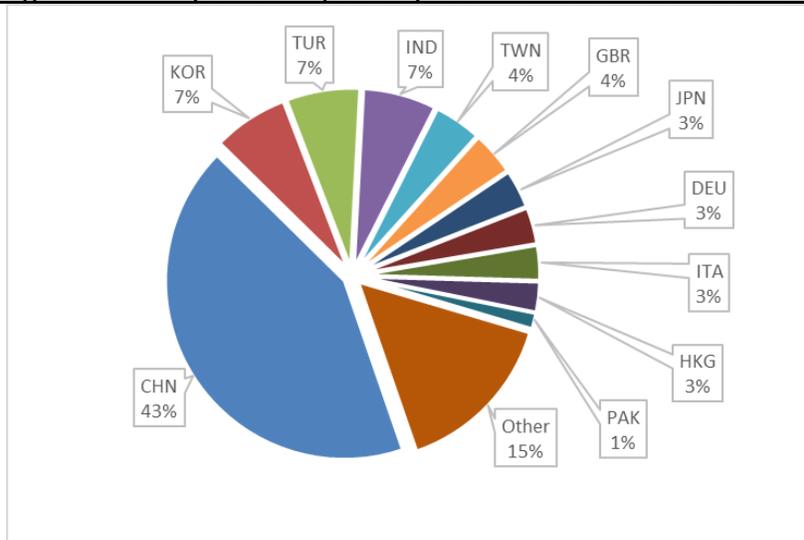
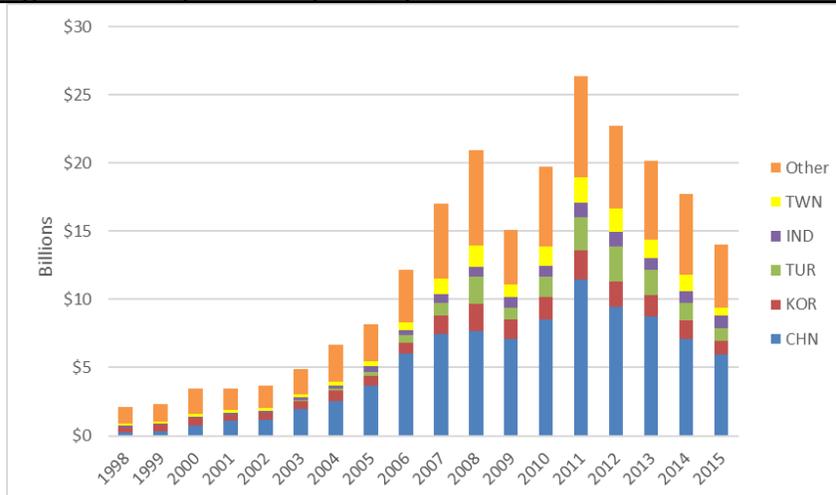


Figure 2i: Recyclable Exports by Sea from U.S. to Countries in 2015 (Vessel Value)



2015 U.S. Seaborne Exports of Recyclables – California Comparison (Figures 3a and 3b)

- The United States exported approximately 37.4 million tons of recyclables by sea worth almost \$14 billion in 2015.
- 44 percent of the country’s recyclable exports by weight passed through California’s ports in 2015.
- California accounted for 38 percent of the nation’s seaborne exports of recyclables by vessel value.

Figure 3a: U.S. Recyclable Exports in 2015 by Region (Weight)

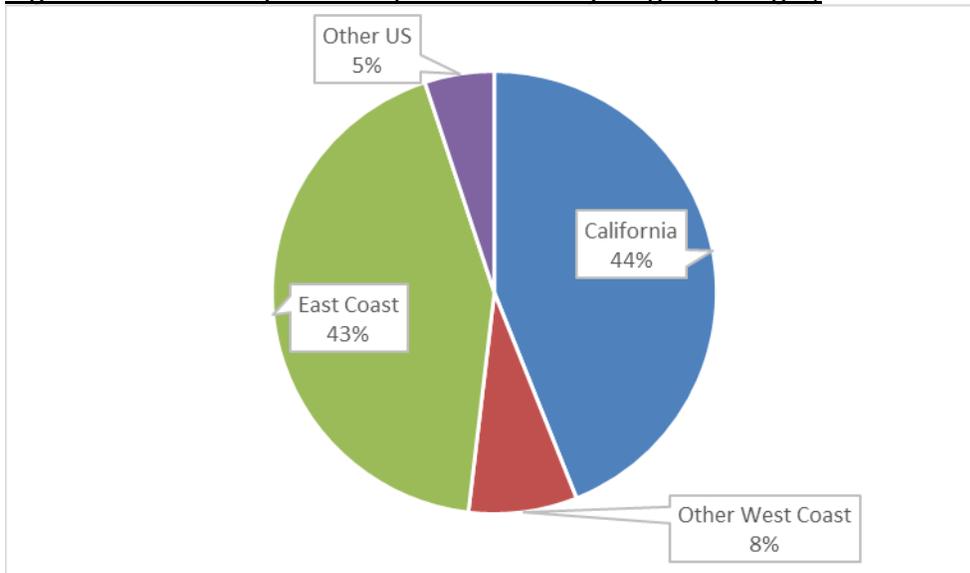
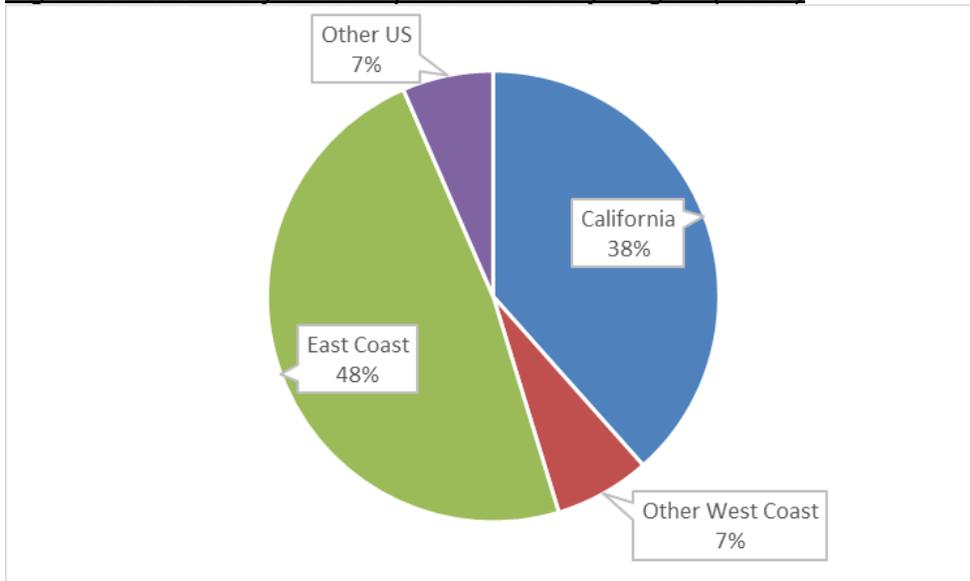


Figure 3b: U.S. Recyclable Exports in 2015 by Region (Value)



Individual Recyclable Commodities

High-Grade Paper (Figures 4a and 4b)

- The total seaborne weight exported from California was about 103,000 tons and made up about 1 percent of recyclable seaborne exports by weight.
- Compared to 2014, exports of High-Grade Paper were down more than 5 percent in 2015.
- The vessel value of High-Grade Paper seaborne exports from California was about \$25 million and made up less than 1 percent of the value of recyclable seaborne exports.
- The following four countries received 74 percent of the seaborne High-Grade Paper exports from California: China, El Salvador, Korea, and Peru.
- High-Grade Paper tonnage has fluctuated since a peak high amount in 2001.

Figure 4a: High-Grade Paper Exports from California by Country in 2015 (Weight)

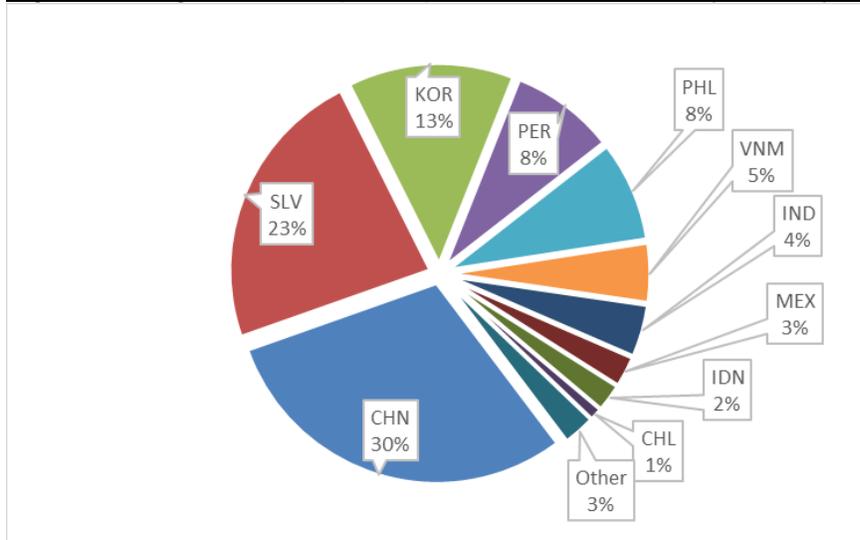
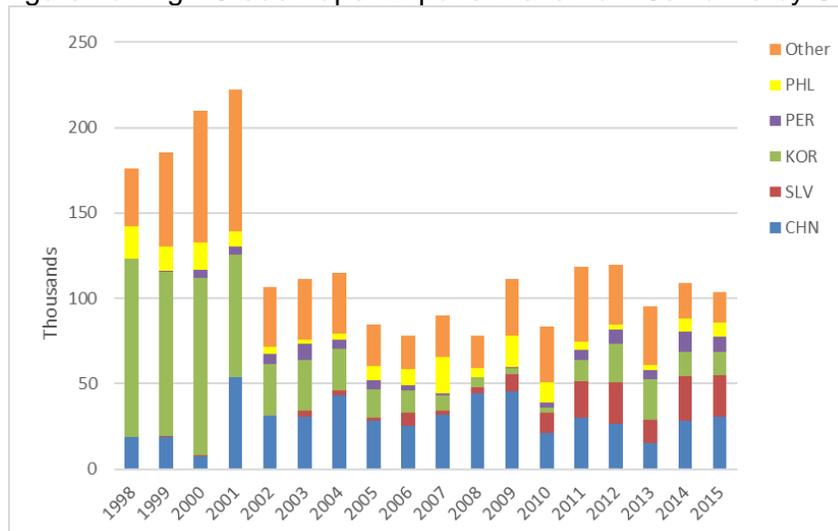


Figure 4b: High-Grade Paper Exports Trend from California by Country in 2015 (Tons)



Mixed Paper (Figures 5a and 5b)

- The Mixed Paper category includes mixed paper, cardboard, and paperboard.
- The total seaborne weight exported from California was more than 9.7 million tons. Compared to 2014, exports of Mixed Paper were up more than 1 percent in 2015.
- Mixed Paper made up 59 percent of recyclable seaborne exports. This represents the largest category by weight.
- The vessel value of Mixed Paper seaborne exports from California was nearly \$1.3 billion.
- Mixed Paper made up about 25 percent of the value of recyclable seaborne exports.
- Two countries received 94 percent of the seaborne Mixed Paper exports from California: China and Korea.

