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This handbook for the port of San Remo, 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.

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Monterey, CA 93943-5006

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SEVERE WEATHER GUIDE MEDITERRANEAN PORTS

26. SAN REMO

by R. E. Engelbretson

Don Jacobs 87

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FOREWORD

This handbook on Mediterranean Ports was developed as part of an ongoing effort at the Naval Environmental Prediction Research Facility 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 the Naval Environmental Prediction Research Facility for review and incorporation as appropriate. This document will be a dynamic one, changing and improving as more and better information is obtained.

W. L. SHUTT
Commander, U.S. Navy

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.

1988 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	MONACO
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

1989	PORT
26	SAN REMO, ITALY
27	GENOA, ITALY
28	PORTO TORRES, ITALY
29	PALERMO, ITALY
30	MESSINA, ITALY
31	TAORMINA, ITALY
	BENIDORM, SPAIN

1990	PORT
	TARANTO, ITALY
	ALEXANDRIA, EGYPT
	PORT SAID, EGYPT
	ANTALYA, TURKEY
	ISKENDERUN, TURKEY
	IZMIR, TURKEY
	GOLCUK, TURKEY
	ISTANBUL, TURKEY

1991	PORT
	ROTA, SPAIN
	TANGIER, MOROCCO
	ALGIERS, ALGERIA
	TUNIS, TUNISIA
	BIZERTE, TUNISIA
	SFAX, TUNISIA
	VALETTA, MALTA

1992	PORT
	SOUDA BAY, CRETE
	PIRAEUS, GREECE
	KALAMATA, GREECE
	THESSALONIKI, GREECE
	CORFU, GREECE
	KITHIRA, GREECE
	LARNACA, CYPRUS
	DUBROVNIK, YUGOSLAVIA
	SPLIT, YUGOSLAVIA
	GULF OF SOLLUM

PREFACE

Environmental phenomena such as strong winds, high 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 NEPRF 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 previsit 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 of 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

San Remo is located on the coast of extreme northwest Italy near the French border at approximately 43°39'N 7°47'E (Figure 2-1). The coast near San Remo is aligned nearly east-west. Mountains back the coastline north of San Remo.

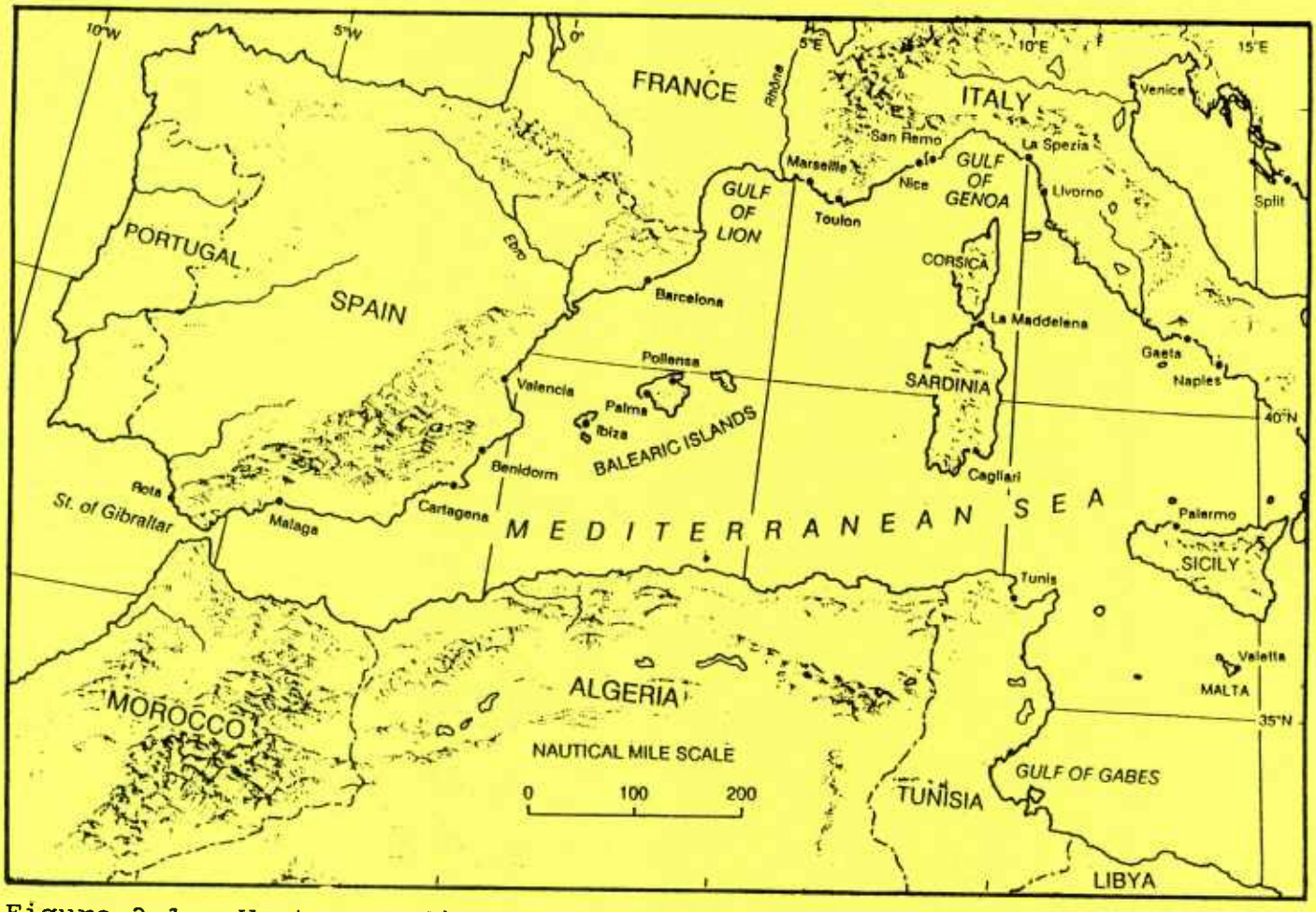


Figure 2-1. Western Mediterranean Sea.

The Port of San Remo is located about 60 n mi southwest of Genoa (Figure 2-2). San Remo is the chief resort for the part of the Italian Riviera known as the Riviera di Fiori. Monte Bignone (4258 ft) located about 3 n mi north-northwest of the port dominates the landscape.

