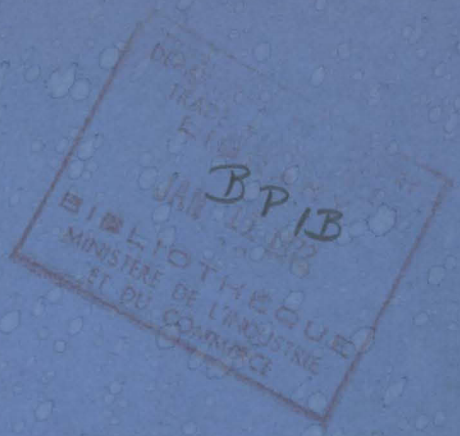
Report of the Committee on Shipbuilding in Canada : volume 2 : regional sections and appendices.

REPORT OF THE COMMITTEE ON SHIPBUILDING IN CANADA



VOLUME 2

REGIONAL SECTIONS AND APPENDICES

PART III

ATLANTIC REGION

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ATLANTIC REGION

CHAPTER I

DEMAND FOR SHIPPING SERVICES

Commercial Cargoes

This Chapter examines waterborne trade patterns and volumes for both coastal and international trade in the Atlantic Region and makes forecasts of future trade volumes to 1980 which are used as the basis for establishing shipping requirements. For the purpose of this analysis, the waterborne trade in the Atlantic Region has been divided into the following cargo movements:

(a) Coastal trade between Canadian ports within the area consisting of the Atlantic Coast, Gulf of St. Lawrence and the St. Lawrence River up to and including Montreal;

(b) trade between the area described above and U.S. Atlantic and Gulf Coast;

(c) off-shore trade between the Atlantic area and off-shore ports.

The inclusion of Montreal and the Lower St. Lawrence area in the Atlantic Region is in accordance with the D.B.S. definition of the region. Information on trade in the Lower St. Lawrence area is therefore presented in this part of the report rather than in the Great Lakes and St. Lawrence Region section. (Trade between the Atlantic Region and the Great Lakes is "inland" trade and is covered in the Great Lakes and St. Lawrence Region section).

The method of forecasting has involved the division of each of the above trades (a) to (c) into its main components, this

TABLE A-2

ATLANTIC REGION COASTAL TRADE (1)

BY MAJOR COMPONENTS

1958 - 1967
(million tons - 2,000 lb.)

	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967
Ores, concentrates and minerals	3.1	2.5	2.4	1.6	1.6	1.7	1.6	2.8	2.3	2.8
Petroleum	3.3	3.7	4.2	5.0	5.0	4.7	5.6	5.5	5.6	5.8
Forest products	2.8	3.2	3.5	3.3	2.6	2.6	2.3	1.9	2.2	1.8
Coal	1.9	1.8	1.4	1.8	1.5	1.0	0.6	0.5	0.5	0.3
Unspecified and general cargo	2.1	2.1	2.2	2.5	1.9	2.0	2.9	1.3	1.2	1.2
Total	13.2	13.3	13.7	14.2	12.6	12.0	13.0	12.0	11.8	11.9

(1) Trade within the Region including the Atlantic Coast, Gulf of St. Lawrence, and St. Lawrence River up to and including Montreal.

Note: Figures on coastal trade have a minor degree of approximation because the statistics for cargoes loaded and unloaded differ slightly.

Source: DBS.

CHART A-1

ATLANTIC REGION

WATERBORNE TRADE

1953 – 1967 WITH FORECASTS TO 1980

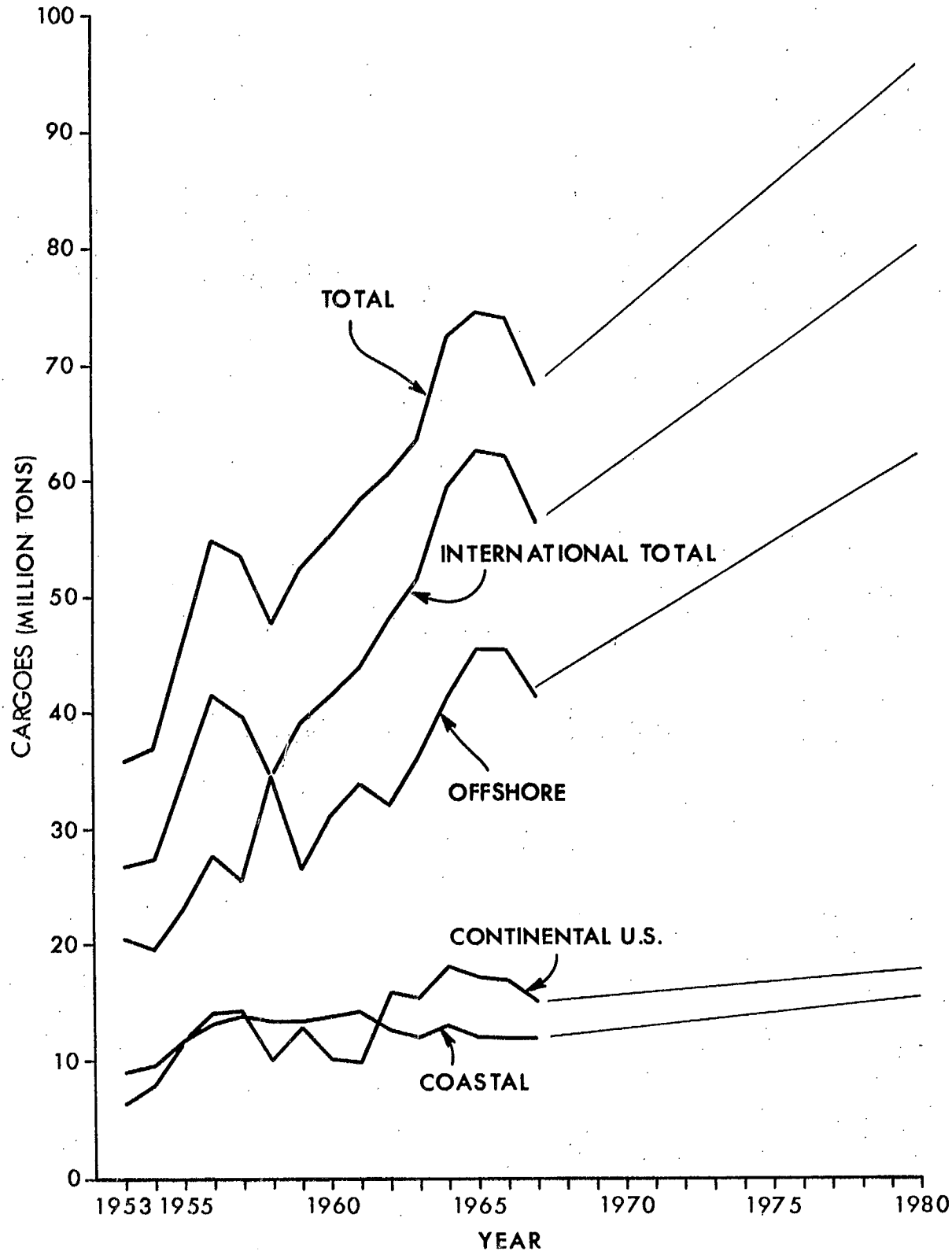


TABLE A-1

ATLANTIC REGION

WATERBORNE TRADE

1953 - 1967
(million tons - 2000 lb.)

	Coastal (1) (within Region)	International			Total
		U.S.(2)	Offshore(3)	Total	
1967	11.9	15.0	41.3	56.3	68.2
1966	11.8	16.8	45.3	62.1	73.9
1965	12.0	17.1	45.4	62.5	74.5
1964	13.0	18.1	41.3	59.4	72.4
1963	12.0	15.3	36.3	51.6	63.6
1962	12.6	15.7	32.1	47.8	60.4
1961	14.2	9.9	33.9	43.8	58.0
1960	13.7	10.1	31.2	41.3	55.0
1959	13.3	12.7	26.4	39.1	52.4
1958	13.2	10.0	24.4	34.4	47.6
1957	13.8	14.2	25.4	39.6	53.4
1956	13.1	13.9	27.7	41.6	54.7
1955	11.5	11.5	23.0	34.5	46.0
1954	9.6	7.8	19.5	27.3	36.9
1953	9.0	6.3	20.4	26.7	35.7

(1) Trade between Canadian ports in the Atlantic Region and St. Lawrence River area up to and including Montreal. Coastal trade figures have a minor degree of approximation due to differences in statistics between cargoes loaded and unloaded.

(2) Trade with U.S. Atlantic Coast.

(3) Foreign trade excluding U.S. Atlantic Coast.

Source: DBS.

division being mainly by commodity groups. The forecast for each of these components has been based on a projection of the 1958-1967 trend as determined by computer analysis, with this projection modified in accordance with any developments indicated by a general analysis of the trade and economic prospects for the commodity. The forecast for each of the trades has been assembled by totalling the forecasts for its main components.

This does not purport to be an exhaustive forecast, but rather a broad indication of trade volumes and its main components for the purpose of establishing additional ship requirements and ship types. Coastal trade is given first priority in the analysis because it is the main area of activity for Canadian built and registered vessels. International trade is also examined as Canadian built and registered vessels are involved to an extent, and because the forecast growth in ship traffic may provide an indication of future repair requirements.

Table A-1 shows the volumes of waterborne trade in the Atlantic Region by its major trades for the period 1953-1967. In 1967, the Atlantic Region waterborne trade totalled 68.2 million tons. Of this total 60% was with off-shore sources, 22% with the U.S. Atlantic and Gulf Coasts and 18% coasting trade within the Region.

Chart A-1 illustrates the 1953-1967 trade growth as shown in Table A-1, together with the forecasts to 1980 which are discussed in detail in the sections following.

Coastal Trade

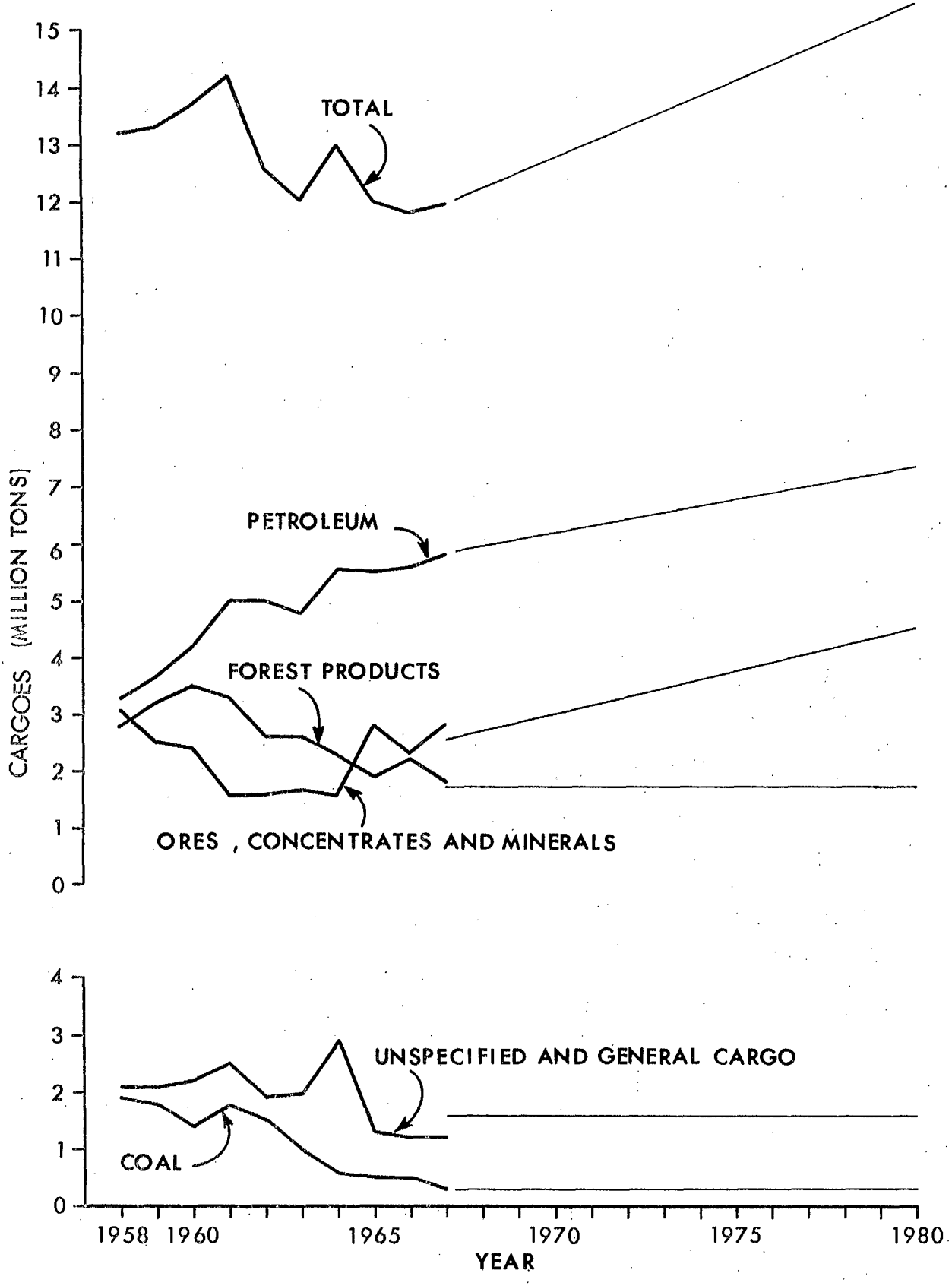
Table A-2 shows the coastal trade with the Atlantic Region by its major components for the period 1958-1967. The Region

CHART A-2

ATLANTIC REGION

COASTAL TRADE - WITHIN REGION

1958 – 1967 WITH FORECASTS TO 1980



includes the Atlantic coast, Gulf of St. Lawrence and St. Lawrence River up to and including Montreal. This trade and the forecasts to 1980 are illustrated on Chart A-2.

In 1967, the major components of the regional coastal trade were ores and concentrates, petroleum products, forest products, coal, and unspecified and general cargo.

Ores, Concentrates and Minerals: In 1967 this traffic consisted of titanium ore (64%), iron ore (13%), non-metallic minerals (20% consisting mainly of gypsum but also including fluorspar, salt and stone) and base metal concentrates (3%). After levelling off between 1961 and 1964, shipments have grown between 1965 and 1967. The overall 1958-67 trend is down but this appears to be pessimistic in light of the growth since 1965. The growth to 1980 has been projected on the basis of the 1961-1967 trend which indicates potential shipments of 3.0, 3.7 and 4.5 million tons per annum in 1970, 1975 and 1980 respectively. This may prove to be conservative if any substantial expansion of the gypsum or titanium mining industries occurs. While further base metal development is expected, particularly in the Eastern Arctic area, base concentrates are only a small part of the total ores and concentrates shipments at present, and they would not be a major factor in the projected growth of shipments of 1.6 million tons per annum between 1967 and 1980. In addition, Arctic ores and concentrates are likely to find off-shore markets, and would therefore not add significantly to coastal shipments.

Petroleum: The petroleum traffic consists of the distribution of refined products from refineries to secondary distribution centres. Since 1958 shipments have shown a steady increase with some levelling off of the growth rate since 1964. It appears that in addition to normal economic growth, the replacement of coal by petroleum fuels was a factor in the growth of petroleum shipments to 1964. Chart A-2 shows that the decline of coal shipments is coincident with the growth of petroleum with both tending to level off since 1964. The projection of the 1958-67 trend (not a linear projection) indicates potential volume of 6.2, 6.8 and 7.3 million tons in 1970, 1975 and 1980. This could however be optimistic for the following reasons:

(a) About 1.2 million tons of the 1967 shipments consisted of deliveries from Montreal to Quebec City. The construction of refinery capacity in Quebec City is now under way and this will reduce the waterborne deliveries from Montreal, particularly when this refinery capacity is expanded in future years.

(b) This reduction may be partially offset by increased flows of specialized products (e.g. jet fuels) from new eastern refineries (Come-by-Chance and Pt. Tupper) toward Montreal.

The foregoing developments are expected to be gradual, and the projection indicated should be reasonably accurate. The major exception to the foregoing arises from the possibility of significant oil discoveries in the Canadian Eastern Arctic areas. This would constitute a new source of supply with major implications to the Atlantic Region, by the creation of a coastal crude oil trade. Because of its broader national implications, this possibility is dealt with in the Canada paper rather than here.

Forest Products: In 1967, the forest products shipments consisted mainly of pulpwood (94%). The declining volume of waterborne pulpwood shipments has been the main factor in the decline of forest product traffic since 1960. The interim figures indicate that the decline continued in 1968 to 1.7 million tons. The main reason for the decline appears to be the construction of new pulp mills closer to the pulpwood sources. These mills are relatively new and are utilizing local sources of pulpwood which do not require water transport. This, however, tends to be a temporary situation because after local sources are exhausted the resumption of waterborne shipments becomes necessary. For this reason, it is not believed that the 1958-1967 down trend can be projected as a longer-term forecast. Since a large part of the new mill capacity added during the last expansion cycle is now in operation, the decline in shipments should soon level off, if it has not already done so. Since a specific upturn cannot be forecast, the forecast is taken at 1.7 million tons per annum through the 1970's, but with the expectation that this will be conservative probably by the mid to late 1970's.

Coal: Coal shipments have declined steadily since 1958, reflecting its loss of energy markets to petroleum fuels. The rate of decline has levelled off since 1964. It is possible that the decline may be over, markets having been reduced to those where Nova Scotia coal can retain its competitive advantage. The 1968 shipments showed a very small increase over 1967. A significant revival of coal shipments is not foreseen and shipments of 300,000 tons per annum are forecast to 1980.

Unspecified Commodities and General Cargo: This category consists of a wide range of food and industrial products including cement (19%) and steel (10%). The 1966-1967 volumes of 1.2 million tons per annum appear to be the basic normal supply requirements for the waterborne dependent areas. Very substantial increases in

traffic have occurred when major new projects are under way and construction materials and supplies have to be moved. It appears that the extensive iron ore and other development along the Gulf of St. Lawrence north shore were responsible for the higher level of shipments to 1964. While the basic level of shipments can be expected to increase gradually with normal population growth and economic development, periodic increases in activity from new major projects can be expected. While projects of the size of the Quebec-Labrador iron mines will be rare, such developments as the Ungava asbestos and base metal projects and Baffin Island iron development will probably be undertaken during the 1970's. The forecast therefore calls for an average annual cargo volume of 1.6 million tons per annum through the 1970's, with the probability that this may be substantially exceeded in some years and may be conservative toward the end of the decade.

Summary

The following table summarizes the forecasts of Atlantic Region waterborne coastal trade (within region) for 1970, 1975 and 1980:

(million tons)	Year 1970	1975	1980
Ores and Minerals	3.0	3.7	4.5
Petroleum	6.2	6.8	7.3
Forest Products	1.7	1.7	1.7
Coal	0.3	0.3	0.3
Unspecified and General Cargo	1.6	1.6	1.6
Total	12.8	14.1	15.4

The forecast indicates an end to the declining volume experienced since 1961, attributable to lower coal and forest products shipments, both of which are expected to level off. Sustained growth of ore and mineral shipments and regional petroleum distribution, and high general cargo shipments due to major mining developments, are expected to be the main factors in the increased coastal trade.

International Off-Shore Trade

International off-shore trade includes trade between the Atlantic Region (up to and including Montreal) and all foreign countries except the Continental U.S.

CHART A-3

ATLANTIC REGION

OFFSHORE TRADE

1958 – 1967 WITH FORECASTS TO 1980

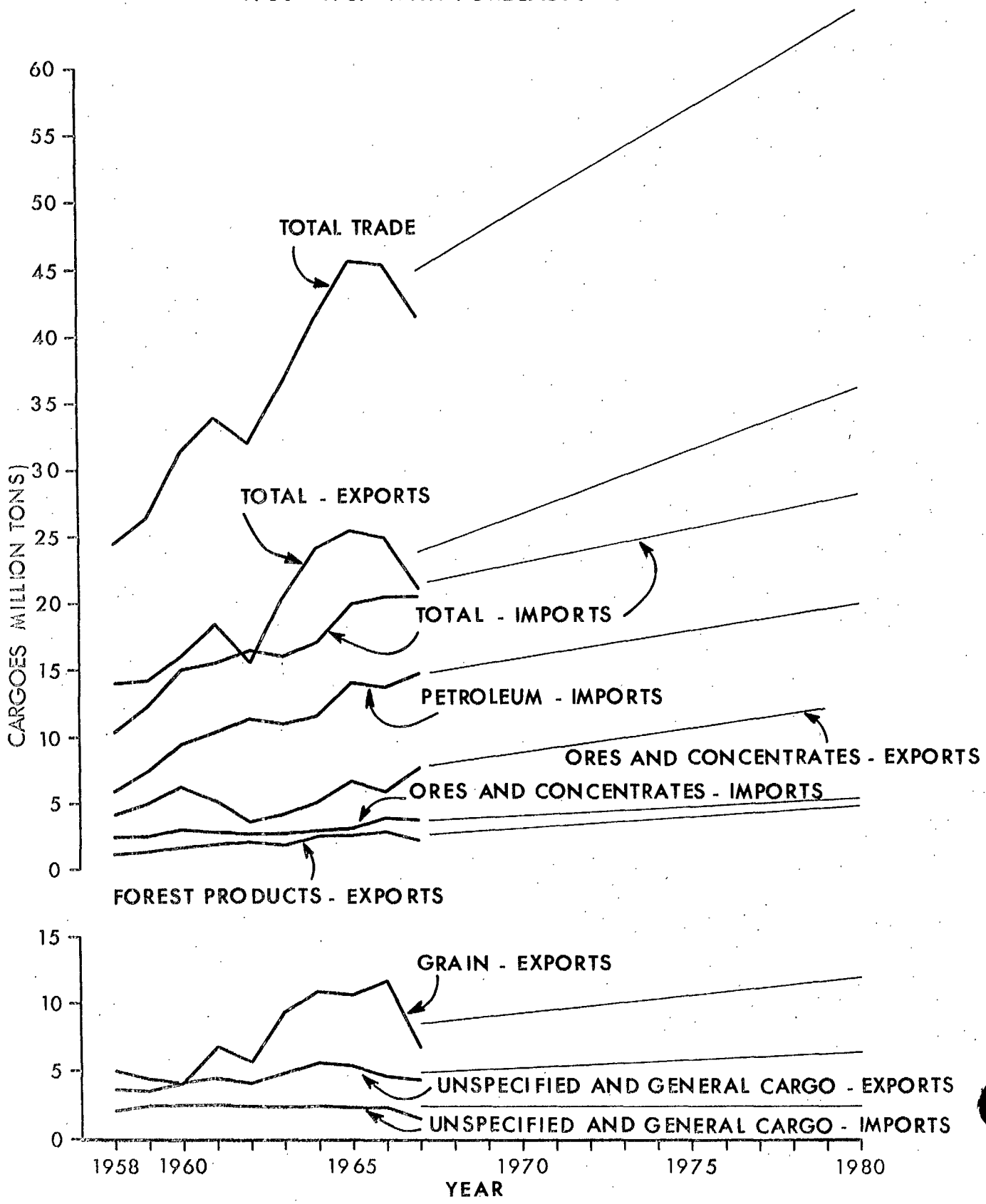


TABLE A-3

ATLANTIC REGION INTERNATIONAL OFFSHORE (1) TRADE BY MAJOR COMPONENTS

1958 - 1967
(million tons - 2,000 lb.)

	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967
Exports										
Grain	5.0	4.4	4.1	6.9	5.7	9.4	10.9	10.7	11.6	6.7
Ores and Concentrates	4.1	5.0	6.2	5.2	3.7	4.2	5.1	6.7	6.0	7.7
Forest products	1.2	1.3	1.7	1.9	2.1	1.9	2.6	2.6	2.8	2.2
Unspecified and general cargo	3.7	3.5	4.1	4.4	4.2	4.8	5.6	5.4	4.5	4.3
Total	14.0	14.2	16.1	18.4	15.7	20.3	24.2	25.4	24.9	20.9
Imports										
Ores and concentrates	2.5	2.5	3.1	2.8	2.7	2.7	3.0	3.1	3.9	3.7
Petroleum	5.9	7.4	9.6	10.3	11.4	11.1	11.7	14.1	13.7	14.6
Raw sugar	-	-	-	-	-	-	-	0.6	0.6	0.6
Unspecified and general cargo	2.0	2.3	2.4	2.4	2.3	2.2	2.4	2.2	2.2	1.5
Total	10.4	12.2	15.1	15.5	16.4	16.0	17.1	20.0	20.4	20.4
Total trade	24.4	26.4	31.2	33.9	32.1	36.3	41.3	45.4	45.3	41.3

(1) Includes trade with all foreign countries except the Continental U.S.

Source: DBS.

Table A-3 shows this trade by its major components, for the years 1958-1967. These are illustrated on Chart A-3 together with the forecasts to 1980 which are discussed in the sections following.

Exports

The major components of the off-shore export trade are grain, ores and concentrates, forest products and unspecified commodities and general cargo.

Grains: Grain shipments consist of wheat and coarse grains, including reloading of U.S. grain shipped from the U.S. Lakes to Gulf of St. Lawrence ports. The sharp decline in shipments in 1967 reflects decreased demand from European markets due to high domestic production, and strong competition from other wheat producing countries. It appears doubtful if the peak grain exporting years of 1965-1966 will be exceeded for a considerable time to come because wheat production in the traditional Canadian markets has been increased by greater acreage planted and the use of new higher yielding strains. On the other hand, the post-1967 shipments are probably lower than long-term prospects because the unusually good weather conditions experienced in all major world wheat producing areas cannot be expected to continue in the longer term. There does not appear to be any general agreement among grain experts as to what the future export prospects are. However, the 1963-1965 period is favoured as a typical period. The forecast assumes that the basic trend is upward from the 1967-1970 level to 11.9 million tons per annum by 1980, with the 1963-1964 average of 10.1 million tons being regained by 1975 based on the following assumptions:

(a) The upturn in shipments will be gradual because of high stocks in Europe at the end of 1969.

(b) Demand will increase in Europe due to population increases.

(c) There may be a decline in European wheat production due to diversion of land to feed grains because of increased meat demand.

(d) A greater portion of Canadian exports may be feed grains (for which markets are stronger) because of diversion of Western Canadian lands to coarse grain production.

It must be recognized that notwithstanding the long-term average forecast, there may be sharp fluctuations in year-to-year exports due to weather conditions.

Ores & Concentrates: In 1967, ore and concentrate exports consisted of 7 million tons of iron ore and 0.8 million tons of base metal concentrates. Since 1958, the trend of ore and concentrate exports has been sharply upward although showing some fluctuations from year-to-year. Base metals have increased in significance from 2.5% of the total ore volume in 1958 to 10% in 1967.

The destination of the iron ore is northern Europe, and is now being shipped in ore carriers of the 100,000 DWT class. While the demand for iron ore should continue to grow, strong competition will come from a number of other sources of iron ore which can be transported to markets by water. The projected growth of shipments to 9.0, 11.0 and 13.0 million tons per annum in 1970, 1975 and 1980 respectively, may be optimistic in the early 1970's due to competitive pressure, but should be achieved later in the decade when the supply demand situation is expected to come into better balance.

Not included in the projections are potential new iron ore developments in the Arctic (particularly Baffin Island) which could add two to four million tons per annum to shipments in the late 1970's. Also in the 1970's there will be base metal concentrate shipments from Ungava which, while high in value, will probably not add significantly to total tonnage. The destination of all of the potential Arctic ore production will probably be Europe.

Forest Products: The forest products exports consist mainly of pulp and paper. The growth of volume since 1958 has generally been steady, and the upward trend is well defined. The projected trend indicates potential shipments of 3.2, 3.9 and 4.6 million tons per annum in 1970, 1975 and 1980 respectively. There appears to be ample forest resources in the Region to meet this growth trend. However, the addition of mill capacity tends to be cyclical and 1970 shipments will probably fall below the total projected, with this probably being made up in subsequent years.

Unspecified Commodities and General Cargo: This consists of a wide range of foods and manufactured materials, the main items in 1967 being raw metals and alloys (23%) and asbestos (14%). While there have been fluctuations from year-to-year, the basic trend is upward, with the trend projection indicating potential shipments of 5.2, 5.8 and 6.4 million tons per annum in 1970, 1975 and 1980 respectively. This forecast is considered to be conservative for a number of reasons:

(a) There will be a number of new container terminals in Eastern Canada which will add to Atlantic Region exports at the expense of other Regions. It is estimated that the diversion of general cargo from the St. Lawrence Seaway to Atlantic Coast ports could be 1.5 million tons per annum by 1980.

(b) The Canadian Atlantic ports have the prospect for handling a significant amount of U.S. Mid-West cargo traffic.

The foregoing does not assume the development of any "land-bridge" traffic.

Imports

The off-shore to Atlantic Region imports consist of petroleum, ores and concentrates, raw sugar and general cargo.

Petroleum: This consists of crude oil imported from the Mid-East and South America as feed stocks for Atlantic Coast refineries and fuel oil and gasoline imported from South America and the Caribbean. This does not include the Montreal refinery requirements which are provided via the Portland - Montreal pipeline. Petroleum imports have grown sharply since 1958, although the growth rate has slowed since 1962. In 1967 the total tonnage is about equally divided between crude oil and refined products.

The trend projection indicates potential shipments of 15.8, 17.8 and 19.8 million tons per annum by 1970, 1975 and 1980 respectively. This projection may be conservative for the following reasons:

(a) Substantial additional refining capacity is being established east of Montreal, which new capacity will be supplied by waterborne crude.

(b) Some of this new capacity will produce specialized products for export markets. Crude requirements should therefore grow faster than domestic demand.

It is apparent that the import balance between crude and refined products will move sharply toward crude oil being the major portion of the imports.

The projection assumes no change in the National Oil Policy. Any substantial discovery of Arctic or Eastern off-shore crude would have the effect of transferring some crude oil movement from the international to the coastal trade category.

Ores and Concentrates: These imports consist mainly of bauxite for the aluminum industry (73%) but also includes iron, manganese and other ores. The main increases in shipments will be created by increases in the refining capacity of the aluminum industry. There are some indications that such increases are levelling off due to the substantial growth of foreign capacity recently completed or now underway. The projection of 4.0, 4.6 and 5.3 million tons per annum in 1970, 1975 and 1980 respectively may therefore be optimistic.

Reference has also been heard as to the possible commencement of imports of iron ore from off-shore sources which would be transferred in the Atlantic Region to inland vessels for movement to the Great Lakes area. This prospect cannot yet be assessed.

Raw Sugar: This is a relatively recent import commodity, commencing with the completion of Atlantic region refining capacity in 1964. Future shipments are projected at 600,000 tons per annum to 1980.

Unspecified Commodities and General Cargo: This consists of a wide range of manufactured goods. While the trend since 1960 has been downward, a revival is forecast to the 1964 high of 2.4 million tons per annum during the 1970's. The main reason is the expectation that the Atlantic Coast ports will become the major container terminals for Eastern Canada. This will increase import volume as well as export volume for the Region. No growth is being projected because it is not possible as yet to estimate the impact of containers on trade patterns, but this is obviously conservative.

The following table summarizes the projections for waterborne off-shore trade:

(million tons)	Year 1970	1975	1980
Exports:			
Grain	9.2	10.1	11.9
Ores and Concentrates	9.0	11.0	13.0
Forest Products	3.2	3.9	4.7
Unspecified and General Cargo	5.2	5.8	6.4
Sub-total	26.6	30.8	36.0

CHART A-4

ATLANTIC REGION
CONTINENTAL U.S. TRADE

1958 - 1967 WITH FORECASTS TO 1980

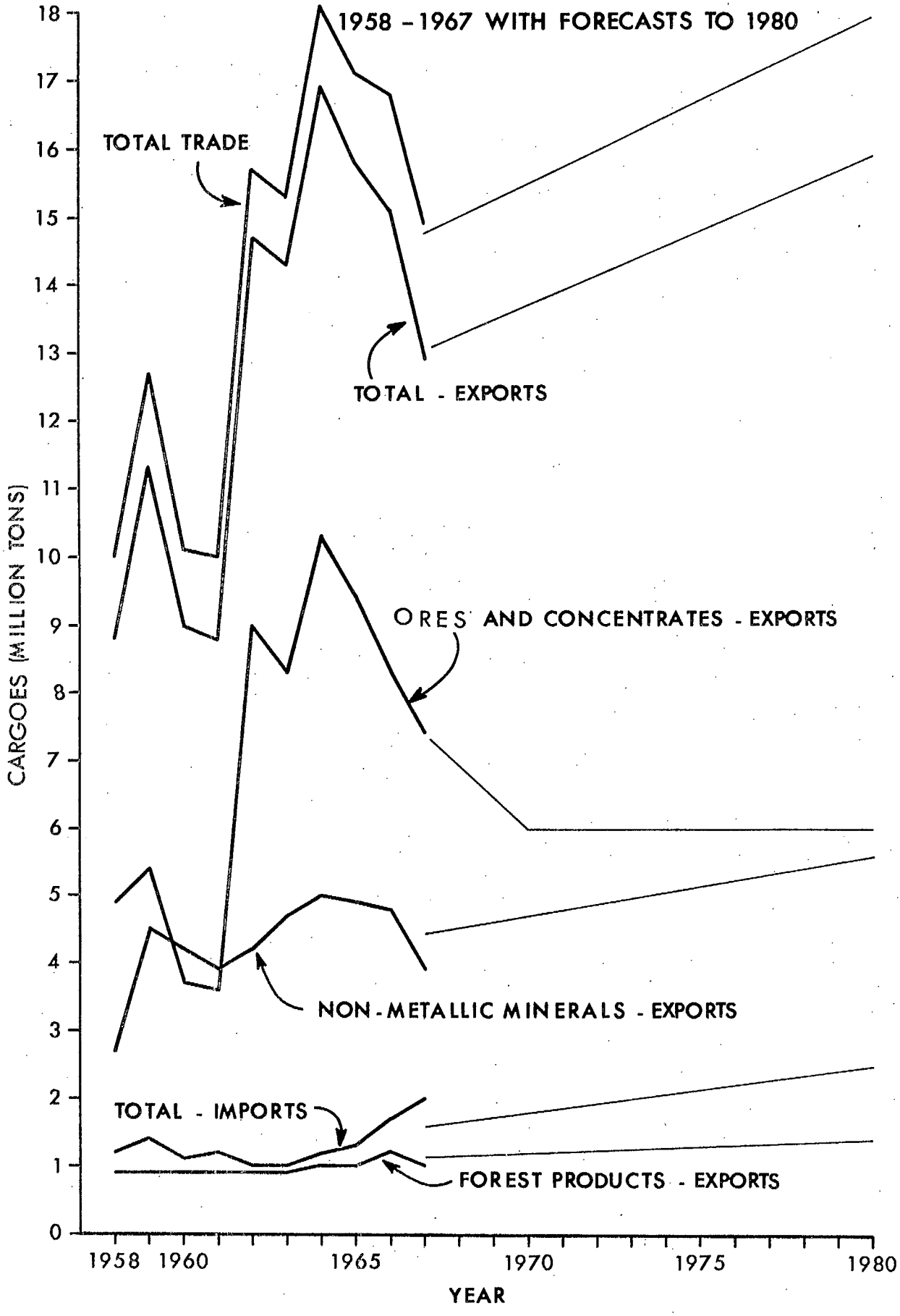


TABLE A-4

ATLANTIC REGION - CONTINENTAL U.S. TRADE (1)
BY MAJOR COMPONENTS

1958 - 1967
(million tons - 2,000 lb.)

	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967
Exports										
Ores and concentrates	4.9	5.4	3.7	3.6	9.0	8.3	10.3	9.4	8.3	7.4
Non-metallic minerals	2.7	4.5	4.2	3.8	4.2	4.7	5.0	4.9	4.8	3.9
Forest products	0.9	0.9	0.9	0.9	0.9	0.9	1.0	1.0	1.2	1.0
Unspecified and general cargo	0.3	0.4	0.2	0.4	0.6	0.4	0.6	0.5	0.8	0.7
Total	8.8	11.3	9.0	8.7	14.7	14.3	16.9	15.8	15.1	13.0
Imports										
Coal	-	-	-	0.2	0.1	0.1	0.1	0.4	0.7	0.5
Ores and concentrates	-	0.5	0.4	0.6	0.4	0.4	0.3	0.2	0.3	0.4
Unspecified and general cargo	1.2	0.9	0.7	0.4	0.5	0.5	0.8	0.7	0.7	1.1
Total	1.2	1.4	1.1	1.2	1.0	1.0	1.2	1.3	1.7	2.0
Total trade	10.0	12.7	10.1	9.9	15.7	15.3	18.1	17.1	16.8	15.0

(1) Includes trade between Atlantic Region and Continental U.S.

Source: DBS.

(million tons)	Year 1970	1975	1980
Imports:			
Petroleum	15.8	17.8	19.8
Ores and Concentrates	4.0	4.6	5.3
Raw Sugar	0.6	0.6	0.6
Unspecified and General Cargo	2.4	2.4	2.4
	22.8	25.4	28.1
Total	49.4	56.2	64.1

The forecast shows a substantial increase in off-shore traffic which may be optimistic with regard to ore exports. This is probably offset by conservative petroleum import projections. The forecast for general cargoes may also be conservative. The Atlantic Region ports are likely to become the major container terminals for Canada - Europe trade and in addition there is potential for handling the U.S. Mid-West - Europe container cargoes.

U.S. Atlantic Coast Trade

Table A-4 summarizes the trade between the Atlantic Region and the U.S. Atlantic and Gulf Coasts by its major components. Trade between the Region and the U.S. West Coast is minimal. The trade from 1958-1967 and the forecasts to 1980 are illustrated by Chart A-4.

Exports

The main exports are ores and concentrates, non-metallic minerals, and forest products.

Ores and Concentrates: This consists mainly of iron ore shipped by bulk carriers from the Gulf of St. Lawrence to the Eastern Seaboard and then by unit-train to the steel-making centres. After a sharp growth in shipments to 1964, which was made possible by the development of the Quebec-Labrador mines, shipments have declined steadily since 1964. This can be attributed to several factors:

(a) The total exports of Atlantic Region ore to the U.S., have levelled off since 1964. This is at least partially due to competition from Australia and Africa.

(b) Some ore shipments have been diverted to the Seaway route because of its cost advantage. This diversion started in 1964 when an adequate fleet of large ore carriers became available.

The prospects are for a continuing decline in ocean shipments, although probably at a slower rate of decline than in recent years. The availability of larger ocean-going carriers and a possible increase in seaway tolls would narrow the seaway's cost advantage, but more rapidly increasing costs of rail transport should act in the opposite direction.

The complexity of the situation makes any reliable forecast difficult. The forecast is for a continued decline to 6.0 million tons per annum to 1970, holding at that level to 1980. This may be conservative after 1975 when a better balance of iron ore supply and demand may increase shipments from Quebec-Labrador. Also U.S. raw steel production is gradually being decentralized from the Mid-West, so that ocean-going shipments to the south may increase.

Non-Metallic Minerals: This consisted mainly of gypsum in 1967. It is primarily used in building products and for that reason shipments tend to fluctuate in accordance with building activity. The long-term prospects are good and the growth forecast is the projection of the 1958-1967 trend. This indicates shipments of 4.7 million tons in 1970 (probably high due to depressed housing market) and 5.1 and 5.6 million tons per annum in 1975 and 1980 respectively. Wide year-to-year fluctuations will probably continue to be experienced.

Forest Products: Shipments consist largely of newsprint and other papers to the New York City area. The market growth is steady but relatively slow. The trend projections indicate shipments of 1.2, 1.3 and 1.4 million tons per annum in 1970, 1975 and 1980 respectively.

Unspecified Commodities and General Cargoes: This includes a wide range of food (particularly sea foods) and manufactured materials and products. The growth has been relatively steady with a well-defined upward trend indicating a volume of 1.8, 2.1 and 2.4 million tons per annum in 1970, 1975 and 1980 respectively.

Imports

The imports from the U.S. Atlantic and Gulf Region have consisted of coal, ores and minerals (mainly phosphates) and general cargo. The total is relatively small at 2.0 million tons per annum in 1967. The forecast of the total imports is taken as a projection of the 1958-1967 trend which indicates potential volume of 1.8, 2.2 and 2.5 million tons per annum in 1970, 1975 and 1980 respectively. This may be conservative in the light of the higher growth rate shown since 1965.

Summary:

The U.S.-Canada ocean-going trade projections to 1980 are summarized in the following table:

	Year		
(million tons)	1970	1975	1980
Exports:			
Ores and Concentrates	6.0	6.0	6.0
Non-Metallic Minerals	4.7	5.1	5.6
Forest Products	1.2	1.3	1.4
Unspecified and General Cargoes	1.8	2.1	2.4
Sub-total	13.7	14.5	15.4
Imports:	1.8	2.2	2.5
Total	15.5	16.7	17.9

There are major uncertainties in the foregoing totals, particularly with regard to ore and concentrate exports.

Fishing Vessels

Present Situation and New Developments

The Atlantic fisheries consist of groundfish, herring and in-shore fishing operations. The nature of the operations and types of vessels used can be summarized as follows:

Groundfish: Groundfish are caught off the off-shore banks by trawling. The preferred vessel is a steel hulled stern trawler with a length of 150', beam of 30', of about 600 gross reg. tons. The stern trawler is a relatively new development, and many of the older side trawlers are still in operation. The groundfish supply is good except certain species such as haddock which is showing signs of depletion and is being protected by international action. Similarly, scallop dragging is carried out in fishing vessels of 75-100', mainly of wooden construction.

Herring: Herring fishing is relatively new in the East. Some of these operations are carried on by Pacific fishermen who moved into the area when the Pacific herring fisheries were closed several years ago. The Atlantic herring operations are still in the development stage. The Pacific boats are not entirely suitable to Atlantic conditions and a number of new boats are now in operation. These are approximately 80-125' long and are wide-beamed at 30-35'.

In-Shore: These operations consist of in-shore drift or gill netting, lobstering and scallop dragging. The boats are generally small, up to 65'. Nearly all in-shore boats are of wood construction.