Figure 5a: Mixed Paper Exports from California by Country in 2015 (Weight)

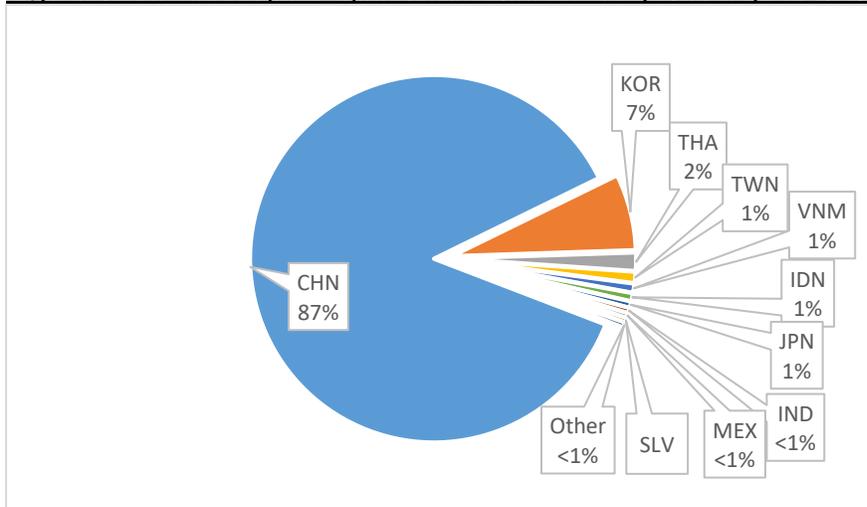
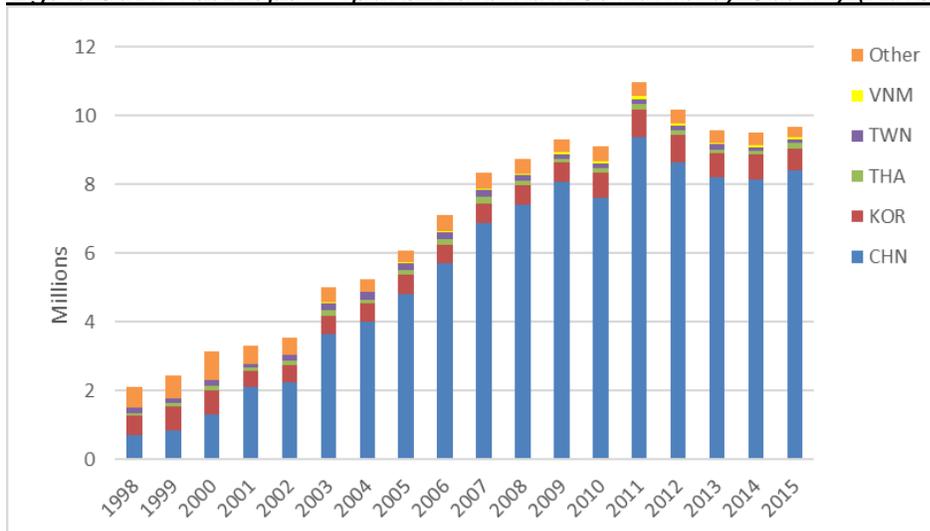


Figure 5b: Mixed Paper Exports Trend from California by Country (Tons)



Plastics 1, 2, and 4 (PET, HDPE, LDPE) (Figures 6a and 6b)

- The total seaborne weight exported from California was more than 514,000 tons. Compared to 2014, exports of Plastics 1, 2, and 4 were down 20 percent in 2015.
- Plastics 1, 2, and 4 made up 3 percent of recyclable seaborne exports by weight.
- The vessel value of Plastics 1, 2, and 4 seaborne exports from California was more than \$171 million.
- Plastics 1, 2, and 4 (High-Grade Plastics) made up 3 percent of the value of recyclable seaborne exports.
- Two countries received 87 percent of the seaborne Plastics 1, 2, and 4 exports from California: China, and Hong Kong.
- High-Grade Plastics exports returned to 2009–2013 levels following an increase in 2014.

Figure 6a: Plastics 1, 2, and 4 Exports from California by Country in 2015 (Weight)

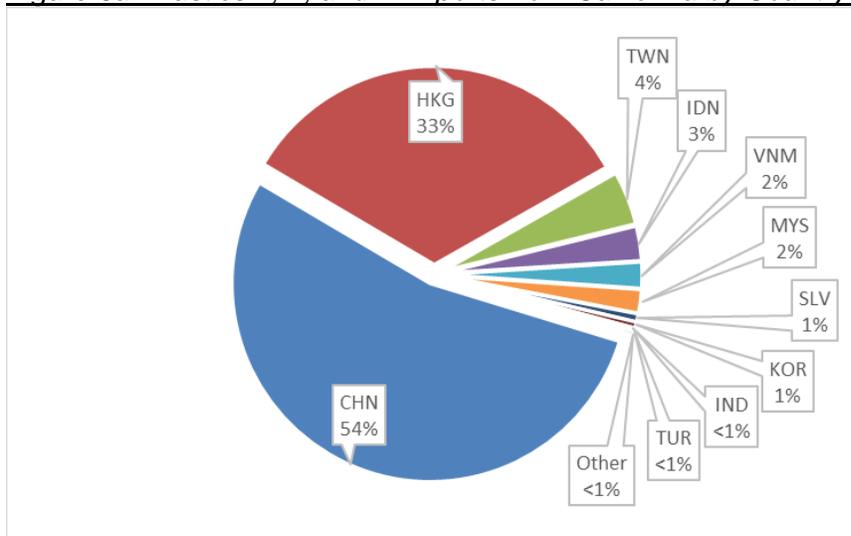
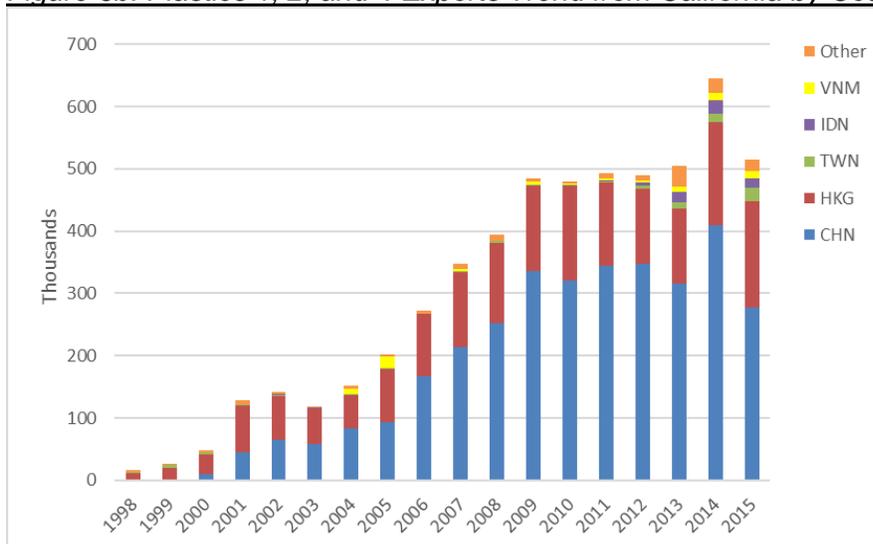


Figure 6b: Plastics 1, 2, and 4 Exports Trend from California by Country (Tons)



Other Plastics 3, 5, 6, and 7 (PVC, Polystyrene, Other) (Figures 7a and 7b)

- The total seaborne weight exported from California was about 623,000 tons. Compared to 2014, exports of Other Plastics went down less than 1 percent in 2015.
- Other Plastics made up 4 percent of recyclable seaborne exports by weight.
- The vessel value of seaborne exports from California was more than \$195 million.
- Other Plastics made up 4 percent of the value of recyclable seaborne exports.
- Two countries received 89 percent of the seaborne Plastics 3, 5, 6, and 7 exports from California: China, and Hong Kong.

Figure 7a: Other Plastics Exports from California by Country in 2015 (Weight)