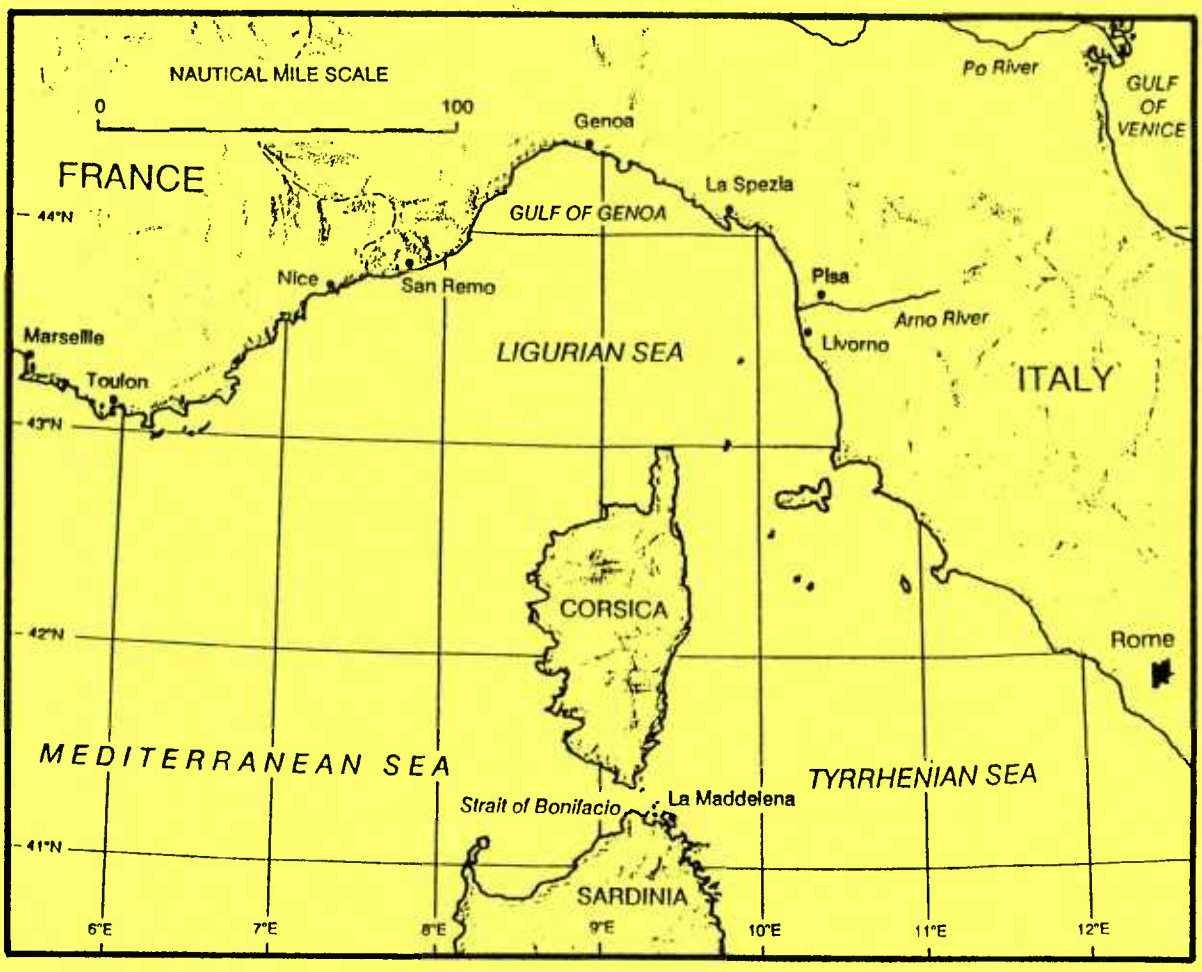


Figure 2-2. Ligurian Sea.

The harbor is man made. Its outer limits are defined by eastern and western breakwaters (Figure 2-3). Two quays are available for berthing, one on the inner side of the west breakwater and the other on the north mole inside the western breakwater. However, as of August 1987, berthing was not available for U.S. Navy ships in the harbor (Port Visit Notes, 1987). The fleet landing is located near the Port Captains Office in the forward end of the north mole. The harbor is very congested and small boats may be required to back into mediterranean type moorings (FICEURLANT, 1982). There are two anchorage areas, both about 3/4 n mi off the breakwater, one to the east of the harbor entrance and one to the west.

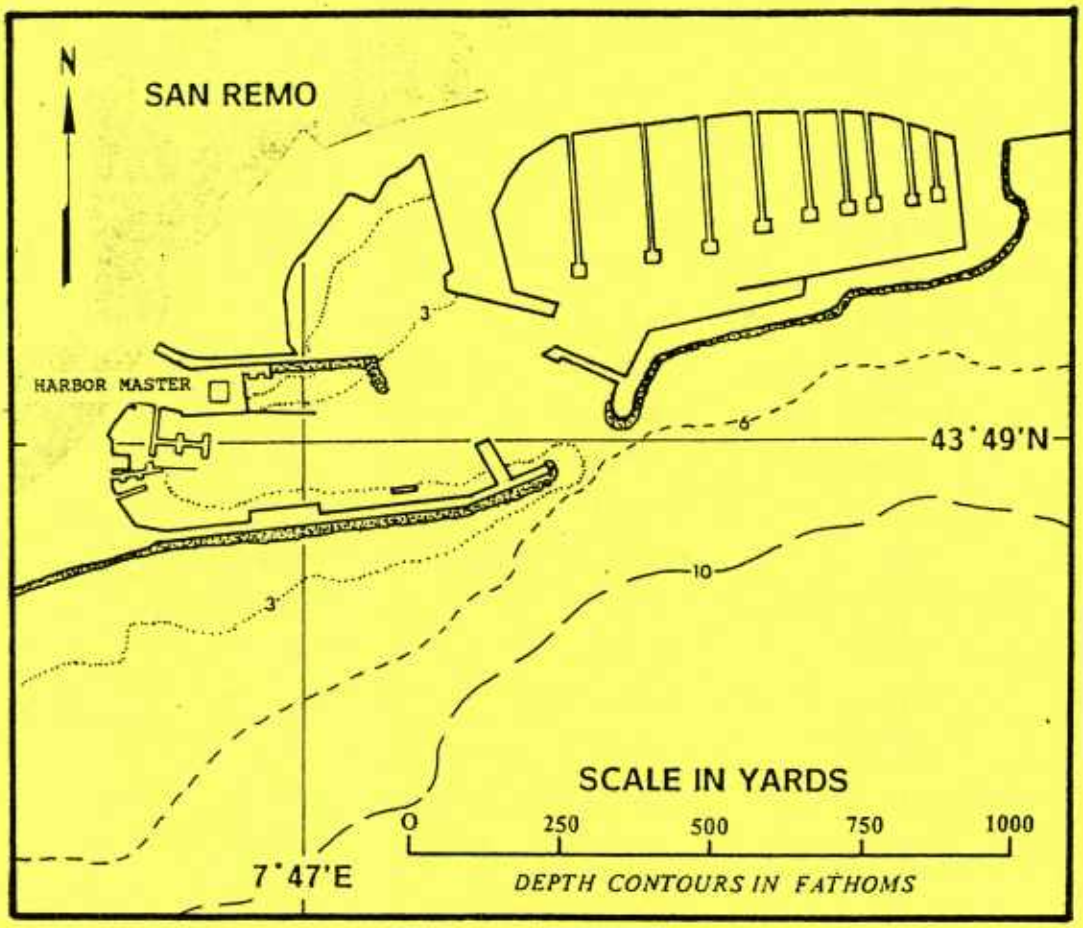


Figure 2-3. Port of San Remo.

The Port of San Remo has limited berthing with alongside depths of 12-15 ft (3.6-4.6m). Entrance depth is approximately 18 ft (5.5m). The entrance is about 100 ft wide (30m). As of August 1987 berthing in the harbor was not available for U.S. Navy ships.

The inner harbor of the Port of San Remo is exposed to easterly winds which will affect berthed ships. However, vessels can ride out the heavy weather by doubling lines or using other appropriate mooring tactics and vessels are not required to sortie.

Anchorage assignments are established by the Italian Navy. There are two anchorage areas; both about 3/4 n mi off the harbor entrance, one to the east and one to the west. The anchorages are fully exposed to wind and waves from the east clockwise through west. Holding conditions are good in mud and sand. The most hazardous conditions are caused by heavy swell combined with local wind waves and strong westerly winds primarily associated with Mistral events, but occasionally with the passage of low pressure/frontal systems. February and March are the months most likely to experience the strongest Mistral conditions. Skies are generally clear under Mistral conditions. The most frequent heavy weather event during the cold season results from the development of a Genoa low to the east of the area. This results in northeasterly winds and rainy, cloudy weather.

During the warmer months a southerly sea breeze is a daily occurrence. On rare occasions the wind is strong enough to necessitate canceling small boat operations outside the harbor.

Specific hazardous environmental conditions, vessel situations, and suggested precautionary/evasive action scenarios for the Port of San Remo are summarized in Table 2-1.

