FINAL REPORT

STUDY OF THE CONVENTIONAL BULK-REFRIGERATED (NON-CONTAINERIZED) CARGO MARKET SEGMENT CONTRACT SAA-154968

Volume I – Conventional Reefer Ships

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9 March 2004

TABLE OF CONTENTS

EXECUTIVE SUMMARY ES-1

GLOBAL TRADE OUTLOOK – REEFER PRODUCTS ES-1
CANAL TRAFFIC – CONVENTIONAL REEFER SHIPS ES-1
THE REEFER AND CONTAINERSHIP FLEETS ES-5
ECONOMIC VALUE OF THE PANAMA CANAL ES-6
MARKETING STRATEGY RECOMMENDATION ES-8
CONCLUSIONS ES-8

I. INTRODUCTION 1

II. GLOBAL REEFER COMMODITY SHIPMENT OUTLOOK 2

THE REEFER FLEET 2
THE GLOBAL OUTLOOK FOR REEFER COMMODITY DEMAND 3
TRADE IN REEFER COMMODITIES 3
REEFER TRADES MOST RELEVANT TO THE CANAL 6
GLOBAL REEFER TRADE FORECAST BY COMMODITY 8
IMPACT OF TRADE AGREEMENTS 26
RISK IN TRADE CREATION 50
THE EL NIÑO EFFECT 53

III. THE CONVENTIONAL REEFER AND REEFER CONTAINER SHIP FLEET 57

CURRENT REEFERSHIP FLEET 57
REEFER ORDERBOOK 66
POOL PATTERNS IN THE INDUSTRY 67
DEPLOYMENT PATTERNS 69
FUTURE DEVELOPMENTS – CONVENTIONAL REEFER SHIPS 70
COMPETITION FROM CONTAINERS 71
THE CONTAINERSHIP FLEET 74
SCRAPPING – CONTAINER FLEET 77
DEPLOYMENT – CONTAINER FLEET 77
THE CONTAINERSHIP ORDERBOOK 80
MAJOR CONTAINERSHIP REEFER OPERATORS 81
CONCLUSION 83

IV. PANAMA CANAL FORECAST 84

TRANSIT AND REVENUE HISTORY – REEFER SHIPS 84
APPROACH 84
FORECAST SUMMARY 85

V. THE ECONOMIC VALUE OF THE PANAMA CANAL ROUTES VERSUS ALTERNATIVES 88

OPERATING COSTS 88
TIME COSTS 89
VALUE OF THE PANAMA CANAL 90

VI. PANAMA CANAL TRANSIT AND REVENUE MODEL 97

TRADE FLOWS IN METRIC TONS 97
TRADE FLOW FILTERS 101
TRADE ROUTES 104
ROUTE OPERATING COSTS 105
SHIP CHARACTERISTICS 107
DEADWEIGHT TONS AND TRANSITS 108
PCUMS 109
REVENUES BY SHIP CHARACTERISTICS 114

VII. RISK ANALYSIS 115

VIII. MARKETING AND PRICING STRATEGY 118

BULK REEFER MARKET SEGMENTATION AND PRICING STRATEGY 119
PROPOSED MARKETING AND PRICING STRATEGY 120
CONCLUSION 121

TABLE OF FIGURES

FIGURE ES.1 CANAL REVENUES & TRANSITS ES-3
FIGURE ES.2 PCUMS CHANGES, 2003-2025 ..... ES-4
FIGURE ES.3 CANAL CARGO - LONG TONS ES-4
FIGURE ES.4 ECONOMIC VALUE OF THE CANAL, BY ROUTE ES-7
FIGURE II.1 CONVENTIONAL REEFER FLEET VS. REEFER SLOTS ON CONTAINER VESSELS 2
FIGURE II.2 WORLD SEABORNE REEFER TRADE BY COMMODITY 5
FIGURE II.3 WORLD SEABORNE REEFER TRADE BY COMMODITY 5
FIGURE II.4 BANANA EXPORTS (MILLION METRIC TONS) 8
FIGURE II.5 BANANA IMPORTS (MILLION METRIC TONS) 9
FIGURE II.6 SEAFOOD EXPORTS (MILLION METRIC TONS) 10
FIGURE II.7 SEAFOOD IMPORTS (METRIC TONS) 11
FIGURE II.8 OTHER DECIDUOUS FRUIT EXPORTS (MILLION METRIC TONS) 12
FIGURE II.9 OTHER DECIDUOUS FRUIT IMPORTS (MILLION METRIC TONS) 13
FIGURE II.10 CITRUS FRUIT EXPORTS (METRIC TONS) 14
FIGURE II.11 CITRUS FRUIT IMPORTS (MILLION METRIC TONS) 15
FIGURE II.12 MEAT EXPORTS (METRIC TONS) 16
FIGURE II.13 MEAT IMPORTS (MILLION METRIC TONS) 17
FIGURE II.14 VEGETABLE EXPORTS (MILLION METRIC TONS) 18
FIGURE II.15 VEGETABLES IMPORTS (MILLION METRIC TONS) 19
FIGURE II.16 POULTRY EXPORTS (MILLION METRIC TONS) 20
FIGURE II.17 POULTRY IMPORTS (MILLION METRIC TONS) 21
FIGURE II.18 APPLE EXPORTS (MILLION METRIC TONS) 22
FIGURE II.19 APPLE IMPORTS (MILLION METRIC TONS) 23
FIGURE II.20 DAIRY EXPORTS (MILLION METRIC TONS) 24
FIGURE II.21 DAIRY IMPORTS (MILLION METRIC TONS) 25
FIGURE III.1 HISTORICAL REEFER CAPACITY 57
FIGURE III.2 NUMBER OF REEFER SHIPS BUILT BY YEAR OPERATING AT NOVEMBER 1, 2003 58
FIGURE III.3 ANNUAL GROWN IN REEFER FLEET CUFT CAPACITY, 1983-2003 60
FIGURE III.4 ANNUAL GROWTH IN CONTAINER CAPACITY, 1983-2003 60
FIGURE III.5 AVG. CUFT AND TEU BY YOB OF SHIPS IN SERVICE AT NOV 2003 64
FIGURE III.6 AVG. CONTAINERSHIP TEU AND REEFER PLUGS BY YEAR OF BUILD 64
FIGURE III.7 REEFERSHIP FLEET AT NOV 2003, BY YOB, SHOWING EFFECT OF CONTAINERS ON OVERALL CAPACITY 71
FIGURE III.8 AVERAGE REEFER SHIP CAPACITY, INCLUDING AVERAGE REEFER TEU CAPACITY BY YOB AT NOV 2003 72
FIGURE IV.1 CANAL TRANSITS & REVENUE FORECAST 86
FIGURE IV.2 AVERAGE PCUMS OF TRANSITING SHIPS BY SIZE (CUBIC FEET) 86
FIGURE IV.3 CANAL REEFER CARGO (LONG TONS) 87
FIGURE V.1 ECONOMIC VALUE OF THE PANAMA CANAL BY COMMODITY 91
FIGURE V.2 ECONOMIC VALUE OF THE PANAMA CANAL BY MAJOR ORIGIN-DESTINATION ROUTES 93
FIGURE VI.1 STRUCTURE OF THE PANAMA CANAL REEFER MODEL 98
FIGURE VI.2 POINT COST ESTIMATES AND THEIR PROBABILITY DISTRIBUTIONS 103
FIGURE VI.3 DEADWEIGHT TONS / PCUMS RELATIONSHIPS, 2003 TRANSITS 113
FIGURE VI.4 CUBIC FEET CAPACITY / BEAM RELATIONSHIP, 2003 TRANSITS 113
FIGURE VIII.1 ACP MARKETING MODEL SIMULATOR 118

TABLE OF TABLES

TABLE ES.1 PANAMA CANAL FORECAST SUMMARY ES-2
TABLE ES.2 ECONOMIC VALUE OF THE PANAMA CANAL BY COMMODITY ES-6
TABLE ES.3 CANAL MARKETING STRATEGY OPTIONS ES-8
TABLE II.1 INTERNATIONAL SEABORNE REEFER TRADE BY COMMODITY (METRIC TONS) 4
TABLE II.2 WORLD SEABORNE REEFER TRADE BY COMMODITY 4
TABLE II.3 TOTAL REEFER COMMODITY VOLUMES ON KEY CANAL TRADES (METRIC TONS) 6
TABLE II.4 TOTAL REEFER COMMODITY TONNAGE BY CANAL TRADE ROUTE (TRADE SHARES - %) 7
TABLE II.5 LARGEST IMPORTERS IN 2003 25
TABLE II.6 IMPACT OF FTA ON U.S. TRADE WITH CHILE AND COMPETITIVE MARKETS 31
TABLE II.7 IMPACT OF FTA ON EU TRADE WITH CHILE AND COMPETITIVE MARKETS 33
TABLE II.8 PERCENTAGE SHARE OF PERU'S EXPORTS TO THE US UNDER DIFFERENT AGREEMENTS 36
TABLE II.9 PERU'S USAGE RATE OF GSP (2000) 38
TABLE II.10 PERCENT SHARE OF ECUADOR'S EXPORTS TO U.S. UNDER DIFFERENT AGREEMENTS 40
TABLE II.11 IMPACT OF TRADE POLICIES ON U.S. TRADE WITH ECUADOR AND COMPETITIVE MARKETS 40
TABLE II.12 ECUADOR'S USAGE RATE OF GSP (2000) 42
TABLE II.13 POLICY IMPACT ON EU TRADES 42
TABLE II.14 IMPACT OF FTA ON U.S. TRADE WITH AUSTRALIA AND COMPETITIVE MARKETS 48
TABLE III.1 NET CHANGES TO REEFER FLEET - 1995-2003, AT END OCT 2003 59
TABLE III.2 BREAKDOWN BY SHIP TYPE AT OCT 1, 2003 59
TABLE III.3 ACTIVITY BY REEFER TYPE, 1995-2003, AT OCT 1, 2003 60
TABLE III.4 REEFER FLEET SHAPE CHANGES, 1983-2003 61
TABLE III.5 BREAKDOWN OF THE REEFER FLEET BY YEAR OF BUILD AT OCT 1, 2003 62
TABLE III.6 REEFER FLEET ADDITIONS IN THE LAST FIVE YEARS 63
TABLE III.7 CHARACTERISTICS OF REEFER FLEET >499,999 CUFT CAPACITY AT NOV 2003 63
TABLE III.8 BIGGEST REEFER FISH CARRIER OWNERS AT NOV 2003 65
TABLE III.9 SECOND HAND REEFER SALES, 1999, OCT 2003 66
TABLE III.10 REEFER ORDERBOOK AT NOV 1, 2003 66
TABLE III.11 REEFERSHIP SCRAPPING HISTORY AT OCT 30, 2003 67
TABLE III.12 REEFERSHIP WITHDRAWALS 1995 TO OCT 2003 67
TABLE III.13 REFRIGERATED POOLS, AS OF JAN 2004 68
TABLE III.14 GLOBAL LINER REEFER CAPACITY AT AUGUST 2003 69
TABLE III.15 NET CHANGES TO TOTAL REEFER FLEET CUFT CAPACITY 1995-2003 AT END OCT 2003 73
TABLE III.16 BREAKDOWN OF THE CONTAINER FLEET REEFER CAPACITY AT NOV 2003 75
TABLE III.17 CONTAINER FLEET ADDITIONS IN THE LAST 5 YEARS AT NOV 2003 76
TABLE III.18 CONTAINERSHIP ADDITIONS AND DELETIONS AFTER 1994 77
TABLE III.19 GROWTH IN GLOBAL LINER SERVICES 79
TABLE III.20 HISTORY OF CONTAINER TRADE CAPACITY GROWTH 80
TABLE III.21 CONTAINERSHIP ORDERBOOK BY DELIVERY YEAR AT NOV 2003 81
TABLE III.22 MAJOR CONTAINERSHIP REEFER CAPACITY OPERATORS AT NOV 2003 82
TABLE III.23 REEFER TEU CAPABILITY OF CONTAINER FLEET AT NOV 2003 82

TABLE III.24 WORLD SEABORNE REEFER CAPACITY AT NOV 2003 83
TABLE IV.1 CONVENTIONAL BULK REEFER FORECAST 85
TABLE V.1 DISTANCES BETWEEN SAMPLE O-D PAIRS 88
TABLE V.2 OPERATING COST ASSUMPTIONS 89
TABLE V.3 OPERATING COSTS, ECUADOR – WESTERN EUROPE NORTH 89
TABLE V.4 TIME COST ASSUMPTIONS, BANANAS 90
TABLE V.5 TIME COSTS, BANANAS 90
TABLE V.6 ECONOMIC VALUE OF THE PANAMA CANAL BY COMMODITY 90
TABLE V.7 ECONOMIC VALUE OF THE PANAMA CANAL BY ORIGIN-DESTINATION PAIR 92
TABLE V.8 ECONOMIC VALUE OF THE PANAMA CANAL BY COMMODITY & REGION (US DOLLARS) 94
TABLE V.9 ECONOMIC VALUE OF THE PANAMA CANAL (U.S. DOLLARS PER METRIC TON, CUBIC FOOT, CUBIC METER) 96
TABLE VI.1A REEFER COMMODITY CATEGORY DETAIL 99
TABLE VI.1B REEFER COMMODITY CATEGORIES AND AGGREGATIONS 100
TABLE VI.2 ORIGIN & DESTINATION COUNTRIES/REGIONS 100
TABLE VI.3A TRADE ROUTES 104
TABLE VI.3B SAMPLE TRADE ROUTES (MILES) 105
TABLE VI.4 ROUTE OPERATING COSTS BETWEEN GUAYAQUIL (ECUADOR) AND ROTTERDAM (WESTERN EUROPE, NORTH) 106
TABLE VI.5 FLEET CHARACTERISTIC SEGMENTS 107
TABLE VI.6 DEADWEIGHT TON CATEGORIES AND 2003 CANAL STATISTICS 109
TABLE VI.7 REEFER FLEET RELEVANT CATEGORIES, 2000-2003 111
TABLE VII.1 REAL GDP PER CAPITA AND INCOME ELASTICITY FOR REEFER PRODUCTS 116
TABLE VII.2 HIGH AND LOW ALTERNATIVE SCENARIOS 117
TABLE VIII.1 CURRENT CANAL TOLL STRUCTURE 120
TABLE VIII.2 BULK REEFER SIZE SEGMENTATION PLAN 120
TABLE VIII.3 CANAL MARKETING STRATEGY OPTIONS 121

Executive Summary

Global Insight, in conjunction with LauritzenCool, initiated this study of the Conventional Bulk-Refrigerated (non-containerized) Cargo Market Segment on July 1, 2003. This report covers the long-term forecast for this segment in terms of cargo demand, Canal transits and revenue, and the conventional reefer ship fleet.

Global Trade Outlook – Reefer Products

Global international trade in perishable products requiring refrigeration totaled 60.7 million metric tons in 2003, up 7 % from the previous year. The long-term forecast, however, calls for slower average annual growth of 2.4% through 2025, reaching 103 million metric tons in the final year. This forecast is in line with population and income growth expected in the major consuming regions of the world. The study analyzed the outlook for 9 major reefer product categories:

- Bananas
- Seafood
- Other Deciduous Fruit
- Citrus Fruit
- Meat
- Vegetables
- Poultry
- Apples
- Dairy

Each product was separately modeled and projected by route, using the Global Insight World Trade Model as the basis of the demand projections.

Bananas, the highest-volume segment of the international reefer trades, is projected to grow more slowly than the group's overall average, at 2.1% annually. However, the second-largest commodity, seafood, is projected to post average growth.

Canal Traffic – Conventional Reefer Ships

The percentage of Canal reefer tonnage that transits on conventional reefer ships has been declining, from 73% in FY1995, to 55% in FY2003. While the new reefer ships are larger in capacity, they have lost market share to reefer containers which are preferred by many importers, especially in the U.S., and which also provide flexibility for inland distribution.

Canal transits by reefer ships were 2,199 in FY2003, down from 2,578 in FY1995, implying an average annual decline of 2.0%. Transits hit a low of 2004 in the year 2000; since 2000 transit growth averaged 3% per year. Total Canal revenues over the 1997-2003 period increased 1.9% per year, reaching $37.1 million last year (2003).

In reefer ships, the Canal handled 9.1% of the world trade in refrigerated commodities in 2003, down from 14.2% in 1995. The largest reefer ship to transit the Canal (2003) was 16,000 deadweight tons, and the average ship was 10,000 DWT. In cubic feet capacity, these figures translate to 766,000 cubic feet for the largest ship, and 455,000 for the average.

Forecast Summary

The Panama Canal Reefer Model developed by Global Insight produces annual forecasts through 2025 for Canal transits, revenues, PCUMS, and cargo long tons. The forecasts are consistent with the trade flows assumptions from the World Trade Model, expectations of toll rates over time, changes in the reefer fleet including competition from containers, and route-switching costs. A summary of the forecast, including two years of history, is shown below.

Table ES.1
Panama Canal Forecast Summary

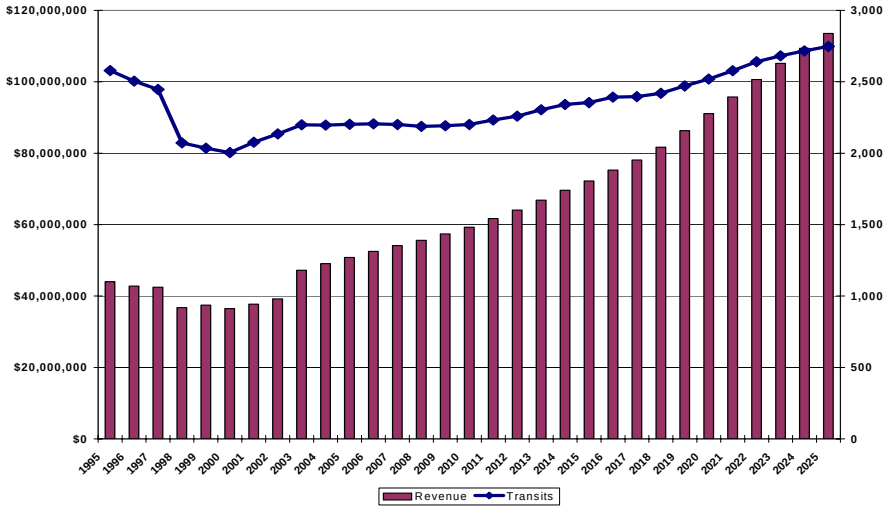
	1995	2000	2003	2010	2025	1995-2003	2003-2025
Transits	2,578	2,004	2,199	2,184	2,702	-2.0%	0.94%
Revenue	$43,989,924	$36,492,142	$47,649,198	$58,428,957	$111,701,847	1.0%	3.95%
PCUMS	18,084,297	15,193,581	17,206,497	17,447,873	23,055,322	-0.6%	1.34%
Cargo	5,781,014	4,781,539	5,453,194	5,570,923	7,038,681	-0.7%	1.17%
World Inflation (1997=100)	104.9	96.0	103.8	125.8	181.3	-0.1%	2.57%

Source: History from ACP. Forecast based on study results

Transits Forecast

The Panama Canal Reefer Model predicts that transits will increase slowly through 2025, averaging only 1% per year and reaching 2,702 in the final year of the forecast. This forecast is based on global projections for reefer trade flows, an expected growth in the average size of reefer ships over time, the impact of continued containerization in the reefer sector, and Canal tolls that increase annually over the forecast with the world inflation rate. The revenues, therefore, reflect the growth in transits and an assumed increase in toll rates, under the current PCUMS-based structure. The forecast also incorporates the decision rules for selecting by-pass alternatives based on total origin-destination costs and the time costs associated with financing the cargo and possible product deterioration. The transits and revenue forecasts are illustrated in the figure below.

Figure ES.1
Canal Revenues & Transits



Source: History from ACP. Forecast based on study results

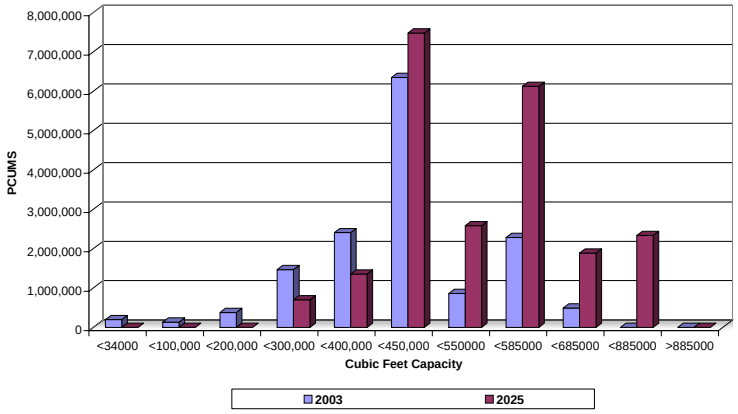
Revenue Forecast

Revenue is forecast through 2025 based on a PCUMS-based toll that increases annually at the rate of world inflation of 2.6%. The shift to larger reefer ships over time has a dampening effect on revenues because toll rates decline as the PCUMS of the ship increases. On average, revenues grow by 4.0% per year, climbing from $47.6 million in 2003 to $111.7 million by 2025. Revenues increases are consistent with a 2.6% average annual increase in toll revenues and a 1.3-1.4% increase in PCUMS discussed below. We assume that service revenues hold the same proportion to tolls revenue, therefore also increasing at the world inflation rate.

PCUMS Forecast

The average PCUMS of Canal-transiting reefer ships is projected to grow from 1.3 million to 2.0 million. This is consistent with the expected growth in the size of reefer vessels over time, coupled with the scrapping of older, smaller vessels, This change can be seen in the figure below. In total, the PCUMS associated with reefer ships transiting the Canal is projected to rise from 17.2 million PCUMS in 2003 to 23.1 million PCUMS by 2025, representing a 1.34% average annual growth rate.

Figure ES.2
PCUMS Changes, 2003-2025



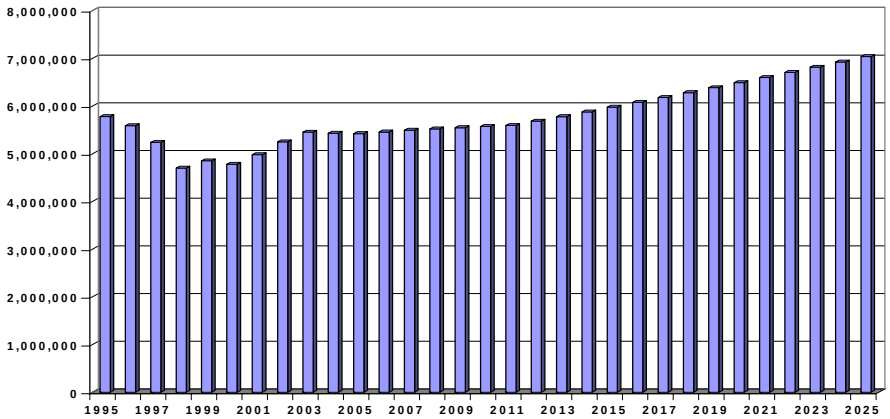
Source: *History from ACP. Forecast based on study results*

Cargo Forecast

The reefer cargo forecast incorporates global trade (demand) projections for reefer products and the expected changes in the reefer fleet over time. Fleet changes include slightly larger ships, more containerization of reefer cargos, and fewer additions to the fleet when compared with history. The cargo projections also reflect the rise in tolls, at the rate of world inflation.

The volume of reefer cargo grows from the 2003 level of 5.5 million long tons, to 7.0 million in the final year of the forecast, 2025. This represents an average annual growth of 1.2% over the forecast period.

Figure ES.3
Canal Cargo - Long Tons



Source: History from ACP. Forecast based on study results

The Reefer and Containership Fleets

At the end of 2003, there were 1,285 conventional reefer ships in operation worldwide, including the fish carriers, and multiple-purpose reefer ships that carry both reefer commodities and general cargo, or passengers, or roll-on/roll-off vehicles, etc. Since 1995, the number of new ships added to the fleet has been less than the number being scrapped; hence, the conventional reefer fleet has shrunk. In 2003, the net change in reefer capacity was a decrease of more than 5.5 million cubic feet. For 2004, only 3 new ships are scheduled for delivery.

While the conventional reefer ship capacity has declined, the container shipping capacity has increased and, therefore, so has the total reefer container capacity. Containership operators realize that the revenue to be earned from the reefer boxes quickly off-sets the investment for the required electricity. The shift to containers is strong and will likely continue, as containers provide the flexibility of delivery needed in many markets. The shift to containers over time, by commodity, is incorporated into the Canal reefer ship transit and revenue model, with the result that the growth in reefer ship cargo is less than overall demand growth for perishable goods.

Whether reefer cargo is shipped on conventional reefer ships or in containers depends not on the freight rates being charged for each mode but rather on the volume of cargo. Based on extensive interviews with exporters, importers, and reefer shipping lines, it is clear that the reefer ships are in highest demand when container capacity on liner services is insufficient to accommodate the demand, and when buyers specify reefer over containers (e.g. Northern Europe).

The conventional future reefer fleet, in the face of a market switch to containers, is likely to continue its decline. We expect the number of ships to decline even as capacity grows slightly, since the few new ships being added are at the large end of the size spectrum.

The current reefer ships transiting the Canal are small in terms of deadweight tons and overall dimensions. Based on the expected growth in reefer demand, we expect the ships to become moderately larger over time, while the number of such vessels declines. The output tables from the Panama Canal model, developed for this project, show that the ***future ship sizes will not be constrained even by the current dimensions of the Canal.***

The strength of reeferships is that they provide cover during peak crop seasons that containerships cannot economically provide. Refrigerating entire holds is considerably cheaper than refrigerating cargo in individual containers, each with its own integral power unit. However, refrigerated cargo shipments are largely one-directional, limiting revenue opportunities on the return legs. Ship designers are still trying to make it easier for reeferships to carry non-refrigerated consumer goods on otherwise dead return legs. The stumbling block is money. The rewards for technological advances are not expected to be sufficient to stimulate significant change. Cargo is king, and increasingly the end-to-end control of the cargo is the key to profitability. Shipping lines are expected to continue to balance smaller reefer ships with larger container ships.

As a result, the forecast of Canal transits is unaffected by the proposal of a larger Canal. The reader is directed to Chapters III and IV.

Economic Value of the Panama Canal

As part of the modeling system for this project, Global Insight developed a model to reflect the value of the Panama Canal route versus bypass alternatives. The model simulates alternative route selection by incorporating distance, operating costs (both fixed variable, such as fuel consumption) and time costs which reflect both the financing of the cargo and the fact that the cargo is perishable. The model uses a 10,000 DWT reefer ship, which is the average ship size transiting the Canal.

The economic value of the Canal is the savings to the shipping line in using the Canal versus the minimum cost alternative bypass.

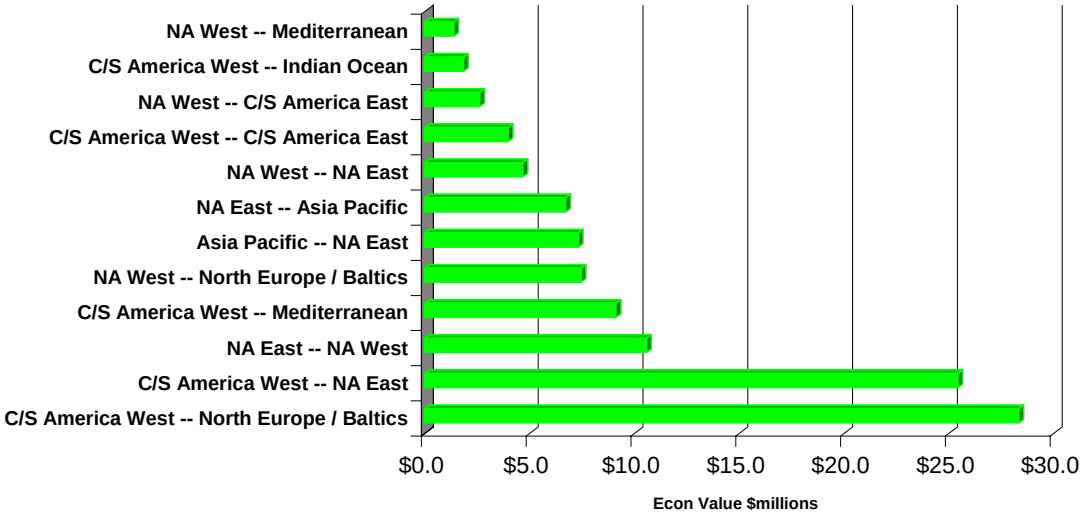
The economic value including both operating savings and time cost savings is $113 million , or $20 per metric ton. By commodity, the value is highest for bananas by a large margin, as shown in the table below. For bananas, the value is $65 million or $24.07 per metric ton, or $.41 per cubic foot, or $14.65 per cubic meter. Other deciduous fruit is a distant second with economic value of $17 million. Table ES.2 identifies the economic value associated with each of the nine refrigerated products analyzed in the study.

Table ES.2
Economic Value of the Panama Canal by Commodity

	Net Value of the Panama Canal		
Commodity	***US Dollars***	***US Dollars per Ton***	***% of Total***
Meat	$2,673,313	***$12.75***	2.40%
Poultry	$2,252,178	***$16.70***	2.00%
Dairy	$468,797	***$9.35***	0.40%
Seafood	$14,463,969	***$19.32***	12.80%
Vegetables	$3,575,599	***$20.09***	3.20%
Citrus	$2,118,674	***$22.38***	1.90%
Bananas	$64,857,077	***$24.07***	57.50%
Apples	$5,146,704	***$11.17***	4.60%
Other Deciduous	$17,171,205	***$16.16***	15.20%
Total:	***$112,727,515***	***$20.01***	***100.00%***

When the economic value is calculated by route, it is clear that the West Coast of Central And South America generates the highest source of economic value, with destinations in the US East Coast and Northern Europe. This is shown in the chart below, where each of the major routes is displayed in terms of the Canal's economic value.

Figure ES.4
Economic Value of the Canal, by Route



Marketing Strategy Recommendation

Global Insight developed a pricing model, delivered to the ACP in December 2003, designed to test the initial impact of changes in toll levels and toll structures, including different toll rates by PCUMS. Because reefer ships are grouped into a relatively small PCUMS category, we divided the ship transits into new PCUMS groupings in order to refine the tolls by PCUMS category. We also examined the discount provided to ballast vessels, and the rate of "other service revenue" which stems from non-toll activities during the transit.

Based on the economic value of the Panama Canal ($113 million) for the conventional reefer ship market segment, Global Insight examined three pricing options designed to capture approximately 50%, 60%, and 70% of the value through new toll levels and structures. Each marketing (pricing) strategy is summarized in the table below, showing the resulting revenues. It should be noted that each of the pricing scenarios was run through the demand and transit model in which there is a pre-calculated toll and service charge elasticity. Therefore, the revenues quoted here reflect this elasticity of demand.

Table ES.3
Canal Marketing Strategy Options

Element	Current Plan FY2003	50% Plan FY2004	60% Plan FY2004	70% Plan FY2004
Laden tolls				
First 3500 PCUMS	$2.96	$3.40	$4.10	$6.00
Next 3000 PCUMS	$2.96	$3.30	$3.90	$4.00
Next 3000 PCUMS	$2.90*	$3.20	$3.75	$3.50
Remaining tons	$2.85	$3.10	$3.45	$3.50
Ballast discount	20.6%	20.6%	15%	15%
Service revenue	$.28 per PCUMS	$.28 per PCUMS	$.28 per PCUMS	$.28 per PCUMS
"Lost" Transits		17	47	53
Net Revenue ($MM)	**$47.6**	**$55.6**	**$65.3**	**$78.0**
Target Rev ($MM)		**$56.5**	**$67.8**	**$79.1**

Conclusions

The outlook for the conventional bulk reefer ship sector calls for steady but slow growth, with little loss of cargo to alternative routes, even under considerable toll increases. Given the shift to containers and the expected slow growth in bulk reefer ship capacity, the outlook will not place any strain on the existing Canal. In short, an expanded Canal will not be viewed as a major benefit by this market segment.

I. Introduction

Global Insight (USA), Inc. was hired by the Autoridad del Canal de Panama to carry out a study of the future of the conventional (non-containerized) reefer ship market segment. The contract, SAA-154968, was initiated in Panama with an effective date of July 1, 2003, and a supplemental task, to analyze the reefer container shipping mode for perishable commodities, was added to the project in November, 2003.

Global Insight assembled a team of modelling specialists to develop a simulation model of the conventional reefer segment. Additionally, other specialists were brought into the working team as needed, including consultants who had worked with the Panama Canal on previous studies.

The working team from Global Insight consisted of the following individuals:

Name	**Title**	**Position in Project**
Robert West	Managing Director	Project Director
Joyce Brinner	Senior Principal	Project Manager, model development
Dan Westenberger	Consultant	Technical Advisor, user interfaces
Frederic Avierinos	Managing Director	European Advisor
Elizabeth Gomez	Associate	Trade Data & Forecast Manager
Ben Hackett	Executive Managing Director	Industry Overview, Ship Characteristics
Junya Tanizaki	Consultant	Database Development
Maria Kulikova	Consultant	Database Development
Eddie Tapiero	Consultant	Advisor, West Coast South America

Annika Sandstrom represented LauritzenCool, from the company headquarters in Sweden.

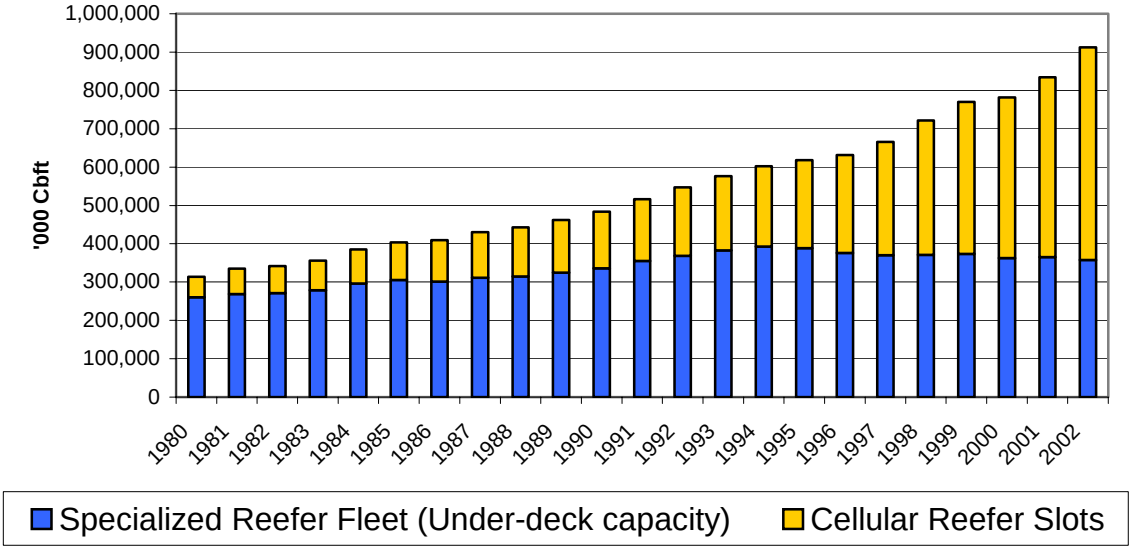
The focus of this study is the conventional reefer ships that transit the Canal, and the trends for this segment over the next 25 years under expanded and unexpanded scenarios. A model was developed to simulate alternative transits and revenues under these two scenarios and also under different marketing strategies for this market segment. The impact of reefer containers, which capture a growing share of the global reefer market, was analysed and included in the modelling effort as a supplemental task to the original contract.

The Global Insight World Trade Model, which served as an initial forecasting tool in this study, is described in detail, including data sources, in Appendix I, under separate cover.

II. Global Reefer Commodity Shipment Outlook

In the main reefer trades, perishable foodstuffs requiring refrigeration are transported from the Southern Hemisphere to the major import markets: Europe, USA, and Japan. Conventional palletized reefers carry the majority of these commodities, but during the latter years container lines have made significant inroads to this market segment. Container vessels with large reefer capacity have absorbed a growing proportion of refrigerated cargoes, and it is estimated that the division now stands at 60-40 in favor of containers, as shown in the chart below.

Figure II.1
Conventional Reefer Fleet vs. Reefer Slots on Container Vessels



Source: LautirzenCool

For both modes of transport, the main commodities are bananas, which represent about a quarter of all reefer trade, followed by meat and seafood at about one fifth each. Following these major commodities are citrus fruits, deciduous fruits[1] and exotic fruits. For conventional (bulk) reefers, the importance of bananas is even greater at about 40% of all cargo. At the same time, meat and seafood are less significant and tend to be transported to a greater extent by container vessels.

The Reefer Fleet

Conventional reefer is one segment of shipping where the order book has been very slim during the last few years. Only one vessel was delivered in 2001, an additional two in 2002, and with only two more expected for delivery during this present year (2003). Thereafter the order book is empty. At the same time, the scrap rate of the reefer fleet has been extremely low during the last two years, and the market has been suffering

[1] Deciduous fruits are apples, pears, and table grapes. Occasionally kiwi & avocados appear in this group, depending on the source of information, but they are normally counted as exotic fruits.

from overcapacity. In total, however, the scrap rate has been moving slightly ahead of the introduction of new tonnage, which means that there has been a net decrease in the fleet. At the beginning of 2002, the total reefer fleet had an under-deck capacity of about 357 million cubic feet, which at the end of the year had been reduced to about 350 million cubic feet. Chapter III covers the reefer fleet and the reefer containers that are a growing competitor.

The Global Outlook for Reefer Commodity Demand

There has been and still is a steady increase in the demand for fresh produce in the main import markets. The annual increase, however, is very small and tends not to be affected to a large extent by economic cycles in developed countries; i.e., reefer commodities are relatively income inelastic. On the other hand, income elasticity seems to be very present in emerging markets such as Russia, where fresh fruit consumption is directly linked to income levels and economic output. These economic variables are incorporated in this study, in determining the Canal's potential market.

Trade in Reefer Commodities

Global Insight developed global forecasts for each of the 9 major reefer commodity groups in the study, using its World Trade Service (WTS) as a starting point (Appendix I). The WTS links Global Insight economic outlooks for over 125 countries to the trade patterns by commodity. In the WTS, 77 commodity groups are modelled and forecasted separately. Commodity totals constitute world trade, with distinct segregation of seaborne trade. For the purpose of this study, two of the WTS reefer commodity groups were disaggregated ("Meat, Fish, and Diary requiring refrigeration", and "Vegetables, Fruits, and Eggs requiring refrigeration").

For the individual reefer products being addressed in this study, historical global trade data were assembled and the forecast was developed using the WTS, in accordance with Global Insight forecasts of population and incomes. The reefer forecasts provide reasonable long-term per-capita growth expectations in light of the individual countries' income growth and stage of development.

The following table shows the history and forecast of seaborne tonnage for each reefer commodity. We estimate that the volume of seaborne reefer trade in 2003 totalled 60.7 million metric tons. The historical growth rate of 3.8% for the 1995-2003 period is now expected to slow to an average annual rate of 2.4% through 2025. On a global basis, bananas and seafood constitute 42.5% of total reefer shipments, as shown in the second table. Details of the reefer product exporters and importers, by product, appear in Appendix D.

Table II.1
International Seaborne Reefer Trade by Commodity
(metric tons)

	1995	2000	2003	2005	2010	2015	2020	2025	CAGR 2003-2025
Bananas	10,371,441	12,751,841	13,402,999	13,983,864	15,574,194	17,326,123	19,272,582	21,411,300	2.1
Seafood	9,139,682	10,889,600	12,375,111	13,105,398	14,984,887	16,962,870	19,037,744	21,260,219	2.5
Other Deciduous Fruit	4,850,308	7,014,456	7,861,771	8,279,442	9,422,085	10,720,519	12,193,284	13,859,684	2.6
Citrus Fruit	4,628,198	5,735,149	6,067,286	6,363,495	7,133,013	8,004,961	8,988,668	10,076,655	2.3
Meat	5,174,203	5,903,537	5,774,698	6,073,088	6,893,750	7,786,051	8,735,420	9,756,169	2.4
Vegetables	3,730,526	5,165,415	5,741,713	6,029,973	6,827,598	7,739,146	8,779,427	9,952,114	2.5
Poultry	3,153,351	4,429,843	4,407,225	4,674,931	5,415,203	6,114,502	6,733,093	7,267,525	2.3
Apples	1,857,657	2,335,363	2,541,423	2,698,417	3,143,194	3,657,944	4,250,737	4,924,670	3.0
Dairy	2,069,685	2,398,206	2,489,671	2,650,632	3,084,451	3,562,652	4,049,372	4,530,309	2.8
Total	44,975,050	56,623,409	60,661,897	63,859,241	72,478,375	81,874,769	92,040,327	103,038,644	2.4

Source: WTS, modified as described

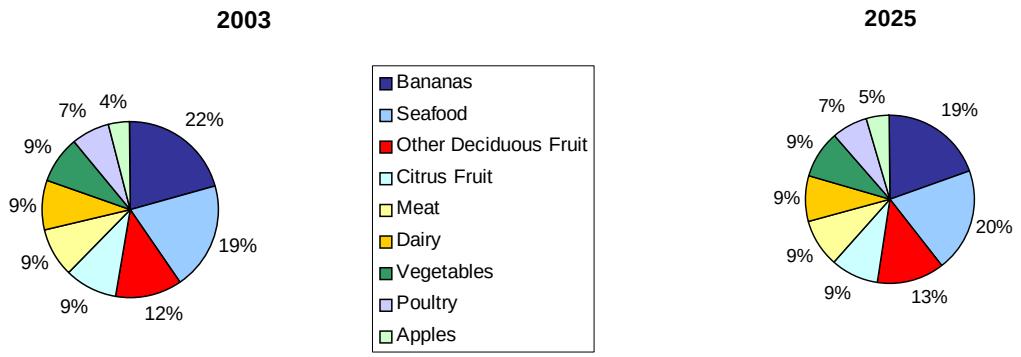
Table II.2
World Seaborne Reefer Trade by Commodity
(percent of total)

	1995	2000	2003	2005	2010	2015	2020	2025
Bananas	23.1%	22.5%	22.1%	21.9%	21.5%	21.2%	20.9%	20.8%
Seafood	20.3%	19.2%	20.4%	20.5%	20.7%	20.7%	20.7%	20.6%
Other Deciduous Fruit	10.8%	12.4%	13.0%	13.0%	13.0%	13.1%	13.2%	13.5%
Citrus Fruit	10.3%	10.1%	10.0%	10.0%	9.8%	9.8%	9.8%	9.8%
Meat	11.5%	10.4%	9.5%	9.5%	9.5%	9.5%	9.5%	9.5%
Vegetables	8.3%	9.1%	9.5%	9.4%	9.4%	9.5%	9.5%	9.7%
Poultry	7.0%	7.8%	7.3%	7.3%	7.5%	7.5%	7.3%	7.1%
Apples	4.1%	4.1%	4.2%	4.2%	4.3%	4.5%	4.6%	4.8%
Dairy	4.6%	4.2%	4.1%	4.2%	4.3%	4.4%	4.4%	4.4%
Total	100%	100%	100%	100%	100%	100%	100%	100%

Source: WTS, modified as described

The mix of reefer commodities is projected to remain relatively stable over time. Bananas maintain their dominant share, but slip from 22.2% of the trade in 2003 to 20.8% by 2025. Citrus, meat, and poultry also show slight declines in their shares, while seafood, deciduous fruit, vegetables, and dairy post modest increases. The changes in these and the other commodity shares are shown in the figure below.

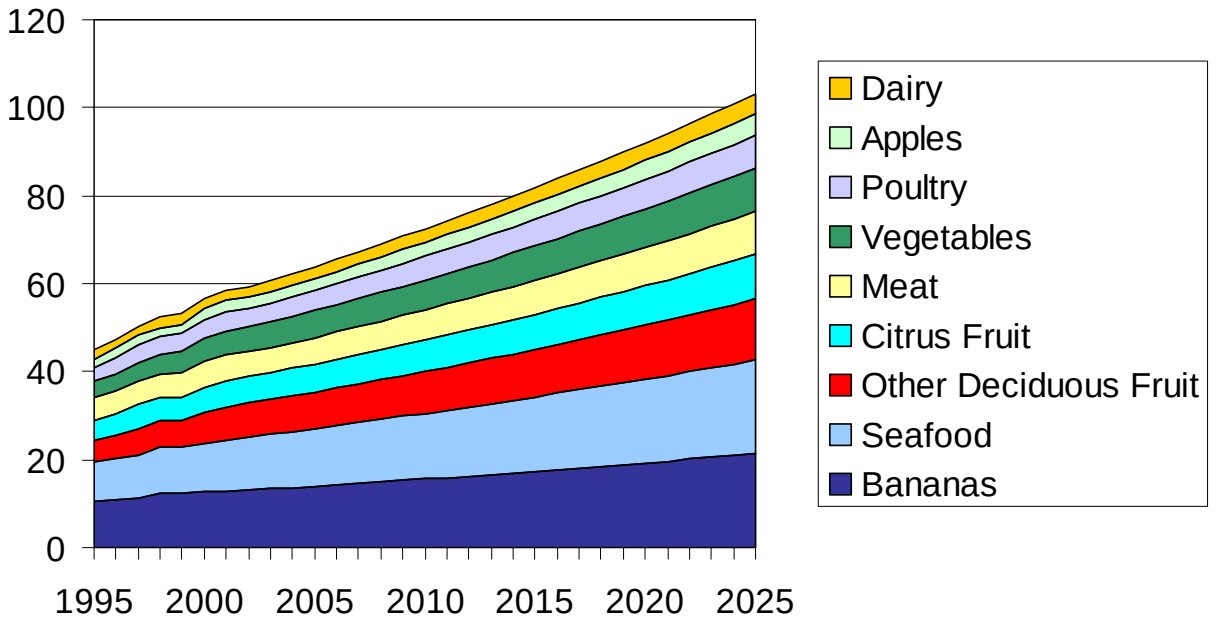
Figure II.2
World Seaborne Reefer Trade by Commodity
Share of Total, 2003 and 2025



Source: WTS, modified as described

The growth in reefer commodity seaborne trade is illustrated in the figure below. Commodities with the largest trade volumes are at the bottom of chart and those with the smallest volumes are at top. World seaborne reefer trade is projected to grow at an average annual rate of 2.4% over the 2003 to 2025 period.

Figure II.3
World Seaborne Reefer Trade By Commodity
(Million metric tons)



Source: WTS, modified as described

Reefer Trades Most Relevant to the Canal

The analysis of the global market was developed by both commodity and origin-destination pairs. The major refrigerated cargo trades for the Panama Canal are ranked in Table II.3 based upon 2003 total seaborne trade volumes. The largest potential market for the Canal is in trade between the West Coast of Central and South America and North Europe, followed by trade between North America East Coast and Asia Pacific. Together, trade flows between these regions account for almost 50% of the Panama Canal's potential refrigerated commodity market (Table II.4).

Table II.3
Total Reefer Commodity Volumes on Key Canal Trades
(metric tons)

Trade Between:	1995	2000	2003	2010	2020	2025	CAGR 1995-2003	CAGR 2003-2025
C/S America West / North Europe / Baltics	1,278,493	1,710,979	1,889,651	2,203,427	2,698,994	2,986,709	5.0%	2.1%
NA East / Asia Pacific	1,192,648	1,694,292	1,722,357	2,039,707	2,527,524	2,761,340	4.7%	2.1%
NA East / C/S America West	998,454	1,193,498	1,456,338	1,681,023	1,970,779	2,118,510	4.8%	1.7%
C/S America West / Mediterranean	538,094	671,175	736,665	904,400	1,223,835	1,431,866	4.0%	3.0%
C/S America East / Asia Pacific	550,996	659,614	727,810	943,992	1,320,853	1,532,173	3.5%	3.4%
NA West / North Europe / Baltics	316,741	282,404	355,468	396,969	459,607	489,417	1.5%	1.4%
C/S America East / C/S America West	190,162	335,808	330,456	444,226	654,258	789,437	7.2%	3.9%
North America West / Mediterranean	33,018	62,830	65,113	75,988	93,655	103,583	8.9%	2.1%
NA West / Other (South and West Africa)	19,883	36,093	39,117	47,854	62,347	70,359	8.8%	2.6%
C/S America West / Other (S. & W. Africa)	38,327	20,510	22,003	28,426	40,406	47,799	-6.7%	3.5%
Total -- Key Markets	5,156,816	6,667,201	7,344,978	8,766,012	11,052,257	12,331,192	4.5%	2.4%

Source: WTS, modified as described

Growth in seaborne refrigerated commodity trade in the Canal's key markets is projected to slow from an annual rate of 4.5% over the 1995-2003 period, to 2.4% over the 2004-2025 period.

Table II.4
Total Reefer Commodity Tonnage by Canal Trade Route

Trade Between:	1995	2000	2003	2005	2010	2015	2020	2025
NA East / Asia Pacific	24.8%	25.7%	25.7%	25.6%	25.1%	24.7%	24.4%	24.2%
C/S America East / Asia Pacific	23.1%	25.4%	23.4%	23.4%	23.3%	23.2%	22.9%	22.4%
NA East / C/S America West	19.4%	17.9%	19.8%	19.7%	19.2%	18.5%	17.8%	17.2%
C/S America West / North Europe / Baltics	10.4%	10.1%	10.0%	10.1%	10.3%	10.6%	11.1%	11.6%
NA West / North Europe / Baltics	10.7%	9.9%	9.9%	10.1%	10.8%	11.4%	12.0%	12.4%
C/S America East / C/S America West	6.1%	4.2%	4.8%	4.7%	4.5%	4.3%	4.2%	4.0%
C/S America West / Mediterranean	3.7%	5.0%	4.5%	4.7%	5.1%	5.5%	5.9%	6.4%
North America West / Mediterranean	0.6%	0.9%	0.9%	0.9%	0.9%	0.9%	0.8%	0.8%
NA West / Other (South and West Africa)	0.4%	0.5%	0.5%	0.5%	0.5%	0.6%	0.6%	0.6%
C/S America West / Other (S. & W. Africa)	0.7%	0.3%	0.3%	0.3%	0.3%	0.3%	0.4%	0.4%
Total -- Key Markets	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

(Trade Shares - %)

Source: WTS, modified as described

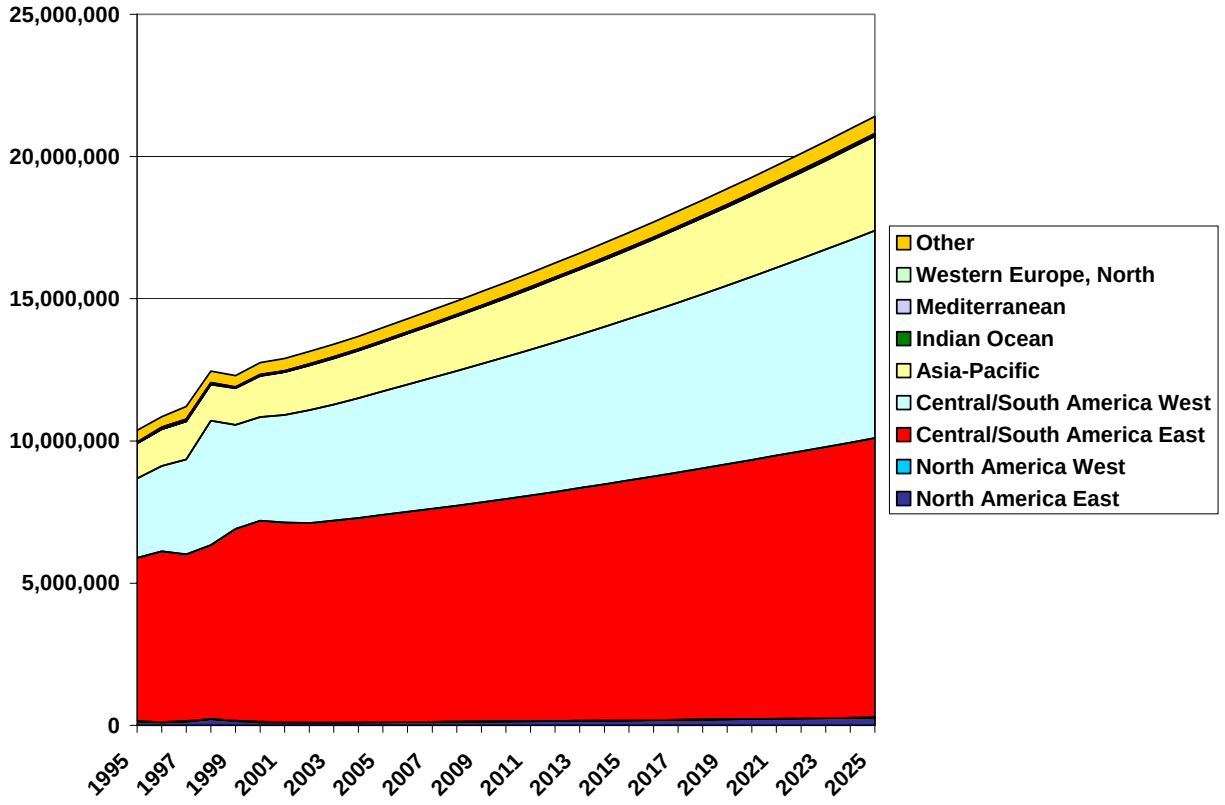
Global Reefer Trade Forecast by Commodity

The Global Insight World Trade Service, with the modifications mentioned above, was used to develop specific forecasts for each of the 9 reefer commodities by export region and by import region. This section of the report outlines the results by commodity, in order of 2003 trade volumes, from both an export and import perspective.

Banana Trade

Banana exports from each of the 9 regions in the study are shown in the chart below, from 1995 to 2025. Clearly, Central and South America are the principal export regions, with a larger volume of exports coming from the eastern countries than the western countries. The historical export growth of 3.3% over the 1995-2003 period will slow to 2.2% through 2025, as both population and income growth slow particularly in the industrialized world and in Eastern Europe.

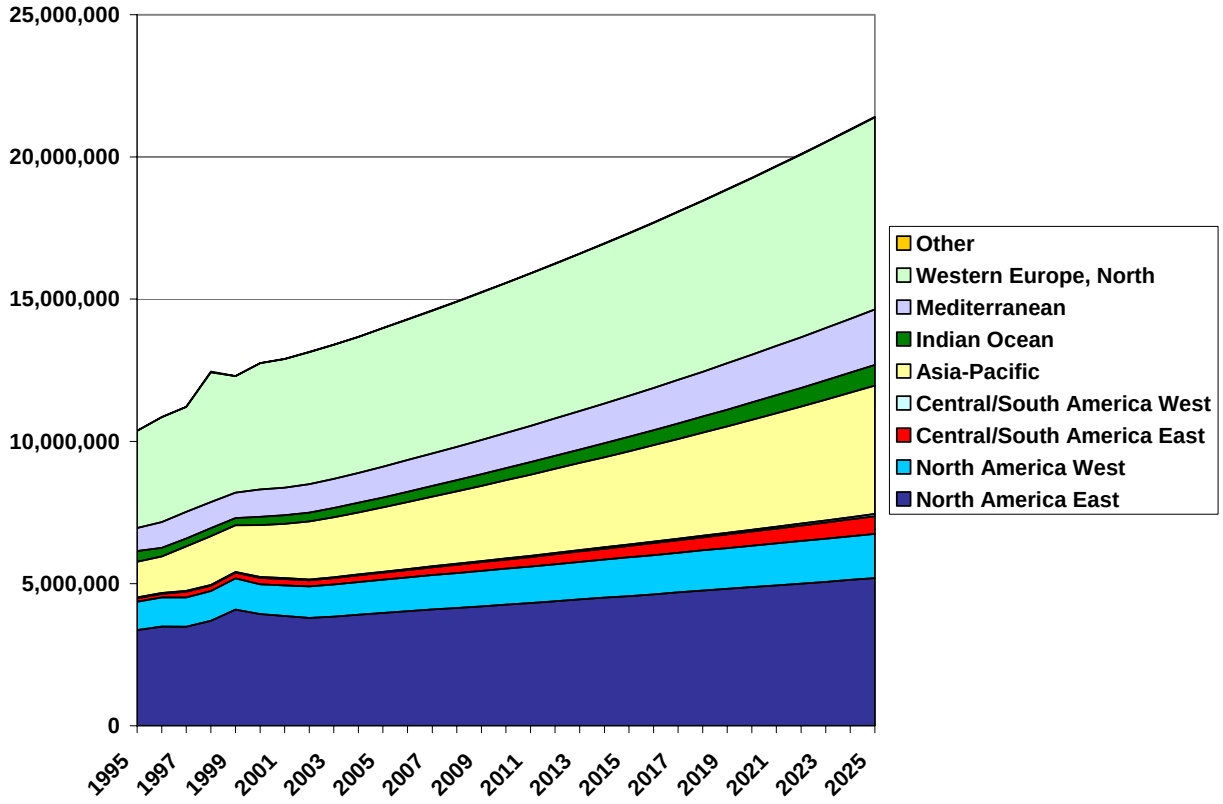
Figure II.4
Banana Exports (Million metric tons)



Imports show the diversity of the end markets. North America East is one of the largest importers of bananas (over 3.8 million tons in 2003), but it is also one of the slowest growing markets, being fairly well saturated. The expected growth in this market is only 1.4% per year through 2025. Western Europe, North is the largest importer of bananas, at 4.7 million tons in 2003. This region's growth has not come through increased per-capita consumption but rather through imports moving through Northern European ports

with final destinations in Eastern Europe. The forecast growth of 1.6% is still below the global average forecast of 2.2%. Asia-Pacific is where we expect the highest growth rate, averaging 3.5% per year through 2025 for banana imports.

Figure II.5
Banana Imports (Million metric tons)

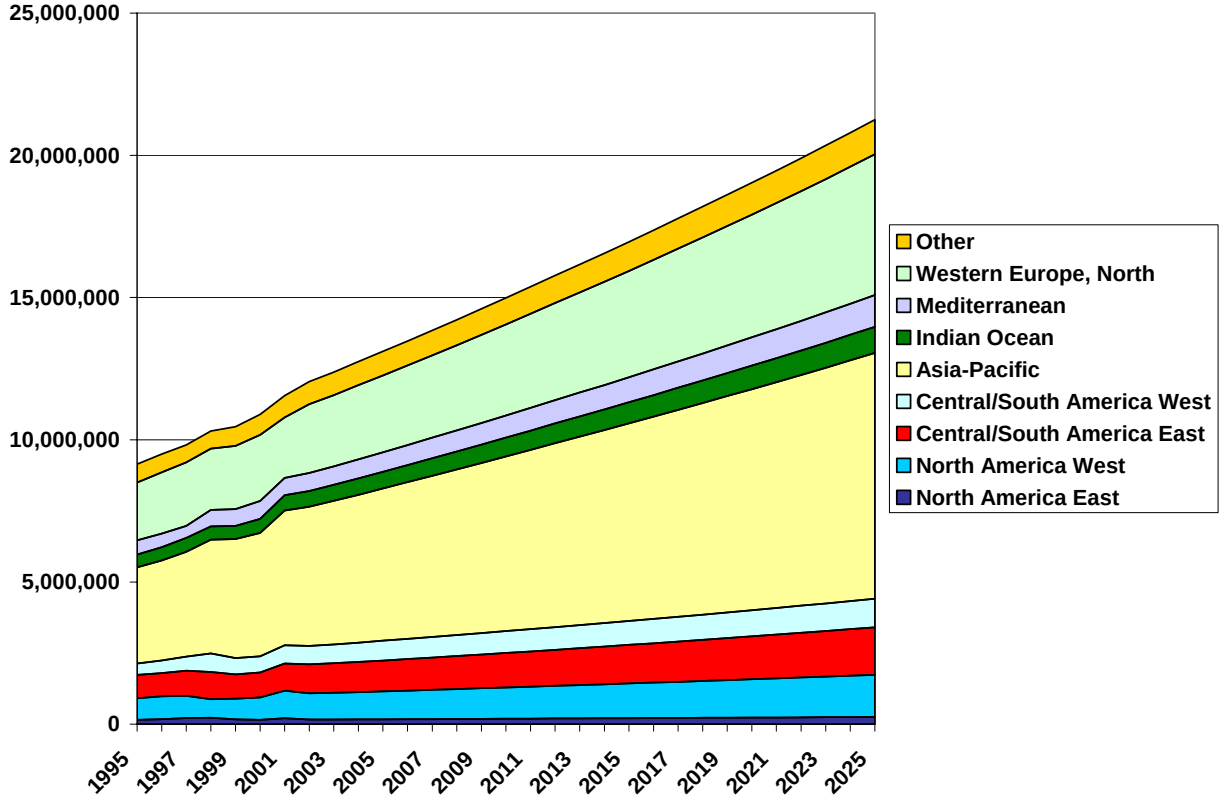


Seafood Trade

International shipments of seafood are expected to expand through 2025 at an average annual rate of 2.5%, slightly slower than the previous 8-year historical growth of 3.9%.

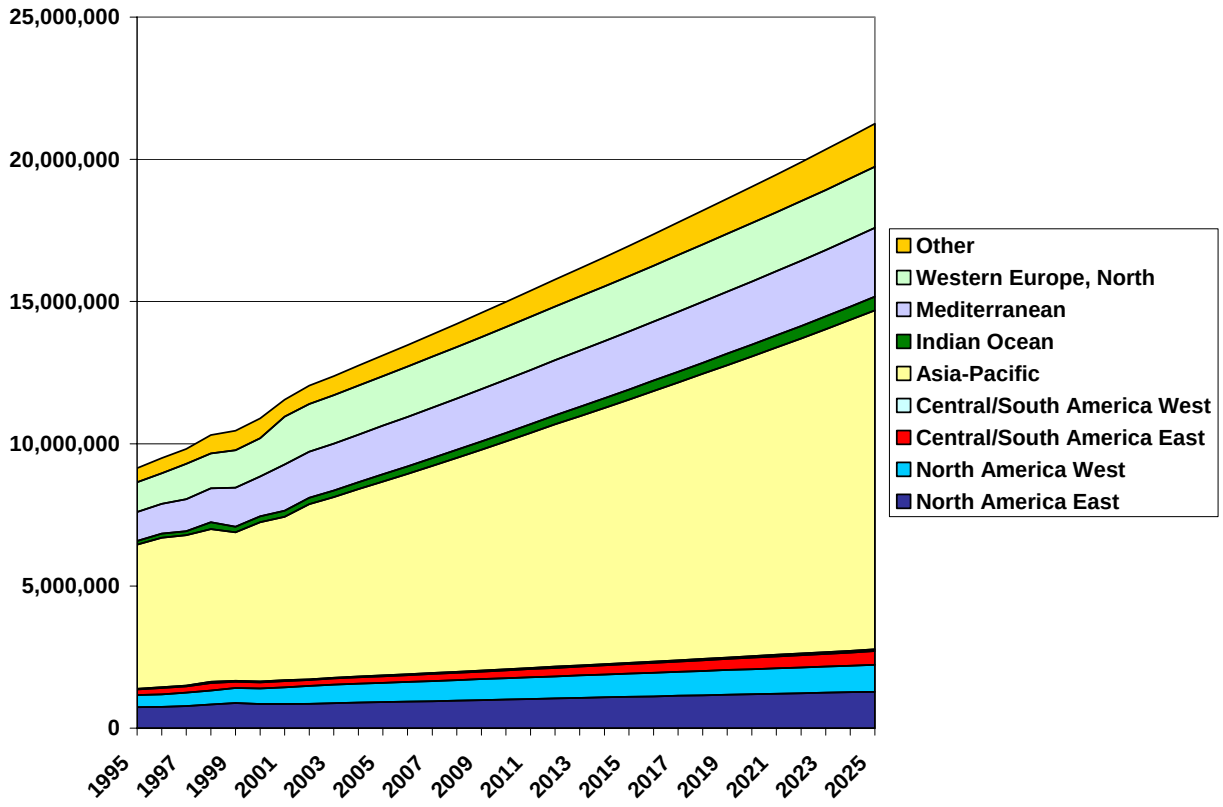
The largest exporter to the world is the Asia-Pacific region, which is also the largest importer. Exports from Asia-Pacific are expected to grow at the average world rate through 2025, namely 2.5%. But most of the growth in this global commodity will stem from the higher export growth rate from northern countries of Western Europe, averaging 3.1% through 2025. Seafood shipments from the West Coast of Central and South America are projected to grow by only 1.8% per year over the forecast period.

Figure II.6
Seafood Exports (Million metric tons)



On the import side, Asia-Pacific is the largest importer of seafood (over 6.3 million tons in 2003), with Europe in second place (with Mediterranean countries at 1.6 million tons, and Western Europe North at 1.7 million tons). Overall seafood import growth is projected to average 2.5% annually through 2025. The Central and South America markets will post significantly stronger growth, averaging more than 3.7% annually, although their volumes will be small in comparison to Asia-Pacific.