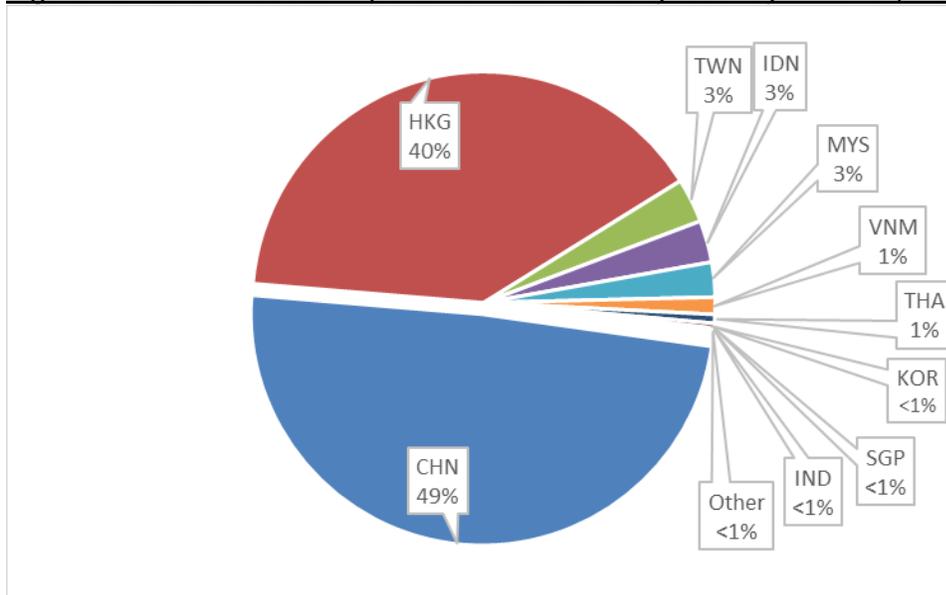
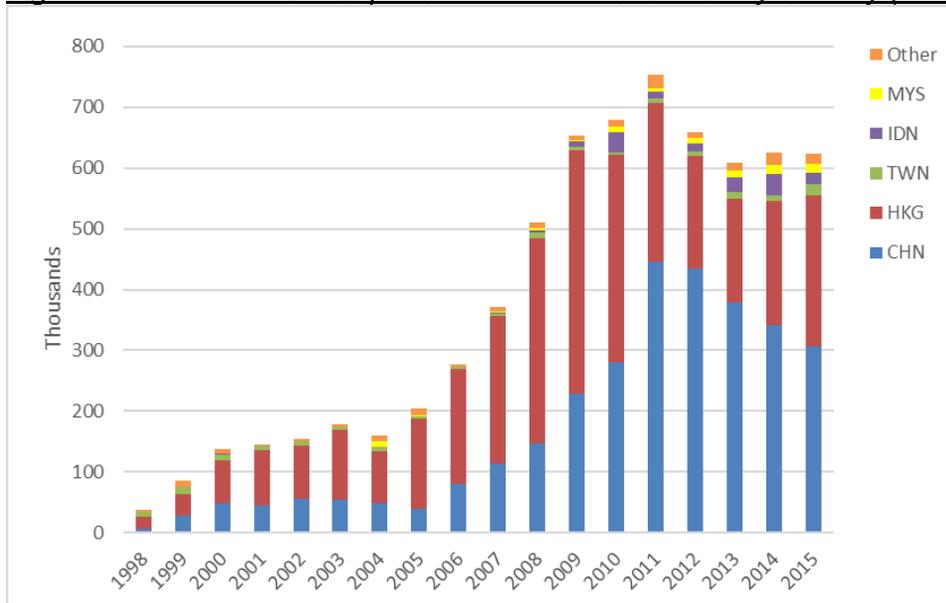


Figure 7b: Other Plastics Exports Trends from California by Country (Tons)



Glass (Figures 8a and 8b)

- The total seaborne weight exported from California was 74 tons. Compared to 2014, exports of Glass were down about 96 percent in 2015.
- Glass made up less than 1 percent of recyclable seaborne exports by weight.
- The vessel value of seaborne exports from California was about \$363,000.
- Glass made up less than 1 percent of the value of recyclable seaborne exports.
- Three countries received 77 percent of the seaborne Glass exports from California: New Zealand, Japan, and Singapore.

Figure 8a: Glass Exports from California by Country in 2015 (Weight)

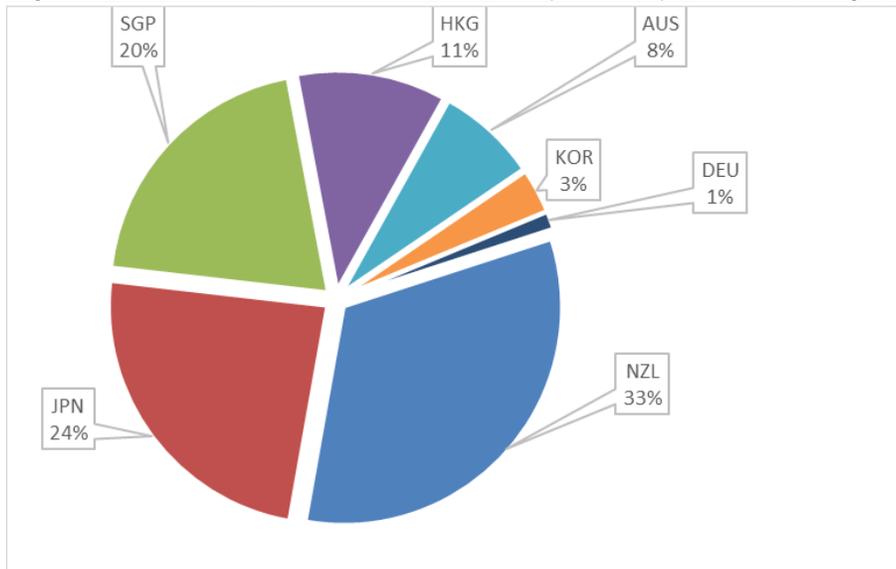
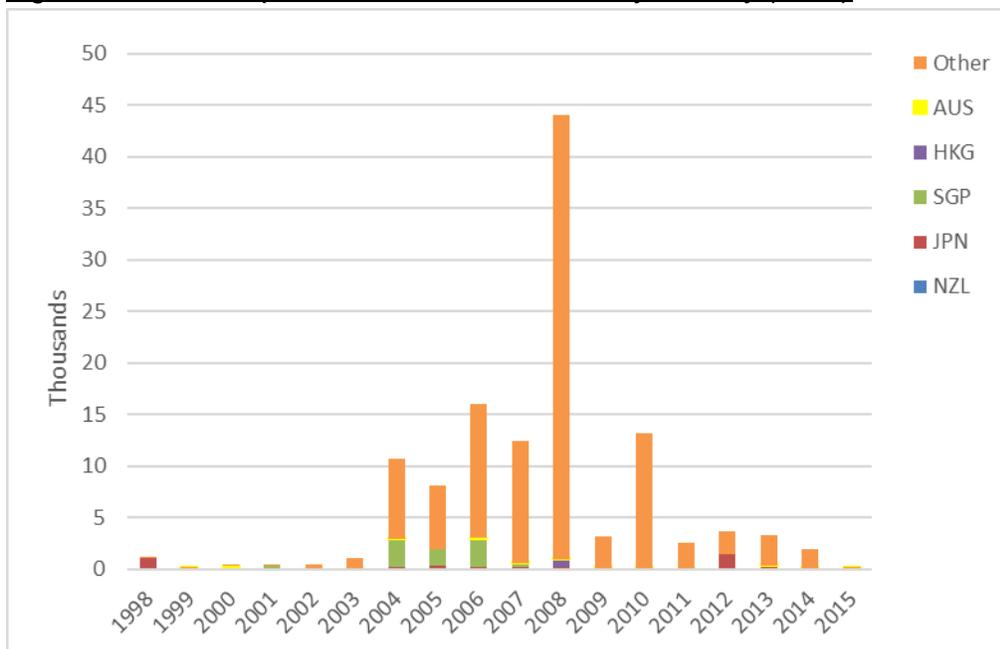


Figure 8b: Glass Exports Trend from California by Country (Tons)



Tires and Rubber Scrap (Figures 9a and 9b)

- The total seaborne weight exported from California was more than 32,000 tons. Compared to 2013, exports of Tires and Rubber Scrap went down 64 percent in 2015.
- Tires and Rubber Scrap made up less than 1 percent of recyclable seaborne exports by weight.
- The vessel value of seaborne exports from California was more than \$8.5 million.
- Tires and Rubber Scrap made up less than 1 percent of the value of recyclable seaborne exports.
- Four countries received 85 percent of the seaborne Tires and Rubber Scrap exports from California: Korea, Vietnam, Hong Kong, and China.
- Tires and Rubber Scrap tonnages have fluctuated since 2008.

Figure 9a: Tires/Rubber Scrap Exports from California by Country in 2015 (Weight)

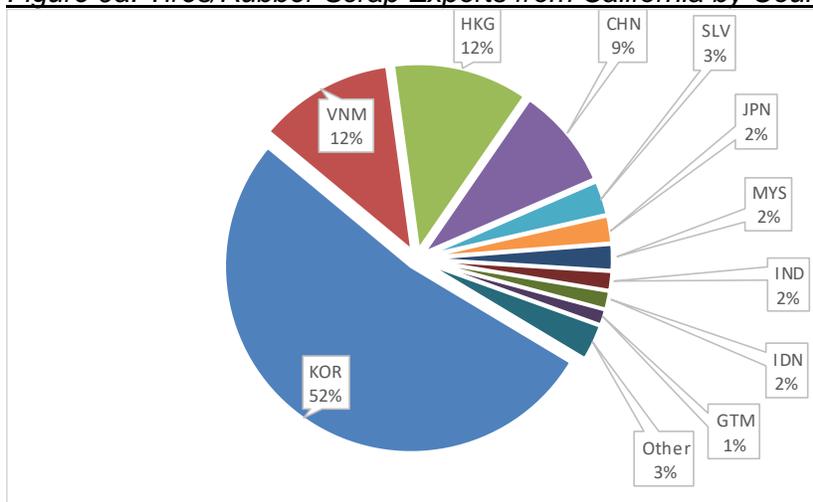
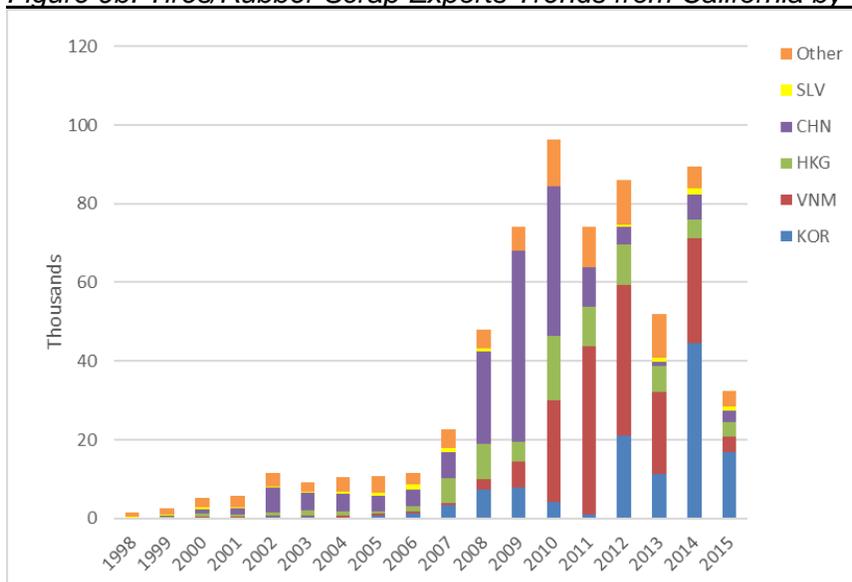


Figure 9b: Tires/Rubber Scrap Exports Trends from California by Country (Tons)



Used Oil and Grease (Figures 10a and 10b)

- The total seaborne weight exported from California was about 93 tons.
- Compared to 2014, exports of Used Oil and Grease were down 68 percent in 2015.
- Used Oil and Grease made up less than 1 percent of recyclable seaborne exports by weight.
- The vessel value of seaborne exports from California was about \$39,000.
- Used Oil and Grease made up less than 1 percent of the value of recyclable seaborne exports.
- Three countries received 100 percent of the seaborne Used Oil and Grease exports from California: Korea, Taiwan, and Singapore.
- Used Oil and Grease tonnages have decreased dramatically since 2007.

