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農業部漁業署 112 年度科技計畫期末研究報告

計畫名稱：西南大西洋魷釣漁業改進計畫之先期資料整備研究**(第 1 年／全程 1 年)**

（英文名稱） Preliminary research on a fishery improvement project (FIP) for the squid jigging fishery in the Southwest Atlantic

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計畫主持人：柯佳吟

研 究 人 員：黃廷緯、蒙彥蓁、張光瑢

執 行 機 關：國立臺灣大學

合 作 機 關：國立臺灣大學

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成果中文摘要

阿根廷短鰭魷*Illex argentinus* 是全球魷魚漁業的主要資源之一，約佔頭足類總捕撈量的10%，管理阿根廷短鰭魷漁業有助於了解西南大西洋海洋生態系，同時平衡保育與經濟，達到現今全球倡議之永續目標。本計畫為匯整國際阿根廷短鰭魷資料，解析基礎生物學，評估資源狀態，以提供資源養護及漁業管理措施之參考，並協助推動西南大西洋魷釣漁業改進計畫(Fishery Improvement Program，FIP)之行動計畫。本計畫以Web of Science為資料庫搜尋基礎，建立阿根廷短鰭魷關鍵字，依據閱讀摘要，將所蒐集文獻分為四個類別(生物學(biology)、管理(management)、族群評估(stock assessment)和人為影響(anthropogenically-induced impacts)，四大類別下續分別細分6-14子類別，本年度總計共收集354篇阿根廷短鰭魷文獻，時間涵蓋1990-2023年。在阿根廷短鰭魷生物學與生物族群模式部分，本計畫針對空間分布、族群結構、資源評估及漁業管理進行文獻回顧，阿根廷短鰭魷分布於西南大西洋巴塔哥尼亞陸棚及陸坡水域，其依體型結構、成熟體長、及產卵的時空分布，至少可分為四系群(stock)，但近年研究亦顯示，其可能為連續型產卵，及添加型態，而從資源量評估主要應用資源遞減模式，並應用於福克蘭群島臨時保護與管理區(Falklands Interim Conservation and Management Zone，FICZ)之資源評估，亦有建議應用經驗模式，即應用環境參數為解釋因子，建立阿根廷短鰭魷資源量指標之統計模式；此外，進一步回顧洄游與空間分布模式與漁業資料時，亦可發現相關生物族群模式，涵蓋廣義線性混合效應模型(Generalized linear mixed-effects models，GLMM)、組織能量累積數值(tissue energy accumulation)、相對組織能量累積數值(relative tissue energy accumulation)、allometric equations、殘差分析(residual index analysis)等，焦點於洄游與空間分布模式與漁業資料者，則包含廣義線性混合效應模型(Generalized linear mixed-effects models，GLMM)、棲地適宜性指數模型(Habitat suitability index，HIS)、廣義加成模型(generalized additive model，GAM)、互相關分析(cross-correlation analysis)、頻譜分析(spectral analysis)等，各模式亦皆輔以統計方法比較。本計畫依據

文獻收集，總結由於各國捕撈地點之差異，對於不同系群有不同漁業捕撈量的使用，而相應的系群研究內容與多寡亦不盡相同，仍需後續持續分析文獻以確實瞭解阿根廷短鰭魷整體生活史變化，方有機會提出國際共同評估與管理方法。整體來看，目前並無針對阿根廷短鰭魷之國際漁業管理組織，但沿岸國有管理措施。臺灣魷釣船隊在2022年加入FIP，有助於資源及漁業之永續發展，而相關之族群生物學、漁業生態學、資源量評估及漁業管理等，為計畫成功與否之關鍵資訊。

成果英文摘要(Abstract)

The Argentine shortfin squid *Illex argentinus* is one of main resources in the global squid fisheries, accounting for approximately 10% of the total cephalopod catches. Managing the Argentine shortfin squid fisheries helps to understand the marine ecosystem in theSouthwest Atlantic, which can benefit balancing conservation and economy and achieve today’s global sustainable development goals. This study was to compile international Argentine shortfin squid references to explore basic biology and assess resource status for resource conservation and fishery management measures, and for an action plan for the squid Fishery Improvement Program (FIP) in the Southwest Atlantic. This project used Web of Science as the basis for database search, established keywords for the Argentine shortfin squid, and divided the collected literatures into four categories (biology, management, stock assessment and anthropogenically-induced impacts), and the major categories were then subdivided into 6-14 subcategories. A total of 354 references were collected, covering the period from 1990 to 2023. For biological information and biological population models of the Argentine shortfin squid, information on spatial distribution, population structure, stock assessment and fisheries management were reviewed in this study. The squid distributed in the waters of Patagonian shelf and slope in the Southwest Atlantic. Based on size composition, size at maturity and spatiotemporal distribution of spawning, the squid was suggested to comprise four stocks. However, a continue spawning and recruitment pattern was proposed in recent years. The depletion model was performed for stock assessment of the squid and had been applied in the FICZ squid fishery. However, to establish empirical model by environmental variables on squid abundance index was also suggested. When focusing on migration and spatial distribution models, some still included biological population models, which further covered generalized linear mixed-effects models (GLMM), tissue energy accumulation, relative tissue energy accumulation, allometric equations, and residual analysis. The migration and spatial distribution models included generalized linear mixed-effects models (GLMM), habitat suitability index model (HIS), generalized additive model (GAM), cross-correlation analysis (cross-correlation analysis), and spectral analysis. Each model

was also supplemented by statistical methods for additional comparisons. Based on literature collection, we conclude that due to differences in fishing locations across countries, different stocks used for different groups, and differences in research efforts, subsequently continuous analyses for the collected literature are still needed to better understand the overall life history of the Argentine shortfin squid, which may provide opportunities to propose internationally common assessment and management methods. In conclusion, there was no international fisheries management organization for Argentine shortfin squid in the region, while coastal states impose management measure separately. Taiwanese squid jigging fishing vessels joined the FIP in 2022, which may benefit sustainable development of squid resource and the relevant fisheries. The information on population biological, fisheries ecology, stock assessment and fisheries management are essential and critical information for success of the FIP.

第一章　前言

1.1 阿根廷短鰭魷物種特性

阿根廷短鰭魷 *Illex argentinus* 是全球魷魚漁業的主要資源之一，約佔頭足類總捕撈量的 10% (FAO，2019)。阿根廷短鰭魷在其短暫的生命週期內在獵物可用後在白天和深夜進行水平和垂直遷移 (Arkhipkin, 1993, 2000; Santos & Haimovici, 1997; Haimovici et al., 1998)。此外，阿根廷短鰭魷是一種遷徙物種：在 1 月至 2 月的 46°S 族群豐度較高，然後向南遷移到福克蘭群島 (3 月至 5 月時達最高)。在此期間結束前，它再次向北遷移到阿根廷北部、烏拉圭和巴西，在 7 月至 8 月左右產卵和死亡 (Wang et al., 2018)。

阿根廷短鰭魷洄游路徑上，主要受巴西暖流以及福克蘭寒流所影響，前者較為溫暖並將大西洋赤道環流的熱量帶往南方，後者源自南極繞極區洋流，相較巴西暖流，其溫度較為寒冷。溫度環境容易改變其個體的生理生長狀況，從而改變其族群結構、 繁殖、收穫量等，因為鄰近福克蘭漁場，福克蘭寒流對阿根廷短鰭魷的影響過去推測應較巴西暖流顯著 (Chemshirova et al., 2021)；而兩者匯流於南緯 38 度位置，實際位置又受海面溫度影響 (Gordon & Greengrove, 1986; Acha et al., 2004; de Souza et al., 2019)。

阿根廷短鰭魷作為短年(一至二年)生物種，其生長速度相當快速，生長年齡與外套膜長關係可以用 von Bertalanffy model 描述，在達到平均最大年齡時， 雄性體長通常較雌性小(Hiroshi, 1985)；在各性別中，外套膜長與體重保持指數關係(Santos & Haimovici, 1997)，因此可以利用外套膜長與體重關係進行推算及模擬。在性成熟上，多數文獻之性成熟度判別使用性器官大小及特徵進行判別(Lipinski, 1979)，兩性性成熟度均分為 1 至 5 級，數字越大代表越成熟；雄性相較於雌性較早成熟，雄性約在出生後 200 天成熟，而雌性需推遲到約 250 天才會達到性成熟(Arkhipkin & Laptikhovsky, 1994)；性器官成長方面，雄性性腺在性成熟度為 3 後就無明顯成長，而雌性性腺 則隨性成熟度增加有明顯增長 (Rodhouse & Hatfield, 1990)，說明兩性在

性腺生長上有不同的模式。

1.2 歷年漁獲變動與衝擊分析

歷年(1997-2021 年)阿根廷短鰭魷漁獲量變動趨勢顯示，1999、2000、2007、2015 年之漁獲量最高，達到 245 千噸以上，2004、2016 年最低，僅分別為 9.8 千噸與 12.1 千噸。25 年間之漁獲量範圍為 253.6 千噸，中位數為 111.4 千噸，平均為 118.9 千噸及標準差 81.7 千噸。近幾年來漁獲量有逐漸降低趨勢，或僅維持特定漁獲量，然而由於阿根廷短鰭魷屬於短年生物種，過去多推測此類型物種族群變動量容易受環境所影響 (Park & Wootton, 2021)，因此氣候變遷、過度捕撈與環境汙染等皆可能衝擊此物種，並對此漁業產生相應之衝擊。

為邁向養護漁業資源及保障漁工基本權利的永續型漁業，臺灣區遠洋魷魚暨秋刀魚漁船魚類輸出業同業公會與中華民國對外漁業合作發展協會於 111 年發起西南大西洋魷釣漁業改進計畫 (Fishery Improvement Project，簡稱 FIP)，目前共 82 艘魷釣漁船加入。希冀透過 FIP 規劃，監控漁船作業動態、資源狀態評估、建立漁獲策略及漁獲管控規則等，遂行以科學為基礎之管理行動，以提升產業素質及韌性，改善漁工勞動條件，確保阿根廷短鰭魷漁業之永續發展。

1.3 計畫目標與最終效益

本計畫為FIP之先期研究計畫，透過文獻收集，彙整阿根廷短鰭魷相關生物資訊，以幫助規劃未來生物採樣之樣本調查數量與頻度，同時瞭解其族群變化之可能尺度，提出適當生物參考點；此外，彙整族群預測與族群變動模式，分析阿根廷短鰭魷之適用性，作為未來評估之基礎參考。

本計畫最終希冀整合我國魷釣船隊之阿根廷短鰭魷資料，解析其基礎生物學，評估資源狀態，以提供資源養護及漁業管理措施之參考，並協助推動西南大西洋魷

釣漁業改進計畫之行動計畫。

第二章　實施方法

2.1 資料庫搜尋與分類

以 Web of Science 為資料庫搜尋基礎，建立阿根廷短鰭魷關鍵字，包含阿根廷短鰭魷、族群、成長模式、洄游路徑、生殖、產卵等，進行全文檢索與下載。所有文獻依其內容分類，初步瞭解歷年阿根廷短鰭魷以完成之研究類型與主要研究國家、科學人員等。

將文獻中有關阿根廷短鰭魷生物參數依個別研究列出與建立資料庫。

再以網路全搜尋，額外進行資料蒐集，包含非學術報告等，續依照上述方法整理資料與建立資料庫。

2.2 列表彙整與分析

依據所收集文獻，列表所建立之使用生物相關模式，包含族群成長曲線、族群成長模式等，及其中相應參數；此外，亦依據所收集文獻，列表所建立之洄游路徑模式與其他空間分析模式，分析使用之環境與生物因子、時間頻度、空間尺度等。

2.3 綜整與評估

比較前述文獻與臺灣現有資料之差異與臺灣現有資料之可使用性，提出可能之使用模式。

第三章　結果與討論

3.1 資料庫建置

本年度於三個不同搜尋引擎進行阿根廷短鰭魷資料收集，搜尋篩選關鍵字訂定為“*illex argentinus*” OR “Argentine short fin” OR “Argentine short finned”，三個搜尋引擎包括有 Web of Science 進階搜尋(所有資料庫和所有出版年份)、Science Direct、Google Scholar。前兩者主要考量經過同儕審查機制，對於相關模式與評估方法已受學術審核，因此未來使用或國際討論時較有一定之標準與依據，第三者則幫助瞭解不同語言文獻資料之參考。整體文章類型主要關注與關鍵字相關的研究和評論文章、會議摘要、書籍章節和編輯評論。另外，篩選標準上，則選定標題和摘要必須包含上述任何關鍵字，最後依據閱讀摘要和/或介紹後，根據這四個類別的定義，將所蒐集到文獻分為四個類別(生物學(biology)、管理(management)、族群評估(stock assessment)和人為影響(anthropogenically-induced impacts)(表 1)，四大類別下續分別細分不同子類別，以作為未來探討分析之使用，子類別數量為 6-14 種(表 2)。本年度總計共收集 354 篇阿根廷短鰭魷文獻，各類別隨時間發表篇數詳見表 3。

3.2 生物族群模式

3.2.1 分類

學名：*Illex argentinus* (Castellanos, 1960)

英文俗名：Argentine shortfin squid

中文名：阿根廷短鰭魷

FAO 字母編碼(alpha code)：SQA

3.2.2 漁業概述

臺灣遠洋魷釣漁業之發展可溯自 1972 年(民國 61 年)。漁業發展初期以北半球之

西北太平洋(Northwest Pacific)，及南半球之紐西蘭水域(New Zealand waters)漁場為主。 於 1983 年開始西南大西洋(Southwest Atlantic)漁場，及 2002 年開始東南太平洋(Southeast Pacific)漁場。近年則維持三處，規模依序為：西南大西洋、西北太平洋(主要是秋刀魚)及東南太平洋。 所利用之對象物種主要有四，分別為西南大西洋之阿根廷短鰭魷(Argentine shortfin squid, *Illex argentinus*)、北太平洋之秋刀魚(Pacific saury, *Cololabis saira*)或赤魷(Neon flying squid, *Ommastrephes batramii*)，及東南太平洋之美洲大赤魷(Jumbo flying squid, *Dosidicus gigas*)。船隊規模約 100 艘漁船。 主要使用漁具為魷釣機或手釣方式，並可機動調整為棒受網漁具(捕捉秋刀魚)。

以近十年(2013-2022 年)漁獲量資料分析，臺灣遠洋魷類之平均年漁獲量為 10.7 萬公噸，其中西南大西洋漁場產量佔 94.4%，東南太平洋漁場產量約佔 4.8%，西北太平洋漁場產量約佔 0.8%。 顯然，我國之遠洋魷釣漁業相當倚重西南大西洋漁場(阿根廷短鰭魷資源)。

臺灣魷釣船隊在西南大西洋漁場之主要目標物種為阿根廷短鰭魷。阿根廷短鰭魷為全球重要的頭足類漁業資源之一。在 1980 年代以前，其年產量約 3 萬餘公噸。在東亞國家投入開發後，其年產量迅速增加，最高超過 100 萬公噸(1999 年及 2015 年)。 近十年(2012~2021 年)平均年產量為 44.1 萬公噸。 投入西南大西洋漁場開發國家有：沿岸國家(巴西、阿根廷等)、歐洲國家之拖網船隊(西班牙)，及東亞國家之魷釣船隊(中國、臺灣、韓國、萬那杜等)。 近十年平均年漁產量最高之五個國家依序為：中國(約佔 34.4%)、阿根廷(約佔 28.3%)、臺灣(約佔 23.5%)、韓國(約佔 9.5%)及西班牙(約佔 3.6%)，此五國已佔總產量 99.3%。

臺灣魷釣船隊於 1983 年開始前往西洋大西洋漁場釣捕阿根廷短鰭魷。 船隊數於 1988 年達最高(132 艘)，之後 10 餘年約維持在 110 艘之規模。 近十年(2013~2022 年)之年平均船數為 81 艘。臺灣船隊的年漁獲量自 1983 年後逐漸上升，在 1999 年首

次達高峰(26.3 萬公噸)，之後快速下降，並在 2004 年降至谷底(約 0.98 萬公噸)。 之後在 2007 年又達高峰(28.5 萬公噸)，但在 2010 年又降至低點(3.0 萬公噸)，於 2015 年又升至高峰(25.7 萬公噸)，次(2016)年卻又降至低點(1.3 萬公噸)。 之後僅 2021 年產量略升(14.6 萬公噸)。 以近十年(2013~2022 年)平均年產量為 10.1 萬公噸，佔全球產量的 23.5%。

3.2.3 空間分布

阿根廷短鰭魷為魷科(Ommastrephidae)，大西洋魷屬(*Illex*)之物種，為大洋表層性魷類(pelagic squid)。 其廣泛分布於西南大西洋的巴塔哥尼亞陸棚(Patagonian shelf)，及向外延伸的陸坡(slope)水域，即大約 22°S 至 55°S 之水域。高密度群通常出現在 35°S 至 52°S 間，水深為 80 至 400 米處，特別是 40°S 以南之亞極帶(subarctic)陸棚水域。