The Atlantic groundfish markets are emerging from a depressed period caused by an invasion of traditional Canadian fisheries markets by cheaper products from abroad. The causes were partially natural, as a result of very large catches, and partially because of very substantial additions to Canadian capacity caused by government action in the form of boat building subsidies and low interest loans for processing plants. The contraction has been largely completed and a better balance of supply and demand is developing.

Further developments in fishing boat construction will come from the following sources:

1. There will have to be some increase in the groundfish fleet to meet growing demand.

2. Replacement of obsolete side trawlers will be necessary. There are approximately 40 of these in operation, and while some are less than 10 years old, replacement will be necessary shortly.

3. Additional herring boats will have to be built. The markets are good, but it is expected that when the Pacific herring fisheries are eventually re-opened a number of the boats will be returning to that area, and will probably have to be replaced with new vessels.

There are also a number of new developments underway which might have a future impact. Being closely watched is a U.K. process for thawing and refreezing fish. This enables relatively large freezer vessels (200-225') to operate in remote areas and deliver their catch frozen for processing and refreezing. This is attractive to the processing industry as it would allow a better balance of their production by using frozen catches in off-peak periods. The process is not however yet economic for Canadian fisheries where the fishing grounds are relatively close to shore.

Some officials foresee greater differentiation of the fishing fleet, including the use of smaller boats making short trips to the closer banks, and larger vessels making longer trips to the farther banks. In principle, this involves a better balancing of transit-time, crew requirements, and fish capacity for greater economy, but at some loss of vessel use flexibility. There will also likely be an increasing sophistication of both fishing and fish finding equipment.

New Fishing Vessel Requirements

Projections concerning new vessel requirements for both the expansion and replacement of the Atlantic Region fishing fleet have been derived from interviews with Provincial fisheries officials and industry sources. The following table summarizes these projections for the period 1970-1979:

Type	No. and Size		Total GRT
Steel: Trawlers & Trawler/Seiners	40	80' - 115'	14,000
	55	140' - 160'	30,000
	95		44,000
Wood: Crab & Shrimp draggers, in-shore	600	45' - 80'	-
trawlers	30	80' - 110'	-
Steel Vessels per annum 1970-1979.			44,000

The projection for steel trawlers and Trawler/Seiners appears to be realistic. The majority of the new construction represents fleet additions, including additional herring seining capacity, but there is also provision for replacement of older trawlers, including some relatively new but obsolete sidetrawlers. The smaller steel vessels are Gulf and mid-water groundfish trawlers or combination Trawler/Seiners.

The projection for small 45'-80' wooden boats may well be optimistic. The major part of this construction would be for Newfoundland in-shore fisheries and is dependant on continuation of the 50% construction subsidy. There is considerable doubt if wooden vessel construction is competitive with ferro-cement or

fiberglass construction for the smaller boats. The continuance of wooden boat construction must be at least partially regarded as a social-economic measure.

Source of Fishing Vessels for the Atlantic Fleet

The construction of new fishing trawlers of 75' and over in Canadian yards dates from 1961 when the subsidization of such construction started. As at March 31, 1967 the total Canadian fishing fleet under 5 years of age was 45,400 GRT (100 GRT and over only) of which approximately 20,000 GRT was produced in Atlantic and St. Lawrence Region yards. During 1967, a further 23,600 GRT were delivered from Canadian yards but this subsequently dropped to 8,500 GRT in 1968 and 2,600 GRT in 1969 due to changes in subsidization and depressed conditions in the fishing industry. It is apparent that more than one-half of the modern fleet is of Canadian origin.

At present, the supply of new trawlers on the international market is plentiful and price competition is prevalent. Poland, Spain and Yugoslavia are particularly active in the market as are such traditional suppliers as the U.K.

TABLE A-5

ATLANTIC REGION

SUMMARY OF WATERBORNE TRAFFIC IN COASTAL TRADE

1963 - 1967

	1963		1964		1965		1966		1967	
Share of Cargo Market (million cargo tons by registry of vessel)										
	Tons	%	Tons	%	Tons	%	Tons	%	Tons	%
Canada	9.1	75.8	10.8	83.0	9.8	81.5	10.1	85.5	10.9	91.5
Commonwealth	2.9	24.2	2.2	17.0	2.2	18.5	1.7	14.5	1.0	8.5
Total	12.0	100.0	13.0	100.0	12.0	100.0	11.8	100.0	11.9	100.0

Traffic Summary (including departures only)

Total:	Departures (000)	85.4	81.6	79.6	81.7	72.2
	NRT (millions)	72.0	74.1	78.9	85.0	77.3
	Average size-NRT	850	900	1,000	1,050	1,100
	Cargo (million tons)	12.0	13.0	12.0	11.8	11.9
	Tonnage ratio	.17	.18	.15	.14	.15
Canadian:	Departures (000)	83.4	79.8	78.5	80.8	71.5
	NRT (millions)	78.6	71.4	76.9	83.3	76.1
	Average size-NRT	850	900	1,000	1,050	1,050
	Cargo (million tons)	9.1	10.8	9.8	10.1	10.9
	Tonnage ratio	.11	.15	.13	.12	.14
Commonwealth:	Departures (000)	2.0	1.8	1.1	.9	0.7
	NRT (millions)	3.4	2.4	2.0	1.7	1.2
	Average size-NRT	1,600	1,350	1,950	1,850	1,900
	Cargo (million tons)	2.9	2.2	2.2	1.7	1.0
	Tonnage ratio	.85	.92	1.10	1.00	.83

Source: DBS.

CHAPTER II

SUPPLY OF SHIPPING SERVICES

Coastal Trade Traffic

The Atlantic Region is the only area in Canada where vessels of foreign (Commonwealth) registry carry a significant part of the waterborne coastal trade. However, the Commonwealth registry share of the coastal trade in this region has been declining steadily from 24.2% in 1963 to 8.5% in 1967. Table A-5 shows the share of the coastal cargo market held by vessels of Canadian and Commonwealth registry between 1963 and 1967, together with the traffic summary.

The developments indicated in Table A-5 are as follows:

(a) Coastal trade by Canadian vessels consists of very heavy movement by relatively small vessels. While the average size of vessel used has been increasing steadily since 1963, it was still only 1050 NRT in 1967. Small populations in a large number of ports require frequent service by relatively small vessels, resulting in a large number of arrivals and departures. The very low "tonnage ratio" probably results from the dominance of package and general cargo on the Canadian vessels and one-way trade patterns. The "tonnage ratio" used here consists of the cargo carried divided by NRT vessel movement, and is used to obtain a relationship between cargo and ship movement.

(b) The vessels of Commonwealth registry are, on the average, almost twice as large as the Canadian ships. In general, the Commonwealth vessels are engaged in bulk commodities movement on a regularly chartered basis. The higher density bulk cargoes provide significantly higher tonnage ratios.

Water transportation constitutes a basic part of the Atlantic Region transportation structure. The same situation exists, but to a lesser extent in the Pacific Region. This differs greatly from the Great Lakes and St. Lawrence Region, where water transportation operates mainly as a carrier of bulk commodities in which trade it is competitive with highly developed railway and road transportation systems.

The Atlantic Coastal Fleet

As at December 31, 1967 (the date being used for projection purposes), the Atlantic coastal fleet was made up as follows (as reported by the Canadian Maritime Commission):

Type	No.	(000) GRT
Dry Cargo/Passenger	29	53.7
Ferries	17	84.8
Tankers	12	53.2
Total self-propelled (1000 GRT and over)	58	191.7
Tugs (100 GRT and over)	39	6.1
Barges, scows, dredges (100 GRT and over)	326	85.2
Small self-propelled vessels (100-999 GRT)	200-225 (est.)	60.0 (est.)
	613	343.0

The foregoing includes both government and privately-owned vessels operating in the commercial sector.

The estimate of 200-225 small ships of between 100 and 1000 gross tons in commercial service at the end of 1967 is based on the fact that as of March 31, 1967 there were 263 such dry cargo vessels totalling 85,000 GRT in service in Canada, and the majority of these were on the Gulf of St. Lawrence and Atlantic Coast service. The estimated total gross tonnage of these vessels in the Atlantic Region is 60,000 at an average size of 320 gross tons.

Of the total 85,200 GRT of barges and scows in the region it is estimated that 27,500 GRT were on the Atlantic Coast, and 57,700 GRT located in the St. Lawrence River area up to Montreal. A significant

proportion of this St. Lawrence tonnage consists of dredges and their supporting scows and barges. This tonnage is not a significant factor in cargo movement.

Ship Types in the Coastal Trade

The coastal trade ships are relatively small, specializing in short-haul, frequent-stop traffic to small ports. Pulpwood is usually carried as deck cargo particularly in the protected waters of the Gulf of St. Lawrence.

The small size of the average coastal vessel is indicated by the fact that of the 341 vessels in Canadian coastal service in 1967, only 108 were larger than 1000 gross registered tons. Since the Pacific Region self-propelled coastal fleet is relatively small, most of these 233 vessels of between 100 and 1000 gross tons were in service on the Gulf of St. Lawrence and/or the Atlantic Coast. The exception to the small coastal vessels are those ships in regularly scheduled, or Arctic supply service. The main regularly scheduled run is Montreal to Newfoundland. These ships are designed for rapid turn-around and flexibility as to the type of cargo which can be carried.

Barges are not as yet a significant factor in the Atlantic Region. In 1967, barge movement accounted for only 574,000 NRT of the total 77 million NRT all-vessel departures in coastal trade in the Region, or less than 1.0% of the total vessel movement in this category. This traffic consisted almost entirely of the distribution of petroleum products from refineries, and occurred mainly in Nova Scotia and New Brunswick.

In 1967, the barge fleet in the Region was estimated to total 85,000 GRT vs. approximately 292,000 tons for the self-propelled fleet (including all vessels over 100 GRT except tugs). It is probable that the barges carried a much larger proportion of the cargo tonnage than their proportion of total movement, particularly on the Atlantic Coast where the 27,500 GRT of barges accounted for 82% of the entire Region barge movements. During 1967 there was no reported barge movement in Newfoundland.

Source of Vessels for the Atlantic Coastal Fleet

As at December 31, 1968 there were a total of 63 ships in the Atlantic coastal fleet including dry cargo, ferry and tanker vessels of 1,000 GRT and over.

The source of these ships were as follows:

Country of Construction	No.	(000) GRT
Canada	37	130.0
U.K.	18	31.6
U.S.A.	6	20.7
Other	2	8.5
	63	190.8

Approximately 68% of the gross tonnage of self-propelled vessels over 1,000 gross tons was built in Canada.

The Atlantic Coast fleet has a record of frequent transfers between the fleet and foreign registry. In the years 1963 to 1966 inclusive there were about 8 transfers to the fleet and 12 transfers out.

TABLE A-6

ATLANTIC REGION

SUMMARY OF WATERBORNE TRAFFIC IN INTERNATIONAL TRADE

1963 - 1967

Share of Cargo Market (million cargo tons by registry of vessel)

	1963		1964		1965		1966		1967	
	Tons	%	Tons	%	Tons	%	Tons	%	Tons	%
Canada	0.8	1.4	1.3	2.2	1.5	2.4	1.2	1.9	1.5	2.7
Foreign	50.7	98.6	58.2	97.8	61.0	97.6	60.9	98.1	54.8	97.3
	51.5	100.0	59.5	100.0	62.5	100.0	62.1	100.0	56.3	100.0

Traffic Summary (vessel movement including arrivals and departures)

Total:	Arrivals & departures (000)	21.2	23.0	23.9	24.7	22.1
	NRT (millions)	70.0	79.7	86.7	89.0	81.8
	Average size-NRT	3,250	3,500	3,600	3,600	3,700
	Cargo (million tons)	51.5	59.5	62.5	62.1	56.3
	Tonnage ratio	.74	.75	.72	.70	.68
Canadian:	Arrivals & departures (000)	4.5	5.1	5.0	5.5	5.2
	NRT (millions)	1.9	2.9	3.1	3.3	3.3
	Average size-NRT	400	550	600	600	650
	Cargo (million tons)	0.8	1.3	1.5	1.2	1.5
	Tonnage ratio	.42	.45	.49	.36	.45
Foreign:	Arrivals & departures (000)	16.6	17.9	18.9	19.2	17.0
	NRT (millions)	68.1	76.8	83.6	85.7	78.5
	Average size-NRT	4,100	4,300	4,400	4,500	4,600
	Cargo (million tons)	51.5	59.5	62.5	62.1	54.8
	Tonnage ratio	.76	.77	.75	.72	.70

International Trade

Table A-6 shows the share of the ocean-going international cargo markets held by vessels of Canadian and foreign registry, together with the traffic summary for the years 1963 to 1967. This combines both the off-shore and Continental U.S. trade as the available statistics do not show these movements separately. The following comments cover the main factors:

(a) The Canadian share of the Atlantic Region international ocean-going trade has fluctuated between 1.4% and 2.7% between 1963 and 1967, with some slight upward tendency. The Canadian traffic consists mainly of movement between the Region, the U.S. Northeast Atlantic Coast and the Caribbean. The individual shipments tend to be small, although some bulk cargoes including iron ore and petroleum are handled.

(b) The ships of foreign registry are on the average considerably larger than the Canadian averaging 4,600 NRT in 1967. The foreign flag movement includes the major part of the bulk commodity traffic including petroleum, grain and iron ore. This is largely one way trade accounting for the relatively low tonnage ratio despite the high density cargoes. The main foreign flag carriers are Norway, Liberia and the United Kingdom.

Canadian flag participation in the Atlantic Region ocean-going trade is made up of the following:

(a) Regular service by the small number of deep-sea ships of Canadian registry.

(b) Occasional or off-season service by coastal vessels with ocean-going capability. This would include periodic off-season service to and from the Atlantic Region by Great Lakes boats with ocean-going capability.

(c) Regular service by the coastal fleet in coasting service to the U.S. Northeast Atlantic Coast and the Caribbean.

Item (b) arises from the fact that for reasons of weather, ice and economic activity the peak coastal shipping season is in summer. The larger vessels are therefore free to engage in international deep-sea service in the winter months which may or may not include the carriage of Canadian international cargoes.

The Atlantic Region Deep-Sea Fleet

As of December 31, 1967 the Canadian deep-sea fleet in the Atlantic Region consisted of the following:

Type	No.	Total GRT (000)
Combination bulk carriers and oil tankers	2	42.6
Dry Cargo Vessels	1	7.2
Tankers	1	15.2
	4	65.0

In addition, the following coastal and Great Lakes vessels had ocean-going capability:

Type	No.	Total GRT (000)
Coastal:		
Dry Cargo Vessels	4	10.0
Tankers	6	32.7
	10	42.7
Great Lakes:		
Package Freighters	4	25.0
Bulk Carriers	3	51.7
	7	76.7
TOTAL	17	119.4

The coastal and lake vessels engage in off-shore trade during the off-season. The total 184,000 GRT of vessels with

ocean-going capability does not therefore constitute the active international trading fleet. Only 65,000 GRT is so engaged on a full-time basis. The participation of the balance depends on season, the market for cargoes, etc.

With the exception of one small vessel of 1,000 GRT the entire 184,000 GRT Atlantic fleet with ocean-going capability was built in Canada.

CHAPTER III

SHIP AND TRANSPORTATION TECHNOLOGY

Waterborne Transportation Developments

The new water transportation developments in the Atlantic Region will consist of the use of larger ocean-going ships, the large scale advent of containerization, the greater utilization of barges, and ice strengthening of vessels.

Ship Size: There is no doubt that a significant increase in the average size of ocean-going bulk carriers will occur in the next 10 years. To accommodate this development existing ports are being enlarged (Sept - Iles), new terminals are being built (at Saint John) or new industrial development is being located where the necessary deep water is available (refineries at Pt. Tupper and Come-by-Chance).

Containerization: The exact extent and impact of containerization cannot yet be forecast, other than it will be substantial. It can be expected that the Atlantic Region ports will become major container terminals in Eastern Canada. Apart from the containerization of the Atlantic ports' traditional general cargo trade, additional volume can be expected through diversion from the Seaway route of both Canadian and the U.S. Mid-West cargoes.

Containerization will have several direct effects on the shipping industry:

(a) A number of new, large and fast container ships will be required, which for reasons of their speed and rapid turnaround will have the cargo carrying capability more than double the equivalent tonnage of conventional general cargo vessels.

(b) For the above reason, a surplus of general cargo vessels can be expected in the 1970's. This may mean more competition and fewer off-season employment opportunities in ocean-going trade for the coastal and lakes general cargo fleets.

The advent of containers with their effect of concentrating ocean-going at relatively few terminals will probably require some adjustments to the coastal services:

(a) The Region distribution network will tend to centre on the container ports where outgoing cargoes will be consolidated and inbound cargoes broken up.

(b) Coastal distribution vessels will on the average be larger with quick turn-around capability to handle many calls. Sailings will be made on a more regular basis to coincide with the regular overseas container services. While no significant degree of containerization is expected for regional cargo, a greater use of unitization of cargoes will be necessary to allow more rapid turn-arounds for larger coastal ships.

Barges: To date, the utilization of barges in the Atlantic Region has been limited mainly to petroleum product distribution, although some pulpwood and chip movement has started. While petroleum movement by barge will continue to grow, it is probable that a major future use of barges will be in chip and pulpwood movement. This would involve primarily the use of well developed Pacific Region techniques in the Gulf of St. Lawrence, including specialized chip barges, self-loading and dumping log and pulpwood barges, etc. In 1967, coastal pulpwood movements were approximately 1.6 million tons, and it is expected that by 1980 most of this will be moved by barge.

Ice Strengthening: Seasonal navigation limitations in the Gulf of St. Lawrence and Labrador coastal areas due to ice have been major adverse factors in the economics of coastal shipping. The matter of navigation and vessel requirements in ice infested waters has been receiving much more attention in recent years and it is expected that through the necessary strengthening of coastal ships and barges, a substantial extension of the navigation season will be achieved.

Lash Systems: No application of Lash concept is expected in the Atlantic Region. In general, the source, destination and the nature of the cargoes are not well suited to the Lash principle for off-shore trade. In the coastal trade, the relatively small cargo drop-offs would not appear to justify the large investment that the system would require.

Competitive Transportation Developments

There are no significant competitive transportation developments which threaten the dominant position of waterborne trade in the Atlantic Region. There is of course no alternative to waterborne carriage for off-shore cargoes. For coastal trade, geography and a relatively small population scattered in small coastal centres precludes the development of competing rail or road services at the high capital costs which such development would entail. The unit-train which will have a significant impact on the Great Lakes Region waterborne trade is not expected, therefore, to have much effect on the Atlantic Region.

Pipelines, for both solids and liquids, will also not have any significant effect before 1980. Solids pipelines will probably initially consist of wood pulp movement and will be confined to movements from inland forests to the coastal mills, rather than to wood transportation parellel to the coastline. A new oil pipeline from Portland, Me., to Quebec City is an eventual possibility, but the build-up in refining capacity in the Quebec City area will not justify such a line until after 1980.

CHAPTER IV

FUTURE DEMAND FOR SHIPS AND SERVICES

Commercial Demand

The future demand for ships and services for the Atlantic Region will derive from the following sources:

(a) increased demand for cargo capacity due to increases in trade;

(b) replacement of tonnage scrapped due to age or obsolesence;

(c) increases in requirements of the commercial non-cargo carrying sector such as ferries and passenger ships;

(d) repair and overhaul of the expanding domestic fleet and the foreign flag vessels entering the region's ports.

The fleet size forecasts combine both the coastal requirements and Canadian-flag participation in international trade. This is necessary because a part of the international trade is carried by the coastal fleet.

Demand from Trade Growth

The method used to forecast demand due to trade growth was as follows:

(a) Waterborne trade volumes were forecast (Chapter I).

(b) Past traffic was analysed to determine vessel movement in net registered tons required to move cargo volumes over past years. From this analysis were determined share of market held by Canadian vessels and a tonnage ratio which indicates vessel utilization. Assumptions were made as to the future values of these indices.

(c) The share of market and tonnage ratio assumptions were applied to the forecast cargo movements to determine future vessel traffic requirements.

(d) The size of the fleet in the base year was determined and the increase in its size in future years was assumed to be proportional to the increase in vessel traffic.

It is recognized that this method of forecasting does not provide an absolute basis of determining future ship requirements, as many factors such as speed increases, faster turn-around, etc., can have an effect. However, within the limitations of the assumptions that traffic patterns and vessel characteristics will remain basically the same, it provides a basis for forecasting of ship movement and fleet size.

For the purpose of forecasting the growth of the Atlantic Region fleet, 1967 was chosen as the base year. In general, it was a period of strong economic activity although waterborne trade volumes were down slightly from 1966. The main doubt about the 1967 data was the relatively small Commonwealth share of the coastal cargo market which at 8.5% in 1967 was down from 14.5% in 1966. This share of market has been adjusted to 10% in the projections. Similarly, the Canadian flag share of the international trade, at 2.7% in 1967, was considerably higher than the 1.9% in 1966; this has been adjusted to 2.4%.

The following table summarizes the main assumptions:

Waterborne Trade Assumptions

	Share of Market	Tonnage Ratio
Coastal:		
Canada	90%	.14
Commonwealth	10	.83
Ocean-Going:		
Canada	2.4%	.45
Non-Canadian	97.6	.70

TABLE A-7

ATLANTIC REGION

PROJECTIONS CANADIAN FLAG VESSEL TRAFFIC AND FLEET SIZE

	YEAR			
	1967 Actual	1970	1975	1980
Coastal:				
Cargo tons (millions)	11.9	12.8	14.1	15.4
Canadian Share - 90%	10.9	11.5	12.7	13.9
Canadian Vessel Traffic (million NRT)	76.1	80.3	88.8	97.0
International:				
Cargo tons - U.S.(millions)	15.0	15.5	16.7	17.9
Cargo tons - Off-shore "	41.3	46.8	54.4	62.2
Total	56.3	62.3	71.1	80.1
Canadian Share - 2.4%	1.5	1.5	1.7	1.9
Canadian Vessel Traffic (million NRT)	3.3	3.3	3.8	4.2
Total Canadian Vessel Traffic (million NRT)	79.4	83.6	92.6	101.2
Fleet Size (000 GRT)	266.8	282.0	311.0	340.0

It has been assumed that during 1967, the coastal fleet consisted of the cargo fleet as at December 31, 1967, as follows:

Deep-Sea	
Dry Cargo	49,700 GRT
Tankers	15,200
	64,900
Coastal	
Dry Cargo (1,000 + GRT)	53,700 GRT
Tankers (1,000 + GRT)	53,200
Small Dry Cargo Vessels (100-999 GRT)	60,000
Barges *	35,000
	201,900
Total	266,800

* includes 27,500 Atlantic Coast plus estimated 7,500 GRT in active cargo service in St. Lawrence River.

Table A-7 opposite summarizes the Canadian fleet growth projection. The projection indicates total vessel movements of 85.5, 94.6 and 103.5 million NRT per annum in 1970, 1975 and 1980 respectively. On the basis of the 1967 year-end Atlantic Region fleet size of 266,800 GRT, the projected fleet sizes are as follows:

1970	282,000 GRT
1975	311,000 "
1980	340,000 "

The total increase of 58,000 GRT between 1970 and 1980 would require an average of 5,800 GRT of new construction per annum to cover cargo trade growth.

Demand for Replacement Vessels

The replacement requirement can arise from scrappage due to age or obsolesence. It has been assumed that all vessels reaching 30 years of age during the 1970's will be replaced. It is

recognized that a number of small vessels (100-999 GRT) now in service are over 30 years old and are quite serviceable from a mechanical point of view. However, it is expected that most of these vessels will become obsolete due to their small size and competition from barges, particularly in the Gulf of St. Lawrence.

The following would be the estimate of the tonnage which will be replaced during the 1970's on a ton for ton basis:

Over 1,000 GRT:	
12 dry cargo & 2 tankers	37,000 GRT
100-999 GRT:	
100-120 vessels	33,000 GRT
Total	70,000

Because of increases in average size, speed and turn-around capability, the ratio of new tonnage to replacement tonnage has been estimated at 0.85:1.0. On this basis replacement tonnage would average 6,000 tons per annum.

Other Commercial Demand

In addition to the dry cargo and tanker fleets, there were 17 ferries totalling 85,000 GRT in the Atlantic and St. Lawrence areas in 1967. The expansion or replacement of this fleet is considered here to be a commercial demand, notwithstanding the fact that other considerations may be involved. The main operator of ferries is the C.N.R. with approximately 9 vessels. Two new vessels are on order to expand the Prince Edward Island service but are not included in this forecast. The further expansion of the P.E.I.

service is considered possible during the 1970's, but cannot be forecast with sufficient certainty so as to allow inclusion of any new tonnage in the forecast. There is also the possibility that traffic increases across the St. Lawrence will require additional ferries.

Replacement requirements will be relatively small in view of the present age of the fleet, possibly no more than 5-10,000 GRT. It is therefore forecast that all Atlantic Region ferry requirements during the 1970's will be 10,000 GRT, an average of 1,000 GRT per annum.

The forecast advent of sizeable barge service in the Atlantic Region and the Gulf of St. Lawrence will bring about a need for additional large tugs in the 3,000 h.p. or more class. In addition, a number of such tugs will be required to assist in docking the larger tankers and ore carriers. While it can be estimated that 5 to 6 tugs will be required for docking purposes, the number and size that will be required for barge towing cannot yet be estimated. In terms of gross tonnage the total tug requirements per annum would be relatively small; they have not been included in the forecast.

Summary of Commercial Demand

The following table summarizes the projected annual ship requirements for commercial services in the Atlantic and St. Lawrence Region, for the period 1970-1979.

Fleet expansion: Dry Cargo and Tankers		5,800 GRT/annum
Replacement		6,000 GRT/annum
Ferries		1,000 GRT/annum
	Total	12,800 GRT/annum

TABLE A-8

ATLANTIC REGION

INTERNATIONAL TRADE FOREIGN FLAG VESSEL TRAFFIC PROJECTION

1970 - 1980

	1967 Actual	1970	1975	1980
Projected Cargo: (million tons)				
Total Cargo	56.3	62.3	71.1	80.1
Foreign Share %	97.3	97.6	97.6	97.6
Foreign Flag Cargo	54.8	60.8	69.4	79.2
Tonnage Ratio	.70	.70	.70	.70
Vessel Traffic (million NRT)	78.5	86.7	99.2	113.0

Types of New Ship Construction

There are not expected to be any significant changes in the dry-cargo vessels and tankers of over 1,000 GRT used in the region, except that they will be of larger average size than at present with more emphasis on rapid turnaround capability.

It is unlikely that the small (under 1,000 GRT) dry cargo fleet will be replaced by similar ships and more probable that barges will take over a substantial part of the Gulf of St. Lawrence pulpwood haulage which is an important cargo for the small vessels. This should accelerate the retirement of the older boats, and sharply reduce new construction of small coastal vessels.

The construction of barges, particularly for the pulpwood and pulp chip trade will probably constitute the major portion of new vessel demand. As a general estimate only, a large part of the 33,000 GRT replacement requirement in the small vessel fleet may be barges. This would constitute about 25% of the total projected commercial tonnage requirements during the 1970's. The advent of a large barge service on the East Coast would require an increase in the tug fleet.

Off-Shore Trade

It is not necessary for present purposes to forecast the increase in fleet size required to service the increase in Canada's Atlantic Region international trade. However, Table A-8 opposite does show the projected increase in vessel traffic which the forecast cargo

flow might require. The projection indicates a traffic increase of 1.45 times from 78.5 million NRT in 1967 to 113.0 NRT by 1980. The number of vessel arrivals and departures will probably decline because a substantial increase in the average size of vessel used is expected.

Repair Services

The projected increase in ship tonnage movements in the region will bring about an increased requirement for ship repair and overhaul services.

A detailed forecast for repair services has not been prepared on a regional basis but information for Canada, as a whole, and on repairs in each Region is presented in the Canada section.

CHAPTER V

THE SUPPLY POSITION OF THE SHIPBUILDING INDUSTRY

Introduction

The data and information on shipping services and ships presented in Chapters I to IV are based on the Atlantic Region as defined by D.B.S. in its shipping statistics, i.e. the trade tonnages include cargoes moving in the Gulf of St. Lawrence, Montreal and below, as well as cargoes on the Atlantic Coast.

The information in this chapter on the supply position of the shipbuilding industry relates to shipyards located in the Atlantic Region proper, i.e. the three Maritime provinces and Newfoundland. Questionnaire data have been used to supplement D.B.S. data in certain respects.

The Level and Composition of Activity in the Industry

The activity of the shipbuilding industry in the Atlantic Region has been primarily in new construction (commercial and government), and ship repair; reconditioning and conversion, and manufacture of fabricated industrial products have been carried on to a limited extent.

D.B.S. shows the following as being the number of shipyards and the value of work performed in the Region during 1958-67:

TABLE A-9

ATLANTIC REGION

ACTIVITY IN THE SHIPBUILDING AND REPAIR INDUSTRY, BY CATEGORY

	Value of All Work Performed $ Million	Value of New Construction Work $ Million	Value of Repair Work $ Million	Value of Conversions and Industrial Work $ Million
1969 Est.	$ 52.8	$ 39.0	$ 11.1	$ 3.7
1968	55.3	39.2	14.5	1.6
1967	46.3	35.2	9.9	1.2
1966	33.2	19.3	9.9	4.0
1965	28.8	16.0	8.2	4.6
1964	34.7	23.5	9.2	2.0
1963	31.7	21.9	7.8	2.0
1962	26.8	18.3	7.7	0.8
1961	26.8	16.1	8.3	2.4
1960	19.1	5.6	9.7	3.8
1959	13.3	4.8	7.2	1.3
1958	13.4	6.4	6.3	0.7
	382.2	245.3	109.8	28.1
	Per Cent	Per Cent	Per Cent	Per Cent
1969 Est.	100%	74%	20%	6%
1968	100	71	26	3
1967	100	75	21	4
1966	100	58	30	12
1965	100	56	28	16
1964	100	68	27	5
1963	100	69	25	6
1962	100	68	29	3
1961	100	60	31	9
1960	100	29	50	21
1959	100	36	54	10
1958	100	48	47	5
	100	64	29	7

Source: Questionnaires to yards representing 77% of the work performed by all yards in the region in 1967.

	Number of Establishments Number	Value of Work Performed $ Million
1967	26	60
1966	24	44
1965	25	40
1964	24	45
1963	24	36
1962	23	31
1961	22	26
1960	22	23
1959	23	21
1958	23	22

Although published information on the types of activity carried on in the region is not available, responses by yards to the questionnaire provided this kind of information. Table A-9 shows the level and trend of activity in total and by category since 1958 in the questionnaire yards, which made up some 77% of the value of work performed by all yards in the region in 1967. It might be noted that the questionnaire did not ask for the value of conversions and of industrial work separately, and these are therefore combined in the last column of the Table.

Total activity increased up to 1965, hesitated in that year and the next, and expanded substantially in 1967 and 1968 although preliminary indications are of a slight fall-off in 1969. Despite this, activity in 1967-69 has been at a level considerably above that reached earlier.

New construction has come to occupy a much more important place in overall activity in the Atlantic Provinces, growing

TABLE A-10

ATLANTIC REGION

THE IMPORTANCE OF FEDERAL GOVERNMENT PROCUREMENT IN NEW CONSTRUCTION ACTIVITY

	All New Construction	New Construction For Federal Government			Federal Government as % of Total		
		Naval	Civilian	Total	Naval	Civilian	Total
	$ Million	$ Million	$ Million	$ Million	%	%	%
1969 Est.	$ 39.0	$ 15.2	$ 0.8	$ 16.0	39%	2%	41%
1968	39.2	23.7	0.9	24.6	61	2	63
1967	35.2	9.5	-	9.5	27	-	27
1966	19.3	0.4	1.7	2.1	2	9	11
1965	16.0	-	-	-	-	-	-
1964	23.5	5.1	0.2	5.3	22	1	23
1963	21.9	4.0	2.5	6.5	18	11	29
1962	18.3	1.9	4.5	6.4	10	25	35
1961	16.1	0.9	2.4	3.3	6	15	21
1960	5.6	0.5	2.7	3.2	8	49	57
1959	4.8	3.8	0.5	4.3	80	11	91
1958	6.4	3.5	2.8	6.3	55	45	100

Source: Questionnaires to Yards

six-fold in dollar value and increasing from less than 50% of total activity in the late 50's to about 75% in the late 60's. Repairs have grown in dollar value although they have declined in relative significance. Industrial and conversion work in the region has been relatively small, associated with the limited scale of the market for industrial products in the region. The following figures compare the patterns of activity in the Region and in Canada during recent years:

	Approximate importance of activity of questionnaire yards in recent years of:		
	New Construction	Repairs	Conversion and Industrial
Atlantic Region	70 - 75%	20 - 25%	5%
Canada	55 - 60	15	30

New Construction

The recent increase in importance of new construction has arisen very largely from government naval work, as is shown in Table A-10. In the late '50's and early '60's both naval and civilian government work were significant in Atlantic Region construction activity. Subsequently, civilian procurement in the region fell off and has been small since the mid - 1960's. The contracts for the O.S.S. ships expanded the role of naval work in the region during 1967 and later.

TABLE A-12

ATLANTIC REGION AND CANADA

SHIPBUILDING AND SHIP REPAIR INDUSTRY

PURCHASED MATERIALS AND UTILITIES, WAGES OF PRODUCTION AND RELATED WORKERS, AND OVERHEAD AND PROFIT, AS PERCENT OF VALUE OF WORK PERFORMED

	1967	1966	1965	1964	1963	1962	1961
Atlantic Region							
Percent of Value of Shipments made up by:							
Purchases	49%	42%	43%	38%	41%	38%	40%
Production Wages	28	35	32	34	45	47	43
Overhead & Profit	23	23	25	28	14	15	17
Total	100%	100%	100%	100%	100%	100%	100%
Canada							
Percent of Value of Shipments made up by:							
Purchases	46%	44%	44%	42%	42%	40%	37%
Production Wages	31	31	29	30	34	39	36
Overhead & Profit	23	25	27	28	24	21	27
Total	100%	100%	100%	100%	100%	100%	100%

Source: D.B.S. Annual Census of Manufactures

TABLE A-11

ATLANTIC REGION

NEW CONSTRUCTION ACTIVITY AND NON-GOVERNMENT PROCUREMENT

	All New Construction $ Million	Dry Cargo $ Million	Tankers $ Million	Ferries $ Million	Fishing Vessels $ Million	Barges $ Million	Tugs $ Million	Other $ Million	Total Non-Government $ Million
1969 Est.	$ 39.0	-	-	$ 4.0	$ 4.7	$ 2.0	$ 1.3	$ 11.1	$ 23.1
1968	39.2	-	-	-	10.4	0.1	0.8	3.2	14.5
1967	35.2	6.4	-	-	18.4	-	0.7	-	25.5
1966	19.3	3.0	-	-	10.0	2.2	1.9	-	17.1
1965	16.0	6.7	-	2.0	5.9	0.3	1.2	-	16.1
1964	23.5	2.6	7.8	3.1	3.5	0.9	-	0.3	18.2
1963	21.9	2.7	9.3	-	2.8	0.6	-	-	15.4
1962	18.3	6.7	3.9	0.5	0.9	-	-	-	12.0
1961	16.1	7.8	3.3	1.7	-	-	-	-	12.8
1960	5.6	-	-	1.2	1.1	0.1	-	-	2.4
1959	4.8	-	-	-	-	0.4	-	-	0.4
1958	6.4	-	-	-	-	-	-	-	-
	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent
1969 Est.	100%	-	-	10%	12%	5%	3%	28%	59%
1968	100	-	-	-	27	-	2	8	37
1967	100	18%	-	-	52	-	2	-	73
1966	100	16	-	-	52	11	10	-	89
1965	100	42	-	13	37	2	7	-	100
1964	100	11	33%	13	15	4	-	1	77
1963	100	12	42	-	13	3	-	-	71
1962	100	37	21	3	5	-	-	-	65
1961	100	49	21	10	-	-	-	-	79
1960	100	-	-	22	21	1	-	-	43
1959	100	-	-	-	-	8	-	-	9
1958	100	-	-	-	-	-	-	-	-

Source: Questionnaire to Yards

Note: Totals may not add due to rounding

Non-government construction business has fluctuated both in value and in the types of vessels that have constituted the market for Atlantic yards. Details are given in Table A-11 which shows the wide variety of vessels ordered in past years. Dry cargo vessels were important in 1961-67 and tankers in 1961-64. Activity in ferries has been sporadic and in barges quite small except in the years 1966 and 1969. Some tugs have been built since 1964. Business in the construction of fishing vessels has been continuous during the 1960's with peak activity in 1967; subsequently there was a fall-off associated with declining demand and reduction in the rate of subsidy. An offshore drill-rig (classed as other in the table) was being built in 1969.

The Resources Used in the Industry

This section uses available data to assess the use of resources in the shipbuilding and repair industry in the Atlantic Region.

Table A-12 shows, for the Region and Canada, the relative proportions of purchased materials and utilities, wages of production and related workers, and overhead and profit, of the total value of all work performed. These data are drawn from the annual D.B.S. publications on the industry, which treat purchases of fuel and power as material purchases and include all hourly paid labour in one total of production and related workers,(whereas the industry's practice in its internal assessments is to class fuel and power, and indirect labour, as overhead costs).

TABLE A-13

ATLANTIC REGION

RELATIVE USE OF RESOURCES BY TYPE OF ACTIVITY IN THE SHIPBUILDING AND REPAIR INDUSTRY

	New Construction				Repairs			
	Est. 1969	1967	1963	1958	Est. 1969	1967	1963	1958
Importance of Activity in Total Activity	74%	75%	69%	48%	20%	21%	25%	47%
Use of Resources within the Activity:								
Materials	57%	60%	38%	43%	18%	18%	15%	22%
Labour	27	23	33	31	35	35	38	35
Overhead & Profit	16	17	29	26	47	47	47	43
Total	100%	100%	100%	100%	100%	100%	100%	100%

	Industrial				Conversion			
	Est. 1969	1967	1963	1958	Est. 1969	1967	1963	1958
Importance of Activity in Total Activity	4%	3%	6%	5%	2%	small	small	small
Use of Resources within the Activity:								
Materials	40%	36%	29%	36%	24%			
Labour	27	25	20	45	38			
Overhead & Profit	33	39	51	19	38			
Total	100%	100%	100%	100%	100%			

Source: Questionnaires to Yards

Note: Fuel and power purchases and indirect labour are included in overhead, and the proportions are thus not comparable with those in the preceding table, which was based on D.B.S. data for all yards and on its classification of these cost items.

Variation in the amounts of government and non-government work, in types of commercial vessels built, and in the mix of building, repair and industrial work, have all affected the resource ratios in the Region compared to Canada as a whole. In general, however, it appears that the industry has been even more labour intensive in the region than nationally. Wages have generally been a higher proportion of value added (value of work performed minus purchases of materials and utilities) in recent years than in Canada.

Further information on relative use of resources by type of activity is shown in Table A-13, on the basis of questionnaire returns from Atlantic yards which reported utilities and indirect labour as overhead items in accord with the industry's usual practice. The pattern of resource use is quite similar to that for Canada presented earlier - greater use of materials, lesser use of labour, and a lower percentage for overhead and profit, in new construction as compared with repair activity.

Other data indicate that the level of fixed assets per worker is much the same in the Atlantic Region as nationally, and also administrative, office, distribution and sales salaries in relation to value of work performed. Fringe benefits in relation to production wages are generally lower in the Atlantic industry than elsewhere, ranging from 10 - 20% whereas the national average is close to 20%.

TABLE A-14

ATLANTIC REGION AND CANADA

SHIPBUILDING AND SHIP REPAIR INDUSTRY

VALUE ADDED, LABOUR COSTS AND MAN-HOURS

1961 - 67

	Value Added per Dollar of Labour Cost		Value Added per Man-Hour, Production and Related Workers		Average Wages per Man-Hour, Production and Related Workers	
	Atlantic Region	Canada	Atlantic Region	Canada	Atlantic Region	Canada
1967	$ 1.83	$ 1.74	$ 3.98	$ 4.77	$ 2.16	$ 2.74
1966	1.69	1.85	3.47	4.70	2.05	2.55
1965	1.79	1.96	3.45	4.75	1.92	2.43
1964	1.80	1.95	3.68	4.58	2.03	2.35
1963	1.30	1.70	2.42	3.78	1.86	2.22
1962	1.32	1.53	2.60	3.27	1.96	2.14
1961	1.40	1.74	2.38	3.55	1.70	2.04
Percent Increases: 1961 - 67			67%	34%	27%	34%

Source : D.B.S. Annual Census of Manufactures

Examining labour costs in more detail, the more labour intensive nature of industry activity in the region has resulted in value added per dollar of labour cost being consistently lower in the region than in Canada until 1967, when the substantial expansion in activity associated with naval and fishing vessels raised output per labour dollar above the national average, as is shown in Table A-14. (Value added is total value of work performed less purchases of materials and utilities; it is thus a measure of activity within the shipbuilding industry itself).

The effect of the increased scale of activity is also apparent in value added per man-hour which, as the table also shows, expanded by 67% during 1961-67 in the region compared with 34% in Canada. It should be noted that a large part of this growth in the region occurred in 1967 and the regional figure in that year remains below the national average. These data are, unfortunately, not yet available for 1968 and 1969, but the continuation of activity at a high level (as reported on questionnaires) suggests that a higher level of productivity has been maintained. It has not been possible to measure productivity in volume terms, apart from price changes, since necessary data do not exist for the region.

Wage costs per man-hour paid increased at a slower rate (27%) in the region in 1961-67 than in Canada as a whole (34%). More recent information on wage rates, derived from the questionnaire

responses and relating in the region to yards that pay higher rates than the regional average is:

	Average Wages per Man-Hour Paid		
	1966	1969 Est.	% Increase 1966-69
Atlantic Region	$ 2.31	$ 2.85	23
Canada	$ 2.57	$ 3.25	26

On the basis of these data, wage rates in the industry in the region have continued to increase less rapidly than in Canada as a whole.