Figure 10a: Used Oil/Grease Exports from California by Country in 2015 (Weight)

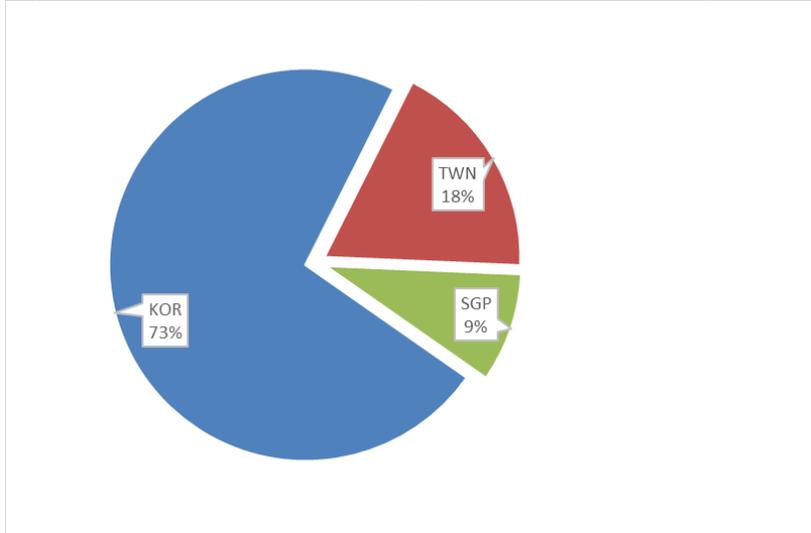
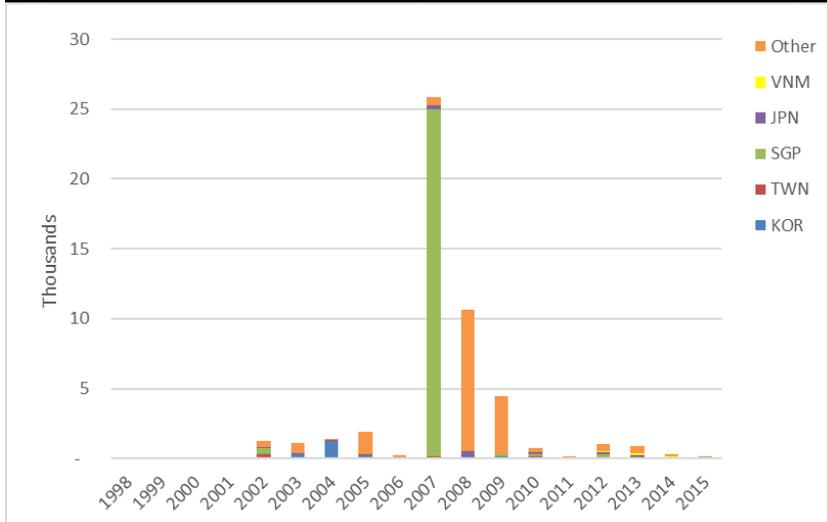


Figure 10b: Used Oil/Grease Exports Trend from California by Country (Tons)



Batteries (Figures 11a and 11b)

- The total seaborne weight exported from California was about 21,100 tons. Compared to 2014, exports of Batteries were up more than 36 percent in 2015.
- Batteries made up less than 1 percent of recyclable seaborne exports by weight.
- The vessel value of seaborne exports from California was about \$22 million.
- Batteries made up less than 1 percent of the value of recyclable seaborne exports.
- Three countries received 89 percent of the seaborne Batteries exports from California: Korea, United Arab Emirates, and Ecuador.

Figure 11a: Batteries Exports from California by Country in 2014 (Weight)

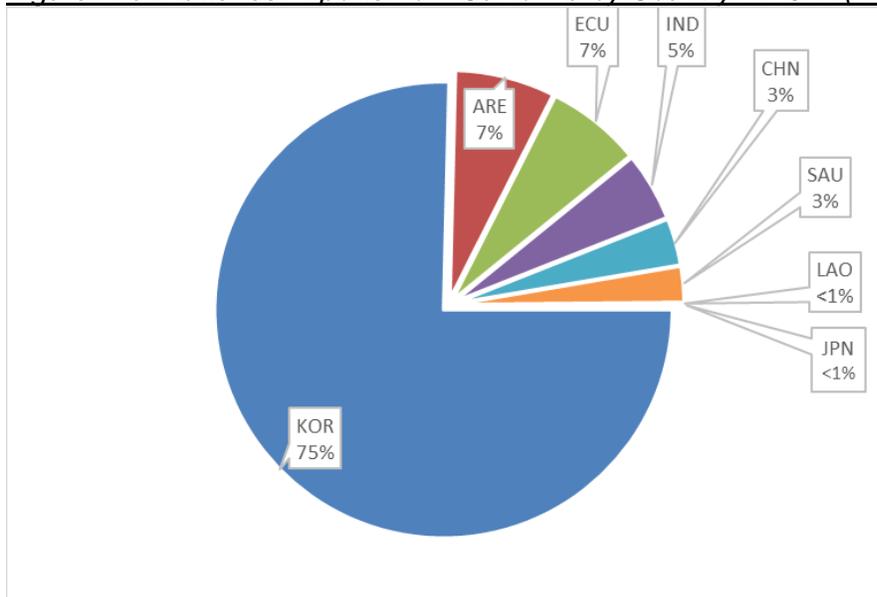
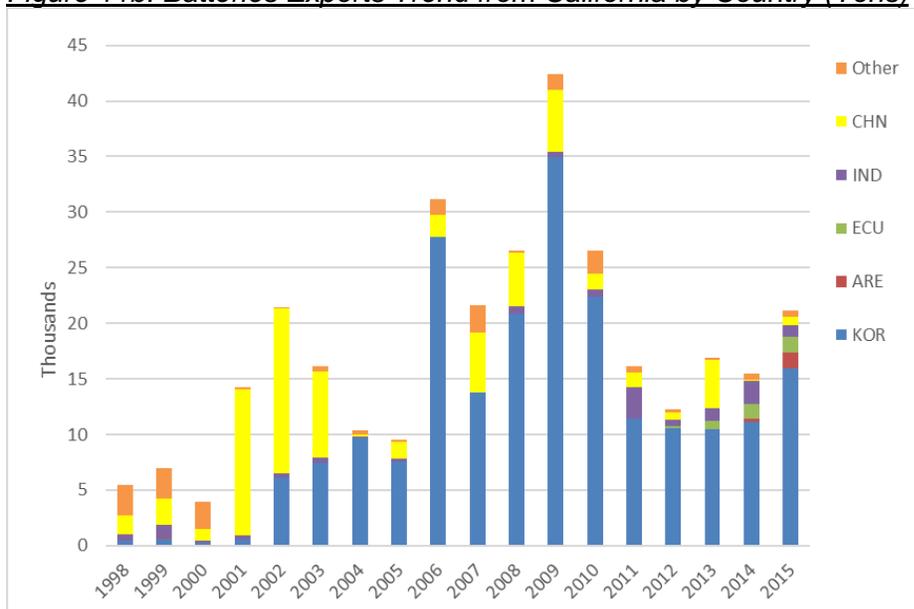


Figure 11b: Batteries Exports Trend from California by Country (Tons)



Copper Wire (Figures 12a and 12b)

- The total seaborne weight exported from California was about 11,000 tons.
- Compared to 2014, exports of Copper Wire went up 72 percent in 2015.
- Copper Wire made up less than 1 percent of recyclable seaborne exports by weight.
- The vessel value of seaborne exports from California was about \$48 million.
- Copper Wire made up less than 1 percent of the value of recyclable seaborne exports.
- The following three countries received 91 percent of the seaborne Copper Wire exports from California: China, Korea, and Taiwan.

Figure 12a: Copper Wire Exports from California by Country in 2014 (Weight)

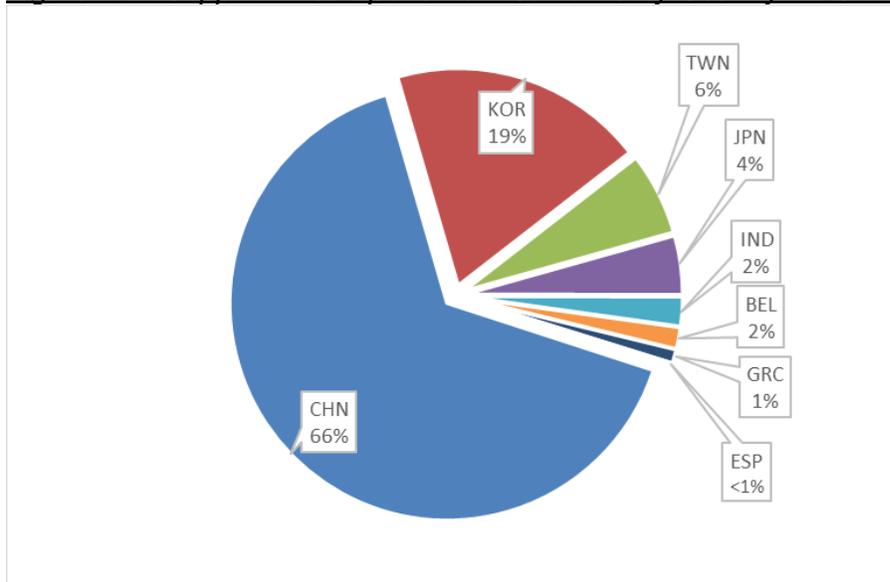
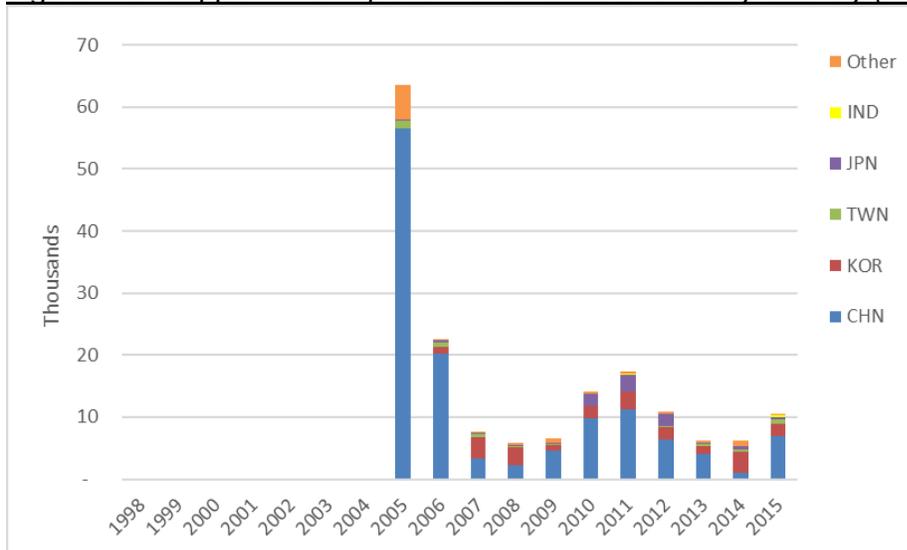