阿根廷短鰭魷的地理分布橫跨巴西(Brazil)、烏拉圭(Uruguay)、阿根廷(Argentina)，及福克蘭群島(Falkland Islands)之管轄水域(Nesis, 1987)，為跨界與高度洄游魚類系群之漁業資源。

阿根廷短鰭魷為多國漁業之釣捕對象物種，主要作業漁場為西南大西洋之近岸(neritic)，及巴塔哥尼亞陸棚-陸坡交界水域。 高密度群通常出現在三處：42°S，45°S 至 46°S，及 54°S 附近。 作業漁期為每年十二月至翌年六月間。

3.2.4 族群結構

阿根廷短鰭魷依體型結構(size structure)、成熟時的體長(length at maturity)、及產卵的時空分布(area and time of spawning)，至少可分為四系群(stock)：

(1) 南巴塔哥尼亞系群(Southpatagonic Stock, SPS)

SPS 群為秋季產卵群。 其在秋季(四至六月)時，於巴塔哥尼亞陸棚南部(45°至 48°S)之福克蘭洋流(Falkland Current)水域產卵。成熟個體之外套長約 180 至 350 mm，

通常在夏-秋季(約二至五月)時集中出現在 43°S 至 50°S 的陸棚外側。

(2) 伯納西斯-北巴塔哥尼亞系群(Bonaerensis-Northpatagonic Stock, BNPS)

BNPS 群為冬季產卵群。 其在冬季(七至九月)時，於巴塔哥尼亞陸棚北部(35°S 至 38°S)之巴西洋流(Brazil Current)與福克蘭洋流輻合區(convergence)產卵。成熟個體之外套長約 180 至 350 mm，通常在秋季(約五至七月)時集中出現在 37°S 至 43°S 的陸棚外側及陸坡水域。

(3) 春季產卵群(Spring-Spawning Stock, SpSS)

SpSS 群在春季(九至十一月)時，於 38°S 至 40°S 之沿岸至陸棚中央水域(水深約 50 至 100 米)產卵。成熟個體之外套長約 230 至 350 mm，通常在十至十一月時，出現在 38°S 至 40°S 附近或更北方水域。但有學者認為此系群是冬季產卵群(BNS 群)的延伸群。

(4) 夏季產卵群 (Summer-Spawning Stock, SSS)

SSS 群在夏季(十二至二月)時，於 42°S 至 45.5°S 之陸棚中央至外緣處(水深約 80 至 150 米)產卵，通常在一至三月間，出現在 42°S 至 48°S 的陸棚水域，其成熟個體之體型較小(外套長約 140 至 250 mm)。

各系群動態依時間序列可歸納如下：

(1) 一至三月(夏季)：

SSS 群在陸棚中央區(約 42°S 至 45.5°S 處)產卵，其成熟個體較小(<250 mm)。

(2) 四至六月(秋季)：

SPS 群在陸棚-陸坡交界處(45°S 至 48°S)成熟，並產卵。SPS 群孵化後之仔魷(或稱類浮游幼生，paralarvae)，由陸坡區上到陸棚水域，並往南洄游。成熟前之 SPS 群由陸棚南部沿陸棚-陸坡交界處往北洄游，大量出現在 43°S 至 50°S 陸棚外側。

(3) 七至九月(冬季)：

BNPS 群在陸棚北部之陸坡水域(35°S 至 38°S)成熟，並產卵。BNPS 群孵化之仔魷(paralarvae)，由陸坡區上到陸棚水域，並往南方洄游。成熟前之 BNPS 群由陸棚

南部沿陸棚-陸坡交界處往北洄游，大量出現在 37°S 至 43°S 陸棚外側及陸坡水域。

(4) 十至十二月(春季)：

SpSS 系群在沿岸及陸棚中央區(38°S 至 40°S)成熟，並產卵。

整體而言，SPS 及 BNPS 群的產卵前集中群(pre-spawning concentration)，為國際船隊的主要漁捕對象，而其高密度集中群主要出現在陸棚外緣，及陸棚-陸坡交界處，亦在此形成主要作業漁場。SPS 及 BNPS 群具相近之外部型態特徵，及經歷相近洄游路徑，其成魷個體之外套長皆為 250 至 390 mm，孵化後仔魷(paralarvae)主要出現在巴西洋流與福克蘭洋流輻合區的西方邊界水域，孵化後仔魷與稚魷(juvenile)會先往陸棚中央水域洄游，並繼續往南，洄游至陸棚南部水域成長(SPS 群約在冬季[七至九月]，BNPS 群約在春季[十至十二月])，亞成魷(subadult)及成魷(adult)則由陸棚南部水域移往陸坡水域，並在附近水域交配及產卵(reproductive and spawning) (SPS 群約在夏季[在一至三月]，BNPS 群則大約在秋季[在四至六月])。

除此之外，在巴西沿岸水域，亦認為有南巴西群(South Brazil Stock, SBS)，分布在 27°S 至 34°S 間(Haimovici et al., 1998)；以及較小個體的中巴西群(Central Brazil Stock, CBS)，分布在陸棚-陸坡交界及陸坡水域(水深 170 至 400 米；Alvarez Perez et al., 2009)。

上述對阿根廷短鰭魷之族群結構假說仍存有問題，如 SPS 群及 BNPS 群在產卵期及產卵場皆有部分重疊，使二者不易區分。亦有學者提出，SPS 群為 BNPS 群之延伸(Brunetti, 1992)，或 BNPS 群為 SPS 群之一部分等(Santos and Haimovici, 1997)。 近年 Crespi-Abril and Barón (2012)考慮產卵場及哺育場之時空環境適合度，對阿根廷短鰭魷族群結構提出新論點，即阿根廷短鰭魷會在不同季節，在陸棚中央及陸棚外緣之陸坡水域產卵，同時會有幾乎持續的(quasi-permanent)往沿岸水域移動的產卵洄游。此結果使阿根廷短鰭魷具有較先前所知更為連續性的添加型態(recruitment pattern)，

並具有微弱的族群分化現象。

3.2.5 資源量評估 Stock assessment

(1) 傳統模式

阿根廷短鰭魷為成長快，成熟早之短生命週期物種，生命週期通常為 1 年，並於產卵後即死亡，每年族群資源量皆為新添加群(recruitment)，且生活史過程行長距離洄游，而易受環境狀態改變之影響，使其年間族群資源量及漁獲量常呈現大幅變動現象(Rodhouse, 2001)。

魷類的資源量評估模式，如同傳統魚類的資源量評估模式，對物種之族群參數，如自然死亡率(natural mortality, M)、族群內在成長率(intrinsic population growth rate, r)、負載量(carry capacity, K)仍有相當不確定性。 必須透過生物採樣資料，模式推測，或假設初始數值，並應用反覆運算方式求算最佳數值，以估算不同物種之族群參數。目前應用於魷類物種之資源量評估模式有：沿用傳統魚類之評估模式(如剩餘生產量模式[production model])、資源遞減模式(depletion model)等(Arkhipkin et al., 2021)。

魷類物種之管理目標，通常為維持其產卵系群生物量(Spawning Stock Biomass, SSB)在一建議門檻，以確保其來年之添加量在安全水平(Beddington et al., 1990)。此產卵系群生物量(SSB)之水平，可稱為殘存量(survival)，或稱逃逸量(escapement)；其可為固定值，或為比例值。而比例逃逸量(proportional escapement)即定義為，在漁期結束時，殘存之資源量(尾數)，相對於假設無漁捕作業時(即漁獲死亡係數= 0)殘存資源量(尾數)，之比例(Beddington et al., 1990)。

Rosenberg et al. (1990) 以資源遞減模式(Leslie-DeLury depletion method)為基礎模式，估算福克蘭島周邊之阿根廷短鰭魷資源，並建議以 40%比例逃逸量(proportional escapement)為管理目標(Beddington et al., 1990)。Basson et al. (1996)延伸先前工作，

並考慮阿根廷短鰭魷洄游及不同船團效應，結果顯示 SSB 門檻為 32,000 至 64,000 公噸(有最小之添加量)。但選擇不同評估模式，會影響 SSB 值估算。

Chen and Chiu (2009)應用成對漁船 CPUE 比較法，計算阿根廷短鰭魷釣漁船間之相對漁捕能力(relative fishing power)，以標準化 CPUE 值。資料來源為臺灣魷釣漁船資料，時間為 1993 至 2003 年。其結果顯示，標準化 CPUE 趨勢在 1995 至 1999 年間阿根廷短鰭魷資源量上升，但在 1999 年至 2003 年間則下降。但是改變模式參數(比較次數，標準船等)，可能會影響 CPUE 值估算。

Chang et al. (2016)應用地理統計技術(geostatistical method)，估算阿根廷短鰭魷資源量。 資料來源為臺灣魷釣漁船資料，以高豐度年(1999 及 2007 年)，低豐度年(2004 年)，及近三年(2010 至 2012 年)為比較。1999，2004，結果顯示西南大西洋阿根廷短鰭魷之分布，因豐度不同，而具有不同空間結構(半變異圖)。以 Kriging 內插法估計阿根廷短鰭魷資源量之空間分布，在低資源量(如 2004 年)，其空間分布較散亂。以 Kriging 內插法估計之阿根廷短鰭魷整體生物量，在研究期間阿根廷短鰭魷之開發率(exploitation rate)皆低於 34%顯示，顯示其系群仍屬於健康狀態。

Wang et al. (2018b)應用考慮環境效應的剩餘生產量模式(environmentally dependent surplus production model)，評估阿根廷短鰭魷 SPS 系群。資料來源為 2000 至 2010 年中國魷釣漁船漁業資料。模式中以環境狀態(最適產卵場面積大小)反映族群參數 K 值。其結果顯示 MSY 為 351,600 至 685,100 公噸。在資料分析期間，阿根廷短鰭魷資源量未過度開發(overfished)，亦未有過度漁捕(overfishing)之情形。

Wang et al. (2020)應用棲地適合度模式，計算有效漁獲努力量，再據以標準化阿根廷短鰭魷 CPUE 值。資料來源為 2003 至 2011 年中國魷釣漁船漁業資料。結果顯示，標準化 CPUE 值皆較名目 CPUE 為高，顯示漁業作業相當集中。環境因子中以

海面高度(SSH)，及葉綠素 a 含量(Chl-a)為主要影響因子。

(2) 經驗模式

除了應用傳統的資源量評估模式，魷類族群對環境狀態改變的敏感度，使海洋環境因子對魷類資源之資源量變動，及空間分布提供相當的解釋能力(Waluda et al., 1999; Anderson and Rodhouse, 2001; Agnew et al., 2002; Waluda et al., 2002; Pierce et al., 2008; Rodhouse et al., 2014)。魷類的短生命週期特徵，使其在環境狀態改變並影響產卵群與添加成功(recruitment success)時，缺少足夠的族群緩衝能力(Piatkowski et al., 2001; Rocha et al., 2001)。而魷類族群的生活史參數(life history traits)具相當可塑性(plasticity)，透過成長率改變，生殖期延長，及產卵場位置移動等，可維持其族群之添加作用(recruitment process, Boyle and Boletzky, 1996)。此結果建議，魷類或可為反映環境或生態系變動之指標物種(Pecl and Jackson, 2008; Pierce et al., 2008)。因此，建立魷類資源量與環境參數的經驗模式，已成為探討魷類族群資源量變動時，除了應用傳統資源量評估方法以外之替代方法(Pierce and Boyle, 2003; Pierce et al., 2008)。

Waluda et al. (1999)應用稚魷期(陸棚北部)和成魷期(陸棚南部)的表層海水溫度(SST)資料，分析環境變動對福克蘭島阿根廷短鰭魷漁業添加量的影響。結果顯示，在孵化高峰期(六至七月)，孵化場(巴塔哥尼亞陸棚北部)之 SST 與次年的漁獲量為負相關。 而 SST 離均值(anomaly)在太平洋和西南大西洋陸棚南部水域有 2 年的延遲效應(time-lagged)，和陸棚北部水域則有 5 年的延遲效應。此一環境狀態的遠距關聯(teleconnection)效應，提供預測西南大西洋阿根廷短鰭魷添加強度的潛力。稍後，Waluda et al. (2001a) 分析阿根廷短鰭魷冬季產卵群(SPS 群)之推測孵化場，在孵化期(六至七月)之海洋狀態對阿根廷短鰭魷添加量之影響。其定義鋒面(front)水團面積及較適 SST 水團面積(16 至 18°C 之面積)，反映海洋狀態。結果顯示，阿根廷短鰭魷的高 CPUE 值，與前一年在孵化場的鋒面面積低，或較適 SST 面積高有關。此外，Waluda et al. (2001b) 則分析在阿根廷短鰭魷漁期間，福克蘭島周邊之海洋作用對阿根廷短鰭

魷分布之影響(1989 至 1996 年)。 結果顯示，阿根廷短鰭魷高資源量通常出現在福克蘭島東北方(陸棚邊緣區)，西北方(陸棚區)，及接近福克蘭島東部的北方沿岸區。阿根廷短鰭魷分布與溫度梯度有關，通常出現在福克蘭洋流及巴塔哥尼亞陸棚水的交界處。

Sacau et al. (2005)應用泛加成(GAM)模式，分析西南大西洋阿根廷短鰭魷的時空間分布變化。 資源來源為 1988 至 2003 年觀察員在西班牙拖網漁船的觀測資料。高 CPUE 值在一至四月，位在 42°S，46°S 及福克蘭島北部水域。GAM 模式亦顯示阿根廷短鰭魷 CPUE 具季節效應。 其高漁獲量與阿根廷短鰭魷之成熟有關，通常為較暖且較深水域。

Waluda et al. (2008)應用國防氣象衛星計畫(DMSP-OLS)資料，探察 1993 至 2005 年西南大西洋阿根廷漁船分布及範圍的長期年間變動。在 13 年間，漁業利用面積為 1-2 年者佔 28%，為 12-13 年者佔 7%。每年的漁獲量水準與漁船利用面積範圍呈正相關。在 2004-2005 年的低漁獲量，對應至漁業利用面積的縮減(contraction)，主要在漁場南部範圍。在相當高漁獲量的年度，其漁業使用範圍幾乎涵蓋此物種分布的緯度範圍。

Chang et al. (2015)以經驗模式，分析阿根廷短鰭魷資源量與次表層海水溫度及大氣環流之關聯。結果顯示，阿根廷短鰭魷 CPUE 與當年 2 至 4 月間巴塔哥尼亞陸棚南方的次表層(5 米深)海水溫度(SST)呈負相關，同時也與前一年 3 月陸棚南方與陸棚北方的次表層海水溫度有正相關。此外，阿根廷短鰭魷 CPUE 也與當年 12 月的南極震盪指標(Antarctic Oscillation index, AAO)有正相關，與前二年 3 月及 5 月的 AAO 有正相關。 以泛線性模式(GLM)分析阿根廷短鰭魷 CPUE 變動，其中漁季前二年 11 月和 3 月的 AAO，以及前一年與當年 3 月巴塔哥尼亞陸棚南方之次表層海水溫度被納入為模式因子，解釋率為 83%。

Chiu et al. (2017)應用臺灣船隊資料，探討阿根廷短鰭魷洄游型態與資源量之關聯性。阿根廷短鰭魷 CPUE 與緯度(46°S 至 50°S 間)，及 SST (10 至 14°C)有線性關係。在低豐度年，CPUE 與緯度為負的交互相關；而在高豐度年，二者為正相關。此結果建議，阿根廷短鰭魷 CPUE 高低與其向南洄游型態有關。

整體而言，應用經驗模式建構(或預測)魷類族群之空間分布型態，及資源量變動趨勢，已成為近年研究之重點。但在適用的物種(底棲或大洋表層)、使用的海洋環境因子(如表層海水溫度或海洋環境狀態指標)、空間範圍(large-scale 或 small-scale)，及建構的統計模式(線性或非線性)上，仍有選擇與討論之空間。雖然如此，傳統資源評估模式可提供族群資源量狀態及漁業管理措施所需之關鍵資訊(如生物參考點等)，對漁業管理措施之建議及規劃仍有其貢獻。

3.2.6 漁業管理

阿根廷短鰭魷為跨界且高度洄游物種，其生活史橫跨許多國家(巴西、阿根廷及福克蘭島)之 EEZ 水域，以及公海水域。以阿根廷短鰭魷為目標物種之漁業國，即有各沿岸國，及歐洲與東亞國家船隊。其資源評估及管理措施，有賴各漁業利用國之共同合作，但目前並無相應之區域漁業管理組織(regional fisheries management organization, RFMO)運作。

福克蘭群島政府於 1987 年劃設半徑 150 浬之水域為「福克蘭島臨時保育區」(Falkland Interim Conservation Zone, FICZ)，以控制努力量(漁船數)，配合漁期間之即時資源量評估進行管理。 在漁期開始前，依歷史作業紀錄與暫訂族群資源量資料，核發漁船執照(控制努力量)。漁期開始後，應用資源遞減模式(Leslie-Delury depletion method)估算每週阿根廷短鰭魷之族群資源量。當資源量接近或低於管理目標時，即關閉此漁業(結束作業)。 其管理目標為維持每年 SSB 在一定水平，實際作法則以 SSB

