Naval Oceanographic and
Atmospheric Research Laboratory

Technical Note 133
August 1991

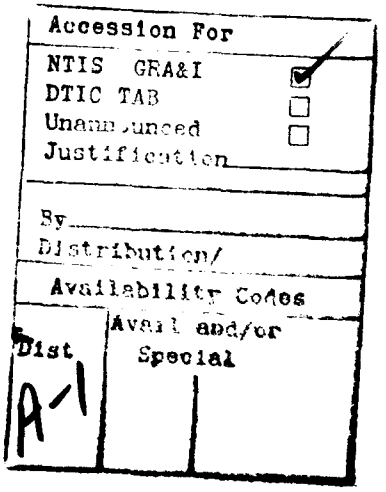
SEVERE WEATHER GUIDE MEDITERRANEAN PORTS

43. SFAX

These working papers were prepared for the timely dissemination of information; this document does not represent the official position of NOARL.

ABSTRACT

This handbook for the port of Sfax, one in a series of severe weather guides for Mediterranean ports, provides decision-making guidance for ship captains whose vessels are threatened by actual or forecast strong winds, high seas, restricted visibility or thunderstorms in the port vicinity. Causes and effects of such hazardous conditions are discussed. Precautionary or evasive actions are suggested for various vessel situations. The handbook is organized in four sections for ready reference: general guidance on handbook content and use; a quick-look captain's summary; a more detailed review of general information on environmental conditions; and an appendix that provides oceanographic information.



ACKNOWLEDGMENTS

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FOREWORD

This handbook on Mediterranean Ports was developed as part of an ongoing effort at the Atmospheric Directorate, Naval Oceanographic and Atmospheric Laboratory (NOARL), Monterey, to create products for direct application to Fleet Operations. The research was conducted in response to Commander Naval Oceanography Command (COMNAVOCEANCOM) requirements validated by the Chief of Naval Operations (OP-096).

As mentioned in the preface, the Mediterranean region is unique in that several areas exist where local winds can cause dangerous operating conditions. This handbook will provide the ship's captain with assistance in making decisions regarding the disposition of his ship when heavy winds and seas are encountered or forecast at various port locations.

Readers are urged to submit comments, suggestions for changes, deletions and/or additions to Naval Oceanography Command Center (NAVOCEANCOMCEN), Rota with a copy to the oceanographer, COMSIXTHFLT. They will then be passed on to NOARL, Monterey for review and incorporation as appropriate. This document will be a dynamic one, changing and improving as more and better information is obtained.

PORT INDEX

The following is a tentative prioritized list of Mediterranean Ports to be evaluated during the five-year period 1988-92, with ports grouped by expected year of the port study's publication. This list is subject to change as dictated by circumstances and periodic review. Computerized versions of these port guides are available for those ports with an asterisk (*). Contact the Atmospheric Directorate, NOARL, Monterey or NOCC Rota for IBM compatable floppy disk copies.

NO.	PORT
*1	GAETA, ITALY
*2	NAPLES, ITALY
*3	CATANIA, ITALY
*4	AUGUSTA BAY, ITALY
*5	CAGLIARI, ITALY
*6	LA MADDALENA, ITALY
7	MARSEILLE, FRANCE
8	TOULON, FRANCE
9	VILLEFRANCHE, FRANCE
10	MALAGA, SPAIN
11	NICE, FRANCE
12	CANNES, FRANCE
13	MONAÇO
14	ASHDOD, ISRAEL
15	HAIFA, ISRAEL
16	BARCELONA, SPAIN
17	PALMA, SPAIN
18	IBIZA, SPAIN
19	POLLENSA BAY, SPAIN
20	LIVORNO, ITALY
21	LA SPEZIA, ITALY
22	VENICE, ITALY
23	TRIESTE, ITALY
*24	CARTAGENA, SPAIN
*25	VALENCIA, SPAIN
*26	SAN REMO, ITALY
*27	GENOA, ITALY
*28	PORTO TORRES, ITALY
*29	PALERMO, ITALY
*30	MESSINA, ITALY
*31	TAORMINA, ITALY

1991	PORT
*32	TARANTO, ITALY
*33	TANGIER, MOROCCO
*34	BENIDORM, SPAIN
*35	ROTA, SPAIN
*36	LIMASSOL, CYPRUS
*37	LARNACA, CYPRUS
*38	ALEXANDRIA, EGYPT
*39	PORT SAID, EGYPT
*40	BIZERTE, TUNISIA
*41	TUNIS, TUNISIA
*42	SOUSSE, TUNISIA
*43	SFAX, TUNISIA
*44	SOUDA BAY, CRETE
	VALETTA, MALTA
	PIRAEUS, GREECE

1992	PORT
	KALAMATA, GREECE
	CORFU, GREECE
	KITHIRA, GREECE
	THESSALONIKI, GREECE
	DELAYED INDEFINITELY
	ALGIERS, ALGERIA
	ISKENDERUN, TURKEY
	IZMIR, TURKEY
	ISTANBUL, TURKEY
	ANTALYA, TURKEY
	GOLCUK, TURKEY

PREFACE

Environmental phenomena such as strong winds, nigh waves, restrictions to visibility and thunderstorms can be hazardous to critical Fleet operations. The cause and effect of several of these phenomena are unique to the Mediterranean region and some prior knowledge of their characteristics would be helpful to ship's captains. The intent of this publication is to provide guidance to the captains for assistance in decision making.

The Mediterranean Sea region is an area where complicated topographical features influence weather patterns. Katabatic winds will flow through restricted mountain gaps or valleys and, as a result of the venturi effect, strengthen to storm intensity in a short period of time. As these winds exit and flow over port regions and coastal areas, anchored ships with large 'sail areas' may be blown aground. Also, hazardous sea state conditions are created, posing a danger for small boats ferrying personnel to and from port. At the same time, adjacent areas may be relatively calm. A glance at current weather charts may not always reveal the causes for these local effects which vary drastically from point to point.

Because of the irregular coast line and numerous islands in the Mediterranean, swell can be refracted around such barriers and come from directions which vary greatly with the wind. Anchored ships may experience winds and seas from one direction and swell from a different direction. These conditions can be extremely hazardous for tendered vessels. Moderate to heavy swell may also propagate outward in advance of a storm resulting in uncomfortable and sometimes dangerous conditions, especially during tending, refueling and boating operations.

This handbook addresses the various weather conditions, their local cause and effect and suggests some evasive action to be taken if necessary. Most of the major ports in the Mediterranean will be covered in the handbook. A priority list, established by the Sixth Fleet, exists for the port studies conducted and this list will be followed as closely as possible in terms of scheduling publications.

RECORD OF CHANGES

CHANGE NUMBER	DATE OF CHANGE	DATE ENTERED	PAGE NUMBER	ENTERED BY

1. GENERAL GUIDANCE

1.1 DESIGN

This handbook is designed to provide ship captains with a ready reference on hazardous weather and wave conditions in selected Mediterranean harbors. Section 2, the captain's summary, is an abbreviated version of section 3, the general information section intended for staff planners and meteorologists. Once section 3 has been read, it is not necessary to read section 2.