Figure 12b: Copper Wire Exports Trend from California by Country (Tons)



Ferrous Metals (Figures 13a and 13b)

- The total seaborne weight exported from California was about 4.2 million tons.
- Compared to 2014, exports of Ferrous Metals were down 25 percent in 2015.
- Ferrous Metals made up 26 percent of recyclable seaborne exports by weight.
- The vessel value of seaborne exports from California was about \$1.4 billion.
- Ferrous Metals made up 25 percent of the value of recyclable seaborne exports.
- The following three countries received 62 percent of the seaborne Ferrous Metal exports from California: Taiwan, Korea, and India.
- Ferrous Metal tonnages have decreased every year since 2011.
- Used Iron or Nonalloy Steel Rail Scrap (HS code 7302101080) was added to the Ferrous Metals category beginning with this report. Prior year tonnages displayed in the trend graph include the weights for this HS code.

Figure 13a: Ferrous Metal Exports from California by Country in 2015 (Weight)

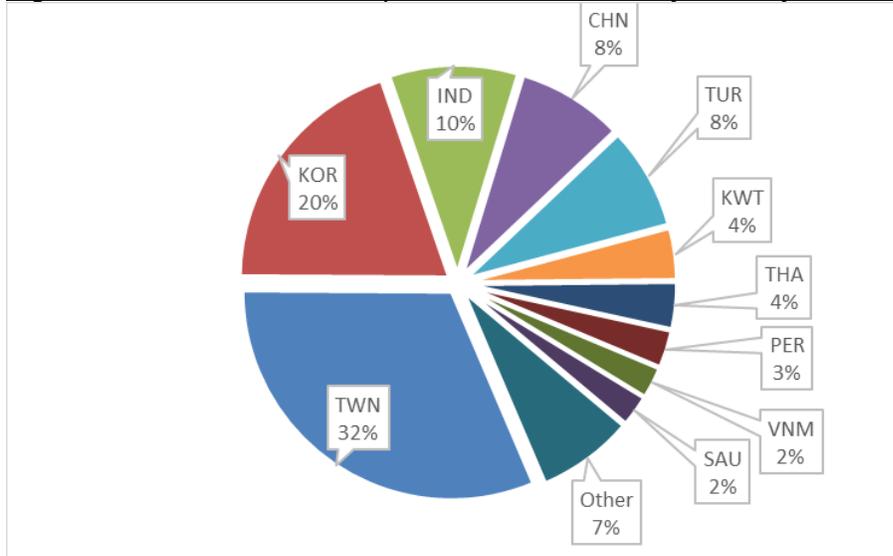
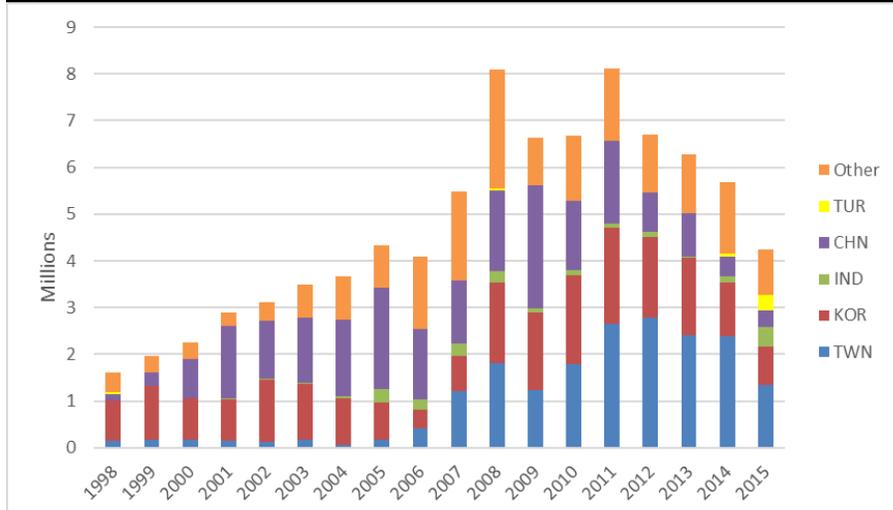


Figure 13b: Ferrous Metal Exports Trend from California by Country (Tons)



Non-Ferrous Metals (Figures 14a and 14b)

- The total seaborne weight exported from California was nearly 1.1 million tons.
- Compared to 2014, exports of Non-Ferrous Metals were down 15 percent in 2015.
- Non-Ferrous Metals made up 7 percent of recyclable seaborne exports by weight.
- The vessel value of seaborne exports from California was about \$2.1 billion.
- Non-Ferrous Metals made up 39 percent of the value of recyclable seaborne exports.
- Non-Ferrous Metals was the third-highest recyclable export category by weight but was the top category in vessel value.
- Three countries received 90 percent of the seaborne Non-Ferrous Metals exports from California: China, Korea, and Hong Kong.
- Non-Ferrous Metals tonnages have decreased every year since 2011.

Figure 14a: Non-Ferrous Metals (Excluding Copper Wire) Exports from California by Country in 2014 (Tons)

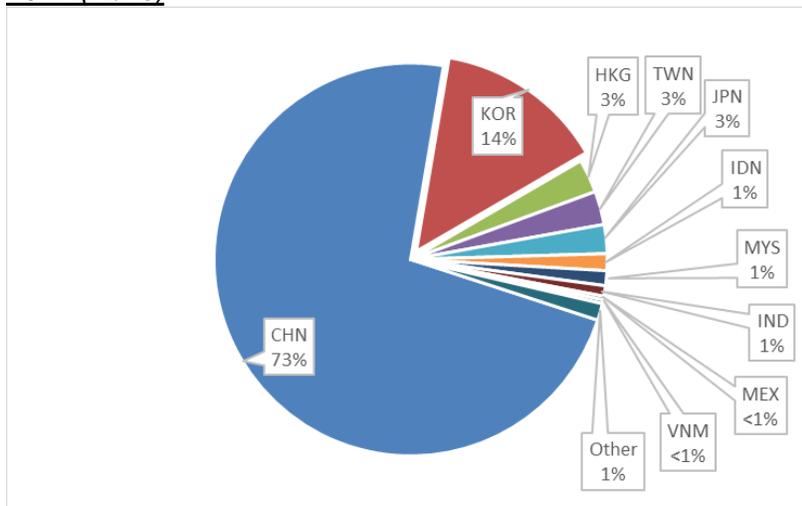
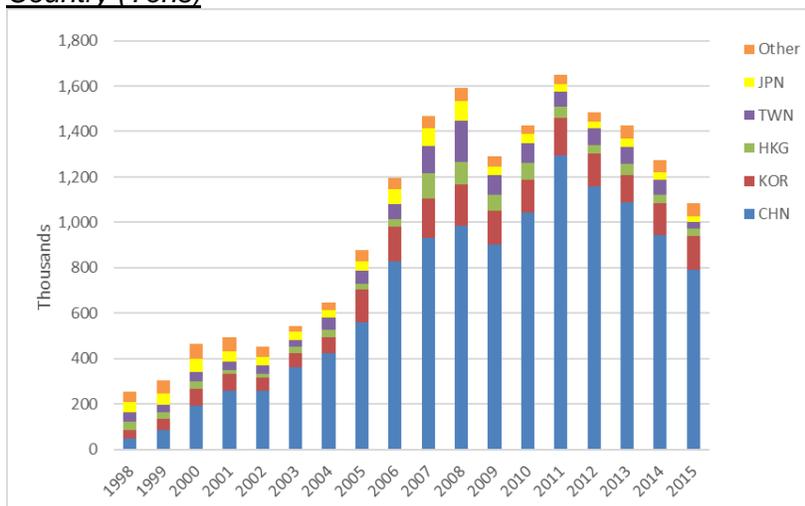


Figure 14b: Non-Ferrous Metals (Excluding Copper Wire) Exports Trend from California by Country (Tons)



Aluminum Cans (Figures 15a and 15b)

Note: Aluminum Cans are also included as part of the total weight and value of Non-Ferrous Metals.

- The total seaborne weight exported from California was about 13,000 tons. Compared to 2014, exports of Aluminum Cans were up 1,425 percent in 2015.
- Aluminum Cans made up less than 1 percent of recyclable seaborne exports by weight.
- The vessel value of seaborne exports from California was about \$18.1 million. Aluminum Cans made up less than 1 percent of the value of recyclable seaborne exports.
- Three countries received 91 percent of the seaborne Aluminum Cans exports from California: Korea, China, and Indonesia.