Shipyard Facilities and Methods

According to data published by the Dominion Bureau of Statistics for 1967 there were 26 shipyards in the Atlantic Region i.e. the Provinces of New Brunswick, Prince Edward Island, Nova Scotia and Newfoundland. One major repair establishment was not listed in that publication and at least one yard has closed and another one has started in business since then. The breakdown of the present establishments is as follows:

- 2 Major Shipbuilding Yards
- 3 Small Shipbuilding Yards
- 10 Ship Repair Establishments
- 12 Boatbuilding Yards

To this list might be added a wooden boatbuilding facility in virtually every fisherman's backyard in many areas of the Atlantic Region. All of the five shipyards listed carry out ship repairs on steel vessels and many of the boatbuilding yards also do repair work on a minor scale.

Seven of the twenty-seven establishments listed were visited by the Committee.

World War II requirements for ships of all types brought about a resurgence of shipbuilding activity in the Atlantic Region which has continued and expanded to the present time. Facilities now exist in the region to build all types of ships, ranging from 100,000 dwt. steel vessels to wooden craft and small reinforced plastic craft. The largest vessel that has been produced in this region was 32,000 dwt. Sophisticated destroyers, destroyer escorts, research vessels, modern trawlers, and special purpose vessels have been built for either Government departments or private industry.

The ship repair facilities in the Atlantic Region provide necessary services to the commercial coastal fleet and to ships of the various Government departments that are in the region, including National Defence, Transport, Energy, Mines and Resources, Fisheries, the Canadian National ferry fleet, and the R.C.M.P. Repair business is also generated by ocean-going vessels calling in the ports of the region, particularly in the winter season. It should be noted that the region's docking facilities extend up to about 100,000 dwt.and this will be insufficient to service the large bulk vessels that will be operating in the region in the immediate future. Practically no repair business is carried out in the Atlantic region for the Canadian inland fleet mainly because these vessels are prohibited from travelling outside the inland water limits east of Anticosti Island.

Building Facilities

A full range of types of building facilities is available in the Atlantic Region; these have been outlined in Table C-34.

The two major shipbuilding yards and the major repair yard are equipped with graving docks. One of the major shipbuilding yards also has a floating dock and a number of marine railways. All six yards that answered the questionnaire have launchway facilities and three of the small yards are equipped with marine railways.

Elevator lift type docks were not reported by any of the six yards that answered the questionnaire. However, from other sources it is known that such a dock is available in one of the yards in the region, capable of handling ships 270 feet long with a lifting capacity of 3,000 tons.

The largest size ship that can be built in one piece in this region varies from yard to yard, the low being 140 feet by 30 feet and the high 1,100 feet by 120 feet. Two yards indicated that they could build ships in two sections to be joined afloat.

Four of the steel ship builders use the block method to build the steel hulls. One major yard has a maximum lifting capacity of 100 tons and the other 140 tons. The other steel yards, which are classified as small yards, are capable of handling blocks in the 15 to 20 ton range.

Lofting

Lofting in the major yards is done by the 1/10th scale method and supplemented by wooden templates; in one of these yards some loft work is also done using the projection method. The small yards continue to use wooden templates exclusively.

In general, the lofting techniques employed in this region are much the same as in the whole of the Canadian industry.

Steelwork

The comments that follow obviously do not apply to yards engaged in the construction of wooden vessels.

In one major yard steel is stored outside in the flat and handled with overhead cranes. In the other major yard, plates are stored either in the flat or on edge; when it is required, it is loaded onto rail cars by either rail cranes or mobile cranes and brought into the shop where it is cut and prepared. After preparation it is transported, either by overland trucks or by rail cars, to the assembly shop.

The two small steel shipyards of this region use much the same storage and handling methods as the first major yard mentioned above. None of the yards in this region have a steel preparation system of the kind that is in some yards in the other regions.

The two major yards are equipped with burning facilities which are controlled by reduced scale drawings. One small yard uses tracer type equipment for contour burning. Oxy-plant burning is also available in these yards. The other small yards use hand burning only.

Apart from a large variety of semi-automatic welding processes using low hydrogen, inert gas, electro-gas and carbon dioxide, used for special applications, production welding in the two major yards is done with the standard unionmelt machines and with stick electrodes. The standard unionmelt process is also used in one small yard but the other small yards use stick electrode welding only.

Some of the yards have made improvements in lofting, burning and welding techniques but not in steel handling facilities. Looking at the indicated possible capital investment over the next ten years, it would appear that only one yard has an overall, integrated plan to modernize and improve its present layout and facilities to the point where substantial productivity improvements may be realized. Two other yards have plans for possible future capital investments that would likely result in some improved productivity.

Outfitting

The steel yards in the Atlantic Region do not differ appreciably from those of other Regions with regard to the number of outfitting operations that are sub-contracted.

In steel shipyards, the type of work sub-contracted during 1958-68 consisted of deck covering, insulation, and some sheet-metal work. However, a large volume of work in the two major yards in the region during 1969 created strain on certain parts of their operations and at the same time brought about a temporary shortage of

skilled tradesmen, forcing them to sub-contract to a greater degree than usual; this will not necessarily be a permanent practice.

Only one major yard has taken definite steps towards outfitting at the block stage, using this particularly in piping systems. The other yards have shown very little interest in adopting this practice. The difficulties in doing so are attributed to the wide variety of vessels built in the Region and to the short lead time traditionally available to shipbuilders in Canada.

Shipyard Personnel

In the Atlantic Region, 75% of shipyard workers were employed on marine work in September 1969, 4% on industrial work, and overhead and administration provided employment to 21%. This latter proportion compares with 23% in Canadian yards as a whole; the make-up of these personnel by function in the region and nationally was as follows:

Function	Percent of Total Overhead and Administration Employees	
	Region	Canada
Marketing	1.9%	3.5%
Research and Development	-	1.3
Design and Drafting	13.3	13.0
Production Control, Planning and Scheduling	6.7	3.9
Supervision	21.9	21.8
Management	3.3	3.9
Maintenance, Cranes and Stores	24.3	30.5
Other	28.6	22.1
Total, Overhead & Administration	100%	100%

While these figures may not be fully representative because they relate to the position in one month only, they do indicate some differences in practices in regional yards compared to those elsewhere.

Thus the marketing function in Atlantic yards was only half as significant as nationally and virtually no personnel were engaged in research and development. Production control, planning and scheduling in the region, however, was relatively more important than elsewhere, based on relative numbers of personnel employed in this function.

PART IV

GREAT LAKES & ST. LAWRENCE REGION

TABLE OF CONTENTS

GREAT LAKES & ST. LAWRENCE REGION

CHAPTER I

DEMAND FOR SHIPPING SERVICES

Commercial Cargoes

This Chapter examines waterborne trade patterns and volumes for both coastal and international trade in the Great Lakes and St. Lawrence Region and makes forecasts of future trade volumes to 1980 which are used as the basis for establishing shipping requirements for this Region.

For the purpose of this analysis, the waterborne trade in the great Lakes and St. Lawrence Region has been divided into the following cargo movements:

(a) Coastal lakes trade including all movement between Canadian ports on the Great Lakes;

(b) Coastal Seaway trade including all cargo movement between Canadian ports on the Great Lakes and Canadian ports in the Lower St. Lawrence and Atlantic area, Montreal and below;

(c) International Seaway trade including all cargo movement between U.S. Great Lakes ports and Canadian ports on the Lower St. Lawrence and Atlantic area, Montreal and below;

(d) International lakes trade including all cargo movement between Canadian and U.S. Great Lakes ports;

(e) Off-shore trade including all cargoes loaded or unloaded in Canadian Great Lakes ports for or from off-shore ports.

Items (a) to (d) above are termed "inland trade" since they are essentially carried in inland vessels operating west of Anticosti Island; a small portion of these cargoes originating or terminating east of Anticosti Island has been included in inland trade for convenience. Coastal trade between ports on the Lower

St. Lawrence (Montreal and below) is "inland trade" but is included in Atlantic Region coastal trade in accordance with the DBS classification of the cargo statistics.

Forecasts were prepared by dividing each of the above trades (a) to (e) into main components, the divisions being mainly by commodity groups. The forecast for each of these components has been based on a projection of the 1958-1967 trends as determined by computer analysis, with the projections modified in accordance with any developments indicated by a general analysis of the trade and economic prospects for that commodity. The forecast for each of the trades has been assembled by totalling the forecasts for its components. Also taken into consideration is the fact that the 1959-1967 period includes the emergence of new traffic patterns following the completion of the Seaway, so that the traffic growth rate may have been greater than is in prospect for the future. It has also been recognized that the 1967 figures were affected by a six week tie-up of the Canadian Lake fleet by a strike. However, no attempt has been made to adjust the 1967 figures, or the trend projections using them; the effect on the trend is probably not great and periodic traffic interruptions may again be encountered during the 1970-1980 forecast period.

This does not purport to be an exhaustive forecast, but rather a broad indication of trade volumes and the main components for the purpose of establishing additional ship requirements and ship types. Coastal trade is given first priority in the analysis because it is the

CHART L-1

GREAT LAKES AND ST. LAWRENCE REGION

WATERBORNE TRADE

1953 - 1967 WITH FORECASTS TO 1980

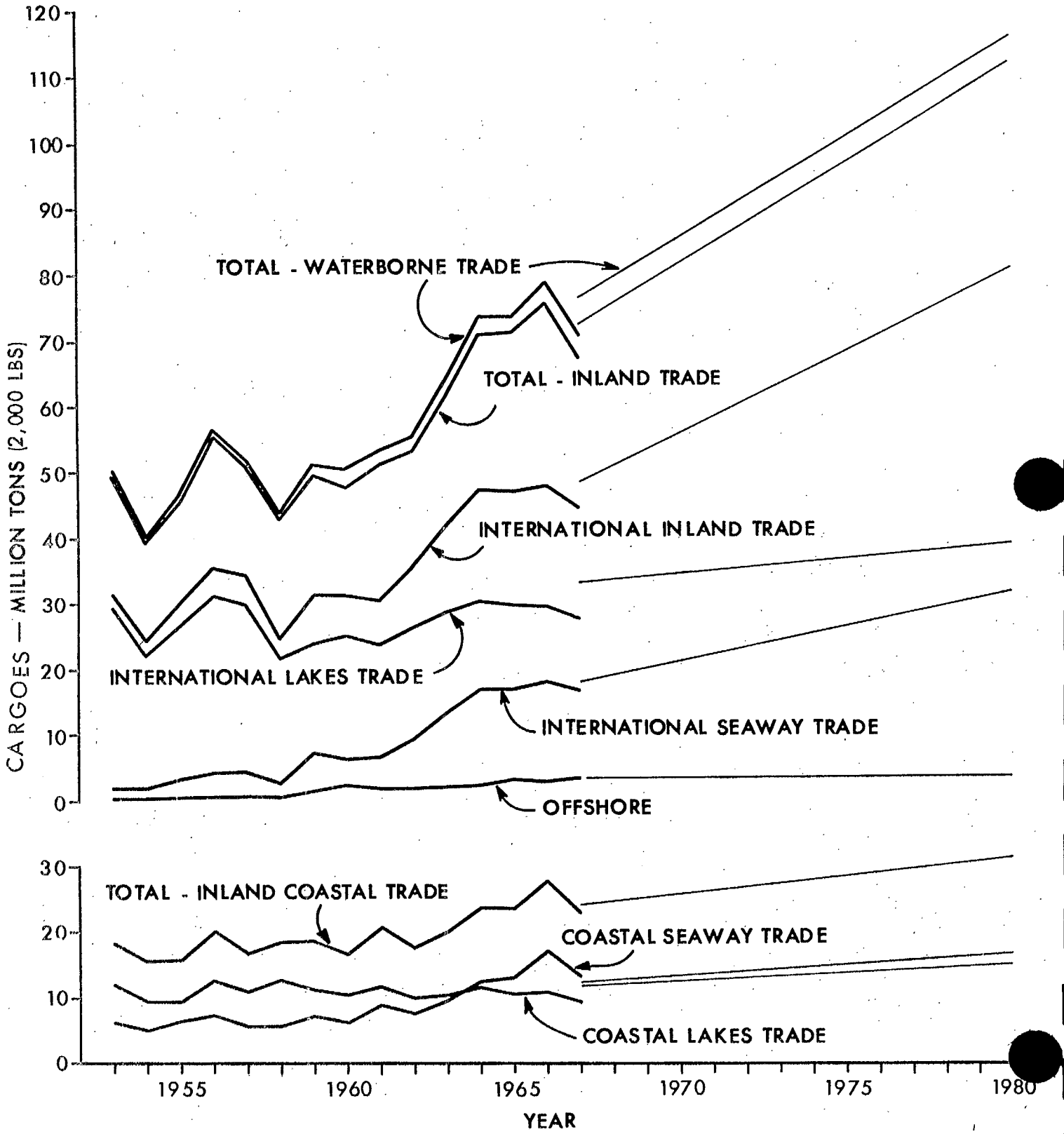


TABLE L-1

GREAT LAKES & ST. LAWRENCE REGION

SUMMARY OF WATERBORNE TRADE

1953 - 1967

(million tons - 2000 lbs.)

	Inland (1)								
	Coastal (2)			International (3)			Total Inland	Offshore Total	Total Region Waterborne Trade
	Lakes	Seaway	Total	Lakes	Seaway	Total			
1967	9.4	13.2	22.6	27.6	16.9	44.5	67.1	3.4	70.5
1966	10.8	17.0	27.8	29.7	18.0	47.7	75.5	3.0	78.5
1965	10.5	12.8	23.3	29.9	17.0	46.9	70.2	3.3	73.5
1964	11.5	12.3	23.8	30.2	16.9	47.1	70.9	2.5	73.4
1963	10.3	9.6	19.9	28.7	13.2	41.9	61.8	2.3	64.1
1962	9.9	7.6	17.5	26.3	9.3	35.6	53.1	2.1	55.2
1961	11.6	8.9	20.5	23.8	6.8	30.6	51.1	2.0	53.1
1960	10.2	6.2	16.4	25.0	6.3	31.3	47.7	2.6	50.3
1959	11.1	7.2	18.3	23.8	7.3	31.3	49.6	1.7	51.1
1958	12.5	5.7	18.2	21.7	2.9	24.6	42.8	0.6	93.4
1957	11.0	5.6	16.6	29.9	4.5	34.4	51.0	0.8	51.8
1956	12.8	7.3	20.1	31.1	4.4	35.5	55.6	0.7	56.3
1955	9.3	6.3	15.6	26.8	3.3	30.1	45.7	0.6	46.3
1954	9.3	6.0	15.3	22.1	2.1	24.2	39.5	0.5	40.0
1953	11.9	6.1	18.0	29.6	2.0	31.6	49.6	0.5	50.1

(1) Consists of inland cargo movements using the Great Lakes and Seaway system.

(2) Trade between Canadian ports; Lakes trade consists of cargoes carried between Great Lakes ports only; Seaway trade consists of cargoes between the Great Lakes and the Lower St. Lawrence and Atlantic area (Montreal and below).

(3) Trade between the U.S. and Canada; Lakes trade consists of cargoes between Great Lakes ports; Seaway trade consists of cargoes between U.S. Lakes ports and the St. Lawrence and Atlantic area (Montreal and below).

Note: Figures on coastal trade contain a minor degree of approximation since statistics for cargoes loaded and unloaded differ slightly.

Source: DBS

main area of activity for Canadian built and registered vessels. International trade is also examined as Canadian built and registered vessels are involved to some extent, and because the forecast growth in ship traffic may provide an indication of future repair requirements.

All projections of trade using the Seaway are based on the assumption that there will not be any change in the dimensions of the Seaway locks during the forecast period, nor will there be any increase in tolls or other charges large enough to cause the diversion of traffic to alternate routes or methods of transportation. The validity of these assumptions is discussed in greater detail in Chapter III.

Table L-1 shows the volume of waterborne trade in the Great Lakes and St. Lawrence Region for each of the above trades for the period 1953-1967. Data for 1968 is not available in the detail necessary for its inclusion. The trends are illustrated in Chart L-1, together with the forecasts to 1980.

The development of waterborne trade during the 1953-1967 period was influenced by the completion of the St. Lawrence Seaway in 1959. The impact was immediately experienced in off-shore trade which tripled between 1958 and 1959 but the effect on Seaway trade did not become fully apparent until after 1961. A very substantial lakes trade existed prior to 1959, so that the impact of the Seaway was proportionately smaller than in the ocean-going sector and it took several years to build up the fleet of larger vessels which could fully use the Seaway dimensions.

CHART L-2

GREAT LAKES AND ST. LAWRENCE REGION

WATERBORNE COASTAL TRADE - WITHIN REGION

1959 – 1967 WITH FORECASTS TO 1980

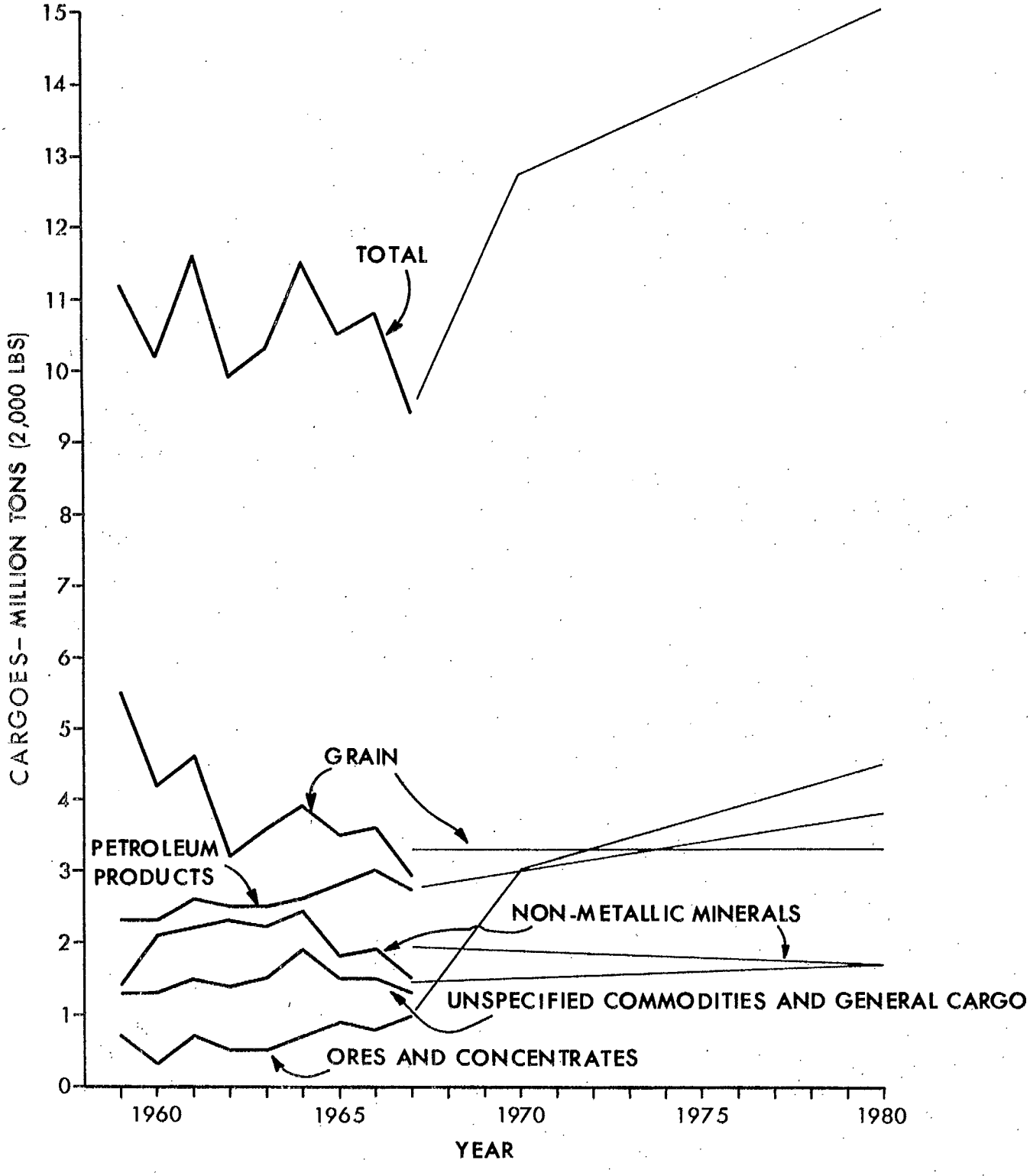


TABLE L-3

GREAT LAKES & ST. LAWRENCE REGION

SUMMARY OF INLAND COASTAL LAKES TRADE (1)

1959 - 1967
(million tons - 2000 lb.)

	1959	1960	1961	1962	1963	1964	1965	1966	1967
Ores & concentrates	0.7	0.3	0.7	0.5	0.5	0.7	0.9	0.8	1.0
Grain	5.5	4.2	4.6	3.2	3.6	3.9	3.5	3.6	2.9
Petroleum products	2.3	2.3	2.6	2.5	2.5	2.6	2.8	3.0	2.7
Non-metallic minerals	1.4	2.1	2.2	2.3	2.2	2.4	1.8	1.9	1.5
Unspecified commodities and general cargo	1.2	1.3	1.5	1.4	1.5	1.9	1.5	1.5	1.3
Total	11.1	10.2	11.6	9.9	10.3	11.5	10.5	10.8	9.4

(1) Cargoes between Canadian ports on the Great Lakes.

Note: Figures on coastal trade contain a minor degree of approximation since statistics for cargoes loaded and unloaded differ slightly.

Source: DBS

TABLE L-2

CANADA - U.S. WATERBORNE
ORE & CONCENTRATE TRADE

1959 - 1967
(million tons - 2000 lb.)

Source of Ore:	1959	1960	1961	1962	1963	1964	1965	1966	1967
From Lower St. Lawrence									
To U.S. via Seaway	5.1	4.0	3.5	5.7	7.9	12.2	11.7	13.3	13.6
To Canada via Seaway	1.2	0.3	0.3	0.1	0.1	0.1	1.0	2.0	2.8
Total Seaway	6.3	4.3	3.8	5.8	8.0	12.3	12.7	15.3	16.4
To U.S. via Ocean	5.3	3.7	3.6	9.0	8.3	10.3	9.3	8.3	7.4
Total - Lower St. Lawrence	11.6	8.0	7.4	14.8	16.3	22.6	22.0	23.6	23.8
From Lakes									
To U.S. from Canada	4.2	3.9	3.7	4.3	4.3	5.3	4.4	4.0	4.2
To Canada from U.S.	2.6	4.9	4.4	5.0	5.6	5.3	4.9	4.4	2.5
Canada coastal	0.7	0.3	0.7	0.5	0.5	0.7	0.9	0.8	1.0
Total	7.5	9.1	8.8	9.8	10.4	11.3	10.2	9.2	7.7
Destination of Ore:									
To U.S.									
St. Lawrence via Seaway	5.1	4.0	3.5	5.7	7.9	12.2	11.7	13.3	13.6
St. Lawrence via Ocean	5.3	3.7	3.6	9.0	8.3	10.3	9.3	8.3	7.4
Subtotal -	10.4	7.7	7.1	14.7	16.2	22.5	21.0	21.6	21.0
Canada Lakes	4.2	3.9	3.7	4.3	4.3	5.3	4.4	4.0	4.2
Total - to U.S.	14.5	11.6	10.8	19.0	20.5	27.8	25.4	25.6	25.2
To Canada									
Coastal - Seaway	1.2	0.3	0.3	0.1	0.1	0.1	1.0	2.0	2.8
Coastal - Lakes	0.7	0.3	0.7	0.5	0.5	0.7	0.9	0.8	1.0
Subtotal -	1.9	0.6	1.0	0.6	0.6	0.8	1.9	2.8	3.8
From U.S. Lakes	2.6	4.9	4.4	5.0	5.6	5.3	4.9	4.4	2.5
Total - to Canada	4.5	5.5	5.4	5.6	6.2	6.1	6.8	7.2	6.3

Iron ore is the main commodity carried on the Great Lakes and Seaway, accounting for 30% of the regional waterborne trade in 1967. It is also a major factor in the traffic growth projections. Table L-2 summarizes the Region iron ore traffic between 1959 and 1967. It does not include U.S. lakes coastal trade which totalled about 62 million tons in 1967. Table L-2 is presented as a reference to indicate the growth relationships between the various aspects of the iron ore trade discussed in the sections following, which include an analysis of the major components of each of the areas of trade and forecasts of waterborne trade tonnages to 1980.

Coastal Lakes Trade

This trade includes cargoes between Canadian ports on the Great Lakes. The main components of coastal shipping within the Great Lakes Region and which totalled 9.4 million tons in 1967, are iron ore, grain, petroleum products, non-metallic minerals and unspecified commodities and general cargo. Table L-3 provides volumes for each of the major components from 1959 to 1967. These are illustrated on Chart L-2 which also shows the forecasts to 1980 discussed in the sections following.

Iron Ore: Iron ore shipments have shown a relatively slow increase since 1959 to 1.0 million tons in 1967. The interim figures indicate a substantial increase to 1.8 million tons in 1968. Subsequent to 1967, the full effect of the Griffith Mine production and other expansion is expected to increase waterborne shipments

by an additional 2.0 million tons to a total of 3.0 million tons by 1970. There are other known deposits in the Ontario Lake Superior area and it is expected that some of these will come into production in the mid-70's. The forecast calls for additional production of 0.75 million tons per annum by 1975 and a further 0.75 million tons per annum by 1980. Total Ontario waterborne shipments could be 3.0 million tons in 1970, 3.7 million tons by 1975 and 4.5 million tons by 1980.

This forecast could prove to be conservative for the following reasons:

a) The demand for iron ores (mainly pellets and concentrates) in Ontario will almost double during the 1970's as the steel industry generally expects primary steel output to increase at a 7% per annum growth rate from 10.8 million tons in 1970 to 21 million tons by 1980.

b) The advent of 1,000' upper-laker ore carriers could substantially reduce the cost of transporting Lake Superior ores. By 1980, there may be more than 7 million tons per annum of basic steel making capacity above the Welland Canal, including Stelco's Lake Erie project, which could use these larger carriers.

Grain: Grain shipments consist of grain moved from Lakehead to Lakes and Seaway elevators for processing and storage. There has been a sharp decline in this movement since 1959, largely it appears because more grain is being moved directly from the Lakehead to lower St. Lawrence elevators, as shown on Table L-4 to follow. The 1959-1967 trend indicates that the decline in interlake grain movement is slackening. While year-to-year fluctuations can be expected to occur depending on international sales, a levelling off of lake traffic at 3.0 to 3.5 million tons per annum level is projected. The direct movement of grain by deep sea vessels from lake ports accounts for only a small part of international shipments. The levelling off of interlake shipments probably reflects the normal processing and storage capacity of the lakes elevators. Where heavy international movement is required the major portion is moved directly from Lakehead elevators to lower St. Lawrence ports.

Petroleum Products: This consists mainly of primary distribution of refined petroleum products to industrial users and secondary distribution centres around the lakes. The growth of this traffic since 1959 has been relatively steady. The projection indicates potential shipments of 3.0, 3.4 and 3.8 million tons in 1970, 1975 and 1980 respectively.

Non-Metallic Minerals: These consist primarily of limestone (60%) and salt (30%). Shipments have declined since 1962, mainly due to declines in limestone shipments. The trend projection indicates shipments of 1.9, 1.8 and 1.7 million tons per annum in 1970, 1975 and 1980 respectively. However, this may be optimistic in light of the 1964-1967 decline, which was at a much greater rate than the long-term projection.

Unspecified Commodities and General Cargo: In 1967 the major components of this group were cement (27%), iron and steel (17%), with the balance consisting of a broad range of other manufactured and food products. The trend projection indicates a slow increase in these shipments to 1.5, 1.6 and 1.7 million tons in 1970, 1975 and 1980 respectively. It is apparent that year-to-year fluctuations can be expected.

Summary

The following table summarizes the projected coastal waterborne trade for traffic within the lakes system:

(Million tons)	Year		
	1970	1975	1980
Iron Ore	3.0	3.7	4.5
Grain	3.3	3.3	3.3
Petroleum	3.0	3.4	3.8
Non-metallic Minerals	1.9	1.8	1.7
Unspecified and General Cargo	1.5	1.6	1.7
Total	12.7	13.8	15.0

In general, the growth rate for traffic between Canadian lakes ports is forecast to be small during the 1970's. This however, represents a reversal of the slowly declining trend experienced in the 1959-1967 period which arose primarily because of a decline in grain movements brought about by an increase in direct shipments via the Seaway. This appears to be the only major effect which the completion

CHART L-3

GREAT LAKES AND ST. LAWRENCE REGION
COASTAL SEAWAY TRADE
1959 – 1967 WITH FORECASTS TO 1980

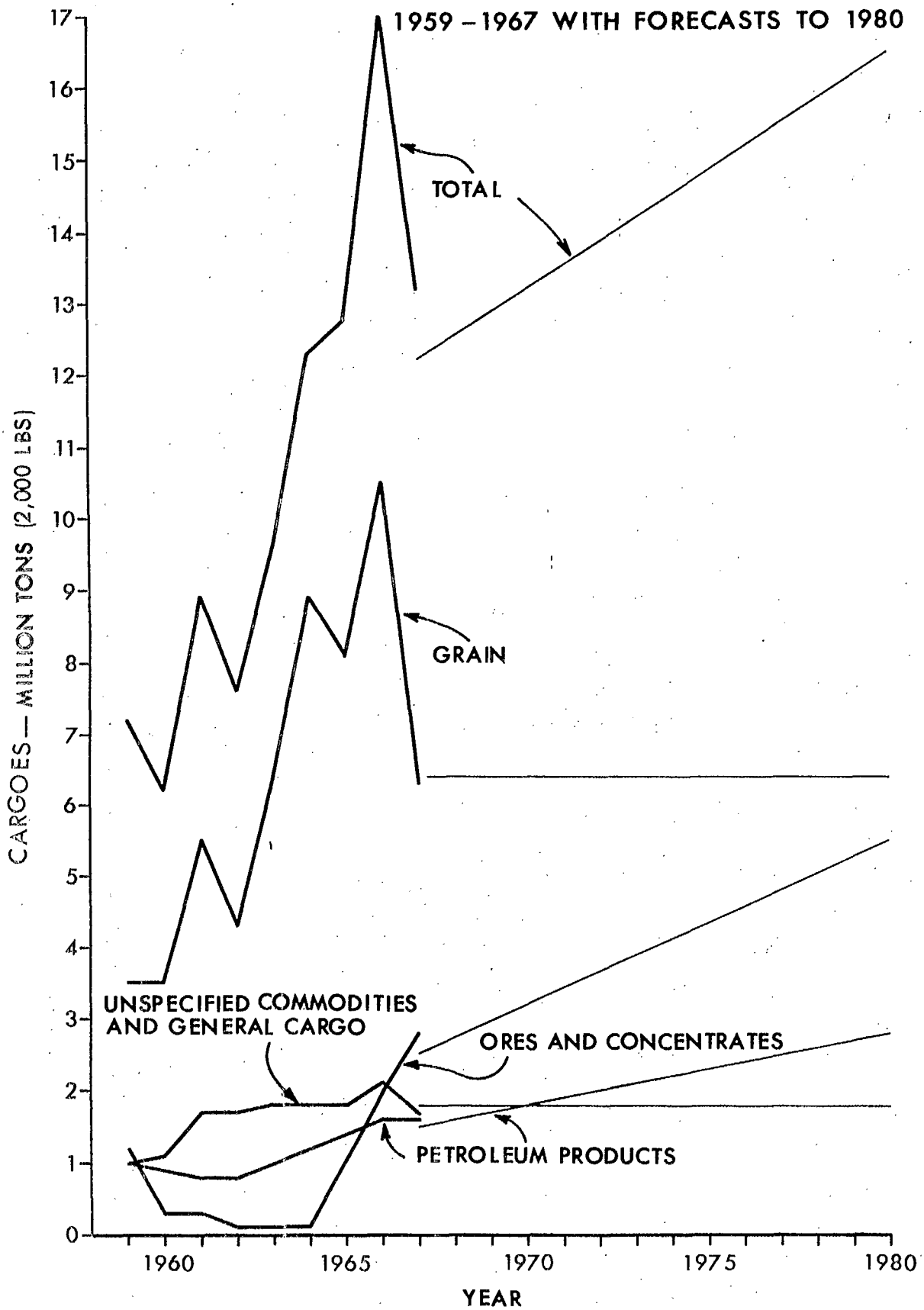


TABLE L-4

GREAT LAKES & ST. LAWRENCE REGION

SUMMARY OF INLAND COASTAL SEAWAY TRADE (1)

1959 - 1967
(million tons - 2000 lb.)

	1959	1960	1961	1962	1963	1964	1965	1966	1967
Grain	3.5	3.5	5.5	4.3	6.4	8.9	8.1	10.5	6.3
Ores & concentrates	1.2	0.3	0.3	0.1	0.1	-	1.0	2.0	2.8
Petroleum products	1.0	0.9	0.8	0.8	1.0	1.2	1.4	1.6	1.6
Coal	0.5	0.3	0.6	0.7	0.5	0.4	0.5	0.8	0.8
Unspecified commodities and general cargo	1.0	1.1	1.7	1.7	1.8	1.8	1.8	2.1	1.7
Total	7.2	6.2	8.9	7.6	9.6	12.3	12.8	17.0	13.2

(1) Cargoes between Canadian Great Lakes ports and Canadian ports in the lower St. Lawrence and Atlantic area, Montreal and below.

Note: Figures on coastal trade contain a minor degree of approximation since statistics for cargoes loaded and unloaded differ slightly.

Source: DBS

of the Seaway had on the well established pattern of interlake coastal trade. Between 1967 and 1970, substantial increases in iron ore shipments should increase overall traffic tonnage. A stabilizing grain situation would allow a gradual increase in traffic arising from normal economic development.

Coastal Seaway Trade

The coastal Seaway trade is defined as cargo movements between Canadian ports on the Great Lakes and Canadian ports in the lower St. Lawrence and Atlantic area below and including Montreal. The main components of this trade are grain, iron ore, petroleum products, coal and unspecified commodities and general cargo, which totalled 13.2 million tons in 1967. The shipments for each component from 1959-1967 are indicated on Table L-4, and are illustrated on Chart L-3 together with the forecasts to 1980 which are reviewed in the section following.

Grain: This traffic consists of wheat and other grains moved mainly from the Lakehead ports to Gulf of St. Lawrence elevators for transfer to ocean-going ships. The volume of grain movement depends mainly on export markets which have been weak since 1966. This weakness has been caused by increased grain production in Europe (particularly France), good crops in Russia due to favourable weather, and increased competitive production from other exporting countries due to increases in acreage and good weather. There are some indications that the 1968-1969 situation may represent a low point in Canadian export shipments. Some recovery is indicated by the December 1969 agreement by Russia to purchase 6 million tons of wheat for shipment in 1970 and 1971. It is apparent, however, that recovery of shipments to European markets is not likely to reach the 1964 to 1966 levels in the foreseeable future. In addition, sharp fluctuations in volume may occur from year-to-year. While established markets remain available to provide a basic volume, there is no agreement among grain experts as to what

traffic these markets will provide. For the purpose of this forecast the level of 1967 shipments (6.4 million tons) has been taken as the median for shipments to 1980. This can probably be regarded as conservative, as it does not take into consideration any natural market growth.

Waterborne carriage of grain may receive stiff competition from unit trains in the late 1970's. The Wheat Board has started its programme of assembling grain in blocks which could provide consistent volumes for a unit train operation. A series of large regional grain elevators will also probably be developed allowing the by-pass of the Lakehead bottleneck where some of the grain cleaning operations are obsolete. The main advantage of the system would be year-round operation reducing seasonal pressure on shipping facilities.

Possible unit train operations are not taken into consideration in the projections. The start of such a system is several years away and natural market growth will initially provide sufficient volume for both waterborne and rail systems.

Iron Ore: Iron ore shipments from the Gulf of St. Lawrence to Ontario date only from 1965, but have shown very significant growth since that time. It is apparent that the steel industry is looking to this area as the major source of its future ore. In 1967, the Ontario steel industry used approximately 9.9 million tons of iron ore. On the basis of the estimated increase in steel production referred to previously, iron ore consumption will rise to about 20 million tons per annum by 1980 less some shrinkage for increased concentration of ore received. Much of this increase will probably have to come from the Quebec-Labrador area. The increase will probably be relatively slow until after 1970 as it will be necessary for Ontario to first absorb a local production increase of about 2 million tons per annum.

The projected increase in iron ore shipments from Quebec-Labrador are based on the increase in Ontario demand less the increase in Ontario production. This totals 3.2 million tons in 1970, 4.4 million tons in 1975 and 5.5 million tons in 1980, and may be optimistic as it assumes only a moderate increase in Lake Superior ore traffic, and no significant increase in the volume of Ontario railborne ores.

Petroleum: There has been a steady increase in the movement of refined petroleum products westward from Montreal since 1962. While technically contravening the National Oil Policy most of this traffic represents refined products for which there is insufficient refinery capacity or appropriate feed stock in Ontario. In the absence of

any basic changes in the situation, the trend indicates potential shipments of 1.8, 2.3 and 2.8 million tons in 1970, 1975 and 1980 respectively. However, two factors could reduce this trade; a change in the National Oil Policy extending domestic supply eastward to include Montreal; and/or an increase in refining capacity in Ontario. For the purpose of this projection no change in the Oil Policy and no surplus of refining capacity in Ontario has been assumed.

Unspecified Commodities and General Cargo: This category consists of two way traffic in a wide range of commodities and manufactured goods, the main items being salt, chemicals and steel. The tonnage has been relatively steady since 1961, although the trend projection indicates potential traffic of 2.0, 2.3 and 2.5 million tons per annum in 1970, 1975 and 1980 respectively. The main threat to this movement is competition from containers carried on unit trains. This is a particular threat for eastbound traffic from Toronto to Montreal, because the general imbalance in container cargoes will provide a surplus of eastbound container capacity. It is not expected that containers will take any substantial part of the present waterborne trade because a large part of the cargoes are unsuitable or marginal for containerization. However the effect may be sufficient to limit the growth of this category, and the traffic volume is projected to remain at 1.8 million tons to 1980.

Coal: Shipments of coal from the Maritimes to Ontario by Ontario Hydro will end by 1970. No coastal coal movement via the Seaway is forecast for the 1970's.

Summary

The following table summarizes the projected coastal waterborne trade for traffic between the Great Lakes and lower St. Lawrence and Atlantic Regions.

(Million tons)	Year		
	1970	1975	1980
Grain	6.4	6.4	6.4
Iron Ore	3.2	4.4	5.5
Petroleum	1.8	2.3	2.8
Unspecified and General Cargo	1.8	1.8	1.8
Total	13.2	14.9	16.5

CHART L-4

GREAT LAKES AND ST. LAWRENCE REGION

INTERNATIONAL SEAWAY TRADE

1959 – 1967 WITH FORECASTS TO 1980

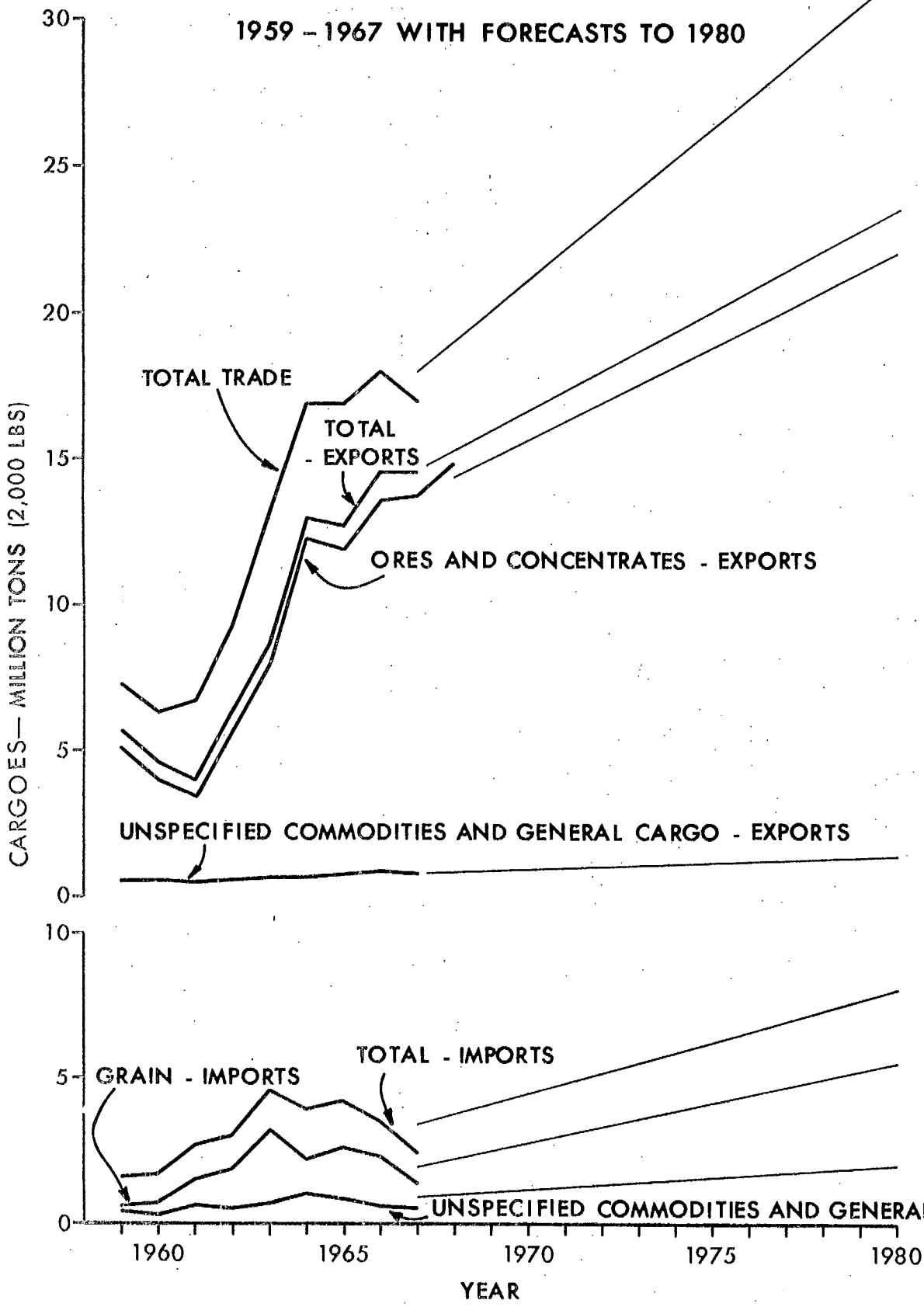


TABLE L-5

GREAT LAKES & ST. LAWRENCE REGION

SUMMARY OF INTERNATIONAL INLAND SEAWAY TRADE (1)

1959 - 1967

(million tons - 2000 lb.)