之比例逃逸量(如 40%；Beddington et al., 1990; Rosenberg et al., 1990)，或 SSB 固定值(如 4 萬公噸)為管理之參考點(Basson et al., 1996)。

阿根廷政府則在 1993 年，規定外國籍漁船可以租船(charted system)，或聯合投資(join venture)方式在阿國經濟水域(EEZA)作業。

在西南大西洋水域之阿根廷短鰭魷漁業，目前對 FICZ 及 EEZA 外之公海船隊，尚無相應之漁業管理組織。因此阿根廷短鰭魷族群資源量每年仍呈現相當震盪，在 2000 年後尤其明顯，可能一定程度反映氣候變動與高度開發之聯合效應。近年研究亦指出，公海作業船隊，可能為跨界洄游魷類資源永續的關鍵影響因素(Arkhipkin et al., 2023; Montecalvo et al., 2023; Seto et al., 2023)。

跨界漁業資源之有效管理，仍有賴區域性漁業管理組織(RFMO)之成立，在此平臺下規畫多年期研究計畫及工作項目，使能全面瞭解漁業資源之族群結構與動態。並建立漁業資料庫，分享現有漁業資料，並進行可行之資源量評估及漁捕管控規則(harvest control rule)。以可用科學資訊為依據，訂定有效之漁業資源養護與管理措施，期使漁業國及沿岸國共同遵從，而能達漁業及資源永續發展之目標。

3.3 洄游與空間分布模式及漁業資料

本年度洄游與空間分布模式及漁業資料之文獻介紹與描述，及模式列表先根據最近 7 年內選擇具有不同子類別的文獻。

在洄游與空間分布模式文獻中，亦有考量生物族群模式者，如下表，其中近期多以廣義線性混合效應模型(Generalized linear mixed-effects models，GLMM)作為分析工具，依據各研究內容則增加組織能量累積數值(tissue energy accumulation)、相對組織能量累積數值(relative tissue energy accumulation)、allometric equations、殘差分析

(residual index analysis)等，輔以統計方法比較。

編號	模式	資料使用年份	文獻發表年份	其他統計方式
1	-組織能量累積數值(tissue energy accumulation) -相對組織能量累積數值(relative tissue energy accumulation) -廣義線性混合效應模型(Generalized linear mixed-effects models，GLMM)	2020/5~6-2021/2~4	2017	
2	-allometric equations	2015/4/14-27	2019	-t test -Mann-Whitney test - Pearson correlation
3	-殘差分析(residual index analysis) -廣義線性混合效應模型(Generalized linear mixed-effects models，GLMM)	2012-2014		-卡方適合度檢驗(X2 Chi-Square Goodness-of-Fit test) -單因子變異數分析(Single-factor variance analysis，ANOVA) 協方差分析(Covariance analysis，ANCOVA) - Kruskal-Wallis test

以下三篇作為個別模式使用範例介紹：

(1) Liu W., Zang N. and Lin D.-M. (2017) The energy accumulation and its relation to the environmental variables of male *Illex Argentinus*. Acta Hydrobiologica Sinica, 48, 1-9.

(2) Queirós, J. P., Phillips R. A., Baeta A., Abreu1 J., and Xavier1 J. C. (2019) Habitat, trophic levels and migration patterns of the short-finned squid Illex argentinus from stable isotope analysis of beak regions. Polar Biology, 42, 2299–2304

(3) Zang, N., Lian J.-X., Chen X.-J., and Lin D.-M. (2021) The yearly growth and body condition of Argentinean Shortfin Squid, *Illex argentines*. Acta Hydrobiologica Sinica, 45, 901-916.

Liu 等人(2017)利用組織能量密度測量技術，對阿根廷短鰭魷雄性個體肌肉、消

化腺和精巢等組織能量累積情況及其與棲息海域環境因素相關性進行分析，用以特徵阿根廷短鰭魷雄性個體能量累積樣貌。研究結果顯示肌肉能量累積占比最大，消化腺次之，精巢最小；肌肉、消化腺相對能量累積均存在顯著年間差異，精巢相對能量累積則沒有年間差異；海水表面溫度是影響肌肉相對能量累積的重要環境因子，精巢相對能量累積與棲息海域環境則沒有顯著相關性。本研究主要地點為阿根廷外海，研究期間為 2020 年 5-6 月間至 2021 年 2-4 月間。

根據所測得的組織能量密度值，計算出精子巢、肌肉、消化腺等組織*能量累積*(tissue energy accumulation)、相對組織能量累積數值(relative tissue energy accumulation)。計算方程式分別如下：

$$E_{\mathrm{ai}} = E_{\mathrm{di}} \times W_{\mathrm{ti}} \times W_{\mathrm{di}} / W_{\mathrm{wi}}$$

Ea 為組織能量的累積，單位為千焦耳(kJ)

Ed 為組織能量的密度，單位為千焦耳/克(kJ/g)

Wt 為組總總濕眾，單位為克(g)

Wd 為凍乾組織樣本的乾重，單位為克(g)

Ww 凍乾組織樣本的濕重，單位為克(g)

i 為不同組織，如肌肉、消化腺和精巢

$$R_{\mathrm{ai}} = E_{\mathrm{di}} / T_{\mathrm{Ei}} \times 100$$

Ra 為組織的相對能量累積，單位為百分比(%)

TE 為樣本個體的總能量累積，單位為千焦耳(kJ)

i 為不同組織，如肌肉、消化腺和精巢

利用廣義線性混合效應模型(Generalized linear mixed-effects models，GLMM)對不同組織(包含精肌肉、消化腺和精巢)的總能量累積和相對能量累積以及海水表面溫度(Sea surface temperature，SST) 、海面鹽度(Salinity，Sal)、海面高度(Sea surface height，SSH)和葉綠素 a 濃度(Chlorophyll a 濃度，Chl.a)進行分析，並以取樣月份作為隨機效應因子。

Queirós 等人(2019)從胃內含物的穩定同位素分析，瞭解阿根廷短鰭魷的棲地、營養階層與遷徙途徑等。本研究主要地點為南喬治亞的鳥島(Bird Island, South Georgia (54°00′S, 38°03′W)，研究期間為 2015 年 4 月 14-27 日間。研究結果顯示幼體和成體階段 δ13C(棲息地)值分別為− 18.4 ± 0.7 ‰和− 17.1 ± 0.4 ‰，表示個體向北移動；幼體 δ15N 值(+5.9 ± 1.1‰)低於成體 (+8.4 ± 1.3‰)，顯示阿根廷短鰭魷一生中營養級增加了一個，表明其飲食結構從浮游動物轉向魚類和魷魚。 根據氣候變遷的預測影響，由於海洋溫度變暖，北界南移，阿根廷短鰭魷的分布可能會變得更加受限。

根據喙(beak)的量測，利用 allometric equations 推估量測阿根廷短鰭魷的外套膜長(ML, mm)、體重(M, g)，此外喙會被切成不同的部分，本研究中樣本數為喙尖(n=8)與喙翼(n=10)，喙翼的差別反應可進一步反應為幼體或成體。最後以下列統計方法檢定：透過 t 檢定和 Mann-Whitney 檢定比較阿根廷短鰭魷生命階段 δ13C 和 δ15N 的平均值；Pearson 相關性剖析外套膜與喙翼 δ13C 之間的關係。

Zang 等人(2021)則透過殘差分析(residual index analysis)和廣義線性混合效應模型(GLMM)分析阿根廷短鰭魷體重與外套膜長的關係，以及體型變異。本研究主要地點為阿根廷外海(41°56’-47°09’S, 57°48’-60°49’W)，研究期間為 2012 年至 2014 年，樣本收集期間為 2012 年 1-3 月、2013 年 1-3 月、2014 年 4-6 月。研究結果顯示整體雌雄比例為 1.25:1，雌性和雄性個體體型均以 2014 年為最大。阿根廷短鰭魷的生長是異速生長(allometric)，採樣年份和採樣月份使身體狀況顯著不同，身體狀況與外套膜長呈現負相關。

採樣方式為根據船舶，每個地點隨機抽取 60 個樣本。共分析 1733 個樣本，包

括 2012 年 688 份、2013 年 655 份、2014 年 390 份，記錄每個樣本的外套膜長度(ML)、體重(BW)和性別。長度精確到 1 毫米，體重精確到 1 克。以頻度分布法分析各年份雌性及雄性樣本的組成，體重-外套膜長度關係採用非線性迴歸(nonlinear regression)：

$$\mathrm{BW} = a \times \mathrm{ML}^{b}$$

BW 為體重 (g)

ML 為外套膜長度 (mm)

a 和 b 為欲估計的參數。

使用殘差值以個體層次為基礎，與個體大小無關，反應個體品質。

• 當殘值為負時，表示個體品質不好。

• 當殘值為正時，表示個體品質良好。身體質量和外套長度的殘差值(BW-ML 殘差)再進一步作為個體身體狀況指數(CI)。

• 使用 GLMM 建立殘差與外套膜長度之間的關係，其中取樣月份視為隨機效應變數。模型方程式如下：

$$CI = \alpha_0 + \alpha_1 \mathrm{ML} + \beta_0 + \varepsilon$$

ML 為外套膜長度

$\alpha 0$ 為月份對模型截距的隨機影響

$\alpha 1$ 為外套膜×採樣月份對指標的影響

$\beta 0$ 為年份對模型截距的隨機影響

ε 為模型誤差

最後續以下列統計方法檢定：卡方適合度檢驗(X2 Chi-Square Goodness-of-Fit test)，檢驗 2012 年、2013 年及 2014 年及合併年份雌性比例是否相同；單因子變異數分析(Single-factor variance analysis，ANOVA)檢定分析雄性和雌性樣本在不同年和同年不同月份之間的大小差異，需要的話將進一步進行 Tukey HSD 檢定分析；t 檢定

(t-test)分析雌性和雄性重量-外套膜長度關係 b 值和生長差異;協方差分析(Covariance analysis，ANCOVA)瞭解雌性和雄性重體重和軟骨之間關係的差異；非變異 Kruskal-Wallis 檢定(non-variant Kruskal-Wallis test，K-W test)分析不同年份及同年不同月份雌性和雄性之間的差異。

焦點於洄游與空間分布模式與漁業資料如下表，同前，近期分析工具多元，包含廣義線性混合效應模型(Generalized linear mixed-effects models，GLMM)、棲地適宜性指數模型(Habitat suitability index，HIS)、廣義加成模型(generalized additive model，GAM)、互相關分析(cross-correlation analysis)、頻譜分析(spectral analysis)等，輔以統計方法比較。

編號	模式	資料使用年份	文獻發表年份	其他統計方式
1	-廣義線性混合效應模型(Generalized linear mixed-effects models，GLMM)	2003/1~6-2011/1~6	2018	-均方誤差(mean square error，MSE) -平均相對方差(average relative variance，ARV)
2	-棲地適宜性指數模型(Habitat suitability index，HIS)	1979/1~4-2017/1~4	2022	
3	-廣義加成模型(generalized additive model，GAM) -互相關分析(cross-correlation analysis) -頻譜分析(spectral analysis)	2004-2013	2017	

以下三篇作為個別模式使用範例介紹：

(1) Wang J., Chen X., and Chen Y. (2018) Projecting distributions of Argentine shortfin squid (*Illex argentinus*) in the Southwest Atlantic using a complex integrated model. Acta Oceanologica Sinica, 37, 31-37.

(2) Liu H., Yu W., and Chen X. (2022) Melting Antarctic sea ice is yielding adverse effects on a short-lived squid species in the Antarctic adjacent waters. Frontiers in Marine

Science, 9, 819734.

(3) Chiu T.-Y, Chiu, T.-S., and Chen C.-S. (2017) Movement patterns determine the availability of Argentine shortfin squid *Illex argentinus* to fisheries. Fisheries Research, 193, 71–80.

Wang 等人(2018)整合廣義加成模型(Generalized additive model，GAM)和神經網路模型(neural network model，NNM)預測阿根廷短鰭魷分布。從數個環境因子(海水表面溫度 SST、海面相對高度 SSH 和葉綠素濃度 Chla)評估對阿根廷短鰭魷空間分布的影響，發展用於預測空間 CPUE 分布的神經網路模型，再將海洋環境變數的時空變化與阿根廷短鰭魷遷徙模式串連。本研究主要地點為阿根廷外海(40°-50°S and 55°-70°W)，研究期間為 2003 年 1-6 月間至 2011 年 1-6 月間，本研究針對 South Patagonic stock (SPS)系群進行分析。

收集漁業資料包括有捕獲日期(年和月)、捕獲地點(緯度和經度)、每日捕獲量(噸)和努力量(捕撈天數)，在 0.25°×0.25°空間解析度下計算月別 CPUE

$$CPUE_{ymi} = \frac{C_{ymi}}{F_{ymi}}$$

即在特定網格中所有漁船的總捕獲量，y 與 m 分別表示年與月，i 則是特定網格

環境因子由美國國家海洋和大氣管理局取得 the Live Access Server of the National Oceanic and Atmospheric Administration Ocean Watch (http://oceanwatch.pifsc.noaa.gov/las/ser- vlets/dataset)，利用 GAM 量化阿根廷短鰭魷豐度(CPUE)和環境變數之間的關係。模型內變數包括年、月、經度、緯度、SST、SSH 和 Chla，為了處理對數轉換中的零捕獲，每筆捕獲量加入平均 CPUE 的 10% 。

GAM 模式可以寫成

$$\ln(CPUE + mean(CPUE) \times 10\%) = factor(year) + factor(month) + s(longitude) + s(latitude) + s(SST) + s(SSH) + s(Chl\ a) + \varepsilon,$$

s 為平滑函數(spline smoother function)

ε 為殘差(residual error, **ε**=σ2 and **E**(ε)=0)

本研究不考慮交互作用，初步進行 7 個變化自相關分析，以 GAM 選擇重要環境變數後，運用到神經網路模型。此外，透過 2003-2010 年的資料以 70%和 30%比例隨機取樣前者作為訓練資料集(training)，後者為評估資料集(validation)，最後再以 2011 年資料測試資料集(testing)。

本研究以均方誤差(mean square error，MSE)和平均相對方差(average relative variance，ARV)來量化比較結果並確認最佳神經網路模型。MSE 表示模型的正確性，ARV 則是模型的穩定性，當 ARV=1.0 為模型獲得預測平均值的結果，當 ARV=0.0 則表示模型達到了預期結果，ARV 越小表示模型越佳

$$MSE = \frac{1}{n}\sum_{i=1}^{n}\left(\hat{Y}_i - Y_i\right)^2,$$

$$ARV = \frac{\sum_{i=1}^{n}\left(\hat{Y}_i - Y_i\right)^2}{\sum_{i=1}^{n}\left(\bar{Y}_i - Y_i\right)^2},$$

Yi 為漁業資料的觀測 CPUE

Ÿi 為漁業資料的平均 CPUE

ŷi 為神經網路模型的估計 CPUE。

Liu 等人(2022)則是推測南極海冰變化將強烈影響海洋生態系和漁業。本研究以南極

海冰範圍(Antarctic sea ice extent，SIE)作為特徵南極洲變化的指標，瞭解海冰變化對阿根廷短鰭魷棲息地的影響，以棲地適宜性指數模型(habitat suitability index，HIS)對西南大西洋鄰近水域進行評估。環境因子以不同海洋深度溫度(50、100、200 m)收集。研究結果顯示 SIE 與阿根廷短鰭魷適宜區域有顯著正相關，SIE 高的年份產生了更溫暖的海洋，因此，適宜棲息地擴大；而阿根廷短鰭魷最適溫度等溫線向北移動，導致適宜棲地向北移動。整體而言，融化的南極海冰影響三個深度的海水溫度，並對西南大西洋阿根廷短鰭棲地產生不利影響。本研究主要地點為阿根廷外海(41°-49°S and 55°-61°W)，研究期間為 1979 至 2017 年的 1-4 月間。本研究針對 South Patagonic stock (SPS)系群進行分析。

漁業資料來自中國國家遠洋漁業資料中心(National Data Center for Distant-water Fisheries of China, Shanghai Ocean University)，收集之漁業資料以 CPUE 作為資源評估指標：噸(t)/天(d)，總捕獲量除以總捕撈努力量。

南極海冰範圍由國家冰雪資料中心取得(National Snow and Ice Data Center ，https://nsidc.org/data/seaice_index/)，不同深度每月海水溫度資料來自夏威夷大學亞太資料研究中心(he Asia-Pacific Data-Research Center, University of Hawaii，http://apdrc.soest.hawaii.edu/las_ofes/v6/dataset?catitem=71)。

