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NIS 55

NATIONAL INTELLIGENCE SURVEY

ETHIOPIA AND THE SOMALILANDS

SECTION 22

COASTS AND LANDING BEACHES

Section 22 on NIS 55 is issued under the NIS maintenance program. It and NIS 106, Part IV supersede Section 21, Oceanography, dated April 1950, and Section 22, Coasts and Landing Beaches, dated March 1950, on NIS 55, copies of which should be destroyed.

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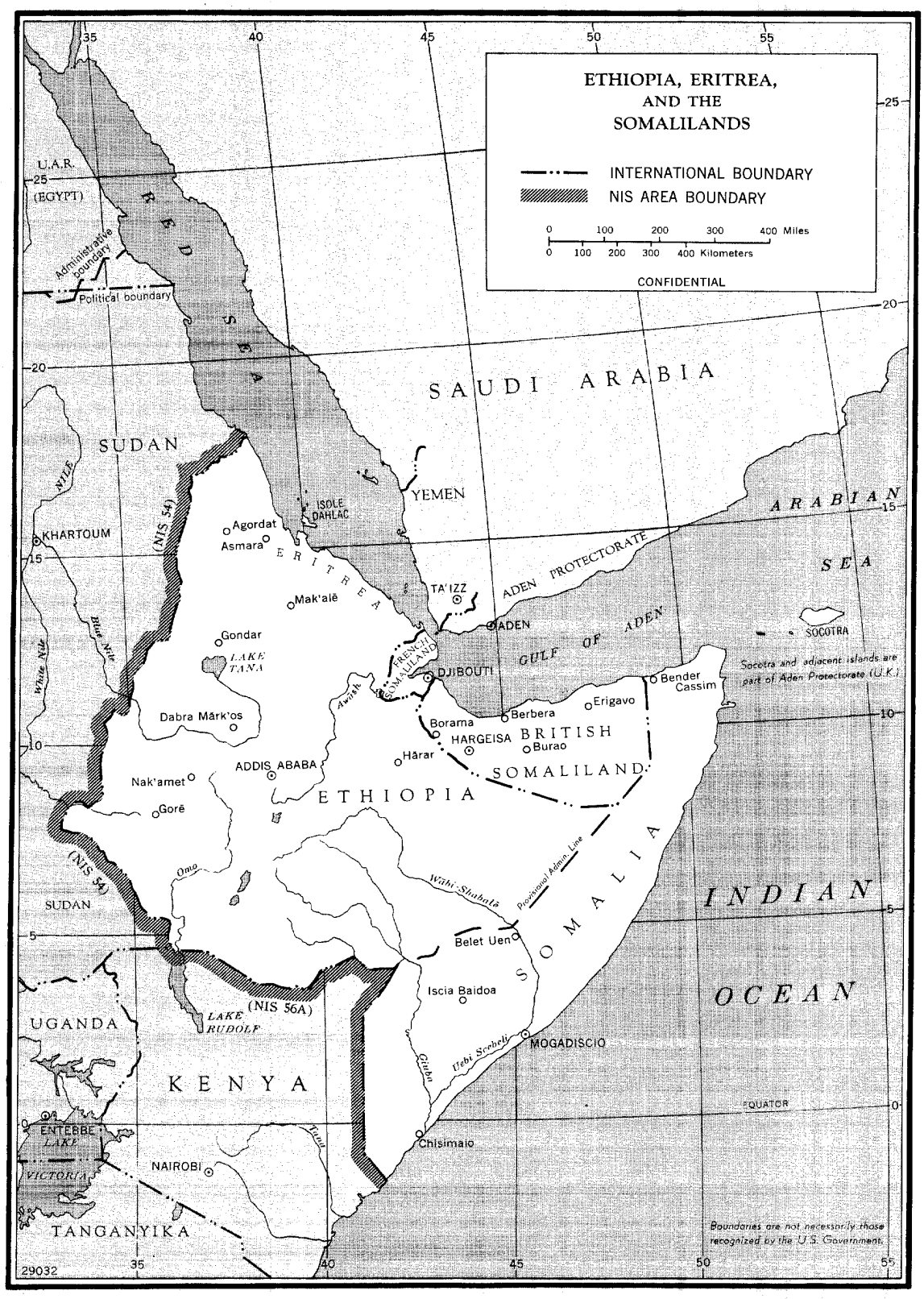

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This Section was prepared for the NIS by the Office of Naval Intelligence, with contributions on coastal oceanography from the U.S. Hydrographic Office and on routes of transportation from the Office of the Chief of Transportation, Department of the Army. The material on landing beaches was prepared under the general supervision of the Assistant Chief of Staff for Intelligence, Headquarters, Department of the Army, by the Office of the Chief of Engineers.

22. Coasts and Landing Beaches

The user can supplement the information in this Section by referring to Section 20 for a strategic appreciation of the Area's external geographic relationships and its internal geographic characteristics. Topical treatment of Weather and Climate is given in Section 23; Topography, including Terrain, Vegetation, and Cross-country Movement, in Section 24; and Urban Areas in Section 25. Integrated analysis of key military aspects of these topical sections by regions is presented in Section 21.

A. General

1. Summary

The NIS 55 Area consists of about 3,055 miles* of coastline and comprises Ethiopia (including Eritrea**), French Somaliland, and the Somali Republic (FIGURE 22–76). Socotra and the adjacent islands,*** located off the "Horn of Africa," have about 275 coastline miles. On the north, the mainland coasts are fronted by the Red Sea and the Gulf of Aden which are connected by a narrow strait, the Bab el Mandeb. On the east, the mainland coasts are fronted by the Arabian Sea and the Indian Ocean. Socotra and the adjacent islands lie in the westernmost part of the Arabian Sea.

The coastal zones of the NIS 55 Area are mostly hot desert and semidesert regions, sparsely populated, and served only by the most meager network of roads and tracks. A wide coastal plain prevails in the southeastern part of the Area. Elsewhere, the coastal plains are much narrower and compartmentalized by ridges which extend to the sea from a rugged hilly-to-mountainous hinterland. Numerous intermittent streams emanate from these highlands and flow in entrenched courses across the coastal plains.

The NIS 55 Area is bordered on the northwest by Sudan (NIS 54) and on the south by Kenya (NIS 56A). The adjacent coast of Sudan has sandy shores, fronted in most places by reefs, shoals, and islands. A low and sandy coastal plain, as wide as 40 miles, backs the shores and rises gently to barren rugged mountains. In places, isolated hills rise abruptly from the coastal plain.

The adjacent coast of Kenya has mostly sandy shores fringed by coral reefs and interrupted by stretches of rocky cliff-bound shores. Many islands, reefs, and rocks front the shores. A flat-to-undulating coastal plain, mainly covered by grass and brush, but partly cultivated, extends for many miles inland behind the shore. A low ridge rises from the plain, roughly paralleling the shore about 11 miles inland.

Based on political divisions, the Area is divided into three sectors as follows:

Sector 1—Ethiopia (Eritrea).
Sector 2—French Somaliland.
Sector 3—Somali Republic and Socotra and adjacent islands.

Twenty major beach areas, 16 minor beach areas, and 31 landing places are in the NIS Area; 3 major beach areas and 3 landing places are on Socotra and adjacent islands. Major beach areas, the distribution of which is shown on FIGURE 22–76, range from 1 mile to 40 miles in length and are widely scattered throughout the Area. Minor beach areas are similarly distributed, as shown in FIGURES 22–71 through 22–75, and range from 400 yards to 1,720 yards in length. The largest concentration of the major and minor beach areas is along the eastern part of the north coast (Subsector 3–A) and the southern part of the east coast (Subsector 3–C).

Most of this NIS Area is unsuitable for large-scale amphibious operations because of poor approaches, principally fringing coral reefs; cliffs, bluffs, or steep hills and mountains close behind the shore; and the general lack of roads. The coastal areas most suitable for large-scale amphibious operations are near Massaua and Assab in Ethiopia (Eritrea) (Sector 1), Djibouti in French Somaliland (Sector 2), Berbera and Bender Cassim on the north coast of the Somali Republic (Subsector 3–A), and at Itala and Mogadiscio on the east coast of the Somali Republic (Subsector 3–C). These areas have been selected primarily because they include several or all of the following: generally unobstructed approaches; port facili-

* In the text, distances are in statute miles unless nautical miles are specifically indicated by "n.," as in "14 n. miles."

** Eritrea became federated with Ethiopia on 15 September 1952 and a province of Ethiopia on 15 November 1962.

*** Socotra and adjacent islands are treated in this Section because of their proximity to the Somali Republic. They are politically a part of the Aden Protectorate (NIS 32).

ties; relatively large plains behind beaches; and proximate roads, railroads, and air facilities.

The Eritrean coast (Sector 1) has predominantly sandy shores backed mostly by low sandy stretches or sand dunes which in turn are backed by flat-to-undulating coastal plains mostly about 5 to 15 miles wide. Parts of the shores are fringed by marsh or swamp while the coastal plains are mostly barren but have scattered clumps of grass or brush. Backing the coastal plains is an extensive partly brush- and tree-covered mountainous plateau with elevations up to 10,000 feet. In places, hilly-to-mountainous spurs of the interior highlands reach to or near the water's edge, compartmentalizing the coastal plains. Isolated hills and mountains are also scattered over many parts of the plains. The interior plateau is deeply dissected by numerous intermittent streams which flow across the plains in entrenched courses and, in many places, terminate in swamps, marshes, or porous sandy areas on the coastal plains. For brevity, these intermittent streams are referred to as "wadies" in the beach tables appearing in this SECTION 22.

French Somaliland (Sector 2) has mostly sandy shores but there are many rocky cliffed stretches of shore as well as some muddy stretches bordering the Golfe de Tadjoura. Along most of the Golfe de Tadjoura, narrow pocket plains back the shore, in turn backed and flanked by rugged hills and a mountainous plateau. In many places these highlands terminate in cliffs at the water's edge. Along the Bab el Mandeb and Gulf of Aden, the shores are primarily backed by flat-to-gently sloping sandy coastal plains which extend as much as 30 miles inland. Rugged hills and a mountainous plateau back the coastal plains. The coastal areas are mostly barren, but clumps of grass and brush are scattered over the coastal plains while the highlands are partly wooded.

The Somali Republic (Sector 3) has mainly sandy shores, although there are some stretches of rock, pebble, or mud. Rocky slopes, cliffs, or low bluffs back most of the shores, and at the headlands rise directly from the water's edge. The southwestern shores of the Somali Republic (south of approximately 8°N.) are backed by a flat-to-undulating coastal plain that extends over 100 miles inland. In the remainder of the Somali Republic, the shores are backed by plains that are mostly 5 to 25 miles wide and sporadically interrupted by isolated hills and mountains. The plains are separated by hilly-to-mountainous spurs and ridges that extend to the sea from highly dissected rugged hills and mountains which back the plains. Most of the Somali Republic coast is barren with scattered clumps of grass or brush, but there are prominent areas of grass, pasture, and cultivation in the southern part of the country. This southern part is drained by the only perennial rivers in the entire NIS Area. The remainder of the country is dissected by numerous intermittent streams. These streams flow in entrenched courses across the coastal plains, and many of them terminate in the sands before they reach the sea.

The principal off-lying islands are the Isole Dahlac (Sector 1), a dense cluster of islands and islets in the Red Sea, and Socotra and adjacent islands (Subsector 3–B) in the Arabian Sea. The numerous islands and islets of the Isole Dahlac are principally low, composed of sand and coral outcroppings, and have mostly sandy shores with fringing coral reefs. Socotra and the adjacent islands are mainly hilly and mountainous, and although Socotra has many stretches of sandy shores, the other islands are chiefly bordered by rocky shores.

In many places throughout the Area, movement inland from the shores is difficult because of steep bluffs and cliffs. Cross-country movement over broad areas of the coastal plains is good; however, isolated hills and mountains, sand dunes, and sandhills are local obstacles to movement in places but they can generally be bypassed. Vehicular movement on the plains is impeded in many places by the steep sides of entrenched intermittent streams. During rainy periods, many of the streams on the coastal plains flood and inundate broad areas. There are also many areas of sandy clay along the coastal plains which become very slippery during rainy periods, presenting a trafficability problem for wheeled vehicles. The rugged hills, mountains, and plateaus which back and flank the plains are formidable obstacles to movement. Movement through these highlands is mainly limited to stream valleys or to the skeletal network of roads and tracks.

Within this NIS Area, the offshore approaches are mostly clear although in Sectors 1 and 2 there are several groups of off-lying islands, rocks, reefs, and shoals. The principal group of offshore obstructions is the islands, islets, and reefs of the Isole Dahlac which lie as much as 80 n. miles off the mainland coast of Sector 1. The Isole Dahlac, however, are separated from the mainland by a relatively broad navigable channel; an additional but more devious channel leads through the archipelago. Throughout the Area, coral reefs fringe most of the shores of both the mainland and islands and constitute the principal nearshore encumberance; however, there are also scattered rocks, shoals, and islands encumbering parts of the nearshore approaches, especially in the southern part of the Area.

In this Section anchorages are classified either as fleet anchorages or anchorages. A fleet anchorage is one that affords clear anchorage in an area of 4 square miles or more in not less than 7 fathoms and offers some protection from the weather. All fleet anchorages are symbolized on the location maps (FIGURES 22–71 through 22–76). The other anchorages are those that fail to meet the size, depth, or protection criteria for a fleet anchorage and are not symbolized on the location maps.

There are four potential fleet anchorages, all located off Eritrea (Sector 1). These fleet anchorages are off the mainland in Golfo di Zula and Baia di Beilul, and on the western side of Isola Dahlac Chebir, an island in the Isole Dahlac. In addition to the potential fleet anchorages, there are many smaller anchorages scattered through the Area, but only a few offer any protection.

The ports in this Section are classified as principal, secondary, and minor ports on a basis of alongside berthing capacity and commercial and strategic importance. Massaua in Ethiopia (Eritrea) and Djibouti in French Somaliland are principal ports; Assab in Eritrea is a secondary port. These ports are the only ports in the area that have alongside accommodations for oceangoing vessels.

Massaua handles about 90% of the waterborne cargo for Eritrea and has highway connections with the hinterland as well as a railroad leading inland. Although Djibouti lacks good road connections, it has a railroad leading inland to Addis Ababa, making it the principal port for Ethiopia. The secondary port of Assab is also very significant as an outlet for Ethiopian trade, particularly because it has good highway connections with Addis Ababa.

In addition to the principal and secondary ports, there are 15 minor ports with piers, which are located principally along the Gulf of Aden and the Indian Ocean. Also, a number of places, not classified as ports and without piers, handle cargo over the shores.

In general, the ports are the largest coastal centers of urban population, with Mogadiscio in the Somali Republic being the most populous. Other important coastal urban areas are: Massaua and Assab, in Eritrea; Djibouti, in French Somaliland; Berbera, Merca, Brava, and Chisimaio, all in the Somali Republic. Also, there are widely scattered villages and settlements, the population of which are seasonally increased and decreased by seminomads, the principal inhabitants on the coastal plains.

The transportation routes in this Section are classified as surfaced roads, unsurfaced roads, tracks, or trails. Surfaced roads have either bituminous, bituminous-treated, gravel, or earth and gravel surfaces, 14 to 22 feet wide. Except for spot flooding during rainy periods, the surfaced roads may be regarded as being all-weather routes. Unsurfaced roads are composed of earth and are graded and drained, but in general are trafficable only during dry weather. In places, both the surfaced and unsurfaced roads may be in a poor state of repair, particularly in the Somali Republic. The remaining land routes are classified as tracks or trails. In general, tracks are dry-weather routes that are wide enough for a small truck to negotiate. Trails are routes which can be used by pack animals and foot troops, but are generally unsuitable for wheeled or tracked vehicles. Source data on the transportation routes were incomplete in many places, and classification of the routes may be subject to changes in localized areas.

A skeletal network of roads, tracks, and trails extends over the plains and only a few routes lead into the interior. Vehicles can move cross-country over the greater part of the coastal plains, and the lack of roads and tracks on the plains is not as great a handicap as it is in the hilly-to-mountainous hinterland where off-road movement is difficult to impossible. There are only six places in the NIS Area where surfaced roads lead any appreciable distance inland from the shores; these are at Massaua and Assab in Eritrea, and Berbera, Bender Beila, Obbia, and Mogadiscio in the Somali Republic. However, only the roads leading inland from Massaua, Assab, and Mogadiscio are bituminous or bituminous treated; the others are gravel or gravel and earth.

There are only two railroads of importance in the NIS Area, and both are narrow gage and single tracked. The longest railroad is a 3′3⅜″ meter-gage line extending some 490 route miles from the principal port of Djibouti, in French Somaliland, to Addis Ababa, the capital city of Ethiopia. The other is a 3′1⅜″-gage line running some 190 route miles from the principal port of Massaua to Asmara and Agordat, serving most of the important urban areas of Eritrea.

The Fiume Giuba, in the southern part of the Somali Republic, is the only navigable river in the NIS Area. There are seasonal variations in the water level, but during the higher water period of March or April through November, craft drawing 3 feet can ply the river more than 300 miles upstream.

Air facilities in this Section are classified according to Vol. 18 of *Airfields and Seaplane Stations of the World* as follows:

AIRFIELDS

CLASS	LENGTH OF DELINEATED RUNWAY* (FEET)
1	7,000 feet or over
2	6,000 to 6,999
3	5,000 to 5,999
4	4,000 to 4,999
5	2,000 to 3,999, or any usable potentially important airfield of intelligence significance over 2,000 feet without delineated runways

SEAPLANE STATIONS

CLASS	DESCRIPTION
6	Adequate shelter and complete facilities
7	Adequate shelter but limited or abandoned facilities

* Delineated runway is a defined or marked area on an airfield prepared or selected for landing and takeoff of aircraft.

Runway surfaces are symbolized on the location maps as follows: P—Permanent, T—Temporary, and N—Natural. Air facilities not described in the Airfield and Seaplane Station publication are referred to as "unclassified" and are not symbolized on the location maps (FIGURES 22–71 through 22–75). The "unclassified" airfields or seaplane stations are areas potentially available for the landing of aircraft.

The only Class 1 air facility is at Djibouti where there is also a Class 7 seaplane station, the only classified facility for seaplanes in the NIS Area. Other airfields are well distributed on the plains and on the highlands in the interior with the most important coastal air facilities located at Massaua, Bender Cassim, Alula, and Mogadiscio. In addition to the airfields, there are broad areas on the plains that are suitable for helicopter landings, though loose sand and rocks make landing hazardous in places. There are also helicopter landing areas on the plateaus and tablelands in the hinterland.

A hot, dry monsoonal type of climate prevails over the coastal areas. While the area is extremely hot the year around, the months of May or June through September are the hottest with prevailing mean monthly maximum temperatures of 85° F. to 110° F. Along most of the arid coastal lowlands, mean annual rainfall is 10 inches or less but the interior highlands receive from 15 to more than 40 inches of rainfall annually.

While land and sea breezes dominate at times, the general wind patterns are monsoonal in nature. Along the Red Sea coast, winds are mostly from the southeast and south during the period of October through April, while winds from the northwest quadrant prevail during June through August. Along the Gulf of Aden coast, winds are primarily from the east and northeast during the period of October through April and from the southwestern quadrant during June through August. The Indian Ocean and Arabian Sea coasts have winds mainly from the northeast and north during November through March and predominantly from the southwest and south during June through August. Throughout the Area, wind directions are variable during the transitional periods between the monsoon seasons.

In the coastal areas, sporadic sandstorms and the flash flooding of streams are significant results of weather factors bearing on ground operations. In many places the flooding of streams washes out portions of nearby roads or tracks.

The sea approaches, beach areas, and coastal terrain are summarized in tabular form in FIGURE 22–1, Summary of Coasts and Landing Beaches.

2. Maps and charts

The position of the coastal sectors and subsectors, and the distribution of major beaches are shown on FIGURE 22–76: *Coastal Divisions and Distribution of Major Beaches.* The delineation of the coastal sectors, subsectors, and segments and the location and orientation of major and minor beach areas and landing places are shown on the location maps (FIGURES 22–71 through 22–75), produced from World Aeronautical Charts, scale 1:1,000,000. Only limited generalized hydrography is shown on the location maps and should not be used for navigational purposes. For complete information on rocks and shoals, anchorages, and dangers to navigation, the largest scale hydrographic charts of the Area and the following publications should be consulted: USHO Pub. No. 61, *Sailing Directions for the Red Sea and the Gulf of Aden,* and USHO Pub. No. 60, *Sailing Directions for Southeast Coast of Africa.* Reference should also be made to appropriate NIS Sections and Supplements.

3. Criteria for beach selection

This Maintenance Section reflects major changes in the selection and description of the landing beaches of Ethiopia (Eritrea) and the Somalilands contained in SECTION 22 of NIS 55, dated March 1950. The changes are based on revised criteria for selecting landing beaches and information obtained subsequent to publication of the original NIS Section, which has made possible a more accurate selection and appraisal of several beaches. In general, the beaches were selected by analysis of hydrographic charts, topo-

FIGURE 22–1. SUMMARY OF COASTS AND LANDING BEACHES
(*Map reference:* FIGURE 22–76)

SECTOR OR SUBSECTOR	SEA APPROACHES	BEACHES	COASTAL TERRAIN
1 Ethiopia (Eritrea)..... (18°02′N., 38°36′E. to 12°42′N., 43°08′E.)	Islands, rocks, and shoals encumber many parts of offshore approaches, particularly at the entrance to the numerous large bays indenting the coast. The principal nearshore obstruction is a discontinuous fringing coral reef and in places there are sandbars, some of which dry. Potential fleet anchorages are located off the mainland in Golfo di Zula and Baia di Beilul in the central part of the sector. There are two additional potential fleet anchorages on the western side of Isola Dahlac Chebir, an island in the offshore archipelago of Isole Dahlac. Nearshore bottom slopes range from *moderate* to *flat*. Primary nearshore bottom material is sand. During the period October through April, the expected average occurrence of surf 4 feet or higher ranges from infrequent up to 12% of the time; it is infrequent in all other months. Spring tides of 3 feet occur in the northern half of the sector and diurnal tides of 2½ feet occur in the southern half.	Sector contains 4 major beach areas, 6 minor beach areas and 9 landing places on the mainland. There are no beaches on the islands of the archipelago. Major beach areas range in length from 1½ to 3¼ miles. L.W. widths of major beach areas range from 40 to 150 yards; H.W. widths range from 10 to 35 yards. Beach gradients are predominantly *gentle* to *mild* in the L.W. to H.W. zone and mostly *steep* in the H.W. zone. Primary beach material is sand. Exits mostly cross-country to tracks and trails.	The mainland shores are predominantly sandy and are backed mostly by low sandy stretches or sand dunes. Coastal terrain consists of plains of variable width backed by high mountains and plateaus. Isolated hills and peaks rise from the plains and back the shores in several places. Sparsely scattered grass and brush are the predominant vegetation cover in this sector. The numerous islands and islets of the offshore archipelago are principally low and sandy with scattered coral outcroppings. Obstructions in the approaches to the islands make them generally unsuitable for amphibious operations. Massaua is a principal port and Assab a secondary port. A narrow-gage railroad runs westward into the interior from Massaua. Two main surfaced roads lead from Massaua and Assab westward into the hinterland. There is also one principal coastal track traversing the length of the sector from 1 to 13½ miles inland. Elsewhere, a scattered network of tracks and trails leads inland from the shores. There are only tracks and trails on the larger inhabited islands of the archipelago. Class 1 air facilities are located at Asmara and Gura, a Class 2 air facility at Massaua, a Class 3 facility at Maacaca; there are several unclassified facilities as well.

FIGURE 22–1 (*Continued*)

SECTOR OR SUBSECTOR	SEA APPROACHES	BEACHES	COASTAL TERRAIN
2 French Somaliland..... (12°42′N., 43°08′E. to 11°28′N., 43°16′E.)	Offshore approaches to the sector are relatively unobstructed while nearshore approaches are principally obstructed by a fringing reef extending throughout most of the sector. Nearshore bottom slopes range from *steep* to *flat*. Primary nearshore bottom material is sand or sand mixed with mud. The expected average occurrence of surf 4 feet or higher is infrequent during all months. Diurnal tides range from 4 to 5½ feet.	There are no major beach areas; however, there are 2 minor beach areas and 7 landing places. Minor beach areas are 750 and 780 yards long; H.W. widths range from 15 to 50 yards, L.W. widths 50 to 500 yards. Beach material is sand or sand mixed with gravel. Exits cross-country to tracks, trails, or a surfaced road.	The shores of the northern part of the sector are predominantly sandy; the southern part consists of sandy or muddy stretches interrupted by cliffs and numerous intermittent streams. The northern shores are backed mostly by a low coastal plain covered with scattered sand dunes and clumps of grass and brush; the southern shores are backed principally by partly wooded and brush-covered hills and mountains except at the southern end of the sector where there is a broadening coastal plain. On the northern and southern parts of the sector the coastal terrain consists of desert plains of variable width backed by hills and mountains; parts of plains interrupted by isolated hills and peaks. Elsewhere, there are narrow broken stretches of sandy plain. Djibouti is a principal port, and there are minor ports at Obock and Tadjoura. A single-track meter-gage railroad runs from Djibouti to Addis Ababa. Land transportation is very poor and consists essentially of scattered tracks and trails. One main route, which starts out at Djibouti as a hard-surfaced road, extends inland west-southwestward to the Ethiopian border. One principal coastal track serves the northern plain while another main coastal track extends along the coastal plain south of Djibouti. Cross-country movement across the northern and southern coastal plain is relatively unimpeded but movement inland through the mountains backing the plain is mostly impossible. There are a Class 1 air facility and Class 7 seaplane station at Djibouti.

FIGURE 22–1 (*Continued*)

SECTOR OR SUBSECTOR	SEA APPROACHES	BEACHES	COASTAL TERRAIN
3–A French Somaliland – Somali Republic border to Capo Guardafui. (11°28′N., 43°16′E. to 11°50′N., 51°17′E.)	Islands, rocks, shoals, and reefs encumber the offshore approaches to the westernmost part of the subsector. Nearshore approaches partly encumbered with scattered rocks, reefs, shoals, islets, and sandbars. Open anchorages are available off many parts of the coast, but only those at Zeila and Berbera have some protection. Nearshore bottom slopes range from *steep* to *flat*. Nearshore bottom material is sand or sand mixed with shells. The expected average occurrence of surf 4 feet or greater on beaches ranges from 5% to 15% of the time October through April, infrequent to 4% in May; it is infrequent in all other months. Diurnal tides of 5 feet occur.	Subsector contains 7 major beach areas, 6 minor beach areas, and 7 landing places. One major beach area is 40 miles long, but the others range from 1½ to 15¼ miles in length. Four beach areas are separated or interrupted by wadi mouths. Where known L.W. widths of major beaches range from 50 to 110 yards. H.W. widths range from 5 to 20 yards. Beach gradients in the L.W. to H.W. zones range from *moderate* to *gentle* but are unknown on one beach. Beach gradients in the H.W. zones are *steep*. Primary beach material is sand. Exits mostly cross-country to tracks.	The subsector is bordered mostly by sandy shores separated and backed by bluffs and cliffs, most of which range from 12 to 25 feet in height. Coastal terrain consists of series of generally narrow arid plains separated by spurs and ridges extending from rugged hills and mountains that comprise the hinterland. Plains interspersed with detached hills and mountains and intersected by many intermittent streams. During rainy periods streams on westernmost plain flood and inundate broad areas. Dominant vegetation is generally widely scattered clump grass and brush with some trees. Tracks and unsurfaced roads closely parallel the coast, and in several places surfaced and unsurfaced roads and tracks extend over the rugged hills and mountains into the interior. Zeila, Berbera, Bender Cassim, Candala, and Alula are minor ports. Class 2 air facilities are at Bender Cassim and Alula, and a Class 4 facility is at Berbera.
3–B Socotra and adjacent islands. (12°45′N., 12°05′N., to 52°00′E., 54°35′E.)	Offshore approaches to Socotra and its off-lying islands generally clear; nearshore approaches partly obstructed by reefs and rocks. Nearshore bottom slopes range from *steep* to *mild*. Nearshore bottom material consists of sand or sand mixed with rocks, coral, and mud. The expected average occurrence of surf 4 feet or higher is infrequent during all months on major beach area **(14)**. However, the average occurrence of surf 4 feet or higher on the remaining beaches ranges from 7% to 14% of the time during October through April; it is 4% in May and infrequent during all other months. Diurnal tides of about 5½ feet occur.	Subsector contains 3 major beach areas on Socotra; 1 landing place is on Socotra and 2 are on 'Abd al Kūrī. Major beach areas range from 1 to 17 miles in length. L.W. widths range from 40 to 90 yards, H.W. widths 5 to 20 yards. Beach gradients are *moderate* to *gentle* in the L.W. to H.W. zone and *steep* in the H.W. zone. Beach materials are sand or sand mixed with gravel. Exits cross-country to tracks and trails.	The shores of Socotra are predominantly sandy but interrupted in many places by high marine cliffs. In general, coastal terrain consists of a northern and southern coastal plain, separated inland by a deeply dissected, mountainous plateau. The plains and inland plateau are covered with scattered brush and trees. The shores of the off-lying islands are predominantly rocky except for sandy shores on the northern coast of 'Abd al Kūrī; inland terrain is mostly rocky and mountainous; the islands are uninhabited. There are no ports, urban areas, or roads on Socotra or its off-lying islands. Routes of communication on Socotra are limited to a coastal track across the northern side of the island with a branch route extending to the western side. Elsewhere, there are only trails. Cross-country movement is impeded by the mountains backing the narrow plains.

FIGURE 22–1 (*Continued*)

SECTOR OR SUBSECTOR	SEA APPROACHES	BEACHES	COASTAL TERRAIN
3–C Capo Guardafui to Somali Republic – Kenya border. (11°50′N., 51°17′E. to 1°40′S., 41°34′E.)	Offshore approaches generally clear. Nearshore approaches partly obstructed by reefs, shoals, rocks, and islets; chain of reef-fringed islands and islets extend from Chisimaio to Kenya border. Anchorages are along the generally open coast; only protected harbor is at Chisimaio. Nearshore bottom slopes range from *moderate* to *flat*. Nearshore bottom material is sand or sand mixed with rock, shell, coral, or mud. The expected average occurrence of surf 4 feet or greater on beaches ranges from 4% to 20% of the time during November through March, 9% to 47% April and May, 12% to 76% June through August, and 9% to 56% September and October. Spring tides range from 5½ to 9 feet.	Subsector contains 9 major beach areas, 2 minor beach areas, and 8 landing places. One major beach area is 27 miles long but others range from 1¼ to 8 miles in length. A few beaches have interruptions. L.W. widths of major beach areas range from 30 to 300 yards, H.W. widths from 10 to 30 yards. Beach gradients in L.W. to H.W. zone range from *steep* to *flat* and in H.W. zone are *steep*. Beach material is sand. Exits cross-country to tracks; surfaced and unsurfaced roads lead inland from several beach areas.	The subsector is bordered by sandy shores, which alternate with rocky stretches in the center of the subsector and mud near the southwestern end. Shores are in most places backed and separated by escarpments, several hundred feet in height in the north and decreasing southward to elevations little above the general level of the sea. Coastal terrain is mainly a plateau 5 to 25 miles wide in the northeast progressively declining in elevation in the southwest where it becomes a plain which extends inland 80 to 120 miles before elevations of 1,000 feet are attained. Greater part of the shore is closely backed by long lines of sandhills and escarpment-backed terraces. A low mountain rises west of Obbia, and hills and dune-covered areas of sand are interspersed over the plain. Northern end of subsector intersected by intermittent streams; two perennial rivers, the only ones in the Area, intersect the southern part of the plain. Dominant vegetation on plain is scattered clump grass and desert brush that increases in density westward; on the southern part of plain it gives way to pastureland and areas of cultivation. Tracks and unsurfaced roads closely parallel the coast, and in several places surfaced and unsurfaced roads and tracks extend into interior. The Fiume Giuba, one of the perennial rivers, is navigable for distances of about 300 miles. Dante, Merca, Brava, Mogadiscio, and Chisimaio are minor ports. A Class 2 air facility is located at Mogadiscio, and a Class 4 facility is maintained at Chisimaio.

graphic maps, Sailing Directions, and recent photography.

In this Maintenance Section the landing beaches are divided into three categories: 1) major beach areas, 2) minor beach areas, and 3) landing places. Major beach areas are numbered and plotted on the location maps and described in detial for the planning of amphibious operations at elements of information considered to be essential for the planning of amphibious operations at strategic or high operational levels. Minor beach areas are also numbered, plotted on the location maps, and described in tabular form, but their descriptions are brief. Landing places are neither numbered nor described but are plotted on the location maps.

The landing beaches in this Section are classified primarily by length. In addition, all beaches are accessible from the sea, fringe on coasts considered favorable for amphibious landings, and have feasible exits. The length criteria are:

a) Major beach area ... Total length 1 statute mile or more.
b) Minor beach area ... Total length 400 yards or more but less than 1 statute mile.
c) Landing places ..... Total length less than 400 yards.

The beach areas considered best for amphibious landings in this NIS Area are as follows: major beach (2) in Sector 1; minor beach *8* in Sector 2; major beach (5) and minor beach *12* in Subsector 3–A; part of major beach (2) in Subsector 3–B;

and major beaches (18) through (20) and minor beach *15* in Subsector 3–C. The five landing places of Assab in Sector 1, if considered a single landing area, also offer good landing possibilities.

4. Major beach areas

The location, approximate dimensions, slopes, approaches, surf and tidal conditions, beach material and firmness, coastal terrain, and exits for each major beach area are tabulated at the end of the coastal description of each sector or subsector; brief textual summaries of beach characteristics precede the tables. Explanations of beach area numbering and column headings in the tables, and definitions of terms used in the tables and the text summaries follows. The Generalized Beach Profile Diagram for a Tidal Sea (FIGURE 22–2) illustrates the significance of terms used in the text and beach tables.

a. BEACH NUMBERS AND LOCATION — Major beach area numbers appear in parentheses, as (1), in the text and tables, but are shown enclosed in circles on the location maps (FIGURES 22–71 through 22–75) and on photographs. The approximate position and, where possible, the limits of the usable part of each beach are shown on the location maps. In the first column of the major beach tables, each beach is located with reference to a geographical feature and by geographical coordinates to the nearest minute. Geographical coordinates are given for both flanks of a beach 2 miles or more in length and for the center of a beach less than 2 miles in length. The coordinates given in the tables were taken from the location maps. In the beach number and location column are also listed references to photographs which illustrate the beach area, and a reliability evaluation of the source information used in preparing the beach table.

b. LENGTH AND USABLE LENGTH — The usable length of a beach area is the total length minus such unusable stretches as: 1) separations consisting of breaks in beach continuity caused by natural features such as wadi mouths which prevent lateral movement along the beach without the aid of special equipment, and 2) unusable sections consisting of those parts of a beach which are closely backed by salt water lagoons which make exit from the beach infeasible. Interruptions are considered to be partial obstructions such as wadi mouths and piers that would impede but would not block lateral movement along the beach. Beach lengths are expressed in yards or statute miles.

c. WIDTHS — Beach widths at high water and low water are referred to in the text and tables. Width at low water (L.W.) is the maximum usable width of a beach that can be expected to be dry during periods of low tide and slight wave action. Width at high water (H.W.) is the minimum width of a beach that can be expected to remain dry during periods of high tide under normal wind, wave, and tide conditions and is measured from the landward limit of normal wave action (FIGURE 22–2). All beaches may be subject to inundation under abnormal storm conditions such as might exist when heavy gales occur. The extreme landward limit reached by waves during

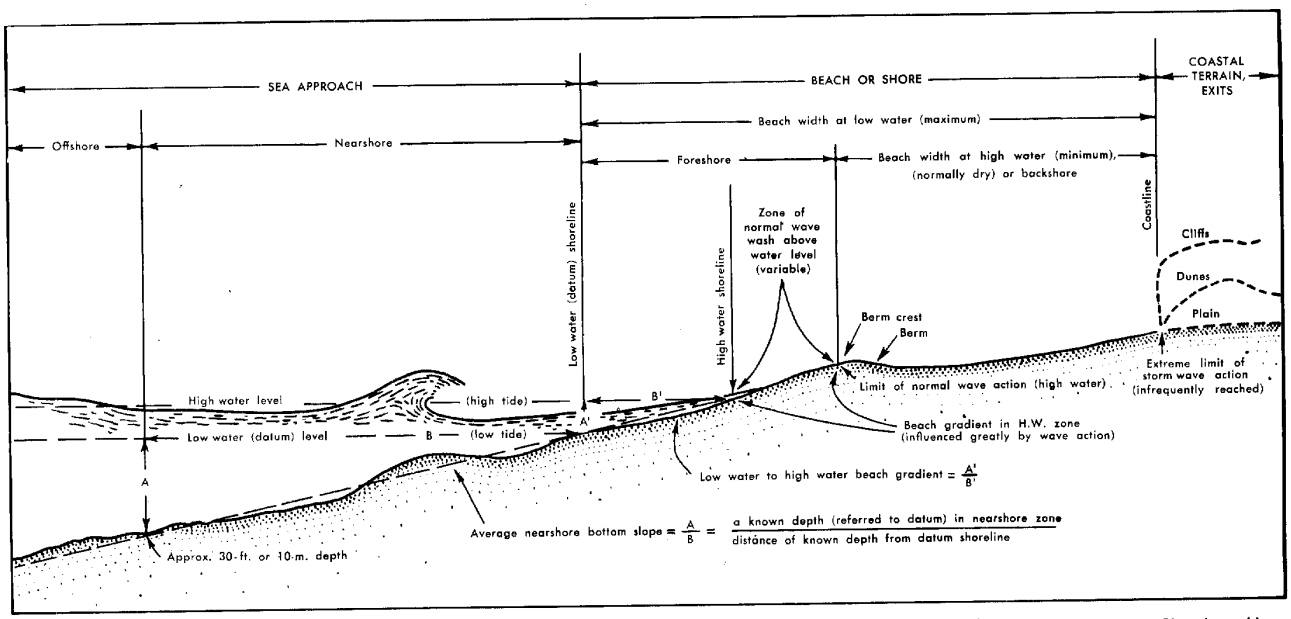

FIGURE 22–2. GENERALIZED BEACH PROFILE DIAGRAM FOR TIDAL SEA. Zones used in estimating widths and gradient ratios (vertical distance over horizontal distance) for beaches in tidal areas.

these abnormal storms is an accepted landward limit of a beach. Where wave action is slight, the zone of normal wave wash becomes insignificant and for all practical purposes the minimum width of a beach bordering on a tidal sea would be measured from the high water line to the extreme limit of storm wave action.

d. BEACH GRADIENTS — The beach gradients given in the tables are expressed as a ratio of vertical rise to horizontal distance (FIGURE 22–2).

Two beach gradients are given: 1) the gradient from low water to high water (L.W. to H.W.), the part of a beach alternately covered and uncovered by the rise and fall of the tide; and 2) the gradient from the high water level to the landward limit of normal wave action (H.W. zone), a relatively narrow part of a beach subject to varying amounts of inundation and wave action. Both gradients (L.W. to H.W. and H.W. zone) may vary considerably from one locality to another a few yards along the beach, from one day or week to the next, or with the passage of a single storm. For these reasons, even those gradient ratios based on accurate beach survey information must be considered to be approximations.

The following terms describe the indicated general ranges of beach gradients and nearshore bottom slopes.

TERM	GRADIENT RANGE
flat	horizontal to (but not including) 1 on 120
mild	1 on 120 to (but not including) 1 on 60
gentle	1 on 60 to (but not including) 1 on 30
moderate	1 on 30 to (but not including) 1 on 15
steep	1 on 15 and steeper

For example, a gradient range of "1 on 30 to 1 on 15" is classed as *moderate,* "1 on 40 to 1 on 15" as *gentle* to *moderate;* a single gradient value of "1 on 16" is classed as *moderate,* but "1 on 15" as *steep.*

e. APPROACH — Characteristics and features of the nearshore zone (generally shoreward of 30- and 36-foot depths) are stressed in the tables under this heading; however, important features in the offshore zone (seaward of 30- and 36-foot depths) such as obstructions and anchorages are mentioned when it is apparent that they would affect amphibious landings. All depths are referred to chart datum planes which reflect depth conditions during stages of low water. For more complete information on the offshore and nearshore zone, the Sailing Directions, and the most recent and largest scale hydrographic charts of the Area should be consulted.

The nearshore bottom slope, also referred to in the "Approach" column of the major beach tables, is an average gradient of the nearshore bottom, determined by the relationship between known depths and their corresponding distances from the low water shoreline. Because the nearshore bottom slope represents a computed average gradient which may vary considerably, it is best expressed in comparative terms, such as *steep, gentle,* etc. (FIGURE 22–2 and Subsection A, 4, d).

f. SURF AND TIDAL RANGE — Experience has demonstrated that loss of or crippling damage to existing types of landing craft increases abruptly and prohibitively as the average height of surf reaches 4 feet. For this reason surf 4 feet or greater in height has been given special emphasis in this Section. Operations through surf less than 4 feet in height are considered feasible, and the occurrence of such surf is not reported in the beach tables. Surf 4 feet or greater in height occurring less than a statistical total of 24 hours per month is described as occurring infrequently.

The surf data in the beach tables were derived from breaker and surf data sheets prepared by the U.S. Navy Hydrographic Office and the data were modified by factors of short alinement and exposure when applied to individual beaches.

Tidal information for the beach tables was derived from the tidal range chart (FIGURE 22–63A) compiled by the U.S. Navy Hydrographic Office. The ranges given in the beach tables are spring or diurnal ranges interpolated to the nearest half foot. Tidal ranges are given to the nearest one-tenth of a foot only when a tide station is within the limits of a selected beach.

g. MATERIAL AND FIRMNESS — Beach material for the NIS 55 Area is predominantly sand. To indicate the trafficability of materials, beaches are characterized as *firm, soft,* or *loose.* A *firm* beach (in general, composed of a well-graded mixture of particle sizes or of wet sand) is one that will support the weight of wheeled vehicles and will allow initial movement without special equipment or aids, provided the beach gradient is sufficiently low for normal movement. A *soft* beach (in general, composed of poorly graded sand, dry sand, mud, or sand mixed with mud) may support vehicles but because of poor traction, wheeled vehicles will, in general, require the assistance of tracked vehicles or mats for movement. A *loose* beach (in general, composed of poorly graded materials such as gravel or cobbles, i.e., materials with limited size range and without fine material to fill the voids) will support vehicles but provides poor traction.

The trafficability of most beaches was determined by interpretation of ground photographs and study of factual data contained in documents. The trafficability of the remaining beaches was de-

termined by a study of the physical features and conditions of the beach affecting firmness such as the composition, exposure to wave attack, manner of formation, deposition of materials, gradients, and moisture content.

h. TERRAIN IMMEDIATELY BEHIND BEACH — Information under this heading describes terrain and cultural features inland of the beach and stresses those features which aid or impede movement inland from the beach proper. This description is usually carried to the first major relief feature, but in general, not farther than 15 to 20 miles inland.

i. EXITS AND COMMUNICATIONS INLAND — Under this heading are listed the known or apparent means of moving inland from the beach and the proximity of roads, tracks, trails, railroads, airfields, seaplane stations, and ports. For additional information on transportation facilities, appropriate NIS Sections and Supplements should be consulted.

5. Minor beach areas and landing places

a. MINOR BEACH AREAS — The location, approximate length and width, beach composition, approaches, terrain behind the beach, exits inland and the reliability of the source of information for minor beach areas are briefly summarized in tables following the major beach table for each Sector or Subsector.

The minor beach areas are indicated by numbers on location maps and photographs, and are referred to by italicized numbers in the text, in minor beach area tables, and in captions of the photographs. In general, a line drawn to the minor beach number from the shoreline on the location map shows the approximate center of the minor beach.

b. LANDING PLACES — Landing places are neither numbered nor described but are shown on the location maps and photographs by a symbol consisting of a dot at the end of a line drawn to the approximate center of the beach. A summary of landing places is also included in the textual summaries of landing beaches at the end of each Sector or Subsector.

6. Reliability index

The reliability of information given in the individual beach tables of this Section is rated according to a scale of four values: EXCELLENT, GOOD, FAIR, and POOR. These ratings take into consideration the quality, accuracy, and credibility of source materials, and the amount of interpretation required. Definitions of reliability ratings are as follows:

EXCELLENT—Aerial photographs available at such scales that features of the beach, adjacent terrain, and hydrography can be accurately determined; factual information from intelligence documents, technical documents, geographic or travel literature confirmed by aerial or ground photographs; accurate maps and charts available at such scales that coastal configuration, bottom characteristics, nearshore hydrography, obstructions to navigation in approaches, and detailed topography behind the beaches can be accurately determined; no factual conflicts.

GOOD—Aerial photographs available at such scales that beach and terrain features can be determined with little interpretation; ground photographs showing a limited number of beach features and characteristics; factual information from intelligence documents, technical documents, and geographic or travel literature which may or may not be confirmed by aerial or ground photographs; maps and charts available at such scales that coastal configuration is clearly shown, but hydrographic and topographic data may be incomplete; few or no factual conflicts.

FAIR—Aerial photographs available but at such scales that beach features and characteristics can be determined only with considerable interpretation; no ground photographs available, or only a few which show a limited amount of beach characteristics; little factual data from intelligence documents, technical documents, and geographic or travel literature that may or may not be confirmed by photographs; maps and charts available at such scales that coastal configuration is clearly shown, but hydrographic and topographic data may be inaccurate and incomplete; data may occasionally conflict.

POOR—Aerial photographs poor or nonexistent; meager information from intelligence and technical documents or other literature; maps and charts available only at such scales that coastal delineation and hydrographic and topographic data are generalized and incomplete; factual conflicts are common.

Some interpretation is necessary in all beach descriptions. In the higher reliability ratings (EXCELLENT and GOOD), interpretation is resorted to only for minor features; however, in the lower ratings (FAIR and POOR), the facts are often so meager that interpretation is necessary even for some of the major features. Beach lengths are usually determined accurately when large-scale photographs, topographic maps, or hydrographic charts provide complete coverage. Lengths are approximate when obtained from small-scale charts and from poor or incomplete photographic coverage. Beach width, material, and gradient data are approximations under average wind and wave conditions determined mainly by interpretation of photographs, maps, and charts. Although not exact, this information is believed to be sufficiently accurate for strategic and high-level planning of amphibious operations. Within this NIS Area the reliability evaluations

of all beach descriptions vary from GOOD to POOR.

7. Glossary

Generic terms relating to features of terrain and hydrography, together with their English equivalents, are listed as follows:

TERM	MEANING
bab	strait
baia	bay
canale	channel
capo	cape
djeziret	islands
fiume	river
ghubbat, ghubbet, gubbet	bay, gulf
golfo, gulfe	gulf
ile(s)	island(s)
isola	island
isole	islands
mersa	bay, inlet
penisola	peninsula
ras, ra's	cape, point, hill
uebi, uadi	wadi, stream

B. Coastal oceanography

Coastal oceanography covers the marine environment affecting nearshore and naval amphibious operations. Broadly speaking, this is the zone where oceanographic conditions are modified by bottom and land configurations or surface runoff. The oceanography and marine climatology for the open ocean adjacent to this Area are contained in NIS 106–PART IV (Indian Basin–IV).

1. Introduction

The coasts of Ethiopia and the Somalilands border some of the warmest water bodies in the world, namely, the Red Sea, Gulf of Aden, Arabian Sea, and western Indian Ocean. Generally, deep water (100 fathoms) lies close to shore, i.e., within 1 to 10 n. miles offshore. The coast of Socotra is bold, with moderate depths (20 fathoms) near shore.

The principal climatic control of this Area is the Indian Ocean monsoonal regime, although seasons vary from region to region. The Siberian *high* controls the monsoonal flow during the cooler months, whereas the Asian heat *low* controls flow during the warmer months. Severest sea conditions in the Red Sea occur during the northeast monsoon; however, severest conditions in the Gulf of Aden and the Indian Ocean region occur during the southwest monsoon.

Prevailing currents also are governed by the monsoonal flow, with speeds ranging from 0.2 to 3 knots. Tidal currents may reach 7 knots, as off Socotra.

In this Area coral, sand, and shell are the dominant bottom materials near shore, and mud and mud-sand in the deeper parts.

Many species of potentially dangerous animals inhabit the nearshore waters of this Area. These include the scorpionfish, stingray, stinging jellyfish, shark, and barracuda.

2. Tides and currents

a. TIDES

(1) *Astronomic tides* — Although the tidal regime in the Red Sea is complex and not well defined, the tide at Massaua is principally semidiurnal (FIGURE 22–3). In the central two-thirds of the sea, the tide is controlled by an amphidromic system (region of no perceptible tide) which is centered somewhere along an east – west line between Port Sudan (19°37′N., 37°14′E.) and Al Qunfudhah (19°08′N., 41°04′E.). In the extreme southeastern part of the sea, the tide seems to be maintained by energy from the Gulf of Aden which enters the Red Sea through Bab el Mandeb.

In the Gulf of Aden, two high waters and two low waters occur daily, with considerable diurnal inequality, principally in the low waters; see the curve for Zeila, FIGURE 22–3. There are also considerable diurnal inequalities during times of equatorial declination when the semidiurnal effect should be greatest.

The tide along the east coast of the Somali Republic is also semidiurnal, with some inequality, principally in heights of successive high waters, as shown on the tidal curve for Brava, FIGURE 22–3. The range of the tide along this coast increases southward from about 5 feet at Capo Guardafui to more than 9 feet at the southern limit of this NIS Area.

The tides around the island of Socotra (12°30′N., 54°00′E.) are semidiurnal with considerable inequality in heights of successive high and successive low waters. High water occurs at about 4 hours after lunar transit of the Greenwich meridian. The mean tide range is about 3.6 feet, and the diurnal range is about 5.3 feet.

The areal distribution of tide ranges within this Area is shown in FIGURE 22–63A. The tidal progression or time of high water in hours after the moon's transit of the Greenwich meridian is shown in FIGURE 22–63B.

(2) *Meteorological tides* — Changes in wind speed and direction and atmospheric pressure also cause variations in sea level. In general, onshore winds or a decrease in atmospheric pressure will cause an increase in sea level, whereas offshore winds or an increase in atmospheric pressures will cause a lowering of sea level.

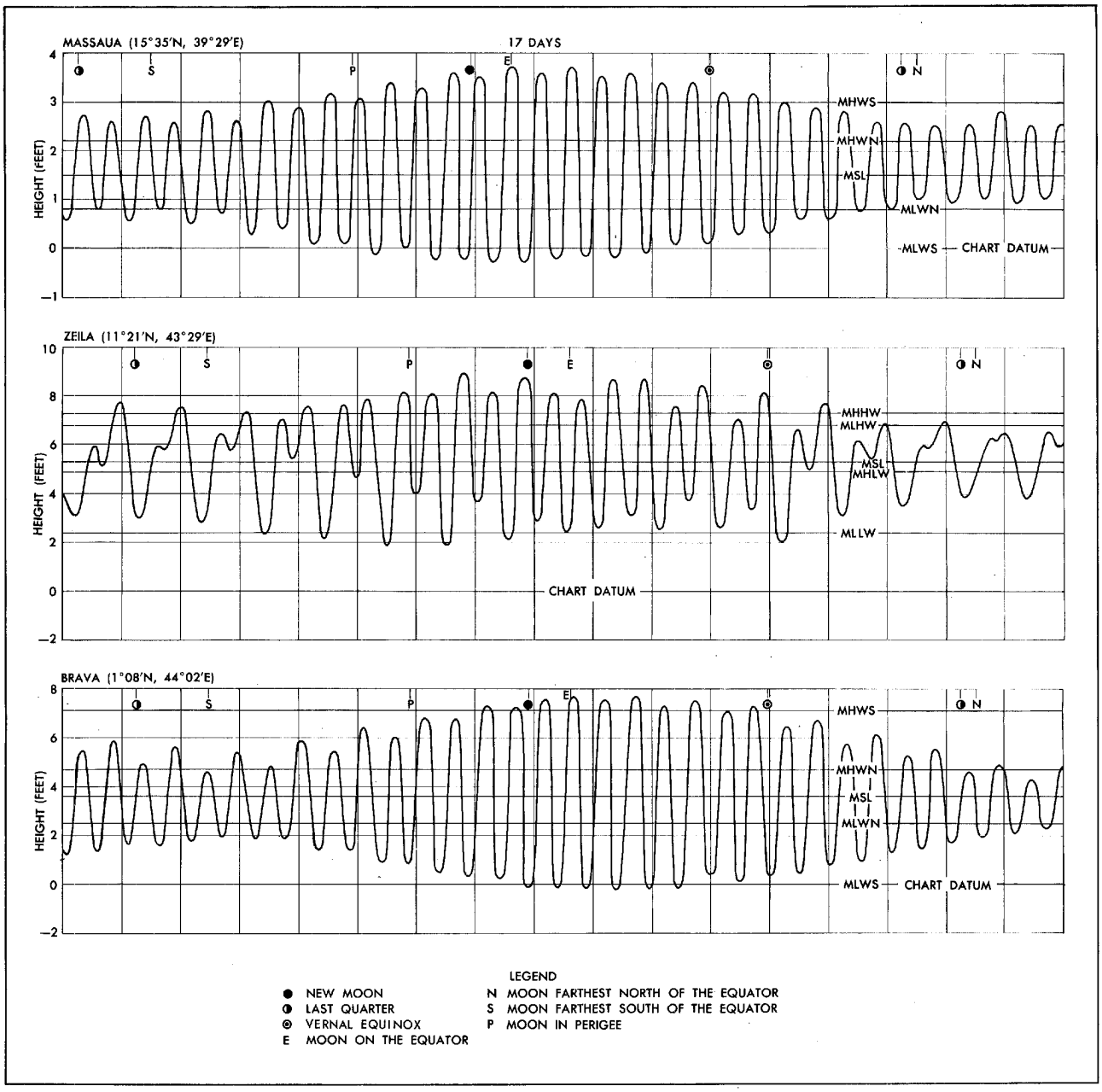

FIGURE 22–3. TIDAL CURVES

Higher evaporation rates in the summer cause the level of the Red Sea to fall lower than during winter.

b. CURRENTS

(1) *General surface currents* — The surface currents of this Area are primarily caused by stresses exerted upon the water by monsoonal winds. The time of establishment of the monsoon varies with latitude. The periods during which the currents set in alternate directions do not correspond entirely with wind directions of the two monsoons. In the Arabian Sea and Indian Ocean the current may change direction one to two months earlier than the wind because of the effect of a transient gradient current which develops as a result of differential cooling of the Arabian Sea by the northeast winds.

FIGURES 22–64B and 22–64C show prevailing surface currents associated with the northeast and southwest monsoons, respectively. For the three main coastal alinements (Red Sea, Gulf of

Aden, and Indian Ocean), the periods for the duration of the monsoons and transition periods for the currents have been derived on the basis of similarity of direction of flow. Differences between wind direction and current direction occur most markedly along the eastern Somalia coast.

(a) RED SEA — The general circulation in the southeastern part of the Red Sea is counterclockwise during the year. The current setting northward along the coast of Saudi Arabia is more persistent during the southwest monsoon (June through September) and the current setting southeastward along the African coast is more persistent during the northeast monsoon (November through March). The average current speed is about 0.5 knot. Of 6,000 observations covering 23 years, 1½ percent showed speeds greater than 1.2 knots.

Currents which set across the axis of the sea may be observed during any month, but the speed seldom exceeds 1 knot. Variability of speed and direction may be encountered at any time of year; however, the currents are extremely variable during the transition periods.

(b) GULF OF ADEN — During the period October through March the current sets generally between northwest and southwest over the greater part of the gulf. The speed varies between 0.2 and 0.8 knot and increases to about 1 knot in the vicinity of Bab el Mandeb. The current is generally weaker from November to January than from February to April.

During April and May, the spring transition, the currents in the gulf have average speeds of about 0.2 to 0.5 knot. The stronger currents occur on the Arabian side of the gulf.

During the period June through August, the current sets eastward through Bab el Mandeb into the Gulf of Aden, primarily along the Arabian side of the gulf. Currents again are generally stronger on the Arabian side of the gulf than in the middle or on the African side. A countercurrent sets around Capo Guardafui from the south and flows westward along the African coast as far as Djibouti.

During September, the autumn transition for currents, speeds in the Gulf of Aden vary from about 0.3 knot on the African side to 0.8 knot close inshore on the Arabian side.

The variability of direction of flow in the Gulf of Aden is shown below:

PERIOD	SET	PERCENT OF TIME
Nov.–Jan.	WNW–WSW	*44*
Feb.–Apr.	WNW–WSW	*34*
May–July	ENE–ESE	*43*
Aug.–Oct.	ENE–ESE	*35*

(c) INDIAN OCEAN AND ARABIAN SEA — During the northeast monsoon the ocean current sets toward the northern part of the eastern Somalia coast. At about 10°N. the current divides and sets north and south along the coast of Africa. Between Capo Guardafui and Socotra, the rate is about 0.2 to 0.4 knot. From about 1°30′S. to 2°30′S., the southerly set meets a northerly current, and the combined currents set offshore. The strongest part of the southwesterly setting current near the coast is between 2°N. and 4°N., where the mean speed is about 1 to 1.4 knots from November to January.

During the spring transition period for currents (March) between the Equator and 4°N., the current sets west and northwest with a mean speed of about 0.3 to 0.5 knot. From about 4°N. to the southern limit of this NIS Area, the set is southerly at speeds of about 0.8 knot. The main part of the westward setting current passes south of Socotra and divides when it reaches the coast at about Ras Hafun (10°27′N., 51°24′E.). A part of this current sets into the Gulf of Aden and the Red Sea; the remainder sets south along the African coast. The speed between Socotra and the mainland is less than 1 knot. A branch of this current sets into the Gulf of Aden, whereas the remainder sets northward along the Arabian coast.

Of the two monsoons, the southwest is stronger, of longer duration, and more stable in the Arabian Sea, causing the currents to be stronger and more persistent. During the period April through October the currents set northeast along the Somalia coast at a rate of 1 to 3 knots. The current passes through the channels between Capo Guardafui and Socotra at speeds of 0.6 to 1.4 knots and joins the easterly set from the Gulf of Aden. The current speed off the eastern end of Socotra is about 1 knot. From 3°S. to 4°N. the current is generally weaker during August, but from 6°N. to Capo Guardafui the strongest period is August to October. Between 3°S. and 3°N. the current speed is about 2.3 knots and the direction about 56° true. It is weakest between Capo Guardafui and Ras Hafun with a mean drift of 0.5 knot from May to July and 0.8 knot from August to October.

During November, the autumn transition period for currents, a clockwise eddy is centered at about 8°N., 55°E. In the southwestern part of this area, the currents set southwestward south of 5°N.; north of 5°N. the current sets fairly steadily northward along the African coast at speeds which average slightly over 1 knot. The current passes between Socotra and Capo Guardafui at about 0.7 to 1 knot.

Along the coast of Somalia, the strongest currents occur within 30 to 40 n. miles of the shore. Speeds as high as 2.5 knots may be observed within 60 n. miles of shore but are rare between 60 and 120 n. miles offshore.

(2) *Subsurface currents* — The subsurface water movements within the Red Sea are influenced by the wind regime and the excess of evaporation over precipitation. No comprehensive synoptic measurements are available from which subsurface water movements may be determined. However, from theoretical considerations, the general movements of subsurface waters may be deduced.

In the Northern Hemisphere, the effect of wind parallel to a coast is to cause transport of surface and subsurface water to the right of the wind, and to a lesser extent in the direction of the wind. In a narrow water body such as the Red Sea, piling up of water will produce a compensating bottom current flowing away from the coast. Thus, a north-northwest wind over the Red Sea will pile up water against the west shore and cause water movements which are a combination of a clockwise circulation in a vertical plane perpendicular to the direction of the wind looking downwind, and a flow parallel to the coasts which is less pronounced in the subsurface than in the surface layers. A south-southeast wind will produce the same phenomenon as above except that the direction of transport will be reversed.

The controlling sill depth between the Red Sea and Gulf of Aden is about 300 feet. During the southwest monsoon a vertical view of water movement shows a surface flow out of the Red Sea, an intermediate compensating flow into the sea, and a very small outflow of highly saline water along the bottom. During the northwest monsoon, the water flows into the Red Sea at the surface and outward at depth. The depths of the intervening transition layers are unknown.

FIGURE 22–4 lists current speeds and directions and observed winds at selected locations and depths within the Red Sea. FIGURE 22–64A shows the resultant speeds of both tidal and nontidal currents in the Bab el Mandeb at depths of 5, 50, and 150 meters predominantly setting into the Red Sea.

(3) *Tidal currents* — Tidal currents within this Area are noticeable only as negative or positive accelerations of the nontidal flow. The period of the tidal current (about 12 hours) and its mean speed (about 1 knot) can be deduced from FIGURE 22–64A. The figure also indicates that the tidal current at 150 meters is almost completely out of phase with that at 5 and 50 meters; i.e., the velocity at the surface is at a maximum while that at 150 meters is at a minimum.

FIGURE 22–4. CURRENT SPEEDS AND DIRECTIONS AT SELECTED LOCATIONS AND DEPTHS IN THE RED SEA, TOGETHER WITH SIMULTANEOUS OBSERVATIONS OF WIND DIRECTIONS

LOCATION (SEE FIG. 22–64B)	MONTH	DEPTH (m.)	SPEED (KNOTS)		CURRENT DIRECTION (TRUE°)	WIND DIRECTION AND STRENGTH
			Max.	Min.		
A.....	Jan.	5	1.0	0.5	33	SE Strong.
		15	1.0	0.7	0	SE Strong.
		40	1.0	0.7	0	SE Strong.
B.....	Jan.	5	0.6	0.4	35	SE Strong.
		20	0.7	0.4	32	SE Strong.
		40	0.9	0.1	22	SE Strong.
C.....	Nov.	5	0.6	0.4	34	SE Strong.
		10	0.4	*na*	35	SE Strong.
		25	0.6	*na*	*na*	SE Strong.
D.....	Dec.	5	0.8	0.3	33	S Moderate.
		15	0.8	0.3	33	S Moderate.
		30	0.7	0.1	33	S Moderate.
E.....	Apr.	5	0.3	0.2	14	E Light.
		15	0.4	0.3	21	E Light.
		30	0.1	0.1	5	E Light.
F.....	Dec.	5	1.4	0.4	34	NW Light.
		15	1.4	0.4	34	NW Light.
		35	1.2	0.4	34	NW Light.
		40	1.0	0.7	33	NW Light.

na Data not available.

(4) *Local currents*

(a) ETHIOPIA (ERITREA) — In the entrance to Gubbet Mus Nefit (15°42′N., 40°00′E.) tidal currents attain speeds as high as 2 knots.

At times the current leading to Dubellu anchorage (15°44′N., 40°09′E.) and through the passages east and west of Isola Erua attain considerable speed.

(b) FRENCH SOMALILAND — The tidal current setting through the passes into Ghubbet Kharab (11°30′N., 42°35′E.) causes whirls and ripples; it attains a speed of 7 knots in Petite Passe.

Tidal currents in the bay at Djibouti are scarcely perceptible; they generally set eastward during the falling tide and westward during the rising tide.

(c) SOMALI REPUBLIC — At springs the tidal currents usually set westward through the roadstead at Zeila (11°21′N., 43°29′E.) during the rising tide and eastward during the falling tide at speeds of about 0.5 knot. Along the coast off Zeila a current which usually sets with the wind attains speeds as high as 0.8 knots.

During the northeast monsoon, a countercurrent occasionally sets eastward along the coast between Mait Island (11°12′N., 47°13′E.) and the 49°E. meridian at a speed which ranges between

0.5 and 2.3 knots. Onshore currents with speeds as great as 1.5 knots have been reported.

Tidal currents in the anchorage at Alula (11°58′N., 50°45′E.) are often strong, especially during spring tides.

At Capo Guardafui (11°49′N., 51°15′E.) when the northeast monsoon is established, the current usually sets southwestward at speeds not exceeding 2 knots. At the change of the monsoons the currents become quite variable. During the southwest monsoon, the current sets strongly northward along the coast south of the cape. During February, March, and April the current rounds the cape close to shore and sets westward. A short distance from the shore, the currents continue northward and east-northeastward.

In August the current sets northward at Mogadiscio (2°04′N., 45°22′E.) very nearly parallel to the shore but with a slight onshore component at speeds as high as 3 knots.

At Merca (1°43′N., 44°53′E.) tidal currents cause positive and negative accelerations of the monsoonal currents. The speed at times is as much as 4 knots.

The current in the Brava roadstead (1°08′N., 44°03′E.) attains speeds as high as 4 knots during the southwest monsoon. During the northeast monsoon the speeds may be greater.

At Isole Giuba (1°10′S., 42°10′E.) and Chisimaio (0°22′S., 42°32′E.) the current sets southwestward from about November to April at a speed of about 2 knots; it is strongest during January and February. From about April to November, the set is northeast at a speed of about 3.5 knots.

The ingoing current at Bircao (1°25′S., 41°51′E.) has speeds of about 1.5 knots and the outgoing about 2 knots. During the southwest monsoon there is usually a heavy sea over the bar, especially during the outgoing current.

(d) SOCOTRA AND ADJACENT ISLANDS — Nontidal currents close inshore off Socotra are affected by tidal currents to some extent but are primarily influenced by winds. During the northeast monsoon, a northwesterly current of 2.5 knots has been observed in a position about 1 n. mile offshore about 3 n. miles south-southwest of Da'iri (12°26′N., 54°11′E.).

During May the current off 'Abd al Kūrī (12°12′N., 52°15′E.) has been observed to set east-northeast at a speed of 1.5 knots with many tide rips in shoal water. Through the passages between the islands west of Socotra, the tidal currents set northward during the rising tide and southward during the falling tide. The speeds are reported to be 1 to 2.5 knots, but are likely to be greater when the monsoons are at their strongest.

The tidal currents are very irregular. They sometimes set in one direction for 16 hours and at other times for only 6 hours. During the rising tide, the tidal currents set westward on the southern side of the island and eastward on the northern side. During the falling tide the currents flow in the opposite direction. The rate of the eastgoing current on the southern side of the island is about 1 knot. In the general vicinity of Socotra, the strongest currents observed anywhere in the Indian Ocean are encountered. Many rates of 4.5 to 5 knots have been observed with occasional reports of 6 and 7 knots.

3. Sea and swell, and breakers and surf

a. SEA AND SWELL

(1) *Introduction — Sea* is defined as waves caused by local winds, whereas *swell* refers to wind-generated waves that have advanced beyond the region of generation. The direction of sea is that of the local wind, whereas the direction of swell is independent of, but may coincide with, the local wind. Both sea and swell may be present at the same time.

Sea and swell vary locally with passing atmospheric disturbances, such as tropical easterly waves, tropical squall lines, invading cold fronts, and tropical storms. As these disturbances seldom remain very long in a particular region, their effects on sea and swell are generally of short duration, although often of consequence. In the tropics, the land – sea breeze effect is very pronounced and will influence the sea conditions locally, but will not affect the persistent swell which penetrates these locally derived waves.

The sea and swell roses presented in FIGURES 22–65 through 22–68 show the frequency of various height categories by direction. Bar graphs showing the frequency of various height categories for all directions are presented with each rose. These roses and bar graphs are compiled from monthly sea and swell data.

For purposes of discussion, the Area is divided into three regions: the Red Sea region including Bab el Mandeb (four sea and swell sections), the Gulf of Aden (three sea and swell sections), and the Indian Ocean region (six sea and swell sections). While the Area lies within the climatic influence of the Indian Ocean monsoonal regime, seasons vary from region to region because of topographic and latitudinal differences. The seasons for the Red Sea and the Gulf of Aden regions are the northeast monsoon (October through April), spring transition (May), southwest monsoon (June through August), and autumn transition (September); and for the Indian Ocean region the northeast monsoon (November through

March), spring transition (April and May), southwest monsoon (June through August), and autumn transition (September and October). Because of insufficient data, the April and October swell roses and bar graphs for the middle section of the Gulf of Aden are omitted.

The northern exposures of Socotra are subjected to sea and swell conditions similar to those in the Gulf of Aden (easternmost section). Socotra's southern exposures have sea and swell conditions resembling those of the Indian Ocean region (section between 9°N. and 6°N.).

(2) *Seasonal characteristics* — The alternation of the monsoons associated with the climate of the Indian Ocean is the chief control of the sea and swell conditions of the nearshore area. Although high pressure cells form over northern Africa and the Arabian Peninsula during the cooler months of the Northern Hemisphere, the intense Siberian *high* is the chief source of the northeast monsoon as it flows from Asia toward low pressure over southern Africa and in the intertropical front now south of the Equator. Between Capo Guardafui and the Arabian coast, a small branch of this monsoon diverges in a clockwise circulation around the high pressure over Arabia, which becomes more easterly over the Gulf of Aden and southeasterly over the southern Red Sea.

The southwest monsoon, which flows out of the south Indian Ocean *high* toward Asia during the warmer months of the Northern Hemisphere, is controlled chiefly by the intense south Asian heat *low,* although low pressure cells form over northeast Africa and the Arabian Peninsula at this time. However, a counterclockwise circulation around the low pressure cell over Arabia, which backs from northwest winds over the southern Red Sea to westerly and southwesterly winds over the Gulf of Aden, forms a minor branch of the southwest monsoon.

The transitional seasons are generally periods of weak and variable winds. However, because of the large latitudinal extent of the Area, seasons vary from region to region and with local conditions.

The intertropical front, which migrates across the Area during each transition season, has little dynamic effect because of the divergent nature of the winds and generally represents only the boundary between Northern Hemisphere air and Southern Hemisphere air during its rapid transit. For this reason easterly atmospheric waves rarely occur in this Area, whereas tropical squalls, gales, and thunderstorms are generally related to the thermal differential between land and sea.

Land and sea breezes are an important feature throughout the Area and have such strength that they may deviate the monsoonal winds; i.e., they may retard or neutralize them, but more frequently they reinforce them. During weak anticyclonic conditions the land and sea breezes are the dominating winds.

Gales and squalls occur most frequently over the southern Red Sea during the northeast monsoon. During this season an occasional gale with cold front characteristics may enter the Area from the Arabian *high.* In the Gulf of Aden, gales and squalls occur most frequently during the southwest monsoon. Although gales and squalls occur during both monsoons over the Indian Ocean region, they are much more frequent during the southwest monsoon, especially over the northern part. Thunderstorms occur infrequently in this moisture-deficient air, whereas no cyclones have been observed in the Red Sea, and only the effects of an occasional distant cyclone are noted in the Gulf of Aden and along the coast of the Indian Ocean region. (Three cyclones are recorded as entering the Gulf of Aden since 1894.)

Seas 5 feet or lower (slight to moderate) are the most frequent sea condition in the Red Sea; seas are roughest during the northeast monsoon except in the northern part. In the Gulf of Aden, seas 5 feet or lower are the most common, with roughest seas during the southwest monsoon. In the Indian Ocean region, seas less than 5 feet are also the most common sea condition except along the northern part during the southwest monsoon, when seas 5 feet or higher (rough through high) are more frequent.

Low swell (1 to 6 feet) is the most frequent swell condition during the northeast monsoon in the Red Sea except in the section north of Bab el Mandeb, where moderate swell (6 to 12 feet) is most frequent. Periods of no swell are most frequent during the southwest monsoon and the transition seasons except in the northern section, where low swell occurs most often from June through September. In the Gulf of Aden, low swell is generally most frequent during the northeast monsoon, and no swell during the spring transition. However, swell conditions vary from no swell to moderate swell during the southwest monsoon and from no swell to low swell during the autumn transition. In the Indian Ocean region low swell is the most frequent during the northeast monsoon except during December in the north-central sections and during January in the middle and south, when moderate swell occurs most often. Moderate swell is most frequent during the southwest monsoon except in the northern sections during July, when high swell (higher than 12 feet) occurs most frequently.

(3) *Red Sea and Bab el Mandeb* — The high mountains and plateaus bordering the Red Sea on both sides affect the major climatic controls as well as the local weather. The northeast monsoonal winds are diverted to southeast winds over the southern Red Sea, whereas the southwest monsoonal winds arise as northwest winds. The prevailing northwest winds of the northern Red Sea are an important factor in the northern section even during the northeast monsoon.

Sea breezes accentuate the prevailing winds and seas mostly during the afternoon, whereas night cooling of the land generally causes a period of calm winds and seas during the early morning hours. Gales and squalls are most frequent during the northeast monsoon in the southern sections, but the southwest monsoon is more severe in the northern section. Gales associated with easterly moving *lows* over northeast Africa (frequently dust laden) may on occasion enter or extend into the Red Sea region, whereas cold front squalls may occasionally penetrate from the Arabian side. Thunderstorms (10 to 15 days per year) occur most frequently during the southwest monsoon. On the rare occasions when cyclones enter the Gulf of Aden, the effects may be noted in the Bab el Mandeb.

Except in the northern section, where seas 5 feet or higher are more frequent during the southwest monsoon than during the northeast monsoon, sea and swell conditions are roughest during the northeast monsoon.

(a) NORTHEAST MONSOON (OCTOBER THROUGH APRIL) — While the winter high pressure cell lies over Arabia, southeast winds, seas, and swell are generally the most frequent wave conditions of the region. In the northern section swell conditions tend to vary from southeasterly to south.

Calm seas are least frequent during this season except in the north section. Seas 5 feet or higher occur most frequently for the year except in the northern section, where frequencies range from 2% to 14%. Farther southward annual maximum frequencies of 33%, 60%, and 41% occur.

No swell conditions occur least frequently for the year during this season (16% to 33%). However, swell higher than 12 feet occurs most frequently this season, having annual maximums southward of 3% to 7%.

(b) SPRING TRANSITION (MAY) — Winds are generally mild and variable as the high pressure dissipates and before the low pressure cell is established. Northwest winds, seas, and swell predominate in the northern section, while southeast winds, seas, and swell are still most prevalent in the south.

Except in the northern section and Bab el Mandeb, calm seas are more frequent (3% to 13%) than during the northeast monsoon and about equal to those of the southwest monsoon. Seas 5 feet or higher are generally less frequent (4% to 15%) than during the northeast monsoon.

Periods of no swell occur more frequently (44% to 64%) than during the northeast monsoon, whereas swell higher than 12 feet is considerably less frequent (1%).

(c) SOUTHWEST MONSOON (JUNE THROUGH AUGUST) — In the cyclonic circulation around the Arabian summer *low*, northwest winds, seas, and swell form the chief wave direction of the region. In Bab el Mandeb westerly swell occurs more frequently than northwesterly during July and August.

Calm seas are less frequent (4% to 15%) than in the autumn transition but, except in the northern section, more frequent than during the northeast monsoon and the spring transition. Seas 5 feet or higher occur with an annual maximum of 20% in the northern section and a seasonal maximum of 15% in Bab el Mandeb during July, but average only 4% or less in the other two sections throughout the season.

The occurrence of no swell ranges in frequency from 27% to 69%, averaging more than during the northeast monsoon. Swell 12 feet or higher does not exceed 3%.

(d) AUTUMN TRANSITION (SEPTEMBER) — While the winter high pressure cell is gradually replacing the summer low pressure cell over Arabia, winds are generally mild and variable. Northwest winds, seas, and swell continue to dominate the northern sections, whereas southeast winds, seas, and swell increase to a greater frequency than those from the northwest in the Bab el Mandeb.

Calm seas, except in the northern section, occur with annual maximum frequencies of 13% to 17%. Seas 5 feet or higher, except in the northern section, occur with annual minimum frequencies of 1% to 5%.

Periods of no swell are most frequent for the year, except in the north section, having annual maximums of 59% to 75%. Swell higher than 12 feet occurs with least annual frequency (less than 0.5%) throughout the region.

(4) *Gulf of Aden* — The high mountains and plateaus that border the Gulf of Aden on the north and south affect the major climatic features as well as the local weather. The northeast monsoon winds are diverted to a more easterly direction, especially over the head of the gulf. Although the southwest monsoon is the season

of severest winds and waves, in this region they are milder than at the same latitude in the open Indian Ocean.

Sea breezes in the afternoon and land breezes before morning are characteristic during the northeast monsoon and the transition seasons; however, the strength of the southwest monsoon is generally greater than the land – sea breeze effect. Gales and squalls are infrequent during the northeast monsoon, but the winds of the southwest monsoon are often of gale force. During periods of weak southwest monsoonal winds, southward moving squalls with northerly winds may arise suddenly over the sea. Although thunderstorms occur infrequently, their greatest occurrence is during the southwest monsoon. The rare cyclone that enters the region is most dangerous because of its unpredictability.

Seas less than 5 feet are the most frequent sea condition in this region. Although seas are roughest during the southwest monsoon, they are also rough in February when the northeast monsoon is strongest. The most frequent swell condition varies between no swell and low swell, but high swell occurs most frequently during the southwest monsoon.

(a) NORTHEAST MOONSOON (OCTOBER THROUGH APRIL) — East and northeast winds, seas, and swell predominate throughout the season, when the high pressure cell lies over Arabia. Easterly winds and waves are most prevalent in the western section, whereas northeasterly winds and waves predominate in the middle and eastern sections. Easterly winds and waves become more frequent than those from the northeast in the eastern section during March and April.

Calm seas decrease from the annual maximums of the autumn transition to a monthly frequency of 4% or less when the northeast monsoon is strongest (about January) and then increase again during March and April. However, seas 5 feet or higher increase to a seasonal maximum in February of 21% in the west, to the annual maximum of 46% in the middle, and to a seasonal maximum of 12% in the east, and then decrease during March and April.