	1959	1960	1961	1962	1963	1964	1965	1966	1967
Exports									
Ores & concentrates	5.1	4.0	3.5	5.7	7.9	12.3	11.9	13.6	13.7
Unspecified commodities and general cargo	0.6	0.6	0.5	0.6	0.7	0.7	0.8	0.9	0.8
Total	5.7	4.6	4.0	6.3	8.6	13.0	12.7	14.5	14.5
Imports									
Grain (2)	0.6	0.7	1.5	1.8	3.2	2.2	2.6	2.3	1.3
Coal and Coke	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.6	0.6
Unspecified commodities and general cargo	0.4	0.3	0.7	0.5	0.7	1.0	1.0	0.6	0.5
Total	1.6	1.7	2.8	3.0	4.6	3.9	4.3	3.5	2.4
Total trade	7.3	6.3	6.8	9.3	13.2	16.9	17.0	18.0	16.9

(1) Cargoes between U.S. Great Lakes ports and Canadian ports in the Lower St. Lawrence and Atlantic area (Montreal and below).

(2) Mainly cargoes received for transfer shipment.

Source: DBS

There are, of course, major uncertainties in this forecast, particularly for grains and iron ore. In the case of grain, substantial fluctuations can be expected from year-to-year. The increase in iron ore requirements is reasonably assured, the main uncertainty being in the distribution of the tonnage rather than in total requirements.

International Seaway Trade

International Seaway trade includes cargoes between U.S. Great Lakes ports and Canadian ports in the lower St. Lawrence and Atlantic area, Montreal and below.

The major components of this trade are shown on Table L-5 for the period 1959-1967. These are illustrated on Chart L-4, together with the forecasts to 1980 which are discussed in the sections following.

Exports

The export trade totalling 14.5 million tons in 1967 consisted mainly of iron ore from the Gulf of St. Lawrence to the U.S. lake ports, with less than 6% of the tonnage consisting of other commodities and general cargo.

Iron Ore: Shipments of iron ore via the Seaway have shown a strong surge of growth since 1959. This reflects the completion and expansion of the Quebec-Labrador iron mines. While total shipments to all countries have continued to grow despite some leveling off in the growth rate since 1964, total shipments to the United States have declined since 1964 as was shown on Table L-2. The decline can be accounted for mainly by the increased concentration of the ore, reducing the volume of the shipment without reduction of iron content, and by a sharp increase in the supply of taconite ores from Minnesota. However, between 1964 and 1967, shipments via the Seaway have increased at the expense of a sharp decline in shipments via the Atlantic Coast.

Because the 1959-1967 period includes the initial growth phase of the Quebec-Labrador projects, a forecast based on a projection of the trend would tend to overstate future prospects. In arriving at the forecast, the following factors have been considered:

(a) Quebec-Labrador will continue to be an important source of iron ore to the U.S. steel industry. The mines are vertically integrated with the steel industry and the quality of the ore is good.

(b) The Seaway will continue to be the preferred route of shipment and it should experience further growth of tonnage moved at the expense of the Atlantic route. However some of the increase in tonnage will be offset by a continuing trend toward concentration. An increase in Seaway tolls of the magnitude necessary to give the Atlantic route a cost advantage is not expected. The Atlantic route requires additional handling and use of railways and its costs can be expected to rise faster than that of Seaway shipments.

(c) U.S. primary steel production is becoming less concentrated in the Mid-West due to population growth in other areas. The Canadian ore sources are not as well located in relation to this new capacity as they are to the Mid-West, and will face severe competition from cheap sea-borne ores from such places as Africa and Australia.

(d) The advent of the 1000' upper-lakes ore carriers in the early 1970's will substantially reduce transportation costs for Lake Superior ores. This may cause increased development of U.S. domestic taconite ores, mainly at the expense of Quebec-Labrador production.

Chart L-4 (which includes 1968 Seaway shipment figures) indicates that the growth rate has leveled off since 1964. A projection of the 1964-1968 trend indicates shipments of 19.0 million tons per annum by 1975 and 22 million tons by 1980. This constitutes an average increase of 600,000 tons per annum in shipments to the U.S. between 1968 and 1980. This may prove to be conservative, as it represents an average growth rate of only 4% per annum and there may be potential for further diversion of Atlantic seaboard shipments to the Seaway. However, a conservative approach is used for reasons (c) and (d) above.

Unspecified Commodities and General Cargo: The unspecified and general cargo consists mainly of pulp and paper products. The growth of tonnage has been quite steady since 1962. The projection of the 1959-1967 trend indicates a potential volume of 1.2 million tons in 1975 and 1.4 million tons in 1980.

Imports

The imports from the U.S. Lakes region to the Lower St. Lawrence and Atlantic area via the Seaway totalled 2.4 million tons in 1967. This consisted mainly of grain (56%) unloaded at Gulf of St. Lawrence ports for transhipment off-shore, coal (15%) and unspecified commodities and general cargo (29%).

Grain: The grain traffic consists primarily of wheat, coarse grains and corn enroute from the U.S. Mid-West to European markets. In 1967, it consisted of 40% wheat, 2% coarse grains and 58% corn. In general, unloadings of wheat have been relatively steady, in the 500,000 to 700,000 ton per annum range, the main fluctuations occuring in corn tonnages. While the 1959-1967 period does not indicate any clear trend, a linear projection indicates possible shipments of 3.7 million tons per annum by 1975 and 5.5 million tons by 1980. These represent only moderate annual increases over the 1964 peak of 3.2 million tons. These expectations are based mainly on increases in corn and coarse grain shipments for use as feed grains in Europe, where a rising standard of living should increase meat demand. However, since feed grains tend to be highly sensitive to prices, there may be sharp fluctuations in shipments from year to year depending on the supply-demand situation.

Coal and Coke: Coal and coke shipments have declined slightly between 1959 and 1967. Coal shipments have declined sharply but coke tonnage has increased to offset much of this loss. It appears that the seaway route is only holding its own and increases in Atlantic Region coal and coke consumption are being delivered by ocean from the U.S. Atlantic seaboard. The trend indicates total coal and coke shipments of 500,000 tons per annum in 1975 and 1980. This could be conservative if there is any significant increase in Atlantic Region (particularly Quebec's) primary steel production.

Unspecified Commodities and General Cargo: This consists primarily of bulk cargoes including soya beans and industrial supplies including salt, bentonite, etc. While shipments have declined since 1965, the longer term trend is up, with potential shipments of 1.6 million tons indicated for 1975 and 2.0 million tons for 1980. These shipments are primarily bulk cargoes destined for diverse locations and there does not appear to be any significant threat of the diversion of this trade to containers or unit-trains.

CHART L-5

GREAT LAKES AND ST. LAWRENCE REGION
INTERNATIONAL LAKES TRADE
1959 – 1967 WITH FORECASTS TO 1980

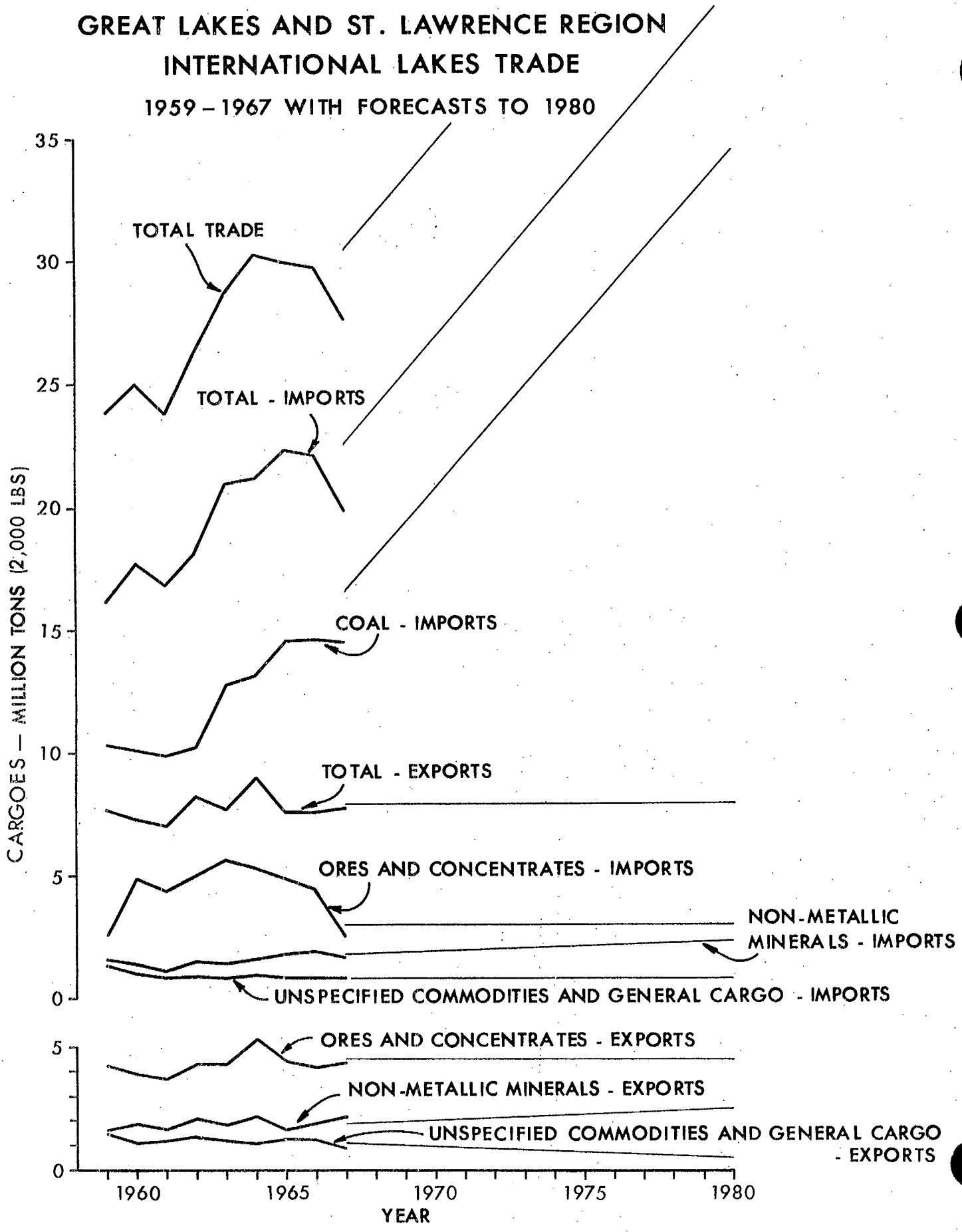


TABLE L-6

GREAT LAKES & ST. LAWRENCE REGION

SUMMARY OF INTERNATIONAL INLAND LAKES TRADE (1)

1959 - 1967
(million tons - 2000 lb.)

	1959	1960	1961	1962	1963	1964	1965	1966	1967
Exports									
Ores & concentrates	4.2	3.9	3.7	4.3	4.3	5.3	4.4	4.1	4.3
Non-metallic minerals	1.6	1.9	1.6	2.1	1.8	2.2	1.6	1.9	2.1
Forest products	0.4	0.4	0.5	0.5	0.4	0.4	0.4	0.4	0.4
Unspecified commodities and general cargo	1.5	1.1	1.2	1.3	1.2	1.1	1.2	1.2	0.9
Total	7.7	7.3	7.0	8.2	7.7	9.0	7.6	7.6	7.7
Imports									
Ores & concentrates	2.6	4.9	4.4	5.0	5.6	5.3	4.9	4.5	2.5
Coal	10.3	10.1	9.9	10.2	12.8	13.1	14.5	14.6	14.5
Grain	0.3	0.3	0.4	0.5	0.4	0.3	0.3	0.3	0.4
Non-metallic minerals	1.6	1.4	1.3	1.5	1.4	1.6	1.8	1.9	1.7
Unspecified commodities and general cargo	1.3	1.0	0.8	0.9	0.8	0.9	0.8	0.8	0.8
Total	16.1	17.7	16.8	18.1	21.0	21.2	22.3	22.1	19.9
Total - Lakes	23.8	25.0	23.8	26.3	28.7	30.2	29.9	29.7	27.6

(1) Cargoes between U.S. and Canadian Great Lakes ports.

Source: DBS

Summary

The following table summarizes the projected totals of waterborne trade between the Lower St. Lawrence and Atlantic area and the U.S. Lakes via the Seaway.

(Million tons)	1970	1975	1980
Exports			
Iron Ore and Conc.	15.7	19.0	22.0
Unspecified and General Cargo	1.0	1.2	1.4
	16.7	20.2	23.4
Imports			
Grain	2.8	3.7	5.5
Coal and Coke	.5	.5	.5
Unspecified and General Cargo	1.2	1.6	2.0
	4.5	5.8	8.0
Total Trade	21.2	26.0	31.4

The projections must be used with caution as major uncertainties exist with regard to iron ore and grain volumes. Iron ore shipments particularly may tend to level off. However, the potential for achieving the projected tonnage does exist, and the forecast is a realistic basis for assessing future shipping requirements.

International Lakes Trade

The international lakes trade consists of cargoes between Canadian and U.S. Great Lakes ports. Table L-6 provides a breakdown of the major components of this trade between 1959 and 1967. The trends are illustrated in Chart L-5, which also shows the forecasts to 1980 discussed in the sections following.

Exports

The exports which totalled 7.7 million tons in 1967 consisted mainly of iron ore, non-metallic minerals, forest products, and miscellaneous and general cargo.

Iron Ore: Iron ore shipments have tended to level off since 1962 and little if any growth can be expected in future years. While an increase in production in Ontario is expected, it will probably find domestic markets because of local demand, and the Ontario Government's restriction requiring Ontario ores to be processed in Canada. Exports are forecast at 4.5 million tons per annum from 1970 to 1980, the small increase between 1967 and 1970 representing mainly additional production available since 1967, with no further increase after 1970.

Non-Metallic Minerals: In 1967, the non-metallic mineral exports consisted mainly dolomite (54%) and salt (46%). Since 1959, total exports have shown slow but erratic growth. The tonnages indicated for 1975 and 1980 are 2.3 and 2.5 million tons respectively.

Forest Products: Since 1959 forest products exports consisting mainly of pulp and paper have not shown any growth, fluctuating between 400,000 and 500,000 tons per annum. Exports are forecast to stay at the 400,000 ton per annum level because of limitations in wood resources to support any substantial expansion of output, and because growing domestic markets will absorb production increases.

Unspecified Commodities and General Cargo: These consisted of a wide range of foods and manufactured products. In 1967 the main items were textiles (34%) and cement (30%). The trend is a declining one with projected cargoes of 800,000 tons in 1975 and 500,000 tons in 1980. The decline is likely to be in manufactured goods, with some growth possible in bulk cargoes such as cement, steel, etc.

Imports

The imports from the U.S. Lakes area totalled 19.9 million tons in 1967 and consisted mainly of iron ores and concentrates, coal, grain, and unspecified commodities and general cargo.

Iron Ore: Iron ore imports have turned down sharply since 1963, reflecting in part a sharp increase in supplies from Quebec and from Ontario sources. This decline is expected to continue as increases in Ontario production have occurred since 1967, including several new mines and by-product pellets from base metal mines. However,

Canadian steel mills will continue to import iron ore from the U.S. Lake Superior area in order to maintain some diversity of supply. The sharp drop in 1967 and 1968 imports (both approximately 2.5 million tons) may be partially attributable to shipping interruptions.

Canadian producers are increasing their vertical integration and it appears that future ore supplies will mainly come from domestic sources, with some outside purchases to provide diversity of supply. The forecast that imports from the U.S. will remain at 3.0 million tons per annum until 1980 may be conservative when the U.S. 1000' upper-lakers become operational in sufficient quantities to meet their domestic requirements and be able to undertake export shipments. These ships could reduce transportation costs to the extent that the Canadian steel industry would increase its purchases of U.S. ores.

Coal: By 1970, Ontario will be importing its entire coal requirements from the United States. In 1967 the 14.5 million tons of imports were consumed by the steel industry (5.7 million tons), Ontario Hydro (4.6 million tons) and other industrial and domestic users (4.2 million). Consumption by the steel industry and hydro will increase sharply between 1970 and 1980 while industrial use will probably decline. The projections for coal shipments have been developed by projecting the requirements of the three main consuming groups indicated above. In the case of Ontario Hydro, the figures used are their estimates. Coal consumption by the Ontario steel industry has been projected on the basis of primary steel output of 21 million tons by 1980. This in turn depends on a 7% annual growth rate from a 1970 output of 10.8 million tons, both of these being assumptions made by the steel industry. Industrial use (excluding steel) is forecast to stay constant at 4.0 million tons.

(Million tons)	Year		
	1970	1975	1980
Ontario Hydro	10.7	14.8	19.0(1)
Steel Industry(2)	6.0	8.5	11.5
Other	4.0	4.0	4.0
Total	20.7	27.3	34.5

(1) projected from Hydro estimates to 1978;

(2) includes industrial use for Hamilton and Sault Ste. Marie.

The forecast indicates a very sharp increase in coal shipments, with Ontario Hydro accounting for the major portion of the increase.

Grain: Imports of grains into Ontario consist primarily of feed grains, predominantly corn. While shipments have fluctuated between 268,000 and 550,000 tons per annum between 1959 and 1967 the trend is flat at approximately 350,000 tons per annum. Sharp year-to-year fluctuations are expected to continue but average shipments of 350,000 tons per year are projected.

Non-Metallic Minerals: These imports consist mainly of limestone, sand and gravel. Growth of volume has been steady since 1961 indicating potential tonnages of 1.9, 2.1 and 2.3 million tons per annum in 1970, 1975 and 1980 respectively.

Unspecified Commodities and General Cargo: This category consisted in 1967 of a wide range of manufactured products, chemicals, etc. Since 1961 the volume has been relatively steady in the 700,000 to 900,000 ton per annum range. The projection indicates a continuation of volume at 800,000 tons per annum through the 1980's.

Summary

The following Table summarizes the forecast totals of international lakes trade to 1980.

(Million tons)	Year		
	1970	1975	1980
Exports			
Iron Ore	4.5	4.5	4.5
Non-metallic Minerals	2.0	2.3	2.5
Forest Products	0.4	0.4	0.4
Unspecified and General Cargo	1.0	0.8	0.5
Total	7.9	8.0	7.9
Imports			
Iron Ore	3.0	3.0	3.0
Coal:			
Steel and other industrial	10.0	12.5	15.5
Hydro	10.7	14.8	19.0
Subtotal - coal	20.7	27.3	34.5
Grain	0.4	0.4	0.4
Non-metallic Minerals	1.9	2.1	2.3
Unspecified and General Cargo	0.8	0.8	0.8
Total	26.8	33.6	41.0
Total Trade	34.7	41.6	48.9

TABLE L-7

SUMMARY OF FORECASTS

COASTAL AND INTERNATIONAL INLAND TRADE

1970, 1975, 1980
(million tons - 2000 lb.)

	1967 (actual)	1970	1975	1980
Coastal:				
Seaway	13.2	13.2	14.9	16.5
Lakes	9.4	12.7	13.8	15.0
Total	22.6	25.9	28.7	31.5
International:				
Seaway	16.9	21.2	26.0	31.4
Lakes	27.6	34.7	41.6	48.9
Total	44.5	55.9	67.6	80.3
Total Inland	67.1	81.8	96.3	111.8

The main uncertainties in the projections relate to iron ore imports and exports; however, the effect of error in the total projection is lessened by the relative certainty of coal traffic estimates, particularly for the Hydro requirements.

Summary - Inland Trade Forecasts

Table L-7 summarizes the lakes and Seaway trade projections for both the coastal and international movements, as discussed in the preceeding sections, and as indicated on Chart L-1.

The projection calls for a substantial increase in inland and lakes traffic from 67.1 million tons in 1967 to 111.8 million tons in 1980, but the increases will be largely concentrated in iron ore and coal movements. While there will probably be periods of higher shipments, grain is expected to decrease in importance as a factor in inland and lakes traffic.

With the exception of coal and iron ore, other commodity movements largely reflect normal economic growth.

The major uncertainty lies in the iron ore shipments which can be summarized as follows:

(Million tons)	Iron Ore		
	1967	1980	Increase
International:			
St. Lawrence to U.S.	13.7	22.0	8.3
U.S. to Canada Lakes	3.0	3.0	-
Canada to U.S. Lakes	4.2	4.5	0.3
Total	20.9	29.5	8.6
Coastal:			
St. Lawrence to Great Lakes	2.8	5.5	2.7
Great Lakes - interlake	1.0	4.5	3.5
Total	3.8	10.0	6.2
Total	24.7	39.5	14.8

The projection calls for a virtual freezing of the Canada-U.S. lakes ore trade between 1968 and 1980. The Ontario Government has already taken one step in this direction by requiring domestic treatment of additional ores mined (with some possible exemptions). The forecast increase in Quebec-Labrador shipments to the U.S. is only about 4% per annum which may be conservative as it implies some loss of its share of the U.S. market.

The Ontario ore shipments are based on the projected increase in iron ore consumption being supplied from domestic sources. The main uncertainty is the source of supply. Of the projected 3.5 million tons per annum increase in coastal lake shipments to 4.5 million tons by 1980, approximately 3.0 million tons will be on-line in 1970, leaving a relatively modest 1.5 million ton per annum expansion forecast for the next decade. If 1,000' upper-lakers are used by Canadian coastal shippers, the transportation cost reduction may result in a substantial expansion of Lake Superior ore production, making this forecast very conservative. The main source for the balance of Ontario requirements will probably be Quebec-Labrador.

It should be noted that the main uncertainty in the projections relates to the distribution of the traffic, rather than to total tonnages. The implications to the shipping industry relate to the distribution between coastal and international traffic.

CHART L-6

GREAT LAKES AND ST. LAWRENCE REGION

OFFSHORE TRADE

1959 - 1967 WITH FORECASTS TO 1980

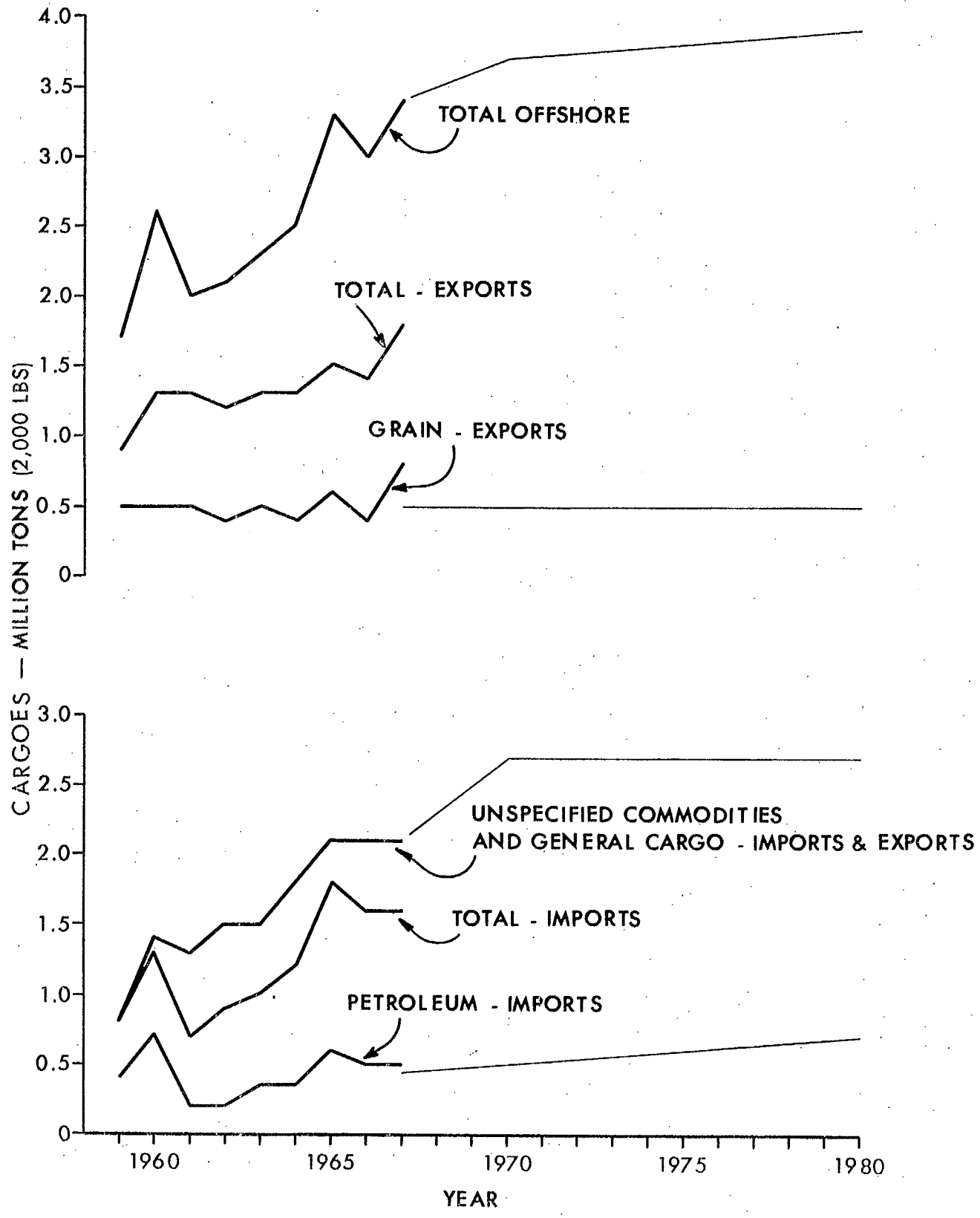


TABLE L-8

GREAT LAKES & ST. LAWRENCE REGION

SUMMARY OF INTERNATIONAL OFFSHORE TRADE (1)

1959 - 1967
(million tons - 2000 lb.)

	1959	1960	1961	1962	1963	1964	1965	1966	1967
Exports									
Grain	0.5	0.5	0.5	0.4	0.5	0.4	0.6	0.4	0.8
Unspecified commodities and general cargo	0.4	0.8	0.8	0.8	0.8	0.9	0.9	1.0	1.0
Total	0.9	1.3	1.3	1.2	1.3	1.3	1.5	1.4	1.8
Imports									
Petroleum	0.4	0.7	0.2	0.2	0.3	0.3	0.6	0.5	0.5
Unspecified commodities and general cargo	0.4	0.6	0.5	0.7	0.7	0.9	1.2	1.1	1.1
Total	0.8	1.3	0.7	0.9	1.0	1.2	1.8	1.6	1.6
Total Offshore	1.7	2.6	2.0	2.1	2.3	2.5	3.3	3.0	3.4

(1) Cargoes between the Great Lakes ports and offshore ports.

Source: DBS

Offshore Trade

Offshore trade covers ocean-going waterborne traffic originating in or destined for the Great Lakes area and using the St. Lawrence Seaway. The total offshore trade volume of 3.4 million tons in 1967 was relatively small in relation to the inland and lakes cargos of 67.2 million tons.

Table L-8 summarizes the main components of this trade. These are illustrated in Chart L-6, together with the forecasts to 1980 which are discussed in the sections following.

Exports

The main components of the export trade of 1.8 million tons in 1967, were grain and unspecified and general cargo.

Grain: The grain traffic consists of both wheat and course grains loaded at lake ports. While the shipments fluctuate from year to year they do show a slight uptrend during the 1959-1967 period. The volume fluctuations are considerably smaller than in the coastal trade because grain represents one of the few available eastbound cargos for dry cargo vessels. The sharp increase in 1967 probably reflects the labour difficulties that affected Canada's coastal shipping industry. The future of the offshore grain traffic depends mainly on the availability of vessels to carry it. The lake vessel is a much more efficient carrier of grain to the Gulf of St. Lawrence, and any decline in the availability of eastbound cargo space could significantly reduce direct offshore grain exports. Such a decline is forecast due to the increasing use of containers, as discussed in the following paragraphs, so that direct offshore grain shipments are forecast to stay at the 500,000 tons per annum level during the 1970's. This may prove to be optimistic for the latter part of the decade.

Unspecified Commodities and General Cargo: (This section covers both exports and imports). In general the exports tend to consist of foods, semi-manufactured products, etc. The imports tend to be manufactured consumer and industrial products. In 1967 the flow was reasonably balanced consisting of 1.0 million tons of exports and 1.1 million tons of imports. (This related to cargo flows only and not to the carrying capacity of the vessels used).

It is expected that the advent of containerization will have a very significant effect on Great Lakes offshore cargoes. A substantial part of the import trade is suited for containerization. While a large part of the exports are marginal in this regard, they may become economical to containerize as cargo for the otherwise empty eastbound containers. For the reasons outlined later in this report, the Great Lakes ports are not likely to become a significant container terminals and offshore traffic from this region is likely to be diverted by unit train to the Atlantic Region.

Chart L-6 shows the rapid increase there has been in export - import volume of unspecified cargo. Projection of this trend to 1980, however is invalidated by the likely movement to containerization. Although the timing and full extent of the container impact is difficult to predict, it is forecast that lakes exports and imports will level off after 1970 when large scale container service will come into effect. This places general cargo traffic at the 2.7 million tons per annum diverted to Atlantic Region ports. This may be optimistic regarding Great Lakes traffic prospects, but it also includes the containerized cargo handled at Great Lakes ports.

Imports

The Great Lakes offshore imports consist mainly of petroleum and miscellaneous and general cargo (discussed previously).

Petroleum: The petroleum consists of fuel oils and crude petroleum mainly from South America. The imports cover a part of the regional shortage between supply and demand in the case of the refined products. The crude petroleum consists of specialized refinery and petrochemical feed stock not available from Canadian sources. These imports appear to be related to basic factors in the industry and are forecast to continue at the projected rate to 0.5, 0.6 and 0.7 million tons per annum by 1970, 1975 and 1980 respectively.

Summary

The following table summarizes the Great Lakes offshore traffic projections to 1980:

(million tons)	Year 1970	1975	1980
Grain (export)	0.5	0.5	0.5
Petroleum (import)	0.5	0.6	0.7
Unspecified and General Cargo (import and export)	2.7	2.7	2.7
Total	3.7	3.8	3.9

The projection indicates only very slow growth above the 1967 actual traffic of 3.4 million tons. The main factor is the expected impact of containerization which will divert general cargo traffic to the railways and reduce the availability of outbound wheat capacity. The projection takes a relatively moderate view of the impact of containers, and may, therefore, be optimistic.

Fishing Vessels

There is no significant fishing industry in the Great Lakes or Seaway Region at the present time. While redevelopment of inland fisheries may occur in the future it is not expected to have any great impact within the forecast period.

TABLE L-9

GREAT LAKES & ST. LAWRENCE REGION

SUMMARY OF VESSEL TRAFFIC IN COASTAL LAKES AND SEAWAY TRADE

1963-1967

	1963		1964		1965		1966		1967	
Share of Cargo Market (by registry of vessel)	million tons	%	million tons	%	million tons	%	million tons	%	million tons	%
Canada	18.0	90.5	21.5	90.5	21.1	90.0	27.8	100.0	22.6	100.0
Commonwealth	1.9	9.5	2.3	9.5	2.2	10.0	-	-	-	-
Total	19.9	100.0	23.8	100.0	23.3	100.0	27.8	100.0	22.6	100.0

Traffic Summary

Seaway (vessel arrivals & departures)

Arrivals & Departures (000)	2.5	2.8	2.8	3.0	2.6
NRT (millions)	8.1	10.3	9.9	12.0	10.6
Average size (NRT)	3,250	3,700	3,500	4,000	4,000
Cargo (million tons)	9.6	12.3	12.8	17.0	13.2
Tonnage ratio	1.18	1.20	1.29	1.41	1.24

Lakes

Arrivals & Departures (000)	18.0	19.3	13.9	11.2	9.2
NRT (millions)	32.6	34.1	32.6	32.3	27.9
Average size (NRT)	1,800	1,750	2,350	2,900	3,000
Cargo (million tons)	10.3	11.5	10.5	10.8	9.4
Tonnage ratio	.32	.34	.32	.33	.34

CHAPTER II

SUPPLY OF SHIPPING SERVICES

Traffic and Participation

Coastal Trade Traffic

Table L-9 summarizes the share of the coastal lakes and Seaway traffic held by vessels of Canadian and Commonwealth registry and the vessel movement statistics in the period 1963-1967. Ships of Commonwealth registry held a consistent 10% share of the coastal cargo market until this trade was closed to them in 1966. In 1967, their participation was minimal, at only 71,000 tons out of total cargoes of 22.6 million tons.

The traffic statistics on Table L-9 include the number of arrivals and departures, the total net registered tonnage of this movement and cargo carried. The average size of vessel in NRT and a "tonnage ratio" have been calculated from these data. The "tonnage ratio" consists of the total cargo carried divided by the net registered tonnage moved, and is used as a relationship between vessel capacity and cargo carried for forecasting purposes.

The following is a summary of comments on the coastal seaway traffic:

(a) Between 1963 and 1966, Seaway vessel movement increased from 8.1 to 12.0 million net registered tons. (The decline in 1967 is attributable to the seamen's strike).

(b) The average size of vessel increased from 3,250 to 4,000 NRT. Thus the increase in the number of arrivals and departures was proportionately less than the traffic increase. The increase in vessel size reflects the continued build up in the number of maximum-sized Seaway bulk carriers.

TABLE L-10

GREAT LAKES & ST. LAWRENCE REGION

SUMMARY OF VESSEL TRAFFIC IN INTERNATIONAL SEAWAY TRADE

1963 - 1967

	1963		1964		1965		1966		1967	
Share of Market (by registry of vessel)	million tons	%	million tons	%	million tons	%	million tons	%	million tons	%
Canada	8.9	67.5	11.1	65.6	12.0	70.6	15.8	87.8	16.9	84.6
U.S.	1.6	12.2	3.0	17.7	1.7	10.0	1.6	8.9	1.7	10.0
Foreign	2.7	20.3	2.8	16.7	3.3	19.4	0.6	3.3	0.9	5.4
Total	13.2	100.0	16.9	100.0	17.0	100.0	18.0	100.0	16.9	100.0

Traffic Summary (vessel movement by arrivals and departures)

Total:					
Arrivals & departures (000)	1.8	2.0	2.1	1.8	1.9
NRT (million)	7.8	7.7	8.8	9.6	10.3
Average size (NRT)	4,200	3,900	4,100	5,200	5,550
Cargo (million tons)	13.2	16.9	17.0	18.0	16.9
Tonnage ratio	1.70	2.18	1.94	1.88	1.65
Canadian					
Arrivals & departures (000)	1.2	1.2	1.3	1.5	1.3
NRT (million)	5.7	5.9	6.4	8.2	8.8
Average size (NRT)	4,750	4,850	5,050	5,550	6,650
Cargo (million tons)	8.9	11.1	12.0	15.8	16.9
Tonnage ratio	1.55	1.88	1.87	1.93	1.92
U.S.					
Arrivals & departures (000)	0.4	0.6	0.6	0.3	0.5
NRT (million)	1.0	1.7	1.0	1.1	1.4
Average size (NRT)	2,450	3,000	1,600	3,400	2,650
Cargo (million tons)	1.6	3.0	1.7	1.6	1.7
Tonnage ratio	1.68	1.78	1.76	1.41	1.21

(c) The tonnage ratio was a maximum of 1.4 in 1966 reflecting heavy movement of iron ore and grain in that year.

The situation with regard to coastal lake traffic, shown on Table L-9, is summarized as follows:

(a) Vessel movements declined slightly between 1963 and 1966, from 32.6 million to 32.3 million NRT. (Again, the 1967 decline is attributable to the seamen's strike). Cargo tonnage remained quite steady over this period.

(b) The number of ship movements declined sharply from 18,000 to 11,200 between 1963 and 1966. The average size of vessel increased from 1,000 to 3,000 NRT reflecting the modernization of the lake fleet which was occurring in the early 1960's, including the scrapping of canallers.

(c) The tonnage ratio was steady at the .33 level. The sharp difference between the Seaway and the lakes load factors is attributable to differences in the nature of the two trades. The lakes have fewer opportunities for return cargoes (the two main cargoes grain and iron ore both being west to east movement and petroleum being one way) and the lakes cargoes are of lower average density.

International Seaway Trade

Table L-10 summarizes the International Seaway traffic by ship movement and registry between 1963 and 1967.

(a) Overall Seaway traffic has increased from 7.8 million to 10.3 million NRT between 1963 and 1967. The average size of vessel has increased from 4,200 NRT to 5,550 NRT.

(b) Canada accounted for 85% of traffic movement in 1967 (NRT) and an equivalent share of cargo movement. The average size of Canadian ships in 1967 of 6,650 NRT is substantially higher than the 4,750 NRT in service in 1963. This reflects not only the build up of the Canadian fleet but the specialized nature of the traffic which is almost entirely bulk cargo (iron ore and grain) allowing the maximum use of the largest vessels.

(c) The U.S. Lake and Seaway fleet has not been subject to modernization to the same extent as the Canadian fleet, and vessels are older and smaller.

(d) Other foreign participation was small in 1966 and 1967.

TABLE L-11

GREAT LAKES & ST. LAWRENCE REGION

SUMMARY OF VESSEL TRAFFIC IN INTERNATIONAL LAKES TRADE

1963 - 1967

	1963		1964		1965		1966		1967	
Share of Market (by registry of vessel)	million tons	%	million tons	%	million tons	%	million tons	%	million tons	%
Canada	18.2	63.4	16.8	55.9	18.5	62.0	21.5	72.3	18.4	66.7
U.S.	5.6	19.5	5.8	18.9	4.3	14.4	3.7	12.5	6.1	22.1
Foreign	4.9	17.1	7.6	25.2	7.1	23.6	4.5	15.2	3.1	11.2
Total	28.7	100.0	30.2	100.0	29.9	100.0	29.7	100.0	27.6	100.0

Traffic Summary (Cdn. & U.S. vessel movement inc. arrivals and departures)

Canadian:					
Arrivals & departures (000)	5.2	5.9	4.8	5.0	3.5
NRT (million)	18.8	19.5	21.9	26.1	22.1
Average size (NRT)	3,600	3,300	4,600	5,150	6,350
Cargo (million tons)	18.2	16.8	18.5	21.5	18.4
Tonnage ratio	.97	.86	.85	.83	.83
U.S.:					
Arrivals & departures (000)	4.5	3.3	2.0	2.1	2.4
NRT (million)	6.5	6.7	5.3	4.7	6.3
Average size (NRT)	1,450	2,000	2,600	2,200	2,600
Cargo (million tons)	5.6	5.8	4.3	3.7	6.1
Tonnage ratio	.87	.87	.81	.79	.97

Source: DBS

(e) The Canadian tonnage ratio of 1.88 in 1966 reflects the two-way trade (ore west, grain east) and the high density cargoes. Both the tonnage factors and average size of vessels in U.S.-Canadian Seaway traffic are higher than for Canadian coastal Seaway traffic (Table L-9). The International traffic is highly specialized in bulk cargoes with a good two-way trade pattern. The Canadian coastal Seaway traffic has a larger one way movement of cargo and a large proportion of liquid and general cargoes carried in smaller vessels.

International Lakes Trade

Table L-11 summarizes the International Lakes traffic by ship movement and registry between 1963 and 1967. It has not been possible to determine the lakes ship movement by itself because the lakes to/from offshore arrivals and departures are included in the traffic totals. These ocean-going vessels frequently make a number of calls back and forth across the lakes in the course of their voyage. Table L-11 does include the Interlake movement of vessels of Canadian and U.S. registry, based on the assumption that neither the U.S. or Canadian flag vessels engage in offshore trade from the lakes; while there may be exceptions, they are minor as confirmed by the cargo movement statistics. The following comments apply to the U.S.-Canada lakes traffic:

(a) The Canadian share of the cargo has fluctuated between 62% and 72% between 1963 and 1967. The average size of vessel has increased from 3,600 to 6,350 NRT. As the overall cargo volume has been steady, the number of sailings has declined.

(b) Foreign participation has declined from its maximum of 25.2% in 1964 to 11.2% in 1967. To a great extent foreign participation is incidental to the vessels being on the lakes to load or discharge offshore cargoes. The decline in their activity in 1966 and 1967 is probably related to the closing of the Canadian coastal trade which reduced their market and caused the departure and/or transfer of registry of the vessels specializing permanently in lakes trade.

(c) The U.S. fleet appears to have picked up the major portion of the foreign vessel cargo decline. The U.S. vessels are on the average considerably smaller at 2,600 NRT (in 1967) than the Canadian vessels.

(d) The Canadian tonnage ratio has been steady at .83 in 1966 and 1967.

Offshore Trade

Virtually all of Canada's offshore trade to or from the Great Lakes Region is carried by vessels of foreign registry. The main carriers are Bermuda, Norway, Liberia and the United Kingdom.

Traffic statistics on offshore trade cannot be separated from the International Lakes trade totals. The St. Lawrence Seaway traffic statistics for 1967 indicate that the total offshore trade to and from the Canadian Great Lakes involved a total of 578 transits, totalling 2.4 million NRT and 4.2 GRT. This places the average size of ocean-going seaway vessel at 4,150 NRT or 7,200 GRT. In view of the forecast that there will not be any significant increase in lakes to/from offshore cargo tonnage, the 1967 level of traffic will probably prevail over the longer term.

