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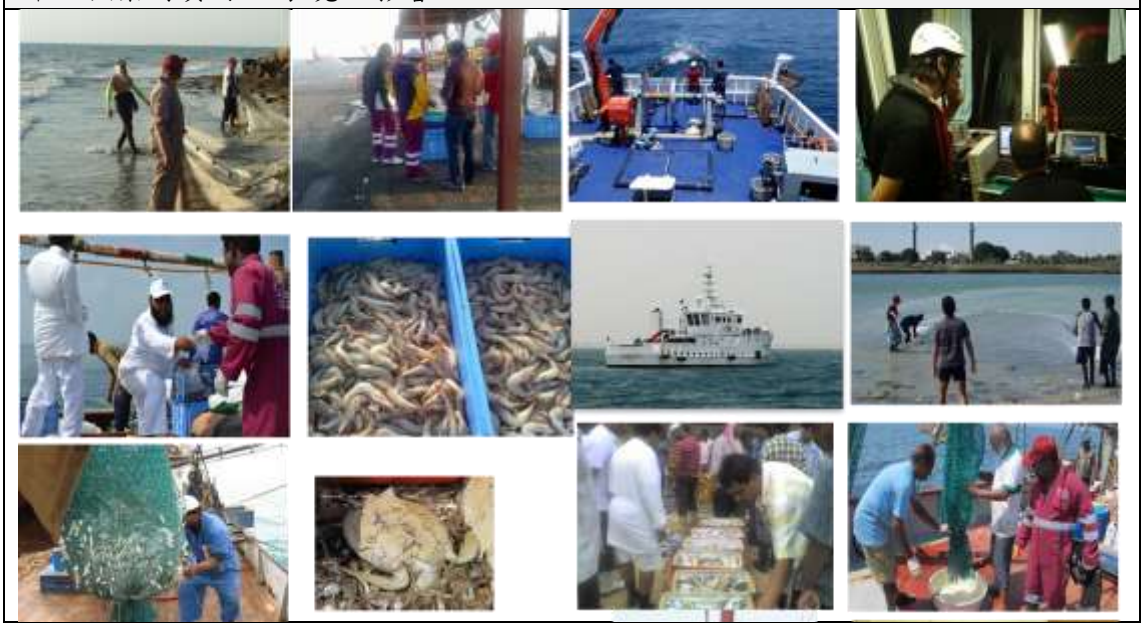
專長領域

評估漁業對資源及環境之影響



評估海洋生態系健康情況以及收集基礎資料

魚類生物學及生活史研究比較

最近三年發表之 SCI 期刊文章

1. **Lin, Y.J.,** Roa-Ureta, R.H., Premlal, P., Nazeer, Z., Pulikkoden, A.R.K., Qurban, M.A., Prihartato, P.K., Alghamdi, H.A., Qasem, A.M. and Rabaoui, L. (2022). Habitat-forming organisms in the offshore seabed of the western Arabian Gulf. Regional Studies in Marine Science, p.102446. (SCI, 5-year IF = 2.24, 54/113 in Marine and Freshwater Biology, Q2).
2. **Lin, Y. J.,** Roa-Ureta, R. H., Pulikkoden, A. R. K., Premlal, P., Nazeer, Z., Qurban, M. A., & Rabaoui, L. (2021). Essential fish habitats of demersal fish in the western Arabian Gulf. Marine Pollution Bulletin 173, 113013. (SCI, 5-year Impact Factor = 5.907, 3/110 in Marine and Freshwater Biology, Q1).
3. **Lin, Y. J.**, Roa-Ureta, R. H., Basali, A. U., Alcaria, J. F. A., Lindo, R., Qurban, M. A., Prihartato, P. K., Qasem, A. & Rabaoui, L. (2021). Coarser taxonomic resolutions are informative in revealing fish community abundance trends for the world's warmest coral reefs. Coral Reefs 40(6), 1741-1756. (SCI, 5-year Impact Factor = 3.880, 12/110 in Marine and Freshwater Biology Q1).
4. Rabaoui, L., Yacoubi, L., **Lin, Y. J**., Joydas, T. V., Maneja, R. H., Dagoy, J., Qurban,

M.A & Roa-Ureta, R. H. (2021). Distribution, abundance, and life history traits of the blue swimming crab *Portunus segnis* (Forskål, 1775) in the Saudi waters of the Arabian Gulf. Regional Studies in Marine Science 101895. (SCI, 5-year Impact Factor = 1.962, 66/110 in Marine and Freshwater Biology, Q3)