The occurrence of no swell has a range of 15% to 53% frequency and varies from month to month in different sections. Swell higher than 12 feet occurs infrequently throughout the season, the highest being 8%.

(b) SPRING TRANSITION (MAY) — Winds and waves are variable during this transition season. Easterly winds and seas are most prevalent in the western and eastern sections, while westerly winds and seas are most prevalent in the middle. Easterly swell predominates throughout the region.

In the middle and eastern sections, calm seas are more frequent in this season than during either monsoon. Seas 5 feet or higher have a frequency of 12%, 7%, and 4% from west to east, reflecting the generally milder conditions of the transition period.

Periods of no swell occur with annual maximum frequencies of 58%, 79%, and 52% from west to east, whereas swell higher than 12 feet is not observed.

(c) SOUTHWEST MONSOON (JUNE THROUGH AUGUST) — When the low pressure cell is established over Arabia, southwesterly winds, seas, and swell are most prevalent in the region. Westerly swell in the middle section, and westerly, southerly, and southeasterly swell in the east at times equal or surpass the frequency of the southwest swell.

Calm seas have a greater average frequency than during the northeast monsoon and occur with seasonal minimums of 3% to 9% in July. Seas equal to or greater than 5 feet are roughest for the year in July with the annual maximum of 36% in the west, the seasonal maximum of 34% in the middle, and the annual maximum of 26% in the east.

For no swell conditions, July has the seasonal minimum in the west, and the annual minimum frequencies of 13% and 10% in the middle and east, respectively. Swell 12 feet or higher occurs throughout the season, ranging from 1% to 9%.

(d) AUTUMN TRANSITION (SEPTEMBER) — During this transition season winds and waves are most variable for the region. East and northeast winds and seas occur with equal frequency in the western section, southwest winds and seas predominate in the middle section, while south and southeast winds and seas occur with equal frequency in the eastern section. Southerly swell predominates in the west, westerly swell in the middle section, and southeasterly swell in the east.

Calm seas occur with annual maximum frequencies of 16% to 27%. Seas 5 feet and higher occur with less frequency than during any other season.

Periods of no swell (52%, 61%, 36% from west to east) occur less frequently than during the spring transition but are generally greater than during either monsoon. Swell 12 feet or higher occurs with a frequency of 3% in the west and 2% in the east.

(5) *Indian Ocean and Arabian Sea* — Although this region lies in the Indian Ocean monsoonal regime, the land and sea breezes cause diurnal variations near the coast (extending about 15 n. miles from shore). The land breeze tends to retard the prevailing wind at night, whereas the sea breeze accelerates the prevailing wind during the afternoon; sea breezes increase the easterly direction of the northeast monsoonal winds and the southerly component of the southwest monsoonal winds. During the transition seasons land and sea breezes are the prevailing winds.

Gales and squalls occur during both monsoons but most frequently during the southwest monsoon, especially off the northern half of the region. Although thunder may accompany the squalls, thunderstorms do not occur frequently. Cyclones almost never pass this far south of the storm tracks.

Although seas are roughest during the southwest monsoon, heights less than 5 feet are the most frequent in the southern half of the region, whereas seas 5 feet or higher are most frequent in the north. The most common swell conditions vary from mostly low swell in October through April (except for moderate swell during January in the central and southern sections) to mostly moderate swell in May through September (and high swell in the northern sections).

(a) NORTHEAST MONSOON (NOVEMBER THROUGH MARCH) — As the northeast monsoon is being established during November between the Siberian winter *high* and the low pressure of the intertropical front now south of the Equator, northeast winds, seas, and swell become predominant over the northern and middle sections and increase in the southern sections, where southeast winds, seas, and swell predominate. During the remaining months of the season northeast winds, seas, and swell are most prevalent throughout the region.

Calm seas during November, with frequencies ranging from 8% in the north to 1% in the south, generally decrease in occurrence during midseason and then increase again in March. Seas equal to or greater than 5 feet increase rapidly in frequency to seasonal maximums during December or January of as much as 40% and then decrease gradually during the remainder of the season.

While the occurrence of no swell (range of less than 1% to 37% frequency) is variable from section to section along the coast, it is always at least 5% greater in March than in November. Swell 12 feet or higher varies in frequency from less than 1% to 8%; it occurs least often in November and most often in January, and is generally more frequent in the north and south than in the middle.

(b) SPRING TRANSITION (APRIL AND MAY) — During April the northeast winds and seas decrease rapidly, especially in the south, and are replaced by east winds and seas in the northern and middle sections, and by southeast winds and seas in the south. Southeasterly swell predominates throughout the region during April. As the southwest monsoon develops during May, south winds and seas predominate in the northernmost and southern sections; southwest winds and seas predominate in the middle sections. Southerly swell predominates throughout the region during May.

Calm seas generally decrease in April from the north - south range of 14% to 2% to the north - south range in May of 5% to 0%. Seas 5 feet or higher increase sharply from April (1%–7%) to May (6%–38%).

The occurrence of no swell decreases sharply from April (8%–30%) to May (6%–19%). During April swell higher than 12 feet is noted only in the south with a frequency of less than 1%, but occurs during May throughout the region with a range of 1% to 9%.

(c) SOUTHWEST MONSOON (JUNE THROUGH AUGUST) — During the full development of the southwest monsoonal flow from the south Indian Ocean *high* to the south Asian heat *low,* southerly winds and seas generally predominate throughout the region. Southwest winds and seas are more prevalent in the central sections throughout most of the season, and southeast winds and seas are more prevalent in the southernmost section during July and August. Southerly swell predominates throughout the region, but southwest swell is more prevalent in the section between 9° and 6°N. at all times; southeast swell is more prevalent south of 2°N. during June and July and south of 0° during August.

Calm seas are infrequent, occurring less than 1% of the time in most months. Seas equal to or greater than 5 feet are generally severest during July. The seasonal range of frequency is 18% to 40% in the southern half and 54% to 95% in the northern half.

The occurrence of no swell is generally least for the year, ranging 0% to 9% in June, 0% to 2% in July, and 0% to 4% in August. Swell greater than 12 feet during June occurs about 30% of the time in the two northern sections and averages 10% in the middle and southern sections. During July the frequency increases to about 48% in the north to a 13% average in the middle and south. August frequencies decrease to a 37% to 24%

range in the north and a 5% to 8% range in the middle and south.

(d) AUTUMN TRANSITION (SEPTEMBER AND OCTOBER) — Although the strength of the southwest monsoonal winds gradually decreases during this period, southerly winds and seas generally predominate in the region during September and over the northern half during October. Southeast winds and seas, prevalent south of the Equator during September, extend northward until they predominate over the southern half of the region during October; northeast and east winds and seas also increase during October. Southerly swell continues in the northern half during September, but is only predominant in the northernmost sections during October; southeasterly swell is predominant over the southern half during September and October. Northeast and east swell also show an increase during October.

Calm seas, except for the 1% frequency in the northernmost section, are not noted during September; however, during October they occur with a range in frequency of 13% in the north, to 1% in the south. Over the northern half, seas 5 feet or greater decrease from a frequency range of 42% to 74% in September to 7% to 13% in October; over the southern half, seas 5 feet or higher decrease from a 9% to 17% frequency range in September to a 5% frequency in October.

Periods of no swell increase in frequency from a 0% to 6% range in September to a 5% to 31% range in October. Swell 12 feet and higher decreases from 4% to 17% in September to 0% to 4% in October.

b. BREAKERS AND SURF

(1) *Introduction* — This Subsection presents wave and breaker data for representative coastal alinements. Terms used in this discussion are defined as follows:

Waves—Sea, swell, or composites of the two, whichever describes the surface of the ocean.
Surf—The disturbed water in the area extending from the outer breaker line to the limit of uprush on a beach.
Breakers—Waves that break in shoaling water, over a reef, or on a shore.

Although breakers overlap, they can be classified into three types:

Plunging breakers—Waves, the crests of which advance faster than the bases, falling forward on the front face with a violent action.
Spilling breakers—Waves that become unstable and form white water at the crest. Breaking action is mild.
Surging breakers—Waves that surge up on the beach as a wall of water with little or no breaking action, and which may or may not include white water.

Breakers less than 4 feet in height on landing beaches are considered safe for all small landing craft. Breakers 4 to 8 feet high will slow down landing operations, permitting only the larger craft to remain operational in the upper limit of this range. Breakers more than 8 feet high will generally stop landing operations for most types of landing craft. Although hazards to landing craft increase with increasing breaker height, the difficulties depend also upon the period of the waves, the type of breakers, and the direction of breaker approach onto the beach.

Waves with long periods can peak up to greater heights before instability and breaking take place. On the other hand, long-period waves are easier to navigate, as fewer breakers are encountered.

Plunging breakers are usually the most dangerous because breaking action is generally very severe; however, spilling breakers that exceed 8 feet in height can be equally hazardous. Surging breakers, although generally mild in landing operations, can be hazardous while the craft is on the beach or retracting.

The width of the breaker zone also affects the use of landing craft. Gently sloping nearshore bottoms have a wide surf zone with many lines of breakers. These nearshore zones usually have several lines of irregular bars, with waves breaking on the outer bars, re-forming, and breaking again on the inner bars. When breakers are high, the length of time required to pass through a wide surf zone imposes a severe strain upon the landing craft and operating personnel. Retraction through such a surf zone is slow and difficult.

Bottom slopes are also important because landing operations usually cannot be carried out efficiently where the slope is flatter than 1 on 50. With steeper slopes, however, plunging breakers increase in frequency. Slopes as steep as 1 on 8 can produce hazardous plunging breakers, even where deepwater wave heights are as low as 2 feet.

(2) *Criteria for wave and breaker computations* — The influence of climatic wind systems together with beach exposures are the main factors in defining coastal alinements. Other factors are bottom topography, the presence of islands offshore, and barrier and fringing reefs adjacent to oceanic depths.

For any particular coastal alinement only waves from exposed directions are considered. The remaining directions are assumed to produce waves 3 feet or less in height. For purposes of computation a representative part of each alinement is selected. The wave heights for each part are derived for the waves just prior to refraction and shoaling. However, a coastal alinement may be subdivided into smaller units if either the exposure

or the nearshore bottom slope of the larger coastal alinement varies markedly. At the juncture of two coastal alinements, breakers from one alinement will merge with those of the other and can assume the characteristics of either or both alinements.

The breaker analysis for the four seasons is given in FIGURE 22–69. Twelve representative coastal alinements provide coverage for this NIS Area. A representative bottom slope of 1 on 50 has been used in the computations.

Each of the breaker roses shows the frequency, by direction, of specified breaker-height ranges. The bar graphs show cumulative frequencies from all directions of breakers less than 4 feet and types of breakers 4 feet and higher.

Wave and breaker conditions have been derived from available wind data for each of the four seasons. Wave and breaker percentage frequencies shown in the text and in the roses are for straight beaches parallel to the bottom contours. Where the contours are concave to the sea, actual breaker heights will generally be lower, and for contours convex to the sea, breaker heights will be higher than for parallel contours.

Refraction and shoaling factors have been considered for the representative part of each coastal alinement in deriving breaker heights and characteristics. The principles outlined in H.O. Pub. No. 234, *Breakers and Surf, Principles in Forecasting,* were employed in deriving breaker characteristics.

On the northern coast of Socotra, breakers and surf are generally similar to those on the nearby Gulf of Aden shore (Alinement 8). Breakers on the southern coast of Socotra resemble those of the Indian Ocean region (Alinement 10) for all seasons except the northeast monsoon. During this season, conditions are milder because the island is sheltered from the predominant northeasterly waves.

(3) *Seasonal characteristics* — The chief climatic controls of breakers and surf in the northeast monsoon are the high pressure area over the interior of Asia (*Siberian high*) and the *low* over southern Africa. The resulting winds cause waves and breakers predominantly from the easterly quadrant in this NIS Area.

In the southwest monsoon the principal controls are the *low* over northwestern India and the *high* in the south Indian Ocean. Wind circulating about these pressure centers causes waves and breakers generally from the northwesterly quadrant in the Red Sea and Gulf of Aden, and generally from the south and southeast in the Indian Ocean. The transitional seasons are short periods with waves and breakers of variable direction and often of decreased heights.

On an average the frequency of moderate and rough breakers (equal to or greater than 4 feet) in the Red Sea and Gulf of Aden is greatest during the northeast monsoon and least during the southwest monsoon.

On Indian Ocean alinements the greatest frequency of moderate and rough breakers occurs during the southwest monsoon and the least frequency during the northeast monsoon, principally because of the oblique approach of the predominantly northeasterly waves during the latter season.

Spilling breakers are the predominant type on most alinements in the Red Sea and Gulf of Aden. However, plunging breakers predominate on Alinements 2 and 6 during most seasons, and on Alinement 8 during the monsoons only. Plunging breakers are predominant on Alinements 10, 11, and 12 on the Indian Ocean (because of long fetch and decay distances), but spilling breakers prevail on partially sheltered Alinement 9.

(a) RED SEA AND GULF OF ADEN

1) Northeast Monsoon (October Through April) — During this season breaker-producing waves are predominantly from the southeast or east, on Alinements 1 through 6 and from the northeast on Alinements 7 and 8. On an average, breaker heights are at their annual maximum during this season.

The seasonal maximum of breakers 4 feet or higher is 46% on Alinement 5 (because of its exposure to a long easterly fetch), and the minimum frequency is 9% on Alinement 4 (exposed to short fetches only). The frequency of breakers 8 feet or higher ranges from a minimum of 1% or less to a maximum of 12%.

Maximum breaker periods vary from 10 seconds on Alinements 3 and 4 to 14 seconds on Alinement 7.

2) Spring Transition (May) — During this season the South African *low* deteriorates and is replaced by a *high,* and the Asiatic *low* develops in northwestern India.

Breaker-producing waves show little change in direction except in the north. Breaker heights are considerably lower than during the northeast monsoon. The maximum frequency of breakers equal to or greater than 4 feet is 19% on Alinement 5, and the minimum frequency is 2% on Alinement 4. The frequency of breakers 8 feet or higher ranges from nil on Alinements 3 and 4 to a maximum of 4% on Alinement 5.

Maximum breaker periods are 10 seconds on Alinements 1, 3, 6, and 7, 11 seconds on Alinements 2 and 5, and 12 seconds on Alinements 4 and 8.

3) Southwest Monsoon (June Through August) — This part of the Area is under the influence of the rather weak counterclockwise circulation around the Arabian extension of the Asiatic *low*. Hence, breakers are the result of predominantly northwesterly or northerly waves on most alinements, and westerly on Alinements 7 and 8. On an average, breaker heights reach an annual minimum frequency in this season.

The seasonal maximum frequency of breakers 4 feet or higher is 6% on Alinement 2, and the minimum frequency is 1% on Alinement 1. The frequency of breakers 8 feet or higher is less than 1% on all alinements in this region.

The maximum breaker periods range from 8 seconds on Alinement 7 to 12 seconds on Alinement 4.

4) Autumn Transition (September)— During this season the controlling pressure systems of summer (the south Indian Ocean *high* and the Asiatic *low*) begin to weaken. However, on most alinements predominant wave and breaker directions deviate little from those of the previous season.

Breaker-producing waves are predominantly north or northwest on alinements in the Red Sea but mostly northeast or east in the Gulf of Aden.

On the average, breaker heights are somewhat greater than during the southwest monsoon. The maximum frequency of breakers 4 feet or higher is 8% on Alinement 5, and the minimum frequency is 1% on Alinement 4. The frequency of breakers 8 feet or higher is 1% or less on all alinements.

Maximum breaker periods range from 9 seconds on Alinement 1 to 12 seconds on Alinement 8.

(b) INDIAN OCEAN REGION

1) Northeast Monsoon (November Through March) — Breakers on all alinements are the result of predominantly northeasterly waves. However, the average frequency of breakers equal to or greater than 4 feet is at the annual minimum because of their oblique approach and consequent refraction on the African coast.

The maximum frequency of breakers 4 feet or higher is 30% on Alinement 10, and the minimum frequency is 16% on Alinement 11. The frequency of breakers 8 feet or higher is at a maximum of 3% on Alinement 12 and 2% on Alinements 9, 10, and 11.

Maximum breaker periods range from 13 seconds on Alinement 9 to 18 seconds on Alinement 11.

2) Spring Transition (April and May) — Breaker heights are considerably increased on the southern half of this coast because of strengthening of southerly and southeasterly winds as the southwest monsoon develops.

The maximum frequency of breakers 4 feet or higher is 48% on Alinement 12, and the minimum frequency is 10% on Alinement 9. The frequency of breakers 8 feet or higher ranges from a minimum of 1% on Alinement 9 to a maximum of 15% on Alinement 12.

Maximum breaker periods vary from 12 seconds on Alinement 9 to 17 seconds on Alinement 11.

3) Southwest Monsoon (June Through August) — The monsoonal circulation is strongly onshore during this season. Consequently, breakers (the results of predominantly southerly or southeasterly waves) are on the average the highest of the year.

The maximum frequency of breakers equal to or greater than 4 feet is 77% on Alinement 12, and the minimum frequency is 27% on Alinement 9, which is partially sheltered from the predominantly southerly waves. The frequency of breakers 8 feet or higher ranges from a minimum of 2% on Alinement 9 to a maximum of 28% on Alinement 12.

Maximum breaker periods vary from 17 seconds on Alinement 11 to 19 seconds on Alinement 9.

4) Autumn Transition (September and October) — Breaker heights are lower, on the average, than during the previous season. The maximum frequency of breakers 4 feet or higher is 56% on Alinement 12, and the minimum frequency is 14% on Alinement 9. The frequency of breakers 8 feet or higher varies from a minimum of less than 1% on Alinement 9 to a maximum of 15% on Alinement 11.

Maximum breaker periods are 14 seconds on Alinement 9 and 15 seconds on Alinements 10, 11, and 12.

4. Bottom sediments

The distribution of the bottom materials in this NIS Area is shown in FIGURE 22–70B. Coral, sand, and shell are the dominant bottom materials near shore, and mud and mud-sand in the deeper areas. The coral occurs as fringing reefs, barrier reefs, or detritus. Most of the reefs have sand and shell associated with them. Small patches of mud and rock occur near shore, but because of the small scale of the chart they have been combined with the other bottom materials.

From the northern boundary of the NIS Area to just about 15°N. the bottom materials adjacent to the coast are sand and coral. Farther offshore mud-sand-coral is dominant. The Isole Dahlac are formed by a large coral reef with many coral islands. Sand and shell also are present.

Southeast and east of the Isole Dahlac a region of mud-sand-shell-coral covers the bottom. At the southern end of the Red Sea sand-shell-coral predominate. Bab el Mandeb occupies a shallow sill covered by 90 to 100 fathoms of water between the Red Sea and the Gulf of Aden.

Sand-shell-coral form a nearshore fringe along the shores of the Golfe de Tadjoura. Mud-sand-shell-coral extend along the coast southeast of the Golfe de Tadjoura to about 10°45'N. The remainder of the coast in the NIS Area has a narrow shelf with sand-shell-coral as the most probable major bottom materials. In the Gulf of Aden, mud occurs seaward of the sand-shell-coral zone, while along the Indian Ocean coast a band of mud-sand separates the nearshore deposits from the mud in deep water. The nearshore region around the island of Socotra and the shallow region to the southwest are floored by sand with a few patches of coral. This sand region extends all the way to 'Abd al Kūrī. Mud-sand is probably more extensive than is shown on the bottom sediments chart.

The mud and mud-sand in the NIS Area is a mixture of terrigenous inorganic and organic materials occurring in various proportions. The organic material is made up primarily of calcium carbonate which occurs as coral and in the form of tests of benthic and pelagic animals, such as foraminifera, pteropods, and various other marine organisms with calcium carbonate tests. The calcium carbonate can make up as much as 80% to 90% or as little as 1% to 2% of the sand and gravel portions of the sediment. The brown and green colors of the mud and mud-sand here may result from the organic matter.

FIGURE 22–70A shows the quantity of data available for each 30-minute quadrangle. The quantity is adequate in the Red Sea part of the chart, and the accuracy of the bottom sediment chart for this region is considered good to fair. The quantity of data are sparse in the Gulf of Aden and in the nearshore area along the Indian Ocean coast, and the chart reliability is fair to poor. Away from the coast in the Indian Ocean, data are almost completely lacking, and the chart reliability is poor.

5. Marine biology

a. DANGEROUS MARINE LIFE

(1) *Introduction* — A number of potentially dangerous animals inhabit the marine waters of this NIS Area. Some are provided with a means of injecting venom into their enemies, some are capable of inflicting severe biting wounds, and one can deliver a powerful electric shock. Venomous animals of these waters include certain fishes, jellyfishes, sea urchins, and cone shells; the principal nonvenomous forms are sharks, barracudas, moray eels, and electric rays.

Records of dangerous animals off Socotra are rare, but its proximity to the African mainland and the general distributional pattern of the Arabian Sea fauna indicate that the same species may be expected here as are found elsewhere in this NIS Area.

(2) *Venomous animals* — Among the most dangerous of all venomous fishes are the scorpionfishes (Scorpaenidae), represented in these waters by the stonefish (*Synanceja*) and the lionfish (*Pterois*) (FIGURE 22–5), as well as other less virulent species. The stonefish is a sluggish, dull-colored fish, difficult to detect as it lies motionless on the bottom among rocks or chunks of coral. Human victims of its venomous dorsal spines have succumbed within a few hours. In contrast to the inconspicuous stonefish, the lionfish is brilliantly marked with orange and black bars and possesses delicate fanlike fins. Wounds from the dorsal spines result in severe throbbing pain and occasionally in death.

Stingrays (*Dasyatis*) (FIGURE 22–5) are common in quiet shoal waters of this Area. These kite-shaped fishes bear one or more serrate venomous spines near the base of the long whiplike tail. Their habit of burying in the soft bottom makes them a menace to waders, who may receive painful and disabling wounds by stepping on a hidden ray. The closely related eaglerays (*Aetobatus*), also present in these waters, are seldom encountered on the bottom and therefore pose little threat to waders.

Marine catfishes (*Plotosus, Tachysurus*) (FIGURE 22–5) are armed with venomous dorsal and pectoral spines, wounds from which result in immediate stinging pain followed by local swelling

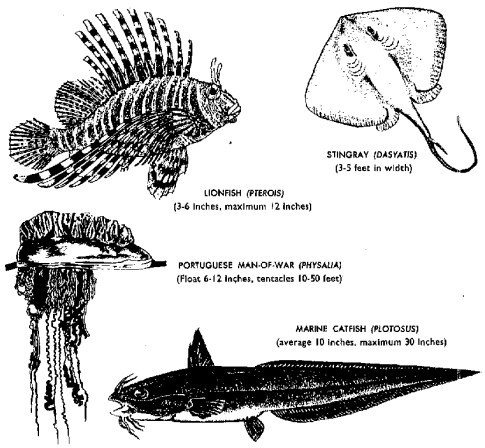

FIGURE 22–5. VENOMOUS MARINE ANIMALS

and numbness. These catfishes inhabit shoal waters, particularly in the vicinity of river mouths and among seaweed beds.

Another fish to be avoided in these waters is the rabbitfish (*Siganus*). The numerous venomous spines of this fish can inflict stinging wounds when specimens are handled carelessly.

Stinging jellyfishes may be encountered here, especially after onshore winds have prevailed for a considerable period of time. One of the most dangerous marine stingers, the Portuguese man-of-war (*Physalia*) (FIGURE 22–5), is easily recognized by the bladderlike float that appears to sail upon the sea surface. Beneath this float trail numerous long tentacles armed with batteries of stinging cells. Contact of a human with the tentacles results in violently painful stings, often followed by stomach cramps, dizziness, and respiratory distress. Among the other jellyfishes reported from this region is a sea wasp (*Tamoya*) that is known to possess virulent stinging cells. Members of the sea wasp family (Carybdeidae) have been implicated in fatal stingings in Indo-Pacific waters.

Spiny sea urchins inhabit reefs, creeping slowly over rocky ledges and coral formations. Their sharp venomous spines produce painful injuries that are susceptible to infection.

Another dangerous reef-inhabiting invertebrate is the cone shell (*Conus*), a marine snail capable of inflicting a venomous puncture wound if handled. In spite of its venomous nature, this beautifully patterned mollusk is a favorite of shell collectors. The textile cone (*Conus textile*), reported from the Red Sea and the western Indian Ocean, has been implicated in fatal poisonings in the western tropical Pacific.

(3) *Nonvenomous animals* — Large predatory sharks reported from these waters include the white shark, or maneater (*Carcharodon*), tiger shark (*Galeocerdo*), mako (*Isurus*), hammerhead (*Sphyrna*) (FIGURE 22–5), sand shark (*Carcharias*), and several gray sharks (*Carcharhinus*). Despite the presence of these dangerous sharks, attacks on man are rare in this region.

Barracudas (*Sphyraena*) (FIGURE 22–5) inhabit coastal waters of this NIS Area. Large solitary individuals lurk about wharves, wrecks, and submerged rocks or coral heads, ready to attack unwary prey.

Moray eels (*Gymnothorax*) are common in reef areas where they hide under rocky ledges and in coral crevices. They grow to a length of 5 or 6 feet and are provided with numerous sharp teeth set in powerful jaws.

Another potential hazard of tropical coastal waters is the electric ray (*Torpedo*). This bottom dweller is able to generate a powerful electric shock, one that may knock a man down.

b. BIOLUMINESCENCE (PHOSPHORESCENCE)

(1) *Introduction* — Bioluminescence, the production of light by living organisms, is important in military operations because prominent displays at night may reveal shorelines, disclose vessel operations by illuminating wakes of surface craft and periscopes of submarines, reveal underwater swimmers or personnel wading ashore, and interfere with adaptation of personnel to the dark and with general visibility.

Luminescent displays may be grouped into three general categories: 1) Sheet-type, often appearing as a diffuse glow extending over a large area of sea surface; 2) spark-type, observed as innumerable flickering points of light; and 3) globe-type, appearing as glowing balls of light. The organisms causing these displays include various types of protozoans, pelagic crustaceans, and jellyfishes, respectively.

(2) *Geographic distribution* — Large patches of discolored water are seen frequently along the Ethiopian coast, due usually to massive accumulations of plankton. Although not all discolored water results in bioluminescence, a large percentage of discolored water in this region is luminescent at night. This bioluminescence is produced by concentrations of a miscroscopic dinoflagellate, *Noctiluca*, and is usually exhibited as a brilliant sheet type. Concentrations of this organism can develop during all seasons of the year.

Discolored water due to *Noctiluca* is prevalent in the Isole Dahlac and near Massaua. Extremely rich plankton populations are present all year between Isola Dahlac Chebir and Massaua. At times during the winter and summer months the water takes on the consistency of thick soup, owing to the countless numbers of bioluminescent dinoflagellates.

Bioluminescent displays have been reported with great frequency in the southern Red Sea. Numerous displays have been described as undulating bands of light, rotating wheels of light ("phosphorescent wheels"), or milky seas. The highest percentage of observed displays occurs during the period July through October.

Strong bioluminescence is a common occurrence during all seasons along the coast of French Somaliland and inside the Golfe de Tadjoura. Some very notable springtime displays are seen regularly near Djibouti and Obock. Large plankton blooms occur in the summer and extend throughout the Bab el Mandeb. These blooms

generally consist of bioluminescent dinoflagellates.

The Gulf of Aden is one of the most luminescent regions in the world. Maximum luminescence takes place during August and September although very bright and colorful displays can be observed during all seasons. In this region numerous observations of "phosphorescent wheels" occur annually. This unexplained phenomenon gives off extremely bright luminescence, at times capable of lighting up ships that are in the near vicinity. In addition, large stretches of luminescent water, usually caused by *Noctiluca,* are commonly seen within the Gulf of Aden. Masses of jellyfishes are responsible for some very strong globe-type displays within the Gulf of Aden and near the Somalia coast. To the east, in the vicinity of Socotra, bioluminescence is a common occurrence throughout the year. The same bioluminescent conditions ascribed to the Gulf of Aden occur here. Luminescent displays occur throughout the year along the coast of northern Somalia, reaching a maximum during the period July through October.

Bioluminescent displays are frequently seen during the year in the vicinity of Capo Guardafui and Ras Hafun. As in the Gulf of Aden, masses of dinoflagellates and occasional concentrations of jellyfishes contribute to numerous displays of bioluminescence. Few bioluminescent displays have been observed within the eastern Somalia coastal region south of Ras Hafun; those recorded are generally due to dinoflagellate blooms or masses of jellyfishes, and usually are seen during August and September.

e. MARINE ALGAE

(1) *Introduction* — Marine algae may affect nearshore naval operations in several ways: a) by mechanically fouling the screws of small craft operating in nearshore waters, b) by impeding waders and underwater swimmers in dense growths or by creating difficult underfooting, c) by making beach operations difficult, and d) by clogging ship and small craft intakes.

(2) *Geographic distribution* — Algae grow most luxuriantly between mean low water and a depth of about 50 feet on rocky ledges or coral reefs found along some parts of this coast. Above or below these levels, algal growth decreases, particularly in the intertidal zone, where high temperatures and extreme desiccation prevent their establishment. Some algae may be torn loose from their substrate during storms and accumulate at the surface as floating masses that eventually wash ashore. Since the largest algae in these waters, *Sargassum, Turbinaria,* and *Cystophyllum,* are usually no longer than 3 or 4 feet, algae are not likely to entangle swimmers or the screws of small craft. Also, they are not likely to clog small craft intakes or hinder amphibious landing operations, although they may at times form floating masses and windrows on the beach. Concentrations of small algae at about mean low water may make surfaces slippery for men wading ashore in some places.

The algal flora of Socotra resembles that in similar marine habitats on the Somalia coast.

d. SEAGRASSES — The seagrasses *Cymodocea* and *Halophila,* which usually are no larger than most algae in these waters, are well represented on mud or mud-sand bottoms in protected waters less than 50 feet deep. Although they may contribute somewhat to the accumulation of floating masses of seaweed and windrows on the beaches, they are not abundant enough to increase the significance of marine vegetation in naval operations.

C. Sector 1: Ethiopia (Eritrea)

18°02′N., 38°36′E. to 12°42′N., 43°08′E.
(FIGURES 22–71 and 22–72; USHO Charts 2815 and 2816)

Sector 1, consisting of approximately 680 miles of coast on the mainland and 300 miles of coast on the off-lying archipelago of Isole Dahlac, extends southeastward from the Ethiopia – Sudan border to the Ethiopia – French Somaliland border, and fronts on the Red Sea.

The mainland shores of the sector are predominantly sandy and are bordered in many places by marsh or swamp. There are four major beach areas, six minor beach areas, and nine landing places on the mainland. Most of these are in southern half of the sector; there are none on the off-lying islands. The major beach areas vary from 1¼ miles to 3¼ miles in length, and the minor beaches from 450 yards to 1,700 yards. Most of the beaches are backed by sandy desert and semidesert plains.

The areas best suited for large-scale amphibious operations are in the vicinity of the principal port of Massaua and the secondary port of Assab. In addition to port facilities, these two areas have good roads, large stretches of flat-to-undulating terrain, and nearby air facilities. Elsewhere, poor approaches, lack of roads, or limited areas of flat terrain combine to make the remaining parts of the sector generally unfavorable for large-scale amphibious operations.

Low, flat-to-undulating coastal plains, mostly about 5 to 15 miles wide, extend inland behind the mainland shores. The plains in turn are backed by hilly-to-mountainous outliers of the extensive interior mountainous plateau which attains peak elevations from 3,000 to over 10,000 feet. In several places, hilly-to-mountainous spurs of the interior highlands extend to or near the water's edge, compartmentalizing the coastal plains. In addition to these spurs, the coastal plains are sporadically interrupted by isolated hills or mountains.

The predominant vegetation of the coastal region is scattered grass and brush, which is most dense near the banks of streams. The partly brush- and tree-covered interior highlands are deeply dissected by numerous intermittent streams which flow out onto the coastal plains and in many places terminate in the porous sands before reaching the sea. Many of these streams have deeply entrenched streambeds, and most have marshy areas adjoining their lower limits.

The majority of the off-shore islands have predominantly sandy shores backed by low, barren, sandy terrain. Many islands have scattered coral outcroppings and are reef fringed.

Sea approaches to much of Coastal Segments [1] and [3] are obstructed by the Isole Dahlac, an archipelago of coral reefs, shoals, islets, and islands, which extend 6¼ to 80 n. miles offshore. Between the mainland and the Isole Dahlac is a deepwater channel, Canale di Massaua, which provides a clear offshore approach to the port of Massaua. A chain of islands, extending about 54 n. miles north-northeastward of Baia di Beilul in Coastal Segment [4], is another major obstruction in the offshore approaches to the sector. Rocks, shoals, and islets, particularly at the entrances to the numerous large bays indenting the coast, are additional offshore obstructions. The principal nearshore obstruction is a discontinuous fringing coral reef. Approaches to the islands of Isole Dahlac are generally unfavorable due to surrounding reefs, rocks, and shoals.

Protected anchorages are available in several of the bays. Potential fleet anchorages are located along the mainland in Golfo di Zula (Coastal Segment [3]), and Baia di Beilul (Coastal Segment [4]). In the Isole Dahlac there are two additional potential fleet anchorages, both on the western side of Isola Dahlac Chebir (Coastal Segment [2]).

There are one principal port, one secondary port, and three minor ports in Sector 1. The principal port is at Massaua (Coastal Segment [3]) which is also the most important urban area on the coastal plain. Assab is the secondary port and is the largest urban area in Coastal Segment [4]. There are minor ports at Archico, Capo Malcatto, and Mersa Fatma. Most of the coastal population is distributed among widely scattered villages, but the density is sparser than on the inland plateaus of the highlands where there are numerous towns, villages, and settlements, including Asmara, the most important town in Eritrea.

On the whole, land transportation is poor and there are only two roads of importance in the sector. One surfaced road leads inland from Massaua to Asmara where several connecting roads branch out into the interior. Another surfaced road leads southwest from Assab and provides the shortest route inland to Addis Ababa. In addition to these roads, there is one principal coastal track which traverses the length of the sector from 1 to 13½ miles inland, and connects at various points with the two main roads by means of other tracks and trails or by cross-country movement. There is only one railroad in the sector, a narrow-gage (3′1⅜″) line running westward from Massaua through Asmara and Cheren (Coastal Segment [1]). Cross-country movement would be hindered by soft sand, hilly and mountainous areas, deeply entrenched streambeds, sand dunes, and areas of lava rock. Movement inland is also impeded by the hills and mountains backing the coastal plain with only valley corridors and wide streambeds affording, at best, difficult routes of access.

There are four classified and three unclassified airfields throughout the sector with the greatest concentration in Coastal Segment [3]. These facilities can be used for helicopter landings. There are other suitable helicopter landing areas on flat uninterrupted stretches of the coastal plain and on some of the islands of the Isole Dahlac.

The coastal area of Sector 1 has a hot, dry monsoonal type of climate. While the area is hot the year round, the months of June through September are the hottest, with mean daily maximum temperatures of 90° F. to over 100° F. Along the coastal lowlands, the mean annual rainfall is less than 10 inches, but the littoral highlands receive from about 15 to 45 inches annually. During the period of June through August, winds are mostly from the northwest quadrant while southeasterly and southerly winds predominate during October through April. Wind directions tend to be variable during the transition months of May and September. Throughout the year, local land and sea breezes may dominate the wind direction in many coastal areas. In terms of ground operations, the most important weather phenomena

are the sporadic sandstorms and flash flooding of streams following periods of rain.

1. Coast

Coastal Segment [1], Sudan – Ethiopia border to Ras Dogon (190 coastline miles; USHO charts 2815 and 2822)

General—The coastal area consists of a broad, undulating, sparsely vegetated plain backed by a dissected mountainous plateau (FIGURES 22–14 through 22–18B and 22–71). The shores are predominantly sandy with some stretches bordered by marshy areas and mangrove swamps. The offshore approaches to the northern third of the segment are clear. The southern two-thirds is obstructed by the islands, rocks, reefs and shoals of the archipelago, Isole Dahlac, but there are adequate approach channels through or around these obstructions. In the nearshore approaches the principal obstruction is a discontinuous fringing reef. There are no protected anchorages except for small boats but all along the coast partly protected deepwater anchorages are available, particularly on the western side of the Canale di Massaua.

In general, this coastal segment is not suitable for large-scale amphibious operations, principally because of poor approaches and lack of roads. However, the area best suited for such operations is near the southern end of the segment where there are two major beach areas. These beaches lie from 3¼ to 7 miles north of the principal port of Massaua (Coastal Segment [3]) and the main road and railroad which connect this port with the hinterland.

The coastal plain is devoid of roads and is served only by scattered tracks. Cross-country movement across the plain is generally good. In the hills and mountainous plateau backing the plain, steep slopes and deep-cleft valleys virtually preclude off-road movement. There are no classified air facilities but there is one unclassified airfield; many flat stretches of the plain are suitable for helicopter landings.

Shore and coastal terrain—The shores are predominantly sandy and bordered in places by marsh or mangrove swamp (major beach areas (1) and (2); FIGURES 22–14 through 22–16 and 22–18A). The terrain behind the shores consists of a broad, undulating coastal plain backed by a dissected mountainous plateau (FIGURE 22–17). The plain is about 15 miles wide in the north, narrows to less than 10 miles at the center, and again widens to a maximum of more than 20 miles near its southern end. Isolated hills, ranging from about 140 to 800 feet high, are scattered over the plain and lie as close as 4 miles inland in the northern part of the segment and 12 miles in the southern part. The plain is mostly bare, arid, and sandy with low dunes and sand ridges. However, scattered small thorny bushes and trees line the dry streambeds, and elsewhere there are sporadic patches of brush or grass (FIGURE 22–18B). In addition, there are several widely scattered areas of cultivation and saltpans, mostly near the southern end of the segment. In many places intermittent streams issuing from the interior plateau are lost in shifting sands or marshes before reaching the shore. After a heavy rainfall, these streams turn into torrents. About 17 miles south of Mersa Mubarec there is a large intermittent stream that does reach the sea. It has a broad flood plain incised by broad streambeds and flanked by steep sides.

Backing the coastal plain is the interior plateau whose steep serrated foothills attain elevations up to 1,000 feet. Numerous mountainous areas rise from this plateau and attain peak elevations of over 6,000 feet about 30 to 50 miles inland from the shore. Steep-sided valleys severely dissect the plateau. Brush and scattered areas of small trees and grasses are the predominant cover of the plateau.

Approaches—Offshore approaches to the northern third of the segment are clear while the remaining two-thirds are severely obstructed by the islands, rocks, reefs, and shoals of the Isole Dahlac. This archipelago, which has one principal approach channel through it, is discussed in Coastal Segment [2] (FIGURE 22–71).

From the northern border of the segment to Mersa Deresa, about 65 miles southeastward, the offshore approaches are generally clear; however, many scattered shoals and banks lie 5 to 12 n. miles offshore. The nearshore approaches are partly obstructed by fringing coral reefs which in places extend about 1 n. mile from the shore. Where charted, the 10-fathom curve lies 650 yards to 2½ n. miles offshore.

Between Mersa Deresa and Ras Dogon, at the southern end of the segment, the offshore approaches are obstructed by the islands, rocks, reefs, and shoals of the Isole Dahlac and other scattered shoals. Approach channels to the mainland are limited to 1) the northern part of the Canale di Massaua, which lies parallel to the coast between the shore and the westernmost islands of the Isole Dahlac for a distance of about 108 n. miles, and 2) to a channel through the Isole Dahlac. The Canale di Massaua fairway varies from 2½ to 14 n. miles in width, and is mainly from 10 to 70 fathoms deep with occasional shoal patches. The channel affords a safe and convenient passage which may be navigated either

by day or night. In the nearshore approaches (western side of the Canale di Massaua), the principal obstruction is a discontinuous fringing reef. Between Mersa Deresa and Ras Dogon the 10-fathom curve extends from 500 yards to 4 n. miles offshore. An irregularly charted 6-fathom curve lies from 400 yards to 1¾ n. miles offshore.

Ports and urban areas—There are no ports in the segment, and the very few villages on the barren coastal plain are confined principally to widely separated areas of cultivation or salt works. Permanent villages and towns are located in the highlands. The most important of these urban areas is Cheren, a local trading center and rail transit point, which lies about 70 miles west of Ras Dogon. The town has good road and rail connections with the town of Asmara and the port of Massaua.

Routes of communication—The coastal plain is devoid of roads, the primary routes being coastal tracks which roughly parallel the shore 1 to 6 miles inland along the northern and southern parts of the plain. These tracks are joined by several other tracks leading inland across the plain and ultimately connecting with a north – south unsurfaced road. This road lies 18 to 66 miles inland and skirts the eastern edge of the plateau backing the plain. At its southern end, the road connects with a hard-surfaced all-weather road that passes through Cheren enroute westward from Massaua to the Sudan border.

Marshy and swampy areas are the principal obstacles to movement inland from the shores. Although most of these areas are relatively short belts paralleling the shores, they extend up to 4 miles inland in many places and would hinder movement laterally along the coast (see FIGURES 22–15 and 22–16). At high water, many of the tidal marshes are unfordable. Sand dunes line sections of the shore and areas of shifting sand dunes and sand ridges are sporadic along the coastal plain (FIGURES 22–15 and 22–16). In some places, these sand dunes and ridges are of sufficient height and steepness to be obstacles to vehicular movement. Isolated, rocky hilly formations also dot the coastal plain, presenting obstacles that can be bypassed for the most part (FIGURES 22–14 and 22–17). The only other major obstacles encountered along the coastal plain are the numerous intermittent streams whose banks are sufficiently high and steep in many places to block the passage of vehicles. During rainy periods, all movement is generally restricted because of floods, torrential streams, and sticky, slippery soils. The steep slopes of the hills and the mountainous plateau backing the coastal plain are a formidable barrier to movement. However, foot troops might be able to ascend some of the stream valleys through the highlands and reach relatively flat parts of the interior plateau.

Helicopter landing areas—There are no classified air facilities in the segment but an unclassified airfield, approximately 2 miles south of major beach area (2), is suitable for helicopter landings. Level stretches of the coastal plain are also suitable as helicopter landing areas; however, loose sand and sand dunes may be a problem in places. There are also some relatively level areas suitable for landing on the plateau backing the plain. Exits from the helicopter landing areas on the plain or the plateau are primarily by cross-country movement to scattered tracks and trails, but movement over much of the plateau is severely limited by the steep-sided valleys and gorges which dissect the interior highlands.

Coastal Segment [2], Isole Dahlac (approximately 300 coastline miles; USHO Charts 2815, 2821, 2822)

General—The Isole Dahlac is an archipelago of over 100 large and small islands which extend for about 150 n. miles on a northwest – southeast axis off the northern part of the Eritrean coast (FIGURES 22–19 through 22–21, and 22–71). The archipelago is separated from the mainland by the Canale di Massaua. The islands are principally low and sandy with scattered coral outcroppings and are fringed by reefs, rocks, shoals, and islets. These obstructions in the approaches make the islands generally unfavorable for amphibious operations. Much of the Isole Dahlac has been only partially surveyed, and there are many indications of discrepancies on existing hydrographic charts. There is one principal approach channel leading through the archipelago to the port of Massaua (annotated on FIGURE 22–71), as well as some minor devious and difficult channels leading to individual islands. Two potential fleet anchorages lie on the western side of Isola Dahlac Chebir, and open anchorage is available off some of the islands.

There are no landing beaches or landing places in this segment; however, short stretches of sandy shores on many of the islands might be suitable for the landing of small parties. Most of the islands have areas suitable for helicopter landings, but loose sand and rocks may be a problem in places. Roads are lacking but the larger inhabited islands have tracks and trails. Except for sand ridges and hills, marshy or swampy areas, and isolated cliffs, cross-country movement is generally good.

Isola Dahlac Chebir—The largest island of the Isole Dahlac is Isola Dahlac Chebir which is about 35 miles long and averages 11 miles in width (FIGURES 22–19 through 22–21). It is composed principally of coral and is generally low with its northern and western sides deeply indented. The shores are predominantly sandy and fringed in most places by coral reefs, although along the northern side of the island scattered mangrove areas fringe the shore. The terrain immediately behind the shores in many places consists of old beach ridges, particularly on the western side of the island. Inland, the terrain is relatively flat and sandy with scattered coral outcroppings and small marshy areas. The vegetation consists mainly of scattered grassy patches, a few palms, and brush along the intermittent streams whose waters normally sink beneath the ground in the shifting sands of the beach ridges backing the shores.

Cross-country movement is generally good. The major obstacles to inland movement are marshy areas scattered about the island and a cliffy area inland from the southeastern shores of Gubbet Mus Nefit, a bay on the western coast. There are a number of small coastal villages, most of which are located on the western side of the island. Tracks and trails connect these villages and are most numerous in the western half of the island.

Approaches to Isola Dahlac Chebir are obstructed off its northern and eastern shores by rocks, reefs, shoals, and islands. On its southern side a discontinuous reef extends offshore about 1,000 yards at its southwestern end and lies up to 7 n. miles offshore at its southeastern end. Reefs, rocks, shoals, and islands lie up to 10 n. miles offshore along the western side of the island.

Two large bays which indent the western coast of the island are considered potential fleet anchorages; deepwater channels lead into the bays. Shoals and islets border the entrance to Gubbet Entatu, the northwesterly bay, but they are separated by a navigable channel which has depths of more than 6 fathoms and a minimum width of about 700 yards. Inside the bay, however, there is good anchorage in depths of 10 or more fathoms. Islands and reefs obstruct most of the entrance to Gubbet Mus Nefit, the southwesterly bay, but there is a clear entrance channel having depths of 5½ to 14 fathoms and a minimum width of 300 yards. This bay is large and deep and affords anchorage area in depths of 6 to 11 fathoms over a sandy bottom. There is a small landing pier and village on the southeastern shore of the bay. No data are available regarding protection from prevailing weather in either Gubbet Entatu or Gubbet Mus Nefit.

Isola Norah—Located about 7 n. miles north of Isola Dahlac Chebir, Isola Norah is the second largest island in the Isole Dahlac and averages about 6 miles long and 5 miles wide (FIGURES 22–19 and 22–20). The island is generally low, irregular, and deeply indented by several bights and bays. The shores are sandy and fringed by coral reefs, but in places there is a border of mangrove. The terrain behind the shores is low, mostly barren, and sandy with scattered coral outcroppings. In places the shore is backed by a zone of sandy beach ridges, in turn backed by extensive marshy areas which would impede cross-country movement. There are scattered habitations and tracks and trails on the island. Approaches to the island are partly obstructed by the coral reefs, shoals, and smaller islets and islands surrounding it; however, several navigable passages thread through these obstructions.

Isola Mahun—Lying 1½ n. miles east of Isola Norah, this island is low, mainly sandy, and about 3 miles in extent. The shores are sandy and completely fringed by coral reefs. A narrow belt of mangrove borders most of the southern side of the island and scattered places along the northern side. The terrain is flat, predominantly sandy, but partly marshy, and covered by patches of grass in many places. There is virtually no habitation except for a small cluster of huts on the western end of the island where there are a few tracks and trails.

Isola Naheleg—Located 1¾ n. miles north-northwest of Isola Mahun, Isola Naheleg is a low, sand-and-coral island about 7 miles in length. The shores are probably sandy and fringed by coral reefs.

Isola Ghabbi Hu—Situated about 3¾ n. miles northeast of Isola Naheleg, this island is about 1 mile wide and 3 miles long. It is a low, sand-and-coral island with a few bushes on it.

Isola Entaentor—Located about 1¾ n. miles north of Isola Ghabbi Hu, this island is narrow and about 2 miles in length. It is low, composed of coral and sand, and is bordered by reefs which extend 1 n. mile off its eastern side.

Isola Harmil—This island lies at the northeastern end of the approach channel through the Isole Dahlac (FIGURE 22–71) and is located about 10 n. miles northwest of Isola Entaentor. Isola Harmil, a coral island, is low, sandy, and irregular in shape, and averages about 3 miles in length and width. Reefs and rocks fringe the southern and eastern sides of the island, and the reef extends as far as 1 n. mile southeastward from the southeastern extremity of the island. There is an almost landlocked bight on the northern side of the island.

Isola Isra-tu—Located 14½ n. miles southwest of Isola Harmil, this island is irregular in shape, being deeply indented by two large mangrove-fringed inlets, and is about 3 miles in extent. The sandy shores are fringed by coral reefs and rocks. The terrain is mostly flat and sandy except off the southwestern side of the island where sandhills back the shore. These hills, ranging up to 100 feet high, are covered with grass and brush and extend across the island in isolated peaks. There are no tracks or trails indicative of habitation.

Isola Difnein—This, the northwesternmost island of the Isole Dahlac and lying about 34 n. miles northwest of Isola Isra-tu, is about 1 mile in extent, and is indented by inlets. Difnein is one of several islands forming the perimeter of the seaward side of the northern part of Canale di Massaua. The other islands include Isola Entesile, Isola Harat, Isola Dul Baut, and Isola Dehel. Isola Difnein, reportedly about 30 feet high, is composed of coral and sand, and is partly covered with mangrove. Its fringing reefs are steep-to and narrow on the northern side, and about 1,000 yards wide on the southeast.

Isola Entesile—Located 6 n. miles south of Isola Difnein, this small coral island is about 20 feet high, covered with dense brush, and bordered by a narrow reef.

Isola Harat—Located about 22 n. miles south of Isola Entesile and 12 n. miles off the mainland, it is the largest island bordering the northern part of the Canale di Massaua. The island, about 7½ miles long and 35 feet high, is relatively flat and is covered by scattered patches of grass and brush. The shores are sandy and fringed by coral reefs and rocks, which are most extensive off the western side of the island. An extensive area of reefs also extends about 8½ n. miles northward from the northern extremity of the island. A small village is located at the southern end of the island with a few tracks and trails in its vicinity.

Isola Dehel—Located about 11½ n. miles southeast of Isola Harat, this island is flat, about 20 feet high, and 2¼ miles in extent. The shores are sandy and fringed by a reef which extends as far as 1,000 yards offshore. Narrow fingers of marsh back the shores along the southern coast. Patches of grass and brush cover much of the island, and near the northwestern side is a village with a grove of palm trees in its vicinity.

Isola Sciumma—Located about 4 n. miles southward of the southwestern extremity of Dahlac Chebir, this island is 50 feet high, 2½ miles long, and is bordered by a reef extending as far as 1,000 yards offshore in places (FIGURE 22–21). The island's shores are sandy and reef fringed and backed by relatively flat terrain mostly covered by grass and brush. Two streams, with partly marshy basins, drain the central part of the island.

Some sources report a minor port within the small harbor on the southwestern side of Isola Sciumma but 1943 photography does not reveal any extant facilities. Except for fringing coral reefs, the approaches to the island within the narrows of Canale di Massaua are clear.

Coastal Segment [3], Ras Dogon to Ras Sciaks (250 coastline miles; USHO Charts 2815, 2822)

General—The coastal area consists of a flat-to-undulating sandy, sparsely vegetated plain averaging from 1 to 10 miles in width (FIGURES 22–22 through 22–24 and 22–71). The plain merges with a rugged mountainous interior except in the central part of the segment where a narrow discontinuous belt of hills and mountains backs the plain and is in turn backed by a large valley. Offshore approaches are generally clear; nearshore approaches are partly obstructed by islands and other obstructions. A potential fleet anchorage is located in Golfo di Zula in an area about 7 by 10 n. miles with depths of 10 to 20 fathoms.

Two minor beach areas, and two landing places are in this coastal segment. The Massaua area with its accessibility to excellent road and rail routes is the best suited for large-scale amphibious operations. In general, the remainder of the coastal area is unfavorable for large-scale amphibious operations, principally because of the lack of roads and the limited areas of flat terrain.

Throughout most of the coastal area, movement is confined to a poor network of tracks and trails because of soft sand, hilly and mountainous areas, and deeply entrenched streambeds which form serious obstacles to extended cross-country movement. Inland, the mountains prevent easy egress from the coastal area, and movement is restricted to valleys and stream corridors which are difficult to negotiate. Class 1 air facilities are located at Asmara and Gura, and a Class 2 facility at Massaua. In addition to these air facilities and one unclassified airfield northwest of minor beach *1*, there are also scattered flat-to-undulating areas on the coastal plains that provide suitable helicopter landing areas.

Shore and coastal terrain — The coast is very irregular and deeply indented by several large bays and numerous inlets and coves. The shores are predominantly sandy (minor beach areas *1* and *2*, and 2 landing places; FIGURE 22–23), and bordered in places by marsh or mangrove. Be-

hind the sandy shores are coastal plains of variable width, in turn backed for the most part by brush- and tree-covered hills and mountains which in places interrupt the plains and extend to the water's edge (FIGURES 22–23 and 22–24). In the central part of the segment, the hills and mountains are much lower in elevation and form a narrow discontinuous barrier which separates the plain from a large inland valley.

In the northwestern half of the segment from Ras Dogon to Mersa Fatma, scattered marshy or sandy areas border the sandy shores. Here, the coastal plains are narrowest and average from 1 to 7 miles in width. At the heads of Baia d'Archico, Golfo di Zula, and Baia di Hauachil, hilly-to-mountainous spurs of the interior highlands extend to or near the water's edge. The coastal plains are broadest in the vicinity of Massaua and on both sides of Golfo di Zula, particularly on the eastern side of the gulf; a large salt lake lies in the center of this plain east of Golfo di Zula.

Throughout the northwestern half of the segment, the plains are low and sandy, although there are some isolated hills and rocky outcrops. The coastal plains are mainly devoid of vegetation but there are patches of grass and brush which are most dense along the banks of the many intermittent streams that cross the plains. The hills and mountains which back and flank the plains are partly covered by brush and trees and deeply cut by steep-sided stream valleys. From the Golfo di Zula westward, the mountainous interior is highest, reaching peak elevations from about 3,000 feet to over 10,000 feet. Southeastward from the head of Golfo di Zula the hills and mountains are lower. Narrow stream valleys and lowland corridors thread through this zone of coastal hills and mountains.

In the southeastern half of the segment from Mersa Fatma southeastward, the sandy shores are interspersed with fringing mangrove which is quite dense in places, particularly in the inlets northeast of Mersa Fatma. The coastal plain is low and sandy and widens considerably between Mersa Fatma and the southeastern end of the segment, averaging about 10 miles in width. The hills and isolated mountain peaks that characterize the northwestern half of the segment are much less evident although in a few places low hills lie close behind the shores. Here too, patches of grass and brush are interspersed over the coastal plain, being most dense along the banks of the numerous intermittent streams. A discontinuous zone of hills and mountains, partly covered by grass, brush, and trees, backs the coastal plains and reaches a peak elevation of over 4,000 feet.

Between Mersa Fatma and Baia d'Anfile, about 30 miles east-southeastward, the hills and mountains are generally much lower in elevation and form a discontinuous barrier between the coastal plain and an extensive inland valley. The barrier, consisting mostly of high hills, is interspersed with elevations of slightly more than 1,000 feet and is traversed by a number of corridors. The corridors give access to the valley which is about 130 miles long and 30 to 40 miles wide. Much of its surface lies below sea level and consists of salt lakes and marshes which are fed by intermittent streams draining from the adjacent highlands. Elsewhere, the valley is mainly sandy or gravelly although there are areas of rocky volcanic outcrops. The valley is mostly barren although there are scattered patches of grass and brush.

Numerous islands front the shores, with the majority concentrated in Baia di Hauachil. The largest island, Isola di Hauachil, has sandy shores, is mostly low and sandy, and has coral outcroppings in its northern half; its southern half is hilly with volcanic peaks over 700 feet high. Isola Monte Baca, the second largest island, also has sandy shores, is predominantly hilly with heights over 400 feet, and is covered with brush and trees. The remainder of the islands in Baia di Hauachil are mostly low, sandy, and barren, and are fringed in places by mangrove. The second largest concentration of islands is located in Baia d'Anfile, to the southeast. Isola Midiri, the largest island in this bay, consists of coral and is barren, but the sandy shores on the southern side of the island are thickly fringed with mangrove. On the remaining islands of this group the shores and terrain are sandy, but are mangrove bordered in many places. The only other island of importance is Isola Dissei, which lies in the entrance to the Golfo di Zula. It has sandy shores backed in places by hills, partly covered by clumps of grass or brush.

Approaches—Offshore approaches are in general clear; the southern part of the Canale di Massaua provides a deepwater channel between the southern islands of the Isole Dahlac and the mainland. Minor obstructions in the channel consist of several small islands and a few widely scattered reefs and shoals. Nearshore approaches are partly obstructed by fringing coral reefs, shoals, rocks, and by numerous islands that encumber the entrances to the several large bays which indent the coast.

In the nearshore approaches, from Ras Dogon southeastward about 40 n. miles to Ras Lamma Tacaito, the principal obstruction is a discontinuous, narrow fringing coral reef surmounted by rocky areas and a few islets. Six-fathom

depths lie from 500 yards to 1,500 yards offshore except near Massaua and the eastern entrance point to Golfo di Zula where it lies up to 2¼ n. miles offshore.

Unlike the northwestern part of the segment, most of the nearshore approaches from Ras Lamma Tacaito to the southern end of the segment are obstructed by a more extensive coral reef combined with numerous rocks, shoals, and islands. In most places the fringing reef does not extend more than 1 n. mile offshore; however, there is a stretch of shore extending about 55 miles southeastward from Mersa Fatma where the reef completely fills several inlets and extends as much as 7 n. miles seaward, probably uncovering in places.

In the outer part of Baia di Hauachil there are numerous obstructions consisting of islands, rocks, and shoals. Rocks, reefs, and shoal patches also lie close inshore throughout most of the bay; however, a channel with depths of 3¾ to 7 fathoms threads in a southwesterly direction between the islands and other obstructions and leads into the inner part of the bay. A smaller group of reef-fringed islands similarly obstructs approaches to Baia d'Anfile near the southeastern end of the segment. Off this stretch of coast 6-fathom depths lie from 1,000 yards to 13 n. miles seaward, lying farthest off the head of Baia di Hauachil.

Ports and urban areas—Massaua, the only principal port in Ethiopia, lies in this segment. The town is also the largest urban area on the coastal plain and has good road and railroad connections. An aerial tramway extends from Massaua to Asmara, about 41 miles southwestward, but it is not presently in use. Although specific data are lacking, there are piers at the minor ports of Archico, 6 miles south of Massaua, at Capo Malcatto on the west-central side of Golfo di Zula, and at Mersa Fatma.

Elsewhere on the plain, population is limited to a few coastal fishing villages. The population and areas of cultivation are centered mostly around Massaua and in the valleys and on the plateaus that lie inland from that port. Asmara is the second most important town in Ethiopia as well as being the communications hub and economic center for Eritrea.

Routes of communication—A hard-surfaced all-weather road leads inland from Massaua to Asmara, where it branches northwestward and southward into the interior regions. A narrow-gage (3′1⅜″) railroad roughly parallels the road from Massaua to Asmara and also follows the road extending northwestward from Asmara to a terminus point about 71 miles farther inland to the northwest. Access to this road and railroad from the shore, especially south of Massaua, is by cross-country movement for short distances to established tracks and trails. There is also a short stretch of surfaced road leading from Archico to Massaua. Formerly a short railroad extended from Mersa Fatma southward across the plain. Elsewhere throughout the segment, the coastal plain is poorly served by scattered tracks and trails. One of these coastal tracks traverses the length of the segment and lies from 100 yards to 10 miles inland; it lies closest to the shore along the Golfo di Zula, Baia di Hauachil, and Baia d'Anfile.

The coastal terrain is unfavorable for extended cross-country movement, the prime obstacles being soft sand, hilly and mountainous areas, and deeply entrenched stream beds. Movement inland through the highlands is restricted to valleys and steep-sided ravines, which at best are difficult to traverse.

Helicopter landing areas—There are several classified air facilities in the segment which can be used for helicopter landings. These include a Class 2 air facility at Massaua, and Class 1 air facilities at Asmara and Gura, about 50 miles southwest of Massaua. There is also an unclassified airfield 9 miles northwest of minor beach area *1* suitable for landings. Elsewhere, flat-to-undulating areas along the coastal plains and the larger islands adjacent to the coast are suitable for landings; however, loose sand may be a problem in places. Exit from the helicopter landing areas on the plains would be primarily by cross-country movement to the coastal tracks and trails. The main inland roads and railroad are readily accessible from the air facilities.

Coastal Segment [4], Ras Sciaks to the French Somaliland border (240 coastline miles; USHO Charts 2816, 2819, and 2821)

General—The coastal area consists of a flat-to-undulating, sandy, sparsely vegetated plain of variable width, interrupted in many places by extensive rocky outcrops and scattered hills and mountains (FIGURES 22–25 through 22–28B, 22–71, and 22–72). Backing the plain are rugged mountains and high mountainous plateaus, which in the northern half of the segment are backed by a large valley. Offshore approaches are in general clear except off several bays; nearshore approaches are partly obstructed by a fringing coral reef, islands, rocks, and shoals. A potential fleet anchorage is located in Baia di Beilul, a large open bay with depths of 7 to 13 fathoms in the anchorage.

Two major beach areas, four minor beach areas, and seven landing places have been selected in this segment. In general, the segment is not favorable for large-scale amphibious operations, principally because of poor approaches, lack of roads, and limited areas of flat terrain. However, the best area for large-scale amphibious operations is in the vicinity of the secondary port of Assab where a series of landing places afford access to the port, the main road network, and a nearby air facility. Aside from the roads emanating from Assab, the coastal area is served only by a poor network of tracks and trails, and conditions for extended cross-country movement are poor. A Class 3 air facility at Maacaca and an unclassified airfield behind minor beach *5* would provide suitable helicopter landing areas as could numerous level areas along the coast.

Shore and coastal terrain—The shores are predominantly sandy (major beach areas (3) and (4), minor beach areas *3* through *6*, and 7 landing places; FIGURES 22–25 through 22–28B), although there are scattered rocky shores and muddy mangrove-bordered stretches. Backing the shores is a stream-dissected plain of variable width, in turn backed by an almost continuous chain of rugged volcanic hills and mountains, which in places interrupt the plain and reach to the water's edge. The coastal plain, which is dotted with isolated peaks, consists mainly of sandy areas, rocky outcrops, and some areas of clay.

In the northwestern part of the segment, from Ras Sciaks 60 miles southeastward to major beach area (4), the shores are mostly sandy, backed by loose sandy areas or sand dunes (major beach areas (3) and (4), minor beach areas *1* and *2;* FIGURES 22–25 and 22–26). Here, the coastal plain is widest and extends inland from about 8 to 24 miles. The plain is broadest in the vicinity of major beach area (4) where it penetrates deeply inland to interrupt the southeast-trending mountains backing most of the plain, and provides an access route to a large inland valley (see Coastal Segment [3]). Numerous intermittent streams cross the coastal plain, and near the shore there are marshy areas which overflow during rainy periods. At the northern end of the segment the plain is mostly barren, and vegetation is confined principally to the banks of streams; however, as the plain extends southward toward major beach area (4), scattered patches of grass and brush cover the plain as well as the streambanks. The mountains behind the plain are over 4,000 feet high. Isolated hills and peaks, predominantly conical in shape, interrupt the plain. These coastal mountains are steep sided and deeply dissected by many streams.

In the central part of the segment, from major beach area (4) about 75 miles southeastward to Baia di Beilul, the shores are mostly sandy (minor beach areas *3* through *6*, and 2 landing places; FIGURE 22–27) and are interrupted by scattered rocky or muddy swamp-bordered stretches. Low plains covered with partly brush-covered dunes back most of the shores, although there are large areas of lava-rock outcroppings and low hills. There are high hills and low mountains as close as 5 miles inland in this area although the plain reaches a maximum width of about 20 miles in the area south of minor beach area *4*. The coastal plain is backed by a plateau which reaches heights of almost 7,000 feet and is dissected by steep-sided stream valleys. At the heads of both Baia Bahar Assoli and Baia di Beilul hilly spurs of the plateau lie close behind the shores.

In the southeastern part of the segment, from Baia di Beilul about 80 miles southeastward to the French Somaliland border, the shores are predominantly sandy (5 landing places; FIGURES 22–28A and 22–28B), although there are muddy mangrove-bordered stretches. A low, undulating coastal plain extends for about 2 to more than 15 miles behind the shores, having its greatest expanse in the area south of Assab. Scattered hills interrupt parts of the plain while hills and a plateau, having a peak elevation over 6,500 feet, back the plain. Brush, grass, and scattered trees cover most of the coastal area but there are many barren sandy areas on the coastal plains and a large area of saltpans south of Assab.

Numerous scattered islands lie close offshore and are prevalent at the entrances to and within the bays. The major concentration of islands is in Baia d'Assab where the two largest islands are located. The largest, Isola Haleb, lies in the outer part of the bay, has sandy shores and is partly covered by brush and trees. Isola Fatmah, the second largest and outermost island of the group, lies in the middle of the bay entrance. The island, with a maximum height of 50 feet at its northeastern end, is also partly covered by brush and trees and has sandy shores. The remaining islands in Baia d'Assab are in general low, sandy, and brush-covered and fringed in places by mangrove.

Approaches—Offshore approaches are generally clear except off Baia Bahar Assoli, Baia di Beilul, and Baia d'Assab, where numerous islands and rocks obstruct the entrances to these bays. Nearshore approaches are partly obstructed by fringing coral reefs, shoals, and rocks.

In the sea approaches to the northwestern part of the segment from Ras Sciaks to major beach area (4), there are relatively few obstructions except for a wreck and several widely scattered

shoals and volcanic islets. Where charted, the 5-fathom curve lies from 1,000 yards to 2 n. miles offshore.

The offshore approaches to the central part from major beach area (4) to Baia di Beilul are obstructed by islands and rocks. The principal nearshore obstruction is a discontinuous fringing coral reef, which is most extensive in the Baia Bahar Assoli area. The nearshore approaches to the inner part of Baia di Beilul are partly obstructed by several shoals and rocks. A partially charted 6-fathom curve extends from about 500 yards offshore in Baia di Beilul to 4¾ n. miles off Baia Bahar Assoli.

The nearshore approaches to the southeastern part of the segment from Baia di Beilul to the French Somaliland border are obstructed by a fairly continuous fringing coral reef. This reef is most extensive at both the northern and central sections of this part of the segment; off the southeastern entrance point to Baia d'Assab it extends up to 4 n. miles offshore and probably uncovers at low water. Off the southeastern part of the segment a 6-fathom curve lies from 500 yards to almost 6 n. miles offshore, lying farthest off the head of Baia d'Assab.

Numerous reef-fringed islands, rocks, and shoals fill Baia d'Assab and obstruct both the inner and outer parts of the bay; however, there are several channels leading through these obstructions. The best channel leading into the southern part of the bay lies on the western side of Baia d'Assab and has depths of from 33 to 57 feet in the fairway. Another main channel, located in the northeastern part of the bay, has least depths of 19 feet but shoal patches, with depths of from 7 to 15 feet over them, render this channel intricate.

Ports and urban areas—Assab is the only port in the segment and the only secondary port in Ethiopia. The port is also the largest urban area on the sparsely populated coastal plain and has good road connections. Elsewhere on the plain, population is limited to a few coastal fishing villages, usually located at or near the large bays. There is little evidence of any cultivation, and a large area of saltpans south of Assab is the only prominent cultural feature on the plain. Villages are the most numerous on the inland plateaus in the southeastern part of the segment.

Routes of communication—A hard-surfaced all-weather road extends inland southwest from Assab, connecting with the main Asmara – Addis Ababa highway. In addition, an unsurfaced road trends northwestward from Assab, and passes behind minor beach area *5* and the landing places north of Assab. Elsewhere throughout the segment, the coastal plain is poorly served by scattered tracks and trails. One of these coastal tracks traverses the length of the segment and lies from 880 yards to 13½ miles inland.

The tracks and trails offer the best means of movement inland because the coastal terrain is unfavorable for extended cross-country movement. The primary obstacles are loose sand and sand dunes, extensive lava areas, hilly and mountainous areas, and deep streambeds. Movement inland across the steep-sided mountains and high plateaus is restricted to valley corridors and wide streambeds which afford the best access routes into the hinterland. Volcanic craters and rocky lava beds would be additional obstacles to movement on the plateaus.

Helicopter landing areas—A Class 3 air facility at Maacaca, 7 miles northwest of Assab, and an unclassified airfield behind minor beach *5* can be used for helicopter landings. Elsewhere, flat-to-undulating areas along the coastal plain and many relatively flat areas on the mountainous inland plateau are also suitable for helicopter landing areas; however, loose sand and sand dunes on the plain may be a problem in places. Exit from the landing areas is primarily by cross-country movement to coastal tracks and trails.

2. Landing beaches

There are four major beach areas, (1) through (4); six minor beach areas, *1* through *6;* and nine landing places in Sector 1. The major beaches are located near Massaua, Ras Nammeita, and Ras Gumudli. One minor beach is located south of Massaua, another on the south shore of Golfo di Zula, and the remainder in the southern part of this sector. The landing places are located on the south shore of Golfo di Zula and in the vicinity of Ras Gumudli and Assab.

The coasts in this sector, in general, are unsuitable for amphibious landings because of fringing reefs, rocks, steep cliffs, and mountainous terrain. Although no areas along these coasts are considered ideal for amphibious landings, a few beaches and landing places have been selected in areas where approaches, beach characteristics, and exits to the inland terrain most nearly meet the requirements for amphibious landings.

Major beach area (2) is considered the best suited for an amphibious landing. In general it has favorable approaches and physical characteristics. Exits are by cross-country movement to a coastal track.

Lengths of the major beaches in this sector range from 1½ to 3¼ miles. Widths at low water levels range from 40 to 150 yards and at high water levels from 10 to 35 yards. The beach gradients in the low water to high water zone range from *gentle* to

mild; gradients in the high water zone are *steep.* The beaches are of sand which is *firm* in the wetted area and *soft* where dry.

The offshore approaches to two beaches are clear; to the remaining beaches the offshore approaches are restricted to Canale di Massaua and channels between islands, reefs, rocks, and shoals. Nearshore approaches to most of the beaches are partly obstructed by bars or seaweed. The nearshore bottom material is sand; however, off one beach the sand is probably mixed with mud. Nearshore bottom slopes range from *moderate* to *flat.*

Spring tides of 3 feet occur in the northern half of the sector, and diurnal tides of 2½ feet occur in the southern half. The expected average occurrence of surf 4 feet or greater on the beaches ranges from infrequent to 12% of the time during October through April; it is infrequent in all other months.

Backing the beaches are sandy plains which are drained by wadies and covered with scattered brush and grass and which extend inland to partly brush- and tree-covered hills rising to mountains. Villages are in the vicinity of nearly all the beaches. Exit from the beaches is by cross-country movement to coastal tracks. A single-track narrow-gage railroad, a principal port (Massaua), a Class 2 airfield, and an unclassified airfield are in the vicinity of the two northern beaches.

Lengths of the minor beaches range from 450 to 1,700 yards; however, one-half are 1,000 yards or less in length. The beaches are concave or straight and are composed of sand. Widths at

FIGURE 22–6. MAJOR BEACH AREAS
(*Map reference:*

BEACH NUMBER AND LOCATION	LENGTH AND USABLE LENGTH	WIDTHS: AT L.W.; AT H.W.	BEACH GRADIENTS: L.W. TO H.W.; H.W. ZONE	APPROACH
(1) Centered 3¾ mi. S. of Ras Arb, coast of Ethiopia (Eritrea), between 15°46′N., 39°27′E. and 15°44′N., 39°27′E. (FIG. 22–18A) (Reliability: FAIR)	3¼ mi.; concave; terminated to N. where backed by marsh and to S. by wadi mouth; all usable.	80 to 100 yd. at L.W.; 15 to 30 yd. at H.W.	1 on 65 to 1 on 70, L.W. to H.W.; 1 on 10 or steeper in H.W. zone.	Nearshore bottom slopes *mild* to *flat* shoreward of 18-ft. depth contour 600 to 1,000 yd. off H.W. line; discontinuous 36-ft. depth contour 1,000 yd. to 1¾ n. mi. off H.W. line; offshore approach restricted to Canale di Massaua and to channels between numerous islands, reefs, rocks, and submerged shoals; nearshore approach partly obstructed by submerged bar with least depth of 4½ ft., 700 yd. off center part and flanked to N. by point fronted by seaweed and to S. by drying bars; bottom sand and prob. mud.
(2) Centered 9 mi. S. of Ras Arb, at 15°41′N., 39°28′E. (Reliability: FAIR)	1½ mi.; concave; terminated to NW. by wadi mouth and to SE. by fringing reef; interrupted by wadies; all usable.	100 to 150 yd. at L.W.; 20 to 35 yd. at H.W.	1 on 80 to 1 on 115, L.W. to H.W.; 1 on 10 or steeper in H.W. zone.	Nearshore bottom slopes *mild* to *flat* shoreward of 18-ft. depth contour 685 to 880 yd. off H.W. line; offshore approach restricted to Canale di Massaua and to channels between numerous islands, reefs, rocks, and submerged shoals; nearshore approach clear but flanked to SE. by fringing reef; bottom sand.
(3) Centered 7¼ mi. NW. of Ras Nammeita, at 14°24′N.; 41°20′E. (Reliability: FAIR)	1¾ mi; concave; terminated by low sandy points; all usable.	40 to 100 yd. at L.W.; 10 to 20 yd. at H.W.	1 on 35 to 1 on 95, L.W. to H.W.; 1 on 10 or steeper to H.W. zone.	Nearshore bottom slopes *gentle* to *flat* shoreward of 18-ft. depth contour 400 to 1,180 yd. off H.W. line; offshore approach clear; nearshore approach partly obstructed by sandbars near L.W. line; bottom sand.

NOTE Beach lengths and distances along the coast and inland are expressed in statute miles; distances across water are expressed in nautical miles except when referring to beach locations. Italicized words refer to terms defined in Subsection A, 4, d.

low water levels range from 20 to 110 yards and at high water levels from 5 to 20 yards. The nearshore bottom slopes range from *moderate* to *mild*.

The offshore approaches to most of the minor beaches are restricted to channels, bays, or a gulf, two of which are partly obstructed by shoals. Nearshore approaches to most of the minor beaches are clear but flanked by rocks, reefs, islands, or points. The nearshore bottom material off the beaches is mostly sand. Fleet and local anchorages are in the vicinity of half of the beaches.

In general, the beaches are backed by sandy, partly brush- and grass-covered plains extending inland to partly brush- and tree-covered hills rising to mountains. Villages are near half of the beaches. Exit from most of the beaches is by cross-country movement to coastal tracks. A surfaced road, a principal port (Massaua), and a singletrack narrow-gage railroad are in the vicinity of minor beach *1*. An unsurfaced road is located behind minor beach *5*. A Class 2 airfield and/or an unclassified airfield are in the vicinity of half of the minor beaches.

Approaches, terrain, and exits from the landing places are similar to those given for the major and minor beaches in the sector. Villages or buildings are at or near some of the landing places. The five landing places at Assab provide one of the best areas in the sector for amphibious landings.

Tabular descriptions for the major beaches are given in FIGURE 22–6 and for the minor beaches in FIGURE 22–7. Locations of the major and minor beaches and landing places are shown on the location maps, FIGURES 22–71 and 22–72.

OF COASTAL SECTOR 1
FIGURES 22–11 *and* 22–72)

SURF AND TIDAL RANGE	MATERIAL AND FIRMNESS	TERRAIN IMMEDIATELY BEHIND BEACH	EXITS AND COMMUNICATIONS INLAND
Surf 4 ft. or greater can be expected to occur 4% of the time Oct.–Apr. and infrequently in all other months; tidal range 3 ft., springs.	Sand; *firm* in wetted area, *soft* where dry.	Backed by sandy plain drained by wadies, containing marsh areas behind N. part, and extending inland to partly brush- and tree-covered hills rising to mts. 12 to 15 mi. behind beach; isolated sandhills on plain; village close SW. of S. end; Massaua 7 mi. S. of S. end.	Exit cross-country as far as 3½ mi. to coastal track; surfaced road and single-track narrow-gage RR. lead inland from Massaua; Class 2 airfield 7½ mi. to S.; unclassified airfield 6 mi. to S.; principal port at Massaua.
Surf 4 ft. or greater infrequent in all months; tidal range 3 ft., springs.	Sand; *firm* in wetted area; *soft* where dry.	Backed by sandy plain drained by wadies and extending inland to partly brush- and tree-covered hills rising to mts. 13 to 19 mi. behind beach; isolated sandhills on plain; Massaua 3¼ mi. S. of SE. end.	Exit cross-country as far as 3 mi. to coastal track; surfaced road and single-track narrow-gage RR. lead inland from Massaua; Class 2 airfield 4 mi. SW. of SE. end; unclassified airfield 2¼ mi. S. of SE. end; principal port at Massaua.
Surf 4 ft. or greater can be expected to occur 12% of the time Oct.–Apr. and infrequently in all other months; tidal range 2½ ft., diurnal.	Sand; *firm* in wetted area, *soft* where dry.	Backed by sandy, partly brush-covered plain extending as far as 12½ mi. inland to hills rising to mts. 20 mi. behind beach.	Exit cross-country 1,000 yd. to coastal track.

