

2018 fishackathon



Smart solution to problems in fisheries management

漁業問題之妙方

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2018/1/27 (六) 2:00-3:30 pm

Keywords: Communication, fish identification, IUU, monitoring, sustainability

Curriculum vitae

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學歷

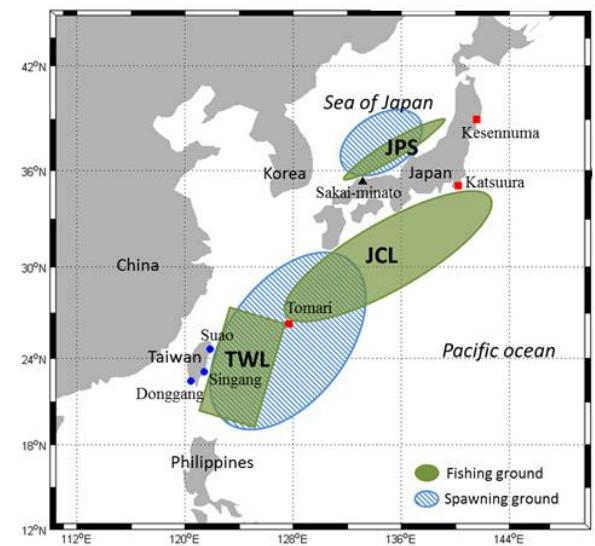
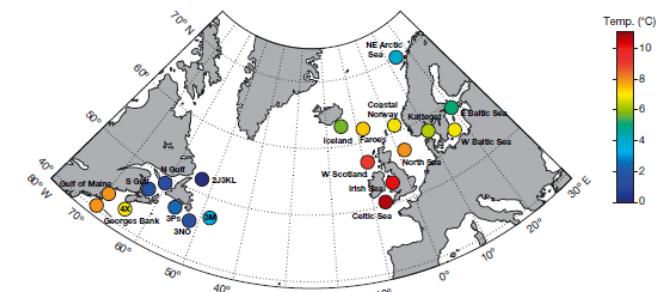
台大動物系學士、密西根大學自然資源與環境研究所碩士、博士