5. Rabaoui, L., Roa-Ureta, R., Yacoubi, L., **Lin, Y.J**., Maneja, R., Joydas, T.V., Panickan, P., Gopalan, J., Loughland, R., Prihartato, P.K. and Qassem, A., 2021. Diversity, distribution, and density of marine mammals along the Saudi waters of the Arabian Gulf: update from a multi-method approach. Frontiers in Marine Science 8. (SCI, 5-year Impact Factor = 5.125, 6/110 in Environmental Science, Q1.)
6. **Lin, Y.J**., Rabaoui, L., Maneja, R.H., Pulikkoden, A.R.K., Premlal, P., Nazeer, Z., Qurban, M.A., Abdulkader, K., Prihartato, P.K., Qasem, A.M. and Fita, N. (2021). Strengths and weaknesses in the long-term sustainability of two sympatric seabreams (*Argyrops spinifer* and *Rhabdosargus haffara*, Sparidae). Journal of Fish Biology 98(5), pp.1329-1341. (SCI, 5-year IF = 2.250, 46/110 in Marine and Freshwater Biology, Q2).
7. **Lin, Y.J**., Rabaoui, L., Basali, A.U., Lopez, M., Lindo, R., Krishnakumar, P.K., Qurban, M.A., Prihartato, P.K., Cortes, D.L., Qasem, A., Al-Abdulkader, K., Roa-Ureta, R., (2021). Long-term ecological changes in fishes and macro-invertebrates in the world's warmest coral reefs. Science of The Total Environment 750(1), p.142254. (SCI, 5-year IF = 6.419, 22/265 in Environmental Sciences, Q1).
8. Williams, C.T., McIvor, A.J., Wallace, E.M., **Lin, Y.J.** and Berumen, M.L., 2021. Genetic diversity and life-history traits of bonefish *Albula* spp. from the Red Sea. Journal of Fish Biology 98(3) 855-864. (SCI, 5-year IF = 1.941, 50/110 in Marine and Freshwater Biology, Q2).
9. **Lin, Y.J.** and Jessop, B.M. (2020). Application of generalized depletion model to recruitment of American eel elvers and empirical support from survey data. Transactions of the American Fisheries Society 149(5) 576-586. (SCI, 5-year IF = 1.694, 28/53 in Fisheries, Q3).
10. Hsu, H.H., Nazeer, Z.M., **Lin, Y.J**., Panickan, P., Al-Abdulkader, K., Loughland, R. and Qurban, M.A. (2020). Biological aspects of juvenile great hammerhead sharks Sphyrna mokarran from the Arabian Gulf. Marine and Freshwater Research 72(1) 110-117. (SCI, 5-year IF = 1.773, 51/106 in Marine and Freshwater Biology, Q2).
11. Rabaoui, L., Cusack, M., Saderne, V., Krishnakumar, P.K., **Lin, Y.J**., Shemsi, A.M., El Zrelli, R., Arias-Ortiz, A., Masqué, P., Duarte, C.M. and Qurban, M.A. (2020). Anthropogenic-induced acceleration of elemental burial rates in blue carbon repositories of the Arabian Gulf. Science of The Total Environment, p.135177. (SCI, 5-year IF = 6.419, 22/265 in Environmental Sciences, Q1).

右邊生殖腺較長是鯙科的「常規」？

生物特徵的研究，是生物學中基本的題目。生物外部特徵的不對稱由於很容易觀察，因此有較多研究。相反探討體腔內內臟器官不對稱的研究，卻是少之又少。為了解鯙科在生殖腺上左右不對稱的情況，此次研究調查了棲息在台灣海域中的 20 個鯙科及 2 種不同的鰻科物種，共 2959 尾個體。調查發現，所有鯙科物種的右邊生殖腺均比左邊的生殖腺明顯地長(如下圖)，但 2 種非鯙科物種(合鰓鰻科及蛇鰻科)的生殖腺皆沒有發現統計上顯著的左右不對稱。由此可見，生殖腺左右不對稱是鯙科物種獨有的。這現象被推測為鯙科在歷史演化中衍生出來的副產物。

研究團隊從 2003 年開始至 2008 年，從台灣北部及東部海岸，以不同方法收集樣本，其中大部分透過向漁民收集。研究團隊使用了 2 個指標去表明生殖腺長度的不同。分別是生殖腺左右長度比值跟生殖腺左右長度差值。透過數量龐大的樣本，及台灣多年來對鯙科的研究所累積下來的數據，最終使團隊能同時對多個物種進行調查及比較。