FIGURE 22–6. MAJOR BEACH

BEACH NUMBER AND LOCATION	LENGTH AND USABLE LENGTH	WIDTHS: AT L.W.; AT H.W.	BEACH GRADIENTS: L.W. TO H.W.; H.W. ZONE	APPROACH
(4) Ras Gumudli, W., at 13°56′N., 41°41′E. (FIG. 22–26) (Reliability: FAIR)	1½ mi.; concave; terminated to N. by fringing reef and to S. by rocky headland; all usable.	40 to 60 yd. at L.W.; 10 to 15 yd. at H.W.	1 on 35 to 1 on 55, L.W. to H.W.; 1 on 10 or steeper in H.W. zone.	Nearshore bottom slopes *moderate* to *mild* shoreward of 6-ft. depth contour 75 to 350 yd. off H.W. line; 18-ft. depth contour 1,100 to 1,600 yd. off H.W. line; offshore approach clear; nearshore approach restricted to bay and partly obstructed by seaweed off N. part and flanked to N. by rocks and to S. by rocky headland; bottom sand; anchorage in 27-ft. depth 1 n. mi. off beach, bottom prob. sand.

NOTE Beach lengths and distances along the coast and inland are expressed in statute miles; distances across water are expressed in nautical miles except when referring to beach locations. Italicized words refer to terms defined in Subsection A, 4, d.

FIGURE 22–7. MINOR BEACH AREAS OF COASTAL SECTOR 1
(*Map reference*: FIGURES 22–71 *and* 22–72)

NUMBER AND LOCATION	REMARKS
1. Centered 7½ mi. S. of Massaua, coast of Ethiopia (Eritrea), at 15°31′N., 39°29′E. (FIG. 22–23) (Reliability: FAIR)	1,700 yd.; concave; sand; 70 to 110 yd. wide at L.W. and 15 yd. at H.W.; nearshore bottom slopes *mild;* offshore approach restricted to channels between numerous islands, reefs, rocks, and submerged shoals; nearshore approach restricted to bay and clear but flanked to E. by rocks; bottom mud; anchorage in 39-ft. depth in N. part of bay, bottom prob. sand and mud; beach backed by sandy, partly brush-covered plain drained by wadies and extending 2 mi. inland to partly brush- and tree-covered hills rising to mts. as far as 10 mi. behind beach; village 3 mi. to NW.; Massaua 7½ mi. to N.; exit cross-country 100 to 150 yd. to coastal track leading NW. to surfaced road leading to Massaua; single-track narrow-gage RR. and another surfaced road lead inland from Massaua; Class 2 airfield 8½ mi. to NW.; unclassified airfield 9 mi. to NW.; principal port at Massaua.
2. Centered 10½ mi. S. of Capo Malcatto, at 15°05′N., 39°45′E. (Reliability: FAIR)	1,000 yd.; straight; sand; 40 to 50 yd. wide at L.W. and 10 to 15 yd. at H.W.; nearshore bottom slopes *gentle;* offshore approach restricted to Golfo di Zula and clear; nearshore approach partly obstructed by reef about 200 yd. off H.W. line and flanked to E. by reef and submerged shoal and to W. by rocks and reef; bottom sand; fleet anchorage with least depths of 60 to 120 ft. in Golfo di Zula, bottom mud; beach backed by sandy plain drained by wadies and extending 1½ mi. inland to partly brush- and tree-covered hills rising to mts. 2 mi. behind beach; village close behind E. part; exit cross-country 900 to 1,000 yd. to coastal track; another track leads S. from village.
3. Centered 3¼ mi. NW. of Ras Sceraier, at 13°49′N., 41°58′E. (FIG. 22–27) (Reliability: FAIR)	900 yd.; straight; sand; 20 to 30 yd. wide at L.W. and 5 to 10 yd. at H.W.; nearshore bottom slopes *gentle;* offshore approach clear; nearshore approach clear but flanked to NW. by rocky point and to SE. by fringing reef; bottom sand; beach backed by low scarp; in turn backed by partly brush-covered sand dunes extending as far as 600 yd. inland to sandy, partly brush- and tree-covered plain; all in turn backed by brush- and tree-covered hills rising to mts.; exit cross-country as far as 2 mi. to coastal track.
4. Centered 1 mi. W. of Ras Sceraier, at 13°46′N., 42°01′E. (FIG. 22–27) (Reliability: FAIR)	450 yd.; straight; sand; 30 to 45 yd. wide at L.W. and 10 to 15 yd. at H.W.; nearshore bottom slopes *mild;* offshore approach clear; nearshore approach clear but flanked to E. by rocky headland and to W. by fringing reef; bottom sand; beach backed by low scarp; in turn backed by narrow area of sand dunes; in turn backed by sandy, partly brush- and tree-covered plain extending inland to brush- and tree-covered hills rising to mts.; exit cross-country 1½ mi. to coastal track.
5. Centered 11½ mi. W. of Ras Darma at 13°12′N., 42°23′E. (Reliability: POOR)	1,500 yd.; slightly concave; sand; 75 to 90 yd. wide at L.W. and 15 to 20 yd. at H.W.; nearshore bottom slopes *mild;* offshore approach restricted to Baia di Beilul and partly obstructed by submerged shoals; nearshore approach clear; bottom sand and rocks; fleet anchorage in 42- to 78-ft. depths in Baia di Beilul, bottom prob. sand and rocks; beach backed by sandy plain extending 1 mi. inland to wooded hills rising to mts.; village close behind beach; exit cross-country 1 mi. to unsurfaced road; track leads inland from village; unclassified airfield at village.
6. Centered 2¾ mi. SW. of Ras Darma, at 13°12′N., 42°31′E. (Reliability: POOR)	1,500 yd.; concave; sand; 70 to 90 yd. wide at L.W. and 15 to 20 yd. at H.W.; nearshore bottom slopes *moderate* to *mild;* offshore approach restricted to Baia di Beilul and partly obstructed by submerged shoals; nearshore approach clear but flanked to W. by island; bottom sand; fleet anchorage in 42- to 78-ft. depths in Baia di Beilul and another anchorage in 48-ft. depths 1 n. mi. off NE. end, bottoms prob. sand and rocks; beach backed by sandy plain extending 600 yd. inland to wooded hills rising to mts.; exit cross-country 1 mi. to coastal track; unsurfaced road 5 mi. inland; unclassified airfield 9 mi. W. of beach.

AREAS, SECTOR 1 (*Continued*)

SURF AND TIDAL RANGE	MATERIAL AND FIRMNESS	TERRAIN IMMEDIATELY BEHIND BEACH	EXITS AND COMMUNICATIONS INLAND
Surf 4 ft. or greater can be expected to occur 4% of the time Oct.–Apr. and infrequently in all other months; tidal range 2½ ft., diurnal.	Sand; *firm* in wetted area, *soft* where dry.	Backed by sandy plain drained by wadies, containing scattered rock outcrops, and extending about 5 mi. inland to partly brush-covered hills rising to mts.; extensive lava area to S.; village close behind S. end.	Exit cross-country 800 to 1,000 yd. to coastal track; other tracks lead inland from village.

D. Sector 2: French Somaliland

(12°42′N., 43°08′E., to 11°28′N., 43°16′E.)
(FIGURE 22–72; USHO Charts 2819 and 3635)

Sector 2 is about 195 coastline miles long and borders on Bab el Mandeb (Strait of Mandeb), the Golfe de Tadjoura, and the Gulf of Aden. The shores of the northern part of the sector are predominantly sandy; the southern part consists of sandy or muddy stretches of shore interrupted by cliffs and numerous intermittent streams.

Along the Bab el Mandeb and Gulf of Aden coasts, the shores are primarily backed by flat-to-gently sloping, sandy coastal plains which extend as much as 30 miles inland and are covered with scattered clumps of grass and brush. Rugged hills and a dissected plateau with isolated mountain peaks back the coastal plains.

Narrow pocket plains are scattered along the coast of the Golfe de Tadjoura, in turn backed and flanked by rugged, partly wooded hills and a mountainous, stream-dissected plateau. In many places, these highlands terminate in cliffs at the water's edge.

Two minor beach areas and seven landing places have been selected; there are no major beach areas in the sector. The minor beaches are approximately 750 yards long and the landing places range up to almost 400 yards in length. The Djibouti area is considered the best suited for large-scale amphibious operations because it possesses principal port facilities, road and rail clearances, a nearby Class 1 air facility, and large proximate areas of flat-to-undulating terrain. The remainder of the sector is generally unsuitable for large-scale amphibious operations because of poor nearshore approaches, lack of roads, or limited areas of flat terrain.

Offshore approaches to the sector are relatively unobstructed while nearshore approaches are principally obstructed by a fringing reef extending throughout most of the sector. There are no fleet anchorages.

Sector 2 has only one principal and two minor ports. The principal port is at Djibouti, which is also the only significant urban area. Tadjoura and Obock, the minor ports, have little urban significance except that they are permanent settlements. Most of French Somaliland is inhabited by a nomadic population, and there are only a very few widely scattered villages on the coastal plain. The largest population density is centered at Djibouti. A Class 1 air facility and Class 7 seaplane station are located here also.

On the whole, land transportation routes are very poor and consist essentially of scattered tracks and trails. There is only one main hard-surfaced road in the sector which extends about 22 miles inland west-southwest from Djibouti and then continues as a track to the Ethiopian border (Coastal Segment [2]). In addition to this road, there is one principal coastal track which traverses the length of Coastal Segment [1] from 700 yards to 4 miles inland and serves the coastal plain in the northern part of the sector. Another coastal track serves the southern coastal plain and lies 500 yards to 1 mile inland between Djibouti and the Somali Republic. There is only one railroad in the sector, a single-track meter-gage (3′3⅜″) line which runs southwest from Djibouti to Addis Ababa. Cross-country movement over the coastal plain is relatively unimpeded although clayey sands would make such movement difficult during rainy periods. Movement inland in the plateau regions backing the plains is for the most part extremely difficult because of the rugged terrain.

A Class 1 air facility at Djibouti is suitable for helicopter landings. With the exception of the mountain regions, additional landing sites are readily available on the coastal plain and inland plateaus; however, loose sand and dust storms may be obstacles at times.

Sector 2 has a hot, dry monsoonal type of climate. While the area is hot the year round, the period of May through September is usually the hottest, with mean maximum temperatures of 95° F. to 105° F. at Djibouti. Whereas land and sea breezes may predominate at times, the general wind patterns are monsoonal in nature. The winds are primarily from the eastern quadrant during the period October through April; winds from the southwestern quadrant prevail during June through August. Winds are variable in direction during the transitional months of May and September. Along the coastal lowlands the mean annual rainfall is much less than 10 inches; the rainfall probably does not exceed 20 inches in the highlands. In terms of ground operations, the most important weather phenomena are sporadic sandstorms and the flash flooding of the streams following periods of rain.

1. Coast

Coastal Segment [1], Ethiopia – French Somaliland border to Cap Obock (65 coastline miles; USHO Charts 2819 and 3635)

General—A low coastal plain extends throughout the segment and is backed by a mountainous region with spurs which interrupt the plain in several places (FIGURES 22–29, 22–30, and 22–72). The shores are predominantly sandy and broken only by seasonal streams and several inlets and coves. The plain is variable in width, virtually desert, and covered with sparse vegetation. The mountain region has many intervening valleys and gullies; near the coast, the streams flowing in the valleys and gullies are shallow and subject to extensive flooding during the rains. Offshore approaches are generally clear while nearshore approaches are principally obstructed by a fringing reef extending throughout most of the segment. Anchorage is available off Île Doumeïra, Ras Siyan, and in a small bay east of Cap Obock.

In general, the coastal area is not favorable for amphibious operations because of the lack of landing beach areas; however, the three landing places selected can probably accommodate small amphibious landings. Cross-country movement over the plain is in general good except during rainy periods; movement through the mountain region would be difficult or impossible due to steep-sided slopes and deep gorges. A sparse network of widely scattered tracks and trails serves the coastal zone, and there are no air facilities.

Shore and coastal terrain—A low sandy plain extends throughout the coastal zone, in turn backed by a mountainous region which also interrupts the plain in several places. The shores are predominantly sandy (three landing places) and are backed by a desert plain, variable in width, and sparsely covered with vegetation consisting of grass and brush which grow mainly along the seasonal streams. The mountain region consists mainly of lava beds which have been faulted and uplifted into mountain ranges and plateaus; valleys and gullies dissect the mountain region.

Ras Doumeïra is a clifflike projection rising over 150 feet above the surrounding plain at the northern extremity of the segment. Île Doumeïra, a cliffy island whose highest summit is 262 feet, lies about 700 yards eastward of Ras Doumeïra (FIGURE 22–29). The northern part of the plain extends 24 miles from Ras Doumeïra southeastward to Ras Siyan, a promontory connected with the mainland by a low, sandy narrow neck of land (FIGURE 22–30). The northern side of this promontory is rocky and precipitous and rises to a reddish volcanolike peak almost 500 feet high. Situated from 2½ to 7½ n. miles off Ras Siyan on an east – west axis are a group of six rocky islets known as Djeziret Seba. On the largest and northernmost of the islets is a conspicuous peak 370 feet high. Between Ras Doumeïra and Ras Siyan the shores of the plain are sandy and unbroken except for several intermittent streams. The shores are backed by small dunes up to 16 feet in height and are composed of a clayey sand which also forms the main surface of the plain. The plain reaches a maximum width of 15 miles before elevations of 600 feet or more are reached. However, the plain narrows down to about a 3-mile minimum west of Ras Siyan where outliers of the inland mountain range all but cut off the northern part of the plain from the central part.

The central part of the plain lies between Ras Siyan and Godoria, about 18 miles to the southeast, and is almost hemmed in at its north and south boundaries by mountain spurs. Unlike the northern part of the plain which is sandy and almost uninterrupted, the central part is interrupted throughout by outliers consisting of several large isolated tabular massifs with clifflike slopes rising to a maximum height of over 900 feet. The shores of the central plain are sandy but more irregular than in the north. There are two mangrove-bordered inlets, 4 and 8 miles south-southeast of Ras Siyan. These inlets are separated from the sea by sandy barrier bars and during the rainy season are subject to extensive flooding by the streams emptying into them. There are also several indentations for a distance of about 6 miles northwest of Godoria, and the shore is backed by flat-topped uplands and peaks rising to about 750 feet close to the shore. The central plain has a maximum width of about 12 miles but narrows again along its southern end where there are mountain peaks 8 miles west of Godoria.

Southward from Godoria to Cap Obock the coastal plain is unbroken and again widens to a maximum width of about 18 miles. About 3 miles south of Godoria a mangrove-filled inlet interrupts the otherwise regular shore. This inlet, like those on the central part of the coast, is subject to flash flooding by the normally dry streams feeding into it. For about 10 miles south of Godoria the coast remains low and sandy and then for a distance of 5 miles the land begins to rise and reaches its highest point at Ras Bir, a cliffy promontory about 100 feet high which also marks the northern entrance point to the Golfe de Tadjoura. The cliffed coast extends westward about 5 miles, almost to Cap Obock. A small bay just east of Cap Obock is bordered by the escarpment, which along the northern side of the bay reaches a maximum height of about 80 feet. On the western side of the bay, the escarpment is interrupted by a large seasonal river, which is confined to a gorgelike valley. Behind the escarpments, the coastal area is a flat plateau interrupted in places by seasonal streams.

Approaches—The approaches to the segment are generally deep but in the strait of Bab el Mandeb they are confined to a channel that is about 10 n. miles wide between the French Somaliland mainland and Perim Island, located off the southwesternmost point of the Arabian Peninsula.

Deep water lies relatively close to the shores of the coastal segment. An irregular 20-fathom curve lies 3 n. miles off the northern end, widens to 6 n. miles off the center part, and narrows to 2 n. miles near the southern end. Off Ras Bir, near the southern end of the segment, the increase in depth brings the 100-fathom curve to within 1 n. mile of the shore. The 5-fathom curve is situated about 500 yards off Cap Obock, but it is generally uncharted along the remainder of the segment.

The offshore approaches are generally clear except off Ras Doumeïra, Ras Siyan, and in the small bay at Cap Obock. About 700 yards east of Ras Doumeïra is Île Doumeïra, a small rocky islet surrounded by shoals, reefs, and above and below water rocks. From 2½ to 7½ n. miles east of Ras Siyan is Djeziret Seba, a group of six abrupt rocky islets. There are rocks around the islets and depths in the vicinity are irregular. Off Ras Siyan there are additional shoals and obstructions which include a dangerous wreck about 1¾ n. miles north of the point. In the small bay east of Cap Obock shoals and drying reefs lie across the entrance, limiting passage into the bay to two channels. The channel at the western entrance is the only one which is suitable for use.

The nearshore approaches to the segment are obstructed almost everywhere by a fringing reef that extends as far as 1 n. mile from the shore. Rocks are charted along the shore that extends about 8 miles north from Ras Bir, and it is possible that rocks exist off other parts of the coast as well. The reef in the bay east of Cap Obock uncovers up to 1 foot. A lack of soundings elsewhere precludes an estimate of water depths near the shores, but it is probable the seaward edge of the reefs uncovers at low water.

Ports and urban areas—There is a minor port at Obock, at the southern end of the segment, and urban areas are confined to a few small permanent settlements of which Obock is probably the largest. The inhabitants in the area are nomadic and their presence on the plain depends on the availability of water and pasture which varies from year to year.

Routes of communications—The main transportation route on the plain is a coastal track that lies between 700 yards and 4 miles from the shore and traverses the length of the segment. Another track extends northward from Obock through the mountains, and from it a branching route connects with the coastal track about 8 miles south of Ras Siyan. There are no railroads. Except for detached hills, which can be bypassed, cross-country movement on the plain is unimpeded; however, during the rainy periods, movement is severely restricted by the sandy clay soil, which becomes slippery, and by the flash flooding of the intermittent streams. Movement of vehicles in the mountainous hinterland is generally impossible because of the steep slopes and the many deep gorges. Movement of foot troops in the mountains is limited essentially to the intervening valleys and streambeds, except during the periods when flooding occurs.

Helicopter landings—There are no classified air facilities, but many areas on the plains are suitable for helicopter landings. Because of irregular surfaces, there are no helicopter landing areas in the mountains.

Coastal Segment [2], Cap Obock to French Somaliland – Somali Republic border (130 coastline miles; USHO Chart 3635)

General—The coastal zone consists mostly of a coastal plain which is discontinuous throughout most of the segment except in the southeastern part along the Gulf of Aden where it widens considerably and extends into the Somali Republic (FIGURES 22–31 through 22–33 and 22–72). A high plateau and mountain region back or interrupt the plain, and in many places the uplands rise from the sea or from immediately behind the shores. Offshore approaches are in general clear,

whereas nearshore approaches are obstructed throughout by a fringing reef. There are numerous anchorages scattered throughout the segment, the majority of which are only suitable for small craft.

Although two minor beach areas and four landing places have been selected in the segment, the coastal area is not generally suitable for amphibious operations due principally to limited areas of flat terrain, inadequate transportation routes, and poor nearshore approaches. Landing conditions are probably best on a minor beach at Djibouti, a principal port from which there is good road and railroad clearance.

Cross-country movement over the limited stretches of flat terrain and the broad southeastern coastal plain is mostly unimpeded; movement through the severely dissected, hilly and mountainous regions is poor. The transportation network, which is poor during the dry season, is impassable during rainy periods. A Class 1 air facility and a Class 7 seaplane station are located at Djibouti.

Shore and coastal terrain—The shores are sandy (minor beach areas *7* and *8,* and 4 landing places; FIGURES 22–31 through 22–33) or muddy, interrupted by cliffs and intermittent streams. Backing the shores for the most part are narrow pocket plains, in turn backed and flanked by rugged hills and a mountainous plateau, which in places reach to the water's edge. Southeast of Djibouti, however, the mountains are fronted by a broad plain.

On the northern side of the Golfe de Tadjoura, from Cap Obock 55 miles southwest to the entrance of Ghubbet Kharab, an almost completely landlocked bay at the head of the gulf, there are sandy or muddy stretches of shore interspersed by cliffs and escarpments. The sandy stretches front on small pockets of low terrain located at the mouths of streams flowing from the mountains. Escarpments closely back the narrow plains and extend west-southwestward from Cap Obock along the coast for a distance of about 30 miles to the vicinity of Ras Ali. Behind these escarpments the terrain rises in a series of plateaus with heights of 1,500 to 2,200 feet located 3 to 5 miles inland, respectively. Farther inland, mountains rise from the plateau and reach heights of over 4,000 feet.

West of Ras Ali the sandy shores (three landing places; FIGURE 22–31) are backed by a low, brush-covered coastal plain which extends about 20 miles to the southwest. This plain is partly wooded and has a maximum width of 3 miles at a small village about 9 miles west of Ras Ali. Backing the plain is a high tableland capped by mountains with heights up to 5,600 feet. These highlands are deeply incised by intermittent streams into narrow, twisting valleys with many tributary ravines and gullies. The western flanks of the highlands are particularly rugged and broken and extremely arid with little vegetation apart from brush. The lower east-facing slopes are well wooded although the trees are widely spaced, while on the higher slopes the vegetation becomes quite dense, and there is a fair amount of undergrowth. Near the entrance to Ghubbet Kharab the sandy shores are closely backed by barren cliffs.

Ghubbet Kharab has a circumference of about 33 miles with a narrow entrance divided by a small island. The bay is irregular in shape, having several indentations with sandy stretches of shore, and is almost surrounded by steep cliffs at or close to the water's edge.

From Ghubbet Kharab for about 30 miles eastward to Djibouti, sandy shores, mostly formed by the outwashes of intermittent streams, alternate with cliffy sections of coast. These cliffs, which form most of the coast, are very steep and rocky and rise either from sandy shores or from the water's edge to as much as 500 feet high. At Pointe des Boutres, just east of the southern entrance point of Ghubbet Kharab, there is a small bight with a sand-and-gravel beach (minor beach area *7;* FIGURE 22–32) fringing a small, partly sandy and partly brush-covered valley. Backing the valley are brush-covered steep-sided hills and high sheer cliffs rising to a broken plateau over 1,000 feet high.

The dissected high plateau and mountains which back the coast gradually descend to high hills toward the east. At Ras Eiro, a narrow, high rocky point 10 miles east of Ghubbet Kharab, the mountains reach their maximum height of almost 2,500 feet 5 miles inland. Nine miles farther eastward, however, hills about 750 feet high lie 3 miles inland. East of this point, the escarpment backing the shores recedes inland and peters out in the low terrain which forms the northern extension of a large coastal plain lying southeast of Djibouti. Along the northern extension of the plain the shores are muddy and partly covered with mangrove; the most extensive belt of mangrove fringes the deltalike outwash of a large seasonal river 1½ miles west of Djibouti. Inland of the plain, higher terrain is formed by a series of terraces. Behind the mountain region backing the southern coast of the Golfe de Tadjoura are scattered interior sandy plains surrounded by higher plateaus and mountains.

On the eastern side of the hook-shaped peninsula on which Djibouti is located, there are sandy shores (minor beach area *8;* FIGURE 22–33), backed

by a densely populated, flat sandy isthmus. West and southeast of Djibouti large saltpans are the most prominent cultural feature of the low terrain. From Djibouti about 12 miles southeast to Loyada, at the southern end of the segment, the shores are mostly sandy, but in places become muddy and covered with mangrove. Behind the shores the coastal plain, about 4 miles wide at Djibouti, broadens to a maximum width of 30 miles at Loyada. This small village is situated near the center of a sandy bight (one landing place). The plain, which extends into the Somali Republic (Subsector 3–A), is generally undulating but has many isolated hills and level stretches. Wide expanses of sandy and stony desert are incised by numerous intermittent streams. The plain is backed by a high plateau with isolated peaks reaching heights of over 4,000 feet.

The largest islands in the Golfe de Tadjoura are the îles Moucha, centered about 9 n. miles northeast of Djibouti, at the entrance to the gulf. This group of coral islands and islets, lie on a reef and attain a height of about 40 feet. île Ouaramos is a small escarpment-encircled islet lying on the coastal reef 3 n. miles southeast of Djibouti.

Approaches—The coastal segment borders principally on the Golfe de Tadjoura with a small portion in the southeastern part fronting the Gulf of Aden. Deep water lies relatively close offshore except for the part southeast of Djibouti where the 10-fathom curve lies up to 4 n. miles offshore and an irregularly charted 5-fathom curve lies as far as 2 n. miles offshore.

A group of coral islands, îles Moucha, lie in the offshore approaches to the Golfe de Tadjoura and also obstruct the approaches to Djibouti. These islands are completely surrounded by rocks, reefs, and a large shoal area with least depths of ¼ to 2½ fathoms extending from 1 to 2 n. miles offshore. Additional shoals and reefs between îles Moucha and Djibouti further obstruct the approaches to the latter. One passage to the port passes northward of îles Moucha and is over 7 n. miles wide and clear of dangers while the other passage lies southward of these islands and is at least 3½ n. miles wide in its narrowest part. Approaches to the inner parts of the gulf are in general clear.

Offshore approaches to the most southern part of the segment, between Djibouti and Loyada, are encumbered by several drying reefs located from 2 to 4 n. miles offshore. Approaches from the southeast are also obstructed by islands, reefs, and shoals.

Approaches to Ghubbet Kharab are obstructed by a rocky islet, which divides the entrance into two passages. Only the northern passage is navigable. Once inside the bay, the approaches are generally clear.

In the nearshore approaches the principal obstruction is a discontinuous fringing reef. This reef, with as little as ¼ fathom over it in many places, is narrow throughout most of the segment; however, southeast of Djibouti, it extends as far as 1¾ n. miles off the coast and continues with few interruptions beyond the southern end of the segment. Elsewhere, including the bay of Ghubbet Kharab, numerous rocks and shoals lie in the nearshore approaches. In the Djibouti area there are extensive mudflats and reefs with foul, rocky ground which uncover up to 5 feet and extend from ½ to 1½ n. miles offshore.

Ports and urban areas—Djibouti, the capital of French Somaliland, is the only principal port, and Tadjoura the only minor port in the segment. Djibouti is strategically situated on an important shipping lane and handles the greater part of Ethiopia's maritime commerce, a very important factor in the port's activity. The port has good road and railroad clearances. Djibouti is also the only important urban area in French Somaliland.

The minor port of Tadjoura has local importance as a trading and communications center, and as a provincial capital, is one of the few permanent settlements on the northern side of the Golfe de Tadjoura in an otherwise nomadic area.

Routes of communication—The only main hard-surfaced road in French Somaliland leads inland west-southwest for about 22 miles from Djibouti; thereafter it becomes a loose-surfaced track extending to the Ethiopian border. This track is passable only to vehicles with special equipment due to deep sand and is impassable when wet. An earthen track also extends along the coast southeast from Djibouti, from 500 yards to 1 mile inland, across a tidal mudflat to Loyada and continues to the minor port of Zeila in the Somali Republic; however, the track is impassable at high tides and during heavy rains. Elsewhere, the segment is poorly served by a sparse network of tracks and trails. The only railroad in the segment, as well as within the sector, is a single-track meter-gage railroad which links Djibouti with Addis Ababa, Ethiopia's capital and principal city.

Cross-country movement throughout much of the segment is severely limited by the hills and mountains backing most of the shores. Exits from the shores and through the mountains, particularly on the northern side of the Golfe de Tadjoura, are restricted to scattered tracks and trails. Movement on the coastal plain south of Djibouti and the flat portions of the inland pla-

FIGURE 22–8. MINOR BEACH AREAS OF COASTAL SECTOR 2
(*Map reference:* FIGURE 22–67)

NUMBER AND LOCATION	REMARKS
7. Centered 1 mi. SE. of Pointe des Boutres, coast of French Somaliland, at 11°33′N., 42°42′E. (Reliability: POOR)	780 yd.; concave; sand and gravel; 50 yd. wide at L.W. and 15 yd. at H.W.; nearshore bottom slopes *steep;* offshore approach clear but restricted to Golfe de Tadjoura; nearshore approach clear but flanked to E. by reef-fringed islands; bottom sand; anchorage with least depths of 90 to 102 ft., 650 yd. off H.W. line, bottom sand; beach backed by partly sandy and partly brush-covered valley extending 700 yd. inland; valley in turn backed and flanked by brush-covered steep-sided hills and high, sheer cliffs rising to dissected plateau; exit cross-country 70 yd. to coastal trail leading E.; surfaced road 16 mi. to E.
8. E. side of tombolo at Djibouti, at 11°36′N., 43°09′E. (FIG. 22–33) (Reliability: POOR)	750 yd.; concave; sand; 200 to 500 yd. wide at L.W. and 50 yd. at H.W.; nearshore bottom slopes *flat;* offshore approach clear; nearshore approach restricted to 500-yd.-wide channel through fringing reef and clear; bottom sand and mud; anchorage in 24-ft. depth 9½ n. mi. SE., bottom prob. sand and mud; beach on flat sandy strip of tombolo 200 to 300 yd. wide and partly covered with trees; RR. embankment 75 yd. behind beach; Djibouti 100 yd. inland; numerous buildings on tombolo; exit cross-country to tracks or trails leading 50 to 80 yd. to single-track meter-gage RR. and 200 to 400 yd. to surfaced road; Class 1 airfield close S. of Djibouti; Class 7 seaplane station in bay behind beach; principal port at Djibouti.

teau is relatively unimpeded during dry weather although duststorms are a frequent hazard. During rainy periods movement is difficult due to soft sand and clay surfaces which become slippery.

Helicopter landing areas—A Class 1 air facility at Djibouti is suitable for helicopter landings. Additional landing sites are readily available on the coastal plains and on parts of the plateaus. Loose sand and duststorms may be temporary obstacles. Exits from the landing areas are primarily by cross-country movement or by tracks and trails; however, along the southern coastal plain the road and railroad running southwest from Djibouti and the coastal track extending southeast from that port are readily accessible.

2. Landing beaches

There are no major beach areas in Sector 2; however, there are two minor beach areas and seven landing places. One minor beach is located in a bight near the head of the Golfe de Tadjoura and the other on the east side of a sandy tombolo at Djibouti. The landing places are located in the vicinity of the villages of Obock and Tadjoura on the north shore of Golfe de Tadjoura and near the French Somaliland – Somali Republic border.

The coasts in this sector, in general, are unsuitable for amphibious landings because of fringing steep cliffs and mountainous terrain. Although no areas along these coasts are considered ideal for amphibious landings, the minor beaches and landing places selected are in areas where approaches, beach characteristics, and exits to the inland terrain most nearly meet the requirements for amphibious landings.

Minor beach *8* is considered the best suited for an amphibious landing because of its favorable approaches and physical characteristics, and the excellent routes of communication from the beach area.

The beach material of the minor beaches and the landing places consists of sand or sand mixed with gravel. The approaches are clear and anchorages are in the vicinity of these landing areas. Exits are by cross-country movement to tracks or trails and surfaced roads. Minor ports are near the landing places at Obock and Tadjoura.

Diurnal tides range from 4 to 5½ feet in this sector. The expected average occurrence of surf 4 feet or greater is infrequent during all months in this sector.

Tabular descriptions for the minor beaches are given in FIGURE 22–8. Location of the minor beaches and landing places are shown on the location map, FIGURE 22–72.

E. Sector 3: Somali Republic and Socotra and adjacent islands

11°28′N., 43°16′E. to 1°40′S., 41°34′E.
(FIGURES 22–72 through 22–75; USHO Charts 1586, 3881, 3882 and BA5660)

Sector 3 consists of about 2,155 coastline miles and includes the mainland of the Somali Republic as well as Socotra and the adjacent islands, which are a part of the Aden Protectorate. The Somalia coast is fronted by the Gulf of Aden on the north and by the Arabian Sea and the Indian Ocean on the east. Socotra and the adjacent islands lie in the Arabian Sea near the eastern end of the Gulf of Aden.

The mainland and island shores are composed mostly of sand, though there is some rock and mud, the latter occurring mostly along the southwesternmost part of the sector. The shores are separated and are in most places backed by rocky slopes, cliffs, and bluffs which range from heights of about 400 feet to low wave-cut scarps and sand dunes. In the sector there are 16 major beach

areas, 8 minor beach areas, and 15 landing places on the mainland and 3 major beach areas and 3 landing places on Socotra and the adjacent islands. In general, the beach areas are widely scattered, with the largest concentrations on the eastern part of the north coast and the southwestern part of the east coast. The major beach areas on the mainland vary from 1¼ to 40 miles and the minor beach areas range from 400 to 1,720 yards in length. Most of the beach areas are backed by barren sandy ground on which there are towns, villages, and settlements.

The most suitable areas on the mainland for large-scale amphibious operations are at Berbera and Bender Cassim on the north coast and at Itala on the east coast. Heavy breakers will limit use of the east coast area during the southwest monsoon and transition periods. Bluffs, cliffs, obstructed approaches, lack of roads, or limited areas of flat terrain make the remaining beach areas generally unfavorable for large-scale amphibious operations. Socotra and the adjacent islands have limited areas of coastal plains and are generally hilly and mountainous, making large-scale amphibious operations generally infeasible, but the best area is a short stretch along the central part of the north coast.

The coast on the north and northeasternmost part of the mainland is a series of generally narrow plains, separated by hilly-to-mountainous spurs and ridges that extend to the sea from the highly dissected rugged hills and mountains of the hinterland. Along the east coast there is an extensive plateau that slopes from elevations of 200 to 400 feet in the north to a gently inclined plain that is little above the general level of the sea in the south. The northern part of this plain is confined by mountains to general widths of 5 to 25 miles, but it progressively broadens to over 100 miles before elevations of 1,000 feet are reached. Detached hills and low mountains are scattered over the plains and close inland of the bluffs and cliffs on the northern and central part of the east coast are long, generally narrow, rocky and sandy terraces that are backed by high, steep escarpments. Sandhills lie between the terraces and generally extend in long lines close behind the shores bordering the southern part of the sector. The plains on the north and northeast coasts are intersected by many intermittent streams, most of which are deeply entrenched in their lower reaches. A broad region on the central part of the east coast is almost entirely devoid of streams. On the southern part of the east coast there are two long perennial rivers, the Uebi Scebeli and Fiume Giuba, and a number of small streams, most of which are intermittent. The Uebi Scebeli is subject to seasonal flooding, sometimes devastating large areas. The perennial rivers are bordered by areas of marsh and swamp and several places along the southernmost part of the coast are covered with mangrove. On the southern part of the plain there is considerable vegetation with broad areas of pastureland and some cultivation. Elsewhere in the sector the plains are virtually desert, although a broad area on the westernmost part of the north coast is inundated by flooding streams during the rainy period. Broad areas are barren sand and rock; however, the greater part of the plains are sparsely covered with scattered clumps of grass and brush which generally increase in density toward the interior.

Socotra and the adjacent islands are mainly hilly to mountainous with only limited areas of coastal plains. Cliffs rise directly from the sea or close behind sandy shores along most of the coastal areas. Only on Socotra are there plains areas behind some of the sandy shores.

Except for scattered islets, rocks, shoals, and reefs near the shores, the seaward approaches to the coast are in general deep and unobstructed. The obstructions extend as far as 22 n. miles from the westernmost part of the north coast, and along the southernmost part of the east coast obstructions are within the 6-fathom curve that ranges up to 5 n. miles offshore. Between these two obstructed areas the dangers are mostly within 1 n. mile of the shores; however, unobstructed deep water fronts the coasts in many places.

Anchorages are scattered along the coasts of the mainland, but most of them are exposed to the monsoon winds. On the north coast, Zeila and Berbera have partial protection. The only protected anchorage on the east coast is at Chisimaio.

The only classified ports are the ten minor ports, which are equally distributed along the north and east coasts of the sector. There are also several places where cargoes are handled over the shores. The ports are generally at the locations of the largest urban areas; Mogadiscio, the capital, is the most important. In the intervening areas between the ports there are scattered villages and settlements, the populations of which are seasonally increased by the pastoral nomads, the principal inhabitants of the country.

In general, land transportation in the sector is poor. The principal routes are surfaced and unsurfaced roads which link most of the ports and large urban areas. The best roads are located on the southern part of the east coast where commercial activity is largely concentrated. Augmenting the sparse network of roads are tracks

which closely parallel the greater part of the shore and link most of the wells and waterholes near the shores and in the interior. The Fiume Giuba, one of the perennial rivers on the southern part of the east coast, can be navigated by shallow-draft craft as far as 300 miles upstream. Vehicles can move cross-country over much of the coastal plains, and the lack of roads there is not as great a handicap as it is in the hilly-to-mountainous hinterland. Major barriers to cross-country movement on the plains are scattered dunes, escarpments, hills, low mountains, swamps, marshes, and deeply entrenched streams.

Six classified air facilities are in the sector and are equally distributed on the north and east coasts. Several airfields are also located in the interior. There are no classified seaplane stations; however, seaplane landing areas are located at Berbera, Bender Cassim, Dante, Brava, Chisimaio, and Mogadiscio. In addition to the classified air facilities, there are large areas on the plains which are suitable for helicopter landings.

A hot, dry monsoonal type of climate prevails over all of Sector 3 but there are slight seasonal differences between the Gulf of Aden coast and Indian Ocean coast. Mean daily maximum temperatures of 85° to 110° prevail over the Gulf of Aden coast, with May through September being the hottest months. Slightly cooler temperatures occur along the Indian Ocean coast.

While land and sea breezes may predominate at times, the general wind patterns are monsoonal in nature. Along the Gulf of Aden coast, winds are primarily from the east and northeast during October through April, while winds from the southwestern quadrant predominate during June through August. Winds are variable in direction during the transitional months of May and September. Along the Indian Ocean coast, winds are generally from the northeast and north during November through March, while winds are predominantly from the southwest and south during May through September. April and October are transitional with variable wind directions.

A mean annual rainfall of 10 inches or less occurs over the lowlands of all of the Gulf of Aden coast and the northern half of the Indian Ocean coast. Greater rainfall prevails along the southern half of the Indian Ocean coast and the littoral highlands throughout the sector. In terms of ground operations, the most important weather phenomena are the sporadic sandstorms and the flash flooding of streams following periods of rain.

Climatic data were lacking for Socotra and adjacent islands, but presumably the climate for these islands would approximate that of the adjacent mainland coast.

1. Subsector 3–A: French Somaliland – Somali Republic border to Capo Guardafui

11°28′N., 43°16′E. to 11°50′N., 51°17′E.

(FIGURES 22–72 and 22–73) USHO Chart 1586)

Subsector 3–A extends about 625 coastline miles from the French Somaliland – Somali Republic border to Capo Guardafui, the northeastern extremity of the "Horn of Africa." The shores are predominantly sand and are almost everywhere backed by bluffs and cliffs which are mostly between 12 and 25 feet high. Seven major beach areas, six minor beach areas, and seven landing places have been selected in places where the terrain grades gently inland from the shores. The terrain behind the shores consists of generally narrow arid plains which are separated by spurs and ridges that extend to the sea from rugged highly dissected hills and mountains of the hinterland. The plains, intersected by many intermittent streams, range from narrow margins up to about 25 miles in width and are interspersed with detached hills and mountains. The intermittent streams in the westernmost part of the subsector are shallow, and many of the larger ones flow into lagoons, tidal inlets, and swampy areas that fringe and back the shore. During rainy periods, these streams overflow and inundate broad areas. Elsewhere, the lower limits of the main streams are in general deeply entrenched; however, some streams disappear in the porous sandy ground before they reach the sea. The dominant vegetation on the plains is clump grass and brush, widely scattered in most places, but increasing in density along the courses of the larger streams.

The subsector is generally unfavorable for large-scale amphibious landings primarily because of difficult terrain and poor transportation routes. The areas most suitable for large-scale amphibious operations are in the vicinity of Berbera and Bender Cassim where there are broad coastal plains and roads and tracks lead over the hills and mountains into the interior. Air and minor port facilities are also available at these areas.

The sea approaches to the coast are clear, except for islets, reefs, and shoals near the coast. The obstructions are most extensive in the westernmost part of the subsector where they lie as far as 21 n. miles offshore. Elsewhere they are widely scattered and lie mostly within 1 n. mile of the shore. There are many anchorages in the subsector, but only those at Zeila and Berbera have partial protection.

The minor ports of Zeila, Berbera, Bender Cassim, Candala, and Alula are the most important coastal urban areas of the widely scattered small

towns, villages, and settlements. There is permanent habitation in most of the urban areas that seasonally is augmented by nomads which are the principal inhabitants in the subsector.

Communication routes in the subsector consist of a sparse network of roads and tracks. The main routes both parallel the shores and extend southward over the hills and mountains, principally from the minor ports. Cross-country movement over the plains is good in some areas, but in most places it is impeded either by hills, mountains, and sand dunes, or by entrenched steep-sided intermittent streams. Close behind the shore in the westernmost part of the subsector movement is also impeded by swamps, inlets, and lagoons.

Class 2 air facilities are at Bender Cassim and Alula and a Class 4 airfield is located at Berbera. There are also unclassified seaplane stations at Berbera and Bender Cassim. Two Class 2, one Class 3, and one Class 4 facilities are located in the interior between 57 and 120 miles from the shores. In addition to the airfields, there are large areas on the plains where helicopters can land.

a. Coast

Coastal Segment [1], French Somaliland – Somali Republic border to Ras Khanzira (215 coastline miles; USHO Chart 2816)

General—The coastal area is a comparatively flat plain about 5 to 23 miles wide and fronted in most places by low bluffs which rise from narrow shores that are composed mostly of sand (FIGURES 22–34 through 22–39 and 22–72). The plain is intersected by intermittent streams that terminate in lagoons, marshes, swamps, and sand-blocked inlets which are most numerous on the western part of the segment. Barren sandy areas, some of which are surmounted by dunes, back the shore in places, and detached hills and mountains rise from the central and eastern part of the plain. Sea approaches to the western shore are almost entirely obstructed, to the eastern shore they are partly obstructed, and along central part they are mostly clear. A roadstead at Zeila and a harbor at Berbera, both minor ports, afford partly protected anchorages.

Three major beach areas and two minor beaches are in the segment. In general, the coastal area is not favorable for amphibious landings, primarily because of obstructions in the sea approaches and poor exits into the interior. The best area for landing is in the vicinity of Berbera where there is a minor port and an airfield, and where surfaced roads extend southward into the interior. Except for these roads and an unsurfaced road connecting with Zeila, there is only a sparse network of tracks. Movement across the plain is only fair, primarily because of loose sand and detached hills and mountains. Movement into the interior is poor because of the mountains backing the plain. A Class 4 airfield and an unclassified seaplane facility are located at Berbera, and a Class 2 airfield is located about 90 miles southwestward at Hargeisa.

Shore and coastal terrain—The shores are in general sandy (major beach area (5) through (7) and minor beach areas *9* and *10;* FIGURES 22–36 through 22–38), but there are some stretches of mud. The muddy shores border and flank the lagoons and inlets that are most numerous along the western part, widely separated on the central part, and almost entirely absent along the eastern end of the segment. Sandspits project from the western and central parts of the shore, and several rocky and cliffy points are along the eastern end.

The shore, extending about 50 miles southeastward from the French Somaliland border to Lander (FIGURES 22–34 and 22–35), is backed by low bluffs and gently sloping ground. The inland terrain is a sandy, partly dune-covered plain about 10 to 15 miles wide in most places. Marshy and swampy areas, as well as lagoons and inlets, are along the seaward margin of the plain marking the terminals of the many intermittent streams that intersect the coast. During rainy periods the streams overflow and inundate broad areas. When the floodwaters recede, large areas of salt-crusted mud and sand are exposed, seasonal ponds form near the shore, and small sand-blocked inlets develop at the mouths of the drying streams. Generally rugged hilly terrain that rises to mountains lies about 30 miles from the shore. Scattered grass tussocks, thorny brush, and trees which are most dense along the watercourses are the principal forms of vegetation on the plain. The low slopes of the hills and mountains are also partly covered by grass and brush with some scattered trees.

The greater part of the shores extending from Lander to Ras Khanzira are backed by bluffs that in most places range in height from 12 to 25 feet, however, Ras Hamra, 8 miles southwest of Ras Khanzira, is about 235 feet high. Berbera, about 60 miles southwest of Ras Khanzira, is flanked to the north and to the west by narrow swamps. The swamps west of Berbera are linked to the town by a short stretch of sand (minor beach area *9;* FIGURE 22–36), the central part of which is closely backed by a small shallow lagoon. The swamps to the north of Berbera extend about 650 yards northward from the minor port facilities to a partly inundated spit that extends about 1½

miles westward from the mainland. Extending eastward from the base of the spit on its seaward side is a stretch of sandy coast about 4½ miles long (major beach area (5); FIGURE 22–36). The sandy shore is succeeded to the east by an almost continuous line of bluffs rising from or near the water's edge and extending about 22½ miles farther eastward where the bluffs become low and alternate with gentle slopes that grade away from the sandy shore at major beach areas (6) and (7) (FIGURES 22–37 and 22–38). A low rocky point separates these beaches, and there are several steep sloping points within the limits of major beach (6).

There are also gentle slopes behind the sandy shore near Ras Hamra (minor beach area *10*). A plain extends from 1 to 20 miles inland behind the shores and is a continuation of the generally flat plain of the western part of the segment. Closely backing the shores are broad sandy areas on which there are narrow irregular belts of low dunes. Detached hills and mountains are scattered over the plain, and several of those southwest of Ras Khanzira terminate in rocky points along the shore. The plain is intersected by shallow intermittent streams which are most widely separated in the eastern part of the segment. The mountains backing the plain at the western end of the segment continue eastward in an arc. The foothills lie about 1½ miles west of Berbera and about 4½ miles southeast of the town. The mountains continue eastward to Ras Khanzira in irregular-trending ridges, the foothills of which are mostly between 5 and 23 miles from the shore (FIGURE 22–39). The mountains generally range between 2,000 and 3,000 feet in elevation, but there are outstanding peaks over 5,000 feet high. There is some cultivation around Berbera, but the dominant vegetation on the plain is sparse stands of grass tussocks, thorny brush, and trees which increase in density along the intermittent streams. Broad areas are barren sand.

Approaches—The offshore approaches are deep and clear, except off the western quarter where they are encumbered by islets, rocks, reefs, and shoals which extend into the nearshore zone. The nearshore approaches to the central half of the segment are generally clear, and along the eastern quarter they are partly obstructed.

The obstructions to the western quarter of the segment lie mostly within 11 n. miles of the shore; however, a shoal about 2¾ n. miles long with depths 4 to 6 fathoms over it is located about 10 n. miles farther seaward. Except for the offlying shoal, most of the obstructions are contained within the 10-fathom curve which ranges as far as 11 n. miles from shore. The obstructions are generally low islets and partly uncovering shoals and reefs on which there are patches of rock. There are some deep and generally unobstructed channels, but most of the channels separating the obstructions are shallow.

Depths of 6 to 7 fathoms lie close to the shore along the central half of the segment. Except for sandbars near the shore, there are no known obstructions in the nearshore approaches; however, approaches are not well charted.

Along the eastern quarter of the segment there are narrow sandbars, scattered rocks, shoals, and reefs that lie as far as 1 n. mile from the shore. Depths of 100-fathoms range from 1 to 6½ n. miles off this part of the coast.

Ports and urban areas—Berbera and Zeila are the principal urban areas on the coast which is occupied primarily by nomads. The two towns are the only minor ports; however, cargo is also handled at Bulhar near the center of the segment.

Berbera, close southwestward of major beach area (5), is built on flat terrain and consists of a number of masonry buildings and many huts. The number of huts decreases during the summer and increases in the winter when the nomads bring livestock and hides to Berbera for shipment to Aden. Berbera is also the principal transportation center on the north coast of the Somali Republic.

Zeila stands on a sandy spit and consists of about 50 stone houses and 600 huts, mostly in a dilapidated condition. Generally poor quality transportation routes link Zeila with other coastal towns and with the interior.

Routes of communication—The shore between Zeila and Berbera is paralleled by an unsurfaced road; tracks continue to the northwest and to the northeast along the coast. The road and tracks closely parallel the shore and in places are impassable at high tide. Two surfaced roads extend southward into the interior from Berbera, and a number of tracks extend inland from the coastal road and tracks. When the streams flood, parts of the roads and tracks are impassable and broad areas on the western part of the plain are inundated. Cross-country movement is impeded by swamps, marshes, loose sand, detached hills and mountains, and deeply entrenched streams. With these exceptions cross-country movement over the plain during the dry period is generally good. Egress into the interior, however, is generally difficult because of the rugged hills and mountainous terrain.

Helicopter landings—A Class 4 air facility at Berbera is available for the landing of helicopters. Suitable landing areas are also available the length of the coastal plain; however, loose sand

and stones will be encountered in many places. The central and eastern part of the plain affords the most desirable areas for landings though detached hills and mountains in these areas would in places limit the size of the helicopter landing areas. The western part of the plain is less desirable because of lagoons, marshes, and swamps. Exits from the helicopter landing areas would be primarily by cross-country movement to the coastal tracks.

Coastal Segment [2], Ras Khanzira to Ras Adado (220 coastline miles; USHO Chart 1586)

General—The coastal plain of this segment is about 1 to 16 miles wide and bordered seaward in most places by bluffs and cliffs 12 to 25 feet high which rise from sandy shores (FIGURES 22–40A, 22–72, and 22–73). Detached hills, low mountains, ridges, and spurs extend across the plain from the mountainous interior. The surface of the plain is scarred by the courses of many intermittent streams, a considerable number of which are deeply entrenched in their lower reaches. Low brush and clump grass are scattered on the coastal area, but broad stretches are barren and consist partly of sandhills and dunes. Only widely separated obstructions lie in the seaward approaches. There are no ports and only open anchorages are available.

Four major beach areas, one minor beach area, and three landing places have been selected in the segment. In general, the coastal area is not favorable for amphibious landings, primarily because of the poor exits into the interior. The best landing areas are at major beach areas (**10**) and (**11**). These beaches are backed by an earth road that junctions with a similar route that extends southward across the mountains into the interior. In addition to these roads, there is a sparse network of tracks. Loose sand, spurs and ridges, and detached hills and mountains will impede cross-country movement, but the primary obstructions are the deeply entrenched streams. The plain is backed by mountains that would prevent easy egress into the interior. There are no airfields, but helicopter landings could be made on the generally level plain.

Shore and coastal terrain—The coast is bordered by sandy shores (major beach areas (**8**) through (**11**), minor beach area *11*, and 3 landing places; FIGURE 22–40A), separated by relatively short stretches of bluffs and cliffs. The shores are generally narrow and are interrupted by the outlets of several small lagoons and many intermittent streams. Behind the shores stretch almost continuous lines of bluffs and cliffs which range mostly from about 12 to 25 feet in height. The bluffs and cliffs are eroded in places and behind the major and minor beach areas and landing places, give way to gently sloping ground. The terrain inland is composed of a generally level or undulating plain about 1 to 16 miles wide that is backed by the foothills of mountains.

Several spurs and ridges extend across the plain which is also interspersed with detached hills and low mountains (FIGURE 22–40A). In places sandhills or dunes lie close behind the bluffs and cliffs bordering the shores. The plain is crossed by the many intermittent streams and their numerous branches. Some of the main stream courses are only a little below the general level of the surrounding ground, but most streams flow in steep-sided beds that are deeply entrenched in their lower reaches. Some of the main streams disappear into the porous ground close to the shore, but most have scoured out deep gorges in the bluffs and cliffs and flow to the sea. During most of the year, the outlets of the streams crossing the shore are closed by wide bars of dry sand, some of which enclose small water-filled inlets. The western part of the plain is backed by irregular low mountains that are penetrated by generally narrow steep-sided valleys. Behind the eastern part there is a precipitous limestone ridge about 6,000 to 7,000 feet high with a summit 7,898 feet high, located about 20 miles inland near the western end of the ridge.

The vegetation on the plain is sparse, and broad areas are entirely barren. There are some scrub trees and grass tussocks but the dominant vegetation is a low brush, widely scattered in most places but increasing in density along many of the intermittent streams. The inland hills and mountains are partly covered with brush and trees, but the spurs and ridges and the detached hills and mountains on the plain are generally bare.

Approaches—Mait Island lies in the offshore approaches and is located about 6 n. miles from the shore, about 11 n. miles west northwestward of minor beach area *11*. The island is a bare rock 430 feet high with a spit extending 200 yards from its western end. The 5-fathom curve is uncharted but the 20-fathom curve ranges from less than 1,000 yards to about 4 n. miles from the shore. Heis Island, a rocky islet 170 feet high, is located in the nearshore zone about 1 n. mile from the shore, 6 miles southwest of Cape Jilbo. The islet is connected to a high bluff on the mainland by a causeway that dries about 2 feet. Within the nearshore zone are widely scattered reefs, shoals, and sandbars, most of which are within 700 yards of the shore.

Urban areas—The coastal area is sparsely populated, mostly by nomads, though there is permanent habitation in most of the small villages and settlements that surround widely separated wells

and waterholes. Some centers are uninhabited except when seasonally frequented by the nomads.

Routes of communications—A track, closely paralleling the shore, extends eastward from Ras Khanzira to the small settlement of Mait, about 6 miles northeast of Cape Jilbo, and an earth road closely parallels the shore between Mait and Ras Adado. An earth road extends about 30 miles southeastward from Mait through a mountain pass to the village of Erigavo where it connects with other roads in the northern part of the Somali Republic. There are also several tracks leading southward across the mountains from the coastal routes.

Cross-country movement is generally good but is impeded by the many entrenched steep-sided streams. The rugged, stream-dissected slopes of hills and mountains are generally impassable barriers. Movement inland over the mountains is generally confined to the earth road and the tracks.

Helicopter landing areas—Helicopter landing areas are available on the generally level coastal plain; however, the spurs and ridges extending from the mountainous interior and the detached hills and mountains will limit the size of some of the landing areas. Steep-sided entrenched streams, loose sand, and stones would be encountered on most of the landing areas. Exits from the helicopter landing areas would be primarily cross-country to the coastal roads and tracks.

Coastal Segment [3], Ras Adado to Capo Guardafui (190 coastline miles; USHO Chart 1586)

General—The coastal area is composed of generally level plains that vary from extremely narrow margins to zones about 16 miles wide (FIGURES 22–40B through 22–43 and 22–73). The plains are bordered almost everywhere by bluffs and cliffs that rise from mostly sandy shores. The plains, separated by eroded ridges and interspersed with sand dunes, detached hills, and low mountains, are generally barren. Their surfaces are scarred by the courses of many intermittent streams, most of which are deeply entrenched in their lower reaches. Some obstructions lie within 2 n. miles of the shore, but the sea approaches to the coastal area are predominantly clear. Open anchorages are available, and there are three minor ports.

Three minor beach areas and four landing places are in the segment. In general, the coastal area is not favorable for amphibious landings, primarily because of the rugged hills and mountains surrounding the plains and the poor exits into the interior. The best area for landing is at Bender Cassim on the western part of the coast where the terrain grades gently from the shore to one of the largest plains in the segment. A minor port and an airfield are available in the landing area and roads lead west and southward into the interior.

Transportation routes are sparse on the remainder of the coast, though the greater extent of the shore is closely paralleled by roads or tracks. Loose sand, entrenched streams, and detached hills and mountains will impede cross-country movement on the plains. Movement across the ridges surrounding the plains would be difficult in most places. Class 2 air facilities are located at Bender Cassim and Alula. There is also an unclassified seaplane station at Bender Cassim. A Class 2 airfield is located at Scusciuban about 120 miles south of Alula, a Class 3 facility is available about 120 miles south of Bender Cassim at Gardo, and a Class 4 facility is located in the vicinity of Darin about 55 miles southeast of Bender Cassim. Helicopter landing areas are available on the plains.

Shore and coastal terrain—The coastal area is bordered by generally sandy shores (minor beach areas *12* through *14;* and 4 landing places; FIGURES 22–40B and 22–43) that are separated by bluffs and cliffs. The bluffs and cliffs form an almost continuous line along the middle part of the segment between the Uadi Tog Ueni and the village of Durbo, but elsewhere they form relatively short stretches. The shores are generally narrow and are intersected by many intermittent streams, the mouths of which are generally closed by wide bars of sand most of the year. The shores along the eastern part of the segment are also separated by the outlets of two fairly large shallow lagoons. Except for the minor beach areas and the landing places, the shores are generally backed by low bluffs and cliffs. Level plains that vary from narrow margins to widths up to 16 miles back the shores.

One of the most extensive areas of generally level ground lies at the western end of the segment between Ras Adado and Ras al Hamar, about 44 miles eastward. The area is backed and interspersed with hills and low mountains, several of which come close to the shore and trend southeastward from Ras Adado and southwestward from Ras al Hamar. Ras al Hamar, a rocky promontory 300 feet high, is the northwestern extremity of a hilly ridge about 650 feet in elevation. The ridge extends inland to the rugged and precipitous foothills of a high mountainous area. Extending about 48 miles eastward from Ras al Hamar to the Uadi Tog Ueni is a narrow margin of generally level ground (FIGURE 22–41) that is interrupted by several high hilly ridges. The ridges project from the rugged foothills of the mountainous area rising inland of Ras al Hamar and reaching a peak elevation of 7,218 feet.

Except for several small valleys close eastward of the Uadi Tog Ueni, the coast extending about 28 miles eastward to the village of Durbo, is a mass of eroded hills and low mountains that drop almost vertically to the sea in cliffs. The hills and mountains recede inland east of Durbo and give place to a margin of level and gently sloping ground (FIGURE 22–42) that broadens to a width of several miles and extends to Ras Filuch about 33 miles northeastward. Ras Filuch is 1,020 feet high and is the northwestern extremity of an eroding ridge of hills and low mountains. About 6¼ miles southwest of Ras Filuch is the northern end of a narrow marshy lagoon about 8 miles long. The lagoon is separated from the sea by a narrow stretch of low ground that is broken by a narrow outlet near the southern end. Close east of Ras Filuch the mountains recede over 16 miles inland and are replaced by a plain that extends about 18 miles eastward to a slightly rounded promontory that rises from the sea. Seven miles east of Ras Filuch is the western end of a lagoon about 4 miles long that extends about 2 miles southward. The lagoon, reported to be almost dry at low tide, is separated from the sea by low narrow spits.

The coast that extends about 10 miles eastward from the slightly rounded promontory is a narrow margin of low ground behind which are rugged mountains that recede inland; Bereda is situated on the lowland. A narrow sandy shore extends eastward from a rocky point close east of Bereda. The steep mountains that back the shore for about 7 miles from the rocky point abruptly turn southeastward behind a narrow slightly undulating plain on which the village of Damo is located. The coast east of Damo again becomes bold as it rises to Capo Guardafui, which is a rocky and precipitous headland about 837 feet high.

Interspersed over the plains throughout the segment are rocky outcrops and sand dunes, the latter being most extensive between Ras Filuch and Capo Guardafui. Many of the streams intersecting the shores flow across the plains through generally steep-sided courses. Some streams disappear into the porous rock and soil near the bluff- and cliff-backed shores. Extensive areas are scarred by the many branching streams, the beds of which are generally only a little below the general level of the surrounding ground. The hills and mountains are generally rugged and are incised by the intermittent streams and their numerous branches.

Vegetation on the plains is generally sparse. Except for the marshy and swampy lagoons and several small grassy areas, the dominant vegetation is spiny desert brush. The brush is widely scattered but increases in density along most of the intermittent streams. The hills and low mountains on the coast are generally barren, but the high mountains farther inland are in many places covered with brush and scrub trees.

Approaches—Widely separated rocks, reefs, and shoals lie near the coast, and in several places shallow depths extend as far as 1 n. mile from the shore; however, the approaches to the coast are deep and in most places unobstructed. The 5-fathom curve is uncharted, but the 20-fathom curve ranges from several hundred yards to about 5 n. miles offshore with depths increasing rapidly to 100 fathoms close seaward.

Ports and urban areas—Bender Cassim, about 35 miles east of Ras Adado, Candala, near the middle of the segment, and Alula (FIGURE 22–43), about 7 miles east of Ras Filuch, are minor ports.

The coast is sparsely populated, and inhabited centers are widely scattered. Bender Cassim is the largest community with about 3,000 to 5,000 inhabitants, depending on the season (FIGURE 22–40B). There are stone buildings in most of the inhabited centers; however, the dominant structures are poorly constructed huts, which increase and decrease in number with the movement of the nomads, the principal inhabitants along the coast.

Routes of communications—The shore between Ras Adado and Bender Cassim is closely paralleled by an earth road that extends eastward from the village of Mait in Coastal Segment [2]. This route continues as a track eastward from Bender Cassim to Candala. There are no roads or tracks within the coastal area between Candala and Durbo about 33 miles eastward. A dry-weather unsurfaced road extends a short distance eastward from Durbo where it joins a track that closely parallels the shore to Alula. An earth road, paralleling the shore from 1 to 6 miles inland, extends eastward from Alula across the rugged hills and mountains to the village of Tohen about 8 miles south of Capo Guardafui. The coastal roads and tracks are linked by earth roads leading inland from Bender Cassim and Candala and by tracks elsewhere.

Cross-country movement on the plains is good except for the many entrenched streams, sand dunes, and detached hills and mountains. The rugged stream-dissected hills and mountains intersecting and rising from the plains would be difficult to cross. Movement inland over the mountains is generally confined to the few dry-weather unsurfaced roads.

Helicopter landing areas—Class 2 air facilities at Bender Cassim and Alula can be used for helicopter landings. Landing areas are also available on the generally level plains; however, their extent will be limited by the ridges and the de-

tached hills and mountains. Loose sand and stones will be encountered on most of the landing areas. Exits from the landing areas would be cross-country to the sparse network of roads and tracks.

b. **Landing beaches**

There are seven major beach areas, (5) through (11); six minor beach areas, *9* through *14;* and seven landing places in Subsector 3–A. The major beaches are located roughly along the central part of the coast. The minor beaches are unevenly distributed along the coast. The landing places are concentrated in the central and eastern parts of this subsector.

Long stretches of the coast in this subsector west of Berbera and Bender Cassim and west and east of Alula, in general, are unsuitable for amphibious landings because of such features as reefs, banks, bars, rocky headlands, dunes, and hills. Although the remainder of these coasts are not ideal for amphibious landings, beaches and landing places have been selected in areas where approaches, beach characteristics, and exits to the inland terrain most nearly meet the requirements for amphibious landings.

Major beach area (5) and minor beach *12* are considered best suited for amphibious landings because of generally favorable approaches and physical characteristics. Exits are by cross-country movement to coastal tracks, surfaced and unsurfaced roads.

Except for one beach which is 40 miles long, lengths of the major beaches range from 1½ to 15¼ miles. Major beach area (9) is separated by wide wadi mouths. The beach width at low water level for major beach area (5) is unknown; widths of the remaining beaches at low water levels range from 50 to 110 yards. Widths at high water levels range from 5 to 20 yards. The beach gradient in the low water to high water zone for major beach area (5) is unknown; gradients for the remaining beaches range from *moderate* to *gentle*. Beach gradients in the high water zone are *steep*. The primary beach material is sand which is *firm* in the wetted area and *soft* where dry.

The offshore approaches are clear; the nearshore approaches to most of the beaches are partly obstructed by sandbanks or sandbars. The nearshore bottom material off the beaches consists of sand or sand mixed with shells. Bottom

FIGURE 22–9. MAJOR BEACH AREAS, (*Map references:*

BEACH NUMBER AND LOCATION	LENGTH AND USABLE LENGTH	WIDTHS: AT L.W.; AT H.W.	BEACH GRADIENTS: L.W. TO H.W.; H.W. ZONE	APPROACH
(5) Centered 2¼ mi. NE. of Berbera on N. coast of Somali Republic, between 10°27′N., 45°01′E. and 10°29′N., 45°04′E. (FIG. 22–36) (Reliability: FAIR)	4½ mi.; slightly concave; terminated to SW. at base of low sandy spit and to NE. where fronted by shoal; all usable.	Unknown at L.W.; 10 to 20 yd. at H.W.	Unknown L.W. to H.W.; 1 on 10 or steeper in H.W. zone.	Nearshore bottom slopes prob. *steep;* no depths charted in nearshore area; 66- to 102-ft. soundings 1,185 to 1,420 yd. off H.W. line; offshore approach clear; nearshore approach partly obstructed by sandbars near L.W. line and flanked by shoals; bottom sand and shells; anchorage in 30- to 60-ft. depths in harbor 1¼ mi. to SW., bottom prob. sand and mud.
(6) Ras Walhun, E. and W., between 10°40′N., 45°22′E. and 10°44′N., 45°34′E. (FIG. 22–37) (Reliability: FAIR)	15¼ mi.; irregular; terminated to SW. by sandy point and to NE. where backed by cliffs; interrupted by wadies; all usable.	80 to 100 yd. at L.W.; 15 to 20 yd. at H.W.	1 on 40 to 1 on 50, L.W. to H.W.; 1 on 10 or steeper in H.W. zone.	Nearshore bottom slopes *moderate* to *flat* shoreward of 18-ft. depth contour 235 to 1,895 yd. off H.W. line; 30-ft. depth contour 1,660 yd. to 2¼ n. mi. off H.W. line; offshore approach clear; nearshore approach clear, however, a bank with least depth of 18 ft. fronts entire beach; bottom sand and shells; anchorages in 36- to 48-ft. depths 1¼ n. mi. N. of NE. part, bottom prob. sand and shells.

NOTE Beach lengths and distances along the coast and inland are expressed in statute miles; distances across water are expressed in nautical miles except when referring to beach locations. Italicized words refer to terms defined in Subsection A, 4, d.

slopes in the nearshore area range from *steep* to *flat*. Anchorages are in the vicinity of most of the beaches.

Diurnal tides of 5 feet occur in this subsector. The expected average occurrence of surf 4 feet or greater on the beaches ranges from 5% to 15% of the time October through April, infrequent to 4% in May; it is infrequent in all other months.

In general, the beaches are backed by sandy plains partly covered with scattered grass, brush, and trees. The plains are drained by wadies and extend inland to partly brush- and tree-covered hills rising to mountains. Villages are in the vicinity of all the beaches. Exits from the beaches are by cross-country movement to an unsurfaced coastal road and coastal tracks. Surfaced roads lead inland south of southwest end of major beach area (5). A Class 4 airfield, an unclassified seaplane station, and a minor port are in the vicinity of beach (5).

Lengths of the minor beaches range from 400 to 1,720 yards. The beach material is sand. Beach widths at low water levels range from 50 to 210 yards and at high water levels from 10 to 40 yards. The nearshore bottom slopes range from *moderate* to *flat*. The offshore and nearshore approaches to most of the beaches are clear. The nearshore bottom material is sand or sand mixed with mud, shells, rocks, or coral. Anchorages are in the vicinity of most beaches.

In general, the terrain behind the minor beaches is similar to that of the major beaches. Villages are in the vicinity of nearly all of the beaches. Exits from the minor beaches are by cross-country movement to coastal tracks or trails; however, surfaced or unsurfaced roads are immediately behind or in the vicinity of a few of the beaches. Airfields are in the vicinity of half of the beaches; minor ports are at minor beaches *9, 12,* and *13*.

In general, the approaches to the landing places are similar to those of the major and minor beaches given in this subsector. Narrow sandy plains or steep slopes back most of the landing places. Exits are by cross-country movement to coastal tracks or unsurfaced roads.

Tabular descriptions for the major beaches are given in FIGURE 22–9 and for the minor beaches in FIGURE 22–10. Locations of the major and minor beaches and landing places are shown on the location maps, FIGURES 22–72 and 22–73.

OF COASTAL SUBSECTOR 3–A
FIGURES 22–72 *and* 22–73)

SURF AND TIDAL RANGE	MATERIAL AND FIRMNESS	TERRAIN IMMEDIATELY BEHIND BEACH	EXITS AND COMMUNICATIONS INLAND
Surf 4 ft. or greater can be expected to occur 10% of the time Oct.–Apr. and infrequently in all other months; tidal range 5 ft., diurnal	Sand; *firm* in wetted area, *soft* where dry.	Beach immediately backed by scarp and low bank in places; in turn backed by low sandy plain partly covered with grass, cultivation, brush, and trees, and containing dunes; plain, drained by wadies, extends 4½ to 6½ mi. inland to partly brush- and tree-covered hills rising to mts.; village 2 mi. E. of NE. end; Berbera 1,450 yd. S. of SW. end.	Exit cross-country as far as 1,700 yd. to coastal track; surfaced roads and tracks lead inland from Berbera; Class 4 airfield 2 mi. S. of SW. end; unclassified seaplane station in harbor at Berbera; minor port at Berbera.
Surf 4 ft. or greater can be expected to occur 5% of the time Oct.–Apr. and infrequently in all other months; tidal range 5 ft., diurnal.	Sand; *firm* in wetted area, *soft* where dry.	Backed by scarps and sand dunes partly covered with brush; in turn backed by sandy plain partly covered with grass and brush, containing scattered dunes; plain, drained by wadies, extends as far as 23 mi. inland to partly brush- and tree-covered hills rising to mts.; village close behind NE. part.	Exit cross-country 1 to 1¼ mi. to coastal track; movement farther inland cross-country.

FIGURE 22–9. MAJOR BEACH AREAS,

BEACH NUMBER AND LOCATION	LENGTH AND USABLE LENGTH	WIDTHS: AT L.W.; AT H.W.	BEACH GRADIENTS: L.W. TO H.W.; H.W. ZONE	APPROACH
(7) Ras Sudda, SW., at 10°45′N., 4°35′E. (FIG. 22–38) (Reliability: FAIR)	1½ mi.; concave; terminated to SW. by cliffed headland and to NE. by rocky point fringed by reef; all usable.	75 to 90 yd. at L.W.; 10 to 15 yd. at H.W.	1 on 40 to 1 on 45, L.W. to H.W.; 1 on 10 or steeper in H.W. zone.	Nearshore bottom slopes prob. *steep;* no depths charted in nearshore area; 120-ft. sounding 1 n. mi. off H.W. line; offshore approach clear; nearshore approach clear but flanked to E. by reef; bottom sand and shells; anchorages in 36- to 48-ft. depths 2 n. mi. SW. of SW. end, bottom prob. sand and shells.
(8) Centered 19¼ mi. SE. of Ras Khanzira, between 10°47′N., 45°58′E. and 10°46′N., 46°10′E. (Reliability: FAIR)	13 mi.; irregular; terminated by wadi mouths; interrupted by wadies; all usable.	70 to 110 yd. at L.W.; 10 to 15 yd. at H.W.	1 on 35 to 1 on 55, L.W. to H.W.; 1 on 10 or steeper in H.W. zone.	Nearshore bottom slopes *mild* to *flat* shoreward of 24- to 42-ft. soundings 1,260 to 1,575 yd. off H.W. line; offshore approach clear; nearshore approach partly obstructed by sandbars near L.W. line and flanked to E. by reef; bottom prob. sand; anchorage in 42-ft. depth 1,200 yd. N. of E. part, bottom sand and coral.
(9) Centered 36¾ mi. SW. of Cape Jilbo, between 10°47′N., 46°15′E. and 10°49′N., 46°47′E. (Reliability: FAIR)	40 mi.; irregular; terminated to W. by sandy point and to E. by wadi mouth; separated near W. end and center parts by wadi mouths; interrupted by numerous wadies; nearly all usable.	60 to 110 yd. at L.W.; 10 to 15 yd. at H.W.	1 on 30 to 1 on 55, L.W. to H.W.; 1 on 10 or steeper in H.W. zone.	Nearshore bottom slopes *mild* shoreward of 24- to 42-ft. soundings 945 to 1,575 yd. off H.W. line; offshore approach clear; nearshore approach partly obstructed by sandbars as far as 200 yd. off H.W. line; bottom sand; anchorage in 42-ft. depth 1 n. mi. N. of E. part, bottom prob. sand; another anchorage reported in 78-ft. depth about 2¾ n. mi. NW. of E. end, bottom unknown.
(10) Centered 4½ mi. SE. of Cape Sura, between 11°09′N., 47°32′E. and 11°07′N., 47°35′E. (Reliability: FAIR)	4½ mi.; straight; terminated to NW. by wadi mouth and to SE. by sandy point; interrupted by wadies; all usable.	50 to 90 yd. at L.W.; 5 to 15 yd. at H.W.	1 on 25 to 1 on 45, L.W. to H.W.; 1 on 10 or steeper in H.W. zone.	Nearshore bottom slopes *gentle* to *flat* shoreward of 18-ft. depth contour 315 to 1,575 yd. off H.W. line; offshore approach clear; nearshore approach partly obstructed by sandbars near L.W. line; bottom sand.
(11) Centered 13¾ mi. SE. of Cape Sura, between 11°05′N., 47°40′E. and 11°05′N., 47°42′E. (Reliability: FAIR)	2 mi.; irregular; terminated by wadi mouths; all usable.	50 to 70 yd. at L.W.; 10 to 20 yd. at H.W.	1 on 25 to 1 on 30, L.W. to H.W.; 1 on 10 or steeper in H.W. zone.	Nearshore bottom slopes *flat* shoreward of 18-ft. depth contour 945 to 1,575 yd. off H.W. line; offshore approach clear; nearshore approach partly obstructed by sandbars near L.W. line; bottom sand.

NOTE Beach lengths and distances along the coast and inland are expressed in statute miles; distances across water are expressed in nautical miles except when referring to beach locations. Italicized words refer to terms defined in Subsection A, 4, d.

SUBSECTOR 3–A *(Continued)*

SURF AND TIDAL RANGE	MATERIAL AND FIRMNESS	TERRAIN IMMEDIATELY BEHIND BEACH	EXITS AND COMMUNICATIONS INLAND
Surf 4 ft. or greater can be expected to occur 5% of the time Oct.–Apr. and infrequently in all other months; tidal range 5 ft., diurnal.	Sand; *firm* in wetted area, *soft* where dry.	Backed by low sandy plain partly covered with brush and scattered trees, containing isolated hills, drained by wadi, and extending as far as 6 mi. inland to partly brush- and tree-covered hills rising to mts.; village 1 mi. S. of SW. end.	Exit cross-country as far as 1½ mi. to coastal track; movement farther inland cross-country.
Surf 4 ft. or greater can be expected to occur 14% of the time Oct.–Apr., 4% in May and infrequently in all other months; tidal range 5 ft., diurnal.	Sand; *firm* in wetted area, *soft* where dry.	Backed by low sandy plain partly covered with grass and brush, containing isolated hills, drained by several wadies, and extending as far as 9½ mi. inland to partly brush- and tree-covered hills rising to mts.; village behind E. part; other villages 1 mi. E. of E. end and 1¼ mi. SW. of W. end.	Exit cross-country as far as 3 mi. to coastal track; movement farther inland cross-country and by track.
Surf 4 ft. or greater can be expected to occur 14% of the time Oct.–Apr., 4% in May and infrequently in all other months; tidal range 5 ft., diurnal.	Sand; *firm* in wetted area, *soft* where dry.	Backed by low sandy plain partly covered with grass, brush, and trees, containing isolated ridges, drained by several wadies, and extending as far as 10 mi. inland to partly brush- and tree-covered hills rising to mts.; villages close behind beach.	Exit cross-country 495 yd. to 3 mi. to coastal track; movement farther inland cross-country and by track leading inland from village behind center part.
Surf 4 ft. or greater can be expected to occur 15% of the time Oct.–Apr., 4% in May and infrequently in all other months; tidal range 5 ft., diurnal.	Sand; *firm* in wetted area, *soft* where dry.	Beach backed by dunes; in turn backed by low sandy plain, partly covered with brush, drained by several wadies, and extending 3 to 5¾ mi. inland to partly brush- and tree-covered hills rising to mts.; village behind SE. part.	Exit cross-country as far as 1¾ mi. to unsurfaced road; movement farther inland cross-country.
Surf 4 ft. or greater can be expected to occur 14% of the time Oct.–Apr., 4% in May, and infrequently in all other months; tidal range 5 ft., diurnal.	Sand; *firm* in wetted area, *soft* where dry.	Beach backed by partly brush-covered dunes; in turn backed by low sandy plain partly covered with brush and trees, drained by wadies, and extending as far as 3 mi. inland to partly brush- and tree-covered hills rising to mts.; village 1¼ mi. SW. of W. end.	Exit cross-country 165 yd. to unsurfaced road; movement farther inland cross-country.