1.1.1 Objectives

The basic objective is to provide ship captains with a concise reference of hazards to ship activities that are caused by environmental conditions in various Mediterranean harbors, and to offer suggestions for precautionary and/or evasive actions. A secondary objective is to provide adequate background information on such hazards so that operational forecasters, or other interested parties, can quickly gain the local knowledge that is necessary to ensure high quality forecasts.

1.1.2 Approach

Information on harbor conditions and hazards was accumulated in the following manner:

A. A literature search for reference material was performed.
B. Cruise reports were reviewed.
C. Navy personnel with current or previous area experience were interviewed.
D. A preliminary report was developed which included questions on various local conditions in specific harbors.
E. Port/harbor visits were made by NOARLW personnel; considerable information was obtained through interviews with local pilots, tug masters, etc; and local reference material was obtained.
F. The cumulative information was reviewed, combined, and condensed for harbor studies.

1.1.3 Organization

The Handbook contains two sections for each harbor. The first section summarizes harbor conditions and is intended for use as a quick reference by ship captains, navigators, inport/at sea OOD's, and other interested personnel. This section contains:

A. a brief narrative summary of environmental hazards,
B. a table display of vessel location/situation, potential environmental hazard, effect-precautionary/evasion actions, and advance indicators of potential environmental hazards,
C. local wind wave conditions, and
D. tables depicting the wave conditions resulting from propagation of deep water swell into the harbor.

The swell propagation information includes percent occurrence, average duration, and the period of maximum wave energy within height ranges of greater than 3.3 feet and greater than 6.6 feet. The details on the generation of sea and swell information are provided in Appendix A.

The second section contains additional details and background information on seasonal hazardous conditions. This section is directed to personnel who have a need for additional insights on environmental hazards and related weather events.

1.2 CONTENTS OF SPECIFIC HARBOR STUDIES

This handbook specifically addresses potential wind and wave related hazards to ships operating in various Mediterranean ports utilized by the U.S. Navy. It does not contain general purpose climatology and/or comprehensive forecast rules for weather conditions of a more benign nature.

The contents are intended for use in both pre-visit planning and in situ problem solving by either mariners or environmentalists. Potential hazards related to both weather and waves are addressed. The

oceanographic information includes some rather unique information relating to deep water swell propagating into harbor shallow water areas.

Emphasis is placed on the hazards related to wind, wind waves, and the propagation of deep water swell into the harbor areas. Various vessel locations/situations are considered, including moored, nesting, anchored, arriving/departing, and small boat operations. The potential problems and suggested precautionary/evasive actions for various combinations of environmental threats and vessel location/situation are provided. Local indicators or environmental hazards and possible evasion techniques are summarized for various scenarios.

CAUTIONARY NOTE: In September 1985 Hurricane Gloria raked the Norfolk, VA area while several US Navy ships were anchored on the muddy bottom of Chesapeake Bay. One important fact was revealed during this incident: Most all ships frigate size and larger dragged anchor, some more than others, in winds of over 50 knots. As winds and waves increased, ships 'fell into' the wave troughs, BROADSIDE TO THE WIND and become difficult or impossible to control.

This was a rare instance in which several ships of recent design were exposed to the same storm and much effort was put into the documentation of lessons learned. Chief among these was the suggestion to evade at sea rather than remain anchored at port whenever winds of such intensity were forecast.

2. CAPTAIN'S SUMMARY

The Port of Sfax, Tunisia is located on the North African coast at approximately 34°44'N 10°46'E (Figure 2-1).

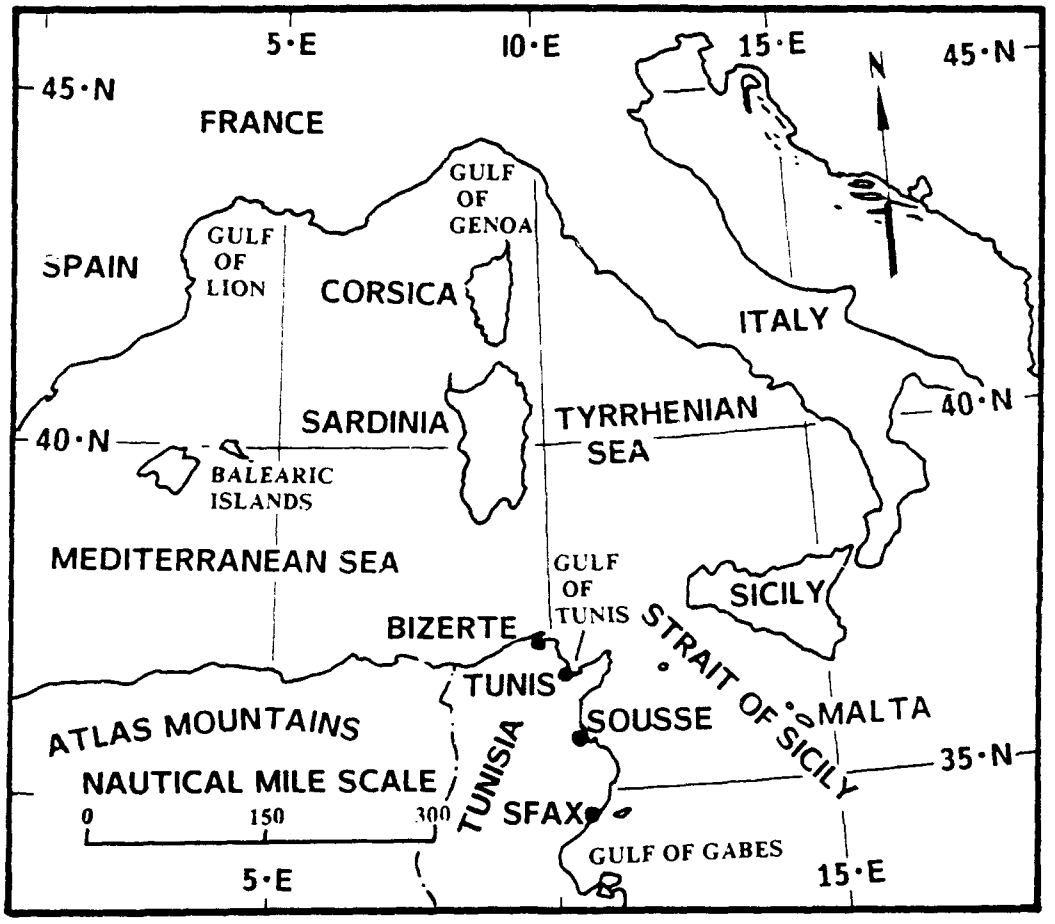

Figure 2-1. West and Central Mediterranean Sea.

Situated on the extreme north shore of the Gulf of Gabes, the Port of Sfax is protected to the east by the Kerkennah Islands, the nearest point of which is located about 11 n mi offshore (Figure 2-2). The terrain west of the port is low lying, gradually increasing to the west, with elevations of 328 ft (100 m) about 10 n mi west of the port.