研究團隊指出，棲地類型、深度、物種的最終大小，以至分類學上的相似度均沒有發現重要的關聯性。生殖腺左右不對稱一直被認為是異常的現象，但對於鯙科卻有可能是一種常規。既然這個「常規」沒有對牠們的生存造成明顯的劣勢，影響牠們的族群數量，那為什麼會出現這個情況？性選擇及歷史演化副產物被認為是最有可能解釋的原因。但詳細因素，還需團隊往後進一步的研究。

Lin, Y.J. and Chen, H.M., 2023. Directional asymmetry in gonad length indicates moray eels (Teleostei, Anguilliformes, Muraenidae) are “right-gonadal”. *Scientific Reports*, *13*(1), p.2963

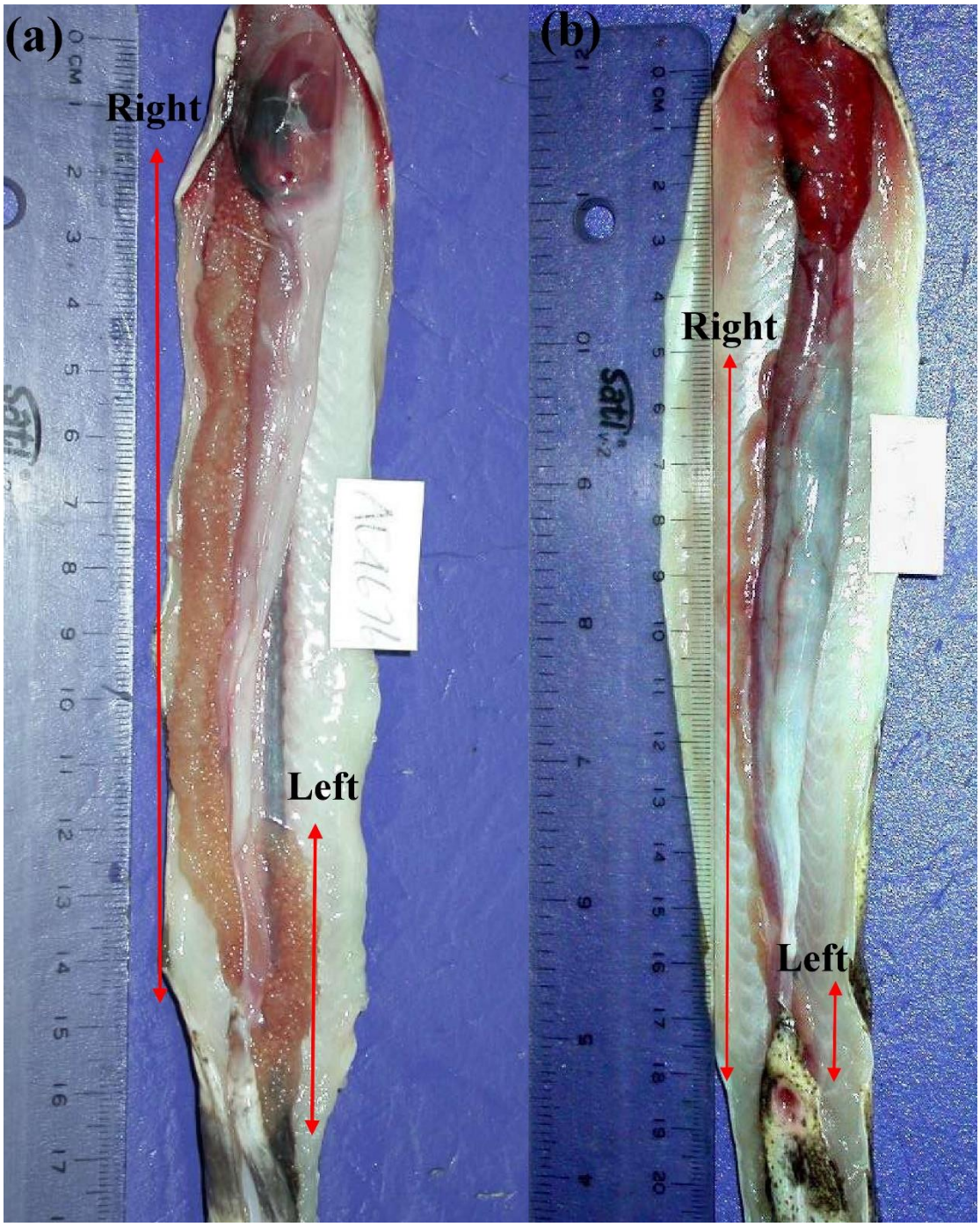
Is a longer 'right-gonadal' the norm in moray eel species?