FIGURE 22–10. MINOR BEACH AREAS OF COASTAL SUBSECTOR 3–A
(*Map references:* FIGURES 22–72 *and* 22–73)

NUMBER AND LOCATION	REMARKS
9. Berbera, on N. coast of Somali Republic at 10°27′N., 45°00′E. (FIG. 22–36) (Reliability: GOOD)	400 yd.; concave; sand; 100 to 210 yd. wide at L.W. and 20 to 30 yd. at H.W.; nearshore bottom slopes *moderate* to *gentle;* offshore approach restricted to harbor channel and clear but flanked to N. by sandy spit fringed by sandbanks, rocks, and coral heads and to S. by sandbanks and coral heads; nearshore approach clear but flanked by piers; bottom sand and mud; anchorage in 30- to 60-ft. depths in harbor, bottom prob. sand and mud; beach backed by sandy plain partly covered with grass, cultivation, brush, and trees, containing dunes and ridges; plain, drained by wadies, extends as far as 5½ mi. inland to brush- and tree-covered hills rising to mts.; tidal lagoon close behind center part; Berbera close behind beach; exit cross-country 50 to 200 yd. to surfaced road; surfaced roads and tracks lead inland from Berbera; Class 4 airfield approx. 1 mi. S. of Berbera; unclassified seaplane station in harbor at Berbera; minor port at Berbera.
10. Centered 6 mi. NE. of Ras Sudda, at 10°47′N., 45°40′E. (Reliability: FAIR)	480 yd.; straight; sand; 60 to 80 yd. wide at L.W. and 10 to 15 yd. at H.W.; nearshore bottom slopes *gentle;* offshore approach clear; nearshore approach partly obstructed by sandbars near L.W. line; bottom sand and shells; beach backed by sandy, partly grass-covered plain containing dunes and extending 4½ mi. inland to partly brush- and tree-covered hills rising to mts.; exit cross-country as far as 2 mi. to coastal track; movement farther inland cross-country and by track.
11. Centered 5¼ mi. W. of Cape Sura, at 11°10′N., 47°25′E. (Reliability: FAIR)	480 yd.; straight; sand; 50 to 80 yd. wide at L.W. and 10 to 15 yd. at H.W.; nearshore bottom slopes *mild;* offshore approach clear; nearshore approach partly obstructed by sandbars near L.W. line and by reported bank 880 yd. off H.W. line and flanked to W. by fringing reef; bottom sand; beach backed by low sandy plain partly covered with brush, containing ridges and extending as far as 5 mi. inland to partly brush- and tree-covered hills rising to mts.; village behind E. end; exit cross-country 1 mi. to coastal track; movement farther inland cross-country to unsurfaced road.
12. Bender Cassim, at..... 11°18′N., 49°11′E. (FIG. 22–40B) (Reliability: FAIR)	800 yd.; concave; sand; 50 to 180 yd. wide at L.W. and 15 to 30 yd. at H.W.; nearshore bottom slopes *gentle* to *flat;* offshore approach clear; nearshore approach restricted to channel 350 yd. wide between reefs as far as 500 yd. off H.W. line and flanked to E. by pier; bottom sand and coral; anchorage in 24-ft. depth about 900 yd. off H.W. line, bottom sand; beach backed by valley partly covered with brush and extending about 10 mi. inland to brush- and tree-covered hills rising to mts.; Bender Cassim close behind beach; exit cross-country to Bender Cassim; unsurfaced road leads W.; track and another unsurfaced road leads inland from Bender Cassim; Class 2 airfield about 2½ mi. W. of Bender Cassim; unclassified seaplane station at Bender Cassim.
13. Alula, at..... 11°58′N., 50°44′E. (FIG. 22–43) (Reliability: FAIR)	1,200 yd.; straight; sand; 60 to 150 yd. wide at L.W. and 15 to 30 yd. at H.W.; nearshore bottom slopes *gentle* to *mild;* offshore approach clear; nearshore approach clear but flanked by rocks; bottom sand, shells, and rocks; anchorages in 39- to 117-ft. depths 700 to 1,300 yd. off H.W. line, bottom sand and shells; beach backed by sandy plain partly covered with brush and extending 16 mi. inland to brush-covered hills rising to mts.; plain flanked to E. by wadi and lagoon; Alula close behind beach; exit cross-country 135 yd. to coastal track leading SW. from Alula and to unsurfaced road leading SE.; another track leads inland; Class 2 airfield about 1 mi. SW. of Alula; minor port at Alula.
14. Centered 3 mi. W. of Capo Guardafui, at 11°50′N. 51°14′E. (Reliability: POOR)	1,720 yd.; slightly concave; sand; 80 to 100 yd. wide at L.W. and 20 to 40 yd. at H.W.; nearshore bottom slopes *gentle;* approaches clear; bottom sand; anchorage with least depths of 48- to 54-ft., 1,200 yd. off H.W. line, bottom sand; beach backed by sandy plain extending 4 mi. inland to hills rising to mts.; village close behind E. part; exit cross-country 1 mi. to coastal trail; movement farther inland cross-country to unsurfaced road as far as 4 mi. behind beach.

2. Subsector 3–B: Socotra and adjacent islands (12°45′N. to 12°05′N., 52°00′E. to 54°35′E.) (FIGURE 22–73; 275 coastline miles, USHO Charts 1586 and BA5660)

a. Coast

General—Subsector 3–B consists of the island of Socotra (Suquṭra), about 83 miles long, and the smaller off-lying islands of 'Abd al Kūrī, Samḥah, Darsa, and Sabuniyah (FIGURES 22–44 through 22–47, and 22–73).*

* Socotra and adjacent islands are treated in this Section because of their proximity to the Somali Republic. They are politically a part of the Aden Protectorate (NIS 32).

Socotra, located about 130 n. miles east-northeast of Capo Guardafui and about 190 n. miles off the Arabian Peninsula, lies in the path of important Middle East and East African trade routes. The island consists primarily of a mountainous, cliff-fringed plateau with only limited areas of coastal plain. Three major beach areas, and one landing place, all located along the northern and western coasts of the island, have been selected. The remaining islands are mainly rocky and hilly to mountainous; there are two landing places along the northern coast of 'Abd al Kūrī, the largest of the off-lying islands.

The islands are in general unfavorable for large-scale amphibious operations because of the prevalence of high sea cliffs or high cliffs close behind the shores, rugged inland terrain, and the general lack of roads and tracks. The area most suitable for amphibious operations is located on the north-central part of Socotra where a coastal plain extends up to 5 miles inland.

Socotra has coastal plains on its northern and southern sides, which are separated by a rugged mountainous plateau. The shores are predominantly sandy, interrupted in many places by marine cliffs and streams. The coastal plains are narrow and covered with brush. Rugged, brush-covered mountains, which are dissected by many steep-sided valleys and gorges, rise from the plateau. Cross-country movement over the coastal plains is unimpeded; the plateau, however, is an insurmountable obstacle, and penetration through the interior mountains is similarly impossible except via narrow steep-sided valleys and gorges. Socotra is very inadequately served by a poor network of tracks and trails.

Offshore approaches to Socotra are generally clear except from the west and southwest, while the nearshore approaches are principally obstructed by rocks and coral reefs. Suitable seasonal anchorages are located off most of the coast, especially in the large bays.

The hilly-to-mountainous islands adjacent to Socotra lack roads and tracks. The approaches to them are mainly clear but obstructed in places by islets, rocks, or reefs.

There are no air facilities in the subsector. Socotra has several villages but the remaining islands are uninhabited.

Shore and coastal terrain—The shores of Socotra are predominantly composed of sand (major beach areas (12) through (14) and 1 landing place; FIGURE 22–44), although in several places there are gravel, cobbles, or boulders. These shores are separated in many places by high, rugged marine cliffs (FIGURE 22–45) and interrupted by numerous intermittent streams. The coast is irregular and broken by numerous bays, inlets, and capes.

The terrain consists primarily of a northern and southern coastal plain (FIGURE 22–46), separated inland by a deeply dissected mountainous plateau, 1,000 to 2,000 feet high, which extends the whole length of the island. Rugged mountains rise from the eastern half of the plateau and reach a height of almost 5,000 feet. The western half of the plateau is capped by low dome-shaped mountains more than 2,000 feet high which surround a large interior basin (FIGURE 22–47).

On the northern side of the island, extending 80 miles westward from Ra's Erisal, the eastern tip of Socotra, to Ra's Bashuri, in the northwest corner, the shores consist mostly of sand (major beach areas (12) and (13), and 1 landing place), although gravel, cobbles, or boulders are present in places. The sandy shores are backed by discontinuous stretches of coastal plain. These stretches average 2 to 3 miles in width and are flanked by hilly-to-mountainous spurs extending from the interior highland to the shores. The plain is most extensive behind major beach area (12); here also are found a mangrove-fringed salt water lagoon and marshy patches (FIGURE 22–44). In this area, the plain extends inland for varying distances up to 5 miles before reaching the plateau. The plain is predominantly sandy and supports not only brush but numerous date palm groves. Inland, the hills and valleys are chiefly covered by brush although there are scattered areas of trees. Sandhills are particularly prominent along the northeastern part of the plain on its seaward side. The plain is pinched off at both ends by high cliffs, with heights up to 2,000 feet, which rise steeply from the water's edge or close behind the shores.

Along the western side of the island from Ra's Bashuri (FIGURE 22–45) to Ra's Shu'ab, 20 miles to the southwest, the coast is bordered by sea cliffs and alternating stretches of sandy and gravelly shores which are most extensive at the head of Ghubbat Shu'ab (major beach area (14)). A lagoon bordered by mangrove backs the central part of this beach area. The sandy shores are mostly backed by narrow pockets and belts of sandy plain which give way close inland to steep escarpments of the interior plateau.

On the southern side of the island extending 96 miles eastward from Ra's Shu'ab to Ra's Erisal, the southern coastal plain is fringed by sandy shores, and terminated at both ends by escarpments and sea cliffs up to 1,500 feet in height (FIGURE 22–46). The sandy brush-covered plain, which is less dissected by streams than the northern plain, has a maximum width of about 3 miles and is covered extensively with dunes.

The mountainous brush- and tree-covered interior of the island consists of a broad, undulating plateau which is severely dissected by steep-sided valleys and gorges drained by intermittent streams. The gorges are deep and narrow and during rainy periods would be extremely dangerous because of flooding. On the western side of the island the mountains have less elevation and wider separation and there is a large interior basinlike depression (FIGURE 22–47). This basin drains out on the northern coastal plain behind or at the flanks of major beach area (12) and in places the floor of

the basin is wide and flat. On the eastern side of the island, deep, fingerlike valleys penetrate into the mountainous interior.

The shores of the off-lying islands are predominantly rocky except for sandy stretches (two landing places) on the northern coast of 'Abd al Kūrī, the largest island. 'Abd al Kūrī is about 21 miles long and 3 miles wide and lies about 57 n. miles southwest of Socotra. The inland terrain of the island is mostly rocky and mountainous. The northern coast of the island has sandy shores with a few rocky points; its southern coast is composed of abrupt cliffs with mostly rocky shores. Mountains in the eastern part of the island have two main summits, almost 1,900 and over 2,400 feet high; the hills in the western part attain an elevation of almost 900 feet.

Samḥah, 7 miles long and 3 miles wide, lies about 36 n. miles eastward of 'Abd al Kūrī and 25 n. miles southwestward of Socotra. It has rocky shores, with the southern coast fringed by precipitous bluffs. The island rises to a table mountain over 2,500 feet high whose summit is near the middle of the island.

Darsa, about 4 miles long and 2 miles wide, lies 9 n. miles east of Samḥah, and has rocky shores backed by cliffs. Inland, a table summit rises to about 1,300 feet and extends nearly the whole length of the island.

Sabuniyah, located about 10 n. miles off the western tip of Socotra, is a small rocky islet reaching a peak elevation of about 225 feet.

Approaches—Offshore approaches to Socotra are clear except from the southwest and west. Here, the islands of 'Abd al Kūrī, Samḥah, Darsa, and Sabuniyah lie in the approaches from 10 to 57 n. miles off Socotra, but are easily circumvented in the deep waters surrounding them. The 20-fathom curve is farthest off the southern side of Socotra where it lies about 18 n. miles seaward but closes to about 2 n. miles off the northern and western sides.

The principal obstructions in the nearshore approaches to Socotra are the rocks and coral reefs, which extend from 500 to 1,000 yards offshore off many parts of the coast. In many places rocky areas lie close to the shore below the waterline. An irregularly charted 5-fathom curve generally lies less than 1,000 yards offshore, but there are several embayments where it lies as far as 1⅓ n. miles seaward.

Approaches to the off-lying islands are in general clear, the major exception being the northern coast of 'Abd al Kūrī. Two rocky islets with peaks over 250 feet lie about 12 n. miles northwest of the island. A 3¼-fathom shoal also lies 8 n. miles off the northwest corner of the island, and a 3-fathom shoal about 2 n. miles off the northeast corner; rocks lie close inshore in places. The nearshore approaches of Samḥah and Darsa are partly obstructed by scattered fringing reefs but seaward of them approaches are clear.

Ports and urban areas—There are no ports or urban areas on Socotra or its associated islands. The principal village is Tamrida, the capital of Socotra, about 8 miles east of major beach area (13). Most of the main villages are scattered along the northern side of the island. The population is mostly pastoral in the inland regions and centered in fishing villages on the coast. The islands off Socotra are uninhabited, but 'Abd al Kūrī is visited occasionally by itinerant fishermen.

Routes of communication—There are no roads on Socotra or the off-lying islands. During World War II a motorable track was constructed from Ghubbat Qualansiyah at the western end of Socotra to a now abandoned airfield at Ra's Qurmah on the northeastern side of Ghubbat Qurmah, but the track has fallen into disrepair. It still, however, remains the principal coastal track across the northern side of the island. A branch of this track, also in disrepair, extends inland from behind major beach area (12) to major beach area (14) on the western side of Socotra. Elsewhere, there are only trails, mostly suitable for pack animals, which link the main villages. Vehicular movement across the plains would be restricted chiefly to lateral movement due to the impenetrability of the mountains backing the plains. Movement over the mountains between the northern and southern coasts is difficult since there are no motorable routes linking the northern and southern plains. Foot troops could gain access to the interior by means of the valleys or dry streambeds dissecting the plateau; however, during rainy periods, raging torrents race through these valleys, barring any movement. There are only a few scattered trails on the off-lying islands.

Helicopter landing areas—The abandoned airfield at Ra's Qurmah is most suitable for helicopter landings. Flat expanses on the plains and the flat floor of part of the interior basin of the inland plateau provide additional landing sites. There are many small, relatively flat and clear areas on the interior plateau that might be suitable for helicopter landing areas. Loose sand and rocks may be a problem in places. Exits from landing areas are essentially by cross-country movement to widely scattered tracks and trails.

b. **Landing beaches**

There are three major beach areas (12) through (14), and three landing places in Subsector 3–B. No minor beaches have been selected in this subsector. The major beach areas are on the north and west coasts of Socotra; one landing place is on the north coast of Socotra, and two are on the north coast of 'Abd al Kūrī.

The coasts in this subsector, in general, are unsuited for amphibious landings because of such features as rocks, banks, reefs, and escarpments. Although no areas along these coasts are considered ideal for amphibious landings, a few beaches and landing places have been selected where approaches, beach characteristics, and exits to the inland terrain most nearly meet the requirements for amphibious landings.

The southeastern 5-mile section of major beach area (12) is considered the best suited for an amphibious landing. This section of the beach has generally favorable approaches and physical characteristics, and exit is cross-country to a track leading inland.

One major beach is 17 miles long, and the other two are 1 and 1¾ miles in length. Major beach area (12) contains an unusable section where backed by a salt water lagoon. Beach widths at low water levels range from 40 to 90 yards and at high water levels from 5 to 20 yards. The beach gradients in the low water to high water zone range from *moderate* to *gentle;* gradients in the high water zone are *steep*. The beach materials are sand which is *firm* in the wetted area and *soft* where dry, or sand and gravel which is probably *loose*.

The approaches to the major beaches are, in general, clear. The nearshore bottom material consists of sand or sand mixed with rocks, coral, and mud. Nearshore bottom slopes range from *steep* to *mild*. Anchorages are located in the vicinity of all the beaches.

Diurnal tides of about 5½ feet occur in this subsector. The expected average occurrence of surf 4 feet or greater is infrequent during all months on major beach area (14). The average occurrence of surf 4 feet or greater on the remaining beaches ranges from 7% to 14% of the time during October through April; it is 4% in May and infrequent during all other months.

In general, the beaches are backed by sandy plains or a valley partly covered with brush, drained by wadies, and extending inland to a plateau covered with brush and trees. Villages are located in the vicinity of most of the beaches. Exits are by cross-country movement. Tracks are located in the vicinity of all beaches. An unclassified airfield is near two beaches.

In general the approaches to the landing places are clear. The landing places are backed by narrow sandy plains or steep cliffs rising to a plateau. Exits are by cross-country movement or by track.

Tabular descriptions for the major beaches are given in FIGURE 22–11. Location of the major beaches and landing places are shown on the location map, FIGURE 22–73.

3. Subsector 3–C: Capo Guardafui to Somali Republic – Kenya border

11°50′N., 51°17′E. to 1°40′S., 41°34′E.

(FIGURES 22–73 through 22–75; USHO Charts 1586, 3882, and 1606)

Subsector 3–C extends about 1,255 coastline miles southwestward from Capo Guardafui to the Somali Republic – Kenya border. The shores are mostly sandy but there are some prominent rocky stretches in the center of the subsector and some muddy stretches at the southwestern end. Most of the shores are backed by steep rocky slopes, cliffs, and bluffs that range up to several hundred feet in height in the northeastern half of the subsector but are generally only several feet high in the southwestern half. Nine major beach areas, two minor beach areas, and eight landing places have been selected in this subsector.

The coastal terrain in the northeast is mainly a plateau with some separated coastal plains; in the southwest there are broad coastal plains. In the northeast the plateau is about 250 to 400 feet above sea level and ranges from about 5 to 25 miles in width in most places. Progressing southward the plateau decreases in elevation, gradually becoming a coastal plain that is generally little above the level of the sea and slopes gently inland from 80 to 120 miles before elevations of 1,000 feet are attained. The northeastern part of the subsector is intersected by several large deeply entrenched streams, and broad areas are furrowed by many small seasonal watercourses. The southwestern part of the subsector is intersected principally by the Uebi Scebeli and Fiume Giuba, the only perennial rivers in the NIS Area. The dominant vegetation in the northern and central parts of the subsector is scattered clump grass and low desert brush which increases in density toward the interior where there is some cultivation and large areas of pastureland. On the southern part of the plain, the vegetation is more dense and there are areas of marsh and swamp, some of which border the shore.

The greater part of the subsector is generally unfavorable for large-scale amphibious landings primarily because of obstructed approaches, steep escarpments, and poor transportation routes.

FIGURE 22–11. MAJOR BEACH AREAS
(*Map reference:*

BEACH NUMBER AND LOCATION	LENGTH AND USABLE LENGTH	WIDTHS: AT L.W.; AT H.W.	BEACH GRADIENTS: L.W. TO H.W.; H.W. ZONE	APPROACH
(12) Ra's Kadarma SE. on N. coast of Socotra, between 12°43′N., 53°38′E. and 12°37′N., 53°51′E. (FIG. 22–44) (Reliability: FAIR)	17 mi.; slightly concave; terminated to NW. by point and to SE. where fronted by rocks and reefs; unusable section in SE. part where backed by salt water lagoon; nearly all usable.	40 to 80 yd. at L.W.; 10 to 20 yd. at H.W.	1 on 15 to 1 on 35, L.W. to H.W.; 1 on 10 or steeper in H.W. zone.	Nearshore bottom slopes *moderate* to *mild* shoreward of discontinuous 18-ft. depth contour 135 to 945 yd. off H.W. line of SE. and center parts and unknown off remainder; discontinuous 30-ft. depth contour 360 to 1,350 yd. off H.W. line; offshore approach restricted to bay and clear; nearshore approach partly obstructed in SE. part by shifting bars with least depth of 12 ft. as far as 400 yd. off H.W. line and flanked to E. by rocks and reef-fringed shore; bottom sand, rocks, and coral; anchorage in 30- to 36-ft. depths 1,300 yd. off NW. end, bottom sand.
(13) Centered 18¾ mi. E. of Ra's Kadarma on N. coast of Socotra, at 12°39′N., 53°54′E. (Reliability: FAIR)	1 mi.; concave; terminated by rock- and reef-fringed shores; all usable.	55 to 90 yd. at L.W.; 5 to 15 yd. at H.W.	1 on 25 to 1 on 40, L.W. to H.W.; 1 on 10 or steeper in H.W. zone.	Nearshore bottom slopes *gentle* shoreward of 18-ft. depth contour 270 to 450 yd. off H.W. line; 30-ft. depth contour 540 to 810 yd. off H.W. line; offshore approach clear; nearshore approach clear but flanked by rocks and reefs; bottom sand, rocks, and prob. mud; anchorage in 30- to 36-ft. depths 2½ n. mi. SW. of W. end, bottom sand.
(14) Centered 4½ mi. S. of Ra's Baduwa on W. coast of Socotra, at 12°35′N., 53°24′E. (Reliability: FAIR)	1¾ mi.; concave; terminated to N. where backed by cliff and to S. by steep escarpment; all usable.	50 to 85 yd. at L.W.; 10 to 15 yd. at H.W.	1 on 20 to 1 on 40, L.W. to H.W.; 1 on 10 or steeper in H.W. zone.	Nearshore bottom slopes *steep* to *gentle* shoreward of 18-ft. depth contour 90 to 370 yd. off H.W. line; 30-ft. depth contour 450 to 1,000 yd. off H.W. line; offshore approach restricted to bay and clear; nearshore approach clear; bottom sand; anchorage in 60-ft. depth 1,400 yd. off N. part, bottom sand.

NOTE Beach lengths and distances along the coast and inland are expressed in statute miles; distances across water are expressed in nautical miles except when referring to beach locations. Italicized words refer to terms defined in Subsection A, 4, d.

However, the area in the vicinity of Itala in the southwestern part of the subsector affords the most suitable conditions for amphibious landings in the NIS Area. In this area the terrain is generally flat, cross-country movement is good, and there are surfaced and unsurfaced roads that connect with the skeletal network of roads and tracks which serve the country.

The offshore approaches to the coast are clear in most places, but the nearshore approaches are partly obstructed by islets, rocks, shoals, and reefs; a chain of small reef-fringed islands extend from Chisimaio to the Kenya border. A number of anchorages are available along the coast but the only protected anchorage is in a harbor at Chisimaio.

Minor ports are located at Dante, Merca, Brava, Mogadiscio, and Chisimaio; however, there are also several places where cargoes are handled over the shores. The most important of the ports are Mogadiscio, the capital and largest city in the Somali Republic, and Chisimaio, which is the location of the only natural harbor in the subsector. Outside the port areas, nomads and seminomads are the principal inhabitants in the subsector, although there is permanent habitation in the agricultural areas on the southwestern part of the plain.

A sparse network of surfaced and unsurfaced roads is augmented by a network of tracks and trails. Except for a short narrow-gage railway in the vicinity of the minor port of Dante, there are no railroads in the subsector. The Fiume Giuba, on the southwestern part of the plain, can be navigated by shallow-draft craft for a distance of about 300 miles.

OF COASTAL SUBSECTOR 3–B
FIGURE 22–73)

SURF AND TIDAL RANGE	MATERIAL AND FIRMNESS	TERRAIN IMMEDIATELY BEHIND BEACH	EXITS AND COMMUNICATIONS INLAND
Surf 4 ft. or greater can be expected to occur 14% of the time Oct.–Apr., 4% in May, and infrequently in all other months; tidal range 5½ ft., diurnal.	Sand; *firm* in wetted area, *soft* where dry.	Segment of SE. part backed by mangrove-fringed salt water lagoon; remainder of beach and lagoon backed by sandy plain partly covered with brush, drained by numerous wadies, and extending as far as 4 mi. inland to escarpment rising to plateau; plateau dissected by valleys covered with brush and trees; scattered huts on plain behind SE. part; village 4 mi. NE. of SE. end.	Exit cross-country as far as 7 mi. to coastal track; another track leads inland from behind SE. part; unclassified airfield 3½ mi. E. of SE. end.
Surf 4 ft. or greater can be expected to occur 7% of the time Oct.–Apr., 4% in May, and infrequently in all other months; tidal range 5½ ft., diurnal.	Sand; *firm* in wetted area, *soft* where dry.	Backed by sandy plain partly covered with brush, drained by wadies, and extending as far as 5 mi. inland to escarpment rising to plateau; plateau dissected by valleys covered with brush and trees; village close behind beach.	Exit cross-country as far as 2 mi. to coastal track; unclassified airfield 3 mi. S. of beach.
Surf 4 ft. or greater infrequent in all months; tidal range 5½ ft., diurnal.	Sand and gravel; prob. *loose*.	Backed by partly brush-covered valley drained by wadies and extending 1 mi. inland to foothills; valley flanked by escarpments to plateau; plateau dissected by valleys covered with brush and trees; lagoon, bordered by mangroves, close behind center part.	Exit cross-country or by track leading inland from S. part.

A Class 2 airfield is located at Mogadiscio, a Class 4 facility is at Chisimaio, and there is a Class 4 facility at Gelib, about 60 miles north of Chisimaio. Several airfields are also maintained in the hinterland. There are no classified seaplane stations; however, landing areas are available in the vicinity of Dante, Brava, Chisimaio, and Mogadiscio. Besides the airfields, there are broad areas on the coastal plain suitable for the landing of helicopters.

a. Coast

Coastal Segment [1], Capo Guardafui to the western end of major beach area (17) (185 coastline miles; USHO Chart 1586)

General—The segment has a partly irregular coast and at the southern end there is a peninsula composed of a hilly promontory that is linked to the mainland by a long, low, narrow isthmus (FIGURES 22–48 through 22–54, and FIGURE 22–73). Except for the hilly promontory and a small sandy area south of Capo Guardafui, the coastal area is composed of two comparatively narrow flat plains that are separated by a steep-sided tableland near the center of the segment. Sandy shores which are backed in places by low cliffs, bluffs, and beach scarps border the plains; mountains and plateaus rise from their inland margins. The plains are either rocky or sandy and are intersected by several large and many small intermittent streams, which are deeply entrenched in places. Although most of the coastal areas are barren, there are scattered clumps of grass and brush.

Although three major beach areas and one landing place have been selected in this segment, it is not favorable for amphibious landings, primarily because of confined lateral movement and poor egress into the interior. The best landing area is major beach area (17) which is partly backed by a broad coastal plain.

Cross-country movement is fair over the coastal plains but very poor in the interior mountains and plateaus. The sparse network of tracks serve the coastal segment. There are no air facilities on the plains, but Class 2 air facilities are located at Alula (Subsector 3–A), about 38 miles west of Capo Guardafui, and at Scusciuban, about 47 miles west of major beach area (17). A seaplane landing area is in the vicinity of major beach area (17). The plain inland from major beach area (15) is the best suited area for helicopter landing, but there are potential landing areas elsewhere on the plains or tablelands.

Shore and coastal terrain—The greater part of the segment is bordered by generally sandy shores (major beach areas (15) through (17) and 1 landing place; FIGURES 22–48 through 22–54). There are, however, several sections of rocky cliffs and sandy bluffs, the northernmost stretch of which extends about 15 miles southward from the precipitous headland of Capo Guardafui to Ras Shenaghef, the steep eastern end of a tableland over 2,000 feet high. About 20 miles south of Ras Shenaghef, a large eroded detached hill (FIGURE 22–48) backs a narrow rocky steep-sided terrace which borders the sea. Rocky cliff-bound shores are also found around Ras Binnah, near the center of the segment, and around Ras Hafun, near the southern end of the segment. Scattered ponds, swamps, and lagoons closely back the shores along the central and southern parts of the segment.

The intervening terrain between Capo Guardafui and Ras Shenaghef is a relatively small, elevated, undulating barren sandy area. The southern part of the area is intersected by an intermittent stream near the mouth of which is a landing place.

The coastal terrain south of Ras Shenaghef to the end of the segment is composed of two plains separated near the center by a narrow stream-cut tableland. This tableland terminates in 400-foot cliffs at Ras Binnah (FIGURES 22–49 and 22–50) and extends about 28 miles south-southwestward of the point. The plain lying between Ras Shenaghef and Ras Binnah is bordered by sandy shores; along the southern part is major beach area (15). The plain, narrow in the north, progressively broadens to a width of about 10 miles west of Ras Binnah. This northern plain continues farther southward inland of the narrow tableland.

A sandy shore (major beach area (16); FIGURES 22–49 and 22–50) extends southward from Ras Binnah along the southern coastal plain. South of the end of the tableland which extends southwestward from Ras Binnah, the plain broadens to over 10 miles and extends to the southern limit of the segment (FIGURE 22–51). An isthmus about 15 miles long and between 1,000 yards and 2 miles wide extends eastward from the southern end of the broad plain. It is composed of sand, shells, and mud, and along the southern side there is a sandy shore (major beach area (17); FIGURES 22–51, 22–52, and 22–54) that extends westward to cliffs that form the southern limit of the segment. The hilly promontory at the end of the peninsula is about 14 miles long, between 4 and 10 miles wide, and ranges from 400 to 600 feet in height. Its eastern section is perfectly flat, and the interior is composed of hills and ravines (FIGURE 22–53).

Throughout the segment, the plains are intersected by several broad intermittent streams and a number of small seasonally dry streams, many of which are entrenched in their lower reaches. During the dry periods the mouths of the streams are closed by sandbars, creating many water-filled inlets. There is a large seasonal lagoon close west of Ras Binnah (FIGURE 22–49), and swamps, ponds, and lagoons are scattered along the narrow low areas behind the shores. Rock outcrops and sandy areas, principally drifting dunes, characterize most of the coastal plains (FIGURE 22–51). There are some relatively thick stands of low brush; however, the greater part of the plains are either barren or are covered with scattered grass and brush.

The terrain inland of the coastal plains is composed of high steep escarpments and generally rugged slopes that rise to tablelands and low mountains.

Approaches—The offshore approaches to the segment are in general deep and clear. Scattered rocks, shoals, and sandbars are near the coast, and a wreck is located near the shore about 7½ n. miles southwest of Ras Shenaghef. The 5-fathom curve is not charted as deep water closely approaches the shores; however, depths are generally shoal in the embayments north and south of major beach area (17). In the large embayment on the northern side of the isthmus there are charted depths of less than 1½ fathoms over sand and rocks, and the entrance is reported to be slowly filling up with sand.

Ports and urban areas—The coastal area is sparsely populated. There are several small settlements and villages, but most of the habitations are centered around a very large saltworks in the southern part of the segment. The salt refineries are located in the vicinity of Hordio, situated along the embayment on the north side of the isthmus. The town is small and has about 1,200 inhabitants. By means of an overhead transporter, salt is brought from Hordio across the embayment to warehouses thence by an overhead

conveyor to an offshore loading point near the eastern end of major beach area (17). Dante is a minor port (FIGURE 22–53) and is the only port in the segment. Most of the inhabitants supporting the loading of salt live in huts scattered over the eastern end of the isthmus behind the beach. The present status of the loading facilities is not known. Cargoes are also handled over the shore at Bargal north of major beach area (15).

Routes of communication—Transportation routes are sparse and consist principally of a coastal track with several branches extending westward into the interior. The coastal route, ranging as far as 7 miles inland, passes west of the large detached hill on the plain south of Ras Shenaghef, and then extends through a narrow gorge intersecting the tableland which trends southwestward from Ras Binnah. The village of Tohen in the valley between Capo Guardafui and Ras Shenaghef is joined to Alula (Subsector 3–A) by an unsurfaced road. A short railroad, probably narrow gage, extends northward from Dante along the southwestern side of the hilly promontory.

Cross-country movement over the plains is unobstructed in many places; however, near the shores it is impeded by entrenched streams, swamps, ponds, and lagoons. Rock outcrops may obstruct movement in places, and the sand dunes are generally impassable. Because of escarpments and rugged terrain, egress into the interior from the coastal plains is generally confined to the tracks or the one unsurfaced road extending westward from the coastal route.

Helicopter landing areas—Broad areas on the plain north of Ras Binnah are available for helicopter landings. The sand dunes limit the extent of landing areas on the plain south of Ras Binnah. The principal hazards in the landing areas are entrenched streams, swamps, lagoons, outcroppings of rock, and loose sand. Exits from the helicopter landing areas are cross-country and are good in localized areas, but movement to adjacent areas and into the interior is obstructed by steep escarpments and the rugged mountain slopes. Helicopter landings are also feasible on many parts of the tablelands backing the coastal lowlands (see FIGURE 22–48); however, movement here is seriously impeded by the numerous deep ravines and valleys.

Coastal Segment [2], Major Beach Area (17) to El Meghet (580 coastline miles; USHO Charts 3881 and 3882)

General—The coastal area is a gently sloping plateau or elevated plain about 5 to 25 miles wide in the north and progressively broadening to over 100 miles in the south (FIGURES 22–54 through 22–56, and 22–73 and 22–74). The coast is bordered by rocky slopes, cliffs, and bluffs, which are mostly fringed by rocky or gravel shores, but there are some scattered sandy stretches. Offshore approaches are relatively clear, but the nearshore approaches are partly obstructed by rocks, shoals, and reefs. There are no ports, and only exposed anchorages are available.

The coastal segment is not favorable for amphibious landings primarily because there are only three available landing places, and these are hemmed in between the steep slopes, cliffs, and bluffs bordering the coast; however, the most favored landing place is at Obbia where an unsurfaced road provides movement northward along the coast, and a surfaced road leads inland.

In the north the plateau is generally rugged and is furrowed by many intermittent streams which make cross-country movement difficult. The broad southern part of the plateau is lower and less dissected, and cross-country movement is generally impeded only by sandhills, dunes, and scattered detached hills.

A Class 2 air facility is located about 47 miles west of major beach area (17) and a Class 3 facility is at Gardo about 95 miles farther southwest. There is also a Class 4 airfield at Rocca Littorio about 125 miles northwest of Obbia. In addition to the air facilities, large areas on the broad southern part of the plateau are suitable for the landing of helicopters.

Shore and coastal terrain—The coastal terrain is bordered by a generally unbroken line of rocky slopes, cliffs, and bluffs (FIGURES 22–54 through 22–56), which are highest in the north and become progressively lower toward the south. The coast is steep and is fringed by either gravel or rocky shores; however, there are short stretches of sandy shores (three landing places) at the mouths of stream valleys and along the heads of the numerous coves. The shores of the northern part of the segment between major beach area (17) and El Fosc, a watering hole about 50 miles south of Baia del Negro, are backed by cliffs and bluffs ranging from 250 to 400 feet in elevation. Between El Fosc and El Meghet the cliffs and bluffs, in general, range downward to less than 50 feet, although in places heights are considerably greater. Many of the latter stretches of the bluffs and cliffs rise to long, narrow rocky and sandy terraces backed by high steep rocky escarpments.

The terrain inland behind the cliffs and bluffs is an undulating plateau or elevated plain that gently rises inland and decreases in height from north to south. In the northern part of the segment the plateau reaches inland from 5 to 25

miles to mountains which are penetrated by valleys, the largest of which extends about 65 miles northwestward from the shore at Baia del Negro. The plateau decreases in height southward where it becomes only a slightly elevated plain and progressively broadens to over 100 miles wide west of the town of Obbia. Detached hills are scattered over the plain, and an isolated low mountain lies about 22 miles west of Obbia. High sandhills are scattered over the elevated plain and form long continuous lines near the shores. There are also many broad areas of generally barren sand partly covered with shifting dunes. In the coastal area between major beach area (17) and Baia del Negro, several large intermittent streams have cut broad steep-sided gorges into the plateau, and the terrain adjacent to the cliffs and rocky slopes along the coast is furrowed by many short seasonally dry streams. There is an almost complete absence of streams (see FIGURE 22–56) on the seaward side of the plateau between Baia del Negro and El Meghet; however, the Uebi Scebeli lies far inland at the southern end of the segment and intermittent streams intersect small areas in the interior.

The vegetation in the northern part of the segment is composed of generally sparse stands of grass and low desert brush interspersed with broad areas of barren sand and rock. The greater part of the terrain bordering the sea between Garad, a small village about 70 miles south of Baia del Negro, and El Meghet is generally barren although there is some scattered grass and brush. Progressing westward into the interior, the density of the vegetation increases; the grass supports nomadic stockraising which is the principal livelihood of the natives. Broad fields of grass are enclosed by thickets and hedges set on foundations of raised earth. There is also some subsistence cultivation.

Approaches—The offshore approaches are generally clear, although there are widely separated rocks, shoals, and reefs lying as far as 5½ n. miles from shore. Deep water closely borders long stretches of the coast between major beach area (17) and Obbia, elsewhere the 6-fathom curve is charted and lies mostly within 1 n. mile of the shore but ranges as far as 2¾ n. miles offshore. From Obbia southward to El Meghet the 6-fathom curve ranges as far as 3 n. miles seaward, although the greater part of the curve lies less than 1½ n. miles offshore. Within the 6-fathom curve are scattered shoals and rocks, and parts of the shores are bordered by reefs. In general, the sea approach area is inadequately charted. Charted data should be used with caution, and there may be uncharted dangers.

Ports and urban areas—There are no classified ports; however, cargoes are handled at Bender Beila, about 56 miles south of major beach area (17), and at Obbia. The town of Obbia, with about 2,000 inhabitants, is the largest of several permanently inhabited centers on the coast. South of Baia del Negro there are many wells and waterholes, around which are the portable huts of nomads and seminomads, the principal inhabitants on the plain.

Routes of communication—The shores are closely paralleled by a track, and a network of tracks link many wells and waterholes in the central and southern parts of the segment. Surfaced roads extend into the interior from Bender Beila and from Obbia. Also, an unsurfaced road extends about 133 miles northward from Obbia to the town of El Hamurre. About 65 miles southwest of Obbia, another unsurfaced road, ranging from several hundred yards to about 12 miles inland, extends to Itala, about 43 miles southwest of El Meghet.

Cross-country movement on the plateau between major beach area (17) and Garad is impeded by rugged terrain near the shore that is furrowed by the many intermittent streams. On the plain between Garad and El Meghet cross-country movement is unimpeded over broad areas. The major obstructions are sandhills and dunes; however, the vegetation in the interior is an obstacle, particularly where thickets enclose cultivated areas and pastureland.

Helicopter landing areas—Because of the rugged terrain between major beach area (17) and Garad, helicopter landing areas are available only in scattered places. Between Garad and El Meghet there are extensive landing areas on which the major hazards are sandhills and broad areas of loose sand with dunes. Exits from the helicopter landing areas are generally cross-country.

Coastal Segment [3], El Meghet to Somali Republic – Kenya border (490 coastline miles; USHO Charts 1606 and 3881)

General—The coastal area consists of a broad, gently inclined, flat-to-rolling plain which extends far inland and is mainly covered with brush, although grass and cultivation become prominent in the southwestern half of the segment (FIGURES 22–57 through 22–62C, 22–74 and 22–75). A low interrupted escarpment fronts the plain in the northeastern half of the segment. The shores throughout the segment are predominantly sandy and are backed in most places by sandhills and dunes. Six major beach areas, two minor beach areas, and four landing places have been selected along this coast.

In general, the segment is one of the most suitable in the NIS Area for amphibious operations, although heavy breakers occur on the shores during part of the year, especially during the southwest monsoon. The area best suited for large-scale operations is in the vicinity of Itala. Suitable nearshore bottom slopes, and the availability of roads and tracks, and extensive, relatively flat terrain makes this area most suitable.

Offshore approaches are in general clear; nearshore approaches are partly obstructed by reefs, shoals, islands, and islets. There are a number of open anchorages, but the harbor at Chisimaio affords the only protected anchorage.

A skeletal network of roads and tracks, probably the densest net of the NIS Area, serves the coastal region. Throughout most of the coastal area, cross-country movement is unrestricted except for local obstacles most of which can be easily bypassed. Movement inland for long distances over flat-to-rolling terrain is mostly unimpeded. Classified air facilities, suitable also for helicopter landing areas, include a Class 2 airfield at Mogadiscio and Class 4 facilities at Chisimaio and Gelib. Unclassified seaplane stations are located at Mogadiscio, Brava, and Chisimaio.

Shore and coastal terrain—The predominantly sandy shores (six major beach areas, two minor beach areas, and four landing places; FIGURES 22–57, and 22–59A through 22–62C) are fringed in scattered areas by drying coral reefs and interrupted in places by rocky stretches and marine cliffs which rise from the water's edge. Near the southern extremity of the segment there are scattered areas of fringing mangrove. Immediately backing most of the shores are fairly continuous lines of sandhills and dunes which parallel the shores at short distances inland. Behind these hills and dunes lies a large, relatively flat-to-rolling plain which slopes gently and almost imperceptibly upward to elevations of 1,000 feet about 80 to 120 miles behind the shores.

In the northeastern half of the segment from El Meghet about 240 miles southwest to Brava, fairly regular sandy shores are sporadically interrupted by low cliffy points fringed by rocks. The shores are backed almost throughout by a low escarpment, but in places where the escarpment disappears the sandy shores are backed by low sandy terrain. A break in the escarpment occurs in the vicinity of Itala, a town about 45 miles southwest of El Meghet, where sandy shores (major beach areas (18) through (20); FIGURE 22–57) are backed by low terrain. Between Itala and Mogadiscio, about 85 miles farther southwest, the escarpment again appears and the shores are alternately rocky and sandy (one landing place). Seawalls and embankments front the seaward side of Mogadiscio (FIGURE 22–58), but southwest of the town there is a low sandy stretch (minor beach area *15;* FIGURES 22–59A and 22–59B). The low escarpment extends from Mogadiscio 45 miles southwest to Merca where there are sandy shores (minor beach area *16;* FIGURE 22–60). For the remaining 65-mile stretch of coast from Merca to Brava, the escarpment becomes less prominent and the sandy shores (one landing place) are interrupted by rocky and cliffy patches. Sandy shores again front the coast north and south of Brava (major beach areas (21) and (22), and 2 landing places; FIGURES 22–61 through 22–62B).

Behind the virtually unbroken escarpment stretching from El Meghet southwestward to the vicinity of Brava are long lines of sandhills and dunes, which in places lie at or close behind the shores and interrupt the otherwise flat expanse of the plain. Behind the hills and dunes, however, the partly brush-covered sandy plain extends for considerable distances inland and varies from flat to undulating; rolling terrain is created by the scattered sandhills that dot the plain. Desert and semidesert-type vegetation covers the plain and consists mainly of thorny brush interspersed with large areas of barren sand. Cultivation is limited to small areas immediately surrounding the towns and is restricted to subsistence needs.

The part of the plain from El Meghet to Brava is principally dissected by the perennial river, the Uebi Scebeli. Northwest of Mogadiscio this river flows generally parallel to the coast, then divides into two tributaries at Merca, and southwest of Brava reunites into one main channel. In its lower reaches, the river dissipates in the intermittent marshes and seasonal swamps that flank the river without reaching the sea. Low areas adjacent to the river are subject to inundation during rainy periods and severe flooding is not uncommon. In the valley of the Uebi Scebeli, immediately fringing the riverbanks, there is extensive tree growth and marsh vegetation, and the surrounding plain is cultivated.

In the southwestern half of the segment (from Brava about 250 miles southwestward to the Kenya border) the coastline is very regular between Brava and Chisimaio, about 145 miles to the southwest, but beyond Chisimaio it becomes quite irregular and is broken by numerous cliffs, rivers, and intermittent streams. Between Brava and Chisimaio there is an almost uninterrupted stretch of sandy shore backed by narrow belts of sand dunes and occasional sandhills. At Chisimaio the shores are sandy (major beach area (23); FIGURE 22–62C) but to the southwest, rocky shores fringe the cliffs and elsewhere, the shores are alternately sandy or muddy and fringed by

partly drying coral reefs. Most conspicuous in the southwestern half of the segment is the absence of the low escarpment backing the shore that characterizes much of the northeastern half. In its place, wave-cut dunes give a blufflike appearance to stretches of the coast, which may be mistaken for an escarpment. There is a large mangrove-studded lagoon north of Chisimaio, but most of the fringing mangrove is confined to the creeks and inlets near the southern end of the segment.

Behind the coastal sand dunes is a flat-to-undulating plain extending over 100 miles inland with little change in elevation. The section of the plain from Brava to the Kenya border is more dissected by intermittent streams than the northeastern half and is principally drained by the Fiume Giuba, the largest perennial river in the Somali Republic. This river flows from the north, passes close to the terminating marshes and swamps of the Uebi Scebeli, and empties into the Indian Ocean about 10 miles northeast of Chisimaio. Its valley, like that of the Uebi Scebeli, is cultivated. The vegetation on the plain changes from the desert and semidesert-type found in the northeastern half into broad areas of grassland and brush with a variety of tree growth along the banks of the intermittent streams.

A chain of islands lies 2 to 3 n. miles off the mainland and extends from Chisimaio over 100 miles southwest to the Kenya border. The large islands have sandy shores fringed by reef and covered for the most part by sand dunes and hills. Many of the smaller islands, however, are rocky and barren.

Approaches—In the northeastern half of the segment the offshore approaches are clear. The principal obstruction in the nearshore approaches is an almost continuous fringing reef extending from 1 to 2 n. miles offshore, parts of which uncover at low water. Rocks and shoals lie close inshore in many places and there are a few scattered islets. Where charted, the 6-fathom curve ranges from 500 yards to almost 2 n. miles offshore.

In the southwestern half of the segment offshore approaches are also clear. There are rocks, reefs, and shoals in the vicinity of Brava, but otherwise, nearshore approaches are relatively clear as far southwestward as the vicinity of Chisimaio. From Chisimaio to the Kenya border, a broad fringing reef is the principal obstruction, together with the chain of islands which lie mostly within the 6-fathom curve. The approaches to these islands are obstructed by rocks, shoal patches, and connecting reefs. The 6-fathom curve ranges from 1,500 yards to 5 n. miles offshore.

Ports and urban areas—Mogadiscio, Merca, Brava, and Chisimaio are all minor ports. Mogadiscio, also the capital of the Somali Republic, has the largest population density and is the largest urban area in Sector 3. The remaining areas of permanent population are centered in the small agricultural villages scattered throughout the coastal area. Large segments of population, however, are cattle-raising nomads.

Routes of communication—The coastal zone is served by a track which traverses the length of the segment from 100 yards to about 2 miles inland from El Meghet southwestward to Chisimaio; it lies much farther inland for most of the stretch southwest of Chisimaio. An unsurfaced road roughly parallels the coastal track at variable distances inland throughout most of the segment and serves as a connecting link with the larger towns. Two all-weather surfaced roads extend into the hinterland from Mogadiscio, and a short stretch of surfaced road serves the town of Merca. Elsewhere, numerous tracks branch from the principal coastal track into the hinterland. There are no railroad facilities in the segment.

Another route of inland communication is the Fiume Giuba, the only navigable river in the NIS Area. The entrance to the river is limited by an extensive sandbar which is subject to seasonal as well as yearly change and is variously reported to have a least depth of 3 to 6 feet at high water. Inside the entrance bar, depths range from 7 to 20 feet for several miles upstream, and an estimated average depth of 4 feet prevails for an additional 300 miles or so upstream. The river is perennially navigable by shallow-draft craft for about 23 miles upstream while during the period of March or April through November, craft drawing up to 3 feet can navigate more than 300 miles upstream to Bardera (2°20′N., 42°17′E). Throughout its length, however, navigation is difficult at all times due to shifting channels and sandbars and the tortuous course of the river.

Cross-country movement is generally good and unrestricted for long distances across the almost level plain. Local obstacles to vehicular movement are steep sandhills and dunes, widely spaced streams, marshes, and swamps, and the more dense areas of brush, most of which are located chiefly in the southwestern half of the segment. These obstacles can be bypassed for the most part.

Helicopter landing areas—There are several classified air facilities in the segment which can be used for helicopter landings. These include a Class 2 air facility at Mogadiscio, and Class 4 fa-

cilities at Chisimaio and Gelib, about 60 miles northwest of Chisimaio. Elsewhere, there are numerous areas on the almost flat plain which are suitable as additional landing sites. Exits from the airfields and landing sites are generally easy via cross-country movement or by means of roads and tracks.

b. **Landing beaches**

There are nine major beach areas, (15) through (23); two minor beach areas, *15* and *16;* and eight landing places in Subsector 3–C. The major beaches are located in the vicinity of the large villages of Bargal and Dante in the northern part of this subsector and near Itala, Brava, and Chisimaio in the south part. The minor beaches front Mogadiscio and Merca. The landing places are unevenly distributed along the coast throughout the subsector.

The coasts in this subsector, in general, are unsuited for amphibious landings because of such features as fringing reefs, rocks, banks, cliffs, and dunes. Although no areas along this coast are ideal for amphibious landings, a few beaches and landing places have been selected in areas where approaches, exits, and beach characteristics most nearly meet the requirements for amphibious landings.

Major beach area (18) is considered best suited for amphibious landings in spite of minor obstructing features in the nearshore approaches. The beach has *moderate* to *gentle* bottom slopes and good exits to unsurfaced roads.

One major beach is 27 miles long, and the remaining beaches range from 1¼ to 8 miles in length. A few beaches have interruptions. The beach widths at low water levels range from 30 to 300 yards; widths at high water range from 10 to 30 yards. The beach gradients in the low water to high water zone range from *steep* to *flat,* and in the high water zone the gradients are *steep.* The beach material is sand which is *firm* in the wetted area and *soft* where dry.

The offshore approaches to nearly all of the beaches are clear. The nearshore approaches to about half of the beaches are clear; the remaining beaches are partly obstructed. The nearshore bottom material off the beaches consists of sand or sand mixed with rocks, shells, coral, or mud. Nearshore bottom slopes range from *moderate* to *flat.* Anchorages are in the vicinity of nearly all of the beaches.

Spring tides range from 5½ to 9 feet in this subsector. The expected average occurrence of surf 4 feet or greater on the beaches ranges from 4% to 20% of the time during November through March, 9% to 47% April and May, 12% to 76% June through August, and 9% to 56% September and October.

In general, the beaches are backed by dunes on wide, sandy, partly brush-covered plains which extend inland to plateaus partly covered with brush. The east half of major beach (17) lies on a narrow isthmus. There are villages in the vicinity of all of the beaches. Exit from the beaches is by cross-country movement to coastal tracks. Unsurfaced roads lead inland from a few of the beaches. A mining railroad leads inland behind major beach area (17). A Class 4 airfield is in the vicinity of major beach (23). There are unclassified seaplane stations near approximately half the beaches. Minor ports are located at or near one-third of the beaches.

The minor beaches are 500 and 1,100 yards in length. These sandy beaches range from 50 to 110 yards at low water and at high water levels from 15 to 25 yards. The nearshore bottom slopes are *gentle* and *mild.* The offshore approaches are clear, and the nearshore approaches are partly obstructed by a reef or shoals. The nearshore bottom material is sand and probably coral. Anchorage is available off minor beach *16.*

The minor beaches are backed by sandy, partly brush-covered plains containing dunes and extending inland to plateaus partly covered with brush. There are villages in the vicinity of the beaches. Exit from the minor beaches is by cross-country movement to a coastal track and surfaced roads. A Class 2 airfield and an unclassified seaplane station are at beach *15.* Minor ports are located at both of the beaches.

In general, the approaches to the landing places are clear. The landing places are backed by steep slopes or narrow sandy plains. Exits are by cross-country movement to coastal tracks or unsurfaced roads. Villages or buildings are in the vicinity of a few of the landing places. An unclassified airfield and an unclassified seaplane station are located near the landing place at Obbia.

Tabular descriptions for the major beaches are given in FIGURE 22–12 and for the minor beaches in FIGURE 22–13. Locations of the major and minor beaches and landing places are shown on the location maps, FIGURES 22–73 through 22–75.

FIGURE 22–12. MAJOR BEACH AREAS
(Map references:

BEACH NUMBER AND LOCATION	LENGTH AND USABLE LENGTH	WIDTHS: AT L.W.; AT H.W.	BEACH GRADIENTS: L.W. TO H.W.; H.W. ZONE	APPROACH
(15) Centered 7½ mi. NW. of Ras Binnah on E. coast of Somali Republic, between 11°16′N., 51°04′E. and 11°10′N., 51°06′E. (FIGS. 22–49 and 22–50) (Reliability: FAIR)	8 mi.; concave; terminated to N. by wadi mouth and to S. where backed by lagoon; interrupted by wadies; all usable.	75 to 100 yd. at L.W.; 15 to 20 yd. at H.W.	1 on 30 to 1 on 45, L.W. to H.W.; 1 on 10 or steeper in H.W. zone.	Nearshore bottom slopes *gentle* to *flat* shoreward of discontinuous 18-ft. depth contour 315 to 1,260 yd. off H.W. line; offshore approach clear; nearshore approach clear but flanked by submerged sandbars; bottom sand; anchorage in 39-ft. depth 1 n. mi. NE. of N. end, bottom sand.
(16) Centered 15½ mi. S. of Ras Binnah, between 10°59′N., 51°06′E. and 10°53′N., 51°06′E. (FIGS. 22–49 and 22–50). (Reliability: FAIR)	7 mi.; straight; terminated by wadi mouths; interrupted by several wadies; all usable.	70 to 300 yd. at L.W.; 20 to 30 yd. at H.W.	1 on 25 to 1 on 145, L.W. to H.W.; 1 on 10 or steeper in H.W. zone.	Nearshore bottom slopes *mild* to *flat* shoreward of 18-ft. depth contour 630 to 1,575 yd. off H.W. line; approaches clear; bottom sand.
(17) Centered 23 mi. W. of Ras Hafun, between 10°25′N., 51°15′E. and 10°18′N., 50°53′E. (FIG. 22–52) (Reliability: FAIR)	27 mi.; concave; terminated to E. by groin and to W. where backed by rocky shore; interrupted by wadi mouth; all usable.	50 to 100 yd. at L.W.; 20 to 30 yd. at H.W.	1 on 20 to 1 on 40, L.W. to H.W.; 1 on 10 or steeper in H.W. zone.	Nearshore bottom slopes *mild* to *flat* shoreward of 6-ft. depth contour 200 to 600 yd. off H.W. line of E. part, and *moderate* to *flat* shoreward of discontinuous 36-ft. depth contour 350 yd. to 2½ n. mi. off H.W. line; offshore approach restricted to bay and clear; nearshore approach partly obstructed by aerial conveyor towers off E. part and flanked to E. by shoal area; bottom sand, rocks, mud, and shells; anchorage in 31- to 40-ft. depths about 1¼ n. mi. off H.W. line of E. end, bottom sand, mud, and shells.
(18) Centered 6¾ mi. NE. of Ras Mallable, between 2°48′N., 46°23′E. and 2°46′N., 46°21′E. (FIG. 22–57) (Reliability: FAIR)	3¾ mi. slightly concave; terminated to NE. by rocks and to SW. by reef; all usable.	80 to 120 yd. at L.W.; 20 to 25 yd. at H.W.	1 on 30 to 1 on 45, L.W. to H.W.; 1 on 10 or steeper in H.W. zone.	Nearshore bottom slopes *moderate* to *gentle* shoreward of discontinuous 6-ft. depth contour 80 to 200 yd. off H.W. line; 18-ft. depth contour 800 yd. to 1¼ n. mi. off H.W. line; 36-ft. depth contour 1¾ to 2¼ n. mi. off H.W. line; offshore approach clear; nearshore approach partly obstructed by shoal with least depth of 18 ft., 1¾ n. mi. off center part and by reef 1,700 yd. off SW. part and flanked by rocks and reef; bottom sand and mud; anchorage in 22- to 27-ft. depths 1,500 yd. off SW. part, bottom sand and coral.

NOTE Beach lengths and distances along the coast and inland are expressed in statute miles; distances across water are expressed in nautical miles except when referring to beach locations. Italicized words refer to terms defined in Subsection A, 4, d.

OF COASTAL SUBSECTOR 3-C
FIGURES 22-73 *through* 22-75)

SURF AND TIDAL RANGE	MATERIAL AND FIRMNESS	TERRAIN IMMEDIATELY BEHIND BEACH	EXITS AND COMMUNICATIONS INLAND
Surf 4 ft. or greater can be expected to occur 20% of the time Nov.–Mar., 9% Apr.–May, 12% June–Aug., and 9% Sept.–Oct.; tidal range 5½ ft., springs.	Sand; *firm* in wetted area, *soft* where dry.	Backed by sandy, partly brush-covered plain drained by wadies and extending as far as 9 mi. inland to escarpment rising to partly brush-covered plateau dissected by valleys; Bargal 1,320 yd. N. of N. end; village close behind S. part.	Exit cross-country as far as 3½ mi. to coastal track; another track leads inland from near N. end.
Surf 4 ft. or greater can be expected to occur 19% of the time Nov.–Mar., 9% Apr.–May, 12% June–Aug., and 9% Sept.–Oct.; tidal range 5½ ft., springs.	Sand; *firm* in wetted area, *soft* where dry.	Backed by sandy, partly brush-covered plain drained by several wadies and extending as far as 2½ mi. inland to escarpment rising to partly brush-covered plateau dissected by valleys.	Exit cross-country as far as 1½ mi. to coastal track.
Surf 4 ft. or greater can be expected to occur 4% of the time Nov.–Mar., 21% Apr.–May, 38% June–Aug., and 38% Sept.–Oct.; tidal range 5½ ft., springs.	Sand; *firm* in wetted area, *soft* where dry.	E. half on sandy, partly brush-covered isthmus 1 to 2 mi. wide; W. half of beach backed by sandy, partly brush-covered plain drained by wadies and extending as far as 14 mi. inland to escarpment rising to partly brush-covered plateau dissected by valleys; Dante close behind E. part; village close behind W. part.	Exit cross-country 165 to 990 yd. to coastal track; other tracks lead inland behind W. part; mining RR. at Dante; unclassified seaplane station in bay off Dante; minor port at Dante.
Surf 4 ft. or greater can be expected to occur 10% of the time Nov.–Mar., 28% Apr.–May, 49% June–Aug., and 38% Sept.–Oct.; tidal range 6 ft., springs.	Sand; *firm* in wetted area, *soft* where dry.	Backed by extensive sandy plain partly covered with brush, containing dunes and isolated hills, and extending up to 100 mi. inland to brush-covered plateau; Itala 900 yd. SW. of SW. end.	Exit cross-country as far as 650 yd. to coastal track; unsurfaced roads lead NE. and inland from Itala.

FIGURE 22-12. MAJOR BEACH AREAS,

BEACH NUMBER AND LOCATION	LENGTH AND USABLE LENGTH	WIDTHS: AT L.W.; AT H.W.	BEACH GRADIENTS: L.W. TO H.W.; H.W. ZONE	APPROACH
(19) Centered 3½ mi. NE. of Ras Mallable, at 2°45′N., 46°20′E. (FIG. 22–57) (Reliability: FAIR)	1½ mi.; slightly concave; terminated to NE. by sandy point fronted by reef and to SW. by fringing reef; all usable.	100 to 150 yd. at L.W.; 15 to 25 yd. at H.W.	1 on 40 to 1 on 60, L.W. to H.W.; 1 on 10 or steeper in H.W. zone.	Nearshore bottom slopes *moderate* to *flat* shoreward of 6-ft. depth contour 65 to 550 yd. off H.W. line; 18-ft. depth contour 875 to 1,450 yd. off H.W. line; offshore approach clear; nearshore approach partly obstructed by reef about 1 n. mi. off NE. part and flanked by rocks and reefs; bottom sand, rocks, and coral; anchorage in 22-ft. depth 1,500 yd. off center part and another anchorage in 30-ft. depth about 1½ n. mi. SE. of SW. end; bottoms sand.
(20) Centered 2¾ mi. SW. of Ras Mallable, between 2°42′N., 46°18′E. and 2°40′N., 46°15′E. (FIG. 22–57) (Reliability: FAIR)	3½ mi.; straight; terminated to NE. by fringing reef and to SW. where fronted by rocks; all usable.	75 to 100 yd. at L.W.; 20 to 30 yd. at H.W.	1 on 25 to 1 on 35, L.W. to H.W.; 1 on 10 or steeper in H.W. zone.	Nearshore bottom slopes *flat* shoreward of 36-ft. depth contour 1,950 yd. to 1¼ n. mi. off H.W. line; offshore approach clear; nearshore approach clear but flanked to NE. by fringing reef and to SW. by rocks; bottom sand and coral; anchorage in 30-ft. depths 3 n. mi. NE. of NE. end, bottom sand.
(21) Centered 2¾ mi. SW. of Ras Dai, between 1°10′N., 44°08′E. and 1°08′N., 44°05′E. (FIG. 22–61) (Reliability: FAIR)	4 mi.; straight; terminated to NE. by rocky point and to SW. where beach narrows; all usable.	30 to 200 yd. at L.W.; 10 to 30 yd. at H.W.	1 on 10 to 1 on 70, L.W. to H.W.; 1 on 10 or steeper in H.W. zone.	Nearshore bottom slopes *flat* shoreward of 36-ft. depth contour 1¼ n. mi. off H.W. line; offshore approach clear; nearshore approach partly obstructed by exposed rocks 1,000 to 1,700 yd. off H.W. line of NE. and SW. parts, respectively, and flanked to NE. by rocky point; bottom sand and prob. rocks; anchorage in bay about 1¼ n. mi. to NE., depth and bottom unknown.
(22) Centered 11¼ mi. SW. of Ras Dai, between 1°05′N., 44°02′E. and 1°04′N., 44°00′E. (FIG. 22–62B) (Reliability: FAIR)	2 mi.; straight; terminated to NE. by reef-fringed point and to SW. where fronted by rocks; all usable.	60 to 100 yd. at L.W.; 15 to 30 yd. at H.W.	1 on 20 to 1 on 30, L.W. to H.W.; 1 on 10 or steeper in H.W. zone.	Nearshore bottom slopes *mild* shoreward of 18-ft. depth contour 500 to 700 yd. off L.W. line of NE. part and unknown off remainder; offshore approach clear; nearshore approach clear but flanked to SW. by rocks and to NE. by reef-fringed point and reef-fringed islet; bottom sand; anchorage in 60 ft. depth 1 n. mi. NE. of NE. end, bottom sand and shells.
(23) Chisimaio, at 0°22′S., 42°33′E. (FIG. 22–62C) (Reliability: FAIR)	1¼ mi.; concave; terminated to E. by pier and to W. by fringing reef; interrupted near E. end by pier; all usable.	35 to 110 yd. at L.W.; 10 to 20 yd. at H.W.	1 on 10 to 1 on 30, L.W. to H.W.; 1 on 10 or steeper in H.W. zone.	Nearshore bottom slopes *moderate* to *flat* shoreward of 6-ft. depth contour 35 to 400 yd. off L.W. line; 18-ft. depth contour 1,000 yd. to 1 n. mi. off L.W. line; offshore approach restricted to passages through barrier reef and partly obstructed by scattered shoals and reef patches as far as 6 n. mi. off L.W. line; nearshore approach restricted to bay and partly obstructed by pier near E. end, and by wrecks and submerged and exposed rocks, flanked to E. by reef-fringed island and rocks and to W. by rocks; bottom sand and rocks; anchorage in 20- to 30-ft. depths in bay, bottom prob. sand.

NOTE Beach lengths and distances along the coast and inland are expressed in statute miles; distances across water are expressed in nautical miles except when referring to beach locations. Italicized words refer to terms defined in Subsection A, 4, d.

SUBSECTOR 3-C (*Continued*)

SURF AND TIDAL RANGE	MATERIAL AND FIRMNESS	TERRAIN IMMEDIATELY BEHIND BEACH	EXITS AND COMMUNICATIONS INLAND
Surf 4 ft. or greater can be expected to occur 15% of the time Nov.–Mar., 28% Apr.–May, 49% June–Aug., and 38% Sept.–Oct.; tidal range 6 ft., springs.	Sand; *firm* in wetted area, *soft* where dry.	Backed by extensive sandy plain partly covered with brush, containing dunes and isolated hills, and extending up to 100 mi. inland to partly brush-covered plateau; Itala close behind NE. part.	Exit cross-country 660 yd. to coastal track; unsurfaced roads lead NE. and inland from Itala.
Surf 4 ft. or greater can be expected to occur 15% of the time Nov.–Mar., 28% Apr.–May, 49% June–Aug., and 38% Sept.–Oct.; tidal range 6 ft., springs.	Sand; *firm* in wetted area, *soft* where dry.	Backed by extensive sandy plain, partly covered with brush, containing dunes and isolated hills, and extending up to 100 mi. inland to partly brush-covered plateau; village 800 yd. behind SW. end; Itala 4½ mi. NE. of NE. end.	Exit cross-country as far as 1,700 yd. to coastal track; movement farther inland cross-country 1,300 yd. to 1¼ mi. to another coastal track.
Surf 4 ft. or greater can be expected to occur 17% of the time Nov.–Mar., 47% Apr.–May, 76% June–Aug., and 56% Sept.–Oct.; tidal range 7 ft., springs.	Sand; *firm* in wetted area, *soft* where dry.	Backed by extensive sandy plain partly covered with brush, containing dunes and areas of swamp, and extending up to 100 mi. inland to partly brush-covered plateau; Brava 4 mi. SW. of SW. end.	Exit cross-country 1,000 yd. to coastal track; movement farther inland cross-country 5 mi. to unsurfaced road; other tracks lead inland from unsurfaced road; unclassified seaplane station at Brava; minor port at Brava.
Surf 4 ft. or greater can be expected to occur 17% of the time Nov.–Mar., 47% Apr.–May, 76% June–Aug., and 56% Sept.–Oct.; tidal range 7 ft., springs.	Sand; *firm* in wetted area, *soft* where dry.	Backed by extensive sandy plain partly covered with brush, containing dunes and areas of swamp, and extending up to 100 mi. inland to partly brush-covered plateau; brush- and tree-covered hills 2½ mi. inland; Brava 1½ mi. NE. of NE. end.	Exit cross-country 1,000 yd. to coastal track; unsurfaced road leads inland from Brava; unclassified seaplane station at Brava; minor port at Brava.
Surf 4 ft. or greater can be expected to occur 7% of the time Nov.–Mar., 45% Apr.–May, 76% June–Aug., and 55% Sept.–Oct.; tidal range 7.5 ft., springs.	Sand; *firm* in wetted area, *soft* where dry; rock patch in E. part.	Backed by extensive sandy plain partly covered with grass, brush, and trees and containing dunes and areas of swamp; Chisimaio close behind beach.	Exit cross-country to streets; unsurfaced road leads NE. and track to SW. from Chisimaio; Class 4 airfield 7 mi. to N.; unclassified seaplane station at Chisimaio; minor port at Chisimaio.

FIGURE 22–13 MINOR BEACH AREAS OF COASTAL SUBSECTOR 3–C
(*Map references:* FIGURES 22–73 *through* 22–75)

NUMBER AND LOCATION	REMARKS
15. Centered 4 mi. SW. of Mogadiscio on E. coast of Somali Republic, at 2°00′N., 45°18′E. (FIGS. 22–59A and 22–59B) (Reliability: GOOD)	500 yd.; concave; sand; 50 to 75 yd. wide at L.W. and 15 to 20 yd. at H.W.; nearshore bottom slopes *gentle;* offshore approach clear; nearshore approach partly obstructed by drying reef reported about 250 yd. off H.W. line and flanked by rocky points; bottom sand and prob. coral; beach backed by extensive sandy plain partly covered with brush, containing dunes, and extending inland up to 100 mi. to partly brush-covered plateau; scattered buildings behind beach; Mogadiscio 4 mi. to NE.; exit cross-country as far as 1 mi. to coastal track; other tracks lead to Mogadiscio; surfaced roads lead inland from Mogadiscio; Class 2 airfield close behind beach; unclassified seaplane station off beach; minor port at Mogadiscio.
16. Merca, at 1°42′N., 44°46′E. (FIG. 22–60) (Reliability: FAIR)	1,100 yd.; concave; sand; 85 to 110 yd. wide at L.W. and 15 to 25 yd. at H.W.; nearshore bottom slopes *mild;* offshore approach clear; nearshore approach restricted to narrow passages in reef about 700 yd. off H.W. line and partly obstructed by scattered shoals with least depth of 2½ ft. and flanked to NE. by reef, shoals, and pier and to SW. by rocks and reefs; bottom sand and prob. coral; anchorage in 66- to 90-ft. depths about 1,000 yd. off beach, bottom sand and coral; beach backed by extensive sandy plain partly covered with brush, containing dunes and areas of swamp, and extending up to 100 mi. inland to partly brush-covered plateau; Merca close behind NE. part; exit cross-country as far as 300 yd. to surfaced road; movement farther inland by network of roads; minor port at Merca.

Next 2 Page(s) In Document Exempt

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MORI BUNDLE # _____

# of Missing Pages 13

DATE 9/08/15

FIGURES 22-1 THRU 22-13

PAGE

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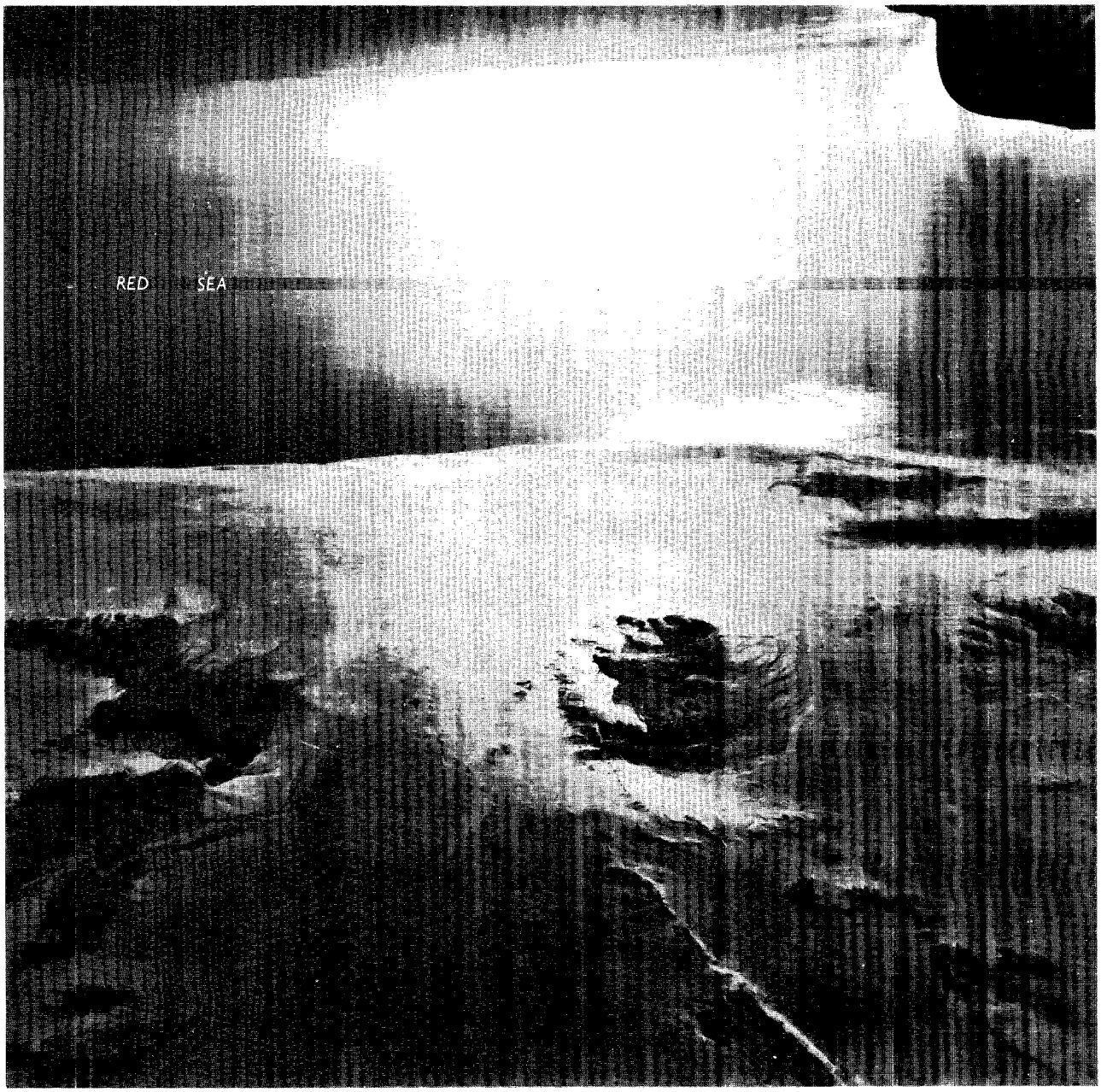
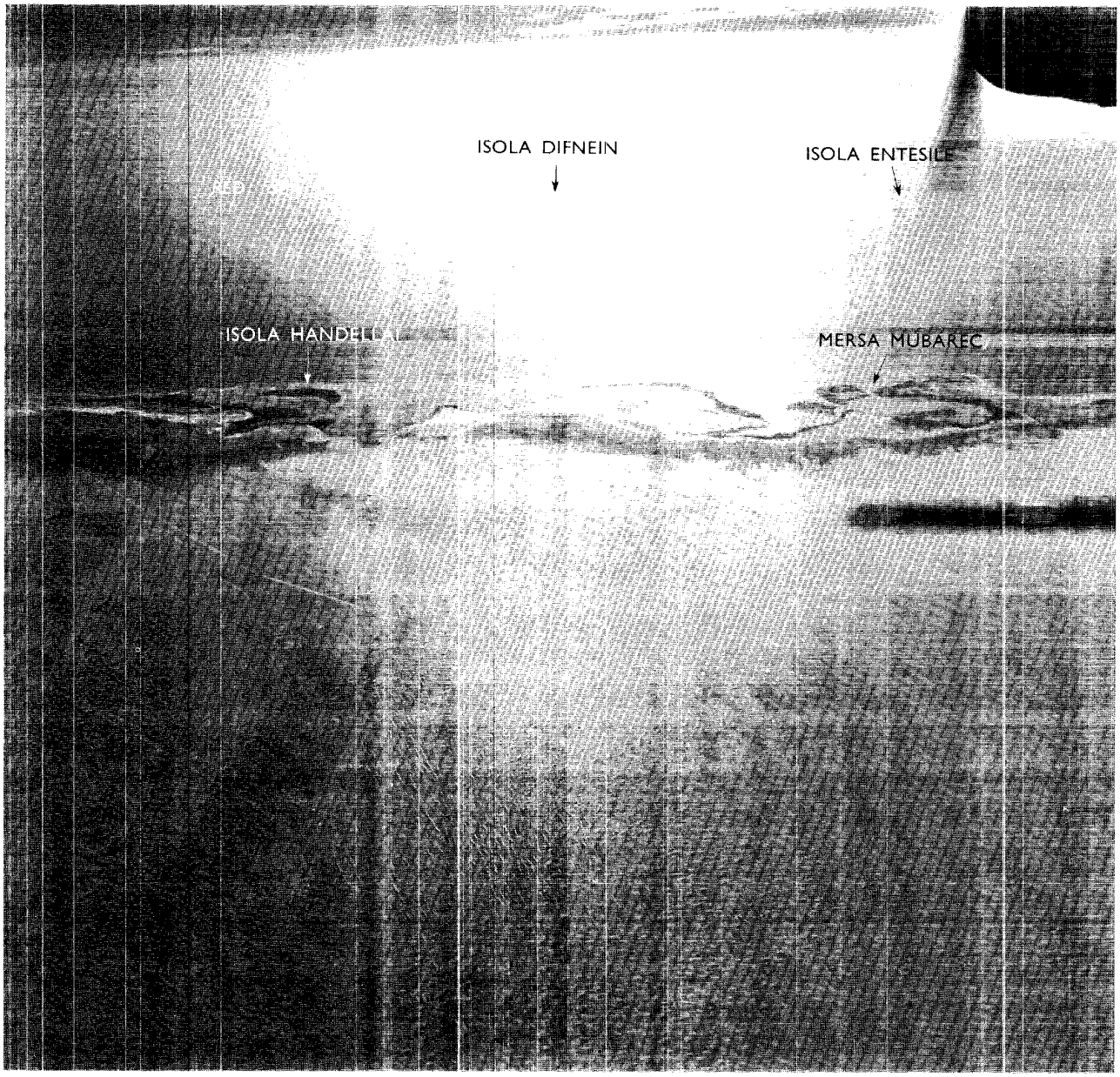
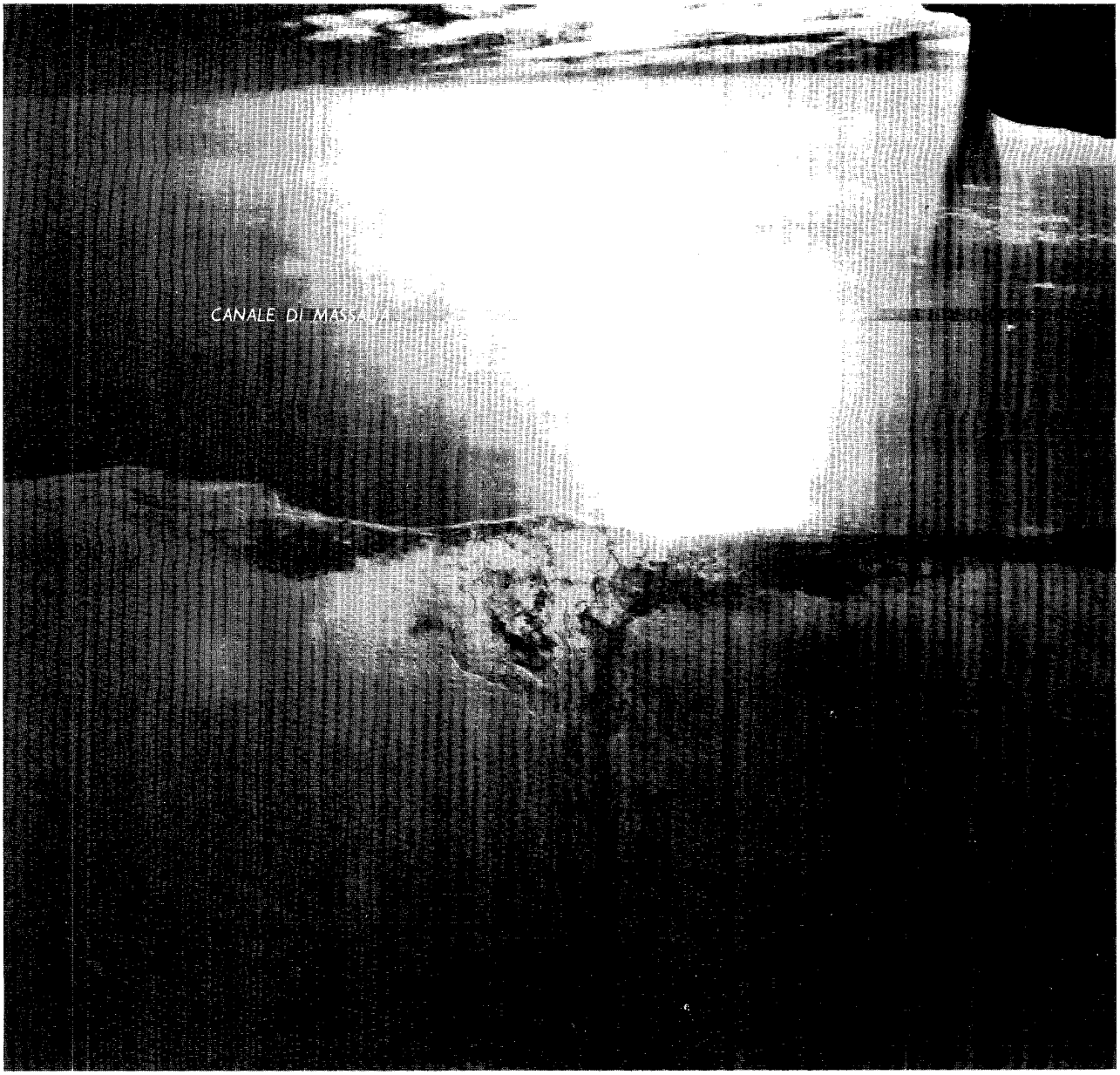
Approved For Release 1999/09/24 : CIA-RDP85-00671R000200100001-0



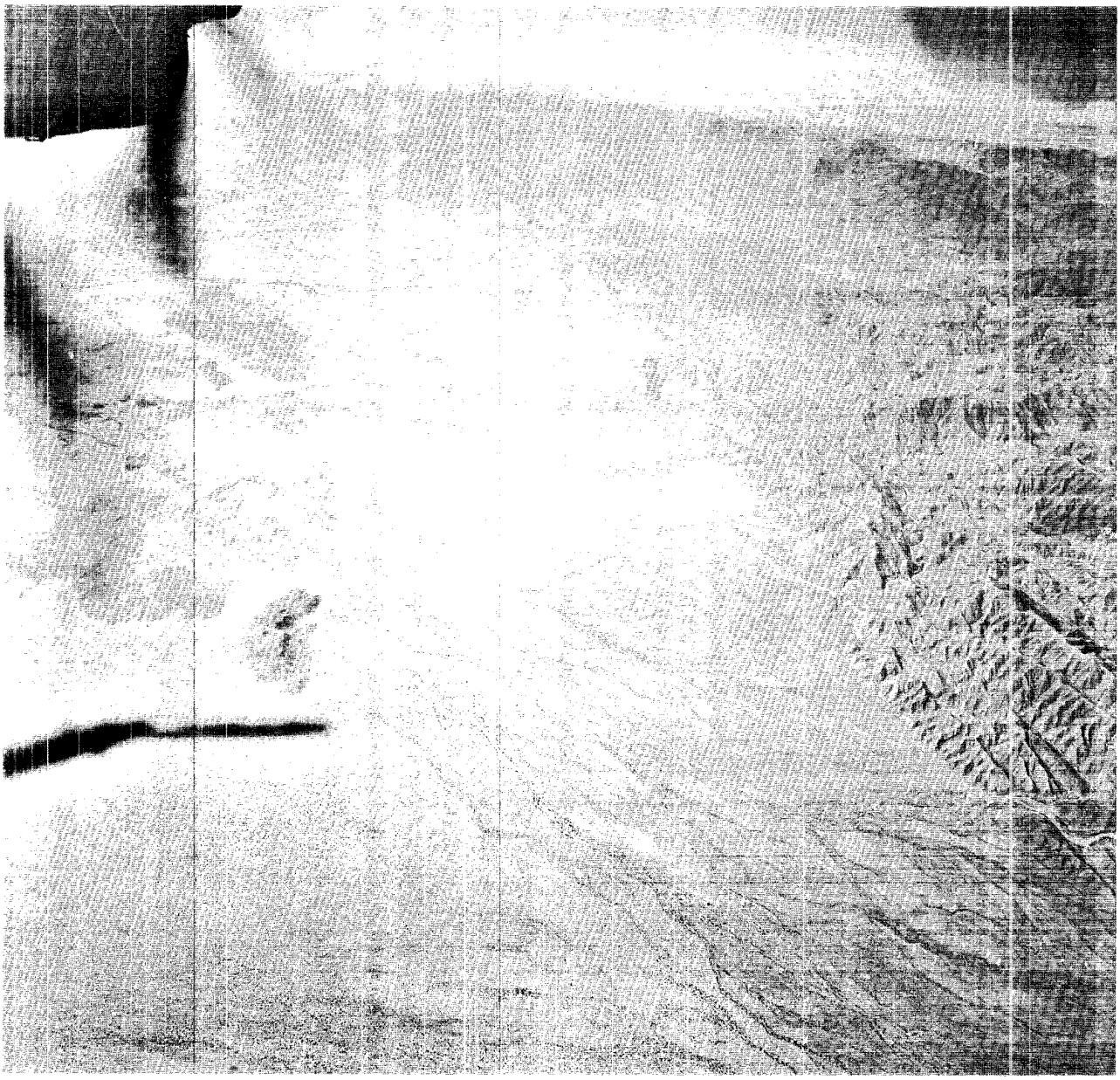
SECTOR 1, SEGMENT [1]. NORTHERN COAST OF ETHIOPIA. Oblique view looking northeast showing isolated hills on the coastal plain. Approximate position 16°59'N., 39°03'E.