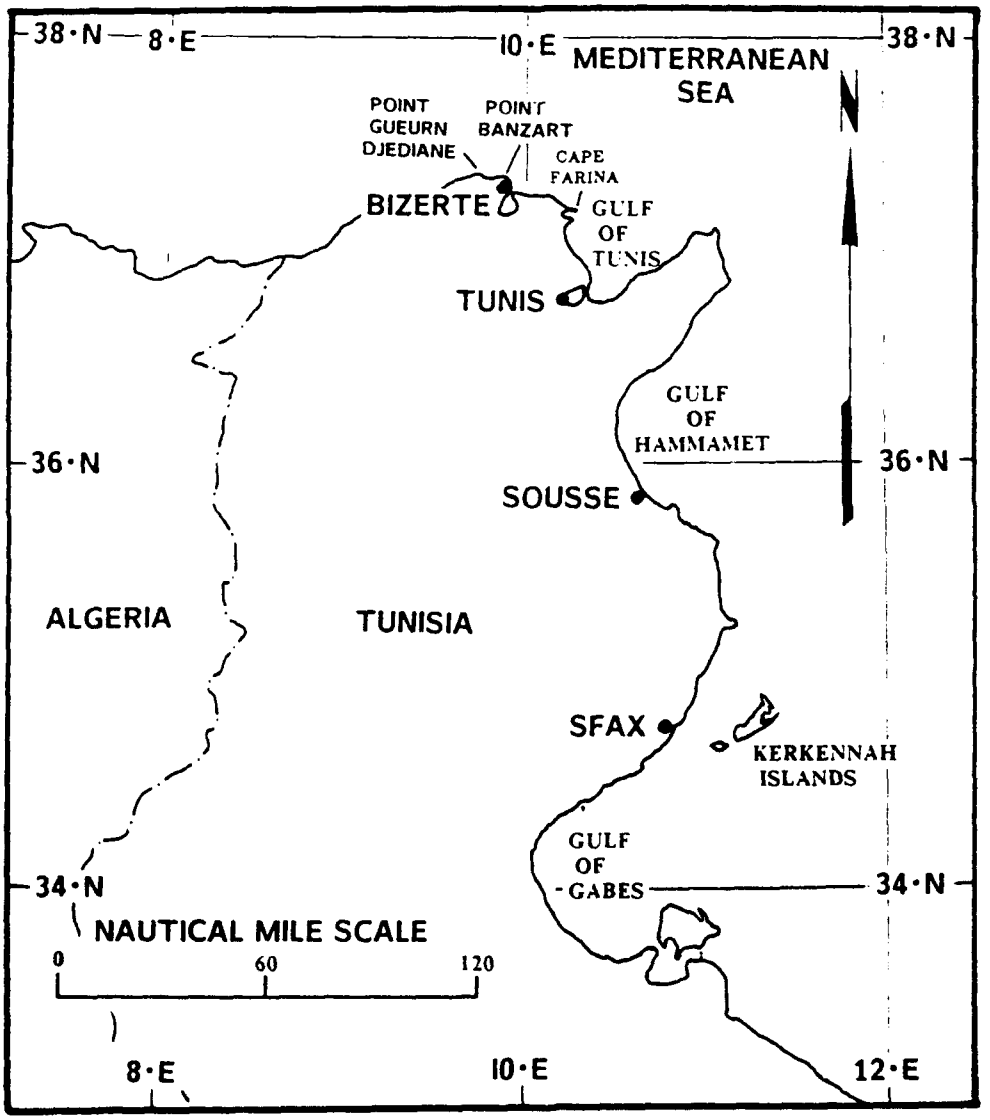

Figure 2-2. Tunisia and adjacent waters.

The Port of Sfax has berthing available for approximately 7 to 10 fair-sized merchant vessels (Figure 2-3). The inner harbor is sufficiently large to provide pierside mooring for several large merchant vessels at one time. The turning basin has sufficient room for all but the largest ships. The only boat landing is adjacent to the wharf of the Phosphate Company of Sfax, south of the shore patrol headquarters (FICEURLANT, 1978). The exact location of the shore patrol headquarters was not specified during a visit to the port.

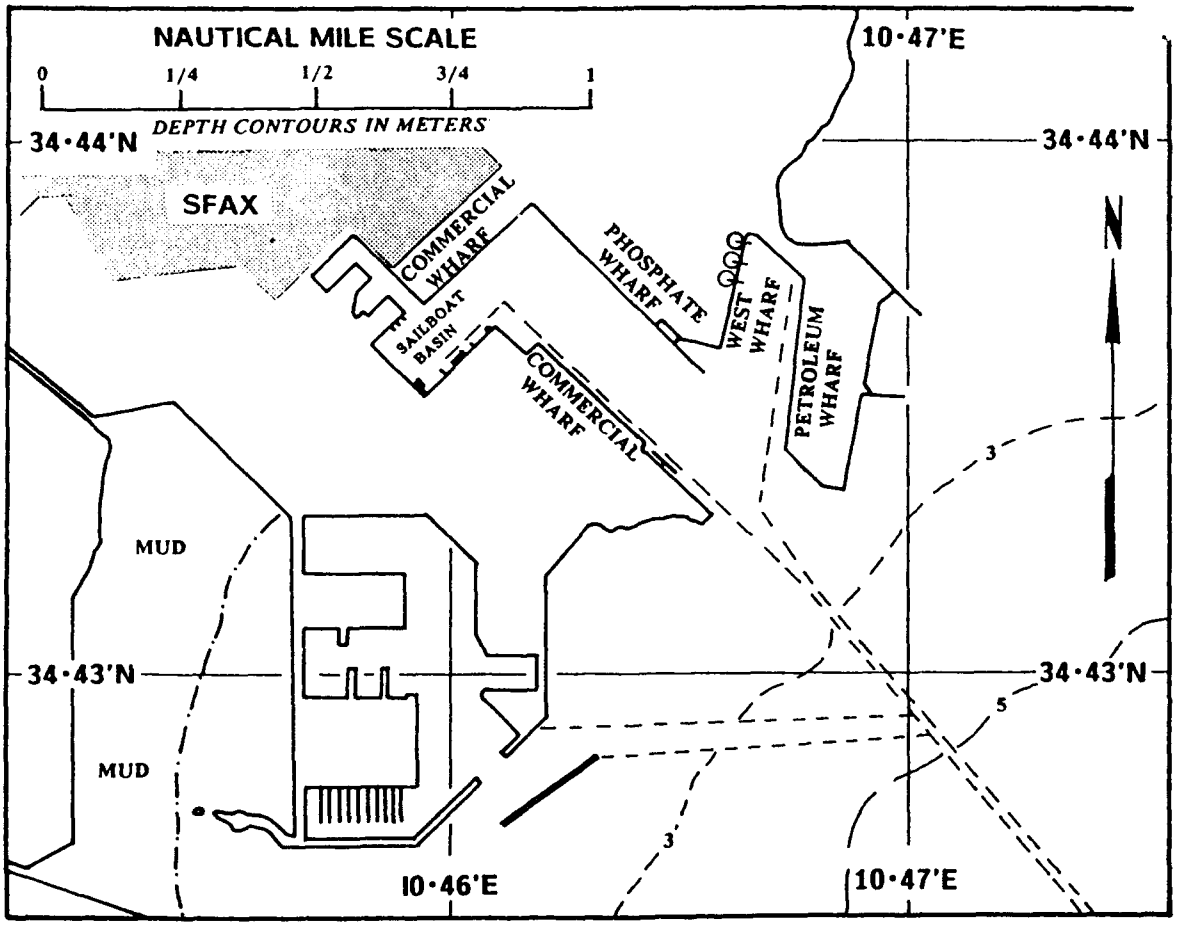

Figure 2-3. Port of Sfax, Tunisia.