Development of the Great Lakes Fleet

Size of Fleet

As of March 31, 1967 it is estimated that the Canadian registered Great Lakes and Seaway commercial fleet consisted of the following vessels (on the basis of Canadian Maritime Commission data):

TABLE L-12

SUMMARY OF CHANGES IN THE CANADIAN INLAND CARGO FLEET
(Years ended March 31, 1959-1967)

	1959 & 1960		1961 & 1962		1963 & 1964		1965 & 1966		1967		Total	
	No.	000 GRT	No.	000 GRT	No.	000 GRT	No.	000 GRT	No.	000 GRT	No.	000 GRT
Dry Cargo												
Additions:												
New construction	4	54.3	12	161.9	16	193.8	12	179.8	5	90.9	49	680.7
Transfers	-	-	-	-	-	-	25	179.5	9	65.8	34	245.3
Other	-	9.3	3	47.4	1	18.6	-	-	-	-	4	75.3
Total	4	63.6	15	209.3	17	212.4	37	359.3	14	156.7	87	1,000.3
Losses:												
Scrappage	12	21.9	45	119.1	26	87.6	20	64.7	5	24.5	108	317.8
Transfers	-	-	12		12		3		3		30	
Other	-	-	1	2.2	-	-	1	18.1	-	-	2	20.3
Total	12	21.9	58	121.3	38	87.6	24	72.8	8	24.5	140	338.1
Net gain (loss)	(8)	41.7	(43)	88.0	(19)	124.8	13	287.5	6	132.2	(53)	663.2
Fleet size:												
End of period	219	1,017.5	176	1,105.5	147	1,347.5	170	1,347.5	176	1,479.7		
Tankers												
New construction	-	-	3	2.2	2	8.1	-	-	-	-	5	10.3
Transfers In	-	-	-	-	2	6.7	1	4.9	1	2.2	4	13.8
	-	-	3	2.2	4	14.8	1	4.9	1	2.2	9	24.1
Scrappage	4	31.7	1	0.5	2	10.2	3	9.8	-	-	15	52.2
Transfers Out	-	-	-	-	3		2		-	-		
	4	31.7	1	0.5	5	10.2	5	9.8	-	-	15	52.2
Net gain (loss)	(4)	(31.7)	2	1.7	(1)	4.6	(4)	4.9	1	2.2	6	28.1
Fleet size:												
End of period	38	74.3	37	76.0	36	81.6	32	76.7	33	78.9		

Source: Canadian Maritime Commission

Type	No.	GRT (000)
Dry Cargo *	176	1,480
Tankers *	33	79
Total	210	1,559
Tugs **	27	8
Barges, Scows **	23	47
Total - all vessels	260	1,614

* 1,000 gross tons and over

** 100 gross tons and over

The tugs and barges are the estimated vessels in operation on the Great Lakes, and exclude vessels whose home port is on the lower St. Lawrence. There is relatively little cargo movement up or down the Seaway by tug and barge systems and the lower St. Lawrence barges are involved in coastal trade which is included in the section on the Atlantic Region.

Growth and Source of Vessels for the Canadian Great Lakes Fleet

Table L-12 shows the changes which have occurred in the Great Lakes commercial fleet in the period April 1, 1958 to March 1, 1967. During this period, the gross registered tonnage of the dry cargo fleet has increased from 975,000 tons to 1,480,000 tons. The tanker fleet has declined steadily from 106,000 gross tons in 1958 to 79,000 tons in 1967, (although several tankers have been delivered during 1968 and 1969).

The following summarizes the main developments in the fleet:

(a) After the opening of the Seaway in 1959 there was a very high scrappage of obsolete canallers. Between 1959 and 1963 inclusive, 82 vessels were scrapped and 13 transferred or converted to other uses (mainly barges).

(b) The construction of new bulk carriers more than made up the retirement losses, with the new construction pace reaching a peak in 1964, when 10 new vessels were launched.

(c) Losses of vessels due to collision or grounding have been small with only 2 vessels totalling 20,300 GRT involved.

(d) In 1965 and 1966, 33 Commonwealth flag vessels were transferred to the Great Lakes fleet. This was done in anticipation of the prohibition of non-Canadian registered vessels from the lakes trade commencing in 1966. These vessels were for the most part very old.

The following table summarizes the source of new ships for the Canadian Great Lakes Fleet in the 9 year period ended March 31, 1967.

Source	No.	GRT (000)
Canada (by Region)		
Lakes	22	288.0
St. Lawrence	23	299.5
Atlantic	2	36.4
Commonwealth	2	36.5
Total	49	660.4

There have also been a number of major conversions of lake vessels which have added to the Lake Fleet gross tonnage. Three of the conversions have consisted of jumboizing ocean-going T-2 tankers which have added about 45,000 GRT to the fleet. Two of these T-2 conversions were done in Germany and one in the U.K.

Ship Types in Lakes & Seaway Trade

The terms used to describe the types of dry-cargo ships engaged in Great Lakes and Seaway trade are "ocean-going", "upper-lakers" and "canallers". Upper lakers may be "straight" or "self-unloading" bulk carriers or package freighters.

Ocean-Going: These are deep-sea vessels to the maximum size which can be designed to pass through the Seaway locks. Their presence on the lakes usually arises from the pick-up or discharge of offshore cargoes, during the course of which they often engage in U.S. - Canada lakes trade.

Upper Lakers: These ships are bulk carriers specially designed to carry the maximum economic loads through the Seaway system. With few exceptions, they do not have ocean-going capability and are restricted to waters west of Anticosti Island.

Package Freighters: Vessels of up to 7,000 GRT which carry general cargo and in some cases bulk cargoes. Most of them are designed for rapid turn-around by side loading, etc.

Canallers: Small vessels of the size which could navigate the pre-Seaway St. Lawrence locks.

In 1967, there were approximately 9 package freighters in service totalling 61,500 gross tons.

At present, tug and barge utilization on the Canadian side of the Great Lakes is minimal, being restricted mainly to local traffic. Seaway conditions place the barges at a disadvantage.

The lake vessel is highly specialized in design, in most cases being a motorized barge. There is a much greater utilization of barges by U.S. operators in their coastal trade. Under U.S. regulations, the tug-barge system enjoys a crew reduction advantage over vessels operating under Canadian regulations.

CHAPTER III

SHIP AND TRANSPORTATION TECHNOLOGY

Waterborne Transportation Developments

New developments in waterborne transportation in the Great Lakes and Seaway area are expected to occur in the following areas:

(a) refinement of Seaway vessels in the areas of carrying capacity and operating efficiency;

(b) the entry into service of large upper-lake bulk carriers to take the maximum advantage of the Sault Ste. Marie lock dimensions;

(c) the development of barge traffic, particularly to carry coal across Lake Erie.

Refinement of Seaway Vessels: Developments in vessels using the Seaway system are expected to be minor. The most likely improvements are in propulsion machinery where the possible use of gas turbines would increase cargo capacity by reducing machinery size, and reduce operating costs. It is possible that more self-unloaders will be introduced into Seaway service. The advantage is, however, narrow because the cargo carrying penalty tends to offset the turn-around advantage. An increase in self-unloaders could result from customer demands rather than from the basic shipping economics. The availability of additional space from machinery size reductions could provide an advantage to self-unloaders. Reference has been made to very high unloading rates for self-unloaders in the range of 20,000 tons per hour, which could give the advantage to this type of vessel.

Larger Upper-Lakers: In the early 1970's two new U.S. self-unloading bulk carriers are due to go into upper-lakes service. They will have 105' beams to take maximum advantage of the Sault Ste. Marie locks, and will carry 45/55,000 tons of ore. Some present estimates indicate that they will considerably reduce the U.S. cost of carrying iron ore from the head of Lake Superior to Lake Erie or Chicago. In addition they will have a very fast turn-around capability.

The impact which these super carriers may have is as follows:

(a) Iron ore from the Lake Superior Region may gain a cost advantage over Quebec - Labrador sources. This effect has been referred to in the commodity flow forecasts.

(b) If this proves to be the case, it would justify a detailed assessment by Canadian operators of the feasibility of acquiring such vessels.

(c) These carriers may inspire some lengthening and enlarging of existing bulk carriers for Upper Lakes service. Conversion may offer the most economical method of providing these large ships to the Canadian trade.

(d) The use of the upper-lakers on a large scale in the grain trade is not expected. A major part of this movement requires the use of the Seaway and the turn-around duplication for transfer to smaller vessels above the Welland Canal would be a major cost. In addition the grain movement on the Upper Lakes would be in the same direction as iron ore and, unlike the Seaway situation, grain would not be a return cargo.

In the longer term, there will be a tendency toward segregation of Seaway and Upper Lakes trade, mainly in the iron ore traffic. The potential levelling-off in traffic from the Seaway to the Upper Lakes does not create any threat of a shortage of eastbound grain capacity. There will continue to be a growing volume

of up-bound iron ore, and the capacity of these vessels will far exceed any foreseeable east-bound grain carriage requirement.

Some references have been heard as to the possibility of further enlarging the Sault Ste. Marie locks, which would permit the introduction of even larger ore carriers than the ones under construction. Such a development is not expected within the forecast period.

Barge Utilization: By 1980, it is forecast that approximately 5 million tons of coal will be required annually by the new steel mill and thermal generating plant which are planned for the Nanticoke area on Lake Erie. The main source of this coal is expected to be the U.S., delivered from Conneaut, across the Lake. The utilization of self-unloading barges in this short haul traffic is possible.

The prospect of a more general use of barges on the Great Lakes, particularly for Seaway bulk cargo haulage is uncertain. This would require specialized barge-pusher-tug units with a satisfactory pusher linkage. The concept is now regarded in some areas as being feasible. The main advantage of such a system would be a reduction of crew size. It is quite possible that some prototype tug-barge combinations will see operation on the Seaway bulk trade during the 1970's, as a part of the replacement tonnage requirements.

Competitive Transportation Developments

The main competitive transportation development which will have an impact on the Great Lakes and St. Lawrence Region may be the unit-train.

The earliest competitive effect will be the carriage of general cargo in containers by unit-trains between the Great Lakes Region and Montreal and Atlantic ports, by-passing the Seaway for both international and coastal trade. While ton-mile costs may be higher than waterborne movement for the rail segment of trip, it is claimed that it will be more than offset by lower terminal costs and ocean freight charges made possible by the use of fast, large, specialized container ships. In the case of coastal trade, the advantage is faster delivery.

The full extent to which cargo tonnage will be diverted to trains via containers cannot as yet be accurately forecast. The cargo flow forecasts in Chapter I do make provision for such diversions. The diversion is expected to be substantial despite the imbalance of the east-west containerizable cargo traffic. The early indications are that much west-bound import cargo is readily containerizable. Because the container would otherwise be returning empty, much of the east-bound export tonnage that would normally be only marginally containerizable can be moved in this way.

Two potential threats of the unit train to waterborne trade are the carriage of grain from the producing areas to the Atlantic ports, and the carriage of coal from U.S. mines to Canadian steel mills and thermal generating plants.

In the case of wheat, the Canadian Wheat Board is now developing a block system of regional collection which would allow the consistent assembly of unit-train loads of grain. A series of large regional processing elevators would handle cleaning and grading prior to shipment. This would constitute partial replacement of the Lakehead processing facilities, some of which are obsolete. The advantages claimed are reduced handling, faster movement and the elimination of seasonal movement stoppages. Unit-train movements of grain have been used between the U.S. Mid-West and the Gulf coasts and have proven successful. There appears to be little doubt that it will eventually be used in Canada but the extent and timing of its use are the main questions.

The possibility of the use of unit-train for coal haulage arises from the fact that a substantial part of the existing movement must use the Welland Canal and pay tolls which the unit-train can avoid. While some unit-trains may be used in coal haulage service any large movement by this method is not expected for the following reasons:

(a) Much of the future coal requirements will be above the Welland Canal so that no tolls are involved.

(b) The existing thermal generating plants and steel mills generally lack the space for unit-train unloading facilities.

The impact of the unit train on Seaway traffic is based on the assumption that there will be no increase during the next ten years in the dimensions of the St. Lawrence Seaway

(including the Welland Canal) which would allow large vessels into Seaway service to reduce unit train competition. This assumption is based on the following:

(a) The capital cost of Seaway expansion would be very high and commensurate benefits would be uncertain.

(b) The commitment of further public capital to the Seaway is unlikely in the face of strong political pressure from other U.S. transportation interests and the East Coast States. The project appears to be too large for Canada to undertake alone.

(c) Unit-trains may well offer an economic alternative to the Seaway, even for bulk cargoes, particularly in the face of the high capital cost required for Seaway expansion.

(d) Containerships would not use the Seaway even if it was enlarged to accommodate them. The slow transit of locks and restricted channels would negate their speed advantage which is an important factor in their operating economics.

(The foregoing does not preclude an increase in tolls, but assumes that they will probably be moderate in the face of competitive pressures.)

Reference has also been heard as to the possibility of using unit-trains to carry iron ore from the St. Lawrence ports to the Great Lakes Region. We do not consider this to be a serious prospect as it would involve a lengthy new rail line over difficult terrain. The transit time reduction and seasonal inventory accumulation are not significant offsetting advantages for a low unit value cargo such as iron ore.

Except for unit-trains, there are no other significant competitive transportation developments foreseeable during the forecast period. Solid pipelines, in cases where they might be used, are mainly competitive with railway transportation.

CHAPTER IV

FUTURE DEMAND FOR SHIPS AND SERVICES

Commercial Demand

The future demand for ships and services will derive from the following sources:

(a) Increased demand for cargo capacity due to increases in trade;

(b) Replacement of tonnage lost due to losses or scrappage caused by age or obsolescence;

(c) Repair and overhaul of the expanding domestic fleet and the foreign flag vessels entering the region's ports.

Demand from Trade Growth

The method used to forecast demand arising from trade growth was as follows:

(a) Waterborne trade volumes were forecast (Chapter I).

(b) Past traffic was analysed to determine vessel movements in net registered tons required to move cargo volumes over a specific period. From this analysis the share of market held by Canadian vessels was determined together with a tonnage ratio which indicates vessel utilization. Assumptions as to the future values of these indices were made. This required an examination of potential traffic patterns to assure that no major changes in loads and distances were expected which would significantly alter the vessel traffic volumes or the tonnage ratios.

(c) The share of market and tonnage ratio assumptions were applied to the forecast cargo movements to determine future vessel traffic requirements.

(d) The size of the fleet in the base year was determined, and the increase in its size was assumed to be proportional to the traffic increase.

In the case of the Great Lakes Region, it is necessary to analyse each segment of the traffic separately. While the vessels used have been to a large extent interchangeable between the various

Lakes and Seaway services, there have also been substantial differences in shares of market and utilization due to characteristics of the various trades, the differences between the Canadian vs. U.S. fleets and the existence of ocean-going competition.

It is recognized that the method of forecasting used provides only a general estimate of future requirements. Except for replacement of old vessels, such factors as increases in vessel utilization by higher speeds and faster turnaround have not been taken into effect.

In the case of the Lakes and Seaway trade, the total cargo market excludes that portion carried by U.S. vessels. Because of import barriers, it is not considered that U.S. operators are a market for Canadian built ships, so the forecasts are based only on the established shares of this market held by Canadian flag vessels.

For the purpose of forecasting the growth of the Canadian registered Lake and Seaway fleet, the following assumptions were made:

(a) The share of market and tonnage ratios have varied substantially from year-to-year between 1963 and 1967 as indicated on Tables L-9, 10 and 11. The values used in the forecasts have been weighted in favour of 1966 and 1967 figures. In particular, 1966 was a year of heavy traffic movement for both grain and iron ore which places a heavy demand on shipping capacity due to turnaround delays, etc. Reserve capacity was therefore probably at a minimum during this period.

(b) The share of market assumptions carry some risk, particularly because of the possibility of more aggressive activity by the United States.

TABLE L-13

GREAT LAKES & ST. LAWRENCE REGION

SUMMARY OF FORECAST VESSEL DEMAND
DUE TO GROWTH OF WATERBORNE TRADE

1970 - 1980

	1966 (actual)	1970	1975	1980
Coastal - Seaway				
Cargo - million tons	17.0	12.7	13.8	15.0
Tonnage ratio	1.41	1.30	1.30	1.30
Traffic - million NRT	12.0	9.8	10.5	11.5
Coastal - Lakes				
Cargo - million tons	10.8	13.2	14.9	16.5
Tonnage ratio	.33	.34	.34	.34
Traffic - million NRT	32.5	38.8	43.8	48.5
Total: Coastal - million NRT	44.5	48.6	54.3	60.0
U.S.: Canada - Seaway				
Cargo - million tons	15.8	21.2	26.0	31.4
Canada - share of market	.88	.85	.85	.85
Tonnage ratio (Canadian)	1.93	1.80	1.80	1.80
Traffic - million NRT (Cdn)	8.2	11.8	14.4	17.4
U.S.: Canada - Lakes				
Cargo - million tons	21.5	34.6	41.6	48.9
Canada - share of market	.72	.70	.70	.70
Tonnage ratio (Canadian)	.83	.83	.83	.83
Traffic - million NRT (Cdn)	26.1	30.4	35.0	42.1
Total: International - million NRT (Cdn)	34.3	42.2	49.4	59.5
Total: Lakes & Seaway (million NRT - Canadian)	78.8	90.8	103.7	119.5
Size of Canadian Fleet (000 Gross tons)	1,500	1,725	1,970	2,260

In line with these assumptions, the following summarizes the main figures used;

Trade	Canadian Registry Share of Market	Tonnage Ratio
Coastal:		
Seaway (per Table L-9)	100%	1.30
Interlake (per Table L-9)	100	.34
International:		
Canada-U.S. Seaway (per Table L-10)	85	1.80
Canada-U.S. Lakes (per Table L-11)	70	.83

An examination of potential traffic changes indicates that the tonnage ratios may be conservative. The forecasts indicate a greater emphasis on dry bulk cargoes during the forecast period which would increase tonnage ratios.

Table L-13 shows the forecast vessel traffic for 1970, 1975 and 1980 which will be required to move the cargoes projected for both the coastal and International Seaway and Lakes trade. The projection indicates a total vessel movement of 90.8, 103.7 and 119.5 million NRT in 1970, 1975 and 1980 respectively. On the basis of average fleet size in 1966 (average of beginning of year and end of year gross tonnages including tankers) of 1,500,000 tons, the projected fleet sizes are as follows (this refers to Canadian registry and makes no assumption as to source of vessels).

1970 - 1,725,000 GRT
1975 - 1,970,000 GRT
1980 - 2,260,000 GRT

TABLE L-14

GREAT LAKES & ST. LAWRENCE REGION

AGE PROFILE - INLAND FLEET
(March 31, 1967)
(Self-Propelled Vessels over 100 gross tons)

Age - Years	0 - 25		26 - 35		35 - 50		50+		Total	
	No.	GT (000)	No.	GT (000)	No.	GT	No.	GT (000)	No.	GT
Canallers	21	57.0	2	5.0	8	19.3	4	6.4	35	87.7
Bulk Carriers and Package Freighters	75	882.4	-	-	8	65.4	62	384.3	145	1,442.1
Canaller - Tankers	11	27.6	5	8.3	11	22.4	2	2.9	29	61.2
	107	1,077.0	7	13.3	27	107.1	68	393.6	209	1,591.0

Source: Canadian Maritime Commission

The total increase of 535,000 gross tons between 1970 and 1980 would require an average of 53,500 gross tons of new construction per annum to cover trade increases alone.

Demand from Replacement of Scrapped Vessels

Table L-14 provides a profile of the age of the lakes fleet as at March 31, 1967. Both the total number of vessels and gross tonnage on Table L-14 compares closely with the totals (including tankers) on Table L-11, even though Table L-14 includes vessels of between 100 and 1,000 gross tons. Apparently, there are very few vessels of the 100 to 1,000 gross ton size in commercial operation on the lakes.

Table L-14 indicates that a large portion of the Great Lakes fleet is very old, 25% of the gross tonnage being more than 50 years old in 1967. (Approximately 60% of this tonnage was received as a transfer from foreign registry in 1965 and 1966).

For the purpose of forecasting replacement tonnages, the following assumptions have been made:

(a) All vessels 45 years or older during the 1970's will be replaced. It is recognized that a 45 year old inland hull is still in serviceable condition but the replacement assumption is based on the high costs of operating such ships and increasing government and union pressures to upgrade the equipment. Substantial expenditures on improvements are not considered feasible for many of the old vessels. The vessels reaching 45 years of age during the 1970's and assumed to be replaced total approximately 500,000 GRT.

(b) Because of increases in average size, speed and turnaround capability, the ratio of new tonnage to replacement tonnage has been estimated at 0.85:1. It is recognized that during the 1960's, significantly lower replacement ratios were experienced by some operators but this included the replacement of canallers and rapid advances in bulk cargo loading and unloading rates. During the 1970's the increase in size of the replacement vessels will be smaller and turnaround advances are expected to be slower.

On the basis of the foregoing assumptions, replacement requirements are forecast at 85% of 500,000 GRT, totalling 425,000 GRT, or 42,500 GRT per annum.

No provision is made in the projections for losses due to collisions, groundings, etc. Historically such losses have been very low in relation to total Great Lakes tonnage, and coverage of such losses would fall within the normal error range in the projections.

Summary - Inland Commercial Demand Forecasts

The following table summarizes the average annual shipbuilding and conversion forecasts for the Inland commercial fleet from 1970 to 1980;

	GRT/Annum
New Vessels:	
for trade expansion	53,500
for scrappage replacement	42,500
Total	96,000

The foregoing does not include major conversions which may add to the total gross tonnage of the fleet. This shipbuilding activity is covered under the section dealing with repair services.

Types of New Ship Construction

This outline of the types of new vessels required for Great Lakes service is preliminary only. It would require a much more detailed evaluation of new developments to forecast precisely what new vessel types may be required.

Upper-Lakers: There is potential for utilization of 1000' upper-lakers in the service of Canadian operators by 1980.

Barges: The Lake Erie coal service could require three large self-unloading barges by 1980. This may provide the possibility of a balanced service, one loading, one unloading and one in transit. The sizes of the units would depend on the coal requirements. The prospects for major developments of Seaway tug-barge combinations are uncertain. However, the construction of several prototype units in the 1970's is possible.

Package Freighters: It is expected that a levelling off of package freighter requirements will occur. The impact of containers on the Toronto - Montreal traffic may create some excess package freight capacity in the early to mid 1970's. The growth of waterborne general cargo volume on the lakes is relatively slow so that it may take a prolonged period to absorb this excess capacity.

Bulk Carriers: Straight and self-unloading bulk carriers will probably constitute the major portion of the new vessel requirements. Inland traffic constitutes the major area of trade growth, and new vessels will be required to handle it.

Tankers: There may be some increase in tanker requirements, partially as replacements for the existing fleet which is getting old. The replacement units will tend to be larger both to meet the demand increases and because both production and receiving units have increased in capacity.

Tugs: Any significant increase in the Great Lakes conventional tug fleet is not expected unless a significant increase in barge movement develops. The new ships require fewer docking aids. There is at present a surplus of harbour tugs in the Montreal area which is expected to continue for a long period. This surplus will probably be drawn upon to meet Great Lakes replacement requirements. With the exception of a large tug to handle the Lake Erie coal traffic, no other new tugs are expected to be required.

Ferries: No new ferry services requiring new vessels are foreseen for the Great Lakes Region. The number of ferries will probably decline as they are replaced by bridges.

Repair Services

The projected increase in ship tonnage movements in the region will bring about an increased requirement for ship repair and overhaul services.

A detailed forecast for repair services has not been prepared on a regional basis, but information for Canada as a whole and on repairs in each region is presented in the Canada section.

CHAPTER V

ST. LAWRENCE REGION

THE SUPPLY POSITION OF THE SHIPBUILDING INDUSTRY

Introduction

The data and information on shipping services and ships presented in Chapters I to IV are based on the Great Lakes and St. Lawrence Region as defined by D.B.S. in its shipping statistics, i.e. the trade tonnages relate to cargoes moving on the lakes and through the Seaway including tonnages which originate or terminate below Montreal.

The information presented in this chapter on the supply position of the shipbuilding industry in the St. Lawrence Region refers to the operations of shipyards located in the province of Quebec; the next chapter refers to yards located in Ontario. Questionnaire data have been used to supplement D.B.S. data in certain respects.

The Level and Composition of Activity in the Industry

The activity of the shipbuilding industry in the St. Lawrence Region has been in new construction (commercial and government), reconditioning and conversion, ship repair, and manufacture of fabricated industrial products.

D.B.S. shows the following as being the number of shipyards and the value of work performed in the Region during 1958-67, from which it can be seen that the level of activity expanded considerably during the period:

TABLE L-15

ST. LAWRENCE REGION

ACTIVITY IN THE SHIPBUILDING AND REPAIR INDUSTRY, BY CATEGORY

	Total Activity %	New Construction %	Repairs %	Conversions & Industrial %
1969 Est.	100	45	9	46
1968	100	48	8	44
1967	100	54	8	38
1966	100	41	10	49
1965	100	45	7	48
1964	100	42	9	49
1963	100	54	8	38
1962	100	57	7	36
1961	100	50	11	39
1960	100	53	12	35
1959	100	48	14	38
1958	100	49	12	39

Source: Questionnaires to Yards representing 85% of the work performed by all yards in the region in 1967.

Note: The percentages have been calculated from data on the value of work performed, which represents the activity being carried on in each year.

	Number of Establishments Number	Value of Work Performed $ Million
1967	10	$ 130
1966	10	164
1965	11	139
1964	10	109
1963	9	89
1962	9	76
1961	10	61
1960	12	74
1959	12	62
1958	12	63

D.B.S. does not publish detail on the types of activity carried on by the industry in each region, but information on this is available from questionnaire responses that were received from yards that accounted for 85% of total activity in the Region in 1967. This information cannot always be published, however, without risk of infringing confidentiality. Hence certain of the following comments are made without quoting the supporting data. It should be mentioned that the questionnaire did not ask for the value of conversions and of industrial work separately, and these are therefore combined in the last column of Table L-15 which shows the pattern of activity in questionnaire yards.

Looking first at the trend in activity, total activity reached a peak in 1966 as a result of coincident high levels of new construction, repair, industrial and other work. Subsequently all three categories declined to a level that in 1969 was almost one-third lower than in 1966 though still above any year prior to 1965.

TABLE L-16

ST. LAWRENCE REGION

THE IMPORTANCE OF FEDERAL GOVERNMENT PROCUREMENT IN NEW CONSTRUCTION ACTIVITY

		Federal Government as % of Total		
	All New Construction %	Naval %	Civilian %	Total %
1969 Est.	100	12	40	52
1968	100	1	36	37
1967	100	2	30	32
1966	100	3	37	40
1965	100	4	27	31
1964	100	11	14	25
1963	100	26	14	40
1962	100	38	10	48
1961	100	41	10	51
1960	100	21	17	38
1959	100	9	36	45
1958	100	26	16	42

Source: Questionnaires to Yards

New construction in 1969 was 80% of the level in 1966, repairs about 50%, and industrial and other work about 70%.

The pattern of activity in the St. Lawrence Region is considerably different from elsewhere in Canada because of the substantial amount of industrial work carried on by several companies in the region in facilities that are to a large extent separate from their shipbuilding operations. As a result, new construction and repair activity appear to be a relatively smaller part of total activity in the region than in Canada as a whole, as the following data for recent years indicate:

	Approximate importance in activity of questionnaire yards:		
	New Construction	Repairs	Conversion and Industrial Work
St. Lawrence Region	40 - 55%	10%	40 - 50%
Canada	55 - 60	15	30

In terms of marine activity as such, however, new construction is the primary activity in the St. Lawrence as in other regions.

New Construction

Table L-16 indicates the major importance of Federal Government procurement in the building activity of St. Lawrence yards during 1958-69. A substantial part of the naval programme in the early 1960's was placed in the St. Lawrence, and recently yards in this area commenced building the helicopter destroyers. Federal Government non-naval work has also been very important in this Region, particularly since 1964. In total, Federal Government work has represented an average of 40% of the value of all new construction work in the region during 1958-69.

TABLE L-18

ST. LAWRENCE REGION AND CANADA

SHIPBUILDING AND SHIP REPAIR INDUSTRY

PURCHASED MATERIALS AND UTILITIES, WAGES OF PRODUCTION AND RELATED WORKERS, AND OVERHEAD AND PROFIT, AS PERCENT OF VALUE OF WORK PERFORMED

	1967	1966	1965	1964	1963	1962	1961
St. Lawrence Region							
Percent of Value of Shipments made up by:							
Purchases	50%	46%	46%	41%	43%	41%	34%
Production Wages	30	27	26	27	32	36	33
Overhead & Profit	20	27	28	32	25	23	33
Total	100%	100%	100%	100%	100%	100%	100%
Canada							
Percent of Value of Shipments made up by:							
Purchases	46%	44%	44%	42%	42%	40%	37%
Production Wages	31	31	29	30	34	39	36
Overhead & Profit	23	25	27	28	24	21	27
Total	100%	100%	100%	100%	100%	100%	100%

Source: D.B.S. Annual Census of Manufactures

TABLE L-17

ST. LAWRENCE REGION

NEW CONSTRUCTION ACTIVITY AND NON-GOVERNMENT PROCUREMENT

	All New Construction %	Dry Cargo %	Tankers %	Ferries %	Fishing Vessels %	Barges %	Tugs %	Other %	Total Non-Government %
1969 Est.	100	11	28	-	-	-	2	6	48
1968	100	40	17	-	5	-	-	-	63
1967	100	33	3	14	18	-	-	1	68
1966	100	33	3	6	20	-	-	-	60
1965	100	66	-	-	3	-	-	-	69
1964	100	52	4	2	7	-	-	11	75
1963	100	37	6	-	8	-	4	4	60
1962	100	33	3	1	5	2	8	-	52
1961	100	42	4	-	1	2	-	-	49
1960	100	52	10	-	-	-	-	-	62
1959	100	18	36	-	-	-	-	-	55
1958	100	30	23	-	4	-	1	-	58

Source: Questionnaire to Yards

Note: Totals may not add due to rounding

As is shown in Table L-17, another 40% or so of regional new construction has been in dry cargo vessels which have been built in quantity throughout the period, particularly following the opening of the Seaway. Activity in dry cargo ships has fallen off both absolutely and in relative terms in 1969, but has been replaced to an extent by work on tankers which have been built fairly steadily throughout the period.

The balance of the work in the region has been in a variety of other craft, with ferries and fishing vessels being particularly important during 1966 and 1967. The extent of these new building activities indicates the range of vessel types that even the larger Canadian yards have had to build due to lack of volume of activity in the sizes and types of ship particularly suited to them.

The Resources used in the Industry

This section examines the resources that are used in the shipbuilding and repair industry in the St. Lawrence Region, on the basis of the data available.

Regarding relative use of all resources, Table L-18 shows the proportions of value of work performed made up by purchased materials and utilities, wages of production and related workers, and overhead and profit in the region and in Canada during 1961-67. These data are drawn from the annual D.B.S. publications on the industry, which treat purchases of fuel and power as material purchases and include all hourly paid labour in one total of production

TABLE L-19

ST. LAWRENCE REGION

RELATIVE USE OF RESOURCES BY TYPE OF ACTIVITY IN THE SHIPBUILDING AND REPAIR INDUSTRY

	New Construction				Repairs			
	Est. 1969	1967	1963	1958	Est. 1969	1967	1963	1958
Importance of Activity in Total Activity	45%	54%	54%	49%	9%	8%	8%	12%
Use of Resources within the Activity:								
Materials	49%	63%	58%	52%	20%	34%	31%	37%
Labour	29	29	25	25	36	30	29	25
Overhead & Profit	22	8	17	23	44	36	40	38
Total	100%	100%	100%	100%	100%	100%	100%	100%

	Industrial				Conversion			
	Est. 1969	1967	1963	1958	Est. 1969	1967	1963	1958
Importance of Activity in Total Activity	45%	33%	34%	38%	small	5%	4%	small
Use of Resources within the Activity:								
Materials	48%	47%	41%	43%		34%	30%	
Labour	20	18	23	15		40	38	
Overhead & Profit	32	35	36	42		26	32	
Total	100%	100%	100%	100%		100%	100%	

Source: Questionnaires to Yards

Note: Fuel and power purchases and indirect labour are included in overhead, and the proportions are thus not comparable with those in the preceding table, which was based on D.B.S. data for all yards and on its classification of these cost items.

and related workers (whereas the industry's practice in its internal assessments is to class fuel and power, and indirect labour, as overhead costs). The data for 1967 should be disregarded because substantial losses were experienced by one yard in the region which has since withdrawn from building operations.

Apart from this, it will be seen that the pattern of resource use in the region is similar to general experience in Canada, which is not surprising since the yards in the region make up a substantial part of the industry's total activity.

Resource use in the different types of activity in the region is illustrated in Table L-19. As in Canada as a whole, use of materials is greater and of labour less in new construction than in repair, and the margins for overhead and profit are markedly less in building than in other activities. The inference is drawn in the Canada section in greater detail that these data indicate highly competitive bidding for new construction activity. The Canada section also establishes that the use of resources and percentage for overhead and profit in the industrial activities carried on in St. Lawrence yards are similar to those in other metal fabricating industries. This also is not surprising since the market for industrial work is a competitive one.

As regards overhead elements, the level of administrative, office, distribution and sales salaries for all activities is not greatly different in relation to value of work performed in

TABLE L-20

ST. LAWRENCE REGION AND CANADA

SHIPBUILDING AND SHIP REPAIR INDUSTRY

VALUE ADDED, LABOUR COSTS AND MAN-HOURS

1961 - 67

	Value Added per Dollar of Labour Cost		Value Added per Man-Hour, Production and Related Workers		Average Wages per Man-Hour, Production and Related Workers	
	St.Lawrence Region	Canada	St.Lawrence Region	Canada	St.Lawrence Region	Canada
1967	$ 1.65	$ 1.74	$ 4.63	$ 4.77	$ 2.81	$ 2.74
1966	2.00	1.85	5.17	4.70	2.58	2.55
1965	2.08	1.96	5.06	4.75	2.43	2.43
1964	2.16	1.95	4.17	4.58	2.40	2.35
1963	1.80	1.70	4.04	3.78	2.24	2.22
1962	1.61	1.53	3.26	3.27	2.02	2.14
1961	1.96	1.74	4.03	3.55	2.06	2.04
Percent Increases: 1961-66			28%	32%	36%	34%

Sources: D.B.S. Annual Census of Manufactures

Note: Percentage increases are calculated between 1961 and 1966 in view of the special situation in the region in 1967.

the region from that in Canada, and fringe benefits are similarly about 20% of production wages. Sizeable capital investments by St. Lawrence yards in 1968 and 1969, reported in questionnaires, have raised fixed capital per worker above the level for Canada as a whole.

A more detailed assessment of labour costs is presented in Table L-20. Value added per dollar of labour cost in the Region has been above that nationally except in 1967 where regional data was affected by the special circumstances in one yard. (Value added is total value of work performed less purchases of materials and utilities; it is thus a measure of activity within the shipbuilding industry itself).

This results almost entirely from output per man-hour being generally at a higher level than in Canada as a whole, although growth in productivity in the region was slightly less than nationally in 1961-66. It has not been possible to measure productivity in volume terms, apart from price changes, since necessary data do not exist for the region.

Wage rates in the industry in the Region are very close to the national average and have increased to a similar extent (by 35% or so in 1961-67). More recent information, on the basis of questionnaire returns from the yards, shows that there has been no recent change.

	Average Wages per Man-Hour Paid		
	1966	1969 Est.	% Increase 1966-69
St. Lawrence Region	$ 2.62	$ 3.30	26%
Canada	2.57	3.25	26

Shipyard Facilities and Methods

The Dominion Bureau of Statistics listed ten establishments engaged in shipbuilding and ship repairing in the St. Lawrence River Region in 1967. Of these, two have now closed and one major shipyard has discontinued shipbuilding but is still actively engaged in ship repairing. A breakdown of the eight establishments is as follows:-

- 2 Major Shipbuilding Yards
- 5 Ship Repair Establishments
- 1 Boatbuilding Yard

Both shipyards and the boatbuilding yard are active in the ship repair business. Three of the operations were visited by the Committee.

During the second World War, shipbuilding in this region, as in all other regions of Canada, increased its facilities and activities and produced numerous vessels for both naval and commercial use. Since 1945 the St. Lawrence Region yards, though subject to uncertain market conditions, have steadily improved their facilities and procedures and have built all types of vessels, including destroyer escorts, minesweepers, oceanographic vessels, icebreakers and other special service vessels, cargo and cargo passenger vessels, large tankers up to 42,000 dwt., upper-lakers, trawlers, tugs, and others.

Ship repair activity is an important part of overall business in the St. Lawrence Region because this is a "terminal port" area and also there are corporate links between shipowners and yards. As in the Atlantic Region, the ship repair facilities in the St. Lawrence provide required services to the ships of various Government departments that operate in the Region, including National Defence, Transport, the Canadian National ferry fleet, and others.

Building Facilities

Information on four yards located in this Region was received through questionnaire. Three of these are classed as major yards, one of which having discontinued shipbuilding is now in the category of a major ship repair yard. The fourth yard, which closed down in the fall of 1969, was doing mainly outfitting work on ships built by one of the three major yards of the Region.

Building facilities available in the St. Lawrence Region are shown on Table C-34. Both major building yards have a number of launchways. One is equipped with a marine railway and the other has access to the adjacent Department of Public Works dry docks.

Both building yards in this region have adopted the block building technique and have cranage capacity to handle blocks weighing around 100 tons.

The largest ship that can be built in one piece is 500 feet by 75 feet in one yard and 900 feet by 140 feet in the other. Ships built in two sections could be of overall lengths

of 800 and 1,000 feet respectively in these yards.

Loft

The lofting techniques used in this region are similar to those in other regions. One yard uses 1/10th. scale lofting exclusively and the other this method together with wooden templates. The major repair establishment reported using wooden templates for this purpose.

Steelwork

In the repair yard, steel plates are stored on edge and handled with mobile cranes. In the two building yards the steel is stored in the flat and handled with magnet-equipped overhead cranes. The two yards have steel surface preparation systems consisting of descaling and paint priming equipment, one having power driven conveyors to deliver the steel to the shop.

Oxy-plane burning is used by all three yards. However, the two building yards have burning equipment which can be controlled by 1/10th. scale drawings, and in one case this equipment could be readily adapted for tape controlled operation.

On the welding side, unionmelt machines are standard equipment in all three yards. The repair yard and one building yard are equipped with some automated positioning equipment. Also available in the same building yard is prototype one side welding equipment which eliminates the necessity of turning panels 180° for back-pass welding. Other various forms of semi-automatic

welding processes using low hydrogen, inert gas, electro gas and carbon dioxide are also available in the yards of this Region.

The transfer of steel from operation to operation is done in the conventional way as no permanently installed mechanized equipment is available in any of the yards for this purpose.

With regard to the investment possibilities over the next ten years, the repair yard reported prospective expenditures to improve efficiency in that operation. Both building yards indicated very definite interest in streamlining their layout arrangement and expanding on their already advanced cost improvement program.

Outfitting

The questionnaires received from the shipyards of this Region show that the only operations sub-contracted by those yards from 1958 to 1969 were deck covering and insulation; in one of the yards, insulation was the only work sub-contracted. These are the two operations most often sub-contracted by Canadian shipyards; in fact, it can be said that over 90% of all deck covering and insulation work done in Canadian shipyards is by sub-contractors.

The two major yards have demonstrated an increasing trend towards outfitting at the block stage and this trend is distinctively greater in this Region than in the other parts of the country.

Shipyard personnel

In September 1969, employment in marine work was 36% of total employment in the three major yards in the region, industrial

work provided 38% of employment, and 26% was in overhead and administration functions. The amount of industrial work performed in this region, and consequently the percentage of workers employed on this type of work, is high compared to the rest of the country; in the other regions the percentage of people employed on industrial work was 4% in the Atlantic, 18% in the Great Lakes and 6% in Pacific Region. Accordingly, the marine percentage, at 36%, was lower in the St. Lawrence than in the other regions - 75% in the Atlantic, 59% in the Great Lakes, and 69% in the Pacific Region. The percentage of employees in the overhead and administration functions was 26%, which is slightly higher than in the other regions (Atlantic 21%, Great Lakes 23%, Pacific Region 25%).

The breakdown of employment in overhead and administration functions in the region and nationally was as follows in September 1969:

Function	Percent of Total Overhead and Administration Employees	
	Region	Canada
Marketing	2.7%	3.5%
Research and Development	2.3	1.3
Design and Drafting	15.8	13.0
Production Control, Planning and Scheduling	2.7	3.9
Supervision	23.5	21.8
Management	1.9	3.9
Maintenance, Cranes and Stores	23.5	30.5
Other	27.6	22.1
Total, Overhead and Administration	100%	100%

While these figures may not be fully representative because they relate to the position in one month only, certain differences in practices in regional yards compared to those elsewhere may be noted.

Research and development activities in regional yards are more significant than in yards generally; indeed, the three largest operations in the region employ more people in this function than do all other yards in Canada. Design and drafting is also relatively more important in the region because a commercial drawing office is operated by one of the yards. It is interesting to note that although the three largest yards in the region use network planning extensively, the proportion of their administrative and overhead employees engaged in the production control, planning and scheduling function was, in fact, less than in Canadian yards generally.

While the percentages of overhead employees in supervision, management and other functions were affected by the low level of activity in one yard in September 1969, in management the difference from the national proportion arises because three of the yards in the region are major yards and the number of management positions does not vary directly with the number of employees in each yard.

CHAPTER VI

GREAT LAKES REGION

THE SUPPLY POSITION OF THE SHIPBUILDING INDUSTRY

Introduction

The data and information on shipping services and ships presented in Chapters I to IV are based on the Great Lakes and St. Lawrence Region as defined by D.B.S. in its shipping statistics; i.e. the trade tonnages relate to cargoes moving on the lakes and through the Seaway including tonnages which terminate or originate below Montreal.

The information presented in this chapter on the supply position of the shipbuilding industry in the Great Lakes Region refers to the operations of shipyards located in the province of Ontario; the previous chapter referred to yards located in Quebec. Questionnaire data have been used to supplement D.B.S. data in certain respects.

The Level and Composition of Activity in the Industry

The activity of the shipbuilding industry in the Great Lakes Region has been in new construction, reconditioning and conversion, ship repairs and manufacture of fabricated industrial products.

D.B.S. shows the following as being the number of shipyards and the value of work performed in the region during 1958-67:

TABLE L-21

GREAT LAKES REGION

ACTIVITY IN THE SHIPBUILDING AND REPAIR INDUSTRY, BY CATEGORY

	Total Activity %	New Construction %	Repairs %	Conversions and Industrial Work %
1969 Est.	100	75	4	21
1968	100	77	7	16
1967	100	86	9	5
1966	100	83	10	7
1965	100	83	10	7
1964	100	65	10	25
1963	100	68	9	23
1962	100	75	16	9
1961	100	63	23	14
1960	100	70	13	17
1959	100	74	13	13
1958	100	66	9	25

Source: Questionnaire to Yards representing 75% of the value of work performed by all yards in the region in 1967.

