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PART I

CHAPTER 1 SOCIO-ECONOMIC CONDITIONS

1.1 Population

As shown in Table 1.1.1, the population of Algeria increased at an annual rate of about 3% from 1979 to 1988 and reached 24,697 thousand in 1990. This is primarily due to a decline in the death rate, from 2.4% in the early 1950s to less than 1% in the 1980s. The decline was brought about by social development and economic progress.

Because of the topographic and climatic conditions of Algeria, population is concentrated in the north coastal districts, as shown in Table 1.1.2. In particular, the concentration is most dense in the districts that have the big cities such as Algiers, Oran and Annaba.

Such an rapid increase and uneven distribution of population led to serious social and economic problems such as overcrowding, insufficient housing and inadequate food supply-demand adjustment.

To cope with these situations, the Algerian government has promoted a local development plan for decentralization, and at the same time has been increasing the construction of houses, schools and medical facilities in the populous areas.

Table 1.1.3 reveals that the percentage of the population under the age of 20 is very large, more than 55%. Therefore, the creation of new jobs will continue to be an important political issue.

According to the projection by Conseil National de la Planification, it is expected that the population of Algeria will continue to increase and reach 33,000 thousand in 2000. Also the United Nations estimates that the population of Algeria will reach 33,000 thousand in 2000 and 41,000 thousand in 2010 (Global Estimates and Projections of Population by Sex and Age, The 1988 Revision).

Table 1.1.1 Demographic index

	1950-55	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Increase rate (per 1000 population)	20.8	31.1	31.8	31.6	31.5	31.6	31.58	31.1	27.39	27.63	27.3	24.7	-
Crude birth rate (per 1000 population)	51	42.8	42.7	41.04	40.6	40.4	40.18	39.5	34.73	34.6	33.91	30.68	-
Crude death rate (per 1000 population)	23.9	11.7	10.9	9.44	9.1	8.8	8.6	8.4	7.34	6.97	6.61	5.98	-
Population (thousands)	9,715 (1955)	17,864	18,375	18,956	19,564	20,192	20,841	21,510	22,191	22,807	23,446	24,095	24,697

Source: ONS, DEMOGRAPHIE ALGERIENNE, L'ALGERIE EN QUELQUES CHIFFRES(EDITION 1990)

UNITED NATIONS, Global Estimates and Projections of Sex and Age, The 1988 Revision

Table 1.1.2 Population by wilaya in 1987

Wilaya	Population	%	Area(K m²)	Density	Wilaya	Population	%	Area(K m²)	Density
Adrar	218,505	0.94%	439,700	0.50	Medea	655,344	2.83%	8,866	73.92
Chlef	686,792	2.97%	4,795	143.23	Mostaganem	507,855	2.20%	2,175	233.50
Laghouat	213,195	0.92%	25,057	8.51	M'sila	606,991	2.62%	18,718	32.43
Oum-el-Boughi	405,471	1.75%	6,768	59.91	Mascara	569,055	2.46%	5,941	95.78
Batna	755,477	3.27%	12,192	61.96	Ouargla	285,535	1.23%	211,980	1.35
Bejaia	703,616	3.04%	3,268	215.30	Oran	936,017	4.05%	2,121	441.31
Biskra	431,837	1.87%	20,986	20.58	El-Byadh	153,836	0.67%	78,870	1.95
Bechar	186,050	0.80%	162,200	1.15	Illizi	19,002	0.08%	285,000	0.07
Blida	704,856	3.05%	1,696	415.60	B.Bou-Arreridj	426,442	1.84%	3,765	113.26
Bouira	528,902	2.29%	4,439	119.15	Boumerdes	653,449	2.83%	1,591	410.72
Tamenrasset	96,186	0.42%	556,200	0.17	El-Tarf	276,361	1.19%	3,339	82.77
Tebessa	411,792	1.78%	14,277	28.84	Tindouf	16,490	0.07%	159,000	0.10
Tlemcen	717,570	3.10%	9,061	79.19	Tissemsilt	228,987	0.99%	3,152	72.65
Tiaret	577,982	2.50%	20,673	27.96	El-oued	378,341	1.64%	54,573	6.93
Tizi-ouzou	940,509	4.07%	3,568	263.60	Khenchela	247,478	1.07%	9,811	25.22
Alger	1,696,614	7.34%	273	6214.70	Souk-Ahras	297,202	1.29%	4,541	65.45
Djelfa	496,373	2.15%	66,415	7.47	Tipaza	622,508	2.69%	2,166	287.40
Jijel	474,107	2.05%	2,577	183.98	Mila	513,549	2.22%	9,375	54.78
Setif	1,004,497	4.34%	6,504	154.44	Ain-Defla	539,298	2.33%	4,891	110.26
Saida	236,389	1.02%	6,764	34.95	Naama	114,132	0.49%	30,300	3.77
Skikda	624,876	2.70%	4,026	155.21	Temouchent	276,035	1.19%	2,379	116.03
Sidi-bel-abbes	448,970	1.94%	9,096	49.36	Ghardia	216,961	0.94%	86,105	2.52
Annaba	457,620	1.98%	1,439	318.01	Relizane	546,948	2.36%	4,870	112.31
Guelma	354,652	1.53%	4,101	86.48					
Constantine	666,828	2.88%	2,187	304.91	Total	23,127,482	100.00%	2,381,791	9.71

Note: Population in the middle of year
Source: DEMOGRAPHIE ALGERIENNE (EDITION 1989)

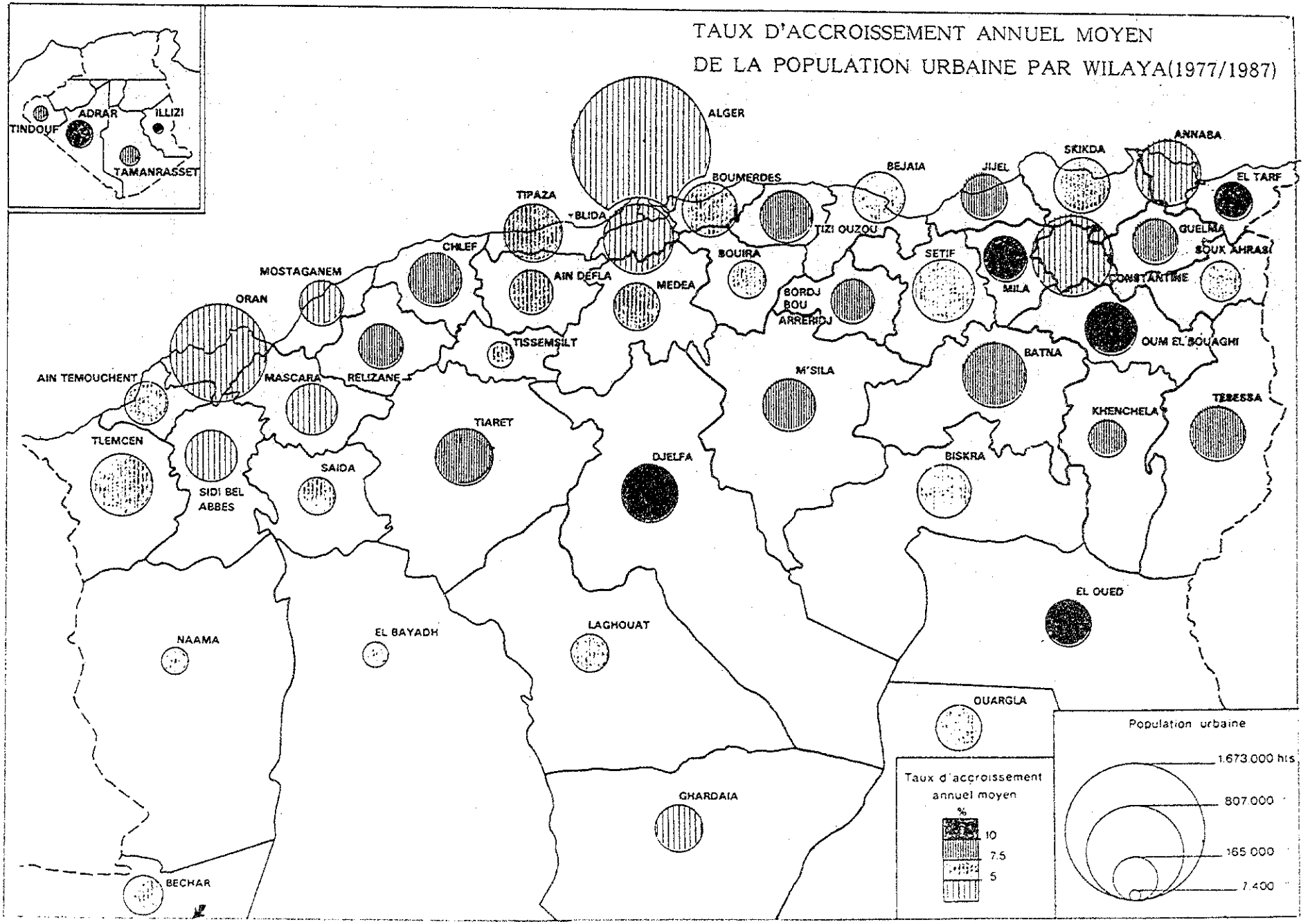

TAUX D'ACCROISSEMENT ANNUEL MOYEN
DE LA POPULATION URBAINE PAR WILAYA(1977/1987)
TINDOUF
ADRAR
ILLIZI
TAMANRASSET
ALGER
BOUMERDES
BEJAIA
JIJEL
SKIKDA
ANNABA
EL TARF
TIPAZA
BLIDA
TIZI OUZOU
GUELMA
SOUK AHRAS
CHLEF
SOUIRA
SETIF
MILA
CONSTANTINE
MOSTAGANEM
AIN DEFLA
MEDEA
BORDJ BOU ARRERIDJ
ORAN
TISSEMSILT
OUM EL BOUAGHI
AIN TEMOUCHENT
MASCARA
RELIZANE
M'SILA
BATNA
TIARET
KHENCHELA
TEBESSA
TLEMCEN
SAIDA
DJELFA
BISKRA
SIDI BEL ABBES
EL OUED
NAAMA
EL BAYADH
LAGHOUAT
OUARGLA
GHARDAIA
BECHAR
Taux d'accroissement annuel moyen
%
10
7.5
5
Population urbaine
1.673.000 hts
807.000
165 000
7.400

Table 1.1.3 Breakdown of the Algerian Population(thousands) by Age (1984-1989)

Age	1984	%	1985	%	1986	%	1987	%	1988	%	1989	%
0-4	3,698	18%	3,817	18%	3,938	18%	3,789	17%	3,895	17%	4,003	17%
5-9	3,138	15%	3,239	15%	3,342	15%	3,390	15%	3,485	15%	3,581	15%
10-14	2,752	13%	2,840	13%	2,930	13%	2,876	13%	2,957	13%	3,039	13%
15-19	2,329	11%	2,404	11%	2,480	11%	2,494	11%	2,564	11%	2,635	11%
(0-19)	11,917	57%	12,300	57%	12,690	57%	12,549	55%	12,901	55%	13,258	55%
20-24	1,814	9%	1,872	9%	1,931	9%	2,219	10%	2,281	10%	2,344	10%
25-29	1,516	7%	1,656	8%	1,615	7%	1,659	7%	1,706	7%	1,753	7%
30-34	1,142	5%	1,179	5%	1,216	5%	1,390	6%	1,429	6%	1,469	6%
35-39	766	4%	791	4%	816	4%	1,041	5%	1,070	5%	1,100	5%
40-44	754	4%	778	4%	803	4%	733	3%	754	3%	775	3%
45-49	707	3%	730	3%	753	3%	708	3%	727	3%	747	3%
50-54	579	3%	597	3%	616	3%	662	3%	681	3%	700	3%
55-59	448	2%	462	2%	477	2%	536	2%	551	2%	566	2%
60-64	380	2%	392	2%	404	2%	408	2%	420	2%	432	2%
65-69	286	1%	295	1%	304	1%	322	1%	331	1%	340	1%
70-74	247	1%	255	1%	263	1%	227	1%	234	1%	240	1%
75-	285	1%	294	1%	303	1%	351	2%	361	2%	371	2%
Total	20,841	100%	21,510	100%	22,191	100%	22,807	100%	23,446	100%	24,095	100%

Source: ONS, L'ALGERIE EN QUELQUES CHIFFRES (EDITION 1990)

1.2 Economic Activities

Since the late 1960s, the Algerian economy, as measured by the GDP evolution, had witnessed impressive growth. The average annual rate of growth was 7% during the 1970s, and 5% between 1980 and 1985.

As a result of rapid industrialization due to income received from oil exports during the 1970s, the structure of the economy underwent rapid changes characterized by a significant increase in the contribution of industry to GDP. Indeed, while the share of agriculture relative to GDP declined from 15% to 8% between 1965 and 1980, the share of industry grew from 34% to 44% during the same period (As shown in Table 1.2.1).

After 1980, to adjust the imbalance in the inter-industrial relationship caused by rapid industrialization, the development strategy changed its course slightly in order to achieve more balanced economy. Although it continued to focus on manufacturing, the economic policy aimed at reinforcing agriculture, water supply, housing, education and professional training, as well as basic economic infrastructures.

As a result of the reform programs, the Algerian economy evolved favorably, with steady growth in domestic industries and a constant surplus in the trade balance, thanks to high hydrocarbon exports, as shown in Table 1.2.2.

However, since 1986, Algeria has experienced an economic stagnation due to falling demand for hydrocarbon, a collapse of hydrocarbon prices, and a poor harvest marked by persistent drought. GDP growth fell from about 5% per year during 1981-1985, to about 1.1% in 1986, and recessions in 1987 and 1988 resulted in a further decline 0.7% and 2.1% respectively (As shown in Table 1.2.2).

The sharp drop in export receipts (-46% in 1986) created a deficit and payment pressures, which led to 20% decrease in the volume of imports in 1986, 1987 (As shown in Table 1.2.3). Accordingly, private consumption per capita declined by 1.4% in 1986, 0.7% in 1987, 8% in 1988, and gross domestic investment per capita declined by 8.8% in 1986, 9.7% in 1987, 8.3% in 1988 (As shown in Table 1.2.4). Furthermore, this economic stagnation has at times generated a disruption in the supply of certain basic goods, as well as sharp increases in domestic prices.

As a solution to these difficult conditions, the government has been promoting drastic socio-economic reforms, such as reintroducing market mechanisms into the economy, transforming public enterprises into commercial enterprises, liberalizing the price system to bring it in line with the restoration of market mechanisms and so on. In addition, the new policy of encouraging joint ventures with foreign companies is expected to stimulate the growth of investments.

In the supply and demand conditions of the international hydrocarbon market, the U.S. and U.S.S.R. will reduce their output of hydrocarbon products, leaving OPEC countries a larger share of the world market, while demand will increase steadily in countries with newly industrializing economies (NIEs) and so on. Taking into account these international hydrocarbon market conditions, and providing that the socioeconomic reforms in Algeria are successful, the Algerian economy will be revitalized in the near future. In fact, GDP showed a growth rate of 3.4% in 1989, and 3% in 1990 (at constant price).