According to local authorities, the harbor is approached directly from the east-southeast regardless of wind direction. Maximum draft is 34.5 ft (10.5 m) throughout the port. Under normal conditions night entry is not allowed. Glare from the light of the city at night presents some problems.

The primary anchorage area is located two miles due east of the port in 85 ft (26 m) of water. A sand and mud bottom provides good holding.

Local authorities state that there is a 1.5 kt northeast-southwest current outside the harbor and a .05 kt current inside the harbor. Both are associated with daily tidal fluctuations. FICEURLANT (1978) specifies that 1 to 3 kt crossing currents can be expected in the channel leading to the port entrance. Mediterranean Pilot, Volume I, (1963), states that in the roadstead the flood current (tidal stream) sets northeastward, and the ebb southwestward. Spring tides may result in 1 kt currents. The direction of the current changes shortly before the time of half-tide, and the greatest rate is attained shortly before high and low water. The currents set across the dredged channel, and are noticeable to within about 0.5 n mi of the entrance of the basin. The tidal range is 4 ft (1.2 m) in the anchorage area.

Specific hazardous conditions, vessel situations, and suggested precautionary/evasive action scenarios are summarized in Table 2-1.

Table 2.1. Summary of hazardous

HAZARDOUS CONDITION	INDICATORS OF POTENTIAL HAZARD
1. SE'ly winds. * Most troublesome condition for the port, but impact is minor. * ESE'ly fresh breeze (17-21 kt) may cause difficulty for ships maneuvering away from commercial wharf.	Advance warning. * Any weather pattern which indicates that a N African low moving S of the Atlas Mountains will enter the Gulf of Gabes near Sfax. Duration. * No more than 12 hours.
2. NNE'ly winds. * Blow phosphate dust from phosphate loading wharf to vessels moored to commercial wharf.	Advance warning. * None identified.

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nary of hazardous environmental conditions for the Port of Sfax, Tunisia

RS OF HAZARD	VESSEL LOCATION/ SITUATION AFFECTED	EFFECT - PRECAUTIONARY/EVASIVE ACTIONS
ıttern which : a N African of the Atlas . enter the near Sfax. 12 hours.	(1) Moored - inner harbor.	(a) Sfax is the best protected port in the country. * SE'ly winds are the most troublesome for the port, but the impact is relatively minor. * Ships moored to the commercial wharf may have difficulty maneuvering away from the wharf if wind direction is SSE and wind speed reaches 17-21 kt. * Tug assistance may be required.
	(2) Anchored.	(a) None.
	(3) Arriving/ departing.	(a) Vessels departing the commercial wharf may have difficulty maneuvering away from the wharf if wind direction is SSE and wind speed reaches 17-21 kt. * Tug assistance may be required.
	(4) Small boats.	(a) Small boat runs between the anchorage and the inner harbor would be adversely impacted if the wind direction were from the E semicircle and wind speeds approach 20 kt in the roadstead. Otherwise, no significant problems.
ed.	(1) Moored - inner harbor.	(a) Dust accumulation on exposed surfaces may be considerable if the vessel has been in port for more than a day or two. * Extensive fresh water washdown may be required after departure.

SEASONAL SUMMARY OF HAZARDOUS WEATHER CONDITIONS

Sfax is the best protected port in the country. The adjacent Kerkennah Islands and the surrounding shallows offer excellent protection to the harbor and anchorage from both wind and seas. The shallows break up any high swell or waves entering the anchorage area. South winds do not have enough fetch to generate heavy swell.

While no significant hazardous weather scenarios have been identified for Sfax, the following events of limited significance could occur during all seasons of the year.

* A fresh breeze (17-21 kt) from east-southeast can make maneuvering away from the commercial wharf difficult. Tug assistance should be used.
* North-northeasterly winds carry phosphate dust to the commercial piers, so dust accumulation is probable for ships staying in the port very long.

REFERENCES

FICEURLANT, 1978 (Reissued 1987): Port Directory for Sfax, Tunisia. Fleet Intelligence Center Europe and Atlantic, Norfolk, VA.

PORT VISIT INFORMATION

JANUARY 1990. NOARL Meteorologists R. Fett and Lieutenant M. Evans, U.S. Navy, met with Port Captain Hedider Moiltor, and Pilot Nokdud Bennour to obtain much of the information included in this port evaluation.

3. GENERAL INFORMATION

This section is intended for Fleet meteorologists/oceanographers and staff planners. Paragraph 3.5 provides a general discussion of hazards and table 3-1 provides a summary of vessel locations/situations, potential hazards, effect-precautionary/evasive actions, and advance indicators and other information about potential hazards by season.

3.1 Geographic Location

The Port of Sfax, Tunisia is located on the North African coast of the Mediterranean Sea at approximately 34°44'N 10°46'E (Figure 3-1).

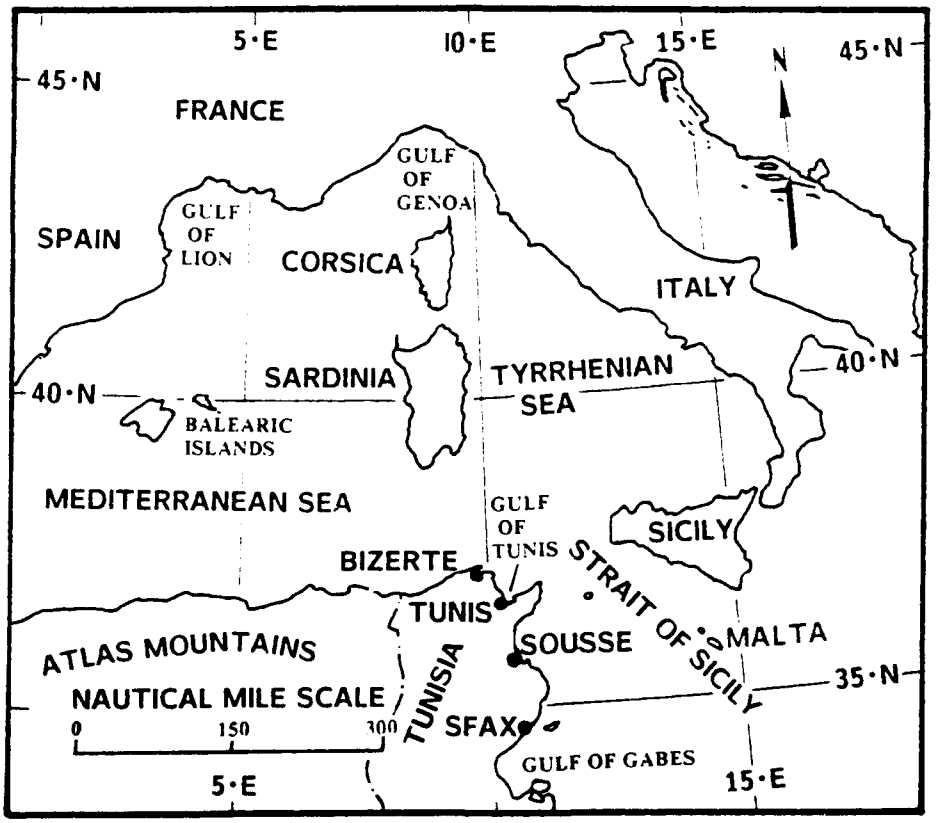

Figure 3-1. West and Central Mediterranean Sea.