Table 2-1. Summary of hazardous environmental conditions for the Port of San Remo, Italy.

HAZARDOUS CONDITION	INDICATORS OF POTENTIAL HAZARD	VESSEL LOCATION/ SITUATION AFFECTED	EFFECT - PRECAUTIONARY/EVASIVE ACTIONS
1. W'ly Winds/waves - Mistral Events. Most hazardous conditions. * Strongest and most common in late winter early spring. * SW'ly swell 10-13 ft with W'ly 22-33 kt. Extreme conditions 20 ft swell with 41-47 kts. * Strong low level wind shear.	Advance warning * Mistral will start west of San Remo when the following pressure differences are achieved--highest pressure to west. * Perpignan - Marseille, 3 mb. * Marignane - Nice, 3 mb. * Perpignan - Nice, 6 mb. * Conditions favorable for Genoa low formation are conducive to the start of a Mistral at Marseille. * For Mistral winds to affect the San Remo/Nice area, they will first be observed at Marseille/ Toulon. * Mistral will spread east to San Remo/Nice area if a 10 mb pressure difference exists between Toulon and Nice. * With only 2 mb difference between Marseille and Toulon the Mistral will stop near Toulon.	(1) Anchored. (2) Small boats. (3) Aircraft operations.	(a) Heavy swell and winds may create hazardous conditions. * Winds drop off rapidly to eastward, but swell persists. * Two anchors may be required. * Villefranche affords better protection, but carrier anchorage still fully exposed. (a) Small boat runs to/from anchorage hazardous. * Cancel small boat operations outside of harbor. * Consider wind chill factor. (a) Strong low level wind shear, flight hazard. * Westerly flow over runs surface easterlies, near eastern extent of Mistral. * Also likely to be area of low ceilings and precipitation. * With westerlies reaching surface, directional shear gone and skies generally clear.
2. E'ly winds/waves - Genoa lows. * Most frequent cold season inclement weather conditions. * Typically 11-21 kt, extremes 34-40 kt. Waves 5-6 ft, shorter periods due to fetch limitation. * Several days of cloudy rainy conditions with repeated secondary frontal passages.	Advance warning * Strong west to northwest jet stream over Gulf of Lion precedes Genoa low development by 1-2 days. * Cold air entering Po Valley from northeast precedes rapid development. * Surface pressure falls over Gulf of Genoa/Po Valley indicates beginning development. * Clouds forming over mountains from the north indicates low is moving eastward. * Strong or strengthening high pressure cell over central Europe with low passing to south.	(1) Moored - inner harbor. (2) Anchored. (3) Small boats.	(a) Low easterly swell enters harbor. * May require special berthing and ship/small boat handling. (a) Strong events may expose vessels to heavy weather conditions * Deployment of two anchors may be required. * Moving westward will provide improved conditions. * Villefranche offers protected anchorage. (a) Short period wind waves causes hazards for small boats. * Operations may have to be canceled outside harbor. * Consider wind chill factor.
3. S'ly swell - Migratory low passing south of area. * Infrequent cold season event. * S'ly swell 4-6 ft may persist for 2-3 days, wind speeds only moderate but shift out of south.	Advance warning * Migratory low passing to the south of area. * Lows may have entered through the Straits of Gibraltar or formed north of the Atlas Mountains of North Africa.	(1) Anchored.	(a) S'ly swell persists for 2-3 days, local wind/waves shift from southerly direction, ships at anchor swing to align with wind. * Excessive ship rolling may result from taking abeam swell. * Creates hazards for alongside or well deck operations. * When condition develops it is wide spread over the region.
4. Sea Breeze - Daily warm season event. * S'ly 11-16 kt, peaks mid-afternoon. * Extremes of 28-33 kt most likely in July and August.	Advance warning * Develops daily during warm season. * Onset about 1100L, peaks mid-afternoon, ends late evening.	(1) Small boats.	(a) A daily afternoon event during warm season. * Extremes likely during July-August. * Small boat operations to/from anchorages may have to be curtailed during afternoons.

SEASONAL SUMMARY OF HAZARDOUS WEATHER CONDITION

WINTER (November through March):

* Westerly winds, swell, and waves outside the harbor associated most often with Mistral events, occasionally with migratory low/frontal systems. Conditions typically 22-33 kt (force 6-7), swell 10-13 ft (3-4 m). Extreme conditions reach 41-47 kt (force 9), swell to 20 ft (6 m) and local seas 13-16 ft (4-5 m). Clear skies experienced with Mistral events.
* Easterly winds with development of Genoa lows. Typically 11-21 kt (force 4-5), waves are fetch limited. Strong systems result in 34-40 kt (force 8). Weather is cloudy, rainy, with reduced visibility. The inner harbor is affected by easterly winds.

SPRING (April through May):

* Mistral and Genoa low events occur through April, generally of weaker category.

SUMMER (June through September):

* Strong sea breeze events. Daily southerly winds of 11-16 kt (force 4) peak in mid-afternoon. Extreme events to 28-33 kt (force 7).
* Thunderstorms over mountains spread over harbor areas.
* Morning visibility restricted in haze and fog.

AUTUMN (October):

* Rapid transition to Winter conditions. Return of Mistrals and Genoa lows. Marked increase in precipitation.

NOTE: For more detailed information on hazardous weather conditions, see previous Table 2-1 in this section and Hazardous Weather Summary in Section 3.

References

FICEURLANT, 1987: Port Directory. Fleet Intelligence Center Europe and Atlantic, Norfolk, VA.

Port Visit Information

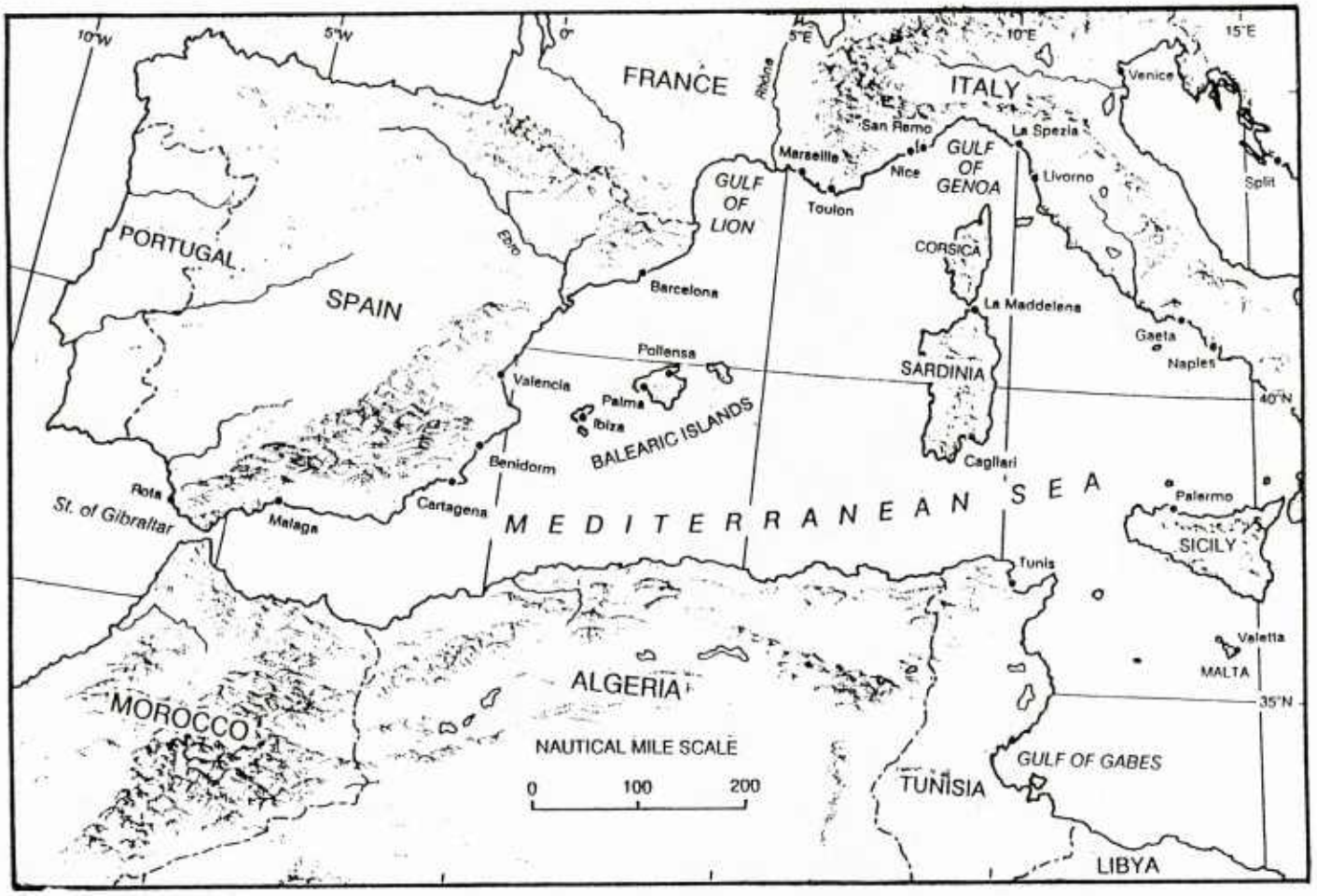
August 1987: NEPRF Meteorologist R. Fett and D. Perryman met with the Port Captain and the Yacht Harbor Director to obtain much of the information included in this port evaluation.