計算 HIS 模式包含下列步驟：

$$SI = \frac{Effort}{Max(Effort)}$$

Effort 為不同海水溫度捕獲量

Max(Effort) 為不同海水溫度最大捕獲量

$$SI_T = exp[a \times (T - b)^2]$$

a 和 b 是透過最小平方法將觀測 SI 值與預測 SI 值之間的殘差降至最低而估計的模型參數。

SI_T 為不同深度海水溫度的 SI 值

SI 值範圍從 0 到 1

T 為不同深度的海水溫度。

$$HSI = k_{50m} \times SI_{50m} + k_{100m} \times SI_{100m} + k_{200m} \times SI_{200m}$$

k 為權重係數，其中 HSI ≤ 0.2、0.2 < HSI < 0.6 和 HSI ≥ 0.6 分別定義為不適合棲息地、一般(common)棲息地和適合棲息地。最後為確保垂直海水溫度變化與 SIE 的關係，將時間分為兩組，分別為高 SIE (1982, 1983, 1987, 2003, 2008, 2013, 2014, and 2015)與低 SIE (1980, 1984, 1992, 2005, 2006, 2007, 2010, and 2016)，以統計方式計算並比較兩組適宜棲地和 HSI 的緯度重心(LATG)：

$$LATG = \frac{\sum(LAT_{is} \times HSI_{is})}{\sum HSI_{is}}$$

ATis 是在 s 月份捕獲網格 i 的緯度。

HSIis 是在 s 月份捕獲網格 i 的總 HSI。

Chiu 等人(2017)則以廣義加成模型(generalized additive model，GAM)分析可能影響 CPUE 的因素，區分高低豐度年間的分布情形，以及討論緯度與溫度對 CPUE 的影響，最後以頻譜分析了解阿根廷短鰭魷豐度與緯度位置變化情形。本研究主要地點為阿根廷外海(41°-49°S and 55°-61°W)，研究期間為 2004 至 2013 年。本研究針對 Bonaerensis-North Patagonic Stock (BNPS)系群進行分析。

本研究在 0.5°×0.5°空間解析度下以標準化 CPUE(standardized CPUE)作為指標

$$CPUE_{i,j} = Catch_{i,j}/Effx_{i,j}.$$

Effx 有效捕獲努力量船舶天數(v-d)

Catch 為第 j 天船隻 i 的捕獲量

$CPUE_{j,k} = Sum(CPUE_{i,j,k})/N_{j,k}$;

Nj,k 表示時空網格單元(j,k)中出現的船數

GAM 模式以高斯分布以及前向選擇變數建立，方程式如下：

$$log(CPUE + 1) = a + s(Year) + s(Month) + s(Latitude) + s(Longitude) + s(SST) + s(Depth) + s(Lunar\ index) + \varepsilon,$$

a 是常數

ε 是隨機誤差

s 為平滑函數(spline smoother function)

漁業資料 CPUE 加 1 後進行對數轉換，避免零捕獲資料問題，最後並計算每個模型的 Akaike information criterion (AIC)，最低為最佳模型。

此外，作者分別利用互相關分析(cross-correlation analysis)，分析時間序列 CPUE 和緯度，以探討阿根廷短鰭魷在年度捕撈季節的時空模式，以及頻譜分析(spectral analysis)評估時間序列中的循環模式。互相關分析中假設兩個變數在不同時間延遲(k)的互相關係數(ρ)。計算如下：

$$\rho_{xy}(k) = E[(X_t - \mu_x)\ (Y_{t+k} - \mu_y)]/(\sigma_x\sigma_y);$$

E 為期望值運算子。

Xt 為時間 t 時 CPUE。

Yt 為時間 t 時緯度。

k 為時間延遲。

μx 和 σx 為 CPUE 的平均值和變異數的值。

μy 和 σy 為緯度。

頻譜分析使用傅立葉變換將時間序列 CPUE 投影到頻域上。此分析透過正弦函

數將年度 CPUE(X)的變化以緯度分量(Y)分解為特定頻率：

$$X_i = \sum_{j=1}^{N} (A_j\cos(jFt) = B_j\sin(jFt))$$

Aj 和 Bj 為隨機傅立葉係數。

F 為頻率。

t 為時間。

$$X_i = \sum_{j=N}^{N} C_j\exp(ijFt)$$

頻率 F 的頻譜密度，即 S(F)，Cj 係數為：S(Fj) = E|Cj|2

最後透過計算兩個變數 Xj 和 Yj 在頻率 Fj 處的平方相干性(squared coherency，R(F))來完成：

$$R(F_j) = |EC_{Xj}C_{Yj}|^2/(E|C_{Xj}|^2\ E|C_{Yj}|^2).$$

R(F)為估計量，類似迴歸分析中的決定係數(r2)。

3.4 生物參考點及可用模式分析

本計畫前述模式列表顯示近期發展較少利用傳統模式如 Depletion model 進行，改以加入環境考量的模式，推測原因為阿根廷短鰭魷生物資料，如單位入添漁獲量、單位入添產卵親魚量、成長率、繁殖率、死亡率等並未能收集，仍多以漁業資料為主，因此較難以傳統數據呈現，然以上述科學文獻介紹仍可發現，可用模式多，但解釋力與解釋面向略有差異，仍需依所需回應問題進行使用選擇。

此外，阿根廷短鰭魷漁業資料多屬於各國各自擁有，捕撈時間與捕撈物種生活史階段皆不相同，目前單就已分析之文獻並未能看出完整阿根廷短鰭魷生活史整體變化，因此較難訂定單一生物參考點，若未來能結合各國於阿根廷短鰭魷不同生活

階段與不同遷徙路徑之漁業資料，並搭配全球捕撈量與分析年度豐度變化情形，應較有機會擬定。

若依過去文獻，並結合目前以有漁業資料類型，本年度建議剩餘生產模式(surplus production model)或環境依賴剩餘生產模式(environmentally dependent surplus production model)將可能為可用模式，模式所需漁業資料為每日漁獲量、努力量(捕撈天數)、捕撈日期、捕撈位置(經緯度)，環境因子則可包含海水表面溫度、海面高度、葉綠素濃度等，生物參考點則可以 Ps 作為承載力(carrying capacity)與 F0.1 作為參考數值。

3.5 採樣及族群調查計畫

依據收集文獻，採樣及族群調查至少需考量船舶位置、年份、月份等，生物資料則至少包含量測外套膜長、體重、性別，輔以嘴喙收集，漁業資料則至少包含每日漁船數、每日漁船捕撈位置、每日總捕獲量等，以上各項將持續時間收集，另外再輔以遙測環境因子協助進一步探討環境影響。

考量臺灣魷釣船隊時空關係緊密，建議可擇定 3-5 艘分屬不同船公司魷釣漁船，以增加隨機空間採樣，每次捕撈地點每月至少進行一次採樣，單次採樣隨機留存 1-2 箱樣本，採樣需記錄採樣時間(含年、月、日)、採樣地點、採樣深度、採樣溫度、當日捕獲量等。待樣本回港送置實驗室，則進行生物測量，包含量測外套膜長、體重、性別，可額外加以判定成熟度，若有機會解剖則保留胃、生殖腺、卵巢、精巢、輸卵管、輸精管、卵、肌肉等器官與組織，作為協助了解族群成長變動趨勢之基礎資料。

第四章　檢討與建議

4.1 綜合說明

阿根廷短鰭魷屬於 r-策略之物種，此外，目前已知阿根廷短鰭魷由四個系群所組成，此四個系群組成一個有基因交流，但產卵場有限或適度隔絕的族群(meta-population)。依據文獻收集，由於各國捕撈地點之差異，對於不同系群有不同漁業捕撈量的使用，而相應的系群研究內容與多寡亦不盡相同。就方法而言，則可發現近期使用模式多非以傳統漁業相關模式進行評估與族群瞭解，主要改以加入環境因子考量之模式，可能因細部生物資料獲得不易導致。此外，多年相異時空樣本收集屬於必要，因阿根廷短鰭魷生活史中的遷徙，使得必須對各階段有相應的瞭解，且國際間的標準方法，方更能找出年間規律性，以預測與管理該漁育與永續阿根廷短鰭魷漁獲量。

4.2 遭遇困難與因應對策

選定適當生物參考點對於幫助漁業生物族群維護與漁業永續管理有相當的助益，但是也相對困難，尤其在目前不同國家對阿根廷短鰭魷有不同利用時期時，相異系群是否會相互影響，目前資料由於缺乏整合與整併，因此較難全面看出阿根廷短鰭魷受氣候變遷或其他人為環境變化造成之衝擊。建議持續具體管理本漁業，並加強教育漁會與漁民，鼓勵協助科學收集與正確資料填寫，甚至協調固定科學人員上船採樣與記錄相關環境因子，將可促使本漁業合理使用與合理預測，永續發展之終極目標。

4.3 後續精進措施

本年度主要著重文獻整體收集與分類，僅探討較近期使用方法與模式利用，持續針對個別文獻進行閱讀與方法剖析，將可提供更完整相關方法演進過程，以及資料限制下可以計算之阿根廷短鰭魷族群與瞭解其分布之方法，此外，仍需進一步瞭解各國

所擁有之阿根廷短鰭魷生活史階段資料，作為整體評估之依據，透過持續分析各系群國家研究團隊，有機會剖析相關國家資料收集情形以及系群使用，隨後方可評估西南大西洋海域阿根廷短鰭魷整體(含所有系群)豐度，進而作為漁業管理之參考數據。

第五章　成果效益說明及重大突破(outcome)

5.1 學術成就

1.探討阿根廷短鰭魷族群成長曲線與生長模式。

2.探討阿根廷短鰭魷洄游路徑與相應模式。

5.2 技術創新

1.獲得阿根廷短鰭魷生物參數，以描述阿根廷短鰭魷之漁業生物學特性。

2.綜合多種模式方法，以評估生物與空間環境參數之不確定性。

5.3 經濟效益

1.配合產業發展，執行基礎調查與研究，以持續產業。

2.預先準備研究能量與生物資訊背景，因應可能之國際管理組織需求。

5.4 社會影響

1.阿根廷短鰭魷漁業對遠洋漁業之社經發展具相當規模，且串聯民生經濟。

2.對海洋資源保育及海洋生物永續利用之教育意義與國際目標。

5.5 其他效益

1.建立阿根廷短鰭魷漁業文獻資料庫。

2.提供阿根廷短鰭魷漁業科學調查、科學管理與永續利用建議。

5.6 國際比較

已知使用阿根廷短鰭魷主要為臺灣、阿根廷、韓國與中國大陸等國，未來將持續整理與更新各國相關研究，瞭解各國利用情形與時間，作為臺灣阿根廷短鰭魷漁業來游與生物量基礎與剖析環境對其之影響，提供更加適宜之國際管理策略。

5.7 績效亮點與重大突破

(1) 阿根廷短鰭魷漁業利用國正發起建立相應國際組織，本計畫內容將可作為臺灣參與國際組織之準備，且創新科學研究可顯示臺灣於本漁業物種的研究能量。

(2) 匯整生物族群與洄游遷徙模式，提估管理之考量。

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Wang, J., Chen, X., & Chen, Y. (2018). Projecting distributions of Argentine shortfin squid (*Illex argentinus*) in the Southwest Atlantic using a complex integrated model. Acta Oceanologica Sinica, 37, 31-37.

附圖

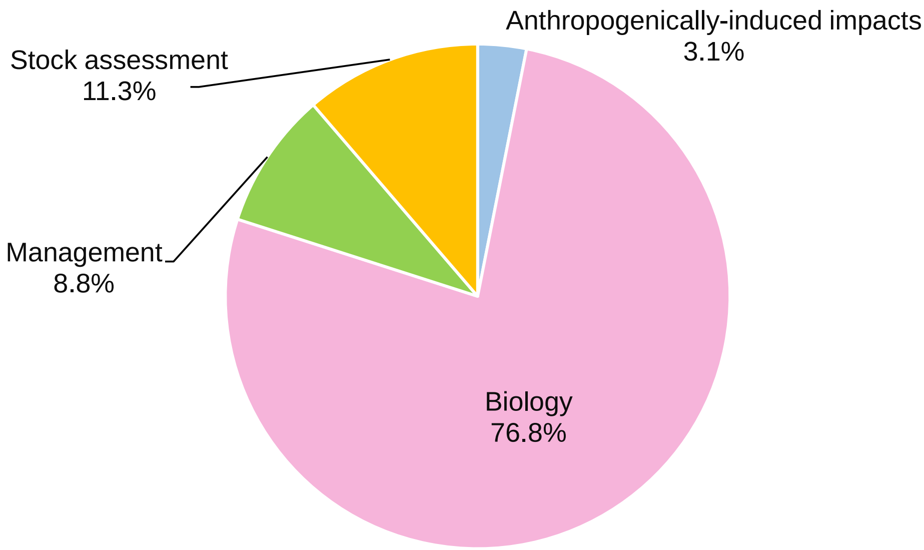

圖 1、阿根廷短鰭魷文獻收集分類情形。

附表

表 **1**、本計畫文獻類別定義。

Category	**Definition**
Biology	The study of the structure, function, growth, origin, evolution, and distribution of living organisms by focusing on their morphology, physiology, anatomy, behavior, origin, and distribution.
Management	The process that creates and enforces the rules that are needed to prevent overfishing and help overfished stocks rebound.
Stock assessment	The scientific process of collecting, analyzing, and reporting on the condition of a fish stock and estimating its sustainable yield.
Anthropogenically-induced impacts	Changes to the biophysical environments and to ecosystems, biodiversity, and natural resources caused directly or indirectly by humans.

表 2、本計畫文獻子類別列表。

Anthropogenically-induced impacts	Biology	Management	Stock assessment
Bioaccumulation	Behavioral ecology	Experimentation	Abundance estimation
Climate change impacts	Chemistry	Fishing effort	Age estimation
Industrialization	Community ecology	Fishing intensity	Age-length key
Organic compounds	Developmental biology	Management method evaluation	Biomass
Pollution impacts	Food science	Negative subsidies	Condition
Trace metals	Genetics	Overfishing	CPUE
	Morphology	Protected marine areas	Individual growth
	Parasitology	Regional management	Landings
	Population ecology	Resource management	Mark-recapture
	Physics	Stock assessment method evaluation	Recruitment
	Physiology	Sustainable yields	
	Reproductive biology		
	Soundscape ecology		
	Taxonomy		

表 3、本年度蒐集阿根廷短鰭魷文獻類別與隨時間發表篇數列表。

分類 / 年	Biology	Anthropogenically-induced impacts	Management	Stock assessment
1970	1			
1971				
1972				
1973				
1974				
1975				
1976				
1977				
1978				
1979				
1980				
1981	1			
1982	1			
1983				
1984	1			
1985	1			
1986	2			
1987	4			
1988	5	1		
1989	1			
1990	7		1	2
1991	5			
1992	7			
1993	2	1	1	1
1994	9		1	1
1995	5			
1996	4			1
1997	12			
1998	14			1
1999	12			
2000	8	1		3
2001	9		1	2
2002	7	1	4	
2003	3		1	
2004	4			3

2005	8		1	1
2006	3			
2007	3	1	1	
2008	7		2	
2009	2		2	2
2010	7	1	1	3
2011	12			1
2012	9			2
2013	9		1	4
2014	12		1	1
2015	6		1	2
2016	6	1	2	2
2017	16	2	1	1
2018	7		2	2
2019	11			
2020	8		1	2
2021	8	1	2	2
2022	5	1	1	1
2023	8		3	
Total	**272**	**11**	**31**	**40**