Situated on the extreme north shore of the Gulf of Gabes, the Port of Sfax is protected to the east by the Kerkennah Islands, the nearest point of which is located about 11 n mi offshore (Figure 3-2). The terrain west of the port is low lying, gradually increasing to the west, with elevations of 328 ft (100 m) about 10 n mi west of the port.

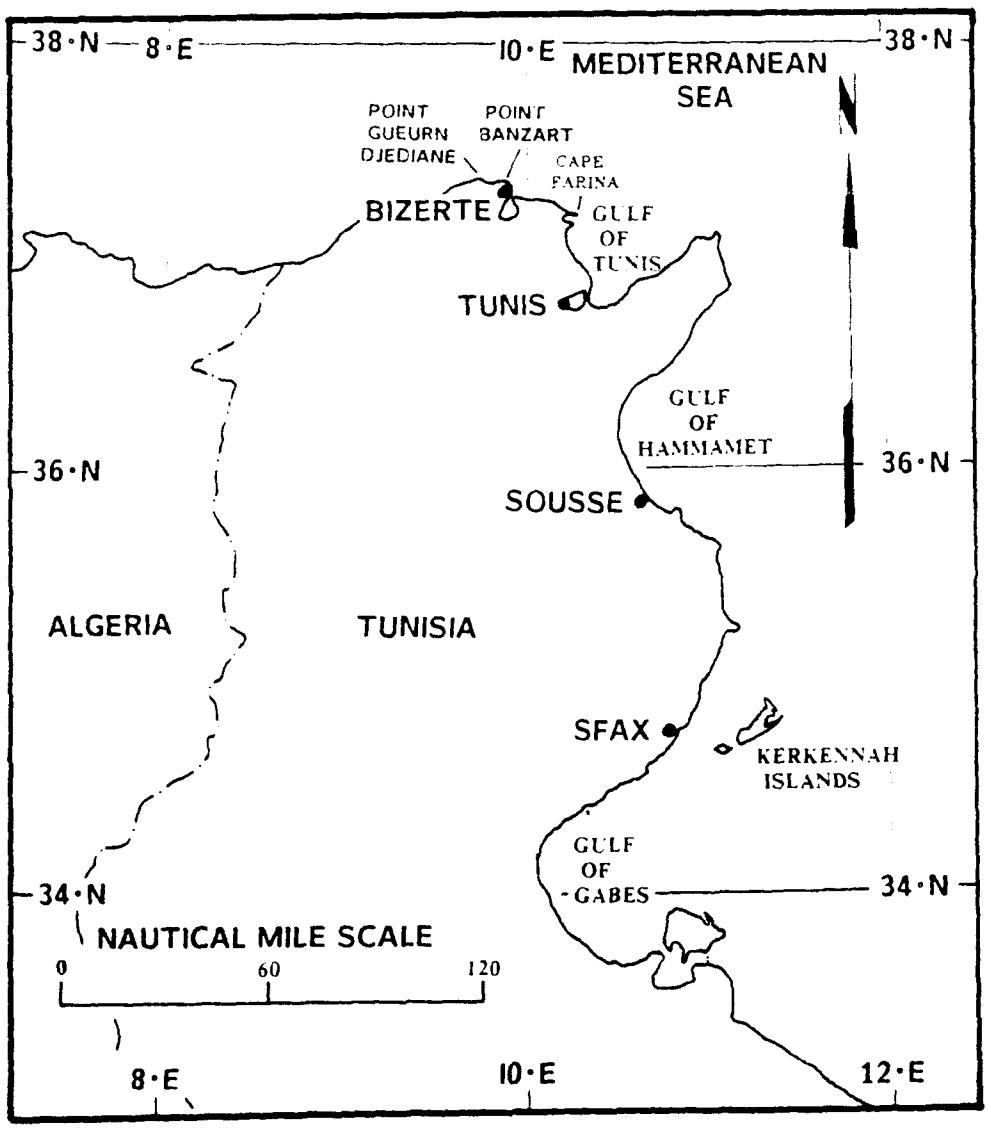

Figure 3-2. Tunisia and adjacent waters.

The Port of Sfax has berthing available for approximately 7 to 10 fair-sized merchant vessels (Figure 3-3). The inner harbor is sufficiently large to provide pierside mooring for several large merchant vessels at one time. The turning basin has sufficient room for all but the largest ships. The only boat landing is adjacent to the wharf of the Phosphate Company of Sfax, south of the shore patrol headquarters (FICEURLANT, 1978). The exact location of the shore patrol headquarters was not specified during a visit to the port.