Figure II.7
Seafood Imports (metric tons)

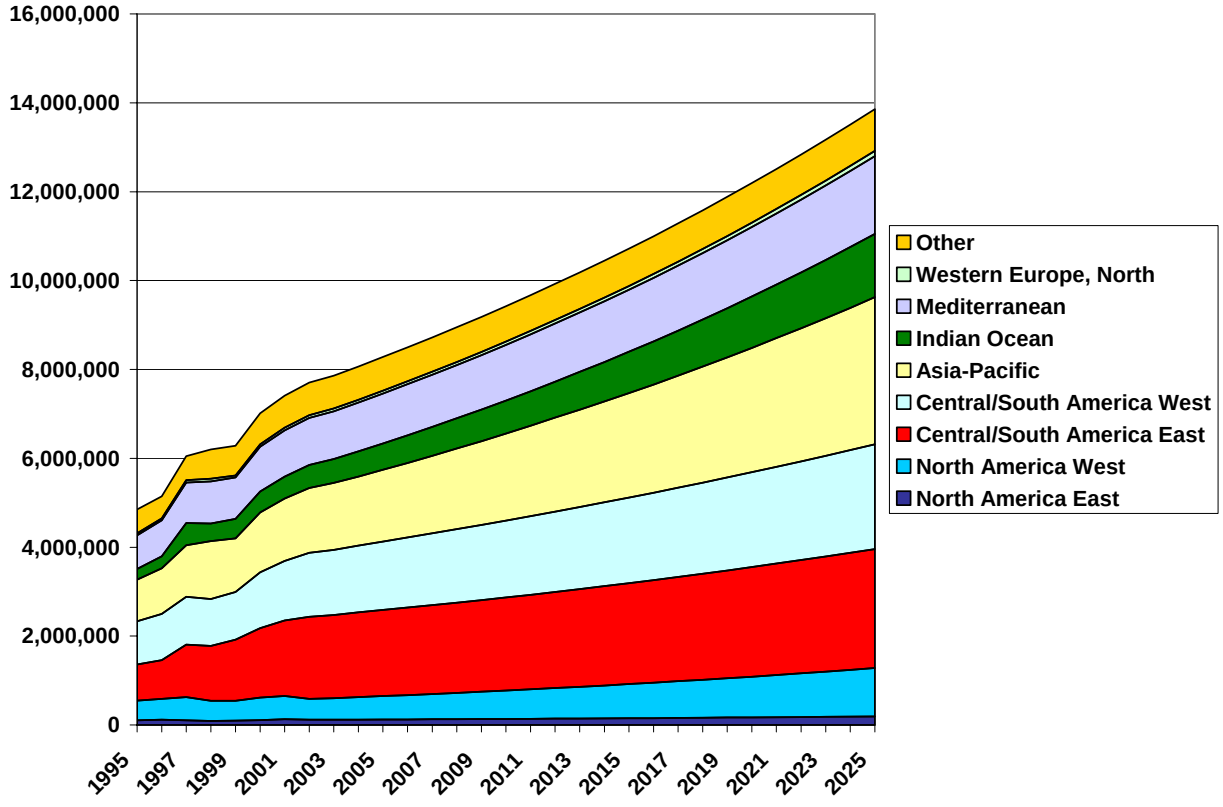


Other Deciduous Fruit Trade

Exports of other deciduous fruits totalled 7.9 million tons in 2003, up 2% for the year. Over the forecast period, Global Insight expects exports to these fruit exports to grow 2.6% worldwide, or significantly below their historical rate of 6.2%. Growth in specialized fruits such as kiwis will moderate over time, bringing down the expected overall growth in this category.

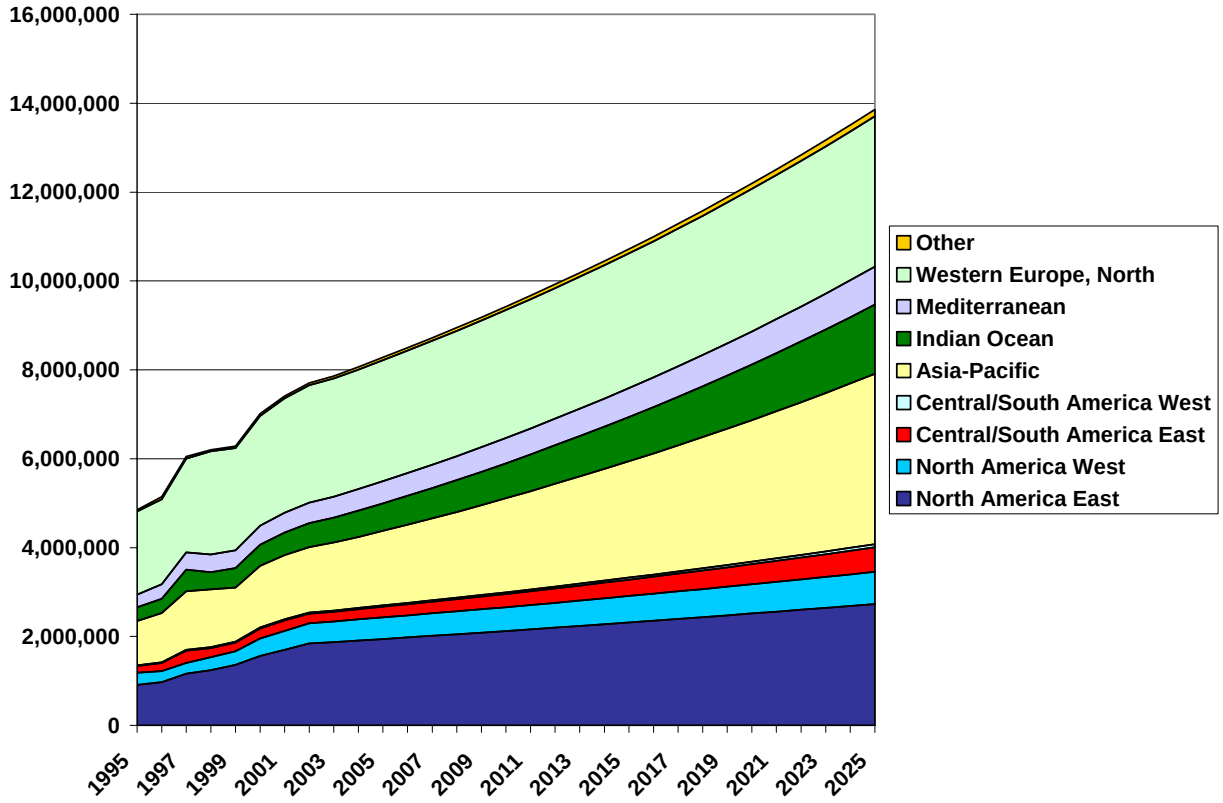
Exports are spread over a wide set of regions. The largest exporters in 2003, in order, are Central and South America East, Central and South America West, and Asia-Pacific. Of these, we expect the highest rate of export growth to come from Asia-Pacific.

Figure II.8
Other Deciduous Fruit Exports (Million metric tons)



Imports of deciduous fruits will grow at 2.6% (same as exports), with the largest importer, Asia-Pacific growing at 4.3% or well above the world average. The Indian Ocean region, with import growth of 4.8%, will top the world average growth rate, while North America East will grow by only 1.7% in view of market saturation and slow population growth rates.

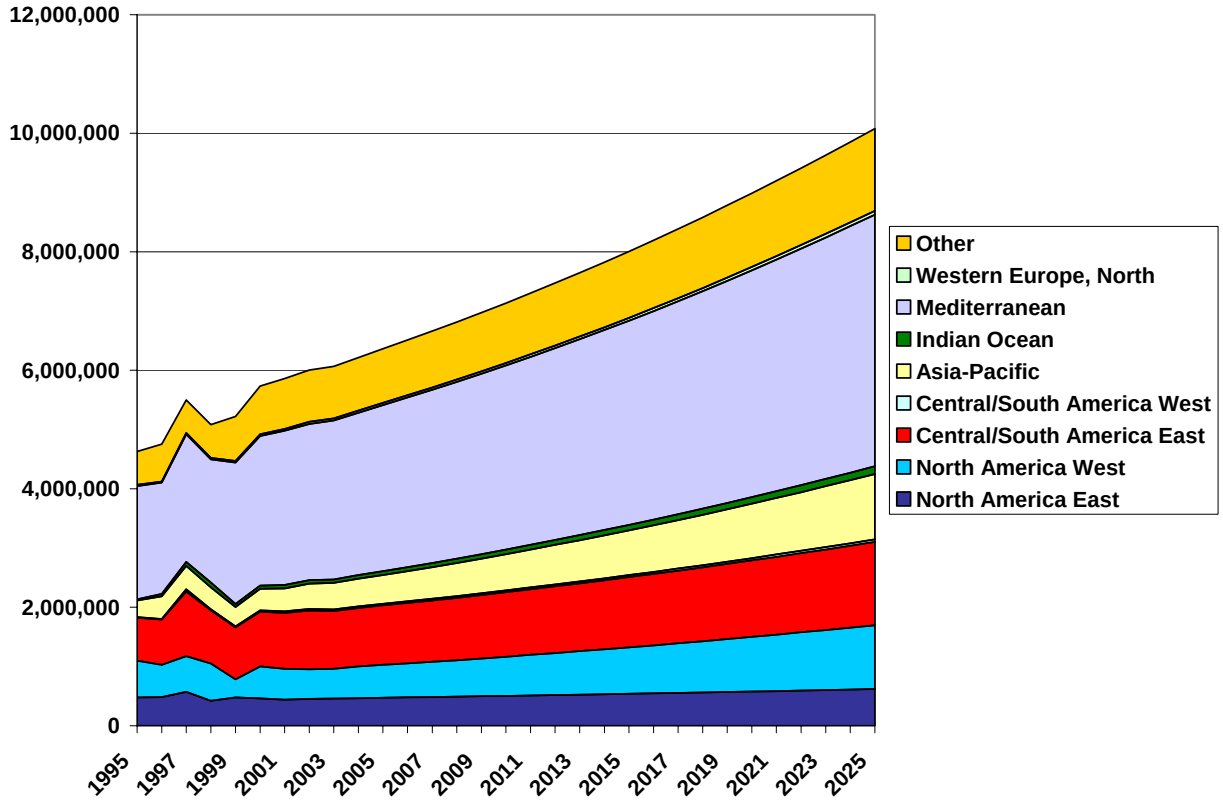
Figure II.9
Other Deciduous Fruit Imports (Million metric tons)



Citrus Fruit Trade

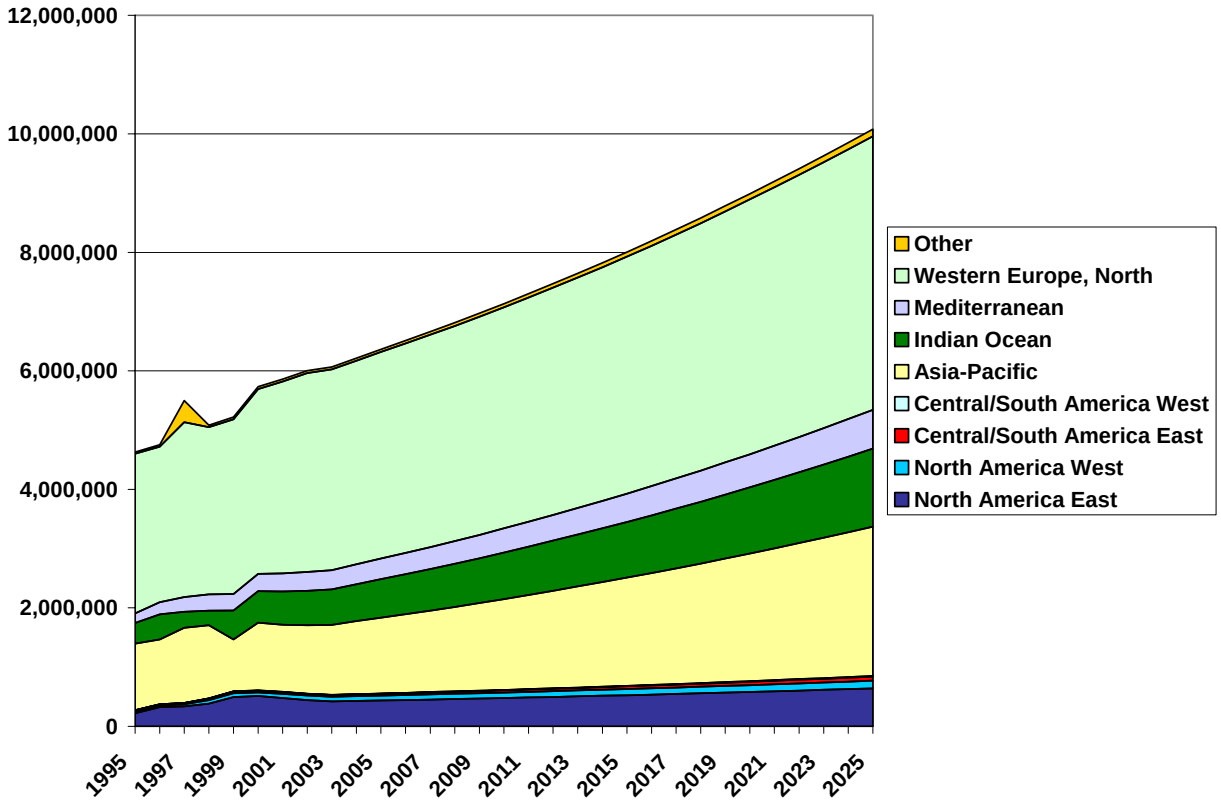
Citrus fruit exports worldwide will reach 6.1 million metric tons this year (2003) up from 6.0 million last year. Historically, global international shipments have averaged a 3.4% annual growth over the 1995-2003 period, but the forecast calls for a slight slowing of this rate to 2.3% through 2025. The largest exporter, the Mediterranean region, shipped 2.7 million tons in 2003, and will grow at 2.1% through 2025 as the region's production increases as a result of expansion in the growing areas in North Africa (e.g. Algeria).

Figure II.10
Citrus Fruit Exports (metric tons)



Exports from North America (east and west coasts) are expected to improve from their slow decline in market share over the last 8 years. Targeting the fast-growing Asian market, exporters will increase their shipments at an average annual rate of 3.5% from the West Coast and 1.4% from the East Coast through 2025.

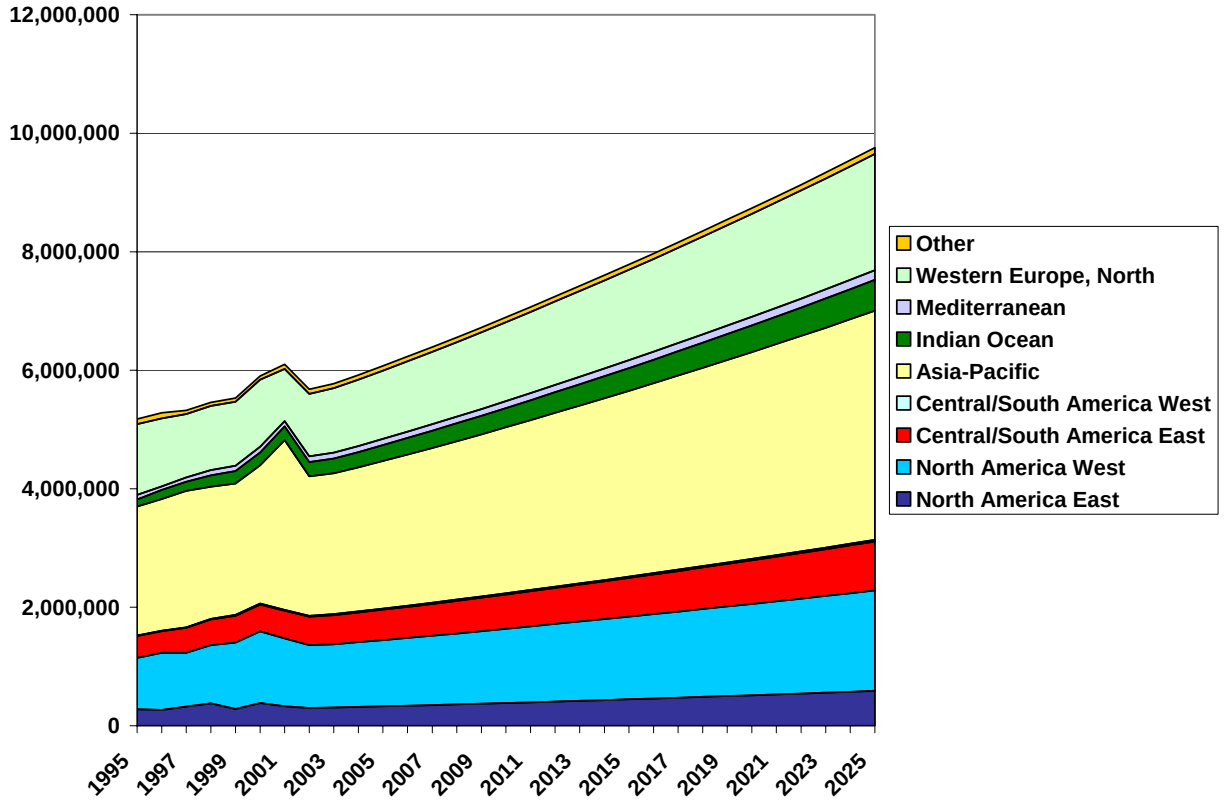
Figure II.11
Citrus Fruit Imports (Million metric tons)



Meat Trade

Global shipments of meat will reach almost 5.8 million metric tons this year, finishing off an 8-year period during which global shipments averaged just 1.4% per year. The outlook calls for little change in growth, at 1.3% per year through 2025. The largest exporter is the Asia-Pacific region (primarily Australia and New Zealand). This region has historically grown at only 1.1% per year, but is expected to improve its share through 2025 by growing at 2.2% annually as higher incomes in the Far East create demand for higher-protein foods such as meat.

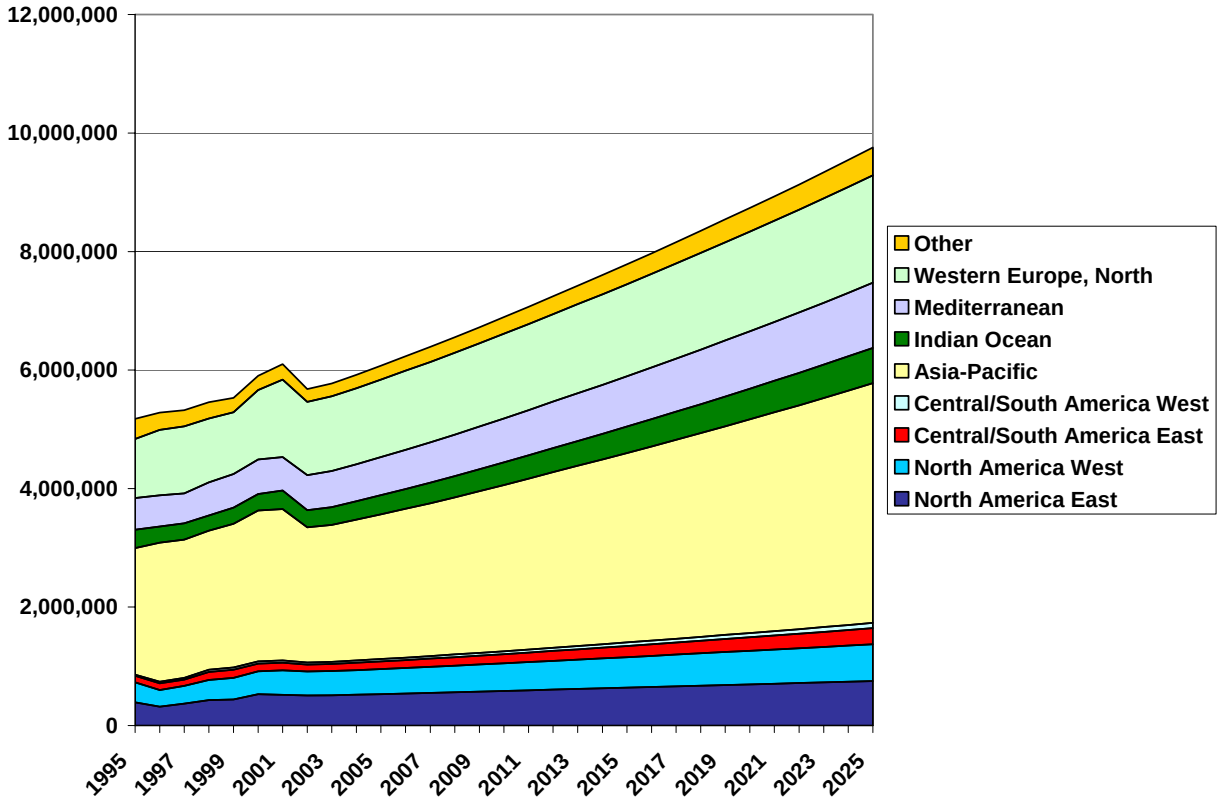
Figure II.12
Meat Exports (metric tons)



Meat imports, on the other hand, shown in the figure below, will average 1.4% annual growth through 2025, with Asia Pacific, the largest importing region, averaging 2.6% per year. Since this region is both the largest exporter and importer, it is clear that Australia/New Zealand captures the growth on the supply side, while the fast-growing nations such as China cause the imports to grow sizably as well.

The U.S. is not a major exporter of meat compared to some of the others (approximately 1.1 million metric tons in 2002). At the time of this writing, there was a BSE scare in the U.S., which stopped beef exports to Japan, Mexico, and most destinations in Europe. We do not anticipate that this stoppage will have an impact on the Panama Canal forecast. Also, there are early signs that the Japanese may agree to the new contingency measures proposed by the U.S. so exports may resume soon.

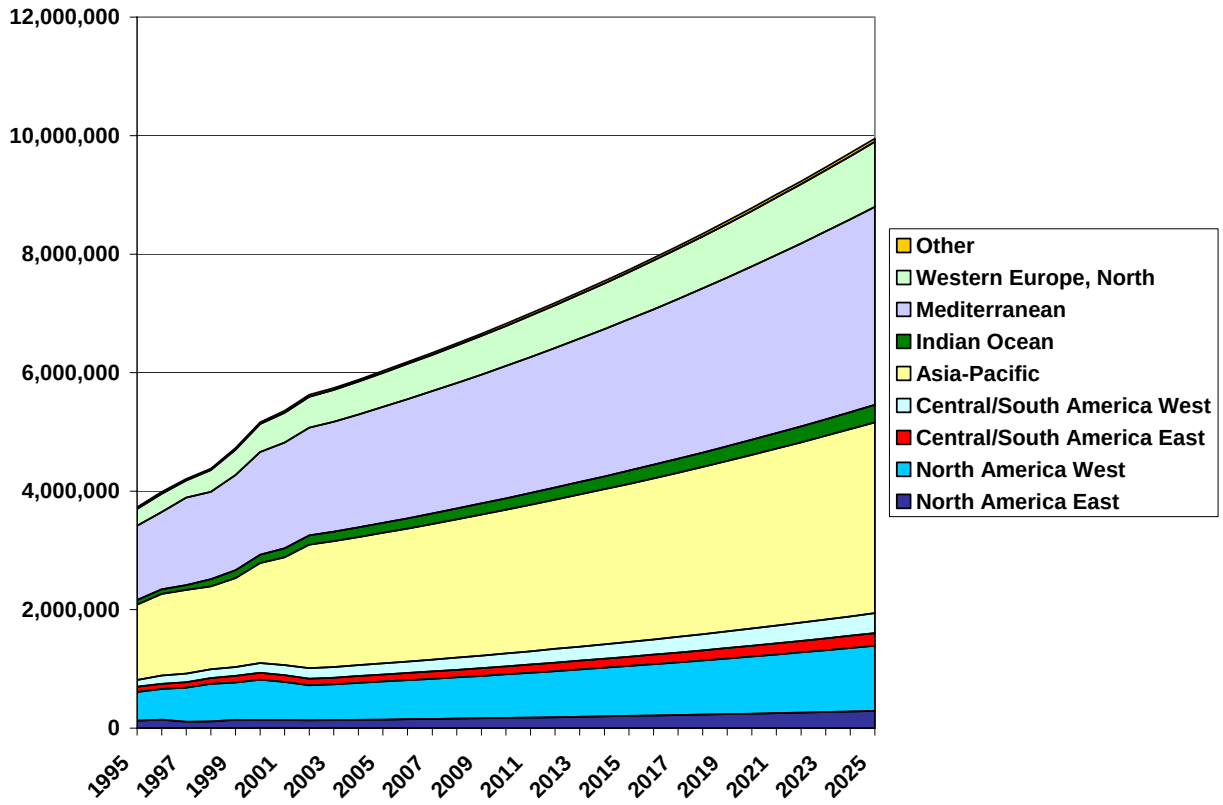
Figure II.13
Meat Imports (Million metric tons)



Vegetables Trade

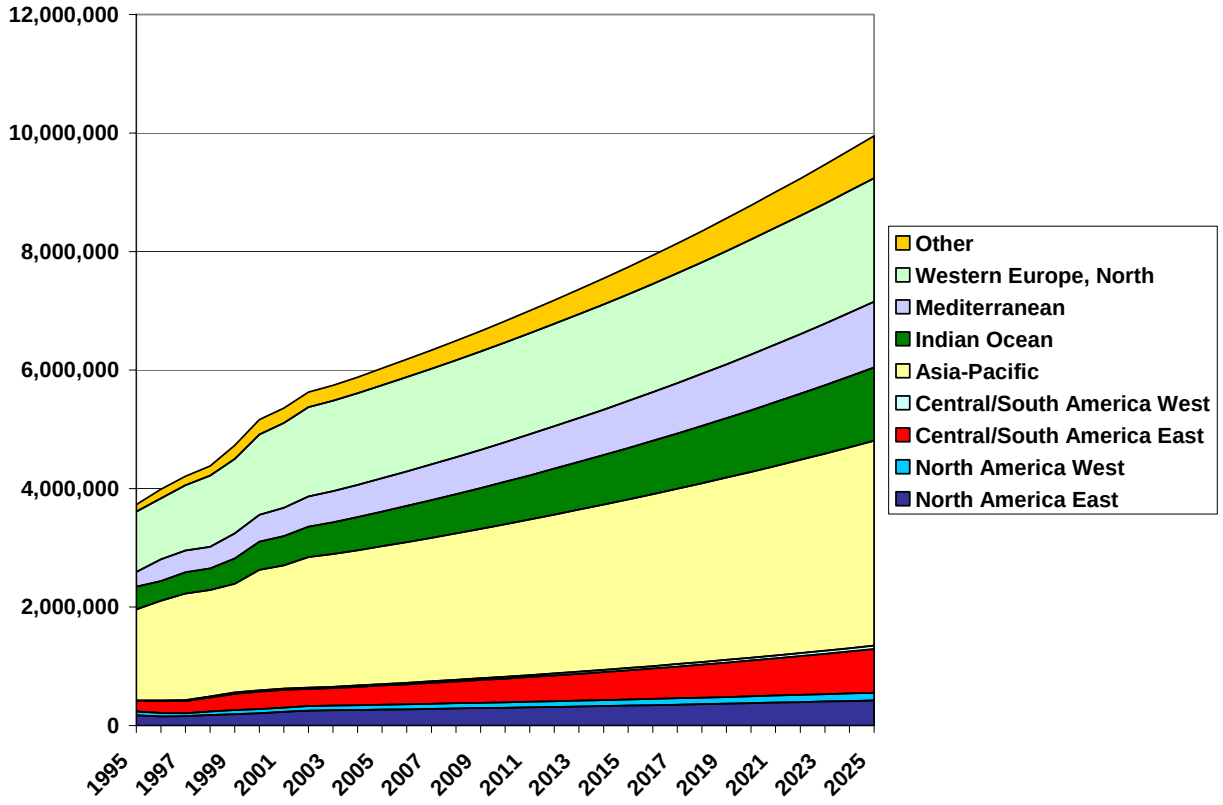
Vegetables exports historically grew at 5.5% per year over the 1995-2003 period. In the forecast, this rate will slow to 2.6% due to an expected slowdown in exports from the Mediterranean, the second largest exporter, and also a reduction in growth from the Asia-Pacific region, the largest exporter. Together, these two regions in 2003 accounted for 69% of global shipments.

Figure II.14
Vegetable Exports (Million metric tons)



Vegetables imports, shown in the figure below, will be spurred by relatively high growth in the Indian Ocean region (at 3.9% per year through 2025), and the Mediterranean, averaging 3.4% per year. The long-term growth rate is reduced by the expected imports to Western Europe North, averaging only 1.4% per year through the end of the forecast period.

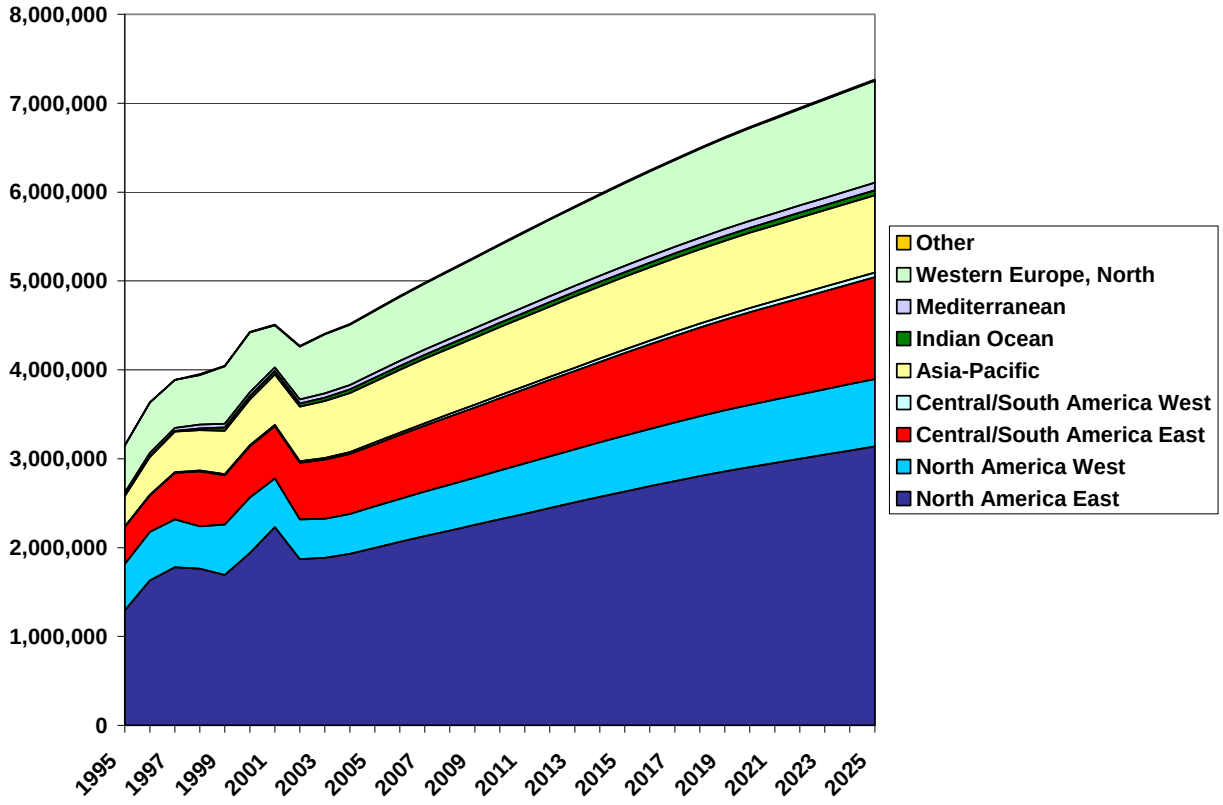
Figure II.15
Vegetables Imports (Million metric tons)



Poultry Trade

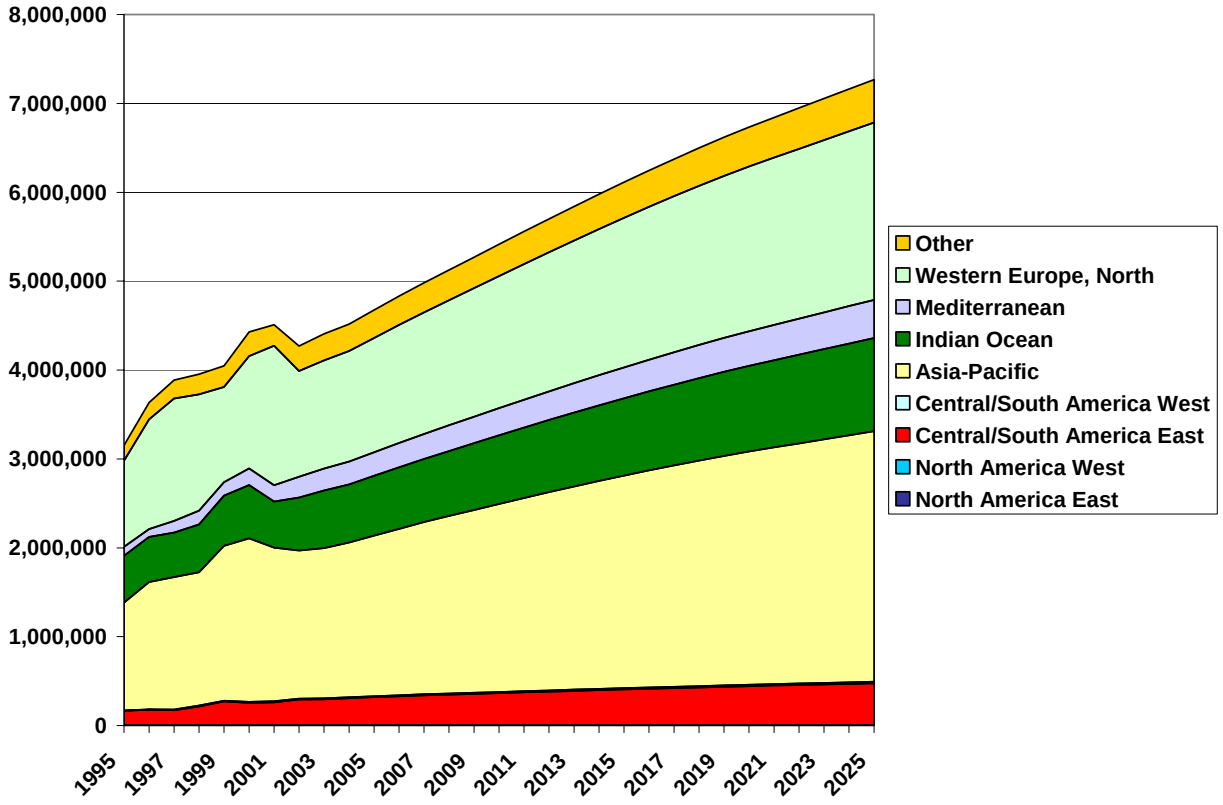
As shown in the figure below, poultry exports from the East Coast of North America are sizable, amounting to 43% of total world exports in 2003. Historically total global poultry exports averaged 4.3% annual growth (1995-2003), much of which was stimulated by huge demand from the CIS countries. This growth rate is expected to be more moderate in the future, averaging 2.0% per year through 2025, but North America's position will be maintained. The other major region is Central and South America East, which, in this case, really means Brazil, whose cost of poultry production in the lowest in the world. Exports from this region will top 1 million tons in 2019 and will reach 1.15 million tons by the end of the period.

Figure II.16
Poultry Exports (Million metric tons)



Global poultry imports this year (2003) will reach 4.4 million metric tons, up 3.2% over last year. The largest importer, the Asia-Pacific region, will hold that position through 2025 as imports average 2.4% annual growth, compared to 2.3% for the global poultry shipments worldwide. This forecast is based on the expected economic growth in the region, which will cause a shift from vegetable sources of protein to higher-quality sources.

Figure II.17
Poultry Imports (Million metric tons)



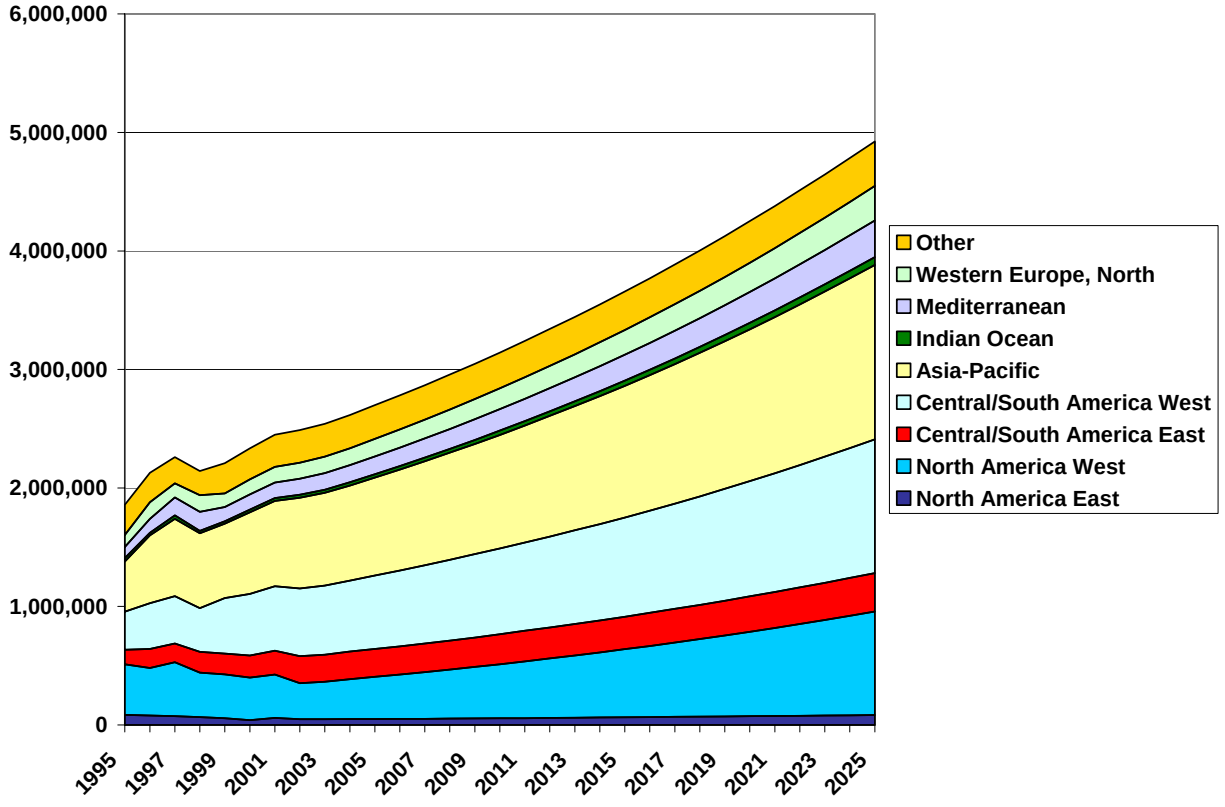
The Western Europe North region, ranked second in volume terms in 2003, will reach 2 million tons in 2025, averaging 2.3% over the forecast period 2003-2025. We expect Brazil to gain share in the market as a supplier, in competition with the U.S.

Apple Trade

The global apple trade is currently spread across several major suppliers, from Central and South America West (mainly Chile), Asia-Pacific (primarily Australia, and now China), and the US Northwest. Western Europe North produces high quality fruit but in much smaller volumes than the above regions, and most is consumed within the region itself.

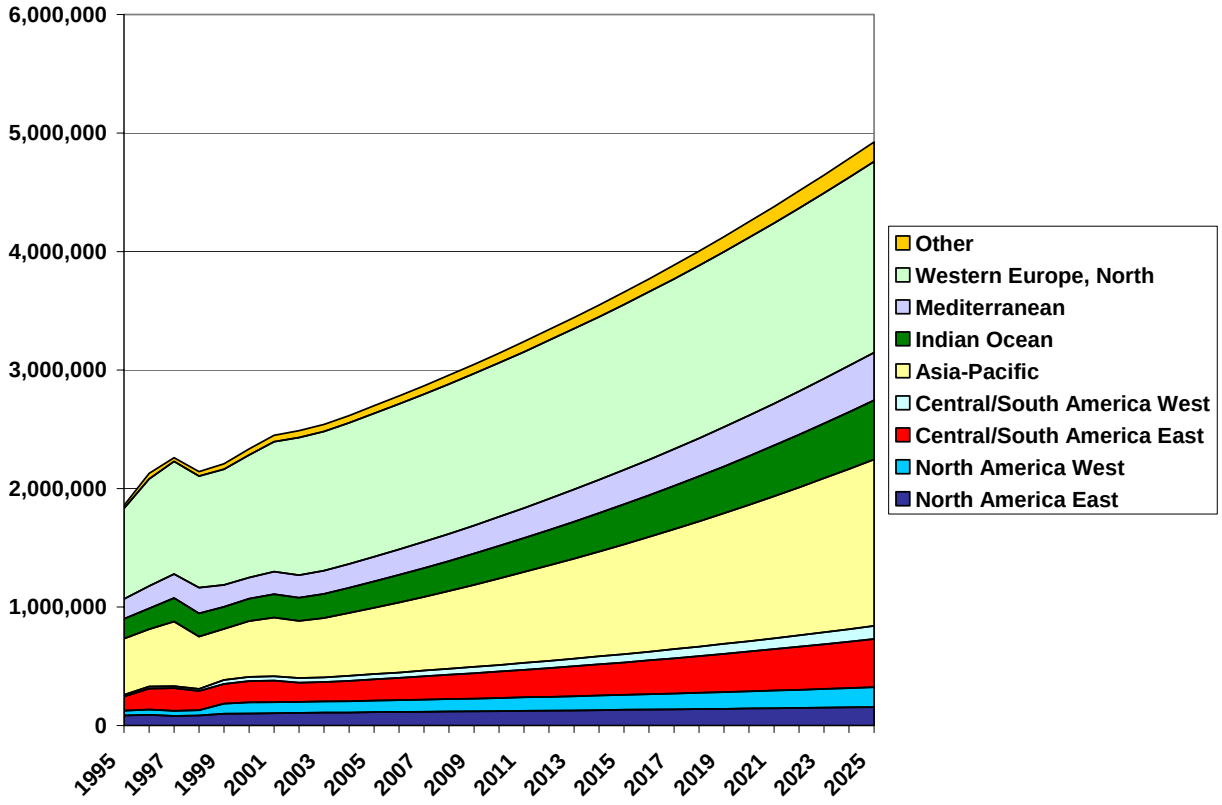
The historical growth in this market has been 4.0% per year, but the forecast calls for a slight slowdown to 3.1% through 2025. This is more in line with the expected population growth in the key end markets (see below), and income growth. By the end of the forecast period, 30% the world's 4.9 million tons of apple exports will come from the Asia-Pacific region, and 23% from the West Coast of South America.

Figure II.18
Apple Exports (Million metric tons)



As for imports, the largest importer is Western North Europe, absorbing 46% of world exports in 2003, but sliding to only 33% in 2025 in view of the huge expansion in imports to the Asia-Pacific region. By the end of the period, the world's largest exporter is also the world's largest importer. Import growth in Western Europe North is projected to average only 1.4% growth, while import growth in the Asia-Pacific region will average 4.8% through 2025.

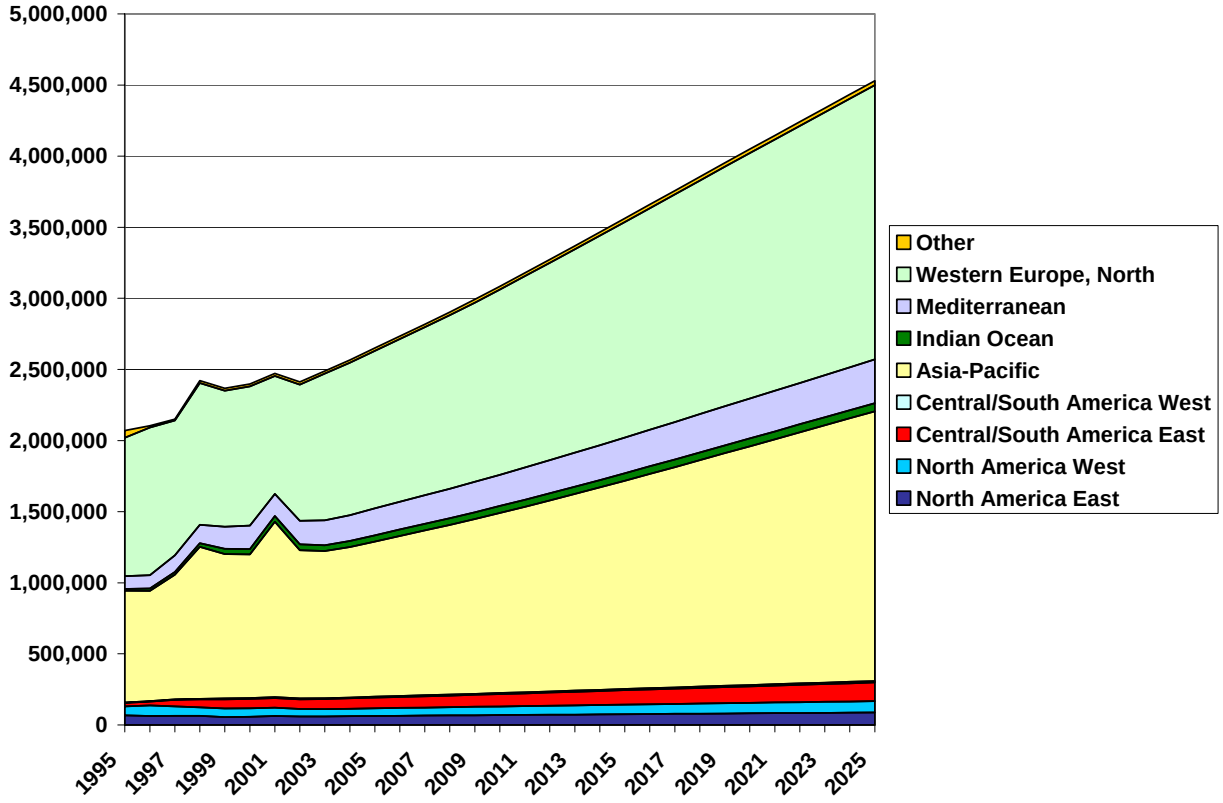
Figure II.19
Apple Imports (Million metric tons)



Dairy Trade

Following an export decline in 2003, the Asia-Pacific region tied with Western Europe North for 41% of total world dairy product exports. Dairy exports on a global basis are projected to increase at an average annual growth rate of 2.8% through 2025, and we foresee little shift in regions' current shares of the world market. No new entrants are expected on the supply side and growth in both Western Europe North and the Asia-Pacific region will be in line with total world trade growth in these products.

Figure II.20
Dairy Exports (Million metric tons)



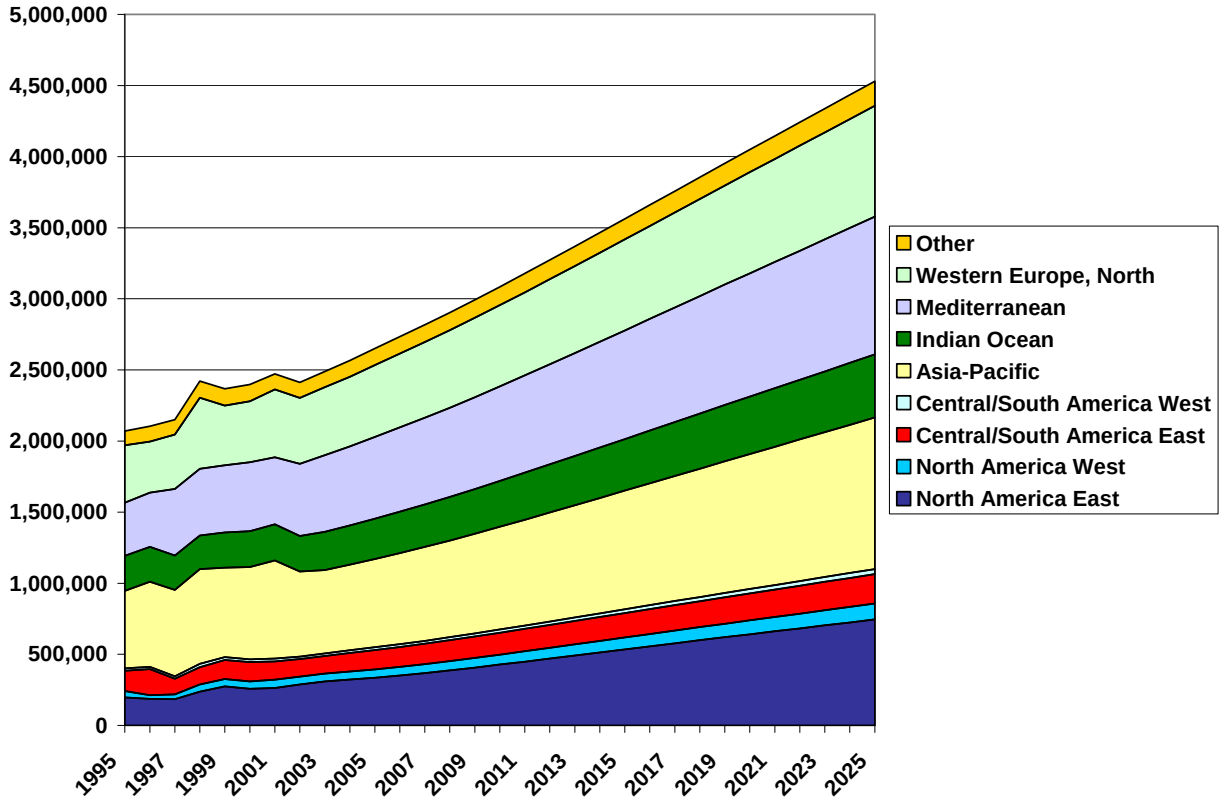
On the import side, the 2.5 million ton market (2003) is segmented into distinct regions of some significance. In 2003, the shares of the largest importers were

Table II.5
Largest Importers in 2003

North America East	12.5%
North America West	2.2%
Central/South America East	5.1%
Central/South America West	0.6%
Asia-Pacific	23.5%
Indian Ocean	10.8%
Mediterranean	21.6%
Western Europe, North	19.2%
Other	4.5%

Dairy import demand in the Asia-Pacific region, the world's largest dairy import region, is projected to grow 2.8% per year through 2025, in line with the world's average growth. Therefore, the Asia-Pacific region will maintain its share of the final year's 4.5 million ton global import forecast. Most other regions will remain relatively fixed in terms of share of the total market, with Western Europe North slipping slightly to 17% from 19%. North America East Coast will increase its share from 12.5% to 16.5% over the forecast period.

Figure II.21
Dairy Imports (Million metric tons)



Impact of Trade Agreements

The ACP requested that Global Insight undertake an evaluation of trade agreements, especially free trade agreements, in terms of their effect on the flows of reefer commodities worldwide. For the purpose of this study, the trade agreements analyzed were those that relate principally to the major producing and consuming areas of interest to the Panama Canal. These are Chile, Peru, Ecuador and Australia as producers, and the rest of the world by region as consumers. Snapshots of each of these countries can be found in Appendix C.

Impact on Chile

Chile signed Free Trade Agreements (FTAs) with the EU and the U.S.[2] in 2002. The FTAs are expected to have a positive impact on the trade between Chile, the U.S., and the EU, leading to greater traffic flow through the Canal. The growth estimates vary between 6-7 percent (*industry estimate*) to 30 percent (*government estimate*). The FTA with the United States went into effect January 1, 2004.

Impact on Peru

Peru is currently not a signatory of any free trade agreement. However, the U.S. and the EU have enacted unilateral trade acts that provide duty free access to Peruvian goods to their market. This was done to inhibit facilitation of narcotics trade between Peru, the U.S., and the EU.

Impact on Ecuador

Ecuador also is not a signatory of any free trade agreement. However, as in case of Peru, the country is a beneficiary of the U.S. and the EU's trade policy against narcotics trade.

The unilateral acts have meant that the majority of exports from Peru and Ecuador are already entering duty free into the U.S. and the EU. Therefore, the signing of FTAs in the future is not expected to substantially benefit these countries. Thus, an increase in exports through the Panama Canal might contribute to economic growth (GDP) for the concerned economies.

Impact on Australia

Australia has been cautious in signing FTAs. The country has only recently started negotiating an FTA with the U.S. The country's exports to the EU have been limited by geographical distance. Therefore, no major moves to sign an FTA with the EU or any of its constituents is anticipated. The signing of the FTA with the U.S. is expected to lead to a rise in the country's exports, as the U.S. is the second largest market for Australian reefer products.

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[2] Subject to Congress Approval

Net Impact on Canal Trade

The following sections detail the impact of the Free Trade Agreements and trade policies on trade flows. On net, the agreements and policies are projected to increase potential refrigerated trade flows (both on reefer and container ships) through the Canal by an estimated 93,000 metric tons in 2010 and 220,000 metric tons in 2025. (Simulation of the reefer model, removing each of the identified trade agreements and policies reduces cargo tons on reefer ships through the Canal by only 87,000 tons in 2025.) All of the trade policies except for one boost trade through the Canal. Trade policies affecting U.S. and Ecuador trade are expected to reduce Canal transits because they improve trade between Ecuador and the U.S. West Coast, a non-Canal route, and reduce trade flows from the east coast of Central America to the U.S. West Coast, a Canal route. This change in trade flows more than offsets increased transits between the U.S. East Coast and Ecuador as a result of the trade policies affecting U.S. trade with Ecuador.

Net Impact of Free Trade Agreements and Trade Policies on Canal Trade Flows (metric tons)

	2005	2010	2015	2020	2025
FTA Between U.S. and Chile	3,984	14,928	27,360	29,150	30,959
FTA Between EU and Chile	18,447	44,442	48,625	51,519	54,642
Trade Policies Affecting U.S. and Ecuador Trade	-12,335	-22,499	-22,656	-22,664	-22,668
Trade Policies Affecting EU and Ecuador Trade	0	17,616	20,693	23,282	26,319
FTA Between U.S. and Australia	9,325	38,876	70,395	101,136	131,109
Total	**19,421**	**93,363**	**144,417**	**182,423**	**220,361**

Impact of Trade Agreements on Chile

This section contains a discussion of the impact of the following trade agreements on exports from Chile:

- Chile – U.S. FTA
- Chile – EU FTA

Chile – U.S. FTA[3]

Description of the FTA

On December 12, 2002, Chile and the U.S. announced the conclusion of a 12-year negotiation process for an FTA between the two countries. The objective of the trade agreement was primarily to reduce trade distortions and to increase the competitiveness of agricultural products against the other trade blocks.

The following were the underlying provisions of the FTA between the two countries:

- The elimination of tariffs in a maximum period of 12 months, including a 0 percent tariff on 95 percent of the Chilean products and 90 percent of the U.S. products.
- Effective dispute resolution mechanism
- The agreement also covered the Intellectual Property, Labor, Environment and e-commerce chapters

Impact of the U.S. FTA

The U.S. is Chile's main trading partner, as a destination for U.S. $3.8 billion of Chilean exports in 2002, or 20.7 percent of the country's total[4] exports. The products exported by the two countries are complementary and not competitive in nature. The trade agreement between the two, ratified in 2003, is therefore expected to enhance the trade opportunity. According to the Chilean government, the agreement has a potential of increasing the trade between the two parties by 30 percent. The following sectors would most benefit as a result of the trade agreement:

- Agriculture and Construction Equipment
- Farm Products: Pork, Beef, Soybeans, Grains, Potatoes, Processed Food Products
- Textile and Apparel
- Banks, Securities, Insurance and Related Services.

The agreement will be implemented in January 2004.

[3] Foreign Agriculture Service Department of The U.S. Department of Agriculture

[4] U.S. Department of State

Impact on Refrigerated Goods

The following section discusses the impact of the U.S. FTA on exports of the following refrigerated goods:

- Beef
- Dairy Products
- Deciduous Fruits
- Vegetables
- Wine

Beef

As a result of the trade agreement, Chile gains preferential access to the U.S. market according to the following schedule:

- The existing tariffs are reduced over 4 years and then eliminated in the fourth year of the trade agreement.
- Upon implementation of the agreement, Chile receives a tariff-free quota of 1,000 metric tons of beef to ship into the U.S., which rises by 10 percent annually over four years and is then eliminated.
- The FTA also eliminates the 4 percent tariff Chile currently faces on beef on the existing WTO tariff-rate quota amount that is not allocated among WTO members. A net importer of beef products, Chile is not expected to become a significant supplier to the U.S. market.

Dairy Products

The following schedule has been devised for elimination of tariffs on dairy products:

- Initial duty-free quotas are established for dairy products, which are then increased 7-percent annually until all quotas are eliminated after 12 years.
- During the first year of the agreement, the following duty-free quotas are established on Chilean dairy products entering the United States: 1,432 metric tons for cheese; 300 metric tons for butter and butterfat; 828 metric tons for milk powders; 489 metric tons for condensed and evaporated milk; and 452 metric tons for other dairy products including some chocolates and food preparation.
- Under the agreement, the FDA will continue to have authority to test and approve imports from Chile, similar to what it does for other countries.

Deciduous Fruits

Since Chile already has duty-free access for most deciduous fruits, the agreement is expected to have little impact on Chile's total fresh fruit shipments to the U.S. market. The following are the specifications of the FTA with respect to deciduous fruits:

- The nominal duties will be immediately eliminated on table grapes.

- In the case of fresh berries, nominal duties will be immediately eliminated, which may allow Chile to improve its competitive position vis-à-vis China.
- The tariffs on most frozen berries will be eliminated in 8 or 12 years, depending upon the product. The agricultural safeguard mechanism will apply to frozen cherry products.
- In the case of canned pears, canned apricots, canned nectarines, and canned fruit mixtures, a 12-year, non-linear tariff reduction schedule applies as well as the agricultural safeguard provision. Under the non-linear formula, the tariff remains at current rates for the first 4 years, is reduced by one-third over the next four years, and the remaining duty is phased out over the subsequent four years. The non-linear formula also applies to canned peaches.
- An 8-year tariff reduction schedule will apply to dried apricots and most other dried fruit. The non-linear tariff reduction formula will be used to eliminate the tariff on dried plums.

Vegetables

The following is the impact of the FTA on vegetable exports:

- Some fresh and processed vegetables from Chile will continue to benefit from duty-free access, while others facing tariffs will benefit from immediate tariff elimination.
- In other cases where the U.S. industry is more sensitive to trade, tariffs will be phased out over 4 to 12 years.
- For some products, different schedules are established for different times of the year. For example, cucumbers entering December 1 through February will be liberalized immediately, while the tariff on cucumbers entering March 1 through April will be eliminated in 8 years, and the tariff on cucumbers entering May 1 through June and September 1 through November will be eliminated in 10 years.

Wine

Chilean wines gain preferential access to the U.S. market.

- The U.S. will apply the same graduated tariff reductions to Chilean wine exports as Chile will apply to imports from the United States.
- Thus, wine tariffs in both countries will be eliminated at the end of the 12-year phase

Table II.6
Impact of FTA on U.S. Trade with Chile and Competitive Markets

	2005	2010	2015	2020	2025
Other Deciduous Fruit					
U.S. East Coast Imports From:					
Chile	4,853	18,206	33,411	35,663	37,960
New Zealand	-210	-783	-1,423	-1,501	-1,574
Southern Africa	-176	-649	-1,166	-1,215	-1,260
South East Asia	-148	-563	-1,045	-1,130	-1,219
Argentina	-873	-3,255	-5,934	-6,269	-6,584
Brazil	-679	-2,558	-4,722	-5,077	-5,449
Peru	-341	-1,295	-2,415	-2,639	-2,894
U.S. West Coast Imports From:					
Chile	2,429	9,155	16,935	18,230	19,560
New Zealand	-380	-1,418	-2,589	-2,739	-2,877
South East Asia	-367	-1,396	-2,601	-2,822	-3,049
Peru	-297	-1,127	-2,108	-2,311	-2,539
Argentina	-120	-449	-822	-871	-916
Brazil	-43	-163	-302	-326	-350
Southern Africa	-7	-25	-44	-46	-48

The Chile-EU FTA

Description of the FTA

Twenty-four percent of Chile's gross exports are shipped to Europe. The elimination of custom duties was therefore the most important outcome of the agreement. The agreement also included sections on services, market access, and investment.

With respect to the custom duties, the following are the highlights of the agreement.

- From the EU's side, there will be 100 percent liberalization in industrial sectors and quasi-total liberalization in fishing and agriculture, with respect for a very limited number of sensitive sectors. For the EU's imports, 99.7 percent of imports by value are covered immediately. For Chile's imports, the FTA will cover 97 percent of imports by value over 7 years and 94 percent of imports by value immediately.
- The total transition period is up to 10 years for certain products
- Tariff quotas are applied on a limited number of products, for example in fisheries, either as a transitional measure with an increase in the tariff quota in each year towards open trade or in a very limited number of cases to restrict entry in order to safeguard the domestic industry.
- Non-Tariff measures included Custom cooperation and rules of origin, agreement on the fight against trade related fraud, trade facilitation, and Institutional cooperation agreement etc.

Impact of Chile–EU Trade Agreement

The trade agreement between Chile and the EU has a varied impact across the product portfolio of both parties. However, the following sectors have the maximum impact as a result of these sectors being directly opened to competition as a result of the trade agreement.

- Mining and Non-Ferrous Metals
- Fishing
- Processed Food
- Grains
- Forestry
- Textile and Clothing
- Beverage and Tobacco

Impact on Refrigerated Goods[5]

This section discusses the impact of the EU FTA on exports of the following refrigerated goods:

- Fisheries
- Wines
- Fruits and Vegetables

<u>Fisheries</u>

- The agreement allowed European companies to purchase 100 percent ownership rights in Chilean fishery enterprises. The net impact on fisheries exports as a result of the agreement is expected to be positive.
- In addition, with Chile in the process of introducing Individual Transferable Quotas (ITQs) that will privatize access rights to fisheries and will encourage the concentration of quotas in the hands of a few large companies, there is a possibility of export growth as a result of economies of scale and scope.
- Another aspect of the trade agreement that has a positive impact on the export growth is the elimination of tariff barriers over a span of 10 years. As a result of the agreement, duties on 34.3 percent of the fisheries products were immediately reduced to zero with a tariff elimination schedule of further reducing the tariff on 42 percent of the products by 2010 and the remainder by 2012. However, the impact of the tariff elimination process is negatively impacted by the quantitative restriction (5000 metric tons) imposed by the EU on Chilean exports of fisheries.

<u>Wine</u>

- As part of the trade agreement between the two parties, the EU agreed to cut its tariffs from the current level of 5 percent to 6 percent to zero in four years' time. This will enable Chile to expand its exports to EU markets more rapidly.

[5] European Commission analysis

- Chile will withdraw all European names like Bordeaux, Burgundy, Champagne and Chateau from Chilean wine over a transition period of five to 12 years for which the EU will not pay Chile any financial compensation.

Fruits And Vegetables

- Exports of processed fruits and vegetables are expected to be positively impacted by the trade agreement as a result of the tariff elimination process agreed upon by the European Union.
- The EU immediately eliminated tariffs on 33 percent of the agricultural products, including refrigerated goods, while the rest of the tariffs will be eliminated by 2012. However, quantitative restrictions remain in place, ranging from 1000 metric tons to 7250 metric tons, depending on the product classification[6].

Table II.7
Impact of FTA on EU Trade with Chile and Competitive Markets

	2005	2010	2015	2020	2025
Other Deciduous Fruit					
Western Europe, South Imports From:					
Chile	2,337	5,126	5,667	6,343	7,134
Argentina	-459	-1,007	-1,115	-1,249	-1,404
New Zealand	-257	-565	-625	-700	-789
Western Africa	-202	-443	-489	-545	-611
Southern Africa	-165	-358	-392	-434	-483
Brazil	-74	-164	-184	-210	-241
South East Asia	-4	-9	-11	-12	-14
Australia	-3	-7	-8	-9	-10
Peru	-2	-5	-6	-7	-8
Other E. Coast S.A.	-2	-4	-5	-6	-6
Western Europe, North Imports From:					
Chile	7,257	15,028	15,509	16,022	16,531
Southern Africa	-1,222	-2,529	-2,608	-2,690	-2,770
New Zealand	-826	-1,709	-1,761	-1,816	-1,868
Western Africa	-608	-1,252	-1,283	-1,316	-1,347
Argentina	-454	-946	-984	-1,025	-1,066
Brazil	-403	-828	-847	-866	-883
East Africa	-35	-76	-82	-89	-96
South East Asia	-35	-77	-84	-92	-102
Australia	-27	-59	-65	-73	-82
Peru	-16	-35	-39	-43	-48
Other E. Coast S.A.	-1	-2	-2	-2	-3
Apples					

[6] Product classifications are available in the **Texts of the EU-Chile Association Agreement** available at http://www.eurochile.cl/pags_i/acuerdo/index.html

Western Europe, South Imports From:					
Chile	1,643	3,607	3,993	4,478	5,047
Argentina	-573	-1,261	-1,399	-1,573	-1,776
Southern Africa	-167	-364	-399	-443	-494
New Zealand	-81	-179	-199	-224	-253
Western Europe, North Imports From:					
Chile	4,764	11,561	11,989	12,450	12,915
New Zealand	-2,230	-5,419	-5,628	-5,855	-6,083
Southern Africa	-1,453	-3,514	-3,630	-3,753	-3,875
Argentina	-911	-2,215	-2,300	-2,393	-2,486
Brazil	-122	-297	-308	-319	-331
Australia	-23	-56	-58	-60	-63
Other E. Coast S.A.	-18	-44	-48	-53	-58
South East Asia	-7	-16	-17	-18	-19

Seafood					
Western Europe, South Imports From:					
Chile	2,143	7,987	9,765	10,466	11,196
Argentina	-269	-1,007	-1,244	-1,352	-1,468
South East Asia	-240	-887	-1,073	-1,136	-1,199
Southern Africa	-226	-846	-1,038	-1,117	-1,199
Western Africa	-163	-602	-728	-769	-810
Other E. Coast S.A.	-76	-285	-351	-378	-407
New Zealand	-54	-202	-249	-270	-293
East Africa	-22	-81	-97	-102	-106
Peru	-10	-36	-44	-48	-51
Brazil	-8	-30	-37	-40	-43
Australia	-4	-17	-20	-22	-23
Western Europe, South Imports From:					
Chile	332	1,212	1,795	1,863	1,931
Argentina	-76	-277	-408	-422	-436
South East Asia	-36	-132	-196	-203	-210
Southern Africa	-24	-88	-131	-135	-140
Western Africa	-10	-35	-53	-57	-60
Other E. Coast S.A.	-9	-33	-49	-52	-54
New Zealand	-7	-24	-36	-37	-39
East Africa	-3	-11	-17	-17	-18
Peru	-1	-3	-4	-5	-5
Brazil	0	-1	-2	-2	-2
Australia	0	-1	-1	-1	-1

Impact of Trade Agreements on Peru

Peru currently is not a part of any FTA. This section contains a discussion of the impact of the following unilateral trade acts on exports from Peru:

- US trade policy with respect to Peru
- EU trade policy with respect to Peru

US Trade Policy[7]

Description

Though Peru has no FTA with the U.S., it has substantially benefited from certain unilateral acts of the U.S. government, such as the Andean Trade Promotion and Drug Eradication Act (ATPDEA), the Andean Trade Preference Act (ATPA), Generalized System of Preferences (GSP) and Most Favored Nation (MFN) Treatment.