附錄 I

本年度阿根廷短鰭魷文獻蒐集詳細列表。

Category	Sub-category	PDF ID#	Publications	Authors	Year of Publication	Journal
Anthropogenically-induced impacts	pollution	AI-1036	Cephalopods And Cetaceans As Indicators Of Offshore Bioavailability Of Cadm	Dorneles et al	2007	Environmental Pollution
biology &Anthropogenically-induced im	Feeding behaviour	AI-1057	Dietary Shifts And Risks Of Artifact Ingestion For Argentine Shortfin Squid Illex	Chang et al.	2021	Frontiers in Marines Science
Anthropogenically-induced impacts	climate change	AI-1107	Melting Antarctic Sea Ice Is Yielding Adverse Effects On A Short-Lived Squid S	Lin et al.	2022	Frontiers in Marine Science
Anthropogenically-induced impacts	pollution	AI-1331	Concentration Of Cadmium In Livers Of Several Kinds Of Squids And An Appr	Kurihara et al.	1993	Bulletin of the Faculty of Fisheries Hokkaido University
Anthropogenically-induced impacts	pollution	AI-1390	Blood Cadmium And Metallothionein Concentrations In Females Of Two Symp	Polizzi	2017	Marine Pollution Bulletin
Anthropogenically-induced impacts	pollution	AI-1409	Metal Bioaccumulation And Detoxification Processes In Cephalopods: A Review	Pernicaud et a	2017	Environmental Research
Anthropogenically-induced impacts	pollution	AI-1410	A Study About Determination Of Microbial And Heavy Metal Load In One Of T	Çağlak et al.	2010	Journal of Fisheries and Aquatic Sciences
Anthropogenically-induced impacts	pollution	AI-1411	Critical Aspects Of The Falkland Islands Pelagic Ecosystem: Distribution, Spaw	Agnew	2002	Aquatic conservation-Marine and Freshwater Ecosystems
Anthropogenically-induced impacts	pollution	AI-482	Valorisation Of Effluents Obtained From Chemical And Enzymatic Chitin Produ	Vazquez et al.	2016	Biochemical Engineering Journal
Anthropogenically-induced impacts	Bioaccumulation	AI-653	Trace-Metals In Squid Illex-Argentinus	Falandysz et a	1988	Zeitschrift für Lebensmittel-Untersuchung und Forschung
Anthropogenically-induced impacts	pollution	AI-760	Cadmium, Zinc And Copper Accumulation In The Squid Illex Argentinus From	Gerpe et al.	2000	Marine Biology
biology	physiology & chemistry	BI-1001	Physico-Chemical And Functional Properties Of Myofibrillar Proteins From Diff	Mignino et al.	2006	LWT Food Science And Technology
biology	physiology	BI-1015	Vestigial Phragmocone In The Gladius Points To A Deepwater Origin Of Squid (	Arkhipkin et a	2012	Deep-Sea Research Part I-Oceanographic Research Papers
biology	physiology & chemistry	BI-1018	Phenoloxidase Activity Of Intact And Chemically Modified Functional Unit Rvh	Dolashki et al	2011	Comparartive Biochemistry and Physiology B-Biochemistry and Molecular Biology
biology	food science	BI-1021	Effect Of Frozen Storage On Emulsifying Properties Of Actomyosin From Mant	Mignino et al.	2011	European Food Research and Technology
biology	physiology & chemistry	BI-1025	Fractionation Of Urea-Pretreated Squid Visceral Oil Ethyl Esters	Hwang et al.	2001	Journal of American Oil Chemists Society
biology	Trophic ecology	BI-1031	Far From Home: Record Of A Vagrant Striped Dolphin In Patagonia With Notes	De Castro et a	2011	Mammalian Biology
biology	Trophic ecology	BI-1032	Ontogenetic Dietary Changes In Male South American Fur Seals Arctocephalus	Vales et al.	2015	Marine Ecology Press Series
biology	population ecology	BI-1045	The Spatial And Temporal Distribution Patterns Of The Argentine Short-Finned	Chen et al.	2007	Zoological Studies
biology	Genetics	BI-1048	Microsatellite Analysis Of Genetic Diversity In The Squid Illex Argentinus Duri	Adcock et al.	1999	Marine Ecology Progress
biology	reproductive biology	BI-1059	Preliminary Experiments On Artificial Insemination Of The Argentine Shortfin S	Sakai et al.	1997	Fisheries Research
biology	Trophic ecology	BI-1062	Fishery And Ontogenetic Driven Changes In The Diet Of The Spiny Dogfish, Sq	Alonso et al.	2002	Environmental Biology of Fishes
biology	behavioral ecology	BI-1066	The Behavior Of The Argentine Shortfin Squid (Illex Argentinus) Exposed To B	Perez et al.	2018	Latin American Journal Of Aquatic Research
biology	Community Ecology	BI-1068	Environmental Associations Of Shortfin Squid Illex Argentinus (Cephalopoda :	Bazzino et al	2005	Fisheries Research
biology	parasitology	BI-1071	Enteric Helminths Of The Shortfin Squid Illex Argentinus In San Matias Gulf (A	Gonzalez et al	2000	Acta Parasitologia
biology	physiology & chemistry	BI-1074	Statolith Chemistry As A Stock Tag In The Argentine Shortfin Squid Illex Argen	Avigliano et a	2020	Regional Studies In Marine Science
biology	physiology & chemistry	BI-1078	Comparison Of Physicochemical And Volatile Flavor Properties Of Neon Flying	Huo et al.	2023	Frontiers in Nutrition
biology	Trophic ecology	BI-1082	First Record Of Cestode Cysts Of Phyllobothrium Delphini (Phyllobothriidae) Fr	De Castro et a	2014	Hidrobiologia
biology	population ecology	BI-1085	Biological Patterns Of The Argentine Shortfin Squid Illex Argentinus In The Slo	Perez et al.	2009	Latin American Journal Of Aquatic Research
biology	population ecology	BI-1087	Projecting Distributions Of Argentine Shortfin Squid (Illex Argentinus) In The S	Wang et al.	2018	Acta Oceanologica Sinica
biology	Genetics	BI-1089	Complete Mitochondrial Genome Of Argentine Shortfin Squid (Illex Argentines)	Jiang et al.	2016	Mitochondrial DNA Part A
biology	Genetics	BI-1091	Genetic Diversity And Population Differentiation Of The Shortfin Squid Illex-Ar	Carvalho et al	1992	Journal of Experimental Marine Biology and Ecology
biology	Trophic ecology	BI-1094	Food Habits Of Dipturus Chilensis (Pisces : Rajidae) Off Patagonia, Argentina	Alonso et al.	2001	ICES Journal Of Marine Science
biology	Trophic ecology	BI-1099	Diet Composition Of Expanding Breeding Populations Of The Magellanic Pengu	Fernandez et a	2019	Marine Biology Research
biology	developmental biology	BI-1102	Tied Hands: Synchronism Between Beak Development And Feeding-Related Mo	Franco-Santos	2020	Hydrobiologia
biology	Trophic ecology	BI-1104	Shared Dietary Niche Between Sexes In Magellanic Penguins	Castillo et al.	2019	Austral Ecology
biology	parasitology	BI-1111	Transmission Of Corynosoma Australe (Acanthocephala: Polymorphidae) From	Hernandez-Or	2019	Parasitology Research
biology	Community Ecology	BI-1113	Feeding Of The Squid Illex Argentinus (Cephalopoda, Ommastrephidae) In The	Bazzino et al	2001	Gayana
biology	physiology & chemistry	BI-1116	Distribution And Extraction Condition Of Endoprotease And Exopeptidase From	Kim, Jin-Soo	2007	Applied Biological Chemistry
biology	Community Ecology	BI-1122	Environmental Processes And Recruitment Variability	Bakun et al.	1998	FAO (Food and Agriculture Organization of the United Nations)
biology	Community Ecology	BI-1125	Using Interviews As Complementary Source Of Information On Marine Ecology	Crespi-Abril e	2011	Ecologia Austral
biology	Feeding behaviour	BI-1127	Trophic Relationships, Ecosystem Variability, And Recruitment	Dawe et al.	1998	FAO (Food and Agriculture Organization of the United Nations)
biology	reproductive biology	BI-1132	Egg Size, Fecundity, And Spawning In Females Of The Genus Illex (Cephalopod	Laptikhovskii	1993	ICES Journal Of Marine Science
biology	genetics	BI-1135	Highly Polymorphic Microsatellite Loci Of The Heavily Fished Squid Genus Ille	Adcock et al.	1999	Molecular ecology
biology	population ecology	BI-1138	Larvae Of Illex Argentinus From Five Surveys On The Continental Shelf Of Sou	Haimovici et a	1995	ICES Marine Science Symposia
biology	population ecology	BI-1143	Illex Argentinus: Life Cycle, Population Structure, And Fishery	Rodhouse et a	1995	ICES Marine Science Symposia
biology	population ecology	BI-1147	Biological And Ecological Characteristics Of Illex Argentinus (Cephalopoda, Om	Bazzino et al	1999	Gayana
biology	Community Ecology	BI-1155	Habitat, Trophic Levels And Migration Patterns Of The Short-Finned Squid Illex	Querios et al.	2019	Polar Biology
biology	population ecology	BI-1157	Stock Structure Analysis And Species Identification	Carvalho et al	1998	FAO (Food and Agriculture Organization of the United Nations)
biology	Community Ecology	BI-1163	Cephalopods In Bottom Trawl Fishing Off South Brazilian Coast	Haimovici et a	1986	Arquivos De Biologia E Tecnologia
biology	Trophic ecology	BI-1177	Foraging Location And Range Of White-Chinned Petrels Procellaria Aequinoctia	Berrow et al.	2000	Journal of Avian Biology
biology	Community Ecology	BI-1188	Observation Of The Vertical-Distribution And Behavior Of Nektonic Squids Usi	Moiseev Si	1991	Bulletin Of Marine Science
biology	Trophic ecology	BI-1194	Cephalopod Remains From The Stomach Of A Sperm Whale Stranded At Rio-G	Clarke et al.	1980	Marine Biology
biology	Community Ecology	BI-1196	Environmental Effects On Cephalopod Life History And Fisheries	Pierce et al.	2005	Aquatic Living Resources
biology	Trophic ecology	BI-1202	Cephalopod Prey Of King Penguins (Aptenodytes Patagonicus) Breeding At Vol	Patkowski et a	2001	Fisheries Research
biology	Community Ecology	BI-1212	Interactions Between Oceanography, Ecology And Fishery Biology Of The Omm	Gonzalez et al	1997	Marine Ecology Progress Series
biology	Trophic ecology	BI-1216	Combining A Geographic Information System, Known Dietary, Foraging And Ha	Ciancio et al.	2015	EMU-Austral Ornithology
biology	Trophic ecology	BI-1229	Food Habits Of The South American Sea Lion, Otaria Flavescens, Off Patagonia	Koen-Alonso	2000	Fishery Bulletin
biology	food science	BI-1236	Aspects To Consider In The Assessment Of The Freshness Of Squid (Illex Argen	Melaj et al.	1997	Alimentaria
biology	Genetics and Taxonomy	BI-1241	A Molecular Systematic Evaluation Of The Squid Genus Illex (Cephalopoda : O	Carlini et al.	2006	Molecular Phylogenetics and Evolution
biology	food science	BI-1243	Characteristics Of Squid Viscera Oil	Kim, Eun-Mi	1997	Journal of the Korean Fisheries Society
biology	population ecology	BI-1247	Integrated Statolith And Genomic Analysis Reveals High Connectivity In The Ne	Chemshirova	2023	ICES Journal Of Marine Science
biology	population ecology	BI-1249	A Revision Of The Systematics And Distribution Of Illex Species (Cephalopoda	Roper et al.	1998	Smithsonian Contributions to Zoology
biology	food science	BI-1259	Effect Of Boiling Time On The Texture And Related Characteristics Of Tentacle	Lo, Leah et al	1996	Journal of the Fisheries Society of Taiwan
biology	physiology & chemistry	BI-1262	Debittering Of Enzymatic Hydrolysate Using Exopeptidase Active Fractions Fro	Kim, Jin-Soo	2014	Korean Journal of Fisheries and Aquatic Sciences
biology	genetics & reproductive	BI-1273	Displacement Of Histones By Sperm-Specific Proteins At Different Stages Of Sp	Kadura et al.	1988	European Journal of Biochemistry
biology	food science	BI-1280	Heat-Induced Changes In Thiol-Groups In Squid Proteins	Synowiecki et	1988	Journal of Food Biochemistry
biology	physiology & chemistry	BI-1282	Occurrence Of 4-O-Methyl-D-Glucosamine In Squid Mucin	Kimura et al.	1999	Fisheries Science
biology	Trophic ecology	BI-1284	Food Habits Of The Peale'S Dolphin, Lagenorhynchus Australis: Review And Ne	Schiavini. Et	1997	Report of the international whaling commission
biology	physiology & chemistry	BI-1291	Antioxidative Activity Of Phospholipid From Squid Mantle Muscle	Komatsu et al	1990	Bulletin of the Faculty of Fisheries Hokkaido University
biology	Trophic ecology	BI-1310	The Trinidade Petrel (Pterodroma Arminjoniana) At Golfo San Matias: A New S	Savigny et al.	2005	El horneo
biology	physiology & chemistry	BI-1319	Emulsifying And Gelling Properties Of Weakfish Myofibrillar Proteins As Affec	Suarez et al.	2014	Brazilian Journal of Food Technology
biology	food science	BI-1333	Effects Of Storage Time And Thermal-Treatment On The Nutritive-Value Of Sq	Seidler et al.	1987	Nahrung-Food
biology	physiology & chemistry	BI-1335	Effect Of Chitosan Characteristics And Solution Conditions On Gelation Temper	Tsai et al.	2011	Carbohydrate Polymers
biology	food science	BI-1337	A Rapid Analytical And Quantitative Evaluation Of Formaldehyde In Squid Bas	Gu et al.	2017	Food Chemistry
biology	physiology & chemistry	BI-1344	Development Of Edible Films From Gelatin Extracted From Argentine Shortfin	Waheed et al.	2017	McGill University (Canada)
biology	physiology & chemistry	BI-1346	Tailoring Nanohole Sizes Through The Deacetylation Process In Chitosan Powde	Lucanera et al.	2022	Carbohydrate Polymers
biology	physiology & chemistry	BI-1351	Proteolytic Activity Of The Viscera And Partial Purification Of Acid Proteases O	Kolodziejska	1995	Polish Journal of Food and Nutrition Sciences
biology	physiology & chemistry	BI-1358	Extraction Of Chitosan From Squid Pen Waste By High Hydrostatic Pressure: Ef	Huang et al.	2020	International Journal Of Biological Macromolecules
biology	physiology & chemistry	BI-1360	Novel Insights Into The Inhibitory Mechanism Of (+)-Catechin Against Trimeth	Li et al.	2022	Food Chemistry
biology	Trophic ecology	BI-1400	The Opportunistic Sense: The Diet Of Argentine Hake Merluccius Hubbsi Reflec	Alonso et al.	2019	Regional Studies In Marine Science
biology	physiology & chemistry	BI-1403	New Solvent Systems For Thin-Layer Chromatographic Determination Of Nine I	Lapa-Guimar	2004	Journal Chromatography A
biology	population ecology	BI-1419	Fishery Biology And Life History Of Illex Argentinus	Brunetti et al.	1998	
biology	population ecology	BI-1421	Illex Argentinus, Argentine Shortfin Squid	Rodhouse et a	2013	Advances in Squid, Biology, Ecology and Fisheries. Part II
biology	Trophic ecology	BI-1423	The Argentine Short-Finned Squid Illex Argentinus In The Food Webs Of South	dos Santos et	2000	Sarsia
biology	population ecology	BI-1426	Crecimiento Y Estructura Intraespecífica Del Calamar, Illex Argentinus (Castella	Arkhipkin et a	1991	Scientia Marina
biology	developmental biology	BI-1436	Scale for the identification of stages of sexual maturity of the squid (Illex argenti	Brunetti et al.	1990	oceanrep.geomar.de
biology	population ecology	BI-1438	Contribución Al Conocimiento Biológico-Pesquero Del Calamar Argentino (Cep	Brunetti et al.	1988	sedici.unlp.edu.ar
biology	reproductive biology	BI-1447	Preliminary Study On Reproductive Biology Of Summer Spawning Stock Of Ille	Lin et al.	2014	Journal of Fisheries of China
biology	Feeding behaviour	BI-1449	Feeding of Illex argentinus squid in the Patagonian region during the summer of	Ivanovic	2010	Instituto Nacional de Investigacion y Desarrollo Pesquero
Stock assessment	Landings	BI-1450	Evolución De La Pesquería De Illex Argentinus (Castellanos, 1960)	Brunetti et al.	1990	digital.csic.es
biology	food science	BI-1475	Quality Changes Of Sous-Vide Cooked And Blue Light Sterilized Argentine Squ	Zhao et al.	2022	Slovak Journal of Food Sciences
biology	population ecology	BI-1477	Fishing Grounds Characteristics Of Illex Argentinus In Southwest Atlantic	Yu-mei et al.	2009	Yingyong Shengtai Xuebao
biology & Stock Assessment	population ecology & C	BI-1479	Influence Of Antarctic Sea Ice Variation On Abundance And Spatial Distribution	Hewei et al.	2021	Journal of Fisheries of China
biology	population ecology	BI-1481	Aspectos Biológicos Del Calamar Illex Argentinus	Leta et al.	1981	aquadocs.org
biology	population ecology	BI-1483	Effects Of Antarctic Sea Ice Variations-Driven Seawater Cooling On Habitat Pat	Zhang et al.	2021	Journal of Shanghai Ocean University
biology	reproductive biology	BI-1485	Aspectos Reproductivos Del Calamarete (Loligo Gahi). El Calamar (Illex Argent	Portela et al.	1994	Oceanografico de Vigo
biology	population ecology	BI-1487	An Analysis Of Biological Characteristics Of Argentine Shortfin Squid Illex Arg	Yan et al.	2012	South China Fisheries Science
biology	developmental biology	BI-1489	Effects Of Hatching Season On The Growth And Development In Illex Argentin	Lin et al.	2020	Journal of Shanghai Ocean University
biology	morphology	BI-1491	Effects Of Individual Size On Beak Morphology Of Illex Argentinus In The Sout	Huajie et al.	2013	Journal of Fisheries of China
biology	population ecology	BI-1492	Study On The Distribution Of Production Of Illex Argentinus And Its Relationsh	Xinjun et al.	2005	Journal of Zhangjiang Ocean
biology	morphology & developm	BI-1493	Size And Maturity Differences Between Trawl Illex Argentinus (Cephalopoda: O	Koronkiewicz	1995	Acta Ichthyologica et Piscatoria
biology	reproductive biology	BI-1494	The Effective Fecundity In Male Illex Argentinus In Southwest Atlantic Ocean	Xuan et al.	2018	Acta Hydrobiologica Sinica
biology	population ecology	BI-1495	Analysis Of Pigmentation Change On Beak For Illex Argentinus In The High Se	Fang et al.	2013	Journal of Fisheries of China
biology	physiology & chemistry	BI-1496	Isolation And Characterization Of Pepsin-Solubilized Collagen From Skin Of Ar	Zhang et al.	2011	Advanced Materials Research
biology	population ecology	BI-1497	Comparison Of Life Cycles Of Five Ommastrephid Squids Fished By Japan: To	Hatanaka et a	1985	NAFO Science Coun. Studies
biology	food science	BI-1498	Effect Of Protease Inhibitors On Thermal Gelation Of Squid (Illex Argentinus): S	Paredi et al.	2014	International Journal of Food Studies
biology	reproductive biology	BI-1499	Fertilizacion Artificial En Illex Argentinus Artificial Fertilization In Illex Argent	Sakai et al.	1999	Seminario Final Proyecto INIDEP - JICA
biology	physiology	BI-1500	Validation Of Daily Increments Of Illex Argentinus Statoliths Validacion De Inc	Sakai et al.	1999	Seminario Final Proyecto INIDEP - JICA
biology	physiology and populati	BI-1501	The Energy Accumulation And Its Relation To The Environmental Variables Of	Lin et al.	2023	Acta Hydrobiologica Sinica
biology	population ecology	BI-1502	Population Structure Of The Argentine Shortfin Squid Illex Argentinus (Castella	Chemshirova	2023	macau.uni-kiel.de
biology	food science	BI-1503	Optimisation Of Yield And Rancid Stability Of Oil Extracted From Squid (Illex	Rodriguez et	2021	Comunicaciones congresos
biology	physiology & Chemistry	BI-1504	Effect Of Drying Process On Some Chemical Properties Of Squid (Illex Argentin	Ngamnik et al	2020	Researchgate.net
biology	community Ecology	BI-1505	Squid Interspecific Competition: Possible Impact Of Illex Argentinus On Loligo	Arkhipkin et a	2000	International Council for The Exploration of the Sea
biology	population ecology	BI-1506	A Comparative Description On The Life Cycles Of Five Ommastrephid Squids F	Hatanaka et a	1984	Scientific council meeting
biology	reproductive biology	BI-1507	Estudio De La Biologia Reproductiva Y De La Fecundidad En Dos Subpoblacion	Brunetti et al.	1991	Frente Maritimo
biology	food science	BI-1508	Emulsifying Properties Of Squid Mantle Actomyosin (Illex Argentinus) Stored A	Lorena et al.	2011	Journal of Food and Processing Technology
biology	population ecology	BI-1509	The Continental Shelf And Slope	Castello et al.	1997	Universidade do Rio Grande
biology	food science	BI-1510	Comparison Of The Quality Of Surimi Gel From Three Squid Species	Qi-Xin et al.	2023	Food and Machinery
biology	Trophic ecology	BI-1511	Cephalopods In The Diet Of Wandering Albatrosses And Sea-Surface Temperatu	Rodhouse	1989	Scientia Marina
biology	physiology	BI-1512	Statolith-Based Species Identification Methods For Ommastrephidae Species	Fang et al.	2017	International Congress on Image and Signal Processing, BioMedical Engineering and Informatics
biology	Chemistry and Trophic e	BI-1513	Proximate Composition And Energetic Value Of Demersal And Pelagic Prey Spe	Eder et al.	2005	Marine Ecology Progress Series
biology	population ecology	BI-1514	Links Between Marine Fauna And Oceanic Fronts On The Patagonian Shelf And	Arkhipkin et a	2013	ARQ-Life and Marine Sciences
biology	population ecology	BI-1515	Life-History Reconstruction	Arkhipkin et a	1998	FAO Fisheries Technical paper
biology	Community ecology	BI-1516	A Review Of Cephalopod-Environment Interactions In European Seas	Pierce et al.	2008	Hydrobiologia
biology	population ecology	BI-1517	Abundance And Distribution Of Rhynchoteuthion Larvae Of Illex-Argentinus (C	Leta et al.	1992	South African Journal Of Marine Science
biology	population ecology	BI-1518	Analysis Of Habitat Distribution Of Argentine Shortfin Squid (Illex Argentinus)	Chen et al.	2016	Journal of Fisheries of China
biology	developmental biology	BI-1519	Analysis Of Shape Variability And Life History Strategies Of Illex Argentinus In	Schroeder et a	2017	Journal Of Natural History
biology	Trophic ecology	BI-1521	Cephalopods In The Trophic Relations Off Southern Brazil	dos Santos	2002	Bulletin of Marine Science
biology	morphology	BI-1522	Description Of Illex Argentinus Beaks And Rostral Length Relationships With S	Brunetti et al.	1997	Aquadocs.org
biology	Community Ecology	BI-1523	Effects Of Environmental Variability And Change On Cephalopod Populations: A	Rodhouse	2010	ICES Journal Of Marine Science
biology	morphology	BI-1524	Effects Of Individual Difference On Statolith Morphology Of Illex Argentinus In	Lu et al.	2011	Journal of Fisheries of China