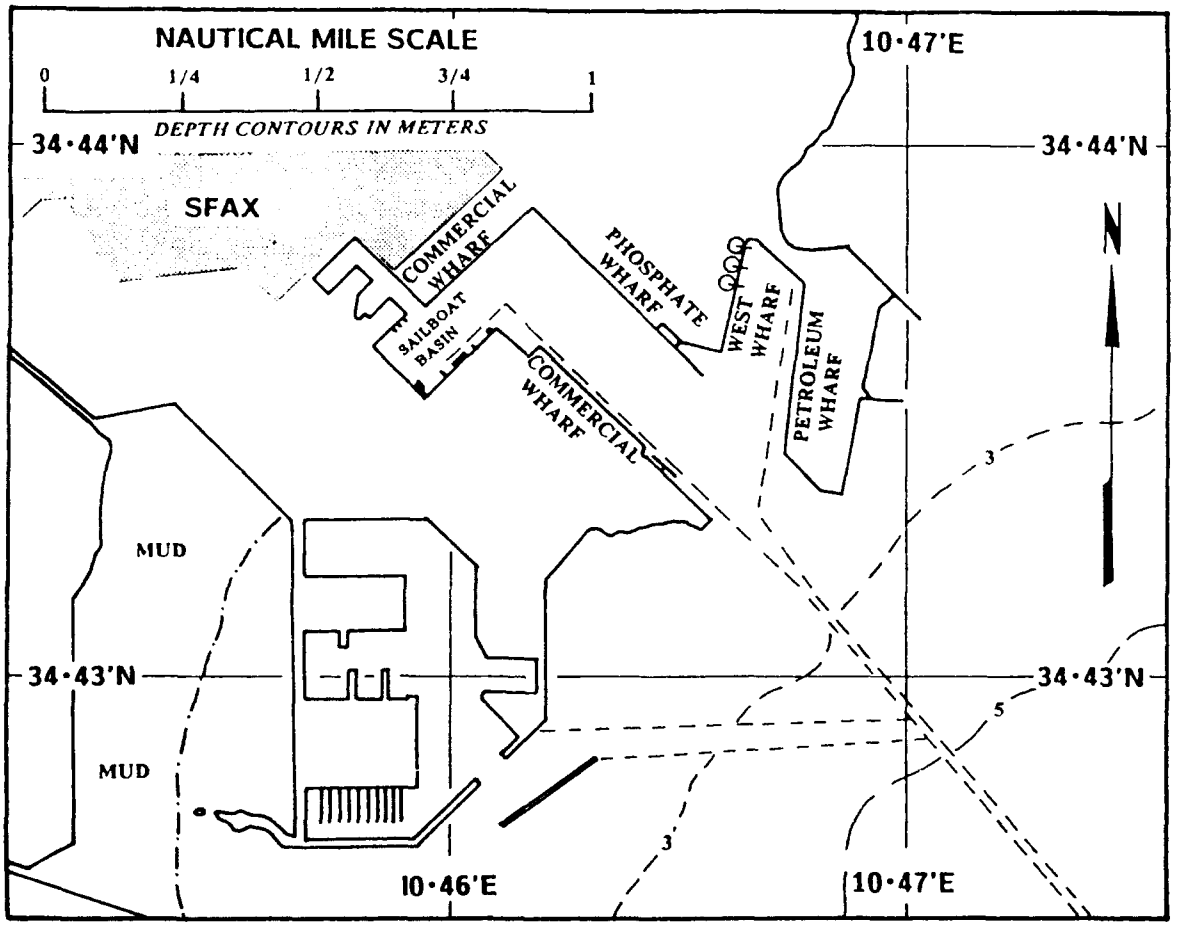

Figure 3-3. Port of Sfax, Tunisia.

According to local authorities, the harbor is approached directly from the east-southeast, regardless of wind direction. Maximum draft is 34.5 ft (10.5 m) throughout the port. Under normal conditions night entry is not allowed. Glare from the light of the city at night presents some problems.

The primary anchorage area is located two miles due east of the port in 85 ft (26 m) of water. A sand and mud bottom provides good holding.

3.2 Qualitative Evaluation of the Port of Sfax

Sfax is the best protected port in the country. It has never been closed due to bad weather. The adjacent Kerkennah Islands and the surrounding shallows offer excellent protection from both wind and seas. The shallows break up any high swell or waves entering the anchorage area. South winds do not have enough fetch to generate heavy swell, but according to FICEURLANT (1978), a fresh breeze (17-21 kt) blowing from the east-southeast can make maneuvering away from the commercial wharf difficult. The anchorage is protected from the east and southeast by offshore islands. Northeast swell is broken up in the shallows. The 164 ft (50 m) depth contour is approximately 40 n mi east of the harbor entrance.

3.3 Currents and Tides

Local authorities state that there is a 1.5 kt northeast-southwest current outside the harbor and a 0.5 kt current inside the harbor. Both are associated with daily tidal fluctuations. FICEURLANT (1978) specifies that 1 to 3 kt crossing currents can be expected in the channel leading to the port entrance. Mediterranean Pilot, Volume I, (1963) states that in the roadstead the flood current (tidal stream) sets northeastward, and the ebb southwestward. Spring tides may result in 1 kt

currents. The direction of the current changes shortly before the time of half-tide, and the greatest rate is attained shortly before high and low water. The currents set across the dredged channel, and are noticeable to within about 0.5 n mi of the entrance of the basin.

The tidal range is 4 ft (1.2 m) in the anchorage area.

3.4 Visibility

Visibility is good at Sfax, with no reported problems.

3.5 Hazardous Conditions

As mentioned in section 3.2 above, Sfax is the best protected port in the country and has never been closed due to bad weather. Because of its unique location and protection, few hazardous weather scenarios have the potential to significantly impact port operations. Strong northwesterly winds that are a problem at Bizerte become northerly at Tunis and northeasterly in the Gulf of Gabes, but, according to local authorities, pose no problem to Sfax.

One minor impact of wind at Sfax is when a fresh breeze (17-21 kt) is blowing from the east-southeast, ships have a difficult time maneuvering away from the commercial wharf. It is recommended that tugs be used to aid in bresting the ship away from the wharf.

Although uncommon, storms having tropical characteristics with fully developed eyes have been observed on at least three occasions in the Mediterranean Basin. On one occassion, in September 1983, the storm was first detected, and probably formed, in the Gulf of Gabes adjacent to Sfax (Figure 3-2). Weather conditions at Sfax during the episode are not known, but the forecasters should be aware of the possibility that such a storm may again develop in the area.

the Atlas Mountains before reaching the Mediterranean Sea through the Gulf of Gabes.

Precipitation falls on Gabes, a Tunisian city about 60 n mi southwest of Sfax, on an average of 41 days during an average year. Figure 3-4 shows the annual distribution. No specific record for Sfax is available, but the general precipitation pattern should closely approximate that of Gabes.

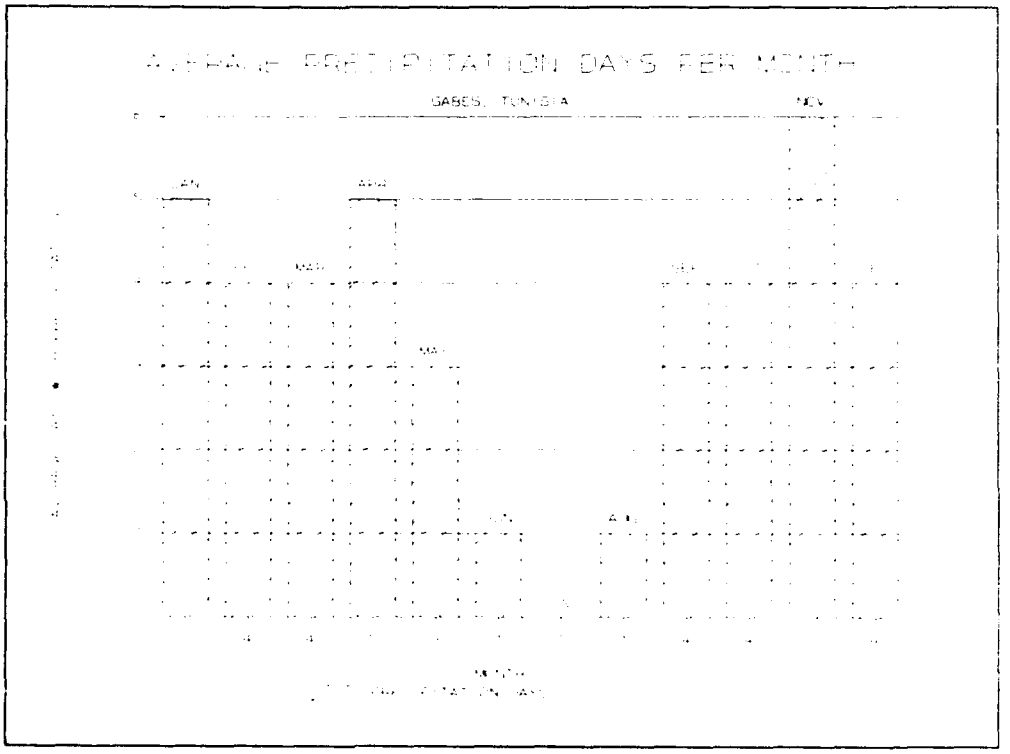

Figure 3-4. Days with precipitation at Gabes, Tunisia.