- ATPA - The objective of the ATPA was to promote broad-based economic development, diversify exports, consolidate democracy, and defeat the scourge of drug-trafficking by providing sustainable economic alternatives to drug-crop production in Bolivia, Colombia, Ecuador and Peru. The ATPA covered 5500 products that were allowed duty free entry into the US.
- ATPDEA -The Andean Trade Promotion and Drug Eradication Act was enacted into a law on August 6, 2002, as part of the Trade Act of 2002. The program provides enhanced trade benefits for the four ATPA beneficiary countries. The ATPDEA renewed and amended the ATPA to provide duty-free treatment for certain products previously excluded under the ATPA. With the modification in the ATPA, more than 6000 products were included under duty free entry in the US.
- GSP - The U.S. Generalized System of Preferences (GSP) provides preferential duty-free entry for more than 4,650 products from approximately 140 designated beneficiary countries and territories. Peru and Ecuador are beneficiaries of the system.
- MFN - Imports may also enter the United States unconditionally if the column 1-general tariff rate is zero (column 1-general lists what were formerly known as Most-Favored-Nation (MFN) rates and are now known as normal trade relations (NTR) rates). Such traditional U.S. imports from the region as coffee, bananas, shrimp and bituminous coke and coal enter the U.S. market NTR duty free.

It is unclear, whether all of the refrigerated products exported by Peru are categorized in one of these agreements. However, according to the Office of the United States Trade Representative, more than 60 percent of the total exported goods from Peru enter duty free into the U.S.

[7] Office of the US Trade Representatives

Impact of the Trade Policy

- The growing importance of the U.S. market for Peruvian exporters is reflected by the fact that the U.S. share of Peru's total exports grew from about 16.6 percent in 1994 to 25.7 percent in 2002. Peru became eligible for preferential trade benefits under ATPA in August 1993 and received renewed and expanded benefits under ATPDEA in October 2002. Exports under ATPA, and now ATPDEA, have gained an increasingly important role in Peru's economy, as exporters have discovered that the ATPA as amended offers greater advantages than the benefits offered under the Generalized System of Preferences (GSP). The table below gives the percentage share of Peru's exports under one of these agreements.

Table II.8
Percentage Share of Peru's Exports to the US Under Different Agreements

Agreement	Percentage of Exports (2001)	Percentage of Exports (2002)
GSP	4.1	8.5
ATPA	38	19.6
ATPDEA	-	0.001
MFN	25.5	29.2

Source: Office Of The US Trade Representatives

- The impact of these trade agreements is positive for Peru, as it makes the export product more competitive with respect to other countries outside the bounds of the agreement.
- However, any amendment or change both in the terms of the agreement as well as the product portfolio categorized under the agreement might create a negative impact on total exports to the US. For example, in 2002, the pattern of U.S. imports from ATPA countries changed compared to previous years, primarily due to the expiration of ATPA for approximately eight months, from December 4, 2001, until August 6, 2002. In 2002, just over half of U.S. imports from ATPA countries entered the United States duty free, a decline from previous years, largely because ATPA-eligible products were subject to NTR duties when ATPA was not in effect.

EU Trade Policy[8]

Description

The trade policy of the European Union is similar to that of the U.S. The similarities in the trade policy are linked to the negative impact on both economies as a result of the illicit drug-trafficking and money-laundering originating from the Andean Community. To counter such exports, the EU has formally made almost all products originating from Andean Countries duty free via various unilateral acts.

[8] European Commission Delegation in Peru

The EU does not have any FTA with the Andean Community or any of its beneficiaries individually. However, unilateral acts like GSP and National Plan for the Fight Against Drugs and International Cooperation for the fight against drugs help facilitate free trade between the two parties.

- GSP - The European Union GSP grants custom duty reductions without quantitative limits. The countries benefiting from the EU GSP are those nations under development (transition economies). Given its non-reciprocal nature, the GSP allows some 90 countries to benefit from trade preferences, in the same way as those that do have preferential agreements with the EU. Peru and Ecuador are both beneficiaries of the EU GSP.
- National Plan for the Fight Against Drugs- There is also a special regimen of additional preferences for countries that are fighting the production and traffic of drugs: Bolivia, Colombia, Ecuador, Peru, Venezuela, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, Panama and Pakistan. The drug regimen contemplates access to the European market free of customs duties for industrial products that appear in the general regimen and that are classified as sensitive products. This regimen also contemplates access free of customs duties for certain agricultural products, which are included in the general regimen and are classified as sensitive products. The regimen also establishes access, free of customs duties, for specific agricultural products that are not included in the general regimen.
- Most Favored Nations (MFN) status

The Andean Community does not have any formalized trade agreement with the EU. However, the trade is primarily free of customs duties as the majority of the exports get classified under the GSP or the Special Act to Fight Against Drugs. The net impact of any future FTA is debatable as the trend is expected to shift to increased exports from the EU to the Andean Community and will not have any substantial impact on exports from the Andean economies to EU.

Impact of the Trade Policy

- Peru is the Andean country that has enjoyed the maximum increase in exports due to the EU trade policy.
- The main groups of products exported by Peru to the European Union are food and live animals, raw materials (excluding fuels), basic manufactured items, and other unclassified goods.
- Within the group of 'Food and Live Animals', Peru exports to the European Union mainly fresh fish, crustaceans and molluscs, fresh vegetables and tubers, as well as coffee and products for animal feed. The exports in this group go mainly to Germany, the UK, and Spain.
- With the current acts in place, Peru's exports to the EU are increasing at an annual growth rate of 5.5 percent[9]. With few exceptions, all the refrigerated goods are classified either under the GSP or Special Drug Act resulting in an overall increase in these exports. According to the European Commission

[9] European Commission Delegation in Peru

Delegation to Peru, around 60 percent of the agricultural products eligible under GSP entered EU custom free in 2000. This includes edible preparations, fisheries, and live plants.

Table II.9
Peru's Usage Rate of GSP (2000)

EUR (000)	Total Exports	Eligible for GSP	GSP Utilized	Rate of Use
All Products	1,684,449	520,897	331,939	63.72%
Agriculture	607,212	379,553	225,036	59.29%
Industry	957,089	48,278	35,410	73.35%
Textiles	113,400	93,065	71,492	76.82%

Source: European Commission Delegation in Peru

- In 2002, the European Union imposed restrictions on non-pectineus bivalve molluscs and animal foods on the grounds of serious deficiencies with regards to hygiene. The impact of the restriction on Peruvian exports was substantial since molluscs contributed U.S. $60 million in 2001 to the total exports, and the EU was the single largest market for Peruvian molluscs. In addition to these examples of how hygiene concerns can trigger restrictive trade policies, controversial environmental issues, labor rights violations, and quality concerns can also spur the imposition of serious restrictions on products that could potentially have an adverse impact on the EU economies.

Impact of Trade Agreements on Ecuador

Ecuador currently is not a part of any FTA. This section contains a discussion of the impact of the following unilateral trade acts on exports from Ecuador:

- U.S. trade policy with respect to Ecuador
- EU trade policy with respect to Ecuador
- Lomé Convention

US Trade Policy[10]

Description

Due to the relatively small size of the Ecuadorian economy, there is no current FTA between Ecuador and the U.S. However, the similarities between the Andean economies have led to the development of exports for both Ecuador and Peru. Ecuador is one of the four beneficiaries of the Andean Trade Promotion and Drug Eradication Act (ATPDEA) and the Andean Trade Preference Act (ATPA). With similar competitive advantages, the economies of Peru and Ecuador have benefited in a similar fashion. According to the Office of the United States Trade Representative, more than 50 percent of the total exported goods from Ecuador enter duty free into the U.S.

Impact of Trade Agreements

Ecuador's primary export product to the U.S. remains Petroleum and its derivatives, which are not a part of the Act. However, some of the non-traditional products have seen a jump of 100 percent as a result of these acts.

- The non-traditional export products that include plywood and other wood products, crabmeat, pineapples, and broccoli, experienced triple-digit sales increases to the United States in 2002.
- Exports of some traditional products have also increased since 2000. Banana exports rose from U.S. $ 821 million in 2000 to U.S. $ 969 million in 2002. Cacao exports jumped from U.S. $39 million in 2000 to U.S. $89 million in 2002. However, exports of other traditional products, such as shrimp and coffee, have fallen. Ecuador expects to significantly increase its exports of tuna in pouches due to the inclusion of the product in the ATPDEA.

[10] Office Of The US Trade Representatives

Table II.10
Percent Share of Ecuador's Exports to U.S. Under Different Agreements

Agreement	Percentage of Exports (2001)	Percentage of Exports (2002)
GSP	1.7	3.5
ATPA	10.9	4.1
ATPDEA	-	4.3
MFN	39.4	36.1

Source: Office of the US Trade Representative

Table II.11
Impact of Trade Policies on U.S. Trade with Ecuador and Competitive Markets

	2005	2010	2015	2020	2025
Bananas					
U.S. East Coast Imports From:					
Ecuador	17,809	33,094	33,562	33,562	33,562
Central America, East	-11,808	-21,926	-22,219	-22,201	-22,184
Columbia, East	-3,493	-6,509	-6,621	-6,642	-6,661
Central America, West	-621	-1,154	-1,169	-1,168	-1,168
Venezuela	-81	-148	-148	-146	-145
Caribbean	-20	-38	-38	-39	-39
South East Asia	-5	-10	-10	-10	-10
U.S. West Coast Imports From:					
Ecuador	37,374	69,451	70,435	70,435	70,435
Central America, East	-30,934	-57,501	-58,334	-58,351	-58,365
Central America, West	-1,628	-3,026	-3,070	-3,071	-3,072
Peru	-902	-1,655	-1,657	-1,636	-1,618
South East Asia	-81	-152	-155	-157	-158
Caribbean	-79	-149	-153	-155	-157
Mexico, West	-12	-22	-22	-22	-21
Seafood					
U.S. East Coast Imports From:					
Ecuador	2,842	5,830	6,226	6,226	6,226
South East Asia	-1,025	-2,090	-2,223	-2,218	-2,215
China Region	-705	-1,465	-1,568	-1,561	-1,551
Western Europe, North	-310	-638	-688	-694	-701
Chile	-192	-394	-423	-427	-431
Indian Subcontinent	-170	-347	-370	-372	-373
Central America, East	-155	-313	-332	-332	-332
U.S. West Coast Imports From:					
Ecuador	2,724	5,587	5,967	5,967	5,967
South East Asia	-1,125	-2,292	-2,440	-2,438	-2,438
China Region	-877	-1,821	-1,951	-1,945	-1,935
Indian Subcontinent	-215	-439	-468	-471	-474

Russia	-96	-194	-206	-206	-207
Chile	-79	-162	-174	-176	-178
New Zealand	-59	-121	-131	-135	-138
Other Deciduous Fruit					
U.S. East Coast Imports From:					
Ecuador	865	1,739	1,827	1,827	1,827
Central America, East	-458	-923	-971	-974	-975
Chile	-226	-449	-465	-458	-451
Caribbean	-26	-53	-55	-54	-53
Argentina	-25	-52	-57	-59	-62
Central America, West	-24	-49	-51	-51	-51
Brazil	-20	-41	-45	-48	-51
U.S. West Coast Imports From:					
Ecuador	1,426	2,844	2,982	2,982	2,982
Chile	-923	-1,827	-1,898	-1,878	-1,856
Central America, East	-216	-433	-456	-458	-459
China Region	-40	-84	-93	-98	-103
New Zealand	-38	-78	-84	-87	-91
South East Asia	-37	-76	-85	-90	-96
Peru	-30	-62	-68	-74	-80
Vegetables					
Ecuador to U.S. East Coast	342	909	987	987	987
Ecuador to U.S. West Coast	49	62	62	62	62

EU Trade Policy[11]

Description

The EU and Ecuador have signed the following agreements:

- Framework Co-Operation Agreement Between The European Economic Community And The "Cartagena Agreement" And Its Member Countries, Bolivia, Colombia, Ecuador, Peru And Venezuela
- Agreement Between The European Economic Community And Ecuador Relating To The Chemical Substances Frequently Used In The Manufacturing Of Illegal Drugs And Psychotropic Substances
- Framework Agreement Related To The Execution Of Financial And Technical Aid And The Economic Co-Operation In The Republic Of Ecuador By Virtue Of The Asian – Latin American Set Of Rules.
- Ecuador is also a beneficiary of the Generalized System Of Preferences

[11] European Commission Delegation To Ecuador

Impact of the Trade Policy

- Ecuador's exports to the EU have shown an annual growth of 3 percent. Since Ecuador is a beneficiary of GSP and the EU's National Plan for the Fight Against Drugs, the majority of the products enter the EU duty free. Shrimp, one of the major export items from Ecuador, enters the European market with a tariff of 3.6 percent, as opposed to 4.5 percent of other countries like Thailand.

Table II.12
Ecuador's Usage Rate of GSP (2000)

EUR (000)	Total Exports	Eligible for GSP	GSP Utilized	Rate of Use
All Products	855,903	431,021	258,065	59.87%
Agriculture	793,134	396,982	238,510	60.08%
Industry	43,599	26,990	15,175	56.22%
Textiles	19,031	7,013	4,379	62.44%

Source: European Commission Delegation To Ecuador

Table II.13
Policy Impact on EU Trades

	2005	2010	2015	2020	2025
Bananas					
Western Europe, North Imports From:					
Central America, East	0	-6,600	-7,725	-8,692	-9,826
Caribbean	0	-943	-1,104	-1,242	-1,404
Ecuador	0	9,428	11,036	12,417	14,037
Western Africa	0	-1,886	-2,207	-2,483	-2,807
Western Europe, South Imports From:					
Central America, East	0	-5,731	-6,760	-7,605	-8,598
Ecuador	0	8,188	9,657	10,865	12,282
Caribbean	0	-819	-966	-1,086	-1,228
Western Africa	0	-1,638	-1,931	-2,173	-2,456

Ecuador is the world's largest single exporter of bananas. After an intense negotiation with the EU and the U.S. and a resulting agreement signed between the concerned parties, Ecuador has finally been able to increase its exports based on its competitive advantage.

The agreement abolishes the EU's import breakdown on a country quota basis, increases the import volumes from Latin America by 100,000 tonnes, and improves market access to traditional and non traditional importers from Ecuador, following the WTO ruling on GATS. The new regime will hold for a transitional period through to the establishment of a tariff-only system by 2006.

Lomé Convention[12]

The Lomé Convention is an international aid and trade agreement between the 71 countries of the ACP (African Caribbean and Pacific Countries) group and the EU. It is aimed at supporting the efforts of ACP states to achieve comprehensive, self reliant and self-sustained development. Under the Lomé Convention, all ACP industrial exports and most agricultural exports are free from import duties. Certain financial and technical aid was also agreed upon, and the European Development Fund was set up to administer foreign aid to the ACP countries.

Four such conventions have been signed to date. The first Convention (Lomé I) was signed on February 28, 1975. Lomé II and III were signed in 1979 and 1985, respectively. The last convention, the Lomé IV, covers the period from 1990 to 2000 and is the most extensive development co-operation agreement between Northern and Southern countries, in terms of scope (aid and trade) and the number of signatories.

Lomé IV covers a broad range of sectors eligible for support under the development finance cooperation chapters of the convention. These include the environment, agriculture, food security and rural development, fisheries, commodities, industry, mining and energy, enterprise (private sector) development, services, trade, cultural and social cooperation and regional cooperation. Lomé also has extensive provisions for trade cooperation, which provide preferential treatment to ACP exports to the EU. In 1994, Lomé IV underwent a mid-term review, which resulted in approval of the 8th environment development fund to cover the five-year period between 1995-2000.

Trade in Bananas to the European Union[13]

Banana exports to the EU are vital to the economies of Caribbean States. These exports depend on protective measures from the EU, provided under the Lomé Convention through the EU banana regime.

[12] General Secretariat of the African, Caribbean and Pacific Group of States

[13] The European Commission

Original Situation

Protocol No.6 appearing in the Lomé Convention provides for measures designed to offer the ACP countries better access to the Community markets:

- ACP states would have access to the European markets and market advantages. No ACP State will be placed in a less favorable situation as regards its exports of bananas to the EU.
- European Community and ACP states would jointly undertake and implement appropriate measures, particularly with respect to investments, in order to enable the ACP States, particularly Somalia, to increase their banana exports to their traditional Community markets.
- European Community and ACP states would jointly endeavor to enable the ACP States to gain access in new community markets to extend their banana exports to those markets.

A permanent group shall be established to assist in the achievement of these objectives. The group would review the progress and make such commendations as are considered appropriate.

U.S. – EU Conflict

The history of the dispute began in the early 1990s over the importation and exportation of bananas. The EU has been held in violation of the GATT (General Agreement on Tariffs and Trade) for their external agricultural practices. Five other countries - Guatemala, Ecuador, Honduras, Mexico, and Panama - also brought their opposition to the trade restrictions at the WTO.

The US claims that the EU has excluded Latin American produce from their shelves in order to cater to their ACP program. According to US, prior to 1993, the countries of France, Spain, and the UK were the only ones to restrict the entrance of bananas from American companies into their markets. But after the formation of the EU, all fifteen nations participated in this practice.

The WTO ruled in favor of the US in 1997 and granted the EU until January 1, 1999 to restructure their practices into compliance.

The Dispute Settlement and Future Scenario

The long dispute over the EU banana import regime is now over. In April 2001 the EU finally reached agreement with the USA and Ecuador, the main critics of the previous regime, on a two-stage end to the dispute. This provided for an amended quota regime to apply to the end of 2005; and thereafter for only a flat rate tariff, at a level still to be negotiated.

The agreed regime retains the fundamental element of tariff quotas, which limit the total volumes of bananas imported into the EU and thus provide a degree of market stability. The ACP has a specific quota for their exclusive use, duly authorised by a WTO waiver.

The ACP quota has been reduced to 750,000 metric tons, compared to 857,000 metric tons hitherto, while the two-dollar quotas (A/B) have been increased by 100,000 metric tons to a total of 2,653,000 metric tons.

Moreover, the European Commission decided in February 2002, that 11 percent of the ACP quota should be set-aside for new operators who had not imported from ACP origins. This has left traditional operators who imported from the Caribbean with lower licence allocations than in the past. These are likely to be inadequate to meet the needs of the Caribbean growers dependent on them.

Implications

US led objections to the banana protocol and the WTO ruling against it has spelled the end for the Lomé convention in its present form. With the recent developments at the WTO and settlement of EU – US conflict, the protective treatment and quotas for ACP states will come to an end by 2005. Countries such as Ecuador, Honduras, Mexico, and Panama would be benefiting the most from this new arrangement and would see an increase in their banana exports to the EU.

Impact of Trade Agreements on Australia

Australia does not have FTA with the US or the EU. The section contains a discussion of the impact of the following on exports from Australia:

- US trade policy with respect to Australia
- EU trade policy with respect to Australia

US Trade Policy with Respect to Australia[14]

Australia has recently started negotiations with the US on a FTA as described below.

Description

Australia and the US are in the process of negotiating a FTA and are committed to finalizing the negotiations by the end of 2003. Australia's specific objectives for negotiations with the United States are as follows:

- Removal of tariff rate quota restrictions on Australian exports to the United States, including those affecting exports of beef, dairy products, sugar, peanuts and cotton
- Elimination or reduction of United States agricultural subsidies that affect Australian exports to the United States or to third country markets, as well as agreement for the United States not to subsidize exports of agricultural products to Australia

Impact of the Trade Agreement

- Australia's main exports to the United States in 2002 were beef, crude petroleum, alcoholic beverages, aircraft and parts, and motor vehicles. The US is Australia's second largest market for elaborately transformed manufactures (ETMs),
- According to the Center for International Economics, liberalization of bilateral trade and investment could boost Australia's GDP by 0.3 to 0.4 percent per annum within ten years, which comes to a gain of US$ 4 billion annually.

<u>Impact of Trade Agreement on Refrigerated Goods</u>

The section discusses the anticipated impact of the FTA on exports of the following products to the US:

- Dairy Products
- Beef
- Wine

[14] Australian Department of Foreign Affairs and Trade

Dairy Products

- The US maintains Tariff Rate Quotas (TRQ) on the importation of a range of dairy products, with out-of-quota tariffs set at prohibitive levels. Under the Uruguay Round Agreement global cheese access was set at 140 000 metric tons, of which Australia was allocated 7 000 metric tons.
- In-quota tariffs range between 10 and 16 percent and out-of quota tariffs range between 60 and 65 percent, depending upon the international spot price. The estimated tariff equivalent of these TRQ is around 20 percent across cheese varieties.
- The free trade agreement is expected to liberalize tariff quotas or lower the tariff rate on these products and hence is expected to boost the Australian exports to the US.

Beef

- The US maintains a TRQ on beef. Australia has a TRQ allocation of 378,214 tonnes of beef. The TRQ did not limit access to the US until recently, when the quota was filled for the first time in 2001.
- In-quota tariffs of 4.4c/kg apply to most beef items, while the general out-of quota tariff is an ad valorem tariff of 26.4 percent. It is difficult for out-of-quota Australian beef to compete with domestic US production once the out-of-quota tariff is applied, effectively limiting Australian exports of beef to the US to little more than the TRQ allocation.
- The possible impact of the Australia US free trade agreement could be rationalization of non-tariff restrictions, usually tariff quota on exports of beef to US. Industry assessments rate the export values increase at between US$ 125 - 450 million, depending on world price and market demand.

Wine

- At present, a small tariff applies on wine exports to the US. Labelling requirements are detailed and strictly enforced. A certificate of label approval from the Bureau of Alcohol, tobacco and Firearms is required to release wine from Customs. The free trade agreement would address these issues and possibly reduce the barriers affecting the Australian exports to the US to the minimum.

Table II.14
Impact of FTA on U.S. Trade with Australia and Competitive Markets

	2005	2010	2015	2020	2025
Meat					
U.S. East Coast Imports From:					
Australia	11,080	44,039	78,652	112,509	145,692
New Zealand	-1,640	-6,528	-11,691	-16,783	-21,816
Western Europe, North	-613	-2,457	-4,431	-6,385	-8,316
Central America, East	-404	-1,582	-2,767	-3,877	-4,923
Mexico, East	-28	-109	-190	-265	-336
China Region	-27	-110	-193	-270	-339
Canada, East	-26	-103	-179	-249	-315
Central America, West	-21	-83	-146	-204	-259
South East Asia	-6	-23	-42	-59	-76
Chile	-2	-7	-11	-15	-19
Western Europe, South	-1	-5	-8	-11	-14
Argentina	0	-2	-3	-5	-7
Other Mediterranean	0	-1	-2	-3	-3
U.S. West Coast Imports From:					
Australia	3,725	14,807	26,444	37,827	48,984
New Zealand	-860	-3,418	-6,103	-8,730	-11,307
Western Europe, North	-59	-235	-423	-608	-789
China Region	-7	-29	-52	-72	-90
South East Asia	-4	-18	-32	-45	-58
Central America, East	0	-1	-2	-2	-3
Dairy					
U.S. East Coast Imports From:					
Australia	0	2,071	4,828	7,459	9,901
New Zealand	0	-216	-504	-778	-1,028
Western Europe, North	0	-144	-340	-537	-729
Central America, East	0	-74	-164	-239	-300
Mexico, East	0	-51	-121	-188	-251
China Region	0	-16	-40	-65	-91
Canada, East	0	-6	-13	-20	-26
Central America, West	0	-3	-8	-13	-17
South East Asia	0	-2	-5	-7	-9
Chile	0	-2	-4	-5	-7
Western Europe, South	0	-2	-4	-6	-7
Argentina	0	-1	-3	-5	-6
Other Mediterranean	0	-1	-2	-4	-5
U.S. West Coast Imports From:					
Australia	0	35	74	109	141
Western Europe, North	0	-6	-12	-18	-24
South East Asia	0	-1	-2	-3	-3
Eastern Europe	0	-1	-2	-2	-3

Western Europe, South	0	-1	-1	-2	-2
Argentina	0	0	-1	-1	-2
New Zealand	0	0	-1	-1	-1

EU Trade Policy with Respect to Australia[15]

There is no FTA between the EU and Australia. The main agreement governing the bilateral relationship is the 1997 'Joint Declaration on Relations' between Australia and the European Union. In this agreement both sides reaffirmed their determination to build up their relationship in order to support democracy, to promote peace and security, non-proliferation, a sound world economy with low inflation, high employment, a stable international financial system and a strong multilateral trade system based on free and open market principles.

The following agreements underline the importance and contribute to the success of the bilateral economic relationship:

- The Wine Agreement (1994) aims at protecting a number of geographic indications and traditional expressions while improving access of Australian wines to the European Community market
- The Mutual Recognition Agreement (1999) is expected to facilitate more than a third of bilateral trade in industrial products

Australia is the largest supplier of wine to the EU. As far as the other refrigerated goods such as fruits, vegetables, fish, and meat are concerned; Australia does not have much trade with the EU. So, Australia does not compete with Chile, Peru, and Ecuador as regards the export of refrigerated goods to the EU.

[15] The European Commission

Risk In Trade Creation

The section contains a discussion of the external factors that might impact the flow of the goods through the Panama Canal. The following are the risks in trade creation:

- North African Nations – EU Trade Policy
- The El Niño Effect

North African Nations – EU Trade Policy

The North African nations do not have separate FTAs with the EU. However, as per the Barcelona declaration adopted at the Euro-Mediterranean conference on 28th November 1995, a free-trade area will be established through FTA between partners of the European Union. All North African countries such as Algeria, Morocco, Tunisia, and Egypt were partners in this declaration. The parties have set year 2010 as the target date for the gradual establishment of this area, which will cover most trade in conformity with the regulations of the WTO.

The free trade area would be implemented through 'Association Agreements'. The European Economic Commission (EEC) is responsible for preparing, negotiating, and implementing Association Agreements with the partner states. The new generation of Euro-Mediterranean Association Agreements provides for the gradual implementation of bilateral free trade. The Euro-Mediterranean Free-Trade Area proposes free trade in manufactured goods and progressive liberalization of trade in agricultural products.

Morocco

The EU-Morocco Association Agreement was signed on 26th February 1996 in Brussels. It came into force on 1st March 2000 following its ratification by the Parliaments of the 15 EU Member States, the European Parliament and the Moroccan Parliament. It replaces the 1976 Co-operation Agreement.

The EU is Morocco's biggest trading partner and trade between the EU and Morocco has increased substantially in the last decade. EU imports from Morocco almost doubled between 1993 and 2002 (growing from EUR 3.394 billion to EUR 6.27 billion).

Morocco's main exports to the EU are foods (fishery products, fruit, early produce – particularly tomatoes and citrus fruit), flowers and finished consumer products (mainly textiles).

Morocco poses the biggest threat to Chile, Peru, and Ecuador as regards the trade in refrigerated goods to EU after the implementation of free trade area by 2010.

Algeria

The EU-Algeria Association Agreement was signed on 19 December 2001 in Brussels. It will come into force after ratification by the European Parliament and the parliaments of Member States as well as Algeria.

The Association Agreement commits both sides to further liberalization of bilateral trade. It provides for the gradual removal of import duties on EU industrial products. Algeria already enjoys duty and quota free access to EU markets for its industrial exports. The EU has opted for a policy of immediate liberalization (without duty or quota) for a number of Algerian agricultural products except for a limited list of sensitive categories. Both Algeria and EU agreed on significant tariff reductions for processed agricultural products and for fish products.

The Algerian economy is largely dependent on hydrocarbons (oil and gas), which contributes 97 percent of its exports. Agriculture is marginal, while the non-hydrocarbons industrial sector contributes just 7 percent to GDP. So, Algeria does not currently pose any major threat for Chile, Peru, and Ecuador regarding the trade in refrigerated goods to the EU after the implementation of the free trade area by 2010. Even post establishment of a free trade area, the impact on the total exports of refrigerated goods is not projected to be substantial since the relative contribution of refrigerated goods is not expected to increase drastically. In 2001, refrigerated goods contributed a mere U.S. $20 million to total exports of U.S. $16.98 billion.

Tunisia

Tunisia was the first country in the North African region to sign an Association Agreement with the European Union in July 1995. The agreement came into force on 1st March 1998. Under the terms of the Agreement, the EU and Tunisia commit themselves to creating a free trade area between themselves by the year 2010. Tunisia has also concluded free trade agreements with Egypt, Jordan, and Morocco.

Tunisia is the most advanced of the North African countries as far as the introduction of a free trade area with the European Union is concerned. Dismantling of tariffs has resulted in a substantial increase in the trade and its integration into the European market and 80 percent of Tunisian exports goes to the EU.

Tunisia and the EU have made mutual concessions for trade in agricultural products. Tunisia's main exports include olive oil and wine. The EU has increased the preferential quota for Tunisian olive oil. But Tunisia does not have a high volume of refrigerated goods exports, so it does not pose any major threat for Chile, Peru and Ecuador.

Egypt

Egypt and European Economic Community (EEC) signed the EURO Mediterranean Association Agreement on 25th June 2001 in Luxembourg. However, it is still pending final approval for Egyptian People Assembly and the Parliaments of EU members. The agreement aims at establishing a Free Trade Area between Egypt and the EU members in 2010. The ratification process is underway and may be completed by the end of 2004.

The EU is Egypt's major trading partner and currently accounts for 31 percent of Egyptian exports and 30 percent of its imports. Italy, Germany, France, and the UK are

Egypt's main EU trading partners and account for over 70 percent of EU - Egyptian trade. Egypt's main exports to the EU in 2001 were oil and oil products (38 percent), textiles and clothing (17 percent), and agricultural products (9 percent), and chemicals.

Egypt does not have much exports as regards to refrigerated goods so, it does not pose any major threat for Chile, Peru, and Ecuador.

Conclusion

Establishment of a free trade area will increase the trade of refrigerated goods from North African countries such as Morocco and Tunisia to the EU. This would certainly have an adverse impact on the trade from Chile, Peru, and Ecuador to the EU. However it is difficult to quantify the impact, as the free trade area would come into effect only by 2010.

The El Niño Effect

El Niño can briefly be defined as the anomalous appearance of warm sea surface temperatures in the central and eastern equatorial Pacific Ocean. The phenomenon occurs in conjunction with another effect known as the Southern Oscillation, which refers to a seesaw-like pressure pattern in the western part of the tropical Pacific. El Niño originally referred to the appearance of warm water off the coast of Peru and Ecuador, where the upwelling of deep cold-ocean water normally occurs. By the 1970s, it was understood that these two Pacific Basin phenomena interact, affecting climate processes around the globe.

The basin-wide phenomenon is referred to as ENSO (El Niño-Southern Oscillation). ENSO has both a warm and a cold phase. The cold phase is referred to as La Niña, and El Niño is the warm phase.

El Niño reappears at intervals of 2 to 10 years with an average return of 4 ½ years. Once an El Niño event begins, it can last from 12 to 18 months, and sometimes as long as 24 months. The socio-economic and even political impacts on society of El Niño related climate anomalies, such as droughts, floods, fires, frosts and infectious disease outbreaks, often last much longer.

El Niño events can have different levels of intensity from weak to very strong, depending on how warm the ocean surface water gets, how long it remains well above average, how much of the ocean's surface it covers, and how deep the warm water is. El Niño's impacts around the globe will vary. The severity of those impacts is also affected by the degree of vulnerability in a given society, and that degree of vulnerability can vary from one event to another.

The last El Niño event started in mid-2002 and is ensuing to date. The previous El Niño event occurred between mid -1997 and June 1998, and was easily the most destructive El Niño of the century. Estimates of global losses range from U.S. $32 billion to U.S. $96 billion[16]. The countries in South America most severely impacted by the El Nino effect are Ecuador and Peru.

Effects on Peru[15]

During the 1997-98 event, the members of the scientific community in Peru issued a forecast about El Niño in June 1997, prompting the central government to set in motion a plan of preventive measures. It was the first time that a plan of this nature had been implemented in Peru. In all the previous El Niño events, the government reacted in the midst of the El Niño-related Southern Hemisphere summer rains. The 1997 forecast provided a six-month lead-time to implement a structured plan.

The government's stumbling block, however, was that it wanted to accomplish everything itself without the assistance of other governmental agencies or of society at large. The central government was interested in highlighting its importance as a

[16] The United Nations

guarantor of the security and prosperity of Peruvians. In addition, the government of President Alberto Fujimori wanted to highlight its efficiency and start paving the way for a third term in office without the interference of another agency that might question or dilute its leadership.

Impact on Agriculture

- Agriculture was one of the sectors most strongly affected by El Niño. It was one of the first economic sectors to feel the negative effects of the event in 1997 because a number of products such as olives and mangoes did not develop appropriately due to the unusually high temperatures and the disappearance of winter for that year.
- El Niño also silted up canals and drainage systems, and generally wreaked havoc on irrigation the systems. Consequently, agricultural output for the 1998-99 season was poor.
- Next to El Niño, diseases have been one of the principal problems facing Peruvian agriculture. The elevated temperatures that "tropicalized" the winter season along the coast gave rise to new pests and crop stresses starting in 1997 and continuing at damaging levels into the year 2000, affecting many valleys and a variety of crops.

Fisheries

- The El Niño had a negative impact on the fishing industry as well.
- However, the Instituto del Mar del Peru (IMARPE) managed the 1997-98 El Niño in a more prudent manner than it had done in earlier events. It did not allow over-fishing in 1997 before the warmer temperatures had set in. The marine biota withstood the trauma with enough remaining vitality to bounce back after only two bad years. Biological normality returned to the seas by the third year.
- Even though the catch of anchovies and sardines rebounded in 1999, this has not been the case for the hake catch, currently in its worst crisis.

Effects on Ecuador[15]

Impacts on Agriculture

- The anomalies in the weather pattern-especially in precipitation air temperature and humidity-were observed along coastal Ecuador as early as August 1997 in response to anomalous oceanic conditions.
- At this time some of the export crops such as mango, asparagus, and melon, among others, were not sown or were lost because of a lack of flowering. In the case of sugar cane, out of the 900 million pounds expected, only 50 million pounds (5.5 percent) were harvested. This resulted in the need to import sugar from neighboring countries to cover the production deficit during 1997.

- After August, heavy rainfall started inland affecting the entire agricultural sector. Until February 1998, total losses in rice, soy, banana (lack of production), and sugar cane (not sown) crops were up to US $ 300 million[17].
- The losses during 1997-98 (U.S. $302 million) were over 50 percent higher than those of 1982-83 (U.S. $200 million).
- However, a known post-El Niño benefit for agriculture is that the soil receives a lot of nutrients and it is better prepared for the next crops due to the heavy rainfall and flooding.
- The short cycle crops were the most affected; rice and corn for the second harvest of 1997 were lost totally. The rains that came with that El Niño episode flooded the fields over a long period of time and obstructed the initial sowing of these crops in 1998.
- Other crops such as beans, vegetables, and fruit were almost completely decimated due to flooding over a long period and premature flowering because of rain. As a result, production was either greatly reduced or lost entirely.
- The commercial products that were affected were sugar cane, banana, coffee, and cacao. The floods on the plantations damaged the first two crops, and the last two crops were damaged because of the rains during flowering.
- The damages to the banana plantations in the country did not have an effect on exports. The plantations are managed under high-tech standards, so prevention was oriented toward drainage systems. The main losses in this sub-sector were due to transport problems (e.g., highway and bridges destruction).
- The total area affected by El Niño reached 613,000 ha; some areas suffered a double impact due to the loss of the 1997 harvest and because the fields were flooded, affecting mainly rice and hard corn. The area affected by El Niño represented approximately 15 percent of the total agricultural land of the coastal area.
- The total amount of estimated direct loss for agriculture was U.S. $524 million, including the crops ready to be harvested and those lost in 1997 due to lack of transport. The indirect loss due to the impossibility of the first sowing of 1998 was estimated at U.S. $441.2 million. Thus, the total damage to the sector reached U.S. $996 million.

<u>Impact on Fisheries</u>

- The main impact of El Niño on the principal fisheries of the region (Ecuador, Peru and Chile) depended on the characteristics of the different resources. For example, sardine (*Sardinops sagax*) captures were drastically reduced (CPPS, 1998) while an increase was observed in the landings of "chuhueco" (*Cetengraulis mysticetus*).
- However, experts believe that this could have occurred because the sardine fleet was fishing closer to the coast than usual when fishing for sardine, and was in an area where "chuhueco" was usually abundant.
- Stocks of sardines and other pelagic species from Ecuador migrated southward to the Peru and Chile coasts, with a reduction of 57 percent of total landings

[17] Mundo Económico, Diario El Universo, March 17, 1998

during 1997 (248,277 metric tons) when compared to 1996 landings (435,961 metric tons).

- As a positive impact of El Niño, an increase in the recruitment success of yellow fin tuna was forecast and in fact did occur two years after the event (1999). This resulted in larger catches for the Latin American fleet than had been observed after previous ENSO warm events.

Effects on the Panama Canal

- With rainfall 35 percent below average, the usual maximum draft of 39.5 feet for a ship passing through the canal was cut to 36 feet.
- Another impact was the shippers leaving behind heavy empty containers on port lots, rather than having them place costly weight on returning ships.
- To save water, the canal - which used about 2 billion gallons of water a day in its lock system - implemented a variety of measures to cut consumption. Smaller ships were being squeezed into canal locks with bigger ships when possible.

Current Status[18]

- Four years later in March 2002, the El Niño impact re-emerged in the Pacific and is expected to continue in 2003. It is premature to determine the potential impact of this El Niño.
- The current El Niño has impacted only Peru among the Latin American countries.
- The impact of El Niño in 2002-03 is expected to be much more moderate than the devastating El Niño of 1998. Consequently, the Central Bank of Peru expected lower but still positive growth in agriculture (2003: +3.8 percent; 2002: +5.0 percent) and fishing (2003: +2.3 percent; 2002: +4.1 percent) in Peru. This is expected to positively influence output based on raw materials, which will grow 4 percent, according to Central Bank estimates, while non-primary GDP is expected to grow by 3.9 percent in 2003.

[18] CNN

III. The Conventional Reefer and Reefer Container Ship Fleet

Global Insight obtained reefer fleet data and an analysis of recent trends from Clarkson Research, London. The analysis covers both reefer ships and reefer container capacity.

Current Reefership Fleet

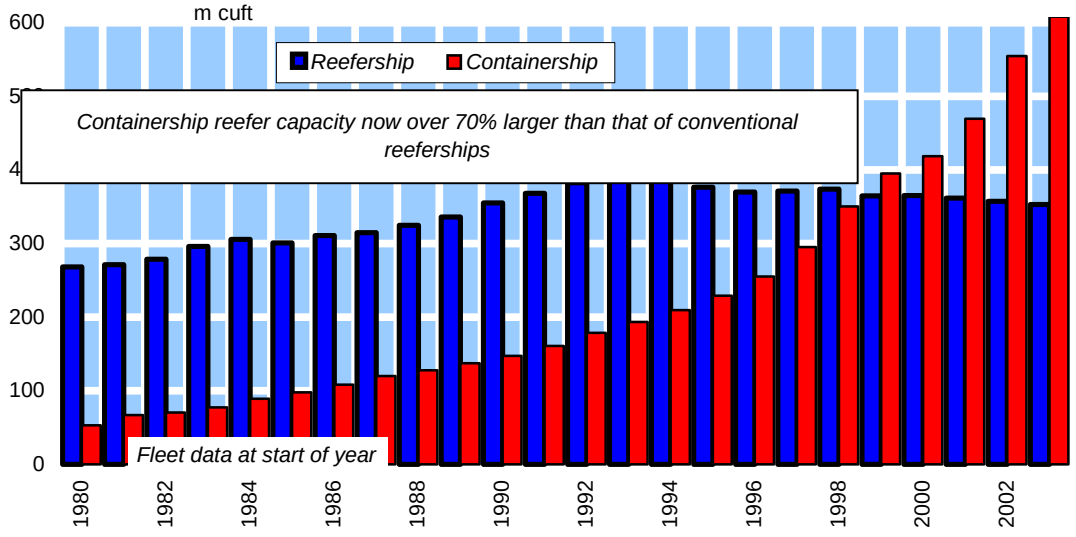
Background

A statistical breakdown of the conventional reefer fleet, in ACP dimensional categories can be found in Appendix G to this report.

The reefer fleet is shrinking. Scrapping currently, and for some years, has exceeded newbuild deliveries, and the fleet is elderly (average age 20 years), with the older ships widely spread between owners. Some substantial owners have been reducing their commitment to the reefer sector, and few have been building new ships.

Refrigerated cargo averaged growth of 3% per year over the last 5 years, and Global Insight projects that global refrigerated cargos will be advancing at a compound annual rate of 2.4% over the 2003-2025 time frame. This is much slower than the 10-11% growth of the containership fleet in recent years. The proportion of slots capacity of the containership fleet is already ahead of the aggregate refrigerated capacity of the 1285 ship conventional reefer fleet. With the containership orderbook capacity standing at 37.2% of the active TEU fleet on November 1, 2003, the proportion of overall reefer capacity provided by the container fleet is going to rise substantially.

Figure III.1
Historical Reefer Capacity



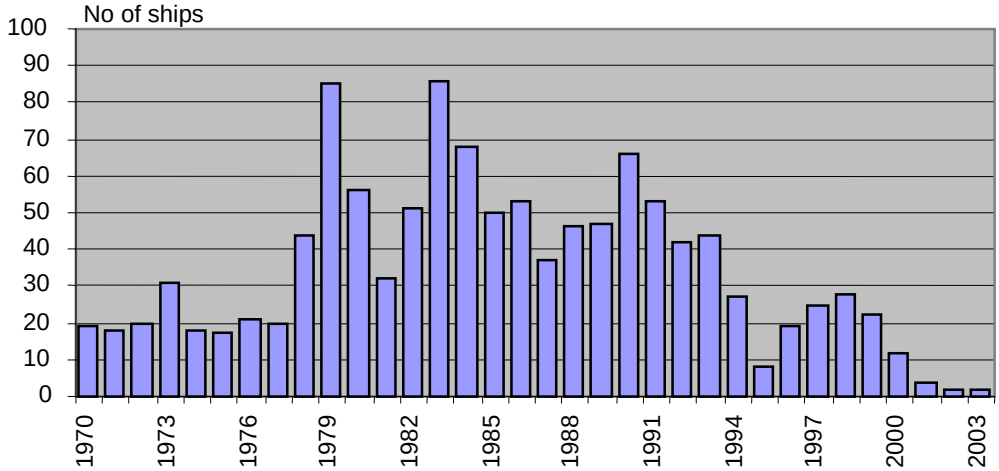
Source: Clarkson Research Studies

It is hardly surprising that owners approach reinvestment in their ageing fleets with considerable caution.

Format of the Fleet at 1st November 2003

The age profile of the November 1st fleet is as follows.

Figure III.2
Number of Reefer Ships Built by Year
Operating at November 1, 2003



Source: Clarkson Research Studies

The aging pattern is clear. 21.5% of the ships and 13.5% of their cubic foot capacity is over 25 years old; 31.5% of the ships and 22.3% of their cubic capacity is over 23. In all, there are 276 ships over 25 years of age and 405 ships over 23 years of age, so a massive new-build program would be necessary to maintain the fleet's current size. There is little sign of this happening.

Builders deliver ships generally between one and two years after contracting, and the orderbook contains only 3 ships for delivery this year and 3 for delivery in 2004. Today's orderbook is in line with recent history. Four new ships were delivered in 2001, 2 in 2002 and, by year-end, a total of 4 will have been delivered in 2003.

These figures contrast with 14 ships scrapped in 2001, 14 in 2002 and 20 so far in 2003.

Since 1995, it has remained consistent that the number of ships being added is less than the number of ships being deleted. Hence, the fleet has shrunk.

Table III.1
Net Changes to Reefer Fleet - 1995-2003, at End Oct 2003

Net Changes to Reefer Fleet 1995-2003 at end October 2003						
	Additions		Deletions		Net position	
	No. ships	cuft	No. ships	cuft	No. ships	cuft
1995	8	1,618,269	37	11,346,223	-29	-9,727,954
1996	19	5,554,319	39	10,931,802	-20	-5,377,483
1997	25	8,058,638	20	4,893,549	5	3,165,089
1998	28	11,605,254	31	8,933,287	-3	2,671,967
1999	22	9,983,488	54	17,423,296	-32	-7,439,808
2000	12	5,562,614	17	6,582,914	-5	-1,020,300
2001	4	1,306,407	14	4,258,990	-10	-2,952,583
2002	2	125,204	14	4,945,781	-12	-4,820,577
2003	2	399,764	20	5,961,747	-18	-5,561,983

Source: Clarkson Research Studies

Fleet Components

The statistics in this report refer to the entire fleet, unless otherwise stated, but the fleet comprises several types of ships. The size of the fish carrier fleet, in particular, needs to be noted because of the effect it has on aggregated statistics

Table III.2
Breakdown by Ship Type at Oct 1, 2003

						Dimensions of ships with biggest ref cuft						
		No.	Avg.	Avg.	Avg.	YOB	dwt	cuft	loa	breadth	draft	speed
			cuft	teu	YOB		tonnes		ft	feet	feet	knots
Reeferships		1026	281,935	124	1984	1990	16,950	758,743	539.14	78.74	32.81	20.50
Reefer Fish Carriers		221	220,721	82	1979	1971	14,947	794,475	612.86	82.05	19.42	19.00
Reefer/General Cargo Ships		13	104,285	26	1971	1974	5,219	231,780	376.18	53.15	21.88	17.00
Reefer/Pallets Carriers		17	215,672	65	1983	1990	6,704	361,484	452.76	65.62	24.28	19.00
Reefer/RoRo Cargoships		8	280,205	322	1985	1990	9,096	525,584	503.61	75.46	28.58	20.00
Reefer/Passenger/RoRos		1	83,122		1986	1986	1,778	83,122	308.43	42.68	14.17	12.50
Reefer Fleet Replenishment Ship		1	63,746		1966	1966	1,245	63,746	233.53	37.60	17.45	12.00
TOTAL		**1287**	**268,419**	**123**	**1983**							
Source : Clarkson Research Studies												

A closer look at the pattern of changes to the fleet shows that while reefer ships have constituted almost all the additions in the last nine years, 41% of scrapped ships have been fish carriers.

Table III.3
Activity by Reefer Type, 1995-2003, at Oct 1, 2003

	Additions to the fleet			Scrapping		
	No. ships	Cuft	Total TEU	No. ships	Cuft	Total TEU
Reeferships	116	44,387	14,765	144	42,675	1,556
Reefer Fish Carriers	6	953	0	101	32,621	0
Reefer/General Cargo Ships	0	0	0	2	473	0
Reefer/Pallets Carriers	0	0	0	1	143	0

Source : Clarkson Research Studies

Fleet Developments

The biggest annual growth of the reefer fleet over the last 22 years was in 1984, when 6.2% was added to the fleet's cubic foot capacity. In 1987-1994, bulge capacity was added at an average 3% per year, but between 1995 and 2003 capacity declined by 1% per year. A comparison of growth patterns in the reefer fleet and in the containership fleet is illuminating.

Figure III.3
Annual Grown in Reefer Fleet
Cuft Capacity, 1983-2003

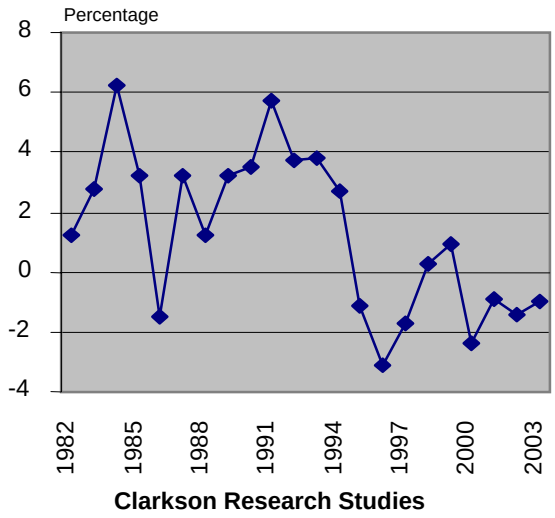
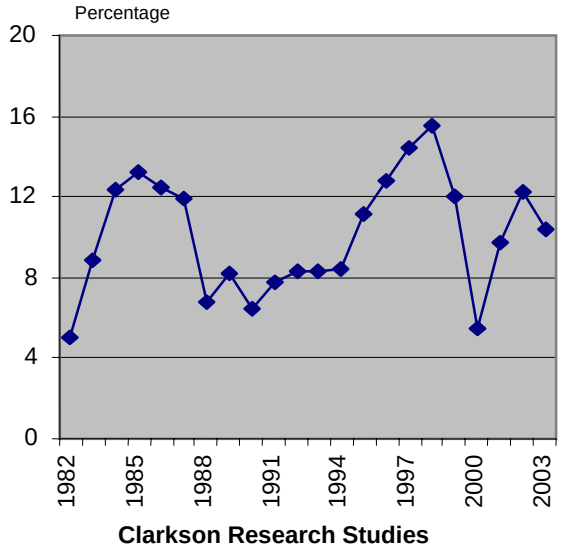


Figure III.4
Annual Growth in Container
Capacity, 1983-2003



As with the containership fleet, the upper end of the size range has been steadily becoming more significant within the reefer fleet.

Table III.4
Reefer Fleet Shape Changes, 1983-2003

000 cuft	<100	100-199	200-299	300-449	450-549	>550	TOTAL	
NO OF SHIPS								
start 1983	358	258	227	224	105	46	1218	
share	*29.40%*	*21.20%*	*18.60%*	*18.40%*	*8.60%*	*3.80%*		
1988	355	284	215	245	140	62	1301	
share	*27.30%*	*21.80%*	*16.50%*	*18.80%*	*10.80%*	*4.80%*		
1993	351	298	271	287	185	83	1475	
share	*23.80%*	*20.20%*	*18.40%*	*19.50%*	*12.50%*	*5.60%*		
1998	326	276	246	248	204	88	1388	
share	*23.50%*	*19.90%*	*17.70%*	*17.90%*	*14.70%*	*6.30%*		
2003	311	264	220	219	202	93	1309	
share	*23.80%*	*20.20%*	*16.80%*	*16.70%*	*15.40%*	*7.10%*		
avg. p.a. growth	-0.70%	0.11%	-0.15%	-0.11%	3.32%	3.58%	0.36%	
01-Oct-03	308	263	216	212	196	92		
000 CUFT								**largest ship**
start 1983	20,150	39,171	57,289	84,452	50,759	27,469	279,290	690,797
share	*7.21%*	*14.02%*	*20.51%*	*30.23%*	*18.17%*	*9.83%*		
1988	20,568	43,218	54,262	92,144	67,327	37,350	314,869	703,263
share	*6.53%*	*13.72%*	*17.23%*	*29.26%*	*21.38%*	*11.86%*		
1993	20,551	44,746	68,919	107,649	89,794	51,045	382,704	644,322
share	*5.37%*	*11.69%*	*18.00%*	*28.12%*	*23.46%*	*13.33%*		
1998	20,081	41,813	61,849	93,159	100,016	54,319	371,237	600,558
share	*5.41%*	*12.96%*	*16.66%*	*25.09%*	*26.94%*	*14.63%*		
2003	18,371	39,808	55,151	82,597	99,596	57,540	353,063	199,882
share	*5.20%*	*11.27%*	*15.62%*	*23.39%*	*28.21%*	*16.29%*		
avg. p.a. growth	-0.46%	0.08%	-0.19%	-0.11%	3.42%	3.77%	1.18%	
01-Oct-03	18,157	39,807	54,046	79,829	96,635	56,981		

Source : Clarkson Research Studies

Historically, owners were more attracted to the 450,000-549,000 cubic foot size category than to the >549,000 cubic foot sizes, although the number of ships in the biggest size category has been rising since the 1980s. More than half the capacity added since 1998 has, in fact, been by ships that are over 550,000 cubic feet.

The next chart tabulates the fleet by period of building. The speed of the reefer fleet has not been rising, as it has in the container fleet (partly, admittedly, in conjunction with its upsizing). The reefer fleet has become increasingly attracted to containers, as evidenced from the rising average numbers of containers on ships, particularly at the bigger sizes.

Table III.5
Breakdown of the Reefer Fleet by Year of Build at Oct 1, 2003

	Number of ships					
000 cuft	**<100**	**100-199**	**200-299**	**300-449**	**450-549**	**>549**
<1983	222	146	47	56	48	27
1983-1987	53	53	61	60	50	17
1988-1992	26	36	74	52	42	24
1993-1997	5	21	26	29	33	9
1998-2003	2	7	8	15	23	15
	308	**263**	**216**	**212**	**196**	**92**
	Avg cuft					
000 cuft	**<100**	**100-199**	**200-299**	**300-449**	**450-549**	**>549**
<1983	60,042	150,926	242,815	382,308	478,257	614,991
1983-1987	56,339	148,674	250,497	366,152	477,932	615,352
1988-1992	56,200	148,391	258,103	368,987	498,304	642,113
1993-1997	46,540	158,751	243,858	383,329	518,445	618,248
1998-2003	73,647	173,792	239,223	409,790	510,620	596,053
	Avg TEU					
000 cuft	**<100**	**100-199**	**200-299**	**300-449**	**450-549**	**>549**
<1983	28	39	16	53	89	178
1983-1987	19	84	56	64	129	164
1988-1992	21	78	71	101	150	357
1993-1997	0	45	61	67	202	399
1998-2003	0	52	78	90	259	370
	Avg speed					
000 cuft	**<100**	**100-199**	**200-299**	**300-449**	**450-549**	**>549**
<1983	12.19	14.12	15.76	18.75	17.85	20.33
1983-1987	11.92	14.29	16.60	18.47	18.79	18.84
1988-1992	11.73	13.99	16.38	19.13	19.33	20.40
1993-1997	11.78	14.42	16.36	19.26	20.61	21.99
1998-2003	14.00	14.88	15.83	19.25	20.58	20.59

Source: Clarkson Research Studies

Table III.6
Reefer Fleet Additions in the Last Five Years

	No of Ships						
000 cuft	**<100**	**100-199**	**200-299**	**300-449**	**450-549**	**>550**	**Total**
1998	1	4	2	6	11	4	28
1999		1	3	5	8	5	22
2000	1		1	3	3	4	12
2001			2	1	1		4
2002						2	2
2003		2					2
TOTAL	**2**	**7**	**8**	**15**	**23**	**15**	**70**
	000 cuft						
000 cuft	**<100**	**100-199**	**200-299**	**300-449**	**450-549**	**>550**	**Total**
1998	47,367	685,427	531,841	2,399,371	5,641,295	2,299,953	11,605,254
1999		131,353	675,083	2,143,951	4,063,331	2,969,770	9,983,488
2000	99,927		234,988	1,253,742	1,554,904	2,419,053	5,562,614
2001			471,879	349,795	484,733		1,306,407
2002						1,252,021	1,252,021
2003		399,764					399,764
TOTAL	147,294	**1,216,544**	**1,913,791**	**6,146,859**	**11,744,263**	**8,940,797**	**30,109,548**
% of total	***0.50%***	***4.04%***	***6.35%***	***20.41%***	***0.39***	***29.69%***	

Source : Clarkson Research Studies

The characteristics of the big ships are important for Canal considerations, as is the question of whether ships will continue to increase in size. A closer look at the big ship reefer fleet shows that while the biggest ships were built in the 1990s, (the biggest is a fish carrier), at the next level down, substantial ships have been built within the last three years.

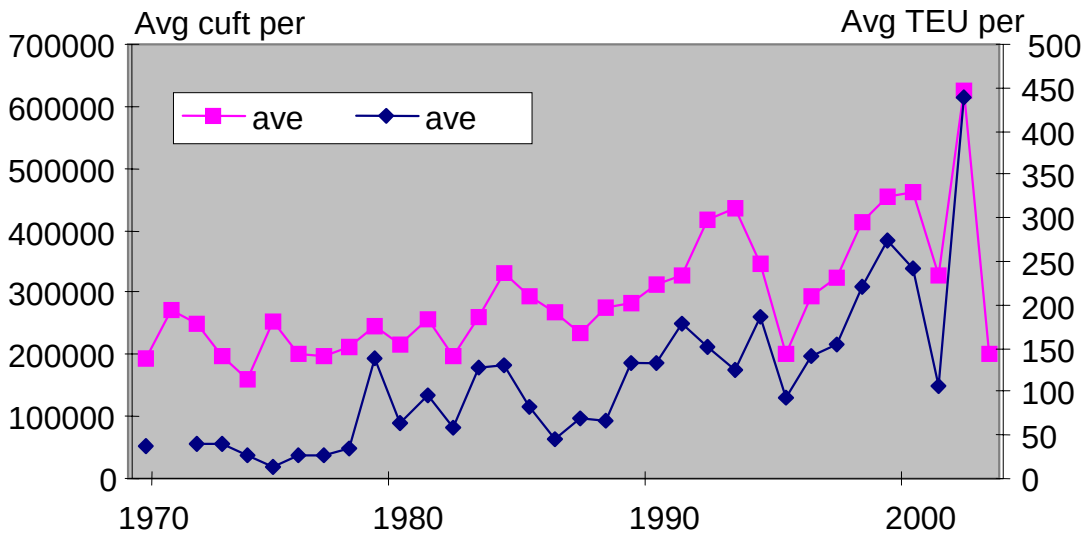
Table III.7
Characteristics of Reefer Fleet >499,999 Cuft Capacity at Nov 2003

		Ships	YOB	Cuft cap	TEU	Draft	loa	breadth	speed	sidedoors	sideports	Holds	Hatches
CuFt Size						**feet**	**feet**	**feet**	**knots**	**no. ships**	**no. ships**		
	Max		1991	794,475	516	32.91	612.86	82.05	19			7	9
>700,000	**Avg**	7	1987	747,996	377	30.93	531.18	78.84	19.71	2	1	5	7
	Min		1971	703,263	0	19.42	474.41	77.43	18.5			4	4
	Max		2002	692,174	472	33.79	590.22	84.51	23			5	5
600-699,999	**Avg**	42	1986	638,848	300	32.08	529.59	80.15	20.63	31	2	4	4
	Min		1972	600,214	16	28.54	474.41	74.15	18			4	4
	Max		2000	599,988	485	33.27	605.31	79.43	23			5	16
500-599,999	**Avg**	118	1989	546,611	198	29.33	506.43	74.64	20.11	74	0	4	4
	Min		1970	502,586	0	22.77	459.91	67.59	15			3	3

Source: Clarkson Research Studies

This table highlights the significance of container capacity on even the biggest reeferships. The following chart shows how average container capability has grown, as ships have gotten bigger. To an extent, the provision for carriage of containers on reeferships is evidence of ambiguity in the minds of owners. The containers may not always be easy to work on deck, where they may get in the way of working open hatches, and they can also get in the way of cargo working on busy quaysides.

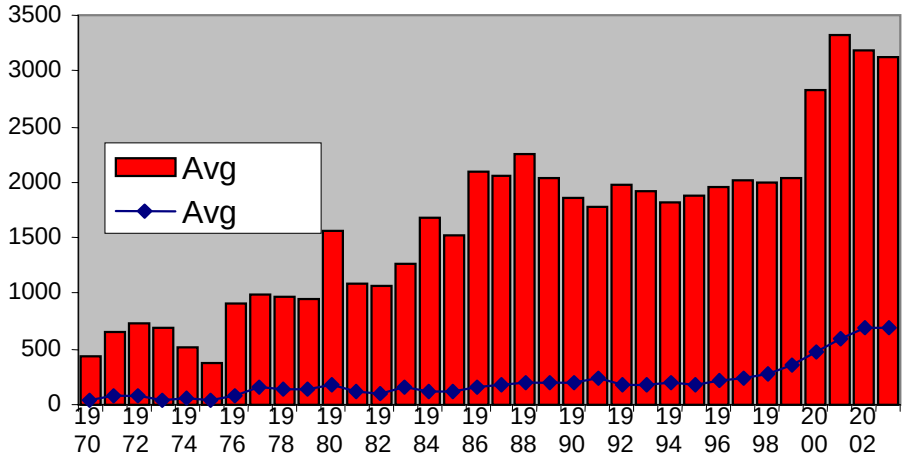
Figure III.5
Avg. Cuft and TEU by YOB of Ships in Service at Nov 2003



Source : Clarkson Research Studies

The proportion of reefer plugs on containerships has also been rising, with up to 20% of the biggest containerships' TEU capacity now capable of carrying reefer products. Reefer containers are expensive and it is hard to optimize their use because of the degree to which empty returns compete with freight-paying cargo on dominant return legs. The cost of providing the extra generating capacity to accommodate them on ships is not high, and the slots may be used for dry cargo when not used for refrigerated cargoes.

Figure III.6
Avg. Containership TEU and Reefer Plugs by Year of Build



Source : Clarkson Research

This chart's one-dimensionality, of course, conceals the enormous aggregate capacity mounted by all the ships serving any single trade.

The container fleet's share of the global reefer cargo has been growing. One authority estimates that 40% of the world's refrigerated trade moves on pallets, 45% in reefer containers and 15% breakbulk, with the switch to containers said to be occurring at around 1% per year. Some commodities and some trades are more container friendly than others, and there are important fresh produce ports that will never attract containerships. It is significant that major global produce companies like Dole and Chiquita, both operators of refrigerated ships, have invested in fully containerized refrigerated ships (which appear in Clarkson container rather than in their reefer ship statistics).

The changing shape of produce distribution systems plays an important part in determination of the preferred mode, as do heavy seasonal demand patterns (see Interview Results in Appendices E (Exporters) and F (Importers)). With container services expanding in all directions, there is a certain inevitability about the decline of the reefer fleet.

Reefer Fleet Ownership

There are at least 429 owners of the total reefership fleet. (Clarkson database lists a number of ships of unknown provenance). Seatrade, Groningen, the single biggest owner in terms of capacity, owns only 4.8% of the global reefership fleet and 6.4% of its cubic foot capacity. Laskarides, the second biggest owner, controls 5.4% of the ships and 5.5% of the cubic foot capacity. The larger pools within which they work may have some influence over the way the reefer fleet develops, but the fragmentation of the sector will, inevitably, work against a common stance.

Within the overall fleet, the structure of the ownership of the fish carrier fleet is significant. Fleets previously operating from countries with command economies dominate fish carriers. Now these fleets are coping with the greater laissez-faire of Capitalism.

Table III.8
Biggest Reefer Fish Carrier Owners at Nov 2003

No. ships	Carrier	Avg YOB	Avg cuft	Total cuft
16	Mayflower Shipmanagement	1982	412,617	6,601,873
9	Laskarides	1978	468,051	4,212,465
8	Sevrybkholodflot	1978	398,484	3,187,876
9	Yugreftransflot	1984	302,476	2,722,292
6	Lavinia Corp	1988	320,393	1,922,363
6	Klaipeda Transflot	1986	308,046	1,848,276
4	Riga Transport	1983	426,228	1,704,914
4	Vostokrykholodflot	1984	279,479	1,117,918
5	Reftransflot	1978	196,741	983,705

Source : Clarkson Research Studies

A complete list of reefership owners and their fleets is in Appendix H.

Secondhand Sales

The following table illustrates that Lavinia, Seatrade and Star (and, as it was formerly, Swan) Reefers have been very active in recent years, buying reefer ships second-hand.

Table III.9
Second Hand Reefer Sales, 1999, Oct 2003

No of Ships Sold					
000 cuft	**2003**	**2002**	**2001**	**2000**	**1999**
700-799	2				
600-699		4			10
500-599	17	13	4	2	3
400-499	5	9	7	4	9
300-399	6	1	2	4	6
200-299	3	5	4	9	18
100-199	5	1	2	2	10
<100				1	1
TOTAL	**38**	**33**	**19**	**22**	**57**
Total cuft	**17023**	**15571**	**7570**	**7073**	**21151**
All reefer unless shown.					
			1 Reefer RoRo 1 Reefer Fish Carrier	5 Reefer Fish Carriers	12 Reefer Fish Carriers
Prominent buyers					
	Chartworld(4)	Chartworld (2)	B.Skaugen (2)	Del Monte (2)	Lavinia (18 plus 2 sold on)
	Denadai (2)	Klaipeda (3)	Holy House (4)	Denadai (3)	Seatrade (7)
	Seatrade (6)	Seatrade (3)		Elmira Shppg (2)	Del Monte (6)
	Swan Reef (2)	Star Reef (5)		Greeks (2)	Samama (2)
	Germans (4)	Target Mar (3)		Lavinia (2)	
	N'wegians (4)	Vroon (3)			
	Russians (9)				

Source : Clarkson Research Studies

Reefer Orderbook

There is only a meager orderbook as of November 1st, containing 6 ships totaling 2,682,000 cubic foot capacity. Four of these ships are for Laskarides, and two – the biggest – are for MPC Steamship, and intended, ultimately, for the Israeli fresh produce company, Agrexco. The MPC ships will not be deployed on Panama Canal routes.