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 3-2 provides a summary of vessel locations/situations, potential hazards, effects, precautionary/evasive actions, and advance indicators and other information by season.

3.1 Geographic Location

San Remo is located on the coast of extreme northwest Italy near the French border at approximately 43°39'N 7°47'E (Figure 3-1). The coast near San Remo is aligned nearly east-west. Mountains back the coastline north of San Remo.



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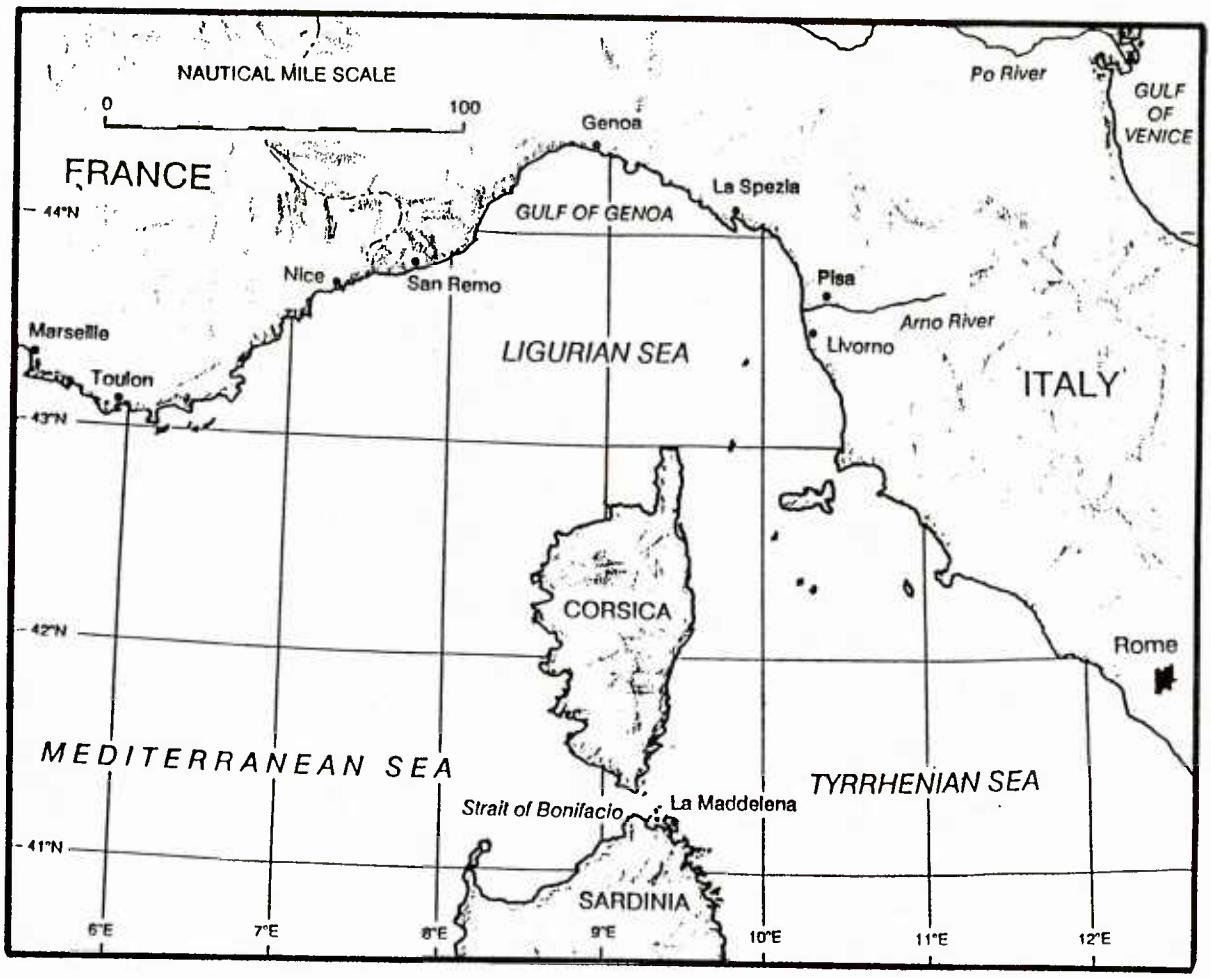
The Port of San Remo is located about 60 n mi southwest of Genoa (Figure 3-2). San Remo is the chief resort for the part of the Italian Riviera known as the Riviera di Fiori. Monte Bignone (4258 ft) located about 3 n mi north-northwest of the port dominates the landscape.



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The harbor is man made. Its outer limits are defined by eastern and western breakwaters (Figure 3-3). Two quays are available for berthing, one on the inner side of the west breakwater and the other on the north mole inside the western breakwater. However, as of August 1987, berthing was not available for U.S. Navy ships in the harbor (Port Visit Notes, 1987). The fleet landing is located near the Port Captains Office in the forward end of the north mole. The harbor is very congested and small boats may be required to back into mediterranean type moorings (FICEURLANT, 1982). There are two anchorage areas, both about 3/4 n mi off the breakwater, one to the east of the harbor entrance and one to the west.