Thunderstorms are not a problem at Sfax.

A seasonal summary of various known environmental hazards that may be encountered in the Port of Sfax follows.

A. Winter (November through February)

Westerly winds are commonly observed at Sfax during winter. The orientation of the harbor facilities and the proximity of the anchorage to the coast prevent a westerly wind from having any significant effect on harbor operations.

Local authorities state that southeasterly winds are the most troublesome for the port, but pose no big problem. Lasting no more than 12 hours, southeasterly winds of any strength would likely precede the passage of a North African low pressure center. The possibility of the lows forming increases as the season progresses. The following discussion of North African lows is taken largely from Brody & Nestor's 1980 document Regional Forecasting Aids for the Mediterranean Basin, NAVENVPREDRSCHFAC Technical Report TR 80-10.

North African lows develop over the desert region south of the Atlas mountains. The synoptic situation favoring development is the presence of an upper trough lying over Spain with its axis lying northeast-southwest, producing a deep south-westerly flow over northwest Africa. The presence of a cold front is apparently immaterial for the development of a low, but when one is present, development usually occurs before the front reaches the mountain range.

The lows which have the greatest potential to produce strong southeasterly winds at Sfax follow an easterly track south of the Atlas mountains before moving over the Mediterranean Sea across the coast of Tunisia at or near the Gulf of Gabes. When North African lows occur south of the Atlas Mountains, strong easterly to southeasterly winds are likely over the southern Mediterranean and will result in high seas in the Strait of Sicily.

A North African low is most likely to form over Tunisia when the long-wave trough is oriented northeast-southwest across the Tyrrhenian Sea. Cold continental polar air will be advected in from eastern Europe and a pocket of cold air (-25°C at 500 mb) will form between Sardinia, Sicily and Tunisia. The subtropical jet also will be evident over North Africa. Wind speeds at 500 mb over Tunisia and Libya will be 55 kt or more.

The speed of movement with these systems is related to the time of year in which they develop. During late autumn and early winter, lows moving out of this area are noted for their extremely slow movement due to their association with a cut-off low aloft.

During late winter and early spring, as the number of North African cyclones increases, North Africa becomes the primary cyclogenesis area for the region. Unlike lows developing early in the winter, these lows are generally associated with open, short wave troughs. They produce little precipitation, but frequently produce high winds in close proximity to their centers. Their increased speed of movement compared with the early winter systems also make them unique. Some lows have been noted to move eastward out of North Africa at 40 to 50 kt. With the scarcity of reports along the cyclogenesis area, the use of satellite data over the region may be the only clue to the presence of a developing low.

As can be seen in Figure 3-4, precipitation can be expected to occur on 19 days during the 4-month winter season, with November being the month of most frequent occurrence at Gabes.

B. Spring (March through May)

Early spring weather at Sfax is much the same as that of winter. See section 3.5.A above. North African lows, the common cause of southeasterly winds, are at their yearly maximum frequency of occurrence during spring, specifically during March and April (Reiter, 1975). But after April, the events occur less frequently, and summer weather usually prevails by the end of May.

C. Summer (June through September)

Summer weather at Sfax is warm and settled with no hazardous weather conditions identified. Summer winds are generally easterly at the port.

D. Autumn (October)

Autumn is a short, transitional season in the Mediterranean Basin, lasting only for the month of October. It results in an abrupt change from summer weather to the unsettled weather of winter (Brody and Nestor, 1980).

By the end of the month, North African lows (see section 3.5.A above) occur with increasing frequency as winter approaches. Prevailing winds gradually shift to westerly.

3.6 Harbor Protection

Sfax is the best protected port in the country and has never been closed due to bad weather. As detailed below, the port is well protected from most hazardous weather.

3.6.1 Wind and Weather

The adjacent Kerkennah Islands offer excellent protection from wind, but according to FICEURLANT (1978), a fresh breeze blowing from the east-southeast can make maneuvering away from the commercial wharf difficult.

3.6.2 Waves

The Kerkennah Islands and adjacent shallows break up any high swell or waves entering the anchorage area. The anchorage is protected from the east and southeast by the offshore islands while northeast swell is broken up in the shallows. South winds do not have enough fetch to generate heavy swell.

3.7 Protective and Mitigating Measures

Since the inner harbor and anchorage are so well protected from potential hazardous winds and waves, no protective or mitigating measures are identified. Phosphate dust is a problem for ships moored at the commercial piers in the harbor when the wind is from the north-northeast. It accumulates on exposed surfaces and is considered a respiratory hazard, so filtered masks may be in order for personnel working on weather decks and other exposed locations.

3.8 Local Indicators of Hazardous Weather Conditions

No local indicators are identified. Meteorologists should be alert for the formation of North African lows as discussed in section 3.5.A above.

3.9 Summary of Problems, Actions, and Indicators

Table 3-1 is intended to provide easy-to-use seasonal references for meteorologists on ships using the Port of Sfax. Table 2-1 (Section 2) summarizes Table 3-1 and is intended primarily for use by ship captains.

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Table 3-1. Potential problem situations at

VESSEL LOCATION/ SITUATION AFFECTED	POTENTIAL HAZARD	EFFECT - PRECAUTIONARY/EVAS
1. Moored - inner harbor. Most common in late Winter & early Spring, uncommon in Summer, possible in Autumn	a. SE'ly wind. SE'ly winds are the most troublesome for the port, but present no big problem. SE'ly winds do not have enough fetch to generate any significant swell.	a. Sfax is the best protected port SE'ly winds are the most troublesor but the impact is relatively minor. to the commercial wharf may have di vering away from the wharf if wind SSE and wind speed reaches 17-21 kt required.
Possible during any season.	b. NNE'ly wind. NNE'ly winds blow phosphate dust from the phosphate loading wharf to the commercial wharf, and the dust accumulates on exposed areas.	b. Dust accumulation on exposed su considerable if the vessel has bee more than a day or two. Extensive washdown may be required after dep
2. Anchored.	a. No specific hazards identified. The adjacent Kerkennah Islands and the surrounding shallows offer excellent protection from both wind and seas. The shallows break up any high swell or waves entering the anchorage area. S winds do not have enough fetch to generate heavy swell.	a. None.
3. Arriving/ departing.	a. No specific hazards identified. The adjacent Kerkennah Islands and the surrounding shallows offer excellent protection from both wind and seas. The shallows break up any high swell or waves entering the anchorage area. S winds do not have enough fetch to generate heavy swell. When departing vessels move north of the shallows, open ocean conditions, including increased wave and swell heights, can be expected.	a. Vessels departing the commercia difficulty maneuvering away from t direction is SSE and wind speed re Tugs may be required.
4. Small boats.	a. No specific hazards identified.	a. Small boat runs between the anc inner harbor would be adversely im wind direction were from the E sem speeds approach 20 kt in the roads wise, no significant problems.