Table III.10
Reefer Orderbook at Nov 1, 2003

	2003		**2004**		**2005 & onwards**	
cuft cap	**ships**	**cuft**	**ships**	**cuft**	**ships**	**cuft**
<100000						
100-199999						
200-299999			**1**	**270000**		
300-449999						
450-549999	**3**	**1417000**	**2**	**994000**		
>549999						

Source : Clarkson Research Studies

Scrapping

The pattern of the 246 ships scrapped in the last nine years, and recorded accurately, looks as follows. Their average size was 306,821 cubic feet, and their removal took over 75 million cubic feet off the fleet. Average age at time of scrapping was 27 years.

Table III.11
Reefership Scrapping History at Oct 30, 2003

No of ships	1995	1996	1997	1998	1999	2000	2001	2002	2003	TOTAL
<100000cuft		4	4	5	5	2	2	1	3	**26**
100-199999	5	8	4	3	6		2	1	3	**32**
200-299999	18	14	6	9	13	2	3	4	4	**73**
300-399999	5	2	1	5	14	4	1	3	2	**37**
400-449999	5	4	5	3	5	2	2		5	**31**
450-549999	2	5		5	9	4	2	4	2	**33**
>549999	2	2		1	2	3	2	1	1	**14**
TOTAL	**37**	**39**	**20**	**31**	**54**	**17**	**14**	**14**	**20**	**246**

Source : Clarkson Research Studies

The total of the changes to the fleet, including conversions and those captured for the database only well after the ship's physical withdrawal, looks as follows. Here, the significance of the reduction in the number of fish carriers is evident.

Table III.12
Reefership Withdrawals 1995 to Oct 2003

	No. ships	Avg cuft	ave YOB
Reeferships	195	257,044	1971
Reefer Fish Carriers	128	302,347	
Reefer/General Cargo Ships	5	136,381	1973
Reefer/Pallets Carriers	2	210,823	1984
Reefer/Fishing Suction	1	43,393	1990
Reefer/Container	6	347,716	1980
Total	**337**		

Source : Clarkson Research Studies

Pool Patterns in The Industry

Although there have been changes in the constituency of the world's produce transport distribution network over the last ten years, its fundamentals remain unchanged. A number of large produce system companies wield enormous power, and though the great national producer boards have been progressively yielding control to smaller producer groups, the rising power of substantial retailers has maintained equilibrium in the market. Some of the recent changes – the rising strength of retail/distribution sectors and the smaller scale shipment requirements of smaller producers - have benefited containers. This has reinforced a long-standing pattern by which the many individual, smaller reefership owners have found it convenient to pool their operations to

service such unified demand and to maximize the benefits arising from complementary hemispheric seasonality.

Reefer pools tend to cluster around the major owners. The next table sets out the pattern of the major pools today.

Table III.13
Refrigerated Pools, as of Jan 2004

Main Operator	Subsidiary Companies	Subsidiary Partners	Pool
Lauritzen Cool	NYK Reefers		
			Leonina
			Arctic Reefer
	ReeferShip	Eastwind Transport	Eco Shipping
		Armada Shipping	
Seatrade	Nissui Shipping	TRC	
Laskaradis		Lavinia	
		Alpha Reefers	
United Reefers		Vroon	
		Sun Group	
		Lapico Shipping	
		Perseverence Marine	
		Nordenfjeldske	

Deployment Patterns

Reefer carriers do not advertise their schedules widely, preferring to market directly to fresh produce firms. Table III.14 sets out the pattern of advertised reefer services, excluding services where details are unknown.

The comparative annual reefer capacity between container and conventional services follows:

Table III.14
Global Liner Reefer Capacity at August 2003

	Container		Conventional				
annual capacity	**estimated ref TEU**	**equivalent ref cuft**	**estimated ref TEU**	**equivalent ref cuft**	**hold ref cuft**	**Tot cap**	**Conventional share**
Transpacific	1,814,325	1,863,311,775					
FE/Eur	1,300,172	1,335,276,644					
Transatlantic	753,933	774,289,191					
N.Am/Carib,C.Am	316,519	325,965,013	241,072	247,580,944		573,545,957	43.1%
EUR/C.Am	122,904	126,222,408					
EUR/Carib	84,032	86,300,864					
Total EUR/C.Am,Carib	206,936	212,523,272	85,568	87,878,336	166,290,014	466,691,622	55.0%
Med./Carib	26,578	27,295,606	22,310	22,912,370	27,598,597	77,806,573	64.9%
FE/Carib,C.Am	53,668	55,117,036					
ECNA/ECSA	215,644	221,466,388					
EUR/ECSA	256,774	263,706,898					
FE/ECSA	102,164	104,922,428					
ECNA/WCSA	72,012	73,956,324					
WCNA/WCSA			56,992	58,530,784	71,718,125		
EUR/WCSA	61,555	63,218,012	10,224	10,500,048	63,141,997	136,860,057	43.8%
FE/WCSA	104,506	107,327,662					
ECNA/ANZ	151,858	155,958,166					
EUR/ANZ	146,988	150,956,676	>7816	8,027,032	>12,026,592	>171,010,300	>11.7%
Jap/ANZ	130,299	133,817,073					
E.Asia/ANZ	121,887	125,177,949					
WCNA/ANZ	54,412	55,881,124					
EUR/WAF	145,585	149,515,795	12,506	12,843,662	71,587,966	233,947,423	36.1%
Med/WAF	110,527	113,511,229	18,928	19,439,056	25,990,432	158,940,717	28.6%
EUR/SAF	70,832	72,744,464					
FE/S & E.AF	216,158	221,994,266					

Source : Alphaliner, MDS-Transmodal, Clarksons

Such a guide to the split can only be approximate, as there are many conventional services not advertised. In particular, there are substantial services out of the southern hemisphere countries, operated by LauritzenCool, Kyokuyo and Cape Reefers, that are not included here because they are not year round operations.

The above table shows conventional liner services concentrated on trades that are not strongly seasonal, like the banana trades between Central America and the Caribbean and prime consumer regions. However, there are other services between countries in

the southern and northern hemispheres that are not year round, but are targeted on high volume, low cost seasonal crops, such as fruit and vegetables.

What is suggested is that on those trade lanes where container services supply substantial reefer capacity, demand for conventional reefer services is restricted. Where there is regularity of demand and the need to serve small ports unequipped to handle container services, container services are less appropriate, and conventional services predominate. Here, the West Africa/Europe trade is particularly noteworthy, because, as in Central America, the high volume of refrigerated demand is incompatible with the level of services required by general cargoes.

These trends are likely to become even more pronounced over time. With the share of fresh produce attracted to container services steadily rising, the global container system is moving away from its focal hub model and embracing smaller scale distribution patterns.

Future Developments – Conventional Reefer Ships

Reefer ships are a cost-effective alternative to container ships. Containerships have many demands on their capacity, causing their freight rates to be high. Consequently, their ability to cover substantial peak season crop cargoes within a limited period at a price that the cargo can afford is restricted. Reefer ships', on the other hand, can provide such cover at an economic rate. Refrigerating entire holds is considerably cheaper than refrigerating cargo in individual containers, each with its own integral power unit.

But, in most circumstances, reefership cargoes, once discharged, must be moved from shipside to nearby cold storage facilities, whereas refrigerated containers can move inland without delay. Storage facilities close to dock gates, as a result, act as a brake on containerization. On the other hand, big retailers' cold storage facilities tend to be closer to the center of their own activities, and this creates a reactionary pull on mode of preference. And where, for obvious reasons, manufactured produce (chocolate, cheese, eggs) is already moving in containers, retailers' preference for containerized receivables is likely to be reinforced. That is, once the switch to containers is made, it is difficult to return to conventional reefer shipping.

Conventional reeferships continue to suffer from the ills that initially drove the liner industry to containers. Cargo working is relatively slow and can be affected by weather, aspects that ship designers are still trying to combat, along with making it easier for reeferships to carry non-refrigerated consumer goods on otherwise dead return legs. The stumbling block is money. The reefer trades have not been very well remunerated in recent years, though rates are currently buoyant (perhaps at least partly because of the effect the military campaign in Iraq is having on the global supply of reefer boxes). The rewards for technological advances may not, therefore, be sufficient to stimulate significant change.

In consequence, owners have been hedging their bets. The two 460,000 cubic foot MPC ships for delivery in December 2003 to Agrexco have space for 800TEU and, just

as Lauritzen have started buying space on Maersk containerships, Maersk will be taking slots on these ships that will trade between Israel and West Mediterranean ports.

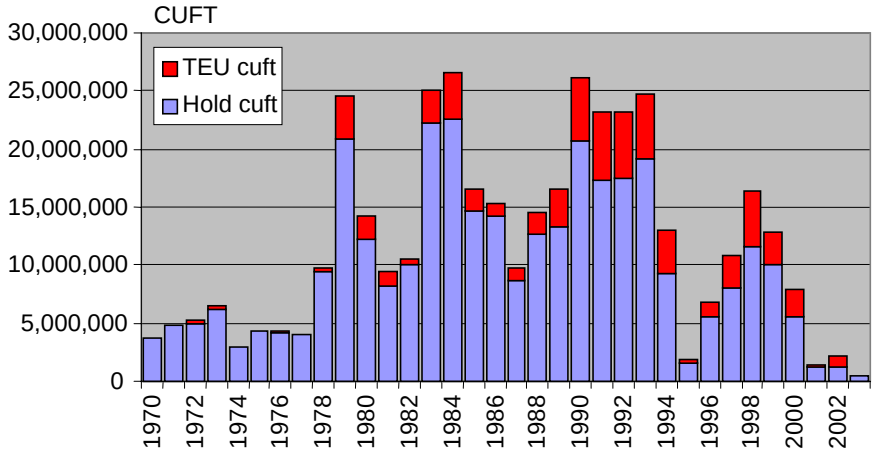
Interchanges between reefer carriers and container operators highlight what has been made apparent by the recent move by NYK Reefers to terminate its arrangement with Star Reefers and throw in its lot with LauritzenCool. In line with other shipping sectors, cargo is king, and increasingly the end-to-end control of the cargo is the key to profitability. As a container line – the only major line with a substantial reefer fleet - NYK knows the importance of logistics and a joint fleet pool. The two lines will participate on a 50/50 basis in LauritzenCool Logistics from January 2004.

Competition From Containers

Conventional Reefers

Competition from container ships has led reefer ships to add container capabilities. The following figure illustrates the amount of container capacity in TEUs and hold capacity in cubic feet in the reefer fleet by year of build. Growth in reefer ships' container capability increases the fleet's overall capacity and its flexibility.

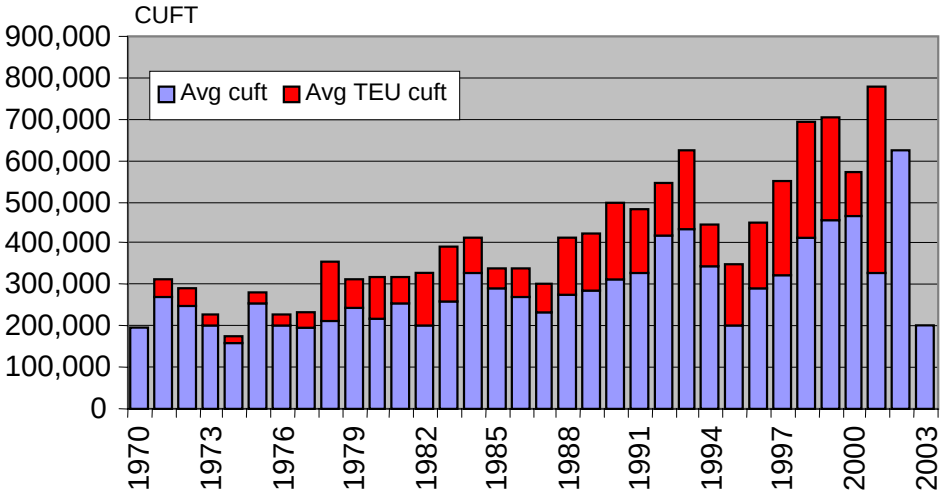
Figure III.7
Reefership Fleet at Nov 2003, by YOB, Showing Effect of Containers on Overall Capacity



Source: Clarkson Research Studies

The effect on the average ship introduced to the fleet in each year makes owners' approach plain: steadily increasing ship sizes and more containers – when they decide to build.

Figure III.8
Average Reefer Ship Capacity, Including Average Reefer TEU Capacity by YOB at Nov 2003



Source: Clarkson Research Studies

Taking reefership container capacity into the picture changes the net additions and deletions position shown in the previous pages somewhat, but far from completely.

Table III.15
Net Changes to Total Reefer Fleet Cuft Capacity 1995-2003
at End Oct 2003

	No.Ships	TEU	TEU cuft	Hold cuft	Total cuft
Additions					
1995	8	284	291,668	1,618,269	1,909,937
1996	19	1,283	1,317,641	5,554,319	6,871,960
1997	25	2,636	2,707,172	8,058,638	10,765,810
1998	28	4,641	4,766,307	11,605,254	16,371,561
1999	22	2,740	2,813,980	9,983,488	12,797,468
2000	12	2,195	2,254,265	5,562,614	7,816,879
2001	4	106	108,862	1,306,407	1,415,269
2002	2	880	903,760	125,204	1,028,964
2003	2			399,764	399,764
Deletions					
1995	37	46	47,242	11,346,223	11,393,465
1996	39	297	305,019	10,931,802	11,236,821
1997	20	100	102,700	4,893,549	4,996,249
1998	31	66	67,782	8,933,287	9,001,069
1999	54	438	449,826	17,423,296	17,873,122
2000	17	203	208,481	6,582,914	6,791,395
2001	14	97	99,619	4,258,990	4,358,609
2002	14	289	296,803	4,945,781	5,242,584
2003	20	20	20,540	5,961,747	5,982,287
Net Position					
1995	-29	238	244,426	-9,483,528	-9,239,102
1996	-20	986	1,012,622	-4,364,861	-3,352,239
1997	5	2,536	2,604,472	5,769,561	8,374,033
1998	-3	4,575	4,698,525	7,370,492	12,069,017
1999	-32	2,302	2,364,154	-5,075,654	-2,711,500
2000	-5	1,992	2,045,784	1,025,484	3,071,268
2001	-10	9	9,243	-2,943,340	-2,934,097
2002	-12	591	606,957	-4,213,620	-3,606,663
2003	-18	-20	-20,540	-5,582,523	-5,603,063

Source: Clarkson Research Studies

Container capability certainly makes reefership operations more flexible, allowing carriers to carry cargo in containers from possibly single commodity ports for consignees for whose distribution patterns they are required. It also facilitates the carriage of general cargo on return legs. But, though important to vessel operators, these are relatively marginal aspects and the containers on reeferships are chiefly to enhance the saleability of the hold space.

Offering container capacity may make reeferships more saleable but it also goes some way to affirming the supremacy of the container system.

The Containership Fleet

A statistical breakdown of the containership reefer fleet, in ACP dimensional categories, constitutes Appendix H to this report.

The vast majority of containerships have some reefer capability, and containership operators have been enthusiastic about the freight rates achievable for reefer cargo, particularly when rates on other types of containers have, at least until very recently, been declining.

As containerships have been getting bigger, the quantum of reefer plugs has been rising.

As demonstrated below, the increase in the quantum of reefer slots on container ships has risen fastest in the last five years, in line with the rapid upsizing of the fleet. As ship sizes have been rising, owners have seen the desirability of widening their appeal in order to improve the prospect of filling the enhanced capacity. Furthermore, relative to the total ship price, the cost of increasing generator capacity is relatively small.

Table III.16
Breakdown of the Container Fleet Reefer Capacity at Nov 2003

TEU Range	<1000	1000-1999	2000-2999	3000-3999	4000-4999	5000-5999	6000-6999	7000-7999	>8000
Number of Ships									
< 1983	301	120	59	13					
1983-1987	122	102	75	47	9				
1988-1992	93	108	51	67	26				
1993-1997	279	304	103	89	85	27	7	2	
>1997	236	278	202	59	113	102	70	24	2
Avg TEU per Ship									
< 1983	403	1,398	2,454	3,244					
1983-1987	566	1,448	2,478	3,206	4,614				
1988-1992	562	1,357	2,597	3,449	4,355				
1993-1997	560	1,410	2,454	3,510	4,422	5,323	6,388	7,228	
>1997	637	1,430	2,467	3,509	4,367	5,547	6,466	7,302	8,063
Avg Reefer TEU per Ship									
< 1983	41	178	190	749					
1983-1987	59	125	232	220	146				
1988-1992	131	118	302	271	339				
1993-1997	74	157	254	254	399	568	1,276	1,406	
>1997	111	262	466	649	771	695	1,120	1,404	710*
Ave % Reefer TEU per Ship									
< 1983	10.2%	12.7%	7.7%	23.1%					
1983-1987	10.4%	8.6%	9.4%	6.9%	3.2%				
1988-1992	23.3%	8.7%	11.6%	7.9%	7.8%				
1993-1997	13.2%	11.1%	10.4%	7.2%	9.0%	10.7%	20.0%	19.5%	
>1997	17.4%	18.3%	18.9%	18.5%	17.7%	12.5%	17.3%	19.2%	8.80%*
* Plugs, not TEU. Exact TEU details not yet available.									
Source: Clarkson Research Studies									

Table III.17
Container Fleet Additions in the Last 5 Years at Nov 2003

TEU Range	<1000	1000-1999	2000-2999	3000-3999	4000-4999	5000-5999	6000-6999	7000-7999	>8000
Number of ships									
1998	85	78	45	21	19	4	8	4	
1999	40	47	18		9	10		4	
2000	32	45	22	5	19	25	5	4	
2001	18	43	45	16	8	34	22	4	
2002	33	38	42	8	37	17	21	2	
2003	28	27	30	9	21	12	14	6	2
Avg Total TEU									
1998	568	1,401	2,401	3,697	4,324	5,164	6,433	7,226	
1999	596	1,486	2,374		4,195	5,667		7,226	
2000	645	1,537	2,430	3,320	4,529	5,555	6,252	7,226	
2001	727	1,388	2,499	3,565	4,225	5,526	6,565	7,226	
2002	755	1,398	2,498	3,354	4,352	5,521	6,372	7,202	
2003	696	1,345	2,554	3,212	4,414	5,657	6,548	7,210	8,063
Avg Reefer TEU									
1998	83	191	324	406	389	425	937	1,406	
1999	104	243	501		526	642		1,406	
2000	113	314	398	800	633	690	1,000	1,406	
2001	176	264	495	861	580	718	1,154	1,406	
2002	164	332	529	712	1,292	773	631	1,403	
2003	126	412	664	783	647	664	1,963	1,404	710
Average % Ref TEU per ship									
1998	14.6%	13.6%	13.5%	11.0%	9.0%	8.2%	14.6%	19.5%	
1999	17.4%	16.4%	21.1%		12.5%	11.3%		19.5%	
2000	17.5%	20.4%	16.4%	24.1%	14.0%	12.4%	16.0%	19.5%	
2001	24.2%	19.0%	19.8%	24.2%	13.7%	13.0%	17.6%	19.5%	
2002	21.7%	23.7%	21.2%	21.2%	29.7%	14.0%	9.9%	19.5%	
2003	18.1%	30.6%	26.0%	24.4%	14.7%	11.7%	30.0%	19.5%	8.8%*
* Plugs, not TEU. Exact TEU details not yet available.									
Source: Clarkson Research Studies									

Not only has this been an era in which ship sizes have risen to in excess of 8000TEU, it has also been one in which both wholly refrigerated container ships like the Dole Colombia and the Dole Chile (2000TEU) have been built, and in which ships have been purposely built with very high reefer capacity for trade legs with high reefer content.

One of the phenomena of the contemporary container fleet is that 51.1% of the ships and 44.9% of the TEU capacity is owned by charter owners, who might be expected to enhance their ships' reefer capacity in order to make them more attractive to liner operators. This does not yet seem to have been borne out by the statistics which show that the proportion of charter owners' ships dedicated to reefer slots was higher in only the 1000-1999TEU, 4000-4999TEU and 5000-5999TEU size ranges, though these do represent 40% of the ship fleet.

Scrapping – Container Fleet

Because the container fleet is relatively young and because ship sizes have been growing fast since the mid 1990s, those ships that have been scrapped have been, on the whole, small with negligible reefer content.

65.5% of the container fleet's total capacity has been added since the start of 1995, while 72% of its reefer capacity has been added since then. Since 1995 the comparative figures for additions and deletions have been as follows:

Table III.18
Containership Additions and Deletions after 1994

CONTAINERSHIP ADDITIONS AND DELETIONS AFTER 1994			
	Ships	Reefer TEU	Cuft Equiv.
Additions	1,728	534,092	548,512,484
Deletions	260	41,005	42,112,135
Net additions	1,468	493,087	506,400,349

Source: Clarkson Research Studies

It is not easy to obtain details of reefer capacity on ships that have not yet been delivered, and this has restricted the details of reefer slots in the 604 ship orderbook to the 47 observations (by MDWT) shown in Appendix 4.

Deployment – Container Fleet

The first fully cellular containership services were deployed in the less competitive post-colonial north/south trade routes in the late 1960s, and their ships had substantial reefer capacity provided by a system that distributed centrally refrigerated cold air to insulated, but machinery-free containers via large porthole couplings. This was the most economical way of cooling large numbers of boxes, but it was not effective where long land hauls were part of origin to destination moves, particularly in USA.

Recognition of the limitations of central cooling in the very early 1970s saw the emergence of the integral container, with its autonomous refrigeration plant making the refrigerated container much more mobile. The integral container has now become standard, in 20', 40', and hi-cube modes, and those trades that started with central cooling have been steadily switching to integrals.

Containerization and intermodalism made liner shipping more flexible and more competitive with other shipping sectors. But until recently, extraordinary demand growth coupled with a steady downward trend in freight rates, has been pre-occupying liner operators. Today, a much-improved relationship between supply and demand has given operators the resources to be selective about cargo, and enhanced their interest in reefers. This interest had already been manifested in an era of declining rates, as a reliable source of quality revenue, albeit against much higher costs than were incurred for the carriage of general cargo.

In recent years, the liner industry has been shaped by its strategic reaction to declining rates and the need to keep investing in new tonnage. Upsizing has been a dominant

trend and major carrier route networks have been designed around spinal east/west services operated by the largest ships. These services were to provide long haul, low unit cost carriage for cargo exchanged over strategically located hubs with medium haul feeder services. They were intended to replace predominantly north/south and high cost intra-hemispheric services. Initially, many of the corridor services were sequential, in which continuous services operated over previously discrete end-to-end trade routes. To provide such corridor services, the big ships had to have substantial reefer, as well as general cargo, capacity.

In theory, this corridor strategy targeted the main reefer commodity export regions: ANZ, S. Africa, and WCSA. Many major shipping lines expanded their fleets and included more reefer capacity. Hamburg-Süd bought a suite of 3739TEU ships, with 800TEU reefer capability for the ECSA trades. This move was quickly emulated by Maersk Sealand's 4340TEU post-Panamax beam "L" class, with 800TEU reefer.

P&ONL and Contship built 4112TEU ships for their Europe/ANZ run which was reorganized to incorporate the ANZ/USEC trade. In doing so, those carriers voted against the global corridor strategy, and the 2600TEU reefer capacity of those ships makes them hard to deploy in other, less reefer-intensive trades.

Maersk Sealand also started an ANZ/USEC,WC operation, suggesting that they, too, saw that reefer was the least likely cargo to take comfortably to relay over equatorial hubs.

Maersk Sealand took over Safmarine to gain access to RSA cargoes, and the high reefer content of trades out of South Africa will have played a part in their decision. New much bigger ships, which will no doubt have much bigger reefer capacity, are on order for the South Africa Europe route.

Maersk Sealand currently control most of the container terminal capacity in Balboa, and this gives them a springboard from which to expand strongly in WCSA. Their approach to Chile is a good indicator of their attitude to refrigerated cargoes. They currently operate a northern Europe/USEC/WCSA service that transits Panama and, over Balboa, sails direct to/from San Antonio, providing that Chilean port with a highly competitive service to both USEC and northern Europe. The 2003-built Olga and Oluf Maersk, both 3000TEU (1600TEU reefer), are deployed here.

The north/south trades are also covered by conventional reefer services, most of which cater to the seasonal crop peaks. Containerships are starting to pick up deciduous fruit, for which they once had insufficient capacity, because of their increased reefer capacities,

There may, however, be a problem for services to Europe via the US because southern hemisphere reefer shippers are less than happy with the security procedures they have to comply with in the US when the cargo is not destined for that market, and this may give an unforeseen, but probably temporary, fillip to conventional services.

So far the banana trades have stayed relatively independent of container services, other than those designed specifically for their carriage. (This includes Dole's Central America/USEC service with the 2000TEU fully refrigerated ships Dole Colombia and Dole Chile, and the Europe/French West Indies service of CMA-CGM/Marfret in which 4x2200TEU of newbuilds with 1100TEU integral reefer capacity have recently replaced four ships with central cooling.) But bananas are increasingly a liner business. For instance, Costa, a container liner operator, runs liner services with reefer ships between West Africa and the Med. To position ships at banana ports, conventional reefer operators have to carry general cargoes, and this blurs the boundary between conventional reefer liner and container liner services.

Currently, containerships are attractively full and carriers are not very aggressive. But as supply starts again to draw ahead of demand, carriers are likely to seek to augment their existing cargoes by competing more vigorously in their expanded refrigerated slots. And it is even conceivable that Ecuadorian bananas, for which the major markets are on the Atlantic seaboard, could be drawn into corridor container services over Balboa as that terminal's capacity is expanded.

While the reefer fleet is shrinking, the rapid expansion of the container fleet is expressed in increased numbers of services.

Table III.19
Growth in Global Liner Services

Numbers at August in year shown			
	Number of Services	**Avg TEU per ship**	**Avg reefer plugs per ship**
1997	582	1,583	138
2000	743	1,722	140
2003	919	1,977	193
growth per ann.	7.9%	3.8%	5.8%
Source : MDS Transmodal			

The next chart shows how this is translated in areas of significance to the reefer trade.

Table III.20
History of Container Trade Capacity Growth

at August in years shown, by trade route												
		Transpac			**FE/EUR**			**Transatlantic**				
	No ships	**Avg TEU**	**Avg plugs**	**No ships**	**Avg TEU**	**Avg plugs**	**No ships**	**Avg TEU**	**Avg plugs**			
1997	328	3,259	245	315	3,281	213	221	2,691	186			
2000	421	3,434	270	356	3,847	282	220	3,056	231			
2003	549	3,563	303	401	4,249	347	308	2,639	245			
growth p.a.	8.96%	1.50%	3.60%	4.11%	4.40%	8.47%	5.69%	-0.32%	4.70%			
		ECNA/ANZ			**WCNA/ANZ**			**N.Am/Carib**			**N.Am/C.Am**	
	No ships	**Avg TEU**	**Avg plugs**	**No ships**	**Avg TEU**	**Avg plugs**	**No ships**	**Avg TEU**	**Avg plugs**	**No ships**	**Avg TEU**	**Avg plugs**
1997	7	1,259	676	24	1,112	285	59	1,584	121	47	1,119	105
2000	8	1,270	69	27	1,323	127	55	1,820	115	67	1,351	128
2003	14	3,657	1,120	20	1,529	218	124	1,214	94	123	899	120
growth p.a.	12.25%	19.44%	8.78%	8.78%	5.45%	-4.37%	13.18%	-4.34%	-4.12%	17.39%	-3.58%	2.25%
		ECNA/ECSA			**ECNA/WCSA**			**EUR/E & SAF**			**EUR/W.AF**	
	No ships	**Avg TEU**	**Avg plugs**	**No ships**	**Avg TEU**	**Avg plugs**	**No ships**	**Avg TEU**	**Avg plugs**	**No ships**	**Avg TEU**	**Avg plugs**
1997	43	1,487	130	14	1,392	122	43	1,806	261	42	1,087	119
2000	38	1,921	206	17	1,877	158	47	1,873	112	69	1,365	107
2003	63	1,940	242	36	1,587	199	57	1,641	127	170	1,103	105
growth p.a.	6.57%	4.53%	10.91%	17.04%	2.21%	8.50%	4.81%	-1.60%	-11.30%	26.24%	0.24%	-2.06%
		EUR/ME			**EUR/ANZ**			**EUR/CARIB**			**EUR/C.Am**	
	No ships	**Avg TEU**	**Avg plugs**	**No ships**	**Avg TEU**	**Avg plugs**	**No ships**	**Avg TEU**	**Avg plugs**	**No ships**	**Avg TEU**	**Avg plugs**
1997	81	3,099	196	42	2,039	374	15	1,331	380	37	1,865	177
2000	97	3,798	287	37	2,368	212	29	1,270	104	49	2,221	150
2003	155	3,485	246	43	2,373	446	80	927	103	110	1,329	111
growth p.a.	11.42%	1.97%	3.86%	0.39%	2.56%	2.98%	32.18%	-5.85%	-19.55%	19.91%	-5.49%	-7.48%
		EUR/ECSA			**EUR/WCSA**			**MED/S.Am**			**FE/WAF**	
	No ships	**Avg TEU**	**Avg plugs**	**No ships**	**Avg TEU**	**Avg plugs**	**No ships**	**Avg TEU**	**Avg plugs**	**No ships**	**Avg TEU**	**Avg plugs**
1997	26	1,785	260	8	2,035	238	15	1,206	128	1	1,597	70
2000	38	1,782	264	7	2,177	238	17	1,578	174	7	1,749	167
2003	50	2,268	336	30	1,844	229	38	1,693	202	48	1,534	166
growth p.a.	11.51%	4.07%	4.37%	24.64%	-1.63%	-0.64%	16.76%	5.82%	7.90%	9.06%	-0.66%	15.47%
		FE/S & EAF			**FE/WAF**			**JAP/ANZ**			**E.Asia/ANZ**	
	No ships	**Avg TEU**	**Avg plugs**	**No ships**	**Avg TEU**	**Avg plugs**	**No ships**	**Avg TEU**	**Avg plugs**	**No ships**	**Avg TEU**	**Avg plugs**
1997	73	1,561	108	176	2,467	160	19	1,485	342	24	1,261	83
2000	60	1,786	149	249	2,757	195	30	1,783	205	37	1,743	114
2003	107	1,841	215	288	2,810	212	35	1,939	236	42	1,727	187
growth p.a.	6.58%	2.79%	12.16%	8.55%	2.19%	4.80%	10.72%	4.54%	-6%	9.77%	5.38%	14.49%
		SEA/ANZ			**FE/Carib,C.Am**			**FE/ECSA**			**FE/WCSA**	
	No ships	**Avg TEU**	**Avg plugs**	**No ships**	**Avg TEU**	**Avg plugs**	**No ships**	**Avg TEU**	**Avg plugs**	**No ships**	**Avg TEU**	**Avg plugs**
1997	27	1,449	149	24	2,933	155	60	1,623	99	16	1,667	118
2000	36	1,590	157	26	2,650	184	45	1,911	141	36	1,761	170
2003	53	1,637	213	31	2,999	229	49	2,135	233	63	1,711	204
growth p.a.	11.89%	2.05%	6.13%	4.35%	0.37%	6.72%	-3.32%	4.67%	15.33%	25.66%	0.43%	9.55%
Source: MDS-Transmodal												

The picture generally is one of substantial expansion of container reefer capacity.

In the early twenty-first century container operators are dominant in the major trade lanes. On less busy routes and particularly where traffic is seasonal, conventional reefer operators hold the upper hand. The deployment of container tonnage is still determined by the volume of general cargo traffic. As trade grows and strings proliferate, however, the role of reefer cargo in determining the characteristics of the ships deployed will become more important. Carriers will be increasingly targeting the best revenue cargo in these trades by deploying the most appropriate tonnage.

The Containership Orderbook

The future is usually similar to the past, and, based on the current 11.5% of total slots in the containership fleet that are reefer capable, the Nov 1st orderbook portends at least an additional 275,000TEU reefer slots (282,425,000cuft – or 69% of the existing conventional reefer fleet's total capacity) being added to the fleet.

The containership orderbook stood at an alarming 37.2% of the active fleet at November 1st. Furthermore, in the first twenty days of November an additional 39 ships

with 184,705TEU capacity was contracted, bringing the total orderbook (based on 11.5% of the new slots being reefer-capable) to the equivalent of 74% of the conventional reefer fleet's capacity.

The split of the November 1st orderbook deliveries looks like this:

Table III.21
Containership Orderbook by Delivery Year at Nov 2003

	No. ships	TEU	>2,999TEU	%>2,999TEU
2003	40	109,624	73,330	66.9
2004	196	669,623	516,390	77.1
2005	202	759,907	609,438	80.2
2006	147	732,748	647,127	88.3
2007	19	118,372	113,372	95.8

Source: Clarkson Research Studies

The high number of ships over 2999 TEU means that the proportion of reefer slots is, in fact, more likely to be higher than 11.5%. What's more, although services will continue to expand, the entry of much bigger ships to main-lane services will release an excess of smaller ships which may well find homes in those smaller trades in which reefer cargo plays an important part.

At the moment it looks as if traffic growth will accommodate without disruption an orderbook as big as this which is spread over four whole delivery years. However, there is still an ordering frenzy. It is possible that orders could be overdone, or that external factors could upset the supply/demand relationship, in which case hungry container operators may become more aggressive toward reefer cargoes.

Major Containership Reefer Operators

The threat to the reefership sector from container operators is spearheaded by the major east/west carriers that have substantial north/south operations, though ship sizes are also in the process of being maximized on north/south routes, with post-Panamaxes operating into ECSA, on order for South Africa and their deployment on Australia's east coast can only temporarily be delayed by access problems in Melbourne.

P&O Nedlloyd have always been substantial north/south reefer operators, but it is Maersk Sealand that seems to be most directly targeting the reefer section, while MSC's current fleet expansion will also reinforce their already strong position in the north/south sphere. That said, all of the 20 biggest carriers, whose combined reefer capacity is 23% greater than the total conventional reefer capacity, have the potential to hurt the conventional fleet, even though the preponderance of their reefer capacity is dedicated to the east/west trades. Most of these carriers are awaiting substantial fleet additions from the orderbook. This will further swell their reefer capacities, as well as release ships from the east/west trades where the preponderant part of their reefer slots are deployed today.

The 20 biggest reefer container operators are shown in the table below.

Table III.22
Major Containership Reefer Capacity Operators at Nov 2003

	Ref plugs	Cuft equiv	cf major reefer ship operators	
Maersk Sealand	91,802	94,280,654		
P&O Nedlloyd	52,350	53,763,450		
Evergreen	36,484	37,469,068		
MSC	34,349	35,276,423		
CMA-CGM	27,187	27,921,049		
NYK	23,514	24,148,878		
Hanjin	22,509	23,116,743	**1** Seatrade	22,047,225
APL	20,541	21,095,607		
Cosco	20,056	20,597,512		
Hamburg-Sud	18,990	19,502,730		
K Line	18,745	19,251,115		
CP Ships	17,602	18,077,254	**2** Laskaridis	18,875,919
MOL	17,407	17,876,989		
OOCL	16,349	16,790,423		
CSCL	14,935	15,338,245		
CSAV	14,854	15,255,058		
Hapag-Lloyd	13,732	14,102,764		
Hyundai	10,808	11,099,816	**3** Star Reefers	10,927,562
Yangming	10,045	10,316,215		
ZIM	9,677	9,938,279		

Source: MDS-Transmodal

A look at the distribution of the ships with the biggest reefer slot capacities is illuminating.

Table III.23
Reefer TEU Capability of Container Fleet at Nov 2003

Hierarchy by number of reefer TEU slots

Reefer population in fleet TEU	number of ships in size category	Total reefer TEU	Total TEU	Reefer as % total TEU	Avg. age	Where trading
3499-3000	4	12,450	25,958	47.9%	0	Transpacific
2999-2500	5	13,000	20,560	63.2%	1	EUR/ANZ/USEC
2499-2000	3	6,300	7,218	87.3%	15	C.Am/USEC, EUR/SAF
1999-1500	2	3,200	5,440	58.8%	6	EUR/USEC/WCSA, Jap,Kor/ANZ
1499-1000	124	143,684	712,504	20.2%	3	
999-500	280	179,835	1,050,774	17.1%	7	
>500	2396	386,952	3,974,547	9.7%	13	
no indicator	361		635,889		6	

Source: Clarkson Research Studies

The four ships with the biggest reefer capacities are NYK's 6489TEU post-Panamaxes, NYK Aphrodite, NYK Athena, NYK Pegasus, and NYK Phoenix, operating within the Global Alliance. NYK, of course, is the only significant liner operator with a major presence in the conventional reefer fleet. P&ONL's 4112TEU ships fall into the 2500-2999TEU bracket. Dole's fully refrigerated ships and P&O Nedlloyd's superannuated City of Capetown fall into the 2000-2499TEU bracket, and Maersk's Olga Maersk, in

that line's EUR/USEC/WCSA service, and P&O Swire's Arafura, in their Japan, Korea/Australia service, fall into the 1500-1999TEU bracket.

The lines named have, with their commitments to large reefer capacities, signaled their enthusiasm for reefer cargo, although it is certain that, as ships get bigger, more names will be added to this list.

Conclusion

Containerships already offer 65% of the world's seaborne refrigerated cargo capacity, and the fleet is growing fast, particularly at the upper end of the size scale, so that the number of reefer slots is almost certainly rising faster.

Table III.24
World Seaborne Reefer Capacity at Nov 2003

	Reefer TEU	Cuft equiv	Hold cuft	Total Cuft	% split
Reeferships	64,581	66,324,687	345,021,948	411,346,635	35%
Containerships	744,439	764,538,853		764,538,853	65%
Grand Total				1,175,885,488	

Source: Clarkson Research Studies

At the same time, the reefer fleet is declining, and much of its current composition is old. Conventional reefer operators face a dilemma. Perishable goods are becoming more attuned to the patterns of container distribution, and cargo-owners appreciate regular deliveries in manageable quantities. Meanwhile, the volume of reefer capacity in many container services is moving closer to a position in which containership operators will be able to cope with much, if not all, of seasonal harvest, crop, catch or kill movements from which restricted services and high unit costs used to debar them.

Reefership operators are becoming more sensitive to liner service requirements, and there are signs that, for some at least, logistics and even slot-chartering on containerships are seen as promising developments. However, it is the paucity of new orders that is beginning to suggest that they may already feel that the outcome of the competing modes has effectively been determined.

Produce companies that run their own shipping services, like Dole and Chiquita, are in the strongest position to define the future, but they have made commitments to containerships. Apart from the fishing industry's requirements (largely, though not completely self-contained), it is the banana trade that is most likely to define the shape of the reefer fleet in the future.

It is our view that the reefer fleet will continue to decline, with conventional operators investing in ever increasing container capability until they themselves become container liner operators on specialist trades.

IV. Panama Canal Forecast

The ACP provided historical transit data by ship, showing the tolls and other revenue associated with each individual transit. Ship characteristics were part of the database, and these were supplemented by cross-reference to an alternative ship database.

Transit and Revenue History – Reefer Ships

In reefer ships, the Canal handled 9.1% of the world trade in refrigerated commodities in 2003, down from 14.2% in 1995. The largest reefer ship to transit the Canal (2003) was 16,000 deadweight tons, and the average ship was 10,000 DWT. In cubic feet capacity, these figures translate to 21,700 cubic feet for the largest ship, and 13,000cubic feet for the average.

The percentage of Canal reefer tonnage that transits on conventional reefer ships has been declining, from 73% in FY1995, to 55% in FY2003. While the new reefer ships are larger in capacity, they have lost market share to reefer containers which are preferred by many importers, especially in the U.S., and which also provide flexibility for inland distribution. See Chapter III concerning the reefer ship fleet.

Canal Transits by reefer ships were 2,199 in FY2003, down from 2,578 in FY1995, implying an average annual decline of 2.0%. Transits hit a low of 2,004 in the year 2000, and there has been some growth in transits from that point, at 3% per year. Total Canal revenues over the 1995-2003 period increased 1.0% per year on average, reaching $47.6 million last year (2003).

Approach

Global Insight developed a detailed forecasting model of Canal transits, PCUMS, and revenues, incorporating, either directly or indirectly through exogenous variables, the effects of:

- Economic projections of the world's major economies
- Trade patterns of refrigerated products by origin-destination pair
- Alternative route selection based on both operating and time costs
- Tolls on volume (i.e. toll elasticity)
- The ongoing shift of reefer cargo from bulk reefer ships to reefer containers
- The expected developments in the global reefer fleet and the containership fleet
-

The model is described in detail in Chapter VI – Panama Canal Transit and Revenue Model.

Forecast Summary

The projections for Canal transits, revenue, and PCUMS are shown in the table below.

Table IV.1
Conventional Bulk Reefer Forecast

	1995	2000	2003	2010	2025	1995-2003	2003-2025
Transits	2,578	2,004	2,199	2,184	2,702	-2.0%	0.94%
Revenue	$43,989,924	$36,492,142	$47,649,198	$58,428,957	$111,701,847	1.0%	3.95%
PCUMS	18,084,297	15,193,581	17,206,497	17,447,873	23,055,322	-0.6%	1.34%
Cargo	5,781,014	4,781,539	5,453,194	5,570,923	7,038,681	-0.7%	1.17%
World Inflation (1997=100)	104.9	96.0	103.8	125.8	181.3	-0.1%	2.57%

Source: History from ACP. Forecast based on study results

The forecast for each of the above concepts is described below.

Transits Forecast

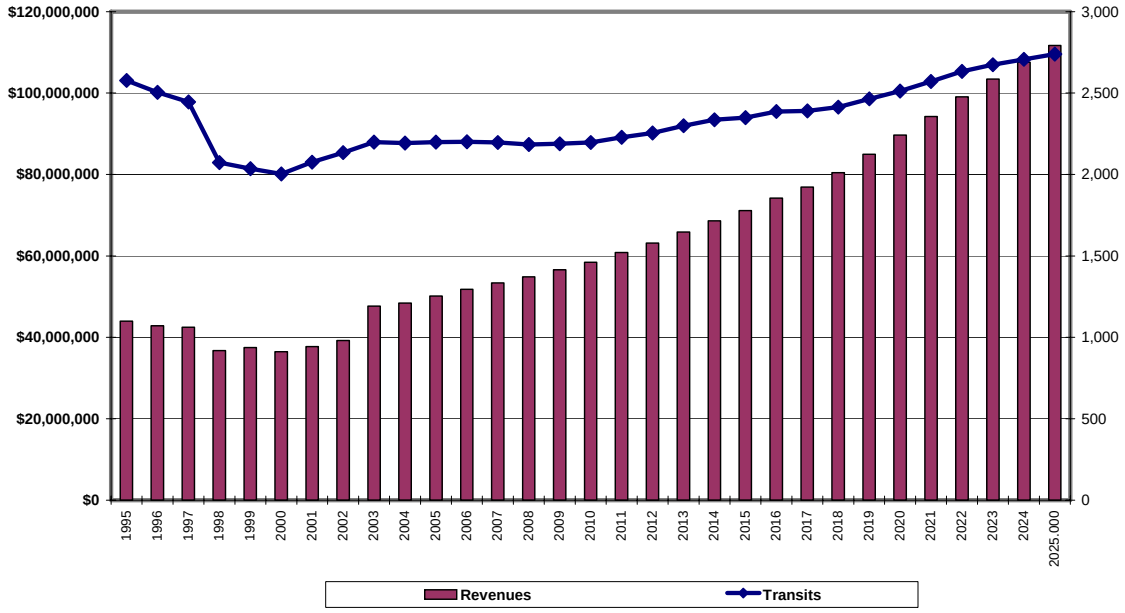
The Panama Canal Reefer Model predicts that transits will increase slowly through 2025, averaging only 1% per year and reaching 2,702 in the final year of the forecast. This forecast is based on global projections for reefer trade flows, an expected growth in the average size of reefer ships over time, the impact of continued containerization in the reefer sector, and Canal tolls that increase annually over the forecast with the world inflation rate. This forecast incorporates the decision rules for selecting by-pass alternatives based on total origin-destination costs and the time costs associated with financing the cargo and possible product deterioration.

Revenue Forecast

Revenue is forecast through 2025 based on a PCUMS-based toll that increases annually at the rate of world inflation of 2.6%. The shift to larger reefer ships over time has a dampening effect on revenues because toll rates decline as the PCUMS of the ship increases. This trend, coupled with slow growth in reefer commodity demand leads to average annual growth of only 4.0% per year over the forecast period. Revenues increases are consistent with a 2.6% average annual increase in toll revenues and a 1.3-1.4% increase in PCUMS as discussed below. Revenues climb from $47.6 million in 2003 to $111.7 million (nominal) in 2025. The revenue per PCUMS reaches $4.84 in nominal in the final year, up from $2.77 in 2003. However, since toll rates are assumed to rise with real inflation, revenue per PCUMS in 2003 dollars remains constant at $2.77. We assume that other services revenue for reefer ships will hold its same proportion to tolls revenue and will, therefore, also increase at the world inflation rate.

This revenue forecast assumes that the current PCUMS-based toll structure is maintained without modification. It incorporates the volume effects of the small annual increases in toll levels, through the tolls elasticity in the forecasting model. The transits and revenue forecasts are illustrated in the figure below.

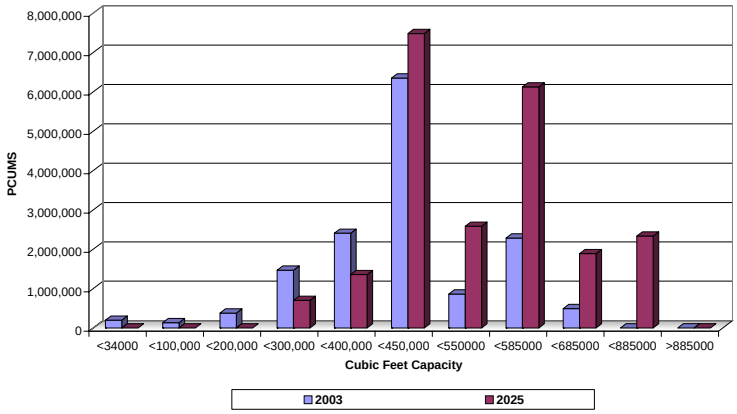
Figure IV.1
Canal Transits & Revenue Forecast



PCUMS Forecast

In line with the expected growth in the size of reefer vessels over time, coupled with the scrapping of older, smaller vessels, the average PCUMS of Canal-transiting reefer ships is forecast to grow from 1.3 million to 2.0 million. This change can be seen in the figure below where the larger ships are reflected in higher cubic feet of capacity, and hence PCUMS. The average annual growth in PCUMS through 2025 is 1.3%.

Figure IV.2
Average PCUMS of Transiting Ships by Size (cubic feet)



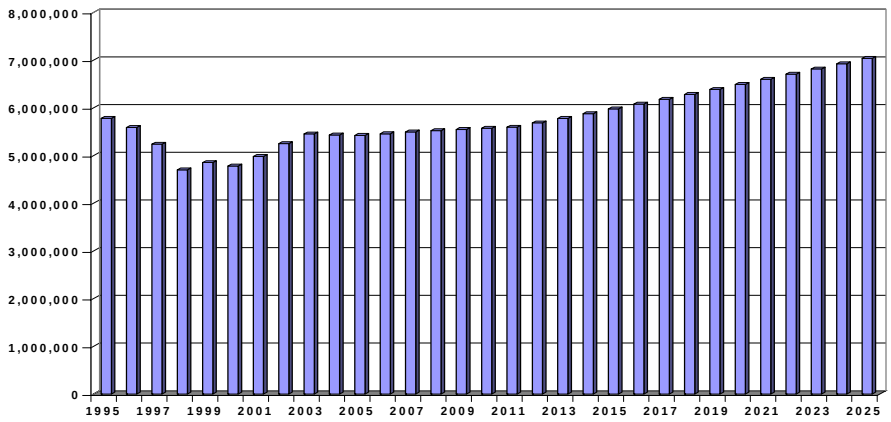
Source: History from ACP. Forecast based on study results

Cargo Forecast

The reefer cargo forecast incorporates the world trade (demand) projections for reefer products and the expected changes in the reefer fleet over time, including slightly larger ships, more containerization of reefer cargos, and fewer newbuildings compared to history. The cargo projections also reflect the rise in tolls, at the rate of world inflation.

The final forecast is shown in the figure below. The volume of reefer cargo grows from the 2003 level of 5.5 million long tons, to 7.0 million in the final year of the forecast, 2025. This represents an average annual growth of 1.2% over the forecast period.

Figure IV.3
Canal Reefer Cargo (Long Tons)



Source: History from ACP. Forecast based on study results

Forecast Tables

Tables showing, by ship size (capacity ranges), the Canal tolls, PCUMS, transits, and cargo tons are contained in an Excel workbook which is on the same CD as the report. These tables are followed by others showing the forecasts for each of

- Canal tolls
- PCUMS
- transits
- cargo tons

by beam ranges, deadweight ton ranges, PCUMS ranges, LOA ranges, gross tonnage ranges, and draft ranges.

In Appendix L (under separate cover), the contract-required tables, using the categorization specifications in the project Terms of Reference, are summarized showing the forecast in detail by 5-year intervals.

V. The Economic Value of the Panama Canal Routes Versus Alternatives

Every route through the Panama Canal has a by-pass alternative. Reefer ships that use the Canal do so because it reduces their cost of transporting cargo begin origins and destinations. This cost reduction defines the value of the Panama Canal for reefer trade. In order to quantify this value, Global Insight first calculated the difference in operating and time costs between the Panama Canal and the minimum cost alternative for reefer trade between relevant origin-destination trade pairs. These cost savings were defined in terms in U.S. dollars per metric ton of cargo transported. Positive cost savings per metric ton were multiplied by the total metric tons of reefer trade in conventional reefer ships between the origin-destination pairs, and then summed across origin-destination pairs. This sum quantifies the economic value of the Panama Canal.

The cost calculation reflects operating and time costs associated with the transport of the reefer cargo. Operating costs reflect the distance between origin-destination pairs via the Panama Canal route and the minimum distance alternative, and model assumptions regarding the speed of the ship and thus the days in transit, the heavy and middle distillate fuel requirements per day, and the non-fuel operating costs per day. Canal tolls are not included in the calculation because they reflect part of the value of the Canal. Time costs include both the finance costs associated with holding the cargo, and possible deterioration of the cargo. Reefer trade includes trade in frozen produce (meat, poultry, and fish), and fresh produce (dairy, vegetables, citrus, bananas, apples, and other deciduous fruit). Only fresh produce is assumed to include costs due to the deterioration of the cargo, and this deterioration is only assumed to result after a minimum of 7 days.

Operating Costs

Global Insight calculated the total sea distance in miles for each route associated with feasible origin-destination pairs (Panama Canal and alternative routes). For example, Chile (Valparaiso) to the US East Coast (Philadelphia) is 4,616 miles through the Canal and 8,325 miles by way of the Straits of Magellan. These distances were calculated using the Fairplay World Shipping Encyclopedia in a software package built by Veson (www.veson.com).

An example is shown below for Japan to the U.S. East Coast (a Canal route with an alternative) and Japan to the U.S. West Coast (a non-Canal route).

Table V.1
Distances Between Sample O-D Pairs

Origin	Destination	Route	Distance - Miles
Japan	U.S. East Coast	Panama	9,651
Japan	U.S. East Coast	Suez	12,966
Japan	U.S. West Coast	Direct	4,832

The complete list of ports used in each route, including both Panama Canal routes and non-Canal routes, is shown in Appendix B.

Assumptions based on inputs from LauritzenCool and the U.S. Army Corps of Engineers were made concerning the ship speed, fuel usage, and non-fuel operating costs per day for an average reefer ship. These input assumptions are summarized below.

Table V.2
Operating Cost Assumptions

Input Description	*Value*	*Units*
DWT	10,000	tons
Speed	19	knots
Bunker Fuel Consumption	35	metric tons per day
Bunker Fuel Cost	173	dollars per metric ton
Auxillary Fuel Consumption	6	metric tons per day
Auxillary Fuel Cost	267	dollars per metric ton
Daily Fixed Cost	4,600	dollars per day
Panama Canal Toll	2.96 / 2.90 / 2.85	dollars per PCUMS
Panama Canal Fees	0.22	dollars per PCUMS
Suez Toll	7.21 / 4.14	dollars per net tons

Typical operating costs for a 10,000 DWT shipment between Ecuador and Western Europe are summarized below. The time in days between Ecuador and Western Europe was calculated by dividing distance by knots (and 24 hours per day). The route cost was then computed as the product of days times the sum of fuel and non-fuel costs per day.

Table V.3
Operating Costs, Ecuador – Western Europe North

Output Description	*Panama*	*Magellan*
Miles	5,594	10,688
Days at Sea	12.27	23.44
Fuel Costs	93,933	179,469
Non-fuel Operating Costs	56,431	107,818
Total Operating Costs	150,363	287,287

Time Costs

Assumptions were made concerning the cargo-to-DWT ratio, the cargo value per metric ton, finance costs, and deterioration rates. Deterioration of cargo was assumed to begin after a specified number of “safe” days, subject to a specified exponential factor. These assumptions vary by type of cargo. For example, the value of the cargo varies from a high of $2,200 per metric ton for meat to a low of $300 per metric ton for bananas. Since meat is frozen, no deterioration is assumed. In the case of fresh fruit and vegetables, deterioration is assumed to begin after 7 days and to grow exponentially after that time. These input assumptions are summarized below.

Table V.4
Time Cost Assumptions, Bananas

Input Description	*Value*	*Units*
PCUMS-to-DWT Ratio	0.777	ratio
Cargo Value /PCUMS	$300	dollars per metric ton
Finance Rate	4.12%	annual rate
Depreciation Rate per Day	0.10%	dollars per metric ton
Days Safe	7	days
Exponential Factor	1.5	exponential

Typical time costs for a shipment of bananas between Ecuador and Western Europe are summarized below.

Table V.5
Time Costs, Bananas

Input Description	*Panama*	*Magellan*
PCUMS	7,770	7,770
Cargo Value	$3,000,000	$3,000,000
Cargo Finance Costs	$3,230	$6,172
Cargo Depreciation Costs	$28,181	$155,360
Total Time Costs	$31,411	$161,532

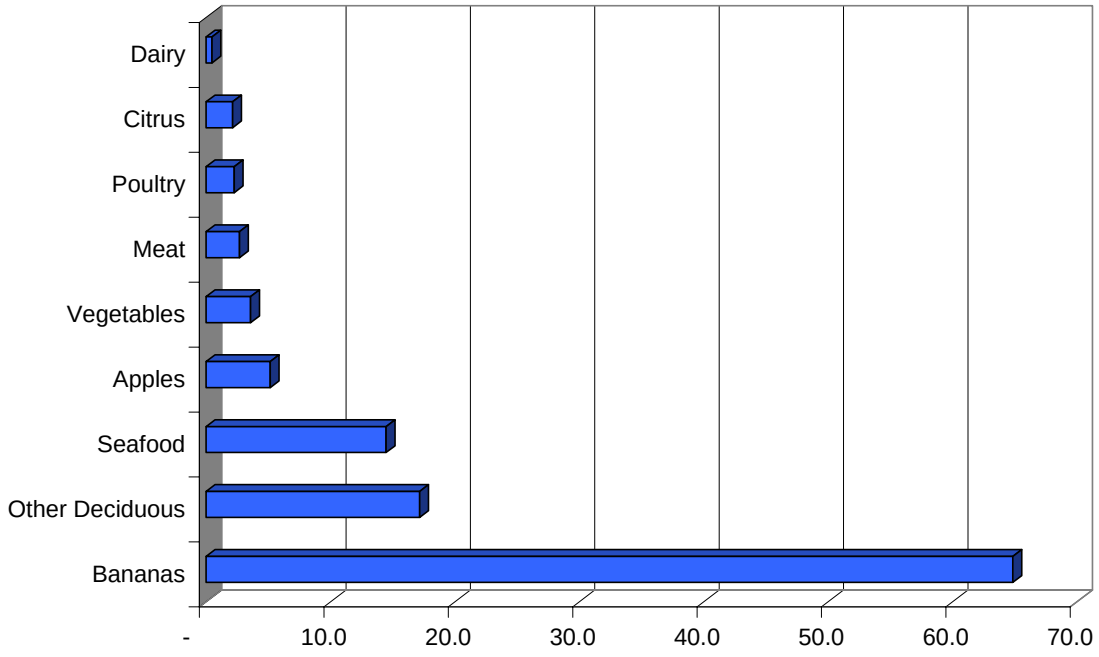
Value of the Panama Canal

Based upon the favorable operating cost differentials between the Panama Canal and the minimum cost alternative route for each origin-destination pair, and the volume of reefer trade between the pairs, Global Insight estimates that the value of the Panama Canal was $112 million in 2003. Trade in bananas accounted for over one-half of the total value, with a value to the banana trade of nearly $65 million. Other deciduous fruit was a distant second, accounting for just 15% of the value or $17 million.

Table V.6
Economic Value of the Panama Canal By Commodity

	Net Value of the Panama Canal	
	US Dollars	*% of Total*
Meat	2,673,313	2.4%
Poultry	2,252,178	2.0%
Dairy	468,797	0.4%
Seafood	14,463,969	12.8%
Vegetables	3,575,599	3.2%
Citrus	2,118,674	1.9%
Bananas	64,857,077	57.5%
Apples	5,146,704	4.6%
Other Deciduous Fruit	17,171,205	15.2%
Total:	***112,727,515***	***100.0%***

Figure V.1
Economic Value of the Panama Canal By Commodity
(Millions of U.S. Dollars)



The traditional origin-destination (O-D) pairs are well served by the Canal, and for good reason. Under the current Panama Canal toll structure, the routes through the Canal are far less expensive than their by-pass options. The main Canal routes on which most of the reefer trade is concentrated are shown in Table V.7 below .

Trade from the west coast of Central and South America to the Northern Europe-Baltics region drew the most benefit from the Panama Canal. Global Insight estimates that the value of the Panama Canal to traders along this route totaled $28 million dollars and accounted for 25% of the Canal's estimated economic value. Trade from the west coast of Central and South America to the east coast of North America benefited nearly as much, with a value of $25 million (23% share). In total, trades originating on the West Coast of Central and South America accounted for 61% of the economic value.

Seaborne trade from the east coast of North America to the west coast was a distant third, accounting for 9% of the economic trade. The reverse route accounted for 7% of the value. In total, trade originating from the east and west coasts each account for 14-16% of the Panama Canal's economic value. Table V.7 summarizes economic value begin origin and destination regions. Table V.8 allocates the economic value of the Canal by both commodity and region.

Table V.7
Economic Value of the Panama Canal By Origin-Destination Pair

Origin -- Destination	*Dollars*	*Percent*	*Cumulative Percent*
C/S America West -- North Europe / Baltics	28,329,114	25.1%	25.1%
C/S America West -- NA East	25,427,290	22.6%	47.7%
NA East -- NA West	10,571,400	9.4%	57.1%
C/S America West -- Mediterranean	9,112,533	8.1%	65.1%
NA West -- North Europe / Baltics	7,447,905	6.6%	71.8%
Asia Pacific -- NA East	7,313,995	6.5%	78.2%
NA East -- Asia Pacific	6,717,954	6.0%	84.2%
NA West -- NA East	4,671,654	4.1%	88.3%
C/S America West -- C/S America East	3,961,537	3.5%	91.9%
NA West -- C/S America East	2,615,544	2.3%	94.2%
C/S America West -- Indian Ocean	1,836,831	1.6%	95.8%
NA West -- Mediterranean	1,370,645	1.2%	97.0%
Asia Pacific -- North Europe / Baltics	963,585	0.9%	97.9%
North Europe / Baltics -- NA West	585,369	0.5%	98.4%
Asia Pacific -- C/S America East	490,888	0.4%	98.8%
C/S America East -- C/S America West	486,414	0.4%	99.3%
NA East -- C/S America West	220,734	0.2%	99.5%
Mediterranean -- NA West	196,330	0.2%	99.6%
C/S America East -- Asia Pacific	153,667	0.1%	99.8%
C/S America East -- NA West	92,107	0.1%	99.9%
North Europe / Baltics -- C/S America West	64,451	0.1%	99.9%
Mediterranean -- C/S America West	50,993	0.0%	100.0%
North Europe / Baltics -- Asia Pacific	34,879	0.0%	100.0%
Asia Pacific -- Mediterranean	4,418	0.0%	100.0%
NA West -- Indian Ocean	3,410	0.0%	100.0%
NA West -- Other (S & W Africa)	2,845	0.0%	100.0%
C/S America West -- Other (S & W Africa)	362	0.0%	100.0%
Mediterranean -- Asia Pacific	339	0.0%	100.0%
Other (S & W Africa) -- C/S America West	167	0.0%	100.0%
Other (S & W Africa) -- NA West	154	0.0%	100.0%
Total	***112,727,515***	***100.0%***	

Figure V.2
Economic Value of the Panama Canal by Major Origin-Destination Routes
(Millions of U.S. Dollars)

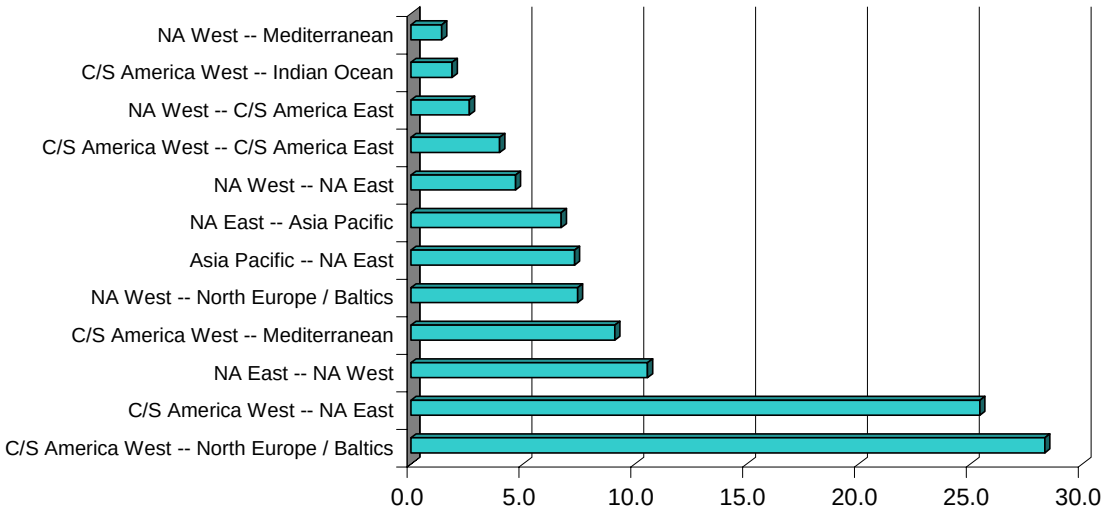


Table V.8
Economic Value of the Panama Canal by Commodity & Region (US Dollars)

Origin -- Destination	*Meat*	*Poultry*	*Dairy*	*Seafood*	*Vegetables*
C/S America West -- North Europe / Baltics	2,162	4,589	26	980,298	612,228
C/S America West -- NA East	507	0	0	1,768,257	393,782
NA East -- NA West	1,102	0	74	150,943	338,151
C/S America West -- Mediterranean	527	81	0	915,464	330,573
NA West -- North Europe / Baltics	62,400	244,803	1,696	2,716,426	85,220
Asia Pacific -- NA East	1,631,568	0	199,415	4,638,652	127,738
NA East -- Asia Pacific	259,937	1,943,112	9,986	905,649	73,592
NA West -- NA East	14,197	0	347	44,485	67,646
C/S America West -- C/S America East	6,034	3,706	3,533	634,284	678,463
NA West -- C/S America East	10,636	1,557	4,056	92,147	421,781
C/S America West -- Indian Ocean	0	0	0	0	0
NA West -- Mediterranean	1,115	370	26	549,464	12,730
Asia Pacific -- North Europe / Baltics	192,287	0	89,837	49,328	7,791
North Europe / Baltics -- NA West	70,425	0	51,762	389,465	71,636
Asia Pacific -- C/S America East	78,630	539	76,389	289,419	39,847
C/S America East -- C/S America West	302,915	4	8,638	59,119	807
NA East -- C/S America West	36,801	53,095	8,602	7,890	87,824
Mediterranean -- NA West	12	0	5,849	20,932	132,393
C/S America East -- Asia Pacific	969	0	0	125,503	0
C/S America East -- NA West	0	0	9	69,595	5,756
North Europe / Baltics -- C/S America West	204	0	4,032	5,034	55,111
Mediterranean -- C/S America West	122	14	506	37,142	12,722
North Europe / Baltics -- Asia Pacific	14	84	3,958	11,741	18,470
Asia Pacific -- Mediterranean	749	0	53	1,340	0
NA West -- Indian Ocean	0	0	0	17	0
NA West -- Other (S & W Africa)	0	224	0	896	1,025
C/S America West -- Other (S & W Africa)	0	0	0	160	0
Mediterranean -- Asia Pacific	0	0	2	1	312
Other (S & W Africa) -- C/S America West	0	0	0	167	0
Other (S & W Africa) -- NA West	0	0	0	154	0
	2,673,313	***2,252,178***	***468,797***	***14,463,969***	***3,575,599***

Table V.8 (continued)
Economic Value of the Panama Canal by Commodity & Region (US Dollars)

Origin -- Destination	*Citrus*	*Bananas*	*Apples*	*Other Deciduous*	*Total*
C/S America West -- North Europe / Baltics	16,315	24,595,277	829,515	1,288,705	28,329,114
C/S America West -- NA East	94,759	14,768,801	726,650	7,674,535	25,427,290
NA East -- NA West	10,161	7,841,757	0	2,229,212	10,571,400
C/S America West -- Mediterranean	1,744	7,620,874	87,858	155,412	9,112,533
NA West -- North Europe / Baltics	46,049	2,504,819	317,228	1,469,264	7,447,905
Asia Pacific -- NA East	3,907	17,416	380,429	314,870	7,313,995
NA East -- Asia Pacific	1,737,345	1,755,042	12,232	21,059	6,717,954
NA West -- NA East	69,517	2,960,447	0	1,515,013	4,671,654
C/S America West -- C/S America East	1,286	332,796	1,522,613	778,822	3,961,537
NA West -- C/S America East	8,956	131,158	848,258	1,096,995	2,615,544
C/S America West -- Indian Ocean	0	1,836,831	0	0	1,836,831
NA West -- Mediterranean	1,316	456,791	107,043	241,789	1,370,645
Asia Pacific -- North Europe / Baltics	3,540	0	303,960	316,842	963,585
North Europe / Baltics -- NA West	0	175	2	1,903	585,369
Asia Pacific -- C/S America East	0	0	2,332	3,733	490,888
C/S America East -- C/S America West	100,000	0	0	14,931	486,414
NA East -- C/S America West	6,921	0	7,706	11,895	220,734
Mediterranean -- NA West	6,154	0	0	30,991	196,330
C/S America East -- Asia Pacific	10,210	16,985	0	0	153,667
C/S America East -- NA West	3	14,803	0	1,941	92,107
North Europe / Baltics -- C/S America West	0	0	69	0	64,451
Mediterranean -- C/S America West	0	0	0	487	50,993
North Europe / Baltics -- Asia Pacific	0	0	0	611	34,879
Asia Pacific -- Mediterranean	0	0	152	2,125	4,418
NA West -- Indian Ocean	491	2,902	0	0	3,410
NA West -- Other (S & W Africa)	0	0	656	45	2,845
C/S America West -- Other (S & W Africa)	0	202	0	0	362
Mediterranean -- Asia Pacific	0	0	0	25	339
Other (S & W Africa) -- C/S America West	0	0	0	0	167
Other (S & W Africa) -- NA West	0	0	0	0	154
	2,118,674	***64,857,077***	***5,146,704***	***17,171,205***	***112,727,515***

The economic value of the Panama Canal averages $20 per metric ton across the 9 reefer commodities. Conversion to dollars per cubic foot and dollars per cubic meter are commodity-specific. The economic value in dollars per cubic foot ranges from a low of $0.17-$0.24 for dairy, meat, and poultry products to a high of $0.41-$0.44 for fruit, vegetables, and seafood. The economic value in dollars per cubic meter is a straight conversion from dollars per cubic foot. The low value for dairy, meat, and poultry is attributed to the low volume of dairy products on conventional bulk reefer ships. Conversely, the higher values for fruit, vegetables, and seafood reflect the higher volume of trade through the Panama Canal on conventional bulk reefer ships.

