

東沙環礁海域之海底地形、地貌調查以及航道、錨泊區規劃
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摘要

關鍵詞：東沙環礁、電子海圖、簡易錨泊區

東沙環礁為一直徑約 25 公里之圓形環礁，主要由造礁珊瑚建造而形成。因在環礁西北尖角和西南尖角中間有一天然缺口，而東沙島恰位於此缺口中間，即形成所謂的南、北水道，此兩水道乃是進入環礁潟湖水域的主要通道。為管理船隻進出東沙島碼頭、環礁內船隻之導引和停泊，針對開發東沙環礁潟湖之航道區和錨泊區規劃為目標，本計畫將東沙環礁分為四區調查區包括：(A)東沙島南北兩側之近岸礁石區、(B)東沙島碼頭東側之錨泊預定區、(C)北水道區及(D)環礁潟湖深水區，進行海域海底地形多音束水深測量以及海床地貌調查，以提供各區船隻導航所需之數位電子海圖資料。

本計畫主要工作項目包含潮間帶地形測量、海域水深測量、水下攝影、海床底質調查，經由執行現場調查工作與地形水深資料處理分析，得到下列結論：

- 1.將本(98)年度 5 月 20 日至 8 月 23 日東沙島潮位觀測連續資料進行調和分析後，可知東沙海域潮汐主要以全日潮 (K_1 & O_1) 為主，小潮時會伴隨半日潮 (M_2 & S_2) 發生，大潮平均高潮位為 0.34m；小潮平均高潮位為 0.28m；平均潮位為-0.15m；小潮平均低潮位為-0.52m；大潮平均低潮位為-0.58m，平均高低潮位差不到 1m。其分析結果與先前文獻資料比對，結果相近。
- 2.水深資料成果顯示，東沙島小潟湖水深值大多在-1m 以內。島南北兩側之近岸礁石區，底床坡度較緩，離岸 1km 內水深約 0~-2m、離岸 2km 內水深約 0~-5m、離岸 2~3km 水深約-3~-7m，北側礁石較南側為多且水深變化較

大。島西側自離岸 1km 至外海水深變化劇烈已達-38m，呈現急陡坡直入深海，平均坡度約 4.3%。島西北隅則從離岸 3km 之水深-2m 驟降至-56m，坡向為 SE-NW 走向，平均坡度約 1.8%。東沙島東側水深約介於-1m 至-20m，海床深度變化較為複雜，高低起伏不定，其西北側水深較淺約-4m~-6m，東南側地形則多佈滿礁岩，水深約-10m~-20m。北水道區水深由-2m 下降至深海-129m，為本計畫範圍內水深最深之處，水深淺處偶有獨立礁岩分布。環礁潟湖區水深約在-10m~-20m 間，其海底地形暗礁密佈，容易形成船隻潛在危險，最深可達-23.14m。

- 3.經以側掃聲納系統及固定式水下攝影執行海床地形地貌調查成果，將東沙環礁底質類型共分為海草、珊瑚礁(包含珊瑚殘骸)、沙及礁岩等四大類型，並編列出海床底質明細表。東沙環礁海域底床分布以沙質海床上遍佈珊瑚礁為主，且伴隨大量珊瑚殘骸及礁石；海草主要遍佈於東沙島周圍沿海岸線向外延伸約 1.5km 之區域。
- 4.本計畫錨泊區主要針對東沙海域研究活動而規劃出簡易錨泊區，以利各項生態調查研究船至觀測點使用，並依據電子海圖提供簡易錨泊區之航海操作設備。

Abstract

【Keywords】

Dongsha Atoll, electronic navigational chart, simple anchoring area

The Dongsha Atoll is a circular atoll with the diameter approximately 25km, mainly forms by the reef-building corals. Between the northwest acute angle and the southwest acute angle area, there is a natural gap. The Dongsha Island is located exactly in this gap and separated the gap into so-called north and south channel where ships passing through. In order to better manage the ships pass in and out in the Dongsha Island wharf and to guide ships for anchoring, the object is developing Dongsha route area and the anchorage area. The object plan divides Dongsha Atoll into four areas to be investigated, includes: (A) Near-shore of reef area Dongsha Island north and south both sides, (B) Anchorage of predetermined area Dongsha Island wharf east side, (C) North channel area, and (D) Atoll lagoon zone by conducting measurement of sea seabed topography Multi-Beam bathymetry and sea-bed topography survey, in order to providing various digital electronic navigational chart data for piloting the ships.

The major projects of this report contain the tidal zone topographic survey, the sea area water depth survey, the underwater photographic survey and the obstacle investigation. By way of carrying out the spot investigation work and the data processing analysis, the following conclusions were obtained:

1. From harmonic analysis of the Dongsha Island tide level observation on continuous data between May 20 of 2009 and August 23, we can see the tide by Dongsha sea area is mainly diurnal tide (K_1 & O_1), when neap tide will follow semidiurnal tide (M_2 & S_2) occurs. H.W.O.S.T is 0.34m, H.W.O.N.T is 0.28m, M.W.L is -0.15m, L.W.O.N.T is -0.52m, and L.W.O.S.T is -0.58m. The average

height tidal range is smaller than 1m. In comparison with the analysis results and the results from previous literature, they are similar.

2. The water depth data shows that the depth of the lagoon on the island of Dongsha is mostly ranging within -1m. Near-shore reef area of both southern and northern Dongsha island, the bottom bed underneath is relatively slow in slope. The water depth is about 0~-2m at 1km offshore, 0~-5m at 2km offshore, and -3~-7m at 2~3 km offshore. There are more rocks in northern side than southern side and the depth of water changes a lot. The water depth has reached -38m from 1km offshore to open sea in the western side of island, and presents the abrupt slope to enter the deep sea straight. The average slope is about 4.3%. The water depth at 3km offshore is ranging from -2m to -56m at northwest corner. The slope is the SE-NW direction and the average slope is about 1.8%. The water depth of the east side of Dongsha Island wharf is approximately between -1m and -20m. The depth changes of sea bed is more complicated and the height fluctuates. The water depth of northwest side is shallow approximately -4m~-6m. The southeast side topography is covered with the reefs and rocks where the water depth is about -10m ~ -20m. The water depth of north channel drops down from -2m to deep sea -129m. It is the deepest place of the survey range in this plan. The shallow part distributes occasionally with reef rocks. The water depth is approximately -10m ~ -20m in Atoll area. The seabed topography hidden reef and rock will potentially danger the passing ships. The deepest depth can reach -23.14m.

3. Through the Side-Scan Sonar System (SSS) and underwater photography sea-bed topography investigation results, the bottom demersal type in Dongsha Atoll is divided into four major types, including seaweed, coral (to contain dead coral), sand, and rock. Related details are tabulated. Dongsha Atoll bottom bed

is distributed by coral reef primarily, and accompany with a large number of dead coral and rock. The seaweed mainly spread around Dongsha Island along the coastline approximately 1.5km outward.

4. This project aims at anchoring area Dongsha field research activity to plan the simple anchoring areas, in order to facilitate the investigation of the ecological research ship to the observation stations, and provides navigation of operating equipment in the simple anchoring areas based on electronic navigational chart.