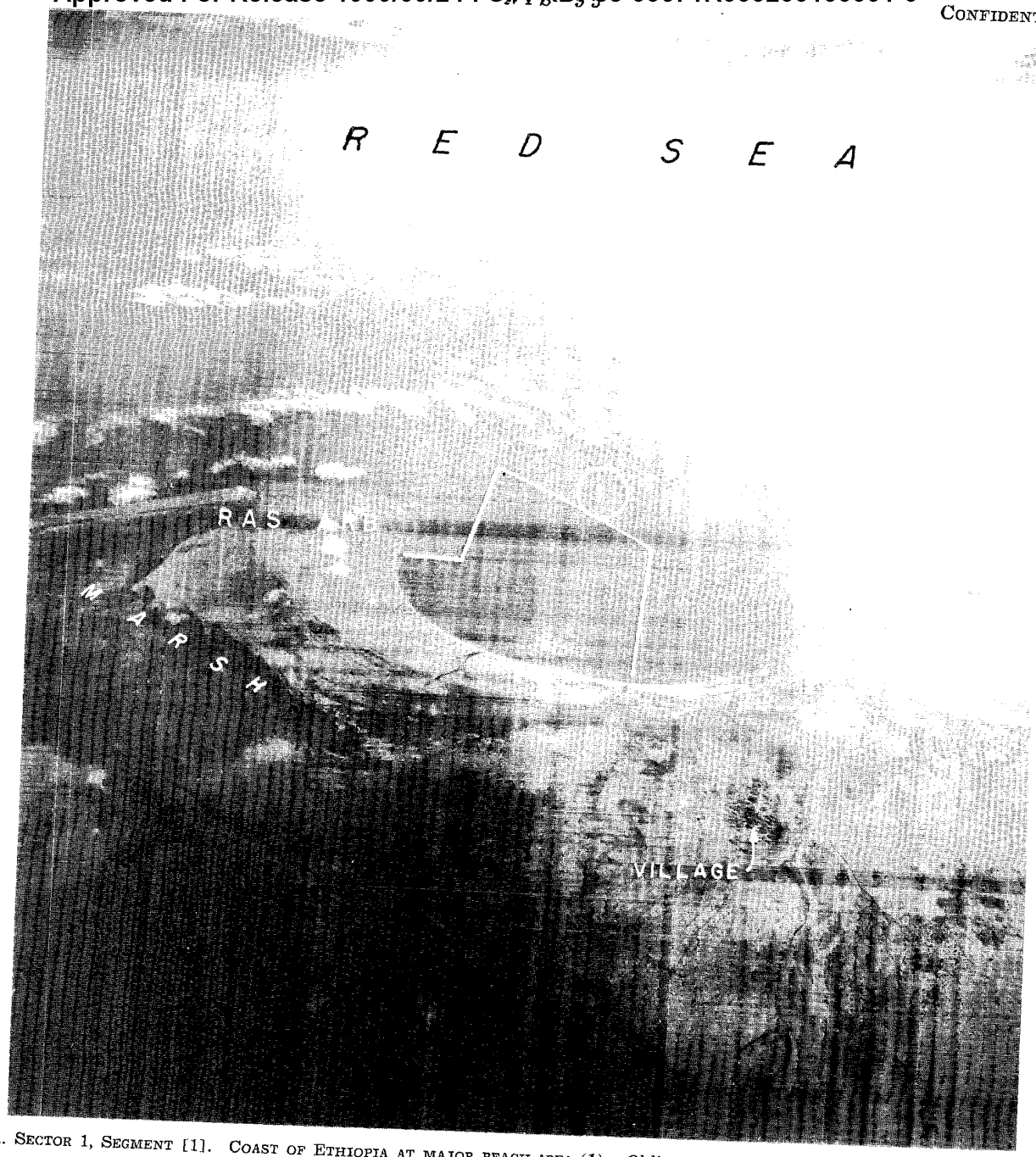
SECTOR 1, SEGMENT [1]. NORTHERN COAST OF ETHIOPIA NEAR MERSA MUBAREC. Oblique view looking east showing areas of mangrove swamp (black areas on the photo) and marsh (dark gray) bordering the shore. Linear sand ridges rise above the plain behind the shore. Approximate position 16°31'N., 39°08'E.



SECTOR 1, SEGMENT [1]. COAST OF ETHIOPIA ABOUT 17 MILES SOUTH OF MERSA MUBAREC. Oblique view looking northeast showing broad entrenched stream dissecting plain, flanked by sand ridges and dunes. Marshy areas lie near the shores. Approximate position 16°17'N., 39°12'E.

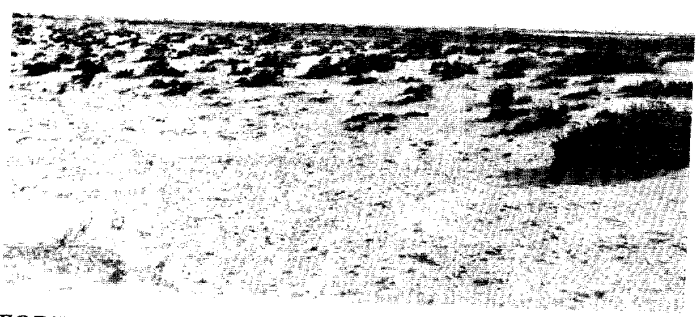


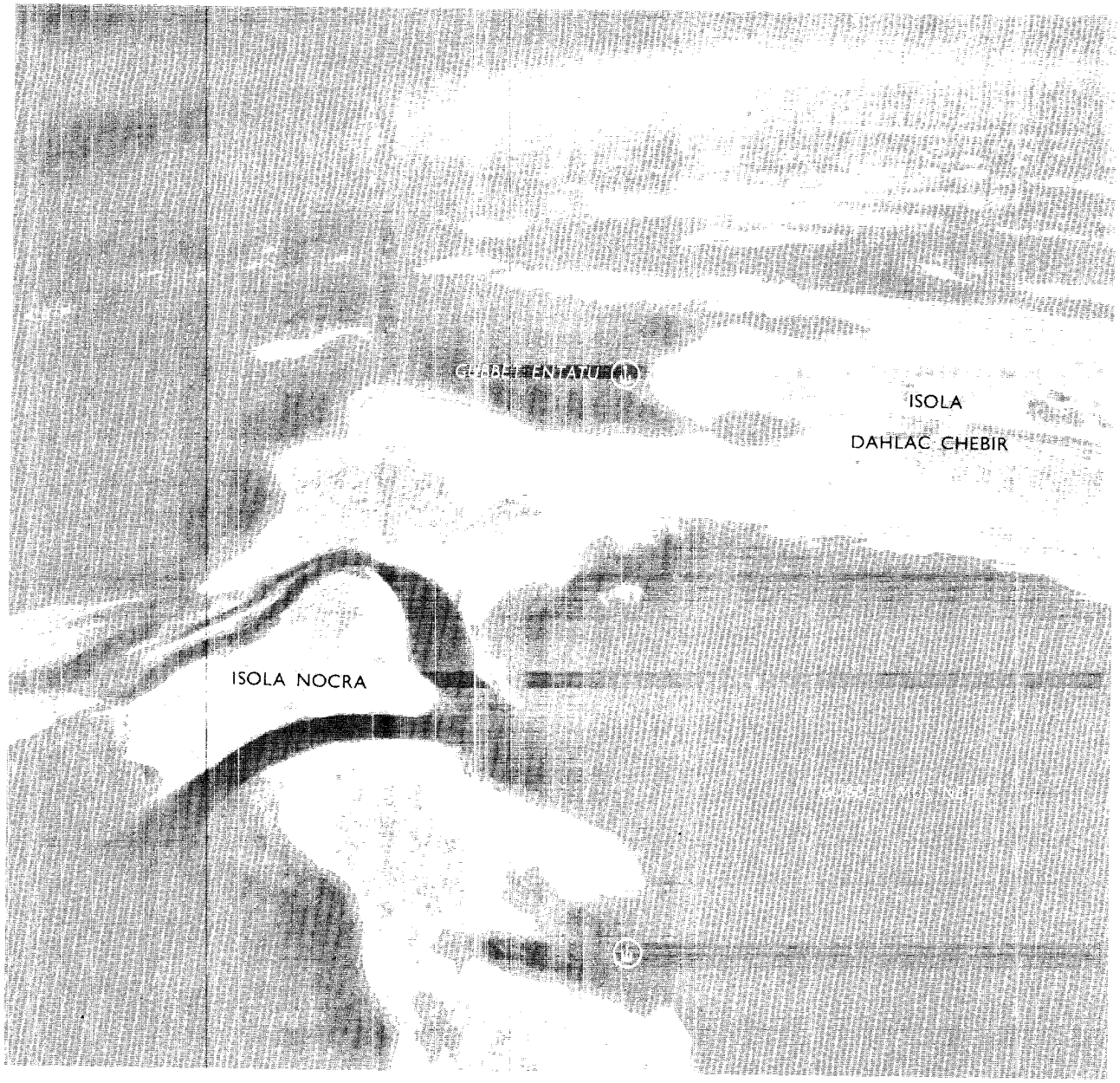
SECTOR 1, SEGMENT [1]. ETHIOPIAN COAST INLAND FROM RAS ARB. Oblique view looking west showing part of the coastal plain and the mountainous plateau backing it. Note areas of cultivation on the plain. Approximate position 15°45'N., 39°10'E.



A. SECTOR 1, SEGMENT [1]. COAST OF ETHIOPIA AT MAJOR BEACH AREA (1). Oblique view northeast. Approximate position 15°45'N., 39°27'E.

B. SECTOR 1, SEGMENT [1]. ETHIOPIAN COAST AT MAJOR BEACH AREA (2). Ground view looking west showing scattered clumps of grass and brush which is the characteristic cover of most of this Segment. Approximate position 15°41'N., 39°28'E. April 1957.



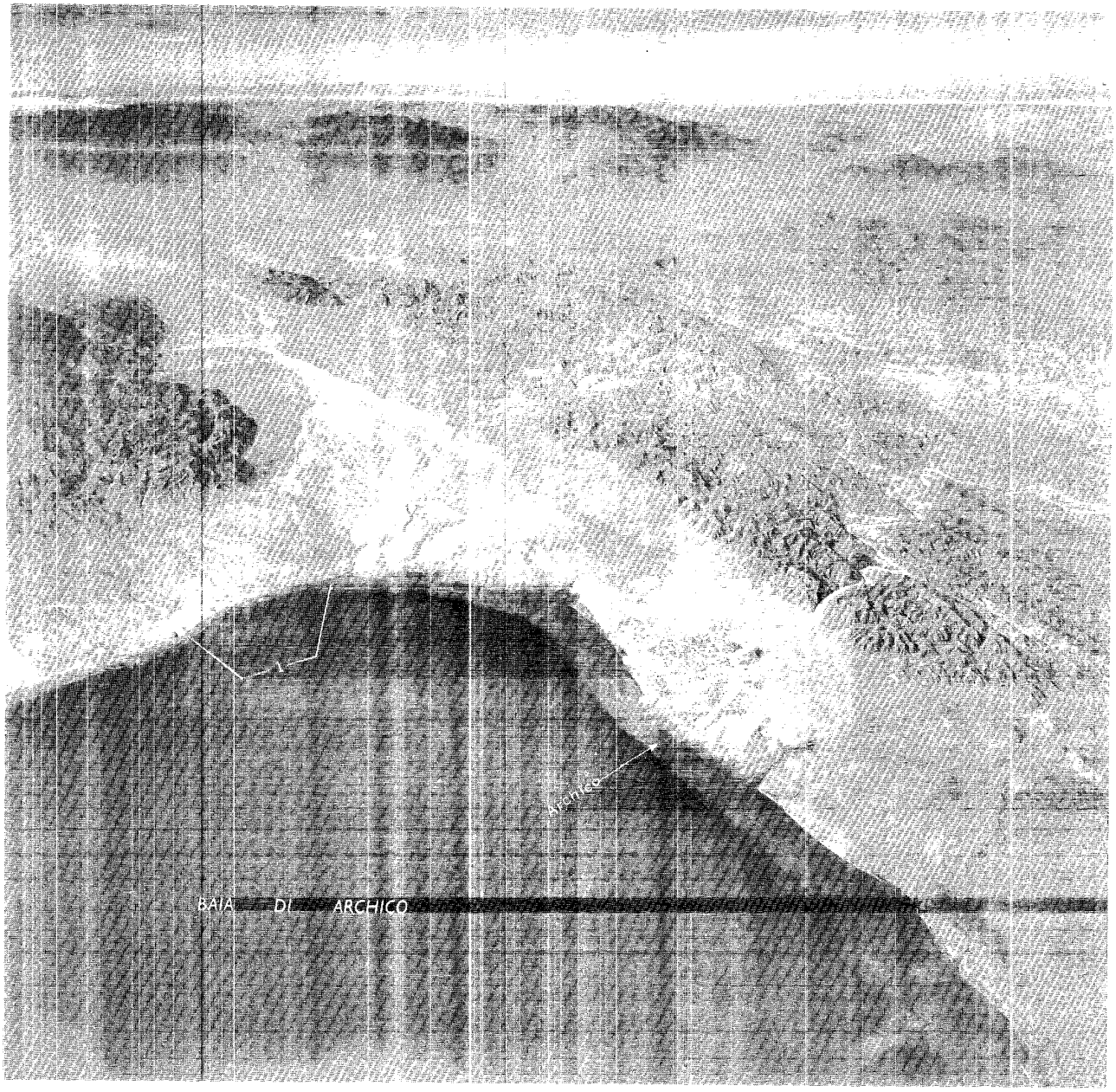


SECTOR 1, SEGMENT [2]. ISOLA DAHLAC CHEBIR OFF COAST OF ETHIOPIA. Oblique view looking north. Approximate position 15°42'N., 39°59'E.

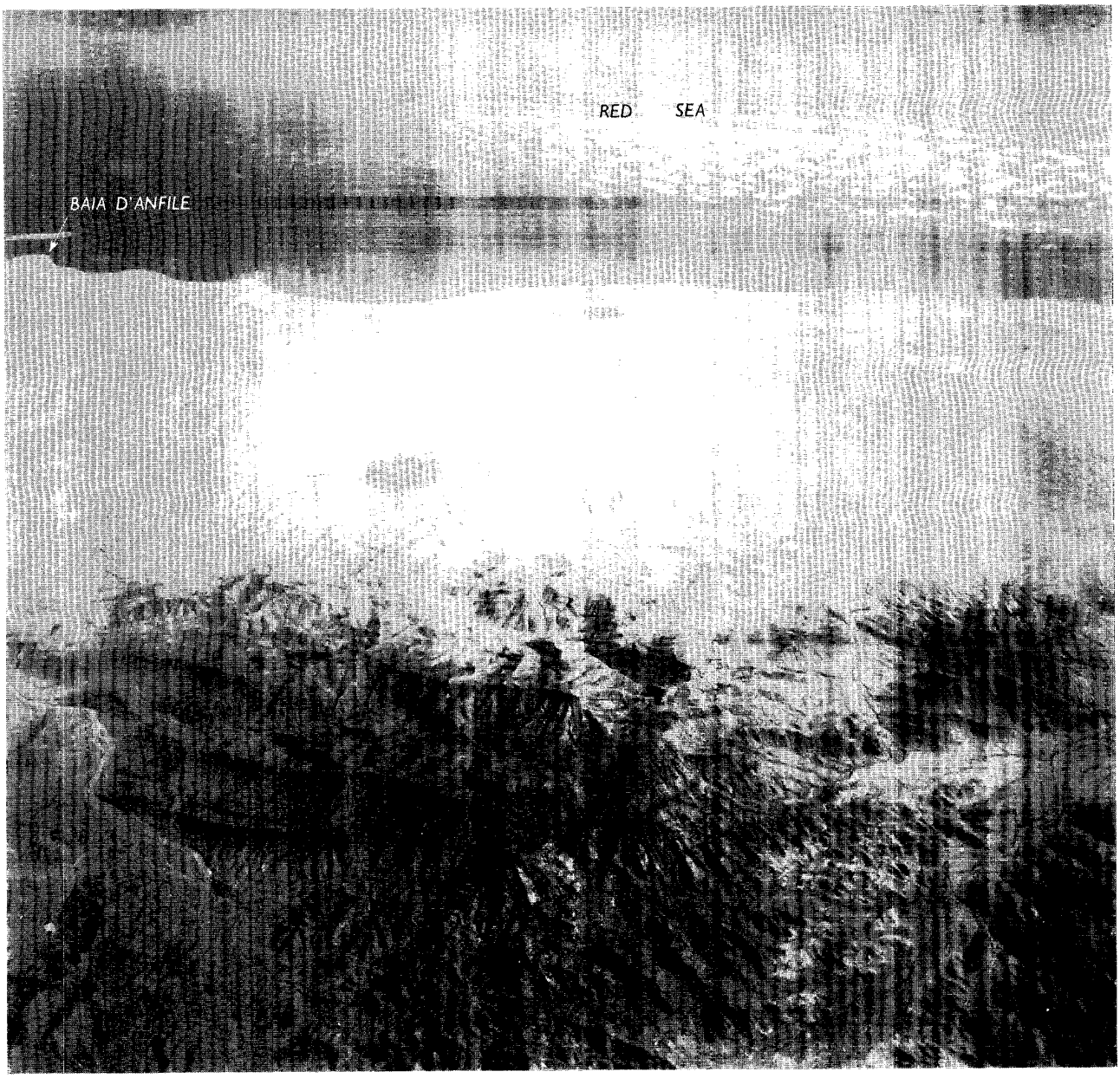
SECTOR 1, SEGMENT [2]. SOUTHWESTERN PART OF THE ISOLE DAHLAC OFF COAST OF ETHIOPIA. Oblique view looking south showing reef-fringed islands with southeastern end of Isola Norah in lower foreground and Isola Dahlac Chebir in center background. Approximate position 15°47′N., 40°05′E.

SECTOR 1, SEGMENT [2]. ISOLA SCIUMMA OFF ETHIOPIAN COAST. Oblique view looking southwest. Approximate position 15°32'N., 40°01'E.

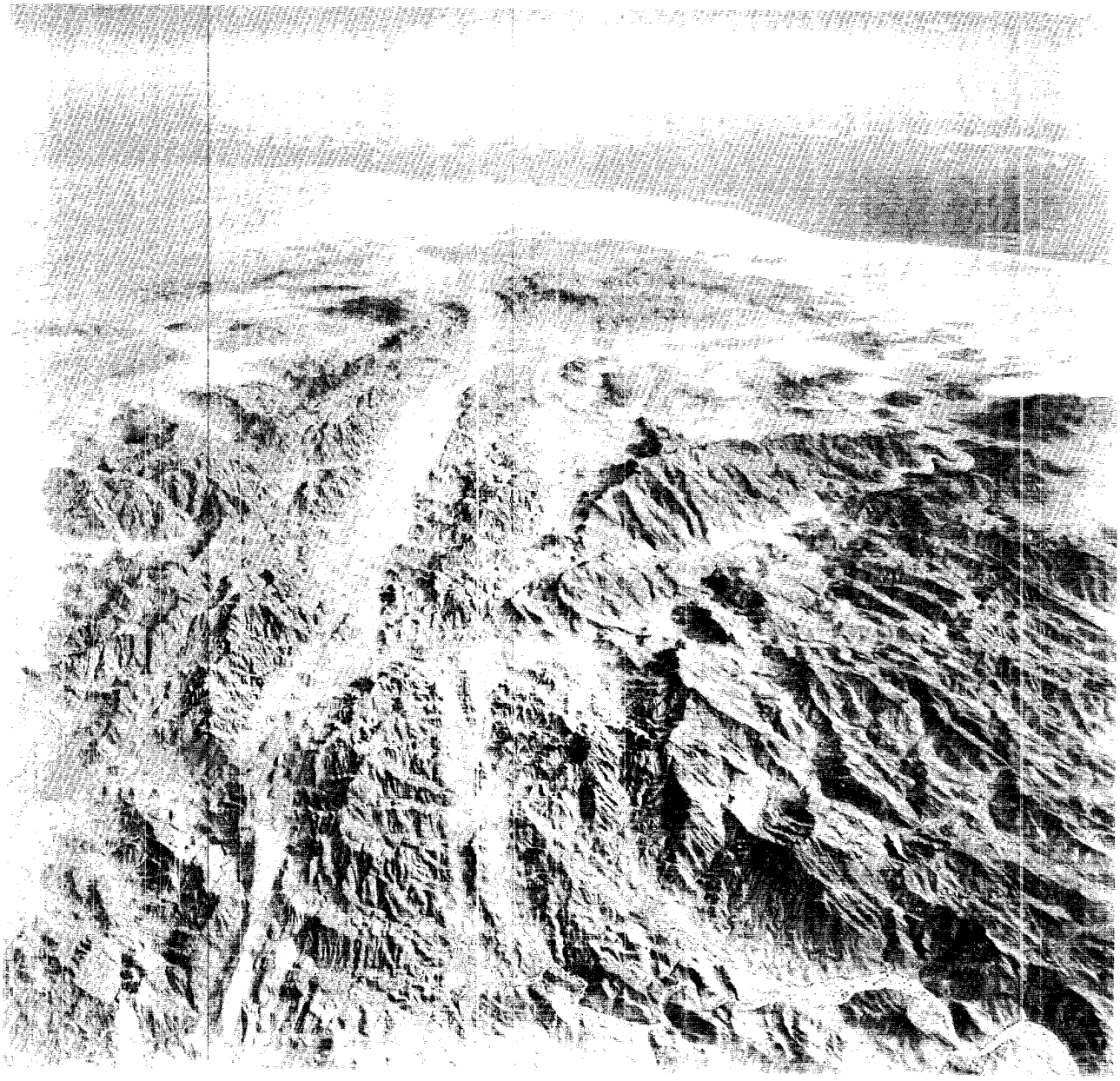
SECTOR 1, SEGMENT [3]. COAST AT MASSAUA, ETHIOPIA. Oblique view looking south showing principal port and adjacent coast. Approximate position 15°38'N., 39°28'E.



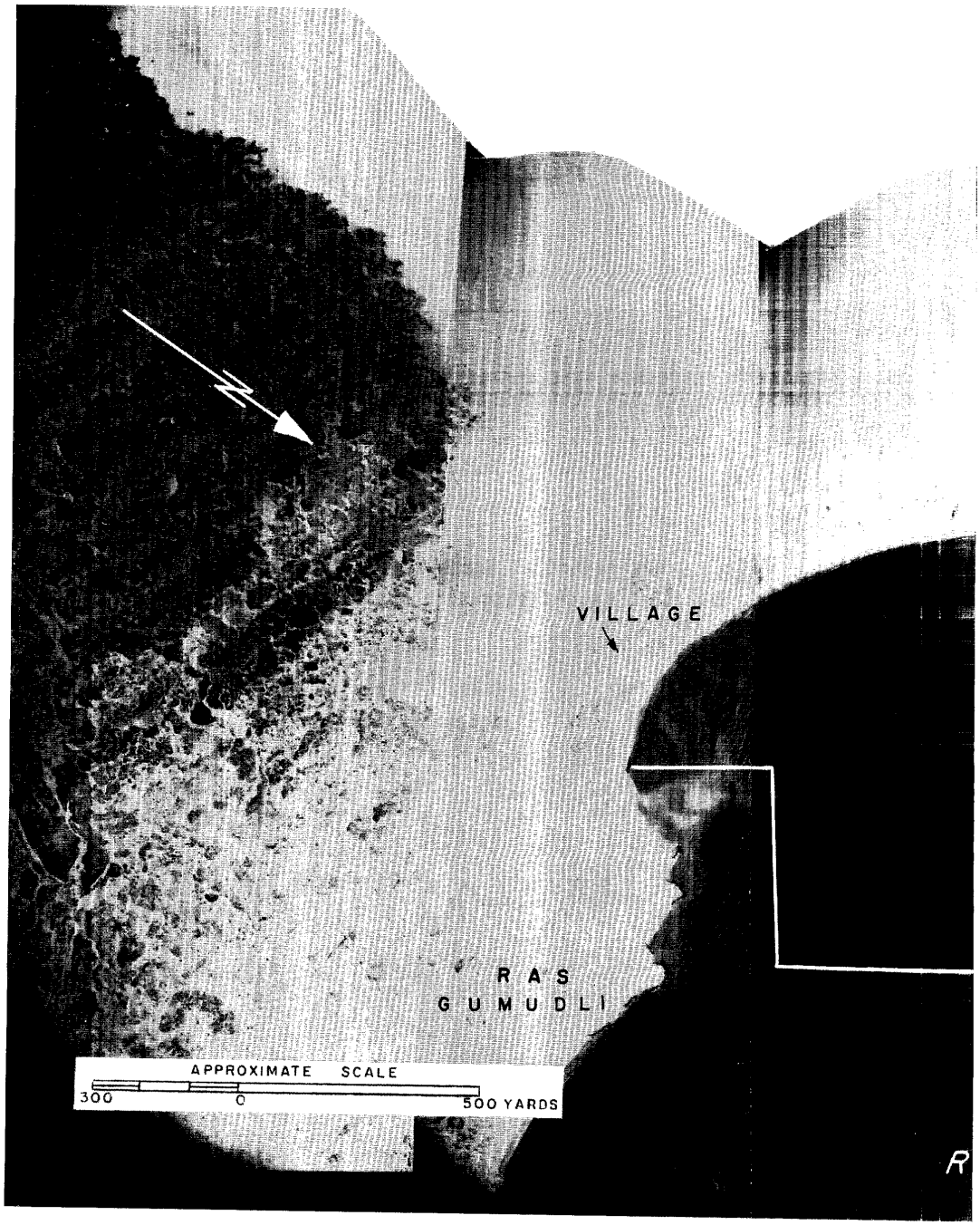
SECTOR 1, SEGMENT [3]. ETHIOPIAN COAST SOUTH OF MASSAUA AT MINOR BEACH AREA *1*. Oblique view looking south showing plain south of Massaua and mountains closely backing plain. Approximate position 15°33′N., 39°28′E.



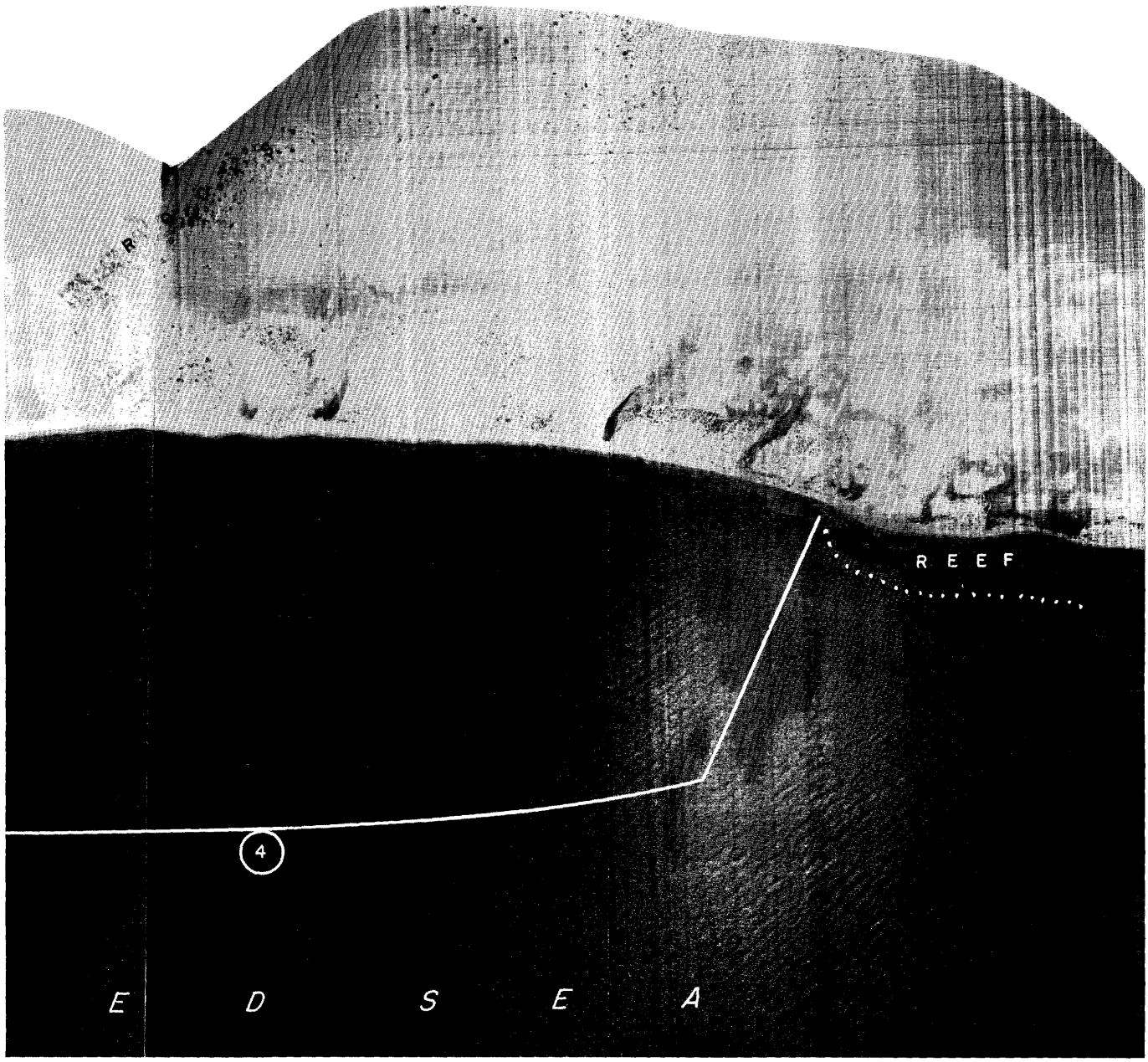
SECTOR 1, SEGMENT [3]. CENTRAL COAST OF ETHIOPIA NEAR BAIA D'ANFILE. Oblique view looking north showing coastal plain and mountain range farther inland. Approximate position 14°38'N., 41°00'E.



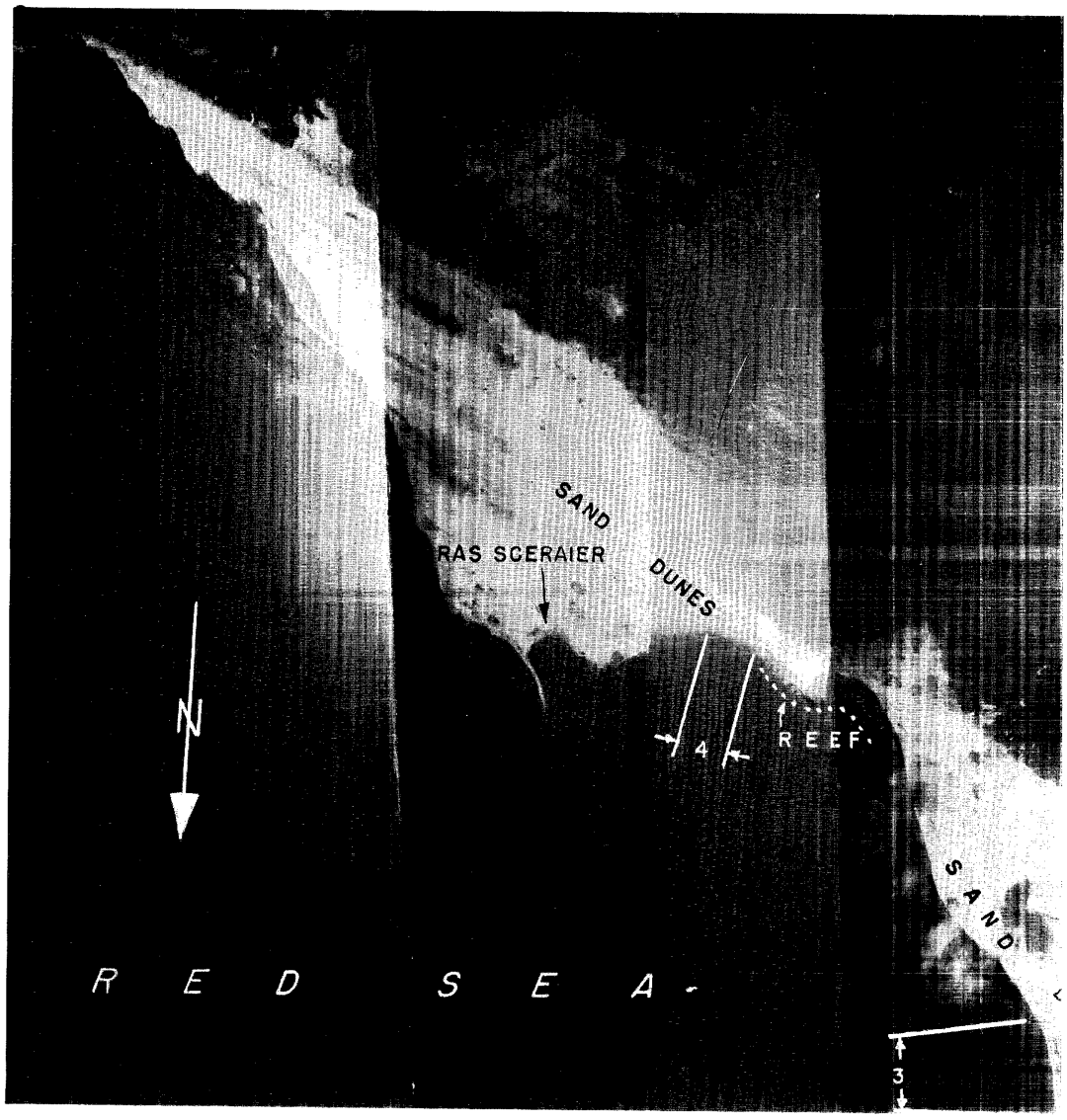
SECTOR 1, SEGMENT [4]. ETHIOPIAN COAST NEAR RAS SCIAKS. View looking northeast showing volcanic hills and mountains backing plain. Valleys and streambeds afford access routes for cross-country movement to interior. Approximate position 14°32'N., 41°10'E.



SECTOR 1, SEGMENT [4]. COAST OF ETHIOP

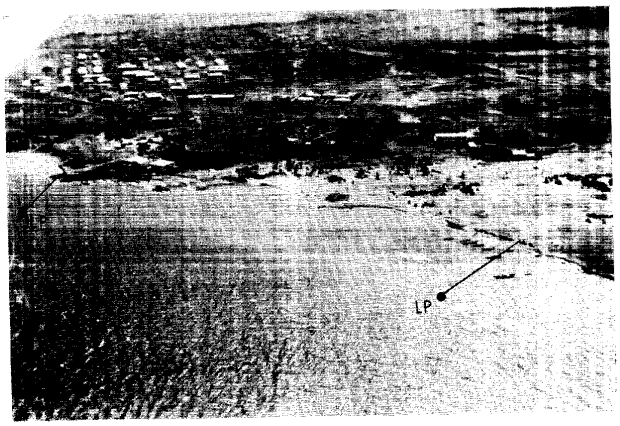


IA AT MAJOR BEACH AREA (4). Uncontrolled vertical mosaic. Approximate position 13°56'N., 41°41'E. June 1955.

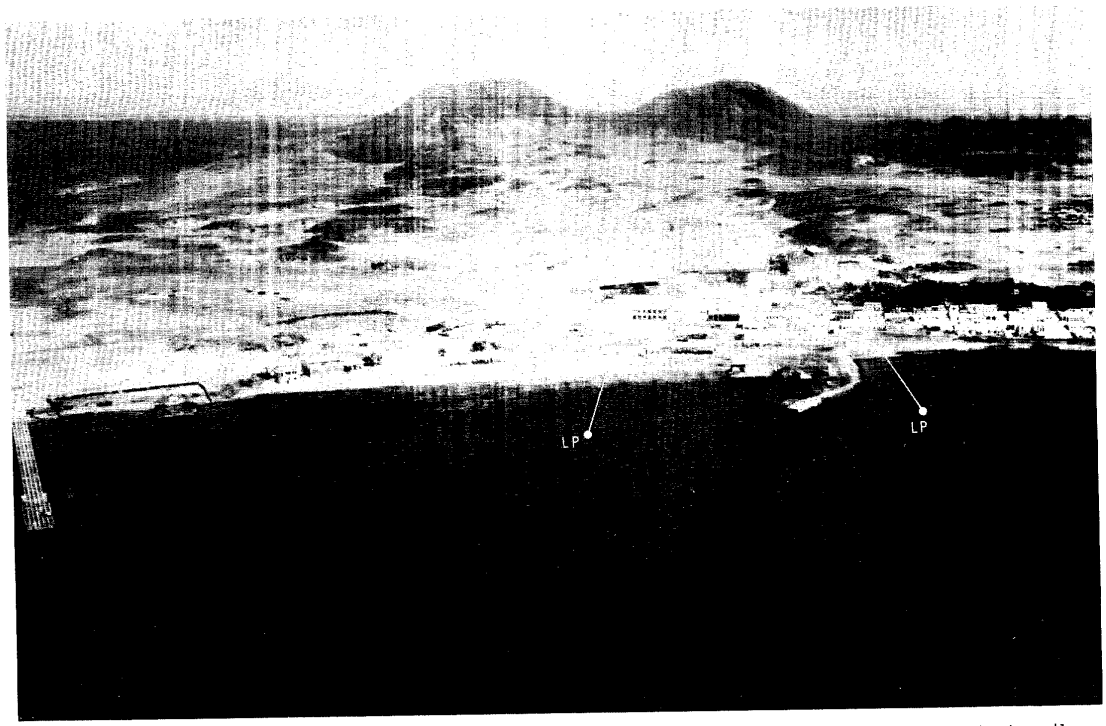


SECTOR 1, SEGMENT [4]. COAST OF ETHIOPIA AT MINOR BEACH AREAS
position 13°46'N., 4

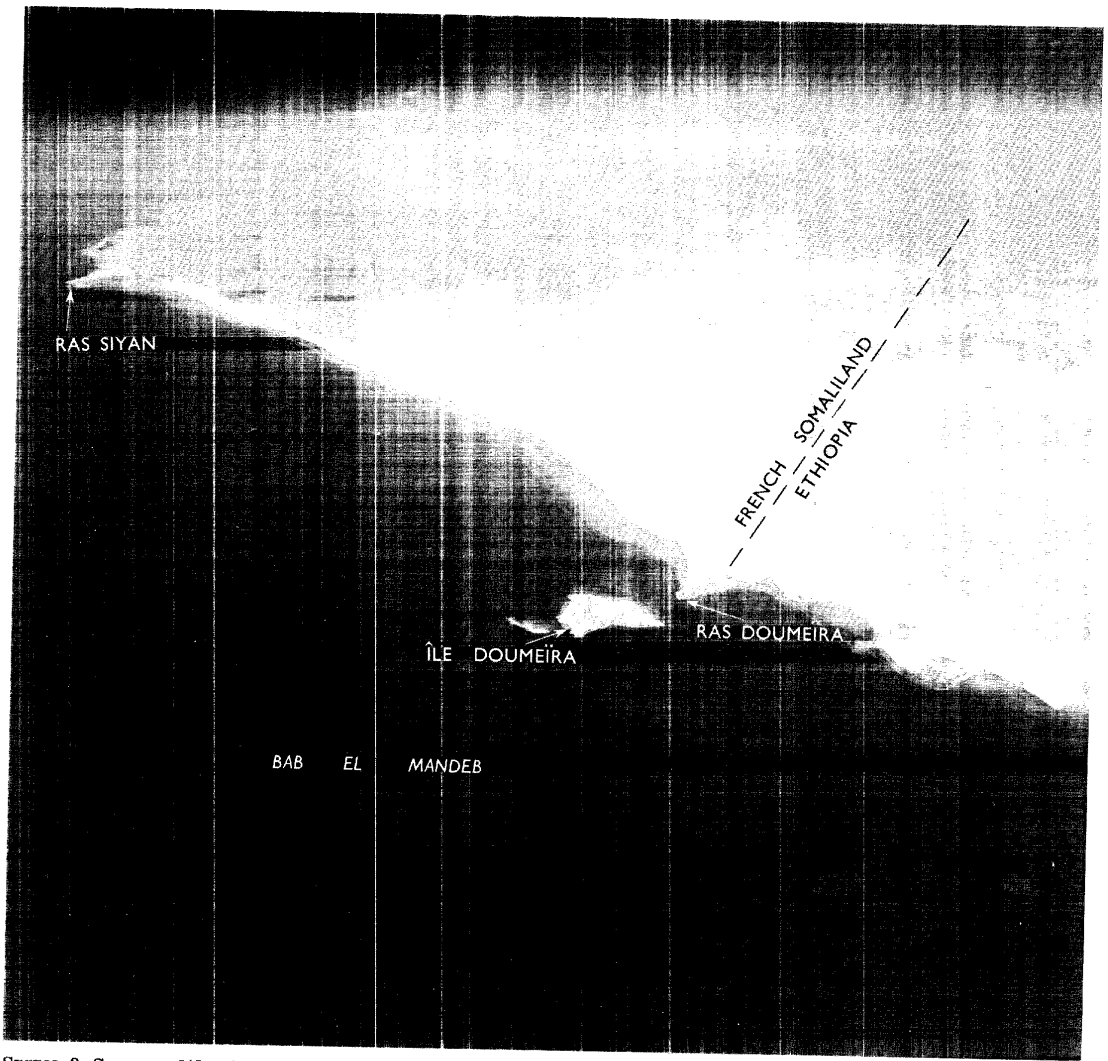
3 AND *4*. Uncontrolled vertical mosaic. Approximate
2°01'E.



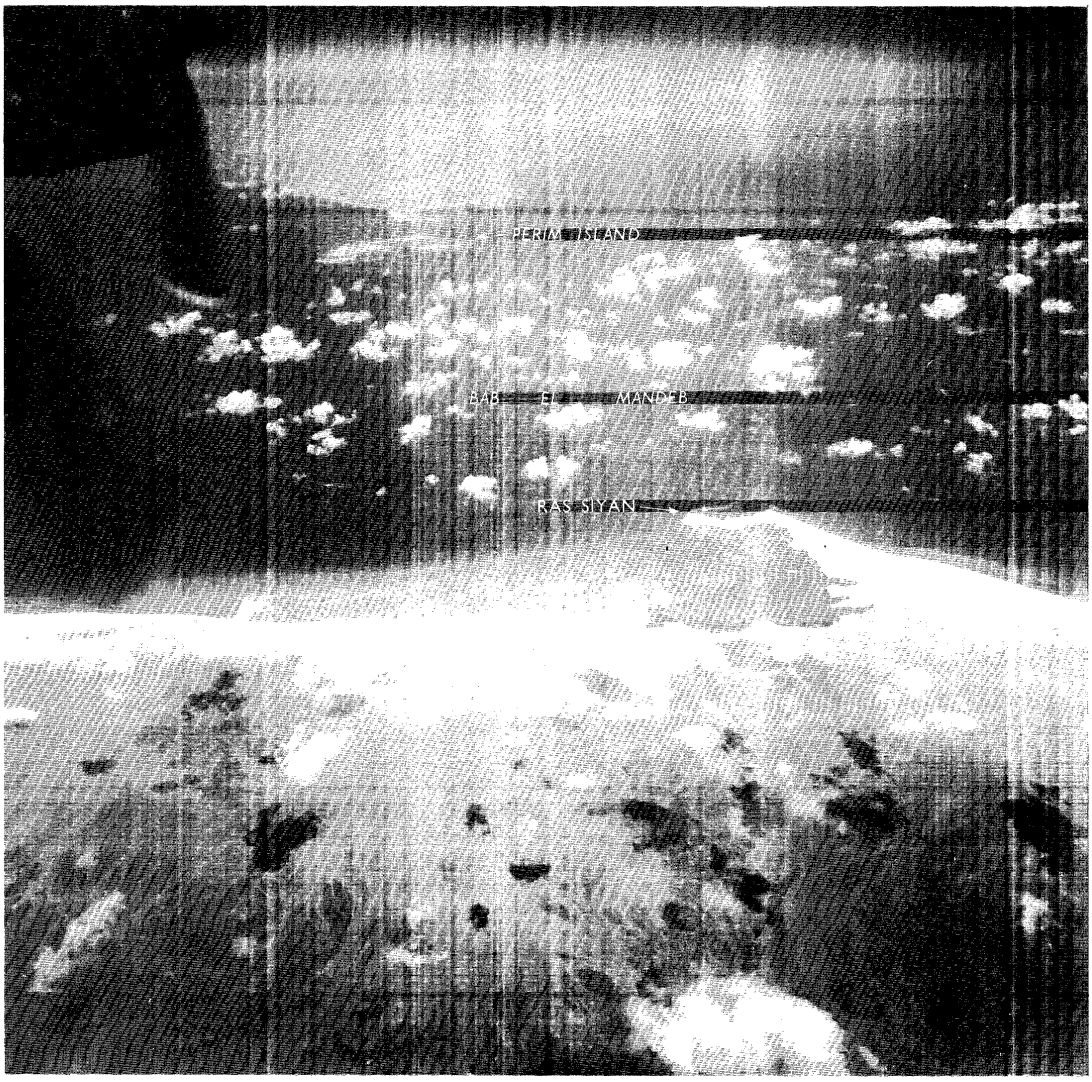
A. SECTOR 1, SEGMENT [4]. COAST NORTH OF ASSAB, ETHIOPIA. View looking southwest showing two landing places (LP). Approximate position 13°02'N., 42°45'E. March 1960.



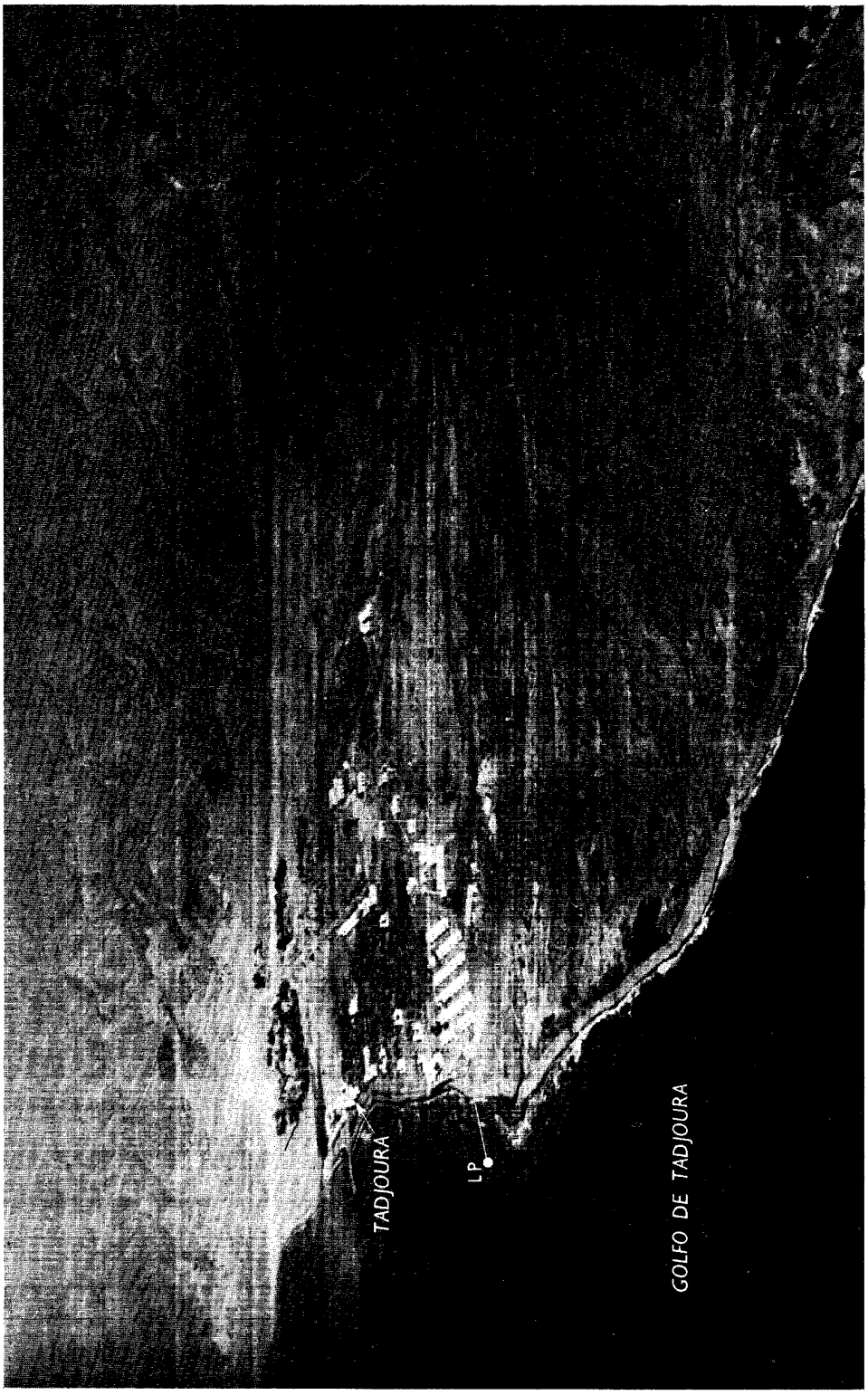
B. SECTOR 1, SEGMENT [4]. ETHIOPIAN COAST AT ASSAB. View looking west showing two landing places (LP) at southern end of Assab. Approximate position 12°59'N., 42°45'E. April 1953.



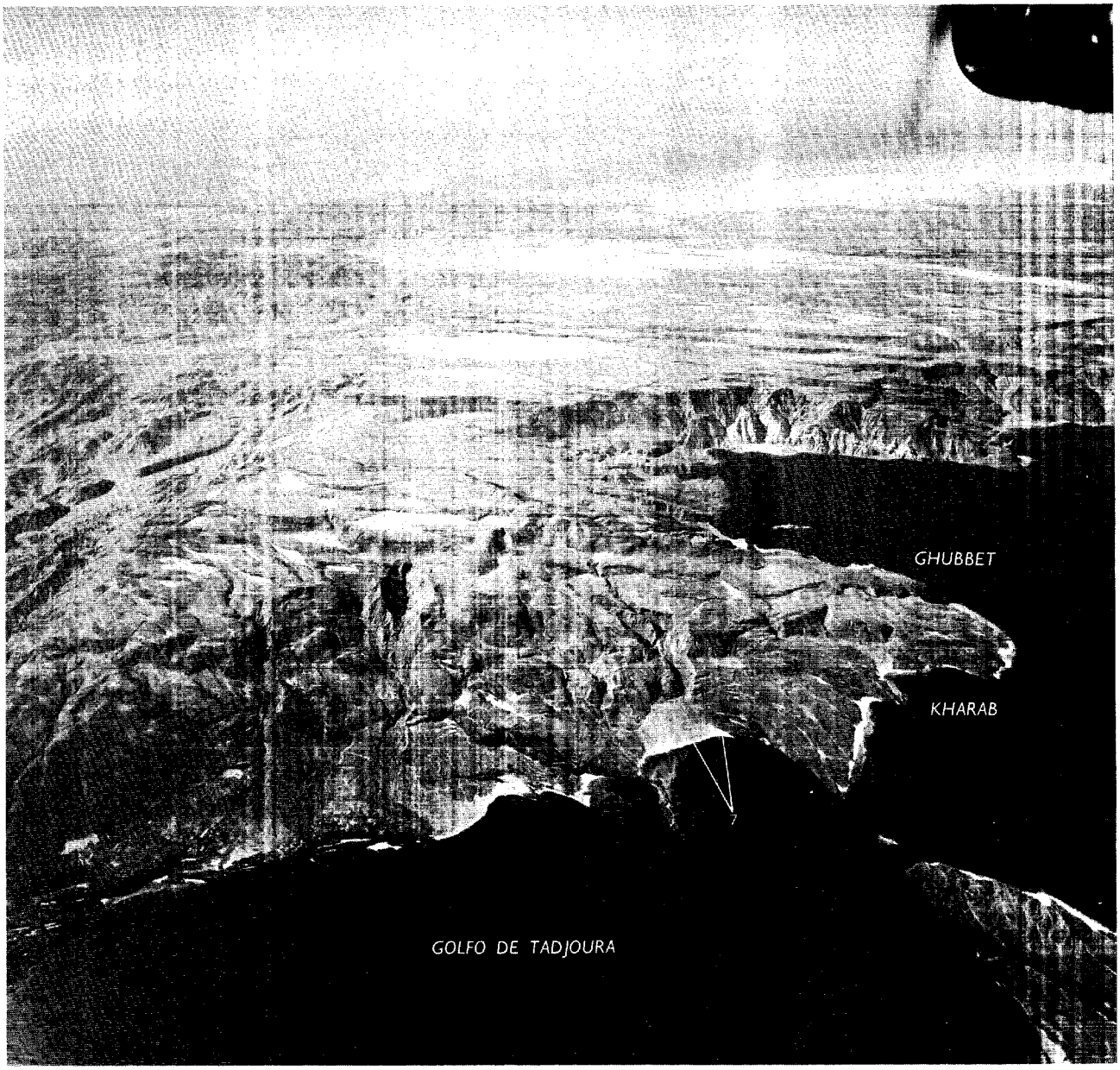
SECTOR 2, SEGMENT [1]. COAST NEAR ETHIOPIA – FRENCH SOMALILAND BORDER. Oblique view looking southwest showing sandy coastal plain, interrupted and backed by hills and mountains. Approximate position 12°42'N., 43°09'E.



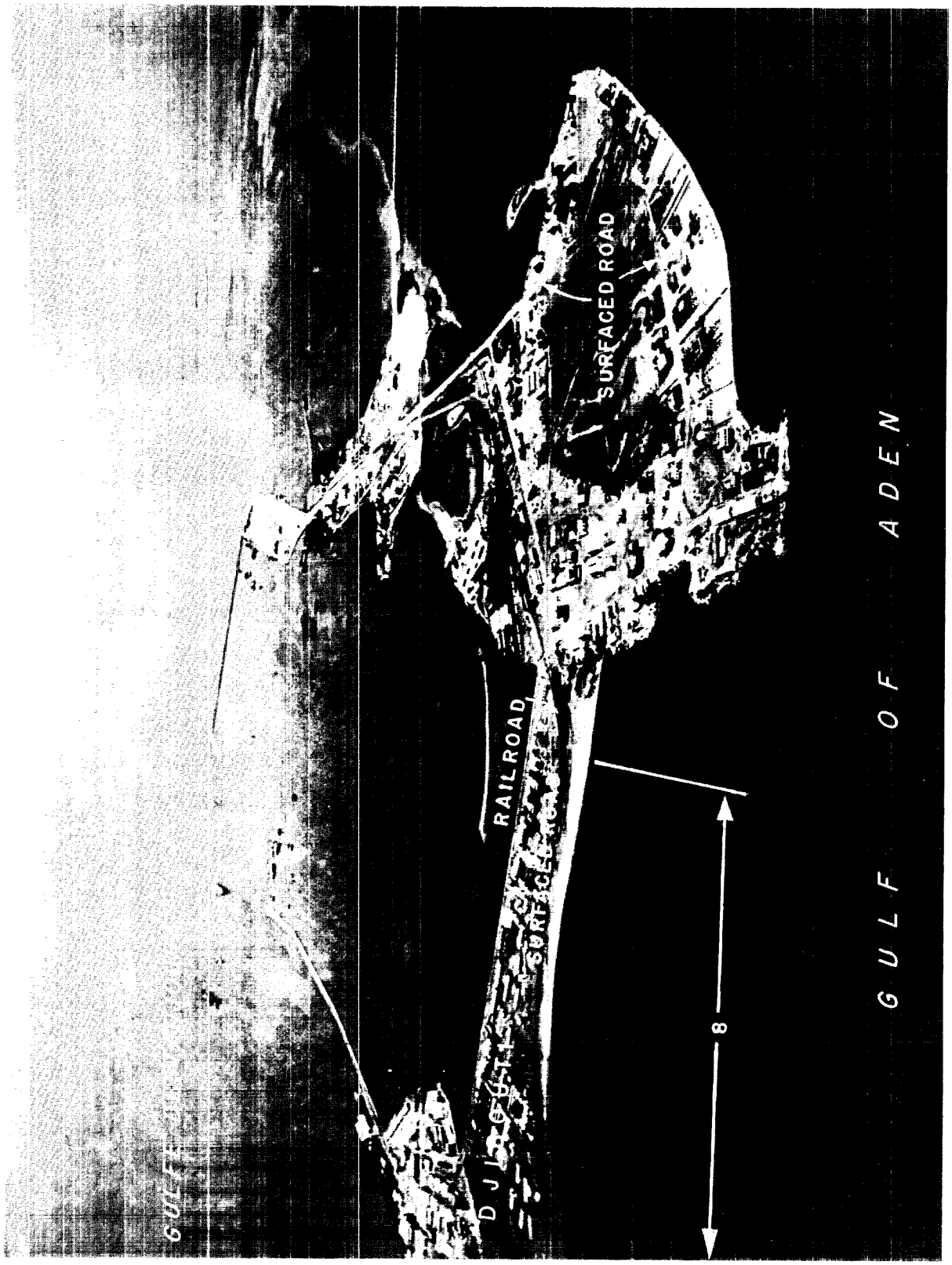
SECTOR 2, SEGMENT [1]. NORTHERN COAST OF FRENCH SOMALILAND AT RAS SIYAN. Oblique view looking northeast showing the narrowest part of Bab el Mandeb, the strait separating French Somalliland, in the foreground, from the Arabian Peninsula, in the background. Approximate position 12°27'N., 43°20'E.



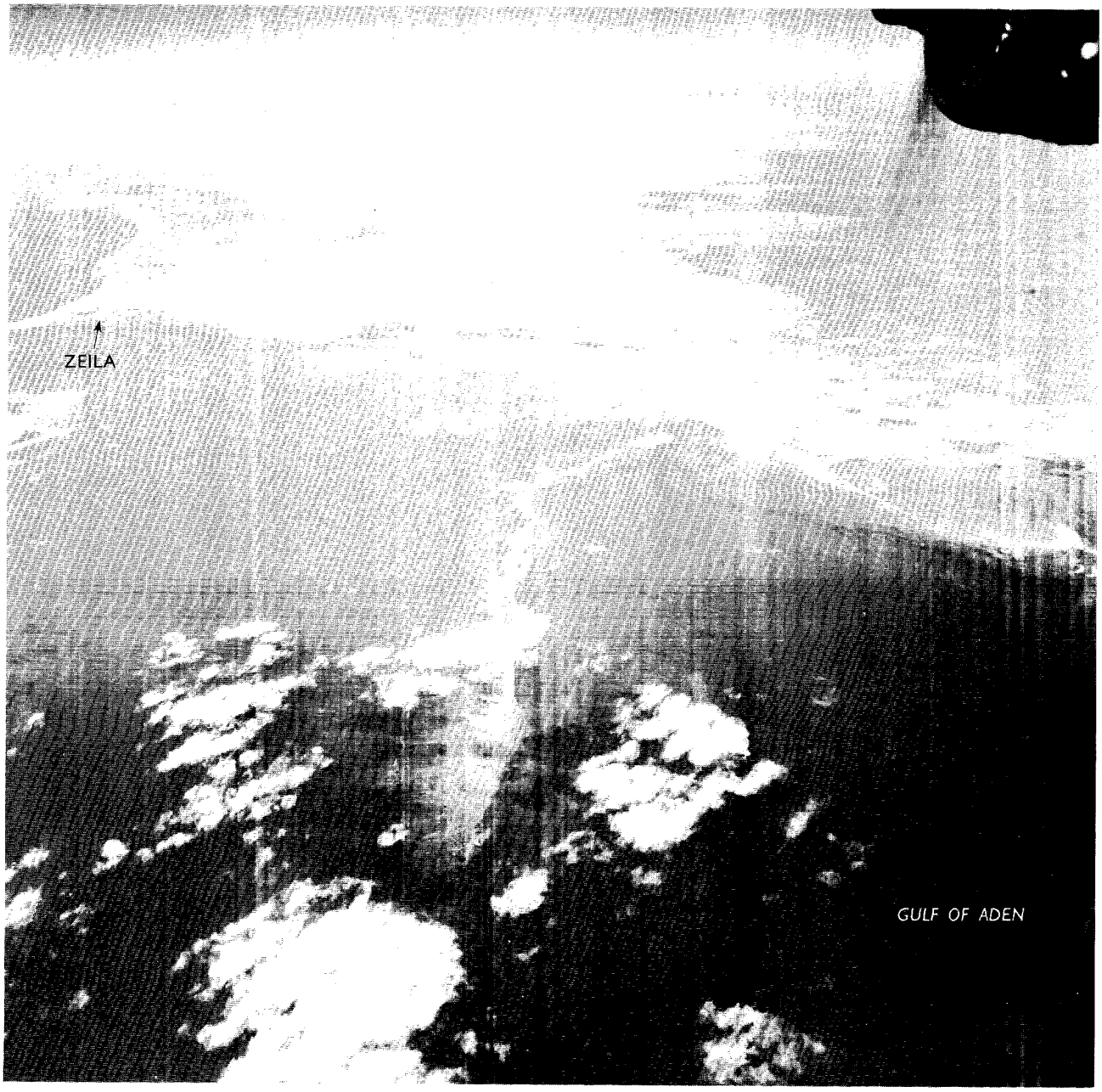
SECTOR 2, SEGMENT [2]. TADJOURA, FRENCH SOMALILAND. Oblique view looking west-northwest showing minor port, landing place (LP), narrow brush- and scrub-covered coastal plain, and hilly-to-mountainous hinterland. Approximate position 11°47′N., 42°54′E. September 1954.



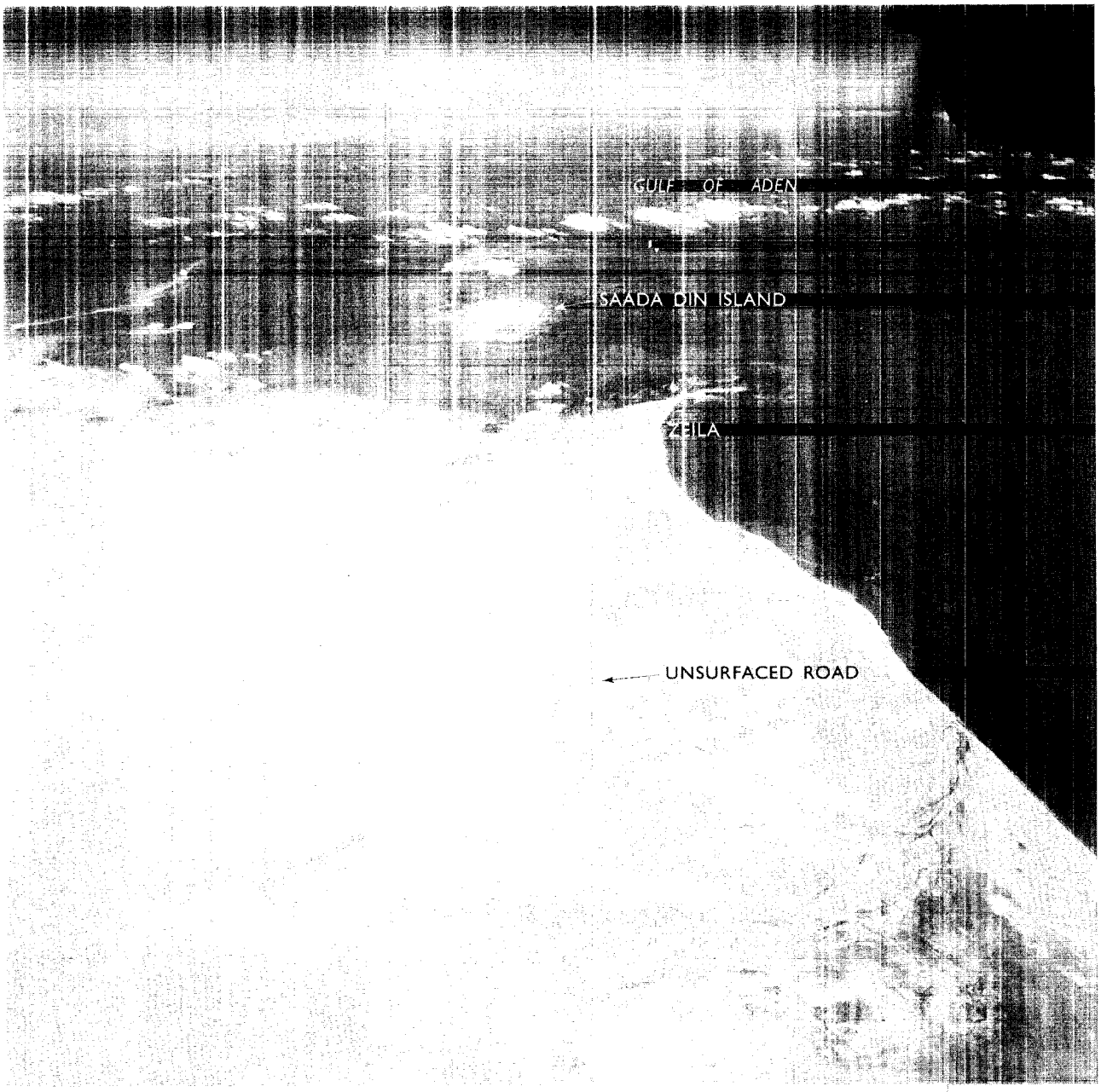
SECTOR 2, SEGMENT [2]. FRENCH SOMALILAND COAST NEAR HEAD OF GOLFE DE TADJOURA. MINOR BEACH AREA *1*. Oblique view looking south showing entrance to Ghubbet Kharab, dissected hills and mountains close behind the shores, and interior plateau in background. Approximate position 11°34'N., 42°43'E.



SECTOR 2, SEGMENT [2]. FRENCH SOMALILAND AT DJIBOUTI SHOWING MINOR BEACH AREA 8. Oblique view looking west showing all except south part of beach. Approximate position 11°36'N., 43°09'E. January 1953.

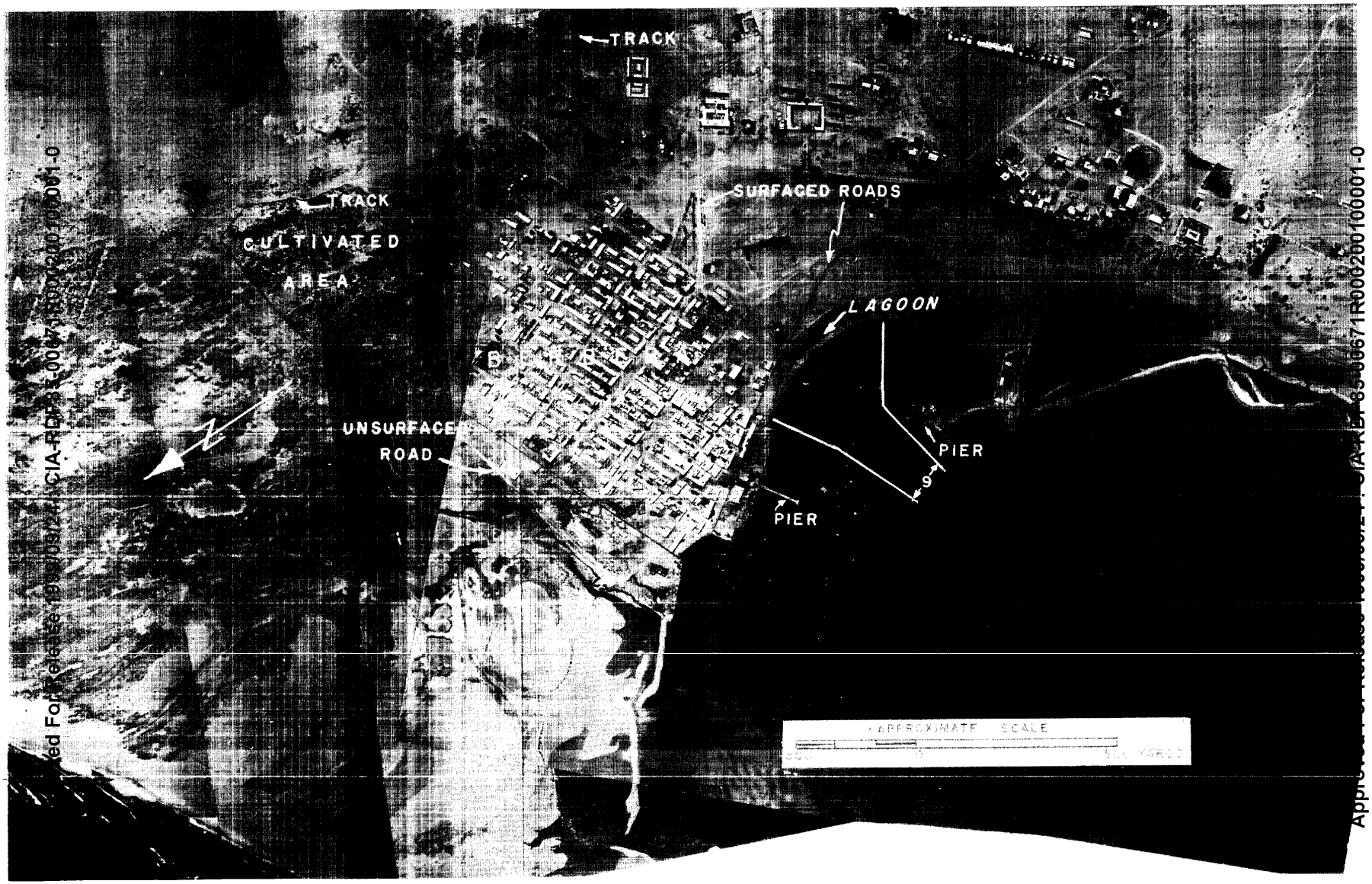


SUBSECTOR 3–A, SEGMENT [1]. COAST NEAR FRENCH SOMALILAND – SOMALI REPUBLIC BORDER. Oblique view looking southward showing broad coastal plain. Approximate position 11°23'N., 43°25'E.



SUBSECTOR 3–A, SEGMENT [1]. NORTHERN COAST OF SOMALIA AT ZEILA. Oblique view looking northward across coastal area. Note the many intermittent streams and their sand blocked entrances and the inlets and small lagoons along the shore. Approximate position 11°20′N., 43°28′E.