研究興趣

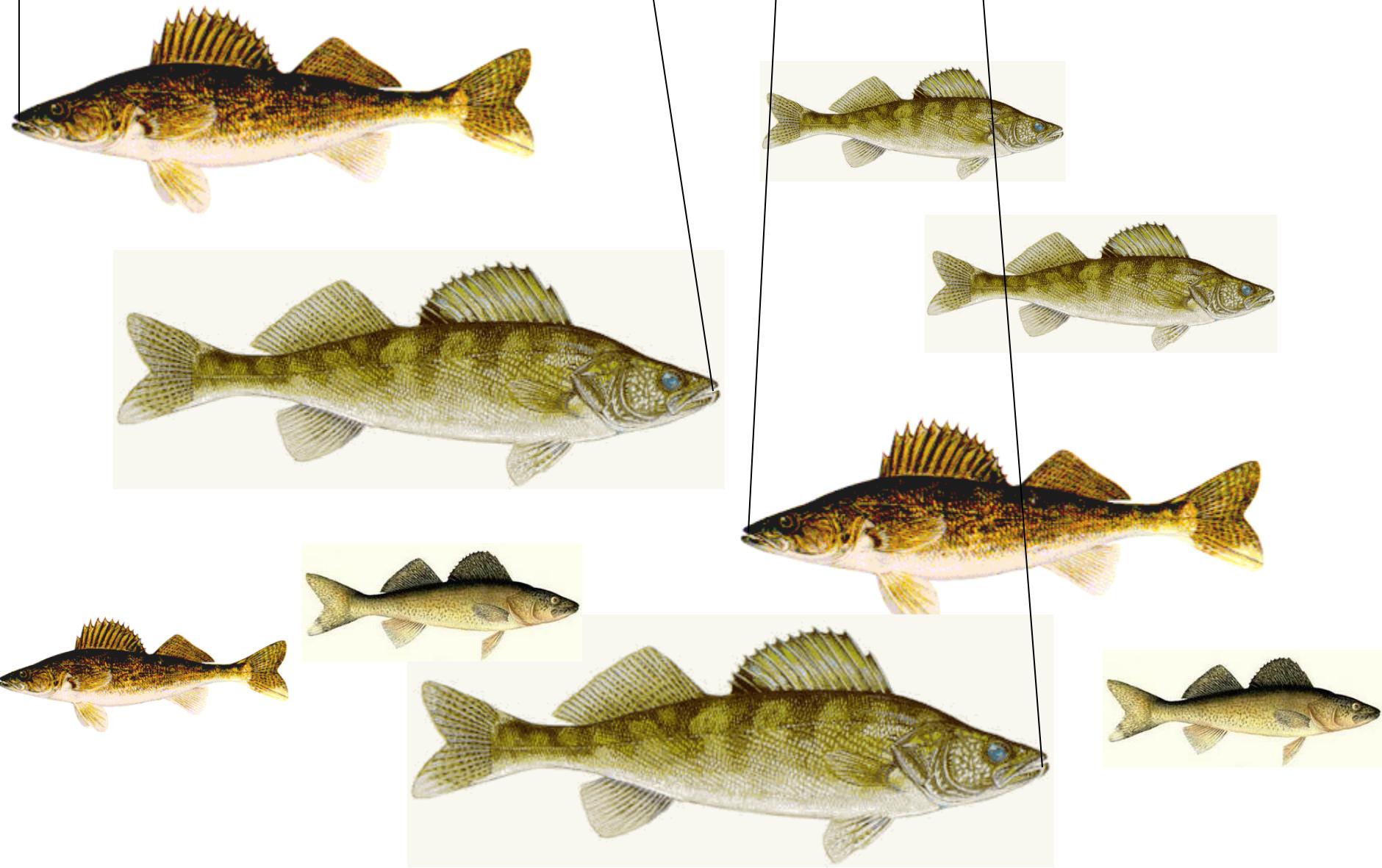
魚類生活史變異、族群生態學、漁業統計

計畫

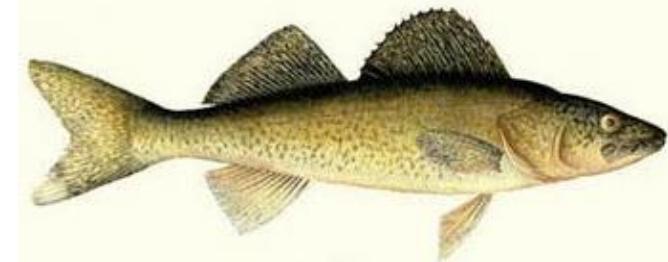
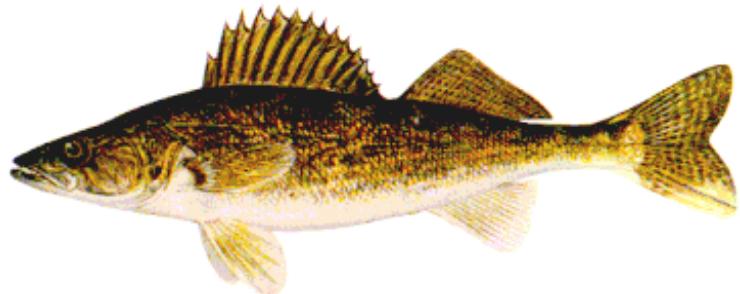
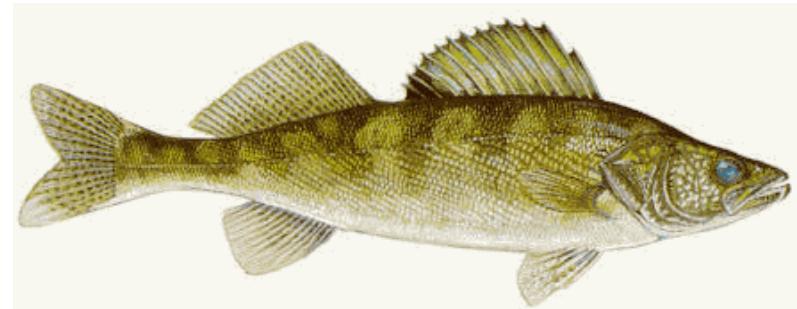
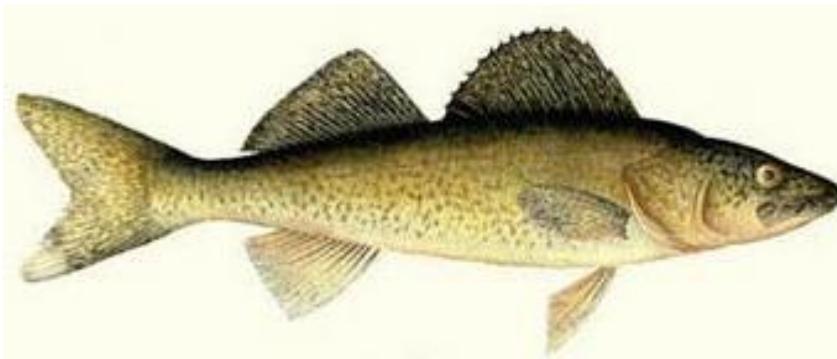
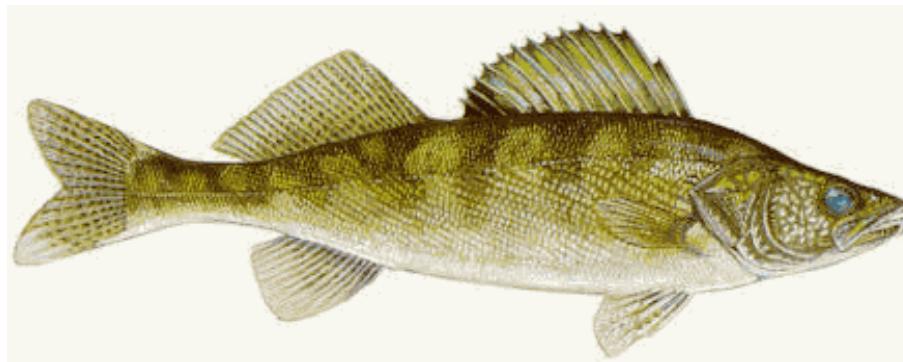
- 溫度與漁撈對生活史與族群動態的影響
- 西太平洋帶魚種類、族群、生活史變異



