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臺灣附近海域花斑刺鰓鮨資源研究之回顧與展望

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前言

臺灣四面環海，海岸線長達 1,100 餘公里，擁有複雜多樣的海岸環境。地理位置上位處熱帶與亞熱帶交界處，又恰巧位於珊瑚三角 (Coral Triangle) 的北端，再加上黑潮、大陸沿岸流與南中國海水團等不同洋流在此交會，造就了極高的海洋生物多樣性，鮨科魚類也不例外。根據 2012 年臺灣魚類資料庫紀錄 (http://fishdb.sinica.edu.tw/)，臺灣周圍海域目前約有 29 屬 119 種鮨科魚類，其中以具高經濟價值魚種的石斑魚屬（Genus *Epinephelus*）43 種最多，分別佔了全世界石斑魚屬物種數(99 種) 的 43%與印度太平洋產石斑魚屬物種數 (76 種) 的 57%；其次為九棘鱸（Genus *Cephalopholis*）屬的 11 種，分別佔了全世界九棘鱸屬物種數 (23

種) 的 48%與印度太平洋產九棘鱸屬物種數 (17 種) 的 65%，顯示臺灣周圍海域擁有豐富的石斑魚資源。

其中，花斑刺鰓鮨，又稱為豹鱠、東星斑或七星斑，(coral trout, *Plectropomus leopardus*)，是一種高經濟價值的珊瑚礁魚類，相較於所有石斑魚種類，價格僅次俗稱老鼠斑的駝背鱸（Humpback grouper, *Cromileptes altivelis*）。在臺灣的售價每公斤價格約在 900 元，活魚價格更可高達每公斤 1200 至 1500 元。在香港的活海鮮批發價格，野生捕撈的花斑刺鰓鮨的售價約每公斤 590 元港幣，僅次於赤點石斑（*Epinephelus akaara*)的 1,010 元港幣及駝背鱸的 990 元港幣，養殖的花斑刺鰓鮨售價則僅有 300 元港幣／公斤（香港魚網：http://www.hk-fish.net）。在過去，花斑刺鰓鮨的來源多半來自自然海域捕撈，由於日益增加的市場需求與高經濟價值，加上缺乏有效的漁業資源管理及保育政策，使得該魚種已面臨過漁窘況。澳洲與菲律賓等地已有報告顯示漁獲量下降與漁獲體型變小趨勢 (Williamson *et al.*, 2004; Mclean *et al.*, 2011、2012)，並於 2004 年列入國際自然保護聯盟紅皮書（IUCN Red List ）Near Threatened 等

級。爰此，許多國家相繼投入花斑刺鰓鮨人工繁養殖技術的研發與建立，盼能減緩野生族群的採補壓力及提供廣大的市場需求。

花斑刺鰓鮨的系統分類

花斑刺鰓鮨在分類上屬於鮨科（Serranidae)、石斑魚亞科（Epinephelinae)、刺鰓鮨屬（*Plectropomus*)。全世界的刺鰓鮨屬共計藍點刺鰓鮨（*P. areolatus*）、黑鞍刺鰓鮨（*P. laevis*）、花斑刺鰓鮨（*P. leopardus*）、斑刺鰓鮨（*P. maculatus*）、點線刺鰓鮨（*P. oligacanthus*）、蠕線刺鰓鮨（*P. pessuliferus*）及雲紋刺鰓鮨（*P. punctatus*）等 7 種，全部分佈於印度-太平洋（Heemstra and Randall, 1993)。依據臺灣魚類資料庫紀錄 ，臺灣僅有藍點刺鰓鮨、黑鞍刺鰓鮨及花斑刺鰓鮨等 3 種的紀錄。依據 Leis（1987）透過比較石斑魚亞科項下不同屬之幼生型態，推論刺鰓鮨屬為該亞科中最原始的一屬，且與貧鱠屬（Genus *Saloptia*）親緣關係最接近，該屬僅有褒氏貧鱠（*Saloptia powelli*）一種。