Table 1.2.1 GDP by industrial origin

	1965	%	1970	%	1980	%	1989	%
GDP at Market Prices	15.64	100%	24.07	100%	162.51	100%	363.9	100%
Agriculture	2.32	15%	2.43	10%	13.25	8%	47.08	13%
Industry	5.26	34%	9.27	39%	70.94	44%	134.56	37%
Manufacturing	1.76	11%	3.37	14%	12.47	8%	34.3	9%
Service, etc	7.35	47%	10.72	45%	47.96	30%	121.03	33%
Indirect Taxes	0.71	5%	1.65	7%	30.36	19%	61.23	17%

Unit: Billions of current Algerian Dinars
Source: The World Bank, World Tables 1991

Table 1.2.2 Trade Balance and GDP (at constant 1987 price)

	1981	1982	1983	1984	1985	1986	1987	1988	1989
Exports of Merchandise	14,412	13,509	12,742	12,792	13,034	8,065	9,029	7,620	9,476
Fuels	14,124	12,908	12,365	12,548	12,826	7,870	8,816	7,433	8,107
Others	288	601	377	244	208	195	213	187	1,369
Imports of Merchandise	10,088	9,889	9,516	9,235	8,811	7,879	6,616	6,675	8,188
Trade balance	4,324	3,620	3,226	3,557	4,223	186	2,413	945	1,288
GDP(at 1987 price)	249.52	265.58	279.88	295.55	311.40	314.98	312.71	306.19	316.69
Agriculture	23.03	21.19	20.72	22.19	28.03	29.53	31.50	29.90	33.63
Industry	87.60	94.29	107.02	115.81	122.00	121.79	109.93	113.94	110.28
Manufacturing	22.71	23.18	30.19	36.72	40.18	41.67	34.31	30.90	25.85
Services, etc	89.98	98.31	94.36	90.32	92.53	98.74	112.14	112.26	127.23
GDP growth rate	3.0%	6.4%	5.4%	5.6%	5.4%	1.1%	-0.7%	-2.1%	3.4%

Unit of Exports and Imports of Merchandise: Millions of current US dollars
Unit of GDP: Billions of 1987 Algerian Dinars

Source: The World Bank, World Tables 1991

Table 1.2.3 Movement of Volume, Price and Value in the Foreign trade

U:%

		81/80	82/81	83/82	84/83	85/84	86/85	87/86
Import	Volume	18.6	-6.1	6.1	0.6	-2.1	-19.8	-20.6
	Price	1.2	7.8	-5.1	2.7	-1.5	9.7	-1.1
	Value	20	1.2	0.7	3.3	-3.5	-12.1	-21.4
Export	Volume	-6.2	-0.5	8	5.9	4.7	1.3	6.1
	Price	31.2	-2.5	-6.4	-1.9	-2.4	-46.9	-12.5
	Value	22.9	-3.1	0.3	3.8	2.2	-46.2	19.3

Source: ONS, STATISTIQUES NO.26 1990

Table 1.2.4 Movement of principal economic indicators

U: 1987 US dollars

	1984	1985	1986	1987	1988	1989	1990
(Annal growth rate)	0.7%	4.4%	-1.4%	-0.7%	-8.0%	4.7%	4.5%
Private consumption per capita	1,350	1,410	1,390	1,380	1,270	1,330	1,390
(Annal growth rate)	-0.9%	-3.8%	-8.8%	-9.7%	-8.3%	-1.3%	-5.3%
Gross domestic investment per capita	1,060	1,020	930	840	770	760	720
(Annal growth rate)	6.0%	10.5%	12.4%	7.4%	6.0%	9.3%	16.6%
Consumer prices (Index Numbers 1985=100)	90.5	100	112.4	120.7	127.9	139.8	163

Source: The World Bank, World Table 1991
IMF, International Financial Statistics 1991

1.3 General View of Industry

The Hydrocarbon industry (oil and natural gas), Heavy chemical industry (developed in large part from rich income derived from hydrocarbon exports) and Agriculture compose Algeria's principal industry.

Because of the past rapid industrialization created an imbalance in the industrial structure, the Algerian government implemented a program of reforms in order to attempt more balanced economy by reinforcing agriculture and light industry and improving the efficiency in industry.

Sectoral breakdown of GDP is shown in Table 1.3.1.

1.3.1 Hydrocarbon industry

Hydrocarbon resources are very important for Algerian economical development. Exports of hydrocarbon products compose about 95% of total exports.

As regards oil, the verified estimated amount of oil reserve is 9.2 billion barrels, and the output is about 700,000 barrels per day.

As regards natural gas, the verified estimated reserve is 3,610 billion cubic meters but it is acknowledged that the actual figure is close to 8,000 billion, and ranking fourth in the world, behind the Soviet Union, Iran, and the United States. Furthermore, the output of natural gas is increasing, and reached to 96 million tons per year in 1989.

Algeria has been diversifying its hydrocarbon exports. In fact, during the 1960s and 1970s, hydrocarbon exports income consisted almost entirely crude oil. But in 1989, diversification of hydrocarbon exports was rather achieved, and the

share of crude oil declined to 21%, whereas petroleum products increase to 26%, condensate increase to 28%, and natural gas increase to 26% (As shown in Table 1.3.2).

Table 1.3.1 Sactoral breakdown of GDP (at current price)

U: Millions of DA

	1985	%	1986	%	1987	%
Agriculture	24,084	9.5%	26,278	10.5%	31,787	12.2%
Water and Energy	3,019	1.2%	3,161	1.3%	3,449	1.3%
Hydrocarbon	65,548	25.9%	39,053	15.6%	45,537	17.5%
Mining	1,189	0.5%	1,018	0.4%	991	0.4%
Manufacturing	32,759	13.0%	39,541	15.8%	38,423	14.7%
Iron,Machine,Electric	11,942	4.7%	14,786	5.9%	13,817	5.3%
Material of construction	3,387	1.3%	4,130	1.6%	3,872	1.5%
Chemical,Rubber,Plastic	2,434	1.0%	2,819	1.1%	2,179	0.8%
Food	6,014	2.4%	8,086	3.2%	9,245	3.5%
Textile	4,798	1.9%	4,742	1.9%	4,441	1.7%
Shoes, Ceramics	975	0.4%	1,090	0.4%	1,111	0.4%
Timber, Paper	2,385	0.9%	2,608	1.0%	2,556	1.0%
Others	824	0.3%	1,280	0.5%	1,202	0.5%
Construction and Public	37,023	14.6%	44,316	17.7%	42,600	16.3%
Petroleum	4,304	1.7%	5,082	2.0%	4,492	1.7%
Transportation,commerce,service	61,590	24.4%	67,762	27.1%	67,526	25.9%
Transportation	14,585	5.8%	16,245	6.5%	16,466	6.3%
Commerce	36,714	14.5%	40,030	16.0%	38,392	14.7%
Service	10,291	4.1%	11,487	4.6%	12,668	4.9%
Custom	23,320	9.2%	24,254	9.7%	25,949	10.0%
G D P	252,836	100.0%	250,465	100.0%	260,754	100.0%

Source: ONS, L'ALGERIE EN QUELQUES CHIFFRES 1990

Table 1.3.2 Value of Export Hydrocarbon products (1985-1989)

U: millions of US dollars

	1985	%	1986	%	1987	%	1988	%	1989	%
Crude oil	3,409	27%	1,511	21%	1,718	20%	1,340	18%	1,894	21%
Condensate	3,050	24%	1,613	22%	2,382	28%	1,744	24%	2,535	28%
Refined petroleum products	2,750	22%	1,685	23%	1,975	23%	1,792	24%	1,985	22%
Liquefied Petroleum Gas	459	4%	334	5%	442	5%	407	6%	386	4%
Liquefied Natural Gas	1,882	15%	1,354	19%	1,162	14%	1,237	17%	1,412	16%
Natural Gas	1,174	9%	782	11%	852	10%	831	11%	884	10%
Total Value	12,724	100%	7,279	100%	8,531	100%	7,352	100%	9,096	100%

Source: ONS, STATISTIQUES COURANTES NO.12 1990

1.3.2 Industry

As a result of the economic stagnation due to the collapse of the hydrocarbon price, industrial production indices by sector changed only slightly in 1987 and 1988.

However, in spite of the overall stagnant tendency, there was a considerable rise in the sector related to private consumption such as food industry, energy and water supply sector (As shown in Table 1.3.3).

In order to encourage economic activity, the Algerian government is trying to promote a series of reforms, such as transforming public enterprises into commercial enterprises and making better use of existing production capacities to raise the productivity.

The movement of principal products since 1980 is shown in the Table 1.3.4.

Table 1.3.3 Index of industrial production

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Water and Energy	64.4	73.5	84.7	92.2	100.0	110.8	119.6	128.3	139.3	145.3
Hydrocarbon	77.9	79.2	91.4	100.7	100.0	104.2	105.1	109	111.2	114.5
Mining and Stone	104.4	107.1	95.4	100.3	100.0	109.6	113.2	109.4	104.4	105.9
Steel making, Machine, Electric	55.9	66.5	76.8	91.2	100.0	108.7	110.2	106.4	101.8	88.7
Material of construction	73.8	76.8	75.6	91.5	100.0	102.6	108.6	114.6	115.7	111.6
Foodstuff	71.7	75.5	74.4	89.3	100.0	100.6	114	117.3	118.9	117.3
Textile	43.7	56.6	68.6	73.1	100.0	90.0	96.3	91.2	83.9	85.6
Shoes, Ceramics	63.8	69.9	89.7	90.9	100.0	95.3	103.1	96.8	89.4	88.5
Timber,Paper	57.2	73.2	81.8	93.4	100.0	96.5	112.1	105.1	100.1	113.2
Total	65.7	71.5	82.1	91.8	100.0	105.3	108	108.6	108.1	106.6
Non Hydrocarbon	59.7	67.5	77.4	87.5	100.0	97.4	109.7	108.6	106.2	101.8
Manufacturing	57.5	66.1	78.2	87.1	100.0	104.1	108.9	107.2	104.6	100

Source: ONS, L'ALGERIE EN QUELQUES CHIFFRES (EDITION 1990, 1986, 1984)

Table: 1.3.4 Principal products of manufacturing industry

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Cast iron (thousand tons)	669	897	1059.6	1113.4	1176	1461.9	1246.3	1478	1500	1300
Ingot, Plate (thousand tons)	384.3	557	871.6	891.5	1143	1245.5	1120	1378	1301	1041
Steel pipe (thousand tons)	216	217.1	240.2	223	243.8	226.2	222	203	180	142
Tractor for agriculture	4206	4379	4500	6002	5927	6250	6323	3513	3404	2965
Car for industry, Truck	6464	5625	5543	6504	6619	5722	6672	5785	3326	3956
Monochrome television (thousand)	75	119	126.5	153	142	132.7	262	227	203	141
Color television (thousand)	-	26.6	47.8	61.4	82	87.2	120	91	119	78
Cement (thousand tons)	4159	4457	3743.2	4776	5539	6096.1	6448	7541	7195	6619
Fertilizer (thousand tons)	171.6	128	133	188	271.2	261.1	257	278	239	193

Source: ONS, L'ALGERIE EN QUELQUES CHIFFRES (EDITION 1984,1986,1990)

1.3.3 Agriculture

In order to relieve the heavy burden of food imports due to low agricultural productivity, the Algerian government introduced a series of reforms such as the partial liberalization of the agricultural sector from administrative controls, both the distribution networks and the pricing of certain products, and a privatisation of the state farms.

Despite these measures, they have not achieved the expected results, because of persistent droughts in 1983, 1987, 1988, a locust invasion in 1988, and a shortage of production materials (such as agricultural machines, fertilizer and seeds) caused by the stagnant economy since 1986. In particular, droughts in 1987 and 1988 brought a very poor harvest, resulting in a severe increase in food imports.

The principal products are wheat, barley, potatoes, beans, citrus fruits, olives, grapes and dates (As shown in Table 1.3.5).

The rate of self-sufficiency in cereals is about 30%, and the supply of sugar and coffee beans is exclusively dependent on imports. A few products such as citrus fruits and dates are exported. Imported foodstuffs have more than a 20% share of total imports, and in 1989, as a result of drought, the share rose to almost 29% (As shown in Table 1.4.1).

The Algerian government is making efforts to increase productivity in the middle or long term by planning an irrigation project and by conducting a study for seed reform.

Table 1.3.5 Principal agricultural Products

U:thousand quintals

	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89
Wheat	12,184	9,771	7,898	8,754	14,781	12,288	11,748	6,144	11,521
Barley	5,248	4,834	4,468	5,111	13,302	10,828	8,199	3,897	7,899
Potato	5,282	4,151	4,907	5,209	8,147	8,117	9,046	8,988	10,007
Tomato	1,342	1,940	1,597	1,441	2,173	3,022	2,912	2,828	3,066
Onion	1,258	1,129	1,214	1,956	1,642	1,649	2,002	2,003	2,276
Melon, Watermelon	1,792	1,932	2,069	2,430	3,182	3,177	3,600	2,321	3,009
Citrus fruits	3,553	3,194	2,554	2,854	2,441	2,531	2,772	3,118	2,681
Date	1,953	2,065	1,815	1,827	1,988	1,888	2,244	1,961	2,101
Olive	2,138	1,433	1,353	1,020	1,593	2,016	1,682	1,429	925
Grape for wine (1000hl)	2,669	1,400	1,875	1,393	938	906	918	621	504

Source: ONS, L'ALGERIE EN QUELQUES CHIFFRES (EDITION 1984,1986,1990)

1.4 Trade and Balance of Payments

The exports of hydrocarbon products (crude oil, condensate, petroleum products, natural gas and so on) had about a 95% share of the total exports, and played an important role in Algerian economic development.

The value of hydrocarbon exports was on an upward trend until 1985, but it declined abruptly with the collapse in oil price in 1986, as shown in Table 1.4.2. Since 1987, however, it has experienced a steady resurgence, climbing to 69 billion DA in 1989.

In recent years, diversification of hydrocarbon exports has been achieved, and the share of crude oil has decreased to 21% of the total hydrocarbon exports value.

Besides hydrocarbon, there are a few other export products of value such as wine, phosphate ore, dates, citrus fruits and so on.

The Algerian government has been attempting to increase nonhydrocarbon exports to alter the current export structure that depends exclusively on hydrocarbon, and in this context, it is noteworthy that exports of industrial goods and machines have been increasing steadily.

As regards import products, in 1989, industrial materials had a 36% share, machine and equipment had a 23% share, and foodstuffs remained a high share of 29% (which is 12% larger than its share in 1986).

The counterparts of trade are shown in Table 1.4.3. The European Community occupies a share of more than 60% in exports and 50% in imports.

The U.S. has a share of 19% in exports, and this figure will increase in the future as exports of natural gas resume.

As regards the balance of payments (as shown in Table 1.4.4), in 1986, the surplus in the balance of trade decreased suddenly because of the collapse in oil prices. Consequently, in 1988, the current balance showed a deficit of 2 billion U.S.dollars. In 1989, the current balance still showed a deficit due to an increase in imports. In the total balance, there has been a deficit since 1986.