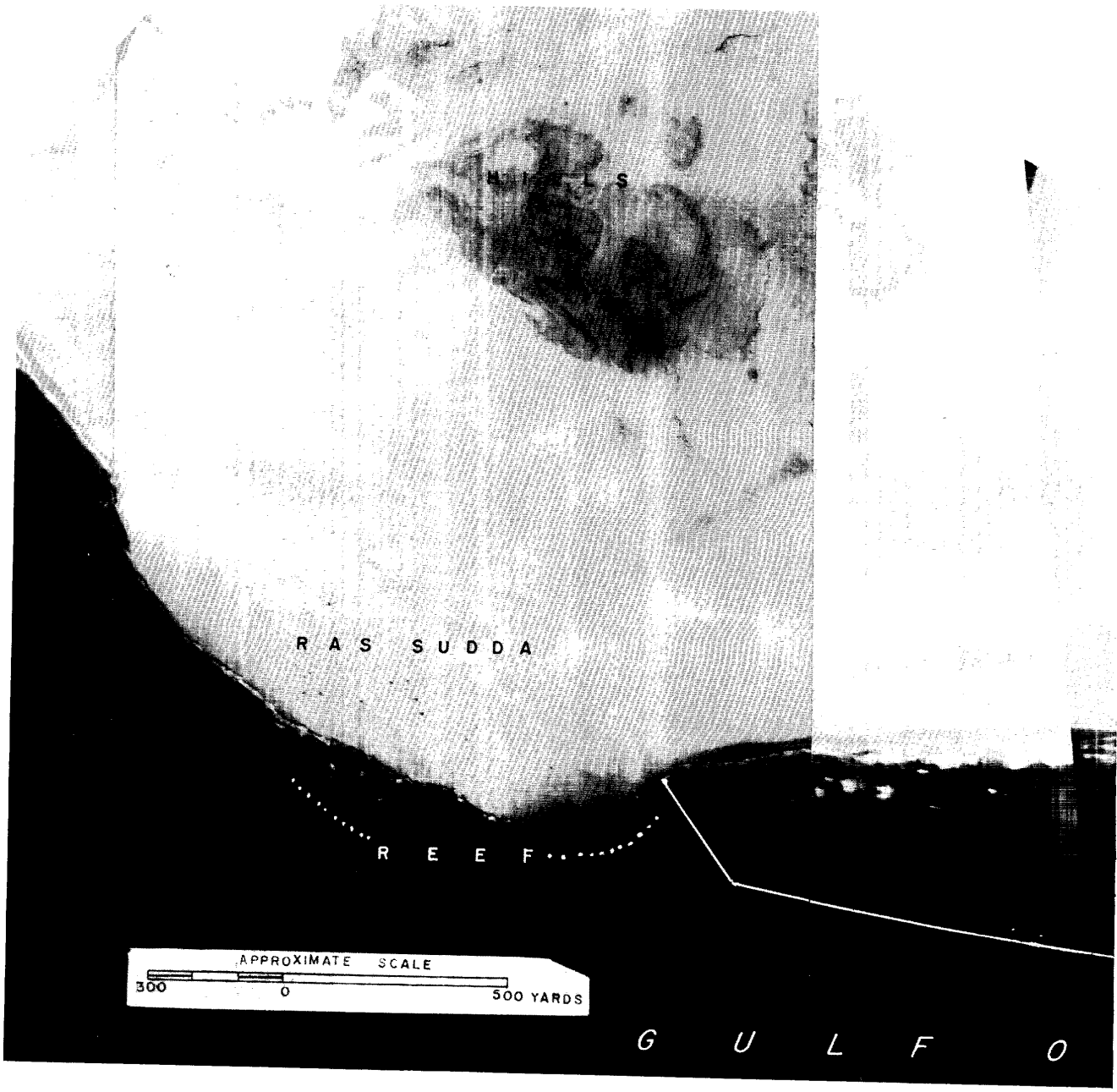
SUBSECTOR 3-A, SEGMENT [1]. VICINITY OF BER
Uncontrolled vertical mosaic showing segmen
proximate



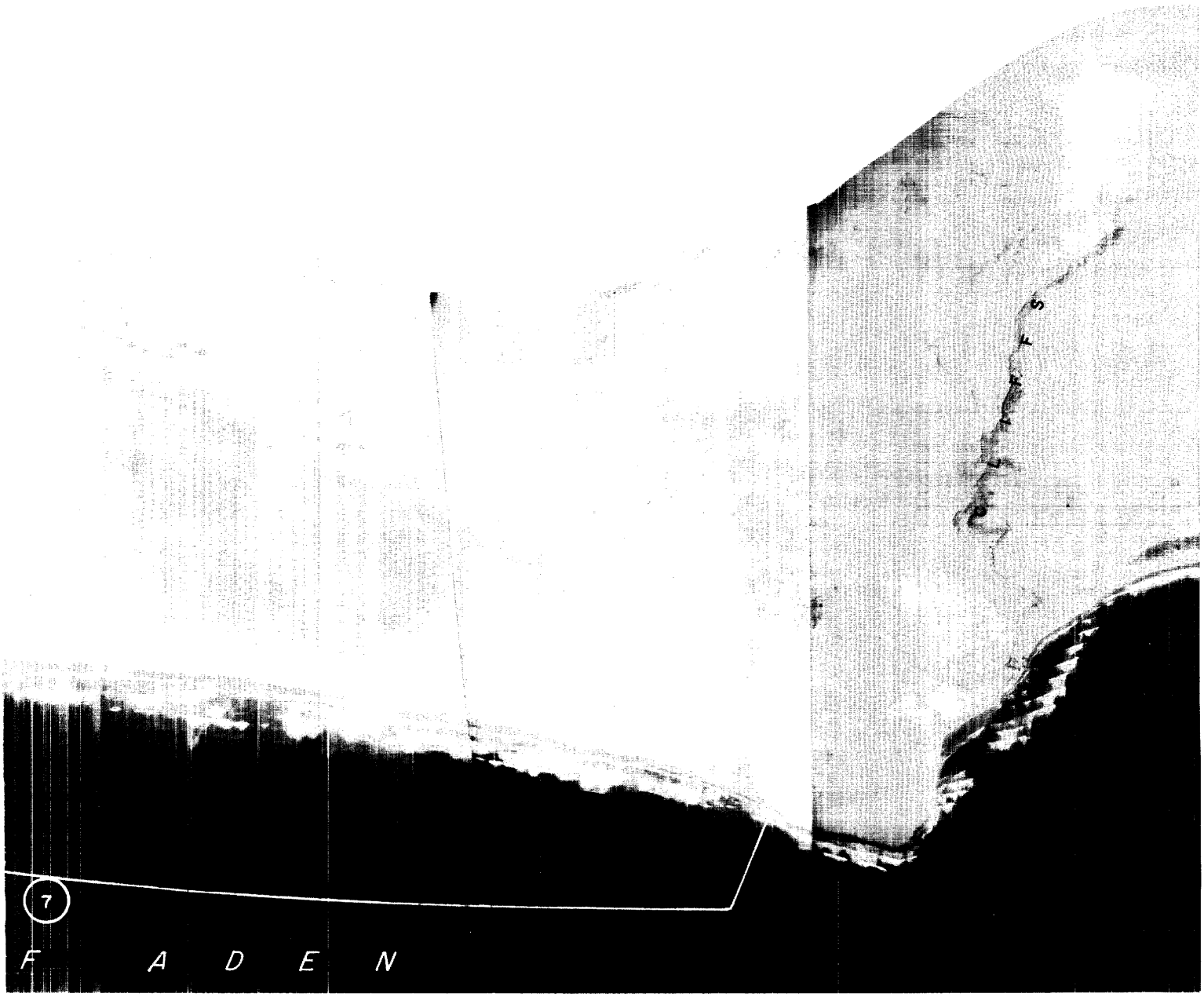
BERA, SOMALI REPUBLIC. MAJOR BEACH AREA (5) AND MINOR BEACH AREA 9. t of southwest part of major beach (5) and all of minor beach 9. Ap- position 10°27'N., 45°01'E. June 1956.

SUBSECTOR 3-A, SEGMENT [1]. COAST OF SOMALIA IN
tical mosaic showing segment of center and north

VICINITY OF RAS WALHUN. MAJOR BEACH AREA (6). Uncontrolled vertical aerial photograph of beach. Approximate position 10°41'N., 45°30'E. June 1956.



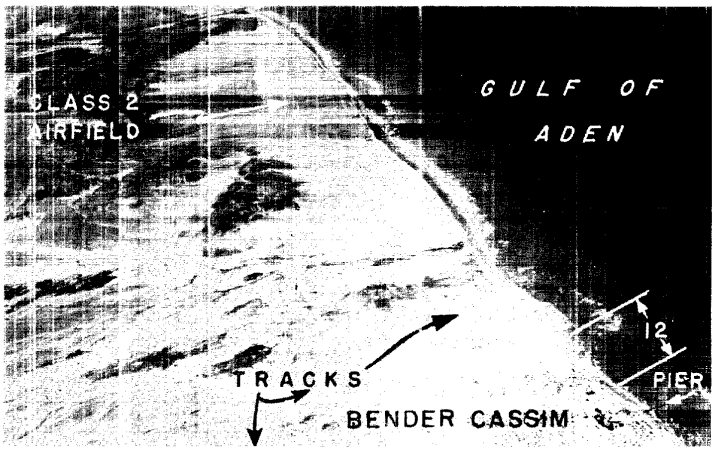
SUBSECTOR 3–A, SEGMENT [1]. SOMALIA COAST SOU
mosaic. Approxima



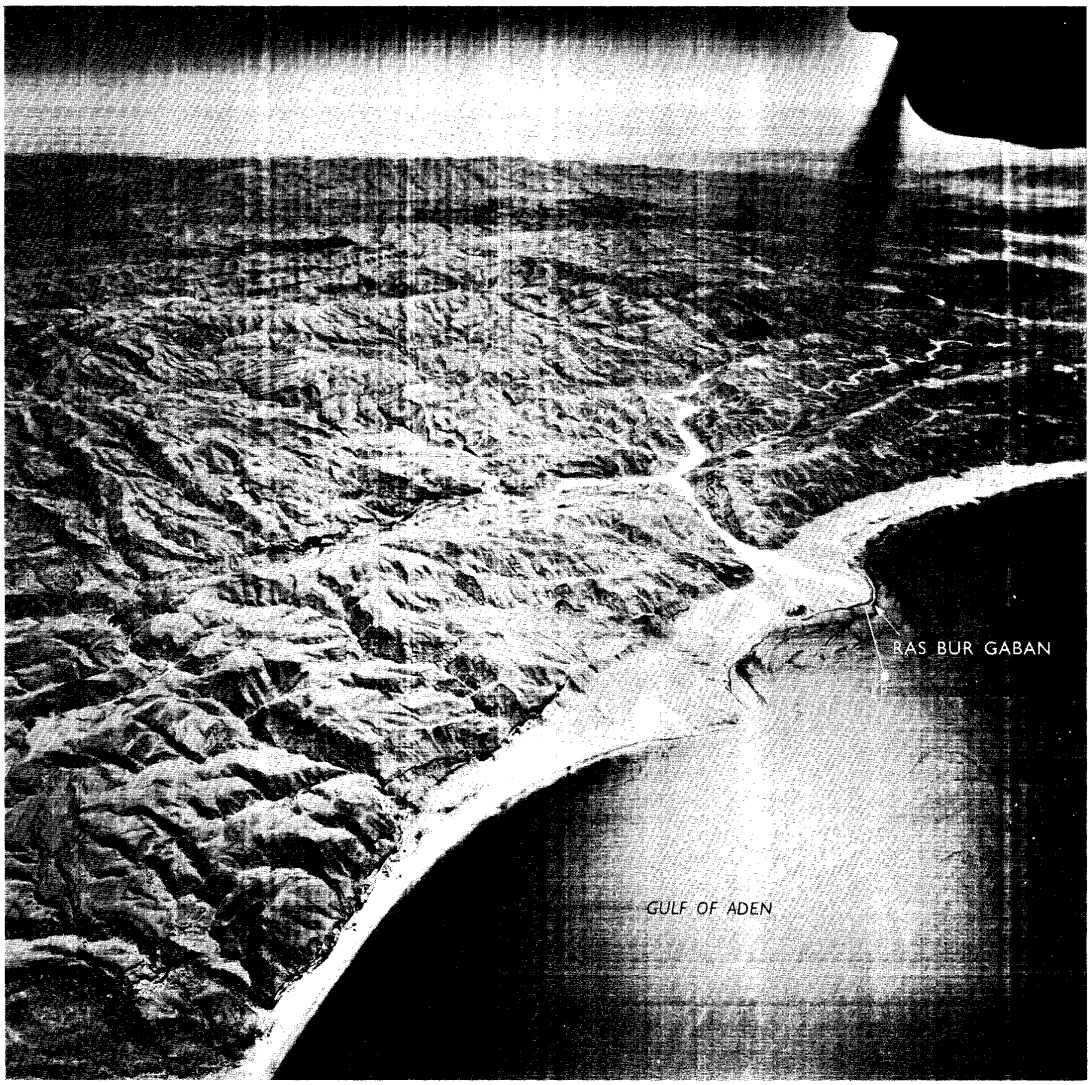
...WEST OF RAS SUDDA. MAJOR BEACH AREA (7). Uncontrolled vertical ...e position 10°44'N., 45°35'E. June 1956.

SUBSECTOR 3-A, SEGMENT [1]. SOMALIA COAST EAST OF BERBERA. Oblique view looking southward across plain. Low bluffs lie behind parts of the shore. Approximate position 10°27'N., 45°05'E. 1950.

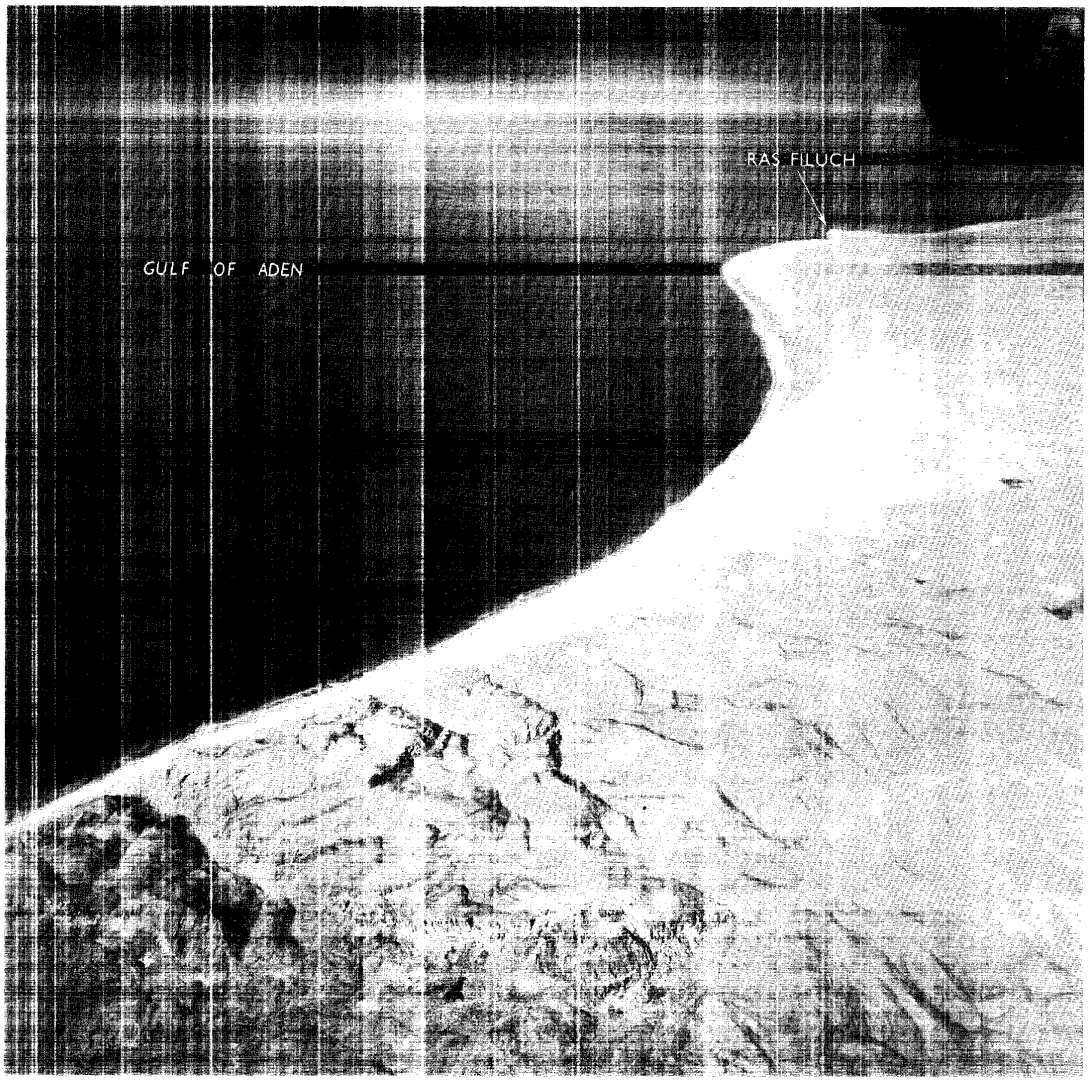
A. SUBSECTOR 3–A, SEGMENT [2]. COAST OF SOMALIA AT VILLAGE OF HEIS. Oblique view looking southeastward showing landing place (LP). Note the bluffs and cliffs behind the shore and the ruggedness of the hilly ridges. Approximate position 10°53'N., 46°54'E.



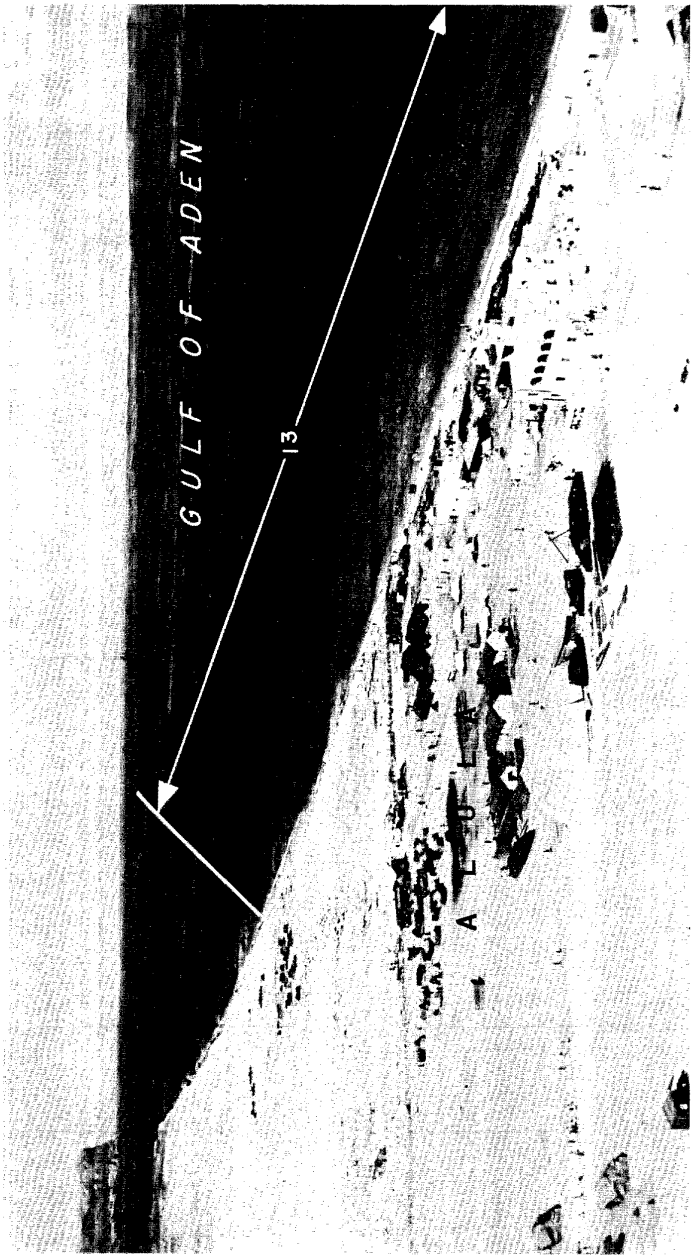
B. SUBSECTOR 3–A, SEGMENT [3]. BENDER CASSIM, SOMALI REPUBLIC. MINOR BEACH AREA *12*. Oblique view west. Approximate position 11°18'N., 49°11'E. February 1960.



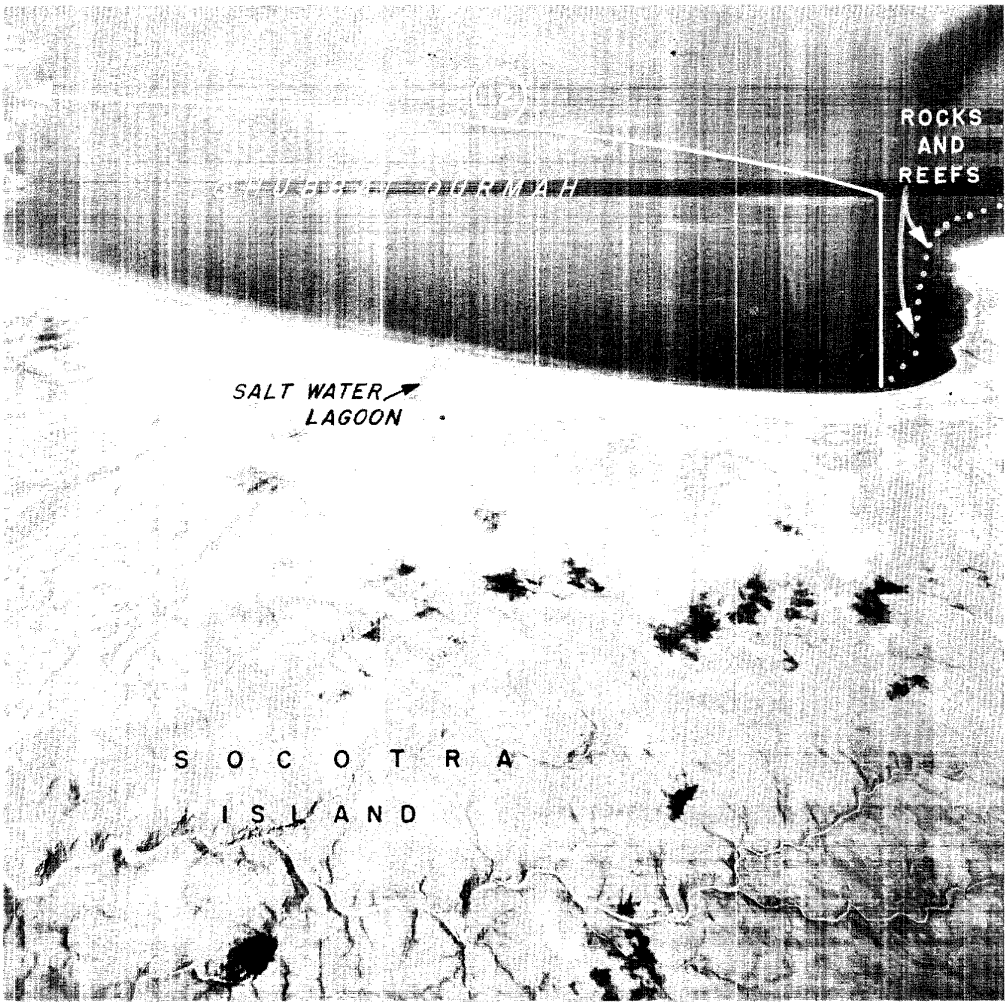
SUBSECTOR 3–A, SEGMENT [3]. SOMALIA COAST AT RAS BUR GABAN. Oblique view looking southeastward showing landing place (LP) and the rugged hilly and mountainous terrain between Ras al Hamar and the Uadi Tog Uene. Approximate position 11°22′N., 49°29′E.



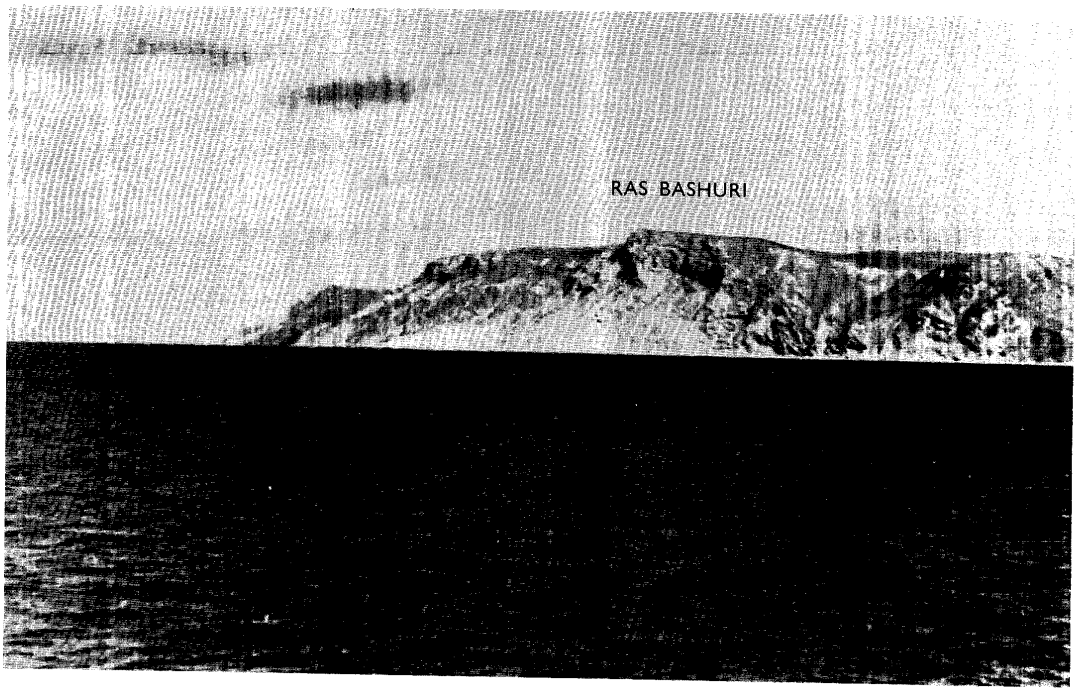
SUBSECTOR 3–A, SEGMENT [3]. COAST OF SOMALIA NEAR RAS FILUCH. Oblique view looking northeastward from a position on the coast near Bender Merhagno. Note lagoon fringing plain, in the background, and the rugged hill and mountain terrain surrounding the plain, in the foreground. Approximate position 11°44′N., 50°30′E.



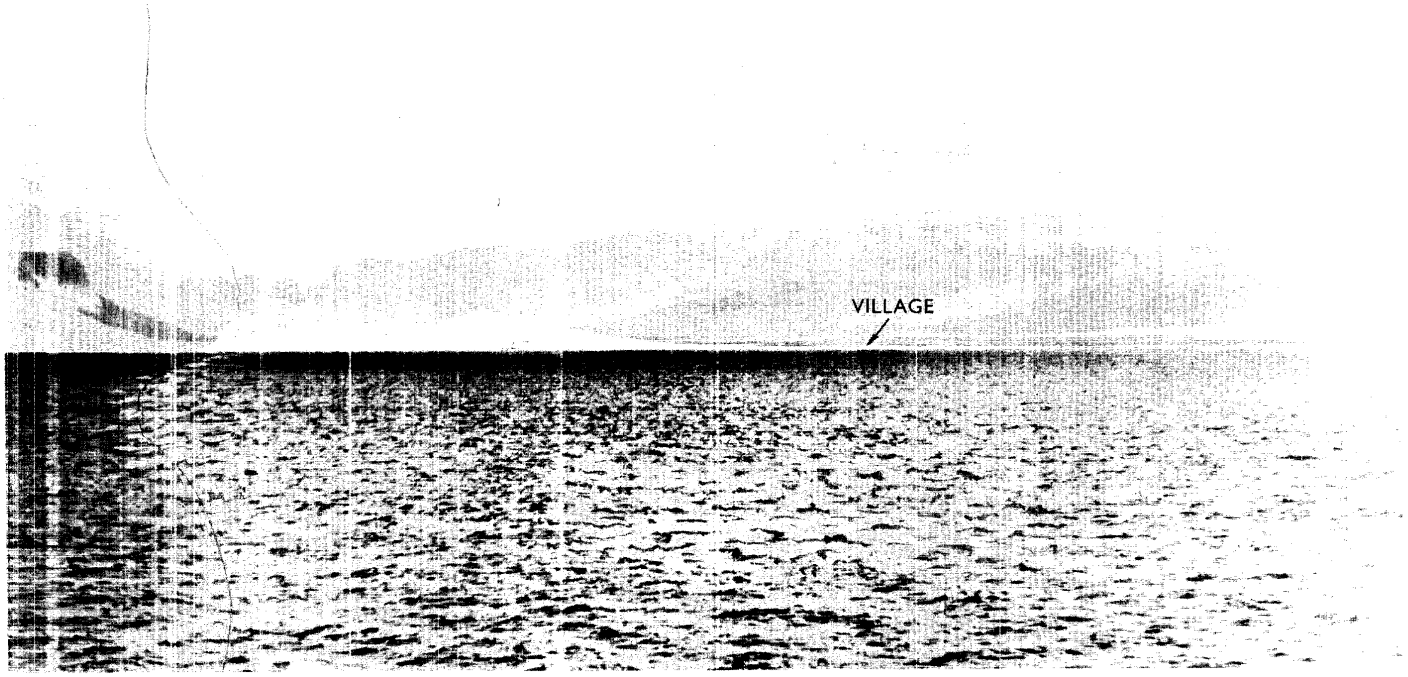
SUBSECTOR 3-A, SEGMENT [3]. ALULA, SOMALI REPUBLIC. MINOR BEACH AREA *13*. Oblique view looking westward showing southwest and center parts of beach. Approximate position 11°58'N., 50°44'E.



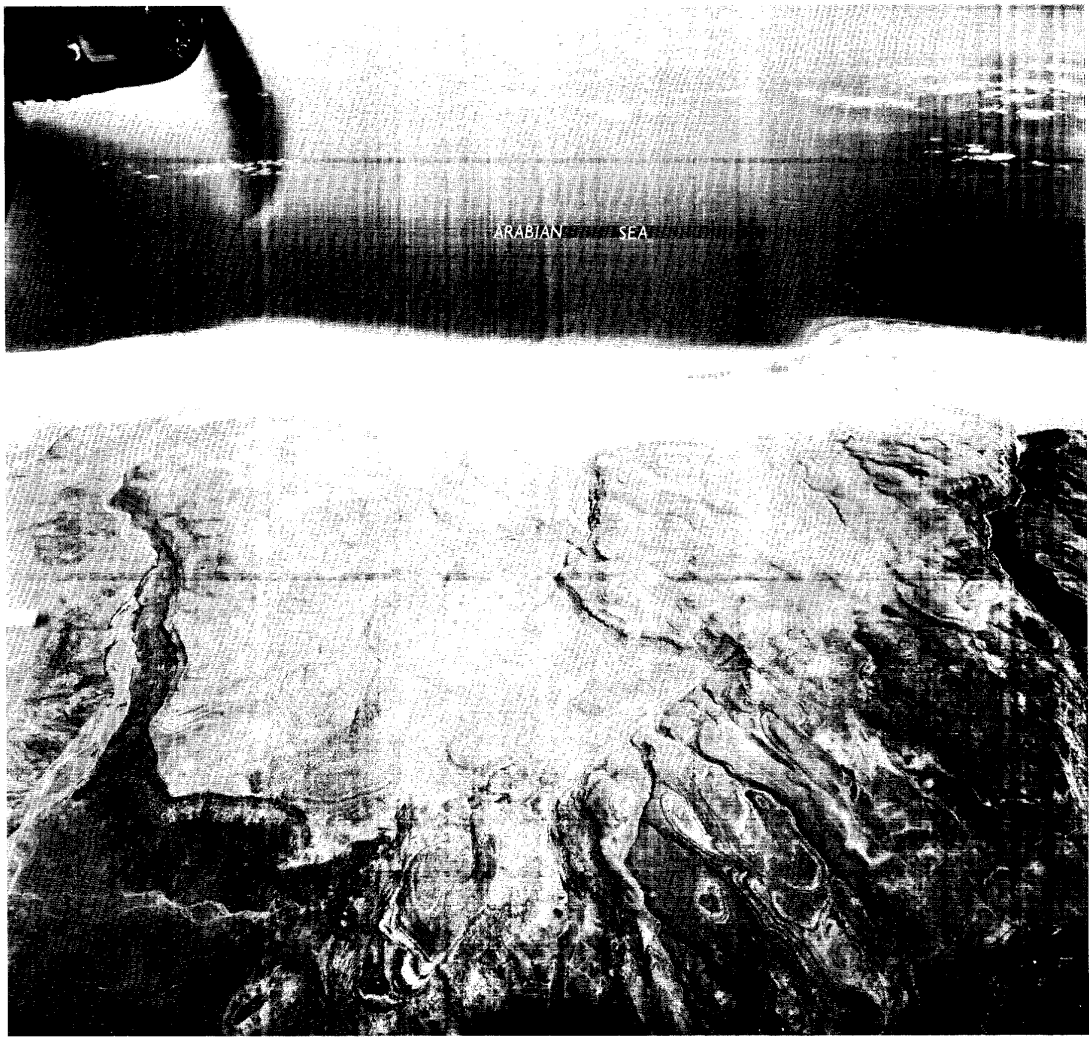
SUBSECTOR 3–B. NORTH COAST OF SOCOTRA IN VICINITY OF RA'S KADARMA. MAJOR BEACH AREA (12). Oblique view looking northward showing southeast part of beach. Approximate position 12°37′N., 53°51′E.



SUBSECTOR 3–B. NORT
ing rugged headlar



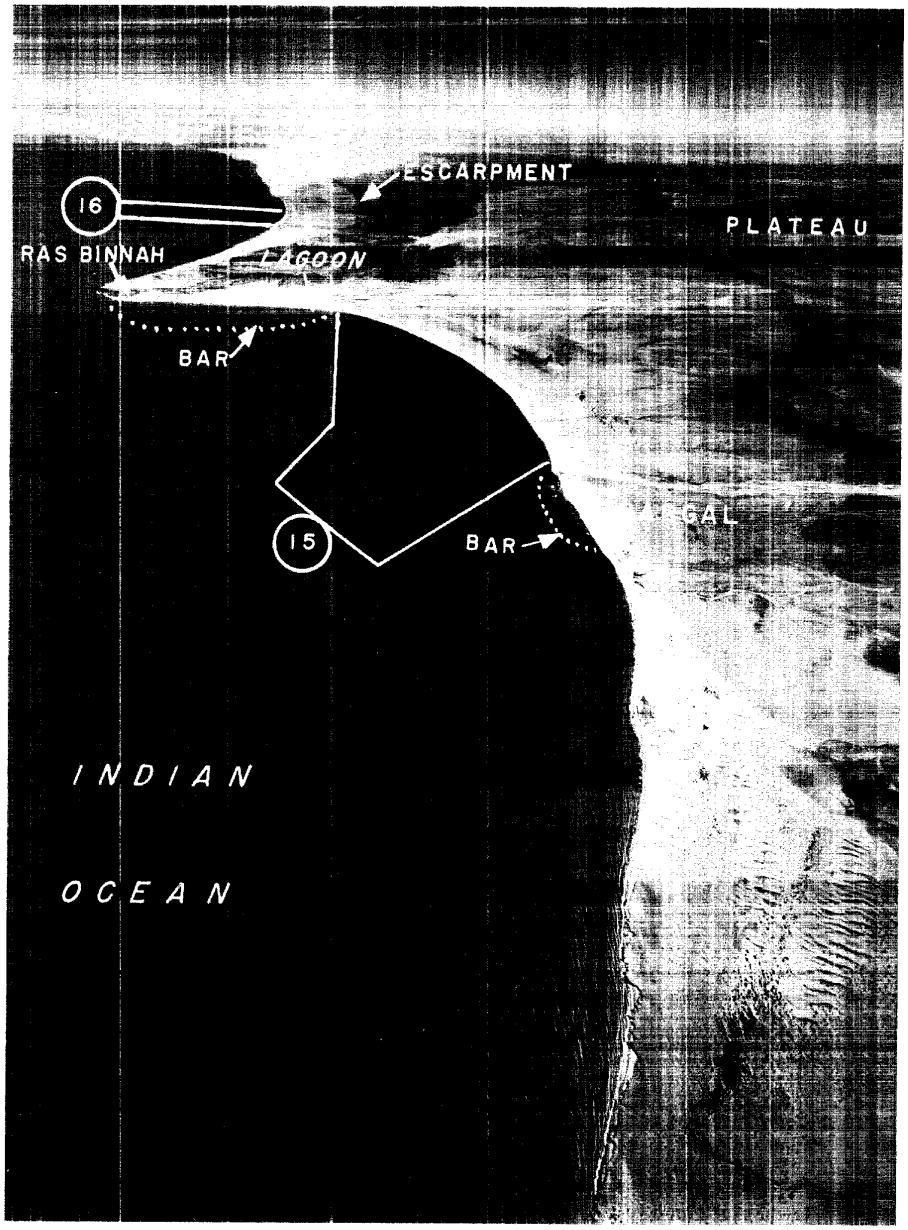
HWEST COAST OF SOCOTRA. View looking southeastward show-
d at Ra's Bashuri Approximate position 12°43'N., 53°32'E.



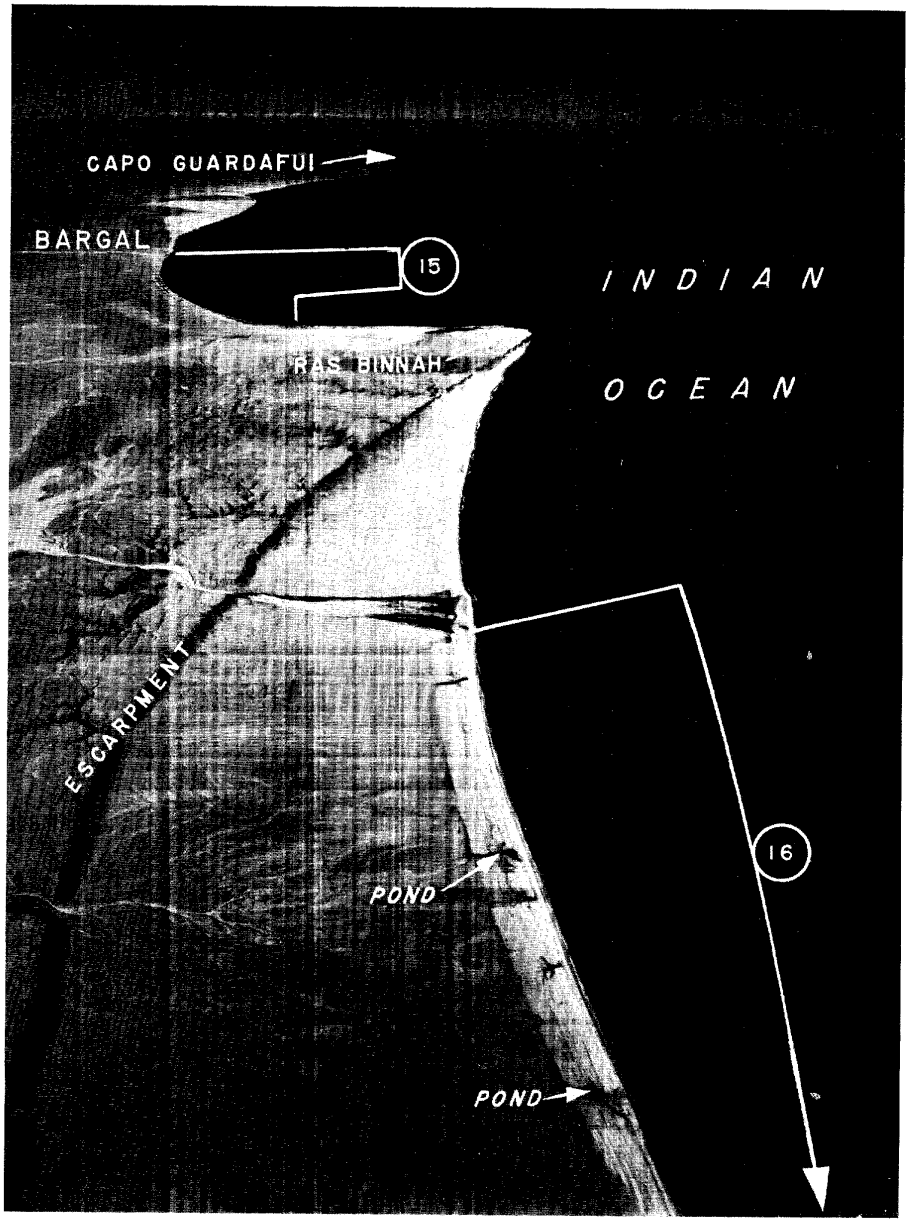
SUBSECTOR 3–B. SOUTH COAST OF SOCOTRA. Oblique view looking southward showing southern coastal plain backed by deeply dissected mountain plateau. Approximate position 12°20'N., 54°00'E.

SUBSECTOR 3–B. SOCOTRA. Oblique view looking southward showing interior basin. Approximate position 12°20'N., 53°33'E.

SUBSECTOR 3–C, SEGMENT [1]. EASTERN COAST OF SOMALIA SOUTH OF RAS SHENAGHEF. View northward toward Ras Shenaghef from detached hill 20 miles south of point. Note the steep escarpments and the rugged inland terrain. Approximate position 11°31'N., 51°08'E.

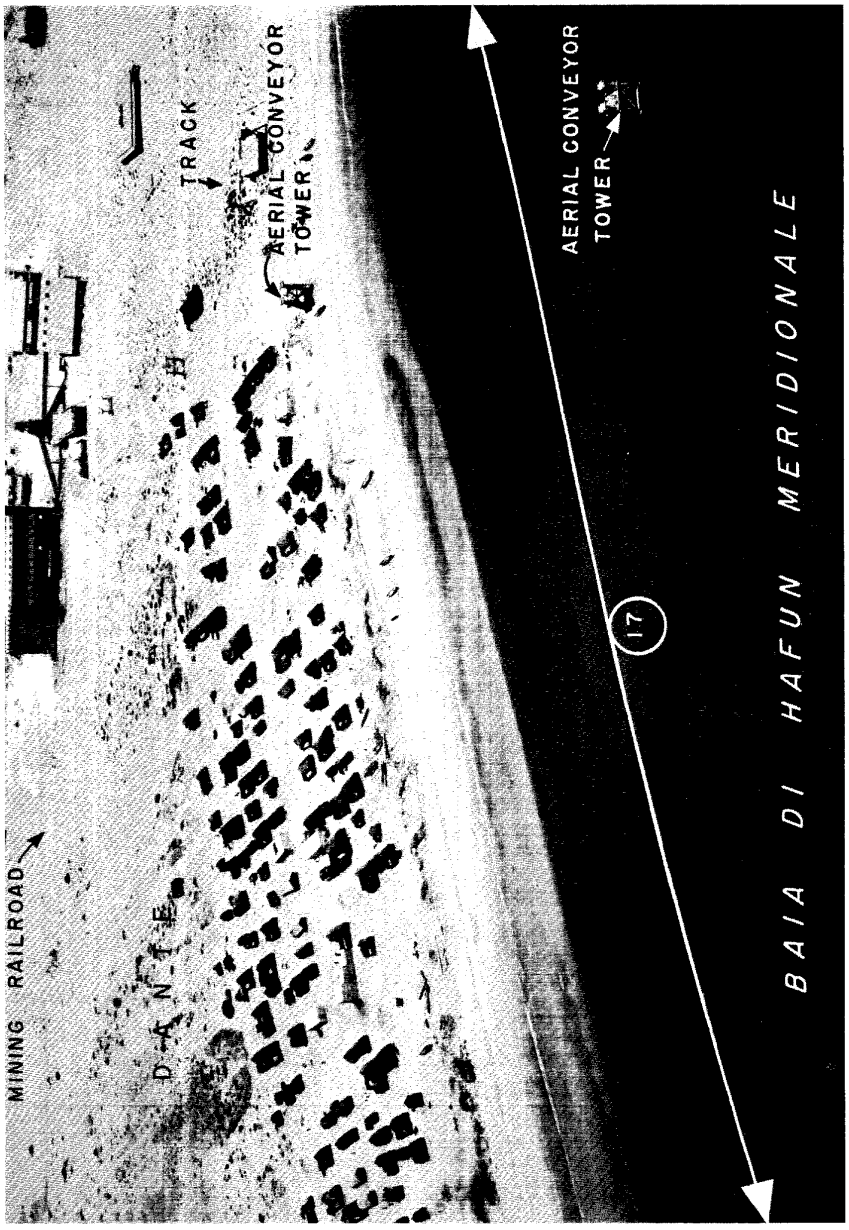


SUBSECTOR 3-C. SEGMENT [1]. SOMALIA COAST IN VICINITY OF RAS BINNAH. MAJOR BEACH AREAS (15) AND (16). Oblique view looking south. See also FIGURE 22–50. Approximate position 11°13'N., 51°05'E.

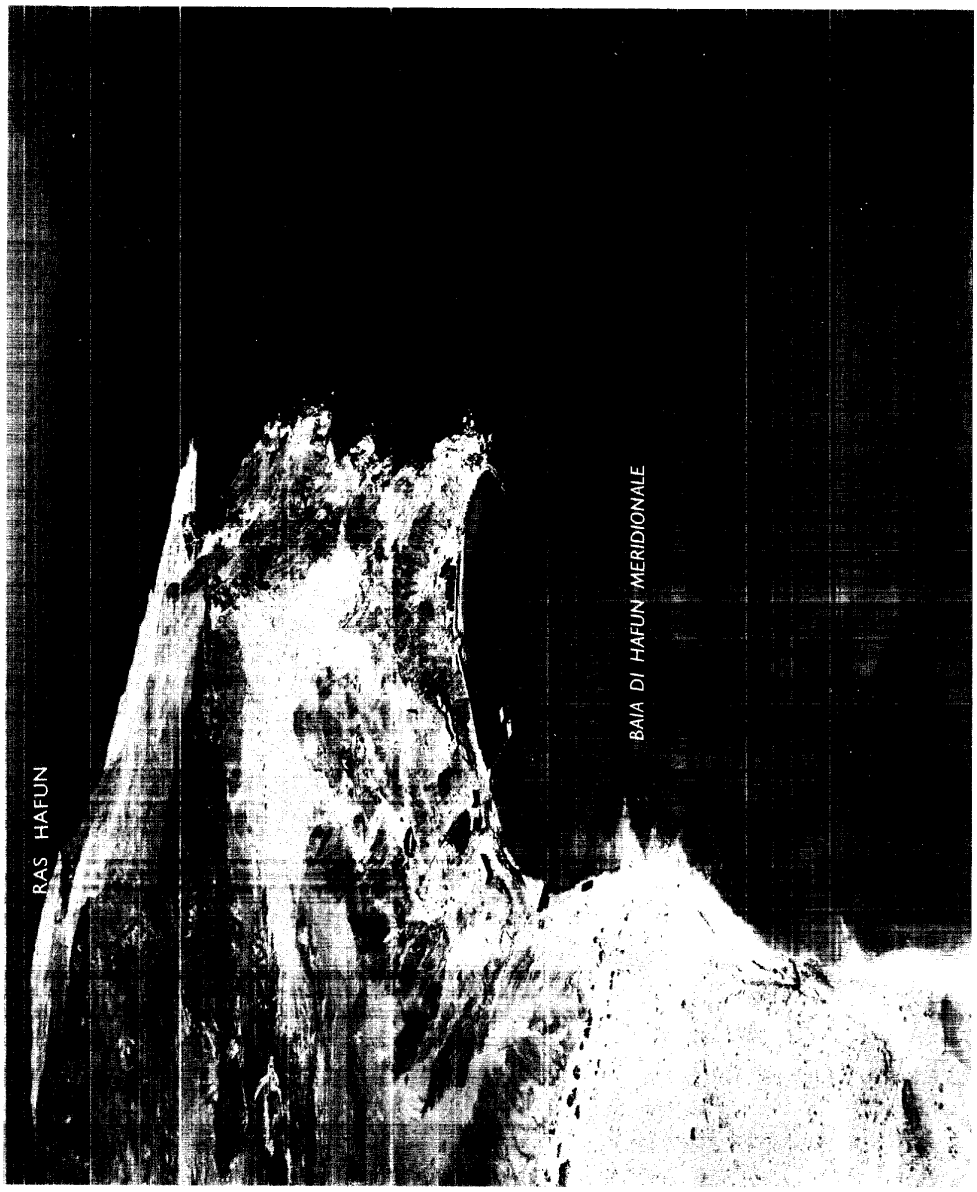


SUBSECTOR 3–C, SEGMENT [1]. SOMALIA COAST SOUTH OF RAS BINNAH. MAJOR BEACH AREAS (15) AND (16). Oblique view looking north showing all of beach (15) and north half of beach (16). See also FIGURE 22–49. Approximate position 10°50'N., 51°06'E.

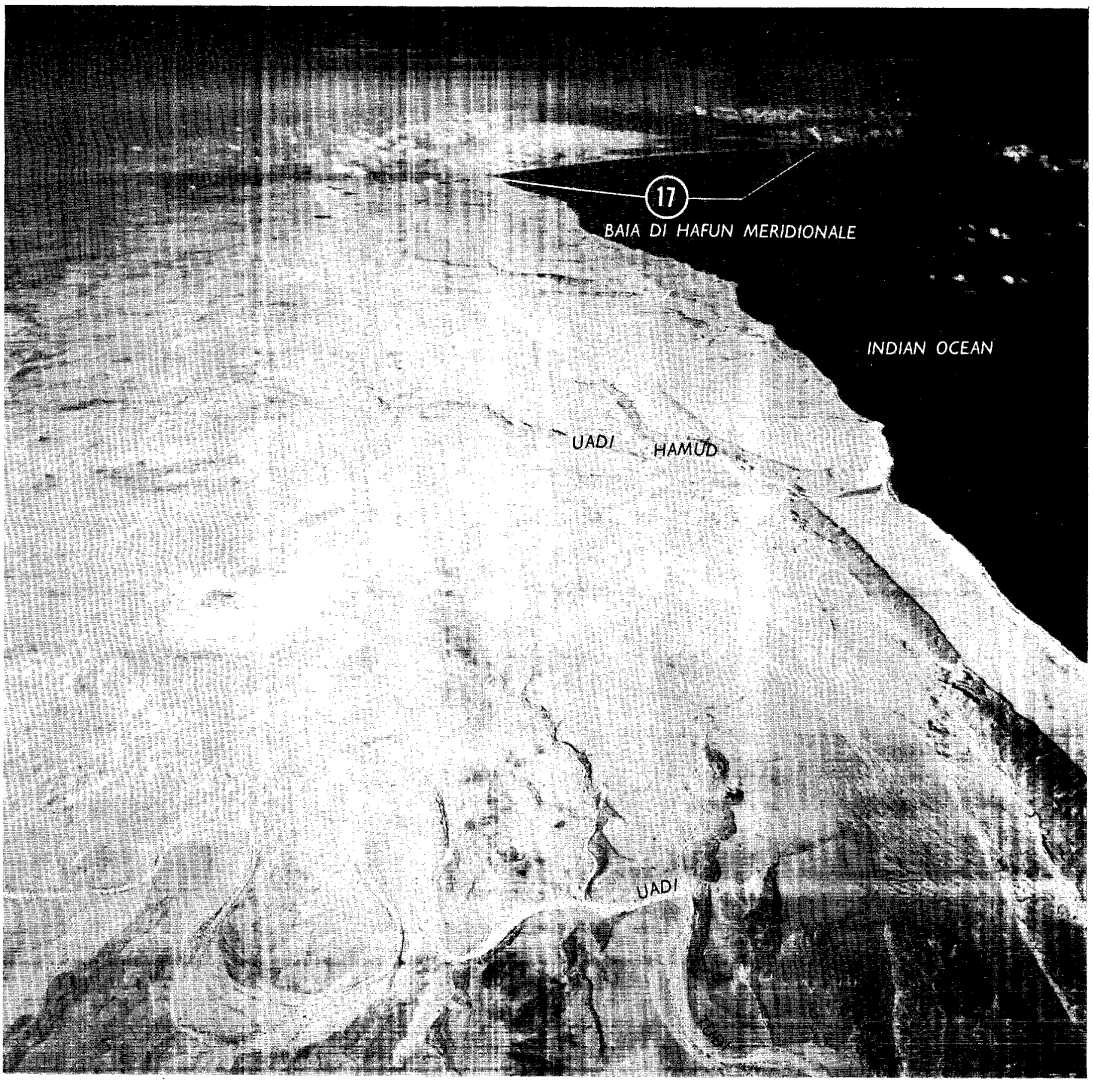
SUBSECTOR 3-C, SEGMENT [1]. COAST OF SOMALIA AT BAIA DI HAFUN SETTENTRIONALE. Oblique view looking southward across the bay. Note the ruggedness of the inland terrain, the dunes, and the sparse vegetation. Approximate position 10°45'N., 51°08'E.



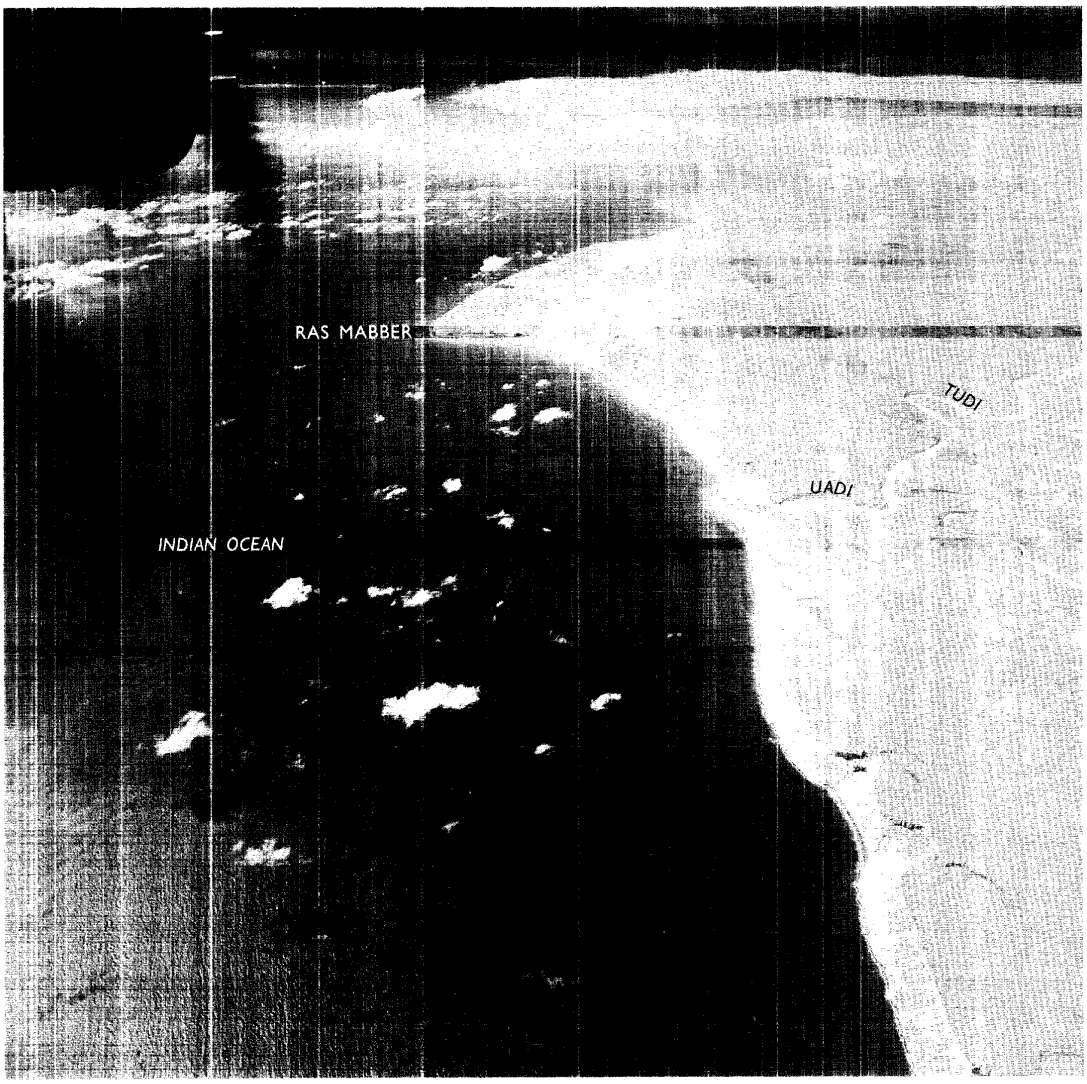
SUBSECTOR 3-C, SEGMENT [1]. DANTE, SOMALI REPUBLIC. MAJOR BEACH AREA (17). Oblique view northeastward showing segment of east part of beach. Approximate position 10°25'N., 51°15'E, March 1953.



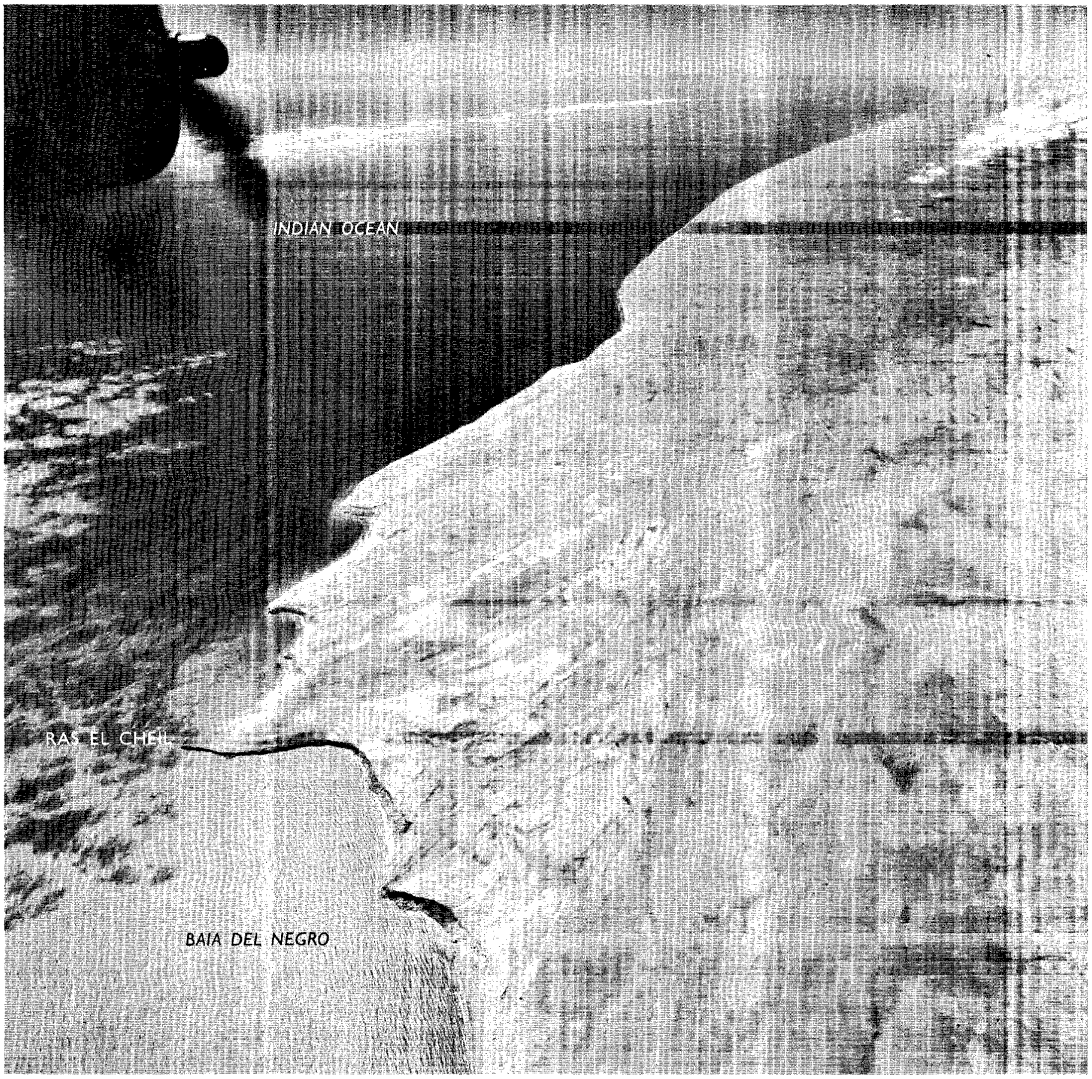
SUBSECTOR 3-C, SEGMENT [1]. SOMALIA COAST NEAR DANTE. Oblique view looking northeastward across harbor at some of the minor port facilities of Dante. Note the rugged terrain at the eastern end of the peninsula. Approximate position 10°24'N., 51°14'E. 1953.



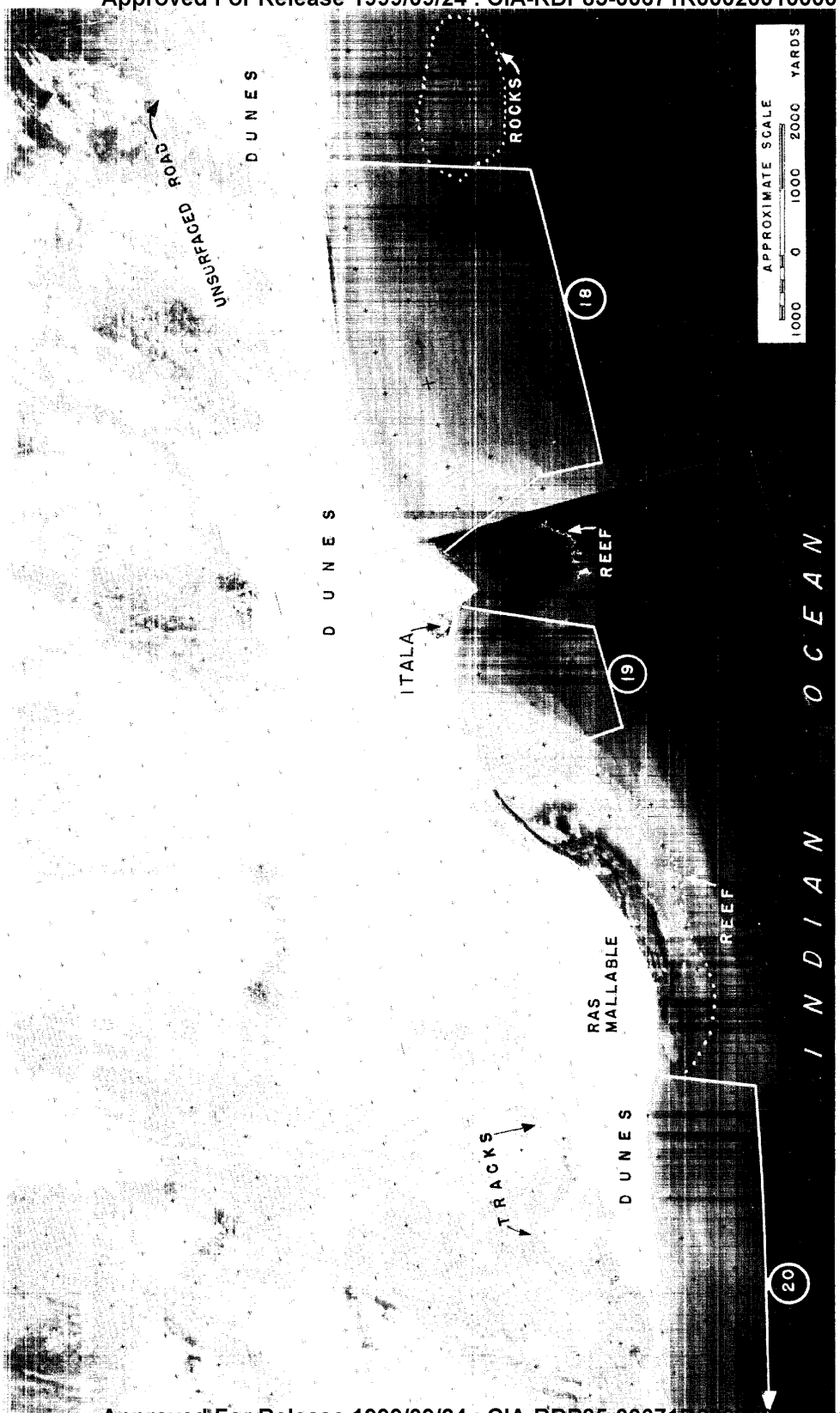
SUBSECTOR 3-C, SEGMENT [2]. COAST OF SOMALIA IN THE VICINITY OF BAIA DI HAFUN MERIDIONALE. Oblique view looking northward along the coast toward the bay. Rugged terrain near the sea and the deep gorges cut by the intermittent streams are typical of this part of the coast. Approximate position 10°12'N., 50°55'E.



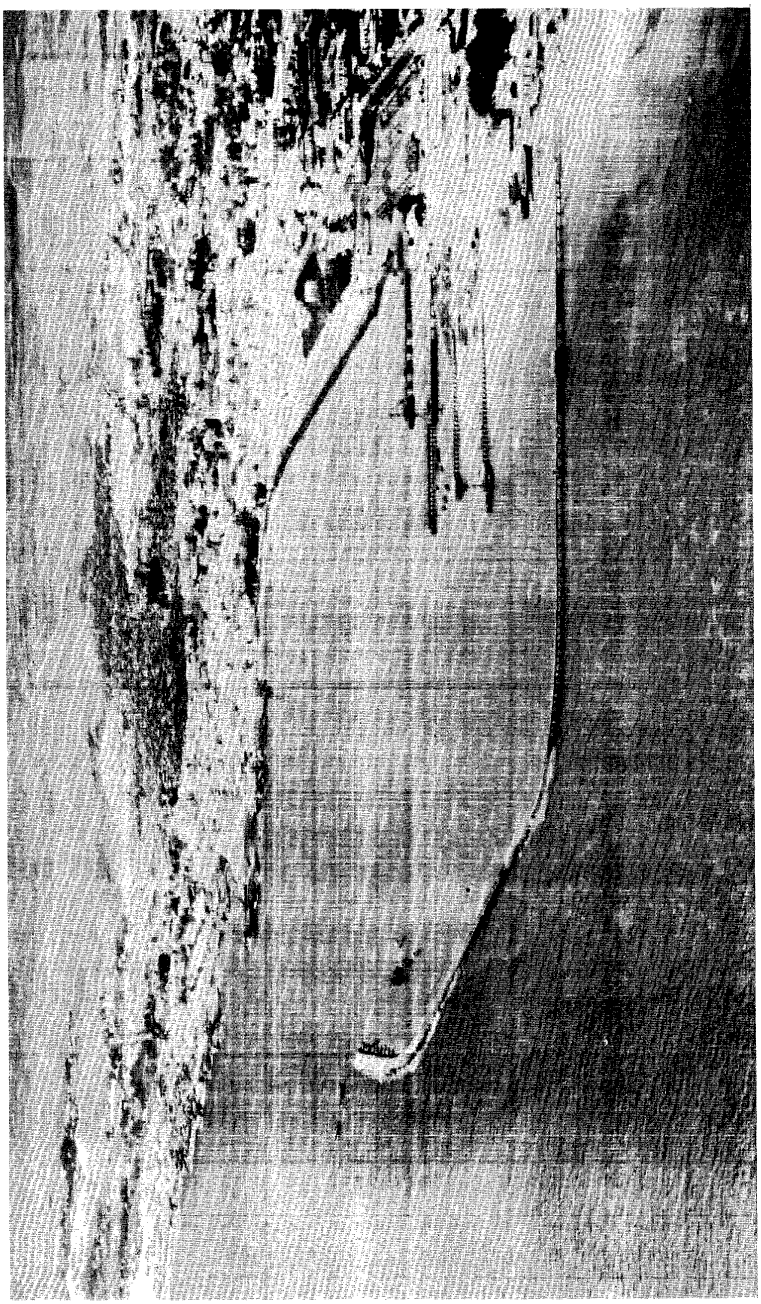
SUBSECTOR 3–C, SEGMENT [2]. SOMALIA COAST IN THE VICINITY OF RAS MABBER. Escarpments rise from the steep slopes bordering the coast; streams are deeply entrenched. Approximate position 9°35'N., 50°50'E.



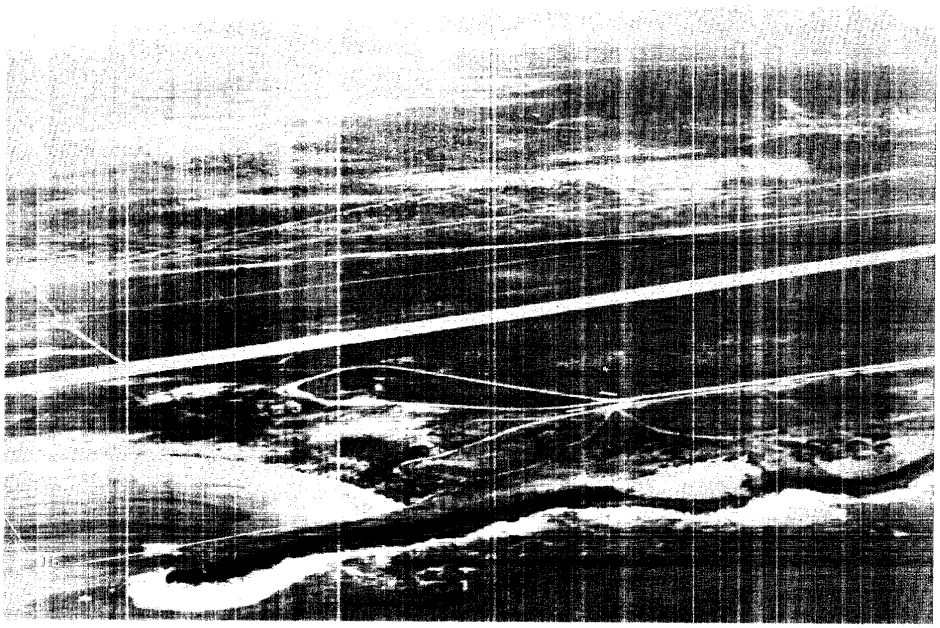
SUBSECTOR 3-C, SEGMENT [2]. SOMALIA COAST IN THE VICINITY OF RAS EL CHEIL. Oblique view looking across Ras el Cheil and along the coast southwestward. The bluffs and cliffs are typical of those bordering the coast southwestward to El Meghet. Note the almost complete absence of streams on the seaward side of the coastal plain. Approximate position 7°48'N., 49°50'E.



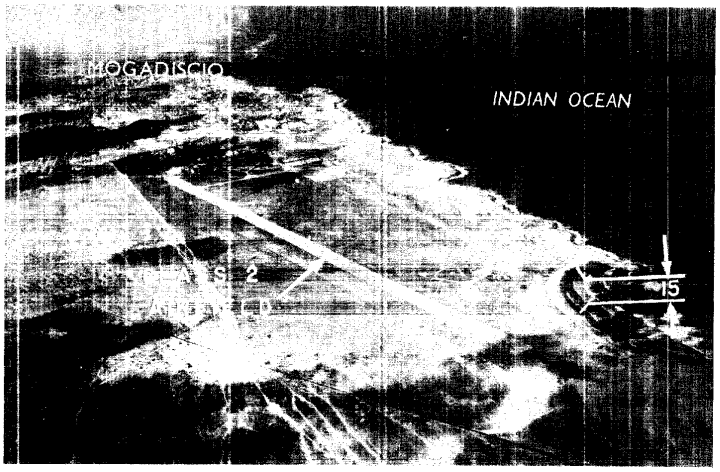
SUBSECTOR 3-C, SEGMENT [3]. COAST OF SOMALIA AT ITALA. MAJOR BEACH AREAS (18), (19), AND (20). Uncontrolled vertical mosaic. Approximate position 2°45'N., 46°19'E. February 1960.



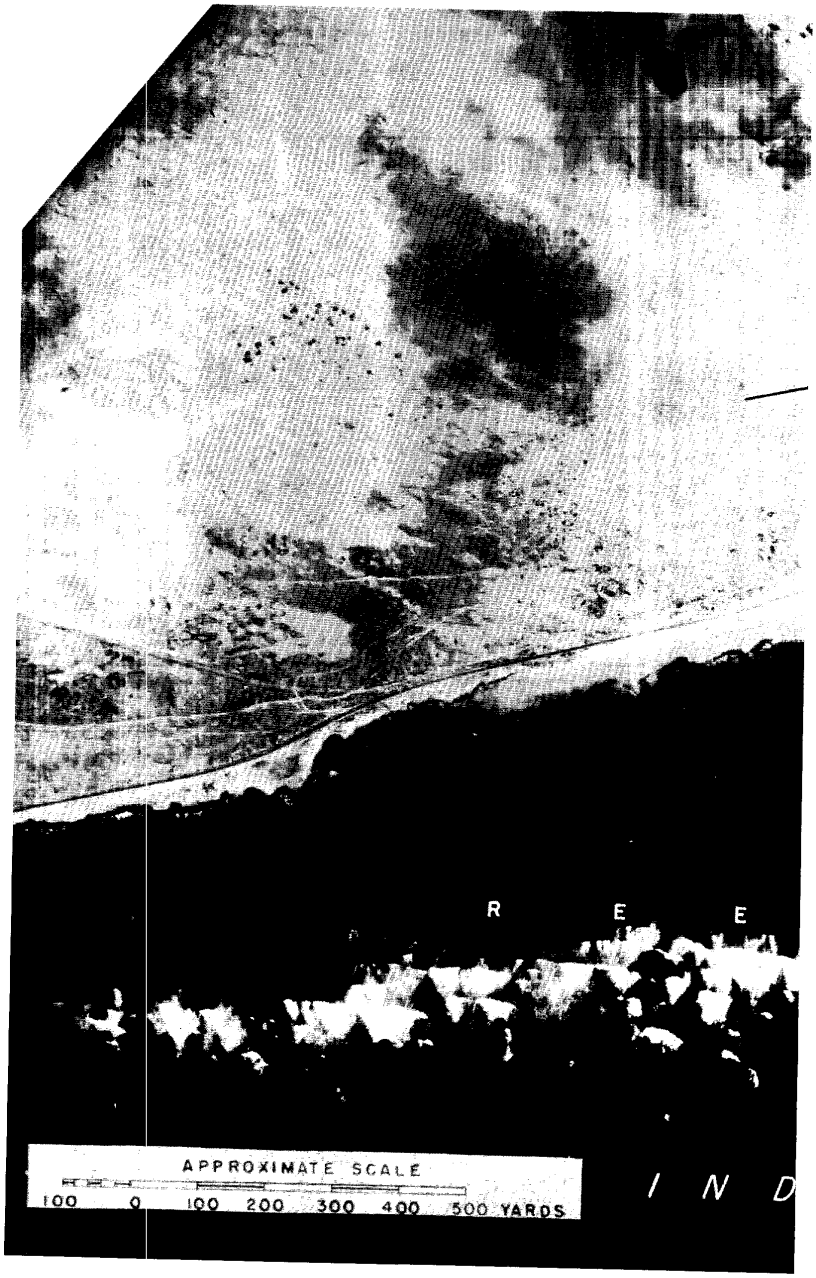
SUBSECTOR 3–C, SEGMENT [3]. MOGADISCIO, SOMALI REPUBLIC. Oblique view looking westward showing town, piers, seawall, and breakwater, with flat-to-undulating plain in background. Approximate position 2°04'N., 45°22'E. November 1952.



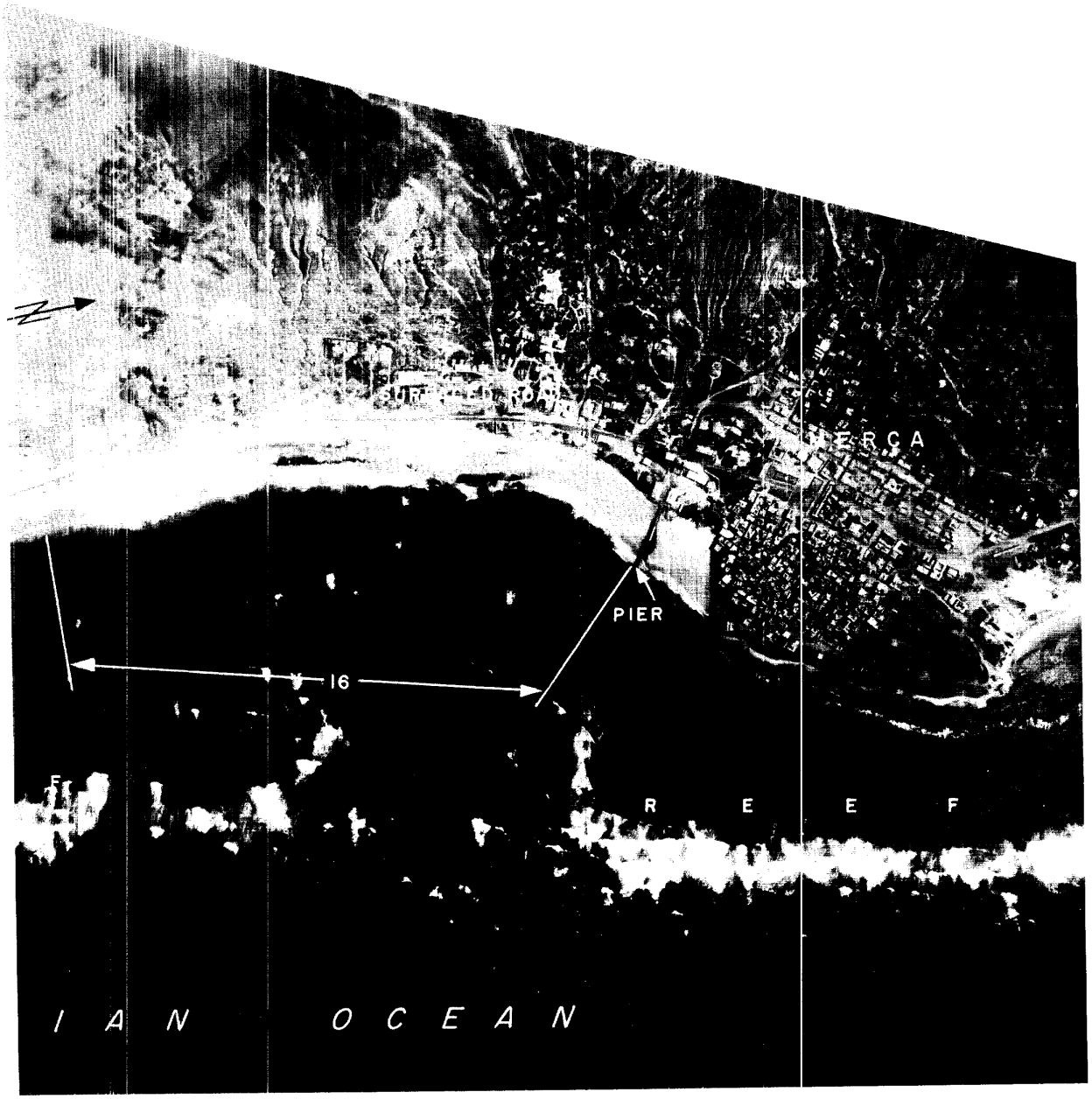
A. SUBSECTOR 3–C, SEGMENT [3]. SOMALIA COAST SOUTHWEST OF MOGADISCIO AT MINOR BEACH AREA *15*. Oblique view locking northeast showing escarpment backing the shores adjacent to minor beach area *15*. Class 2 air facility and extensive brush-covered plain in background. Approximate position 2°01′N., 45°18′E.



B. SUBSECTOR 3–C, SEGMENT [3]. SOMALIA COAST AT MINOR BEACH AREA *15*. Oblique view looking northeastward. Approximate position 2°00′N., 45°18′E. May 1959.