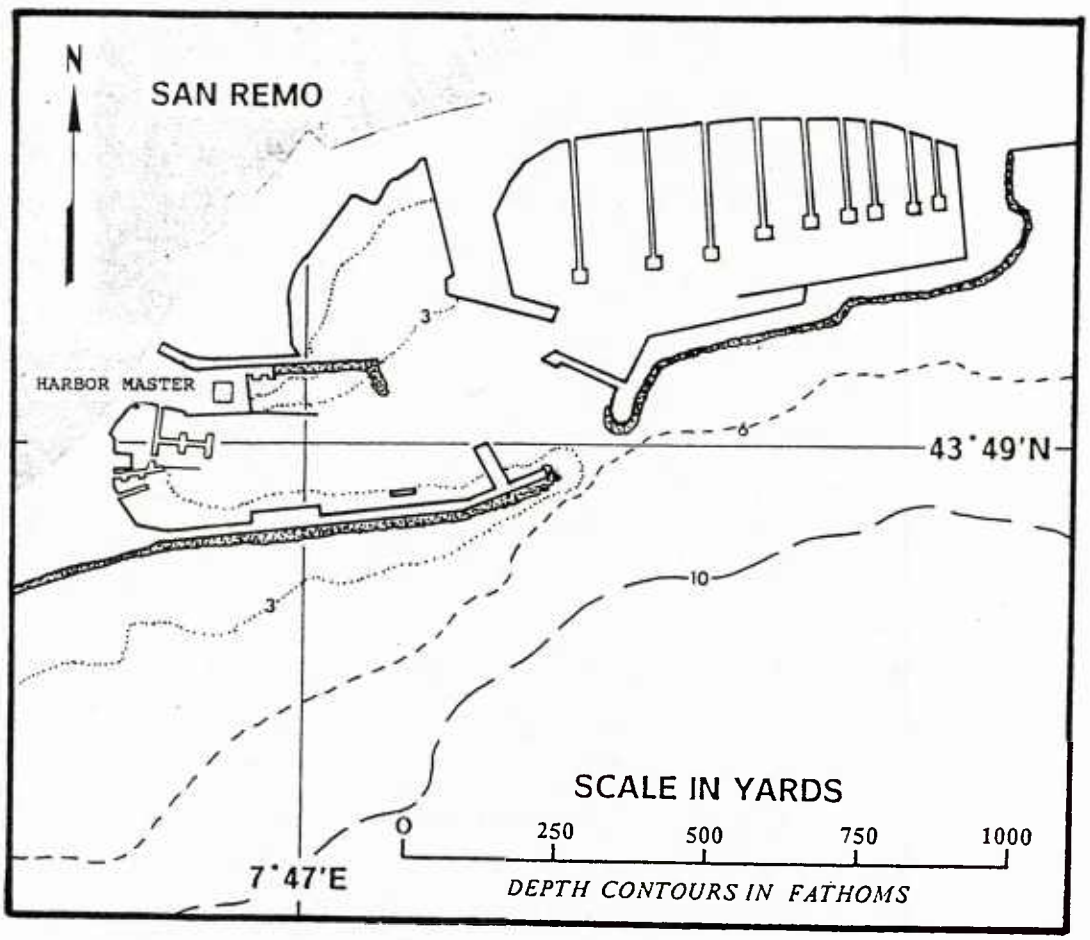

Figure 3-3. Port of San Remo.

3.2 Qualitative Evaluation of the Port of San Remo

As of August 1987 berthing in the harbor was not available for U.S. Navy ships (Port Visit Notes, 1987). The Port of San Remo has limited berthing space with maximum alongside depths of 12-15 ft (3.6-4.6m). Entrance depth is approximately 18 ft (5.5m) and width about 100 ft (30m).

Anchorage assignments are established by the Italian Navy. There are two anchorage areas, one about 3/4 n mi west of the entrance and the other about 3/4 n mi east of the entrance. Holding conditions are good in mud and sand grounds. The anchorages are fully exposed to wind and waves.

The most hazardous conditions are associated with the strong westerly winds of Mistral events which cause heavy swell and local wind waves. Occasionally a frontal/low pressure system passage will bring strong westerlies too. Strong westerly wind events are typically 34-48 kt (force 8-9) with swell of 18-20 ft (6m) and local seas of 13-16 ft (4-5m).

The most frequent heavy weather event during the cold season results from the development of Genoa lows to the east of the area. This brings cloudy, rainy weather and easterly winds typically 11-21 kt (force 4-5) with extreme speeds of 34-40 kt (force 8).

During the warmer months there is a daily sea breeze that occasionally reaches 28-33 kt (force 7) and necessitates canceling small boat operations to/from the anchorage outside the harbor.

3.3 Currents and Tides

Currents at the Port of Remo are weak, limited to a 1/2 kt westward setting current. Tides are negligible. During winter strong easterly wind causes a swell to build in the harbor and may cause problems mooring at the north and south moles.

3.4 Visibility

Night and early morning visibility is frequently reduced to 1 to 2 n mi in haze/fog during the warm season. During the winter period some reduction to visibility typically occurs during cloudy, rainy Genoa low events.

3.5 Hazardous Conditions

The inner harbor of the Port of Remo is exposed to easterly winds which will affect berthed ships. However, vessels can ride out the heavy weather by doubling lines or using other appropriate mooring tactics. Vessels are not required to sortie under high wind conditions.

The anchorage areas are fully exposed to wind and waves from the east clockwise through west. The most hazardous conditions are caused by heavy southwesterly swell combined with local wind waves. This condition occurs most often with on outbreak of strong westerlies associated primarily with Mistral events and occasionally with the passage of low pressure/frontal systems.

The cold season Genoa low events are the most frequent cause of inclement weather at San Remo. The easterly winds are of lesser intensity than the southwesterlies and the wave conditions are lower due to being fetch limited. Therefore, the conditions at the anchorages tend to be less hazardous than during strong southwesterly wind events. However, the inner harbor is exposed to easterly winds which will result in a low swell entering the harbor.

Warm season sea breezes are a daily event. They routinely commence about 1100L, reach 25 kt during the mid-afternoon, and then subside by late evening. Occasionally the sea breeze reaches 28-33 kt and necessitates canceling small boat operations to/from the outer anchorages.

Although rare, storms having tropical cyclone characteristics with fully developed eyes have been observed on at least three occasions in the Mediterranean Basin: 23-26 September 1969, 22-28 January 1982, and 26-30 September 1983. On the latter occasion the storm moved northwest from the Gulf of Gabes (on the southeast coast of Tunisia), through the Straits of Sicily, along the east coast of Sardinia, and into the Gulf of Genoa. Winds of 100 kt were observed near the eye while Cagliari, Sardinia reported winds of 60 kt. While the probability of such a storm striking San Remo is very slight, the meteorologist must be aware of the possibility.

The Port of San Remo takes weather observations during the summer months and keeps radio contact with ships in the area to pass along warnings (Port Visit Notes, 1987). A seasonal summary of various known environmental hazards that may be encountered at the Port of San Remo follows.

A. Winter (November through February)

The winter conditions are wet and cool with frequent periods of squally blustery weather associated with Genoa lows. A particularly hazardous trait of the Genoa low is that several periods of squally frontal type weather is likely to occur with each low. This reflects the combined effects of the low being slow to move out and the tendency for development of secondary troughs or fronts.

The strongest wind events at San Remo occur with southwest winds resulting from Mistral events. Mistral winds can reach 34-47 kt (force 8-9) during strong outbreaks and combined swell and sea waves reach 13-16 ft (4-5m) in nearby open sea areas. There are two causes of strong southwesterly winds: (1) migratory lows and fronts, and (2) Mistral winds which spread eastward from the Gulf of Lion. San Remo is located near the eastern limit of the area normally affected by the Mistral winds. The Mistral impact is usually greater at ports farther west, such as Toulon and Marseille.

Genoa low easterly winds are the most common cause of inclement weather at San Remo. They are usually accompanied by overcast skies, rainy weather, and generate swell which passes through the port entrance into the main harbor. Small boat runs to/from the anchorages may be adversely affected.

Southerly winds and waves are rare, and are caused by depressions moving into the Ligurian Sea or across Corsica into Italy. At the anchorages the resulting swell is generally more of a problem than the wind. The swell seldom exceeds 6 ft (2m), but it may persist for 2 or 3 days. With the southerly swell persisting after the wind changes direction (generally becoming an east wind) the swell direction is at an angle of 45°-90° to the anchored

vessels' longitudinal axis, causing excessive rolling (Shaver, undated).