Table 1.4.1 Evolution of imports per economic groups of commodities

U: Millions of DA

	1984		1985		1986		1987		1988		1989	
Foodstuff products	7,833	15.3%	9,728	19.7%	7,261	16.7%	7,096	20.8%	9,296	21.4%	19,965	28.5%
Industrial materials	21,627	42.2%	18,517	37.4%	16,798	38.7%	13,730	40.2%	17,774	40.9%	25,197	36.0%
Fuel, Oil	894	1.7%	712	1.4%	618	1.4%	643	1.9%	668	1.5%	707	1.0%
Machine, Equipment, Parts	12,030	23.5%	12,492	25.2%	10,970	25.3%	7,631	22.3%	10,043	23.1%	15,786	22.5%
Transport materials	5,625	11.0%	5,250	10.6%	4,842	11.2%	3,136	9.2%	3,272	7.6%	4,075	5.8%
Consumer goods	3,203	6.2%	2,714	5.5%	2,854	6.6%	1,821	5.3%	2,327	5.4%	4,189	6.0%
Others	45	0.1%	78	0.2%	50	0.1%	96	0.3%	47	0.1%	153	0.2%
Total	51,257	100.0%	49,491	100.0%	43,393	100.0%	34,153	100.0%	43,427	100.0%	70,072	100.0%

Source: ONS, Statistiques No.26 1990, L'ALGERIE EN QUELQUES CHIFFRES(EDITION 1990)

Table 1.4.2 Evolution of exports per economic groups of commodities

U: Millions of DA

	1984		1985		1986		1987		1988		1989	
Foodstuff products	235	0.4%	281	0.4%	123	0.4%	145	0.3%	178	0.4%	284	0.4%
Industrial materials	1,204	1.9%	863	1.3%	761	2.2%	729	1.7%	1,462	3.2%	1,711	2.4%
Fuel, Oil	62,298	97.7%	63,299	98.0%	34,003	97.3%	40,700	97.5%	42,934	94.5%	68,927	95.8%
Machine, Equipment, Parts	7	0.0%	17	0.0%	16	0.0%	61	0.1%	609	1.3%	510	0.7%
Transport materials	1	0.0%	92	0.1%	6	0.0%	60	0.1%	146	0.3%	371	0.5%
Consumer goods	13	0.0%	12	0.0%	26	0.1%	41	0.1%	92	0.2%	154	0.2%
Total	63,758	100.0%	64,564	100.0%	34,935	100.0%	41,736	100.0%	45,421	100.0%	71,937	100.0%

Source: ONS, Statistiques No.26 1990, L'ALGERIE EN QUELQUES CHIFFRES(EDITION 1990)

Table: 1.4.3 Tranding distribution per geographic areas and principal countries

U: Millions of DA

Imports

	1985		1986		1987		1988	
E.E.C.	29,446	59.5%	24,803	57.2%	18,689	54.7%	22,583	52.0%
France	12,851	26.0%	10,404	24.0%	7,820	22.9%	8,196	18.9%
F.R.G.	5,566	11.2%	4,797	11.1%	3,586	10.5%	5,752	13.2%
Italy	5,415	10.9%	5,607	12.9%	3,817	11.2%	4,322	10.0%
Belgium	1,966	4.0%	1,282	3.0%	1,508	4.4%	1,931	4.4%
G. Britain	1,494	3.0%	1,102	2.5%	716	2.1%	1,017	2.3%
Holland	1,432	2.9%	1,292	3.0%	997	2.9%	1,068	2.5%
Others	722	1.5%	319	0.7%	245	0.7%	297	0.7%
East Europe	2,248	4.5%	1,838	4.2%	1,794	5.3%	2,331	5.4%
Other European countries	5,346	10.8%	6,405	14.8%	4,835	14.2%	7,141	16.4%
Austria	1,125	2.3%	1,137	2.6%	738	2.2%	1,337	3.1%
Turkey	762	1.5%	967	2.2%	769	2.3%	1,254	2.9%
Spain	679	1.4%	1,990	4.6%	1,558	4.6%	2,000	4.6%
Others	2,780	5.6%	2,311	5.3%	1,770	5.2%	2,550	5.9%
North America	5,255	10.6%	4,302	9.9%	3,045	8.9%	5,728	13.2%
U.S.A.	3,231	6.5%	3,345	7.7%	2,399	7.0%	4,684	10.8%
Canada	2,024	4.1%	957	2.2%	646	1.9%	1,044	2.4%
Latin America	2,054	4.2%	1,774	4.1%	1,739	5.1%	1,593	3.7%
Arabian countries	672	1.4%	765	1.8%	858	2.5%	732	1.7%
Africa	207	0.4%	336	0.8%	384	1.1%	382	0.9%
Asia	3,663	7.4%	2,662	6.1%	2,476	7.2%	2,439	5.6%
Japan	2,867	5.8%	1,976	4.6%	1,330	3.9%	1,883	4.3%
Others	796	1.6%	686	1.6%	1,146	3.4%	556	1.3%
Others	601	1.2%	508	1.2%	332	1.0%	397	0.9%
Total	49,492	100.0%	43,393	100.0%	34,153	100.0%	43,427	100.0%

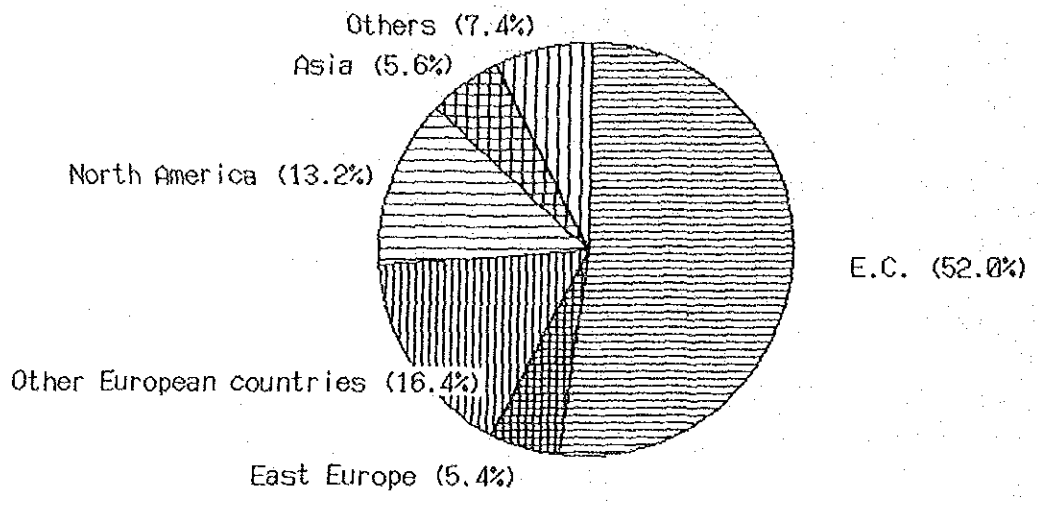
Exports

	1985		1986		1987		1988	
E.E.C.	43,502	67.4%	23,171	66.3%	27,026	64.8%	27,616	60.8%
France	19,264	29.8%	7,529	21.6%	9,231	22.1%	8,920	19.6%
F.R.G.	2,210	3.4%	1,104	3.2%	1,718	4.1%	1,988	4.4%
Italy	14,369	22.3%	6,960	19.9%	6,404	15.3%	7,760	17.1%
Belgium	73	0.1%	2,206	6.3%	2,663	6.4%	3,203	7.1%
G. Britain	1,133	1.8%	395	1.1%	662	1.6%	966	2.1%
Holland	5,931	9.2%	4,968	14.2%	6,322	15.1%	4,777	10.5%
Others	522	0.8%	9	0.0%	26	0.1%	2	0.0%
East Europe	4,091	6.3%	1,053	3.0%	512	1.2%	1,090	2.4%
Other European countries	6,391	9.9%	3,135	9.0%	3,865	9.3%	4,678	10.3%
Austria	211	0.3%	365	1.0%	459	1.1%	496	1.1%
Turkey	904	1.4%	230	0.7%	514	1.2%	519	1.1%
Spain	3,835	5.9%	1,998	5.7%	1,820	4.4%	2,825	6.2%
Others	1,441	2.2%	552	1.6%	1,072	2.6%	838	1.8%
North America	7,736	12.0%	6,083	17.4%	8,104	19.4%	8,539	18.8%
U.S.A.	6,456	10.0%	6,070	17.4%	8,022	19.2%	8,496	18.7%
Canada	1,280	2.0%	13	0.0%	82	0.2%	43	0.1%
Latin America	1,072	1.7%	621	1.8%	784	1.9%	681	1.5%
Arabian countries	698	1.1%	274	0.8%	699	1.7%	1,136	2.5%
Africa	321	0.5%	48	0.1%	36	0.1%	46	0.1%
Asia	753	1.2%	550	1.6%	710	1.7%	1,635	3.6%
Japan	671	1.0%	449	1.3%	611	1.5%	1,146	2.5%
Others	82	0.1%	101	0.3%	99	0.2%	489	1.1%
Total	64,564	100.0%	34,935	100.0%	41,736	100.0%	45,421	100.0%

Source: ONS, Statistiques No.26 1990

Distribution per geographic areas

Imports



Distribution per geographic areas

Exports

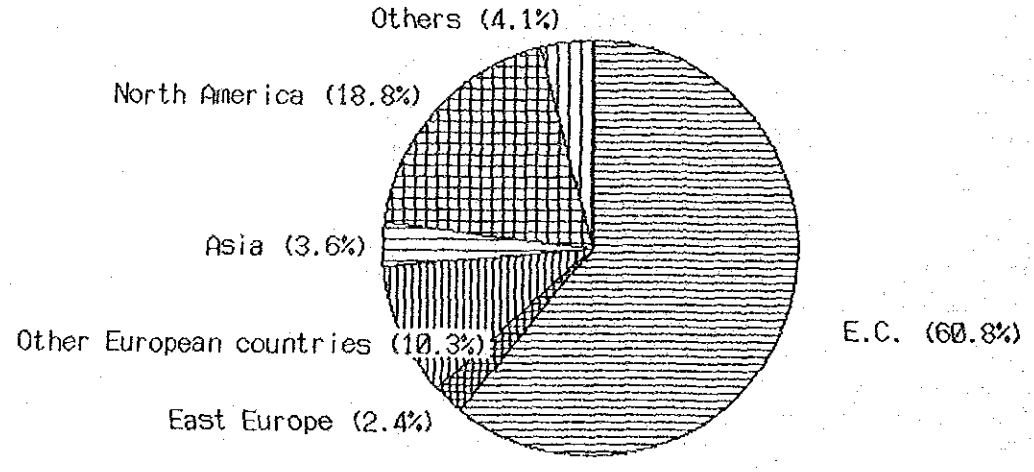


Table 1.4.4 Balance of payments

U: Millions of current US dollars

	1982	1983	1984	1985	1986	1987	1988	1989
(1)Merchandise;Exports(fob)	13,509	12,742	12,792	13,034	8,065	9,029	7,620	9,476
(2)Merchandise;Imports(fob)	-9,889	-9,516	-9,235	-8,811	-7,879	-6,616	-6,675	-8,188
(3)Trade Balance (1)+(2)	3,620	3,226	3,557	4,223	186	2,413	945	1,288
(4)Other Goods, Serv. Credit	856	866	778	722	721	675	542	645
(5)Other Goods, Serv. Debt	-4,989	-4,415	-4,442	-4,309	-3,900	-3,464	-3,917	-3,706
(6)Private Unrequited Transfers	348	237	186	367	765	522	385	519
(7)Official Unrequited Transfers	-18	1	-5	11	-1	-5	5	0
(8)Current Account	-183	-85	74	1,014	-2,229	141	-2,040	-1,254
(9)Direct Investment	-65	-14	-14	-2	11	-11	8	-59
(10)Portforio Investment	-3	2	0	0	0	0	2	0
(11)Other Long Term Capital	-888	-836	-390	-34	353	32	757	416
(12)Other Short Term Capital	157	319	193	-85	226	289	-23	-
(13)Net Errors and Omissions	-88	193	-197	127	142	-802	335	250
(14)Total Balance	-1,070	-421	-334	1,020	-1,497	-351	-961	-647

Source: IMF, INTERNATIONAL FINANCIAL STATISTICS 1990,

THE WORLD BANK, WORLD TABLES 1991

1.5 Transportation

Algeria has a vast land area, with almost 90% lying in the Sahara Desert, just south of the Atlas Mountains. Therefore, the role of domestic transport facilities is very important for socio-economic activities.

1.5.1 Roads

The road network in Algeria includes 47,000km of main (national) and secondary (prefectural) roads and 43,000km of local (community) roads. (As shown in Table 1.5.1). More than 85% of the main roads are paved. The number of cars and volume of transport is shown in Table 1.5.2. The number of cars rapidly increased from 850,000 in 1981 to 1,200,000 in 1985, and it is supposed that the number of cars will continue to increase in the future.

Table 1.5.1 Consistance of National Road framework in 1988

U:Km

	National	Prefactural	Local	Total
Paved	21,785	17,238	17,506	56,529
Not paved	3,785	3,911	25,000	32,696
Total	25,520	21,149	42,506	89,175

Source: ONS, Year Book 1990

Table 1.5.2 Principal Statistics of Transport

	1981	1985	1986	1987	1988	1989
Number of cars	850,221	1,201,293	-	-	-	-
for private	510,681	712,652	-	-	-	-
for business	323,288	471,495	-	-	-	-
motor cycle	16,252	17,146	-	-	-	-
Road transport(goods)						
Volume(million tons)	5.41	5.78	5.69	6.82	8.52	8.2
Ton.KM(million)	1,816	2,284	2,256	2,063	2,093	1,999
Road transport(passenger)						
Number(million)	-	67,737	64,800	80,587	92,093	88,101
Person.KM(million)	-	7,372	3,180	3,623	3,755	3,811
Railway transport(goods)						
Volume(thousand tons)	10,750	12,600	12,500	12,805	13,101	12,563
Ton.KM(million)	2,703	3,048	2,934	2,937	2,814	2,698
Railway transport(passenger)						
Number(thousand)	23,557	47,700	46,700	43,296	44,861	52,524
Person.KM(million)	2,158	2,011	2,035	1,972	2,439	2,724

Source: L'ALGERIE EN QUELQUES CHIFFRES (EDITION 1984, 1990)

1.5.2 Railways

Algerian railways extend 3,800km in length, and an east-west line connects the northern coastal cities, and four north-south lines connects the inland cities. Passenger traffic dominates the east-west line, and cargo traffic is characterized by industrial materials and products. The second railway modernization project is in progress.

1.5.3 Aviation

An extensive domestic air network plays an important role in Algerian domestic transport because of the vast land area and climate conditions in Algeria. There are about 30 airports in Algeria, with the 12 major ones serving as international airports. Besides Air Algeria as a flag carrier, there are 20 foreign airlines are serving to Algeria.

1.5.4 Ports and Shipping

(1) Ports

There are 13 commercial ports in Algeria operated by 10 port enterprises. Some ports, such as Bethioua, Bejaia, Arzew and Skikda, specialize in hydrocarbon exports (liquefied natural gas, ammonia, crude oil and so on). Excluding hydrocarbon exports, imports dominate traffic, and much of the general cargo (60% in 1990) is handled by the Port of Algiers, Annaba and Oran, as shown in Table 1.5.3. These three ports have continued to serve as the main ports in Algeria, namely Oran in the western region, Algiers in the central region and Annaba in the eastern region of the country.

(2) Ships

The movement of the number of ships (entrance and departure) from 1985 to 1990 is shown in Table 1.5.4. The number of ships entering the ports has been on the decline for the last five years. Taking into account that cargo volume has been increasing, it is supposed that the average ship size has been enlarging.

Table 1.5.3 Freight Traffic (metric ton) Broken Down by Port (1990)

	Unloaded							
	Liquid bulk		Solid bulk		General cargo		Total	
Algiers	966,887	32%	1,321,504	20%	3,193,222	41%	5,481,614	31%
Annaba	478,841	16%	2,020,581	30%	622,508	8%	3,121,930	18%
Oran	593,214	20%	1,530,251	23%	806,223	10%	2,929,688	17%
Mostaganem	11,721	0%	496,354	7%	433,517	6%	941,592	5%
Ghazaouet	14,544	0%	266,418	4%	177,816	2%	458,778	3%
Arzew,Bethioua	348,405	11%	62,000	1%	34,822	0%	445,227	3%
Bejaia	453,248	15%	579,604	9%	1,197,906	15%	2,230,758	13%
Skikda	173,151	6%	428,841	6%	790,997	10%	1,392,989	8%
Tenes		0%	2,898	0%	254,685	3%	257,583	1%
Jijel		0%		0%	199,164	3%	199,164	1%
Benji saf		0%		0%		0%	0	0%
Dellys		0%		0%	63,735	1%	63,735	0%
		0%		0%		0%		0%
Total	3,040,011	100%	6,708,451	100%	7,774,595	100%	17,523,059	100%

	Loaded							
	Liquid bulk		Solid bulk		General cargo		Total	
Algiers	740,097	1%	8,428	1%	136,194	32%	884,719	1%
Annaba	86,347	0%	1,021,401	88%	104,335	24%	1,212,084	2%
Oran	2,850	0%	11,743	1%	27,563	6%	42,156	0%
Mostaganem	10,465	0%	96,185	8%	15,574	4%	122,224	0%
Ghazaouet	19,758	0%	14,746	1%	21,117	5%	55,621	0%
Arzew,Bethioua	38,581,521	60%	4,800	0%	44,160	10%	38,630,482	59%
Bejaia	8,338,604	13%		0%	5,823	1%	8,344,427	13%
Skikda	16,492,141	26%		0%	53,248	12%	16,545,389	25%
Tenes		0%		0%	12,288	3%	12,288	0%
Jijel		0%		0%	10,675	2%	10,675	0%
Benji saf		0%		0%		0%	0	0%
Dellys		0%		0%		0%	0	0%
		0%		0%		0%		0%
Total	64,271,783	100%	1,157,303	100%	430,977	100%	65,860,065	100%

Source: MOT Direction des Ports

Table 1.5.4 Number of ships by Port (entrance and departure)

	1986	1987	1988	1989	1990
ANNABA	2,399	2,143	2,017	1,842	1,655
SKIKDA	3,739	3,256	3,016	2,759	2,629
JIJEL	385	322	304	314	254
BEJAIA	1,806	1,590	1,587	1,555	1,451
ALGER	5,011	4,136	3,824	3,798	3,839
TENES	380	268	283	255	248
MOSTAGANEM	880	668	644	565	627
ARZEW	2,000	2,166	2,290	2,562	2,675
ORAN	2,656	2,212	2,033	1,984	1,794
GHAZAOUET	340	190	286	236	269
TOTAL	19,596	16,951	16,284	15,870	15,441

(Cargo Traffic by Port)

U:TON

	1986	1987	1988	1989	1990
ANNABA	4,946,157	5,051,877	5,408,468	4,803,361	4,334,013
SKIKDA	19,152,318	18,272,805	19,015,250	17,475,593	17,938,378
JIJEL	355,901	275,510	246,881	253,106	209,839
BEJAIA	9,001,672	7,982,847	9,673,459	10,988,778	10,575,185
ALGER	6,639,093	5,628,432	6,129,416	6,831,007	6,430,067
TENES	403,448	252,716	288,677	299,553	269,871
MOSTAGANEM	1,115,215	1,019,654	1,139,323	928,056	1,063,816
ARZEW	30,109,396	33,095,765	3,714	35,336,511	39,075,708
ORAN	2,673,043	2,738,892	3,108,821	3,105,480	2,971,844
GHAZAOUET	526,210	266,213	445,708	343,961	517,399
TOTAL	74,922,453	74,584,711	77,869,476	80,365,406	83,386,120

Source: MOT, Annual Statistics des Ports

(3) Cargo

As shown in Table 1.5.5, in accordance with strong economic growth, imports increased sharply, at over 11% per year during 1979-1984. General cargo traffic imports (such as manufactured goods and foodstuffs) increased at about 9% per year and imports of cereals and cement increased at 16% and 23% per year respectively. During the same period, exports, consisting mainly of hydrocarbon products, remained flat.