Table V.9
Economic Value of the Panama Canal
(U.S. Dollars per Metric Ton, Cubic Foot, Cubic Meter)

	Dollars per Metric Ton	*Pounds per Cubic Foot*	*Dollars per Cubic Foot*	*Dollars per Cubic Meter*
Meat	***$ 12.75***	32	$ 0.18	$ 6.53
Poultry	***$ 16.70***	32	$ 0.24	$ 8.56
Dairy	***$ 9.35***	40	$ 0.17	$ 5.99
Seafood	***$ 19.32***	50	$ 0.44	$ 15.47
Vegetables	***$ 20.09***	44	$ 0.40	$ 14.16
Citrus	***$ 22.38***	41	$ 0.42	$ 14.70
Bananas	***$ 24.07***	38	$ 0.41	$ 14.65
Apples	***$ 11.17***	48	$ 0.24	$ 8.59
Other Deciduous	***$ 16.16***	45	$ 0.33	$ 11.65
Total	***$ 20.01***			

Appendix K (under separate cover) includes an 8-page table showing the economic value of the Panama Canal by commodity and by individual route.

VI. Panama Canal Transit and Revenue Model

The Panama Canal Reefer Model determines transits, deadweight tons, gross tonnage, PCUMS and revenues from reefer ships. The primary inputs to the model are global reefer commodity trade flows between origin-destination pairs, trade agreements and constraints, distances along trade routes, ship operating costs, fleet characteristics, conventional/container reefer trends, and toll rates. Chart VII.1 illustrates the structure of the Reefer Model.

Trade Flows in Metric Tons

The key demand inputs in the Model are the total sea borne metric tons of each reefer commodity I going from each origin O to each destination D. These totals include commodities coming from countries whose trade routes to the destination country could potentially involve the Panama Canal, as well as from countries whose trade routes would never involve the Canal. Including all reefer commodity inflows to each destination allows the model user to evaluate the per capita inflows of each commodity by destination, and to alter the source of commodity inflows under alternative simulations. See Tables 1 and 2 for a list of reefer commodities, origins, and destinations.

CI_O_D = Commodity I, I = 1,...9 (metric tons)
O = 1,…37 origins
D = 1,…37 destinations

(1) $CI_D = \sum_{O=1}^{37} CI_O_D$

(2) CI_D_N = CI_D/N_D

Where :
CI_D = total sea borne inflow of commodity I to destination D
CI_D_N = total sea borne inflow of commodity I to destination D per capita
N_D = population of destination D.

Note: CI_O_D is an exogenous model input that can be changed by the model user in alternative simulations.

Figure VI.1
Structure of the Panama Canal Reefer Model

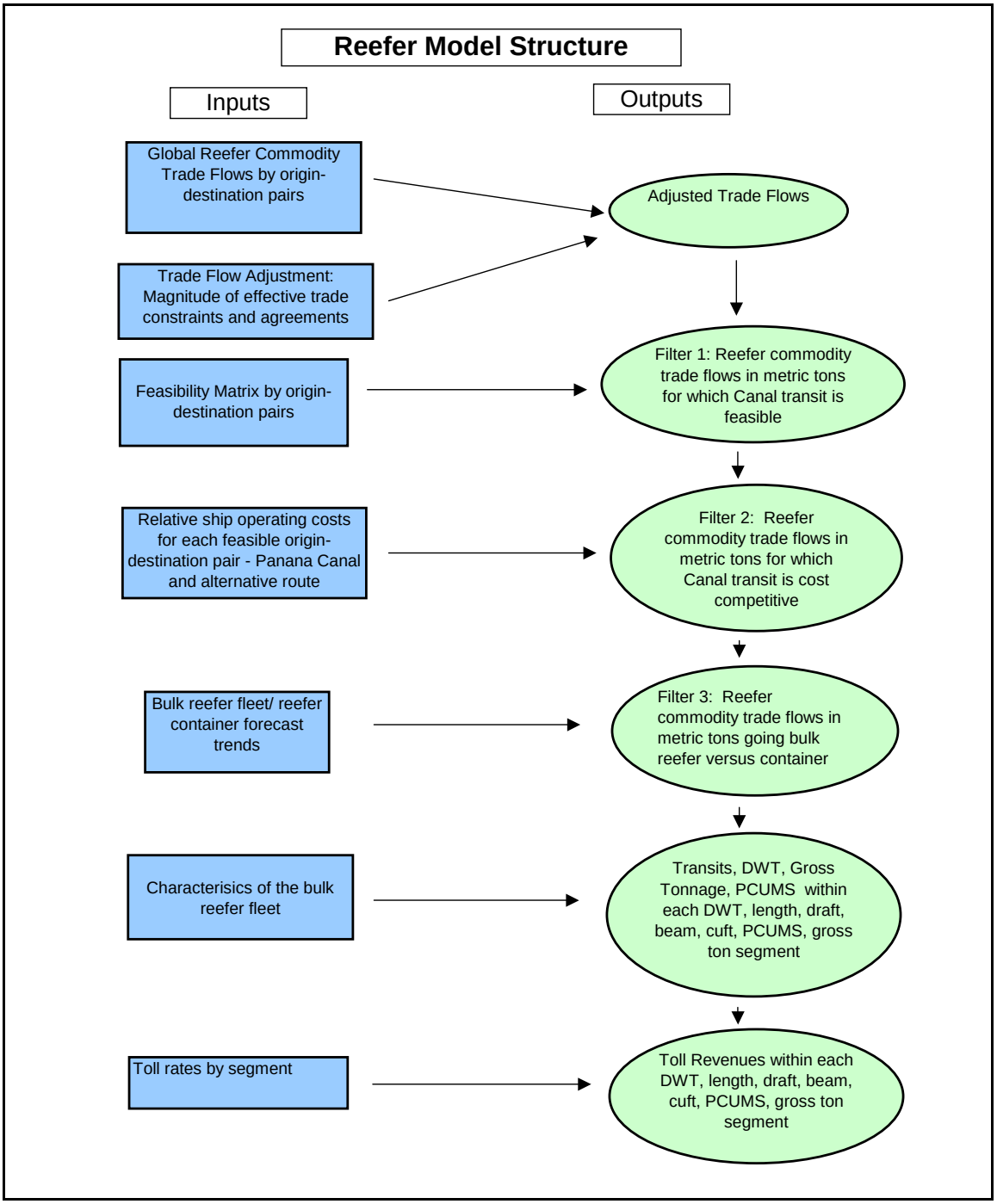


Table VI.1A
Reefer Commodity Category Detail

Code	Commodity Grouping		Commodity Detail
C01	**Meat**	1	Bovine meat, fresh, chilled
		2	Bovine meat, frozen
		3	Meat of sheep or goats
		4	Meat of swine
C02	**Poultry**	5	Poultry, meat and offal
		6	Meat of horses, mules, etc.
		7	Edible offal
		8	Meat, edible offal, n.e.s.
C03	**Dairy**	9	Milk excluding concentrated, sweetened
		10	Milk products
		11	Butter, other fat of milk
		12	Cheese, powdered, grated
		13	Processed cheese, whole
		14	Blue-veined cheese
		15	Other cheese; curd
		16	Bird eggs unshelled; yolks
C04	**Seafood**	17	Fish, fresh, chilled, whole
		18	Fish, frozen excluding fillets
		19	Fish fillets, frozen
		20	Fish fillets, fresh, chilled
		21	Crustaceans, frozen
		22	Crustaceans, not frozen
		23	Molluscs
		24	Fish, prepared, preserved, n.e.s.
C05	**Vegetables**	25	Tomatoes, fresh, chilled
		26	Vegetables frozen
		27	Vegetables prov. preserved
		28	Vegetables, unpickled frozen
		29	Vegetables prepared, preserved, n.e.s.
C06	**Citrus Fruit**	30	Oranges, etc.
		31	Other citrus, fresh, dried
C07	**Bananas**	32	Bananas, fresh or dried
C08	**Apples**	33	Apples, fresh
C09	**Other Deciduous Fruit**	34	Grapes, fresh or dried
		35	Figs, fresh or dried
		36	Fruit, fresh, dried, n.e.s.

Table VI.1B
Reefer Commodity Categories and Aggregations

Product Detail Codes	Product Codes	Definition
1-4 and 6-8	1	Meat
5	2	Poultry
16-Sep	3	Dairy
17-24	4	Seafood
25-29	5	Vegetables
30-31	6	Citrus Fruit
32	7	Bananas
33	8	Apples
34-36	9	Deciduous Fruit
	10	Other, Misc. Reefer Products

Table VI.2
Origin & Destination Countries/Regions

1	**Argentina (ARG)**	20	**Mexico East (MXE)**
2	**Australia (AUS)**	21	**Mexico West (MXW)**
3	**Brazil (BRA)**	22	**New Zealand (NZL)**
4	**Canada East Coast (CNE)**	23	**Northern Africa (NAF)**
5	**Canada West Coast (CNW)**	24	**Peru (PER)**
6	**Caribbean Basin (CRB)**	25	**Russia (RUS)**
7	**Central America East (CAE)**	26	**South East Asia (SEA)**
8	**Central America West (CAW)**	27	**Southern Africa (SAF)**
9	**Chile (CHL)**	28	**United States East Coast (USE)**
10	**China Region (CH)**	29	**United States West Coast (USW)**
11	**Colombia East (COE)**	30	**Venezuela (VEN)**
12	**Colombia West (COW)**	31	**Western Africa (WAF)**
13	**Confederation of Independent States (CIS)**	32	**Western Europe North (WEN)**
14	**East Africa (OEA)**	33	**Western Europe South (SWE)**
15	**Eastern Europe (EE)**	34	**Other East Coast of South America (OEL)**
16	**Ecuador (EB)**	35	**Other Mediterranean (OMED)**
17	**Indian Subcontinent (IND)**	36	**Other Middle East (MIDE)**
18	**Israel (ISR)**	37	**Other Region (OWW)**
19	**Japan (JPN)**		

Including all the trade flows as exogenous model inputs gives the model user the flexibility to alter the origins of the commodity inflows. For example, if the model user wants to evaluate the effect of poor climate in Israel, he could reduce the citrus flow from Israel to Europe (a route that is irrelevant to the Panama Canal) and increase the citrus flow from the west coast of South America to Europe (a route that can potentially be served by the Canal).

Trade Agreement/Constraint Adjustments

The commodity trade flow forecasts incorporate the impacts of existing and projected future trade agreements between relevant origin-destination pairs. The model user can remove the effective impact of trade agreements on reefer trade flows between:

Ecuador and the U.S.,
Ecuador and the EU,
Chile and the U.S.,
Chile and the EU, and
Australia and the U.S.

Each of these agreements is discussed in Chapter II of this report. Chapter II also quantifies the estimated impact of the agreements on reefer trade flows between the affected countries and among competing supply locations.

Trade Flow Filters

Reefer commodity trade flows between each origin-destination pair are subjected to a number of filters to determine the metric tons of each commodity that can feasibly (filter 1) and economically (filter 2) transit the Panama Canal. The split between transits via reefer ships versus container ships (filter 3) is then determined. It was not necessary to consider a final filter based upon the size of the ships (filter 4), since we do not anticipate that reefer ships will be enlarged to such a degree that would prohibit their transit through the Panama Canal.

Filter 1

Only the CI_O_D flows that can be feasibly served by the Canal are carried forward in the analysis. Each CI_O_D flow is multiplied by a feasibility scalar. Feasibility scalars are based upon geography, and since geography does not change we do not need to change this during a solution. Feasibility scalars dictate whether or not it is feasible to transit the Canal when going from one country/region to another country/region. We do not bother to look at the economics of going through the Canal for such routes as US East Coast to Europe, or US West Coast to Asia. The feasibility scalars are set to 0 for these routes. For any routes for which there is even a remote possibility, we look at the economics and let the routes compete for the trade flows.

The feasibility scalar equals 1 if transit through the Canal is feasible, or 0 if transit through the Canal is not feasible. Feasibility scalars are defined for each origin-

destination pair and are not subject to change by the model user. See Appendix A for a list of origin-destination pairs and their associated feasibility scalars.

(3) F1_CI_O_D = FPC_O_D * CI_O_D

Where:
F1_CI_O_D = commodity I from origin O to destination D that can feasibly transit the Panama Canal (Filter 1).
FPC_O_D = 0 or 1 scalar based upon the feasibility of a Panama Canal transit between origin O and destination D.

Filter 2

Feasible trade flows are subjected to a second filter based upon the operating costs associated with a Panama Canal route relative to the costs of alternative trade routes.

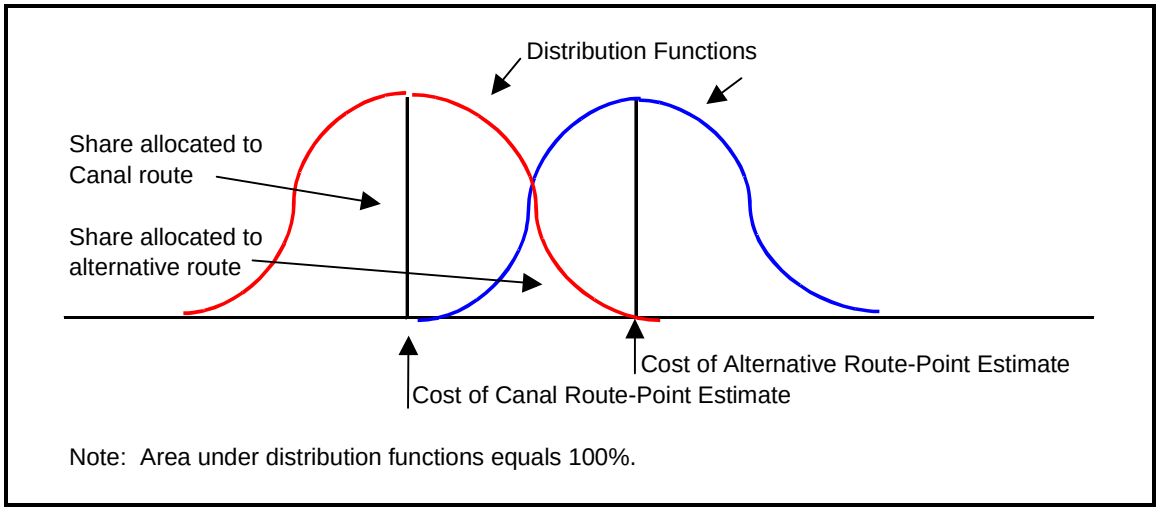
(4) F2_CI_O_D = f(F1_CI_O_D, OCPC_O_D/OCALT_O_D)

Where:
F2_CI_O_D = cost effective metric tons of commodity I from origin O to destination D through the Panama Canal (Filter 2).
OCPC_O_D = operating costs from origin O to destination D via a Panama Canal route.
OCALT_O_D = operating costs from origin O to destination D via alternative routes.

The major trade routes between origin-destination pairs are summarized in the following section, “Trade Routes.” The calculations defining the transit costs between origin-destination pairs for both the Panama Canal routes and alternative competing routes are summarized in the following section “Route Operating Costs.”

The route operating costs are point estimates. The model acknowledges that actual costs vary around these point estimates. Probability distributions are therefore defined around the cost point estimates for the Panama Canal Route and the minimum cost alternative route using a Weibull distribution. Given the distribution about the costs, one of the trade routes can be minimum cost over part of the distribution and one can be minimum cost over another part. Trade flows between the origin-destination pairs are allocated between the trade routes based upon the minimum cost distribution shares. The distribution cost analysis is illustrated in the diagram below.

Figure VI.2
Point Cost Estimates and Their Probability Distributions



Filter 3

The third filter splits cost effective metric tons for each commodity and origin-destination pair between reefer ships and container ships based upon projected trends in the shift to containers by product and by port. Metric tons of each of the nine commodities by origin-destination pairs are allocated between reefer and container ships based upon specified shares that reflect port and product characteristics, and changing fleet characteristics. These shares are based upon our interviews and our discussions with Clarkson and LauritzenCool.

Metric tons of each of the nine commodities by origin-destination pairs are allocated between reefer and container ships based upon specified shares that reflect port and product characteristics, and changing fleet characteristics.

CI_R_O_D = SHR_CI_O_D*F2_CI_O_D
SHR_CI_O_D = f(port and product characteristics, fleet characteristics)
CI_C_O_D = F2_CI_O_D – CI_R_O_D

Where:
CI_R_O_D = cost effective metric tons of commodity I from origin O to destination D through the Panama Canal transported on reefer ships (Filter 3).
CI_C_O_D = cost effective metric tons of commodity I from origin O to destination D through the Panama Canal transported on reefer ships (Filter 3).

Filter 4

Transit through the canal by the existing and projected reefer fleet is not limited by the width and depth of the current Panama Canal. See Chapter III for a discussion of the reefer fleet. Consequently, it was not necessary to add a fourth filter to the model to account for Canal limitations.

Totals

The metric tons of commodity I transported from origin O to destination D through the Panama Canal on reefer and container ships in each year between 2004 and 2025 are summed across all commodities and all origin destination pairs to determine the total metric tons of reefer goods transiting the Canal.

$$CTOT_R_MT_t = \sum_{I}\sum_{O}\sum_{D} CI_R_O_D_t$$

$$CTOT_C_MT_t = \sum_{I}\sum_{O}\sum_{D} CI_C_O_D_t$$

Where:
$CTOT_R_MT_t$ = total metric tons of reefer commodities transported through the Panama Canal on conventional bulk reefer ships.
$CTOT_C_MT_t$ = total metric tons of reefer commodities transported through the Panama Canal on container ships.

Trade Routes

Reefer commodities can be shipped via the Panama Canal or six alternative trade routes. These routes include travel around Cape Horn and Cape of Good Hope, through the Straits of Magellan, the Suez Canal, and the Straits of Gibraltar, and finally a variety of direct ocean routes between two ports that do not pass by or through any of the above trade routes. Each origin-destination pair in the model is associated with an exporting and importing port. Distances are specified between the ports and used to calculate operating costs. Table VI.3A below summarizes the routes, and Table VI.3B provides distances for illustrative origin-destination pairs and alternative trade routes. The operating cost calculations are summarized in the following section.

Table VI.3A Trade Routes

1	Cape Horn
2	Cape Hope
3	Magellan
4	Panama Canal
5	Suez
6	Gibraltar
7	Direct (Ocean)

Table VI.3B
Sample Trade Routes (miles)

Wellington, New Zealand to New York, USA	
Cape Horn	11,530
Cape Hope	14,332
Magellan	11,469
Panama	8,481
Suez	14,258
Wellington, New Zealand to Cannes, France	
Cape Horn	11,726
Cape Hope	13,388
Magellan	11,667
Panama	11,586
Suez	10,596
Wellington, New Zealand to Hamburg, Germany	
Cape Horn	12,283
Cape Hope	13,960
Magellan	12,222
Panama	11,563
Suez	12,666

Route Operating Costs

Route operating costs are computed for each origin-destination pair via a Panama Canal trade route and an alternative route based upon the miles along the trade routes, the price of bunker and middle diesel fuel, and the non-fuel operating costs of the ships.

Sample route operating cost calculations are provided below for travel between Guayaquil, Ecuador and Rotterdam (Western Europe, North) via the Panama Canal and the alternative route through the Straits of Magellan.

Table VI.4
Route Operating Costs Between Guayaquil (Ecuador) and Rotterdam (Western Europe, North)

Model Inputs		
Ship Characteristics		
Deadweight tons	10,000	
Cubic Feet	455,000	
PCUMS	7,770	
Speed (knots)	19	
Cost Assumptions		
Heavy Fuel Oil		
Consumption (tons per day)	35	
Cost per ton	$ 173	
Middle Diesel		
Consumption (tons per day)	6	
Cost per ton	$ 267	
Non-fuel Operating Cost per Day	$ 4,600	
Cargo-to-DWT ratio	$ 0.70	
Cargo Value per Metric Ton	$ 300	
Cargo Value per PCUMS	$ 386	
Cargo Value	$ 3,000,000	
Finance Rate	4.123%	
Depreciation Rate per Day	0.1%	
Days Safe	7	
Exponential Factor	1.5	
Routes	Panama	Magellan
Miles	5,594	10,688

Model Outputs	***Panama***	***Magellan***
Tolls*	$22,999	$0
Charges*	$1,709	$0
Days At Sea	12.27	23.44
Operating Costs		
Fuel Costs	$93,933	$179,469
Non-fuel Operating Costs	$56,431	$107,818
Tolls & Other Charges	$24,709	$0
Cargo Finance Costs	$3,230	$6,172
Cargo Depreciation Costs	$28,181	$155,360
Total Operating Costs	$206,483	$448,818

Model Inputs

Where:
Cubic Feet = 45.5 * Deadweight Tons
PCUMS = .777 * Deadweight Tons
Cargo Value = Cargo Value per PCUMS * PCUMS
Tolls = $2.96 * PCUMS
Charges = $0.22 * PCUMS
Days = Miles / Knots / 24 Hours
Fuel Costs = Days * Tons per Day * Heavy Fuel Oil Cost per Ton +
Days * Tons per Day * Distillate Oil Cost per Ton
Non-fuel Operating Costs = Days * Non-fuel Operating Cost per Day
Cargo Finance Costs = Cargo Value * Finance Rate * Days/365
Cargo Depreciation Costs = Cargo Value * (Positive(Days-Safe Days)) ** Exponential Factor
Total Operating Costs = Fuel Costs + Non-fuel Operating Costs + Tolls & Other Charges + Cargo Depreciation Costs

Ship Characteristics

Changes in the characteristics of the global reefer fleet are tracked and used to infer changes in the fleet transiting the canal. The current reefer fleet is sorted by age, and segmented into 11 deadweight ton, cubic feet, and PCUMS categories, 14 gross ton and draft categories, 9 length categories, and 15 beam categories. The characteristics of the 2003 fleet were obtained from Clarkson Research Studies.

Table VI.5
Fleet Characteristic Segments

DWT	Cubic Feet	PCUMS	Gross Tons
1 < 750	1 < 34,000	1 < 583	1 < 10,000
2 >= 750 < 2,200	2 >= 34,000 < 100,000	2 >= 583 < 1,710	2 >= 10,000 < 19,999
3 >= 2,200 < 4,400	3 >= 100,000 < 200,000	3 >= 1,710 < 3,420	3 >= 19,999 < 29,999
4 >= 4,400 < 6,600	4 >= 200,000 < 300,000	4 >= 3,420 < 5,130	4 >= 29,999 < 39,999
5 >= 6,600 < 8,800	5 >= 300,000 < 400,000	5 >= 5,130 < 6,840	5 >= 39,999 < 49,999
6 >= 8,800 < 10,000	6 >= 400,000 < 450,000	6 >= 6,840 < 7,770	6 >= 49,999 < 59,999
7 >= 10,000 < 12,090	7 >= 450,000 < 500,000	7 >= 7,770 < 9,390	7 >= 59,999 < 69,999
8 >= 12,090 < 12,870	8 >= 500,000 < 550,000	8 >= 9,390 < 10,000	8 >= 69,999 < 79,999
9 >= 12,870 < 15,000	9 >= 550,000 < 585,000	9 >= 10,000 < 11,700	9 >= 79,999 < 89,999
10 >= 15,000 < 19,300	10 >= 585,000 < 685,000	10 >= 11,700 < 15,000	10 >= 89,999 < 9,9999
11 >= 19,300	11 >= 685,000	11 >= 15,000	11 >= 99,999 < 149,999
			12 >= 149,999 < 19,9999
			13 >= 199,999 < 249,999
			14 >= 249,999

Draft	Length	Beam
1 < 10.0	1 < 200.0	1 < 24.3
2 >= 10.0 < 10.5	2 >= 200.0 < 230.9	2 >= 24.3 < 25.9
3 >= 10.5 < 11.0	3 >= 230.9 < 286.6	3 >= 25.9 < 27.7
4 >= 11.0 < 11.5	4 >= 286.6 < 294.1	4 >= 27.7 < 29.0
5 >= 11.5 < 12.0	5 >= 294.1 < 330.9	5 >= 29.0 < 30.4
6 >= 12.0 < 12.5	6 >= 330.9 < 360.9	6 >= 30.4 < 32.3
7 >= 12.5 < 13.0	7 >= 360.9 < 385.6	7 >= 32.3 < 33.5
8 >= 13.0 < 13.5	8 >= 385.6 < 399.9	8 >= 33.5 < 36.6
9 >= 13.5 < 14.0	9 >= 399.9	9 >= 36.6 < 39.6
10 >= 14.0 < 14.5		10 >= 39.6 < 42.7
11 >= 14.5 < 15.2		11 >= 42.7 < 45.7
12 >= 15.2 < 17.5		12 >= 45.7 < 48.8
13 >= 17.5 < 20.0		13 >= 48.8 < 51.8
14 >= 20.0		14 >= 51.8 < 54.9
		15 >= 54.9

The model quantifies the global reefer fleet over time, tracking changes in the fleet within each of the characteristic segments. The global fleet in any given year is defined by the previous year's fleet, less retirements, plus current year additions. The model assumes that ships of 28+ years of age are retired. Fleet additions in aggregate are specified by the model user and allocated to characteristic segments based upon the characteristics of recent builds. Details on the fleet are contained in excel workbook Fleet_Forecast.xls.

Once the reefer fleet is classified by the ACP segments within each characteristic type (deadweight tons, cubic feet, PCUMS, gross tons, draft, length, and beam), stock shares are computed by segment for each characteristic. Segment shares are similarly computed for ACP's historical transit data. ACP's segment shares are assumed to change in line with changes in the global fleet's segment shares.

$SHPC_T_type_n_t = f(SHPC_T_type_n_{t-1}, SHF_T_type_n_t - SHF_T_type_n_{t-1})$
$SHPC_DWT_type_n_t = f(SHPC_DWT_type_n_{t-1}, SHF_DWT_type_n_t - SHF_DWT_type_n_{t-1})$
$SHPC_PCUMS_type_n_t = f(SHPC_PCUMS_type_n_{t-1}, SHF_DWT_type_n_t - SHF_DWT_type_n_{t-1})$

Where:
$SHPC_T_type_n_t$ = share of Panama Canal transits in type n segment, type = DWT, cubic feet, gross tons, draft, length, beam, n=1,…N.
$SHF_T_type_n_t$ = share of the global reefer fleet in type n segment, type = DWT, cubic feet, gross tons, draft, length, beam, n=1,…..N.
$SHPC_DWT_type_n_t$ = share of Panama Canal DWT in type n segment, type = DWT, cubic feet, gross tons, draft, length, beam, n=1,…..N.
$SHF_DWT_type_n_t$ = share of global stock DWT in type n segment, type = DWT, cubic feet, gross tons, draft, length, beam, n=1,…..N.
$SHPC_PCUMS_type_n_t$ = share of Panama Canal PCUMS in type n segment, type = DWT, cubic feet, gross tons, draft, length, beam, n=1,…..N.

Deadweight Tons and Transits

Deadweight tons in the last period of history are grown with the rate of change in metric tons of refrigerated commodities transiting the Canal in conventional bulk reefer ships. Total deadweight tons of reefer ship capacity are allocated to each deadweight ton category based upon DWT shares that reflect the characteristics of the fleet currently transiting the Canal and the changing characteristics of the global reefer fleet. Deadweight tons within each category are then translated into transits by dividing deadweight tons by typical or average "DWTs per transit" scalars. These scalars are computed based upon historical relationships when available, and as the mid-point of the range when not.

$$DWT_TOT_t = DWT_TOT_{t-1} * CTOT_R_MT_t / CTOT_R_MT_{t-1}$$

$DWT_n_t = DWT_TOT_t * SHPC_DWT_n_t$

$T_ DWT_n_t = DWT_n_t / MID_DWT_n_t$

$T_TOT_t = \sum_n T_ DWT_n_t$

Where:
DWT_TOT_t = deadweight tons of reefer ship capacity required to transport reefer commodities through the Panama Canal
$SHPC_DWT_n_t$ = share of DWT within DWT segment n = 1,…..N
$MID_DWT_n_t$ = DWT for mid-point ship within segment n
$T_DWT_n_t$ = transits within DWT segment n = 1,...N
T_TOT_t = total conventional bulk reefer transits through the Panama Canal

Table VI.6 illustrates that deadweight tons in 2003 were concentrated in DWT segments 5-9, with no ships with deadweight tons less than 750 or in excess of 19,300. The model uses the mid-point DWT within each segment to translate deadweight tons within each segment into transits. The table illustrates this relationship over history.

Table VI.6
Deadweight Ton Categories and 2003 Canal Statistics

Dead Weight Tons by Category j	DWT Shares by Category j	2003 DWT	Mid-point DWT per Transit	2003 Transits	Percent of Total
1 < 750	0.0%	0	667	0	0.0%
2 >= 750 < 2,200	0.0%	1,938	1,752	1	0.1%
3 >= 2,200 < 4,400	1.0%	210,577	3,282	64	2.9%
4 >= 4,400 < 6,600	4.2%	929,782	6,004	155	7.0%
5 >= 6,600 < 8,800	13.5%	2,955,453	7,767	381	17.3%
6 >= 8,800 < 10,000	14.8%	3,252,861	9,517	342	15.5%
7 >= 10,000 < 12,090	43.9%	9,621,532	10,765	894	40.6%
8 >= 12,090 < 12,870	6.5%	1,427,861	12,533	114	5.2%
9 >= 12,870 < 15,000	14.4%	3,147,692	13,949	226	10.3%
10 >= 15,000 < 19,300	1.7%	362,570	15,609	23	1.1%
11 >= 19,300	0.0%	0	22,150	0	0.0%

PCUMS

Total transits are distributed to PCUMS segments using the shares defined above. PCUMS by segment is then computed by multiplying transits within each PCUMS segment n by the mid-point ship's PCUMS within segment n.

$T_ PCUMS_n_t = T_TOT_t * SHPC_T_PCUMS_n_t$

$PCUMS_n_t = T_PCUMS_n_t * MID_PCUMS_n_t$

$$PCUMS_TOT_t = \sum_n PCUMS_n_t$$

$$PCUMS_type_n_t = PCUMS_TOT_t * SHPC_PCUMS_type_n_t$$

Where:
$T_PCUMS_n_t$ = transits within PCUMS segment n = 1,…N
$SHPC_T_PCUMS_n_t$ = transit shares within PCUMS segment n = 1,…N
$PCUMS_n_t$ = PCUMS within each PCUMS segment n = 1,….N for reefer commodities through the Panama Canal
$MID_PCUMS_n_t$ = PCUMS for mid-point ship within segment n = 1,…N
$PCUMS_TOT_t$ = total PCUMS for reefer commodities through the Panama Canal
$PCUMS_type_n_t$ = PCUMS by type = DWT, cubic feet, PCUMS, gross tons, draft, length, and beam; for segments n = 1,…N
$SHPC_PCUMS_type_n_t$ = share of PCUMS within type = DWT, cubic feet, PCUMS, gross tons, draft, length, and beam; for segments n = 1,...N

Cargo

Cargo in bulk reefer ships is assumed to grow at the same rate of change as Panama Canal's share of traded refrigerated commodities. Cargo is allocated to each type segment based upon the shares computed above.

$$CARGO_TOT_t = CARGO_TOT_{t-1} * CTOT_R_MT_t / CTOT_R_MT_{t-1}$$

$$CARGO_type_n_t = CARGO_TOT_t * SHPC_CARGO_type_n_t$$

$CARGO_TOT_t$ = cargo tons of reefer commodities through the Panama Canal
$SHPC_CARGO_type_n_t$ = cargo shares within each type = DWT, cubic feet, gross tons, draft, length, beam; for segment n=1,…N
$CARGO_type_n_t$ =Cargo tons with each type = DWT, cubic feet, gross tons, draft, length, beam; for segment n=1,…N

ACP Data

The ACP segment breakdowns for deadweight tons, cubic feet, and PCUMS were expanded because transits were concentrated in only 2 of the original segments. With the new segments, total transits are potentially allocated to 11 deadweight ton, cubic feet and PCUMS categories. Gross tons still fall within only 3 of the 14 gross tonnage segments, 2 of the 14 draft segments, 7 of the 15 beam segments, and 7 of the 9 length segments. The ACP segments for gross tons, beam and draft were not disaggregated further because these ship types are not critical to translating trade into transits, and for computing revenues.

Table 7 illustrates the relevant categories for the reefer fleet for each of the ship characteristics. In total there are 9 relevant deadweight ton categories, 10 cubic feet categories, 3 gross tonnage categories, 2 draft categories, 7 beam categories, 7 length categories, and 11 PCUMS categories.

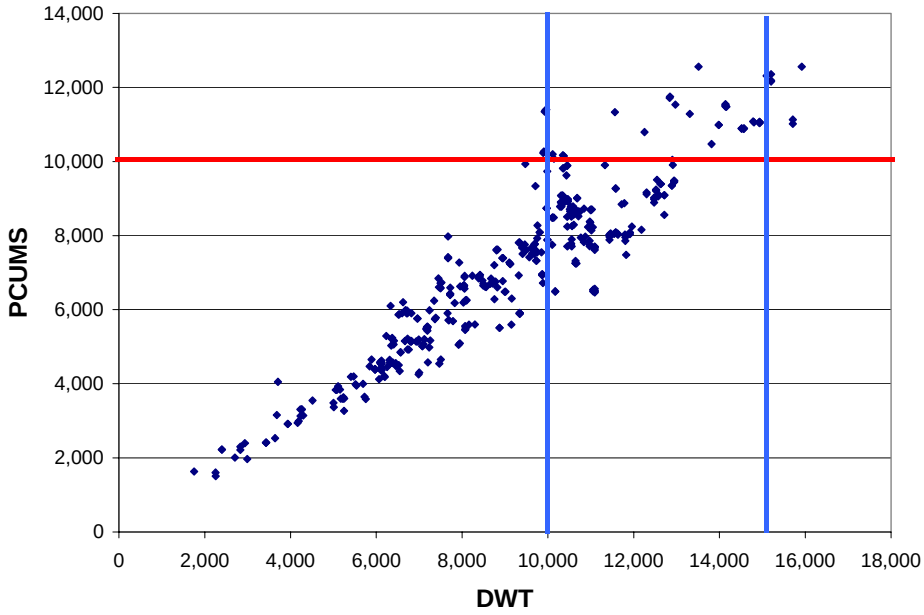
Table VI.7
Reefer Fleet Relevant Categories, 2000-2003

	Total 1995 - 2003		2003	
	Transits	Share of Total	Transits	Share of Total
Total	**20,052**	**100%**	**2,199**	**100%**
Deadweight Tons				
< 750	0	0%	0	0%
>= 750 < 2,200	110	1%	1	0%
>= 2,200 < 4,400	521	3%	64	3%
>= 4,400 < 6,600	2,614	13%	155	7%
>= 6,600 < 8,800	5,147	26%	381	17%
>= 8,800 < 10,000	2,707	13%	342	16%
>= 10,000 < 12,090	5,869	29%	894	41%
>= 12,090 < 12,870	690	3%	114	5%
>= 12,870 < 15,000	1,451	7%	226	10%
>= 15,000 < 19,300	943	5%	23	1%
>= 19,300	0	0%	0	0%
Cubic Capacity				
< 34,000	0	0%	0	0%
>= 34,000 < 100,000	50	0%	0	0%
>= 100,000 < 200,000	478	2%	12	1%
>= 200,000 < 300,000	350	2%	62	3%
>= 300,000 < 400,000	2,409	12%	142	6%
>= 400,000 < 450,000	4,227	21%	320	15%
>= 450,000 < 500,000	2,996	15%	402	18%
>= 500,000 < 550,000	6,591	33%	880	40%
>= 550,000 < 585,000	528	3%	101	5%
>= 585,000 < 685,000	2,150	11%	236	11%
>= 685,000	274	1%	45	2%
Gross Tonnage				
< 10,000	18,276	91%	2,029	92%
>= 10,000 < 19,999	12,605	63%	1,238	56%
>= 19,999 < 29,999	7,447	37%	961	44%
Draft				
< 10	19,236	96%	2,085	95%
>= 10 < 10.5	816	4%	114	5%
Beam				
>= 36.6 < 39.6	2	0%	0	0%
>= 39.6 < 42.7	12	0%	0	0%
>= 42.7 < 45.7	56	0%	7	0%
>= 45.7 < 48.8	99	0%	23	1%

>= 48.8 < 51.8	210	1%	18	1%
>= 51.8 < 54.9	101	1%	3	0%
>= 54.9	627	3%	70	3%
Length				
>= 230.9 < 286.6	8	0%	0	0%
>= 286.6 < 294.1	137	1%	11	1%
>= 294.1 < 330.9	20	0%	2	0%
>= 330.9 < 360.9	310	2%	44	2%
>= 360.9 < 385.6	470	2%	49	2%
>= 385.6 < 399.9	236	1%	22	1%
>=399.9	595	3%	42	2%
PCUMS				
< 583	1	0%	0	0%
>= 583 < 1,710	0	0%	0	0%
>= 1,710 < 3,420	110	1%	9	0%
>= 3,420 < 5,130	521	3%	56	3%
>= 5,130 < 6,840	2,614	13%	170	8%
>= 6,840 < 7,770	5,147	26%	408	19%
>= 7,770 < 9,390	2,707	13%	362	16%
>= 9,390 < 10,000	5,869	29%	871	40%
>= 10,000 < 11,700	690	3%	88	4%
>= 11,700 < 15,000	1,451	7%	110	5%
>= 15,000	943	5%	125	6%

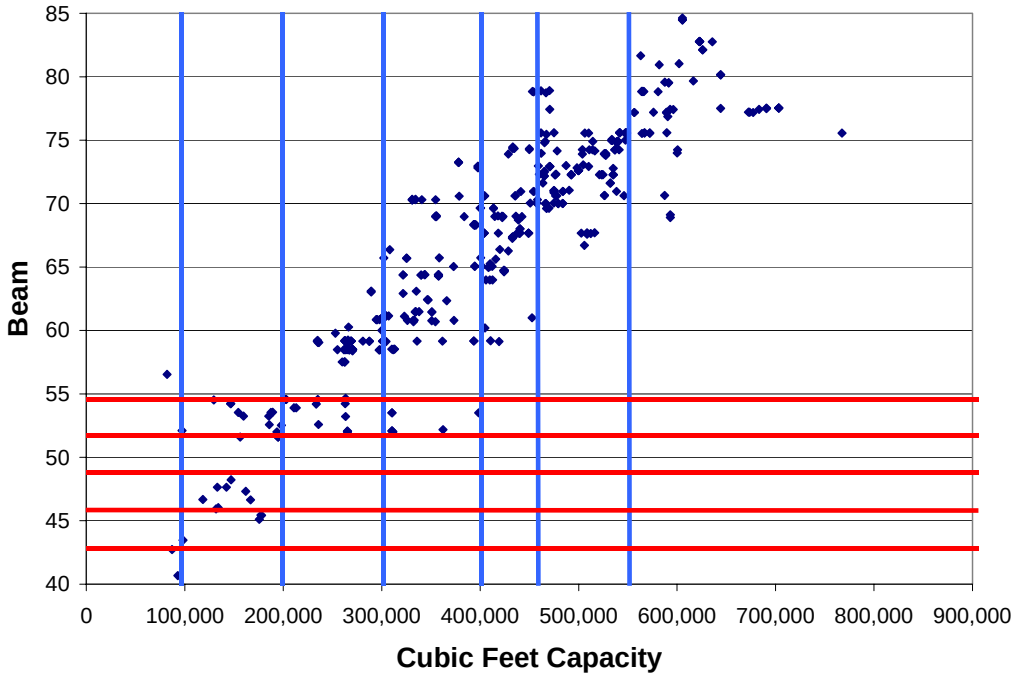
Transits within the gross tonnage, draft, and PCUMS categories are closely related to transits within deadweight ton categories (See Figures VI.3, VI.4, VI.5.) The gross tonnage, draft, and PCUMS of a ship rises linearly with deadweight tons.

Figure VI.3
Deadweight Tons / PCUMS Relationships, 2003 Transits



The beam width and the length of the reefer ships are also positively related with the ships' deadweight tons. The majority of transits are in the longest length category; and consistent with ships having 300,000 cubic feet capacity or more. The majority of transits are also in the widest beam category; and consistent with ships having 200,000 cubic feet capacity or more.

Figure VI.4
Cubic Feet Capacity / Beam Relationship, 2003 Transits



Revenues by Ship Characteristics

Revenues are computed by multiplying toll rates within 4 PCUMS breakdowns times the PCUMS in the segments. PCUMS in each of the 4 segments are first split between ballast and laden so that ballast and laden toll rates can be applied. Total revenues are allocated to segments within each ship type (DWT, cubic feet, gross tons, draft, length, PCUMS) using the share factors derived above.

$$Rev_PCUMS_m_t = SH_BALLAST_t * PCUMS_m_t * TOLL_BALLAST_PCUMS_ m_t + (1 - SH_BALLAST_t) * PCUMS_m_t * TOLL_LADEN_PCUMS_ m_t$$

$$REV_TOT_t = \sum_m REV_ PCUMS_m_t$$

$$REV_type_n_t = REV_TOT_t * SHPC_PCUMS_type_n_t$$

Where:
$REV_PCUMS_n_t$ = revenues associated with PCUMS segment m = 1,…4
$SH_BALLAST_t$ = share of PCUMS associated with ballast ships
$PCUMS_m_t$ = PCUMS within each PCUMS segment m = 1,…4 for reefer commodities through the Panama Canal (specified aggregation of the 11 PCUMS segments)
$TOLL_BALLAST_PCUMS_m_t$ = toll rate for ballast ships segment m = 1,…4
$TOLL_BALLAST_PCUMS_m_t$ = toll rate for ballast ships segment m = 1,….4
REV_TOT_t = total Panama Canal revenues from bulk reefer ships
$REV_type_n_t$ = revenue by type = DWT, cubic feet, PCUMS, gross tons, draft, length, and beam; for segments n = 1,…N
$SHPC_PCUMS_type_n_t$ = share of PCUMS within type = DWT, cubic feet, PCUMS, gross tons, draft, length, and beam; for segments n = 1,…N

VII. Risk Analysis

Global Insight developed alternative simulations of the conventional bulk reefer forecast using the alternative macroeconomic scenarios developed by Global Insight last year in a separate contract with the ACP. These scenarios examine the degree to which the value of the Panama Canal routes may change under these differing scenarios (best case, worst case). The alternative macroeconomic scenarios provided the percentage change in real GDP from baseline levels for a high and a low scenario for only 13 countries. The Reefer Model addresses trade between 37 countries and regions. Global Insight approximated percentage deviations for the high and low scenarios for the 37 countries by mapping the 37 countries to a nearby country in terms of geography and income per capita, or an average of a group of countries.

Trade flows to importing countries in the Reefer Model were adjusted by the percentage change in real GDP for the countries, and country-specific income elasticities for reefer imports. An income elasticity is defined by the percentage change in reefer imports in response to a percentage change in real income. Countries with high incomes per capita view reefer product imports as necessities, thus changing their import demand very little in response to a change in income. Countries with low income per capita levels, on the other hand, view reefer imports as luxuries. Import demands for reefer products in these countries are therefore highly responsive to changes in income.

Table VII.1 summarizes the income elasticities used in the model for imports of refrigerated products. Income elasticities range from a low of .1 for the richest countries to 1.0 for the poorest countries.

The alternative scenarios suggest a range of 1% above baseline transit, PCUMS, revenue, and cargo levels by 2010 in the High Alternative and 1.5% below baseline levels in the Low Alternative. This percentage deviation grows to 4.7% above and below baseline levels by 2025. The detailed results of the High and Low Alternatives are contained in the Excel workbooks ACP_FORECAST_HIGH.XLS and ACP_FORECAST_LOW.XLS.

Table VII.1
Real GDP Per Capita and Income Elasticity for Reefer Products
(1995 U.S. Dollars)

	2003	*2010*	*2025*	*Average 2003-2025*	*Elasticity*
United States, East	33,912	40,387	54,981	44,267	0.075
United States, West	33,912	40,387	54,981	44,267	0.075
Japan	35,490	39,726	53,749	43,500	0.076
Western Europe North	27,393	31,547	42,985	34,611	0.096
Canada, East	24,980	29,451	39,436	32,063	0.104
Canada, West	24,980	29,451	39,436	32,063	0.104
Australia	24,931	28,277	36,524	30,544	0.109
New Zealand	19,781	22,729	30,065	24,675	0.135
Western Europe South	18,751	21,798	30,406	24,116	0.138
Israel	17,422	19,903	27,365	21,961	0.151
Chile	6,071	8,085	16,008	10,137	0.214
Argentina	6,677	7,957	11,497	8,896	0.244
Brazil	5,043	5,990	9,119	6,834	0.317
Eastern Europe	3,856	5,228	9,738	6,420	0.338
Mexico, EAST	4,648	5,447	8,057	6,129	0.354
Mexico, WEST	4,648	5,447	8,057	6,129	0.354
Russia	3,617	4,976	9,022	6,075	0.357
South East Asia	2,646	3,551	5,804	4,155	0.353
Venezuela	2,836	3,599	5,426	4,061	0.361
Peru	2,484	3,171	5,620	3,803	0.386
Other East Coast of S. America	2,855	3,220	4,437	3,547	0.414
Other Middle East	2,862	3,297	4,051	3,485	0.421
Colombia, East	2,498	2,886	3,903	3,138	0.468
Colombia, West	2,498	2,886	3,903	3,138	0.468
Other Mediterranean	2,180	2,647	3,903	2,987	0.491
China Region	1,474	2,178	4,256	2,726	0.538
Northern Africa	1,683	2,159	3,594	2,545	0.577
Central America, East	1,803	2,070	2,908	2,295	0.640
Central America, West	1,803	2,070	2,908	2,295	0.640
CIS	1,305	1,861	3,409	2,269	0.647
Ecuador & Bolivia	1,372	1,638	2,394	1,844	0.796
Southern Africa	1,459	1,630	2,062	1,748	0.840
Other Region	909	1,149	1,892	1,348	1.000
Caribbean Basin	832	1,086	1,897	1,302	1.000
Western Africa	706	832	1,171	926	1.000
Indian Subcontinent	426	515	774	584	1.000
East Africa	261	311	465	351	1.000

Table VII.2
High and Low Alternative Scenarios

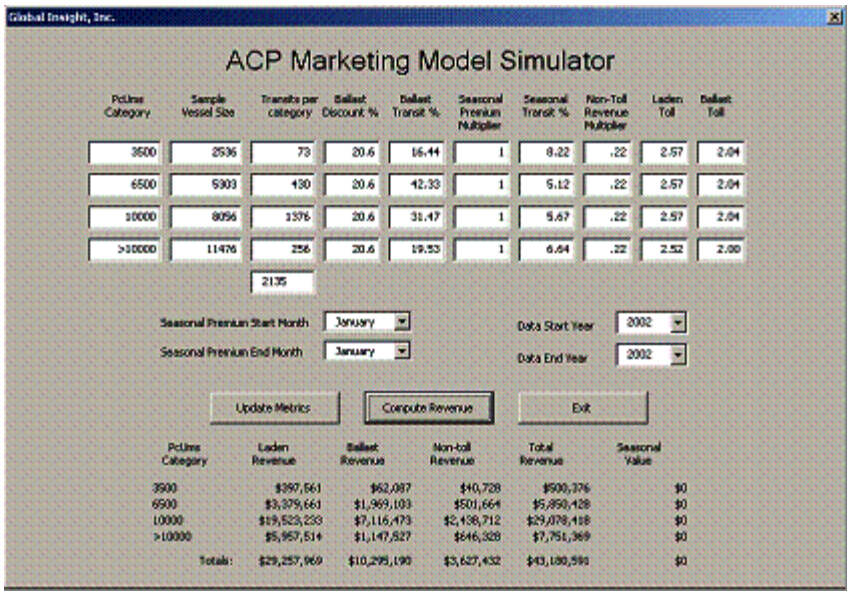
	2003	2004	2005	2010	2025	CAGR 2003-2025
Baseline						
Transits	2,199	2,198	2,204	2,202	2,745	1.0%
PcUms	17,206,497	17,225,630	17,280,236	17,662,959	23,451,855	1.4%
Tolls (U.S. Dollars)	$47,649,198	$47,122,354	$48,798,719	$56,883,580	$108,705,266	3.8%
Cargo (Long tons)	5,453,194	5,445,827	5,480,279	5,620,167	7,179,703	1.3%
High						
Transits	2,199	2,200	2,209	2,226	2,873	1.2%
PcUms	17,206,497	17,241,872	17,318,908	17,857,890	24,547,620	1.6%
Tolls (U.S. Dollars)	$47,649,198	$47,166,786	$48,907,925	$57,511,355	$113,784,414	4.0%
Cargo (Long tons)	5,453,194	5,450,962	5,492,543	5,682,192	7,515,168	1.5%
Percent Change from Baseline						
High						
Transits	0.00	0.09	0.22	1.10	4.67	
PcUms	0.00	0.09	0.22	1.10	4.67	
Tolls	0.00	0.09	0.22	1.10	4.67	
Cargo	0.00	0.09	0.22	1.10	4.67	
Low						
Transits	2,199	2,195	2,197	2,169	2,617	0.8%
PcUms	17,206,497	17,200,928	17,222,599	17,402,910	22,358,150	1.2%
Tolls (U.S. Dollars)	$47,649,198	$47,054,780	$48,635,952	$56,046,090	$103,635,668	3.6%
Cargo (Long tons)	5,453,194	5,438,018	5,462,000	5,537,422	6,844,869	1.0%
Percent Change from Baseline						
Low						
Transits	0.00	-0.14	-0.33	-1.47	-4.66	
PcUms	0.00	-0.14	-0.33	-1.47	-4.66	
Tolls	0.00	-0.14	-0.33	-1.47	-4.66	
Cargo	0.00	-0.14	-0.33	-1.47	-4.66	

VIII. Marketing and Pricing Strategy

This chapter addresses the need to develop, document, and validate a marketing and pricing strategy for the bulk reefer vessels that use the Panama Canal.

In developing the strategy, Global Insight developed pricing models that were used to test various scenarios to predict the impact of these strategies on the economic performance of the Canal. An example of the model screen used to test various pricing scenarios is shown below.

Figure VIII.1
ACP Marketing Model Simulator



Global Insight also considered various market segmentation options and measurement options that might be employed to benefit the Canal. As part of this task, we conducted a pricing strategy workshop in Panama to evaluate and test various options. For example, one outcome of this workshop was to determine that seasonality, although present in the bulk reefer market segment, is not of great consequence in establishing the pricing strategy. Or, in other words, seasonality is not a priority "pricing lever" to maximize revenue for the Canal.

The section below outlines the objectives for the marketing and pricing strategy, the options considered, and our recommendations.

***Objectives of the Marketing and Strategy*:** To create a practical marketing and pricing strategy, we summarize below the basic objectives of the plan:

- **Maintain and improve the market-oriented policies of the ACP.** This means that the marketing and pricing strategy needs to consider the economic incentives of all stakeholders, and in particular the economic position of the

transporters, producers in the country of origin, consumers in the destination countries, and the financial needs of the ACP.

- **Capture an appropriate share of the economic value created by the Canal.** No one questions the fact that the existence and efficient operation of the Canal creates a vast amount of economic value around the world. The major uncertainty is how to measure the value created and how to divide this value between the various stakeholders. Thus, in pursuing this objective, we need to consider two items:

    - **Determine a "fair" division of economic value created.** If the Canal tried to capture too much of the economic value created, it could alter existing trade routes and thereby reduce total revenues and profitability.
    - **Competitive routes.** If the Canal ignored the opportunity costs of alternate routes – for example, the Straits, the Suez Canal, a landbridge route, or the Cape of Good Hope – then it could price itself out of the market and shift trading patterns to the lowest cost alternative route. This could reduce total revenues and profitability.

- **Provide a secure and increasing stream of future income.** The marketing and pricing strategy should not seek to maximize revenue in the short term if it jeopardizes the longer-term competitive position of the Canal.

Starting Point: Determining a "fair" division of economic value created.

As a starting point, Global Insight built economic models of bulk reefer trading patterns and estimated the total economic value created by the Canal as $113 million for this market segment. The methodology and details of the economic model were described in Chapter IV – The Economic Value of the Panama Canal Routes Versus Alternatives.

There is no hard-and-fast rule for dividing this economic value created between the various stakeholders. As we discussed in the pricing workshop in Panama, for this task, we have targeted a pricing strategy that seeks to capture at least 50 percent of this economic value, equivalent to approximately $56.5 million per year. This compares with the current level of revenues from this market segment of approximately $47.6 million.

Bulk Reefer Market Segmentation and Pricing Strategy

We considered different bulk reefer market segmentation plans, as described below:

- **Size of vessel.** The current toll structure for bulk reefer vessels is a declining block plan as shown below.

Table VIII.1
Current Canal Toll Structure

Size of vessel	Laden	Ballast
First 10,000 tons	$2.96	$2.35
Next 10,000 tons	$2.90	$2.30
Remaining tons	$2.85	$2.26

The great majority of bulk reefer vessels fall into the first category, while there are currently no vessels in the third segment (>20,000 PCUMS).

- **Seasonality.** The current toll structure does not discriminate for bulk reefer ships between the seasons of the year, yet the historical data clearly suggests a seasonal pattern. In particular, there is a strong seasonal pattern for deciduous fruit.
- **Time of day.** The current toll structure does not discriminate between day or night transits. Most reefer ships would not pay a premium for daytime passage, while cruise ships and others may be willing to pay a premium for daytime use.
- **Ballast discount.** The current toll structure builds in a 20.6% discount for ships in ballast.
- **Non-toll service fees.** In addition to the toll paid by bulk reefer vessels, the Canal recognizes an increasing volume of non-toll service fees for a wide range of ancillary services ranging from booking fees to safety and security fees.
- **Measurement system.** The current toll structure is based on the PCUMS measurement system. Other measurement systems may be preferable.

Proposed Marketing and Pricing Strategy

Using the bulk reefer pricing model, Global Insight tested three strategies to establish the Canal's revenue and yet be fair, reasonable, and non-discriminatory in concordance with the Panama Canal's Neutrality Treaty.

The three strategies are:

- 50% Plan – capture 50% of the economic value by the Canal
- 60% Plan – capture 60% of the economic value by the Canal
- 70% Plan – capture 70% of the economic value by the Canal

The proposed bulk reefer vessel size segmentation for each of the pricing plans is:

Table VIII.2
Bulk Reefer Size Segmentation Plan

Current plan	*Proposed Plan*	*Notes*
First 10,000 tons	First 3,500 tons	Based on PCUMS
Next 10,000 tons	Next 3,000 tons	
Remaining tons	Next 3,000 tons	
	Remaining tons	

The table below outlines the elements of the three proposed pricing strategies in comparison with the current toll structure. The 50% Plan is designed to capture approximately 50% of the economic value created by the Canal, or $56.5 million. The 60% Plan is designed to capture approximately 60% of the economic value created by the Canal, or $66.8 million. The 70% Plan is designed to capture approximately 70% of the economic value created by the Canal, or $80.0 million. Since we did not examine the structure or role of service revenue, we maintained these revenues at their current level.

Table VIII.3
Canal Marketing Strategy Options

Element	Current Plan FY2003	50% Plan FY2004	60% Plan FY2004	70% Plan FY2004
Laden tolls				
First 3500 PCUMS	$2.96	$3.40	$4.10	$6.00
Next 3000 PCUMS	$2.96	$3.30	$3.90	$4.00
Next 3000 PCUMS	$2.90*	$3.20	$3.75	$3.50
Remaining tons	$2.85	$3.10	$3.45	$3.50
Ballast discount	20.6%	20.6%	15%	15%
Service revenue	$.28 per PCUMS	$.28 per PCUMS	$.28 per PCUMS	$.28 per PCUMS
"Lost" Transits		17	47	53
Net Revenue ($MM)	**$47.6**	**$55.6**	**$65.3**	**$78.0**
Target Rev ($MM)		**$56.5**	**$67.8**	**$79.1**

To validate these strategies, we ran the model twice: once as a static analysis and once with a feedback loop through our demand model with built-in elasticities. In general, Global Insight's pricing strategies are consistent with our elasticity estimates: the percentage price increase for larger vessels is less than the percentage increase for smaller vessels. This strategy, therefore, will mitigate the pricing impact on demand.

Conclusion

The final choice of pricing plans depends on many factors, including how much market risk the Canal is willing to bear, the internal and external financial requirements, possible customer reaction, and the public perception.

Based on the relatively small toll elasticity for this segment, we recommend the 70% plan. This plan needs to be accompanied by a detailed implementation plan to account for the possible reactions from all interested parties, mainly the shipping lines.

FINAL REPORT

STUDY OF THE CONVENTIONAL BULK-REFRIGERATED (NON-CONTAINERIZED) CARGO MARKET SEGMENT CONTRACT SAA-154968

Volume I – Appendices

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15 JANUARY, 2004

Appendix A. Regional Definitions

Table A1. Regional Definitions

China Region
China
Hong Kong
Taiwan
Confederation of Independent States
CIS Southeast
CIS West
Eastern Europe
Baltics
Bulgaria
Czech Republic
Hungary
Poland
Romania
Slovak Republic
Indian Subcontinent
India
Other Indian Subcontinent
Pakistan
Other Middle East
Saudi Arabia
United Arab Emirates
Other Persian Gulf
Northern Africa
Egypt
Other Northern Africa
Western Europe North
Belgium
Denmark
Finland
France
Germany
Ireland
Netherlands
Norway
Other Western Europe
Sweden
Switzerland

United Kingdom

Austria

Western Europe South

Greece

Italy

Portugal

Spain

East Africa

Kenya

Other East Africa

Other Mediterranean

Other Mediterranean

Turkey

Southern Africa

South Africa

Other Southern Africa

South East Asia

Malaysia

Philippines

Singapore

South Korea

Thailand

Vietnam

Indonesia

Appendix B. Port Assignments by Country/Region

In order to calculate distances and then shipping costs between countries/regions, Global Insight selected a port to represent the origin or destination within each country/region. The selection was based upon each port's reefer volumes or general cargo importance. The same set of ports was used for reefer ships and other vessel types (Volume II).

Table B1. Port Assignments by Country/Region

Country	Code	Port
Argentina	ARG	Buenos Aires
Australia	AUS	Sydney
Brazil	BRA	Santos
Canada	CNE	Vancouver
Canada	CNW	Montreal
Caribbean Basin	CRB	Kingston, Jamaica
Central America East	CAE	Limon (East Coast)
Central America West	CAW	Balboa, Panama
Chile	CHL	Valparaiso
China Region	CH	Shanghai
Colombia	COE	Santa Marta
	COW	Buenaventura
CIS	CIS	Odessa
East Africa	OEA	Mombasa
Eastern Europe	EE	Hamburg
Ecuador & Bolivia	EB	Guayaquil, Ecuador
Indian Subcontinent	IND	Colombo
Israel	ISR	Ashdod
Japan	JPN	Yokohama
Mexico	MXE	Veracruz
	MXW	Manzanillo
New Zealand	NZL	Wellington
Northern Africa	NAF	Tunis
Other East Coast of S. America	OEL	Montevideo, Uruguay
Other Mediterranean	OMED	Dubrovnik
Other Middle East	MIDE	Bandar Abbas
Other Region	OWW	
Peru	PER	Callao
Russia	RUS	St. Petersburg
South East Asia	SEA	Pusan, South Korea
Southern Africa	SAF	Durban, South Africa
United States	USE	New York

United States	USW	Los Angeles
Venezuela	VEN	La Guiara
Western Africa	WAF	Lagos
Western Europe North	WEN	Rotterdam
Western Europe South	SWE	Marseille

Appendix C. Country Snapshots

A Snapshot of Chile

Introduction

Economy & Trade

The Chilean economy is highly leveraged due to its openness and relatively small size. In 2002, the country's trade flow (exports + imports) stood at U.S. $39.1 billion, or just over 50 percent of its GDP of U.S. $64 billion. Over the past two decades, the country has pursued bilateral and multi-lateral trade agreements with several countries as a part of its economic growth strategy. As a result, Chile's exports have increased by 300 percent since the mid 1980's.

The figure below gives the percentage of reefer exports by commodity.

Figure C1. Reefer Exports from Chile

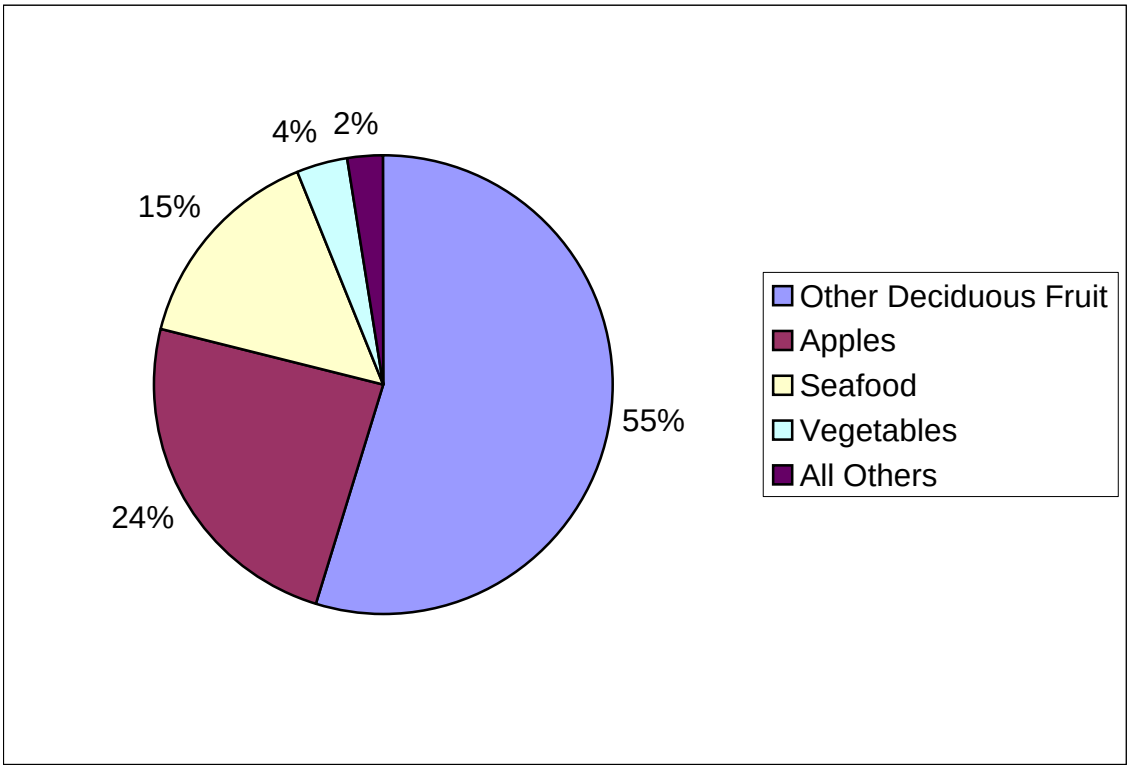

Table C1. Main Export Markets for Chile

Chile's Major Export Markets	2002	Percent of Total	Cumulative Percent of Total
United States, East Coast	556,588	24%	24%
Western Europe, North	437,850	19%	42%
United States, West Coast	272,231	12%	54%
Japan	181,624	8%	61%
Western Europe, South	168,193	7%	69%
China Region	109,895	5%	73%
Middle East	85,461	4%	77%
Columbia, West Coast	83,206	4%	80%
Mexico, West Coast	74,542	3%	83%
Canada, East Coast	71,317	3%	86%
Venezuela	50,430	2%	89%
Peru	46,380	2%	91%

Trade Agreements & Blocs

Chile is a member of the Latin American Integration Association (ALADI) and has bilateral agreements in place to lower trade barriers with Mexico, Colombia, Venezuela, Argentina and Bolivia. It joined the Asian-Pacific Economic Community Pact (APEC) in 1994 and became an associate member of Mercosur[1] in 1996. Chile has also applied for NAFTA membership, which is expected to be conferred upon it sometime in 2003.