The most frequent wind direction in the early morning is northerly, becoming southeasterly or southwesterly in the afternoon, averaging about 7 kt with little diurnal change in speed. Precipitation is common, occurring on about 1/3 of the days during winter. Temperatures are moderate, January being the coldest month with mean maximum and minimum temperatures of 55°F (13°C) and 43°F (6°C) respectively. Wind chill (temperature combined with wind) can be quite cold. Table 3-1 provides wind chill values for various temperature and wind combinations.

Table 3-1. Wind Chill. The Cooling power of the wind expressed as "Equivalent Chill Temperature" (adapted from Kotsch, 1983).

Wind Speed		Cooling Power of Wind expressed as "Equivalent Chill Temperature"								
Knots	MPH	Temperature (°F)								
Calm	Calm	40	35	30	25	20	15	10	5	0
		Equivalent Chill Temperature								
3-6	5	35	30	25	20	15	10	5	0	-5
7-10	10	30	20	15	10	5	0	-10	-15	-20
11-15	15	25	15	10	0	-5	-10	-20	-25	-30
16-19	20	20	10	5	0	-10	-15	-25	-30	-35
20-23	25	15	10	0	-5	-15	-20	-30	-35	-45
24-28	30	10	5	0	-10	-20	-25	-30	-40	-50
29-32	35	10	5	-5	-10	-20	-30	-35	-40	-50
33-36	40	10	0	-5	-15	-20	-30	-35	-45	-55

B. Spring (March through May)

The spring season in the central Mediterranean Sea is characterized by periods of stormy winter-type weather associated with a continued high frequency of Genoa lows, which alternate with a number of false starts of relatively settled-summer type weather (Brody and Nestor,

1980). Although Genoa lows can develop during any month, the strongest spring systems occur in March and April. By May, the transition to the more-or-less settled weather of summer proceeds more smoothly.

Southwesterly winds are possible throughout the season as low pressure systems move into or develop in the Gulf of Genoa. Strongest winds are to be expected in March and April. Since late winter and early spring is the period of maximum Mistral frequency and strength in the Gulf of Lion, southwesterly winds at Genoa which result from an eastward spreading of Mistral winds would also be more frequent and stronger during the same period. In either case, by the end of May strong winds would be rare and of short duration.

Spring precipitation is at a maximum during March. Monthly totals decrease through April to May. Thunderstorms are possible, and are most probable with the development of secondary fronts during strong Genoa low events.

An increase in temperature occurs throughout the season. By May the mean daily maximum and minimum temperatures are 70°F (21°C) and 59°F (15°C) respectively. Wind chill can be a problem for personnel working outdoors in exposed locations through mid-April. See Table 3-1.

C. Summer (June through September)

The Summer season brings warm relatively settled weather to San Remo. Mistral events are rare and of short duration. A sea breeze regime is evident. Evening through early morning winds blow from north clockwise through south and from the southeast to south during afternoons.

Precipitation reaches its minimum during mid-summer with July the driest month of the year. August is nearly as dry with rainfall increasing in September. Thunderstorms may occur during late summer, but are usually widely scattered.

July and August have the highest average temperatures of the year, with about 80°F (27°C) and 71°F (22°C) being the mean daily maximum and minimum temperatures.

D. Autumn (October)

According to Brody and Nestor (1980), the autumn season lasts only for the single month of October, and is characterized by an abrupt change to winter-type weather. The transition to winter-type weather brings an increase in frequency and intensity of Genoa cyclogenesis.

Precipitation amounts continue to increase from the relatively low totals of summer with about 5 inches being recorded during an average October.

Temperatures decrease from those of late summer, but are still moderate, with 67°F (20°C) and 58°F (14°C) being the mean daily maximum and minimum figures for the month.

3.6 Harbor Protection

The eastern and western breakwaters provide protection for vessels in the harbor from all serious wave action. The harbor is exposed to easterly winds. However, vessels can ride out the heavy weather by doubling lines or using other appropriate mooring tactics. Vessels are not required to sortie under high wind conditions. Under easterly winds a low swell does enter the harbor and cause minor problems for vessels berthed

or berthing at the north and south moles. The anchorages are fully exposed to open sea wind and wave conditions.

3.6.1 Wind and Weather

San Remo is located in the overlapping areas between two well known hazardous weather patterns. It is east of the region of strong Mistrals and west of the area of maximum impact of Genoa lows. However, it can at times experience weather associated with either of these events. Conditions of low clouds and rain with northeasterly winds associated with Genoa lows are quite common weather in the winter. Typically easterly winds are less than 20 kt (force 5) but on occasion reach 30-40 kt (force 7-8).

Heavy southwesterly swell and winds are the most hazardous events for vessels anchored in the San Remo area. Southwesterly wind/swell can result from two different synoptic patterns: 1) strong Mistrals events and, 2) passage of migratory fronts/lows. The southwesterly winds reach 34-47 kt (force 8-9) with swell to 20 ft (6m) during the strongest events which are most likely to occur in February or March.

During the warmer months a daily southerly sea breeze develops. The sea breeze typically peaks in mid-afternoon at 11-16 kt (force 4) but can reach speeds of 28-33 kt (force 7) and may necessitate canceling small boat operations outside the harbor. Summer visibilities tend to be restricted in haze and fog during morning hours.

3.6.2 Waves

Except for waves from the east the inner harbor is completely protected from open sea waves by the two breakwaters. Easterly winds will result in a low swell entering the harbor and affecting the area around the north and south mole. The affects are minimal but may result in harbor officials requiring special ship handling and berthing procedures.

Vessels at anchor in the two primary anchorages outside the harbor breakwater (approximately 3/4 n mi east and west of the harbor entrance) are exposed to the open sea wave action. Under extreme southwesterly wind conditions combined swell and sea heights reach 20 ft (6m). On rare occasions southerly swell of 5-6 ft (2m) affects the anchorage areas. Southerly swell events may persist for 2 or 3 days and typically result in the local wind and swell direction becoming out of phase. The wind direction may differ from swell direction by 45° to 90°, causing excessive ship rolling.

3.7 Protective and Mitigating Measures

3.7.1 Sortie/Move to a New Anchorage

Because of the exposure of the anchorages to open sea wind and wave conditions, vessels may be well advised to move to more protected anchorages when strong westerlies threaten. Recalling that San Remo is near the eastern extent of the southwesterly winds of Mistral events, moving a short distance northeastward along the coast will likely give relief from the high winds. However, the swell conditions may extend to Genoa and beyond. Moving southwestward, on the other hand, will

likely result in improving conditions when a Genoa low is the cause of hazardous environmental conditions.

The most protected anchorage (mooring to buoys) in the regions is at Villefranche. The anchorage in the small gulf between the mainland and Point Portofino about 15 n mi southeast of Genoa is also considered one of the more protected in the region. There is little protection available outside of harbors along the local coastal areas of Italy and France.

3.7.2 Sortie/Remain in Inner Harbor

Because of the protection afforded to the inner harbor by the breakwaters, ships should be able to remain in the harbor without significant risk. Strong wind conditions will require that mooring lines be doubled and/or other heavy weather procedures be exercised. As with most harbors in this region, San Remo harbor is typically filled with private yachts and tends to be busy and cluttered. As noted at the time of the 1987 port visit, by NEPRF personnel, berthing for U.S. Navy ships normally is not available in the harbor.

3.7.3 Scheduling

During the months of April through October, evolutions requiring light or calm winds should be scheduled during morning hours. Local scale conditions dominate the winds. The southerly sea breeze is a daily event typically reaching 11-16 kt (force 4) by mid-afternoon and ending by late evening. On occasion it reaches speeds of 28-33 kt which may necessitate canceling small boat operations outside the harbor. Wind and wave conditions are most favorable late evenings through

morning to noon. Early morning visibility is typically restricted by fog and haze.