But during 1984-1987, port traffic was on the decline following its peak of 78 million tons in 1984, as a result of the government's efforts to stabilize its external debt, placing restrictions on imports following the slowdown of hydrocarbon exports in 1985 and the fall in hydrocarbon price in 1986.

During the same period, imports of cement and building materials fell from 4.1 million tons to 1.5 million tons, a reduction of 60%. But imports of cereals and food production rose, unaffected by the slowdown in the economy, and cereal imports exceeded 5.5 million tons in 1988 because of a poor harvest.

Since 1988, there has been a gradual resurgence in port traffic because of increases in the volume of foodstuffs, intermediate and capital goods imports and petroleum products exports.

In 1990, Algerian ports handled a total of 83 million tons of traffic, including about 67 million tons of oil products, 8 million tons of solid bulk cargo and 8 million tons of general cargo. Cereal and foodstuffs imports remained at the high level of 5 million tons and 3 million tons respectively.

As regards to exports, hydrocarbon products increased 6% and reached 64 million tons in 1990. Total export volume has been increasing by about 4% per year since 1987 and amounted to 66 million tons in 1990.

(4) Container traffic

As shown in Table 1.5.6, container traffic has not increased in the last five years as a result of the decline in general cargo imports corresponding insufficient foreign exchange and absence of appropriate facilities. It is supposed that container traffic will grow through the increase of general cargo import, provided foreign exchange conditions improve.

Table 1.5.5 Total Port Traffic by main commodity categories

(thousand metric tons)

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
(Unloaded)												
Cereals	1,805	2,193	1,874	3,009	3,312	3,742	3,611	3,719	3,857	5,544	4,992	4,910
Other agricultural products	772	210	287	404	400	393	287	240	219	211	187	291
Wood	425	674	623	648	888	780	685	547	356	599	741	665
Food products	1,891	2,118	2,384	2,624	2,638	2,644	2,625	2,751	2,813	3,072	3,110	3,233
Combustible materials	297	872	906	1,176	871	1,090	1,132	1,170	1,397	1,319	1,108	927
Petroleum products	2,990	2,873	2,320	2,180	2,313	3,887	3,074	3,183	2,951	2,803	3,086	2,587
Minerals	70	44	70	111	77	77	96	56	45	57	40	56
Metal products	1,137	1,417	1,430	1,364	1,512	1,684	1,158	1,238	761	883	1,160	995
Cement/construction materials	1,467	1,258	1,387	3,462	3,947	4,139	3,011	2,699	1,502	955	1,841	1,890
Fertilizers	156	450	353	103	140	159	285	387	319	120	146	140
Chemicals	334	436	465	427	384	496	536	434	398	401	418	331
Vehicles	402	165	328	204	234	285	220	120	93	75	115	120
Other	1,292	1,721	2,160	2,145	2,779	2,691	2,183	1,717	1,359	1,320	1,348	1,378
Total unloaded	13,038	14,431	14,567	17,786	19,495	22,067	18,972	18,241	16,081	17,359	16,292	17,623
(Loaded)												
Agricultural products	327	309	270	197	121	295	299	258	247	216	91	127
Petroleum products	54,096	45,960	44,008	48,666	52,470	53,155	53,364	54,621	56,251	58,148	60,192	64,242
Minerals	2,494	1,515	1,532	1,543	1,416	1,217	219	265	40	203	112	47
Metal products	153	192	265	209	288	327	351	314	525	538	336	314
Fertilizers	818	762	780	742	609	563	825	869	903	997	1,046	829
Chemical products	37	23	69	73	65	73	57	75	61	88	36	29
Vehicles	28	64	63	53	71	83	66	63	30	40	44	46
Other	92	175	178	102	148	198	218	216	447	280	216	229
Total loaded	58,045	49,020	47,165	51,599	55,167	55,911	55,400	56,681	58,504	60,510	62,073	65,863
Total	71,083	63,451	61,732	69,385	74,665	77,978	74,372	74,922	74,585	77,869	80,365	83,386

Source: MOT, Direction des ports

Table 1.5.6 Container cargo traffic

	1986	1987	1988	1989	1990
Cargo volume in container(TON.)	346,532	304,244	340,040	341,144	311,907
Number of container(TEU)	59,032	52,226	60,676	57,022	55,760
Number of container except empty con.(TEU)	31,782	27,429	34,865	34,021	32,150
Average volume per container(TON.)	10.9	11.1	9.76	10.2	9.7
Ratio of non empty container (%)	53.8	52.5	57.4	59.7	57.7

Source: MOT, Annual Statistics des Ports

CHAPTER 2 NATURAL CONDITIONS

2.1 Topography

Algeria, located in the northwest of the African continent and in the southwest of the Mediterranean, covers an area of approximately 2.4 millon km^2 with a coastline of nearly 1,000 km. It borders Morocco on the west, Tunisia on the east and Niger, Mail and Mauritania on the south across the Sahara Desert which accounts for almost 90% of the territory.

The coastline forms, for the most part, precipitous cliffs as the edges of the Atlas Mountains running almost parallel from east to west fall into the Mediterranean.

The project ports of Oran, Algiers and Annaba are backed by plains 15 to 30 km wide by 8 to 18 km long and are located in circular coastal zones ranging in length from 15 to 30 km. The three sites are cities representing respectively the western, central and eastern parts of Algeria.

2.2 Meteorology

2.2.1 Climate

The climate of the coastal areas of Algeria is characteristically Mediterranean and is broadly divided into the wet season and the dry season. However, the coastal area is characterized by limited rainfalls and a mild climate.

As seen form Fig. 2.2.1 and Table 2.2.1, Oran, located closer to the Moroccan border, has an average annual rainfall about 330mm, or nearly 50% of that of Algiers and Annaba, and fewer rainy days (35 days per year which experience a rainfall of 5 mm/day or more). However, Oran is very similar to the other two cities in atmospheric temperature and humidity.

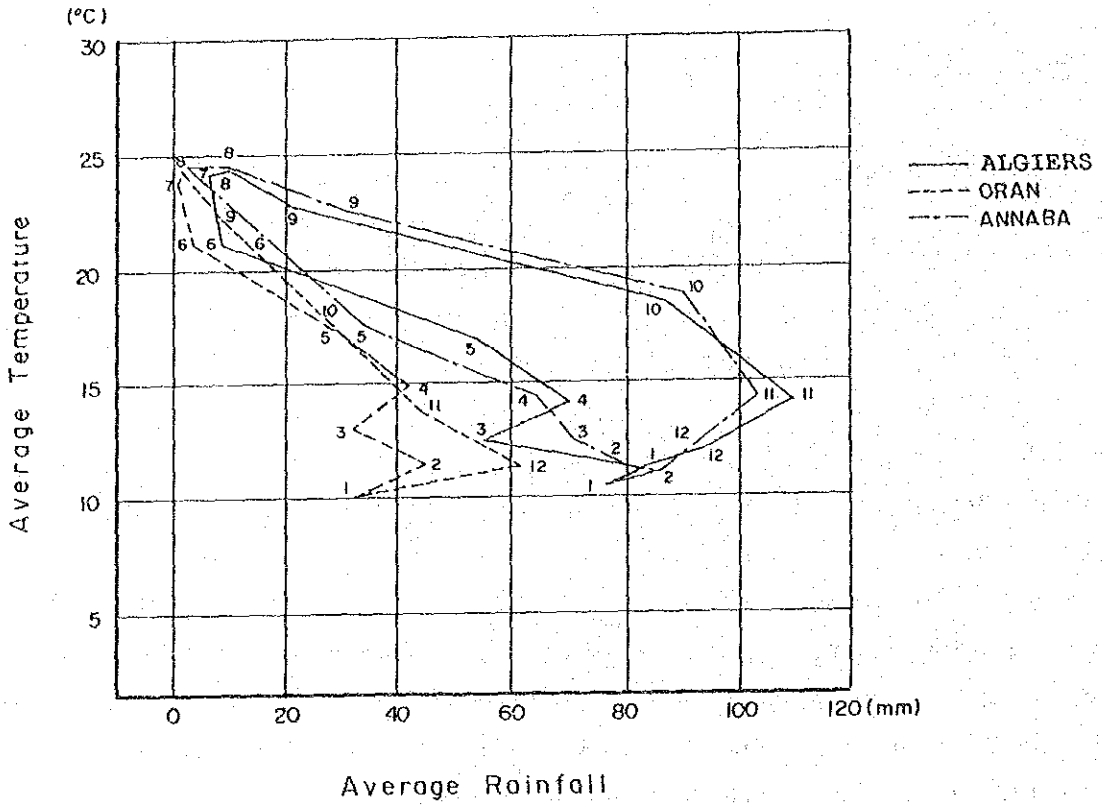


Fig. 2.2.1 Climatological Graph

Table 2.2.1 CLIMATE OF THE PROJECT AREAS

(1975-1984: 8 Time/day observation)

(Algiers: DAR-EL-BEIDA, 36.72N, 03.25E, H=24.2m)

		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	ANN
Temperature	Max.	16.5	17.1	18.6	20.0	22.6	26.9	30.6	30.7	28.8	24.8	20.3	17.6	-
(°C)	Min.	5.4	6.4	6.7	8.7	11.4	15.4	18.4	18.7	16.8	13.1	9.2	7.3	-
	Av.	10.4	11.4	12.3	14.2	16.9	21.1	24.2	24.4	22.4	18.5	14.2	12.0	-
Av. Humidity	(%)	77.1	77.7	76.1	76.5	75.3	71.7	68.7	71.3	72.2	73.9	76.9	77.0	-
Rainfall	(mm)	76	85	55	65	54	9	6	10	22	9	13	10	673
Rainy day(5mm/d>)		8	10	7	6	6	1	1	1	3	9	13	10	74
Av. wind velocity	(m/sec)	3.4	3.5	3.3	3.3	3.2	3.3	3.4	3.3	3.0	3.1	3.1	3.8	-

(Oran: ORAN-SENIA, 35.63N, 00.60W, H=90.0m)

		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	ANN
Temperature	Max.	16.5	17.5	19.2	20.7	22.7	26.9	30.1	30.6	28.6	24.7	20.2	17.5	-
(°C)	Min.	4.8	6.4	7.4	9.6	12.0	15.9	18.3	18.8	16.6	12.8	8.3	6.7	-
	Av.	10.2	11.5	13.0	14.9	17.2	21.2	23.9	24.3	22.2	18.2	13.8	11.6	-
Av. Humidity	(%)	80.3	78.7	74.0	73.2	71.8	68.8	68.0	69.7	72.6	74.4	77.9	79.9	-
Rainfall	(mm)	33	45	32	41	29	4	1	2	9	26	44	62	330
Rainy day(5mm/d>)		3	5	3	5	3	-	-	-	1	3	5	6	35
Av. wind velocity	(m/sec)	5.2	3.6	4.0	4.2	4.3	4.1	4.0	3.8	3.4	3.5	3.1	3.5	-

(Annaba: ANNABA-SALINES, 36.83N, 07.82E, H=3.0m)

		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	ANN
Temperature	Max.	16.2	16.7	18.2	19.8	23.0	26.8	30.4	30.1	28.4	24.7	20.0	17.5	-
(°C)	Min.	6.9	7.1	7.6	9.3	12.3	15.8	18.3	19.2	17.4	13.9	10.3	7.7	-
	Av.	11.0	11.4	12.5	14.3	17.6	21.4	24.4	24.6	22.6	18.9	14.6	12.1	-
Av. Humidity	(%)	76.5	77.8	76.8	75.6	75.0	72.1	68.9	72.4	72.6	74.1	77.5	76.6	-
Rainfall	(mm)	87	77	71	64	34	17	3	10	31	90	113	91	688
Rainy day(5mm/d>)		10	9	8	6	4	2	-	1	3	9	12	10	74
Av. wind velocity	(m/sec)	3.5	3.2	3.2	3.2	3.0	3.3	3.3	3.5	3.2	2.9	3.1	3.4	-

2.2.2 Wind

Figs 2.2.2 and 2.2.3 and Tables 2.2.2 through 2.2.4 present the results of analyses of the wind observation records (accuracy: 8-daily observation) covering Algiers, Oran and Annaba for the 1986-1990 period and available from the weather stations of the three cities.

(1) Frequency of Occurence of Wind Direction

The frequency of occurence of wind direction at the three project ports varies depending on the wet or dry season typical of the Mediterranean climate characteristics and on the local topographic features. Generally, however, winds from WSW prevail during the wet season (October to March), while N winds predominate.

1) Algiers Area

The frequency of occurrence is 64.7% with winds from the WSW, SW and W directions predominant during the wet season and from the ENE, NE and E directions prevailing during the dry season. The WSW, SW and W winds occur with a frequency of 14.26%, while a frequency of 9.8% has been obtained for the ENE, NE and E winds.

In terms of the wind scale, winds below 4 m/sec occur with a frequency of 34%, those ranging form 5 to 9 m/sec with 26.2%, those ranging from 10 to 14 m/sec with 2.3% and those of 15 m/sec and over with a frequency of 0.1%. Winds having directions which are substantially the same as the overall frequency of wind directions prevail, but W and WSW winds tend to be increasingly predominant with an increase in wind velocity.

2) Oran Area

The wind frequecy is 94.7% with WSW, SW and W winds and N winds prevailing. The frequency of occurrence of the former group is 33.8% against 17.0% for the N winds.

By the wind scale, winds below 4 m/sec occur with a frequency of 54.3% followed by those of 5 to 9 m/sec with 31.6%, those of 10 to 14 m/sec with

4.7% and those above 15 m/sec with 0.5% WSW and N winds tend to occur with a higher frequency as wind velocity increases.

3) Annaba Area

The wind frequency is 74.4% with WSW, SW and W winds prevalent during the wet season and NNE, N and NE winds predominant during the dry season. The frequency of occurrence is 19.4% for the former group of winds and 11.5% for the latter group. In terms of the wind scale, winds below 4 m/sec occur with a frequency of 32.9% followes by those of 5 to 9 m/sec with 32.8%, those of 10 to 14 m/sec with 4.5% and those of 15 m/sec and over with 0.3%. NNE and W winds tend to be predominant with an increase in wind velocity.