Figure 15a: Aluminum Cans Exports from California by Country in 2015 (Weight)

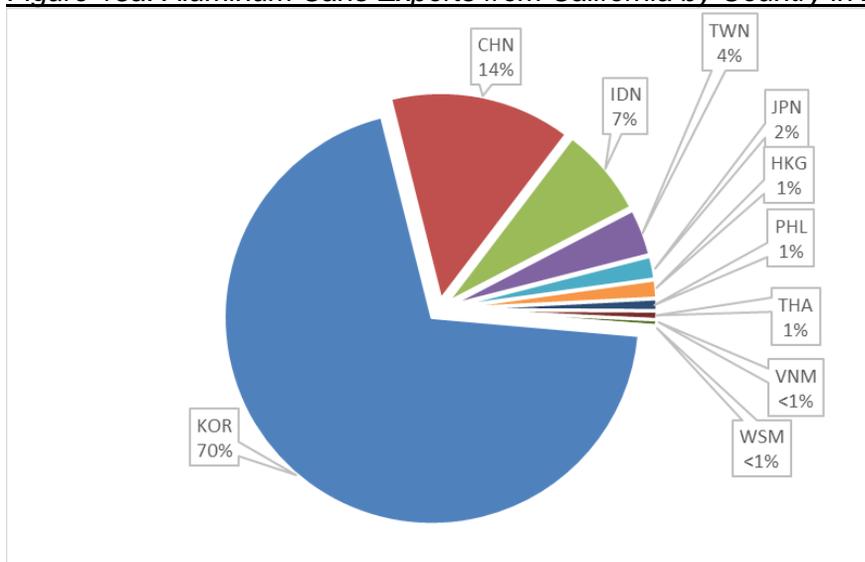
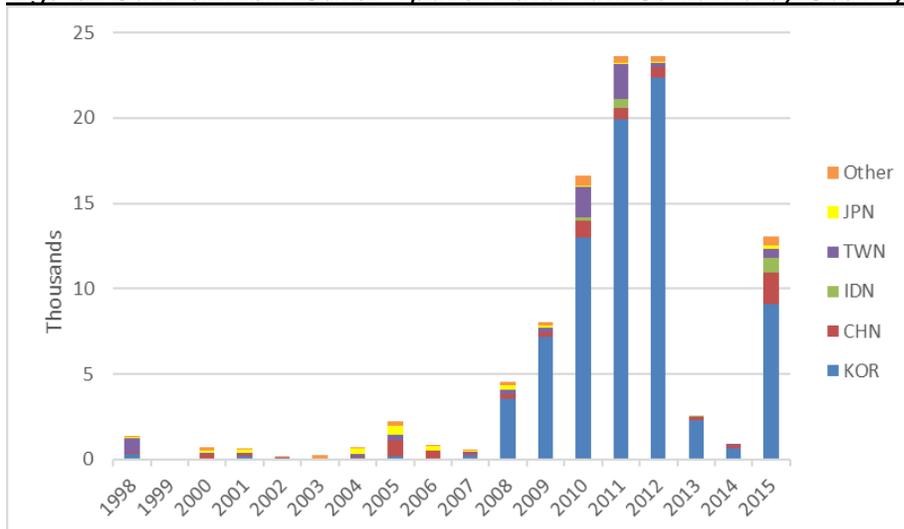


Figure 15b: Aluminum Cans Exports Trend from California by Country (Tons)



Worn Clothing (Figures 16a and 16b)

- Worn Clothing is a new category added in the 2015 exports report.
- The total seaborne weight exported from California was about 128,000 tons.
- Compared to 2014, exports of Worn Clothing were down about 3 percent in 2015.
- Worn Clothing made up 1 percent of recyclable seaborne exports by weight.
- The vessel value of Worn Clothing seaborne exports from California was about \$96 million.
- Worn Clothing made up 2 percent of the value of recyclable seaborne exports.
- The following five countries received 63 percent of the seaborne Worn Clothing exports from California: India, Guatemala, Philippines, Chile, and Pakistan.
- Worn Clothing tonnage has been declining since a peak high amount in 2012.

Figure 16a: Worn Clothing Exports from California by Country in 2015 (Weight)

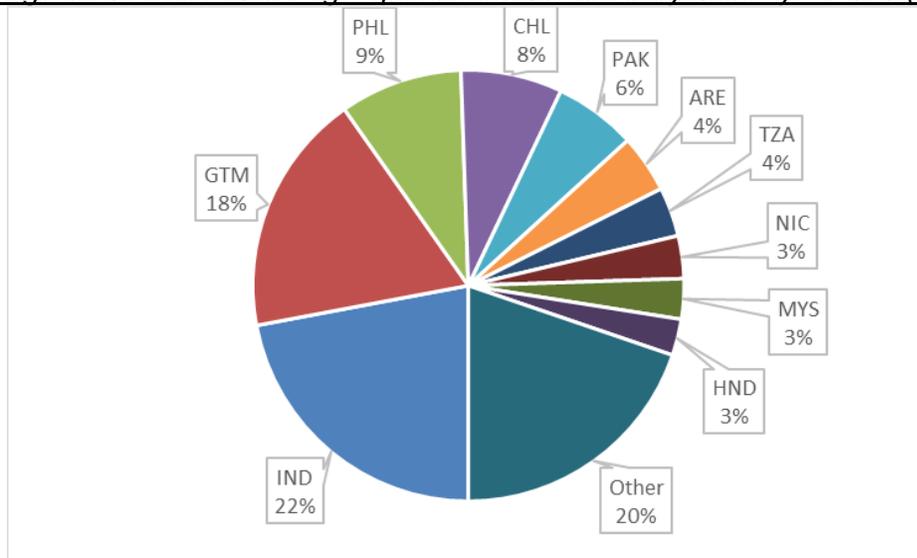
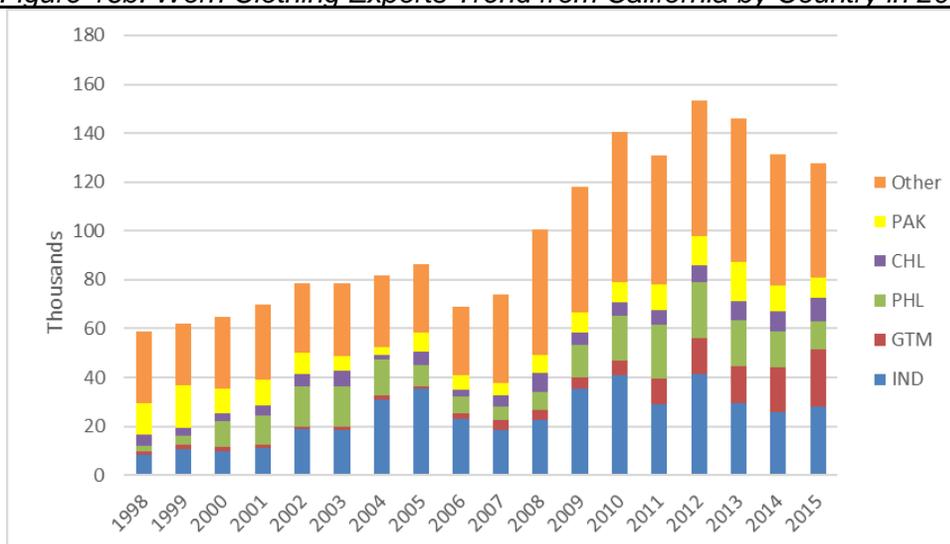


Figure 16b: Worn Clothing Exports Trend from California by Country in 2015 (Tons)



Greenhouse Gas Emissions

Approximately 16.4 million tons of recyclables were shipped out of California's ports on ocean-going vessels in 2015. Using conversion factors from the California Air Resources Board (Board, 2011), below are estimated GHG emissions associated with the seaborne transport of this material. Overall, about 2.4 million metric tons CO₂ equivalent (MTCO₂e) were created in 2015 because this recyclable material was sent overseas. These are emissions that could have been avoided had the material been processed in California.

Countries	Recyclable Materials Exported by Sea from California Ports (millions of tons)	Ocean-Going Emissions for Recyclables (MTCO ₂ e)
China	10.2	1.4
Korea, Republic of	1.7	0.2
Taiwan	1.5	0.2
India	0.5	0.1
Hong Kong	0.5	0.07
Turkey	0.3	0.05
Thailand	0.3	0.07
Vietnam	0.2	0.04
Kuwait	0.2	0.05
Indonesia	0.1	0.03
All Others	0.9	0.09
Total	16.4	2.4

Note that the estimates above are only for the ocean-going vessel leg of the material's journey. It does not include any additional GHG emissions associated with truck or rail transport of the materials prior to arriving at the port, or after arriving at the destination ports.

Truck, Rail, and Air Shipments

Information on recyclables shipped by truck and rail from California is available from the WISERTrade database, but is limited to the value of the shipment. Shipments of recyclable commodities valued less than \$2,500 can be exempted from reporting. There is no way to tell how much recyclable material falls under this exemption. Exports to Canada are not included in the report at this time due to material not entering Canada directly from California.

The values of recyclables in defined commodity groups exported to other countries by truck, rail, and air from California was at least \$72.3 million in 2015. This is a relatively small amount when compared to the \$5.4 billion shipped out by vessels from California's ports. Mexico, Japan, and Germany were the largest export partners and accounted for about \$65.6 million of that total. The remaining \$6.7 million worth went to other countries. More than 90 percent of the value of air shipments to Japan and Germany consisted of

Non-Ferrous Metals, which is a more valuable commodity group compared to other recyclables.

Figure 17a: Truck and Rail Exports of Recyclables to Mexico from California

High-Grade Paper	\$ 3,700,000
Mixed Paper	\$ 206,000
Plastics 1,2,4 (PET, HDPE, LDPE)	\$ 747,000
Other Plastics (PVC, Polystyrene, Other)	\$ 1,800,000
Glass	\$ 7,000
Tires/Rubber Scrap	\$ 6,300,000
Used Oil/Grease	\$ 62,000
Batteries	\$ 3,000
Copper Wire	\$ -
Ferrous Metals	\$ 29,800,000
Non-Ferrous Metals (excludes Copper Wire)	\$ 2,500,000
Worn Clothing	\$ 430,000
Aluminum Cans	\$ 9,000
Total	\$45,600,000

Figure 17b: Air Exports of Recyclables to Japan from California

High-Grade Paper	\$ -
Mixed Paper	\$ -
Plastics 1,2,4 (PET, HDPE, LDPE)	\$ 50,800
Other Plastics (PVC, Polystyrene, Other)	\$ -
Glass	\$ 22,600
Tires/Rubber Scrap	\$ 11,000
Used Oil/Grease	\$ -
Batteries	\$ -
Copper Wire	\$ -
Ferrous Metals	\$ -
Non-Ferrous Metals (excludes Copper Wire)	\$ 13,500,000
Worn Clothing	\$ 1,600,000
Aluminum Cans	\$ -
Total	\$ 15,200,000

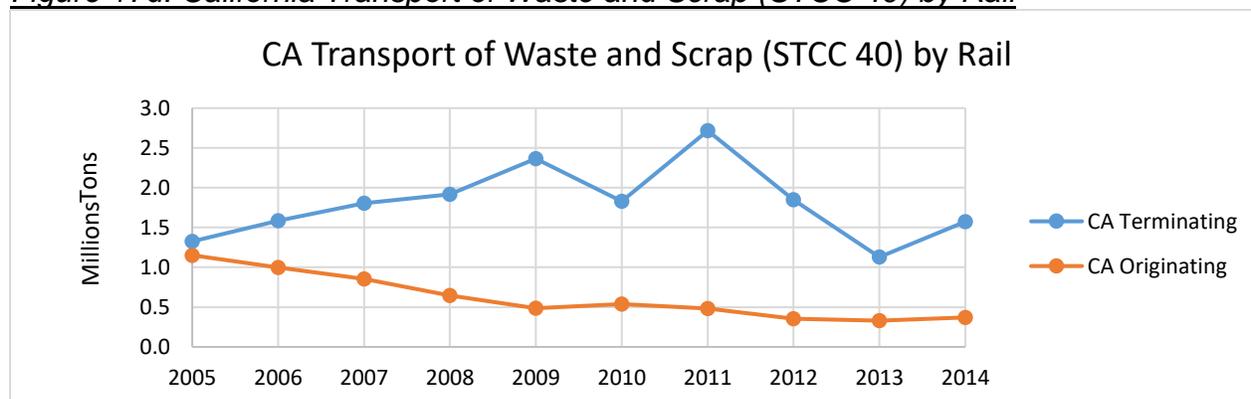
Figure 17c: Air Exports of Recyclables to Germany from California