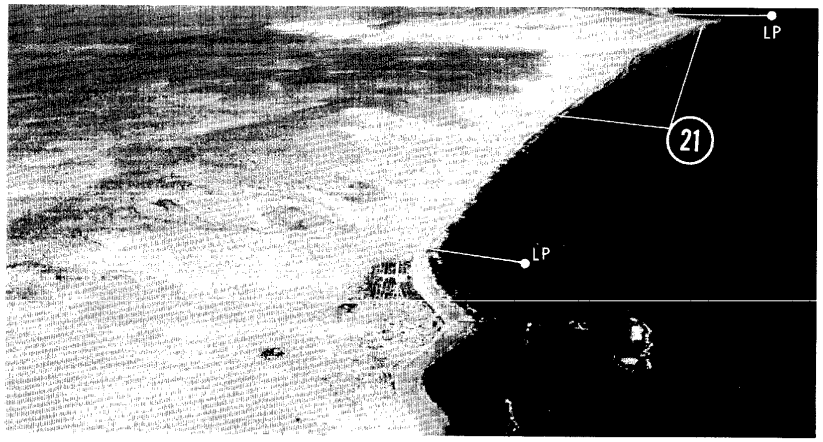
SUBSECTOR 3–C, SEGMENT [31. COAST O



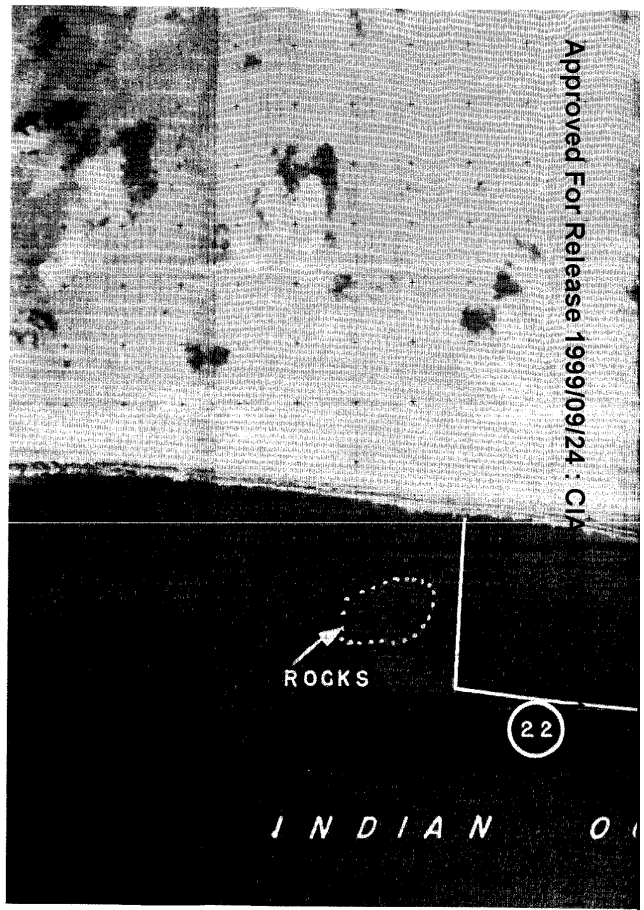
F SOMALIA AT MERCA. MINOR BEACH AREA *16*. Uncontrolled vertical mosaic. Approximate position 1°42'N., 44°46'E. June 1956.

SUBSECTOR 3-C, SEGMENT [3]. SOMALIA COAST AT MAJOR
cal mosaic. Approximate

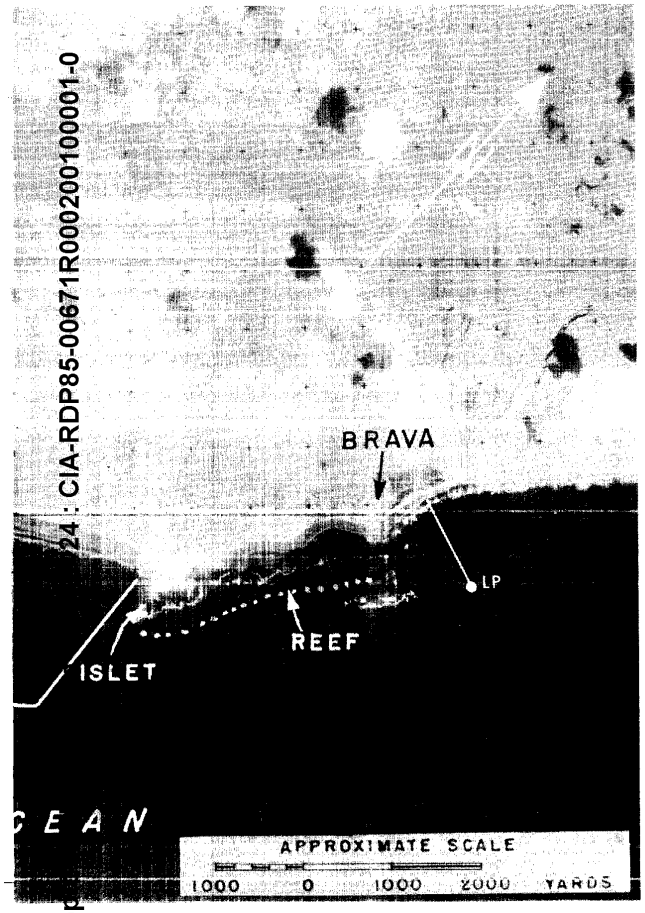
BEACH AREA (21) AND ONE LANDING PLACE (LP). Uncontrolled vertical position 1°10'N., 44°07'E. October 1957.



A. SUBSECTOR 3–C, SEGMENT [3]. BRAVA, SOMALI REPUBLIC. MAJOR BEACH AREA (21) AND TWO LANDING PLACES (LP). Oblique view looking north-northeast. Shores are backed by undulating brush-covered plain. Approximate position 1°08'N., 44°03'E. March 1960.

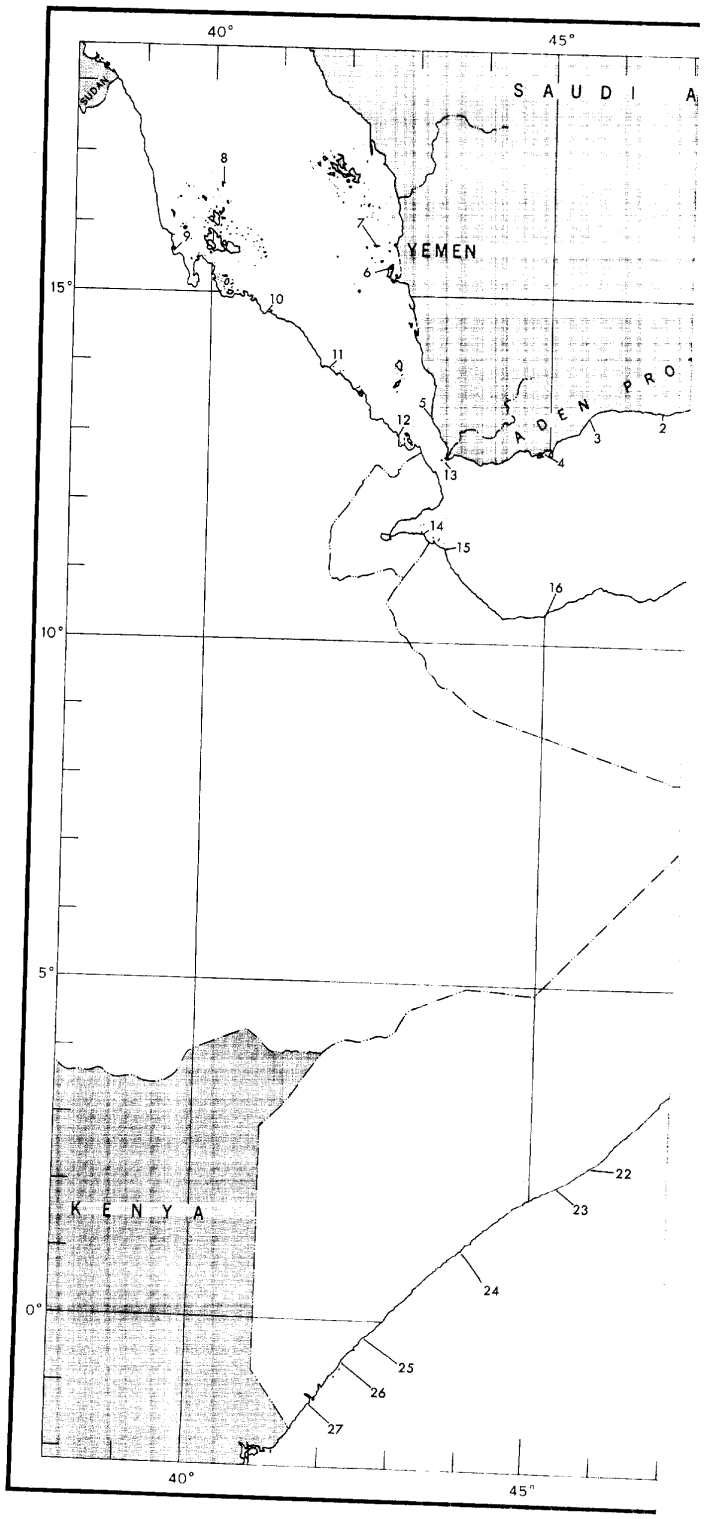


B. SUBSECTOR 3–C, SEGMENT [3]. SOMALIA COAST I
ONE LANDING PLACE (LP). Approximate



N VICINITY OF BRAVA. MAJOR BEACH AREA (22) AND
position 1°05'N., 44°02'E. January 1960.

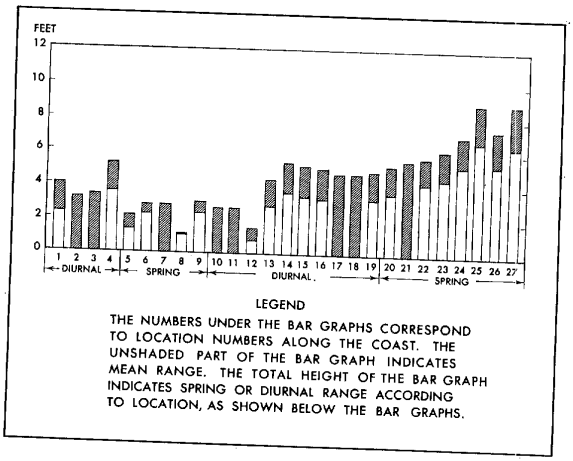
C. SUBSECTOR 3-C, SEGMENT [3]. CHISIMAIO, SOMALI REPUBLIC. MAJOR BEACH AREA (23). Oblique view looking east showing east half of major beach area (23). Approximate position 0°22'N., 42°33'E. March 1953.



NAMES OF STATIONS

1. RA'S AL MUKALLĀ
2. MAQĀṬIN AL KABĪR*
3. SHUQRĀ'*
4. ADEN
5. AL MUKHĀ (MOCHA)
6. KAMARAN PASSAGE
7. JAZĪRAT ANṬŪFASH*
8. ISOLA HARMIL
9. MASSAUA
10. BAIA D'ANFILE*
11. EDD*
12. ASSAB
13. PERIM ISLAND
14. DJIBOUTI
15. ZEILA
16. BERBERA
17. LAS KHOREH*
18. ALULA*
19. CAPO GUARDAFUI
20. OBBIA
21. ITALA*
22. UARSCIECH
23. MOGADISCIO
24. BRAVA
25. FIUME GIUBA
26. CHISIMAIO
27. BIRCAO

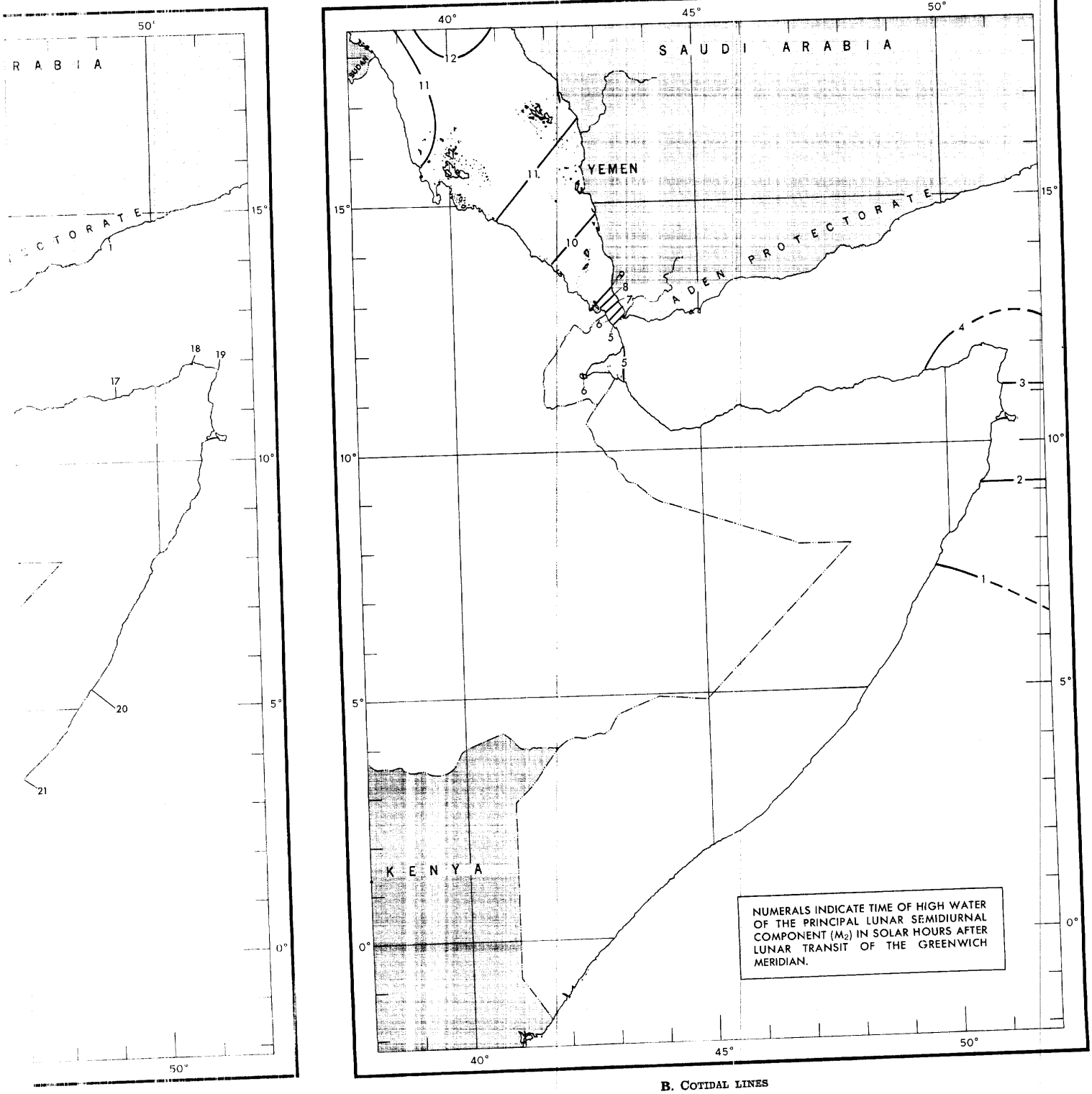
*RANGES AND LOCATIONS TAKEN FROM "THE ADMIRALTY TIDE TABLES, VOL II FOR THE YEAR 1961, ATLANTIC AND INDIAN OCEANS". THE REMAINDER OF INFORMATION IS TAKEN FROM U. S. COAST & GEODETIC SURVEY TIDE TABLES.



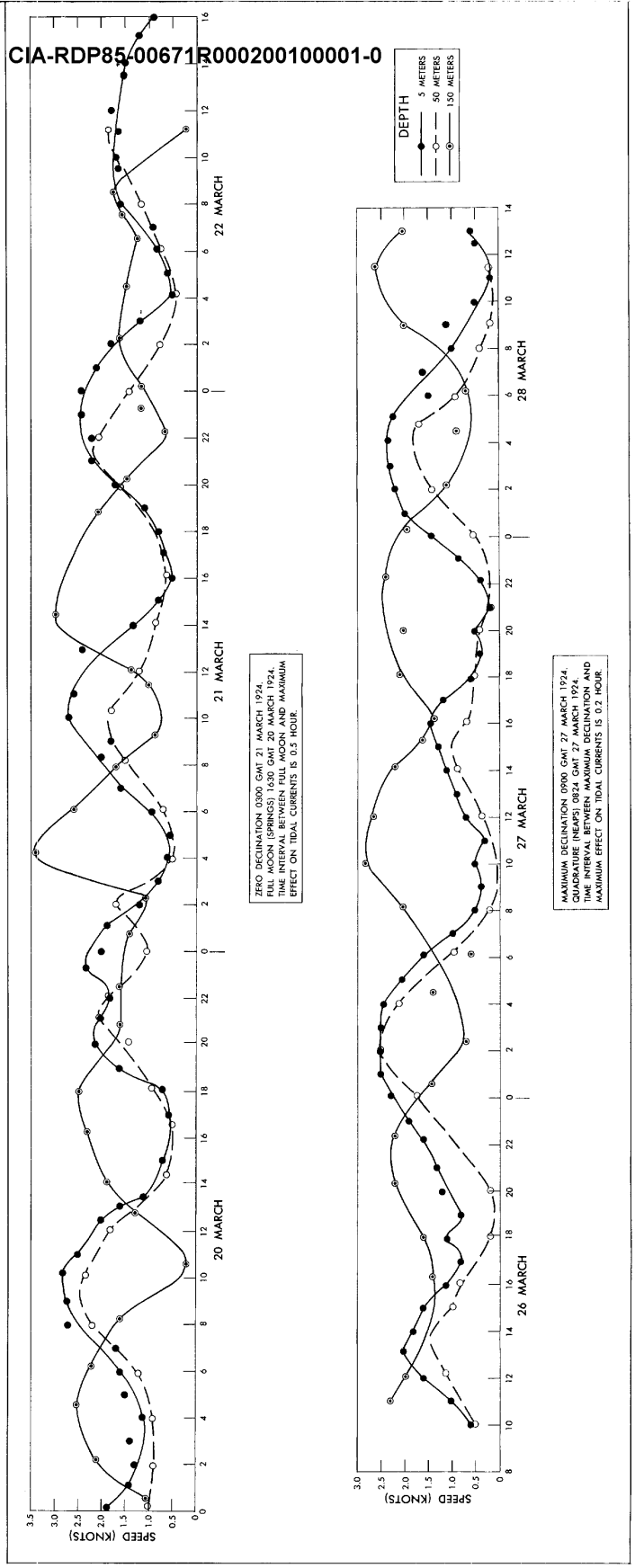
LEGEND

THE NUMBERS UNDER THE BAR GRAPHS CORRESPOND TO LOCATION NUMBERS ALONG THE COAST. THE UNSHADED PART OF THE BAR GRAPH INDICATES MEAN RANGE. THE TOTAL HEIGHT OF THE BAR GRAPH INDICATES SPRING OR DIURNAL RANGE ACCORDING TO LOCATION, AS SHOWN BELOW THE BAR GRAPHS.

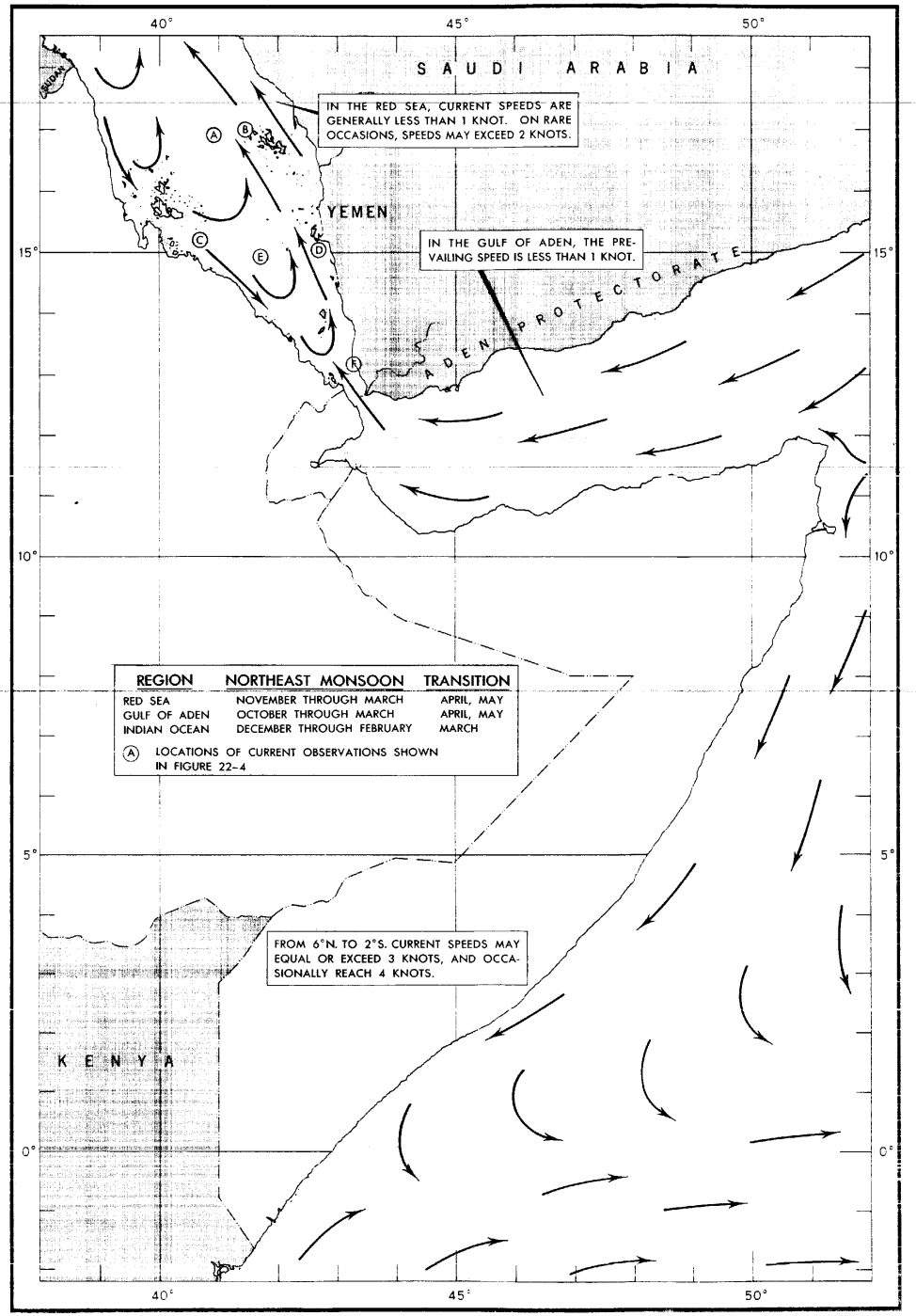
A. TIDE RANGES



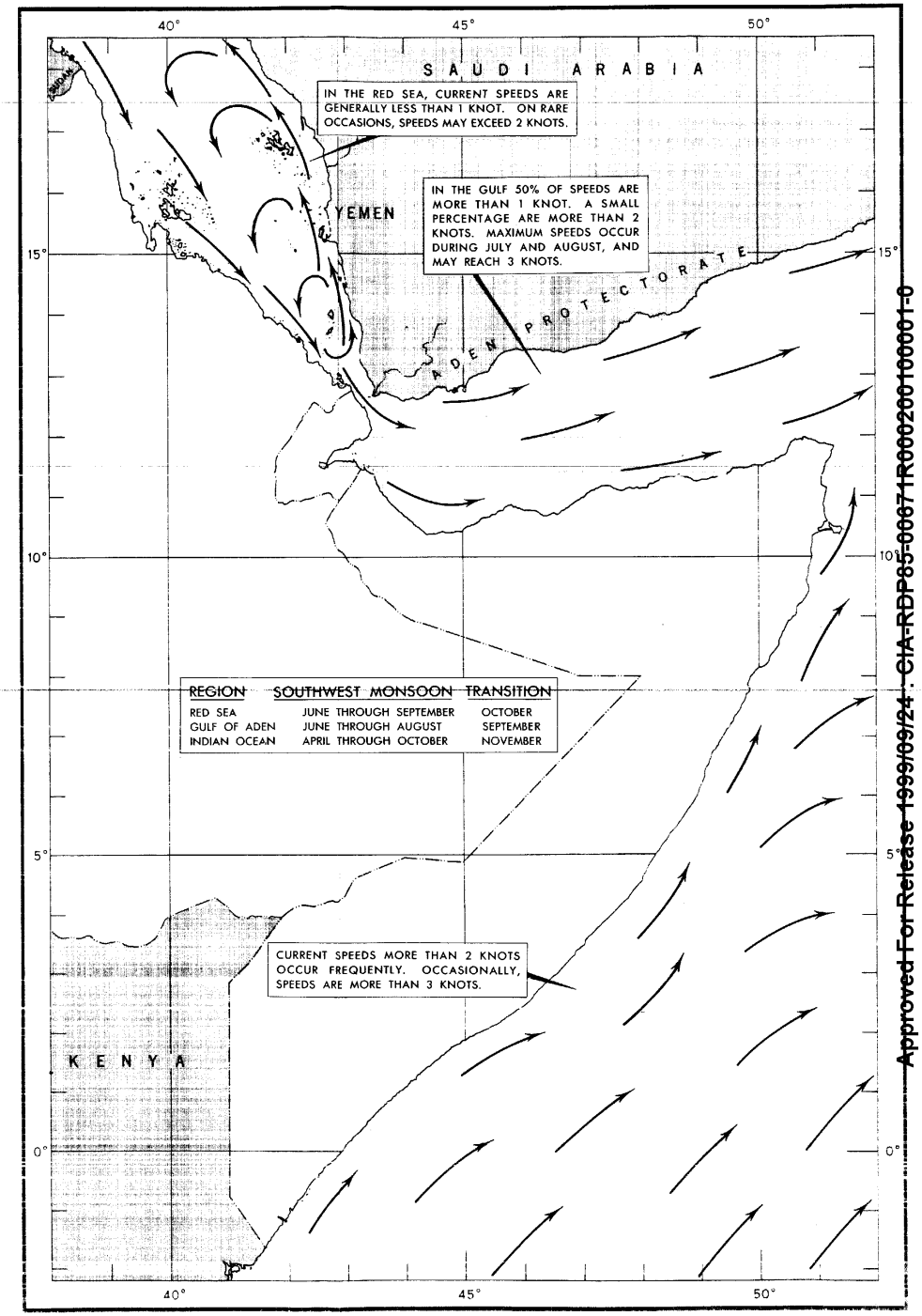
B. COTIDAL LINES



A. BAB EL MANDEB, RESULTANT CURRENTS



B. General surface currents, northeast monsoon



C. General surface currents, southwest monsoon

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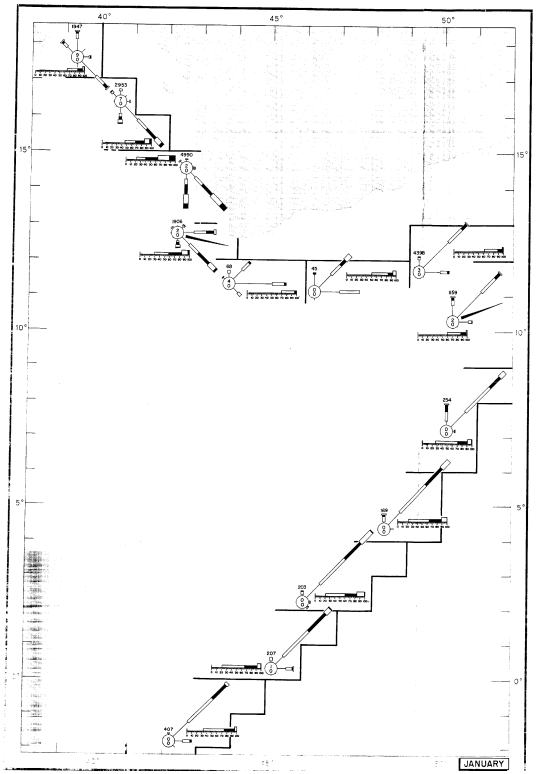
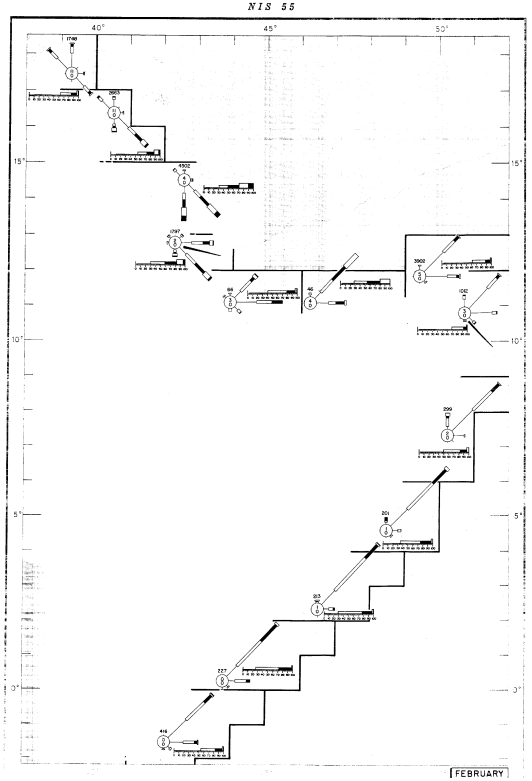
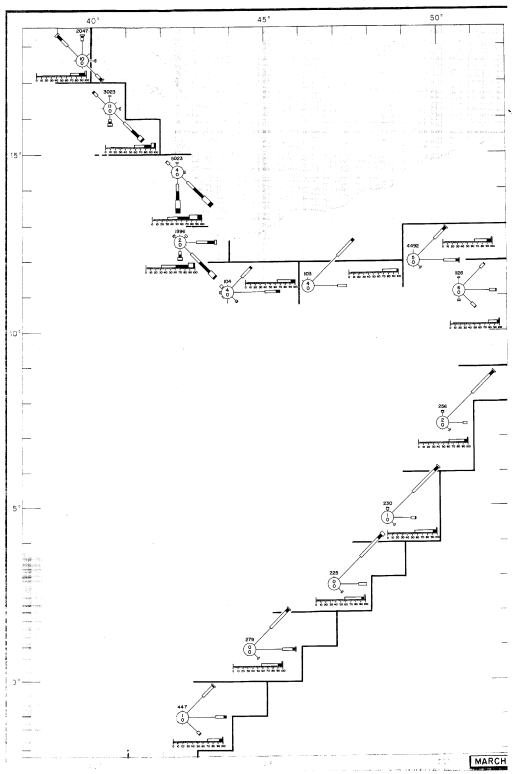
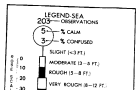
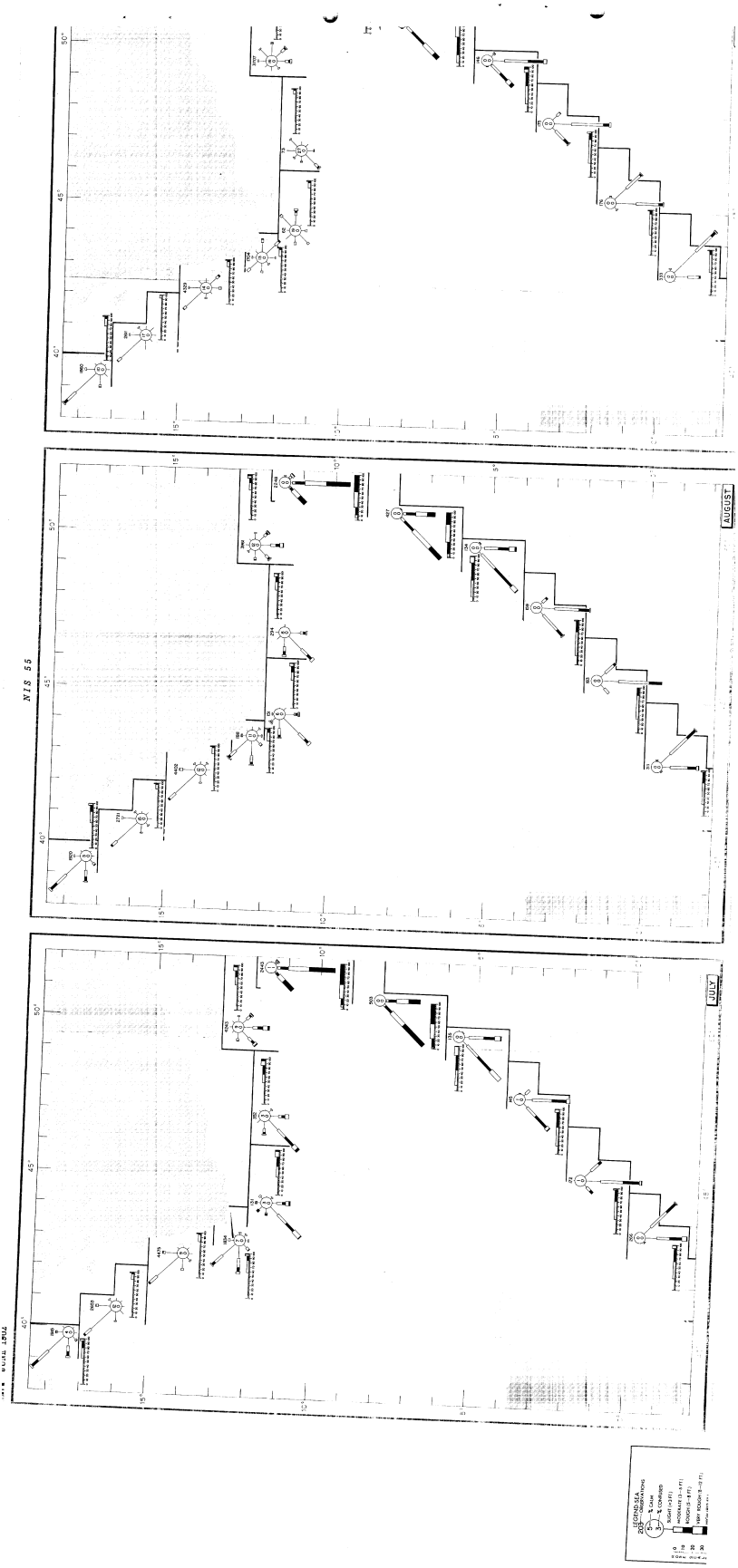


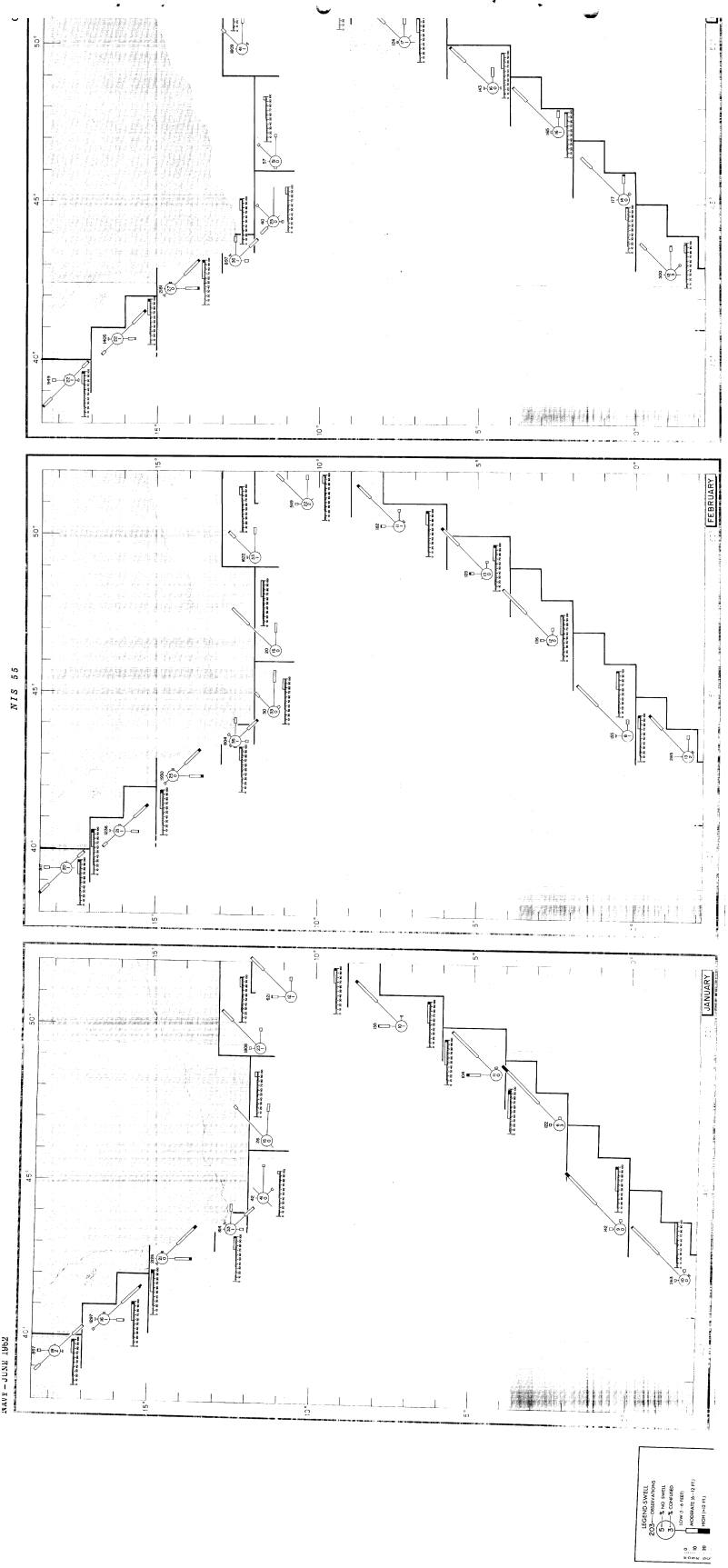


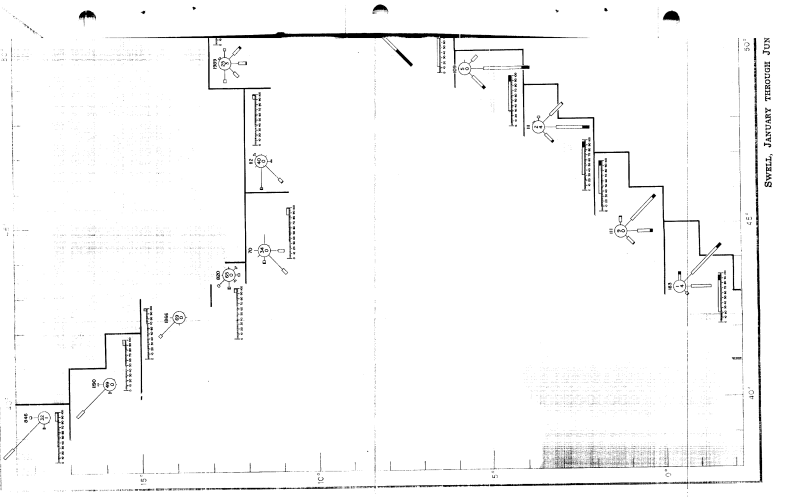


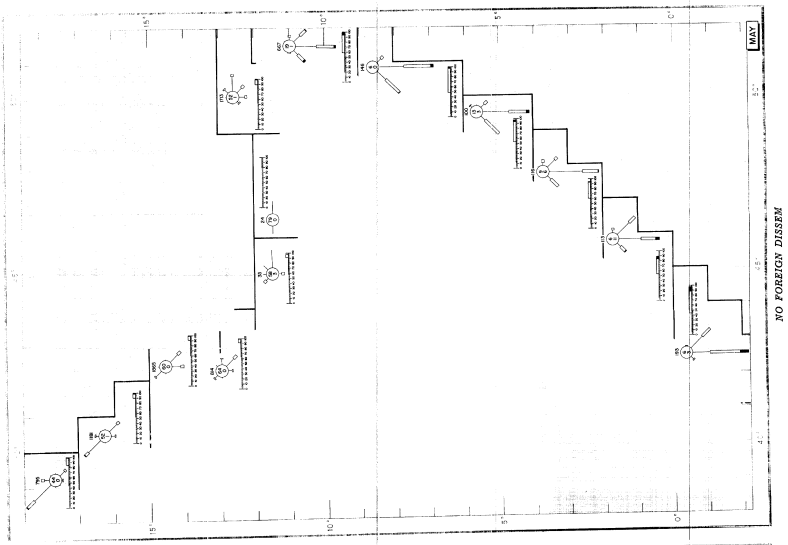


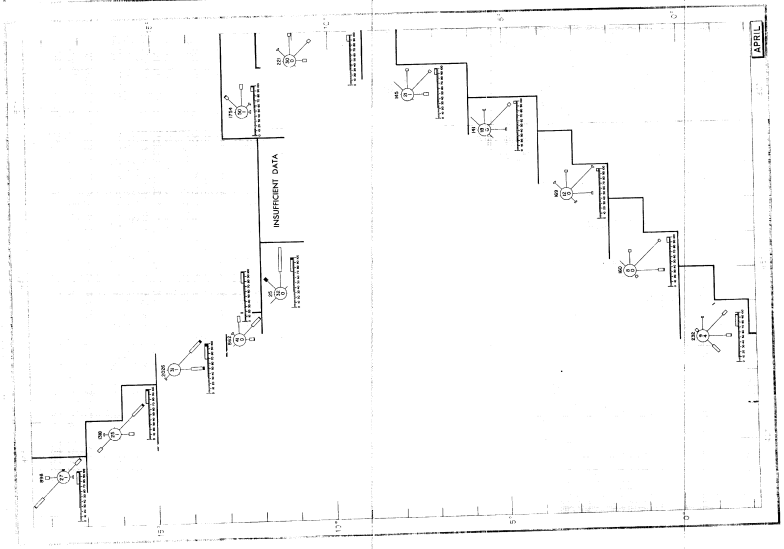
Approved For Release 1999/09/24 : CIA-RDP85-00671R000200100001-0

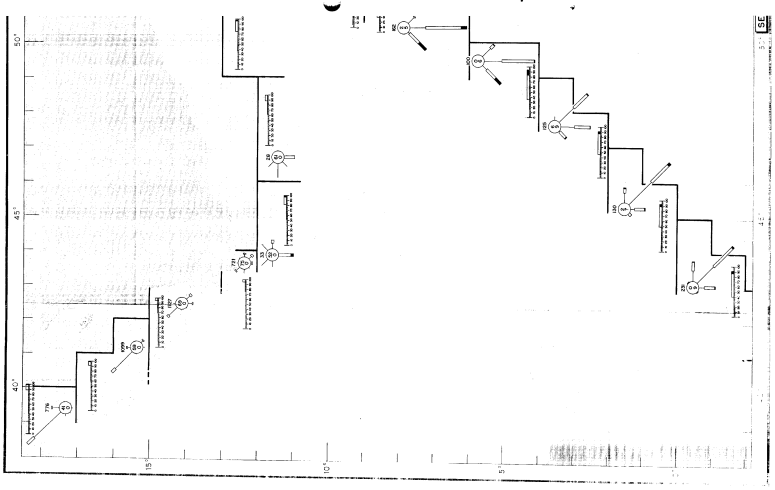


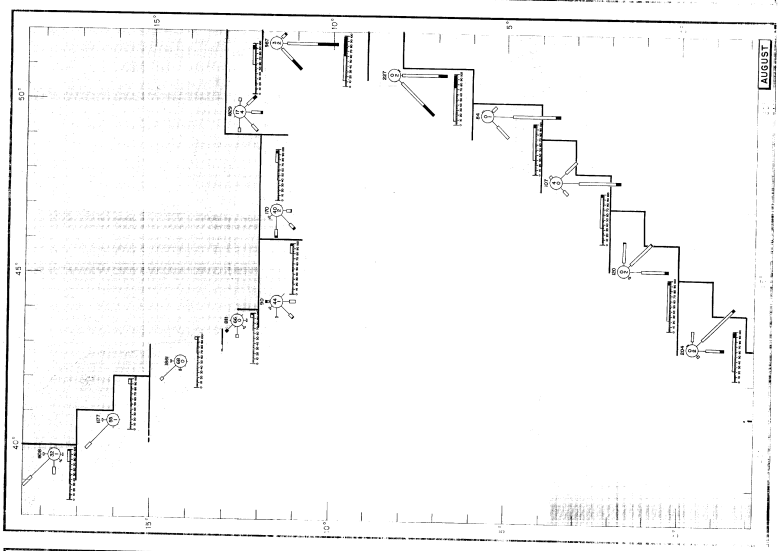


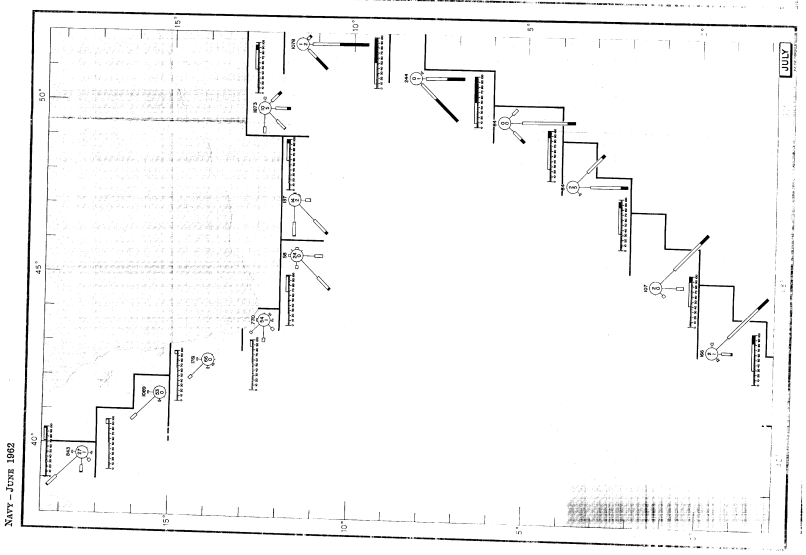


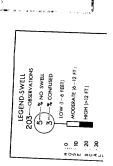






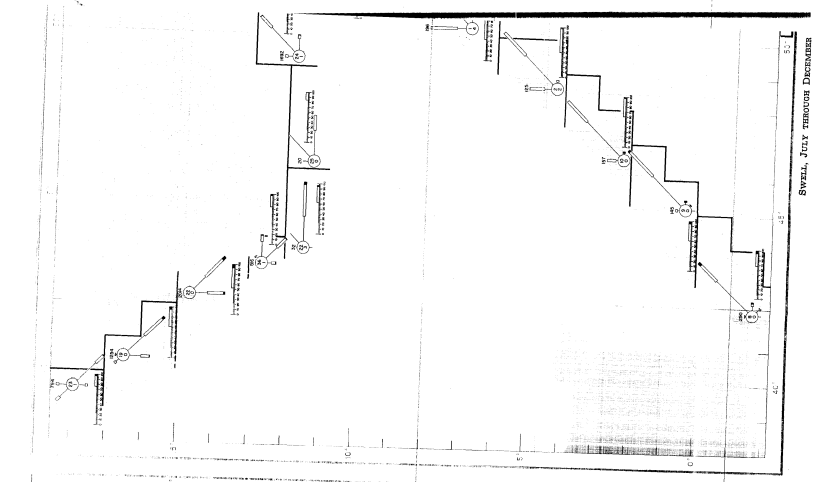




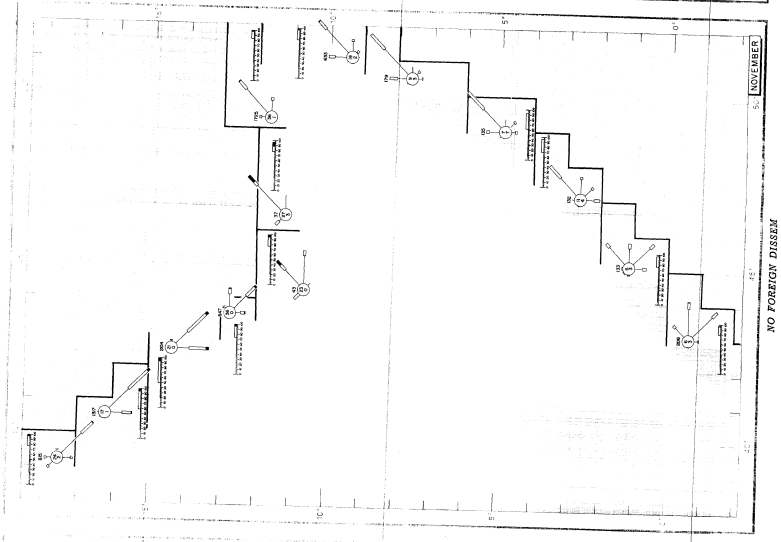


NAVY – JUNE 1962

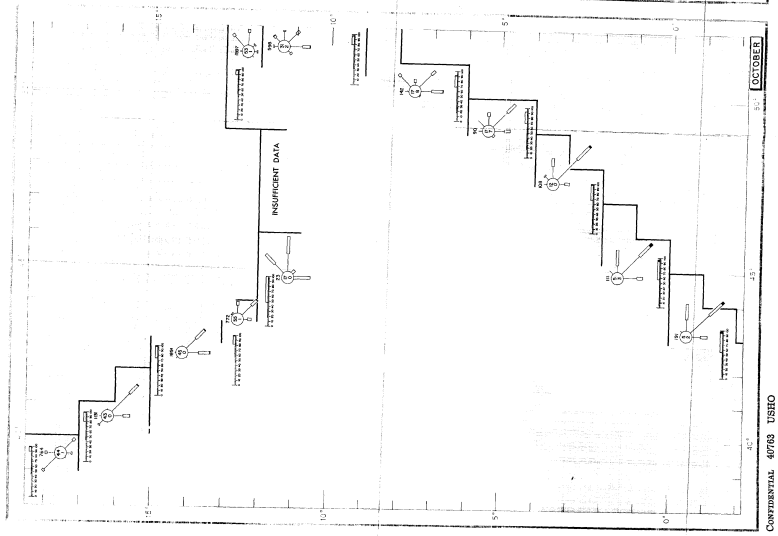
NIS 55



SWELL, JULY THROUGH DECEMBER



NO FOREIGN DISSEM



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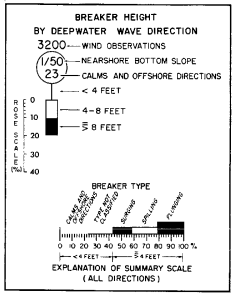
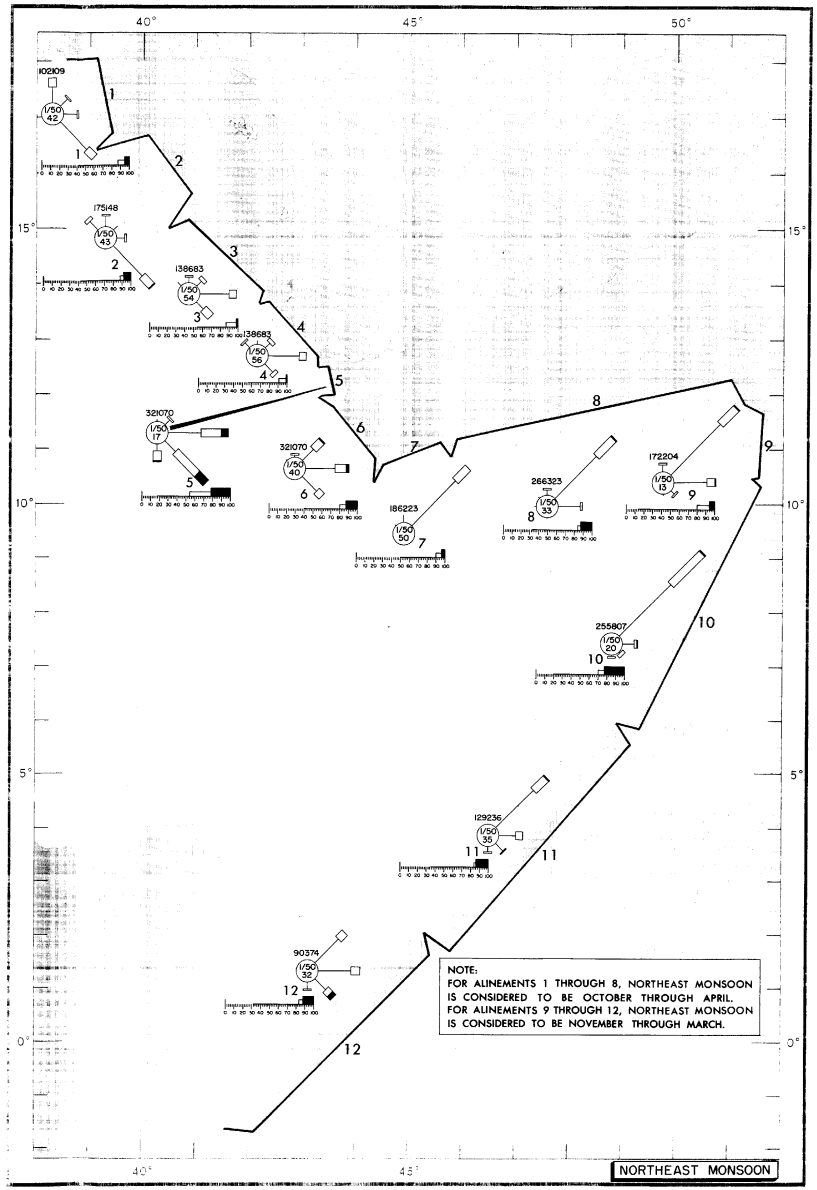
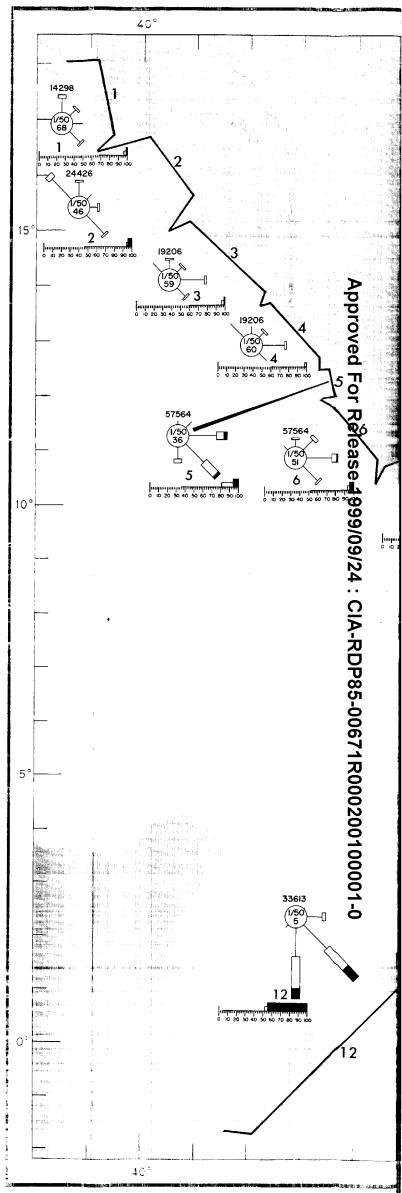


GENERALIZED BREAKER CONDITIONS FOR COASTAL ALINEMENTS DURING NORTHEAST MONSOON, SPRING TRANSITION, SOUTHWEST MONSOON, AND AUTUMN TRANSITION. Breaker heights and frequencies on many of the beaches may vary from the data shown on these charts. For the expected occurrence of breakers on each beach, see beach table.





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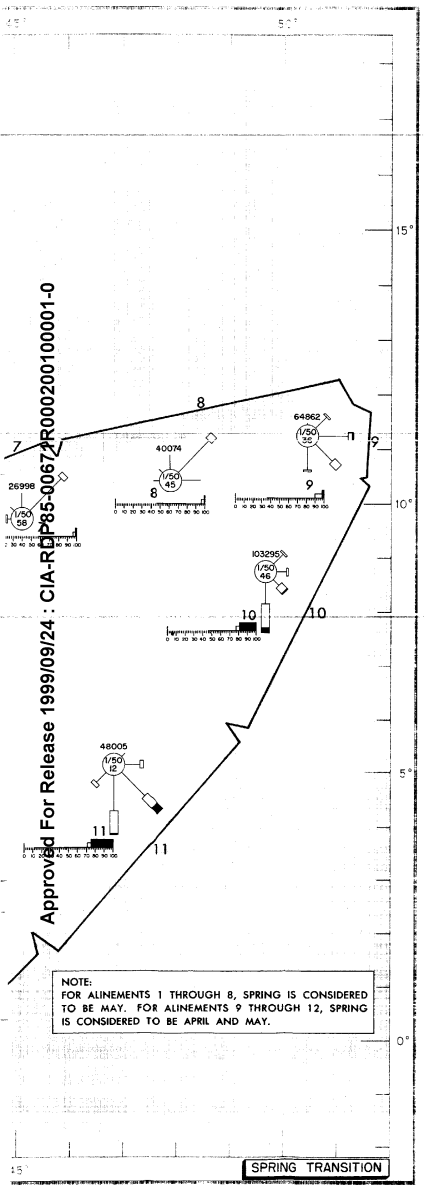
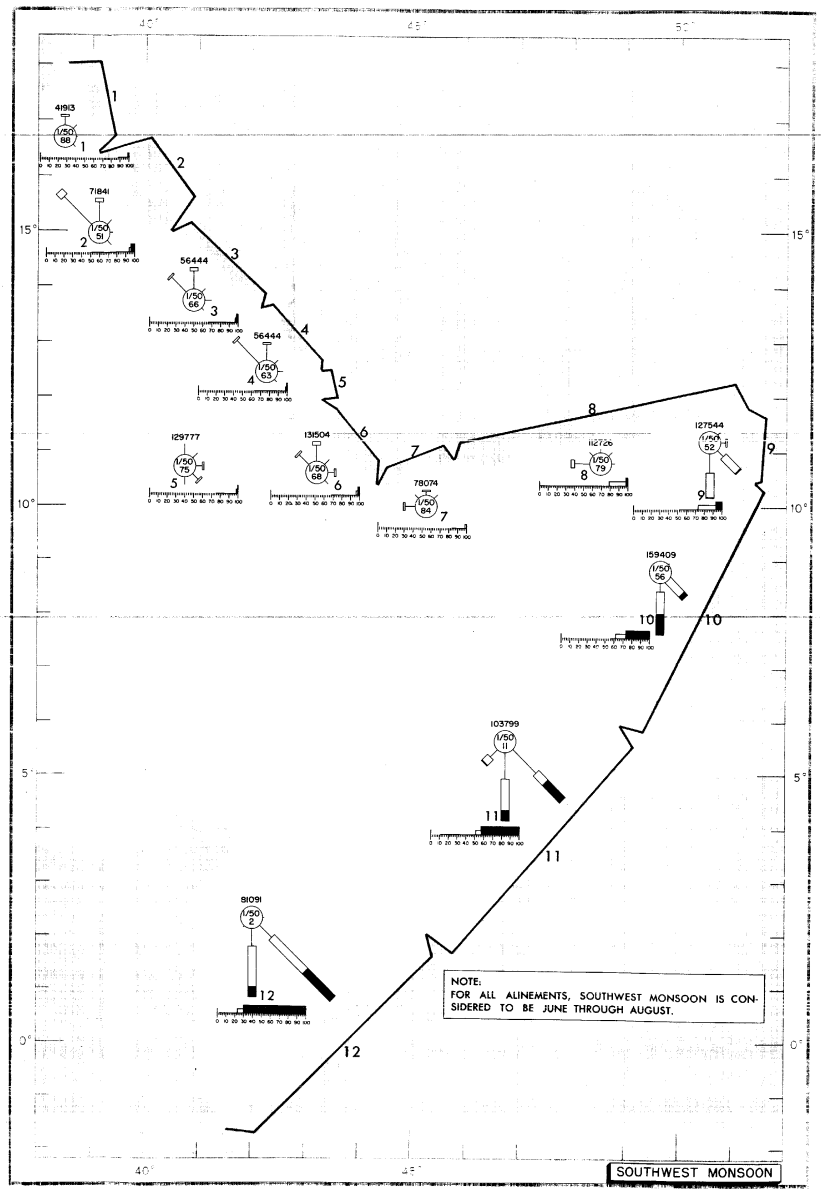
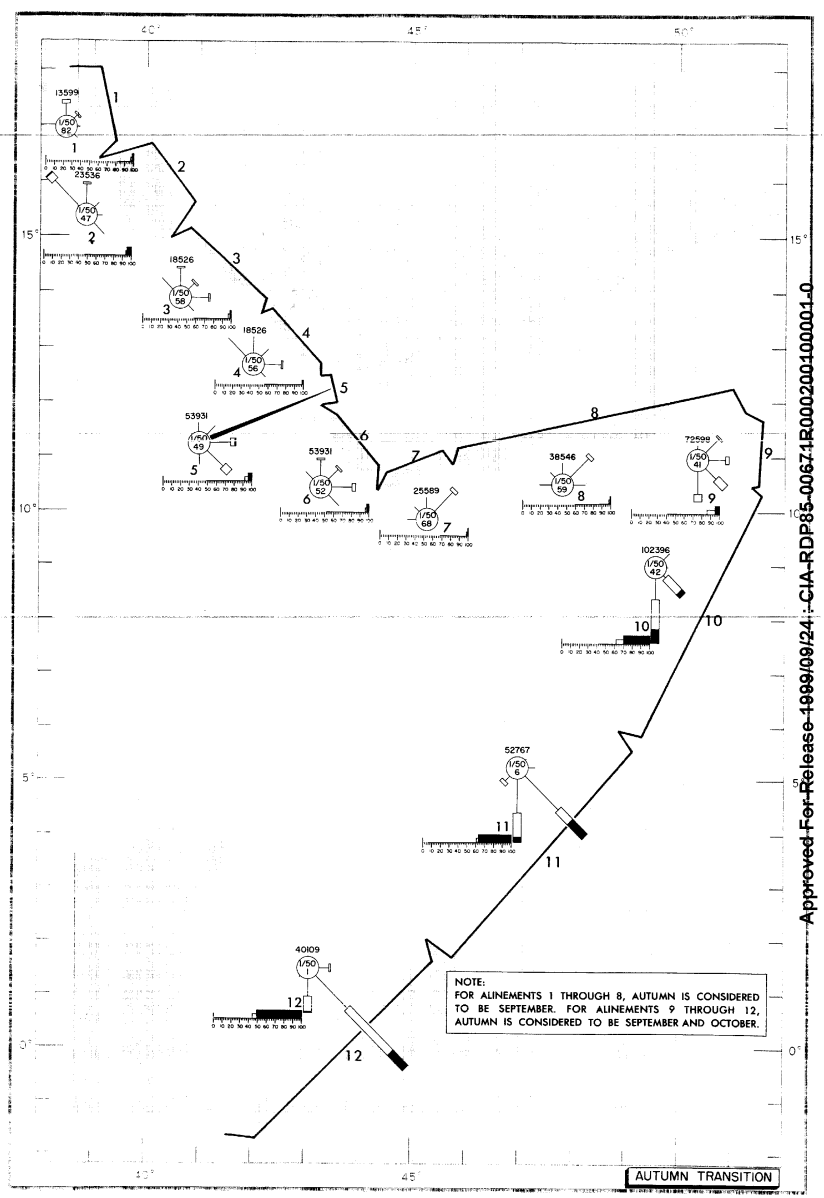
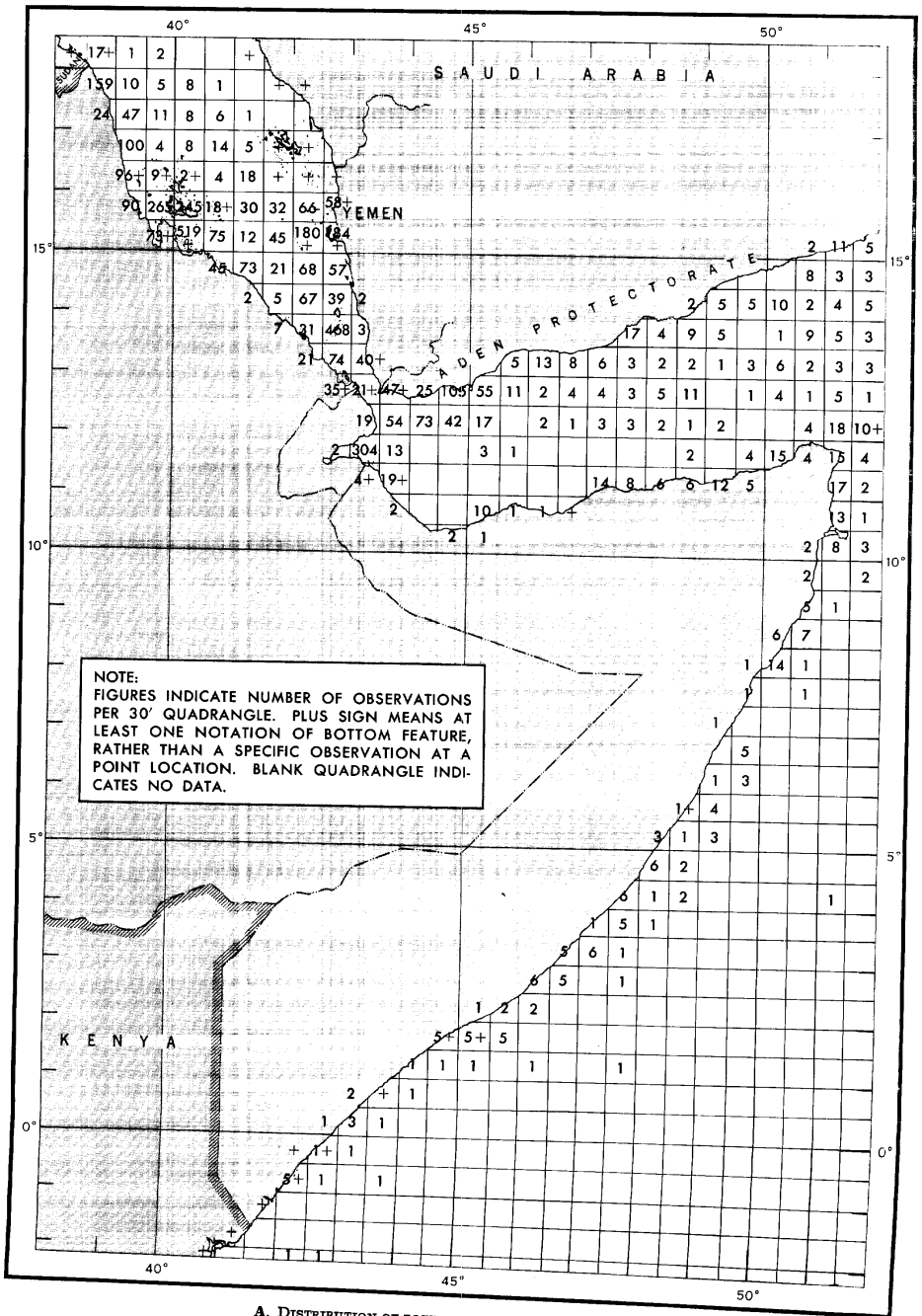
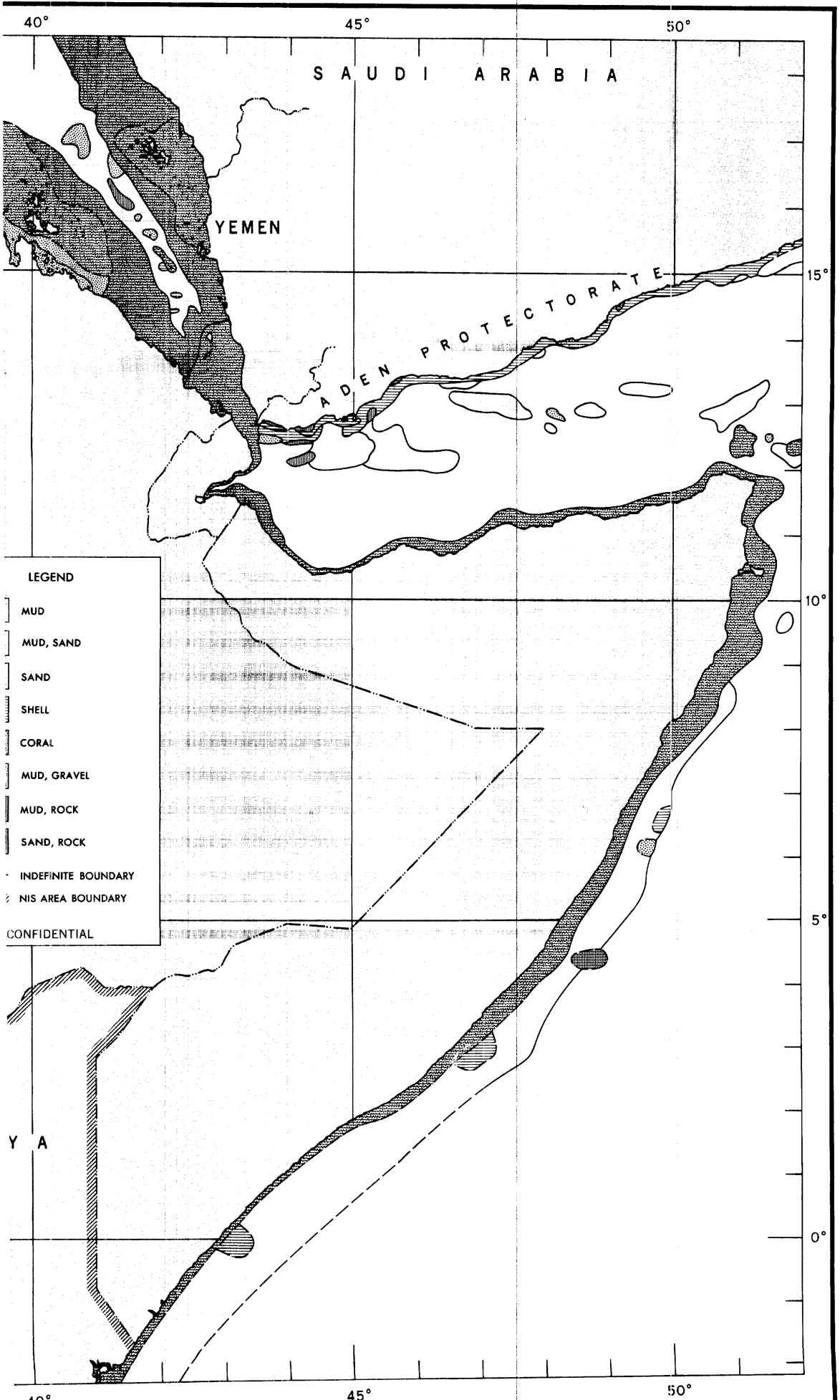






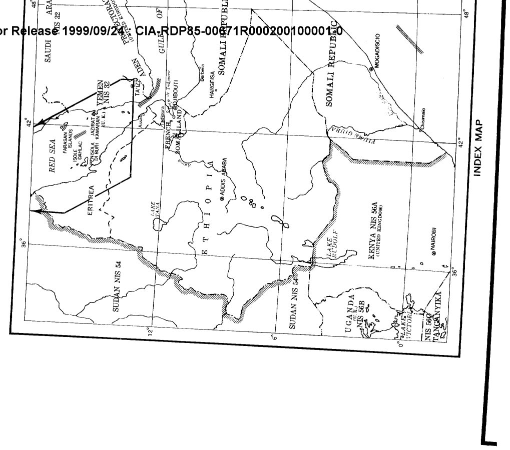


A. DISTRIBUTION OF BOTTOM [illegible]

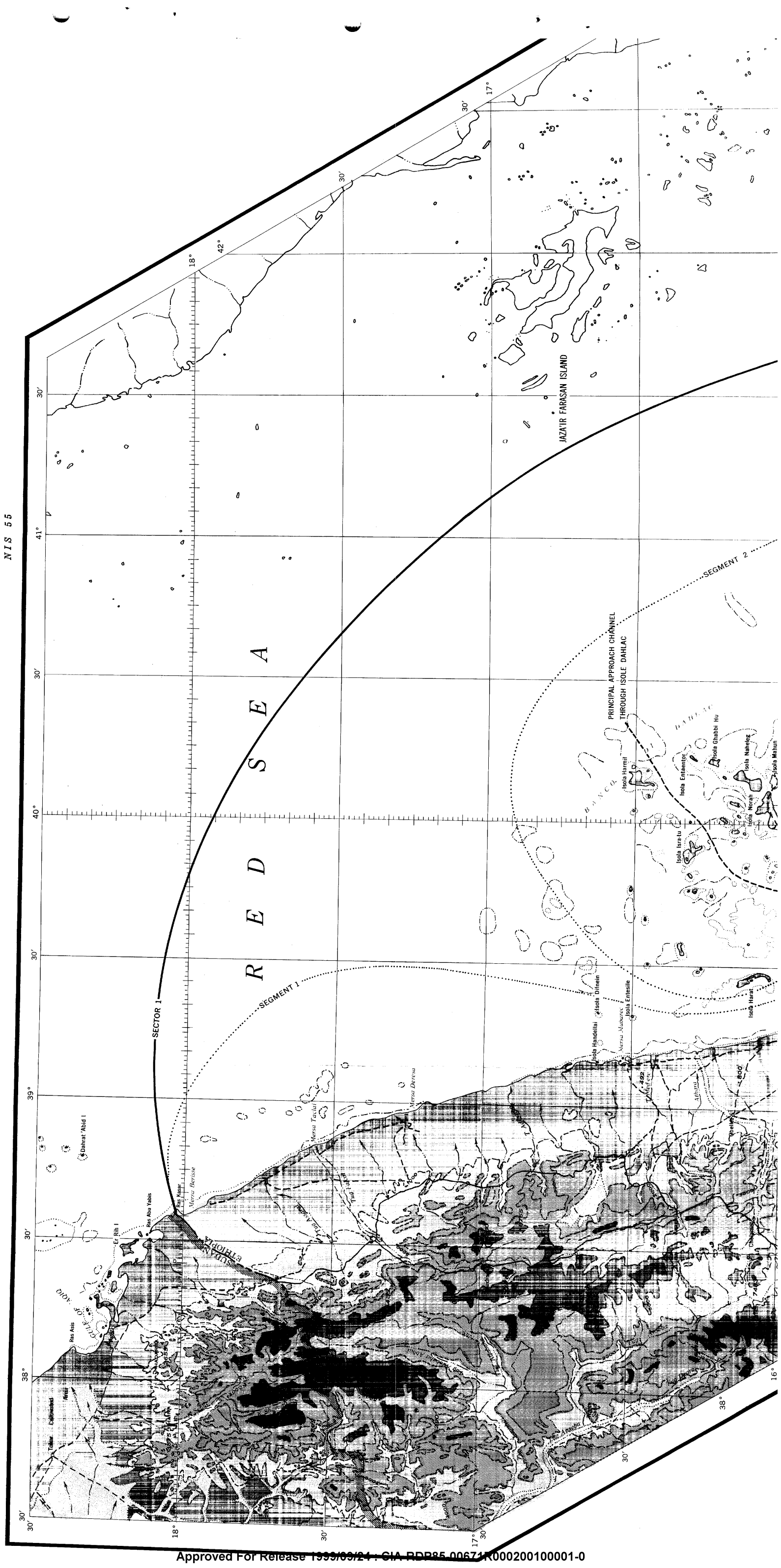


B. BOTTOM SEDIMENTS

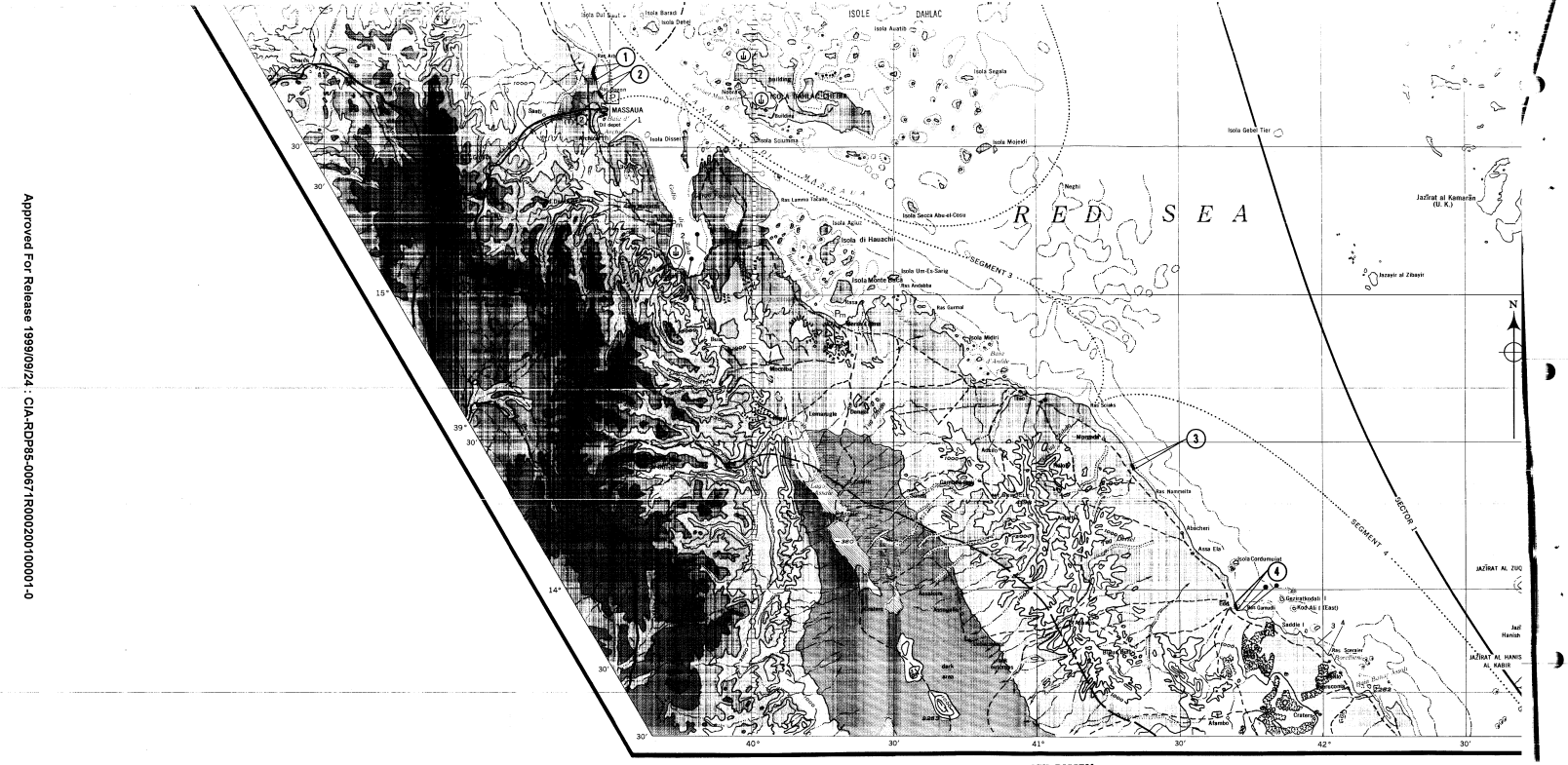
BOTTOM SEDIMENTS FIGURE 22–70



NIS 55



NAVY – JUNE 1962



ETHIOPIA AND THE SOMALILANDS

- MAJOR BEACH AREA (Heavy line indicates usable portions of beach areas. Beach length not necessarily all usable, see beach tab)
- MINOR BEACH AREA
- LANDING PLACE
- PORTS: PRINCIPAL, SECONDARY, MINOR
- SHOAL
- TEN-FATHOM CURVE
- TWENTY-FATHOM CURVE
- FLEET ANCHORAGE
- MARSH OR SWAMP
- RIVER OR STREAM (Intermittent)
- RIVER OR STREAM (Perennial)
- WELL AND WATER HOLE
- INTERMITTENT POND OR LAKE
- ROADS: SURFACED, UNSURFACED
- TRACK OR TRAIL
- NARROW-GAGE RAILROAD
- AIR FACILITY (Number indicates Class.) (Letter indicates (P) Permanent, (T) Temporary, (N) Natural)
- 3095 SPOT ELEVATION (feet)
- INTERNATIONAL BOUNDARY
- BOUNDARY BETWEEN ERITREA AND ETHIOPIA
- BLUFF, CLIFFS, AND ESCARPMENTS
- SAND AREAS
- LAVA AREA
- NIS AREA BOUNDARY