biology	reproductive biology	BI-1525	Energy Accumulation Of Both Somatic And Reproductive Tissues And Its Alloc	Lin et al.	2017	Journal of Fisheries of China
biology	reproductive biology	BI-1526	Escala Para La Identificacion De Estadios De Madurez Sexual Del Calamar (Ille	Brunetti et al.	1990	oceanrep.geomar.de
biology	reproductive biology	BI-1527	Fatty Acid Composition And The Evidence For Mixed Income-Capital Breeding	Lin et al.	2019	Marine & Freshwater Biology
biology	Feeding behaviour	BI-1528	Feeding And The Possible Role Of The Proboscis And Mucus Cover In The Inge	Vidal and Ha	1998	Bulletin Of Marine Science
biology	Trophic ecology	BI-1529	Feeding Habits Of South American And Sub-Antarctic Fur Seals During Their N	de Lima et al.	2023	Marine Mammal Science
biology	population ecology	BI-1530	Forecasting Fishing Ground Of Illex Argentinus Based On Different Weight Hab	Guanyu et al.	2015	hyxbocean.cn
biology	physiology & chemistry	BI-1531	Fractionation Of Exopeptidase From Viscera Of Argentina Shortfin Squid, Illex	Kim, Jin-Soo	2008	Journal of the Korean Society of Food Science and Nutrition
biology	Genetics	BI-1532	Genetic Analyses Of Two Spawning Stocks Of The Short-Finned Squid (Illex Ar	Roldan et al.	2014	Competes Rendus Biologies
biology	developmental biology c	BI-1533	Growth And Life-Span Of Short-Finned-Squid Illex-Argentinus In The Waters O	Hatanaka	1986	Fisheries
biology	food science	BI-1534	Identification Of Cephalopod Species (Ommastrephidae And Loliginidae) In Sea	Chapela et al	2002	Journal of Food science
biology	food science	BI-1536	Modeling Total Volatile Basic Nitrogen Production As A Dose Function In Gam	Tomac at al.	2014	Lwt Food Science And Technology
biology	food science	BI-1537	Molecular Identification Of Cephalopod Species By Fins And Pcr-Rflp Of A Cy	Chapela et al	2003	European Food Research and Technology
biology	Trophic ecology	BI-1538	Ontogenetic Diet Shift In Commerson'S Dolphin (Cephalorhynchus Commerson	Ricciadeli et a	2013	Polar Biology
biology	Physiology & reproducti	BI-1539	Post-Mortem Changes In Adenosine Triphosphate And Related Compounds In M	Sagehal et al.	1997	Journal of Aquatic
biology	Genetics	BI-1540	Primary Structure Of The Basic Nuclear-Protein From Spermatozoa Of Mollusk	Osadchuk et a	1990	Bioorganicheskaya Knimiya
biology	reproductive biology	BI-1541	Production Of Soma And Gonad In Maturing Male Illex-Argentinus (Mollusca, C	Rodhouse and	1992	Journal Of The Marine Biological Association Of The United Kingdom
biology	Trophic ecology	BI-1542	Stomach Contents Of False Killer Whales (Pseudorca Crassidens) Stranded On T	Alonso et al.	1999	Marine Mammal Science
biology	reproductive biology	BI-1543	Structural Rearrangements Of Chromatin During Spermatogenesis Of The Squid	Khrapunov et	1987	Biochemistry-Moscow
biology	Community Ecology	BI-1544	Summer Distribution, Abundance And Population Structure Of Illex Argentinus (	Brunetti et al.	1998	South African Journal Of Marine Science
biology	developmental biology	BI-1545	Description Of Rhynchoteuthion Larvae Of Illex-Argentinus From The Summer	Brunetti et al.	1990	Journal of Plankton Research
biology	Community Ecology	BI-1546	Distribution And Sexual Maturation Of The Argentinian Squid Illex-Argentinus (	Haimovici et a	1990	Scientia Marina
biology	physiology & chemistry	BI-1547	Influence Of The Capture Method On The Physicochemical And Functional Prop	Mignino et al.	2011	Journal Of Shellfish Research
biology	food science	BI-1548	Molecular Identification Of Dried Squid Products Sold In China Using Dna Barc	Shi et al.	2020	Food Additives and Contaminants Part A-Chemistry Analysis Control Exposure & Risk Assessm
biology	Trophic ecology	BI-1549	New Trophic Link And Potential Feeding Area Of Dwarf Minke Whale (Balaeno	Milmann et al	2019	Mammalia
biology	physiology & chemistry	BI-1550	Nutrient Allocation To Eggs In Female Argentine Shortfin Squid, Illex Argentin	Zang et al.	2023	Canadian Journal of Zoology
biology	Trophic ecology	BI-1551	Relevance Of Forage Fish In The Diet Of Magellanic Penguins Breeding In Nort	Yorio et al.	2017	Marine Biology Research
biology	Community Ecology	BI-1552	Seasonal Mesoscale Shifts Of Demersal Nekton Assemblages In The Subtropical	Martins et al.	2017	Marine Biology Research
biology	parasitology	BI-1553	Some Helminth Parasites From Illex-Argentinus (De-Castellanos, 1960) (Cephal	Threlfal. W	1970	Canadian Journal of Zoology
biology	Feeding behaviour	BI-1554	Squid And Their Prey: Insights From Fatty Acid And Stable Isotope Analysis	Stowasser	2004	University of Aberdeen (U.K)
biology	reproductive biology	BI-427	Stable Isotope Evidence For A Shift In Diet With Increasing Energy Demand For	Song et al.	2023	Hydrobiologia
biology	reproductive biology	BI-430	Ovarian Development In Argentinean Shortfin Squid Illex Argentinus: Group-Sy	Lin et al.	2017	Hydrobiologia
biology	Physiology & reproducti	BI-432	Fatty Acid Composition And Its Changes During Sexual Maturation In Female Il	Lin et al.	2019	Journal of Shanghai Ocean University
biology	reproductive biology	BI-434	The Energy Accumulation Of Somatic Tissue And Reproductive Organs In Post-	Lin et al.	2017	Fisheries Research
biology	developmental biology	BI-442	Species Identification Of Ommastrephes Bartrami, Dosidicus Gigas, Sthenoteut	Chen et al.	2012	Marine & Freshwater Biology
biology	parasitology	BI-444	Occurrence Of Larval Ascaridoid Nematodes In The Argentinean Short-Finned S	Cipriani et al.	2019	International Journal Of Food Mircrobiology
biology	developmental biology	BI-447	Sexual Dimorphism Of Statolith Growth For The South Patagonian Stock Of Ille	Chen et al.	2012	Bulletin Of Marine Science
biology	developmental biology	BI-450	Temperature Effects On Size, Maturity, And Abundance Of The Squid Illex Arge	Chemshirova	2021	Estuarine Coastal And Shelf Science
biology	reproductive biology	BI-452	Habitat Of Argentine Squid (Illex Argentinus) Paralarvae In The Southwestern A	Torres Alberto	2022	Marine Ecology Progress Series (Ecology, Marine & Freshwater Biology, Oceanography)
biology	developmental biology	BI-464	Relative Growth Of Paralarvae And Juveniles Of Illex-Argentinus (Castellanos, 1	Vidal	1994	Antarctic Science
biology	developmental biology	BI-466	Seasonal And Interannual Variability In Growth And Maturation Of Winter-Spaw	Arkhipkin and	1994	Aquatic Living Resources
biology	Population ecology	BI-492	Water Density Pathways For Shelf/Slope Migrations Of Squid Illex Argentinus In	Arkhipkin et a	2015	Fisheries Reseaarch
biology	reproductive biology	BI-496	Sex-Specific Reproductive Investment Of Summer Spawners Of Illex Argentinus	Lin et al.	2015	Invertebrate Biology
biology	Community Ecology	BI-497	Differences In The Trophic Niche Along The Gladius Of The Squids Illex Argen	Rosas-Luis et	2017	Regional Studies In Marine Science
biology	reproductive biology	BI-509	Useful Techniques For Artificial Fertilization Of The Ommastrephid Squid Illex	Sakai et al.	2011	Jarq-Japan Agricultural Research Quaterly
biology	food science	BI-518	Sensory Acceptability Of Squid Rings Gamma Irradiated For Shelf-Life Extensio	Tomac at al.	2017	Radiation Physics And Chemistry
biology	Community Ecology	BI-526	Environmental Influences On Commercial Oceanic Ommastrephid Squids: A Sto	Wang et al.	2017	Scientia Marina
biology	Community Ecology	BI-540	Influence Of Oceanographic Variability On Recruitment In The Illex Argentinus	Waluda et al.	1999	Marine Ecology Progress Series
biology	developmental biology	BI-556	Decision Tree Analysis For The Determination Of Relevant Variables And Quan	Crespi-Abril e	2015	Ices Journal Of Marine Science
biology	Community Ecology	BI-569	Remotely Sensed Mesoscale Oceanography And The Distribution Of Illex Argen	Waluda et al.	2001	Fisheries Oceanogrpahy
biology	morphology	BI-574	Relationship Between Beak Morphological Variables And Body Size And Mantle	Chen et al.	2012	Journal Of Ocean University Of China
management	Management evaluation	BI-578	Multispecies Modelling Of Some Components Of The Marine Community Of No	Koen-Alonso	2005	Canadian Journal Of Fisheries
biology	Community Ecology	BI-582	Different Spatiotemporal Distribution Of Argentine Short-Finned Squid (Illex Ar	Chen et al.	2007	Zoological Studies
biology	physiology	BI-585	Interpretation Of Statolith Microstructure In Reared Hatchling Paralarvae Of The	Sakai et al.	2004	Marine & Freshwater Research
biology	reproductive biology	BI-651	Rearrangements Of Chromatin Structure During Spermatogenesis Of Squid	Khrapunov et	1988	European Journal of Biochemistry
biology	Genetics or Community	BI-655	First Genetic Validation And Diagnosis Of The Short-Finned Squid Species Of T	Martinez et al	2005	Marine Biology
biology	Feeding behaviour	BI-657	Feeding Migration Of Short-Finned Squid Illex-Argentinus In The Waters Off Ar	Hatanaka	1988	Nippon Suisan Gakkaishi
biology	physiology & chemistry	BI-660	Characterization Of Chitin From Illex Argentinus Squid Pen	Cortizo et al.	2008	Carbohydrate Polymers
biology	Community Ecology	BI-664	Spatial Distribution Of Illex Argentinus In San Matias Gulf (Northern Patagonia,	Crespi-Abril e	2013	Journal of Sea Research
biology	Genetics (enzymes)	BI-667	Biochemical Genetics In The Argentinean Squid, Illex Argentinus	Jerez et al.	1998	Scientia Marina
biology	parasitology	BI-669	Digestive Tract Parasites In Rhynchoteuthion Squid Paralarvae, Particularly In Il	Vidal et al.	1999	Fishery Bulletin
biology	physiology & chemistry	BI-672	Collagen In The Tissues Of Squid Illex-Argentinus And Loligo-Patagonica - Co	Sadowska et a	1987	Journal of Food biochemistry
biology	food science	BI-675	Texture Of Cooked Mantle Of Squid Illex-Argentinus As Influenced By Specime	Kolodziejska	1987	Journal of Food Science
biology	Feeding behaviour	BI-681	Diurnal Feeding Rhythm Of The Short-Fin Squid Illex Argentinus (Cephalopoda	Laptikhovsky	2002	Fisheries Reseaarch
biology	Trophic ecology	BI-684	Diet Of Dusky Dolphins, Lagenorhynchus Obscurus, In Waters Off Patagonia, A	Alonso et al.	1998	Fishery Bulletin
biology	developmental biology	BI-689	Analysis Of The Ontogenetic Variation In Body And Beak Shape Of The Illex A	Crespi-Abril e	2010	Journal Of The Marine Biological Association Of The United Kingdom
biology	Community Ecology	BI-692	Distribution And Abundance Of Early Life Stages Of Squid (Illex-Argentinus) In	Brunetti et al.	1992	ICES Journal Of Marine Science
biology	physiology & chemistry	BI-694	Comparison Of Fatty-Acids In Liver Lipids From Various Sizes Of Squid (Illex-A	Wako et al.	1993	Bioscience Biotechnology And Biochemistry
biology	Trophic ecology	BI-696	Unusual Occurrence Of Illex Argentinus (Cephalopoda : Ommastrephidae) In Th	Xavier et al.	2002	Bulletin Of Marine Science
biology	Feeding behaviour	BI-698	Diet Of Spring And Summer Spawning Groups Of Illex Argentinus Inhabiting Co	Crespi-Abril e	2011	Aquatic Biology
biology	Trophic ecology	BI-700	Assessing The Trophic Ecology Of Three Sympatric Squid In The Marine Ecosy	Rosas-Luis et	2016	Marine Biology Research
biology	Feeding behaviour	BI-703	Food And Feeding Of Illex-Argentinus	Ivanovic et al.	1994	Antarctic Science
biology	population ecology	BI-705	Contribution To Understanding The Population Structure And Maturation Of Ille	Abril et al.	2008	Journal Of Shellfish Research
biology	reproductive biology	BI-707	Embryonic Development And Hatchlings Of Illex Argentinus Derived From Arti	Sakai et al.	1998	South African Journal Of Marine Science
biology	physiology & chemistry	BI-710	Optimization Of High Purity Chitin And Chitosan Production From Illex Argenti	Vazquez et al.	2017	Carbohydrate Polymers
biology	reproductive biology	BI-713	A New Record Of The Presence Of Two Spermatophoric Complexes In A Male S	Crespi-Abril e	2008	Malacologia
biology	population ecology	BI-716	On The Presence Of Illex Argentinus (Castellanos, 1960) (Cephalopoda: Ommas	Crespi-Abril e	2010	Latin American Journal Of Aquatic Research
biology	food science	BI-719	Gamma Radiation Effect On Quality Changes In Vacuum-Packed Squid (Illex Ar	Tomac at al.	2012	International Journal of Food Science and Technology
biology	Genetics	BI-726	Past, Present And Future Applications Of Dna-Based Markers In Cephalopod Bi	Shaw et al.	2002	Bulletin Of Marine Science
biology	Trophic ecology	BI-728	Feeding Habits And Trophic Interactions Of Doryteuthis Gahi, Illex Argentinus A	Rosas-Luis et	2014	Fisheries Reseaarch
biology	Trophic ecology	BI-731	Patterns In The Diet Of Illex Argentinus (Cephalopoda : Ommastrephidae) From	Mouat et al.	2001	Fisheries Research
biology	Community Ecology	BI-735	Distribution Of Paralarvae And Small Juvenile Cephalopods In Relation To Prim	Vidal et al.	2010	ICES Journal Of Marine Science
biology	reproductive biology	BI-737	Production Of Soma And Gonad In Maturing Female Illex-Argentinus (Mollusca	Hatfield et al.	1992	Journal Of The Marine Biological Association Of The United Kingdom
biology	food science	BI-740	Impacts Of Epsilon-Polylysine Hydrochloride With Thymol On Biogenic Amine	Li et al.	2021	Journal of Food Processing and Preservation
biology	Trophic ecology	BI-744	Squid As Nutrient Vectors Linking Southwest Atlantic Marine Ecosystems	Arkhipkin	2013	Deep-Sea Research Part II-Studies in Oceanography
biology	population ecology	BI-747	Revision Of The Population Structuring Of Illex Argentinus (Castellanos, 1960)	Crespi-Abril e	2012	Fisheries Oceanogrpahy
biology	Trophic ecology	BI-750	Distribution Of Short-Finned Squid Illex Argentinus (Cephalopoda: Ommastreph	Seco et al.	2016	Journal Of The Marine Biological Association Of The United Kingdom
biology	food science	BI-753	Characterisation Of The Key Odorants In A Squid Broth (Illex Argentinus)	Carrascon et a	2014	LWT Food Science And Technology
biology	Feeding behaviour	BI-757	Food And Feeding Of The Short-Finned Squid Illex Argentinus (Cephalopoda : C	Santos et al.	1997	Fisheries Research
biology	reproductive biology	BI-758	Reproductive Biology Of Winter-Spring Spawners Of Illex Argentinus (Cephalop	Santos and Ha	1997	Marine & Freshwater Biology
biology	physiology & chemistry	BI-762	Purification, Characterization And Molecular Cloning Of Tyrosinase From The C	Naraoka et al.	2003	European Journal of Biochemistry
biology	physiology & chemistry	BI-765	Variations In The Biochemical Composition Of The Squid Illex Argentinus From	de Moreno et	1998	Comparartive Biochemistry and Physiology B-Biochemistry and Molecular Biology
biology	physiology & chemistry	BI-768	Cuticle Structure Of Squid Illex Argentinus Pen	Wu et al.	2003	Fisheries Science
biology	food science	BI-771	Effect Of Squid Liver Extract On Proteins And On The Texture Of Cooked Squid	Kolodziejska	1992	Journal of Food Biochemistry
biology	food science	BI-774	Extraction Of Crude Chitosans From Squid (Illex Argentinus) Pen By A Compre	Huang et al.	2018	Food Chemistry
biology	food science	BI-777	Optimisation Of Healthy-Lipid Content And Oxidative Stability During Oil Extr	Rodriguez et a	2021	Marine Drugs
biology	developmental biology	BI-779	Identification Of Illex Coindetii, I-Illecebrosus And I-Argentinus (Cephalopoda	Martinez et al	2002	Marine Biology
biology	food science	BI-781	A Study Of The Antioxidative Substance(S) In Squid Mantle Muscle	Komatsu et al	1991	Journal of the Japanese Society for Food Science and Technology
biology	developmental biology	BI-784	Rapid Selection Effects In A Short-Lived Semelparous Squid Species Exposed T	Murphy et al.	1999	Evolutionary biology
biology	Trophic ecology	BI-790	Feeding Habits And Prey Selection By The Skate Dipturus Chilensis (Elasmobra	Lucifora et al.	2000	Journal Of The Marine Biological Association Of The United Kingdom
biology and Stock assessment	Community Ecology an	BI-793/SA-14	Preliminary Description Of The Overlap Between Squid Fisheries And Vmes On	Portela et al.	2010	Fisheries Research
biology	food science	BI-795	Dimethylamine And Formaldehyde In Cooked Squid (Illex-Argentinus) Muscle I	Kolodziejska	1994	Food Chemistry
biology	food science	BI-798	Purification Of Phosphatidylcholine With High Content Of Dha From Squid Illex	Baudimant et	1996	Journal of Liquid Chromatography & Related Technologies
biology	Trophic ecology	BI-804	Long-Term Changes In The Spiny Dogfish (Squalus Acanthias) Trophic Role In	Belleggia et al	2012	Hydrobiologia
biology	physiology & chemistry	BI-810	Biochemical-Composition In Relation To The Energetics Of Growth And Sexual	Clarke et al.	1997	Fisheries Research
biology	developmental biology	BI-813	Using Different Standardized Methods For Species Identification: A Case Study	Hu et al.	2018	Journal Of Ocean University Of China
biology	population ecology	BI-815	Synchronicity In Southern Hemisphere Squid Stocks And The Influence Of The S	Waluda et al.	2004	Fisheries Oceanogrpahy
biology	soundscape ecology	BI-819	Identification Of Acoustic Records Of The Argentinian Calamar Illex Argentinus	Madureira et a	2005	Fisheries Research
biology	Trophic ecology	BI-821	Squid As A Resource Shared By Fish And Humans On The Falkland Islands' Sh	Laptikhovsky	2010	Fisheries Research
biology	physiology & chemistry	BI-824	Parameters Affecting The Isolation Of Collagen From Squid (Illex Argentinus) S	Kolodziejska	1999	Food Chemistry
biology	Community Ecology	BI-829	Spatial Distribution Of Cephalopod Paralarvae In San Jose Gulf (Northern Patag	Crespi-Abril e	2014	Fisheries Research
biology	physiology & chemistry	BI-832	Occurrence Of A Mucin-Type Glycoprotein In Nidamental Gland Mucosubstanc	Kimura et al.	1994	Fisheries Science
biology	Trophic ecology	BI-837	Upper Trophic Structure In The Atlantic Patagonian Shelf Break As Inferred Fro	Zhu et al.	2018	Journal of Oceanology and Limnology
biology	Community Ecology	BI-839	Early Life-Cycle Of Cephalopods In Relation To The Major Oceanographic Feat	Rodhouse et a	1992	Marine Ecology Progress Series
biology	genetics	BI-853	Allozyme Differentiation Of 16 Species Of Ommastrephid Squid (Mollusca, Cep	Yokawa	1994	Antarctic Science
biology	Trophic ecology	BI-856	Dining Hall At Sea: Feeding Migrations Of Nektonic Predators To The Eastern P	Arkhipkin et a	2012	Journal of Fish Biology
biology	food science	BI-865	Changes In Chemical Constituents And Physical Indices During Processing Of D	Chiou et al.	2000	Fisheries Science
biology	physics	BI-869	Rheological Properties Of Cuttlefish And Squid Raw Meat	Mochizuki et	1994	Fisheries Science
biology	physiology & chemistry	BI-871	Extraction And Characterization Of Collagen From Antarctic And Sub-Antarctic	Coelho et al.	2017	Materials Science & Engineering C- Materials For Biological Applications
biology	physiology & chemistry	BI-874	Biochemical Properties Of Actomyosin From Frozen Stored Mantles Of Squid (I	Paredi et al.	1997	Journal of Agricultural and Food Chemistry
biology	physiology & chemistry	BI-879	Nidamental Gland Mucosubstance From The Squid Illex Argenatinus: Salt-Solub	Suguira et al.	1995	Fisheries Science
biology	food science	BI-883	Textural And Histological Changes Of Different Squid Mantle Muscle During Fr	Ueng et al.	1998	Journal of Agricultural and Food Chemistry
biology	Community Ecology	BI-886	Large-Scale Range Expansion And Variability In Ommastrephid Squid Populatio	Rodhouse	2008	California Cooperative Oceanic Fisheries Investigations Report
biology	Genetics	BI-897	Molecular Differentiation Of The Species Of Two Squid Families (Loliginidae A	Sales et al	2011	Food Control
biology	Trophic ecology	BI-901	Diet Of The Magellanic Penguin On The Coast Of Rio Grande Do Sul, Brazil	Fonseca et al.	2001	Waterbirds
biology	Genetics	BI-905	Identification Of Four Squid Species By Quantitative Real-Time Polymerase Cha	Ye et al.	2016	Molecular and Cellular Probes
biology	food science	BI-910	A Potential Adjuvant Agent Of Chemotherapy: Sepia Ink Polysaccharides	Li et al.	2018	Marine Drugs
biology	physiology & chemistry	BI-914	Thermally Induced Gelation Of Squid (Illex Argentinus) Actomyosin. Influence (	Paredi et al.	1999	Journal of Agricultural and Food Chemistry
biology	physiology	BI-916	Energy Acquisition Strategy For Reproduction In A Semelparous Squid	Lin et al.	2022	Frontiers in Zoology
biology	Community Ecology	BI-925	Coastal Cephalopod Fauna Of Southern Brazil	Haimovici et a	1991	Bulletin of Marine Science
biology	physiology & chemistry	BI-927	Illexins A, B, And C From Squid Ink Should Have A Branched Structure	Takaya et al.	1996	Biochemical and Biophysical Research Communications
biology	physiology & chemistry	BI-930	High Strength Nanostructured Films Based On Well-Preserved Beta-Chitin Nano	Wu et al.	2019	Nanoscale
biology	food science	BI-933	Proteolytic Activity Of Crude Enzyme Extracts Of Squid Illex-Argentinus Liver	Kolodziejska	1994	Journal of Food Biochemistry
biology	population ecology	BI-936	Mesopelagic Fish Distribution In The Southwest Atlantic In Relation To Water M	Figueroa et al.	1998	Deep-Sea Research Part II-Studies in Oceanography