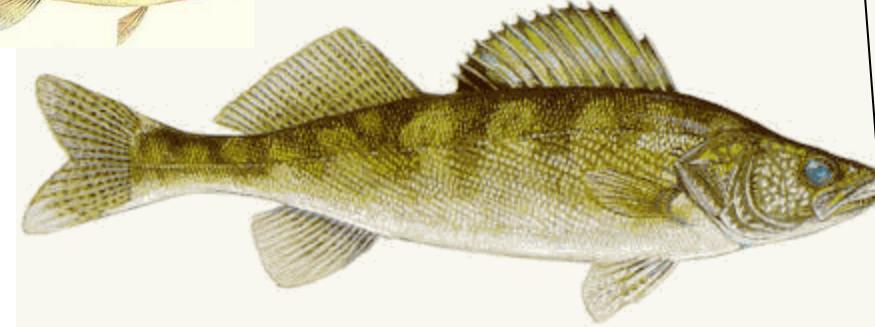
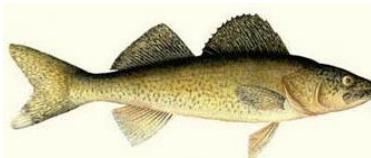
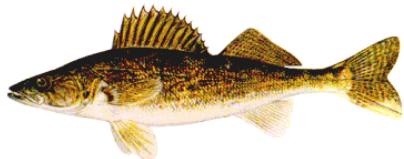
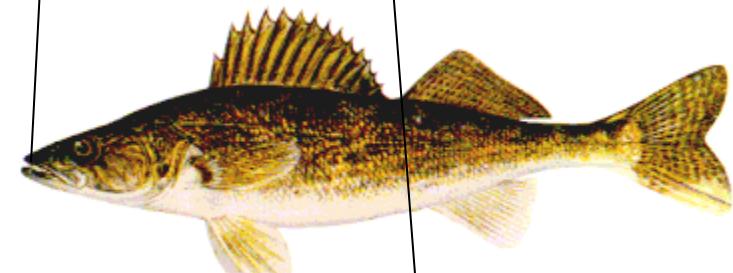
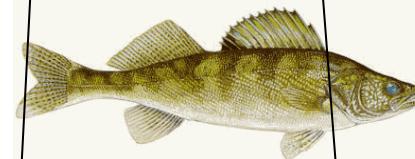
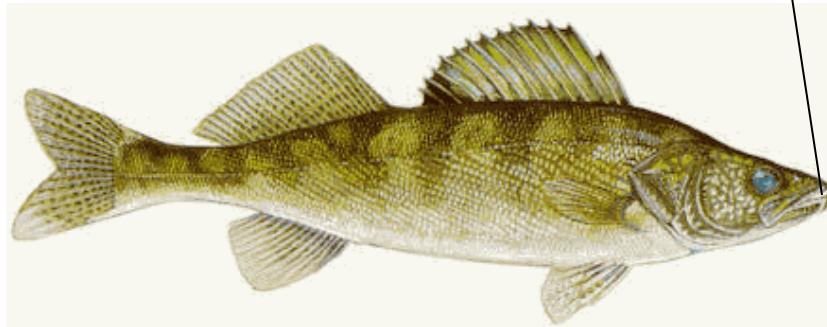
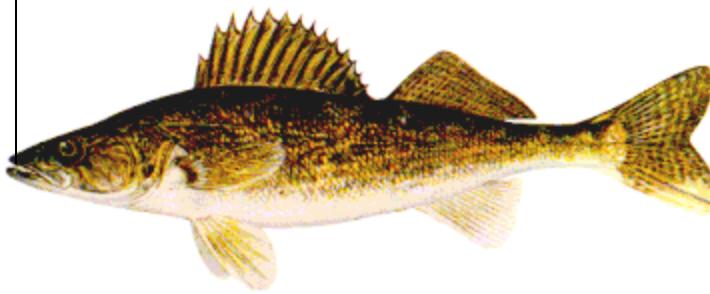
漁撈造成族群密度下降