(2) Frequency of Strong Wind

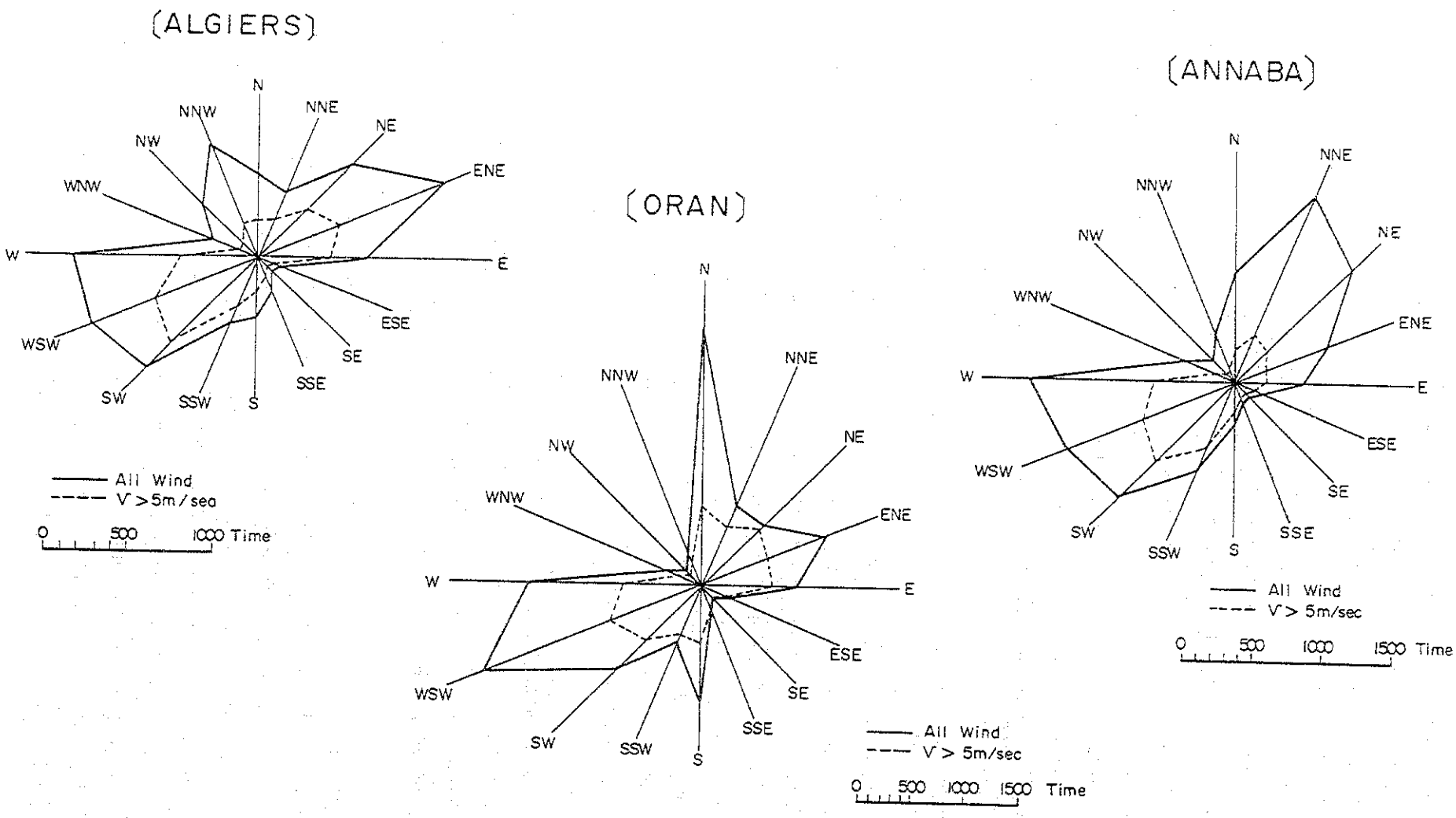
Generally, winds of 10 m/sec or more in velocity which may hamper the arrival and departure and loading and unloading of ships, are called strong winds. Analyses are often undertaken to determine the frequncy of strong winds and their possible impacts on port activities and ship movements.

Field observation records of strong winds (10 m/sec or more) in the three ports of Algiers, Oran and Annaba obtained from the local weather stations have been analyzed with the results presented on Figs. 2.2.3 and Table 2.2.2.

The field data of the port of Algiers indicate that strong winds occurred a total of 264 times during the 1986-1990 period (frequency of occurrence 1.8%). The prevailing winds came from the directions WNW to WSW and ENE with the frequency of 48.1% for the former wind group and 14.4% for the latter.

In the port of Oran, strong winds occurred a total of 539 times (frequency of occurrence 3.7%) during the same five-year period. W to WSW winds prevailed with a frequency of 77.4%.

In the port of Annaba, N to NNE strong winds were prevalent and occurred with a total of 495 times (frequency of occurrence 3.4%) during the same 5-year period, the prevailing winds were N-NNE winds, with a frequency of 44.6% and W winds with 11.3%.



Note ; 1986~1990 8Time/day Observed

Fig. 2.2.2 Wind Roses

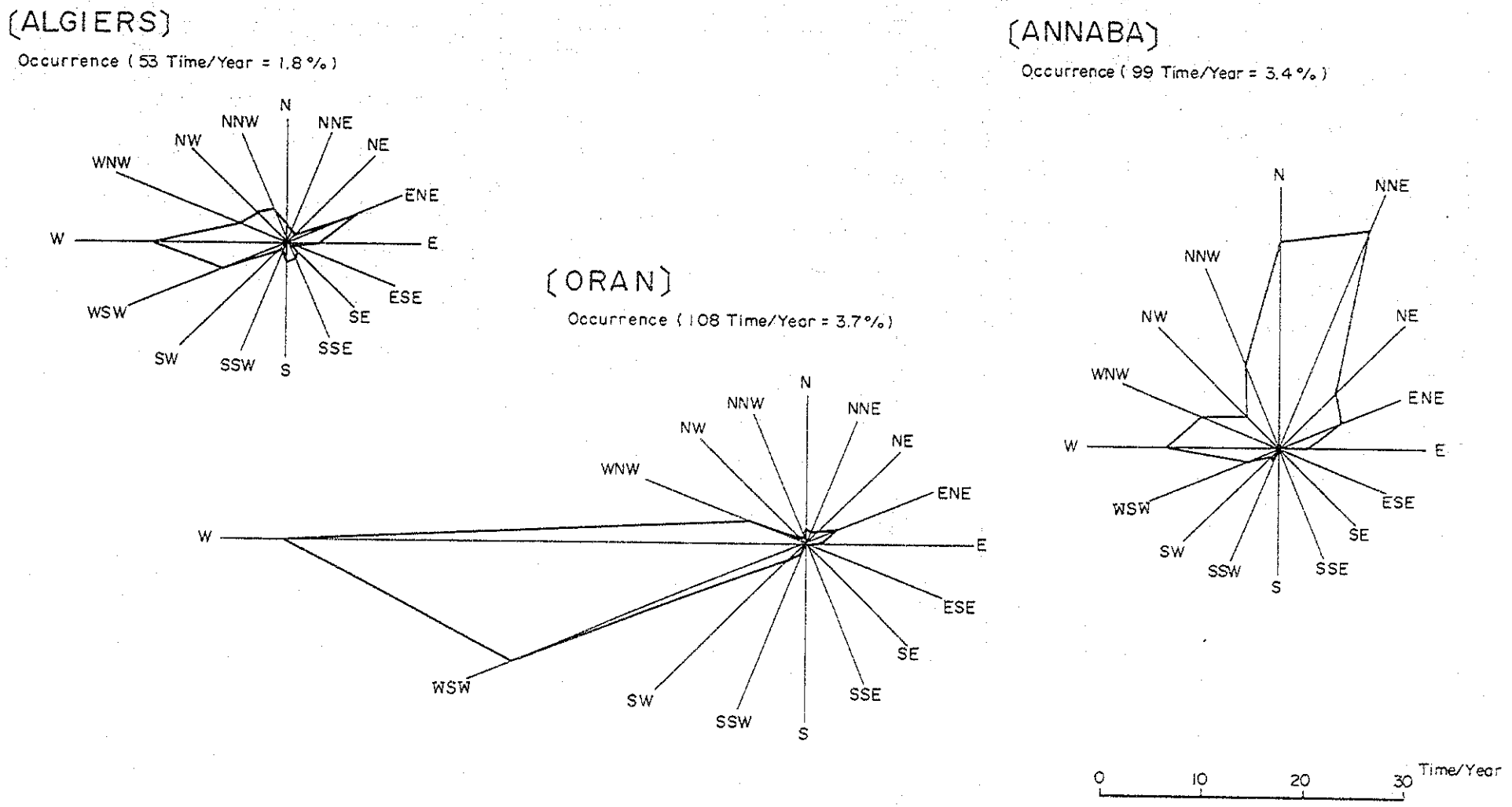


Fig. 2.2.3 Prevailing Wind Roses (V>10m/sec)

Table 2.2.2 FREQUENCY OF STRONG WIND (10m/sec or more)
(1986-1990: 8 Time/day observation)

(Algiers) (Unit: Time)

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Total
Jan.								2	1	1	2	9	18	2	1		36
Feb.	1			2	5		1				2	12	19	5	2		42
Mar.	1											1	5	8	8	3	33
Apr.								3	1			2	11	4	1		22
May			1	8	4										1	3	17
Jun.	1	1		10	1								1	2	1	1	19
Jul.			1	8	1									1	1	1	13
Aug.			4	7	3											2	16
Sep.				1			1						1		1		4
Oct.								3	4	1			2			1	11
Nov.				2	2				3			4	1	1	1		14
Dec.	7	2									1	7	9	2	4	7	39
Total	10	3	6	38	16		2	8	9	2	5	35	67	25	21	18	264

(Oran) (Unit: Time)

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Total
Jan.									1	1	2	27	39	3			73
Feb.											3	39	52	7	1		102
Mar.	3	1	1	3	3						4	11	24	2		2	54
Apr.	2			1							1	32	66	7			109
May	7	1	2	5						1	2	3	11	2		2	36
Jun.	9	1	3	4	1						1	8	9			1	37
Jul.	5			3	1							3	3				15
Aug.	4				2							3	6	1			16
Sep.	3	2										1	2	1			9
Oct.				1							1	9	17		1		29
Nov.										1		9	15	2			27
Dec.											1	12	16	3			32
Total	33	5	6	17	7				1	3	15	157	260	28	2	5	539

(Annaba) (Unit:Time)

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Total
Jan.	3	3	2								1	4	13	7	7	5	45
Feb.	3	3								3	1		7	7	2	4	30
Mar.					2	1				1		1	10	12	4	1	32
Apr.	2	4		4				2	1	1	2	3	12	5	2	6	44
May	11	8	2	5	1								2	2		2	33
Jun.	20	19	3										1	1		4	48
Jul.	23	29	11	3	3								3	1		10	83
Aug.	9	19	15	12	1												56
Sep.	13	11	5	6	2										1		38
Oct.	1	2		1									1				5
Nov.	5	4			3							3		2	1	4	22
Dec.	14	15	1	1								6	7	5	3	7	59
Total	104	117	39	32	12	1		2	1	5	4	17	56	42	20	43	495

(3) Abnormal Weather

In the Mediterranean areas strong winds accompanied by rain often sweep for an extended period when a high atmospheric pressure overhangs or an atmospheric depression passes.

For the purpose of this study an investigation has been undertaken to determine the frequency of occurrence of strong winds of long duration their maximum velocity and characteristics of rainfall accompanying such winds (rain internsity of 5 mm/hr or more or amount of rain of 30 mm/day or more). The investigation results are presented in Tables 2.2.3 and 2.2.4.

From the tables it is seen that the number of days when strong winds swept for 12 hours or more, averages 5 days for the Algiers area, 11 days for the Oran area and 7 days for the Annaba area. Rain brought by strong winds fell during an average of 2 days per year in the Algiers and Oran areas and during an average of one day per year in the Annaba area.

In case of strong winds, the maximum wind speed during the 1981-1990 was 39 m/sec from the W direction in Algiers and Oran and 33 m/sec from the same wind direction in Annaba.

Table 2.2.5 gives information on spells of abnormal weather experienced in Algeria during the period from 1898 to 1989.

Table 2.2.3 INCIDIDENCE OF EXEPCIONAL WEATHER

[No. of Days of Strong Wind] (Unit: day)

	Algiers		Oran		Annaba	
	A	B	A	B	A	B
1986	9	16	15	30	5	15
1987	7	12	11	28	9	18
1988	2	12	10	13	11	17
1989	6	8	13	26	3	9
1990	3	10	8	16	6	11
Total	27	58	57	113	34	70
Average	5.4	11.6	11.4	22.6	6.8	14.0

Note: A: No. of days when winds above 9-10 m/sec blew for over 12 hours continuously.
B: No. of days when winds above 9-10 m/sec blew for over 9 hours continuously.

[No. of Days of Heavy Rain] (Unit: day)

	Algiers		Oran		Annaba	
	A	B	A	B	A	B
1986	3	4	1	1	1	2(1)
1987	3	3	3	1		
1988	4(1)	2(1)	2	2	2(1)	1(1)
1989		1	2(1)	2(1)	1(1)	2(1)
1990	2	1	4	2		1
Total	12(1)	11(1)	12(1)	7(1)	4(2)	6(3)
Average	2.4	2.2	2.4	1.4	0.8	1.2

Note: A: No. of days of rainfall of 5 mm/hr or more.
B: No. of days of daily rainfall of 30 mm/day or more.

Figures in brackets denote those already included and indicate the number of days when strong winds and heavy rain occurred simultaneously.

Table 2.2.4 MONTHLY OCCURRENCE OF MAXIMUM WIND SPEED

(Unit: m/sec)

		Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Max.
ALGIERS	1986	WSW	S	SW	SSE	ESE	ESE	WNW	ESE	ESE	SSE	S	NW	S
		27	34	32	25	19	19	18	23	16	24	19	23	34
	1987	W	W	WNW	WNW	WNW	ESE	ESE	SE	W	S	W	WNW	W
		37	34	28	17	16	19	16	18	17	20	21	20	34
	1988	WNW	NW	N	W	N	SSE	WNW	ESE	N	W	E	W	N
		26	21	28	19	16	20	17	14	20	20	17	21	28
	1989	W	W	SSW	W	W	ESE	NW	NNE	ESE	E	NW	W	W
		17	25	18	39	16	16	13	17	21	16	18	19	39
	1990	S	W	E	W	N	NNW	E	ESE	WSW	W	W	W	W
		17	22	18	19	15	18	19	21	21	24	20	27	27
ORAN	1986	W	W	WSW	W	NE	ESE	W	ESE	NNE	SW	W	W	W
		33	29	26	23	24	19	21	17	17	24	24	19	33
	1987	W	W	WSW	E	WNW	W	W	SSE	W	W	WSW	WSW	W
		38	27	24	25	19	22	28	24	27	29	27	31	38
	1988	W	NNW	WSW	W	W	W	WSW	N	NW	WSW	W	W	NW
		31	16	24	25	24	19	20	14	35	18	31	25	35
	1989	W	W	N	W	W	W	WSW	SSW	WSW	ESE	SSE	W	NW
		14	34	21	28	18	21	19	32	23	16	22	24	34
	1990	SW	WSW	E	W	WSW	W	N	ESE	SW	W	WSW	WNW	WNW
		19	22	21	20	15	21	19	17	25	23	20	28	28
ANNABA	1986	NW	SSW	SW	W	NNW	NNW	W	NNE	NNE	WSW	N	N	SSW
		20	28	22	21	18	18	20	18	7	22	21	25	28
	1987	WSW	WNW	WNW	SSW	NNW	NNE	NNE	NNE	NNW	W	W	SW	W
		26	23	21	25	19	16	20	19	20	33	24	24	33
	1988	NNW	NW	NW	S	NNE	SW	ESE	N	NNW	NNE	WSW	NNE	E
		30	25	32	23	19	32	18	15	27	13	31	23	32
	1989	NNW	NW	NW	SW	WNW	N	SSW	NNE	W	W	WNW	ESE	SW
		20	25	18	28	20	15	20	17	14	17	15	18	28
	1990	W	W	W	WNW	N	NNE	W	N	N	W	NNW	N	W
		19	25	21	20	19	17	24	15	15	27	25	21	27

Table 2.2.5 SITUATIONS METEOROLOGIQUES EXCEPTIONNELLES EN ALGERIE

1898: Tempete le 6 Mars (aucun renseignement)

1930: Tempete le 18 December (Breches dans les jetees des ports)

1931: Tempete le 12 et 13 Decembere
(ANNABA PORT: Jetee BOUCLIER, SEYBOUSE, LION endommag)

1934: Tempete le 3 Fevrier en Mediterranee
(Houle: Amplitude de 6 a 10 m)