biology	food science	BI-939	Production Of Antihypertensive And Antioxidant Activities By Enzymatic Hydr	Amado et al.	2013	Biochemical Engineering Journal
biology	food science	BI-942	Changes In The Volatile Components Of Squid (Illex Argentinus) For Different	Cui et al.	2020	Food science & Nutrition
biology	Trophic ecology	BI-947	Spatio-Temporal And Ontogenetic Changes In The Diet Of The Argentine Hake	Belleggia et al	2014	Journal Of The Marine Biological Association Of The United Kingdom
biology	food science	BI-949	Modelling The Effect Of Gamma Irradiation On The Inactivation And Growth K	Tomac et al.	2013	Journal of Food Engineering
biology	Community Ecology	BI-951	Marine Fronts Are Important Fishing Areas For Demersal Species At The Argen	Alemany et al	2014	Journal of Sea Research
biology	Trophic ecology	BI-954	Seascape Modeling Of Southern Giant Petrels From Patagonia During Different	Blanco et al.	2017	Marine Biology
biology	physiology & chemistry	BI-958	Thermal Denaturation Of Muscle Proteins From Male And Female Squid (Illex A	Paredi et al.	1996	Journal of Agriculture and Food Chemistry
biology	physiology & chemistry	BI-965	High-Strength Nanostructured Film Based On Beta-Chitin Nanofibrils From Squ	Wu et al.	2021	ACS Sustainable Chemistry & Engineering
biology	physiology & chemistry	BI-967	Changes In Myofibrillar Proteins And Lipids Of Squid (Illex Argentinus) During	Paredi et al.	2006	Journal of Food Biochemistry
biology	Trophic ecology	BI-970	Variation In The Diet Of The Red Cod With Size And Season Around The Falkl	Arkhipkin et a	2001	Journal Of The Marine Biological Association Of The United Kingdom
biology	physiology & chemistry	BI-972	Surface Hydrophobicity And Functional Properties Of Myofibrillar Proteins Of M	Mignino et al.	2008	LWT Food Science And Technology
biology	Trophic ecology	BI-979	Biological Data Of The Deep-Water Lizard Catshark Schroederichthys Saurisqua	Sega et al.	2020	Regional Studies In Marine Science
biology	physiology & chemistry	BI-982	From Fish-Processing Waste To Feed Additives For Crayfish	Rodriguez et a	2019	Journal of the World Aquaculture Society
biology	Trophic ecology	BI-987	Feeding Ecology Of Dusky Dolphins Lagenorhynchus Obscurus: Evidence From	De Castro et a	2016	Journal of Mammalogy
biology	population ecology	BI-990	Life Cycles, Oceanography And Variability: Ommastrephid Squid In Variable O	Anderson and	2001	Fisheries Research
biology	Genetics	BI-993	An Insight Into The Chinese Traditional Seafood Market: Species Characterizatio	Wen et al.	2017	Food Control
biology	physiology & chemistry	BI-996	Evaluation Of Alpha-Chitosan From Crab Shell And Beta-Chitosan From Squid	li et al.	2021	Applied Science-Based
biology	physiology & chemistry	BI-998	Fractionation Of Squid Visceral Oil Ethyl Esters By Short-Path Distillation	Liang et al.	2000	Journal of The American Oil Chemists Society
management	fishing intensity	MA-1050	Deep-Water Fisheries In Brazil: History, Status And Perspectives	Perez et al.	2009	Latin American Journal Of Aquatic Research
management	fishing intensity	MA-1054	Remotely Sensed Spatial Dynamics Of The Illex Argentinus Fishery, Southwest	Waluda et al.	2008	Fisheries Research
management	fishing intensity	MA-1150	Risks And Uncertainties In The Management Of Single-Cohort Squid Fishery: T	Basson et al.	1993	Canadian Special Publication of Fisheries and Aquatic Sciences
management	Experimentation	MA-1168	Ethical And Welfare Considerations When Using Cephalopods As Experimental	Moltschaniws	2007	Reviews In Fish Biology And Fisheries
management	resource management	MA-1169	A Review Of The Development Of Chinese Distant-Water Squid Jigging Fisheri	Chen et al.	2008	Fisheries Research
management	fishing intensity	MA-1190	Deep-Sea Fishery Off Southern Brazil: Recent Trends Of The Brazilian Fishing I	Perez et al.	2003	Journal of Northwest Atlantic Fishery Science
management	fishing intensity	MA-1266	Stock Assessment And The Provision Of Management Advice For The Short Fin	Beddington et	1990	Fisheries Research
management	fishing intensity	MA-1372	Use Of Viirs Dnb Satellite Images To Detect Jigger Ships Involved In The Illex A	Cozzolino et a	2016	Remote Sensing Applications: Society and Environment
management	negative subsidies	MA-1375	What Would Article 5.1 Of The 2022 Wto Ministerial Agreement On Fisheries S	Alger et al.	2023	Marine Policy
biology	Trophic ecology	MA-1377	Prey Contribution To The Diet Of Pink Cusk-Eel Genypterus Blacodes (Forster,	Bellegia et al.	2023	Fisheries Research
management	fishing intensity	MA-1378	Spatial Analysis Of Fishing Intensity For Illex Argentinus Based On Fishing Ves	Huimin et al.	2021	South China Fisheries Science
management	resource management	MA-1379	Optimizing Strategy On Exploitation Of Illex Argentinus In The Southwest Atla	Han et al.	2016	Journal of Shanghai Ocean University
management	resource management	MA-1380	Illex Argentinus Fishery Resources Management In Argentina And Its Enlighten	Yue et al.	2014	Journal of Agricultural Science and Technology (Beijing)
management	resource management	MA-1381	Comparison Of suitable habitat models for Illex argentinus and their application	Ding et al.	2015	Chinese Science and Technology Journal Database
management	resource management	MA-1382	Estimating The Economic Benefits Of Cooperative And Non-Cooperative Manag	Villasante et a	2009	Academia.edu
managment	regional management	MA-1383	Managing The Southwest Atlantic : The Case Of Illex Argentinus.	Dunne	2017	aquadocs.org
management	resource management	MA-1384	Game Theory And Fisheries: The Case Study Of The Illex Argentinus Fishery In	Villasante et a	2010	International Institute of Fisheries Economics & Trade
management	resource management	MA-1385	Development Of Extraction Methods To Obtain High Value-Added Products Fro	Rodriguez et a	2018	Universidade de Vigo
management	resource management	MA-1386	The Falkland Islands Squid Fisheries: Stock Assessment, Management And How	Jones et al.	2022	noaa.gov
management	resource management	MA-1387	Sustainability And Management Of Southwest Atlantic Squid Fisheries.	Agnew et al.	2005	Bulletin Of Marine Science
management	fishing intensity	MA-531	High Seas Fisheries: The Achilles' Heel Of Major Straddling Squid Resources.	Arkhipkin et a	2023	Reviews In Fish Biology And Fisheries
managemnent	fishing intensity	MA-547	Integrating Fishing Spatial Patterns And Strategies To Improve High Seas Fisher	Viela et al.	2018	Marine Policy
management	Management evaluation	MA-564	Close Cooperation Between Science, Management And Industry Benefits Sustai	Arkhipkin et a	2013	Journal Of Fish Biology
management	abundance & recruitmen	MA-566	Inverse Patterns In Abundance Of Illex Argentinus And Loligo Gahi In Falkland	Arkhipkin and	2002	Fisheries Research
management	fishing intensity	MA-572	Throwing Light On Straddling Stocks Of Illex Argentinus: Assessing Fishing Int	Waluda et al.	2002	Canadian Journal Of Fisheries
management	fishing intensity	MA-721	Remote Sensing Of The Global Light-Fishing Fleet: An Analysis Of Interactions	Rodhouse et a	2001	Advances in Marine Biology Vol 39
management	fishing intensity	MA-802	Sensing The Same Fishing Fleet With Ais And Viirs: A Seven-Year Assessment	Ruiz et al.	2020	Remote Sensing
management	fishing intensity	MA-850	Modeling The Selective Effects Of Fishing On Reproductive Potential And Popu	Murphy et al.	1994	ICES Journal Of Marine Science
management	Management evaluation	MA-862	Fisheries And Fisheries Management In Falkland Islands Conservation Zones	Barton	2002	Aquatic conservation-Marine and Freshwater Ecosystems
management	Stock assessment evalua	MA-960	Stock Assessment And Management Of Cephalopods: Advances And Challenge	Arkhipkin et a	2021	ICES Journal Of Marine Science
management	Stock assessment evalua	MA-963	The Potential Use Of Environmental Information To Manage Squid Stocks	Agnew et al.	2002	Canadian Journal of Fisheries and Aquatic Sciences
management	resource management	N/A	The Southwest Atlantic; Achievements Of Bilateral Management And The Case	Barton et al.	2004	Management of shared fish
biology	population ecology	N/A	Intraspecific Growth And Structure Of The Squid Illex-Argentinus Ommastrephi	Arkhipkin et a	1991	Scientia Marina
stock assessment	abundance	SA-1052	Biomass And Fishing Potential Yield Of Demersal Resources From The Outer S	Haimovici et a	2009	Latin American Journal Of Aquatic Research
stock assessment	abundance	SA-1080	The Spatio-Temporal Pattern Of Argentine Shortfin Squid Illex Argentinus Abun	Sacau et al.	2004	Aquatic Living Resources
stock assessment & biology	abundance, population e	SA-1120	Abundance Of Argentine Shortfin Squid, Illex Argentinus(Castellanos) In Relati	Kim, Doo Na	2004	Journal of the Korean Society of Fisheries and Ocean Technology
stock assessment	abundance	SA-1185	The Contribution Of Cephalopods To Global Marine Fisheries: Can We Have Ou	Hunsicker et a	2010	Fish and Fisheries
biology	population ecology	SA-1254/BI-1	Illex Argentinus	Haimovici et a	1998	FAO (Food and Agriculture Organization of the United Nations)
stock assessment	CPUE	SA-1265	The Assessment Of Stocks Of Annual Squid Species	Rosenberg et a	1990	Fisheries Research
Stock assessment	Age, growth, Population	SA-1434	Age, Growth And Population Structure Of Illex Argentinus Based On Statolith M	Lu et al.	2012	Journal of Fisheries of China
Stock assessment	Mark-recapture, CPUE &	SA-1452	JAMARC-INIDEP Joint Research Cruise On Argentine Short-Finned Squid Illex	Brunetti et al.	2000	aquadocs.org
Stock assessment	CPUE	SA-1456	CPUE Standardization Of Illex Argentinus For Chinese Mainland Squid-Jigging	Lu et al.	2013	Journal of Fisheries of China
Stock assessment	recruitment	SA-1457	Recruitment Strength Forecasting Of The Shortfin Squid Illex Argentinus (Ceph	Laptikhovsky	2001	Denmark ICES K
stock assessment	CPUE, recruitment & po	SA-1460	The Antarctic Oscillation Index As An Environmental Parameter For Predicting	Chang et al.	2015	Fishery Bulletin
Stock assessment	CPUE	SA-1461	Incorporating Spatial Autocorrelation Into Cpue Standardization With An Applic	Na et al.	2018	hyxbocean.cn
Stock assessment	CPUE & Abundance	SA-1462	The Stock And Fishery Variability Of The Argentine Squid Illex Argentinus In 1	Nigmatullin et	2004	ICES CM
Stock assessment	individual growth, morp	SA-1463	The Yearly Growth And Body Condition Of Argentinean Shortfin Squid, Illex A	Zang et al.	2021	Acta Hydrobiologica Sinica
Stock assessment	CPUE	SA-1464	Distribution Of Fishing Ground Of Illex Argentinus And Its Relationship With S	Fang et al.	2013	Journal of Shanghai Ocean University
Stock assessment	CPUE	SA-1465	Catch Variations Of Argentine Shortfin Squid Illex Argentinus In The Southwest	Eun Ku et al.	2020	Korean Journal of Fisheries and Aquatic Sciences
Stock assessment	abundance estimation &	SA-1466	Analysis Of The Variability In The Abundance Of Shortfin Squid Illex Argentin	Portela et al.	2005	International Council for The Exploration of the Sea
stock assessment	abundance	SA-1468	Cephalopods Of Pacific Latin America	Markaida et al	2016	Fisheries Research
stock assessment	recruitment	SA-1469	Dynamics Of The Confluence Of Malvinas And Brazil Currents, And A Southern	Torres Alberto	2021	Fisheries Oceanogrpahy
stock assessment	age-length key	SA-1470	Intrapopulation Structure Of Winter-Spawned Argentine Shortfin Squid, Illex Ar	Arkhipkin	2000	Fishery Bulletin
stock assessment	population ecology	SA-1471	Surface Oceanography Of The Inferred Hatching Grounds Of Illex Argentinus (C	Waluda et al.	2001	Marine Biology
stock assessment	individual growth	SA-1472	Seasonality In Growth And Hatching Of The Argentine Short-Finned Squid Illex	Bainy and Ha	2012	Journal Of Shellfish Research
stock assessment	CPUE	SA-1473	Catch Per Unit Effort (Cpue) Standardization Of Argentine Shortfin Squid (Illex	Wang et al.	2020	Internation Journal Of Remote
stock assessment	individual growth	SA-459	The Study Of Intra-Specific Growth Variability Of Illex Argentinus (Cephalopod	Schroeder and	2010	Fisheries Research
stock assessment	Individual growth	SA-462	Individual Growth Of The Squid Illex Argentinus Off Brazil As Reconstructed F	Schroeder and	2013	Journal Of The Marine Biological Association Of The United Kingdom
stock assessment	individual growth	SA-468	Growth Model Identification Of Short-Finned Squid Illex Argentinus (Cephalop	Schwarz and I	2010	Fisheries Reseaarch
management	overfishing	SA-480	Heavy Fishery Exploitation Does Not Affect Sizes At Recruitment And Maturity	Arkhipkin et a	2022	ICES Journal Of Marine Science
stock assessment	age structure	SA-487	Age Structure And Life Cycles Of The Argentine Shortfin Squid Illex Argentinu	Schwarz and I	2013	Marine & Freshwater Biology
biology	developmental biology	SA-503	Dynamics Of Growth And Maturation In The Cephalopod Illex-Argentinus Deca	Rodhouse and	1990	Philosophical Transactions of The Royal Society B-Biological Sciences
stock assessment	abundance	SA-521	A Stock Assessment For Illex Argentinus In Southwest Atlantic Using An Envir	Wang et al.	2018	Acta Oceanologica Sinica
stock assessment & management	abundance	SA-523	Assessment And Management Techniques For Migratory Annual Squid Stocks: T	Basson et al.	1996	Fisheries Research
management	Stock assessment evalua	SA-535	Stock Assessment Methods Used For Cephalopod Fisheries.	Pierce and Gu	1994	Fisheries Research
stock assessment	CPUE	SA-546	Standardising The CPUE For The Illex Argentinus Fishery In The Southwest Atl	Chen and Chi	2009	Fisheries Science
stock assessment	abundance	SA-552	Acoustic Characterization Of The Argentinean Short-Fin Squid Aggregations.	Cabriera et al.	2011	Fisheries Research
stock assessment	CPUE	SA-561	Movement Patterns Determine The Availability Of Argentine Shortfin Squid Ille	Chiu et al.	2017	Fisheries Research
stock assessment	abundance	SA-575	Argentine Shortfin Squid (Illex Argentinus) Stock Assessment In The Southwest	Chang et al.	2016	Terrestrial Atmospheric And Oceanic
stock assessment	Age estimation and Indi	SA-587	Age, Growth, Stock Structure And Migratory Rate Of Prespawning Short-Finned	Arkhipkin	1993	Fisheries Research
stock assessment & biology	abundance, population e	SA-589	Abundance, Distribution And Population Dynamics Of The Short Fin Squid Illex	Haimovici et a	2014	Fisheries Research
stock assessment	Age estimation	SA-591	Age Estimation Of Four Oceanic Squids, Ommastrephes Bartramii, Dosidicus Gi	Ajihiko Yatsu	2000	Jarq-Japan Agricultural Research Quaterly
stock assessment	Age estimation & devel	SA-827	Determination Of Squid Age Using Upper Beak Rostrum Sections: Technique In	Liu et al.	2015	Marine Biology