High-Grade Paper	\$ -
Mixed Paper	\$ -
Plastics 1,2,4 (PET, HDPE, LDPE)	\$ -
Other Plastics (PVC, Polystyrene, Other)	\$ -
Glass	\$ 22,800
Tires/Rubber Scrap	\$ 159,900
Used Oil/Grease	\$ -
Batteries	\$ -
Copper Wire	\$ -
Ferrous Metals	\$ -
Non-Ferrous Metals (excludes Copper Wire)	\$ 4,600,000
Worn Clothing	\$ 3,000
Aluminum Cans	\$ -
Total	\$ 4,800,000

To gain insight about the amounts of recyclables shipped to and from other states, we have to turn to additional data sources. The Carload Waybill Sample data prepared by the U.S. Surface Transportation Board (STB) provides a stratified sample of carload waybills for all U.S. large rail traffic carriers. The waybill data tracks materials using the Standard Transportation Commodity Code (STCC) which cannot be directly compared to the commodity groups used in the rest of this paper.

Data from the 2005 through 2014 Waybill (Surface Transportation Board, n.d.) samples shows the amounts of waste and scrap in tons that left California. The data also shows the amounts that arrived in California from other states. During this time, we see that material terminating in California has ranged from 1.1 million to 2.7 million tons. Shipments of waste and scrap originating in California and sent to other states have generally decreased to less than 500,000 tons in 2014 from a high of 1.2 million tons in 2005.

Figure 17d: California Transport of Waste and Scrap (STCC 40) by Rail



The U.S. Department of Transportation conducts a commodity flow survey every five years to show the flows for domestic truck shipments. The survey uses the Standard Classification of Transported Goods (SCTG) commodity codes, and data from this source is limited in the industries that it surveys. The survey is not directly comparable with the data provided for vessel shipments from WISERTrade or the rail shipments from the Carload Waybill Samples. The last commodity flow survey was conducted in 2012 and was cited in CalRecycle's 2016 State of Recycling (CalRecycle, 2016) report. The survey identified more than 450,000 tons of waste and scrap material exported from California to domestic locations by truck, and 1.8 million tons imported to California from domestic locations.

The three systems discussed do not allow us to directly compare the data found because of the different commodity code systems and the various other limitations with these sources. However, the data sources do indicate that significant amounts of waste and scrap enter and leave California annually by truck, rail, and air, and that all shipping methods must be considered if we are to get a complete picture of the movement of recyclables from their origins to their destinations.

Data Limitations, Questions, and Future Research

The data in this report provides a look at seaborne exports of recyclables, but there are still key unanswered questions. We are exploring the different ways to account for how much of the exports truly originated in California as opposed to being collected, consolidated, and then shipped from other states for transit through California ports. Anecdotal estimates say 60 percent to 80 percent of some materials may originate in California. This is a rough estimate and covers a large range.

We have included some data on shipments of recyclables by rail and truck to Mexico and by air to Japan and Germany. Low-value shipments of less than \$2,500 are not necessarily included in those numbers. We have no way of telling how much tonnage those shipments could represent. As data becomes available, we will enhance future reports, by including information about exports to Canada. Additionally, we are exploring how to reliably determine the end uses of the recyclables that were exported. We will continue to look for answers to these and other questions. Please contact us if you have information that could help.

Conclusions

The export of recyclable materials continues to be an essential component of California's recycling infrastructure. If recyclable export markets continue to decline, then either more recyclables will be disposed, or more California domestic markets will need to be found for them. There is currently not enough capacity at California manufacturing facilities to use all 16.4 million tons of recyclables to produce new products (CalRecycle, 2016). If the exported recyclable commodities were used domestically, it is estimated that tens of thousands of new jobs could be created in California. (CalRecycle, 2013). Also due to the reduction in transportation, about 2.4 million metric tons CO2 equivalent of emissions could have been avoided if recyclables exported from our ports stayed in California.

Overall, recyclables exported from California ports had a net reduction of nearly 1.7 million tons in 2015 compared to 2014. Exports to Taiwan and Korea alone had a combined drop of 1.5 million tons, with nearly 1.4 million tons being Ferrous Metals. This drop in Ferrous Metals was likely due to the strength of the U.S. dollar (Recycling Today, 2015). Seaborne recyclable exports to China only declined by 150,000 tons, and China continues to be the largest recipient of recyclables shipped from California ports. China received 62 percent of California's seaborne recyclable exports in 2015. Due to China's shift from a manufacturing based economy toward services (Chappell, 2016), we have seen vessel exports to China decline every year since 2011.

California recyclable export declines in 2015 may be attributed to several factors. Prices for recycled commodities have been in decline for several years (Daniels, 2016), making it more difficult to profit from the collection and sale of these materials. The overall vessel value of recyclable exports, which generally includes the commodity price, freight, insurance, and other port charges (United States Census Bureau, 2016), declined 23 percent in 2015 compared to 2014. Vessel weight declined about 9 percent. The substantially larger decrease in vessel value was likely due in part to the drop in commodity prices, which are influenced by many factors including demand, the costs of virgin equivalents, and the strength of the dollar.

Low oil prices make virgin plastics cheaper (O'Leary, 2015) and push the prices for recycled plastics down in order to compete. The U.S. dollar has been strong against other currencies for several years, which makes U.S. exports relatively expensive compared to other countries (Bogage, 2016). This, along with a weak global economy in 2015 had a negative effect on U.S. exports in general (Bartash, 2016). In addition, a slowdown in imports and exports of goods occurred during contract disputes at West Coast ports in late 2014 and early 2015 (Amiti, 2015).

Despite the information presented in this report, many questions remain. Does the drop in exports mean:

- more recyclable materials went into the domestic market?
- more recyclable materials was disposed?

- less recyclable material was collected in California?
- less material was being sent to California's ports from other states?

The answer is not clear, but it is important to understand where recyclables are being generated and where they are going. With the passage of AB 901 (Gordon, Chapter 976, Statutes of 2015) and the development of recycling reporting regulations, CalRecycle may have additional tools available in the next few years to help answer some of these questions and move us forward in our efforts to meet our goal of 75 percent recycling.

Appendices

Appendix 1: California Recyclables Vessel Weight in Tons Exported by Sea in 2015 (Top 10 Partner Countries and All Others)

	China	Korea, Republic of	Taiwan	India	Hong Kong	Turkey	Thailand	Vietnam	Kuwait	Indonesia	All Others	Total Tons
High-Grade Paper	30,867	13,842	124	4,336	156	0	905	4,933	0	2,274	45,891	103,326
Mixed Paper/Card	8,399,742	649,843	96,238	44,125	5,314	88	155,523	77,155	0	68,720	167,171	9,663,918
Plastics 1, 2, 4	276,359	2,487	22,496	795	171,451	583	581	10,902	0	14,461	14,082	514,196
Other Plastics	305,975	2,093	19,276	795	248,251	0	3,823	7,435	0	18,270	17,300	623,218
Glass	0	2	0	0	8	0	0	0	0	0	64	74
Tires/Rubber	2,866	16,941	122	527	3,798	0	26	3,806	0	502	3,712	32,300
Used Oil/Grease	0	68	17	0	0	0	0	0	0	0	8	93
Batteries	701	15,910	0	1,027	0	0	0	0	0	0	3,468	21,106
Worn Clothing	1	100	0	28,134	73	319	207	0	0	0	98,816	127,649
Copper Wire	6,918	2,006	649	229	0	0	0	0	0	0	759	10,561
Ferrous Metal	348,424	834,333	1,337,192	422,527	24,632	337,395	153,453	102,555	169,859	21,252	495,645	4,247,269
Non-Ferrous (excluding copper wire)	789,416	151,546	29,937	9,317	30,060	0	3,089	3,297	0	15,039	54,057	1,085,759
Aluminum Cans (included in Non- Ferrous)	1,849	9,071	477	21	183	0	85	59	0	915	373	13,034
Total All Selected Materials	10,161,268	1,689,172	1,506,053	511,812	483,742	338,385	317,607	210,082	169,859	140,519	900,972	16,429,472
Total All Exports (Recycled and Not)	20,661,363	4,576,390	3,743,140	1,662,228	1,466,560	514,968	1,052,181	1,429,148	188,128	1,290,274	27,196,136	63,780,515

**Appendix 2: Market Share of California Recyclables Vessel Weight in Tons Exported by Sea in 2015
(Top 10 Partner Countries and All Others)**

	China	Korea, Republic of	Taiwan	India	Hong Kong	Turkey	Thailand	Vietnam	Kuwait	Indonesia	All Others	Total
High-Grade Paper	30%	13%	<1%	4%	<1%	0%	1%	5%	0%	2%	44%	100%
Mixed Paper/Card	87%	7%	1%	<1%	<1%	<1%	2%	1%	0%	1%	2%	99%
Plastics 1, 2, 4	54%	<1%	4%	<1%	33%	<1%	<1%	2%	0%	3%	3%	99%
Other Plastics	49%	<1%	3%	<1%	40%	0%	1%	1%	0%	3%	3%	100%
Glass	0%	3%	0%	0%	11%	0%	0%	0%	0%	0%	86%	100%
Tires/Rubber	9%	52%	<1%	2%	12%	0%	<1%	12%	0%	2%	11%	100%
Used Oil/Grease	0%	73%	18%	0%	0%	0%	0%	0%	0%	0%	9%	100%
Batteries	3%	75%	0%	5%	0%	0%	0%	0%	0%	0%	16%	100%
Worn Clothing	<1%	<1%	<1%	22%	<1%	<1%	<1%	0%	0%	0%	77%	99%
Copper Wire	66%	19%	6%	2%	0%	0%	0%	0%	0%	0%	7%	100%
Ferrous Metal	8%	20%	31%	10%	1%	8%	4%	2%	4%	1%	12%	100%
Non-Ferrous (excluding copper wire)	73%	14%	3%	1%	3%	0%	<1%	<1%	0%	1%	5%	99%
Aluminum Cans (included in Non- Ferrous)	14%	70%	4%	<1%	1%	0%	1%	<1%	0%	7%	3%	99%
Total All Selected Materials	62%	10%	9%	3%	3%	2%	2%	1%	1%	1%	5%	100%
Total All Exports (Recycled and Not)	32%	7%	6%	3%	2%	1%	2%	2%	<1%	2%	43%	100%