花斑刺鰓鮨的外部型態

外部形態上，花斑刺鰓鮨魚體呈長紡錘形，軀幹延長而碩壯，最大體長可達 120 公分（TL），標準體長為體高之 2.9-3.9 倍。頭中大。口大；下頜側邊具小犬齒。鰓耙數 7～8+14，隨成長而漸退化。前鰓蓋骨邊呈圓形，具長短不一的棘，且前鰓蓋骨下緣有細小鋸齒；鰓蓋骨具 3 扁平棘，上下二棘被皮膚覆蓋。鱗片種類為櫛鱗；側線鱗數 89-99。背鰭鰭棘部與軟條部相連，鰭棘部明顯短於軟條部，具硬棘 VIII，軟條 10-12；臀鰭硬棘 III 枚，細弱而可動，軟條 8；腹鰭腹位；胸鰭圓形，中央之鰭條長於上下方之鰭條，鰭條 15-16；尾鰭內凹形（emarginate）。體綠褐色或紅色，眼眶周圍有一藍色圈，並有許多小藍點散在頭部、軀幹與各鰭膜上，惟腹部無藍點，此為與其他種類鑑別的主要特徵之一。體側無黑色橫帶，在受到驚嚇時，則會出現顏色深淺不一之橫帶紋路（Heemstra and Randall, 1993）。

花斑刺鰓鮨的地理分佈及棲息地選擇

花斑刺鰓鮨主要分布於西太平洋的熱帶及亞熱帶海域，北從日本南部的九州、沖繩、臺灣、香港、越南、菲律賓、印尼到澳洲北部，西起印尼婆羅洲、帛琉、新幾內亞、新加利多尼亞至斐濟均有其分佈紀錄。在臺灣，主要分布於澎湖海域，北部海域有零星分佈，在屏東小琉球、墾丁、台東綠島及蘭嶼等珊瑚礁生態繁盛之海域則難以發現其蹤跡（個人觀察）。棲息地的選擇上，花斑刺鰓鮨主要棲息於珊瑚礁狀態良好的潟湖及面海的礁區，亦常出現於外礁斜坡（outer reef or reef slope)，棲息深度大多在 100 公尺以淺，且偏好棲息砂礁交界的環境（Wen *et al.*, 2013)。成體具有固定的領域範圍（home range)，不會有大範圍地移動遷徙，即便在繁殖期實亦是如此（Zeller anf Russ, 1998)。

花斑刺鰓鮨的文獻回顧

根據 Web of Science 學術研究資料庫搜尋的結果，花斑刺鰓鮨相關的研究最早為 Leis（1987）針對花斑刺鰓鮨幼生及早期生活史

的研究，迄今（2015 年）約有 230 篇。依據研究地點來區分，最多的研究於澳洲進行，其他為菲律賓、印尼、日本、加利多尼亞、泰國、臺灣及中國等地。

主要研究範疇包括：動物行為（Kingsford, 1992; Samoilys and Squire, 1994; Samoilys, 1997ab; Zeller,1997、1998; Zeller and Russ,1998; Frisch and Anderson, 2000; Zeller, 2002; Bunt and Kingsford, 2014; Matley *et al.*, 2015)、個體發育（Masuma *et al.*, 1993; Rimmer *et al.*, 1994; StJohn, 1997; Trijuno *et al.*, 2002; Qu *et al.*, 2012）、生殖生物學(Ferreira,1995; Adams, 2003; Frisch and van Herwerden, 2006; Frisch and Hobbs, 2007; Frisch *et al.*, 2007; Carter *et al.*, 2009; Carter *et al.*, 2014、2015)、食性分析(St John, 1999; St John *et al.*, 2001)、幼生加入與定著(Doherty *et al.*, 1994; Light and Jones, 1997; Leis and Carson-Ewart,1999; Wright *et al.*, 2008; Kingsford, 2009)、遺傳多樣性與族群遺傳結構(Adams *et al.*, 2000; Zhu and Yue, 2008; Ding *et al.*, 2009; van Herwerden *et al.*, 2009; Zhang *et al.*, 2010; Cai *et al.*, 2013; Liu *et al.*, 2013)、生理反應調節

(Frisch and Anderson, 2005)、耳石相關（Bergenius *et al.*, 2006; Heath *et al.*, 2007）、人工繁養殖（Yoseda *et al.*, 2008; Ma *et al.*, 2015; Sun *et al.*, 2015; Takebe *et al.*, 2015; Xia *et al.*, 2015）及資源評估管理及保育（Ferreira and Russ, 1994; Russ *et al.*, 1996、1998; Zeller *et al.*,1998; Fulton *et al.*, 1999; Zeller and Russ, 2000; Adams *et al.*, 2000; Little *et al.*, 2005; Mclean *et al.*, 2011、2012; Ebisawa, 2013; Carter *et al.*, 2014; Hobbs *et al.*, 2014）。