During the months of November through March synoptic/long wave scale events dominate. There is little diurnal variation in conditions during an event. Scheduling environmental sensitive evolutions must consider time scales of days, the life cycle of Mistrals and Genoa lows. The long period swell with Mistrals is a major concern while shorter period local sea waves are experienced with Genoa lows. In both cases there is little diurnal variation. During undisturbed periods weak northerly (offshore) winds prevail with little diurnal variation. Special consideration should be made for scheduling alongside or well deck operations when southerly swell and local wind/waves are out of phase, this condition may persist for 2 to 3 days when a low passes south of the area.

3.8 Local Indicators of Hazardous Weather Conditions

The following guidelines have been extracted from various sources and are intended to provide the insight to better enable the meteorologist to understand the various phenomena that affect the Port of San Remo. The Port of San Remo is located near the eastern limit of the area experiencing the Mistral. When Mistral winds do reach the Port they are weak as compared to those experienced farther west along the coast. Weather observations are taken at the port and passed to ships in the area along with area warnings.

Because San Remo is not in an area normally subjected to wind during an initial Mistral onset, most of the more technical guidelines for Mistrals have been omitted from this listing. If a more comprehensive list

is desired, the reader is referred to section 3.8 of the port studies of either Marseille or Toulon, France.

3.8.1 Mistral

1. For Mistral winds to affect the Nice/San Remo area, they will first be observed at Marseille and Toulon. Alongshore pressure gradient with higher pressure to the west is important in predicting Mistral extent. When a 10 mb difference exists between Toulon and Nice, the Mistral will spread eastward. With only a 2 mb difference between Marseille and Toulon, the Mistral will cease near Toulon.

2. Eastward from Iles d'Hyéres there is a rapid decrease in the frequency and force of the Mistral. It blows at times all along this coast but because of its reduced frequency and intensity it is not the same threat as around the Rhône delta. The general climate of the French and Italian Rivieras benefit from being sheltered from the most intense form of Mistral which is experienced farther west. Often light easterlies are reported at Nice/San Remo when strong northwesterlies are reported at Marseille (Hydrographer of the Navy, 1965).

3. The eastern boundary of the Mistral extends downwind from the western edge of the Alps through San Remo, Italy (Brody and Nestor, 1980).

4. Conditions which favor the formation of a Genoa low are conducive to the start of a Mistral at Marseille. A strong Mistral at Marseille may spread eastward to the coastal waters near Nice and Villefranche.

5. The Mistral will start at Marseille when one (or more) of three surface pressure differences is achieved: Perpignan-Marseille, 3 mb; Marseille-Nice, 3 mb; or Perpignan-Nice, 6 mb. Such differences usually develop

within 24 hr after a closed Genoa low appears, but it occasionally occurs earlier (Brody and Nestor, 1980).

6. Associated Weather - When fully established, the Mistral is usually accompanied by clear skies. However, rain (or in winter, rain and/or snow) and violent squalls commonly accompany the cold front which precedes the Mistral (Hydrographer of the Navy, 1965). Skies along the coast are usually clear. Precipitation is uncommon, except when the Mistral is shallow with a southerly flow at mid-levels causing middle clouds and rain. Other exceptions are at the cold front associated with the onset of the Mistral and at secondary cold fronts associated with reintensification of Mistral conditions. However, as the cold air moves out over the warmer water, convective cloudiness increases.

7. If a Mistral is occurring at Marseille while light winds are observed at Villefranche/Nice, wind shear in the lower levels of the atmosphere may create hazardous low level flight/landing conditions in the region where westerly flow is overrunning the surface easterly flow.

3.8.2 Genoa Low

1. The onset or development of a Genoa low is typically signaled by strong west to northwest winds aloft over the Gulf of Lion a day or two before onset. Surface pressure falls over the Gulf of Genoa and/or Po Valley indicate the beginning stage of development. Commencement of Mistral winds in the Gulf of Lion typically coincides with a closed low developing in the Gulf of Genoa.

2. Genoa lows remain nearly stationary during development. Multiple secondary fronts will rotate around a Genoa low during its life cycle. If local winds back

from westerly to southerly expect an approaching secondary front.

3. Clouds forming over the mountains from the north is evidence of winds shifting to northerly and the low moving out.

4. A lee trough often is present in the Gulf of Genoa when a cold or occluded front is moving into western France. Cyclogenesis in the area of the trough is likely to occur when the migratory front overtakes it.

5. A good indication of rapid development of a Genoa low is the appearance of cold air entering the Po Valley of northern Italy from the northeast. If Genoa cyclogenesis is predicted, the following rules can be used to decide whether it will occur in the Gulf of Genoa or to the east in the Gulf of Venice:

(1) If large amounts of cold air penetrate the Po Valley from the northeast, cyclogenesis can be expected in the Gulf of Genoa. This cyclone generally will move southeastward along the west coast of Italy.

(2) If little cold air penetrates the Po Valley from the northeast while a strong push is observed in the Gulf of Lion, cyclogenesis will probable take place in the Gulf of Venice. This cyclone occasionally may move southeast through the Adriatic Sea.

6. Complex low pressure systems with multiple centers at the surface are a common event in the western Mediterranean Basin. One center usually can be found in the Gulf of Genoa, while another is found over North Africa; a weak pressure gradient exists between the two systems. Which of these lows will develop depends greatly on the movement of an upper-level (500 mb) short wave trough. If the trough moves to the North African coast, for example, the low center in that region will develop

rapidly, increasing the pressure gradient and causing easterly gales over the southern Tyrrhenian Sea.