Studies about the external morphological traits form the very basis of biology. The studies of external traits of teleost are rich over the world due to its easy observation. However, the inner organs of teleost are rarely examined. To understand the directional asymmetry in the gonad length of Muraenidae and outgroups, Yu-Jia Lin, an assistant professor of the institute of Marine Ecology and Conservation at National Sun Yat-sen University and Hong Ming Chen, a professor of Department of Aquaculture, National Taiwan Ocean University investigated 20 species of moray eels (Muraenidae) and two outgroup species with 2959 individuals. They found out that moray eel species were generally having a significant longer right gonad length (Figure) but not occurred in the outgroups species. Indicating the directional asymmetry is unique in the moray eels species and is likely considered as a by-product in the evolutionary history without significant disadvantage in survival.

All the specimens were collected from eastern and northern Taiwan between 2003 to 2008 with various method, in particular collected from collaborating fishmen. The teams used two indicators to represent the directional asymmetry, the gonad length ratio(right divided by left) and the gonad length difference(right minus left).To remove the variation in sampling months, they used gonad length instead gonad weight to conduct the experiment. With large sample sizes and a considerable amount of accumulated valuable data, the teams successfully discovered that the directional asymmetry in gonad length is the unique norm in the moray eels.

The team observed that no correlation to major habitat types, depth and size classes, and taxonomic closeness of the species. The asymmetry in the gonad morphology was considered as an abnormal phenomenon . Nevertheless , the directional asymmetry in the gonad length appears to be a norm in the examined moray eel species and the possibility of natural variation can be ruled out. Although this norm doesn't negatively impact population dynamics, the question of why it occurs remains. Both the sex selection or a by-product in the evolutionary history are considered possible explanations for observed asymmetry in the moray eels. These possibilities can be explored and tested in future studies.

Lin, Y.J. and Chen, H.M., 2023. Directional asymmetry in gonad length indicates moray eels (Teleostei, Anguilliformes, Muraenidae) are “right-gonadal”. *Scientific Reports*, *13*(1), p.2963



圖(a)雌性(b)雄性疏條紋裸胸鰨(*Gymnothorax minor*, ID: TOU-AE-4676 and TOU-AE-4592)的生殖腺圖。左右為當魚類頭朝上、腹部朝下時之左右側。拍攝者:黃麗雅。

Figure. (a) A female *Gymnothorax minor*, collection ID: TOU-AE-4676 and (b) a male collection ID: TOU-AE-4592, showing the measurement of gonad length at both sides. The ovary is enclosed in orange and testis in blue. The left side (L) and right side (R) are defined when the fish is head up and belly down, and therefore, left–right direction appears opposite when the belly is up as shown this figure. Scale bar = 1 mm. (Photo credit: Huang, L.Y.)

The resilience of coral reefs is essential for their recovery from mass coral mortality events

珊瑚礁恢復力是對抗大規模珊瑚死亡事件的關鍵

紅海東北海域由杜拜延伸至沙烏地亞拉伯的阿卡巴灣入口，地理位置偏遠，導致該海域的基線數據長期以來沒有更新。為了完整該海域的底棲珊瑚礁及魚類群落的基線數據，研究團隊使用了水下視覺調查和誘餌式遠端水底攝影系統進行調查。並將此次調查結果與 20 年前的基線數據進行比較。調查發現，現在的珊瑚覆蓋率與 20 年前相比沒有顯著差異，但同時亦發現大量死珊瑚骨骼。由此可見，紅海東北海域也曾發生大規模的白化現象，導致大量珊瑚死亡，但由於東北海域珊瑚的高恢復力使珊瑚覆蓋率沒有明顯下降，能夠維持在尚可水平。

The northeastern Red Sea, spanning Duba to the entrance of the Gulf of Aqaba at the Saudi Arabian coast, is remote from major cities. The overlooked location has resulted in outdated of 2 decades and incompleted information of the area. To enhance the baseline data on benthic coral communities and associated fish communities, Yu-Jia Lin, an assistant professor of the institute of Marine Ecology and Conservation at National Sun Yat-sen University, along with his pervious teammates from the King Fahd University of Petroleum and Minerals, conducted underwater survey with Underwater Visual census methods and Baited Remote Underwater Video (BRUV) .They compared the current data to information collected 2 decades ago and found out that, there is a similar level of coral coverage but having a higher proportion dead coral at present. This indicates that a mass coral mortality event has occurred in the northeastern Red Sea. However, the coral in this area has shown high resilience, remaining as healthy as it was two decades ago.