整體而言，花斑刺鰓鮨研究報告的數量雖不若龍膽石斑（*E. lanceolatus*）、點帶石斑（*E. coioides*）、拿騷石斑（*E. striatus*）、烏鰭石斑（*E. marginatus*）、伊氏石斑（E. *itajara*)與小鱗喙鱸（*Mycteroperca microlepis*）等魚種豐富，但由於其自然資源量的減少與市場價值的提昇，該魚種也越來越受到學界與產業界的重視。

花斑刺鰓鮨在臺灣的現況與未來展望

目前在臺灣，僅澎湖海域有較豐富的花斑刺鰓鮨族群，並且存在有青灰色與紅色兩種體色的個體，不論幼魚、亞成魚（圖 1）或

成魚（圖 2）均可發現兩種體色之個體，且目前尚無研究關於花斑刺鰓鮨可轉變體色的研究。根據漁民的說法認為是因為棲息深度不同所造成的差異。然而此種體色上的差異為先天遺傳影響或是受到後天棲息環境所導致，目前仍無相關的研究與定論。根據 van Herwrden 等人（2009）利用粒線體控制區基因序列的差異推論花斑刺鰓鮨在其整個分布範圍內可能區分為：（1）澳洲東岸至斐濟、（2）澳洲北岸至印尼、（3）所羅門群島、（4）菲律賓、（5）臺灣及（6）日本南部等 6 個地理群，且不同群之間在生態尺度上幾乎沒有基因交流（gene flow），故當某一地區之族群滅絕後亦難由其他地區補充。爰此，可進一步利用細胞核基因、粒線體基因與微衛星基因座等數種遺傳標誌進行研究，探討臺灣週圍海域花斑刺鰓鮨的遺傳歧異度與族群遺傳結構，以及兩種體色的花斑刺鰓鮨是否具有遺傳分化狀況。

另一方面，許多珊瑚礁魚類會因為不同的成長階段而利用不同的珊瑚礁或是其他棲地（Lecchini *et al.*, 2007），幼魚時期會利用特定珊瑚棲地作為庇護所，而成長至亞成魚和成魚時，就會分佈到較

深的水域並且活動範圍較廣（Lecchini and Galzin, 2005; Mumby, 2006）。一般而言，棲息於水深較深的魚種較常具有紅色體色，因此將來亦可探討花斑刺鰓鮨個體體色及體型大小與棲息水深的關聯性，以及評估不同體色的個體在漁業生物學上是否具有差異，例如年齡成長模式與體長體重關係式。行政院農業委員會水產試驗所近年雖已完成該魚種的種魚培育及幼苗量產技術，並且大力推廣其產業發展，惟對於花斑刺鰓鮨野生族群現況的了解仍非常有限，實有必要針對臺灣週圍海域的花斑刺鰓鮨族群進行基礎生物學、遺傳結構、聯通性與棲息地偏好選擇等調查研究，俾利協助該魚種之漁業資源管理及保育。

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圖 1（a)體色呈現鮮紅色之花斑刺鰓鮨亞成魚個體(體長約 15cm TL),(b)體色呈現青灰色之花斑刺鰓鮨亞成魚個體(體長約 15cm TL)。

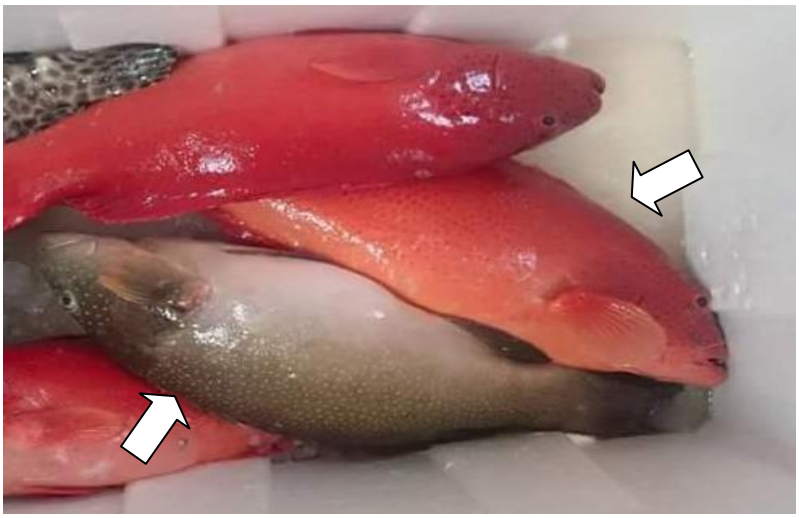

圖 2 箭頭指向於澎湖海域釣獲之兩種體色的花斑刺鰓鮨成體(體長約 40cm ＴＬ)。