Chile has also signed a number of free trade agreements to facilitate better trade relations with its trading partners. The table below lists the free trade agreements along with the year of signing these agreements.

Table C2. Trade Agreements Signed by Chile

S. No	Country/Region	Year
1	Mexico	1991
2	Venezuela	1992
3	Bolivia	1992
4	Colombia	1993
5	Ecuador	1994
6	Peru	1994
7	Mercosur	1996
8	Canada	1997
9	Mexico	1998
10	Central America	2001
11	European Union	2002
12	Korea	2002
13	USA	2003
14	Singapore	2002

[1] The Southern Common Market Agreement signed by Brazil, Argentina, Uruguay and Paraguay

A Snapshot of Peru

Introduction

Economy & Trade

Peru's economic approach for development has been inward looking, and the country's exports and imports have been volatile due to external fluctuations and internal problems. Peru's export performance has been notably less dynamic than that of its neighbours. The country's strategy in the past decade has been protectionist in nature and therefore led to a negative impact on trade flows.

The country's GDP in 2002 stood at U.S. $56.9 billion, while the total trade flow stood at U.S. $14.9 billion.

The figure below gives the percentage of reefer exports by commodity.

Figure C2. Reefer Exports from Peru

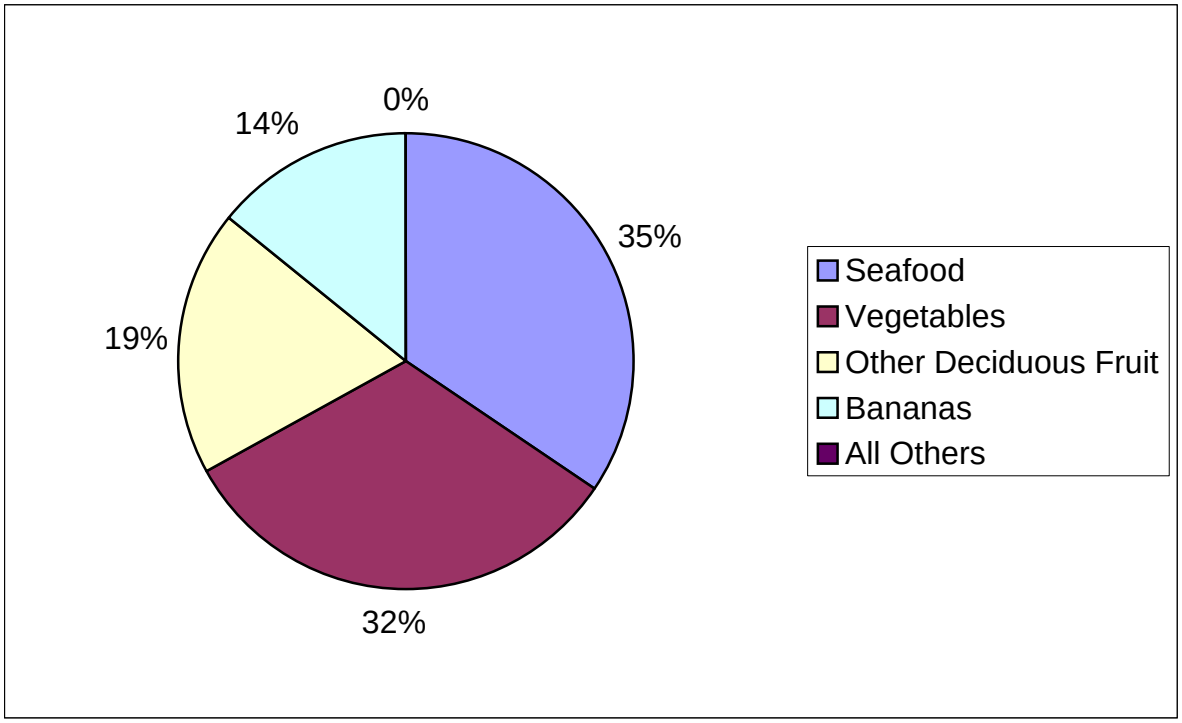

Table C3. Main Export Markets for Peru

Peru's Major Export Markets	2002	Percent of Total	Cumulative Percent of Total
Western Europe, North	50,086	28%	28%
United States, East Coast	46,268	26%	54%
Western Europe, South	33,808	19%	73%
United States, West Coast	16,595	9%	82%
South Africa	4,935	3%	85%
Japan	3,937	2%	87%
Brazil	2,862	2%	89%
Other Central America, West	2,352	1%	90%
Canada, East	2,075	1%	91%
Mexico, West	1,867	1%	92%
China Region	1,789	1%	93%
Indian Subcontinent	1,551	1%	94%

Trade Agreements & Blocs

Peru currently is not a part of any free trade agreement. However, it is a signatory of WTO (Multilateral Trade Agreement, 1996) and has a partial free trade agreement with the Latin American Integration Association and the ALADI (Regional Scope Agreement, 1980). In 1998, the country also signed a partial free trade agreement with Chile. In addition, Peru, being a part of the Andean region, is also a member of the Andean Custom Union.

Peru has signed Economic Complementation Agreements with Argentina (2000) and Brazil (1999), and a Framework Agreement in 1998 with MERCOSUR for the creation of a Free Trade Area between the two parties.

A Snapshot of Ecuador

Introduction

Economy &Trade

Ecuador's economy relies to a large extent on petroleum production and exports, along with exports of agricultural commodities and seafood. The GDP in 2002 stood at U.S. $24.34 billion, while the trade flow stood at U.S. $10.9 billion. In the past decade, Ecuador committed itself to addressing remaining obstacles to trade and a functional free market economy. An unsustainable fiscal deficit and all the associated problems have made it difficult for the country to achieve any meaningful change to date, though it seems to be moving in the right direction.

The figure below gives the percentage of reefer exports by commodity.

Figure C3. Reefer Exports from Ecuador

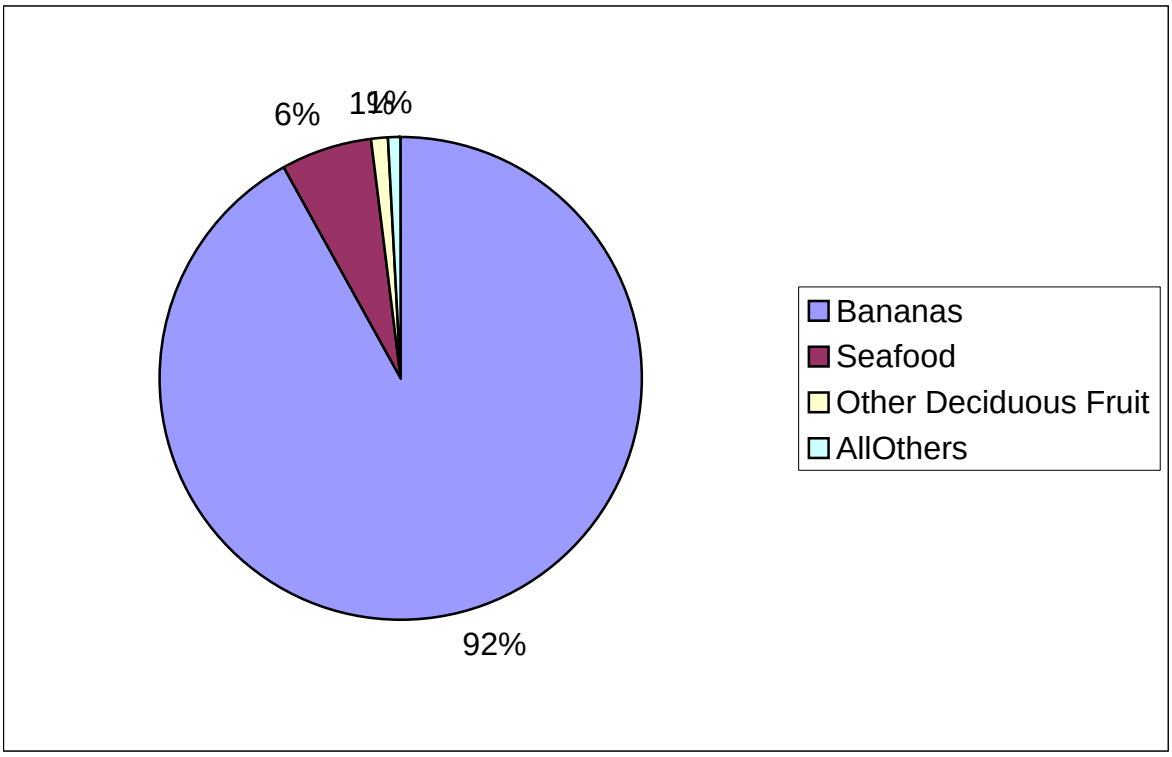

Table C4. Main Export Markets for Ecuador

Ecuador's Major Export Markets	2002	Percent of Total	Cumulative Percent of Total
United States, West Coast	868,670	22%	22%
Western Europe, North	641,109	16%	38%
United States, East Coast	453,390	11%	49%
Russia	366,229	9%	58%
China Region	345,332	9%	67%
Western Europe, South	277,988	7%	73%
Other Mediterranean	198,109	5%	78%
Eastern Europe	197,363	5%	83%
Japan	173,686	4%	88%
Canada, East Coast	170,149	4%	92%
Middle East	122,279	3%	95%
Netherlands	85,909	2%	97%

Trade Agreements & Blocs

Ecuador is a member of various economic complementation and preferential trade agreements. However, it is not a signatory to any free trade agreement. Ecuador joined the WTO in 1996 and is a member of the ALADI (Regional Scope Agreement, 1980). In addition, Ecuador is also a member of the Andean Custom Union.

Ecuador has signed Economic Complementation Agreements with Argentina (1993), Paraguay and Uruguay (1994) and Chile (1995) and a Framework Agreement in 1998 with MERCOSUR for the creation of a Free Trade Area between the two parties. The Andean community has also signed economic complementation agreements with Brazil (1999) and Argentina (2000).

A Snapshot of Australia

Introduction

Economy & Trade

Australia has a prosperous western-style capitalist economy. The GDP of the country for the year 2002 stood at U.S. $410 billion. The Australian economy witnessed low growth and high unemployment in the early 1990s, but has grown at a steady 4 percent annual growth rate in the last five years. Australia is rich in natural resources and therefore is a major exporter of agricultural products, minerals, metals, and fossil fuels. Australia's export structures have changed considerably over the past 15 years. Commodities account for more than 50 percent of the value of total exports. Although trade in commodities still remains strong, new services and sophisticated manufacturing export markets have emerged in recent years. The government is pushing for increased exports of manufactured goods, but competition in international markets continues to be tough.

The figure below gives the percentage of reefer exports by commodity.

Figure C4. Reefer Exports from Australia

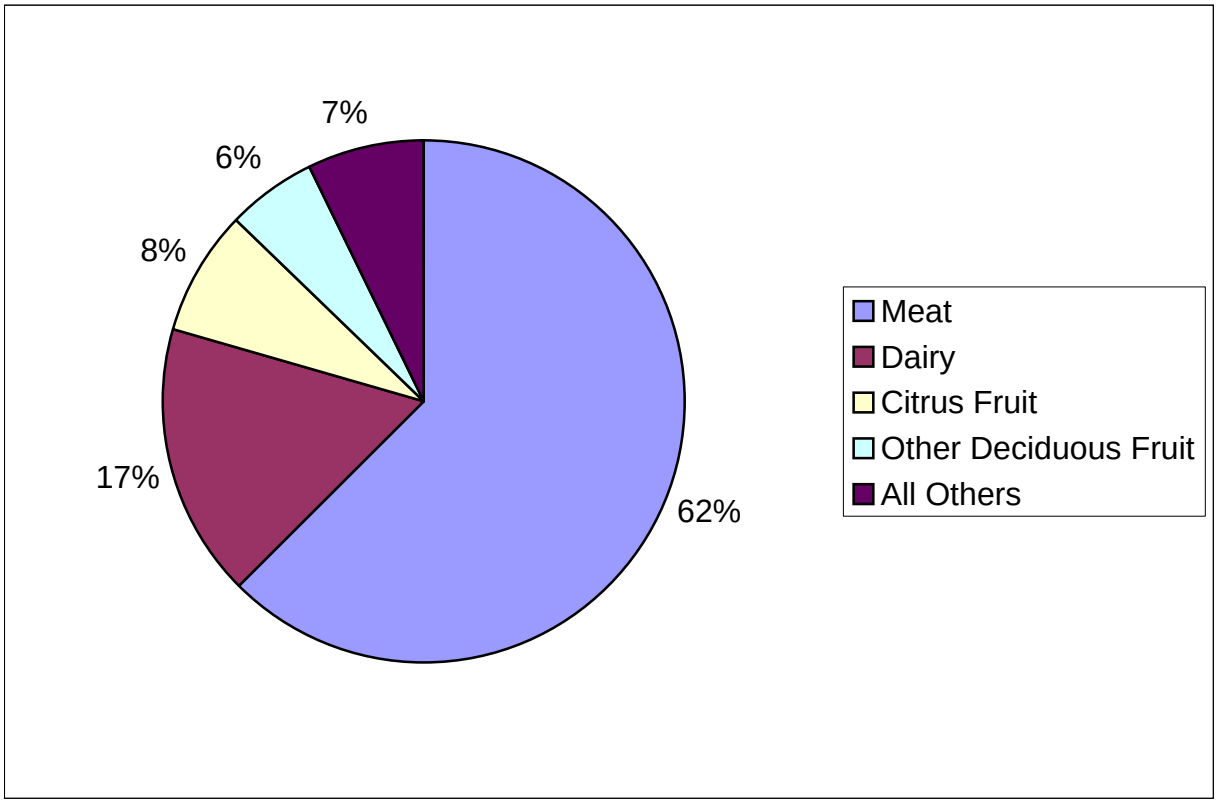

Table C5. Main Export Markets for Australia

Australia's Major Export Markets	2002	Percent of Total	Cumulative Percent of Total
United States, East Coast	351,685	18%	18%
South East Asia	301,901	16%	16%
Japan	283,827	15%	15%
China Region	225,254	12%	12%
United States, West Coast	142,203	7%	7%
Middle East	107,796	6%	6%
Western Europe, North	84,929	4%	4%
Canada, East Coast	61,524	3%	3%
Netherlands	58,549	3%	3%
South Africa	52,371	3%	3%
Mexico, West Coast	46,998	2%	2%
Russia	43,831	2%	2%

Trade Agreements & Blocs

Australia has been cautious in signing FTAs with its trading partners. Australia is currently a member of only two trade associations (New Zealand, 1996 and Singapore, 2003) and is in the process of finalizing two more trade associations with Thailand and the U.S.

Table C6. Australian Free Trade Agreements

S. No.	Country/Region	Year
1	New Zealand	1996
2	Singapore	2003
3	Thailand (under negotiations)	-

Regional Trade Agreements – The Emerging Trend in Free Trade Agreements

In the past two decades, most economies opened up by signing Regional Trade agreements (RTAs) to facilitate free trade. This is evident from the fact that 259 Regional trade agreements (RTAs) have been notified to the WTO, with another 70 RTAs currently operational but not yet notified. Regional agreements among developing countries, such as Chile, Ecuador and Peru account for about 30-40 per cent of all RTAs currently in force, including those not notified to the WTO. The following table shows the trend of RTA development.

Table C7. Regional Trade Agreements Enforced Until 2002

	Developed-Developed	Developed-Developing	Developed-Transition	Developing-Developing	Developing-Transition	Transition-Transition	Total
1958-64	2	0	0	1	0	0	3
1965-69	0	0	0	0	1	0	1
1970-74	5	3	0	2	0	0	10
1975-79	0	5	0	1	0	0	6
1980-84	2	1	0	1	0	0	4
1985-89	1	1	0	2	0	0	4
1990-94	3	3	12	5	0	6	29
1995-99	3	7	10	4	12	28	64
2000-02	0	11	4	5	4	6	30
Total	**16**	**31**	**26**	**21**	**17**	**40**	**151**

Source: World Trade Organisation

RTAs are facilitating free trade across economies. According to WTO, 43% of world trade is done as part of the preferential trade agreements and imports of the world would increase to 51.2% under the umbrella of trade agreements by 2005.

Latin America's RTA exports are expected to increase from 18.3% in 2000 to 63.6% in 2005. The exports from Latin American countries are not expected to flow to either the U.S. or the EU, as the relative increase of imports in North America and Europe would not see a substantial change.

Table C8. Preferential Trade Share of Intra RTAs Trade in Merchandise Exports

	2000	2005
Western Europe	64.7	67
Transition economies	61.6	61.6
North America (incl. Mexico)	41.4	51.6
Africa	37.2	43.6
Middle East	19.2	38.1
Latin America (excl. Mexico)	18.3	63.6
Asia	5.6	16.2
World	43.2	51.2

Source: World Trade Organisation

The world is progressively moving towards a single global economy without any trade barriers. Any Regional trade agreement is the first step towards an economic union,

which in turn facilitates free trade among the member countries. However, in the short term, RTAs are also used as a medium of discrimination against the non-member countries, which undermines the entire concept of free trade. The impact of regional trade agreements on free trade therefore, is an issue debatable primarily due to distinct underlying motives.

Appendix D. Historical Trade Flows Summary

Top Exporters and Importers of Reefer Products, 1998-2002

1. Meat

Table D.1. Meat Exporters, Ranked

		Total Exports, 5-year Average, Metric Tons	Percent of Total Trade Flows	Cumulative Percent of Flows
1	Australia	1,249,546	22.4%	22.4%
2	Western Europe North	1,004,066	18.0%	40.4%
3	United States West Coast	952,232	17.1%	57.5%
4	New Zealand	722,443	12.9%	70.4%
5	United States East Coast	254,914	4.6%	75.0%
6	Indian Subcontinent	188,793	3.4%	78.4%
7	China Region	172,605	3.1%	81.4%
8	Brazil	141,297	2.5%	84.0%
9	Other East Coast of South America	140,886	2.5%	86.5%
10	Argentina	136,407	2.4%	88.9%
11	Canada West Coast	122,644	2.2%	91.1%
12	South East Asia	119,431	2.1%	93.3%
13	Canada East Coast	75,241	1.3%	94.6%
14	Western Europe South	63,993	1.1%	95.8%
15	Southern Africa	40,237	0.7%	96.5%
16	Other Middle East	31,609	0.6%	97.1%
17	Eastern Europe	30,756	0.6%	97.6%
18	Central America East	28,384	0.5%	98.1%
19	Mexico West	28,345	0.5%	98.6%
20	Other Region	27,170	0.5%	99.1%
21	Other Mediterranean	14,286	0.3%	99.4%
22	Northern Africa	12,384	0.2%	99.6%
23	Chile	12,321	0.2%	99.8%
24	Mexico East	4,075	0.1%	99.9%
25	Central America West	1,494	0.0%	99.9%
26	Colombia East	1,154	0.0%	99.9%
27	Confederation of Independent States	928	0.0%	100.0%
28	Western Africa	504	0.0%	100.0%
29	Russia	414	0.0%	100.0%
30	Ecuador	408	0.0%	100.0%
31	Israel	391	0.0%	100.0%
32	Caribbean Basin	327	0.0%	100.0%
33	Japan	182	0.0%	100.0%
34	Peru	30	0.0%	100.0%
35	Venezuela	9	0.0%	100.0%

Table D.2. Meat Importers, Ranked

		Total Exports, 5-year Average, Metric Tons	Percent of Total Trade Flows	Cumulative Percent of Flows
1	Japan	1,427,786	25.6%	25.6%
2	Western Europe North	719,364	12.9%	38.5%
3	South East Asia	502,235	9.0%	47.5%
4	China Region	475,136	8.5%	56.0%
5	United States East Coast	368,975	6.6%	62.6%
6	Russia	331,432	5.9%	68.5%
7	Other Middle East	277,722	5.0%	73.5%
8	Western Europe South	210,423	3.8%	77.3%
9	United States West Coast	200,073	3.6%	80.9%
10	Northern Africa	180,838	3.2%	84.1%
11	Other Mediterranean	108,315	1.9%	86.1%
12	Southern Africa	108,115	1.9%	88.0%
13	Other Region	101,847	1.8%	89.8%
14	Canada West Coast	97,049	1.7%	91.6%
15	Eastern Europe	86,443	1.5%	93.1%
16	Israel	74,151	1.3%	94.4%
17	Caribbean Basin	63,484	1.1%	95.6%
18	Western Africa	36,209	0.6%	96.2%
19	Mexico West	32,955	0.6%	96.8%
20	Confederation of Independent States	30,773	0.6%	97.4%
21	Chile	25,206	0.5%	97.8%
22	Brazil	20,523	0.4%	98.2%
23	Argentina	16,584	0.3%	98.5%
24	New Zealand	16,123	0.3%	98.8%
25	Central America East	13,651	0.2%	99.0%
26	Colombia East	10,070	0.2%	99.2%
27	Australia	9,677	0.2%	99.4%
28	Peru	9,358	0.2%	99.5%
29	Canada East Coast	9,112	0.2%	99.7%
30	Mexico East	4,981	0.1%	99.8%
31	Venezuela	3,672	0.1%	99.9%
32	Indian Subcontinent	3,308	0.1%	99.9%
33	Other East Coast of South America	1,822	0.0%	100.0%
34	Ecuador	1,637	0.0%	100.0%
35	Central America West	718	0.0%	100.0%
36	East Africa	136	0.0%	100.0%

2. Poultry

Table D.3. Poultry Exporters, Ranked

		Total Exports, 5-year Average, Metric Tons	Percent of Total Trade Flows	Cumulative Percent of Flows
1	United States East Coast	1,870,551	44.1%	44.1%
2	Brazil	574,641	13.5%	57.6%
3	Western Europe North	566,937	13.4%	71.0%
4	United States West Coast	495,681	11.7%	82.7%
5	China Region	306,616	7.2%	89.9%
6	South East Asia	200,093	4.7%	94.6%
7	Canada West Coast	34,303	0.8%	95.4%
8	Other Middle East	33,179	0.8%	96.2%
9	Canada East Coast	28,215	0.7%	96.9%
10	Western Europe South	22,885	0.5%	97.4%
11	Other Mediterranean	17,109	0.4%	97.8%
12	Argentina	17,038	0.4%	98.2%
13	Australia	16,707	0.4%	98.6%
14	Chile	13,915	0.3%	99.0%
15	Eastern Europe	13,397	0.3%	99.3%
16	Confederation of Independent States	8,629	0.2%	99.5%
17	Other Region	5,865	0.1%	99.6%
18	Southern Africa	3,214	0.1%	99.7%
19	Japan	3,067	0.1%	99.8%
20	Israel	2,510	0.1%	99.8%
21	Mexico West	2,499	0.1%	99.9%
22	Other East Coast of South America	1,393	0.0%	99.9%
23	Caribbean Basin	1,208	0.0%	99.9%
24	Ecuador	600	0.0%	100.0%
25	Northern Africa	568	0.0%	100.0%
26	Indian Subcontinent	302	0.0%	100.0%
27	Venezuela	276	0.0%	100.0%
28	Central America East	245	0.0%	100.0%
29	Russia	202	0.0%	100.0%
30	Mexico East	138	0.0%	100.0%
31	New Zealand	136	0.0%	100.0%
32	Central America West	13	0.0%	100.0%
33	Western Africa	4	0.0%	100.0%
34	Peru	1	0.0%	100.0%

Table D.4. Poultry Importers, Ranked

		Total Imports, 5-year Average, Metric Tons	Percent of Total Trade Flows	Cumulative Percent of Flows
1	China Region	989,634	23.3%	23.3%
2	Russia	743,129	17.5%	40.8%
3	Other Middle East	559,547	13.2%	54.0%
4	Japan	515,873	12.2%	66.2%
5	Eastern Europe	296,875	7.0%	73.2%
6	South East Asia	185,697	4.4%	77.6%
7	Caribbean Basin	175,828	4.1%	81.7%
8	Western Europe North	133,668	3.2%	84.9%
9	Other Mediterranean	114,082	2.7%	87.6%
10	Western Africa	109,021	2.6%	90.1%
11	Southern Africa	107,415	2.5%	92.7%
12	Confederation of Independent States	106,588	2.5%	95.2%
13	Western Europe South	59,746	1.4%	96.6%
14	Central America East	35,656	0.8%	97.4%
15	Other Region	34,838	0.8%	98.2%
16	Colombia East	17,628	0.4%	98.7%
17	Other East Coast of South America	15,893	0.4%	99.0%
18	Argentina	11,545	0.3%	99.3%
19	Northern Africa	7,962	0.2%	99.5%
20	Peru	6,593	0.2%	99.6%
21	Indian Subcontinent	3,681	0.1%	99.7%
22	New Zealand	2,708	0.1%	99.8%
23	Central America West	1,877	0.0%	99.8%
24	Australia	1,366	0.0%	99.9%
25	Chile	1,164	0.0%	99.9%
26	Brazil	1,133	0.0%	99.9%
27	Ecuador	1,057	0.0%	100.0%
28	Israel	806	0.0%	100.0%
29	Venezuela	500	0.0%	100.0%
30	United States East Coast	271	0.0%	100.0%
31	Mexico East	237	0.0%	100.0%
32	East Africa	74	0.0%	100.0%
33	Mexico West	39	0.0%	100.0%
34	United States West Coast	5	0.0%	100.0%

3. Dairy

Table D.5. Dairy Exporters, Ranked

		Total Exports, 5-year Average, Metric Tons	Percent of Total Trade Flows	Cumulative Percent of Flows
1	Western Europe North	755,798	32.0%	32.0%
2	New Zealand	620,217	26.2%	58.2%
3	Australia	396,259	16.8%	74.9%
4	Eastern Europe	112,504	4.8%	79.7%
5	Western Europe South	77,895	3.3%	83.0%
6	Other Mediterranean	55,967	2.4%	85.4%
7	Confederation of Independent States	49,860	2.1%	87.5%
8	United States West Coast	49,549	2.1%	89.6%
9	United States East Coast	36,560	1.5%	91.1%
10	Other Middle East	32,604	1.4%	92.5%
11	Other East Coast of South America	29,411	1.2%	93.7%
12	South East Asia	26,813	1.1%	94.9%
13	Canada East Coast	22,842	1.0%	95.8%
14	Argentina	17,948	0.8%	96.6%
15	China Region	15,518	0.7%	97.2%
16	Northern Africa	9,589	0.4%	97.7%
17	Other Region	9,315	0.4%	98.0%
18	Southern Africa	7,987	0.3%	98.4%
19	Canada West Coast	7,783	0.3%	98.7%
20	Central America East	5,746	0.2%	99.0%
21	Chile	5,503	0.2%	99.2%
22	Indian Subcontinent	3,578	0.2%	99.3%
23	Caribbean Basin	3,563	0.2%	99.5%
24	Israel	2,866	0.1%	99.6%
25	Venezuela	2,260	0.1%	99.7%
26	Brazil	1,909	0.1%	99.8%
27	Japan	1,657	0.1%	99.9%
28	Colombia East	1,129	0.0%	99.9%
29	Mexico East	787	0.0%	99.9%
30	Mexico West	368	0.0%	100.0%
31	Russia	343	0.0%	100.0%
32	Central America West	302	0.0%	100.0%
33	Western Africa	227	0.0%	100.0%
34	East Africa	113	0.0%	100.0%
35	Ecuador	18	0.0%	100.0%
36	Peru	6	0.0%	100.0%

Table D.6. Dairy Importers, Ranked

		Total Imports, 5-year Average, Metric Tons	Percent of Total Trade Flows	Cumulative Percent of Flows
1	Western Europe North	311,540	13.2%	13.2%
2	South East Asia	254,826	10.8%	23.9%
3	Other Mediterranean	239,390	10.1%	34.1%
4	Other Middle East	237,730	10.1%	44.1%
5	Japan	215,685	9.1%	53.2%
6	United States East Coast	179,745	7.6%	60.8%
7	Northern Africa	128,421	5.4%	66.3%
8	China Region	113,992	4.8%	71.1%
9	Western Europe South	110,994	4.7%	75.8%
10	Russia	99,659	4.2%	80.0%
11	Other Region	55,316	2.3%	82.3%
12	Australia	52,673	2.2%	84.6%
13	Caribbean Basin	44,769	1.9%	86.5%
14	Brazil	42,609	1.8%	88.3%
15	Western Africa	36,944	1.6%	89.8%
16	Mexico West	33,699	1.4%	91.3%
17	Eastern Europe	32,673	1.4%	92.6%
18	Southern Africa	22,337	0.9%	93.6%
19	Mexico East	20,536	0.9%	94.4%
20	Canada East Coast	17,187	0.7%	95.2%
21	Central America East	16,546	0.7%	95.9%
22	Confederation of Independent States	13,593	0.6%	96.5%
23	United States West Coast	12,049	0.5%	97.0%
24	Venezuela	11,832	0.5%	97.5%
25	Indian Subcontinent	9,983	0.4%	97.9%
26	New Zealand	9,270	0.4%	98.3%
27	Peru	8,671	0.4%	98.6%
28	Chile	7,828	0.3%	99.0%
29	Argentina	7,278	0.3%	99.3%
30	Canada West Coast	5,245	0.2%	99.5%
31	Other East Coast of South America	4,021	0.2%	99.7%
32	Israel	2,582	0.1%	99.8%
33	Ecuador	2,364	0.1%	99.9%
34	Colombia East	1,521	0.1%	99.9%
35	Central America West	871	0.0%	100.0%
36	East Africa	419	0.0%	100.0%

4. Seafood

Table D.7. Seafood Exporters, Ranked

		Total Exports, 5-year Average, Metric Tons	Percent of Total Trade Flows	Cumulative Percent of Flows
1	South East Asia	2,439,092	22.1%	22.1%
2	Western Europe North	1,339,686	12.2%	34.3%
3	China Region	1,335,460	12.1%	46.4%
4	Russia	847,110	7.7%	54.1%
5	United States West Coast	707,442	6.4%	60.6%
6	Argentina	469,343	4.3%	64.8%
7	Indian Subcontinent	398,198	3.6%	68.4%
8	Chile	323,101	2.9%	71.4%
9	Western Europe South	323,023	2.9%	74.3%
10	Southern Africa	302,295	2.7%	77.0%
11	Western Africa	289,732	2.6%	79.7%
12	Other Region	285,377	2.6%	82.3%
13	New Zealand	265,205	2.4%	84.7%
14	Northern Africa	242,349	2.2%	86.9%
15	Japan	234,403	2.1%	89.0%
16	Ecuador	203,606	1.8%	90.9%
17	Central America East	120,308	1.1%	91.9%
18	Other East Coast of South America	103,690	0.9%	92.9%
19	Colombia East	79,390	0.7%	93.6%
20	Canada West Coast	73,968	0.7%	94.3%
21	Canada East Coast	70,669	0.6%	94.9%
22	United States East Coast	68,129	0.6%	95.5%
23	Peru	65,161	0.6%	96.1%
24	Australia	61,801	0.6%	96.7%
25	Other Middle East	60,748	0.6%	97.2%
26	Caribbean Basin	54,497	0.5%	97.7%
27	Mexico East	43,327	0.4%	98.1%
28	Other Mediterranean	38,892	0.4%	98.5%
29	Eastern Europe	38,173	0.3%	98.8%
30	Venezuela	33,493	0.3%	99.1%
31	East Africa	33,353	0.3%	99.4%
32	Mexico West	31,103	0.3%	99.7%
33	Brazil	21,506	0.2%	99.9%
34	Central America West	6,332	0.1%	100.0%
35	Confederation of Independent States	1,861	0.0%	100.0%
36	Israel	996	0.0%	100.0%

Table D.8. Seafood Importers, Ranked

		Total Imports, 5-year Average, Metric Tons	Percent of Total Trade Flows	Cumulative Percent of Flows
1	Japan	2,560,760	23.3%	23.3%
2	South East Asia	1,484,358	13.5%	36.7%
3	China Region	1,414,018	12.8%	49.6%
4	Western Europe South	1,288,086	11.7%	61.3%
5	Western Europe North	1,243,477	11.3%	72.6%
6	United States East Coast	602,103	5.5%	78.0%
7	Western Africa	415,698	3.8%	81.8%
8	United States West Coast	365,981	3.3%	85.1%
9	Northern Africa	213,029	1.9%	87.1%
10	Other Middle East	177,478	1.6%	88.7%
11	Australia	144,810	1.3%	90.0%
12	Southern Africa	125,352	1.1%	91.1%
13	Other Region	116,024	1.1%	92.2%
14	Eastern Europe	111,797	1.0%	93.2%
15	Other Mediterranean	104,973	1.0%	94.1%
16	Canada East Coast	97,059	0.9%	95.0%
17	Russia	87,434	0.8%	95.8%
18	Caribbean Basin	81,161	0.7%	96.6%
19	Canada West Coast	79,056	0.7%	97.3%
20	Brazil	48,505	0.4%	97.7%
21	Israel	42,569	0.4%	98.1%
22	Central America East	37,068	0.3%	98.4%
23	Indian Subcontinent	37,047	0.3%	98.8%
24	Colombia East	26,847	0.2%	99.0%
25	New Zealand	16,324	0.1%	99.2%
26	Mexico West	15,150	0.1%	99.3%
27	Ecuador	14,587	0.1%	99.4%
28	Argentina	14,418	0.1%	99.6%
29	Venezuela	12,597	0.1%	99.7%
30	Peru	9,024	0.1%	99.8%
31	Other East Coast of South America	7,215	0.1%	99.8%
32	Confederation of Independent States	5,729	0.1%	99.9%
33	Chile	5,523	0.1%	99.9%
34	East Africa	3,563	0.0%	100.0%
35	Mexico East	2,050	0.0%	100.0%
36	Central America West	1,951	0.0%	100.0%

5. Vegetables

Table D.9. Vegetable Exporters, Ranked

		Total Exports, 5-year Average, Metric Tons	Percent of Total Trade Flows	Cumulative Percent of Flows
1	China Region	1,302,578	26.0%	26.0%
2	Western Europe South	826,297	16.5%	42.4%
3	United States West Coast	563,664	11.2%	53.7%
4	Other Mediterranean	413,326	8.2%	61.9%
5	Western Europe North	394,602	7.9%	69.8%
6	Northern Africa	388,221	7.7%	77.5%
7	South East Asia	245,945	4.9%	82.4%
8	New Zealand	103,816	2.1%	84.5%
9	Indian Subcontinent	82,049	1.6%	86.1%
10	Chile	80,346	1.6%	87.7%
11	Canada East Coast	76,268	1.5%	89.2%
12	Central America East	64,145	1.3%	90.5%
13	Peru	56,071	1.1%	91.6%
14	Eastern Europe	56,038	1.1%	92.7%
15	Canada West Coast	53,819	1.1%	93.8%
16	Israel	52,524	1.0%	94.9%
17	Other Middle East	45,456	0.9%	95.8%
18	United States East Coast	42,643	0.8%	96.6%
19	Australia	37,165	0.7%	97.4%
20	Argentina	19,791	0.4%	97.8%
21	Ecuador	17,439	0.3%	98.1%
22	Mexico West	17,315	0.3%	98.5%
23	Southern Africa	15,083	0.3%	98.8%
24	Other Region	11,558	0.2%	99.0%
25	East Africa	10,872	0.2%	99.2%
26	Mexico East	9,067	0.2%	99.4%
27	Brazil	7,332	0.1%	99.5%
28	Caribbean Basin	4,566	0.1%	99.6%
29	Japan	4,454	0.1%	99.7%
30	Central America West	3,376	0.1%	99.8%
31	Venezuela	3,016	0.1%	99.8%
32	Western Africa	2,885	0.1%	99.9%
33	Confederation of Independent States	2,065	0.0%	99.9%
34	Colombia East	1,400	0.0%	100.0%
35	Russia	1,276	0.0%	100.0%
36	Other East Coast of South America	637	0.0%	100.0%

Table D.10. Vegetable Importers, Ranked

		Total Imports, 5-year Average, Metric Tons	Percent of Total Trade Flows	Cumulative Percent of Flows
1	Japan	1,379,351	27.5%	27.5%
2	Western Europe North	1,164,836	23.2%	50.7%
3	Other Middle East	437,209	8.7%	59.4%
4	South East Asia	270,667	5.4%	64.8%
5	China Region	186,486	3.7%	68.5%
6	Western Europe South	174,948	3.5%	72.0%
7	Other Mediterranean	168,975	3.4%	75.4%
8	Australia	126,147	2.5%	77.9%
9	Western Africa	116,942	2.3%	80.2%
10	Russia	103,465	2.1%	82.3%
11	Brazil	94,066	1.9%	84.2%
12	United States East Coast	93,613	1.9%	86.0%
13	Canada East Coast	88,061	1.8%	87.8%
14	Northern Africa	76,635	1.5%	89.3%
15	Other Region	71,142	1.4%	90.7%
16	Eastern Europe	68,177	1.4%	92.1%
17	Caribbean Basin	58,381	1.2%	93.3%
18	Southern Africa	40,289	0.8%	94.1%
19	Central America East	34,625	0.7%	94.8%
20	Argentina	33,013	0.7%	95.4%
21	United States West Coast	29,450	0.6%	96.0%
22	Venezuela	29,416	0.6%	96.6%
23	Canada West Coast	28,004	0.6%	97.1%
24	New Zealand	27,260	0.5%	97.7%
25	Israel	25,495	0.5%	98.2%
26	Other East Coast of South America	16,262	0.3%	98.5%
27	Confederation of Independent States	14,876	0.3%	98.8%
28	Indian Subcontinent	14,526	0.3%	99.1%
29	Chile	12,660	0.3%	99.4%
30	Colombia East	12,239	0.2%	99.6%
31	Mexico West	4,610	0.1%	99.7%
32	Mexico East	4,130	0.1%	99.8%
33	Peru	3,950	0.1%	99.9%
34	Ecuador	3,019	0.1%	99.9%
35	East Africa	2,359	0.0%	100.0%
36	Central America West	1,822	0.0%	100.0%

6. Citrus Fruit

Table D.11. Citrus Exporters, Ranked

		Total Exports, 5-year Average, Metric Tons	Percent of Total Trade Flows	Cumulative Percent of Flows
1	Western Europe South	916,106	16.7%	16.7%
2	Northern Africa	860,425	15.6%	32.3%
3	Southern Africa	761,127	13.8%	46.1%
4	United States West Coast	496,254	9.0%	55.2%
5	United States East Coast	433,093	7.9%	63.0%
6	Israel	375,356	6.8%	69.9%
7	Argentina	375,351	6.8%	76.7%
8	Other Mediterranean	276,008	5.0%	81.7%
9	Brazil	238,508	4.3%	86.0%
10	China Region	197,297	3.6%	89.6%
11	Australia	140,692	2.6%	92.2%
12	Other East Coast of South America	134,162	2.4%	94.6%
13	Caribbean Basin	72,063	1.3%	95.9%
14	Central America East	45,302	0.8%	96.8%
15	Indian Subcontinent	33,197	0.6%	97.4%
16	Western Europe North	28,712	0.5%	97.9%
17	South East Asia	27,048	0.5%	98.4%
18	Other Middle East	26,613	0.5%	98.9%
19	Mexico East	17,315	0.3%	99.2%
20	Chile	15,566	0.3%	99.5%
21	Venezuela	7,878	0.1%	99.6%
22	Other Region	5,354	0.1%	99.7%
23	Japan	3,459	0.1%	99.8%
24	Mexico West	2,835	0.1%	99.8%
25	Colombia East	2,773	0.1%	99.9%
26	Central America West	2,384	0.0%	99.9%
27	New Zealand	1,674	0.0%	99.9%
28	Eastern Europe	1,356	0.0%	100.0%
29	Ecuador	1,116	0.0%	100.0%
30	Peru	359	0.0%	100.0%
31	Confederation of Independent States	154	0.0%	100.0%
32	Western Africa	52	0.0%	100.0%
33	East Africa	40	0.0%	100.0%

Table D.12. Citrus Importers, Ranked

		Total Imports, 5-year Average, Metric Tons	Percent of Total Trade Flows	Cumulative Percent of Flows
1	Western Europe North	2,604,754	47.4%	47.4%
2	Japan	474,625	8.6%	56.0%
3	Other Middle East	471,483	8.6%	64.6%
4	South East Asia	348,793	6.3%	70.9%
5	Russia	343,432	6.2%	77.2%
6	United States East Coast	293,860	5.3%	82.5%
7	China Region	255,742	4.7%	87.1%
8	Other Mediterranean	173,842	3.2%	90.3%
9	Western Europe South	117,282	2.1%	92.4%
10	Eastern Europe	115,407	2.1%	94.5%
11	Canada East Coast	94,249	1.7%	96.3%
12	Canada West Coast	34,441	0.6%	96.9%
13	Confederation of Independent States	34,431	0.6%	97.5%
14	Other Region	31,044	0.6%	98.1%
15	United States West Coast	25,103	0.5%	98.5%
16	New Zealand	16,943	0.3%	98.8%
17	Australia	11,954	0.2%	99.1%
18	Argentina	10,889	0.2%	99.2%
19	Caribbean Basin	9,725	0.2%	99.4%
20	Indian Subcontinent	8,797	0.2%	99.6%
21	Western Africa	4,111	0.1%	99.7%
22	Ecuador	3,496	0.1%	99.7%
23	Southern Africa	3,391	0.1%	99.8%
24	Brazil	3,299	0.1%	99.8%
25	Colombia East	2,538	0.0%	99.9%
26	Israel	1,567	0.0%	99.9%
27	East Africa	1,249	0.0%	99.9%
28	Central America East	1,169	0.0%	100.0%
29	Peru	553	0.0%	100.0%
30	Chile	511	0.0%	100.0%
31	Northern Africa	469	0.0%	100.0%
32	Other East Coast of South America	393	0.0%	100.0%
33	Central America West	62	0.0%	100.0%
34	Venezuela	26	0.0%	100.0%
35	Mexico East	1	0.0%	100.0%

7. Bananas

Table D.13. Banana Exporters, Ranked

		Total Exports, 5-year Average, Metric Tons	Percent of Total Trade Flows	Cumulative Percent of Flows
1	Central America East	4,080,549	34.5%	34.5%
2	Ecuador	3,414,164	28.9%	63.4%
3	Colombia East	1,656,856	14.0%	77.4%
4	South East Asia	1,345,249	11.4%	88.8%
5	Western Africa	386,360	3.3%	92.1%
6	Caribbean Basin	311,104	2.6%	94.7%
7	Central America West	214,766	1.8%	96.5%
8	Mexico East	134,294	1.1%	97.7%
9	China Region	69,909	0.6%	98.3%
10	Venezuela	59,807	0.5%	98.8%
11	Other Region	29,093	0.2%	99.0%
12	Other East Coast of South America	26,391	0.2%	99.2%
13	Brazil	21,946	0.2%	99.4%
14	Western Europe South	21,459	0.2%	99.6%
15	Western Europe North	17,462	0.1%	99.7%
16	Mexico West	8,124	0.1%	99.8%
17	Indian Subcontinent	7,185	0.1%	99.9%
18	Peru	5,222	0.0%	99.9%
19	Eastern Europe	3,259	0.0%	100.0%
20	East Africa	1,909	0.0%	100.0%
21	Other Middle East	1,666	0.0%	100.0%
22	Confederation of Independent States	727	0.0%	100.0%
23	Southern Africa	520	0.0%	100.0%
24	Israel	386	0.0%	100.0%
25	Chile	213	0.0%	100.0%
26	Argentina	167	0.0%	100.0%
27	Other Mediterranean	113	0.0%	100.0%
28	Australia	45	0.0%	100.0%
29	Northern Africa	20	0.0%	100.0%

Table D.14. Banana Importers, Ranked

		Total Imports, 5-year Average, Metric Tons	Percent of Total Trade Flows	Cumulative Percent of Flows
1	Western Europe North	3,394,492	28.7%	28.7%
2	United States East Coast	2,816,401	23.8%	52.6%
3	Japan	907,199	7.7%	60.2%
4	United States West Coast	790,539	6.7%	66.9%
5	China Region	721,036	6.1%	73.0%
6	Western Europe South	651,221	5.5%	78.5%
7	Russia	557,290	4.7%	83.2%
8	Eastern Europe	427,687	3.6%	86.9%
9	Canada East Coast	357,094	3.0%	89.9%
10	Other Middle East	286,440	2.4%	92.3%
11	Other Mediterranean	269,024	2.3%	94.6%
12	Caribbean Basin	133,488	1.1%	95.7%
13	South East Asia	112,740	1.0%	96.7%
14	Canada West Coast	91,656	0.8%	97.4%
15	New Zealand	84,969	0.7%	98.2%
16	Confederation of Independent States	73,794	0.6%	98.8%
17	Argentina	37,347	0.3%	99.1%
18	Other East Coast of South America	33,592	0.3%	99.4%
19	Chile	28,822	0.2%	99.6%
20	Northern Africa	28,482	0.2%	99.9%
21	Other Region	9,168	0.1%	99.9%
22	Colombia East	4,697	0.0%	100.0%
23	Western Africa	931	0.0%	100.0%
24	Southern Africa	374	0.0%	100.0%
25	Central America East	199	0.0%	100.0%
26	Indian Subcontinent	175	0.0%	100.0%
27	Ecuador	89	0.0%	100.0%
28	Central America West	10	0.0%	100.0%
29	Brazil	5	0.0%	100.0%

8. Apples

Table D.15. Apple Exporters, Ranked

		Total Exports, 5-year Average, Metric Tons	Percent of Total Trade Flows	Cumulative Percent of Flows
1	Chile	482,324	21.0%	21.0%
2	New Zealand	439,593	19.1%	40.1%
3	United States West Coast	342,128	14.9%	55.0%
4	Southern Africa	249,705	10.9%	65.9%
5	China Region	186,589	8.1%	74.0%
6	Argentina	169,962	7.4%	81.4%
7	Western Europe North	102,393	4.5%	85.9%
8	Other Mediterranean	79,580	3.5%	89.3%
9	Western Europe South	55,375	2.4%	91.7%
10	United States East Coast	44,682	1.9%	93.7%
11	Australia	33,256	1.4%	95.1%
12	Brazil	18,250	0.8%	95.9%
13	Other Middle East	16,214	0.7%	96.6%
14	Eastern Europe	16,152	0.7%	97.3%
15	Canada West Coast	13,127	0.6%	97.9%
16	Confederation of Independent States	10,788	0.5%	98.4%
17	South East Asia	10,700	0.5%	98.8%
18	Canada East Coast	9,601	0.4%	99.3%
19	Indian Subcontinent	6,687	0.3%	99.6%
20	Other East Coast of South America	3,630	0.2%	99.7%
21	Other Region	2,958	0.1%	99.8%
22	Japan	2,857	0.1%	100.0%
23	Venezuela	204	0.0%	100.0%
24	Western Africa	178	0.0%	100.0%
25	Caribbean Basin	157	0.0%	100.0%
26	Central America East	63	0.0%	100.0%
27	Peru	28	0.0%	100.0%
28	Israel	27	0.0%	100.0%
29	Northern Africa	24	0.0%	100.0%
30	Mexico East	11	0.0%	100.0%
31	Mexico West	11	0.0%	100.0%
32	Colombia East	5	0.0%	100.0%
33	Central America West	3	0.0%	100.0%

Table D.16. Apple Importers, Ranked

		Total Imports, 5-year Average, Metric Tons	Percent of Total Trade Flows	Cumulative Percent of Flows
1	Western Europe North	871,632	37.9%	37.9%
2	South East Asia	255,646	11.1%	49.1%
3	China Region	207,311	9.0%	58.1%
4	Other Middle East	172,851	7.5%	65.6%
5	Russia	140,860	6.1%	71.8%
6	Western Europe South	76,286	3.3%	75.1%
7	United States East Coast	66,540	2.9%	78.0%
8	Other Mediterranean	59,245	2.6%	80.5%
9	Colombia East	54,999	2.4%	82.9%
10	Northern Africa	49,021	2.1%	85.1%
11	Venezuela	38,875	1.7%	86.8%
12	United States West Coast	36,359	1.6%	88.3%
13	Other Region	29,933	1.3%	89.7%
14	Central America East	29,932	1.3%	91.0%
15	Brazil	28,846	1.3%	92.2%
16	Mexico West	24,696	1.1%	93.3%
17	Eastern Europe	23,734	1.0%	94.3%
18	Peru	19,417	0.8%	95.2%
19	Indian Subcontinent	18,315	0.8%	96.0%
20	Canada East Coast	15,460	0.7%	96.6%
21	Western Africa	15,206	0.7%	97.3%
22	Caribbean Basin	13,670	0.6%	97.9%
23	Ecuador	11,148	0.5%	98.4%
24	Canada West Coast	10,821	0.5%	98.8%
25	Israel	7,349	0.3%	99.2%
26	Confederation of Independent States	5,675	0.2%	99.4%
27	Southern Africa	3,964	0.2%	99.6%
28	East Africa	2,021	0.1%	99.7%
29	Argentina	2,015	0.1%	99.8%
30	Other East Coast of South America	1,994	0.1%	99.9%
31	Central America West	1,575	0.1%	99.9%
32	Japan	1,082	0.0%	100.0%
33	Mexico East	259	0.0%	100.0%
34	Chile	203	0.0%	100.0%
35	New Zealand	185	0.0%	100.0%
36	Australia	134	0.0%	100.0%

9. Other Deciduous Fruit

Table D.17. Other Deciduous Fruit Exporters, Ranked

		Total Exports, 5-year Average, Metric Tons	Percent of Total Trade Flows	Cumulative Percent of Flows
1	Chile	989,882	15.1%	15.1%
2	Central America East	856,033	13.1%	28.2%
3	South East Asia	586,994	9.0%	37.2%
4	Western Europe South	504,102	7.7%	44.9%
5	United States West Coast	446,179	6.8%	51.7%
6	Southern Africa	445,216	6.8%	58.5%
7	New Zealand	421,868	6.4%	64.9%
8	Other Middle East	317,675	4.9%	69.8%
9	Other Mediterranean	279,072	4.3%	74.1%
10	Argentina	267,392	4.1%	78.1%
11	Western Africa	231,978	3.5%	81.7%
12	China Region	212,751	3.3%	84.9%
13	Brazil	138,391	2.1%	87.0%
14	Indian Subcontinent	132,634	2.0%	89.1%
15	Israel	104,286	1.6%	90.7%
16	Australia	103,648	1.6%	92.2%
17	Northern Africa	102,000	1.6%	93.8%
18	United States East Coast	69,102	1.1%	94.9%
19	Caribbean Basin	53,282	0.8%	95.7%
20	Central America West	45,054	0.7%	96.4%
21	Mexico East	37,459	0.6%	96.9%
22	Western Europe North	36,180	0.6%	97.5%
23	Mexico West	33,685	0.5%	98.0%
24	Ecuador	29,382	0.4%	98.5%
25	Peru	19,601	0.3%	98.8%
26	Other Region	18,153	0.3%	99.0%
27	Venezuela	18,017	0.3%	99.3%
28	Eastern Europe	17,193	0.3%	99.6%
29	East Africa	13,305	0.2%	99.8%
30	Japan	7,021	0.1%	99.9%
31	Colombia East	4,720	0.1%	100.0%
32	Other East Coast of South America	1,075	0.0%	100.0%
33	Confederation of Independent States	877	0.0%	100.0%
34	Canada East Coast	616	0.0%	100.0%
35	Canada West Coast	452	0.0%	100.0%
36	Russia	216	0.0%	100.0%

Table D.18. Other Deciduous Fruit Importers, Ranked

		Total Imports, 5-year Average, Metric Tons	Percent of Total Trade Flows	Cumulative Percent of Flows
1	Western Europe North	2,313,068	35.3%	35.3%
2	United States East Coast	1,099,165	16.8%	52.1%
3	China Region	692,564	10.6%	62.7%
4	South East Asia	334,704	5.1%	67.8%
5	Western Europe South	281,639	4.3%	72.1%
6	Japan	260,232	4.0%	76.1%
7	Other Middle East	251,187	3.8%	79.9%
8	United States West Coast	216,780	3.3%	83.3%
9	Indian Subcontinent	216,076	3.3%	86.6%
10	Canada East Coast	128,308	2.0%	88.5%
11	Other Mediterranean	120,225	1.8%	90.4%
12	Russia	89,775	1.4%	91.7%
13	Brazil	77,435	1.2%	92.9%
14	Canada West Coast	53,497	0.8%	93.7%
15	Eastern Europe	50,946	0.8%	94.5%
16	Australia	50,320	0.8%	95.3%
17	Mexico West	38,453	0.6%	95.9%
18	Other Region	36,539	0.6%	96.4%
19	Central America East	32,949	0.5%	96.9%
20	Caribbean Basin	29,944	0.5%	97.4%
21	New Zealand	28,470	0.4%	97.8%
22	Colombia East	27,069	0.4%	98.2%
23	Venezuela	26,098	0.4%	98.6%
24	Argentina	18,557	0.3%	98.9%
25	Northern Africa	13,899	0.2%	99.1%
26	Peru	13,503	0.2%	99.3%
27	Israel	12,065	0.2%	99.5%
28	Confederation of Independent States	6,921	0.1%	99.6%
29	Southern Africa	5,725	0.1%	99.7%
30	Western Africa	5,577	0.1%	99.8%
31	Ecuador	5,118	0.1%	99.9%
32	Other East Coast of South America	3,993	0.1%	99.9%
33	Central America West	1,734	0.0%	100.0%
34	Chile	1,576	0.0%	100.0%
35	Mexico East	963	0.0%	100.0%
36	East Africa	416	0.0%	100.0%

Top Exporters by Import Destination, 1998-2002

1. Meat

1.A. Australia

Japan	26.7%
United States East Coast	17.3%
South East Asia	10.2%
United States West Coast	7.3%
China Region	7.1%
Total Export Volume	1,249,546

1.B. Western Europe North

Western Europe North	17.3%
Japan	15.1%
Northern Africa	12.7%
China Region	11.7%
Western Europe South	10.1%
Total Export Volume	1,004,066

1.C. United States West Coast

Japan	71.5%
South East Asia	17.1%
China Region	9.9%
Russia	1.0%
Western Europe North	0.1%
Total Export Volume	952,232

1.D. New Zealand

Western Europe North	29.5%
United States West Coast	13.8%
United States East Coast	11.5%
Canada West Coast	6.9%
South East Asia	6.4%
Total Export Volume	722,443

1.E. United States East Coast

Russia	30.5%
Western Europe North	13.2%
Northern Africa	11.4%
Caribbean Basin	9.5%
Eastern Europe	7.6%
Total Export Volume	254,914

2. Poultry

2.A. United States East Coast

Russia	36.2%
China Region	19.2%
Eastern Europe	14.8%
Caribbean Basin	6.2%
Confederation of Independent States	4.4%
Total Export Volume	1,870,551

2.B. Brazil

Other Middle East	41.6%
China Region	13.7%
Japan	13.1%
Western Europe North	5.1%
Western Europe South	4.5%
Total Export Volume	574,641

2.C. Western Europe North

Other Middle East	46.3%
China Region	16.5%
Western Africa	14.7%
Southern Africa	5.1%
Other Mediterranean	4.8%
Total Export Volume	566,937

2.D. United States West Coast

China Region	68.6%
South East Asia	11.0%
Japan	10.5%
Russia	6.0%
Other Region	2.6%
Total Export Volume	495,681

2.E. China Region

Japan	76.5%
Other Middle East	5.4%
China Region	4.9%
South East Asia	4.8%
Western Europe North	3.6%
Total Export Volume	306,616

3. Dairy

3.A. Western Europe North

Western Europe North	18.9%
Other Middle East	13.9%
Western Europe South	12.4%
United States East Coast	9.6%
Other Mediterranean	9.3%
Total Export Volume	755,798

3.B. New Zealand

Western Europe North	17.2%
South East Asia	15.8%
Russia	11.0%
Japan	8.9%
United States East Coast	7.0%
Total Export Volume	620,217

3.C. Australia

South East Asia	25.6%
Japan	18.6%
Other Middle East	12.2%
China Region	11.0%
Northern Africa	6.9%
Total Export Volume	396,259

3.D. Eastern Europe

Other Mediterranean	52.8%
Eastern Europe	19.8%
United States East Coast	13.8%
Other Middle East	6.2%
Japan	2.1%
Total Export Volume	112,504

3.E. Western Europe South

United States East Coast	34.6%
Western Europe North	14.4%
Western Europe South	13.9%
Other Mediterranean	7.7%
Canada East Coast	4.5%
Total Export Volume	77,895

4. Seafood

4.A. South East Asia

Japan	24.4%
South East Asia	19.2%
China Region	17.7%
Western Europe North	9.1%
United States West Coast	6.3%
Total Export Volume	2,439,092

4.B. Western Europe North

Japan	23.8%
Western Africa	20.0%
Western Europe North	16.8%
Northern Africa	10.7%
China Region	5.0%
Total Export Volume	1,339,686

4.C. China Region

Japan	35.2%
South East Asia	22.8%
United States East Coast	8.4%
Western Europe North	8.1%
China Region	6.8%
Total Export Volume	1,335,460

4.D. Russia

China Region	48.8%
Japan	25.7%
South East Asia	10.7%
Canada East Coast	4.3%
United States East Coast	2.5%
Total Export Volume	847,110

4.E. United States West Coast

Japan	45.9%
South East Asia	15.3%
Western Europe North	14.7%
China Region	11.8%
Australia	4.9%
Total Export Volume	707,442

5. Vegetables

5.A. China Region

Japan	58.5%
Western Europe North	15.7%
South East Asia	7.4%
Western Europe South	4.3%
Other Middle East	2.8%
Total Export Volume	1,302,578

5.B. Western Europe South

Western Europe North	33.8%
Western Africa	11.2%
Other Middle East	9.2%
Japan	7.7%
Canada East Coast	7.2%
Total Export Volume	826,297

5.C. United States West Coast

Japan	59.2%
China Region	17.3%
South East Asia	17.1%
Central America East	1.2%
Australia	1.1%
Total Export Volume	563,664

5.D. Other Mediterranean

Other Middle East	41.9%
Other Mediterranean	17.6%
Western Europe North	12.8%
Japan	5.8%
Western Europe South	4.6%
Total Export Volume	413,326

5.E. Western Europe North

Western Europe North	23.4%
Other Middle East	12.8%
Brazil	9.3%
Other Region	8.2%
Other Mediterranean	7.0%
Total Export Volume	394,602

6. Citrus Fruit

6.A. Western Europe South

Western Europe North	71.0%
Other Mediterranean	15.1%
United States East Coast	7.4%
Eastern Europe	3.3%
Canada East Coast	1.4%
Total Export Volume	916,106

6.B. Northern Africa

Western Europe North	46.4%
Other Middle East	22.8%
Russia	21.3%
Canada East Coast	4.0%
Eastern Europe	3.4%
Total Export Volume	860,425

6.C. Southern Africa

Western Europe North	62.2%
Other Middle East	15.6%
Japan	4.7%
China Region	4.3%
Western Europe South	4.1%
Total Export Volume	761,127

6.D. United States West Coast

Japan	43.9%
China Region	27.5%
South East Asia	23.8%
Australia	2.4%
New Zealand	1.4%
Total Export Volume	496,254

6.E. United States East Coast

Western Europe North	49.6%
Japan	41.5%
China Region	4.5%
South East Asia	2.0%
Other Middle East	0.5%
Total Export Volume	433,093

7. Banana

7.A. Central America East

United States East Coast	45.1%
Western Europe North	32.5%
Western Europe South	6.4%
Eastern Europe	3.5%
Canada East Coast	3.4%
Total Export Volume	4,080,549

7.B. Ecuador

United States West Coast	20.6%
Western Europe North	17.2%
Russia	10.2%
China Region	8.2%
United States East Coast	7.3%
Total Export Volume	3,414,164

7.C. Colombia East

Western Europe North	44.3%
United States East Coast	33.2%
Russia	7.5%
Western Europe South	6.7%
Canada East Coast	6.5%
Total Export Volume	1,656,856

7.D. South East Asia

Japan	48.8%
China Region	30.5%
Other Middle East	11.2%
South East Asia	8.1%
Russia	0.7%
Total Export Volume	1,345,249

7.E. Western Africa

Western Europe North	84.6%
Eastern Europe	6.6%
Western Europe South	3.5%
Northern Africa	2.2%
Other Mediterranean	1.8%
Total Export Volume	386,360

8. Apple

8.A. Chile

Western Europe North	28.8%
Other Middle East	13.5%
Colombia East	10.0%
Western Europe South	9.5%
United States East Coast	6.1%
Total Export Volume	482,324

8.B. New Zealand

Western Europe North	71.0%
China Region	6.6%
United States East Coast	5.9%
United States West Coast	5.8%
South East Asia	5.6%
Total Export Volume	439,593

8.C. United States West Coast

China Region	40.2%
South East Asia	23.9%
Other Middle East	13.3%
Central America East	5.3%
Western Europe North	3.6%
Total Export Volume	342,128

8.D. Southern Africa

Western Europe North	76.4%
Other Middle East	3.9%
Canada East Coast	3.6%
United States East Coast	3.6%
China Region	2.3%
Total Export Volume	249,705

8.E. China Region

South East Asia	46.3%
Russia	42.8%
Other Region	7.4%
Confederation of Independent States	1.5%
China Region	1.0%
Total Export Volume	186,589

9. Other Deciduous Fruit

9.A. Chile

United States East Coast	31.2%
Western Europe North	21.9%
United States West Coast	14.6%
Western Europe South	6.6%
China Region	5.0%
Total Export Volume	989,882

9.B. Central America East

United States East Coast	68.7%
Western Europe North	19.2%
United States West Coast	3.6%
Canada East Coast	3.6%
Western Europe South	2.9%
Total Export Volume	856,033

9.C. South East Asia

China Region	61.3%
Japan	16.8%
South East Asia	12.0%
Other Region	2.9%
Western Europe North	1.8%
Total Export Volume	586,994

9.D. Western Europe South

Western Europe North	69.7%
Other Mediterranean	13.1%
Brazil	2.8%
Other Middle East	2.3%
Canada East Coast	2.2%
Total Export Volume	504,102

9.E. United States West

China Region	34.5%
Western Europe North	17.4%
Japan	15.7%
South East Asia	14.2%
Central America East	4.0%
Total Export Volume	446,179

Top Importers by Export Origin, 1998- 2002

1. Meat

1.A. Japan

United States West Coast	47.7%
Australia	23.4%
Western Europe North	10.6%
South East Asia	6.0%
Canada West Coast	4.7%
Total Import Volume	1,427,786

1.B. Western Europe North

New Zealand	29.6%
Western Europe North	24.2%
Argentina	9.7%
Australia	7.1%
Brazil	5.3%
Total Import Volume	719,364

1.C. South East Asia

United States West Coast	32.4%
Australia	25.4%
Indian Subcontinent	15.1%
Western Europe North	10.9%
New Zealand	9.2%
Total Import Volume	502,235

1.D. China Region

Western Europe North	24.8%
United States West Coast	19.9%
Australia	18.8%
Brazil	10.8%
New Zealand	7.9%
Total Import Volume	475,136

1.E. United States East Coast

Australia	58.5%
New Zealand	22.5%
Western Europe North	7.3%
Central America East	4.7%
Other East Coast of South America	3.1%
Total Import Volume	368,975

2. Poultry

2.A. China

United States East Coast	36.3%
United States West Coast	34.3%
Western Europe North	9.4%
Brazil	7.9%
South East Asia	2.2%
Total Import Volume	989,634

2.B. Russia

United States East Coast	91.1%
United States West Coast	4.0%
Brazil	2.8%
Western Europe North	1.2%
Canada East Coast	0.5%
Total Import Volume	743,129

2.C. Other Middle East

Western Europe North	46.9%
Brazil	42.7%
United States East Coast	4.8%
China Region	3.0%
Other Middle East	1.7%
Total Import Volume	559,547

2.D. Japan

China Region	45.5%
South East Asia	23.1%
Brazil	14.6%
United States West Coast	10.1%
United States East Coast	6.2%
Total Import Volume	515,873

2.E. Eastern Europe

United States East Coast	93.4%
South East Asia	1.4%
Western Europe North	1.0%
China Region	1.0%
Canada East Coast	0.8%
Total Import Volume	296,875

3. Dairy

3.A. Western Europe North

Western Europe North	45.9%
New Zealand	34.2%
Australia	7.5%
Western Europe South	3.6%
United States East Coast	3.5%
Total Import Volume	311,540

3.B. South East Asia

Australia	39.8%
New Zealand	38.4%
Western Europe North	10.9%
South East Asia	5.0%
United States West Coast	3.5%
Total Import Volume	254,826

3.C. Other Mediterranean

Western Europe North	29.4%
Eastern Europe	24.8%
Confederation of Ind. States	20.3%
Other Mediterranean	19.2%
Western Europe South	2.5%
Total Import Volume	239,390

3.D. Other Middle East

Western Europe North	44.1%
Australia	20.4%
New Zealand	15.9%
Other Middle East	9.3%
Eastern Europe	2.9%
Total Import Volume	237,730

3.E. Japan

Australia	34.2%
New Zealand	25.7%
Western Europe North	20.3%
United States West Coast	12.6%
Canada West Coast	2.1%
Total Import Volume	215,685

4. Seafood

4.A. Japan

South East Asia	23.2%
China Region	18.3%
United States West Coast	12.7%
Western Europe North	12.4%
Russia	8.5%
Total Import Volume	2,560,760

4.B. South East Asia

South East Asia	31.6%
China Region	20.5%
Other Region	9.2%
United States West Coast	7.3%
Japan	6.9%
Total Import Volume	1,484,358

4.C. China Region

South East Asia	30.5%
Russia	29.2%
Argentina	8.8%
China Region	6.4%
United States West Coast	5.9%
Total Import Volume	1,414,018

4.D. Western Europe South

Argentina	13.7%
Southern Africa	11.9%
South East Asia	11.3%
Western Africa	8.8%
Northern Africa	8.5%
Total Import Volume	1,288,086

4.E. Western Europe North

Western Europe North	18.1%
South East Asia	17.9%
Western Africa	9.0%
China Region	8.8%
United States West Coast	8.4%
Total Import Volume	1,243,477

5. Vegetables

5.A. Japan

China Region	55.3%
United States West Coast	24.2%
South East Asia	6.7%
Western Europe South	4.6%
New Zealand	2.1%
Total Import Volume	1,379,351

5.B. Western Europe North

Western Europe South	24.0%
Northern Africa	22.9%
China Region	17.5%
Western Europe North	7.9%
Other Mediterranean	4.6%
Total Import Volume	1,164,836

5.C. Other Middle East

Other Mediterranean	39.6%
Western Europe South	17.3%
Western Europe North	11.6%
Northern Africa	8.8%
China Region	8.3%
Total Import Volume	437,209

5.D. South East Asia

United States West Coast	35.6%
China Region	35.5%
South East Asia	8.9%
New Zealand	3.9%
Canada West Coast	3.5%
Total Import Volume	270,667

5.E. China Region

United States West Coast	52.4%
South East Asia	15.8%
China Region	13.9%
Western Europe North	5.8%
New Zealand	3.7%
Total Import Volume	186,486

6. Citrus Fruit

6.A. Western Europe North

Western Europe South	25.0%
Southern Africa	18.2%
Northern Africa	15.3%
Israel	10.6%
Argentina	9.8%
Total Import Volume	2,604,754

6.B. Japan

United States West Coast	45.9%
United States East Coast	37.8%
Southern Africa	7.5%
Israel	4.0%
Australia	2.0%
Total Import Volume	474,625

6.C. Other Middle East

Northern Africa	41.7%
Other Mediterranean	26.0%
Southern Africa	25.2%
Other Middle East	2.3%
Brazil	1.6%
Total Import Volume	471,483

6.D. South East Asia

China Region	34.4%
United States West Coast	33.9%
Australia	17.8%
Indian Subcontinent	5.0%
Southern Africa	3.1%
Total Import Volume	348,793

6.E. Russia

Northern Africa	53.4%
Argentina	11.4%
China Region	10.2%
Israel	8.6%
Other East Coast of South America	4.6%
Total Import Volume	343,432

7. Banana

7.A. Western Europe North

Central America East	39.1%
Colombia East	21.6%
Ecuador	17.3%
Western Africa	9.6%
Caribbean Basin	7.4%
Total Import Volume	3,394,492

7.B. United States East Coast

Central America East	65.3%
Colombia East	19.5%
Ecuador	8.9%
Central America West	3.4%
Mexico East	1.8%
Total Import Volume	2,816,401

7.C. Japan

South East Asia	72.4%
Ecuador	18.7%
China Region	6.8%
Central America East	1.8%
Mexico West	0.2%
Total Import Volume	907,199

7.D. United States West Coast

Ecuador	88.8%
Central America East	9.6%
Mexico West	0.8%
Central America West	0.5%
Peru	0.2%
Total Import Volume	790,539

7.E. China Region

South East Asia	56.9%
Ecuador	39.0%
Central America East	3.7%
China Region	0.2%
Central America West	0.2%
Total Import Volume	721,036

8. Apple

8.A. Western Europe North

New Zealand	35.8%
Southern Africa	21.9%
Chile	15.9%
Argentina	12.8%
Western Europe North	3.4%
Total Import Volume	871,632

8.B. South East Asia

China Region	33.8%
United States West Coast	31.9%
New Zealand	9.6%
Australia	8.1%
Western Europe North	4.8%
Total Import Volume	255,646

8.C. China Region

United States West Coast	66.3%
New Zealand	14.0%
Chile	10.7%
Southern Africa	2.8%
Australia	1.5%
Total Import Volume	207,311

8.D. Other Middle East

Chile	37.5%
United States West Coast	26.4%
Other Mediterranean	12.9%
Other Middle East	6.9%
Western Europe North	6.3%
Total Import Volume	172,851

8.E. Russia

China Region	56.8%
Argentina	13.6%
Chile	10.4%
Western Europe North	5.1%
New Zealand	4.7%
Total Import Volume	140,860

9. Other Deciduous Fruit

9.A. Western Europe North

Southern Africa	16.1%
Western Europe South	15.2%
New Zealand	11.6%
Chile	9.4%
Western Africa	8.6%
Total Import Volume	2,313,068

9.B. United States East Coast

Central America East	53.5%
Chile	28.1%
Caribbean Basin	3.7%
Argentina	3.3%
Central America West	2.8%
Total Import Volume	1,099,165

9.C. China Region

South East Asia	51.9%
United States West Coast	22.3%
Chile	7.2%
China Region	6.9%
Australia	4.9%
Total Import Volume	692,564

9.D. South East Asia

China Region	33.4%
South East Asia	21.1%
United States West Coast	19.0%
Australia	11.4%
Other Middle East	3.7%
Total Import Volume	334,704

9.E. Western Europe South

Chile	23.3%
Argentina	17.4%
New Zealand	9.1%
Central America East	9.0%
Western Africa	8.3%
Total Import Volume	281,639

Appendix E. Interview Results - Exporters

Global Insight interviewed exporters and importers of reefer products in December 2003.