1948: Tempete le 28 et 29 Fevrier
(ANNABA PORT: Jetee SUD endommagee)

1954: Tempete le 2 Fevrier (ANNABA PORT)

1954: Tempete le 14 Avril (Force 10) Nombreux degats)

1957: Pluies et Crues en Novembre
(KABYLIE: Crues Oueds ISSER, SEBAOU, SAHEL, SOUMMAM)

1957: Pluies et Crues en Novembre
(Routes Alger-Constantine, Tizi-ouzou, Blida, Lakhada)

1957: Pluies et Crues en Novembre
(SKIKDA: Ponts detruits, Cultures devastees, Aerodrome)

1957: Pluies et Cruer en Novembre
(ANNABA: Crues Oued MEDJERDA, SEYBOUSE)

1957: Pluies et Crues en Novembre
(GUELMAA: Crue Oued MELLAH)

1958: Tempete le 17 Janvier
(ANNABA PORT: Jetee SUD et LION endommagees)

1958: Pluies et Crues en Janvier au SAHARA
Septentrional Algerien

1959: Puies et Crues le 20 Mars SUD ORANAIS
(Oueds en crue, pont detruit, Noyades)

1961: Tempete le 4 Novembre en Mediterranee
(SKIKDA PORT: Mer tres forte, Degats/bateau)
(ANNABA: Jetee du Port inondee)

1967: Tempete le 11 et 12 Decembre Vent Violent et Pluie
(Port d'Alger)

1969: Pluies Septembree/Octobre (M'GHAIER, BISKRA, AURES, MEDEA, CONSTANTINE) (50 morts, 50 blesses, 50000 sinistres, cheptel detruit)

1973: Pluies Fin MARS (CONSTANTINE, ANNABA, TLEMCEN, SAIDA)
(20 morts, 20000 sinistres, maisons detruites,)

1974: Pluies Fin MARS (TIZI OUZOU, TLEMCEN, MEDEA, CHLEF, SETIF, AURES) (45 morts, plusieurs dizaines de blesses, des milliers de sinistres support d'energie electrique detruits, routes, ponts, hydraulique detruits ou endommages. (ex TIZI OUZOU 2,5 milliards de degats)

1975: Pluies 18 au 25 Avril (Ouest Algerie et Nord SABURA)
(De nombreux degats)

1980: Tempete, au Port d' ORAN, ARZEW (Degats importants)

1981: Pluie a EL EULMA Sept

1984: Pluies du 9 au 12 novembre a l'QUEST (Crues Oueds El Milli, (Oued BARKACHE, SENANE) 50 Personnes disparues, 110 familles sinistrees.

1987: Pluies Novembere BECHAR (Effondrement habitations)
Pluies Janv, Fev, Mar JIJEL (superficies du cultures detruites)
Vent Fev AIN SEFRA (Palmiers, serres, Poteaux elec detruits)
Pluie et Vent ANNABA (Grues emportees, Perturb Port)
Vent Fev, Mar BISKRA (Serres detruites)
Vent Janv TIPAZA (Cultures de plein champs et plast. detruites)

1989: Tempete au Port de Skikda (Fevrier)

2.2.3 Rainfall

(1) Amount of Rainfall

Similar rainfall patterns were observed between the Algiers and Annaba areas. The average annual rainfall is approximately 680 mm and the monthly rainfall during the wet season (October to March) averages approximately 90 mm. The maximum rainfall of 110 mm has been recorded in November.

In the Oran area, the average annual rainfall is 330 mm, or nearly 50% of that of Algiers and Annaba, while the monthly average rainfall remains almost constant at 40 mm. During the dry season, the three project sites suffer from an acute shortage of rain with the monthly average rainfall of less than 10 mm.

(2) Intensity of Rainfall

From weather observation data covering the three project sites for the period 1986-1990, the maximum hourly rainfall figures for the respective years were extracted to estimate the probable rainfall per hour for different return periods. The estimation results are presented in Table 2.2.6 and 2.2.7. In the tables, the rainfall intensity for the 50 years return period is 26 mm/hr for the Algiers area, 22 mm/hr for the Oran area and 9 mm/hr for the Annaba area.

Table 2.2.6 ANNUAL MAXIMUM RAINFALL PER HOUR

(Unit: mm/hr)

	Algiers	Oran	Annaba
1986	18.4	6.4	6.9
1987	14.1	9.3	3.8
1988	6.8	6.8	6.7
1989	4.4	8.4	6.4
1990	11.5	15.0	4.1

Note: Compiled from local weather station data

Table 2.2.7 PROBABLE HOURLY RAINFALL

(Unit: mm/hr)

Return Period	Algiers	Oran	Annaba
50 years	23.5	22.4	9.1
30 "	23.7	19.6	8.6
20 "	22.2	17.5	8.3
15 "	21.1	16.0	8.0
10 "	19.4	14.1	7.6
5 "	16.1	11.0	6.8

2.3 Marine Conditions

2.3.1 Tide

At the project ports of Algiers, Oran and Annaba, long-term tide observations have not been carried out and harmonic analysis of tidal components based on field data have not been undertaken. For this reason, detailed tidal information on the three ports is not available.

This section gives an overview of the tide conditions of the project ports based on an analysis of some existing data.

According to the MEDITERRANEAN PILOT (1978), the general tidal raange for the entire Algerian waters is about 0.30 m. The tides in the Port of Annaba are as shown in Fig. 2.3.1. The mean tide for a given period during the field survey by the JICA Team (39 days from October 16, 1991 to December 4; observation accuracy = Observations made four times a day at 08.00 hr, 10.00 hr, 12.00 hr, 14.00 hr and 16.00 hr) was approximately 0.20 m and the maximum value of the tidal range (difference between HWL and LWL) was 0.45 m.

For the tides of the Ports of Algiers and Oran, the value of NGA = +0.34 ZH has been adopted as in the case of the Port of Annaba.

(Unit: m)

H.H.W.L	+ 1.14 NGA: (Highest High Water Level)
D.H.W.L	+ 0.84 NGA: (Depression High Water Level)
H.W.L	+ 0.34 NGA: (High Water Level)
M.W.L	+- 0.00 NGA:(Mean Water Level)
L.W.L	- 0.34 NGA: (Low Water Level)
A.L.W.L	- 0.44 NGA: (Anticyclone Low Water Level)
L.L.W.L	- 0.74 NGA: (Lowest Low Level)

Fig. 2.3.1 TIDES IN THE PORT OF ANNABA

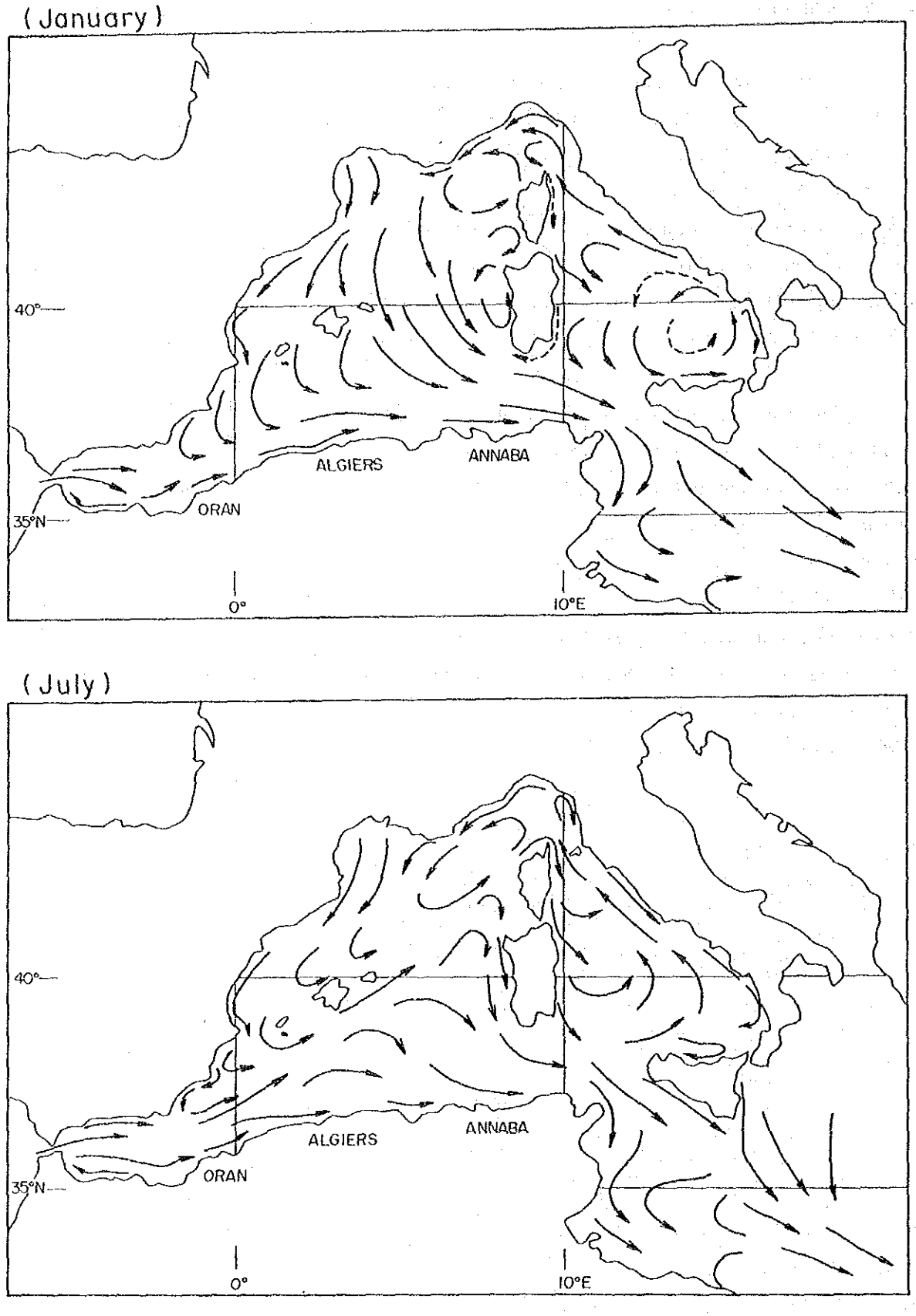
2.3.2 Current

The main current in the Algerian waters is an eastward current as illustrated in Fig. 2.3.2. The currents speed is reported as 1/4 knot in slow-moving areas and 3/4 knot in fast-moving areas.

In the sea areas adjacent to the Port of Annaba, off-shore currents travel at a speed of 1 to 2.5 knots as seen from Fig. 2.3.2' and weak currents branching off from the currents are moving in the vicinity of the harbor entrance.

Off-shore from the Port of Arzew located close to Oran, currents have been observed moving at an average speed of 1 knot and a maximum speed of 3 knots. In the neighborhood of the harbor entrance, a counter current is observed to move at a very low speed equivalent to less than 1/5 of the off-shore current speed.

The currents in the vicinity of the entrances to the three project ports are presumed from the topography of the areas to have branched off form the off-shore currents. For this reason, the entrance currents have a very low speed and are considered unlikely to the an obstacle to incoming and outgoing vessels.



Source ; MEDITERRANEN PILOT (1978)

Fig. 2.3.2 Ocean Current of the South West Mediterraneam Sea

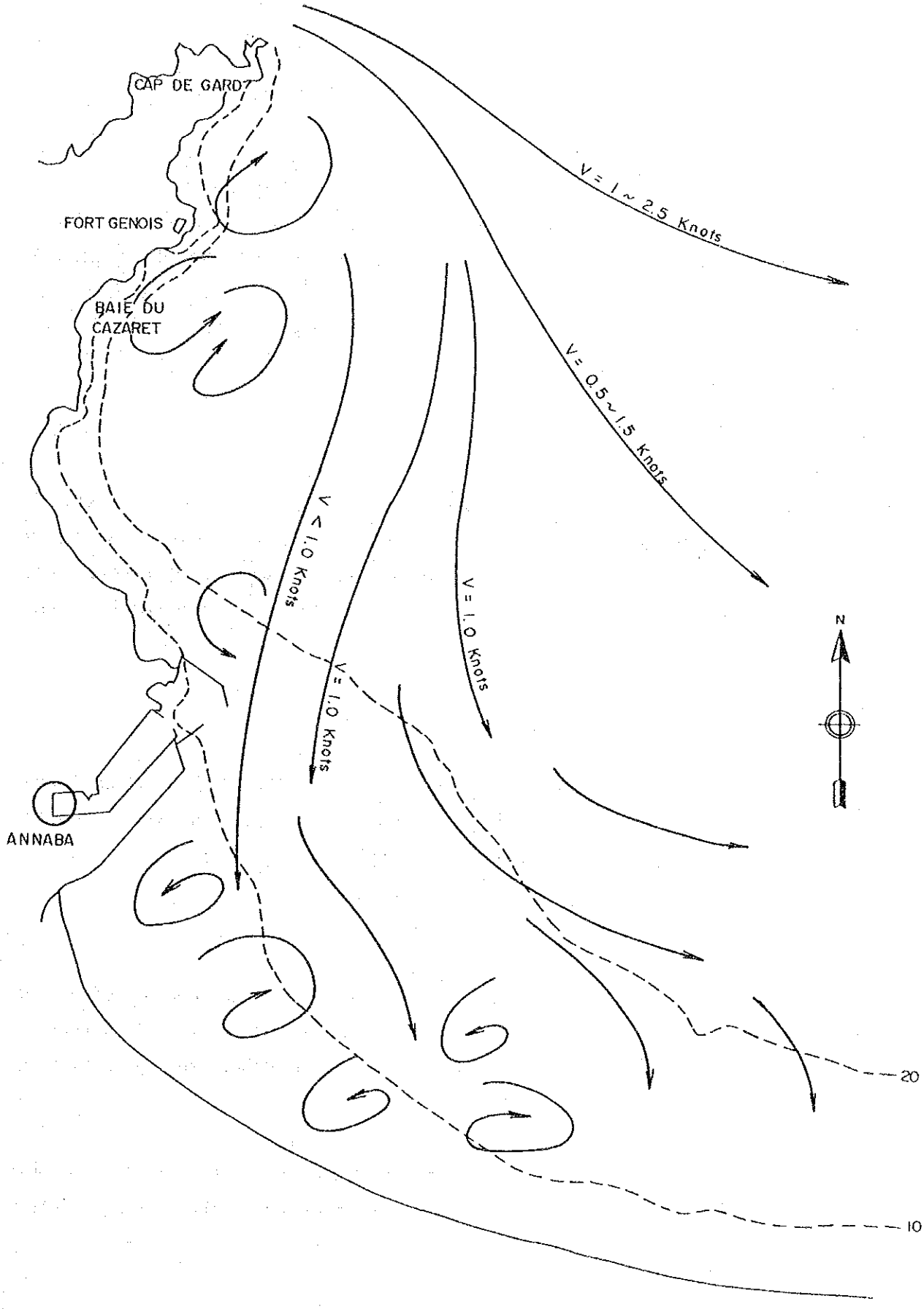


Fig. 2.3.3 Coastal Current of the Port of Annaba

2.3.3 Wave

(1) Frequency of Wave Occurence

1) Wave Characteristics of Offshore Areas

Figs. 2.3.3 to 2.3.5 and Tables 2.3.1 to 2.3.3 present the results of our analysis of deepwater waves in the areas nearly 50 km off the three project ports. These figures and tables have been prepared on the basis of U.S. Navy materials compiled from visual observation reports from ships sailing in the Mediterranean during the 1963-1970 period.

(i) Algiers Sea Area

The frequency of occurrence of wave heights above 0.5 m is 58.4%, of which 17.2% represents wave heights of 2 m or more. The period of relatively high waves is approximately 7 sec, but swell-like waves are also observed. The direction of advance of waves is similar to that in which strong winds blow and W and NE waves prevail.