3.9 Summary of Problems, Actions, and Indicators

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

Table 3-2. Potential problem situations at Port of San Remo, Italy - ALL SEASONS

VESSEL LOCATION/ SITUATION AFFECTED	POTENTIAL HAZARD	EFFECT - PRECAUTIONARY/EVASIVE ACTIONS	ADVANCE INDICATORS AND OTHER INFORMATION ABOUT POTENTIAL HAZARD
1. Moored - inner harbor. Frequent cold season event, weak and uncommon in Summer.	a. E'ly wind/waves - Most frequent cold season inclement weather event. Caused by Genoa lows and/or high pressure over central Europe. Results in cloudy rainy conditions that persist for several days. Low swell enters harbor through eastward opening entrance.	a. Low swell enters harbor. May require special berthing and ship/small boat handling procedures.	a. Strong west to northwest jet stream over Gulf of Lion precedes Genoa low development by 1-2 days. Cold air entering Po Valley from the northeast indicates likely rapid development. Surface pressure falls over Gulf of Genoa Po Valley region indicates beginning of development. Clouds forming over mountains from the north indicate low is moving eastward. A strong or strengthening high over central Europe with low pressure to south or southwest results in strong easterlies in San Remo area.
2. Anchored. Primarily Autumn through Spring, strongest late Winter early Spring.	a. Mistral - Most hazardous cold season weather event. W'ly wind 22-33 kt, SW'ly swell 10-13 ft, extremes reach 41-47 kt and 20 ft swell. Anchorage areas are fully exposed.	a. Heavy swell, strong winds and seas create the most hazardous conditions experienced in anchorages outside San Remo Harbor. Vessels should consider moving eastward out of range of strongest Mistral effects or westward to more protected anchorages such as Villefranche. Small boat operations will be canceled and deployment of two anchors likely necessary.	a. Mistral will start west of San Remo when the following pressure differences develop, highest pressure to the west. Perpignan-Marseille 3 mb, Marignane-Nice 3 mb, or Perpignan-Nice 6 mb. Conditions favorable for Genoa low formation are conducive to the start of a Mistral at Marseille. For Mistral winds to affect the San Remo/Nice area they will first be observed at Marseille/Toulon. Mistral will likely spread to San Remo/Nice area if a 10 mb pressure difference exists between Toulon and Nice.
Frequent cold season event, weak and uncommon in Summer.	b. E'ly wind/waves - Most frequent cold season inclement weather event. Caused by Genoa lows and/or high pressure over central Europe. Results in cloudy rainy conditions that persist for several days. Anchorage areas are fully exposed.	b. Ships should be able to remain at anchor. Deployment of two anchors advised. Small boat operations will be hazardous.	b. Strong west to northwest jet stream over Gulf of Lion precedes Genoa low development by 1-2 days. Cold air entering Po Valley from the northeast indicates likely rapid development. Surface pressure falls over Gulf of Genoa Po Valley region indicates beginning of development. Clouds forming over mountains from the north indicate low is moving eastward. A strong or strengthening high over central Europe with low pressure to south or southwest results in strong easterlies in San Remo area.
Cold season event.	c. S'ly swell - An infrequent winter event. S'ly 5-8 ft swell persists after local wind/waves have shifted (typically easterly), swell and wind become 45° - 90° out of phase. Wide spread regional condition. Caused by slow moving lows passing south of the region.	c. Persistent southerly swell will be 45°-90° out of phase with local wind resulting in excessive rolling action.	c. Lows that either entered through the Strait of Gibraltar or formed north of the Atlas Mountains of North Africa and move slowly northeastward toward Corsica, passing south of the San Remo area, result in southerly swell entering the local waters for 2-3 days.
3. Small Boats. Primarily Autumn through Spring, strongest late Winter early Spring.	a. Mistral - Most hazardous cold season weather event. W'ly wind 22-33 kt, SW'ly swell 10-13 ft, extremes reach 41-47 kt and 20 ft swell. Small boat operations outside harbor typically canceled.	a. Small boat operations in the harbor should not be significantly affected. Operations outside the harbor will not be possible except in the weaker events.	a. Mistral will start west of San Remo when the following pressure differences develop, highest pressure to the west. Perpignan-Marseille 3 mb, Marignane-Nice 3 mb, or Perpignan-Nice 6 mb. Conditions favorable for Genoa low formation are conducive to the start of a Mistral at Marseille. For Mistral winds to affect the San Remo/Nice area they will first be observed at Marseille/Toulon. Mistral will likely spread to San Remo/Nice area if a 10 mb pressure difference exists between Toulon and Nice.
Frequent cold season event, weak and uncommon in Summer.	b. E'ly wind/waves - Most frequent cold season inclement weather event. Caused by Genoa lows and/or high pressure over central Europe. Results in cloudy rainy conditions that persist for several days. Small boat operations outside harbor typically canceled. Low swell affects berthing operations at north and south moles.	b. Low swell entering harbor will cause minor problems. Operations outside the harbor will be hazardous and may have to be canceled.	b. Strong west to northwest jet stream over Gulf of Lion precedes Genoa low development by 1-2 days. Cold air entering Po Valley from the northeast indicates likely rapid development. Surface pressure falls over Gulf of Genoa Po Valley region indicates beginning of development. Clouds forming over mountains from the north indicate low is moving eastward. A strong or strengthening high over central Europe with low pressure to south or southwest results in strong easterlies in San Remo area.
Cold season event.	c. S'ly swell - An infrequent winter event. S'ly 5-8 ft swell persists after local wind/waves have shifted (typically easterly), swell and wind become 45° - 90° out of phase. Wide spread regional condition. Caused by slow moving lows passing south of the region. Out of phase local wind waves and swell make for hazardous along side or well deck operations.	c. No affect in harbor. Outside harbor confused swell and local wind wave patterns will cause hazardous conditions particularly during alongside[1] or well deck operations where different length vessels well be responding to different wave lengths.	c. Lows that either entered through the Strait of Gibraltar or formed north of the Atlas Mountains of North Africa and move slowly northeastward toward Corsica, passing south of the San Remo area, result in southerly swell entering the local waters for 2-3 days.
Warm season event, most intense July/August.	d. Sea Breeze - Daily warm season event. Typically southerly 11-16 kts. Extremes of 28-33 kt most likely in July and August.	d. Choppy wave action will develop in anchorage areas during summer afternoons. Small boat operations may have to be curtailed during strongest events of July and August.	d. From late spring through autumn the sea breeze will commence daily about 1100L, peak in mid-afternoon and cease by late evening.

REFERENCES

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Port Visit Information

August 1987: NEPRF Meteorologist R. Fett and D. Perryman met with the Port Captain and the Yacht Harbor Director 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

DISTRIBUTION LIST
(NOTAL)

SNDL

21A1	CINCLANTFLT
21A3	CINCUSNAVEUR
22A1	COMSECONDFLT
22A3	COMSIXTHFLT
23B3	Special Force Commander EUR
24A1	Naval Air Force Commander LANT
24D1	Surface Force Commander LANT
24E	Mine Warfare Command
24G1	Submarine Force Commander LANT
26QQ1	Special Warfare Group LANT
28A1	Carrier Group LANT (2)
28B1	Cruiser-Destroyer Group LANT (2)
28D1	Destroyer Squadron LANT (2)
28J1	Service Group and Squadron LANT (2)
28K1	Submarine Group and Squadron LANT
28L1	Amphibious Squadron LANT (2)
29A1	Guided Missile Cruiser LANT
29B1	Aircraft Carrier LANT
29D1	Destroyer LANT (DO 931/945 Class)
29E1	Destroyer LANT (DO 963 Class)
29F1	Guided Missile Destroyer LANT
29G1	Guided Missile Frigate (LANT)
29I1	Frigate LANT (FF 1098)
29J1	Frigate LANT {FF 1040/1051 Class)
29K1	Frigate LANT {FF 1052/1077 Class)
29L1	Frigate LANT (FF 1078/1097 Class)
29N1	Submarine LANT #SSN}
29Q	Submarine LANT SSBN
29R1	Battleship Lant (2)
29AA1	Guided Missile Frigate LANT (FFG 7)
29BB1	Guided Missile Destroyer (DDG 993)
31A1	Amphibious Command Ship LANT (2)
31B1	Amphibious Cargo Ship LANT
31G1	Amphibious Transport Ship LANT
31H1	Amphibious Assault Ship LANT (2)
31I1	Dock Landing Ship LANT
31J1	Dock Landing Ship LANT
31M1	Tank Landing Ship LANT
32A1	Destroyer Tender LANT
32C1	Ammunition Ship LANT
32G1	Combat Store Ship LANT
32H1	Fast Combat Support Ship LANT
32N1	Oiler LANT
32Q1	Replenishment Oiler LANT
32S1	Repair Ship LANT
32X1	Salvage Ship LANT

32DD1	Submarine Tender LANT
32EE1	Submarine Rescue Ship LANT
32KK	Miscellaneous Command Ship
32QQ1	Salvage and Rescue Ship LANT
32TT	Auxiliary Aircraft Landing Training Ship
42N1	Air Anti-Submarine Squadron VS LANT
42P1	Patrol Wing and Squadron LANT
42BB1	Helicopter Anti-Submarine Squadron HS LANT
42CC1	Helicopter Anti-Submarine Squadron Light HSL LANT
C40	Monterey, Naples, Sigonella and Souda Bay only
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FD3	Fleet Numerical Oceanography Center - FLENUMOCEANCEN
FD4	Oceanography Center - NAVEASTOCEANCEN
FD5	Oceanography Command Center - COMNAVOCEANCOM (Rota)

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22A2	Fleet Commander PAC
24F	Logistics Command
24H1	Fleet Training Command LANT
28A2	Carrier Group PAC (2)
29B2	Aircraft Carrier PAC (2)
29R2	Battleships PAC (2)
31A2	Amphibious Command Ship PAC (2)
31H2	Amphibious Assault Ship PAC (2)
FA2	Fleet Intelligence Center
FC14	Air Station NAVEUR
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