The main objective of the questionnaire is to determine whether freight rates are an important factor when determining whether to ship perishable cargo via reefer ships versus refrigerated containers. Global Insight contacted exporters in three countries: Chile, Ecuador, and Peru. In Chile, Global Insight contacted agricultural and fish exporters; in Ecuador, Global Insight contacted agricultural exporters; and in Peru, Global insight contacted fish exporters.

At the time of these interviews, the reefer market was relatively active with freight rates on the rise. The reefer fleet has been relatively fixed over the last four years with no additional ships coming into the marketplace. Improvement in weather conditions during the last year has boosted agricultural output in bananas and other tropical fruits, which has created more demand for reefer ships. A tight supply of ships along an expanding demand from the exporters has helped raise overall freight rates. Most ship operators have kept their ships in the marketplace to try to recover some of the revenues that they lost from a five-year recession. This recession was caused by inclement weather conditions such as El Niño and La Niña, and competition against the container market. As a result, the respondent's answer may be slightly biased depending on their recent experience in the reefer marketplace.

Global Insight talked to the three major exporters of bananas from Ecuador, which account for 80-90% of total banana exports.

The Market

The main characteristic of the reefer market is that perishable products have short life spans and require carefully controlled temperatures. Therefore timing is everything in this market. Delays in shipping quickly escalate into costly overruns in terms of damaged goods or, more importantly, a lack of credibility with clients. As a result, producers are constantly seeking faster ways to move their products – even in the face of rising costs.

The most common determinant for shipping mode between reefer ships and refrigerated containers, according to most exporters, is *volume*. Large contracts are fulfilled through reefer ships rather than through refrigerated containers. Reefer ships offer lower per unit costs in all aspects of transportation when compared with refrigerated containers. Refrigerated containers allow for greater mobility and timing of the cargo, albeit a smaller volume. A 40-ft container is easier to handle than loose boxes, and containers can be transported from the producer to the consumer in less time.

Cargo exported via reefer ships requires the use of additional infrastructure, such as cold storage facilities or ripening facilities at the importing end, which involve large sunk costs.

The second common determinant for shipping mode is *ship availability*. Yet, it is important to make a distinction within this determinant between exporters that own their own fleet, such as Dole and Chiquita, and those that do not own their own fleet, such as ReyDonPac and Frujasa. Large exporters that have their own fleets are not affected by tight markets and/or ship availability. These exporters try to reap benefits from economies of scale and scope. In most cases they seem to operate in three markets at the same time: as a producer-exporter, as a transporter, and as the importer. As the exporter and producer, the company carries out production operations of bananas or other perishables directly. It then uses its own ships to transport all of its products. Finally, it receives the products in distribution facilities, which are able to handle the export volume. These firms do not seem to keep a close watch on freight rates and/or ship availability. They operate based on their needs for final distribution, which varies by distribution methods and market, usually defined by the company's market strategy.

On the other hand, large exporters that do not own a shipping fleet seem to be at the mercy of the shipping lines. Most of the time, they are faced with pricey premiums to move their cargo at times of high demand for reefer ships. Their need to use a reefer ship usually keeps these firms as price takers. The high prices are sometimes compensated by offers from shipping lines in empty/semi-loaded ships (usually off-season). Furthermore, some exporters have been forced to ship cargo via containers, at a higher per unit cost and because of the lack of available reefer ships.

Still, export volume is a function of the client. Indeed, all exporters in the survey indicated that their export volume is completely dependent on client orders – the importer. Large producers have regular clients, which place regular orders for specific quantities and frequencies.

On the importing side, the importer has already arranged to receive their products either into his/her own facilities or through a distributor. In the banana trade, the importers are sometimes required to maintain a ripening facility, which gives them extra time to work with the cargo and to line up distribution channels.

In general

When producers receive a large order from a client, they usually look to reefer ships purely because of the volume. The producer contacts a shipping line, which allocates space based on volume and ship availability. Sometimes, the importer charters their own ship and sends it to the exporting nation (Saudis). On the import side, the distributor has a defined client base and knows the volume that he/she requires. His facilities are usually located where distribution costs are lowest, and therefore requests shipment to his own port.

Large distributors have major facilities and tend to dominate the European market.

Small distributors are appearing more now in the European market, and they are able to ship one or two containers directly to the supermarket or store.

Results

--For exporters, freight rates are not a factor that determines shipping mode (reefer ship versus container).

--Exporters are dependent on client needs and ship availability because client contracts usually stipulate the timing, and client volumes usually provide guidance on the type of shipment that should be used. Sometimes the client wants a reefer ship because it suits his needs.

--Exporters are primarily price takers. Volume provides exporters with the opportunity to negotiate rates, but current market prices are the major determination; short-term contracts exist.

--Reefer ships are used mainly in the Europe trades, primarily because of the importers' needs.

A small number of distributors have a very extensive network of clients, which require that large volumes be distributed via truck, rail and barge. Recently, smaller distributors (importers) have been taking advantage of the reefer containers to move their product directly from the producer to the mouth of the client without interrupting the cold-supply chain.

Following are notes from the interviews conducted by Global Insight.

ECOFROZ – Ecuador. This exporter ships only 40-ft reefer containers to the United States, Japan and the European Union, primarily Germany. They work closely with the shipping lines. Ship availability is important; and sometimes they have to wait a short time for a ship to become available, and then have to pay a premium to gain access. The decision on how to ship is based primarily on volume and determined by ship availability. Although they can fill a reefer ship, their client base determines the export volumes. Export volume depends on client needs and their clients usually want containers. The reason – containers are easier to move and because the cargo does not need to go to ripening facilities, it can go directly to the retailer. The dilemma for these types of producers is that the product has to be moved quickly.

Frutería Jambelí – Ecuador. This is the third major exporter of bananas from Ecuador. They use pallets, reefer ships, and containers, and the shipping mode is highly dependent on volume. Ship availability is important, and in some cases they have to pay premiums to obtain a ship. They mainly ship to Italy, New Zealand, and Tokyo. Clients are primarily responsible for choosing the destination point and mode of shipping (container versus reefer ship). If they require large volumes, FUJASA sends reefer ships, but otherwise, they send containers.

BUNDICORPI, REYDONPAC – Ecuador. This banana exporter does not own a fleet. They only use reefer ships for their cargo, which averages 150,000 boxes of bananas. Refrigerated containers are less desired. The main determinant of shipping mode is volume, which is primarily a function of the client. The company ships mostly to the United States and the European Union. Based on the fact that the product has to be moved quickly, and because they require reefer ships, they work closely with shipping lines. At times, freight rates are much higher than expected; yet they have to take the market rate. Sometimes the company is offered good rates on ships that are not filled to capacity on their voyage to Europe. In these cases, the company tries to allocate the

cargo while it is on its way to Europe before it reaches a breaking point—Mediterranean or Baltic Sea. The client, knowing the distribution points, storage costs, and the final market, determines the destination port. Clients know what to expect because the brand is known worldwide. Clients usually have their ripening facilities and distribution networks. (Logistics advances and communications have significantly improved their operations. They are now able to communicate with the captain of the ship via email rather than the previous method of fax or telex machines.)

Comercial Exportadora Pcochay S.A. – Ecuador. This exporter ships bananas to Chile. It is fully dependent on shipping lines for ship availability, and is a price taker. They prefer to ship on refrigerated containers for two reasons. They have a significant amount of export volume, and they believe that the cargo is better handled in containers than in reefer ships. However, ship availability is such that they can send the cargo either way. Most volume is about 20 40-ft containers per week. While containers are more expensive than reefer ships, they prefer to ship via containers, which provide better handling of the cargo. Apparently, in reefer ships the cargo gets stepped on and damaged when the ship closes a floor while trying to create a fully flat surface,

Union de Bananeros Ecuatorianos S.A. – Ecuador. This exporter is a subsidiary of Dole Corp and is a Standard Company. The company ships large quantities of bananas to the United States and to Southern Europe via Containers and Reefer ships—Dole Corp Ships. They use reefer containers exclusively when shipping to the West Coast of the United States, and they mainly use reefer ships when shipping to the European Union -- the primary destination being Valencia. The decision regarding shipping mode is made at the corporate level and is based on the headquarters' market strategy. Other cargo is handled according to space availability on ships. Clients and distribution points are known and are usually Dole subsidiaries. Freight rates are not as important as being able to move the cargo.

HAMBURG SUD Columbus Line – Chile. This firm handles over 200 refrigerated containers that travel to eastern United States and eastern Central America and more than 250 refrigerated containers throughout the European Union. They operate exclusively in refrigerated containers, the clients determining how the cargo is sent. Large volumes use reefer ships, but they do not provide the service. Most clients are happy to work with reefer containers, which thereby allows more control over the supply chain. Large reefer vessels require large storage facilities. With containers, the products travel directly from the ship to the supermarket. European ports have a substantial number of warehouses which function as hubs for cargo travelling via roads, railroads, smaller ships or airplanes.

Chiquita-Enza – Chile. This large exporter uses both reefer ships and containers, and operates mainly through its own fleet. They ship about 75% of the cargo in reefer ships and about 25% in containers. They make substantial deliveries via reefer ships to Philadelphia. They primarily use containers when shipping to the Middle East and Latin America. Freight rates are not as much of a determinant as export volume. However, shipping rates for containers are becoming competitive with those of reefer ships. The client determines the final destination and receiving facilities—usually Chiquita in the US.

Buonarotti Exporters – Chile. This firm, a major exporter of mackerel to Asia and Europe, is at the mercy of the shipping lines. At the time of the interview, they were unable to gain access to a reefer ship for sending 200K pounds of mackerel. The cargo had to be loaded in 40-ft refrigerated containers, thus raising the final cost of the product to the importer (230 Euros per container). The exporter mainly ships cost plus freight, and forwarders indicate the best way to ship the product. While freight rates are very important, ship availability is a greater determinant. Destination facilities are very important and the client determines the final destination and knows his final costs.

ACONEX – Chile. A large exporter of fruits, they determine shipping mode based on client and volume. They have not had problems finding reefer ships, but they had to work with four other operators and forwarders to ensure access to ships. They sends 1000 pallets, or 20 or 40 ft containers.

Inversiones Pacífico – Peru Pacífico. This firm exports all kinds of sea products. They ship primarily in refrigerated containers, but also use reefer ships. The decision about how to ship is made by the client and is based on volume. They have not had problems finding ships. They are price takers and usually pay premiums during the asparagus, avocado, and fruit seasons. Since their work is client-based and the client makes the shipping decision, the client usually pays the freight.

Chiquita Brands – Cincinnati, Ohio. This firm is a major importer of fruits into the United States. The Chiquita Fleet, also called the Great White Fleet, is based in Antwerp. They usually use their own ships to import their cargo and they only use reefer containers. They do not seem to be keen observers of the ongoing freight rates for the market.

APPENDIX F. Interview Results - Importers

Dole Hamburg, Germany
They import only deciduous fruit from Chile, shipping 50% via refrigerated containers and 50% via conventional ships (for Dole as a whole, the proportion is 30-70). Reefer ships provide a better transit time, and are less expensive. They use more containers at the beginning and the end of the fruit season with the increase in cargo volume. Another benefit to using containers is that they provide more flexibility. The exporter makes the decision, after input from the importer, both of who are Dole. The exporter signs the contract of transportation. All containers are stripped at discharge port, and cargo, which includes Eastern Europe, is forwarded conventionally. "The reefer market appears to be shifting towards developing more containers. New technologies can control the temperature within the containers and extend the shelf life of the products. Unfortunately, these are still too expensive to take advantage of."

Buenavista Hamburg, Germany
This company imports bananas only for the German market. They do not re-forward to other European destinations. They use containers for the regularity of shipments and the frequency. They get a flat freight rate and are able to control the shipments. They are very satisfied with the facilities. If they had larger volumes of cargo, they would use reefer ships, which would be more cost effective.

Helfier Rungis (France)
This company imports fruit, mainly grapes, from Chile and mangoes from Peru. They ship 50% via refrigerated containers and 50% via reefer ships. The exporters decide the mode of shipment, the nature of the product being the determining factor. They use reefer ships for shipping grapes and containers for shipping mangoes. Overall, the port facilities are fine – they use Le Havre and Antwerp. They have had some operational problems with the containers from Peru, which are transhipped prior to transit through the Panama Canal. The freight rate is not a major factor, unless they are shipping large volume products such as grapes or pears.

Siemssen & Co (Hamburg)
This importer uses reefer container ships exclusively. They sometimes transport from Chile. They are satisfied with the port facilities that they use for the reefer containers, located in Bremerhafen, Hamburg and Rotterdam. The majority of the containers are transported by truck, and a small portion are transported by feeder to Scandinavia.

Pickenpack – Hussmann & Hahn Seafood GMBH (Luenenburg)
They do not use containers and ship in break bulk only. They do not ship any products inland. Everything is transported by truck to the ports of Bremerhafen and Cuxhafen.

Appendix G. Reefership Owners

Beneficial Owner	No.Ships	Av. YOB	Total Cu.ft	Av. Cu.ft.
Seatrade Groningen	62	1989	22,047,225	355,600
Laskaridis Shpg	69	1987	18,875,919	273,564
Star Reefers AS	20	1989	10,927,562	546,378
Unknown Owner	57	1979	9,592,799	168,295
Eastwind Maritime SA	26	1984	9,515,530	365,982
Norbulk Shpg. UK Ltd	24	1989	7,874,081	328,087
Trireme Vessel Mngt.	12	1986	6,399,743	533,312
Nippon Yusen Kaisha	13	1995	6,238,590	479,892
Del Monte	10	1983	6,015,258	601,526
Lagoa Shipping Corp.	15	1982	5,939,675	395,978
Holy House Shpg. AB	12	1980	5,870,572	489,214
J. Lauritzen	11	1992	5,705,351	518,668
Aquaship Ltd.	11	1980	5,553,212	504,837
Zodiac Maritime Agy.	13	1987	5,216,938	401,303
Chiquita Brands	8	1992	4,912,552	614,069
Latvian Shpg.	14	1985	4,622,506	330,179
Leif Hoegh & Co.	9	1989	4,527,129	503,014
Reefership Marine	9	1988	4,521,577	502,397
Armada (Greece)	11	1987	4,377,731	397,976
Target Marine S.A.	8	1979	4,358,496	544,812
Foresight Ltd.	7	1989	3,688,463	526,923
Nomadic Shpg A/S	17	1986	3,534,514	207,913
Restis Group	7	1985	3,364,797	480,685
Klaipeda Transflot	16	1984	3,334,718	208,420
Yugreftransflot	11	1984	3,208,149	291,650
Vroon B.V.	9	1989	3,207,685	356,409
Sevrybkholodflot	8	1978	3,187,876	398,485
MPC Group	6	1992	3,138,545	523,091
Mediteranska Plovidb	6	1991	3,120,763	520,127
Chartworld Shpg.	9	1982	3,110,629	345,625
Chinese Govt.	42	1979	3,019,383	71,890
Thien & Heyenga	10	1981	3,009,294	300,929
Far-Eastern Shpg. Co	11	1985	2,884,984	262,271
Roswell Navigation	8	1982	2,859,483	357,435
Riga Transport Fleet	10	1983	2,649,863	264,986
Maritima Del Norte	14	1986	2,596,931	185,495
Armatori Partenopei	4	1999	2,399,878	599,970
Leonhardt & Blumberg	4	1990	2,360,000	590,000
Commercial Shpg. Co.	9	1983	2,349,662	261,074
United Ocean Ent.	4	1999	2,192,863	548,216
Unique Shpg. (H.K.)	4	1995	2,182,905	545,726
Eastwind Ltd.	7	1990	2,164,328	309,190
Kyoei Kaiun Kaisha	16	1990	2,005,985	125,374
Triton Schiffahrts	5	1990	1,896,168	379,234

Albion Reefers Ltd.	4	1985	1,885,842	471,461
Lomar Shpg	4	1980	1,830,857	457,714
Boyang Ltd.	8	1991	1,821,801	227,725
IMG Co. Ltd.	8	1975	1,811,171	226,396
Shoei Kaiun	4	1997	1,779,936	444,984
Ugland Int. Holdings	3	1990	1,721,500	573,833
Ost-West-Handel	5	1980	1,713,033	342,607
London Ship Managers	3	1986	1,615,840	538,613
Skaugen, B. Shpg.	3	1992	1,608,305	536,102
Nissui Shpg. Co. Ltd	4	1998	1,604,437	401,109
Fairport Shipping	8	1984	1,600,092	200,011
Atlantic United Mar.	4	1979	1,598,241	399,560
Comninos Enterprises	4	1979	1,572,380	393,095
Cuban Govt.	6	1978	1,526,462	254,410
O. T. Tonnevold A/S	5	1982	1,484,333	296,867
Orient Marine Co.	3	2000	1,474,155	491,385
Sato Steamship	4	1990	1,380,371	345,093
Wallem & Co.	3	1990	1,363,476	454,492
Masumoto Shpg Co	3	1989	1,316,661	438,887
Mitsui Warehouse Co.	7	1982	1,315,231	187,890
Jaczon B.V.	4	1993	1,313,475	328,369
Schoeller Holdings	5	1988	1,302,496	260,499
Baltic Shpg. Co.	3	1978	1,275,697	425,232
Indochina Ship Mngmt	2	1973	1,254,484	627,242
World Wide Reefers	2	1984	1,205,538	602,769
F. Laeisz	3	1993	1,126,464	375,488
Nissen Kaiun K.K.	2	1995	1,105,897	552,949
Ukranian Danube Shpg	10	1988	1,082,041	108,204
Toko Unyu	2	1998	1,059,627	529,814
Shinsei Kaiun K.K.	2	1998	1,039,695	519,848
Arabian Reefer Co.	3	1982	996,602	332,201
Mitsuhama Kisen	2	1999	994,364	497,182
Reftransflot	5	1978	983,705	196,741
Hayama Senpaku K.K.	5	1990	942,736	188,547
Polar Shipping GmbH	2	1971	942,678	471,339
Toei Reefer Line	6	1991	929,452	154,909
Nexus Reefer	3	1972	908,534	302,845
Tachibanaya K.K.	2	1992	902,052	451,026
Wallem Shipmgmt.	2	1989	872,233	436,117
Osaka Shipping	3	1989	867,241	289,080
Shunzan Kaiun K.K.	2	1999	849,262	424,631
Osterreich. Lloyd	3	1986	827,648	275,883
Honma Senpaku Co Ltd	2	1999	808,020	404,010
China Ocean (COSCO)	2	1984	800,195	400,098
R/A Gustaf Erikson	3	1990	797,310	265,770
Trans Vind Flot	2	1970	756,617	378,309
Everett Steamship	2	1990	756,110	378,055
Sun Big Reefer Shpg.	2	1974	738,767	369,383

Dongwon Industries	5	1979	724,519	144,904
Korea Marine Ltd	4	1990	720,156	180,039
A. Abbar & A. Zainy	2	1989	686,923	343,462
Ofer Group	2	1972	680,020	340,010
Taiseimaru Kaiun	3	1989	678,170	226,057
Ji Sung Shipping Co.	4	1984	674,164	168,541
Navimar	3	1978	654,375	218,125
Wako Kisen K.K.	3	1995	608,159	202,720
Wu Pioneers Sea Food	2	1975	604,285	302,143
Fukujin Shipping	1	1998	600,558	600,558
Nisshin Kisen	3	1994	595,882	198,627
United Reefers Chrtg	2	1987	592,262	296,131
Hamburg-Sud.	1	1999	569,666	569,666
Tokumaru Kaiun K.K.	1	1998	569,666	569,666
Seabon Holding Corp.	2	1978	558,328	279,164
GGS Global Ship Serv	1	1983	558,219	558,219
Taiko Shpg.	2	1988	554,485	277,243
Kantoh Kaiun Co. Ltd	2	1984	552,175	276,088
Elmira Shipping	1	1992	540,572	540,572
Kyowa Kisen K.K.	1	1998	539,684	539,684
Tohshin Kisen Co	1	1993	532,061	532,061
Gestra Corp Ltd.S.A.	3	1978	531,999	177,333
Santoku Senpaku	1	1993	526,641	526,641
Paulownia Maritime	1	1994	526,250	526,250
Fairfield-Maxwell	2	1987	525,777	262,889
Bulgaria Government	2	1971	519,126	259,563
Hai Bo Shipping	2	1982	514,853	257,427
Antar Nico Corp.S.A.	2	1975	505,135	252,568
Maruta Industries	1	1992	502,586	502,586
Albacora S.A.	2	1990	484,795	242,398
Tocina Shpg. Co.	1	1968	466,217	466,217
Win Far Fishery	3	1975	465,751	155,250
Zhoushan Distani	1	1981	459,979	459,979
COBRECAF	2	1985	453,777	226,889
Det Nordenfjeldske	1	1991	452,816	452,816
Baltic Bereederung	1	1988	440,016	440,016
AJM Tankship Pte.Ltd	1	1990	439,857	439,857
Banyo Jitsugyo K.K.	2	1999	439,742	219,871
Sunford Shpg. Ltd.	1	1998	439,742	439,742
Goldenport S/Mgmt.	1	1983	439,292	439,292
Win Uni Marine Corp.	1	1971	433,629	433,629
Nisshin Kaiun K.K.	1	2000	429,935	429,935
Shoei Kisen K.K.	1	1993	422,096	422,096
Yamane Sangyo K.K.	2	1993	414,886	207,443
Rederiet H. Saetre	2	1989	401,609	200,804
Saudi Coldstorage	1	1976	401,037	401,037
Towa Kisen K.K.	1	1993	395,543	395,543
Eiko Marine K.K.	1	1994	394,337	394,337

Tonichi Sangyo K.K.	1	1993	394,277	394,277
MISC	1	1993	394,158	394,158
Ishizuchi Line	1	1993	394,125	394,125
Shinsei Kaiun Co Ltd	2	1989	384,822	192,411
Hakko Marine & Corp.	4	1987	378,591	94,648
Khana Enterprise Co.	2	1996	369,903	184,952
Ireland Blyth Ltd.	2	1981	365,414	182,707
Tachibana Kaiun	3	1994	359,012	119,671
Albafrigo S.A.	2	1975	358,536	179,268
Chuyo Kisen	1	1993	347,082	347,082
Antartida	2	1968	345,684	172,842
Shinwoo Shpg Co. Ltd	2	1980	342,848	171,424
Cardiff Marine Inc.	1	1978	342,207	342,207
Frabelle Fishing	4	1972	334,522	83,631
MK Ship Management	1	1989	333,081	333,081
Jin Jin Shipping Co.	1	1968	332,380	332,380
Seiwa Kosan	3	1989	329,729	109,910
Great Pacific Nav	1	1971	325,319	325,319
Ancora Maritime S.A.	2	1982	323,046	161,523
Nor-Cargo Int.	3	1983	320,839	106,946
Vostoktransservis	3	1968	319,315	106,438
Asian-Thai Marine	3	1972	315,037	105,012
Dobson Fleet Mgmt.	1	1983	303,148	303,148
Ch. F. Ahrenkiel	1	1991	298,024	298,024
Umba Shipping Co.	1	1991	298,024	298,024
Choke Reefer Lines	3	1972	295,406	98,469
Nova Hollanda Shpg.	1	1983	293,044	293,044
Romana de Pescuit	1	1981	291,558	291,558
Chainavee	3	1968	290,161	96,720
Nordstrand Maritime	1	1985	269,239	269,239
Govt. Of Vietnam	5	1976	268,940	53,788
Interocean Fishery	2	1986	266,838	133,419
Navicon Co. Ltd.	1	1990	265,770	265,770
Roko Shipmngmnt.	1	1983	265,245	265,245
J. Hagenaes & Co.	1	1984	265,240	265,240
S. Ugelstads Rederi	1	1983	265,240	265,240
Hadron Ltd.	1	1984	264,452	264,452
Trans Ocean Express	1	1985	261,576	261,576
Seavic Reefer Lines	2	1974	261,462	130,731
Stalwart Profitis	1	1983	260,093	260,093
Noorship B.V.	1	1971	259,563	259,563
Pelagique Afrique	1	1969	259,563	259,563
Radex L.L.C.	1	1966	259,563	259,563
White House M/time.	1	1965	259,563	259,563
Global Shipping Ltd.	2	1982	255,910	127,955
Nav. Pinillos S.A.	1	1983	255,256	255,256
Golden Gnosis Shpg.	1	1979	249,011	249,011
Phoenix Ocean System	1	1979	248,845	248,845

H & G Transport	2	1978	239,146	119,573
Interagent Co. Ltd.	1	1978	236,610	236,610
Dhara Marine Ltd.	1	1995	235,127	235,127
Pesquerias Hispano	1	1962	234,388	234,388
Mar Fishing	3	1963	233,034	77,678
Madrigal Trans. Inc.	1	1974	231,780	231,780
Sovgavan	2	1967	230,958	115,479
Pan Pacific Shipping	2	1973	228,328	114,164
Bueno Vista S.A.	1	1970	225,772	225,772
Tuna Reefer Ltd.	2	1980	225,425	112,713
Afko Fisheries	3	1975	222,694	74,231
Hyun Il Shpg. Co.	1	1973	221,747	221,747
Galdar Naviera	1	1990	215,000	215,000
HUB Line (M)	1	1983	214,873	214,873
Brugse Scheep	3	1973	213,767	71,256
Fransov S.A.	1	1973	212,206	212,206
Kristen O. Johnsens	1	1973	212,000	212,000
Fordivat	1	1978	208,302	208,302
Toei Suisan K.K.	2	1989	206,230	103,115
Dae Wang Fisheries	2	1983	206,105	103,053
KDB Capital Corp.	1	1983	202,603	202,603
Chuo Kisen K.K.	1	2001	202,567	202,567
Baltic Atlantic Shpg	1	1977	201,020	201,020
Dech Reefer Co. Ltd.	1	1979	201,020	201,020
Daio Kogyo K.K.	1	1996	200,024	200,024
Kasuga Kaiun	1	2003	199,882	199,882
Yamane Kaiun K.K.	1	2003	199,882	199,882
Sirichai Fisheries	3	1979	194,490	64,830
Toho Kaiun	1	1979	193,004	193,004
Murmansk Shpg. Co.	1	1968	190,699	190,699
Star Reefer S.A.	1	1991	190,003	190,003
Two Lions Shpg. Co.	1	1971	189,181	189,181
Zao Dalrefservice	1	1971	189,181	189,181
Smile Marine	1	1982	184,758	184,758
Transfishing Tuna SA	1	1978	184,071	184,071
Hua Heng Reefer Co.	1	1979	182,734	182,734
Cormorant Bus. Inc.	1	1969	182,629	182,629
Sal Fishing Corp.	3	1979	182,541	60,847
Kholmsk Fishing Port	4	1977	182,436	45,609
Korea Special Shpg.	1	1972	178,535	178,535
Tseklek Reefer	2	1974	172,639	86,320
Maldives Govt.	3	1984	172,543	57,514
Shine Year Fishing	1	1967	168,647	168,647
P.T. Intermarine Co.	2	1979	166,358	83,179
Alphamax Corporation	1	1980	164,432	164,432
Sun Victory Shpg.	1	1980	164,144	164,144
Union M/time. Maroc.	1	1984	160,201	160,201
Ijo Shipping Co. Ltd	1	1982	157,553	157,553

Leningradskaya	2	1967	156,091	78,046
Chang Soon Shipping	1	1992	155,638	155,638
Xiangfan Marine	1	1973	155,091	155,091
Foliage Marine Inc.	1	1968	153,520	153,520
Zhejiang Zhoushan	1	1968	152,879	152,879
Shinko Senpaku K.K.	1	1989	151,693	151,693
Kiku Ocean Ind.	1	1996	151,128	151,128
Dalmoreprodukt	3	1986	150,232	50,077
Palmer Maritime Inc.	1	1972	150,088	150,088
Frigomar	1	1987	146,966	146,966
Lian Chuan Sheng	1	1973	145,249	145,249
Sea Tower Ocean S.A.	1	1967	144,649	144,649
Mariner Shpg. S.A.	1	1979	144,298	144,298
Doun Kisen K.K.	1	1996	144,085	144,085
Chang Sheng Marine	2	1975	143,906	71,953
Fjord Shipping A/S	1	1982	142,572	142,572
Seiichi Ogino	1	1994	142,317	142,317
Wan Shun Steamship	1	1983	139,738	139,738
O Yang Fisheries	1	1972	137,541	137,541
Wei Fong Shipping	1	1983	137,161	137,161
K.S. Marine Co.	1	1979	136,515	136,515
State Stock Corp.	1	1968	136,316	136,316
Dong Sheunn Fishery	1	1969	136,315	136,315
Nyame Na Onyim Co.	1	1968	136,043	136,043
Orient S & T SARL	2	1962	135,229	67,615
Surin & Teelk Reefer	1	1979	134,500	134,500
Silver Sea Reefer Co	1	1979	134,120	134,120
Atlas Marine Co	1	1992	132,734	132,734
Lubmain Shpg. Serv.	1	1999	131,353	131,353
Oerssleff's A.C.	1	1989	129,941	129,941
Fabricius & Co. A/S	1	1989	129,940	129,940
Pafisa S.A.	1	1989	129,919	129,919
Fong Bau Fishery	1	1992	127,345	127,345
Ardis Co. Ltd.	1	1977	127,275	127,275
Arbumasa S.A.	1	1982	126,003	126,003
Win Shu Fishery	1	1973	125,268	125,268
Infitco Ltd.	1	1972	124,289	124,289
Ast. de Huelva	1	1987	123,742	123,742
Fenix Ocean Systems	1	1985	122,002	122,002
Coastal Transp.	2	1978	121,377	60,689
Chin Fu Fishery Co.	1	1980	118,375	118,375
Kyung Il Shpg. Co.	2	1982	117,854	58,927
Inter-Burgo	1	1967	116,607	116,607
Juno Reefers	1	1968	115,479	115,479
Riga Trawling	1	1964	115,479	115,479
Sodel Fisheries	1	1962	115,479	115,479
V.B.T.R.F.	1	1967	115,479	115,479
Vostokintur Tourist	1	1965	115,479	115,479

Fujimura Kisen	2	1983	112,477	56,239
Matenko Enterprises	1	1965	112,442	112,442
Fernandes, J	2	1965	108,815	54,408
Seven Seas Transport	1	1982	104,725	104,725
Siong Soon Shipping	1	1982	104,250	104,250
Central Pertiwi PT	1	1996	103,614	103,614
Ob-Irtysh Shipping	2	1981	102,404	51,202
Palmali Shipping	2	1981	102,404	51,202
Aphirachai Sea Tran.	1	1980	102,000	102,000
Infinity Fisheries	1	1980	102,000	102,000
Kao Sheng Marine	1	1982	101,011	101,011
San Shin Yang Co.Ltd	1	1982	100,634	100,634
Universe Marine	1	1972	99,411	99,411
Myeong Sung Shpg.	2	1977	98,916	49,458
Shinhan Capital	1	1984	98,444	98,444
Unifishery	1	1979	98,245	98,245
Chern Lung Fishery	1	1980	97,292	97,292
Ta Sheng Navigation	1	1972	95,774	95,774
Dongban Ocean	1	1973	95,000	95,000
Flykesbaatane i Sogn	1	1979	94,943	94,943
China Sky Shpg	1	1991	93,200	93,200
Morimoto Kaiun	1	1987	93,200	93,200
Ta Han Enterprises	1	1981	92,713	92,713
Pai Zoong Fishery	1	1980	92,525	92,525
Dago European LLC	1	1979	90,747	90,747
Marutiera Transport	1	1961	89,876	89,876
Boluarte Gylling J.	1	1973	88,776	88,776
Arkhangelsk Base	1	1977	88,660	88,660
Mu Dan Jiang Shpg.	1	1969	88,622	88,622
Temehani	1	1968	88,605	88,605
Dae Bong	1	1969	87,850	87,850
Korea Won Yang	1	1971	87,850	87,850
Island Enterprises	1	1973	87,566	87,566
Ducado Oro S.A.	1	1968	87,000	87,000
Michalakis Shpg.	1	1962	87,000	87,000
Intership Nav. Co.	1	1980	86,192	86,192
Sam Jung Shipping Co	1	1965	85,721	85,721
Ulusoy Deniz	1	1965	85,000	85,000
Pesmar	1	1969	84,967	84,967
Petropavlovsk	1	1971	83,580	83,580
Zheng Yi Enterprise	1	1967	82,734	82,734
Olympic Shpg.	1	1962	82,707	82,707
Maroline Ltd.	1	1969	81,970	81,970
Fairload Shipping	1	1968	79,652	79,652
Seven Trading Ltd.	1	1962	79,635	79,635
Arctic Alaska	1	1990	77,975	77,975
Sandypool Ltd.	1	1970	75,846	75,846
Esco Fisheries	1	1973	73,600	73,600

Pearl Reefer Co. Ltd	1	1985	72,068	72,068
Thaiwijaya Co. Ltd.	1	1968	70,958	70,958
Al Fatah Shipping	1	1961	70,488	70,488
Naveban SA	1	1968	70,276	70,276
South Se Fishing	1	1984	70,170	70,170
Bishop Marine Co.	1	1962	69,712	69,712
Forsban Trading S.A.	1	1966	68,900	68,900
Recomar Ltda.	1	1963	68,900	68,900
Ultramar AE S.A.	1	1967	68,900	68,900
Sun Wah Shipping	1	1970	68,861	68,861
Longeye S.A.	1	1985	68,511	68,511
P.T. Mulia Utama	1	1962	67,204	67,204
Cinape S.A.	1	1965	66,691	66,691
Maghrebine, Soc.Nav	1	1978	65,324	65,324
TOO Murmansk	1	1980	65,223	65,223
El Cashaway Brothers	1	1979	65,200	65,200
Lotus Shpg. Co. Ltd.	1	1978	64,290	64,290
Heung Duck Shipping	1	1985	64,167	64,167
Interatlantik-Flot	1	1997	63,314	63,314
Hyde Shpg. Corp.	1	1962	62,888	62,888
Hai Thong	1	1964	61,801	61,801
ASAP Shipping Co.	1	1964	61,441	61,441
Komniship Shpg	1	1956	61,236	61,236
Denver Development	1	1965	60,106	60,106
Amexcaribe Inc.	1	1967	60,000	60,000
Oman Marine Eng.	1	1962	60,000	60,000
Venetos, J.	1	1961	60,000	60,000
Fulduk Fisheries	1	1960	58,163	58,163
Merchant Ref. Shpg.	1	1974	58,093	58,093
New Seas Navigation	1	1974	58,093	58,093
Shin Ho Sing Ocean	1	1972	57,457	57,457
Prosperity Ocean Int	1	1985	57,352	57,352
McRink, John & Co.	1	1965	56,857	56,857
Tabala & Co	1	1961	56,240	56,240
Hansa Mar. Consul.	1	1967	55,621	55,621
Taiyo Iyo Kisen	1	1984	53,043	53,043
Hengli Ocean Fish's	1	1979	52,937	52,937
Korea Daehung Trans.	1	1983	52,148	52,148
Kowa	1	1982	52,043	52,043
Eastern Shpg. Lines	1	1963	51,701	51,701
Alekseevskaya Rep.	1	1983	51,202	51,202
Elena Industrial	1	1983	51,202	51,202
Kyowa Sansho	1	1982	50,162	50,162
Myanmar Govt.	2	1981	49,582	24,791
Algist Ltd.	1	1971	48,805	48,805
Fujita Kaiun	1	1979	48,770	48,770
R & D Fishing	1	1979	48,770	48,770
Daewoo Marine Co.	1	1979	48,592	48,592

Planeta Co. Ltd.	1	1994	48,461	48,461
Vostok-1 Fishing	1	1994	48,461	48,461
Eiji Katoh	1	1986	48,240	48,240
Zvezda - DISSK	1	1997	46,968	46,968
Sahlman Seafoods	1	1982	46,933	46,933
Azia Sekkei	1	1979	45,980	45,980
Egyptian Shpg. Trans	2	1977	45,774	22,887
Allied Continental	1	1962	45,322	45,322
Sea Lion Transport	1	1979	45,132	45,132
Fiskernes Agnforsyn.	1	1989	45,000	45,000
H.H. Brothers Mar.	1	1962	44,735	44,735
Sae Won Shipping Co.	1	1979	44,602	44,602
Komandor Joint Stock	1	1987	44,200	44,200
Ergomax G.m.b.H.	1	1977	42,650	42,650
Ocean Fisheries Ltd.	1	1966	41,318	41,318
Benguela Lines	1	1969	41,180	41,180
Esperanza Shipping	1	1970	41,180	41,180
Semelstone Trading	1	1970	40,612	40,612
Westport Finance	1	1956	40,357	40,357
Igen Ship Trading	1	1980	39,199	39,199
Atuneros Congeladore	1	1983	38,140	38,140
Shinei Kaiun	1	1991	35,844	35,844
Zhoushan Aquatic	1	1970	35,500	35,500
Kamchatinpex	1	1986	35,315	35,315
Elnile Garden & Sea	1	1973	34,397	34,397
Putuo Santong Trdg.	1	1969	33,196	33,196
Usaha Mina	2	1976	32,136	16,068
Lucky Shipping Co.	1	1974	27,800	27,800
Sheng Wei Navigation	1	1960	25,956	25,956
Te Mautari Ltd.	1	1985	23,731	23,731
Enamar S.A.	1	1973	22,954	22,954
Atlantrybflot	1	1976	22,887	22,887
Kamchatsk Terr.	1	1976	22,887	22,887
Saami Enterprise	1	1978	22,887	22,887
Zapadnny Rumb	1	1977	22,819	22,819
Colwin Investment	1	1974	22,565	22,565
Airmat Singapore Pte	1	1980	22,319	22,319
Dalrybflot Co. Ltd.	1	1990	22,319	22,319
Jaanivald Ltd.	1	1983	22,319	22,319
Vladivostok Trans Co	1	1981	22,319	22,319
Glasear Dorado S.A.	1	1982	22,106	22,106
Coanabo	1	1963	22,000	22,000
Pan Field Lines	1	1986	21,330	21,330
Nossi-Be	1	1970	21,118	21,118
Ishidamaru	1	1987	20,235	20,235
Joint Stock Co.	1	1991	20,151	20,151
Suma Shipping Co.Ltd	1	1987	19,289	19,289
Merce-Pesca S.A.	1	1986	14,241	14,241

Indian Ocean Line	1	1990	11,654	11,654
Govt. of Mozambique	1	1990	10,841	10,841

Source: Clarkson Research Studies

Appendix H. Container Reefership Fleet

Containership Reefer Fleet as at 01/11/2003 by Beam (ft)

	< 24.3		> 24.3 < 25.9		> 25.9 < 27.7		> 27.7 < 29		> 29 < 30.4		> 30.4 < 32.3		> 32.3 < 33.5		> 33.5 < 36.6		> 36.6 < 39.6		> 39.6 < 42.7		> 42.7 < 45.7		> 45.7 < 48.8		> 48.8 < 51.8		> 51.8 < 54.9		> 54.9	
built	No.	RTEU	No.	RTEU	No.	RTEU	No.	RTEU	No.	RTEU	No.	RTEU	No.	RTEU	No.	RTEU	No.	RTEU	No.	RTEU	No.	RTEU	No.	RTEU	No.	RTEU	No.	RTEU	No.	RTEU
<=1960																														
1961																														
1962																													2	112
1963																													2	112
1964																														
1965																														
1966																														
1967																														
1968																			1	4									7	512
1969																			2	36			2	16					2	353
1970																					4	98	2	28	3	106	3	57	10	613
1971																					3	81	1	14	1	76	3	78	12	1,169
1972																					1	33	1	15	1	76	2	47	8	829
1973																					1	20	1	25	3	45	1	20	10	637
1974																			2	24	1	20	1	19			1	6	8	739
1975																					2	50	4	116	3	34			8	464
1976																					1	25	6	163	1	10			22	2,062
1977																					9	195	1	20			2	55	33	6,644
1978																					4	117	1	40	3	109	4	115	39	6,622
1979																					1	72					7	275	51	7,760
1980																					1	66			2	80	1	30	61	12,011
1981																									2	44			32	3,656
1982																									4	190	1	4	61	6,803
1983																					1	39			1	24			74	11,484
1984																													73	8,485
1985																					1	40					1	20	82	9,498
1986																									1	20			66	10,887
1987																											2	80	42	7,832
1988																									1	20	4	155	45	9,749
1989																											2	65	47	9,531
1990																											1	50	69	13,408
1991																			1	36					3	42	6	304	70	18,000
1992																													84	14,373
1993																											5	246	96	17,239
1994																									2	59	4	140	126	24,669
1995																									1	44	9	420	154	29,001
1996																											6	248	188	41,708
1997																									2	120	9	450	228	57,707
1998																	2	64							1	60	7	375	221	62,256
1999																											4	240	97	35,575
2000																													134	62,359
2001																											1	350	161	96,960
2002																													126	88,417
2003																													84	57,738
	0	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**64**	**6**	**100**	**30**	**856**	**20**	**456**	**35**	**1,159**	**86**	**3,830**	**2635**	**737,974**

Clarksons Research 2003

N/B only containerships with confirmed

Appendix I. World Trade Model Methodology and Data Sources

Global Insight World Trade Service
A Brief Introduction to the
World Trade Forecasting Methodology

1. Introduction

The primary purpose of Global Insight's world trade forecasting system is to provide information to assist decision makers involved with international transportation. International transportation businesses, such as ocean shipping companies, terminal operators and port authorities, need detailed global trade volume forecasts for their operations and development planning. Policy makers and managers in companies that are not in the transportation business also can use these comprehensive forecasts to analyze world trade issues.

To meet the needs of the users, our global trade forecasts include all commodities that have physical volume, but not trade in services or commodities without physical volume, such as electricity. These commodities are grouped into our own categories derived from the International Standard Industrial Classification (ISIC). We cover 77 ISIC categories, as listed in Table 1 of the Appendix to this paper.

For all trade partners in the world, we track 54 major countries individually and group the rest of the countries in the world into 16 regions according to their geographic location.[2] Therefore, we forecast 77 commodities traded among 70 country/regions. This is a framework of 77×70×(70-1), or 371,910 potential trade flows. Because not every country trades every commodity with every other country, we presently have about 270,000 trade flows in our forecasts.

We forecast world trade in nominal and real commodity value and then convert to physical volume by transportation mode. Primary modes of transportation include air, overland and maritime transport, all measured in metric tons as well as in value. Maritime transport is further detailed for liquid bulk, dry bulk, general cargo/neobulk, and container trades. Container trade is measured in twenty foot equivalent units (TEUs) as well as metric tons. Table 3 in the Appendix shows the 18 concepts of the world trade in the forecast.

2. Trade Data Sources

The primary international trade history data come from the United Nations as processed and published by Statistics Canada. These commodity trade statistics are collected from each member country's customs agencies. Customs departments have records of both the export and import sides of trade flows. Statistics Canada produces export data in f.o.b. (free on board) terms, which are better to use in estimating the real value of the commodity trade. This

[2] Table 2 in the appendix lists the 54 countries and 16 regions used in the trade forecasting models.

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data covers all UN member countries and non-member economies, such as Taiwan. Global Insight also purchases OECD International Trade by Commodity Statistics for more current data from the developed countries.

Because international trade statistics collected by different countries usually have discrepancies when compared to each other, and because no one source has entirely complete data, we also use U.S. Customs data and IMF Direction of Trade data to calibrate and supplement the historical commodity trade data. Data from different sources are recorded in different classification systems and units of measurement. We convert the data into thousands of current U.S. dollars and then into 1997 real commodity value.

The world trade forecasting models also rely on Global Insight's comprehensive macroeconomic history and forecast databases. Among the data used are population, GDP, GDP deflators, industrial output, foreign exchange rates, and export prices by country. We use these data as exogenous variables in the trade forecast models. For international commodity prices, we also obtain data from the U.S. Bureau of Labor Statistics' on international import and export prices. We also use other data, such as foreign direct investment and import tariffs, as available, as determinants of a country's export capacity and import costs.

3. Modeling International Trade

The basic structure of the model for the trade flow of a commodity is that a country's import from another country are driven by the importing country's demand forces, enabled by the exporting country's capacity of exporting (supplying) the commodity, and affected by the exporting country's export price and importing country's import cost for the commodity. A country will import more of a commodity if its demand for this commodity increases. At the same time, the country will import more of this commodity from a particular exporting country if that exporter's capacity to export this commodity is larger and its export price for this commodity is lower than in other exporting countries. Importers will ultimately purchase based on the delivered cost, importing more when the import cost decreases. The distance between two countries is also an important factor in determining the scale of trade between two countries. Our models are constructed to capture the dynamics of international trade so that geographic distance as a constant is embedded in determining the scale of the base.

Demand forces are commodity specific. Presently, we group 77 commodities into two types. For the first type of commodities, major demand forces are the importing country's population and income growth. For the second type of commodities, the major demand forces are the importing country's production and technology development.

A country's export capacity for a commodity is estimated based on the country's capacity to produce this commodity and its ability to export it. The infrastructure, the establishments and resources that are needed for production determine production capacity. For export capabilities, we pay attention to the capacity that exceeds that needed to meet a country's domestic demand. Export capability is also determined by the quality and cost of the products that face competition in world markets.

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Import costs are determined by export prices, import tariffs, and each importing country's foreign exchange rates. We categorize our 77 commodities into three groups to control the estimation of the impact of import costs on countries' imports of each commodity. These three groups generally can be described as price inelastic, low price elastic, and price elastic.

The models are constructed in real value terms. That is, value type variables are in terms of value minus the effect of price inflation. For example, the trade flow of a commodity is measured in the 1997 value of this commodity, and GDP of a country is measured in its 1990 value of GDP. We use the data in real value terms, because only in real terms do the levels of imports and exports show clear respective responses to changes in demand, supply, and prices.

As the main purpose is not simply forecasting a country's aggregate imports and exports, the models must be able to forecast each country's imports and exports with each of its trade partners. Trade between each pair of trading partners is generally quite volatile with importing behavior exhibiting switching of suppliers on an ongoing basis. A very simple example of switching behavior is when the pattern of an exporter's supply dynamic is smaller than the importer's demand dynamic, the exporter's supply dynamic will dominate the trade. In the opposite case, when an importer's demand dynamic is smaller than the exporter's supply dynamic, the importer's demand dynamic will dominate the trade. To capture such a pattern switch, we use multi-stage switch models.

4. Model Estimation

To minimize the impact of measurement errors and achieve stationarity for valid estimation of times series models, our models are constructed to represent the relationship between year-over-year growth indexes of commodity trade and the year-over-year growth indexes of other exogenous variables. Because the calculated year-over-year index is asymmetric around unity, it can exaggerate growth dynamics if the present year is an upturn and the previous year is a downturn. This problem can be serious for the detailed international trade data that have very volatile dynamics. To reduce such asymmetric distortion in model estimation, we rectify the asymmetry in the data before estimating the trade models.

Our trade models are nonlinear multi-stage switch models. Switch models are not continuous functions, so conventional derivative methods cannot be applied to estimating these models. So to estimate the trade models, we use a direct search method. Though thus use of the direct search method is infrequent in economic forecasting, it is popular in other scientific fields. This is because economists often abstract from reality to fit simplified theoretical models, while scientists must construct their models to capture reality as evidenced in empirical data. Our experience has shown that international trade of goods among world markets are so complicated with regard to each commodity, each pair of partners, and over time that they cannot be sufficiently abstracted to fit into simple continuous functions for accurate forecasting. Instead we have developed our system using complex switch functions, for which we employ a direct search method for estimation.

For estimating simple continuous functions, derivative methods have the advantage of quick convergence. However, with faster computers and decreasing computation costs

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convergence time is no longer a problem. This means our ability to estimate practical models can depend upon the criterion used for choosing our estimation method. The direct search method we use has three major advantages over conventional derivative methods. The first advantage, which is the most important one, is that it can be used to estimate switch functions. The second advantage is that it allows us to freely define our error minimization function. For forecasting it is minimizing the relative absolute error not the sum of squared error that is important for producing the most accurate models. However, an absolute error function is not continuous so we use a direct search method for its estimation. For nonlinear models, the continuous error function defined for derivative methods sometimes cannot avoid multi local minimums, so use of a derivative method frequently cannot attain global minima. Through the use of the direct search method, we can freely define the error function to only contain one minimum. The third advantage is that the direct search method allows us to conveniently set the boundary of model parameters. That means it allows us to apply prior information to our model estimation.

5. Forecast Approach

There are two key factors that influenced our choice of forecasting approach. One is the scale of our trade forecasts, and the other is the real character of international trade. The real character of international trade includes economic resource constraints, heterogeneous import behavior, and overall supply and demand equilibrium.

Previous international trade forecasting approaches can be categorized as bottom-up, top-down, and a (manual) hybrid approach. Our forecasting experience leads us to believe that none of these approaches are suitable to best meet our requirements. The bottom-up approach requires that the individual items to be forecast are not subject to total resource constraints or an overall equilibrium. This denies the existence of real resource constraints in international trade. For just one example, a country's imports are limited by its income constraint. We also find that there is an overall equilibrium in international trade, where no country can export more than what other countries are willing to import from it. In contrast, the top-down approach requires that individual items to be forecast have identical dynamic patterns. Examining commodity trade statistics quickly reveals that it is difficult to find one country's imports of a commodity from two different countries that have the same dynamic patterns. So this approach is not appropriate either. To overcome the shortcomings of using the bottom-up or top-down approaches alone, some economists have forecast individual commodities and their aggregates simultaneously and then manually reconciled the difference between the sum of individual forecasts and the aggregate forecasts. This is called a hybrid approach, which is generally a manual method. Unfortunately, the manual reconciliation is very time consuming, so it cannot be efficiently applied to comprehensive forecasts such as ours, which include more than a quarter million forecast series.

To overcome the weaknesses in these approaches, we have built a system that can be described as a top-down controlled approach. To implement this approach, we aggregate detailed trade flows to three top levels. We call the most detailed trade flows Level 4 (the lowest level) and aggregate them up level-by-level in the following structure:

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Level 1

L1: World trade of total commodities,
$1 \times 1 \times 1 = 1$ series.

Level 2

L2C: World trade by commodity,
$77 \times 1 \times 1 = 77$ series.
L2M: Total commodities that each country/region imports from the world,
$1 \times 1 \times 70 = 70$ series.
L2X: Total commodities that each country/region exports to the world,
$1 \times 70 \times 1 = 70$ series.

Level 3

L3M: Commodities that each country/region imports from the world,
$77 \times 1 \times 70 = 5{,}390$ series maximum.
L3X: Commodities that each country/region exports to the world,
$77 \times 70 \times 1 = 5{,}390$ series maximum.

Level 4

L4: Commodities traded between each pair of countries/regions,
$77 \times 70 \times (70-1) = 371{,}910$ series maximum.

In this hierarchical structure, each series in levels L2C, L3M, L3X, and L4 has its own behavioral equation in the model structure (as described above in section 3). In this top-down controlled forecasting approach, each series is forecast by its own behavioral equation, but individual items at the lower level are forecast under the control of the forecast of their aggregate at the higher level. The forecasting program detects the discrepancy between the sum of individual forecasts and the aggregate forecast, identifies individual items that can be adjusted, and adjusts them step by step to diminish the discrepancies. The identification and adjustment are based on the estimated allowable variation of the behavior models. With such a design, the top-down controlled forecast adheres to the reality that international trade is subject to economic resource constraints, has heterogeneous behavior, and will attain overall supply and demand equilibrium.

6. Forecasting Process

The forecast approach determines our forecasting process, as shown by the flowchart that follows. The numbers in the flowchart indicate the sequence of the forecasting. The forecast starts from L2C. These are the top-level forecasts. We then use them to do top-down controlled forecasting of L3M and L3X, and in turn use L3M and L3X to do top-down controlled forecasting of L4. They are all forecast in real commodity value. After we obtain the detailed forecasts of the international trade in real commodity value, we check whether the overall forecast implies a reasonable trade balance that we should expect for every country/region according to their macro economic development. Trade balance is a financial concept that we need to examine in nominal, not real, value terms. Therefore, we convert real

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value L4 into nominal value L4 and then aggregate them to import and export by country/region, i.e., L2M and L2X in nominal value. Although our forecast does not include service sectors, we take into account the development of services trade for each country/region when examining the trade balance between L2M and L2X. If the forecasted trade balance for a country/region is not reasonable, we adjust L2M or L2X, or both, and then use the adjusted L2M and L2X to do a top-down controlled adjustment of the nominal L4 detailed trade. Because the trade of these countries/regions link to each other, adjusting the trade balance of one country/region affects the trade balance of other country/regions, depending on the magnitudes of their trade links. Therefore, usually we need several rounds of adjustments to attain reasonable trade balances for all country/regions. After completing the trade balance check and adjustment step, we convert nominal value L4 to real value L4 and aggregate these final detailed forecasts to their upper three levels.

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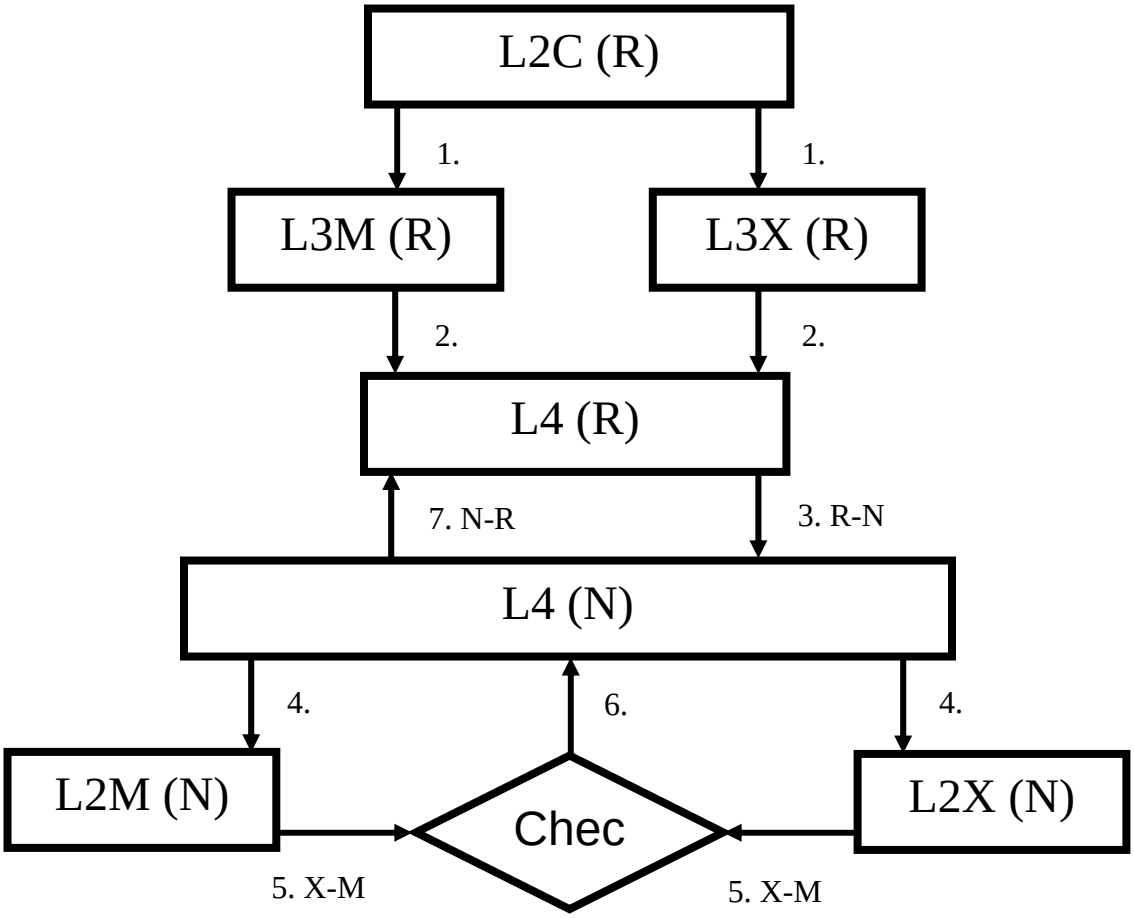
Global Insight World Trade Forecasting Process



Where:

R – real commodity value

N – nominal value
TDCF – top-down-controlled forecast
R-N CV – real-nominal value conversion
AG – aggregation
X-M CP – export-import balance comparison
TDCAD – top-down-controlled adjustment
N-R CV – nominal-real value conversion

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Because the release of trade data always lags behind current trade activity, and because behavioral forecasting models cannot include unexpected events, such as disease outbreaks in livestock, oil price shocks, earthquakes, strikes, wars, etc., we create dummy variable multipliers for each series, and modify some of them at certain levels in accordance with development of events in the world.

7. Converting Real Value Trade to Transportation Volume

There are predictable relationships between the physical volume and the real value of each trade flow. After we obtain the forecasts of world trade in real commodity value, we use these relationships to convert the real commodity value to the physical volume of 77 commodities transported among 70 countries/regions, by transportation mode. We first convert the commodity flows to the value and physical volumes shipped by different transportation modes. Transportation mode represents the primary mode of transport used in the international shipment, usually for the greatest distance (or line haul) part of the complete origin-to-destination shipment. These major modes are air, overland/other (comprised mainly of truck, rail and pipeline) and maritime. For maritime trade, we further distinguish between liquid bulk, dry bulk, general cargo/neobulk and container trade. The volume of commodities carried by each mode reflects the historic shares carried by each mode, at a commodity-specific, and trade route-specific basis with adjustments made to maritime shares based on observed shifts in share between the types of maritime shipping. For container trades, the forecast tonnage volume is further translated into twenty-foot equivalent units (TEUs) through application of commodity-specific and trade route-specific stowage factors for twenty-foot and forty-foot containers and the mix of twenty-foot and forty-foot containers used on each trade route. (The full list of forecast trade concepts produced is shown in Table 3 of the Appendix.).

8. Forecast Range and Frequency

The history of our trade statistics starts from 1980 and extends to about a one-year lag from the current time. We forecast 20 or more years into the future, depending on clients' needs. Our forecasts are annual series, because the main historical trade data are reported as annual series. However, our supplementary trade data and exogenous macro economic data can be annual series, quarterly series, or monthly series. They are updated quarterly or monthly, so we update our trade forecasts every quarter.