GLOSSARY

bab	strait
baia	bay
canale	channel
capo	cape
djezirat	islands
fiume	river
ghubbet, ghubbat	bay, gulf
golfe, golfo	gulf
Tie (s)	island (s)
isola	island
isole	islands
mersa	bay, inlet
penisola	peninsula
ras, ra's	cape, point, hill
vebi, uodi	wadi, stream

(ROAD CLASSIFICATION SHOULD BE REFERRED TO WITH CAUTION)

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ALL SYMBOLS DO NOT NECESSARILY APPEAR ON THIS MAP

10 0 NAUTICAL MILES 20 30 40 50 60

10 0 STATUTE MILES 20 30 40 50 60

10 0 KILOMETERS 30 40 50 60

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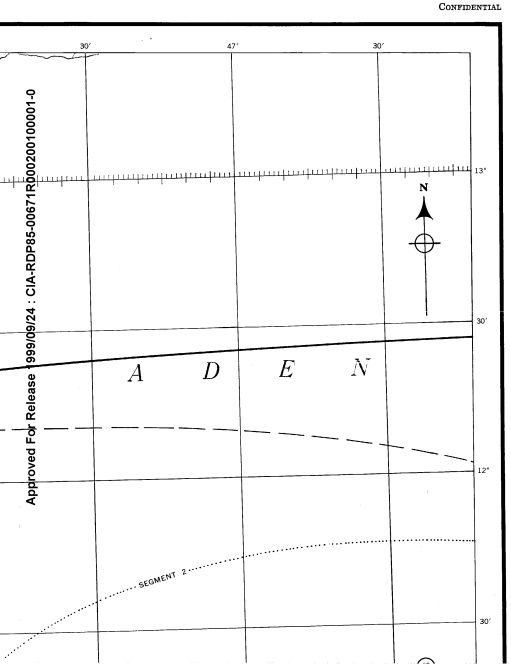
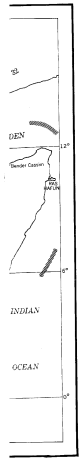
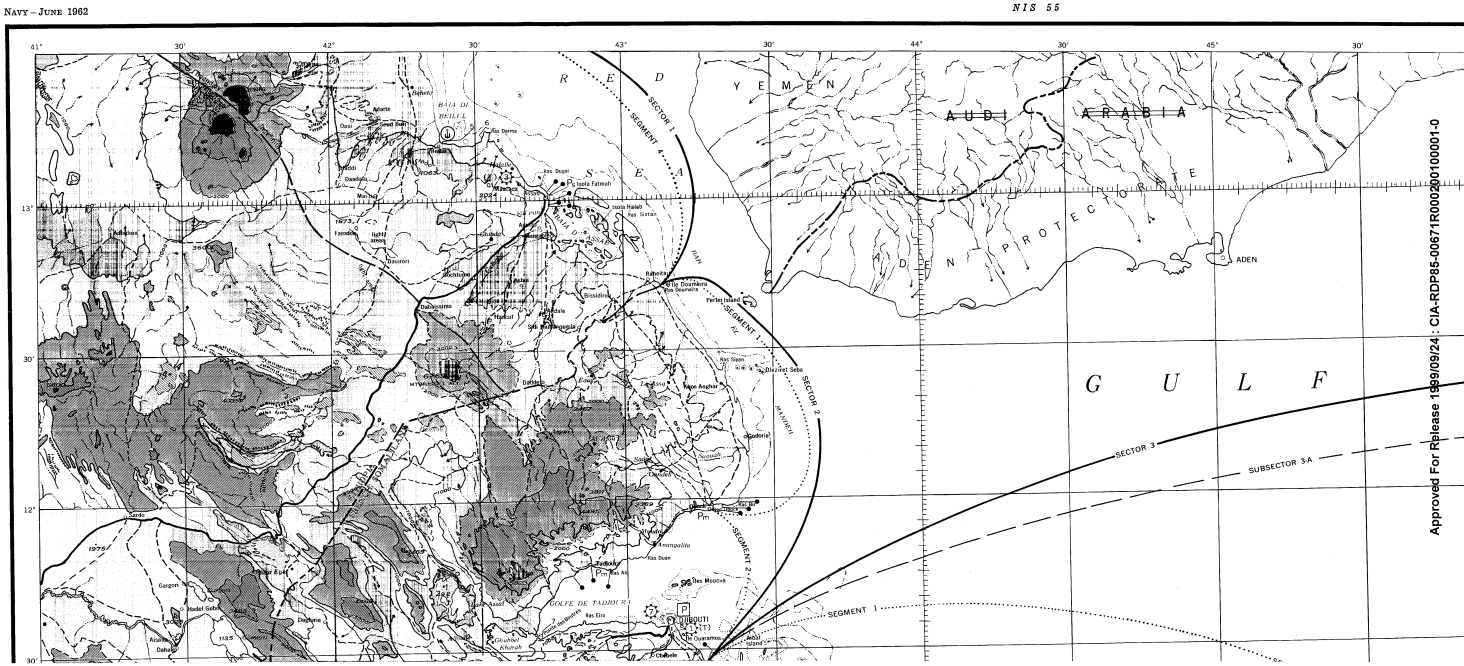
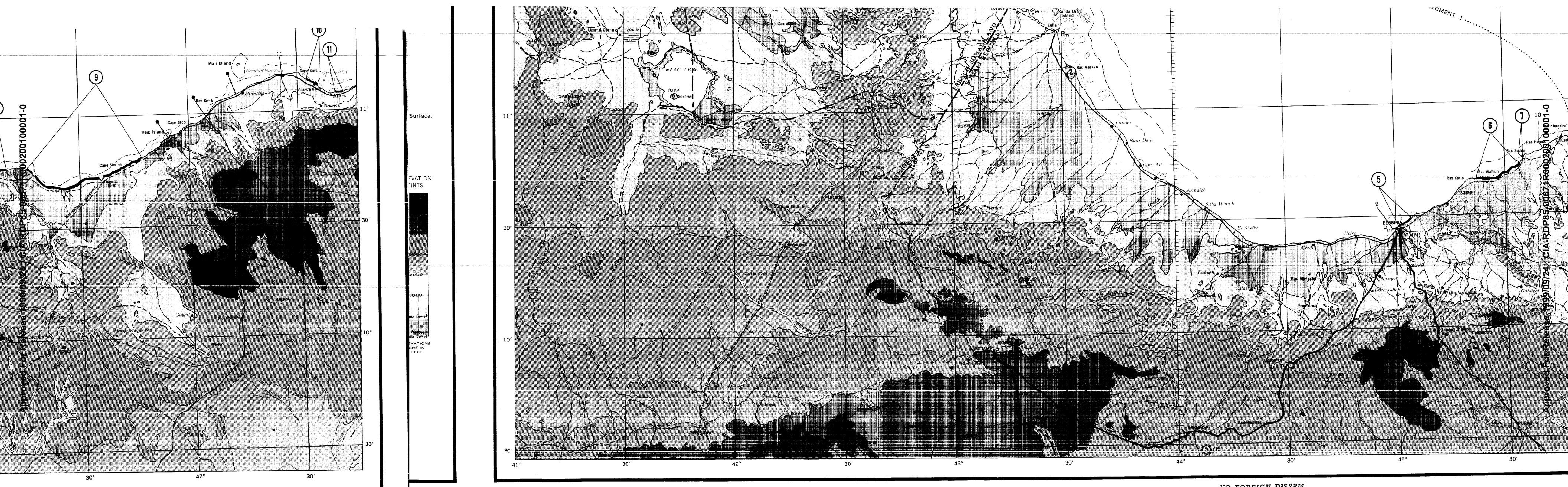
Approved For Release 1999/09/24 : CIA-RDP85-00671R000200100001-0

NO FOREIGN DISSEM









Coastal Sectors 1 and 2, and Subsector 3–A Figure 22–72

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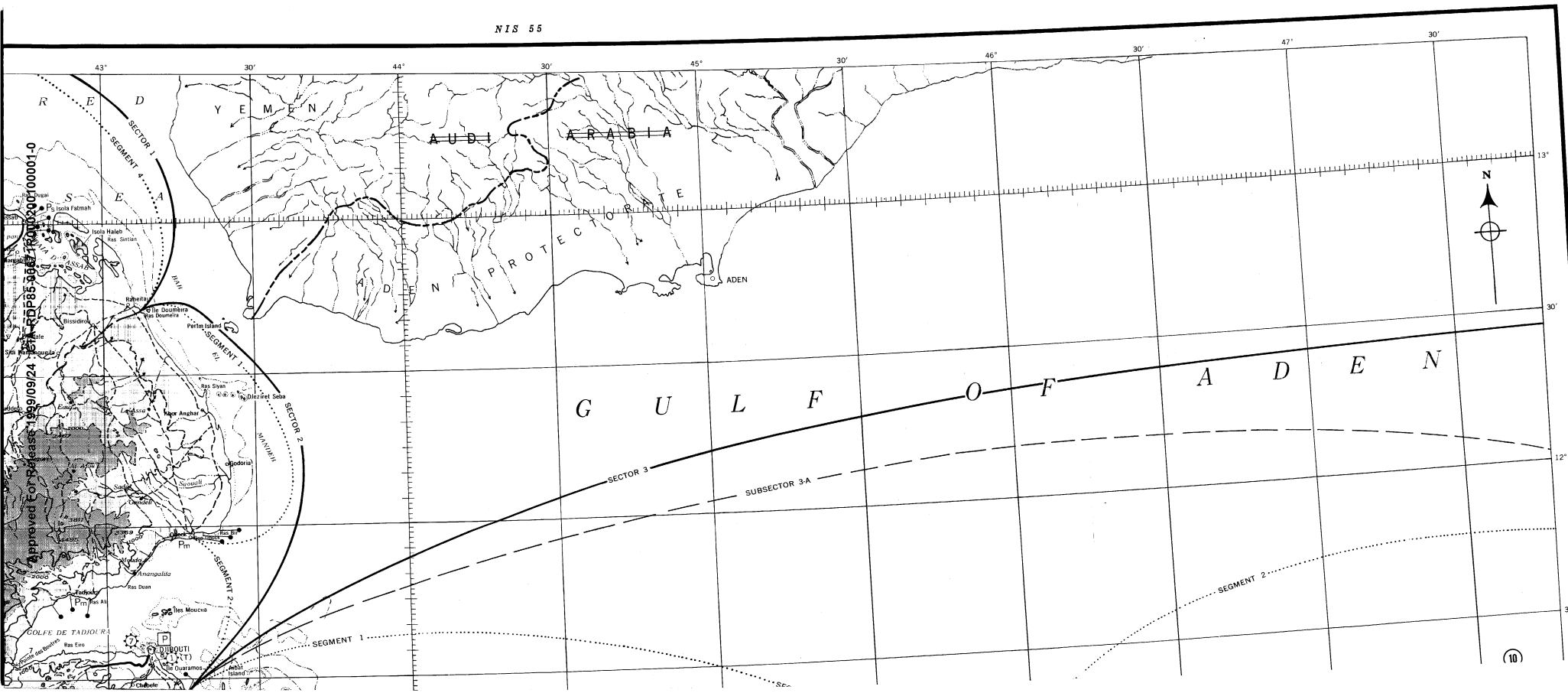
NO FOREIGN DISSEM



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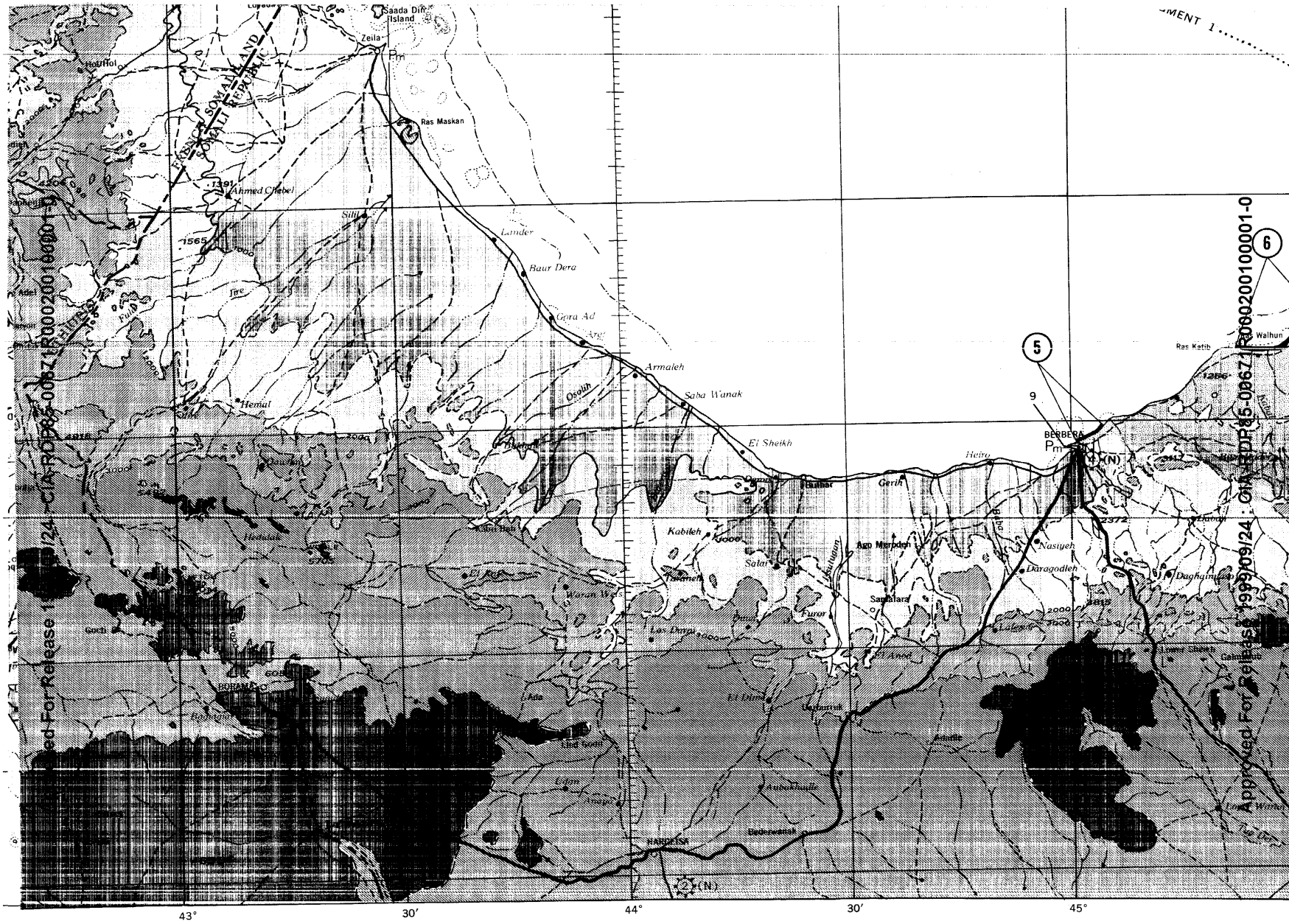

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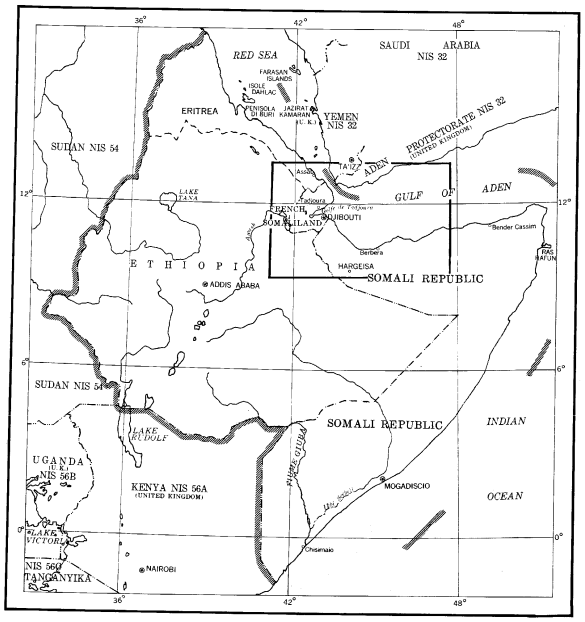


INDEX MAP

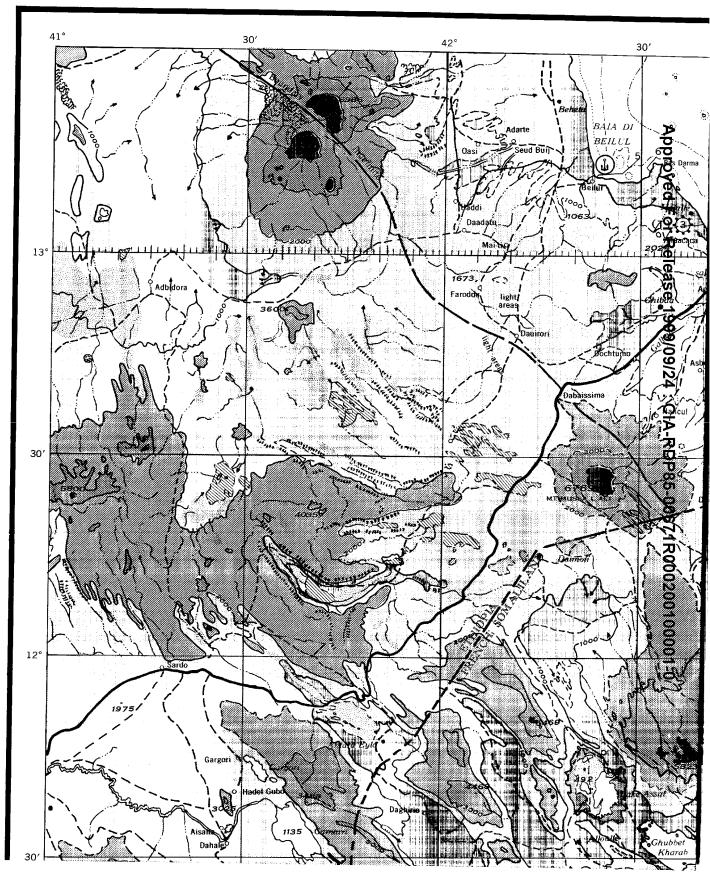
ETHIOPIA AND THE SOMALILANDS

(1) MAJOR BEACH AREA
(Heavy line indicates usable portions of beach areas. Beach length not necessarily all usable, see beach table.)

1 MINOR BEACH AREA

LANDING PLACE

PORTS



SECONDARY
MINOR
SHOAL
TEN-FATHOM CURVE
TWENTY-FATHOM CURVE
FLEET ANCHORAGE
MARSH OR SWAMP
RIVER OR STREAM (Intermittent)
RIVER OR STREAM (Perennial)
WELL AND WATER HOLE
INTERMITTENT POND OR LAKE
ROADS
SURFACED
UNSURFACED
TRACK OR TRAIL
NARROW-GAGE RAILROAD
AIR FACILITY (Number indicates Class.) (Letter indicates Surface: (P) Permanent, (T) Temporary, (N) Natural.)
.1391 SPOT ELEVATION (feet)
INTERNATIONAL BOUNDARY
BOUNDARY BETWEEN ERITREA AND ETHIOPIA
BLUFF, CLIFFS, AND ESCARPMENTS
SAND AREAS
LAVA AREA
NIS AREA BOUNDARY

GLOSSARY

bab	strait
baia	bay
canale	channel
capo	cape
djeziret	islands
fiume	river
ghubbet, ghubbat	bay, gulf
golfe, golfo	gulf
ile (s)	island (s)
isola	island
isole	islands
mersa	bay, inlet
penisola	peninsula
ras, ra's	cape, point, hill
uebi, uadi	wadi, stream

ELEVATION TINTS

3000
2000
1000
Sea Level
Below Sea Level

ELEVATIONS ARE IN FEET

(ROAD CLASSIFICATION SHOULD BE REFERRED TO WITH CAUTION)

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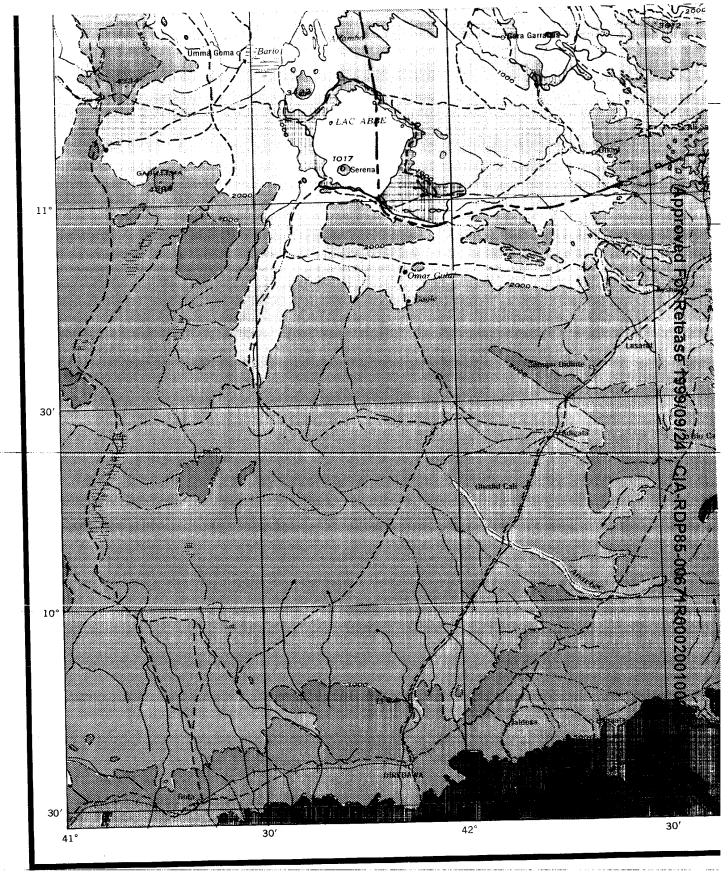
ALL SYMBOLS DO NOT NECESSARILY APPEAR ON THIS MAP

10 0 NAUTICAL MILES 20 30 40 50 60

10 0 STATUTE MILES 20 30 40 50 60

10 0 KILOMETERS 30 40 50 60

CONFIDENTIAL



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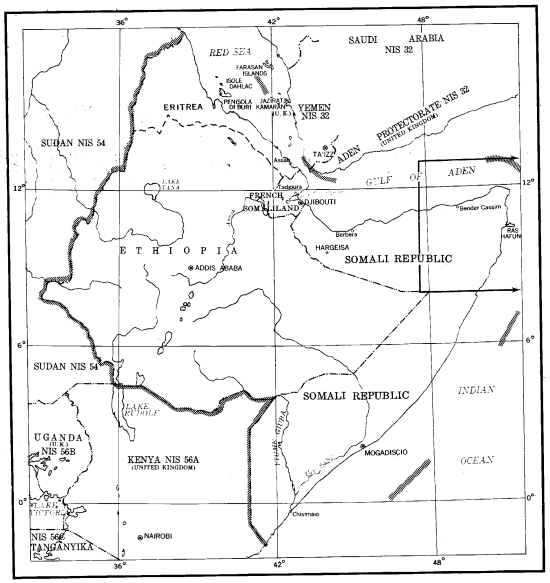
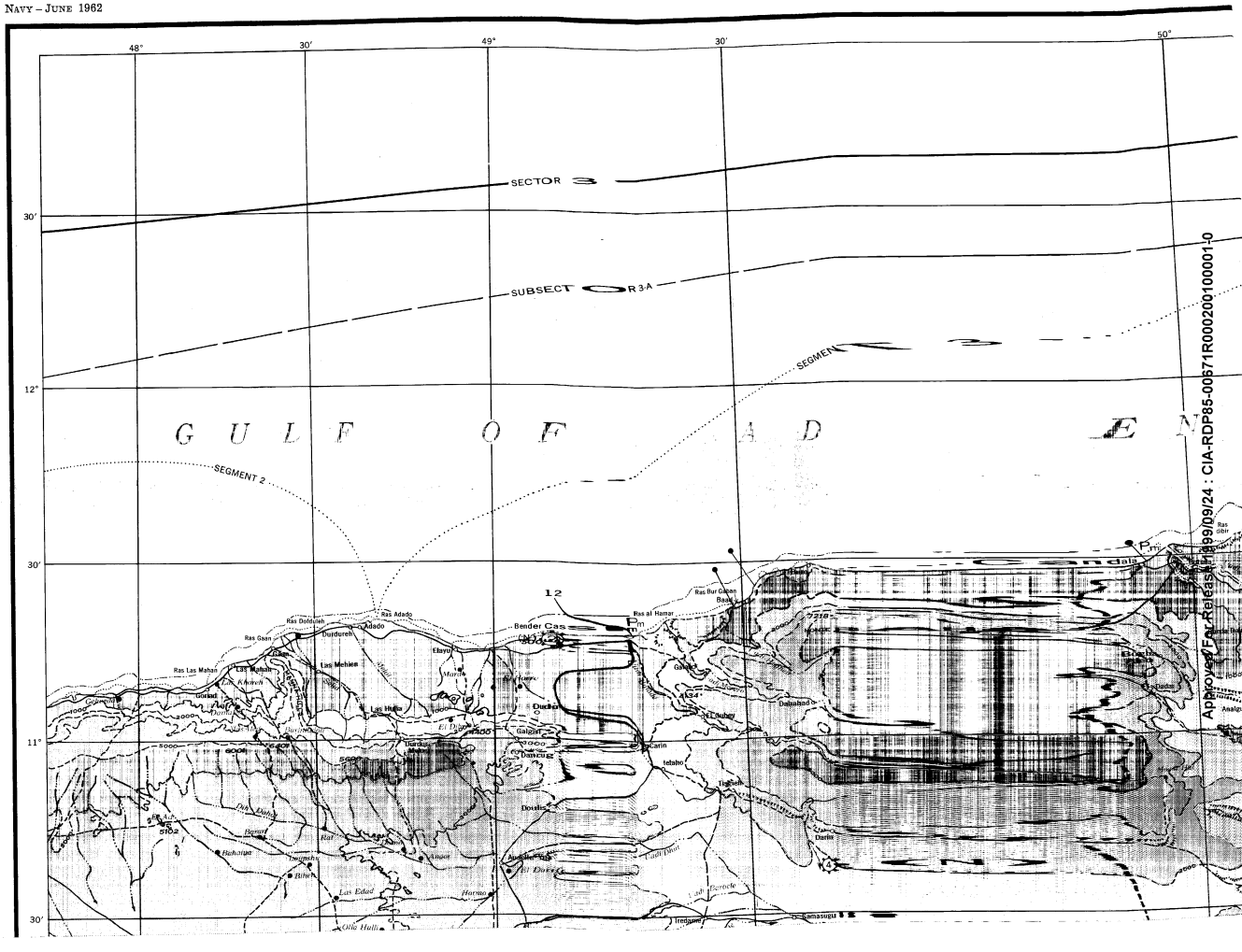
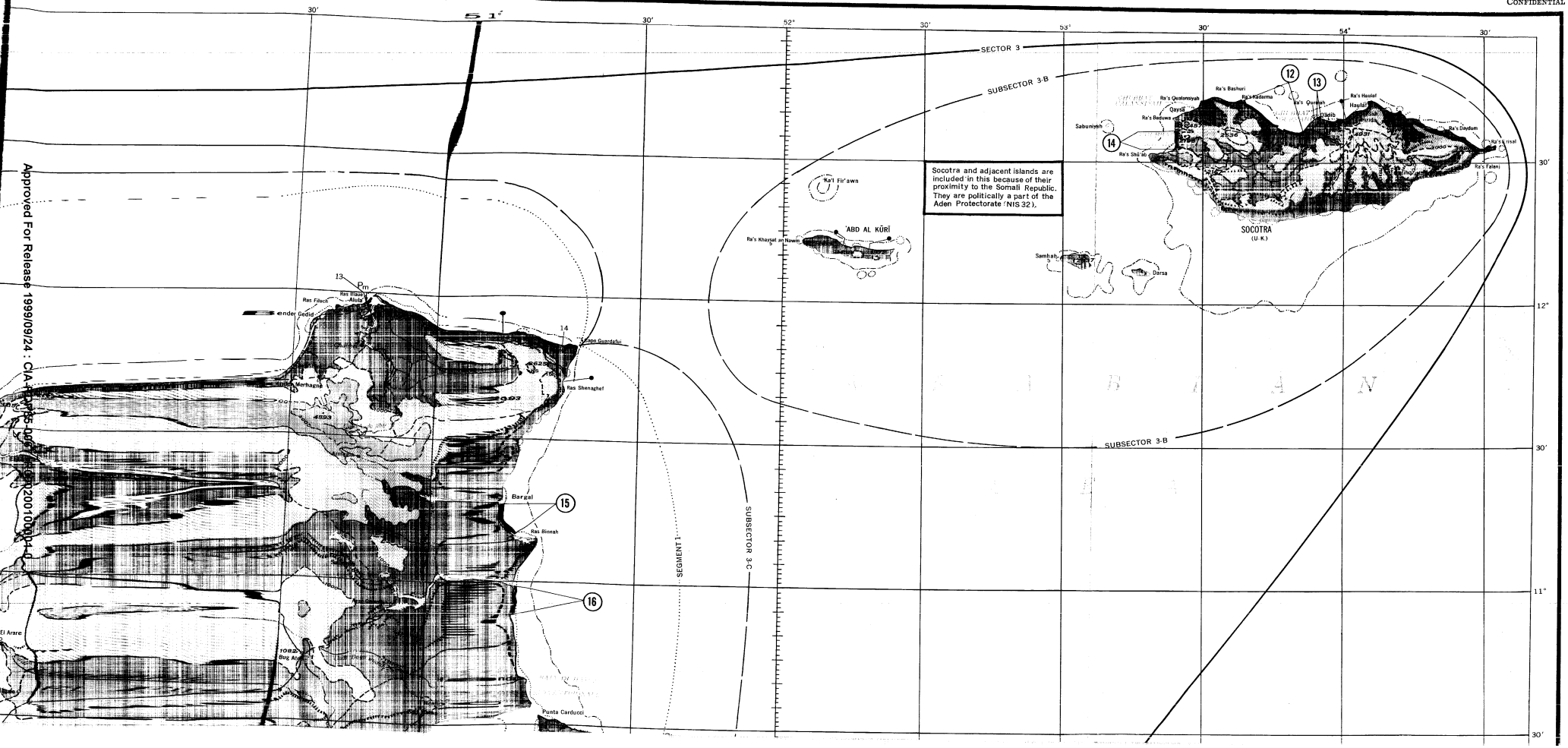


INDEX MAP





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COASTAL SUBSECTORS 3–A, 3–B, AND 3–C FIGURE 22–73

NO FOREIGN DISSEM

ETHIOPIA AND THE SOMALILANDS

MAJOR BEACH AREA
(Heavy line indicates usable portions of beach areas. Beach length not necessarily all usable, see beach table.)
MINOR BEACH AREA
LANDING PLACE
PORTS
PRINCIPAL
SECONDARY
MINOR
SHOAL
TEN-FATHOM CURVE
TWENTY-FATHOM CURVE
FLEET ANCHORAGE
MARSH OR SWAMP
RIVER OR STREAM (Intermittent)
RIVER OR STREAM (Perennial)
WELL AND WATER HOLE
INTERMITTENT POND OR LAKE
ROADS
SURFACED
UNSURFACED
TRACK OR TRAIL
NARROW-GAGE RAILROAD
AIR FACILITY (Number indicates Class.) (Letter indicates Surface: (P) Permanent, (T) Temporary, (N) Natural.)
SPOT ELEVATION (feet)
INTERNATIONAL BOUNDARY
BOUNDARY BETWEEN ERITREA AND ETHIOPIA
BLUFF, CLIFFS, AND ESCARPMENTS
SAND AREAS
LAVA AREA
NIS AREA BOUNDARY

GLOSSARY

bab	strait
baia	bay
canale	channel
capo	cape
djeziret	islands
fiume	river
ghubbet, ghubbat	bay, gulf
golfe, golfo	gulf
ile (s)	island (s)
isola	island
isole	islands
mersa	bay, inlet
penisola	peninsula
ras, ra's	cape, point, hill
uebi, uadi	wadi, stream

ELEVATION TINTS
5000
3000
2000
1000
Sea level
ELEVATIONS ARE IN FEET

(ROAD CLASSIFICATION SHOULD BE REFERRED TO WITH CAUTION)

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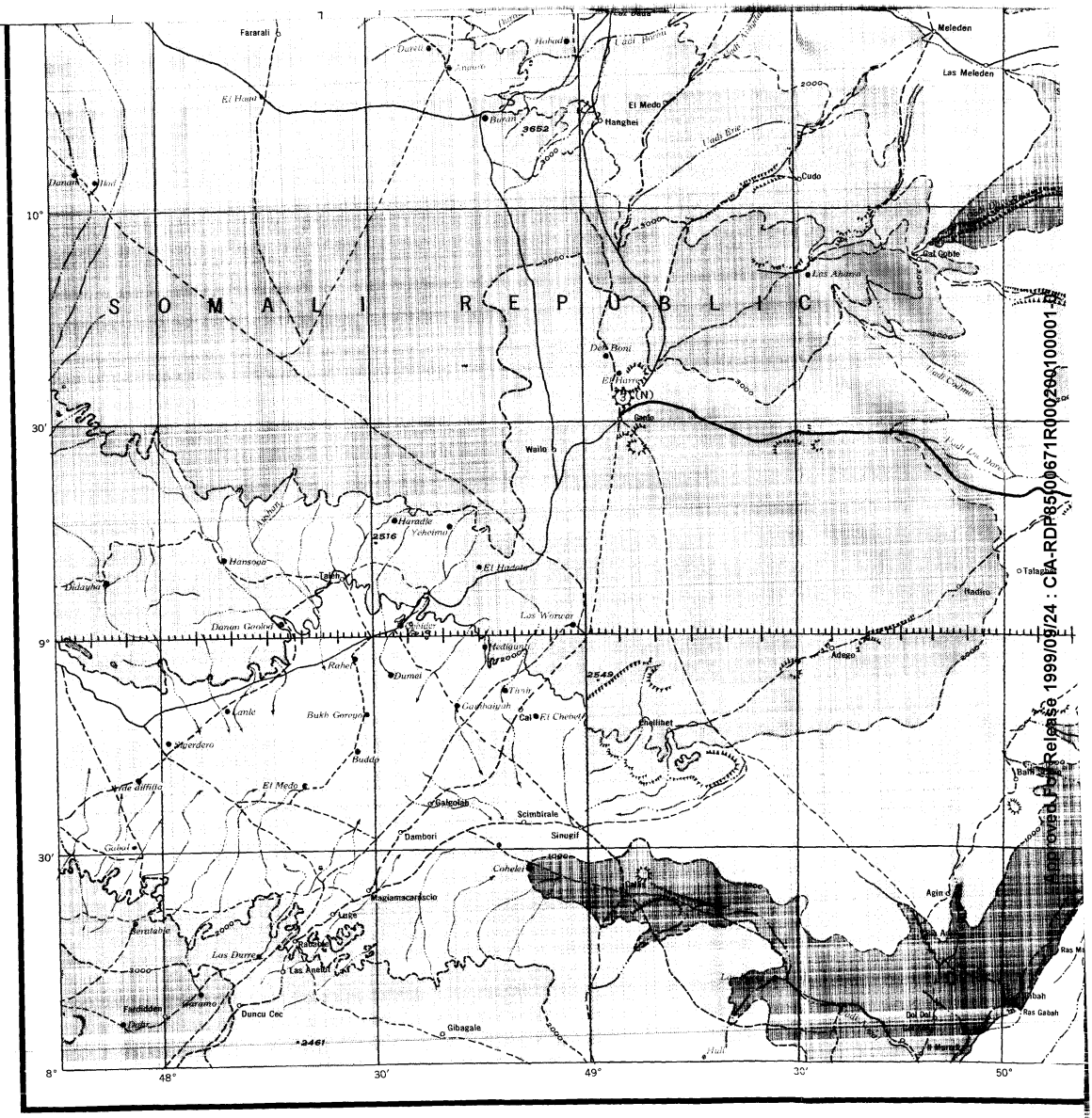
ALL SYMBOLS DO NOT NECESSARILY APPEAR ON THIS MAP

10 0 NAUTICAL MILES 20 30 40 50 60
10 0 STATUTE MILES 20 30 40 50 60
10 0 KILOMETERS 30 40 50 60

CONFIDENTIAL



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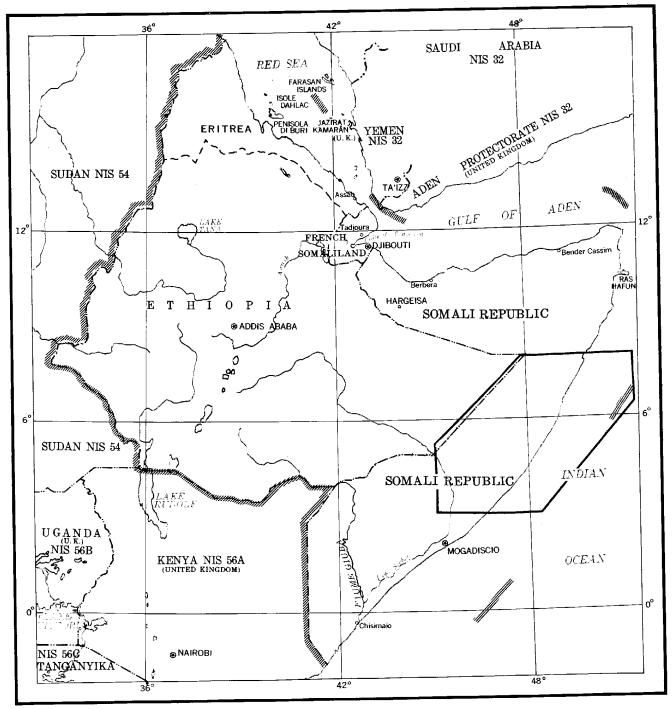
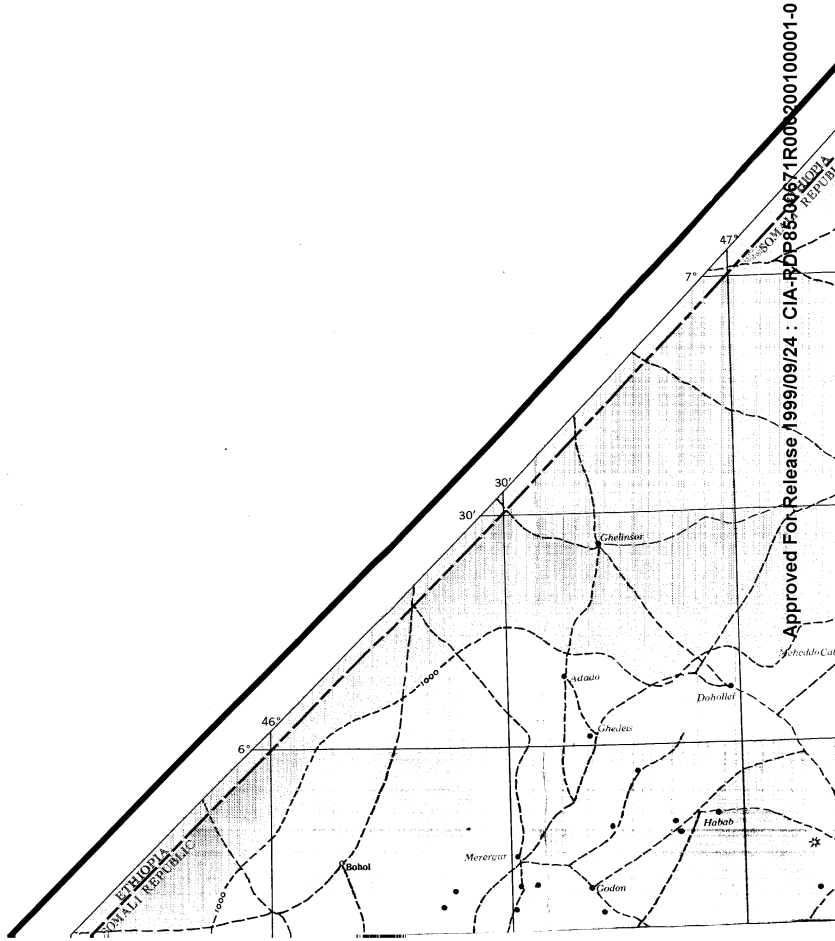
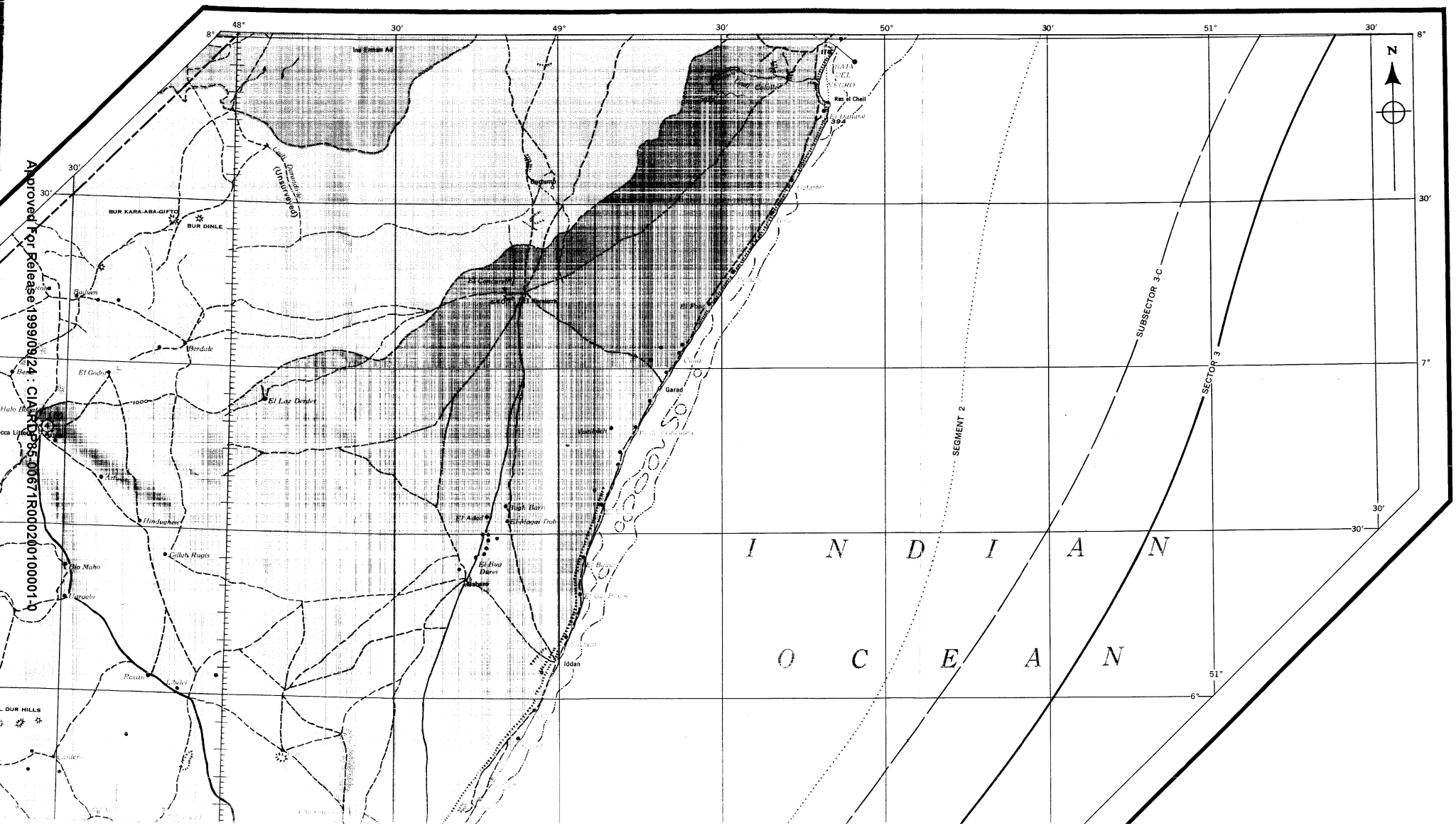


INDEX MAP





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ETHIOPIA AND THE SOMALILANDS

- MAJOR BEACH AREA (Heavy line indicates usable portions of beach areas. Beach length not necessarily all usable, see beach table.)
- MINOR BEACH AREA
- LANDING PLACE
- PORTS
  - PRINCIPAL
  - SECONDARY
  - MINOR
- SHOAL
- TEN-FATHOM CURVE
- TWENTY-FATHOM CURVE
- FLEET ANCHORAGE
- MARSH OR SWAMP
- RIVER OR STREAM (Intermittent)
- RIVER OR STREAM (Perennial)
- WELL AND WATER HOLE
- INTERMITTENT POND OR LAKE
- ROADS
  - SURFACED
  - UNSURFACED
  - TRACK OR TRAIL
- NARROW-GAGE RAILROAD
- AIR FACILITY (Number indicates Class.) (Letter indicates Surface: (P) Permanent, (T) Temporary, (N) Natural)
- SPOT ELEVATION (feet)
- INTERNATIONAL BOUNDARY
- BOUNDARY BETWEEN ERITREA AND ETHIOPIA
- BLUFF, CLIFFS, AND ESCARPMENTS
- SAND AREAS
- LAVA AREA
- NIS AREA BOUNDARY

GLOSSARY

bab	strait
baia	bay
canale	channel
capo	cape
djeziret	islands
fiume	river
ghubbet, ghubbat	bay, gulf
golfe, golfo	gulf
ile (s)	island (s)
isola	island
isole	islands
mersa	bay, inlet
penisola	peninsula
ras, ra's	cape, point, hill
uebi, uadi	wadi, stream

ELEVATION TINTS

2000

1000

Sea Level

ELEVATIONS ARE IN FEET

(ROAD CLASSIFICATION SHOULD BE REFERRED TO WITH CAUTION)

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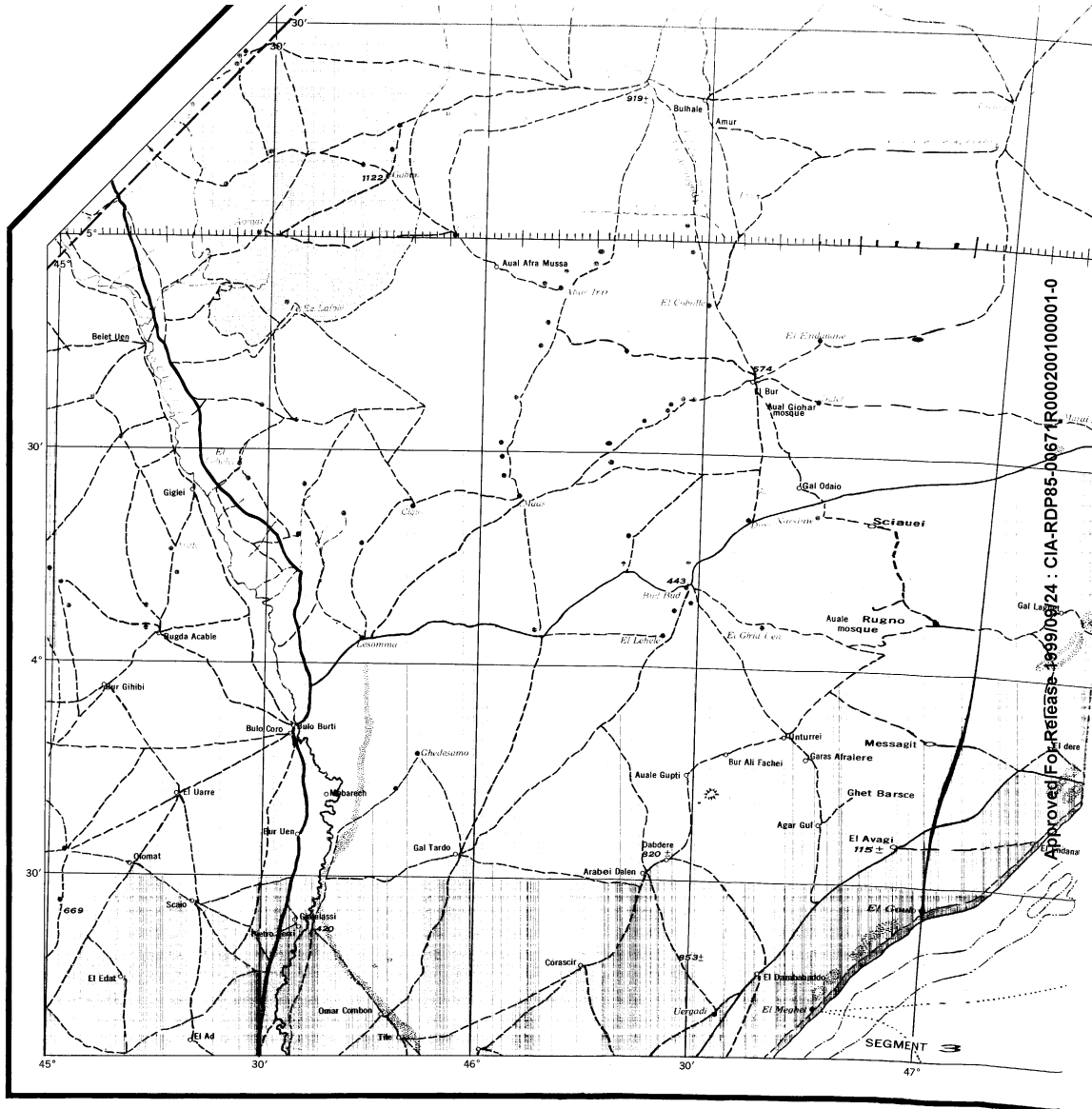
10 0 NAUTICAL MILES 20 30 40 50 60

10 0 STATUTE MILES 20 30 40 50 60

10 0 KILOMETERS 30 40 50 60

CONFIDENTIAL



COASTAL SUBSECTOR 3-C FIGURE 22-74

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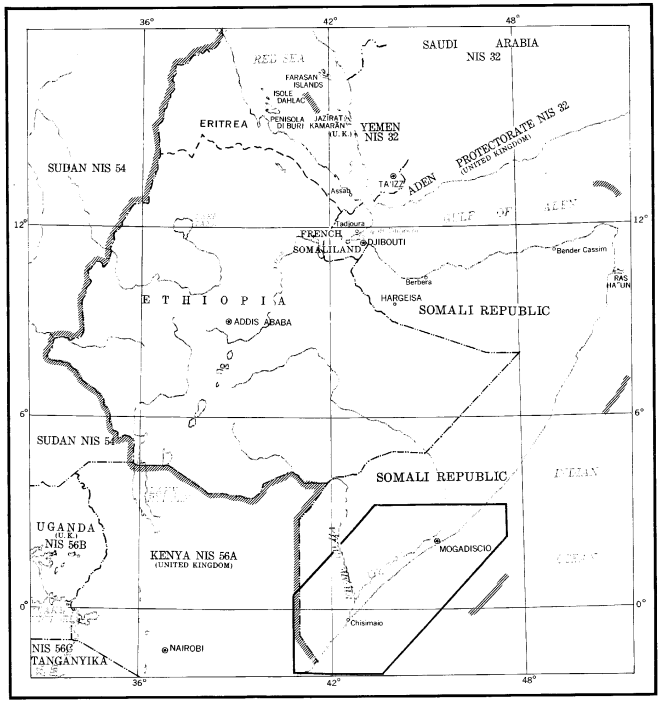

INDEX MAP

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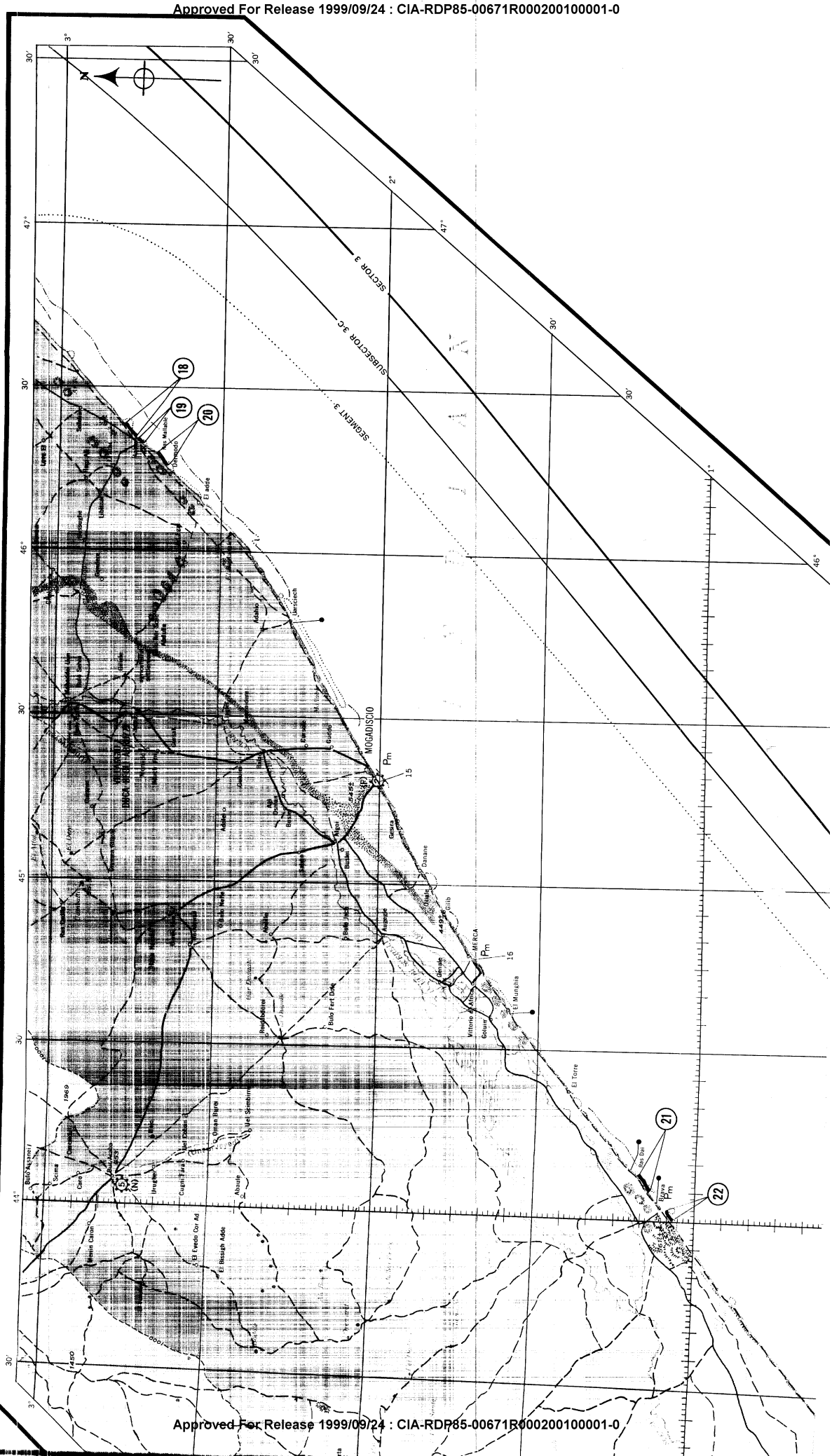

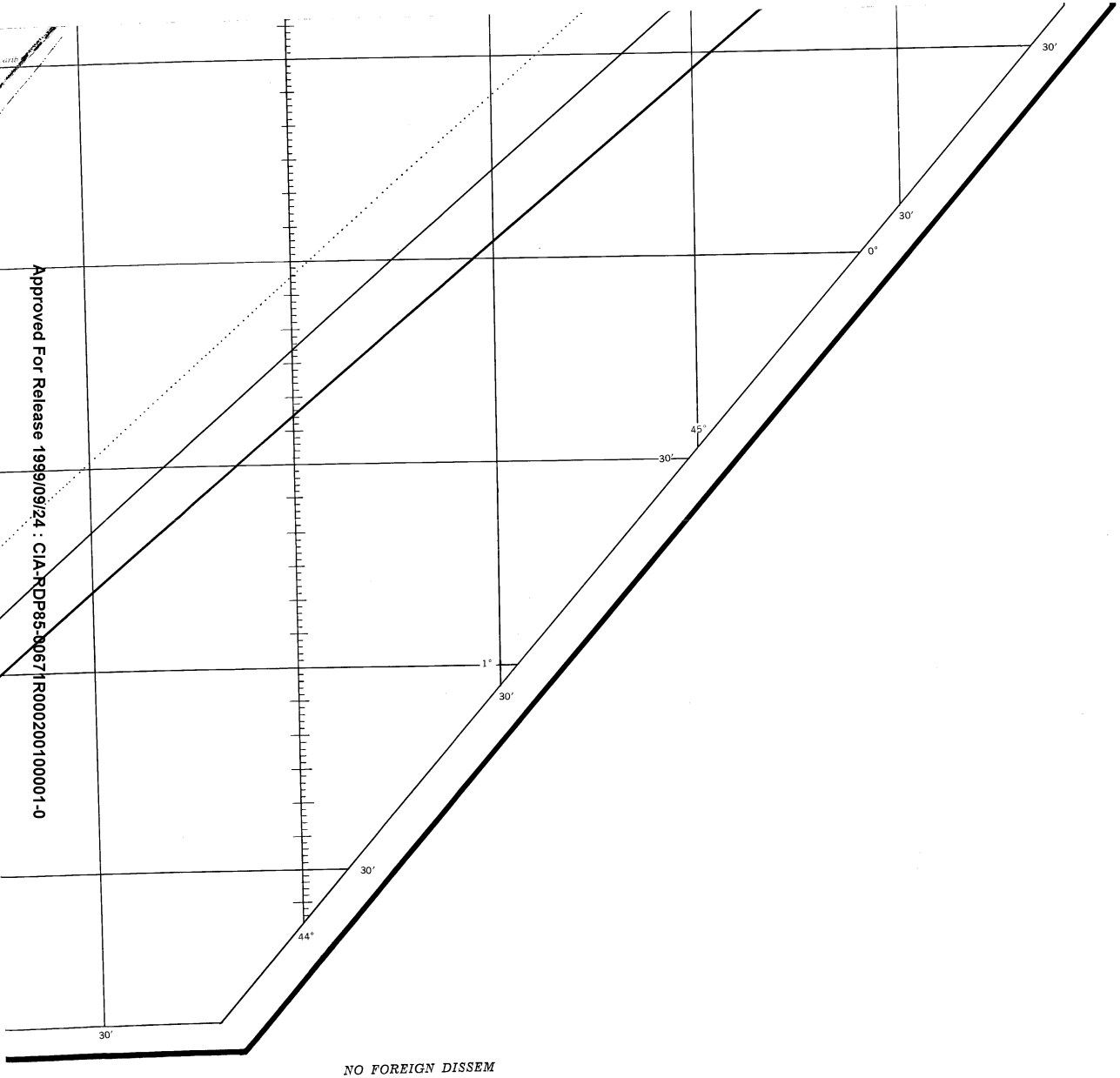

NO FOREIGN DISSEM

COASTAL SUBSECTOR 3–C FIGURE 22–75

Approved For Release 1999/09/24 : CIA-RDP85-00671R000200100001-0

ETHIOPIA AND THE SOMALILANDS

- MAJOR BEACH AREA (Heavy line indicates usable portions of beach areas. Beach length not necessarily all usable, see beach table.)
- MINOR BEACH AREA
- LANDING PLACE
- PORTS
  - PRINCIPAL
  - SECONDARY
  - MINOR
- SHOAL
- TEN-FATHOM CURVE
- TWENTY-FATHOM CURVE
- FLEET ANCHORAGE
- MARSH OR SWAMP
- RIVER OR STREAM(Intermittent)
- RIVER OR STREAM(Perennial)
- WELL AND WATER HOLE
- INTERMITTENT POND OR LAKE
- ROADS
  - SURFACED
  - UNSURFACED
  - TRACK OR TRAIL
- NARROW-GAGE RAILROAD
- AIR FACILITY (Number indicates Class.) (Letter indicates Surface: (P) Permanent, (T) Temporary, (N) Natural)
- SPOT ELEVATION (feet)
- INTERNATIONAL BOUNDARY
- BOUNDARY BETWEEN ERITREA AND ETHIOPIA
- BLUFF, CLIFFS, AND ESCARPMENTS
- SAND AREAS
- LAVA AREA
- NIS AREA BOUNDARY

GLOSSARY

bab	strait
baia	bay
canale	channel
capo	cape
djeziret	islands
fiume	river
ghubbet, ghubbat	bay, gulf
golfe, golfo	gulf
ile (s)	island (s)
isola	island
isole	islands
mersa	bay, inlet
penisola	peninsula
ras, ra's	cape, point, hill
uebi, wadi	wadi, stream

ELEVATION TINTS

Sea Level

ELEVATIONS ARE IN FEET

(ROAD CLASSIFICATION SHOULD BE REFERRED TO WITH CAUTION)

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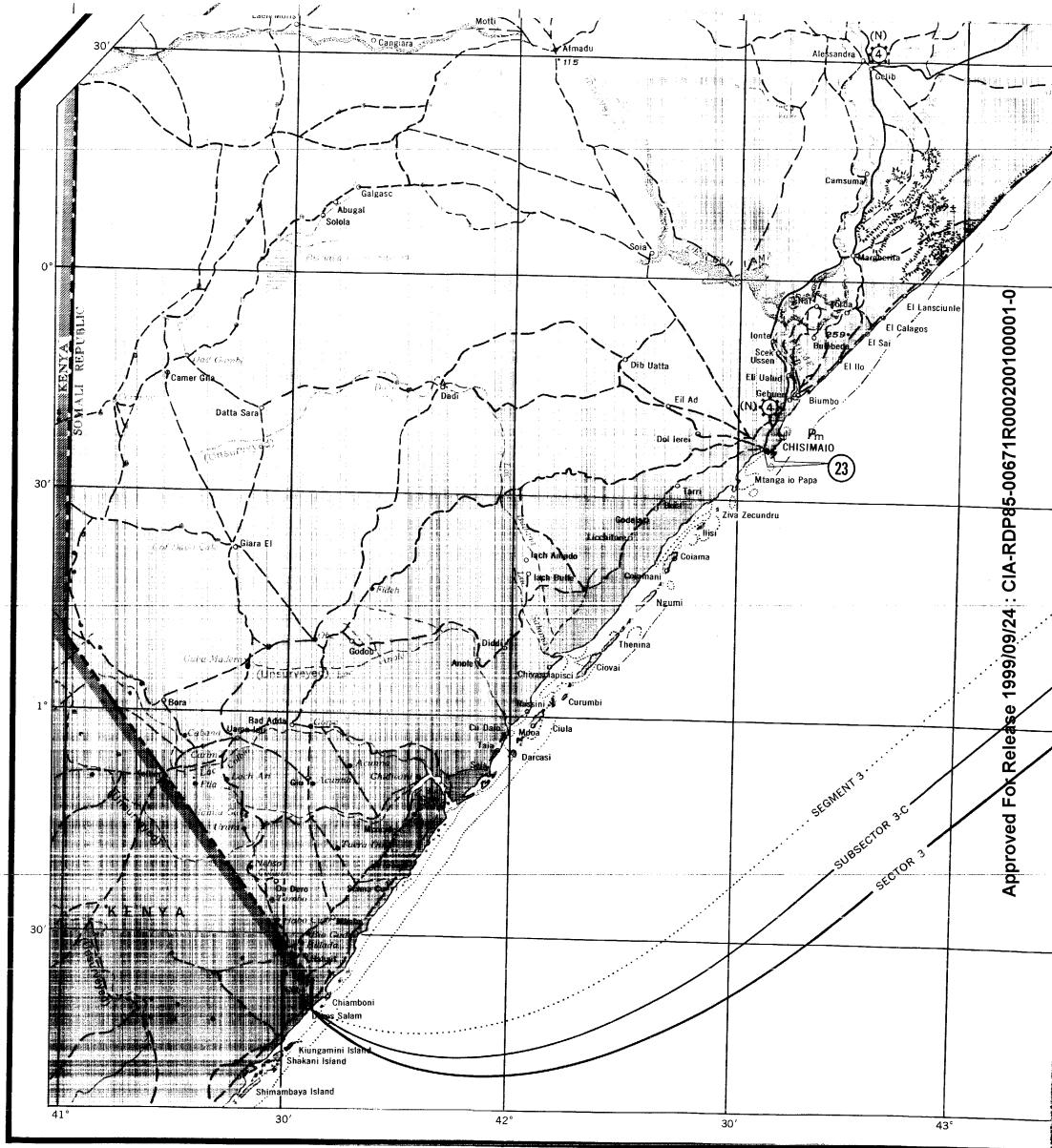
ALL SYMBOLS DO NOT NECESSARILY APPEAR ON THIS MAP

10 0 NAUTICAL MILES 20 30 40 50 60

10 0 STATUTE MILES 20 30 40 50 60

10 0 KILOMETERS 30 40 50 60

CONFIDENTIAL



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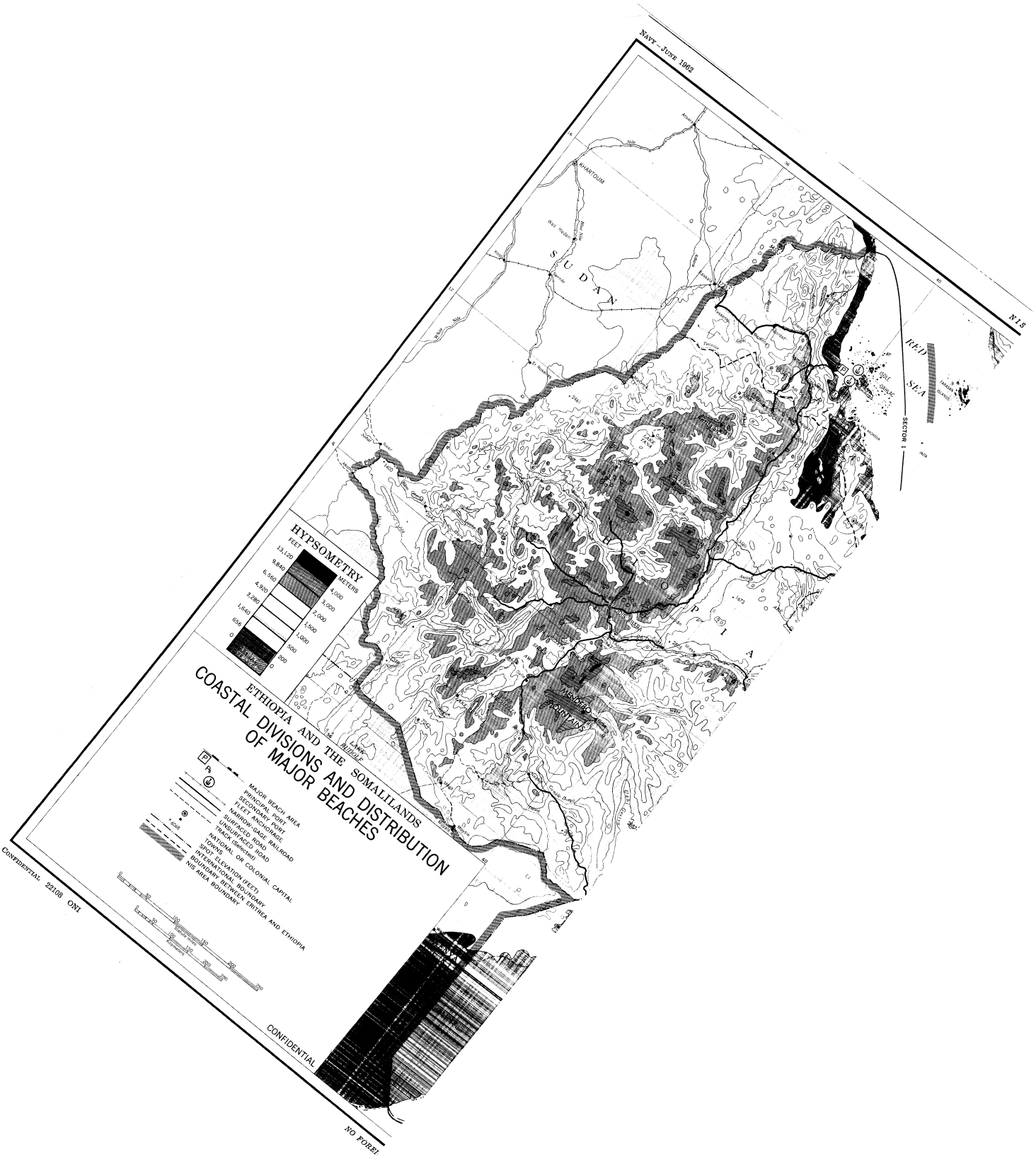

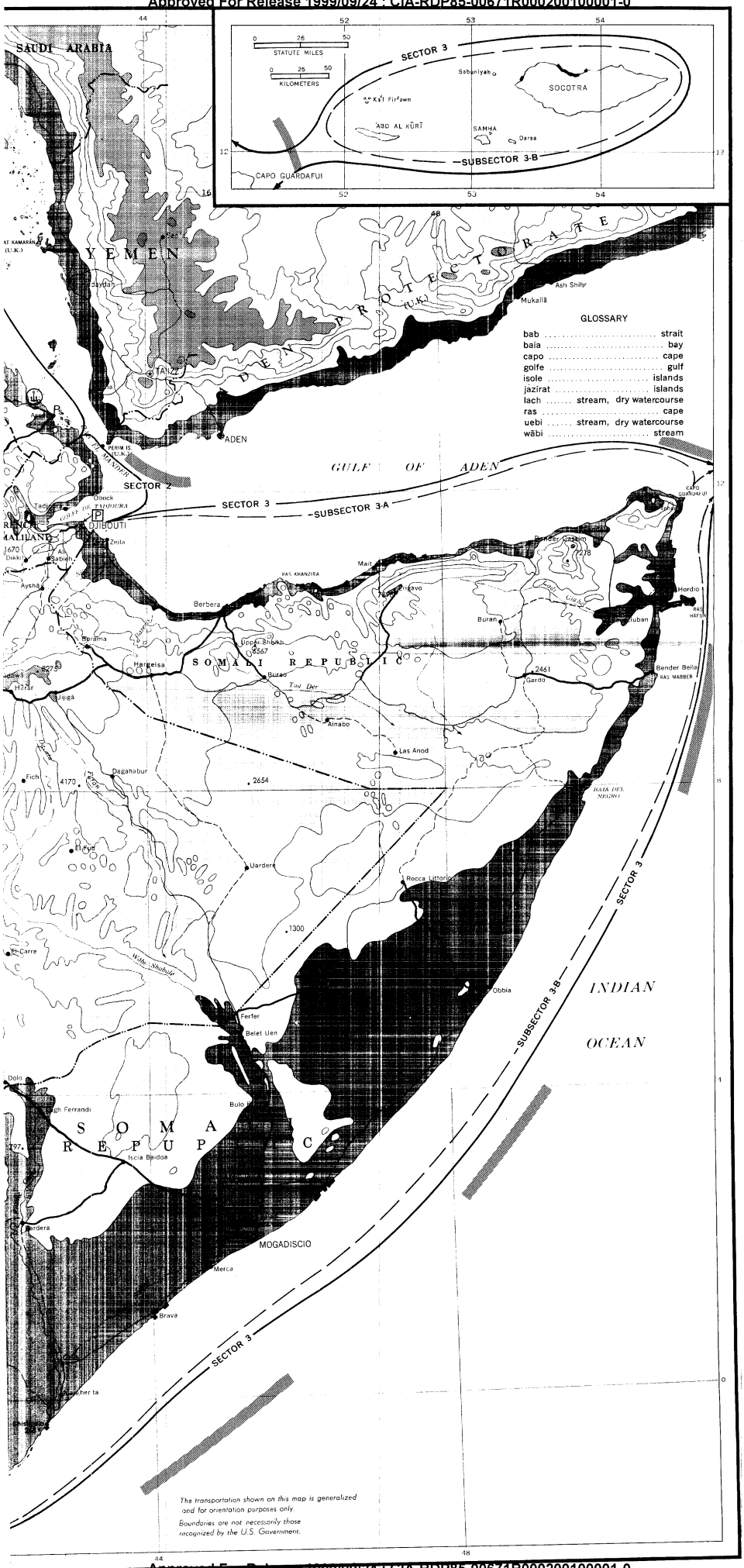

COASTAL DIVISIONS AND DISTRIBUTION OF MAJOR BEACHES FIGURE 22–76

This publication, issued separately for flexibility in production and use, is one of the integral components in the National Intelligence Survey of comprehensive basic intelligence on this NIS Area.

The standard NIS is divided into the following nine Chapters: I Brief; II Military Geography; III Transportation and Telecommunications; IV Sociological; V Political; VI Economic; VII Scientific; VIII Armed Forces; IX Map and Chart Appraisal.

When appropriate, Chapter discussion is amplified by more detailed treatment in one or more of the following Supplements: I Ports and Naval Facilities; II Coasts and Landing Beaches; III Telecommunications; IV Urban Areas; V Petroleum; VI Communism.

The Section, covering a major subtopic, is the NIS basic unit of production and subsequent maintenance. Each Section is individually classified, indicates the Intelligence Agency primarily responsible for the preparation of the Section, and carries the date on which the responsible Agency approved the material for NIS publication. Sections may be combined and issued as a consolidated element, and may be supplemented by Annexes on special subareas.

The standard NIS includes a Gazetteer of geographic names approved by the United States Board on Geographic Names (issued as a separate volume), and a consolidated biographical reference work, Key Personalities.

World sea areas, in terms of major ocean basins, are treated in the NIS on Marine Climate and Oceanography; each ocean basin subdivision is treated in a Part, consisting of three, and under some circumstances four sections, each of which is issued separately. The NIS program also includes publications on special subjects, e.g., International Communism, which are issued as appropriate.

NIS Areas which have been segmented or combined to reflect fundamental political developments are designated by capital letter suffixes. Certain large NIS units are issued in parts, which are identified by Roman numeral suffixes.

Sections are to be bound or filed by topic or area rather than according to the sequence of dissemination. NIS maintenance units supersede previously dated editions on the same topics.

The nature and scope of the NIS program, the allocation of NIS production responsibilities, the delineation of NIS Areas, and the outline guides for topical units are set forth in the NIS Standard Instructions. A convenient summary of the NIS Standard Instructions, designed particularly for NIS users, is available in the NIS Reference Guide which may be requested through official channels. The basic interrelationships between the topical components which make each NIS an integrated and comprehensive survey are summarized in the NIS Correlation Guide which is contained in both the Standard Instructions and the NIS Reference Guide.

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