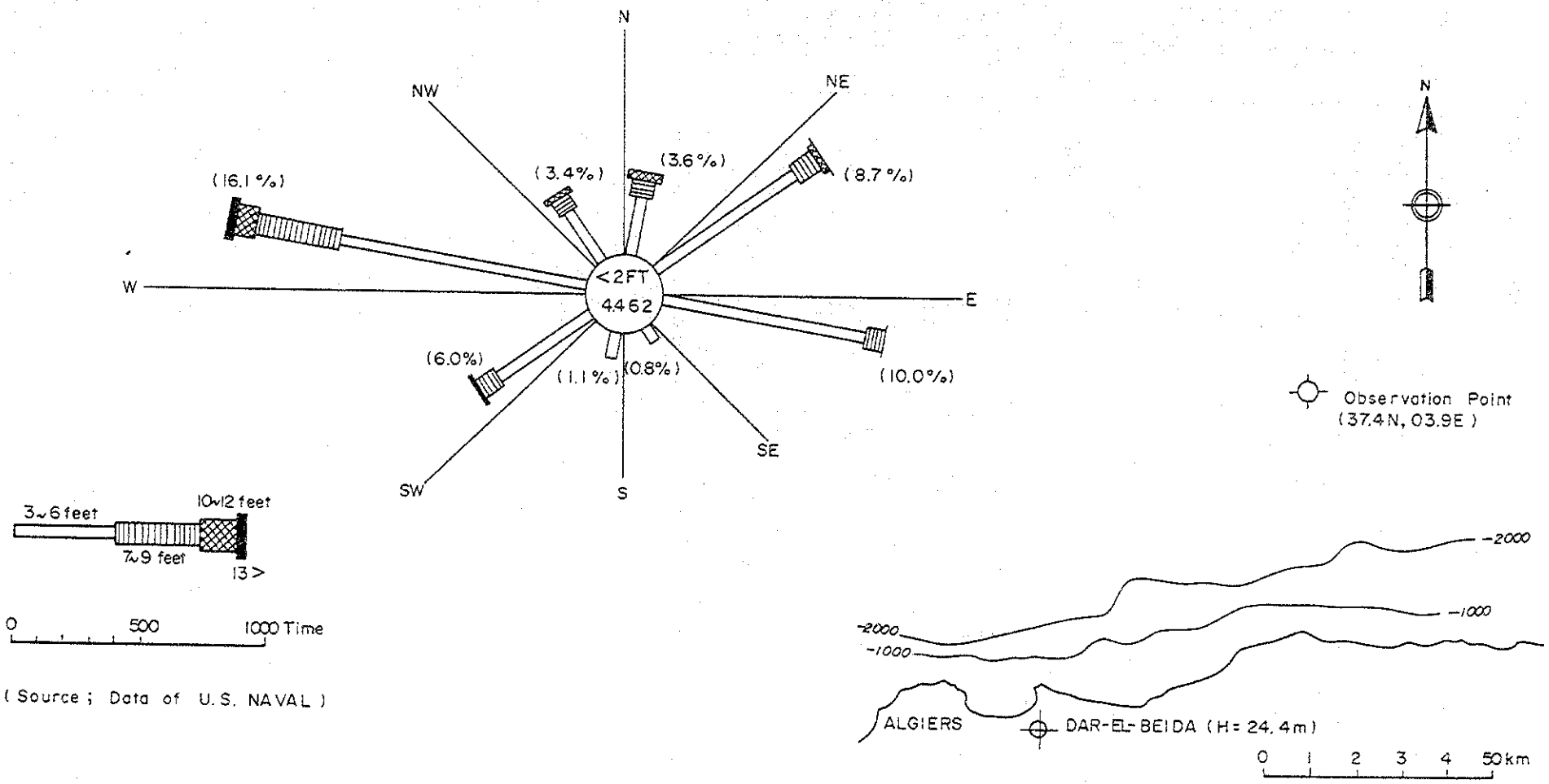
(ii) Oran Sea Area

Wave heights above 0.5 m occurs at a frequency of 60.6%, of which 15.4% represent those above 2 m. Relatively approximately 7 sec and there can be observed slightly more swell-like waves than in the Algier waters.

(iii) Annaba Sea Area

Wave heights above 0.5 m occur with a frequency of 60.9%, of which 21.1% represents those greater than 2 m. Most of the waves have a period of about 7 sec, but swell-like waves tend to occur with a higher frequency than in the other two sea areas.

There can be seen any correlation between wave directions and the frequency of strong winds, and waves from the W direction having a longer fetch prevail.



(Source ; Data of U.S. NAVAL)

Fig. 2.3.3 Off-shore Wave Rose of the Algiers Area

Table 2.3.1 WAVE CHARACTERISTICS IN ALGIES AREA

(Unit: %, Times)

H(feet) T(sec)	<2	3-6	7-9	10-12	13-19	20-25	26<	Total
<6	26.0	24.6	2.6	0.4	0.1			53.8
6-7	2.0	13.1	5.4	1.1	0.3	0.1		22.0
8-9	0.4	2.7	3.1	1.0	0.3	-	-	7.6
10-11	-	0.5	0.9	0.6	0.2	-		2.5
12-13	-	0.2	0.2	0.2	-	-		0.7
>13	-	-	-	-	-	-	-	0.2
INDET	13.1	0.1	-	-				13.2
Total	41.6	41.2	12.1	3.5	1.3	0.3	-	100
Annual Total	4491	4450	1308	370	145	27	2	10,793
January	322	348	141	37	32	5		885
February	327	303	135	56	25	7		853
March	319	440	145	39	25	3		973
April	335	392	125	37	12			901
May	544	356	61	12	6	2		981
June	414	409	66	7	4			900
July	394	385	81	10	1			871
August	443	405	76	12	1	1		938
September	403	397	56	13	1			870
October	371	398	120	36	12	2		939
November	325	323	124	55	14	4		845
December	294	299	173	56	12	3		837

Source: U.S NAVAL Data (Observation Point: 37.4N, 0.3 9E)

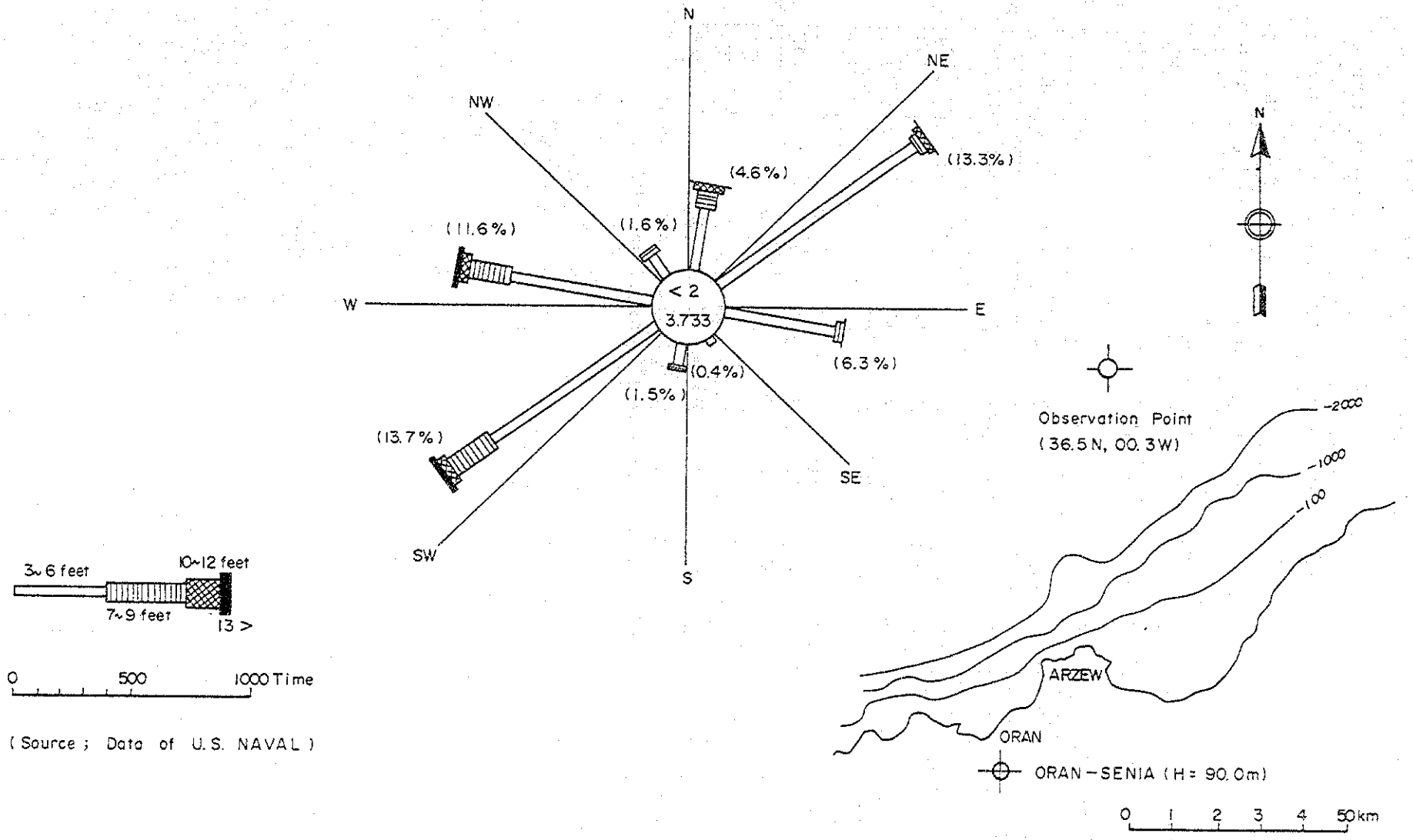


Fig. 2.3.4 Off-shore Wave Rose of the Oran Area

Tale 2.3.2 WAVE CHARACTERISTICS IN ORAN AREA

(Unit: %, Times)

H(feet) T(sec)	<2	3-6	7-9	10-12	13-19	20-25	26<	Total
<6	26.9	28.6	2.9	0.4	0.1			58.8
6-7	1.7	13.2	5.5	0.9	0.2	0.1		21.7
8-9	0.3	2.6	2.5	0.8	0.2	-	-	6.6
10-11	0.2	0.6	0.6	0.3	0.3	-		1.9
12-13	-	0.2	0.1	0.2	0.2	-	-	0.6
>13	-	-	-	-	-	-		0.1
INDET	10.2	0.1	-					10.3
Total	39.4	45.2	11.5	2.7	1.0	0.2	-	100
Annual Total	3617	4149	1060	249	92	15	2	9,184
January	278	316	105	32	24	8	2	765
February	294	285	117	41	16			753
March	248	408	127	33	13	2		831
April	319	374	105	22	6			826
May	349	393	56	9	4			811
June	332	330	64	7	1			734
July	301	365	67	6	3			742
August	346	357	47	6	1			757
September	297	343	66	16	4			726
October	265	383	121	23	8	3		803
November	320	280	75	29	3	2		709
December	268	315	108	25	9			725

Source: U.A NAVAL Data (Observation Point: 36.5N, 00.3W)

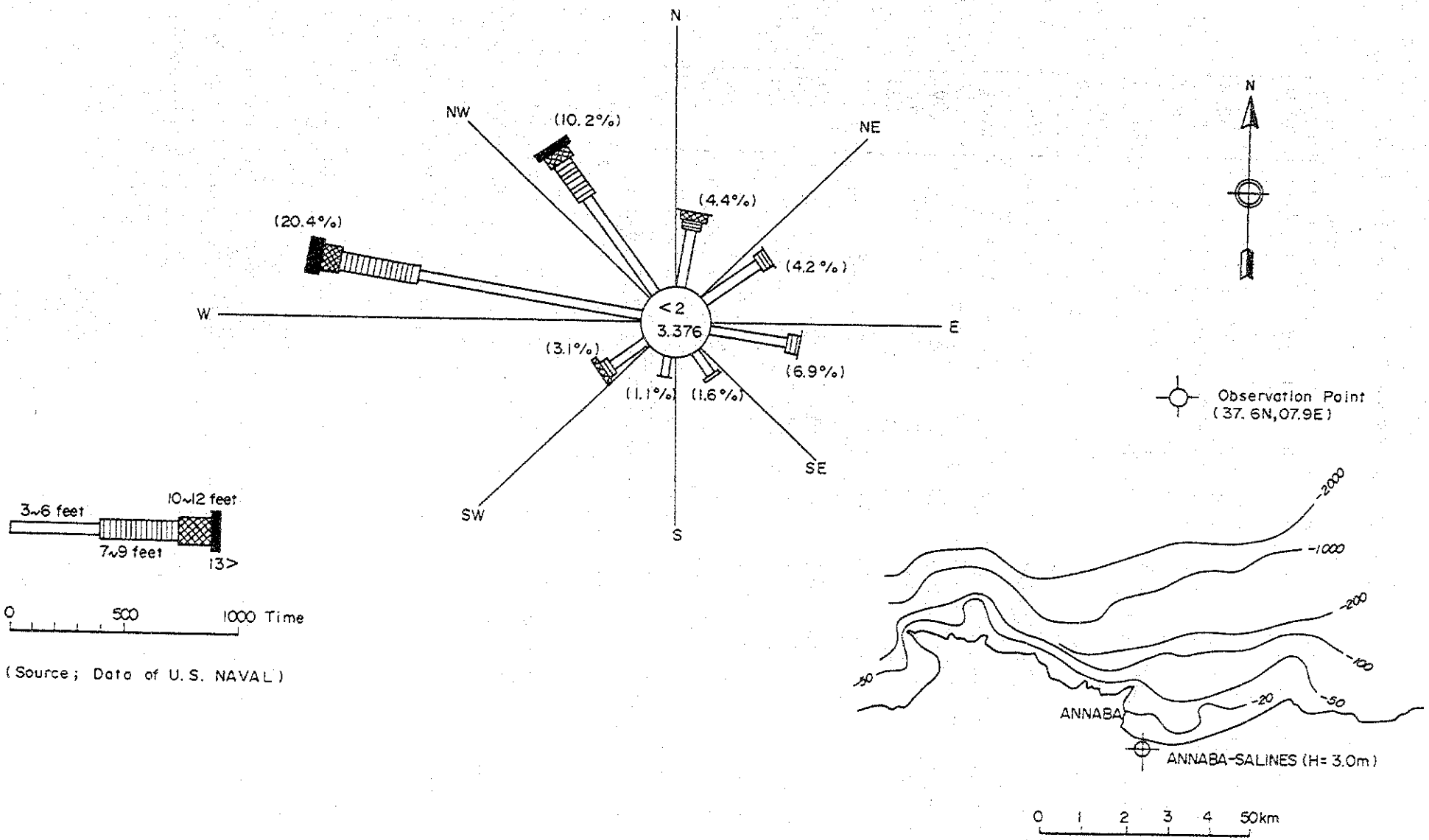


Fig. 2.3.5 Off-shore Wave Rose of the Annaba Area

Table 2.3.3 WAVE CHARACTERISTICS IN ANNABA PORT

(Unit: %, Times)

H(feet) T(sec)	<2	3-6	7-9	10-12	13-19	20-25	26<	Total
<6	25.1		23.6	3.0	0.4	0.3		52.4
6-7	1.7	12.7	5.7	1.2	0.3	-		21.7
8-9	0.2	2.6	3.9	1.4	0.6	0.1	-	8.9
10-11	0.1	0.6	1.1	0.7	0.8	-	-	3.4
12-13	-	0.2	0.3	0.3	0.1	-	-	1.2
>13	-	-	0.1	-	-	-	-	0.4
INDET	11.8	0.1	-	-				12.0
Total	39.1	39.8	14.1	4.3	2.2	0.3	0.1	100
Annual Total	3655	3721	1320	398	202	32	12	9,340
January	275	270	156	57	35	8	1	802
February	258	261	134	55	35	7	7	757
March	240	341	164	54	29	4	2	834
April	236	385	136	41	16	3		817
May	406	327	66	19	4			822
June	373	285	77	13	2			750
July	357	318	69	4	2			750
August	385	326	69	9	2			791
September	386	325	62	10	3			786
October	295	338	102	27	19	1		782
November	243	298	136	38	29	2		746
December	201	247	149	61	33	7	2	709

Source: U.S NAVAL Data (Observation Point: 37.6N, 07.9E)

2) Characteristics of In-shore Waves Attacking Project Sites

In planning the expansion of the three Project ports of Algiers, Oran and Annaba all of which have a steep seabed, it is necessary to build a breakwater so as to secure a certain degree of calmness for the harbor basins and approach channels to shelter them from oncoming waves.

For determining an appropriate breakwater length, it is prerequisite to undertake an in-depth analysis of the wave characteristics.

Analysis was made of the frequency of occurrence of N to E waves considered to affect the calmness of the harbor basins by invading them through the entrances of the project ports. The analytical results are presented in Fig. 2.3.6.