紅海擁有超過 50 屬的造礁珊瑚，超過 1200 種的珊瑚礁魚類，有不少海洋生物更是紅海特有。珊瑚普遍對水溫非常敏感，若水溫高於 30 度，依附在珊瑚上的共生藻就會離開，造成白化現象。但由於紅海的海水溫度夏季時達 35 度，造就了當地珊瑚的高耐熱性。可是，耐熱不等於隔熱，紅海的珊瑚礁也曾多次因熱浪侵襲，經歷大規模珊瑚白化。紅海的珊瑚礁是不平等地受熱浪影響，近岸的珊瑚礁比離岸的更易白化。紅海其他地方及鄰近的阿拉伯灣就曾發生過因大規模的珊瑚死亡，導致棲地退化成由大型藻類主導的珊瑚礁群落或海膽荒漠。

The Red Sea is home to more than 50 genera of hermatypic corals, over 1200 fish species and high level of endemism for marine organisms. Coral in the Red Sea demonstrates an exceptionally high thermal tolerance, allowing them to endure the

surface water temperature that can reach up to 35℃ in the summer . However, the coral in the Red sea are not entirely “heat proof” and they also experienced several intense heating event which caused widespread coral blenching. Furthermore, pervious study found out that nearshore reefs is more susceptible to blenching than offshore reefs. The mass coral mortality may lead to a phase-shift, changing the coral reefs to macroalgae-dominant reefs or sea urchin barren grounds. This phase-shift have occurred in other parts of the Red Sea and nearby Arabian Gulf.

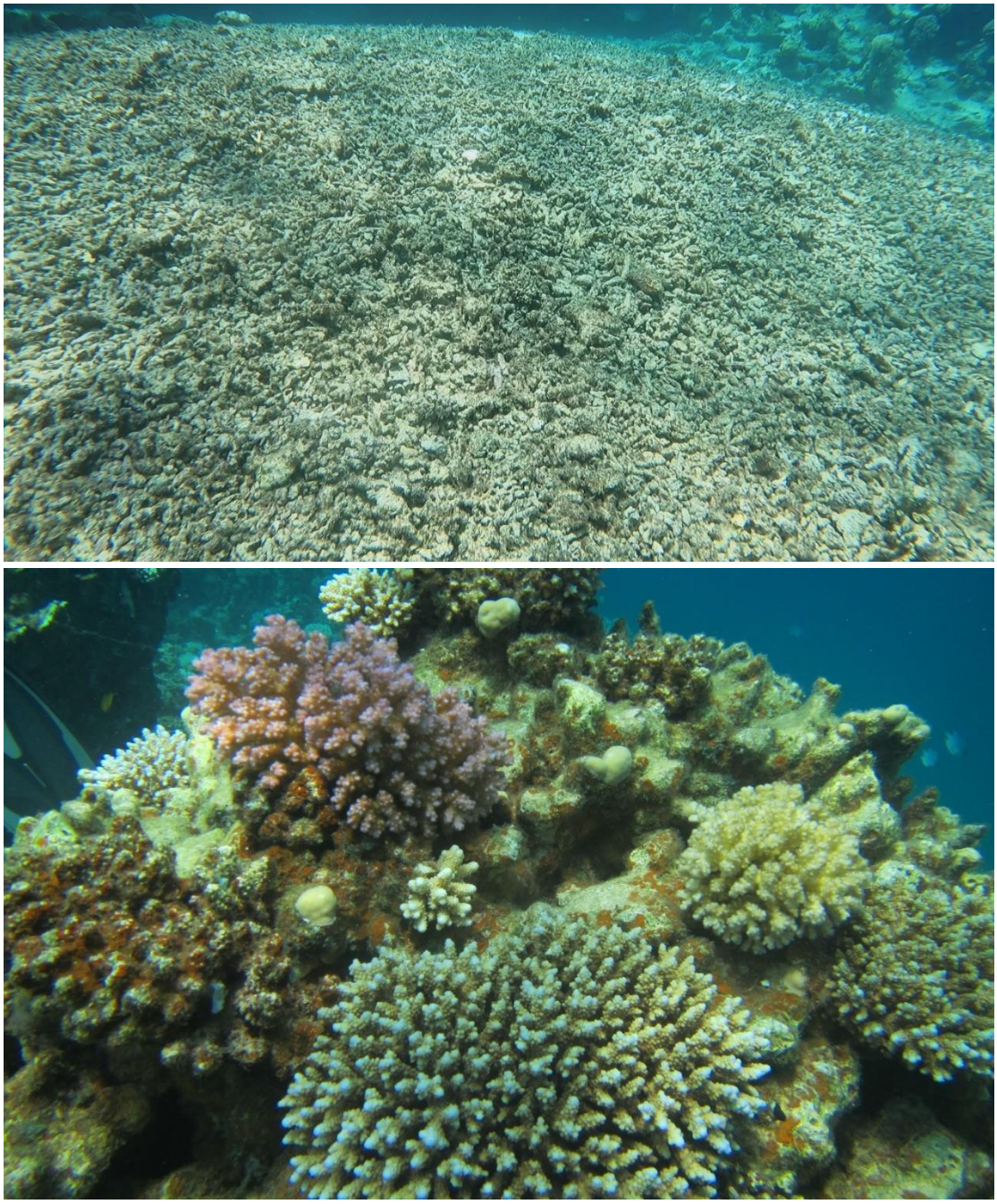
研究團隊在 2021 年 7 月利用潛水調查(UVC)和誘餌式遠端水底攝影系統(BRUV)在紅海東北水域 7 個近岸珊瑚礁區 3 個離岸珊瑚礁區，共 10 個地點進行水下調查，收集珊瑚礁及魚類群落的數據。調查共發現 29 屬珊瑚，其中濱珊瑚屬、軸孔珊瑚屬、角星珊瑚屬和指形軟珊瑚屬最為常見。近岸樣點的珊瑚覆蓋率中位數是 36.2%，與 20 年前的 28.1%相比有明顯增加。同時，死珊瑚覆蓋率從 20 年前的 6.7%，大幅增加至現在的 38.1%。研究證實，大規模的珊瑚死亡事件確實曾在紅海的東北海域發生，同時也展示出當地珊瑚礁生態的驚人回恢復力。