Note: The percentages have been calculated from data on the value of work performed, which represents the activity being carried on in each yard.

	Number of Establishments Number	Value of Work Performed $ Million
1967	13	$ 40
1966	13	34
1965	13	36
1964	12	38
1963	11	33
1962	12	20
1961	12	21
1960	12	26
1959	12	23
1958	12	31

In contrast to the increase in activity in other regions, the value of work performed in the yards in the Great Lakes has barely increased from the level of the late 1950's.

Although detail is not available from D.B.S. on types of activity by region, questionnaire responses provide this information for yards that made up 75% of total activity in the region in 1967. This information cannot always be published, however, without risk of infringing confidentiality. Hence certain of the following comments are made without presenting the supporting data. It should be mentioned that the questionnaire did not ask for the value of conversions and of industrial work separately, and these are therefore combined in the last column of Table L-21 which shows the pattern of activity in questionnaire yards.

After fluctuating without appreciable growth during 1958-67, activity in 1968 was the highest for some time because of a sizeable volume of new construction. Building activity and the total

TABLE L-22

GREAT LAKES REGION

THE IMPORTANCE OF FEDERAL GOVERNMENT PROCUREMENT IN NEW CONSTRUCTION ACTIVITY

	Federal Government as % of Total			
	All New Construction %	Naval %	Civilian %	Total %
1969 Est.	100	-	-	-
1968	100	-	15	15
1967	100	-	-	-
1966	100	-	7	7
1965	100	-	7	7
1964	100	-	-	-
1963	100	-	-	-
1962	100	-	14	14
1961	100	-	26	26
1960	100	-	11	11
1959	100	-	22	22
1958	100	-	-	-

Source: Questionnaires to Yards

value of work performed in the region fell off sharply in 1969 and was little higher than in earlier years. The dollar value of repairs in the late 1960's was lower than at the beginning of the decade due to the replacement of some of the older ships in the lakes fleet by modern vessels. The volume of industrial and conversion work has fluctuated from year to year, with a downward tendency in industrial activity.

In terms of components of total activity, new construction has been more important in the Region than nationally, repairs were more important earlier but have declined, and industrial and conversion work has been below the Canada average. Comparative data for recent years are:

	Approximate importance in the activity of questionnaire yards of:		
	New Construction	Repairs	Industrial and Conversion Work
Great Lakes Region	75 - 80%	5 - 10%	5 - 20%
Canada	55 - 60	15	30

More detailed analysis of the important new construction segment follows.

New Construction

As Table L-22 indicates, Federal Government procurement in the Lakes Region has been limited, though important to the yards at the time.

There has been no naval work. Civilian government work was placed in the region in the four years after the Seaway opening and there has also been some business in later years.

TABLE L-25

GREAT LAKES REGION

RELATIVE USE OF RESOURCES BY TYPE OF ACTIVITY IN THE SHIPBUILDING AND REPAIR INDUSTRY

	New Construction				Repairs			
	Est. 1969	1967	1963	1958	Est. 1969	1967	1963	1958
Importance of Activity in Total Activity	75%	86%	68%	66%	4%	9%	12%	18%
Use of Resources within the Activity:								
Materials	57%	62%	61%	60%	34%	29%	23%	19%
Labour	25	24	25	25	46	41	34	30
Overhead & Profit	18	14	14	15	20	30	43	51
Total	100%	100%	100%	100%	100%	100%	100%	100%

	Industrial				Conversion			
	Est. 1969	1967	1963	1958	Est. 1969	1967	1963	1958
Importance of Activity in Total Activity	5%	5%	11%	7%	16%	-	12%	18%
Use of Resources within the Activity:								
Materials	42%	45%	40%	30%	55%	-	53%	48%
Labour	40	23	27	35	28	-	28	32
Overhead & Profit	18	32	33	35	17	-	19	20
Total	100%	100%	100%	100%	100%	-	100%	100%

Source: Questionnaires to Yards

Note: Fuel and power purchases and indirect labour are included in overhead, and the proportions are thus not comparable with those in the preceding table, which was based on D.B.S. data for all yards and omits classification of these cost items.

TABLE L-24

GREAT LAKES REGION AND CANADA

SHIPBUILDING AND SHIP REPAIR INDUSTRY

PURCHASED MATERIALS AND UTILITIES, WAGES OF PRODUCTION AND RELATED WORKERS, AND OVERHEAD AND PROFIT, AS PERCENT OF VALUE OF WORK PERFORMED

	1967	1966	1965	1964	1963	1962	1961
Great Lakes Region							
Percent of Value of Shipments made up by:							
Purchases	45%	45%	47%	49%	47%	51%	50%
Production Wages	30	31	30	27	27	35	31
Overhead & Profit	25	24	23	24	26	14	19
Total	100%	100%	100%	100%	100%	100%	100%
Canada							
Percent of Value of Shipments made up by:							
Purchases	46%	44%	44%	42%	42%	40%	37%
Production Wages	31	31	29	30	34	39	36
Overhead & Profit	23	25	27	28	24	21	27
Total	100%	100%	100%	100%	100%	100%	100%

Source: D.B.S. Annual Census of Manufactures

TABLE L-23

GREAT LAKES REGION

NEW CONSTRUCTION ACTIVITY AND NON-GOVERNMENT PROCUREMENT

	All New Construction %	Dry Cargo %	Tankers %	Ferries %	Fishing Vessels %	Barges %	Tugs %	Other %	Total Non-Government %
1969 Est.	100	51	26	-	-	15	8	-	100
1968	100	83	-	-	-	2	-	-	85
1967	100	84	-	-	12	4	-	-	100
1966	100	81	9	-	4	-	-	-	94
1965	100	81	9	-	4	-	-	-	94
1964	100	100	-	-	-	-	-	-	100
1963	100	83	-	-	-	8	3	6	100
1962	100	69	17	-	-	-	-	-	86
1961	100	74	-	-	-	-	-	-	74
1960	100	89	-	-	-	-	-	-	89
1959	100	78	-	-	-	-	-	-	78
1958	100	88	11	-	-	1	-	-	100

Source: Questionnaire to Yards

Note: Totals may not add due to rounding

Commercial work has thus been the predominant new construction activity for lakes yards and, within commercial building, dry cargo vessels as Table L-23 shows. Apart from lakers, there has been some intermittent building of tankers, fishing boats, barges and tugs, but the main market has been in dry cargo vessels only.

The Resources Used in the Industry

Use of resources by the industry on the Great Lakes is assessed to the extent that available data allows. Table L-24 shows the proportions of value of work performed made up by purchases of materials and utilities, wages of production and related workers, and overhead and profit in the Region and in Canada during 1961-67.

These data are drawn from the annual D.B.S. publications on the industry, which treat purchases of fuel and power as material purchases and include all hourly paid labour in one total of production and related workers (whereas the industry's practice in its internal assessments is to class fuel and power, and indirect labour, as overhead costs).

On average, materials have been a somewhat higher proportion of the value of work performed than elsewhere, labour much the same, and the percentage for overhead and profit lower.

Further information on resources use by type of activity is available from questionnaire responses and is shown in Table L-25. In new construction activity, materials have been a higher and labour

TABLE L-26

GREAT LAKES REGION AND CANADA

SHIPBUILDING AND SHIP REPAIR INDUSTRY

VALUE ADDED, LABOUR COSTS AND MAN-HOURS

1961 - 67

	Value Added per Dollar of Labour Cost		Value Added per Man-Hour, Production and Related Workers		Average Wages per Man-Hour, Production and Related Workers	
	Great Lakes Region	Canada	Great Lakes Region	Canada	Great Lakes Region	Canada
1967	$ 1.84	$ 1.74	$ 4.85	$ 4.77	$ 2.64	$ 2.74
1966	1.77	1.85	4.29	4.70	2.42	2.55
1965	1.80	1.96	4.29	4.75	2.39	2.43
1964	1.90	1.95	4.26	4.58	2.24	2.35
1963	2.01	1.70	4.37	3.78	2.18	2.22
1962	1.41	1.53	2.93	3.27	2.09	2.14
1961	1.59	1.74	3.14	3.55	1.97	2.04
Percent Increases: 1961 - 67			54%	32%	34%	34%

Sources: D.B.S. Annual Census of Manufactures

a lower proportion of value of work performed than in other regions because most of the new building has been in standard dry cargo vessels; the percentage for overhead and profit has been less in the region than nationally. In repairs, both material and labour inputs have been relatively greater in the region than in Canada, and the percentage for overhead and profit has been less and declining. Labour utilization in industrial work has been high compared to experience elsewhere.

Among overhead elements, the level of administrative, office, distribution and sales salaries for all activities has been about the same in the region in relation to value of work performed as in Canada, and fringe benefits are similarly about 20% of production wages. The amount of fixed capital per worker does not differ greatly in the Region from the national average.

More detailed information on labour costs is presented in Table L-26. Value added per dollar of labour cost and per man-hour have fluctuated from year-to-year in association with the level of building of dry cargo ships, the principal activity in the region.

Labour rates in the yards in the Region are lower than average Canadian rates and have increased much the same. Later information on wage rates for questionnaire yards indicates that this similarity in movement has continued in recent years;

	Average Wages per Man-Hour Paid		
	1966	1969 Est.	% Increase 1966-69
Great Lakes Region	$ 2.28	$ 2.86	25%
Canada	2.57	3.25	26

Shipyard Facilities and Methods

The Dominion Bureau of Statistics listed thirteen establishments in the Great Lakes shipbuilding and ship repairing industry in 1967. Three of these have been closed since the publication of these statistics and one shipyard exists which is not listed, giving a total of eleven establishments at this time. The breakdown of those presently in business is as follows:

- 2 Intermediate Shipbuilding Yards
- 2 Small Shipbuilding Yards
- 7 Repair Establishments

All of the shipyards listed carry out ship repair work to some degree. Of the eleven establishments listed, four were visited by the Committee.

Until the opening of the St. Lawrence Seaway in 1959, the Upper Laker type vessel operating on the Great Lakes provided captive business for the Great Lakes shipbuilding and ship repairing establishments. The opening of the Seaway allowed vessels 730' long by 75' beam into and out of the lakes, and new construction for the new trades then became open to St. Lawrence region and Atlantic yards, as well as to the Great Lakes builders. The result was that 25 of the 39 upper-lakers built from 1959 to the present time were built outside the Lakes, primarily in St. Lawrence yards, and 14 by yards in the Great Lakes Region. It should also be noted that one major establishment in the region has not built any ships since 1959 and

for the purpose of this report has been classed as a major ship repair/conversion operation only.

Shipyards in the Great Lakes Region have been largely responsible for the development of the highly efficient Great Lakes bulk carriers including self-unloaders and were, in fact, pioneers in this field. They have also produced sophisticated vessels for various Government departments, tankers, passenger-cargo vessels, tugs, barges, trawlers, fishing vessels, and other ships.

In the ship repair field, the yards in this region do not carry out a large volume of work for Government departments because few such ships operate in the area; also until recently the policy of the Defence Department appeared to be such that Great Lakes yards did not have the opportunity to quote on refits or conversions, although there was no indication that they were not qualified to do so. While the opening of the Seaway has affected the volume of ship repair work available to the Great Lakes Region, they still have a large share of captive inland ship repair business in existing berthing facilities where ships lay up during the off-season and undergo repairs at that time.

Building Facilities

A complete breakdown of building facilities available in the responding yards in this region was shown in Table C-34. One intermediate shipbuilding yard has launchway facilities to accommodate maximum-size lakers and a graving dock for medium size lakers. The

other has a graving dock for maximum size lakers, as well as side launching facilities capable of handling vessels up to 170 feet long. The only repair yard that answered the questionnaire is equipped with two launchways and a graving dock which is capable of taking maximum-size lakers.

Comparatively speaking, the intermediate yards in this region are equipped with good lifting capabilities at their building berths and can handle blocks weighing from 30 to 50 tons. They both have what is known as shear legs with rated capacities in the area of 120 tons. The small yard has access to rental equipment of up to 100 ton capacity.

Loft

Lofting techniques used in this area are very much the same as those used in the rest of the country. One intermediate yard used the 1/10th. scale method as well as wooden templates; all the other yards use wooden templates exclusively.

Steelwork

The two intermediate building yards and the major repair establishment in this region store their steel in the flat and handle it with overhead cranes. One of the intermediate yards is equipped with a mechanized plate handling and steel surface preparation system consisting of descaling and paint priming equipment and power driven conveyors. This same yard is equipped with tape controlled equipment for flame cutting of steel. The other intermediate shipbuilding yard and the major repair establishment use

oxy-plane burning machines for straight line burning with all other burning being done by hand. The small yard keeps a small inventory of steel which is stored in racks and handled with mobile equipment. In this yard, burning and welding is done by hand.

None of the yards are equipped with fixed mechanized handling equipment to transfer the steel from one operation to the other. Welding in the three larger yards is done with various types of semi-automatic equipment, standard unionmelt machines and stick electrodes.

One of the intermediate yards has indicated the desire to install a plate preparation system and to adopt 1/10th. scale lofting and burning technique. The other intermediate yard, where these improvements have already taken place, has reported contemplating the automation of some of its welding and panel handling processes.

Outfitting

The degrees of sub-contracting of outfitting operations by the Great Lakes Region yards is slightly higher than the Canadian average because one yard, which is located in an area where there is a shortage of skilled tradesmen, sub-contracts quite extensively.

The two intermediate building yards do some outfitting work at the block stage. The degree to which this can be carried out depends largely on delivery of components, manpower availability, and on the type and volume of work in the yard at the time. Attempts are being made to increase the amount of outfitting done at this stage of construction.

Shipyard Personnel

The four yards that answered the questionnaire had a total of 1,196 employees in the month of September 1969 and their distribution was as follows: 59% employed in marine work, 18% in industrial work and 23% in overhead and administration. This distribution is similar to that of the overall Canadian industry.

Since one yard was extremely low in work at the time the questionnaire was filled out, comparative assessment of personnel employed in overhead and administration functions cannot be made in detail.

PART V

PACIFIC REGION

TABLE OF CONTENTS

PACIFIC REGION

CHAPTER I

DEMAND FOR SHIPPING SERVICES

Commercial Cargoes

This Chapter examines waterborne trade patterns and volumes for both coastal and international trade in the Pacific Region and makes forecasts of future trade volumes to 1980 which are used as the basis for establishing shipping requirements. For the purpose of this analysis, the waterborne trade in the Pacific Region has been divided into the following cargo movements:

(a) coastal trade between Canadian ports within the Region;

(b) trade with the Continental U.S. (consisting mainly of traffic up and down the west coast, but including some cargoes to the Atlantic coast);

(c) off-shore trade to all foreign countries except the Continental U.S.

The method of forecasting has involved the division of each of the above trades (a) to (c) into its main components, this division being mainly by commodity groups. The forecasts for each of these components have been based on a projection of the 1958-1967 trend as determined by computer analysis, with this projection modified in accordance with any developments indicated by a general analysis of the trade and economic prospects for the commodity. The forecast for each of the trades has been assembled by totalling the forecasts for its main components.

This does not purport to be an exhaustive forecast, but rather a broad indication of trade volumes and main components

CHART P-1

PACIFIC REGION

WATERBORNE TRADE

1953 – 1967 WITH FORECASTS TO 1980

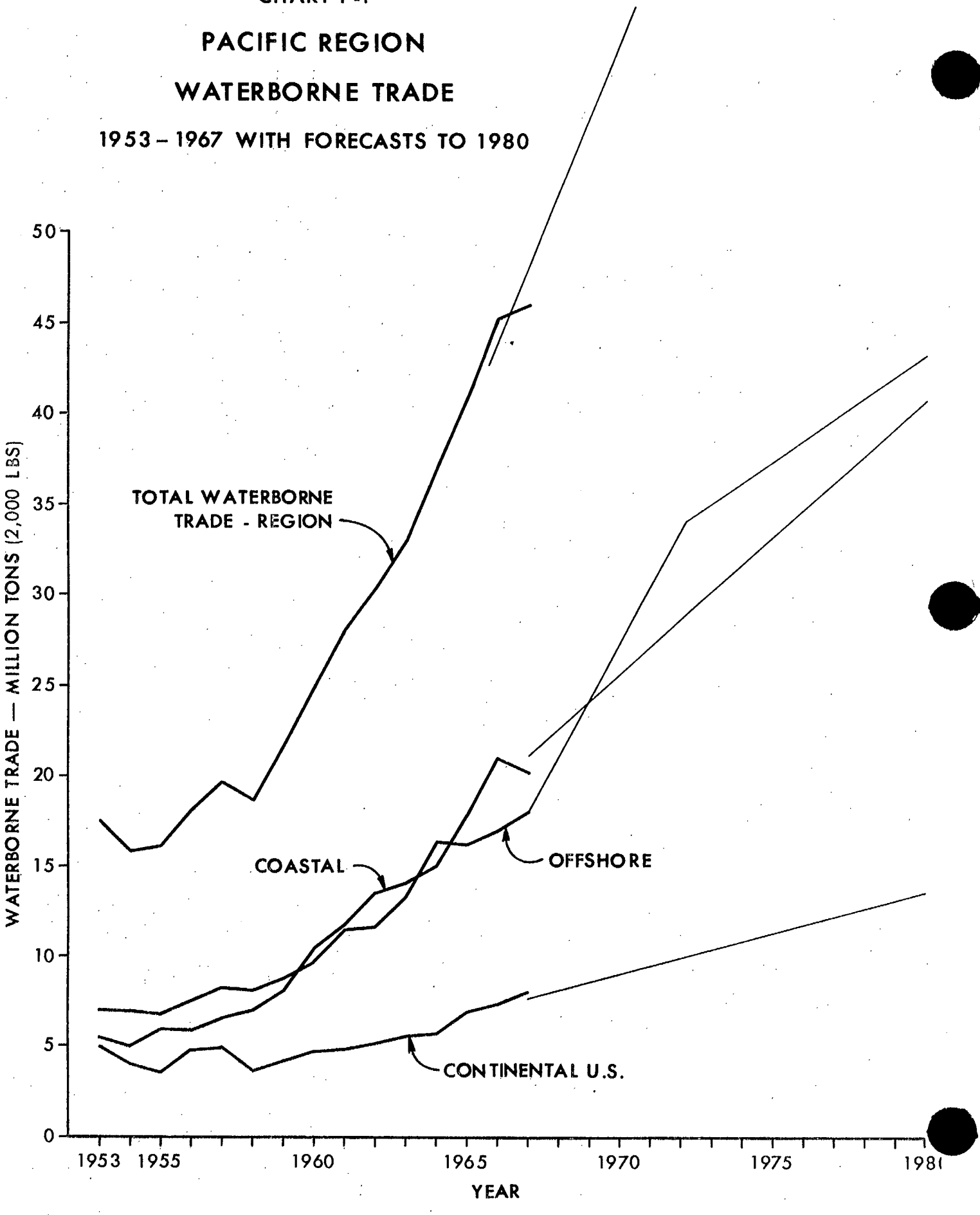


TABLE P-1

PACIFIC REGION

WATERBORNE TRADE

1953 - 1967

(million tons - 2000 lb.)

	Coastal (1)	International			Total Trade
		U.S.(2)	Offshore(3)	Total	
1967	20.2	8.0	18.0	26.0	46.2
1966	21.0	7.3	16.9	24.2	45.2
1965	17.8	6.8	16.2	23.0	40.8
1964	15.0	5.6	16.4	22.0	37.0
1963	14.1	5.5	13.3	18.8	32.9
1962	13.5	5.1	11.6	16.7	30.2
1961	11.7	4.8	11.5	16.3	28.0
1960	10.4	4.7	9.7	14.4	24.8
1959	8.0	4.2	8.6	12.8	21.6
1958	6.9	3.7	8.0	11.7	18.6
1957	6.5	4.9	8.2	13.1	19.6
1956	5.8	4.8	7.5	12.3	18.1
1955	5.8	3.6	6.7	10.3	16.1
1954	5.0	4.0	6.9	10.9	15.9
1953	5.5	5.0	7.0	12.0	17.5

(1) trade between Canadian ports within the Region

(2) trade between the Region and the Continental U.S.

(3) trade with all foreign ports except the Continental U.S.

Source: DBS.

for the purpose of establishing additional ship requirements and ship types. Coastal trade is given first priority in the analysis because it is the main area of activity for Canadian built and registered vessels. International trade is also examined as Canadian built and registered vessels are involved to some extent, and because the forecast growth in ship traffic may provide an indication of future ship repair requirements.

Table P-1 shows the growth in each of the main trades for the period 1953-1967. While total trade has grown from 17.5 to 46.2 million tons a year over the period, the fastest growth has been in coastal trade which has increased from 5.5 to 20.2 million tons. Off-shore trade has more than doubled and trade with the U.S. has shown the slowest growth.

Chart P-1 illustrates the 1953-1967 trade development as shown in Table P-1 together with the forecasts to 1980. The forecasts for each of the trades shown on Chart P-1 is made up of the total of the forecasts for each of its main components. These are reviewed in the sections following.

Coastal Trade

The coastal trade consists of cargo movement between Canadian ports within the Pacific Region. There is virtually no waterborne trade between the Canadian Atlantic and Pacific coasts. Cargoes moving from Canadian ports to the Yukon via ports in Alaska are considered to be coastal trade.

CHART P-2

PACIFIC REGION

WATERBORNE COASTAL TRADE

1958 – 1967 WITH FORECASTS TO 1980

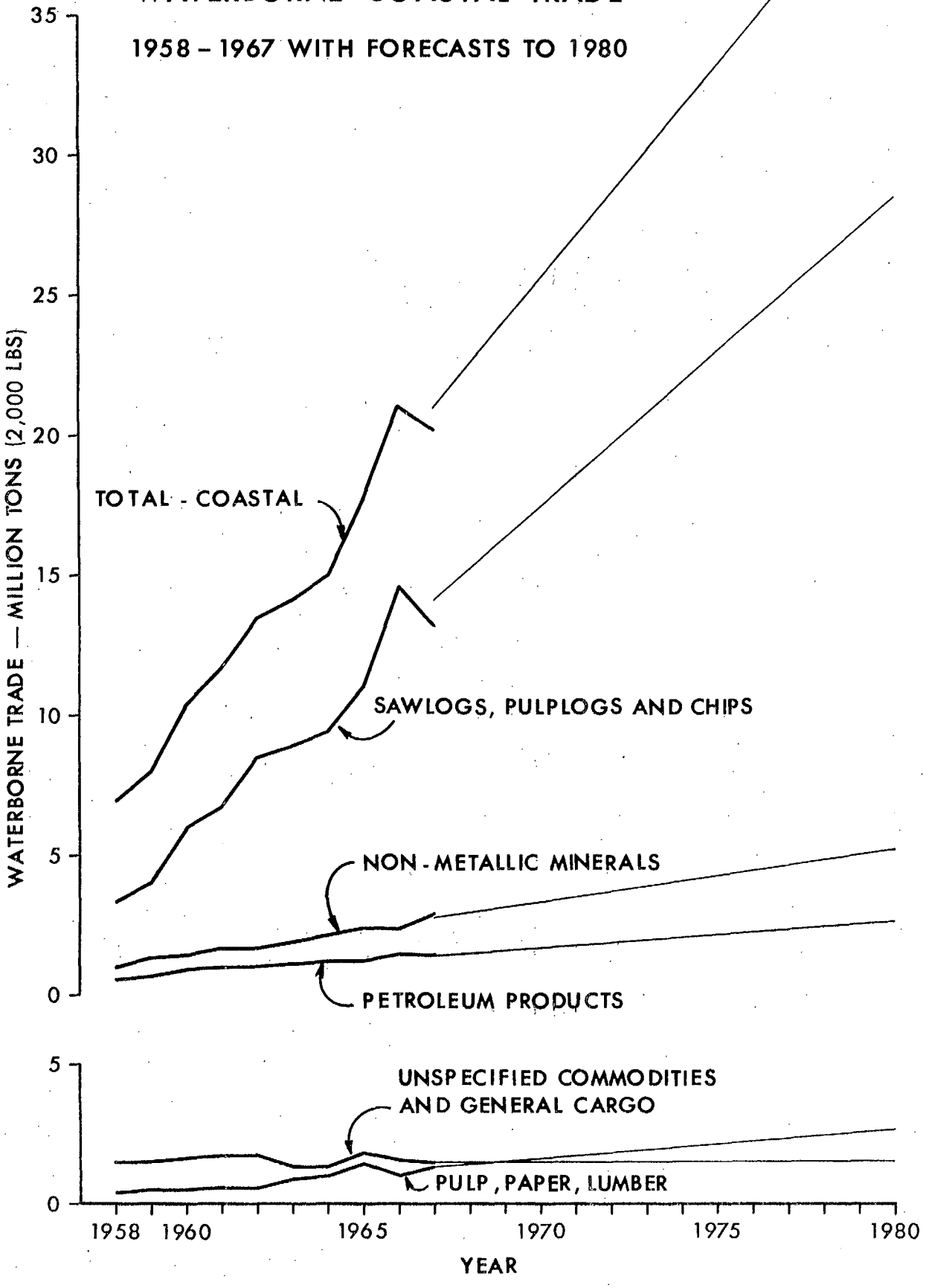


TABLE P-2

PACIFIC REGION

COASTAL TRADE BY MAJOR COMPONENTS (1)

1958 - 1967
(million tons 2000 lb.)

	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967
Sawlogs, pulplogs & chips	3.4	4.0	6.0	6.7	8.5	8.9	9.4	11.0	14.6	13.2
Pulp, paper, lumber	0.4	0.5	0.5	0.6	0.6	0.9	1.0	1.4	1.0	1.3
Petroleum products	0.6	0.7	0.9	1.0	1.0	1.1	1.2	1.2	1.4	1.4
Cement	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.4	0.4
Non-metallic minerals	1.0	1.3	1.4	1.7	1.7	1.9	2.1	2.4	2.4	2.9
Unspecified commodities and general cargo	1.3	1.3	1.4	1.5	1.5	1.1	1.0	1.5	1.2	1.0
Total Coastal	6.9	8.0	10.4	11.7	13.5	14.1	15.0	17.8	21.0	20.2

(1) Trade between Canadian ports. Coastal trade figures have a minor degree of approximation due to differences in statistics between cargoes loaded and unloaded.

Source: DBS.

Table P-2 shows the volume of waterborne coastal trade by its major components in the period 1958-1967. In 1967, the total coastal trade was 20.2 million tons. This 1958-1967 coastal trade and the forecasts to 1980 are illustrated on Chart P-2.

The major components of the coastal trade in 1967 were sawlogs, pulplogs and chips (65%), pulp, paper and lumber (6%), petroleum (7%), non-metallic minerals (14%), cement (2%) and miscellaneous and general cargo (6%).

Sawlogs, Pulplogs and Chips: In 1967, the wood shipments consisted of 55% sawlogs, 37% pulplogs and 8% chips. The main area of growth has been in the transportation of logs. Since 1959, the shipment of logs has increased approximately 4 times, whereas the production of lumber by coastal mills has increased only 1.7 times. This increase has arisen as the result of a combination of factors:

(a) An increasing portion of log production has been from the islands and other areas not within protected waters. This production is largely moved by barges to reduce losses and increase speed.

(b) There has been a restructuring of logging operations involving consolidation of cutting and shipping. This has made possible the assembly of logs in quantities where the speed of barge movement has advantages.

It does not appear that the replacement of booming by barging has been a significant factor in barge traffic growth since 1957, although some replacement of flat booming has probably occurred.

While the growth rate of wood shipments is very high, resulting in an indicated volume of 28.5 million tons per annum by 1980, no specific evidence which would indicate that the growth rate will level off can be found. The supply of coastal wood may become a limiting factor

in the late 1970's, as coastal timber approaches full allocation and an extension of the supply will have to come from more intensive logging and the extension inland of the coastal logging areas by the use of new equipment and roads.

Other Commodities: The growth of the other components of the coastal trade in the 1958-67 period has been relatively smooth, particularly petroleum which consists mainly of the distribution of refined products. There are no indications of any developments which would significantly alter the projections. The trend projection for miscellaneous and general cargo and cement is down, but has been kept at 1.5 million tons per annum with the expectation that the rapidly developing Yukon area will increase general cargo shipments. The shipping volumes indicated by the projections are as follows:

(Million tons)	1970	1975	1980
Pulp, paper & lumber	1.6	2.2	2.7
Petroleum	1.7	2.1	2.6
Non-metalic minerals	3.3	4.3	5.2
General cargo (inc. cement)	1.5	1.5	1.5
Total	8.1	10.1	12.2

Summary: The following table summarizes the coastal trade projections:

(Million tons)	1970	1975	1980
Sawlogs, pulplogs & chips	17.5	23.5	28.5
Other commodities	8.1	10.1	12.2
Total coastal	25.6	33.6	40.7

The major uncertainty in this projection is the wood shipments, where a continuance of the very high 1958-67 growth rate has been assumed.

Trade with Continental U.S.

This trade consists of waterborne cargo movement between the Pacific Region and the Continental U.S.

CHART P-3

PACIFIC REGION

WATERBORNE TRADE WITH CONTINENTAL U.S.

1958 – 1967 WITH FORECASTS TO 1980

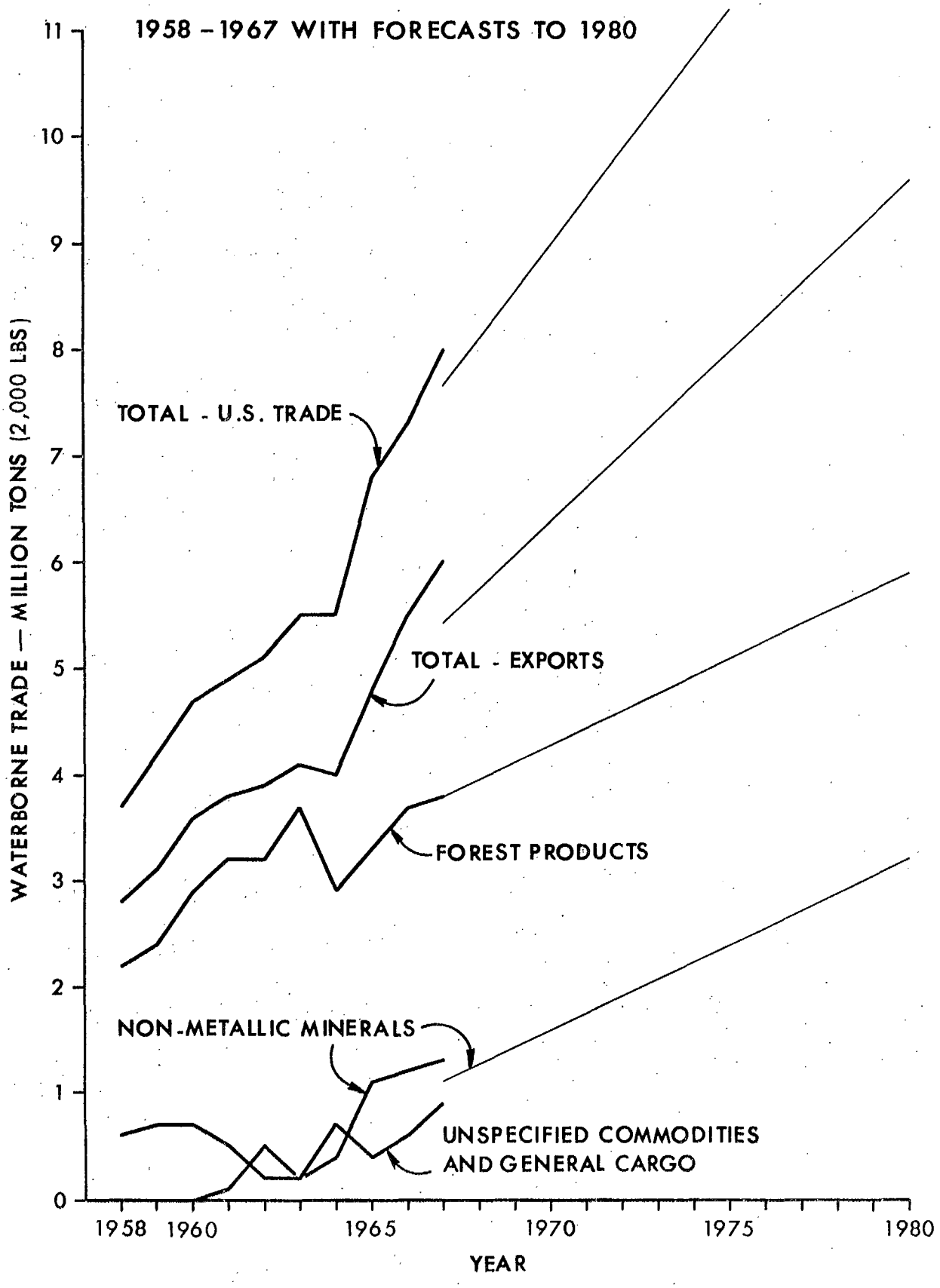


TABLE P-3

PACIFIC REGION

WATERBORNE TRADE WITH U.S. BY MAJOR COMPONENTS (1)

1958 - 1967

(Million tons - 2000 lb.)

	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967
Exports										
Forest products	2.2	2.4	2.9	3.2	3.2	3.7	2.9	3.3	3.7	3.8
Non-metallic minerals	-	-	-	0.1	0.5	0.2	0.4	1.1	1.2	1.3
Unspecified commodities and general cargo	0.6	0.7	0.7	0.4	0.2	0.2	0.7	0.4	0.6	0.9
Total	2.8	3.1	3.6	3.7	3.9	4.1	4.0	4.8	5.5	6.0
Imports										
Petroleum	0.5	0.5	0.5	0.4	0.4	0.5	0.5	0.6	0.7	0.8
Non-metallic minerals	-	0.1	0.1	0.3	0.3	0.3	0.4	0.6	0.5	0.6
Unspecified commodities and general cargo	0.4	0.5	0.5	0.4	0.5	0.6	0.6	0.8	0.6	0.6
Total	0.9	1.1	1.1	1.1	1.2	1.4	1.5	2.0	1.8	2.0
Total - U.S. Trade	3.7	4.2	4.7	4.8	5.1	5.5	5.5	6.8	7.3	8.0

(1) waterborne trade between the Pacific Region and the Continental U.S.

Source: DBS.

Table P-3 shows the volume of the Continental U.S. waterborne trade in the period 1958-67, including both the exports and imports broken down by the main components. These are illustrated on Chart P-3 together with the forecast volumes to 1980. In 1967, this trade totalled 8.0 million tons, of which approximately 6.5 million tons was along the Pacific Coast and 1.5 million tons was with the U.S. Atlantic coast.

Exports

The export trade, totalling 6.0 million tons, consisted of forest products, non-metallic minerals and unspecified general cargo.

Forest Products: In 1967, the main components of the 3.8 million tons forest products exports were lumber (41%), logs and chips (35%) and pulp and paper (24%). The lumber shipments were mainly to the eastern seaboard via the Panama Canal. While the growth of this market is reasonably assured, the main uncertainty in the trend projection is the previously mentioned doubt as to the expanded availability of coastal timber in the late 1970's. However, any slowing in the growth of the supply will probably be offset by the expansion of pulp and paper shipments. While wood shipments constitute a large (35%) portion of current exports, the growth rate of this sector has been slow. It is possible that political action may eventually limit wood exports, but this loss would presumably be partially offset by increased lumber, plywood and pulp and paper exports. The trend projection indicates potential forest product shipments of 5.9 million tons per annum by 1980, but will probably be subject to sharp year-to-year fluctuations indicated in the 1958-67 pattern.

Minerals: The non-metallic mineral shipments of 1.3 million tons in 1967 consisted mainly of limestone. The 1958-67 trend may be conservative as the growth of shipments did not start until 1961. The trend projection indicates possible shipments of 3.2 million tons per annum by 1980.

General Cargo: The growth in the volume of general cargo has been both slow and erratic. The projected 1970-1980 volume of 0.5 million tons per year constitutes only 8% of total 1967 shipments of all commodities, so the significance of the forecast for this cargo is not great. The export trade projections indicates a total volume of 9.6 million tons per annum by 1980.

Imports

The import sector of U.S.-Canada trade in 1967 of 2.0 million tons was made up of petroleum (40%), non-metallic minerals (31%) and unspecified commodities and general cargo (29%). Imports are a relatively small portion of the total trade, and therefore the individual components have not been projected separately. They have, however, been examined for possibilities of very substantial growth or reduction. The import trend projection indicates a potential U.S. import volume of 3.9 million tons per annum by 1980.

Summary:

The following table summarizes the main components of U.S.-Canadian trade projections.

(Million tons)	1970	1975	1980
Exports			
Forest Products	4.3	5.1	5.9
Non-metallic Minerals	1.6	2.4	3.2
Unspecified and General	.5	.5	.5
Total	6.4	8.0	9.6
Imports	2.6	3.2	3.9
Total Trade	9.0	11.2	13.5

CHART P-4

PACIFIC REGION

INTERNATIONAL OFFSHORE TRADE

(EXCEPT CONTINENTAL U.S.)

1958 – 1967 WITH FORECASTS TO 1980

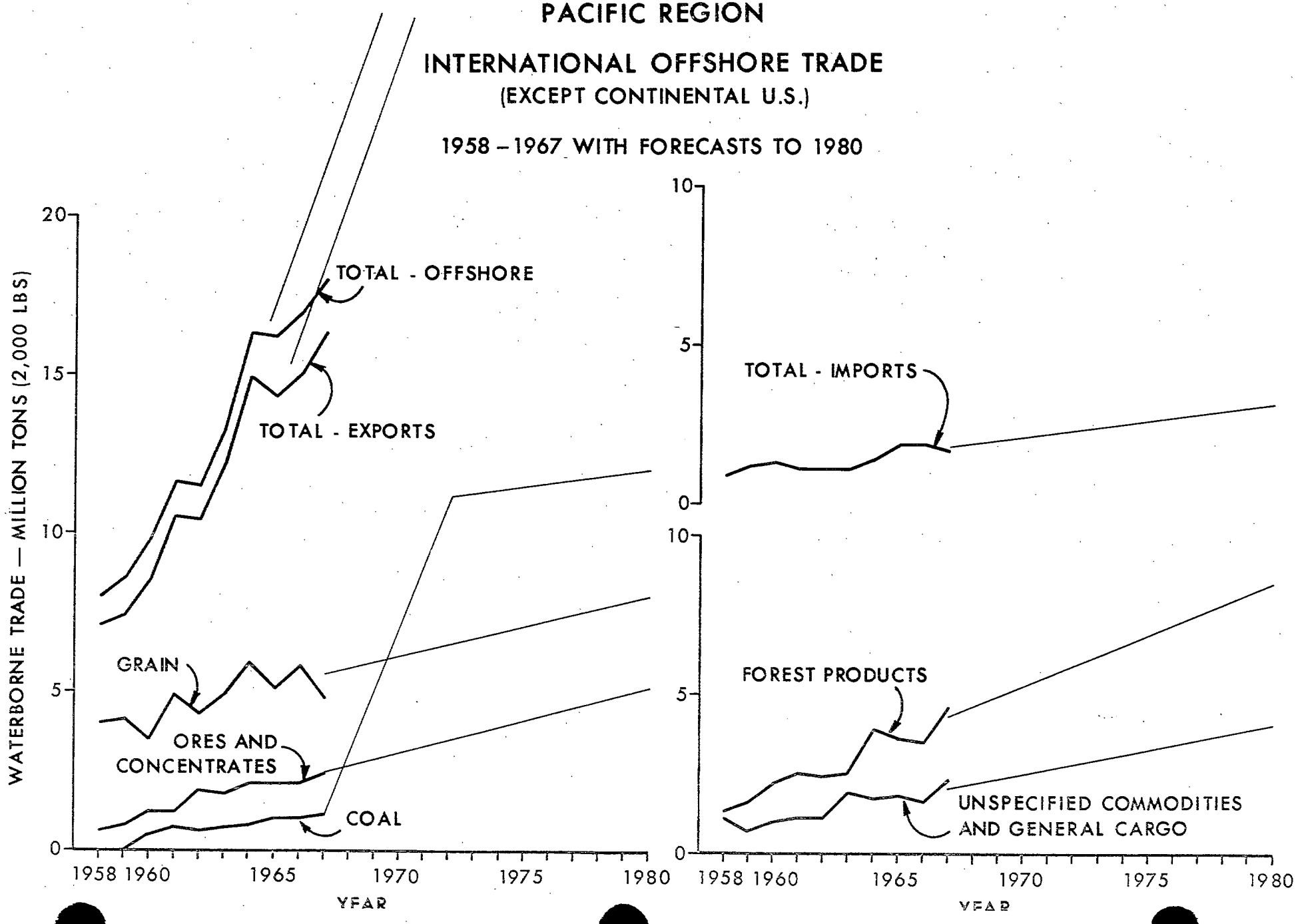


TABLE P-4

PACIFIC REGION

OFFSHORE TRADE BY MAJOR COMPONENTS (1)

1958 - 1967
(million tons - 2000 lb.)

	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967
Exports										
Grain	4.0	4.1	3.5	4.9	4.3	4.9	5.9	5.1	5.8	4.8
Ores & concentrates	0.6	0.8	1.2	1.2	1.9	1.8	2.1	2.1	2.1	2.4
Forest products	1.3	1.6	2.2	2.5	2.4	2.5	3.9	3.6	3.5	4.6
Fertilizer	0.1	0.2	0.1	0.1	0.1	0.4	0.5	0.7	1.0	1.1
Coal	-	-	0.5	0.7	0.6	0.7	0.8	1.0	1.0	1.1
Unspecified commodities and general cargo	1.1	0.7	0.9	1.0	1.2	1.9	1.8	1.8	1.6	2.3
Total	7.1	7.4	8.4	10.4	10.5	12.2	15.0	14.3	15.0	16.3
Imports										
Ores & concentrates	0.2	0.3	0.4	0.3	0.3	0.3	0.4	0.5	0.5	0.4
Minerals	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.4	0.4
Unspecified commodities and general cargo	0.5	0.7	0.7	0.6	0.6	0.6	0.8	1.1	1.0	0.9
Total	0.9	1.2	1.3	1.1	1.1	1.1	1.4	1.9	1.9	1.7
Total - Offshore	8.0	8.6	9.7	11.5	11.6	13.3	16.4	16.2	16.9	18.0

(1) trade with all foreign countries except the Continental U.S.