For estimating the frequency of wave occurrence by direction, the topography was considered and an analysis was made of the speed of winds sweeping the sea and thereby generating waves.

The characteristics of the waves attacking the project ports are as follows:

[1] Port o Algiers

N to E waves of 0.5 m or more in height attacking the entrance of the Port of Algiers have a frequency of 6.1% and ENE directions prevail. The frequency of occurrence of waves of 1.0 m or more in height is only 1.0% and N to NE waves are prevalent, but NE waves occur with a slightly higher frequency.

[2] Port of Oran

In the Port of Oran, N to E waves occur with a frequency of 11.3% and the N waves account for a majority of the waves. NNE to E waves represent a minimal percentage.

[3] Port of Annaba

In the Port of Annaba, the N-E waves occur with a frequency of 17.5% and high waves above 1.0 m have a frequency of 8.7%, a higher value than in the other two project ports.

In terms of the direction of advance, the waves coming from the NNE direction are slightly more prevailing than waves from other directions, but in the entire N to ENE range high waves are observed.

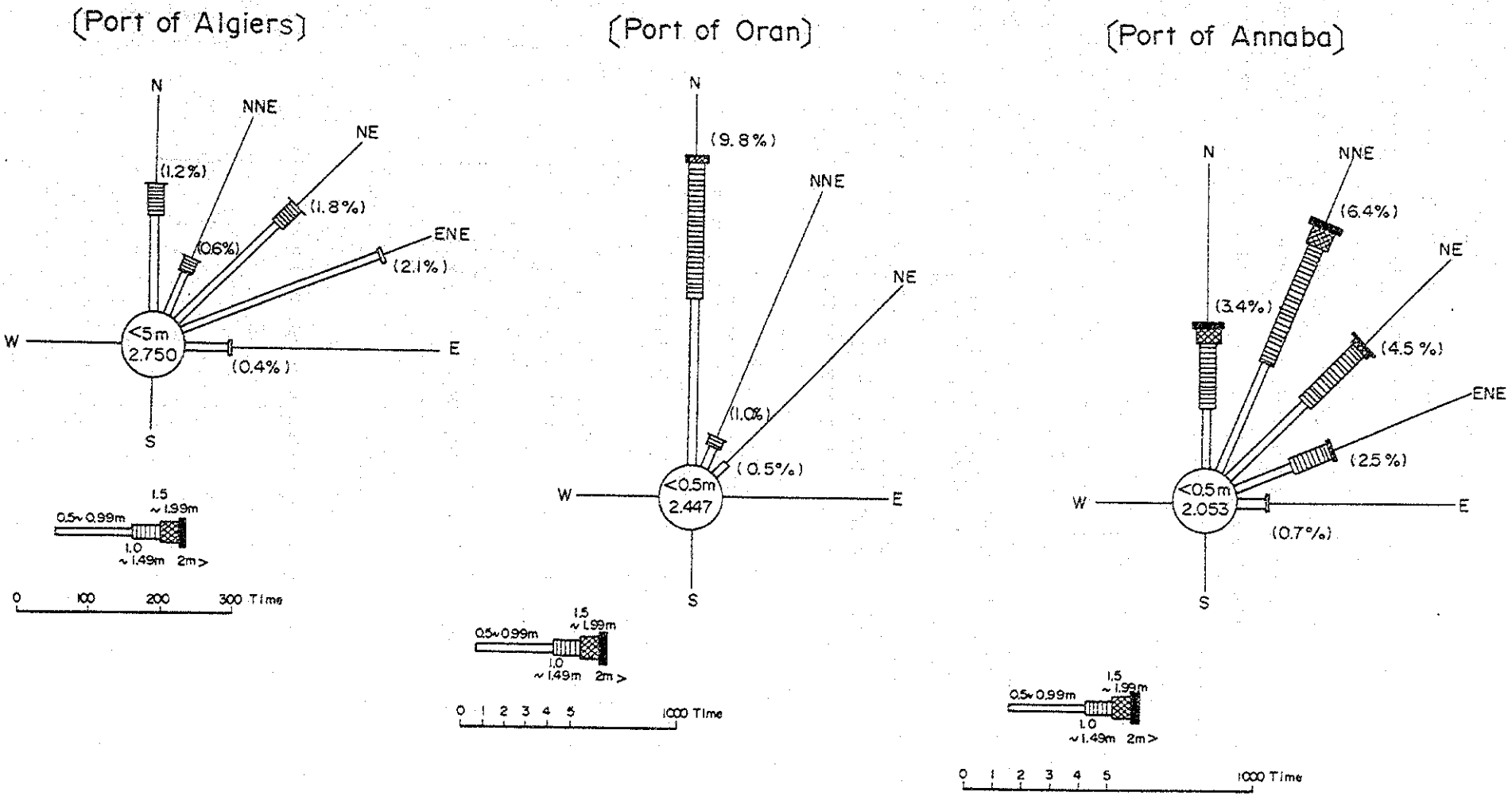


Fig. 2.3.6 Wave Rose of N-E Direction at the Mouth of a Port (Wave orientation and height computed from the analysis of wind speeds, on the basis of wind data for each area in 1988 - 1990)

(2) Incoming Waves in Case of Exceptional Situation

1) Estimation of Deepwater Waves

Estimation of Deepwater Waves to serve the purpose of breakwater and seawall designs, analysis was made of the maximum deepwater waves attacking the project ports of Algiers, Oran and Annaba. In the analysis, the waves were estimated by the method illustrated in Fig.2.3.7.

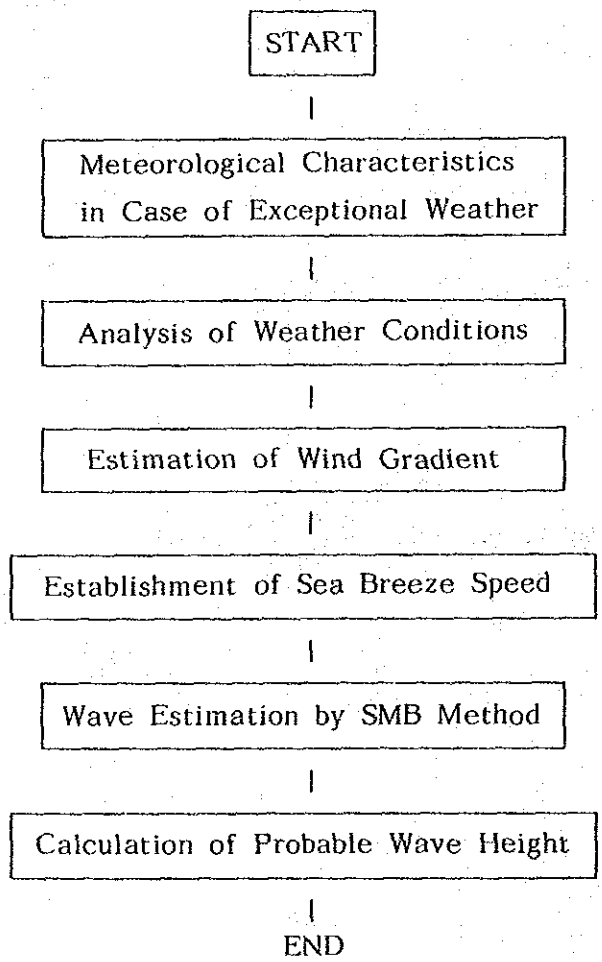


Fig. 2.3.7 Process of Wave Estimation and Analysis

The establishment of weather conditions and of the speed of the sea breeze was a key factor in estimating the maximum deepwater wave. For the weather conditions, the meteorological characteristics of the project ports were analyzed by the use of exceptional weather maps available and the data of Table 2.2.5 listing exceptional weather conditions during the 1898-1991 period. In addition, evaluation was made of the basic conditions for wave estimation, such as the direction of the sea breeze and travel speed of atmospheric pressures.

For the establishment of the sea breeze speed, analysis was made of the conversion factor for wind, gradients wind speed and duration and other factors based on the analysis of the weather conditions of the Japan Sea, located at similar latitudes to those of the Mediterranean, as well as analysis of the wave observation data obtained during exceptional weather. After the analysis specific conditions for estimation of the maximum deepwater wave were examined.

Table 2.3.4 gives the results of the deepwater wave estimation.

Table 2.3.4 Wave Estimation Results
(Max. Wave Height)

1965-1991

	Oran-Port		Algiers-Port		Annaba-Port	
	H	T	H	T	H	T
1	NE 7.6 (1965.1.6)	10.8	NE 7.6 (1965.1.7)	10.8	NE 7.6 (1965.1.7)	10.8
2	NE 6.8 (1967.12.11)	9.8	NE 6.8 (1967.12.12)	9.8	NE 6.8 (1967.12.12)	9.8
3	NE 9.2 (1980.3.5)	12.0	———		———	
4	NE 2.4 (1988.3.5)	6.1	NE 4.3 (1988.3.6)	8.2	NE 5.0 (1988.3.6)	9.1
5	NE 3.8 (1990.2.12)	7.4	NE 4.4 (1990.2.12)	8.3	NE 5.0 (1990.2.12)	9.1
6	NE 8.4 (1990.4.4)	11.6	NE 8.5 (1990.4.4)	11.6	NE 8.9 (1990.4.4)	11.6
7	———		———		NE 5.1 (1991.10.20)	9.0

2) Analysis of Probable Wave Height

On the basis of the estimation results of Table 2.3.4 calculation was made of the probable deepwater wave heights for the three project ports. The calculation results are given in Table 2.3.5.

Table 2.3.5 Calculation of Probable Deepwater Wave Parameters

Return Period (Year)	Algiers Port		Oran Port		Annaba Port	
	Height (m)	Period (sec)	Height (m)	Period (sec)	Height (m)	Period (sec)
100	9.8	12.5	9.9	12.8	10.1	12.3
70	9.4	12.2	9.6	12.5	9.5	11.9
50	8.9	11.8	9.3	12.3	9.0	11.6
40	8.6	11.5	9.1	12.1	8.6	11.3
30	8.1	11.2	8.8	11.8	8.1	11.0
25	7.8	10.9	8.6	11.6	7.8	10.8
20	7.4	10.6	8.4	11.4	7.4	10.6
15	6.8	10.2	8.0	11.1	6.9	10.2
10	5.9	9.4	7.3	10.4	6.2	9.7

2.3.4 Littorral Drift

Detailed observations of littoral drift have not been under-taken in and around the port of Algiers, Oran and Annaba. As the only exception, however, there have been available the results of a qualitative littoral drift analysis covering the area adjacent to the entrance to the Port of Annaba. Fig.2.3.8 gives the resutls of the analysis.

With respect to the three project ports, our preliminary assessment of such potential sources of littoral drift, as the sea bottom configurations, type of bottom material, discharging rivers, current speed and direction, and wave characteristics have not indicated any possibility of serious littoral drift taking place in the inner harbors or in the vicinity of the harbor entrances. Except part of a curved shoreline in the Port of Annaba running southeast where a small amount of drift sand was visible, the coastal areas of the three ports seem to be free from littoral drift and generally in a very stable condition.

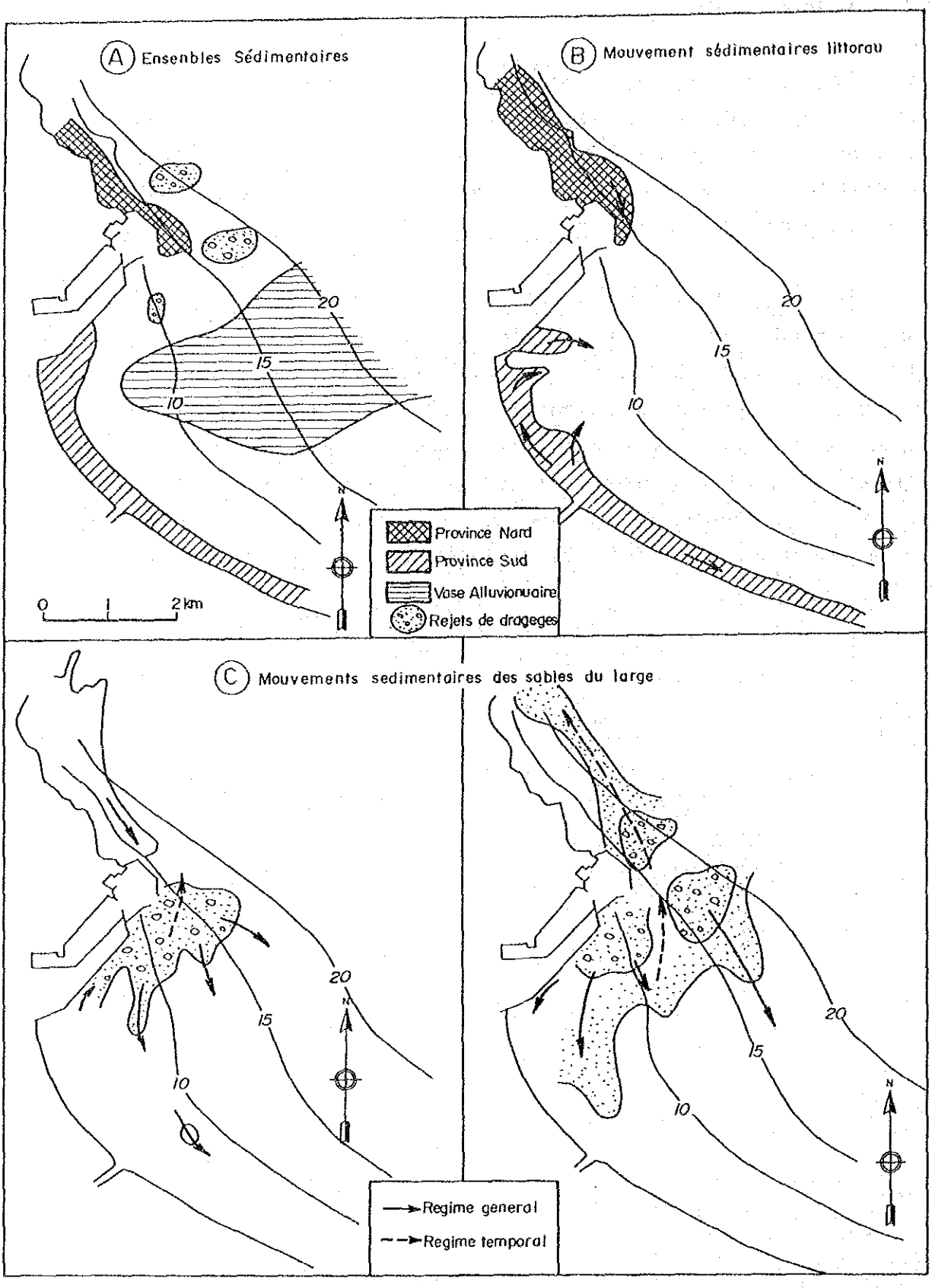


Fig. 2.3.7 Littoral Drift of the Annaba Port Area

2.4 Geological investigation

2.4.1 General

The geological conditions at the three project sites of interest have been inquired by a series of cored drillings of the sea bottom, carried out in the period from October 1991 to February 1992. The purpose was to examine the foundation conditions of the port facilities to be designed for the development of the ports of Algiers, Oran and Annaba. The work was panned as follows:

Table 2.4.1 Drilling data

Location/Hole nr.		Depth (m from the sea floor) Tests	Nr.of Standard Penetration laboratory	Nr of samples tested in the
Algiers	S1	18	4	6
	S2	19.5	1	4
	S3	24	1	6
Oran	S1	15	4	8
	S2	13.5	5	7
	S3	13.5	3	5
Annaba	S1	46	13	7
	S2	31.5	4	7
	S3	37	8	4
Total	9	218 m	43	54

The drilling has been done by the Algerian contractor SONATRAM using a drilling machine of hydraulic rotary type, made by Wirth, in Germany, for operation on and under water.

In the case of Algiers and Annaba the drilling has been done from a floating drilling platform. The latter is supported by 4 legs, 19 m long.

The length of the legs limits the use of the platform to a water depth less than 15 m. The legs are manipulated by air compressors and using thick steel cables. Furthermore there is a hydraulic power source and a water pump on the platform, which were both coupled to the drilling machine. The core samples have been taken with a wire-line type, double core barrel, 117 mm in exterior