Appendix 3: California Recyclables Vessel Value Exported by Sea in 2015 (Top 10 Partner Countries and All Others, in Thousands of Dollars)

	China	Korea, Republic of	Taiwan	Hong Kong	Japan	India	Turkey	Thailand	Indonesia	Vietnam	All Others	Total Dollars
High-Grade Paper	\$6,259,308	\$2,877,033	\$24,000	\$28,415	\$10,470	\$1,157,527	\$0	\$148,100	\$507,427	\$1,618,406	\$12,554,960	\$25,185,646
Mixed Paper/Card	\$1,138,022,532	\$111,287,826	\$16,019,163	\$838,289	\$7,764,945	\$5,132,257	\$25,000	\$19,058,935	\$9,494,203	\$11,906,335	\$26,943,136	\$1,346,492,621
Plastics 1, 2, 4	\$92,492,663	\$1,939,251	\$7,161,274	\$55,966,143	\$173,584	\$454,376	\$181,260	\$147,469	\$4,810,414	\$2,815,114	\$5,431,753	\$171,573,301
Other Plastics	\$91,550,736	\$1,890,625	\$5,180,837	\$82,394,056	\$129,727	\$298,203	\$0	\$1,177,554	\$6,490,400	\$2,460,239	\$4,030,127	\$195,602,504
Glass	\$0	\$17,722	\$0	\$74,990	\$182,269	\$0	\$0	\$0	\$0	\$0	\$88,505	\$363,486
Tires/Rubber	\$2,485,686	\$1,477,717	\$60,103	\$1,232,724	\$809,505	\$74,500	\$0	\$28,552	\$71,100	\$599,896	\$1,680,304	\$8,520,087
Used Oil/Grease	\$0	\$24,181	\$9,936	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$4,968	\$39,085
Batteries	\$853,760	\$16,441,432	\$0	\$0	\$14,400	\$1,670,036	\$0	\$0	\$0	\$0	\$2,992,837	\$21,972,465
Worn Clothing	\$5,289	\$155,375	\$3,942	\$43,276	\$3,559,757	\$9,055,505	\$339,776	\$253,457	\$0	\$0	\$82,480,066	\$95,896,443
Copper Wire	\$30,315,980	\$10,189,925	\$2,997,487	\$0	\$2,109,253	\$912,220	\$0	\$0	\$0	\$0	\$1,245,455	\$47,770,320
Ferrous Metal	\$314,807,215	\$211,785,828	\$390,380,547	\$16,448,561	\$37,079,903	\$104,638,282	\$67,709,782	\$39,129,812	\$5,882,331	\$21,447,886	\$155,034,483	\$1,364,344,630
Non-Ferrous (excluding copper wire)	\$1,438,712,078	\$269,488,077	\$54,167,575	\$48,928,005	\$151,201,148	\$14,062,628	\$0	\$5,732,408	\$20,344,528	\$5,439,937	\$104,524,042	\$2,112,600,426
Aluminum Cans (included in Non- Ferrous)	\$2,727,514	\$12,411,335	\$789,466	\$233,743	\$414,030	\$28,950	\$0	\$92,470	\$1,087,789	\$106,000	\$270,820	\$18,162,117
Total All Selected Materials	\$3,115,505,247	\$627,574,992	\$476,004,864	\$205,954,459	\$203,034,961	\$137,455,534	\$68,255,818	\$65,676,287	\$47,600,403	\$46,287,813	\$397,010,636	\$5,390,361,014
Total All Exports (Recycled and Not)	\$19,301,241,606	\$9,216,781,739	\$5,170,573,489	\$4,383,753,690	\$12,338,924,523	\$1,333,931,307	\$497,600,759	\$1,750,992,070	\$1,409,679,946	\$2,038,122,076	\$27,724,016,184	\$85,165,617,389

Appendix 4: Market Share of California Recyclables Vessel Value Exported by Sea in 2015 (Top 10 Partner Countries and All Others)

	China	Korea, Republic of	Taiwan	Hong Kong	Japan	India	Turkey	Thailand	Indonesia	Vietnam	All Others	Total
High-Grade Paper	25%	11%	<1%	<1%	<1%	5%	0%	1%	2%	6%	50%	100%
Mixed Paper/Card	85%	8%	1%	<1%	1%	<1%	<1%	1%	1%	1%	2%	100%
Plastics 1, 2, 4	54%	1%	4%	33%	<1%	<1%	<1%	<1%	3%	2%	3%	99%
Other Plastics	47%	1%	3%	42%	<1%	<1%	0%	1%	3%	1%	2%	100%
Glass	0%	5%	0%	21%	50%	0%	0%	0%	0%	0%	24%	100%
Tires/Rubber	29%	17%	1%	14%	10%	1%	0%	<1%	1%	7%	20%	100%
Used Oil/Grease	0%	62%	25%	0%	0%	0%	0%	0%	0%	0%	13%	100%
Batteries	4%	75%	0%	0%	<1%	8%	0%	0%	0%	0%	14%	100%
Worn Clothing	<1%	<1%	<1%	<1%	4%	9%	<1%	<1%	0%	0%	86%	99%
Copper Wire	63%	21%	6%	0%	4%	2%	0%	0%	0%	0%	3%	100%
Ferrous Metal	23%	16%	29%	1%	3%	8%	5%	3%	<1%	2%	11%	100%
Non-Ferrous (excluding copper wire)	68%	13%	3%	2%	7%	1%	0%	<1%	1%	<1%	5%	99%
Aluminum Cans (included in Non- Ferrous)	15%	68%	4%	1%	2%	<1%	0%	1%	6%	1%	1%	100%
Total All Selected Materials	58%	12%	9%	4%	4%	3%	1%	1%	1%	1%	7%	100%
Total All Exports (Recycled and Not)	23%	11%	6%	5%	14%	2%	1%	2%	2%	2%	33%	100%

Appendix 5: Summary of California Port Exports of Recyclables in 2015 (By Weight, Value, and Market Share)

Material	Tons	% All Recycle Exports (tons)	% Annual Exports (tons)	Dollars	% All Recycle Exports	% Annual Exports
Mixed Paper/Cardboard and Paperboard	9,663,918	59%	15%	\$1,346,492,621	25%	2%
Ferrous Metal	4,247,269	26%	7%	\$1,364,344,630	25%	2%
Non-Ferrous Metal (excluding copper wire)	1,085,759	7%	2%	\$2,112,600,426	39%	2%
Other Plastics	623,218	4%	1%	\$195,602,504	4%	<1%
Plastics 1, 2, 4	514,196	3%	1%	\$171,573,301	3%	<1%
Worn Clothing	127,649	1%	<1%	\$95,896,443	2%	<1%
High Grade Paper	103,326	1%	<1%	\$25,185,646	<1%	<1%
Tires/Rubber	32,300	<1%	<1%	\$8,520,087	<1%	<1%
Batteries	21,106	<1%	<1%	\$21,972,465	<1%	<1%
Copper Wire	10,561	<1%	<1%	\$47,770,320	<1%	<1%
Used Oil/Grease	93	<1%	<1%	\$39,085	<1%	<1%
Glass	74	<1%	<1%	\$363,486	<1%	<1%
Aluminum Cans (included in Non-Ferrous)	13,034	<1%	<1%	\$18,162,117	<1%	<1%
Total All Selected Materials	16,429,472	100%	26%	\$5,390,361,014	100%	6%
Total All Exports (Recycled and Not)	63,780,515	N/A	100%	\$85,165,617,389		100%

Appendix 6: Country Code Abbreviations by Rank

CHN	China	AGO	Angola	TUN	Tunisia
KOR	Korea, Republic Of	AUS	Australia	SRB	Serbia
TWN	Taiwan	GRC	Greece	ISR	Israel
IND	India	BEL	Belgium	NER	Niger
HKG	Hong Kong	ARG	Argentina	CIV	Ivory Coast
TUR	Turkey	MOZ	Mozambique	IRQ	Iraq
THA	Thailand	SLE	Sierra Leone	BGR	Bulgaria
VNM	Vietnam	DOM	Dominican Republic	OMN	Oman
KWT	Kuwait	DEU	Germany	CMR	Cameroon
IDN	Indonesia	COD	Congo, Democratic Republic Of The Congo	MWI	Malawi
PER	Peru	BOL	Bolivia	GAB	Gabon
JPN	Japan	JOR	Jordan	UKR	Ukraine
SAU	Saudi Arabia	COL	Colombia	IOT	British Indian Ocean Terr.
BGD	Bangladesh	SWE	Sweden	DJI	Djibouti
MEX	Mexico	NGA	Nigeria	BRA	Brazil
SLV	El Salvador	TGO	Togo	HUN	Hungary
MYS	Malaysia	ZAF	South Africa	JAM	Jamaica
PAK	Pakistan	UGA	Uganda	GNQ	Equatorial Guinea
ECU	Ecuador	COG	Congo, Republic Of The Congo	GEO	Georgia
GTM	Guatemala	SOM	Somalia	BRN	Brunei
PHL	Philippines	VEN	Venezuela	CHE	Switzerland
CHL	Chile	LAO	Laos	URY	Uruguay
ARE	United Arab Emirates	GIN	Guinea	LTU	Lithuania
TZA	Tanzania	SEN	Senegal	DMA	Dominica
NIC	Nicaragua	LKA	Sri Lanka	FRA	France
HND	Honduras	LUX	Luxembourg	FSM	Federated States Of Micronesia
SGP	Singapore	LBN	Lebanon	GMB	The Gambia
KHM	Cambodia	HTI	Haiti	BIH	Bosnia-Herzegovina
CRI	Costa Rica	ITA	Italy	LCA	St. Lucia
KEN	Kenya	MLI	Mali	MNG	Mongolia
PAN	Panama	NZL	New Zealand	POL	Poland
ESP	Spain	GHA	Ghana	RUS	Russia
BEN	Benin	WSM	Western Samoa	YEM	Republic Of Yemen
NLD	Netherlands	LBR	Liberia	LVA	Latvia
GBR	United Kingdom	ZMB	Zambia		

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