Source: DBS.

International Off-shore Trade

International off-shore trade covers the cargo movement between the Region and all foreign countries except the Continental U.S.

The major components of this trade are shown on Table P-4. Chart P-4 illustrates the main components of this trade, and shows the forecasts to 1980.

Exports:

The export trade of 16.3 million tons in 1967 consisted of grain, forest products, ores and concentrates, coal, fertilizer and unspecified commodities and general cargo. The following comments cover the trend and projections for each of these components.

Grain: In 1967, grain exports consisted of approximately 86% wheat and 14% other grains. The main destinations of these exports have been the Far-East including India, Pakistan, China and Japan. While the present prospects for wheat exports are dim, it appears reasonable to expect that the 1958-1967 trend will hold to 1980, although large fluctuations can be expected from year-to-year. The main reason for the present depressed condition of the grain export trade is the large increase in the domestic production of traditional importing countries, particularly in India and Pakistan due to the introduction of new high yielding strains, combined with exceptional weather. Also increased competition from other producing countries, partially due to good weather, has been encountered. In the longer term, it can be expected that the weather factor will even out and constrain both the main importers' domestic production, and competitive pressure. (A first indication may be Australia's recent withdrawal from the supply market due to crop difficulties). Despite their current optimism, the Far-Eastern countries appear to be far from self-sufficient in grains. It should be noted that the trend projection is not unduly optimistic as 1980 shipments are only projected at the 8 million ton level, a relatively slow growth rate in view of the 1966 volume of 5.8 million tons.

Forest Products: In 1967, off-shore shipments of forest products totalled 4.6 million tons consisting primarily of pulp and paper (62%), but also including lumber (29%) and logs (9%). The projection is that the 1958-1967 trend will continue, with the result that forest product shipments in 1980 will total 8.5 million tons per annum. Despite the favourable 1958-67 growth experience, this projection may be somewhat optimistic. The limitation may be created by the inability to expand the coastal and island supply of timber, which reportedly is now approaching full utilization. (Interior lumber has generally moved to its markets by rail). Future increases in the supply of coastal timber will have to come mainly from more intensive logging including the extension inland of the coastal logging area by new equipment and roads, and the liberalization of cutting regulations. While it is impossible to predict the additional supply available from these devices, it is possible that the coastal supply may tend to level off in the late 1970's. It is possible that additional pulp and paper shipments will offset any levelling off of coastal lumber production by late 1970's. The northern coastal area has ample pulpwood reserves to support expanded production and a major portion of the rapidly expanding interior lumber and pulp and paper production will probably be shipped by water. Lumber markets appear to be reasonably assured. While competition from Russia is being encountered in Japan, the promotion of lumber frame house construction appears to be progressing well in Europe.

Ore and Concentrates: In 1967, the shipments of mine products totalled 2.4 million tons, consisting mainly of 1.9 million tons of iron ore and 0.5 million tons of base metal concentrates. A projection of the 1958-67 trend would indicate potential shipments of 5.1 million tons per annum by 1980. The following are the main considerations in this forecast.

(a) The B.C. iron mines have a production capacity of approximately 2 million tons per annum. This is unlikely to be expanded substantially in the intermediate term in the face of the very strong supply of iron ore available in the Pacific Rim area, particularly from Australia.

(b) Shipments of base metal concentrates will jump sharply in the early 1970's as a number of large mining projects are expected to be

brought into production in both British Columbia and the Yukon, with the output shipped off-shore. However a domestic copper smelter will probably be constructed in the mid 1970's and this will cause a decline in concentrate exports as concentrates are diverted to the smelter after the present sales contracts expire.

The projected 1980 shipments of 5.1 million tons of ores and concentrates may be somewhat optimistic. Shipments will probably rise above the indicated trend until 1975, and then level off to below the 5.1 million tons per annum rate by 1980.

Coal: The forecast of coal shipments is not made by trend projection because developments now under way provide a firmer basis for the forecast. Long term contracts already signed will result in shipments of metallurgical coal from B.C. and Alberta to Japan reaching approximately 11 million tons per annum by 1973. The prospects for additional sales to Japan are highly favourable. A second series of contracts is expected in the mid 1970's with the result that by 1980, shipments could be substantially above 11 million tons per year. However, in the absence of any firm demand indications, we are conservatively forecasting only a 1.0 million tons per annum increase between 1973 and 1980 to 12 million tons per annum.

Fertilizer: Fertilizer shipments totalled 1.1 million tons in 1967. This does not fully reflect the supply of potash from the Saskatchewan mines which despite current problems will add to ocean shipments. The trend projection which indicates potential shipments of 2.3 million tons per annum by 1980 is probably conservative in the face of the improved markets expected in the 1970's.

Unspecified Commodities and General Cargo: This category includes both commodities shipped in minor quantities (and therefore not included previously as significant components) and manufactured goods. While shipments have varied substantially from year-to-year, the trend projection indicates a potential of 4.1 million tons per annum by 1980. There are several factors which could affect this projection:

(a) Vancouver could lose a substantial portion of its container cargo to the better equipped Port of Seattle.

(b) The establishment of a base metal smelter could add a substantial volume of ingot shipments to the general cargo total. A potential volume of 100,000 - 200,000 tons per annum by 1980 is possible.

Imports

In 1967, off-shore imports totalled 1.7 million tons consisting mainly of ore (bauxite) - 24%, non-metallic minerals (salt, gypsum) - 24% and general cargo - 52%. Off-shore import tonnages have not shown any growth between 1965 and 1967. Bauxite shipments have levelled off reflecting the relatively stable aluminum production. Because total off-shore imports are relatively small, only the 1958-67 trend of total imports has been projected. The 1980 volume is indicated to be 3.2 million tons.

There are two possible developments which could substantially increase the tonnages unloaded, and make the projection conservative, but they are not considered likely:

(a) The "land bridge" concept has been extensively discussed in the past year. This would add approximately 1.0 million tons per annum to both export (loaded) and import (unloaded) traffic which would be entirely a net gain, because it would not be a displacement of import trade.

(b) Any expansion of the B.C. aluminum smelting capacity would increase bauxite imports. Such an increase is not expected to occur until the late 1970's.

Summary:

The following table summarizes the projected totals:

(Million tons)	1970	1975	1980
Exports			
Grain	6.1	7.1	8.0
Ores	3.1	4.1	5.1
Forest Products	5.3	6.9	8.5
Fertilizer	1.2	1.8	2.3
Coal	7.0	11.5	12.0
Misc. & Gen.	2.5	3.3	4.1
Total	25.2	34.7	40.0
Imports	2.1	2.7	3.2
Total Trade	27.3	37.4	43.2

The forecast shipments for ore and forest products may be optimistic. However, this is more than offset by conservative figures for coal and fertilizer and for this reason the totals are considered to be reasonable.

Fishing Vessels

Industry Situation and Developments

The Pacific Region fishing industry pursues four main species or types of fish; these being salmon, halibut, groundfish, and herring. There is some flexibility in the use of boats between the various types of fishing.

Salmon: Salmon is caught by seining, gill netting and trolling. However, salmon resources are being used to the limit, and while there is some evidence that the species is again increasing, there

will probably not be any increase in the allowable catch in the intermediate term. The Federal government is attempting to upgrade the industry and reduce the present large number of marginal and submarginal fishermen to a relatively small number of efficient well equipped operators. It has instituted a system of "A" and "B" licenses in accordance with the operators' past and continuing performance. "A" licensees can upgrade their boats and equipment whereas "B" licensees cannot. By increasing performance specifications, "B" operators can gradually be driven out. The application of the policy seems to be flexible, depending among other factors, on alternative employment opportunities. In addition to the fishing fleet, the salmon packers employ collector and packer boats to assemble and bring in the catch.

Halibut: Halibut is caught by longlining. The vessel involved can also be used for salmon seining and herring fishing. Halibut resources are also limited, so that increases in the total catch are not expected. There is, however, no attempt by government to change the structure of this industry as is the case with salmon.

Herring: Herring is also limited by supply; it is fished by a combination of salmon seiners and herring boats.

Ground Fish: The ground fish industry is not well developed by Canadians on the Pacific Coast, and offers the main potential for expansion of the fishing industry. There are very few of the necessary vessels (trawlers) available. However, in the face of the limitations in the other species, interest in ground fish is increasing.

There also appears to be some potential for increasing tuna fishing activity. This is relatively specialized with frequently fluctuating results. There does not appear to be any problem of markets for the west coast fish production although prices are periodically rather low.

The developments in the fishing boat building industry can be summarized as follows:

1. Salmon "A" license holders are starting to upgrade their equipment. This involves some construction of new vessels and re-equipping others.

2. The basic trend is toward the construction of larger multiple use vessels of the 110-120 ft. length which can be used for a combination of ground fish trawling, halibut and herring fishing and as salmon packers.

3. There does not appear to be any significant prospect of the construction of factory vessels. The economics are marginal because of the proximity of the fishing grounds to Canadian shores. Also the processors have a large investment in shore facilities.

Fishing Vessel Requirements

There are a number of uncertainties in the Pacific fisheries situation which makes it difficult to forecast new vessel requirements. The extent to which the Government will apply its salmon policy, and uncertainty as to the re-opening of the now closed herring fisheries are important factors. It has been concluded that in the face of this situation, no firm forecast can be made, although it is reasonably assured that some vessel construction will continue.

CHAPTER II

SUPPLY OF SHIPPING SERVICES

Coastal Trade

Commonwealth Participation

In 1967, only 21,000 tons of the total 20.2 million tons of coastal cargo was handled by non-Canadian flag vessels. The participation by foreign carriers in the Pacific Region is thus not significant.

The Pacific Region Canadian Fleet

As at December 31, 1967, the Pacific Region Canadian Flag fleet consisted of the following:

Type	No.	Total GRT
Dry Cargo/Passenger	5	16,000
Tankers	3	4,500
Total: Self Propelled Cargo Vessels	8	20,500
Passenger	5	18,100
Ferries	21	73,400
Total: Self Propelled 1,000 GRT & over	34	112,000
Tugs (100 GRT & over)	70	18,400
Barges (100 GRT & over)	1,026	549,400
TOTAL	1,130	679,800

Barges dominate the dry and liquid cargo fleets, constituting 96.5% of the total commercial cargo tonnage.

TABLE P-5

PACIFIC REGION

SUMMARY OF WATERBORNE TRAFFIC IN COASTAL TRADE

1963 - 1967

	1963	1964	1965	1966	1967
Comparison of Barge vs. Self-Propelled Vessel Traffic (Departures Only)					
Barges:					
Departures (000)	22.4	22.4	20.6	23.3	21.8
NRT (millions)	13.4	14.2	14.8	18.6	18.9
Average size - NRT	600	630	720	800	870
Self-Propelled: (Cargo Vessels)					
Departures (000)	10.9	10.5	9.0	7.5	6.3
NRT (millions)	10.5	10.1	6.5	5.6	8.2
Average size - NRT	970	960	720	750	1,300
Summary of Traffic (Barge & Self-Propelled - arrivals & departures)					
NRT (millions)	49.2	49.8	44.0	49.3	48.3
Cargo carried	14.1	15.0	17.8	21.0	20.2
Tonnage ratio	.29	.30	.40	.43	.42

Source: DBS.

The ferries include 17 vessels owned by the Province of British Columbia. There were also 2 trailer and train ferries owned by private companies (increased to 3 in 1968).

The principal self-propelled dry cargo ship in 1967 was one 8,000 GRT container ship (since increased to 2). There were 4 small vessels of 1,400 to 3,150 GRT, and several smaller vessels of under 1,000 GRT. Small self-propelled vessels of under 1,000 GRT are not a significant factor in the Pacific Region dry cargo trade, as is the case in the Atlantic Region.

Coastal Traffic Statistics

Table P-5 shows the traffic statistics for both barges and self-propelled vessels in coastal trade between 1963 and 1967. The data on Table P-5 consists of:

- the number of departures for both barges and self-propelled vessels and the total net registered tonnage for such departures (tugs are included in self-propelled vessel departures but their number of departures is available separately and has been deducted; the net registered tonnage of tugs is not deducted but is negligible);
- total cargo carried (from Table P-2);
- total net registered tonnage of vessels arriving and departing.

The following conclusions are based on this data:

(a) Since 1958, there has been a sharp increase in the total net registered tonnage of barge departures in coastal trade, which increase closely parallels the growth in total coastal trade cargoes.

(b) During the same period, there has been a corresponding sharp decline in the total net registered tonnage of self-propelled vessel departures.

(c) The average size of barge (net registered tons per departure) has increased steadily from 600 tons in 1963 to 870 tons in 1967.

(d) The average size of self-propelled vessel departure declined steadily from 1670 NRT in 1959 to 750 NRT in 1966, but rose sharply to 1300 tons in 1967. The increase in 1967 resulted from the entry into regularly scheduled service of one large containership.

(e) A ratio of cargo tons to net registered tons has been developed so as to obtain an indication of changing relationships between cargoes carried and ships carrying. This "tonnage ratio" for barges and self-propelled vessels combined has improved steadily from .14 in 1959 to .42 in 1967.

It is apparent from both the fleet size and traffic statistics that barges have taken over a substantial part of the coastal trade. The average size of barge has almost doubled between 1959 and 1967. The tonnage ratio improvement is generally consistent with greater use of barges which, for reason of low tie-up costs, can wait for higher loadings before departure. Also, because of their lower cost and specialized uses, they are often used for regular full capacity operations. Trade sources in the Region generally agree that barges now handle 90 to 95% of all coastal trade tonnage. The net registered tonnage of departures in 1967 consisted of 70% barges and 30% self-propelled vessels (in 1966, the net registered tonnage of barge departures was 78% of total vs. 22% for self-propelled). These ratios probably understate the importance of barges in moving tonnage because:

(1) barges carry the heavier commodities such as logs, minerals, etc. vs. lighter general cargo for self-propelled vessels and

(2) barges are probably using a greater portion of their overall carrying capacity because of their use for bulk shipments.

Source of Vessels for the Pacific Fleet

As at December 31, 1967, the source of the 34 self-propelled ships of 1,000 GRT and over was as follows:

Country of Manufacture	No.	Total GRT
Canada	24	71,200
U.S.A.	5	17,700
U.K.	4	21,300
Norway	1	1,800
Total	34	112,000

Three of the foreign built vessels totalling 7,600 GRT have required major alteration or rebuilding in Canada.

Detailed data on the origin of the barge fleet is not available. However, a sampling of the new barge additions to the Canadian fleet from 1965 to 1967, indicates imports accounted for only 1,600 GRT of the total 165,500 GRT added. It is probable therefore that the existing barge fleet is very largely of Canadian origin.

TABLE P-6

PACIFIC REGION

REGISTRY OF VESSELS CARRYING INTERNATIONAL TRADE

1958 - 1967
(million tons cargo)

Country of Registry	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967
Canada (mainly barge traffic)	1.3	1.5	1.7	2.1	2.1	2.5	2.4	2.9	3.4	3.9
U.S.A.	1.5	1.8	1.6	1.3	1.3	1.2	1.2	1.5	1.4	1.4
Japan	1.8	1.5	1.7	1.8	2.6	3.0	3.5	3.4	3.7	4.0
Liberia	1.6	2.4	1.9	1.5	1.5	1.6	2.4	2.8	2.6	3.8
Norway	1.0	1.6	2.1	2.7	2.7	3.1	3.8	4.2	4.1	4.3
Greece	0.4	0.7	1.8	2.8	2.8	3.0	3.0	3.0	3.1	2.4
Others	4.1	3.3	3.6	4.1	3.7	4.4	5.7	5.2	5.9	6.2
Total	11.7	12.8	14.4	16.3	16.7	18.8	22.0	23.0	24.2	26.0

Source: DBS.

International Trade

Foreign Participation

Table P-6 shows the registry of vessels carrying the Pacific Region international trade, including trade with the U.S. The six leading nations are detailed.

As expected, the traditional seafaring nations and flags of convenience including Norway, Greece, Liberia, United Kingdom and Japan are the main carriers. The U.S.S.R. has become a significant carrier but the tonnage appears to coincide closely with wheat purchases.

Canada has increased its share of the Pacific Region international trade from 11.5% in 1958 to 15% in 1967. It should be noted that this gain was in a specialized area as almost all the cargo carried by vessels of Canadian registry was barge traffic between the U.S. and Canada.

There is not likely to be any significant change in the pattern in the future, with the exception of very substantial gains by Japan. This will result primarily from the very large increase in coal exports to Japan during the 1970's which at present appears likely to be carried in Japanese vessels.

Traffic Statistics and Ship Types

The Region's international trade (including trade with the United States) is predominantly in bulk, dry cargo. During 1967, the total miscellaneous and general cargo, (export and import) totalled

TABLE P-7

PACIFIC REGION

SUMMARY OF WATERBORNE TRAFFIC IN INTERNATIONAL TRADE

1963 - 1967

	1963	1964	1965	1966	1967
All Vessels					
Arrivals & Departures (000)	21.4	20.6	20.2	19.9	20.4
NRT (millions)	57.3	56.3	58.2	56.9	61.4
Average size - NRT	2,700	2,800	2,900	2,900	3,000
Cargo (million tons)	18.8	22.0	23.0	24.2	26.0
Tonnage ratio	.33	.39	.40	.42	.42
Self Propelled					
Arrivals & Departures (000)	13.6	13.4	13.4	12.7	12.3
NRT (millions)	52.9	52.3	53.8	51.7	54.8
Average size - NRT	3,900	3,900	4,000	4,100	4,400
Cargo (million tons)	16.3	19.5	20.1	20.8	22.1
Tonnage ratio	.31	.37	.38	.40	.40
Barges					
Arrivals & Departures (000)	7.8	7.1	6.8	7.3	8.1
NRT (millions)	4.4	4.0	4.4	5.2	6.4
Average size - NRT	560	570	640	720	800
Cargo Tons (millions) *	2.5	2.4	2.9	3.4	3.9
Tonnage factor	.56	.60	.65	.65	.60

* Estimated to be total carried by Canadian flag vessels in international trade per Table P-6

Source: DBS.

4.7 million tons, only 18% of the total international trade of 26.0 million tons.

While specific statistics on the type of vessel carrying the international trade are not available, it is possible to draw some conclusions from the available data.

(a) The majority of the trade was carried by deep sea bulk dry cargo vessels.

(b) The exception to (a) above is the barge traffic mainly up and down the North American West Coast. Since there has been virtually no deep-sea international trade carried on by self-propelled vessels of Canadian registry since 1965, it is concluded that the tonnage carried by vessels of Canadian registry (per Table P-6) has been mainly barge traffic. The number of arrivals and departures of such vessels, the total registered net tonnage of these vessels is shown on Table P-7.

(c) The tonnage ratio for barges has fluctuated between .56 and .65 since 1963. Some of these barges may have been of U.S. registry, but this does not affect the projection unless there is a change in the U.S.-Canada share of cargo markets in future years.

(d) The tonnage ratio for self-propelled vessels was .40 in 1966 and 1967. This is smaller than for barges because self-propelled vessels carried a higher portion of lower density general cargo.

In 1967, there was no Canadian flag deep-sea fleet. One vessel, an 8,000 GRT combination container-tanker ship, had ocean-going capabilities but was not used in this role. Therefore, all of the Canadian flag international trade participation was by the coastal fleet and consisted almost entirely of barge traffic.

CHAPTER III

SHIP AND TRANSPORTATION TECHNOLOGY

Waterborne Transportation Developments

The potential new shipping developments in the Pacific Region are evolutionary rather than revolutionary in nature. Their impact will be gradual. They may be summarized as follows:

1. The average size of ocean-going bulk dry cargo vessels will increase sharply. The main factor in this increase will be the very large tonnage of coal shipments to Japan which is now under way and which will be carried by ships of the 100,000 - 125,000 DWT size.

2. Barges will probably become larger. An example is the 20,000 ton capacity self-loading, self-dumping log barge due to go into service in 1970. The extent to which barges will be used in longer distance deep-sea applications will primarily depend on the development of economic and regular trade patterns for certain bulk commodities. Also required will be further development of adequate surge towing gear or pusher-link devices suitable to the requirements of deep-sea conditions. It is possible that these developments will occur during the 1970's.

3. The application of the "Lash" concept to the Pacific Region, is not expected although several parties are reported to be studying the possibility. The large portion of the West coast tonnage is in relatively low unit value commodities, in most cases already unitized to minimize handling costs. The weight of the lighters may impose too large a penalty on the carrying capacity of the primary vessel. For the coastal trade, the haulage distances are too short to use the Lash concept.

4. It is estimated that up to 1.0 million tons of off-shore exports and imports may be suitable for containerization. It is possible that the Port of Vancouver could lose a significant portion of this volume to the Port of Seattle which is well equipped to handle containers. While the emergence of Seattle as the major Northwestern area container port may reduce the general cargo tonnage handled in the Pacific Region, it would not reduce the Canadian flag share of cargoes. General cargoes have in recent years been carried almost entirely by foreign flag vessels.

The precise timing and dollar impact which the new developments will have for the shipbuilding and repair industry cannot be predicted precisely and are not included in the forecasts. The following potential exists:

(a) The repair of very large deep-sea dry bulk cargo vessels and tankers (given the necessary facilities).

(b) The construction of new deep-sea barges and tugs with new or improved design features for deep-sea conditions.

Competitive Transportation Developments

As in the case of waterborne transportation developments, there are no competitive transportation developments which would significantly affect the Pacific Region.

The following are possibilities which have been mentioned, and the reasons for considering that their impact will be limited.

Solid Pipelines: The main competitive possibility would be the transportation of wood chips or pulp by pipeline. However, the mountainous terrain in the coastal region probably precludes any significant movement of wood in this way, in competition with barges.

Unit-Trains: The development of the unit-train has been highly beneficial to Pacific Region export growth because it has made economically feasible the transportation of bulk commodities (particularly coal) from the interior to the coast. The main competitive possibility is the carriage of coastal lumber and timber to the U.S. eastern seaboard by unit-train. This trade currently moves by water, the 1967 shipments amounting to 1.7 million tons. While such a service is possible, the railways may be reluctant to undertake it because it would be necessary to offer the same service to interior lumber producers. This market is at present captive to the railways and is both larger and has more growth potential than the coastal mills. Unit-trains may reduce the railway's margins on this captive trade requiring them to move more freight for the same profit.

Land Bridge: The realization of the "land-bridge" concept is not expected. However, if it does develop, the additional tonnage handled will probably be in the area of 1 million tons per annum.

Other Developments: A sea-level replacement for the Panama Canal would probably not result in any significant gains for Pacific Region tonnage. While still discussed, the prospects for such a development appears to be fading. The main Canadian commodity now moving through the Panama Canal which would benefit is forest products, particularly lumber for the U.S. east coast.

CHAPTER IV

FUTURE DEMAND FOR SHIPS AND SERVICES

Commercial Demand

The future demand for ships and services for the Pacific Region will derive from the following sources:

(a) increased demand for cargo capacity due to increases in trade;

(b) increases in requirements from the commercial non-cargo carrying sector such as ferries and passenger ships;

(c) replacement of tonnage due to age or obsolesence;

(d) repair and overhaul of the expanding domestic fleet and the foreign flag vessels entering the regions' ports.

In the Pacific Region, the forecast covers the increases in the size of the Canadian flag fleet, and the increased ship movement required to carry the international cargo that is forecast.

Demand from Trade Growth

The method used to forecast demand due to trade growth was as follows:

(a) Waterborne trade volumes were forecast (Chapter I).

(b) Past traffic was analysed to determine vessel movement in net registered tons required to move cargoes. From this analysis assumptions for future share of market, tonnage ratios to indicate vessel utilization, etc., were made.

(c) The share of market and tonnage ratio assumptions were applied to forecast cargo movement to determine future vessel traffic requirements.

(d) The size of fleet in the base year was determined and the increase in its size in future years was assumed to be proportional to the increase in vessel traffic.

The method of forecasting used provides a broad estimate of future requirements based on an expansion of traffic without any major change in trade patterns. It does not take into consideration such factors as increased vessel utilization from higher speeds or faster turnaround, but nevertheless provides a reasonable basis for projections.

The basic assumptions which have been used for the Pacific Region are summarized as follows:

(a) Canadian flag vessels (mainly barges) will continue to carry 50% of the Pacific Region - Continental U.S. trade. This is probably conservative as barges have increased their share of this traffic from 38% in 1958 to 50% in 1967, and this upward trend may continue.

(b) There is no significant change in the composition of the coastal trade.

(c) The tonnage ratios will be:

Coastal trade (all vessels)	- .42
International trade (barges)	- .60
International trade (self-propelled)	- .40

These figures are generally consistent with recent experience as shown previously on Tables P-5 and P-7. They assume that there will be no increase in the proportion of import tonnage to total international trade, which would provide cargoes to reduce the present traffic imbalance. Actually the reverse is forecast to occur so that the .40 tonnage ratio is probably conservative.

TABLE P-8

CANADIAN FLAG PACIFIC REGION COASTAL FLEET TRAFFIC AND GROWTH PROJECTIONS

	1967 Actual	1970	1975	1980
Coastal:				
Cargo - million tons	20.2	25.6	33.6	40.7
Tonnage Ratio	.42	.40	.40	.40
Vessel Traffic (million NRT)	48.3	64.0	84.0	100.2
International (Canada-U.S. only)				
Cargo - million tons	8.0	9.0	11.2	13.5
Canadian Share of Market	.50	.50	.50	.50
Canadian Cargoes - million tons	3.9	4.5	5.6	6.7
Tonnage Ratio	.60	.60	.60	.60
Vessel Traffic (million NRT)	6.5	7.5	9.3	11.2
Total: Canadian Vessel Traffic (million NRT)	54.8	71.5	93.3	111.4
Size of Fleet (000 GRT)	570.0	745.0	970.0	1,160.0

It has been necessary to use the same tonnage ratio for both ships and barges in the coastal trade because there is no statistical basis upon which to base any alternative figure. This tends to render conservative the estimates of barge requirements, but this is not a serious distortion.

The year 1967 has been used as the base year for the fleet size. It has been determined from interviews with shipping officials that 1967 was a good year with the shipping supply/demand situation in reasonable balance, particularly in the barge trade. The tonnage ratios experienced in that period probably came close to being a practical maximum.

The base cargo carrying fleet size is taken as the position as at December 31, 1967 as follows:

Dry Cargo/Passenger	-	16,000 GRT
Tankers	-	4,500 GRT
Barges, scows	-	549,400 GRT
		569,900 GRT

Table P-8 opposite summarizes the Canadian cargo fleet traffic and size growth projection. The projection indicates total vessel movement of 71.5, 93.3 and 111.4 million NRT in 1970, 1975 and 1980 respectively. This will require the following size of cargo fleet:

1970	-	745,000 GRT
1975	-	970,000 GRT
1980	-	1,160 000 GRT

The total increase of 415,000 GRT between 1970 and 1980 would require new vessel construction at an average rate of 41,500 GRT per annum. The 1970 actual fleet position will probably fall slightly short of the projection as the industry is absorbing the very substantial construction of past years.

Non-Cargo Commercial Vessels

The major non-cargo carrying vessels in the Pacific Region are ferries, most of which are operated by the Province of British Columbia. While there has been a large increase in ferry services since 1950 and at present the main routes are well serviced, some additional ferry services are expected in 1970's. These additional services are expected to require about 10,000 GRT in new vessels, or an average of 1,000 GRT per annum. Further increases in capacity required to meet traffic demands will probably be provided by lengthening up to 8 of the existing vessels. Additions to the total gross tonnage of the fleet which would result from the lengthening of ferries has not been included in the forecast.

In 1967, the tug fleet consisted of 70 vessels (over 100 GRT) totalling 18,400 GRT. There will need to be substantial increases in the number of tugs to service the projected barge fleet

increase. These tugs will generally be larger than the 1967 average size in order to handle the larger barges coming into service. On the basis of the assumption that the total gross tonnage of the tug fleet will increase in proportion with the barge fleet, the tug fleet will increase by approximately 10,000 GRT between 1970 and 1980, or by 1,000 GRT per annum.

The total new vessel construction in the non-cargo commercial category is thus forecast at an average of 2,000 GRT per annum through the 1970's.

Replacement Requirements

The replacement of vessels due to obsolesence or age is not expected to be a significant part of building requirements in the 1970's. The barge industry has recently undergone a major replacement cycle during which most of the wood and small steel barges built during the 1950's, at the start of the barge boom, have been replaced.

The Pacific Region new barge construction between 1958 and 1967 totalled about 243,000 GRT. If imports are added to this, it appears that about one-half of the Region barge fleet is less than 12 years old.

While new specialized barges are being built, the smaller vessels remain serviceable in other areas. The service life of a steel barge is estimated at 20-30 years, so that the replacement cycle of much of the present equipment is beyond the

forecast period ending in 1980. However, this does indicate a substantial potential for replacement building after 1980.

The self-propelled cargo fleet includes only one vessel of 1,400 GRT which will be 30 years old during the 1970's. Of a tanker fleet of 4 vessels there are 2 ships totalling 1,900 GRT which are already over 30 years old.

The ferry fleet is relatively modern with only 3 vessels totalling 13,600 GRT over 30 years old in the 1970's. The passenger fleet is however quite old with 4 of the 5 vessels totalling 15,500 GRT exceeding 30 years of age by 1980. These passenger ships are used only seasonally as cruise vessels and their replacement is uncertain. For this reason they have not been included in replacement totals.

There will also be some replacement of tugs. However, no data is available on the age of the existing tug fleet upon which such an estimate might be based. While some replacements are expected, they will form only a small part of the total shipbuilding activity so that omission does not significantly distort the forecast.

The replacement potential from 1970 to 1980 is therefore only 17,000 GRT for self-propelled vessels. To this, has been added the estimate of a total of 80,000 GRT in barges, approximately 15% of the 1967 barge fleet.

The total fleet replacement volume is therefore about 10,000 GRT per annum, based on the replacement of scrapped vessels by

new ones on a ton for ton basis. This is considered reasonably accurate as most of the replacement requirements are for barges, where the replacement vessels tonnage is not expected to have significantly higher productivity than the existing fleet.

Summary of Shipbuilding Requirements

The following table summarizes the shipbuilding requirements for the Pacific Region from 1970-1979.

Source	GRT/annum
Fleet growth	41,500
Replacement	10,000
Non-Cargo (tugs & ferries)	2,000
	53,500

Types of New Ship Required

The major part of the 415,000 GRT of new cargo carrying vessel construction will be barges. It is estimated on the basis of interview data that new self-propelled vessel construction of all types including cargo ships, ferries, train and trailer ferries, etc., but excluding passenger ships, will probably not exceed 30,000 GRT between 1970 and 1980 including replacements. Construction is thus likely to be mainly in barges where a potential of about 465,000 GRT (including 80,000 GRT replacements) exists.

Off-shore Trade

It is not necessary for present purposes to forecast a fleet size increase for the foreign vessels engaged in Pacific Region

TABLE P-9

PACIFIC REGION INTERNATIONAL TRADE FOREIGN-FLAG VESSEL TRAFFIC PROJECTION

1970 - 1980

	1967 Actual	1970	1975	1980
Projected Cargo (million tons):				
Off-shore	18.0	27.3	37.4	43.2
U.S.A. (50%) *	3.9	4.5	5.6	6.7
TOTAL	21.9	31.8	43.0	49.9
Tonnage Ratio	.40	.40	.40	.40
Ship Traffic (million NRT)	54.8	80.0	108.0	125.0

* 50% assumed to be carried by Canadian vessels

international trade. However, Table P-9 indicates the increase in traffic expected. The projection indicates an increase in traffic from 55 million NRT in 1967 to 125 million NRT in 1980. The number of arrivals and departures for all vessels has been gradually declining since 1960 because of the larger average size of the ships in use. This decline will probably continue as a substantial part of the projected trade increase is in bulk cargoes particularly coal, where very large ships will be used.

Repair Services

The projected increase in ship tonnage movement in the region will bring about an increase requirement for ship repair and overhaul services.

A detailed forecast for repair services has not been prepared on a regional basis but information for Canada as a whole and on repairs in each Region is presented in the Canada section.

CHAPTER V

THE SUPPLY POSITION OF THE SHIPBUILDING INDUSTRY

Introduction

The information presented in this chapter on the supply position of the industry in the Pacific Region refers to the operations of shipyards located in British Columbia. Questionnaire data have been used to supplement D.B.S. data in certain respects.

The Level and Composition of Activity in the Industry

The number of yards and the level of activity in the shipbuilding industry in the Pacific Region declined at the beginning of the 1960's, but more recent years have seen expansion both in number of yards and in value of work performed on new construction, reconditioning and conversion, ship repair, and manufacture of fabricated industrial products. Data from D.B.S. for all yards in the Region are as follows:

	Number of Establishments Number	Value of Work Performed $ Million
1967	25	$ 57
1966	25	53
1965	22	60
1964	19	43
1963	20	51
1962	18	46
1961	19	30
1960	20	25
1959	20	38
1958	22	34

TABLE P-10

PACIFIC REGION

ACTIVITY IN THE SHIPBUILDING AND REPAIR INDUSTRY, BY CATEGORY

	Value of all Work Performed $ Million	Value of New Construction Work $ Million	Value of Repair Work $ Million	Value of Conversions & Industrial Work $ Million
1969 Est.	$ 43.3	$ 24.4	$ 11.8	7.1
1968	37.3	18.8	13.3	5.2
1967	40.8	23.5	11.7	5.6
1966	32.6	19.0	6.5	7.1
1965	31.1	18.5	7.2	5.4
1964	23.8	13.0	4.9	5.9
1963	28.4	14.8	6.4	3.2
1962	29.0	20.6	5.2	3.2
1961	20.0	12.7	4.8	2.5
1960	12.7	6.1	4.6	2.1
1959	22.9	15.2	5.3	2.4
1958	18.7	12.7	4.4	1.6

	Per Cent	Per Cent	Per Cent	Per Cent
1969 Est.	100%	57%	27%	16%
1968	100	50	36	14
1967	100	57	29	14
1966	100	58	20	22
1965	100	60	23	17
1964	100	55	20	25
1963	100	52	22	26
1962	100	71	18	11
1961	100	64	25	11
1960	100	48	39	11
1959	100	66	23	13
1958	100	68	23	11

Source: Questionnaire to Yards representing 75% of the value of all work performed in the region in 1967.

TABLE P-11

PACIFIC REGION

THE IMPORTANCE OF FEDERAL GOVERNMENT PROCUREMENT IN NEW CONSTRUCTION ACTIVITY

	All New Construction	New Construction For Federal Government			Federal Government as % of Total		
		Naval	Civilian	Total	Naval	Civilian	Total
	$ Million	$Million	$Million	$Million	%	%	%
1969Est.	$ 24.4	-	$ 1.9	$ 1.9	-	8	8
1968	18.8	-	6.4	6.4	-	34	34
1967	23.5	-	8.5	8.5	-	36	36
1966	19.0	-	11.1	11.1	-	59	59
1965	18.5	-	9.7	9.7	-	52	52
1964	13.0	0.4	6.8	7.2	3	52	55
1963	14.8	2.9	2.8	5.7	20	19	39
1962	20.6	9.5	2.8	12.3	46	14	60
1961	12.7	4.3	2.1	6.4	34	17	51
1960	6.1	1.5	1.0	2.5	25	16	41
1959	15.2	5.2	6.6	11.8	34	44	78
1958	12.7	9.0	1.7	10.7	71	13	84

Published information on the types of activity carried on in the region is not available, but data supplied by the yards replying to the Committee's questionnaire provides both later, and more detailed, information. These yards accounted for some 75% of the value of work performed by all yards in the Region in 1967; this proportion would be closer to 90% in subsequent years in view of the fact that one major yard has closed down since then. It might be noted that the questionnaire did not ask for the value of conversions and of industrial work separately, and these are therefore combined in the last column of Table P-10 which shows the pattern of activity in Pacific Region yards during 1958-69.

As regards the trend in activity, the increasing value in the mid-60's was reversed in 1968, but preliminary data for 1969 indicate further growth in new construction and value of shipments in that year. Repair work has increased appreciably in value in recent years.

The percentages in the bottom half of the table indicate that new construction has averaged about 60% of all activity over the period, repairs some 25% and industrial and conversion work about 15%. The importance of new construction to the industry in the Region in recent years has been much the same as in Canada as a whole. Repairs have been relatively greater with Vancouver being a terminal port. Industrial activity in the region has been a lesser part of shipyard operations than elsewhere,

associated with the relatively limited scale of the market for industrial products in the region. The following are the comparative patterns of activity in Pacific yards and nationally in recent years:

	Approximate importance in activity of questionnaire yards in recent years of:		
	New Construction	Repairs	Industrial and Conversion Work
Pacific Region	55 - 60%	20 - 30%	15 - 20%
Canada	55 - 60	15	30

New Construction

Examining new construction in more detail, Table P-11 indicates the pronounced change which has occurred since the mid 60's in the importance of Federal Government procurement in the region's total new construction. Placement of substantial naval business on the West Coast in earlier years, together with civilian government work, had resulted in Federal procurement representing an average of 60% of total new construction activity in 1958-63.

Naval work in the region ceased after these contracts began to be let on national competitive tender, following a change in government policy in 1965. Work for government civilian departments, under transitional arrangements related to the change in policy, was at a high level in 1965-67 but more recently declined to under 10% of total new construction in questionnaire yards in 1969.

Non-government new construction business has increased from under 20% of all new construction in 1958 to about 90% in 1969,

TABLE P-13

PACIFIC REGION AND CANADA

SHIPBUILDING AND SHIP REPAIR INDUSTRY

PURCHASED MATERIALS AND UTILITIES, WAGES OF PRODUCTION AND RELATED WORKERS AND OVERHEAD AND PROFIT, AS PERCENT OF VALUE OF WORK PERFORMED

	1967	1966	1965	1964	1963	1962	1961
Pacific Region							
Per cent of Value of Shipments made up by:							
Purchases	35%	37%	36%	43%	38%	36%	30%
Production Wages	37	38	33	33	36	40	40
Overhead & Profit	28	25	31	24	26	24	30
Total	100%	100%	100%	100%	100%	100%	100%
Canada							
Per Cent of Value of Shipments made up by:							
Purchases	46%	44%	44%	42%	42%	40%	37%
Production Wages	31	31	29	30	34	39	36
Overhead & Profit	23	25	27	28	24	21	27
Total	100%	100%	100%	100%	100%	100%	100%

Source: D.B.S. Annual Census of Manufactures

TABLE P-12

PACIFIC REGION

NEW CONSTRUCTION ACTIVITY AND NON-GOVERNMENT PROCUREMENT

	All New Construction $ Million	Dry Cargo $ Million	Tankers $ Million	Ferries $ Million	Fishing Vessels $ Million	Barges $ Million	Tugs $ Million	Other $ Million	Total Non-Government $ Million
1969 Est.	24.4	-	1.7	2.7	1.5	10.6	6.1	-	22.6
1968	18.8	-	-	1.5	1.8	7.8	1.2	-	12.3
1967	23.5	-	-	-	6.3	7.0	-	1.7	15.0
1966	19.0	-	-	-	1.5	6.0	-	0.4	7.9
1965	18.5	-	-	-	0.9	7.0	1.3	0.1	9.3
1964	13.0	-	-	0.3	0.3	4.2	1.1	-	5.9
1963	14.8	1.6	-	1.7	0.9	5.0	0.3	-	9.5
1962	20.6	2.0	-	1.2	-	5.1	-	-	8.3
1961	12.7	-	-	3.0	-	2.9	-	-	5.9
1960	6.1	-	-	1.1	-	2.4	-	-	3.5
1959	15.2	-	-	1.9	-	1.2	0.3	-	3.4
1958	12.7	-	-	0.4	-	1.6	-	-	2.0
	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent
1969 Est.	100%	-	7%	11%	6%	43%	25%	-	92%
1968	100	-	-	8	10	42	6	-	66
1967	100	-	-	-	27	30	-	7	64
1966	100	-	-	-	8	32	-	2	41
1965	100	-	-	-	5	38	7	-	48
1964	100	-	-	2	2	33	8	-	45
1963	100	11%	-	12	6	34	2	-	61
1962	100	10	-	6	-	25	-	-	40
1961	100	-	-	24	-	23	-	-	49
1960	100	-	-	18	-	35	-	-	59
1959	100	-	-	12	-	8	2	-	22
1958	100	-	-	3	-	13	-	-	16

Source: Questionnaires to Yards

Note: Total may not add due to rounding.

as shown in Table P-12, and this has occurred within a generally rising total value of new construction. Activity in barges has been by far the most important constituent in this growth; construction of barges has grown fairly steadily throughout the period, with accompanying building of tugs, both increasing sharply in 1969. Ferries were sizeable business in 1959-63 and lately also. Fishing vessels have provided activity since 1962, particularly in 1967.

Apart from barges, tugs, ferries and fishing boats, there has been little other demand for new construction on the West Coast; a dry cargo ship has not been built since 1963.

The Resources Used in the Industry

On the basis of data available, this section comments on the resources used in the shipbuilding and repair industry on the West Coast.

Looking, first, at relative use of all resources, Table P-13 shows the proportions of purchased materials and utilities, wages of production and related workers, and overhead and profit, in the total value of work performed in the region and Canada in 1961-67. These data are drawn from the annual D.B.S. publications on the industry, which treat purchases of fuel and power as material purchases and include all hourly paid labour in one total of production and related workers (whereas the industry's practice in its internal assessments is to class fuel and power, and indirect labour, as overhead costs).