期初審查意見回復表

計畫名稱：西南大西洋魷釣漁業改進計畫之先期資料整備研究

序號	審查意見	回復說明	修正頁碼
1	建議補充說明生物參考點估計方法。	謝謝委員建議。將待本年度文獻收集後加以補充。	P25-P26
2	建議可以採用體長別產卵潛能比 LBSFR 模式。	謝謝委員建議。將待本年度文獻收集後加以補充。	P25-P26
3	建議於期末報告敘明FIP所規劃蒐集資料與現行漁撈日誌之差異及如何改善西南大西洋魷魚族群訊息之瞭解。	謝謝委員建議。將待本年度文獻收集後加以補充。	P25-P26
4	建議於期末報告討論本計畫蒐集之生物參數可能應用於未來的資源評估。	謝謝委員建議。將待本年度文獻收集後加以補充。	P25-P26
5	建議評核指標建立予以量化，以歷屆時之審查。	計畫書內容與評核項目依建議辦理。	
6	建議計畫內容與本署公告內容再行比對審視，以扣合原則項目。	計畫書內容與評核項目依建議辦理。	
7	建議計畫說明書之計畫目標及重要工作項目能與漁業署所列之工作項目對應，寫法可為漁業署之工作項目為母項目，目前所列之工作項目經檢視、調整後，列在各母項目下。	計畫書內容與評核項目依建議辦理。	
8	預測112下半年至113年上半年之漁況部分，建議宜用自相關(ARIMA)及頻譜分析之方式顯示其結果。	謝謝委員建議。將納入本年度分析探討。	P33-P35

佐證資料表

AA 決策依據表】

說明 1：**類別**分成 A 新建或整合流程、B 重大統計訊息或政策建議報告。

說明 2：**是否被採納**分成 A 行政院級採納、B 部會署級採納、C 部會署所屬機關採納、D 存參。

說明 3：**公告實施內容**，如「是否被採納」選擇 A、B 或 C，應具體陳述行政院/部會署/部會署所屬機關採納後所公告實施之政策內容、增(修)訂之法規命令條文或其他決策內容；**所屬單位**請填該項績效預算執行機關。

序號	名稱	內容摘要	類別	是否被採納	公告實施內容	成果歸屬(請填細部計畫名稱)	所屬單位
1	西南大西洋魷釣漁業改進計畫之先期資料整備研究	整合我國魷釣船隊之阿根廷短鰭魷資料，解析其基礎生物學，評估資源狀態，以提供資源養護及漁業管理措施之參考，並協助推動西南大西洋魷釣漁業改進計畫之行動計畫。	B	B	1.整合阿根廷魷資源評估所需漁業資料，及應用適當模式之初步評估分析。 2.檢視適用於短年生漁業生物資源或魷類資源之生物參考點，及可用模式分析。 3.檢視阿根廷魷發表文獻，統整其生命週期、產卵時間及空間、體長頻度分布及洄游模式等族群參數，據以規劃阿根廷魷之生物採樣及族群研究計畫。	西南大西洋魷釣漁業改進計畫之先期資料整備研究	漁業署

【B 合作團隊(計畫)養成表】

說明 1：**合作模式**分成 A 機構內跨領域合作、B 跨機構合作、C 跨國合作。

說明 2：**團隊(計畫)性質**分成 A 形成合作團隊或合作計畫、B 形成研究中心、C 形成實驗室、D 簽訂協議。**所屬單位**請

填該項績效預算執行機關。

序號	團隊(計畫)名稱	合作對象	合作內容(100字簡要說明)	合作模式	團隊(計畫)性質	成立時間(西元年)	成果歸屬(請填細部計畫名稱)	所屬單位
1	阿根廷短鰭魷資源研究團隊	陳志炘教授(海大海洋事務與資源管理研究所)	不同領域的團隊成員有橫向聯繫，以相異的研究方法互相討論，分享資源評估及預測方向研究經驗。	A	A	2023	西南大西洋魷釣漁業改進計畫之先期資料整備研究	漁業署

【C 培育及延攬人才表】

說明 1：**學歷**分成 A 博士(含博士生)、B 碩士(含碩士生)、C 學士(含大學生)。

說明 2：**性質**分成 A 在學聘僱、B 學程通過、C 培訓課程通過、D 國際學生/學者交換、E 延攬人才。**所屬單位**請填該項績效預算執行機關。

序號	姓名	機構名稱	學歷	性質	成果歸屬(請填細部計畫名稱)	所屬單位
1	黃廷緯	國立臺灣大學生命科學系	C	A	西南大西洋魷釣漁業改進計畫之先期資料整備研究	漁業署

【D1 研究報告表】

說明 1：**是否被採納**分成 A 院級採納、B 部會署級採納、C 部會署所屬機關採納、D 存參。

說明 2：**公告實施內容**，如「是否被採納」選擇 A、B 或 C，應具體陳述行政院/部會署/部會署所屬機關採納後所公告實施之政策內容、增(修)訂之法規命令條文或其他決策內容。

序號	報告/著作名稱	作者姓名	出版年(西元年)	是否被採納	公告實施內容	成果歸屬(請填細部計畫名稱)

【E 學術活動表】

說明 1：性質分成 A 國內研討會、B 國際研討會、C 兩岸研討會。

序號	研討會名稱	性質	舉辦日期 (YYYYMMDD)	主/協辦單位	主辦/參加	成果歸屬 (請填細部計畫名稱)
1	國立臺灣大學漁業科學研究所研究生成果展	A	20230427	國立臺灣大學漁業科學研究所	參加	西南大西洋魷釣漁業改進計畫之先期資料整備研究
2	國立臺灣大學漁業科學研究所研究生成果展	A	20231130	國立臺灣大學漁業科學研究所	參加	西南大西洋魷釣漁業改進計畫之先期資料整備研究