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Table 1. Global Insight World Trade Service Forecast Commodity Categories

Count	ISIC	Description
1	1A	*Grain*
2	1B	Oil Seeds
3	1C	Vegetables, Fruits and Eggs – Requiring Refrigeration
4	1D	Vegetables and Fruits - non-Refrigerated
5	1E	Cork and Wood
6	1F	Natural Rubber
7	1G	Cotton
8	1H	Other Raw Textile Materials
9	1I	Other Agriculture
10	2A	Stone, Clay and Other Crude Minerals
11	2B	Crude Fertilizers
12	2C	Ores and Scrap
13	2D	Coal
14	2E	Crude Petroleum
15	2F	Natural Gas
16	2G	Scrap
17	311A	Meat/Dairy/Fish Requiring Refrigeration
18	311B	Other Meat/Dairy/Fish
19	311C	Sugar
20	311D	Animal Feed
21	311E	Animal and Vegetable Oils
22	311F	Other Food
23	313	Beverages
24	314	Tobacco
25	321	Textiles
26	322	Wearing Apparel
27	323	Leather and Products
28	324	Footwear
29	331	Wood Products
30	332	Furniture and Fixtures
31	341A	Waste Paper
32	341B	Pulp
33	341C	Paper and Paperboard and Products
34	342	Printing and Publishing
35	3511A	Organic Chemicals
36	3511B	Inorganic Chemicals
37	3512	Fertilizers and Pesticides
38	3513	Synthetic Resins
39	3521	Paints, Varnishes and Lacquers
40	3522	Drugs and Medicines
Count	**ISIC**	**Descriptions (continued)**
41	3523	Soap and Cleaning Preparations
42	3529	Chemical Products, nec.
43	353	Petroleum Refineries

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44	354A	Briquettes and Coke
45	354B	Residual Petroleum Products
46	355	Rubber Products
47	356	Plastic Products, nec.
48	361	Pottery, China etc.
49	362	Glass and Products
50	369	Non-Metallic Products, nec.
51	371	Iron and Steel
52	372	Non-Ferrous Metals
53	381	Metal Products
54	3821	Engines and Turbines
55	3822	Agricultural Machinery
56	3823	Metal and Wood Working Machinery
57	3824	Special Industrial Machinery
58	3825	Office and Computing Machinery
59	3829	Machinery and Equipment, nec.
60	3831	Electrical Industrial Machinery
61	3832A	Radio and TV
62	3832B	Semi-conductors, Electronic Tubes, etc.
63	3832C	Other Communications Equipment
64	3833	Electrical Appliances and Houseware
65	3839	Electrical Apparatus, nec.
66	3841	Shipbuilding and Repairing
67	3842	Railroad Equipment
68	3843A	Motor Vehicles
69	3843B	Parts of Motor Vehicles
70	3844	Motorcycles and Bicycles
71	3845	Aircraft
72	3849	Transport Equipment, nec.
73	3851	Professional Equipment
74	3852	Photographic and Optical Goods
75	3853	Watches and Clocks
76	390	Other Manufacturing, nes.
77	399	Goods not classified by kind

Note: nec – not elsewhere classified; nes – not elsewhere specified

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Table 2. Global Insight World Trade Service Forecasting Countries/Regions

54 Major Countries		Count	Country Name
Count	**Country Name**	41	*Pakistan*
1	United States	42	Venezuela
2	Canada	43	Brazil
3	Japan	44	Argentina
4	Germany	45	*Colombia*
5	France	46	Peru
6	United Kingdom	47	Chile
7	Italy	48	Mexico
8	Austria	49	Israel
9	Belgium	50	Saudi Arabia
10	Denmark	51	United Arab Emirates
11	Finland	52	Egypt
12	Greece	53	Kenya
13	Ireland	54	South Africa
14	Netherlands		
15	Norway		**16 Aggregate Regions**
16	Portugal	**Count**	**Region Name**
17	Spain	55	Other Europe
18	Sweden	56	Baltic States
19	Switzerland	57	CIS West
20	Turkey	58	CIS Southeast
21	Russia	59	Other Indian Subcontinent
22	Poland	60	Other East Coast of South America
23	Czech Republic	61	Other West Coast of South America
24	Slovak Republic	62	Caribbean Basin
25	Hungary	63	Other Central America
26	Romania	64	Other Persian Gulf
27	Bulgaria	65	Other Mediterranean Region
28	Australia	66	Other North Africa
29	New Zealand	67	Other East Africa
30	China	68	Western Africa
31	Taiwan	69	Other South Africa
32	Hong Kong	70	Other Region
33	South Korea		
34	Indonesia		
35	Philippines		
36	Singapore		
37	Malaysia		
38	Thailand		
39	Vietnam		
40	India		

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Table 3. Global Insight World Trade Service Forecast Concepts

Count	Concept
1	*Nominal Value*
2	Real Value
3	Airborne Nominal Value
4	Seaborne Nominal Value
5	Airborne Real Value
6	Seaborne Real Value
7	Airborne Metric Tons
8	Seaborne Metric Tons
9	Tanker Metric Tons
10	Dry Bulk Metric Tons
11	General Cargo/Neobulk Metric Tons
12	Container Metric Tons
13	Number of 20 foot Containers
14	Number of 40 foot Containers
15	Container Twenty-foot Equivalent Units (TEUs)
16	Over Land / Other Transportation Nominal Value
17	Over Land / Other Transportation Metric Tons
18	All Transportation Mode Metric Tons

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Appendix J. Economic Value of the Panama Canal, by Route and by Commodity

Ecnomic Value of the Panama Canal, by Commodity (Columns) and by Route (Rows)

Origin	Dest	Pan C01 Value	Pan C02 Value	Pan C03 Value	Pan C04 Value	Pan C05 Value	Pan C06 Value	Pan C07 Value	Pan C08 Value	Pan C09 Value	Pan Total Value
ARG	**CAW**	0	0	0	15	0	0	0	0	5	**20**
ARG	**PER**	100,951	0	5,083	19,337	0	0	0	0	2,837	**128,207**
AUS	**CNE**	16,093	0	251	59	5	672	0	0	1,467	**18,547**
AUS	**CRB**	127,182	0	65,967	519	0	0	0	0	94	**193,762**
AUS	**CAE**	525	0	12,798	0	0	0	0	0	0	**13,323**
AUS	**COE**	0	0	922	0	0	0	0	2,467	0	**3,389**
AUS	**EE**	95,267	0	3,882	680	0	0	0	0	0	**99,828**
AUS	**MXE**	0	0	0	0	0	0	0	0	0	**0**
AUS	**RUS**	158,714	0	34,406	0	328	130	0	0	236	**193,813**
AUS	**USE**	4,095,567	0	113,623	12,300	249	0	0	0	34	**4,221,773**
AUS	**VEN**	0	0	0	0	0	0	0	0	0	**0**
AUS	**WEN**	158,189	0	89,373	3,472	9,947	6,294	0	12,657	32,596	**312,529**
BRA	**CNW**	0	0	89	6	0	7	0	0	544	**646**
BRA	**CAW**	19	0	0	0	0	0	0	0	0	**19**
BRA	**COW**	0	0	0	0	0	0	0	0	0	**0**
BRA	**EB**	0	54	0	11	112	0	0	0	0	**177**
BRA	**MXW**	0	0	0	0	0	0	0	0	0	**0**
BRA	**USW**	0	0	0	10,866	0	0	7	0	3,206	**14,079**
CNE	**AUS**	5,483	0	146	1,469	1,334	0	0	0	195	**8,627**
CNE	**CNW**	0	0	0	0	0	0	0	0	0	**0**
CNE	**CAW**	0	0	0	0	0	0	0	0	0	**0**
CNE	**CHL**	9,633	0	0	4	29,410	0	0	0	0	**39,047**
CNE	**CH**	0	0	0	0	0	0	0	0	0	**0**
CNE	**COW**	0	0	0	0	0	0	0	0	0	**0**
CNE	**EB**	449	0	0	0	20,002	0	0	0	0	**20,451**
CNE	**JPN**	108,043	37	7,731	73,252	37,175	0	0	0	295	**226,533**
CNE	**MXW**	0	0	0	0	0	0	0	0	0	**0**
CNE	**NZL**	6,299	0	0	887	87	0	0	0	0	**7,273**
CNE	**PER**	28,163	28,781	0	0	21,663	0	0	0	0	**78,607**
CNE	**SEA**	13,274	1,847	422	4,998	11,854	0	0	13,548	29	**45,971**
CNE	**USW**	0	0	0	0	0	0	0	0	0	**0**
CNW	**BRA**	666	176	1,491	34	5,053	0	0	0	0	**7,419**
CNW	**CNE**	0	0	0	0	0	0	0	0	0	**0**
CNW	**CRB**	0	0	0	0	0	0	0	0	0	**0**
CNW	**CAE**	21,998	0	362	0	83,343	0	0	262	0	**105,965**
CNW	**COE**	0	0	0	0	0	0	0	0	0	**0**
CNW	**CIS**	0	0	0	0	0	0	0	0	0	**0**
CNW	**EE**	6,070	561	0	1,227	0	0	0	0	0	**7,858**
CNW	**ISR**	0	0	0	0	0	0	0	0	0	**0**
CNW	**MXE**	0	0	0	0	0	0	0	0	0	**0**

CNW	**NAF**	0	0	0	0	0	0	0	0	0	**0**
CNW	**OMED**	0	0	0	0	0	0	0	0	0	**0**
CNW	**RUS**	0	0	0	0	0	0	0	0	0	**0**
CNW	**SAF**	0	0	0	0	0	0	0	0	0	**0**
Origin	**Dest**	**Pan C01**	**Pan C02**	**Pan C03**	**Pan C04**	**Pan C05**	**Pan C06**	**Pan C07**	**Pan C08**	**Pan C09**	**Pan Total**
		Value	**Value**	**Value**	**Value**	**Value**	**Value**	**Value**	**Value**	**Value**	**Value**
CNW	**USE**	0	0	0	0	0	0	0	0	0	**0**
CNW	**VEN**	0	0	0	0	0	0	0	0	0	**0**
CNW	**WAF**	0	0	0	0	0	0	0	0	0	**0**
CNW	**WEN**	2,327	72	1,730	11,096	5,189	0	0	1,741	129	**22,284**
CNW	**SWE**	510	0	9	601	86	0	0	0	0	**1,207**
CRB	**AUS**	0	0	0	1,201	0	0	0	0	0	**1,201**
CRB	**CNW**	0	0	0	0	0	0	0	0	0	**0**
CRB	**CAW**	0	0	223	298	2	0	0	0	0	**522**
CRB	**CHL**	0	0	0	0	0	0	0	0	0	**0**
CRB	**CH**	0	0	0	1,948	0	0	0	0	0	**1,948**
CRB	**COW**	0	0	0	0	0	0	0	0	0	**0**
CRB	**EB**	0	0	0	0	0	0	0	0	0	**0**
CRB	**JPN**	2,977	0	0	106,802	0	10,786	15,896	0	0	**136,460**
CRB	**MXW**	0	0	0	0	0	0	0	0	0	**0**
CRB	**NZL**	0	0	0	0	0	0	0	0	0	**0**
CRB	**PER**	0	0	0	0	0	0	0	0	0	**0**
CRB	**SEA**	0	0	0	0	0	0	0	0	0	**0**
CRB	**USW**	0	0	0	2,321	0	0	16,042	0	0	**18,363**
CAE	**AUS**	0	0	0	0	0	0	0	0	0	**0**
CAE	**CNW**	0	0	0	4,365	3,978	1,910	2,013,395	0	473,973	**2,497,621**
CAE	**CAW**	0	0	0	0	0	0	0	0	0	**0**
CAE	**CHL**	0	0	0	0	0	0	0	0	0	**0**
CAE	**CH**	5,118	1,161	0	12,529	0	0	1,025,940	0	3,269	**1,048,017**
CAE	**COW**	0	0	0	0	0	0	0	0	0	**0**
CAE	**EB**	10,600	0	0	5,966	0	0	0	0	0	**16,566**
CAE	**JPN**	15,411	0	0	786,647	14,912	0	509,706	0	0	**1,326,675**
CAE	**MXW**	1,930	0	0	394	459	0	0	0	905	**3,688**
CAE	**NZL**	0	0	0	0	0	0	29,397	0	0	**29,397**
CAE	**PER**	0	0	0	0	0	0	0	0	0	**0**
CAE	**SEA**	0	0	0	8,801	1,859	0	0	0	0	**10,661**
CAE	**USW**	1,385	0	292	178,250	332,010	8,564	6,788,359	0	1,889,611	**9,198,471**
CAW	**ARG**	0	0	0	0	0	0	0	0	0	**0**
CAW	**BRA**	0	0	0	0	0	0	0	0	0	**0**
CAW	**CNE**	0	0	0	0	0	0	0	0	0	**0**
CAW	**CRB**	1,128	155	104	856	1,330	121	117,945	0	1,324	**122,964**
CAW	**CAE**	0	0	0	0	0	0	0	0	0	**0**
CAW	**COE**	4,809	0	0	676	0	0	0	0	0	**5,486**
CAW	**CIS**	0	0	0	0	0	0	57,855	0	83	**57,938**
CAW	**OEA**	0	0	0	0	0	0	0	0	0	**0**
CAW	**EE**	0	0	0	0	0	551	202,153	0	3,075	**205,779**
CAW	**IND**	0	0	0	0	0	0	0	0	0	**0**
CAW	**ISR**	2,838	0	0	45	0	0	0	0	0	**2,882**

CAW	**MXE**	107	0	0	22	25	0	0	0	50	**203**
CAW	**NAF**	0	0	0	74	0	0	7,355	0	0	**7,429**
CAW	**OEL**	0	0	0	5	0	0	0	0	0	**5**
CAW	**OMED**	0	0	0	869	0	0	38,991	0	16	**39,876**
Origin	**Dest**	**Pan C01**	**Pan C02**	**Pan C03**	**Pan C04**	**Pan C05**	**Pan C06**	**Pan C07**	**Pan C08**	**Pan C09**	**Pan Total**
		Value	**Value**	**Value**	**Value**	**Value**	**Value**	**Value**	**Value**	**Value**	**Value**
CAW	**MIDE**	0	0	0	20	0	510	2,679	0	0	**3,209**
CAW	**RUS**	0	0	0	0	0	0	84,710	0	1,684	**86,394**
CAW	**SAF**	0	0	0	431	0	0	0	0	0	**431**
CAW	**USE**	42,265	0	1,375	53,892	67,271	71,512	3,711,309	0	1,604,389	**5,552,013**
CAW	**VEN**	0	0	0	410	0	0	0	0	77	**487**
CAW	**WAF**	0	0	0	0	0	0	0	0	0	**0**
CAW	**WEN**	4	0	0	11,029	22,720	21,223	1,744,508	86	226,245	**2,025,816**
CAW	**SWE**	0	0	0	54,330	119	0	329,853	0	31,040	**415,341**
CHL	**CNE**	0	0	0	25,677	16,638	1,662	311	81,338	524,450	**650,075**
CHL	**CRB**	0	4,354	5,346	219,396	111,195	0	0	21,926	22,312	**384,529**
CHL	**CAE**	4,785	0	4,090	12,258	292,884	0	0	165,952	147,318	**627,287**
CHL	**COE**	9,544	611	0	40,134	111,008	0	0	891,366	370,275	**1,422,939**
CHL	**CIS**	0	0	0	137	0	0	0	0	203	**339**
CHL	**EE**	0	0	0	3,486	2,674	0	0	0	2,485	**8,645**
CHL	**ISR**	0	0	0	0	0	0	0	0	0	**0**
CHL	**MXE**	0	0	0	0	0	0	0	0	0	**0**
CHL	**NAF**	0	0	0	0	0	0	0	0	0	**0**
CHL	**OEL**	475	0	5,924	14,709	38,327	0	0	50,398	105,610	**215,443**
CHL	**OMED**	0	0	0	0	116	0	0	9,139	1,506	**10,761**
CHL	**RUS**	0	0	0	42,307	0	0	0	112,385	30,101	**184,793**
CHL	**USE**	1,930	0	52	555,730	23,119	66,712	0	689,565	6,678,606	**8,015,714**
CHL	**VEN**	3,899	1,529	164	31,305	129,308	0	0	339,536	183,656	**689,398**
CHL	**WEN**	8,389	17,359	139	184,179	27,976	18,129	168	898,629	1,371,624	**2,526,592**
CHL	**SWE**	2,638	472	0	96,166	17,761	0	0	156,393	222,717	**496,148**
CH	**CNE**	0	0	0	0	0	0	0	0	0	**0**
CH	**CRB**	0	3,573	0	1,110	267	0	0	0	0	**4,951**
CH	**CAE**	0	0	0	21,903	33,609	0	0	0	519	**56,031**
CH	**COE**	0	0	0	0	1,418	0	0	0	82	**1,500**
CH	**MXE**	0	0	0	0	0	0	0	0	0	**0**
CH	**USE**	21,468	0	1,754	1,906,032	109,043	0	0	1,196	48,261	**2,087,755**
CH	**VEN**	0	0	0	0	1,373	0	0	0	1,512	**2,885**
CH	**WAF**	0	0	0	0	0	0	0	0	0	**0**
COE	**AUS**	0	0	0	0	0	0	0	0	0	**0**
COE	**CNW**	0	0	0	0	0	0	0	0	0	**0**
COE	**CAW**	0	0	0	7,019	0	0	0	0	0	**7,019**
COE	**CHL**	0	0	0	587	43	0	0	0	0	**630**
COE	**CH**	0	0	0	1,284	0	0	0	0	0	**1,284**
COE	**COW**	0	0	0	0	0	0	0	0	0	**0**
COE	**EB**	298	0	23,577	26,561	729	103,866	0	0	12,590	**167,621**
COE	**JPN**	0	0	0	26,543	0	0	0	0	0	**26,543**
COE	**MXW**	0	0	0	0	0	0	0	0	0	**0**
COE	**NZL**	0	0	0	0	0	0	0	0	0	**0**

COE	**PER**	0	0	0	402	13	0	0	0	0	**414**
COE	**USW**	0	0	0	9,079	5,741	0	710	0	193	**15,724**
COW	**BRA**	0	0	0	0	0	0	0	0	0	**0**
COW	**CNE**	0	0	0	0	0	0	0	0	0	**0**
Origin	**Dest**	**Pan C01 Value**	**Pan C02 Value**	**Pan C03 Value**	**Pan C04 Value**	**Pan C05 Value**	**Pan C06 Value**	**Pan C07 Value**	**Pan C08 Value**	**Pan C09 Value**	**Pan Total Value**
COW	**CRB**	0	0	0	0	0	0	0	0	0	**0**
COW	**CAE**	0	0	0	0	0	0	0	0	0	**0**
COW	**COE**	0	0	0	0	0	0	0	0	0	**0**
COW	**CIS**	0	0	0	0	0	0	0	0	0	**0**
COW	**OEA**	0	0	0	0	0	0	0	0	0	**0**
COW	**EE**	0	0	0	0	0	0	0	0	0	**0**
COW	**IND**	0	0	0	0	0	0	0	0	0	**0**
COW	**ISR**	0	0	0	0	0	0	0	0	0	**0**
COW	**MXE**	0	0	0	0	0	0	0	0	0	**0**
COW	**NAF**	0	0	0	0	0	0	0	0	0	**0**
COW	**OMED**	0	0	0	0	0	0	0	0	0	**0**
COW	**MIDE**	0	0	0	0	0	0	0	0	0	**0**
COW	**RUS**	0	0	0	0	0	0	0	0	0	**0**
COW	**SAF**	0	0	0	0	0	0	0	0	0	**0**
COW	**USE**	0	0	0	0	0	0	0	0	0	**0**
COW	**VEN**	0	0	0	0	0	0	0	0	0	**0**
COW	**WAF**	0	0	0	0	0	0	0	0	0	**0**
COW	**WEN**	0	0	0	0	0	0	0	0	0	**0**
COW	**SWE**	0	0	0	0	0	0	0	0	0	**0**
CIS	**CNW**	0	0	0	0	0	0	0	0	0	**0**
CIS	**CAW**	0	0	0	0	0	0	0	0	0	**0**
CIS	**CHL**	0	0	0	0	0	0	0	0	0	**0**
CIS	**COW**	0	0	0	0	0	0	0	0	0	**0**
CIS	**EB**	0	0	0	0	0	0	0	0	0	**0**
CIS	**MXW**	0	0	0	0	0	0	0	0	0	**0**
CIS	**PER**	0	0	0	0	0	0	0	0	0	**0**
CIS	**USW**	0	0	0	0	0	0	0	0	0	**0**
OEA	**CAW**	0	0	0	0	0	0	0	0	0	**0**
OEA	**COW**	0	0	0	0	0	0	0	0	0	**0**
OEA	**MXW**	0	0	0	0	0	0	0	0	0	**0**
EE	**AUS**	0	0	3,561	54	5,729	0	0	0	167	**9,511**
EE	**CNW**	0	0	45	1,168	585	0	0	0	0	**1,798**
EE	**CAW**	0	0	308	70	188	0	0	0	0	**566**
EE	**CHL**	0	0	0	0	582	0	0	0	0	**582**
EE	**COW**	0	0	0	0	0	0	0	0	0	**0**
EE	**EB**	0	0	0	0	0	0	0	0	0	**0**
EE	**JPN**	97	558	6,152	5,681	608	0	0	0	0	**13,096**
EE	**MXW**	0	0	0	0	0	0	0	0	0	**0**
EE	**NZL**	0	0	0	0	7,297	0	0	0	0	**7,297**
EE	**PER**	0	0	0	0	0	0	0	0	0	**0**
EE	**USW**	0	0	0	0	0	0	0	0	0	**0**
EB	**BRA**	0	0	0	915	0	0	7	0	0	**922**

EB	**CNE**	0	0	0	61,815	1,130	1,287	3,142,284	0	19,714	**3,226,230**
EB	**CRB**	0	0	0	17,010	0	0	0	0	0	**17,010**
EB	**CAE**	0	0	0	28,008	0	0	0	0	0	**28,008**
EB	**COE**	0	5,203	450	239,412	259	1,328	97,391	0	8,025	**352,069**
Origin	**Dest**	**Pan C01 Value**	**Pan C02 Value**	**Pan C03 Value**	**Pan C04 Value**	**Pan C05 Value**	**Pan C06 Value**	**Pan C07 Value**	**Pan C08 Value**	**Pan C09 Value**	**Pan Total Value**
EB	**CIS**	0	0	0	0	0	0	0	0	0	**0**
EB	**EE**	0	0	0	333	755	0	3,660,505	0	0	**3,661,593**
EB	**IND**	0	0	0	0	0	0	0	0	0	**0**
EB	**ISR**	0	0	0	0	0	0	0	0	0	**0**
EB	**MXE**	0	0	0	0	0	0	0	0	0	**0**
EB	**NAF**	0	0	0	0	0	0	201,021	0	0	**201,021**
EB	**OEL**	0	0	0	7,081	0	0	215,163	0	0	**222,244**
EB	**OMED**	0	0	0	862	0	1,764	3,259,201	0	285	**3,262,111**
EB	**MIDE**	0	0	0	0	0	0	1,706,846	0	0	**1,706,846**
EB	**RUS**	0	0	0	0	0	937	7,070,576	0	18,061	**7,089,574**
EB	**SAF**	0	0	0	0	0	0	186	0	0	**186**
EB	**USE**	0	0	0	1,357,234	258,919	28,395	10,138,543	0	437,333	**12,220,425**
EB	**VEN**	0	0	0	54,286	1,921	0	0	0	0	**56,207**
EB	**WAF**	0	0	0	0	0	0	0	0	0	**0**
EB	**WEN**	0	0	0	671,649	284,253	1,233	10,906,926	0	44,617	**11,908,679**
EB	**SWE**	0	0	0	1,036,541	1,438	0	3,503,451	0	48,443	**4,589,873**
IND	**CAW**	0	0	0	0	0	0	0	0	0	**0**
IND	**COW**	0	0	0	0	0	0	0	0	0	**0**
IND	**EB**	0	0	0	0	0	0	0	0	0	**0**
ISR	**CNW**	0	0	0	0	0	0	0	0	0	**0**
ISR	**CAW**	0	0	0	3	0	0	0	0	0	**3**
ISR	**CHL**	0	0	0	0	0	0	0	0	0	**0**
ISR	**COW**	0	0	0	0	0	0	0	0	0	**0**
ISR	**EB**	0	0	0	0	0	0	0	0	0	**0**
ISR	**MXW**	0	0	0	0	0	0	0	0	0	**0**
ISR	**PER**	0	0	0	0	0	0	0	0	0	**0**
ISR	**USW**	0	0	0	477	19,737	0	0	0	198	**20,412**
JPN	**CNE**	10	0	0	1,126	424	1,325	0	0	3	**2,888**
JPN	**CRB**	0	0	0	28,048	0	0	0	0	0	**28,048**
JPN	**CAE**	0	0	0	15,324	0	0	0	0	0	**15,324**
JPN	**COE**	0	0	0	0	0	0	0	0	0	**0**
JPN	**EE**	0	0	0	0	0	0	0	0	0	**0**
JPN	**MXE**	0	0	0	0	0	0	0	0	0	**0**
JPN	**RUS**	0	0	0	0	0	0	0	0	0	**0**
JPN	**USE**	0	0	158	84,760	1,558	0	0	0	2,676	**89,152**
JPN	**VEN**	0	0	0	2,432	0	0	0	0	0	**2,432**
MXE	**AUS**	0	0	0	0	0	0	0	0	0	**0**
MXE	**CNW**	0	0	0	0	0	0	0	0	0	**0**
MXE	**CAW**	0	38	225	261	1,006	168	0	6	7,538	**9,241**
MXE	**CHL**	0	0	0	0	0	0	0	0	0	**0**
MXE	**CH**	0	0	0	0	0	0	0	0	0	**0**

MXE	**COW**	0	0	0	0	0	0	0	0	0	**0**
MXE	**EB**	0	0	0	0	0	0	0	0	0	**0**
MXE	**JPN**	0	0	0	0	0	0	0	0	0	**0**
MXE	**MXW**	0	0	0	0	0	0	0	0	0	**0**
Origin	**Dest**	**Pan C01 Value**	**Pan C02 Value**	**Pan C03 Value**	**Pan C04 Value**	**Pan C05 Value**	**Pan C06 Value**	**Pan C07 Value**	**Pan C08 Value**	**Pan C09 Value**	**Pan Total Value**
MXE	**NZL**	0	0	0	0	0	0	0	0	0	**0**
MXE	**PER**	0	0	0	0	0	0	0	0	0	**0**
MXE	**SEA**	0	0	0	0	0	0	0	0	0	**0**
MXE	**USW**	0	0	0	0	0	0	0	0	0	**0**
MXW	**BRA**	0	0	0	0	0	0	0	0	0	**0**
MXW	**CNE**	0	0	0	0	0	0	0	0	0	**0**
MXW	**CRB**	0	0	0	0	0	0	0	0	0	**0**
MXW	**CAE**	0	690	4,075	4,727	18,263	3,042	0	106	136,832	**167,736**
MXW	**COE**	0	0	0	0	0	0	0	0	0	**0**
MXW	**CIS**	0	0	0	0	0	0	0	0	0	**0**
MXW	**OEA**	0	0	0	0	0	0	0	0	0	**0**
MXW	**EE**	0	0	0	0	0	0	0	0	0	**0**
MXW	**ISR**	0	0	0	0	0	0	0	0	0	**0**
MXW	**MXE**	0	0	0	0	0	0	0	0	0	**0**
MXW	**NAF**	0	0	0	0	0	0	0	0	0	**0**
MXW	**OMED**	0	0	0	0	0	0	0	0	0	**0**
MXW	**MIDE**	0	0	0	0	0	0	0	0	0	**0**
MXW	**RUS**	0	0	0	0	0	0	0	0	0	**0**
MXW	**SAF**	0	0	0	0	0	0	0	0	0	**0**
MXW	**USE**	0	0	0	0	0	0	0	0	0	**0**
MXW	**VEN**	0	0	0	0	0	0	0	0	0	**0**
MXW	**WAF**	0	0	0	0	0	0	0	0	0	**0**
MXW	**WEN**	0	0	0	0	0	0	0	0	0	**0**
MXW	**SWE**	0	0	0	0	0	0	0	0	0	**0**
NZL	**CNE**	14,736	0	1,024	641	0	0	0	2,871	2,638	**21,909**
NZL	**CRB**	110,467	0	156,345	0	0	0	0	0	0	**266,812**
NZL	**CAE**	355	0	112,849	0	0	0	0	0	0	**113,204**
NZL	**COE**	0	0	2,872	0	0	0	0	0	1,873	**4,745**
NZL	**EE**	33,988	0	2,677	13,310	0	0	0	0	0	**49,974**
NZL	**MXE**	0	0	0	0	0	0	0	0	0	**0**
NZL	**NAF**	0	0	0	0	0	0	0	0	0	**0**
NZL	**OMED**	0	0	0	0	0	0	0	0	0	**0**
NZL	**RUS**	50,123	0	292,661	19,045	0	0	0	42,819	4,367	**409,015**
NZL	**USE**	1,109,870	0	737,156	219,669	764	0	0	415,621	137,037	**2,620,118**
NZL	**WEN**	627,522	0	282,144	77,227	4,408	99	0	829,378	694,938	**2,515,716**
NZL	**SWE**	9,467	0	909	6,933	0	0	0	667	9,356	**27,332**
NAF	**CNW**	0	0	0	0	0	0	0	0	0	**0**
NAF	**CAW**	0	0	0	374	0	0	0	0	0	**374**
NAF	**CHL**	0	0	0	0	0	0	0	0	0	**0**
NAF	**COW**	0	0	0	0	0	0	0	0	0	**0**
NAF	**EB**	0	0	0	0	0	0	0	0	0	**0**
NAF	**MXW**	0	0	0	0	0	0	0	0	0	**0**

NAF	**NZL**	0	0	0	0	0	0	0	0	0	**0**
NAF	**PER**	0	0	0	0	0	0	0	0	0	**0**
NAF	**USW**	0	0	293	9,710	5,555	0	0	0	290	**15,848**
OEL	**CAW**	0	0	0	15	0	1	0	0	0	**15**
Origin	**Dest**	**Pan C01**	**Pan C02**	**Pan C03**	**Pan C04**	**Pan C05**	**Pan C06**	**Pan C07**	**Pan C08**	**Pan C09**	**Pan Total**
		Value	**Value**	**Value**	**Value**	**Value**	**Value**	**Value**	**Value**	**Value**	**Value**
OEL	**CHL**	814,880	0	221	6,593	0	0	0	0	0	**821,693**
OEL	**EB**	201	0	53	547	0	0	0	0	0	**800**
OMED	**CNW**	0	0	0	0	0	0	0	0	0	**0**
OMED	**CAW**	0	0	0	0	0	0	0	0	0	**0**
OMED	**CHL**	0	0	0	0	0	0	0	0	0	**0**
OMED	**COW**	0	0	0	0	0	0	0	0	0	**0**
OMED	**EB**	0	0	0	0	1,740	0	0	0	0	**1,740**
OMED	**MXW**	0	0	0	0	0	0	0	0	0	**0**
OMED	**NZL**	0	0	0	0	0	0	0	0	0	**0**
OMED	**PER**	0	0	0	0	0	0	0	0	507	**507**
OMED	**USW**	35	0	1,715	0	2,312	706	0	0	29,196	**33,965**
MIDE	**CAW**	0	0	0	0	0	0	0	0	0	**0**
MIDE	**COW**	0	0	0	0	0	0	0	0	0	**0**
MIDE	**EB**	0	0	0	0	0	0	0	0	0	**0**
MIDE	**MXW**	0	0	0	0	0	0	0	0	0	**0**
PER	**ARG**	0	0	0	218	1,338	0	0	0	963	**2,518**
PER	**CNE**	0	0	0	3,654	3,421	0	0	0	25,523	**32,598**
PER	**CRB**	0	0	0	18,441	1,137	0	0	0	0	**19,578**
PER	**CAE**	0	0	0	62,609	961	0	0	0	0	**63,570**
PER	**COE**	0	0	0	32,450	526	0	0	0	0	**32,976**
PER	**CIS**	0	0	0	0	0	0	0	0	0	**0**
PER	**EE**	0	0	0	13,221	0	0	0	0	0	**13,221**
PER	**ISR**	0	0	0	1,124	0	0	0	0	0	**1,124**
PER	**MXE**	0	0	0	0	0	0	0	0	0	**0**
PER	**NAF**	0	0	0	0	0	0	0	0	0	**0**
PER	**OMED**	0	0	0	546	401	0	0	0	0	**947**
PER	**RUS**	0	0	0	16,627	0	0	0	0	0	**16,627**
PER	**USE**	0	89	233	121,361	88,175	0	396,326	0	453,245	**1,059,428**
PER	**VEN**	0	0	0	8,308	3,191	0	0	0	0	**11,499**
PER	**WAF**	0	0	0	247	0	0	0	0	0	**247**
PER	**WEN**	0	0	0	333,291	316,707	441	32	114	78,064	**728,649**
PER	**SWE**	266	0	0	36,893	325,891	0	113	0	3,458	**366,622**
RUS	**AUS**	0	0	0	32	0	0	0	0	0	**32**
RUS	**CNW**	0	0	0	0	0	0	0	0	0	**0**
RUS	**CAW**	0	0	0	355	0	0	0	0	0	**355**
RUS	**CHL**	0	0	0	0	0	0	0	0	0	**0**
RUS	**COW**	0	0	0	0	0	0	0	0	0	**0**
RUS	**EB**	0	0	0	0	0	0	0	0	0	**0**
RUS	**JPN**	0	0	0	0	0	0	0	0	0	**0**
RUS	**MXW**	0	0	0	0	0	0	0	0	0	**0**
RUS	**NZL**	0	0	0	0	0	0	0	0	0	**0**
RUS	**PER**	0	0	0	0	0	0	0	0	0	**0**

RUS	**SEA**	0	0	0	0	0	0	0	0	0	**0**
RUS	**USW**	0	0	0	368,764	0	0	0	0	0	**368,764**
SEA	**CNE**	252	0	1	15,853	3,214	2,372	60	54	2,272	**24,078**
SEA	**CRB**	1,162	0	2,775	197,397	2,812	0	0	0	0	**204,147**
Origin	**Dest**	**Pan C01**	**Pan C02**	**Pan C03**	**Pan C04**	**Pan C05**	**Pan C06**	**Pan C07**	**Pan C08**	**Pan C09**	**Pan Total**
		Value	**Value**	**Value**	**Value**	**Value**	**Value**	**Value**	**Value**	**Value**	**Value**
SEA	**CAE**	0	0	0	81,198	66	0	0	0	0	**81,264**
SEA	**MXE**	0	0	0	0	0	0	0	0	0	**0**
SEA	**RUS**	0	0	0	0	0	0	0	0	0	**0**
SEA	**USE**	5,687	0	12,903	3,439,779	12,892	18	16,278	0	141,737	**3,629,294**
SEA	**VEN**	0	0	0	1,937	0	0	0	0	0	**1,937**
SAF	**CNW**	0	0	0	0	0	0	0	0	0	**0**
SAF	**CAW**	0	0	0	205	0	0	0	0	0	**205**
SAF	**COW**	0	0	0	0	0	0	0	0	0	**0**
SAF	**EB**	0	0	0	0	0	0	0	0	0	**0**
SAF	**MXW**	0	0	0	0	0	0	0	0	0	**0**
USE	**AUS**	12,986	2,355	1,290	6,301	3,949	234	0	0	0	**27,114**
USE	**CNW**	0	0	0	0	0	0	0	0	0	**0**
USE	**CAW**	23,220	86,699	6,423	1,268	5,627	2,676	0	5,678	2,365	**133,957**
USE	**CHL**	785	9,960	9,342	204	306	1,287	0	0	1,151	**23,035**
USE	**CH**	203,565	4,728,822	522	54,974	1,028	181,320	0	335	4,648	**5,175,214**
USE	**COW**	0	0	0	0	0	0	0	0	0	**0**
USE	**EB**	10,693	16,513	4,085	1,144	4,512	3,028	0	2,378	1,430	**43,782**
USE	**JPN**	195,359	382,646	15,222	14,521	5,065	4,160,192	0	0	11,854	**4,784,857**
USE	**MXW**	0	0	0	0	0	0	0	0	0	**0**
USE	**NZL**	8,215	2,763	3,778	482	0	1,699	0	0	359	**17,296**
USE	**PER**	26,835	20,338	17,042	792	4,993	0	0	0	0	**70,001**
USE	**SEA**	228,254	1,198,144	16,036	160,014	0	156,917	0	0	1,876	**1,761,240**
USE	**USW**	0	0	0	0	0	0	0	0	0	**0**
USW	**BRA**	0	0	0	4,070	0	0	0	75	553	**4,698**
USW	**CNE**	0	0	0	0	0	0	0	0	0	**0**
USW	**CRB**	904	0	10,382	9,271	20,282	0	0	196,563	125,199	**362,601**
USW	**CAE**	2,115	3,603	2,248	29,139	279,274	2,152	0	499,708	606,657	**1,424,896**
USW	**COE**	836	0	0	1,323	2,916	3,904	0	111,188	163,652	**283,818**
USW	**CIS**	0	0	0	0	0	0	0	0	0	**0**
USW	**EE**	0	0	0	0	0	0	0	0	0	**0**
USW	**ISR**	0	0	0	12,780	8,422	1,722	0	21,265	82,873	**127,062**
USW	**MXE**	0	0	0	0	0	0	0	0	0	**0**
USW	**NAF**	0	257	0	0	0	0	0	72,232	7,847	**80,336**
USW	**OMED**	0	856	16	22,507	454	0	0	2,842	2,125	**28,800**
USW	**RUS**	167,042	723,380	3,589	40,004	17,587	962	0	39,019	16,908	**1,008,491**
USW	**USE**	0	0	0	0	0	0	0	0	0	**0**
USW	**VEN**	185	341	0	71,898	14,368	0	0	84,160	122,044	**292,996**
USW	**WAF**	0	674	0	834	1,040	0	0	698	60	**3,306**
USW	**WEN**	10,948	21,668	2,199	3,339,933	40,783	25,593	0	297,898	1,299,783	**5,038,806**
USW	**SWE**	16	0	84	586,867	3,776	0	0	16,447	132,192	**739,383**
VEN	**AUS**	0	0	0	0	0	0	0	0	0	**0**
VEN	**CNW**	0	0	0	0	0	0	0	0	0	**0**

VEN	**CAW**	0	0	292	3,495	0	0	0	0	0	**3,786**
VEN	**CHL**	0	0	0	1,163	0	0	0	0	276	**1,439**
VEN	**CH**	0	0	0	0	0	0	0	0	0	**0**
VEN	**COW**	0	0	0	0	0	0	0	0	0	**0**
Origin	**Dest**	**Pan C01**	**Pan C02**	**Pan C03**	**Pan C04**	**Pan C05**	**Pan C06**	**Pan C07**	**Pan C08**	**Pan C09**	**Pan Total**
		Value	**Value**	**Value**	**Value**	**Value**	**Value**	**Value**	**Value**	**Value**	**Value**
VEN	**EB**	0	0	9,103	0	0	0	0	0	0	**9,103**
VEN	**JPN**	0	0	0	8,271	0	0	0	0	0	**8,271**
VEN	**MXW**	0	0	0	0	0	0	0	0	0	**0**
VEN	**PER**	0	0	0	6,523	0	0	0	0	0	**6,523**
VEN	**SEA**	0	0	0	11,605	0	0	0	0	0	**11,605**
VEN	**USW**	0	0	0	69,212	0	0	0	0	0	**69,212**
WAF	**CNW**	0	0	0	0	0	0	0	0	0	**0**
WAF	**CAW**	0	0	0	0	0	0	0	0	0	**0**
WAF	**CH**	0	0	0	0	0	0	0	0	0	**0**
WAF	**COW**	0	0	0	0	0	0	0	0	0	**0**
WAF	**EB**	0	0	0	0	0	0	0	0	0	**0**
WAF	**MXW**	0	0	0	0	0	0	0	0	0	**0**
WAF	**PER**	0	0	0	0	0	0	0	0	0	**0**
WAF	**USW**	0	0	0	196	0	0	0	0	0	**196**
WEN	**AUS**	0	0	20,061	20,602	15,771	0	0	0	939	**57,373**
WEN	**CNW**	758	0	2,180	6,397	2,930	0	0	2	335	**12,601**
WEN	**CAW**	145	0	2,745	1,034	1,382	0	0	0	0	**5,306**
WEN	**CHL**	116	0	5,188	159	31,360	0	0	93	0	**36,916**
WEN	**COW**	0	0	0	0	0	0	0	0	0	**0**
WEN	**EB**	375	0	2,704	567	5,667	0	0	0	0	**9,313**
WEN	**MXW**	0	0	0	0	0	0	0	0	0	**0**
WEN	**NZL**	0	0	942	205	599	0	0	0	40	**1,786**
WEN	**PER**	0	0	7,120	3,992	22,477	0	0	0	0	**33,588**
WEN	**USW**	210,365	358	207,090	99,836	68,440	0	204	0	1,672	**587,964**
SWE	**CNW**	7	0	588	464	12,328	2,508	0	0	2,354	**18,249**
SWE	**CAW**	364	41	728	941	2,294	0	0	0	0	**4,366**
SWE	**CHL**	0	0	1,397	4,955	3,975	0	0	0	0	**10,327**
SWE	**COW**	0	0	0	0	0	0	0	0	0	**0**
SWE	**EB**	0	0	530	40,915	4,889	0	0	0	0	**46,333**
SWE	**MXW**	0	0	0	0	0	0	0	0	0	**0**
SWE	**NZL**	0	0	25	4	1,314	0	0	0	109	**1,452**
SWE	**PER**	0	0	181	497	1,742	0	0	0	0	**2,419**
SWE	**USW**	0	0	20,853	15,137	93,188	3,210	0	0	457	**132,846**

Appendix K. Summarized Model Output Tables

Transits

	1995	2000	2005	2010	2015	2020	2025
TOTAL	**2,578**	**2,004**	**2,204**	**2,202**	**2,355**	**2,518**	**2,745**

Beam	1995	2000	2005	2010	2015	2020	2025
<=24.3	2407	1894	2,080	2,076	2,218	2,368	2,582
<25.9	171	110	124	126	137	150	163
<27.7	0	0	0	0	0	0	0
<29	0	0	0	0	0	0	0
<30.4	0	0	0	0	0	0	0
<=32.3	0	0	0	0	0	0	0
<33.5	0	0	0	0	0	0	0
<36.6	0	0	0	0	0	0	0
<39.6	0	0	0	0	0	0	0
<42.7	0	0	0	0	0	0	0
<45.7	0	0	0	0	0	0	0
<48.8	0	0	0	0	0	0	0
<51.8	0	0	0	0	0	0	0
<=54.9	0	0	0	0	0	0	0
>54.9	0	0	0	0	0	0	0

DWT	1995	2000	2005	2010	2015	2020	2025
<10000	1587	1011	951	889	872	703	709
<15000	941	988	1,230	1,295	1,474	1,814	2,035
<20000	50	5	23	18	9	1	1
<25000	0	0	0	0	0	0	0
<30000	0	0	0	0	0	0	0
<40000	0	0	0	0	0	0	0
<50000	0	0	0	0	0	0	0
<60000	0	0	0	0	0	0	0
<70000	0	0	0	0	0	0	0
<80000	0	0	0	0	0	0	0
<90000	0	0	0	0	0	0	0
<100000	0	0	0	0	0	0	0
<110000	0	0	0	0	0	0	0
<120000	0	0	0	0	0	0	0
<150000	0	0	0	0	0	0	0
<200000	0	0	0	0	0	0	0
>200000	0	0	0	0	0	0	0

PcUms	1995	2000	2005	2010	2015	2020	2025
<10000	2233	1760	1,969	1,955	2,061	2,166	2,352
<15000	345	244	235	247	293	352	393
<20000	0	0	0	0	0	0	0
<25000	0	0	0	0	0	0	0
<30000	0	0	0	0	0	0	0
<40000	0	0	0	0	0	0	0
<50000	0	0	0	0	0	0	0
<60000	0	0	0	0	0	0	0
<70000	0	0	0	0	0	0	0
<80000	0	0	0	0	0	0	0
<90000	0	0	0	0	0	0	0
<100000	0	0	0	0	0	0	0
<110000	0	0	0	0	0	0	0
<120000	0	0	0	0	0	0	0
<150000	0	0	0	0	0	0	0
<200000	0	0	0	0	0	0	0
>200000	0	0	0	0	0	0	0

Length	1995	2000	2005	2010	2015	2020	2025
<=200	2,578	2,004	2,204	2,202	2,355	2,518	2,745
<=230.9	0	0	0	0	0	0	0
<286.6	0	0	0	0	0	0	0
<294.1	0	0	0	0	0	0	0
<=330.9	0	0	0	0	0	0	0
<=360.9	0	0	0	0	0	0	0
<385.6	0	0	0	0	0	0	0
<=399.9	0	0	0	0	0	0	0
>=399.9	0	0	0	0	0	0	0

Gton	1995	2000	2005	2010	2015	2020	2025
<9999	1,746	1,201	1,230	1,132	1,007	860	862
<19999	832	803	975	1,070	1,348	1,658	1,883
<29999	0	0	0	0	0	0	0
<39999	0	0	0	0	0	0	0
<49999	0	0	0	0	0	0	0
<59999	0	0	0	0	0	0	0
<69999	0	0	0	0	0	0	0
<79999	0	0	0	0	0	0	0
<89999	0	0	0	0	0	0	0
<99999	0	0	0	0	0	0	0
<149999	0	0	0	0	0	0	0
<199999	0	0	0	0	0	0	0
<249999	0	0	0	0	0	0	0
>249999	0	0	0	0	0	0	0

Draft	1995	2000	2005	2010	2015	2020	2025
<=10	2,449	1,934	2,089	2,091	2,243	2,413	2,638
<10.5	129	70	116	110	112	105	107
<11	0	0	0	0	0	0	0
<11.5	0	0	0	0	0	0	0
<=12	0	0	0	0	0	0	0
<12.5	0	0	0	0	0	0	0
<13	0	0	0	0	0	0	0
<13.5	0	0	0	0	0	0	0
<14	0	0	0	0	0	0	0
<14.5	0	0	0	0	0	0	0
<=15.2	0	0	0	0	0	0	0
<17.5	0	0	0	0	0	0	0
<20	0	0	0	0	0	0	0
>=20	0	0	0	0	0	0	0

Cuft	1995	2000	2005	2010	2015	2020	2025
<100,000	120	64	0	0	0	0	0
<200,000	20	41	67	16	0	0	0
<300,000	510	154	146	147	138	10	0
<400,000	637	380	322	304	245	175	137
<450,000	251	324	404	412	427	489	533
<550000	690	769	878	866	869	899	1,010
>550000	350	272	387	457	676	945	1,065

Tolls

	1995	2000	2005	2010	2015	2020	2025
TOTAL	**$43,989,924**	**$36,492,142**	**$48,798,719**	**$56,883,580**	**$69,275,913**	**$87,289,237**	**$108,705,266**

Beam	1995	2000	2005	2010	2015	2020	2025
<=24.3	$38,698,182	$32,132,819	$42,829,523	$49,605,980	$60,026,057	$75,327,217	$93,402,078
<25.9	$5,291,741	$4,359,324	$5,969,196	$7,277,600	$9,249,855	$11,962,019	$15,303,189
<27.7	$0	$0	$0	$0	$0	$0	$0
<29	$0	$0	$0	$0	$0	$0	$0
<30.4	$0	$0	$0	$0	$0	$0	$0
<=32.3	$0	$0	$0	$0	$0	$0	$0
<33.5	$0	$0	$0	$0	$0	$0	$0
<36.6	$0	$0	$0	$0	$0	$0	$0
<39.6	$0	$0	$0	$0	$0	$0	$0
<42.7	$0	$0	$0	$0	$0	$0	$0
<45.7	$0	$0	$0	$0	$0	$0	$0
<48.8	$0	$0	$0	$0	$0	$0	$0
<51.8	$0	$0	$0	$0	$0	$0	$0
<=54.9	$0	$0	$0	$0	$0	$0	$0
>54.9	$0	$0	$0	$0	$0	$0	$0

DWT	1995	2000	2005	2010	2015	2020	2025
<10000	$21,463,614	$14,469,274	$16,494,556	$18,106,084	$18,558,455	$18,401,632	$21,905,435
<15000	$21,120,423	$21,872,745	$31,528,395	$38,296,054	$50,684,018	$68,887,604	$86,799,831
<20000	$1,405,886	$150,123	$775,768	$481,442	$33,440	$0	$0
<25000	$0	$0	$0	$0	$0	$0	$0
<30000	$0	$0	$0	$0	$0	$0	$0
<40000	$0	$0	$0	$0	$0	$0	$0
<50000	$0	$0	$0	$0	$0	$0	$0
<60000	$0	$0	$0	$0	$0	$0	$0
<70000	$0	$0	$0	$0	$0	$0	$0
<80000	$0	$0	$0	$0	$0	$0	$0
<90000	$0	$0	$0	$0	$0	$0	$0
<100000	$0	$0	$0	$0	$0	$0	$0
<110000	$0	$0	$0	$0	$0	$0	$0
<120000	$0	$0	$0	$0	$0	$0	$0
<150000	$0	$0	$0	$0	$0	$0	$0
<200000	$0	$0	$0	$0	$0	$0	$0
>200000	$0	$0	$0	$0	$0	$0	$0

PcUms	1995	2000	2005	2010	2015	2020	2025
<10000	$34,689,598	$29,833,370	$41,173,458	$47,797,862	$57,255,126	$71,103,242	$88,324,299
<15000	$9,300,325	$6,658,772	$7,625,261	$9,085,718	$12,020,787	$16,185,994	$20,380,968
<20000	$0	$0	$0	$0	$0	$0	$0
<25000	$0	$0	$0	$0	$0	$0	$0
<30000	$0	$0	$0	$0	$0	$0	$0
<40000	$0	$0	$0	$0	$0	$0	$0
<50000	$0	$0	$0	$0	$0	$0	$0
<60000	$0	$0	$0	$0	$0	$0	$0
<70000	$0	$0	$0	$0	$0	$0	$0
<80000	$0	$0	$0	$0	$0	$0	$0
<90000	$0	$0	$0	$0	$0	$0	$0
<100000	$0	$0	$0	$0	$0	$0	$0
<110000	$0	$0	$0	$0	$0	$0	$0
<120000	$0	$0	$0	$0	$0	$0	$0
<150000	$0	$0	$0	$0	$0	$0	$0
<200000	$0	$0	$0	$0	$0	$0	$0
>200000	$0	$0	$0	$0	$0	$0	$0

Length	1995	2000	2005	2010	2015	2020	2025
<=200	$43,989,924	$36,492,142	$48,798,719	$56,883,580	$69,275,913	$87,289,237	$108,705,266
<=230.9	$0	$0	$0	$0	$0	$0	$0
<286.6	$0	$0	$0	$0	$0	$0	$0
<294.1	$0	$0	$0	$0	$0	$0	$0
<=330.9	$0	$0	$0	$0	$0	$0	$0
<=360.9	$0	$0	$0	$0	$0	$0	$0
<385.6	$0	$0	$0	$0	$0	$0	$0
<=399.9	$0	$0	$0	$0	$0	$0	$0
>=399.9	$0	$0	$0	$0	$0	$0	$0

Gton	1995	2000	2005	2010	2015	2020	2025
<9999	$24,304,408	$18,085,389	$22,940,328	$25,508,043	$29,154,220	$34,551,727	$41,955,692
<19999	$19,685,515	$18,406,754	$25,858,391	$31,375,536	$40,121,693	$52,737,509	$66,749,574
<29999	$0	$0	$0	$0	$0	$0	$0
<39999	$0	$0	$0	$0	$0	$0	$0
<49999	$0	$0	$0	$0	$0	$0	$0
<59999	$0	$0	$0	$0	$0	$0	$0
<69999	$0	$0	$0	$0	$0	$0	$0
<79999	$0	$0	$0	$0	$0	$0	$0
<89999	$0	$0	$0	$0	$0	$0	$0
<99999	$0	$0	$0	$0	$0	$0	$0
<149999	$0	$0	$0	$0	$0	$0	$0
<199999	$0	$0	$0	$0	$0	$0	$0
<249999	$0	$0	$0	$0	$0	$0	$0
>249999	$0	$0	$0	$0	$0	$0	$0

Draft	1995	2000	2005	2010	2015	2020	2025
<=10	$40,516,657	$34,644,022	$45,288,112	$53,481,571	$66,230,855	$85,056,057	$106,618,841
<10.5	$3,473,267	$1,848,121	$3,510,568	$3,402,009	$3,045,058	$2,233,179	$2,086,425
<11	$0	$0	$39	$0	$0	$0	$0
<11.5	$0	$0	$0	$0	$0	$0	$0
<=12	$0	$0	$0	$0	$0	$0	$0
<12.5	$0	$0	$0	$0	$0	$0	$0
<13	$0	$0	$0	$0	$0	$0	$0
<13.5	$0	$0	$0	$0	$0	$0	$0
<14	$0	$0	$0	$0	$0	$0	$0
<14.5	$0	$0	$0	$0	$0	$0	$0
<=15.2	$0	$0	$0	$0	$0	$0	$0
<17.5	$0	$0	$0	$0	$0	$0	$0
<20	$0	$0	$0	$0	$0	$0	$0
>=20	$0	$0	$0	$0	$0	$0	$0

Cuft	1995	2000	2005	2010	2015	2020	2025
<100,000	$898,424	$418,172	$0	$0	$0	$0	$36,787
<200,000	$153,682	$270,761	$472,865	$0	$0	$119,263	$459,139
<300,000	$5,681,223	$1,731,450	$1,824,570	$1,790,852	$1,340,879	$0	$0
<400,000	$9,200,274	$5,506,671	$5,416,750	$5,572,708	$3,900,060	$1,835,785	$314,270
<450,000	$4,298,976	$5,530,830	$8,313,977	$10,056,821	$11,957,520	$16,027,618	$19,948,381
<550000	$14,620,360	$15,927,035	$21,360,205	$24,744,728	$28,788,189	$33,955,907	$43,781,964
>550000	$9,136,983	$7,107,222	$11,410,352	$14,718,471	$23,289,264	$35,350,663	$44,164,726

PCUMS

	1995	2000	2005	2010	2015	2020	2025
TOTAL	**18,084,297**	**15,193,581**	**17,280,236**	**17,662,959**	**19,074,391**	**21,276,311**	**23,451,855**

Beam	1995	2000	2005	2010	2015	2020	2025
<=24.3	16,186,827	13,916,133	15,768,539	16,175,646	17,533,619	19,657,507	21,772,887
<25.9	1,897,470	1,277,448	1,511,698	1,487,314	1,540,772	1,618,803	1,678,968
<27.7	0	0	0	0	0	0	0
<29	0	0	0	0	0	0	0
<30.4	0	0	0	0	0	0	0
<=32.3	0	0	0	0	0	0	0
<33.5	0	0	0	0	0	0	0
<36.6	0	0	0	0	0	0	0
<39.6	0	0	0	0	0	0	0
<42.7	0	0	0	0	0	0	0
<45.7	0	0	0	0	0	0	0
<48.8	0	0	0	0	0	0	0
<51.8	0	0	0	0	0	0	0
<=54.9	0	0	0	0	0	0	0
>54.9	0	0	0	0	0	0	0

DWT	1995	2000	2005	2010	2015	2020	2025
<10000	8,823,711	6,024,313	5,840,928	5,622,132	5,109,875	4,485,305	4,725,834
<15000	8,682,625	9,106,764	11,164,599	11,891,334	13,955,309	16,791,006	18,726,020
<20000	577,961	62,504	274,709	149,493	9,207	0	0
<25000	0	0	0	0	0	0	0
<30000	0	0	0	0	0	0	0
<40000	0	0	0	0	0	0	0
<50000	0	0	0	0	0	0	0
<60000	0	0	0	0	0	0	0
<70000	0	0	0	0	0	0	0
<80000	0	0	0	0	0	0	0
<90000	0	0	0	0	0	0	0
<100000	0	0	0	0	0	0	0
<110000	0	0	0	0	0	0	0
<120000	0	0	0	0	0	0	0
<150000	0	0	0	0	0	0	0
<200000	0	0	0	0	0	0	0
>200000	0	0	0	0	0	0	0

PcUms	1995	2000	2005	2010	2015	2020	2025
<10000	14,260,925	12,421,187	14,580,036	14,841,747	15,764,594	17,331,056	19,054,906
<15000	3,823,372	2,772,394	2,700,200	2,821,213	3,309,797	3,945,254	4,396,949
<20000	0	0	0	0	0	0	0
<25000	0	0	0	0	0	0	0
<30000	0	0	0	0	0	0	0
<40000	0	0	0	0	0	0	0
<50000	0	0	0	0	0	0	0
<60000	0	0	0	0	0	0	0
<70000	0	0	0	0	0	0	0
<80000	0	0	0	0	0	0	0
<90000	0	0	0	0	0	0	0
<100000	0	0	0	0	0	0	0
<110000	0	0	0	0	0	0	0
<120000	0	0	0	0	0	0	0
<150000	0	0	0	0	0	0	0
<200000	0	0	0	0	0	0	0
>200000	0	0	0	0	0	0	0

Length	1995	2000	2005	2010	2015	2020	2025
<=200	18,084,297	15,193,581	17,280,236	17,662,959	19,074,391	21,276,311	23,451,855
<=230.9	0	0	0	0	0	0	0
<286.6	0	0	0	0	0	0	0
<294.1	0	0	0	0	0	0	0
<=330.9	0	0	0	0	0	0	0
<=360.9	0	0	0	0	0	0	0
<385.6	0	0	0	0	0	0	0
<=399.9	0	0	0	0	0	0	0
>=399.9	0	0	0	0	0	0	0

Gton	1995	2000	2005	2010	2015	2020	2025
<9999	9,991,564	7,529,890	8,123,457	7,920,520	8,027,307	8,421,809	9,051,436
<19999	8,092,733	7,663,691	9,156,779	9,742,439	11,047,084	12,854,502	14,400,419
<29999	0	0	0	0	0	0	0
<39999	0	0	0	0	0	0	0
<49999	0	0	0	0	0	0	0
<59999	0	0	0	0	0	0	0
<69999	0	0	0	0	0	0	0
<79999	0	0	0	0	0	0	0
<89999	0	0	0	0	0	0	0
<99999	0	0	0	0	0	0	0
<149999	0	0	0	0	0	0	0
<199999	0	0	0	0	0	0	0
<249999	0	0	0	0	0	0	0
>249999	0	0	0	0	0	0	0

Draft	1995	2000	2005	2010	2015	2020	2025
<=10	16,656,434	14,424,112	16,037,087	16,606,599	18,235,966	20,731,984	23,001,734
<10.5	1,427,863	769,469	1,243,136	1,056,360	838,425	544,326	450,121
<11	0	0	14	0	0	0	0
<11.5	0	0	0	0	0	0	0
<=12	0	0	0	0	0	0	0
<12.5	0	0	0	0	0	0	0
<13	0	0	0	0	0	0	0
<13.5	0	0	0	0	0	0	0
<14	0	0	0	0	0	0	0
<14.5	0	0	0	0	0	0	0
<=15.2	0	0	0	0	0	0	0
<17.5	0	0	0	0	0	0	0
<20	0	0	0	0	0	0	0
>=20	0	0	0	0	0	0	0

Cuft	1995	2000	2005	2010	2015	2020	2025
<100,000	369,343	174,107	0	0	0	0	7,936
<200,000	63,179	112,732	167,447	0	0	29,070	99,054
<300,000	2,335,556	720,893	646,103	556,079	369,197	0	0
<400,000	3,782,241	2,292,714	1,918,139	1,730,385	1,073,840	447,463	67,800
<450,000	1,767,313	2,302,773	2,944,083	3,122,750	3,292,377	3,906,651	4,303,623
<550000	6,010,443	6,631,255	7,563,916	7,683,503	7,926,524	8,276,581	9,445,433
>550000	3,756,222	2,959,107	4,040,548	4,570,242	6,412,453	8,616,546	9,528,009

Cargo (metric tons)

	1995	2000	2005	2010	2015	2020	2025
TOTAL	**5,781,014**	**4,781,539**	**5,480,279**	**5,620,167**	**6,105,630**	**6,624,829**	**7,179,703**

Beam	**1995**	**2000**	**2005**	**2010**	**2015**	**2020**	**2025**
<=24.3	5,063,164	4,236,065	4,834,936	4,955,870	5,382,305	5,849,228	6,348,706
<25.9	717,850	545,474	645,342	664,297	723,325	775,601	830,997
<27.7	0	0	0	0	0	0	0
<29	0	0	0	0	0	0	0
<30.4	0	0	0	0	0	0	0
<=32.3	0	0	0	0	0	0	0
<33.5	0	0	0	0	0	0	0
<36.6	0	0	0	0	0	0	0
<39.6	0	0	0	0	0	0	0
<42.7	0	0	0	0	0	0	0
<45.7	0	0	0	0	0	0	0
<48.8	0	0	0	0	0	0	0
<51.8	0	0	0	0	0	0	0
<=54.9	0	0	0	0	0	0	0
>54.9	0	0	0	0	0	0	0

DWT	**1995**	**2000**	**2005**	**2010**	**2015**	**2020**	**2025**
<10000	2,834,439	1,843,295	1,841,351	1,776,443	1,623,450	1,373,107	1,421,367
<15000	2,817,433	2,933,681	3,548,768	3,793,097	4,479,230	5,251,722	5,758,337
<20000	129,142	4,563	90,159	50,627	2,950	0	0
<25000	0	0	0	0	0	0	0
<30000	0	0	0	0	0	0	0
<40000	0	0	0	0	0	0	0
<50000	0	0	0	0	0	0	0
<60000	0	0	0	0	0	0	0
<70000	0	0	0	0	0	0	0
<80000	0	0	0	0	0	0	0
<90000	0	0	0	0	0	0	0
<100000	0	0	0	0	0	0	0
<110000	0	0	0	0	0	0	0
<120000	0	0	0	0	0	0	0
<150000	0	0	0	0	0	0	0
<200000	0	0	0	0	0	0	0
>200000	0	0	0	0	0	0	0

PcUms	1995	2000	2005	2010	2015	2020	2025
<10000	4,526,495	3,786,865	4,669,451	4,784,911	5,106,169	5,544,937	6,049,931
<15000	1,254,519	994,674	810,827	835,256	999,461	1,079,892	1,129,772
<20000	0	0	0	0	0	0	0
<25000	0	0	0	0	0	0	0
<30000	0	0	0	0	0	0	0
<40000	0	0	0	0	0	0	0
<50000	0	0	0	0	0	0	0
<60000	0	0	0	0	0	0	0
<70000	0	0	0	0	0	0	0
<80000	0	0	0	0	0	0	0
<90000	0	0	0	0	0	0	0
<100000	0	0	0	0	0	0	0
<110000	0	0	0	0	0	0	0
<120000	0	0	0	0	0	0	0
<150000	0	0	0	0	0	0	0
<200000	0	0	0	0	0	0	0
>200000	0	0	0	0	0	0	0

Length	1995	2000	2005	2010	2015	2020	2025
<=200	5,781,014	4,781,539	5,480,279	5,620,167	6,105,630	6,624,829	7,179,703
<=230.9	0	0	0	0	0	0	0
<286.6	0	0	0	0	0	0	0
<294.1	0	0	0	0	0	0	0
<=330.9	0	0	0	0	0	0	0
<=360.9	0	0	0	0	0	0	0
<385.6	0	0	0	0	0	0	0
<=399.9	0	0	0	0	0	0	0
>=399.9	0	0	0	0	0	0	0

Gton	1995	2000	2005	2010	2015	2020	2025
<9999	3,078,793	2,311,550	2,660,963	2,607,066	2,663,847	2,724,672	2,882,003
<19999	2,702,221	2,469,989	2,819,316	3,013,101	3,441,783	3,900,157	4,297,701
<29999	0	0	0	0	0	0	0
<39999	0	0	0	0	0	0	0
<49999	0	0	0	0	0	0	0
<59999	0	0	0	0	0	0	0
<69999	0	0	0	0	0	0	0
<79999	0	0	0	0	0	0	0
<89999	0	0	0	0	0	0	0
<99999	0	0	0	0	0	0	0
<149999	0	0	0	0	0	0	0
<199999	0	0	0	0	0	0	0
<249999	0	0	0	0	0	0	0
>249999	0	0	0	0	0	0	0

Draft	1995	2000	2005	2010	2015	2020	2025
<=10	5,422,152	4,559,855	5,071,371	5,269,017	5,820,948	6,437,649	7,022,726
<10.5	358,862	221,684	408,904	351,150	284,682	187,180	156,978
<11	0	0	4	0	0	0	0
<11.5	0	0	0	0	0	0	0
<=12	0	0	0	0	0	0	0
<12.5	0	0	0	0	0	0	0
<13	0	0	0	0	0	0	0
<13.5	0	0	0	0	0	0	0
<14	0	0	0	0	0	0	0
<14.5	0	0	0	0	0	0	0
<=15.2	0	0	0	0	0	0	0
<17.5	0	0	0	0	0	0	0
<20	0	0	0	0	0	0	0
>=20	0	0	0	0	0	0	0

Cuft	1995	2000	2005	2010	2015	2020	2025
<100,000	123,004	70,680	0	0	0	0	2,436
<200,000	17,704	57,825	56,747	0	0	9,074	30,399
<300,000	729,644	260,787	215,659	187,771	129,274	0	0
<400,000	1,213,624	674,115	616,305	558,895	352,083	148,009	29,778
<450,000	537,288	657,635	974,611	1,035,088	1,096,542	1,262,579	1,367,188
<550000	1,911,029	1,997,497	2,349,522	2,397,202	2,488,139	2,530,708	2,842,040
>550000	1,248,721	1,063,000	1,267,434	1,441,211	2,039,591	2,674,459	2,907,863