TABLE P-14

PACIFIC REGION

RELATIVE USE OF RESOURCES BY TYPE OF ACTIVITY IN THE SHIPBUILDING AND REPAIR INDUSTRY

	New Construction				Repairs			
	Est. 1969	1967	1963	1958	Est. 1969	1967	1963	1958
Importance of Activity in Total Activity	57%	57%	52%	68%	27%	29%	22%	23%
Use of Resources within the Activity:								
Materials	51%	59%	51%	37%	30%	30%	25%	20%
Labour	32	28	27	39	37	40	42	46
Overhead & Profit	17	13	22	24	33	30	33	34
Total	100%	100%	100%	100%	100%	100%	100%	100%

	Industrial				Conversion			
	Est. 1969	1967	1963	1958	Est. 1969	1967	1963	1958
Importance of Activity in Total Activity	8%	12%	14%	9%	8%	2%	12%	-
Use of Resources within the Activity:								
Materials	41%	72%	66%	57%	34%	46%	7%	-
Labour	30	12	16	22	35	28	57	-
Overhead & Profit	29	16	18	21	31	26	36	-
Total	100%	100%	100%	100%	100%	100%	100%	-

Source: Questionnaires to Yards.

In the Pacific region, the cost of purchased materials and utilities has been less relative to value of work performed than in the country as a whole, the cost of production wages has been greater, and the proportion of overhead and profit has been about the same (higher in some years, less in others).

Detailed data are not available which would permit precise assessment of the components of the differentials in material costs. There are questions as to source of supply, price competitiveness, and freight costs for purchases of steel, engines and auxiliary equipment. The physical requirement for materials in the types of vessels being built is also an important factor and one which acts to reduce material input for the substantial quantities of barges being built.

The mix of activities between new construction, repairs, industrial and conversion will also be significant, and information on this is given in Table P-14. It will be recalled that the level of new construction in the Region has been much the same in relation to total activity as in Canada as a whole, of repairs greater and of other work less.

In general the pattern of resource use is similar to that nationally - greater use of labour, lesser use of materials and a lower percentage for overhead and profit, in new construction as compared with repair activity.

TABLE P-15

PACIFIC REGION AND CANADA

SHIPBUILDING AND SHIP REPAIR INDUSTRY

VALUE ADDED, LABOUR COSTS AND MAN-HOURS

1961 - 67

	Value Added per Dollar of Labour Cost		Value Added per Man-Hour, Production and Related Workers		Average Wages per Man-Hour, Production and Related Workers	
	Pacific Region	Canada	Pacific Region	Canada	Pacific Region	Canada
1967	$ 1.78	$ 1.74	$ 5.97	$ 4.77	$ 3.35	$ 2.74
1966	1.66	1.85	4.75	4.70	3.09	2.55
1965	1.92	1.96	5.67	4.75	2.94	2.43
1964	1.70	1.95	4.75	4.58	2.79	2.35
1963	1.76	1.70	4.67	3.78	2.66	2.22
1962	1.61	1.53	4.14	3.27	2.57	2.14
1961	1.74	1.74	4.36	3.55	2.51	2.04
Percent Increases: 1961 - 67			37%	34%	33%	34%

Sources: D.B.S. Annual Census of Manufactures

With regard to overhead costs, the ratio of administrative, office, distribution and sales salaries to value of all work performed is much the same in the region as in all of Canada, according to D.B.S. data. Information from questionnaire yards indicates a generally average level of fringe benefits (some 20% of production labour) on the West Coast, and a level of fixed assets per worker that is somewhat lower than elsewhere in Canada.

Examining labour costs in more detail, value added per dollar of labour cost in the Pacific Region has been similar to that for Canada as a whole in 1961-67, as is shown in Table P-15. Average wage costs per man-hour are higher in the region (a 22% differential in 1967), but value added per man-hour is also above the national average (value added is total value of work performed less purchases of materials and utilities; it is thus a measure of activity within the shipbuilding industry itself).

More recent information on wage rates from questionnaire replies is as follows:

	Average Wages per Man-Hour Paid		
	1966	1969 Est.	% Increase 1966-69
Pacific Region	$ 3.10	$ 4.01	30%
Canada	2.57	3.25	26

Evidently there has been some widening of the differential between regional and national wage costs in the industry in recent years, to some 22½% in 1969.

Shipyard Facilities and Methods

The Dominion Bureau of Statistics listed twenty-five establishments in the West Coast shipbuilding industry in 1967. At least two of these have closed since that time and one new shipyard has opened up. The breakdown of the present number of establishments is as follows:

- 1 Major Shipbuilding Yard
- 1 Intermediate Shipbuilding Yard
- 8 Small Shipbuilding Yards
- 10 Ship Repair Establishments
- 4 Boatbuilding Yards

Of the ten shipyards and four boatbuilding yards listed, seven are engaged only in building of vessels. The other seven carry out ship repair and shipbuilding.

Nine of the yards of this region were visited by the Committee and questionnaires were received from nine yards.

The shipbuilding industry in the region, as in most other regions of Canada, reached its peak capacity during World War II when it built and repaired both naval and commercial vessels. During the post war period, Pacific Coast shipyards built many sophisticated vessels for various government departments, including National Defense, Transport and Public Works, passenger car ferries for the Provincial Government, and tugs, barges, trawlers and cargo/passenger vessels for various commercial owners. In recent years there has been marked growth in tug and barge construction and establishment of new yards specializing in this activity.

Significant amounts of ship repair work are carried out in this region on foreign flag vessels because Vancouver is a terminal port for many vessels. Also, the large tug and barge fleets and the ferry fleets generate a substantial volume of ship repair work. Ship repair facilities in the Pacific region play a more limited role than some other regions in support of vessels for various Government departments. This is due mainly to the Defense Department's policy of carrying out practically all repairs and refits on naval vessels at the Esquimalt Dockyard. There has been a recent trend for the Dockyard to become even more active in this field to the detriment of private yards.

It should be noted that the Regions' docking facilities only extend up to about 100,000 DWT and this will be insufficient to service the large bulk vessels that will be operating in the Region in the immediate future.

Building Facilities

The building and repairing facilities in the 9 yards that answered the questionnaire consist of 12 launchways, 1 drydock, 12 marine railways, 2 elevator lift type docks and 4 floating docks. A more complete description of these facilities can be found in Table C-34.

It should be noted that in this region as in the St. Lawrence region a potential major building dock facility exists in the form of a graving dock owned and operated by the Department of Public Works. A vessel of about 100,000 ton DWT could be constructed in this dock. The present policy of the Department is that this dock is primarily for repair purposes.

The practice of building ships in blocks is widely accepted in this region and yards are equipped with cranes capable of handling blocks of maximum weight of 15 to 65 tons. Five of the eight responding yards have cranes of maximum capacity of 25 tons or less, whereas two other yards can handle blocks of approximately 50 tons and another yard can handle 65 tons. This lifting capacity is somewhat similar to that available in the Great Lakes region, but it is considerably lower than that available in some yards located in the other two regions.

Loft

Based on the yard questionnaires that were returned to the Committee it would appear that conventional lofting, making use of wooden templates, is still prevalent in this region, with the exception of the major shipbuilding yard which uses 1/10th. scale exclusively. One small yard indicated that it uses 1/10th. scale lofting along with wooden templates. The lofting practices in regional yards thus are similar to those in other regions.

Steelwork

Only the major yard stores its steel in the flat. One small yard buys most of its steel already cut to size and flanged and consequently does not carry much inventory. The other five reporting small yards store their plates on edge, and the handling is done with mobile equipment.

The major yard is fully equipped with a steel surface preparation system consisting of overhead magnet-equipped cranes, descaling and paint priming equipment, and a conveyor system which is used to feed the steel shop. The intermediate yard uses overhead and mobile cranes to feed the shipyard from its steel storage area.

The steel storage and handling methods in this region are similar to those in other regions (other than in the Great Lakes area where all yards store in the flat and handle with overhead cranes).

Burning equipment controlled by 1/10th. scale drawings is available in one small yard and in the major yard where tape control features are also available. All responding yards reported using the oxy-plane burning method.

Regarding the welding operation, all yards that answered the questionnaire use the standard unionmelt machines for straight line welding. Other types of semi-automatic welding units using low hydrogen, inert gas, electro gas, carbon dioxide, etc., are also available in some of the yards.

In all cases the handling of plates in the fabrication shops is done by conventional cranes, either overhead or mobile, which vary in capacity from 5 tons to some 65 tons. None of the yards are equipped with mechanized transfer equipment to move the steel from operation to operation.

As can be seen from the above description of the methods and equipment used for steelwork in this region some

improvements have been made by some yards in certain parts of the operations. Only in the major yard were improvements made in three successive operations, namely plate handling and plate preparation, lofting, and burning operations. The improvements made in the other yards were in all cases on one operation only.

Outfitting

Based on the questionnaires that were returned, it would appear that the Pacific region shipyards sub-contract the work of a larger number of operations than the shipyards of other regions. The average number of operations sub-contracted in 1958 in this region was twice as many as in Canada generally. This reflects different practices in the larger and smaller yards; the major and intermediate yards sub-contract only deck covering and in one case insulation, whereas the small yards sub-contract electrical work, sheetmetal, piping, insulation and deck covering, and in some cases machine shop work.

In analyzing the amount of sub-contracting done by the Pacific region yards, consideration must be given to the type of work carried out in those yards. Of the eight responding yards, five specialize in either barge or tug construction, or both; and these yards have indicated that they sub-contract a relatively high number of operations. This is understandable since the degree of outfitting in this type of new construction is small in relation to the total work and it would be uneconomical for the yards to employ tradesmen of all crafts needed for outfitting. Two of the

remaining yards have had a good mix of work (i.e. naval work, Federal Government, cargo, tankers, ferries, barges) and it has been worthwhile for them to have their own skills in various trades. The eighth yard also has had a good mix of work in the past; however, its business in the last few years has been largely concentrated in barges, tugs and ferry boats and its management has preferred to sub-contract rather than carry its own skills.

Shipyard Personnel

In September 1969 the distribution of employment in the Pacific yards that replied to the questionnaire was 69% in marine work, 6% in industrial work and 25% in overhead and administration. This latter proportion compares with 23% in Canadian yards as a whole; the make up of these personnel by function in the region and nationally was as follows:

Function	Percent of Total Overhead and Administration Employees	
	Region	Canada
Marketing	3.2%	3.5%
Research and Development	-	1.3
Design and Drafting	14.0	13.0
Production Control, Planning and Scheduling	2.4	3.9
Supervision	19.2	21.8
Management	7.2	3.9
Maintenance, Cranes and Stores	28.4	30.5
Other	25.6	22.1
Total, Overhead and Administration	100%	100%

While these percentages may not be fully representative because they relate to the position in one month only, they do indicate some differences in regional circumstances compared to those elsewhere.

Few employees in the research and development category are employed by Pacific yards. An apparently lower proportion of personnel in production control, planning and scheduling likely arises from the fact that some Pacific yards concentrate on building specific types of vessels; some of their work is thus of a repeat nature.

In the management category, the proportion of overhead personnel is more than twice the Canadian average. This may be due in part to the relatively high concentration of small yards in the area; the basic management team required in a small yard does not differ appreciably from that in a major or intermediate yard.

PART VI

APPENDICES

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APPENDIX I

LIST OF SHIPYARDS AND SHIP REPAIR ESTABLISHMENTS IN CANADA (1967)

Newfoundland

Newfoundland Marine Works Ltd., Marystown
Newfoundland Shipyards Ltd., Clarenville

Prince Edward Island

The Fishermen's Loan Board of P.E.I., Georgetown

Nova Scotia

Atlantic Shipbuilding Company Ltd., Lunenburg
Ferguson Industries Ltd., Pictou
Hawker Siddeley Canada Ltd., Halifax Shipyards Div., Halifax
Hogan, T., & Co. Ltd., Halifax
Lunenburg Foundry & Engineering Ltd., The, Lunenburg
*McKay, W.C., & Sons Ltd., Shelburne
McLeans Shipbuilding Ltd., Mahone Bay
North Sydney Marine Railway Co. Ltd., North Sydney
Pinaud's Yacht Yard Ltd., Baddeck
Port Hawkesbury Shipyards Ltd., Port Hawkesbury
Purdy Bros. Ltd., Halifax
Scotia Yacht Co. Ltd., Chester
Shelburne Industries Ltd., Shelburne
Smith & Rhuland Ltd., Lunenburg
Snyders Shipyard Ltd., Dayspring
Sweeney, W. Lawrence, Yarmouth
Sydney Engineering & Dry Dock Co. Ltd., The, Sydney
Theriault, A.F., & Sons Ltd., Meteghan River
Wagstaff & Hatfield Ltd., Port Greville

New Brunswick

Fundy Shipbuilding Ltd., Chamcook
Le Chantier Naval Ltée, Middle Caraquet
Saint John Shipbuilding & Dry Dock Co. Ltd., Saint John
Saint John Iron Works Ltd., Saint John

Quebec

Canadian Vickers Ltd., Montreal
*Canadian Vickers Shipyards Ltd., (Geo. T. Davie & Sons Div.), Lauzon
Davie Brothers Ltd., Lévis
Davie Shipbuilding Ltd., Lauzon
*Les Chantiers Maritimes de Paspebiac Inc., Paspebiac
Les Entreprises Maritimes Inc., Gaspé
Marine Industries Ltd., Tracy
Talbot Hunter Engineering & Boiler Works Ltd., Quebec
Walsh, W.F., Ltd., Montreal

Ontario

Bedford Construction Co. Ltd., Kingston
Canadian Shipbuilding & Engineering Ltd., (Collingwood Shipyards Div.), Collingwood
*Canadian Shipbuilding & Engineering Ltd., (Kingston Shipyards Div.), Kingston
*Erieau Shipbuilding & Drydock Co. Ltd., Erieau
Fraser, Herb, & Associates Ltd., Port Colborne

Ontario - Continued

Grant, J.A., & Sons, Port Colborne
Heighton, H.E., & Son Ltd., Port Colborne
Marsh, E.G., Ltd., Port Colborne
Port Arthur Shipbuilding Co. Div., Canadian Shipbuilding & Engineering Ltd., Port Arthur
Port Weller Dry Docks Ltd. St. Catharines
Russel Brothers Ltd., Owen Sound
Ship Repair & Supplies Ltd., Toronto
*Toronto Dry Dock Ltd., Toronto

British Columbia

Alert Bay Shipyards Ltd., Alert Bay
Allied Shipbuilders Ltd., Vancouver
B.C. Marine Shipbuilders Ltd., Vancouver
Bel-Aire Shipyard Ltd., Vancouver
Benson Bros. Shipbuilding Co. (1960) Ltd., Vancouver
British Columbia Packers Ltd., Celtic Shipyards Div., Vancouver
Burrard Dry Dock Co. Ltd., Vancouver
Burrard Iron Works Ltd., Vancouver
Burrard Shipyard & Marine Ways Ltd., Vancouver
Denman Shipyards Div. of Gulf Tug & Barge Ltd., Vancouver
Manly, John, Ltd., New Westminster
MacKay - Cormack Ltd., Victoria

British Columbia - Continued

McKenzie Barge & Derrick Co. Ltd., Vancouver
Nanaimo Shipyard Ltd., Nanaimo
Pacific Marine Construction Ltd., Nanaimo
Point Ellice Shipyard Ltd., Victoria
Queensboro Shipyards Ltd., New Westminster
Star Shipyard (Mercers) Ltd., New Westminster
Sterling Shipyards Ltd., Vancouver
Tom Mac Shipyard Limited, Richmond
Vancouver Pile Driving (Shipyards) Ltd., Vancouver
Vancouver Shipyards Ltd., Vancouver
*Victoria Machinery Depot Co. Ltd., Victoria
West Coast Salvage & Contracting Co. Ltd., Vancouver
Yarrows Limited, Esquimalt

* These yards are known to have closed since 1967.

Source: Dominion Bureau of Statistics.

BIBLIOGRAPHY

Canada Shipping Act and Amendments

Canadian Maritime Commission
- Annual Reports to 1967

Canadian Shipbuilding and Ship Repairing Association
- Annual Reports
- "Ship Technology in the Next Ten Years" - Technical Section

Canadian Shippers Council, Cargo Handling Committee
- "Report on Containerization" - April 1968

Canadian Shipping and Marine Engineering News

Canadian Transport Commission
- "The Ownership and Registration of Ships in Canada" - January 1968 & 1969

Centre for Great Lakes Studies, University of Wisconsin
- "Effect of Containerization on Great Lakes Ports", E. Schenker, January 1968

Centre for Strategic and International Studies, Georgetown University
- "Soviet Sea Power" June 1969

Department of Energy, Mines & Resources, Government of Canada
- Ship Utilization Study" - Marine Sciences Branch

Department of Industry, Government of Canada
- "Oceanology in Canada" - M.J. Colpitts
- "Marketing Report, Off-Shore Industry Equipment and Services" December 1969 - Marine Division

Dominion Bureau of Statistics
- Shipping Report: Parts I - VI, 54-202-3,4,6,&7
- Water Transport - 54-205
- Canal Statistics - 54-201
- Shipbuilding and Repair - 42-206
- Fixed Capital Flows and Stocks, Manufacturing, Canada, 1926-1960, Statistical Supplement 13-523
- Private and Public Investment in Canada, Outlook and Regional Estimates, 61-205

Dominion Bureau of Statistics (Cont'd.)
- Employment and Average Weekly Wages and Salaries, 72-002
- Real Domestic Product by Industry, 1961 Base, 61-506
- Exports by mode of Transport 65-206

Dominion Bureau of Statistics and Canada Department of Labour
- Labour Costs in Manufacturing 1967

Economist
- Various issues

Eyre, John L.
- "The Seventies at Sea" - February 1969 (presented to Canadian Industrial Traffic League, February 1969)

Ferguson et al
- "The Economic Value of the United States Merchant Marine" - 1961

Fortune Magazine
- "Weather Buoys" - October 1969

Goss, R.O.
- "Studies in Maritime Economics" - 1968

Greenwood's Guide to Great Lakes Shipping - 1969

Institute of Marine Engineers, International Marine & Shipping Conference
- "Miscellaneous Craft" - June 1969
- "Ship Types of the Future" - June 1969

International Cargo Handling Co-ordination Association Journal

Little, Arthur D., Inc.
- "Measuring the Miracle" - December 1965, John L. Eyre (presented to Transportation Research Forum, American Economic Association - December 1965)

Litton Systems Incorporated
- "Oceanborne Shipping: Demand & Technology Forecast" - June 1968

Lloyd's Register of Shipping

Lowery, R.
- "Shipyard Production and Management Problems in Canada and How They Differ From Most Other Industries" - February 1969 (presented to Ottawa Valley Branch, Canadian Industrial Management Association)

Marine Technology
- "Japanese Shipbuilding Practices" - October 1969, John McQuaide and K.K. Christensen

Munro, John M.
- "Trade Liberalization and Transportation in International Trade" - 1969 (published by Private Planning Association of Canada)

National Harbours Board
- "The Economics of Vessel Size" - by Trevor D. Heaver, July 1968

O'Laughlin, Carleen
- "The Economics of Sea Transport" - 1967

Organization for Economic Co-operation and Development
- "The Engineering Industries in North America - Europe - Japan" - 1969
- "The Situation in the Shipbuilding Industry" - 1965

Royal Commission on Coasting Trade
- Report 1957

Science Council of Canada
- "Preconceptions on Marine Sciences in Canada" Study Group - August 1969

Shipbuilders Council of America
- "Review of Merchant Fleet Replacement Factors" - 1965

Shipbuilding Inquiry Committee
- (Geddes) Report - 1965-66

Shipbuilding International
- "British and Japanese Shipbuilding" by H.J. Miller - June 1969
- "The Progress at Arendal" - May 1969

St. Lawrence Seaway Authority
- Monthly and Annual Review

Sturney, S.G.
- "British Shipbuilding and World Competition" - 1962

Subcommittee on Merchant Marine of the Committee on Merchant Marine and Fisheries, House of Representatives, Ninetieth Congress
- "Long Range Maritime Program Hearings" - April & May 1968

Subcommittee on Merchant Marine and Fisheries of the Committee on Commerce, United States Senate, Ninetieth Congress
- "A New Maritime Programme" - May 10, 1968

Suzuke, L.
- "Rationalization of Japanese Shipbuilding Industry: Today and Tomorrow" (presented at "Europort 69", November 1969)

Swan Wooster Engineering Co. Ltd.
- "Trends in Bulk Ocean Transport" - October 1969

The Motor Ship
- "British Shipbuilding Today" - Sept. 1968 & Nov. 1969
- "Japanese Shipbuilding & Allied Industries" Dec. 1968 and Sept. 1969
- "The Dutch Shipbuilding Industry" March 1968

Upper Lakes Regional Commission
- "The Great Lakes - St. Lawrence Transportation System: Problems and Potential" by J.L. Hazard, December 1969

U.S. Bureau of Census
- Annual Survey of Manufactures

U.S. Department of Commerce
- "Maritime Subsidies" 1969
- "Relative Cost of Shipbuilding in the various Coastal Districts of the United States" - June 1968

Vollert, W.
- "The Swedish Shipbuilding Industry, Its History - Actual Situation - And Future" (presented to Annual Tanker Conference of the Central Committee on Transportation by Water, of the Division of Transportation of the American Petroleum Institute, - May 1968)

Webb Institute of Naval Architecture Centre for Maritime Studies
- "Improving the Prospects for United States Shipbuilding" Final Report - 1969

LIST OF BRIEFS AND SUBMISSIONS

Axelson, E.R.

Burrard Dry Dock Company Limited

Canadian Association of Marine Equipment Industries

Canadian Labour Congress

Canadian Shipowners Association

Canadian Vickers Limited

Confederation of National Trade Unions and the Federation of Metal, Mining and Chemical Products

Dominion Marine Association

East Coast Wooden Shipbuilders, represented by Atlantic Shipbuilding Co. Ltd., Smith and Rhuland Limited, Snyders Shipyard Limited, Harley S. Cox and Sons Ltd., A.F. Theriault and Son Ltd., Wagstaff and Hatfield Limited

Fisheries Council of Canada

Jan Furst, Shipyard and Marine Consultants

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Seafarers' International Union of Canada

Scotia Yacht Company Limited

Scott Misener Steamships Limited

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Syndicat National des Chantiers Maritimes de Sorel

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Mr. C. Dugay, Director of Shipbuilding.

Department of Fisheries,
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Department of Fisheries,
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Department of Fisheries,
Province of Nova Scotia,
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Department of Highways,
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Department of Industry and Commerce,
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Department of Industry, Trade and Commerce,
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Mr. J.C. Rutledge, General Director.
Mr. G. Hughes-Adams, Director.
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Department of National Defense,
Ottawa, Ontario.
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Captain R. Monteith.

Department of Northern Development,
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Dr. H.W. Woodward, Oil and Gas Administrator.

Department of Public Works,
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Mr. C.G. Benckhuysen.

Department of Regional Economic Expansion,
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Department of Supply and Services,
Building & Heavy Equipment Branch,
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Mr. J. Rankine Strang, Director.
Mr. R.D. Wallace, Director.

Department of Transport,
Ottawa, Ontario.
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Dominion Bureau of Statistics,
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Mr. A.S. Foti, Director, National Accounts Division.
Mr. J.J. Parchelo, Chief, Industry Division.

Dominion Marine Association,
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Werfstrasse 160,
West Germany.
Herr G. Bohlken, Secretary.

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Montreal, Quebec.
Mr. D.M. Craig, Chairman.

Export Development Corporation,
Ottawa, Ontario.
Mr. V.L. Chapin, Vice-President.

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Mr. J. Ferguson, President.

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Hall Corporation of Canada,
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Halifax Shipyards Division,
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Mr. H. Conor-Nolan, General Manager.

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Hike Metal Products Limited,
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Imperial Oil Ltd.,
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International Cargo Handling
Coordination Association,
Montreal, Quebec.
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Canadian Committee.
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London, England.

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Johnson, Higgins, Willis Faber Ltd.,
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Port Arthur, Ontario.
Mr. R.W. Sutton, General Manager.

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Royal Canadian Mounted Police,
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Saint John Shipbuilding and Dry
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Seafarers' International Union of
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Mr. L.J. McLaughlin, President.

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Exploration & Production,
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Shell Canada Limited,
Toronto, Ontario.
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Star Shipyard (Mercers) Ltd.,
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St. Charles Transportation Co. Ltd.,
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Captain N. Levesque.

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Sun Life Assurance Company of Canada,
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Swan Wooster Engineering Co. Ltd.,
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Syndicat National des Chantiers
Maritimes de Sorel, Le,
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Syndicat National des Employes de
Bureau des Chantiers Maritimes de
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Texaco Canada Limited,
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Farmers and Boatbuilders of America,
Vancouver, B.C.
Mr. J.J. Bayer, President.

United Steelworkers of America,
Port Arthur, Ontario.
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Mr. A. Cumyn, Technical Advisor.

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Westcoast Salvage & Contracting Co.
Ltd.,
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Mr. M.W. Oakes.

Westdale Shipping Limited,
Port Credit, Ontario.
Mr. K. Smith, President and
General Manager.

White Pass & Yukon Ltd.,
Vancouver, B.C.
Mr. Wm. Hamilton, Sales Manager.

Yarrows Ltd.,
Victoria, B.C.
Mr. J.A. Wallace, General Manager.

WAGE RATES AND SUBSIDIES IN SHIPBUILDING INDUSTRIES

Average Hourly Earnings ($U.S./HR) in Shipbuilding

Yearly Average(a)	U.S.A.	Germany	Netherlands	U.K.	Japan (b)	Sweden (c)	Canada
1961	2.93	0.81	0.68	-	0.43	1.29	2.00
1962	3.00	0.93	0.75	0.94	0.48	1.36	2.06
1963	3.11	0.97	0.79	0.97	0.53	1.46	2.06
1964	3.15	1.08	0.90	1.04	0.57	1.55	2.18
1965	3.15	1.18	0.98	1.16	0.60	1.69	2.25
1966	3.32	1.27	1.08	1.30	0.67	1.81	2.36
1967	3.44	1.35	1.17	1.34	0.75	2.00	2.52
1968	3.58	1.38	1.25	1.24	0.86	2.09	2.79

(a) Converted to $U.S. on the basis of average exchange rates for the year.
(b) Transportation equipment industry.
(c) Iron and steel works (men).

Sources: D.B.S. for Canada; Shipbuilders Council of America for all other countries.

CONSTRUCTION SUBSIDIES FOR SHIPBUILDING IN COUNTRIES PROVIDING SUCH AID

Country	Subsidy or Aid (a)
Australia	Up to one-third of cost
Belgium	Up to 8% of contract price
Brazil	Difference between West European and domestic price
Canada	25%
France	10%
West Germany	Up to 10% of construction cost
Italy	Up to 15%
Republic of Korea	40% of building cost
Pakistan	Up to 40% of cost
South Africa	Up to 35% of contract price
Spain	Up to 9% of value
United States	Up to 55% for cargo vessels and 60% for passenger vessels

(a) Direct payments generally prevailing during 1969 to buyer or shipyard for construction in domestic yards; does not cover aid to shipowners or shipyards in form of loans or modernization grants.

Source: "Maritime Subsidies" - U.S. Department of Commerce.

APPENDIX VI

NEW SHIP TYPES AND FUTURE TECHNOLOGICAL POSSIBILITIES

Remarkable progress has been made in ship technology during the past ten years. Continuous and unprecedented technical development has brought about changes in every type of merchant ship and has introduced many new types of marine craft. There is no doubt that these changes will continue; they are, in fact, continuing daily and will accelerate as the shipbuilding and shipping industries endeavour to solve new economic problems with new ideas and fresh approaches. A quote from the Litton Systems report on "Oceanborne Shipping Demand & Technology Forecast" is appropriate here, "At first the old technology is less costly than the new; as time passes the old technology becomes increasingly expensive while research and development reduces the cost of the new technology".

This Appendix deals with developments expected in the field of ship technology during the next ten years as forecast by the authorities covered in the bibliography and the many technical publications.

Bulk Carriers

It is expected that bulk carriers will continue to grow in size and numbers; in fact, the number of supertankers larger than 200,000 tons deadweight is expected to comprise one half of the world tonnage by 1973. There is, no doubt that the 500,000 ton deadweight ship will be built in the next ten years and some authorities suggest that the size will increase to 750,000, although no such vessel is planned at this time.

Dry bulk cargo vessels will continue to grow but it is expected that 200,000 ton deadweight will probably be the largest bulk carrier in the next decade, with the size of the single purpose ship being considerably less. The O.B.O. ship for Oil, Bulk & Ore is becoming more prominent and, no doubt, will continue to progress. The average size of the O.B.O. ship today is 120,000 tons deadweight; the possible increase in size will be up to the 200,000 - 250,000 ton deadweight range, depending on the route and port facilities.

On the Great Lakes, developments in the field of self-unloading gear will result in increased operational efficiency. The 850 foot and 1,000 foot self-unloaders presently under construction will have unloading rates of 10,000 tons and 20,000 tons per hour respectively and the 1,000 footer will be capable of carrying approximately 52,000 tons at a draught of 25'6", which is precisely double that carried by the modern 730' Great Lakes bulk carrier.

A considerable amount of research and development is being pursued in the design and construction of Liquified Gas and Chemical Carriers, and more especially the insulation for the tanks. Great advances have been made in this area recently; it is anticipated that in a few years all major problems will have been solved and the size of such vessels will approach the 60,000 tons deadweight figure. As a producer of natural gases, Canada will become increasingly familiar with these sophisticated vessels.

The slow tramp steamer has almost disappeared and has been replaced by modern medium sized cargo liners with speeds in excess

of 20 knots and hull forms comparable to passenger liners or ferries. There will be an increase in the speed of such liners, probably up to 30 knots in the future.

The large vast cellular container ship is already in use and may be expected to develop in both size and speed along lines easily foreseen, but the high speed ship with both container and vehicle carrying capability may well appear in increasing numbers during the next decade and may, in fact, be a more promising type in the future. In Canada, development of marine equipment as feeder lines from major container ports will be required, tailored to suit each locality. The catamaran type hull may develop to serve container transportation requirements because of its speed and broad deck area. The forest product bulk carrier appears to be an increasingly common specialized ship type of the future but only in the context of a changing market. The chip wood carrier is one of the specialized bulk carriers that has been developed to handle wood chips in view of the increasing use of bonded wood chip materials for construction purposes.

Other vessels which may be expected to develop along the bulk handling lines are cable ships and fishing vessels. The cable ship has a good future despite the impact of satellites. The advantage of fast loading by bulk handling of cable by magazine rather than loading in the conventional way, will decrease required port time and therefore increase the cable ship's ability to take full advantage of good operating weather.

The advantage gained by the use of "mother" ships with fleets of small trawlers over the "freezer" stern trawler or wet fish side trawler is considered to be economically sound. Two "mother" ships are used with "on board" processing machinery each capable of, say, 20 knot speed and a capacity of 5,000 tons deadweight. Such fleets may justifiably be referred to as "bulk fishing" and such fleets may well be regarded as a future development in this field.

Car Ferries

In size, technical design and numbers, ferries may well develop considerably in the future, as the provision of deck area rather than deadweight or capacity carrying ability is their special characteristic, in this aspect the catamaran type hull is of special significance. No doubt ferries with this configuration will be built during the next decade. When considering car ferries one must take into account the potential competition from the A.C.V. (Air cushioned vehicle) such as hovercraft S.R.N.4 and its successors travelling at speeds up to 70 knots. Some authorities cannot foresee the large car ferry trade being replaced or even encroached on by A.C.V.s in the next decade.

Car delivery ships and combination vessels

The car delivery ship is another type of ship likely to increase in size number and speed in the near future. However, convertible tonnage is desirable and here again the cellular containership in a slightly modified form may well be developed to handle, without significant compromise of their basic requirement, large numbers of completed vehicles as an alternative to bulk containers.

Barge Carriers

The Lash ship (Lighter aboard ship) is already in service. The Lash concept is one of the most radical ocean cargo ideas to be put forward in modern times. This type of ship is designed to carry several barges, loaded, to their destination. The barge is, in fact, a floating container and is dropped off and picked up with despatch.

Several other types of barge carriers are foreseen for the future. The Portal crane type is a vessel with a single hull in which three or four layers of barges can be placed one upon the other using a portal crane for movement. The Catamaran barge carrier, a twin hull vessel with two main decks between the hulls forming a tunnel through which a barge can pass, is quite a futuristic type. Catamarans up to about 2,000 tons have been built but an increase up to 10,000 tons would require a major step forward. The direct barge flotation type is foreseen as a type of design where direct flotation is used and no water pumping is required. The barges would be floated directly onto the deck while the carrier vessel is settled in the water, the vessel is raised by creating an air bubble between the side walls and the front and reas curtains. This design is based on the air bubble principle and may not be developed for many years to come.

The Straddle Carrier or "thin Hull Carrier with Separable Cargo Units". This type of ship desing is a twin hulled ship forocean going trade carrying a number of barges, which can be used in sheltered waters,

located and secured for ocean voyages in the centre row of the twin hull containing the necessary propulsive and navigational installations. No doubt such ships will be developed in the next decade.

Tugs and Barges

The use of the tug and barge train has been established as an economic unit for river and coastal routes. Ocean towing, using the tow type of operation with 20,000 ton barges over open water for distances of 1,500 to 2,000 miles, is being carried out today in the Pacific. The Mitsui Company in Japan has developed ocean-going barges of the pusher type and has operated them successfully in fairly heavy seas. It is in this type of pusher tug/barge operation that we can expect to see rapid expansion of the "tug barge train" on the ocean and long hauls in sheltered waters. The "tug barge train", operating at high speeds, could well act as feeders to subsidiary ports from major bulk and container terminals.

The first tug barge system has been established on the St. Lawrence.

The relatively low capital and operating costs make this form of marine transportation quite attractive and there is no doubt that there will be an expansion of the more sophisticated "tug and barge train" on all waters systems in Canada during the next ten years, including the McKenzie River and the Arctic.

Little, if any change is foreseen in barge configuration in the next ten years; however, capacities will undoubtedly increase to 50,000 tons deadweight or more.

Catamarans

As mentioned previously, the catamaran has a potential future in the ferry trade and also as a container carrier. Other possible future developments of this twin hulled vessel, with its advantage of a large deck area per ton of displacement, is in the field of research and other special services. The Litton Trisec design has possibilities for a breakthrough in ship speed and costs which may result in significant reductions in freight rates over the long run.

Hydrofoils

The Hydrofoil may become more common before the end of the next decade for high speed passenger use and as a service type craft for off-shore facilities. Providing there is a sufficient market for these ships in the transportation industry this craft could develop to 3,000 tons at 50 knots speed within the next 15 years.

Submarines

The commercial submarine is already in service in some parts of the world for undersea scientific research. These will soon appear in significant numbers as service vessels for undersea oil wells and mines and for use in pipeline and cable laying. The most likely applications of submarine tankers or bulk carriers would be in the exploitation of underwater mineral or petroleum resources or in the movement of cargoes via a polar route in order to dramatically reduce trip distance. General Dynamics have seriously put forward a proposal to major oil companies to build 170,000 tons deadweight nuclear powered submarine oil tankers for the Arctic trade routes in the wake of the "Manhattan" experimental trip.

Off-shore Drill Rigs and Associated Equipment

A start has already been made in Canada in the development of an off-shore oil industry. This industry will grow over the next decade in coastal and inland waters including the Arctic where reports of large oil deposits have already been announced.

Drill rigs of the floating type and jack-up type have already been built, but Arctic conditions will, no doubt, bring about the need for specially designed exploratory rigs and bottom based drilling towers. Specially designed tugs and service vessels will also be required, together with special 500 to 800 tons pipelaying barges. It is also likely that continuous exploration will uncover other underwater mineral deposits which will require different techniques and vessels, such as dredges, for deep-sea mining to exploit them. The next ten years will see considerable progress in this field.

Special Service vessels and equipment

Scientific authorities state with confidence that no alternative to ships as vehicles for data collection will be practical or competitive over the next ten years. Based on this assumption, we can expect to see further technical advances in the development of ships for oceanographic research such as hydrographic vessels, tidal and current survey vessels, acoustic research vessels, and weather ships, although the latter may be phased out at an early stage and replaced by moored buoys or satellites. Continuing research and technological advances will be made mostly in the equipment for these vessels rather than the vessels themselves.

Icebreakers - Coastal - Inland and Polar and Service Support Ships

The opening up of Arctic trade routes will bring about the need for larger and more powerful icebreakers to maintain open shipping lanes for large reinforced tankers and other bulk cargo vessels using these routes. The possibility of nuclear powered icebreakers for this service is doubtful in the next decade.

The development of special shallow draft icebreakers for service in small coastal and inland ports will be a requirement within the next five years.

The well known lighthouse and buoy tender of the present day is now being phased out with the development of helicopters providing these services more economically.

Air Cushion Vehicles

The A.C.V. has already arrived on the Canadian scene and will increase in numbers in a few years. Although not solely for operation over water, the A.C.V. is best suited for a marine environment. A.C.V.s will provide economical short voyage transport in the speed range between 30 and 150 knots and overland are expected to fill the gap between cars and trains at relatively low speeds or aircraft at much higher speeds. The use of the A.C.V. in the Arctic is a future possibility providing it is specifically designed for the environment.

A.C.V.s are suitable for many areas which are, at present, inaccessible or in which existing means of transport are inadequate or expensive. These include sites where combined offshore and inland

operations are necessary, or on ice covered water. Small A.C.V.s will be constructed of reinforced plastic and larger types of aluminum.

Machinery

Other than an increase in the number of ships using gas turbine propulsion plants, the next ten years should not see any revolutionary changes in marine machinery. Gas turbines will increasingly be used on Great Lakes carriers where the light weight and ready availability for planned maintenance during the winter lay-up is attracting shipowners. Appearance of the competitive gas turbine and nuclear installations for both stationary power plants and Naval ships will accelerate improvements in propulsion technology.

Automated engine rooms and bridge controls have already been introduced in newer ships. Shipboard automation will continue and will be extended to other aspects of ship operation. The objectives of shipboard automation are twofold:

a) a reduction in crew size with resulting savings, and

b) improvements in efficiency and reliability of shipboard equipment.

The large number of tankers in the 150,000 ton Class has given prominence to the heavy diesel engine up to 25,000 B.H.P. recently and more engines of this class are likely to be put into service in the next few years. More recently the larger tankers have necessitated the development of the triple reduction steam turbine plant with shaft revolutions of 90 r.p.m. and specific fuel consumptions approaching those of the heavy diesel engine. This type of plant will become more numerous as the number of super tankers increases.

Electrical

Since the end of the Second World War, the power for driving ships auxiliary machinery has been slowly changing from steam to electrical. The next ten years will see the virtual disappearance of the auxiliary boiler and the installation of ship's service generators capable of carrying the full ship's load with a stand-by to take over in case of routine repairs.

Steam heating also will become obsolete and the use of electric heating and air-conditioning coupled with "all-electric" galley, bow thrusters and a multitude of minor items will become general practice.

The electrical and electronic industries, in general, have benefited in the field of miniaturization through the research and development of aeronautics and space agencies. The application of these benefits has already started in the marine field and will shortly become more obvious in almost all phases of ship electrics including lamp design, distribution breakers and motor control equipment. Manufacturers have already moved into micro-miniaturization and before the next decade is over many of present day components of substantial size will have been reduced to that of the proverbial "mustard seed".

Cargo Handling

The cargo handling division is one which has seen many changes over the past 15 years but which will see more and greater changes in the next decade, including an acceleration in the installation of automated or semi-automated cargo systems.

Shipboard cranes, handling containers or other bulk units, will be pre-programmed and computer controlled to perform specific loading and unloading manoeuvres from hold to dock and vice versa.

The use of conveyors for cargo handling has already been established but to a limited extent. Much wider use of this form of cargo movement will be made, together with the adoption of new materials handling systems. These include the use of slurries to pump solid cargoes in suspension and pneumatic systems for materials which do not lend themselves to liquid additives.

Automation

Due to the increasing cost of and shortage of skilled technical labour, there will, in the next ten years, be startling developments in ship control automation and, in particular, a considerable increase in the classes of ships permitting unmanned engine rooms. Thus, very sophisticated control and monitoring systems will be required between main and auxiliary machinery components and ship wheelhouses or control rooms.

More automated navigational control will be introduced, including satellite and weather information being fed into ship computers to establish or modify ship courses.

Cargo disposition, fuel and stores requirements and thus displacement and characteristics of seakindliness will be controlled from an operations control office ashore through radio and ship computer link-up, ensuring best operational ship conditions.

Such instrumentation systems have already been in service in Europe and their widespread use throughout the shipping world is assured.

Materials

Material changes are not quickly accepted in the marine business. This is probably, in part, caused by the industry's reliance on Classification Society standards which are based, to a large extent, on experience.

There will be more widespread acceptance of some new materials in the near future and we will see more use made of high strength steels for some services and low corrosion steels for others.

The use of fiberglas reinforced plastics is now well established in practice for small ships and this trend will continue and perhaps broaden if the costs of the chemicals involved can be reduced. Whether they are or not, we can certainly expect to see many more fiberglas fittings for ship use in the future, especially weatherdeck equipment, guard rails, vents, window frames and furniture.

Another material for small ships presently in its infancy, but with distinct possibilities of becoming quite important in the next ten years, is light aggregate concrete or steel reinforced cement. Classification Societies have classed ships built of these materials and the industry will await their outcome with interest.

Aluminum has been in use on shipboard for many years but its cost, both for the raw material and for its fabrication, has been so high that its general use in the past for other than lightweight superstructures has been retarded. The use of plasma-arc aluminum cutting equipment and good fast aluminum welding techniques have largely corrected these disadvantages and while aluminum remains an expensive material, its use for many applications can now be more economically justified and will grow.

General Comments

Simplified forms: A considerable amount of interest is being demonstrated at the moment in simplified forms for large ships. This has always been recognized in the past and some exponents of the practice have achieved results with various types of ships. This however has been restricted

to small ships, say, below 300 feet. Serious attempts are now being made to introduce straight-line or otherwise simplified forms into quite large vessels. Reduction in cost has been the main motive but the use of computer control cutting machines is facilitated by hull forms which are mathematically totally definable and of course the simpler the definition - the easier the control.

Considerable interest is being shown for example in the United States of America where labour costs are high and the use of automated shipyard plants is of correspondingly great interest. Totally developable forms for large fast ships are currently being investigated and tested both in the United Kingdom and the U.S.A., and straight-line cargo vessels are commercially available in Germany. In Canada, the Upper Laker might well be a type of vessel which would lend to straight-line development.

For total developability, a double or multiple chine bilge is required and this, in fact, can be advantageous to resistance.