Potential problem situations at the Port of Sfax, Tunisia - ALL SEASONS

ECT - PRECAUTIONARY/EVASIVE ACTIONS	ADVANCE INDICATORS AND OTHER INFORMATION ABOUT POTENTIAL HAZARD
ax is the best protected port in the country. winds are the most troublesome for the port, ne impact is relatively minor. Ships moored e commercial wharf may have difficulty maneu- g away from the wharf if wind direction is nd wind speed reaches 17-21 kt. Tugs may be red.	a. E moving N African lows moving S of the Atlas Mountains prior to their passage over the Gulf of Gabes are potential sources of SE winds at Sfax. N African lows develop over the desert region S of the Atlas mountains. The synoptic situation favoring development is the presence of an upper trough lying over Spain with its axis lying NE-SW, producing a deep SW'ly flow over NW Africa. The presence of a cold front is apparently immaterial for the development of a low, but when one is present, development usually occurs before the front reaches the mountain range.
ıst accumulation on exposed surfaces may be ıderable if the vessel has been in port for than a day or two. Extensive fresh water ıown may be required after departure.	b. Light NNE'ly winds at Sfax are the likely result of local effects during an otherwise weak gradient situation, such as the land/sea breeze regime.
ɔne.	a. E moving N African lows moving S of the Atlas Mountains prior to their passage over the Gulf of Gabes are potential sources of SE winds at Sfax. N African lows develop over the desert region S of the Atlas mountains. The synoptic situation favoring development is the presence of an upper trough lying over Spain with its axis lying NE-SW, producing a deep SW'ly flow over NW Africa. The presence of a cold front is apparently immaterial for the development of a low, but when one is present, development usually occurs before the front reaches the mountain range.
ssels departing the commercial wharf may have culty maneuvering away from the wharf if wind tion is SSE and wind speed reaches 17-21 kt. may be required.	a. E moving N African lows moving S of the Atlas Mountains prior to their passage over the Gulf of Gabes are potential sources of SE winds at Sfax. N African lows develop over the desert region S of the Atlas mountains. The synoptic situation favoring development is the presence of an upper trough lying over Spain with its axis lying NE-SW, producing a deep SW'ly flow over NW Africa. The presence of a cold front is apparently immaterial for the development of a low, but when one is present, development usually occurs before the front reaches the mountain range.
ıall boat runs between the anchorage and the harbor would be adversely impacted if the direction were from the E semicircle and wind ıs approach 20 kt in the roadstead. Other- no significant problems.	a. E moving N African lows moving S of the Atlas Mountains prior to their passage over the Gulf of Gabes are potential sources of SE winds at Sfax. N African lows develop over the desert region S of the Atlas mountains. The synoptic situation favoring development is the presence of an upper trough lying over Spain with its axis lying NE-SW, producing a deep SW'ly flow over NW Africa. The presence of a cold front is apparently immaterial for the development of a low, but when one is present, development usually occurs before the front reaches the mountain range.

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PORT VISIT INFORMATION

JANUARY 1990. NOARL Meteorologists R. Fett and Lieutenant M. Evans, U.S. Navy, met with Port Captain Hedider Moiltor, and Pilot Nokdud Bennour to obtain much of the information included in this port evaluation.

APPENDIX A

General Purpose Oceanographic Information

This section provides some general definitions regarding waves and is extracted from H.O. Pub. No. 603, Practical Methods for Observing and Forecasting Ocean Waves (Pierson, Neumann, and James, 1955).

Definitions

Waves that are being generated by local winds are called "SEA". WAVES that have traveled out of the generating area are known as "SWELL". Seas are chaotic in period, height and direction while swell approaches a simple sine wave pattern as its distance from the generating area increases. An in-between state exists for a few hundred miles outside the generating area and is a condition that reflects parts of both of the above definitions. In the Mediterranean area, because its fetches and open sea expanses are limited, SEA or IN-BETWEEN conditions will prevail. The "SIGNIFICANT WAVE HEIGHT" is defined as the average value of the heights of the one-third highest waves. PERIOD and WAVE LENGTH refer to the time between passage of, and distances between, two successive crests on the sea surface. The FREQUENCY is the reciprocal of the period ($f = 1/T$); therefore as the period increases the frequency decreases. Waves result from the transfer of energy from the wind to the sea surface. The area over which the wind blows is known as the FETCH, and the length of time that the wind has blown is the DURATION. The characteristics of waves (height, length, and period) depend on the duration, fetch, and velocity of the wind. There is a continuous generation of small short waves from the time the wind starts until it stops. With continual transfer of energy from the wind to the sea surface the waves grow with the older waves leading the growth and spreading the energy over a greater range of frequencies. Throughout the growth cycle a SPECTRUM of ocean waves is being developed.

A Beaufort Scale table with related wave effects is shown on the following page.

BEAUFORT SCALE

Beaufort Number	Wind Speed Knots	Wind Speed MPH	Seaman's term	Effects observed at sea	Term and height of Waves in meters
0	Under 1	Under 1	Calm	Sea like mirror.	Calm, glassy, 0
1	1-3	1-3	Light air	Ripples with appearance of scales; no foam crests.	
2	4-6	4-7	Light breeze	Small wavelets; crests of glassy appearance, not breaking	Rippled, less than 0.5
3	7-10	8-12	Gentle breeze	Large wavelets; crests begin to break; scattered whitecaps.	Smooth, 0.5
4	11-16	13-18	Moderate breeze	Small waves, becoming longer; numerous whitecaps.	Slight, 1.0
5	17-21	19-24	Fresh breeze	Moderate waves, taking longer form; many whitecaps; some spray.	Moderate, 1.0-2.5
6	22-27	25-31	Strong breeze	Larger waves forming; whitecaps everywhere; more spray.	Rough, 2.5-4.0
7	28-33	32-38	Moderate gale	Sea heaps up; white foam from breaking waves begins to be blown up in streaks.	
8	34-40	39-46	Fresh gale	Moderate high waves; edges of crests begin to break; foam is blown in steaks.	Very rough, 4.0-6.0
9	41-47	47-54	Strong gale	High waves; sea begins to roll; dense streaks of foam; spray may reduce visibility.	
10	48-55	55-63	Whole gale	Very high waves with overhanging crests; sea takes white appearance as foam is blown in very dense streaks; rolling is heavy and visibility reduced.	High, 6.0-9.0
11	56-63	64-72	Storm	Exceptionally high waves; sea covered with white foam patches; visibility still more reduced.	Very high, 9.0-13.5
12 13 14 15 16 17	64-71 72-80 81-89 90-99 100-108 109-118	73-82 83-92 93-103 104-114 115-125 126-136	Hurricane	Air filled with foam; sea completely white with driving spray; visibility greatly reduced. Winds of force 12 and above very rarely experienced on land; usually accompanied by widespread damage.	Phenomenal, greater than 13.5

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