To collect data on coral and fish communities, the team conducted Underwater Visual Census methods (UVC) and Baited Remote Underwater Video (BRUV) at a total of ten stations along the northeastern Red Sea in July 2021. The stations included seven nearshore and three offshore sites. A total of 29 coral genera were observed, with stony corals such as Porites sp., Acropora sp., Goniastrea sp., and Sinularia sp. being frequently recorded.The mean coral coverage for all nearshore stations was 36.2%, which was higher than the 28.1% recorded two decades ago. Meanwhile, the coverage of dead coral significantly increased from 6.7% two decades ago to 38.1% at present. This result demonstrated a mass coral mortality has occurred and has recovered with their marvelous resilience.

刺尾鯛跟鸚哥魚等草食性魚類，能藉由攝食來抑制大型藻類跟絲狀海藻的生長；單棘魨、隆頭魚和龍占魚會捕食海膽，因此可控制海膽的數量。這些魚種在 UVC 或 BRUV 調查中都十分常見。研究團隊指出，很大可能是因為這些魚類扮演了天敵的角色，防止了藻類及海膽的生長。棘冠海星沒有在當地爆發、人為活動的干擾稀少、有充足的珊瑚幼蟲從紅海其他地方加入、以及有利珊瑚重新形成礁體的環境條件等，促使當地的珊瑚礁擁有驚人回恢復力。

Surgeonfish and parrotfish likely play a crucial role in controlling the colonization of macroalgae and turf algae, while triggerfish, wrasses, and emperors serve as important predators of sea urchins. These fish species are commonly observed in Underwater Visual Census (UVC) or Baited Remote Underwater Video (BRUV) surveys. The

research team suggests that the remarkable resilience of the coral in the Red Sea could be attributed to fish communities facilitating the removal of macroalgae and sea urchins, infrequent occurrences of crown-of-thorns starfish outbreaks, the absence of other atherogenic disturbances, a sufficient supply of coral recruitment from other areas of the Red Sea, and favorable environmental conditions for coral growth. Lastly, it's important to note that both UVC and BRUV methods have their pros and cons. Integrating both methods can form a holistic framework for monitoring coral reef ecosystems. Regular and comprehensive monitoring of coral reefs is crucial to safeguard against unforeseen circumstances.



上圖: 死珊瑚骨骼的海床；下圖:在死珊瑚骨骼上生長的珊瑚聚落。

Upper panel: a flat of dead coral rubbles; lower panel: colonies of *Acropora* and *Pocillopora* on a dead coral colony