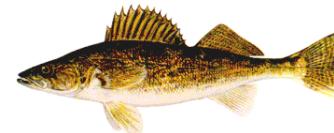
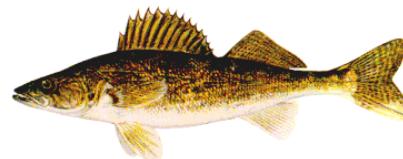
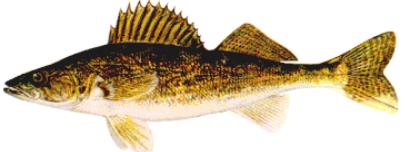
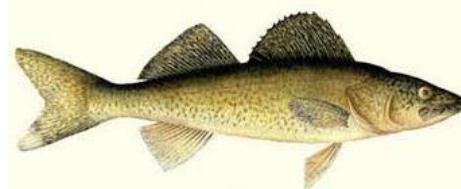
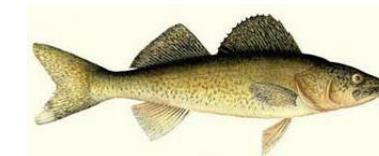
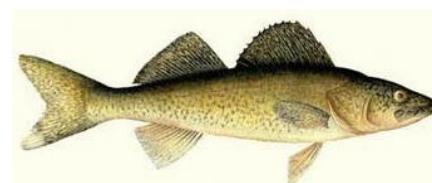
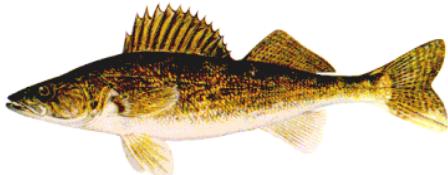
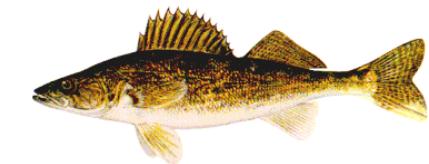
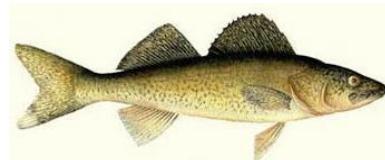
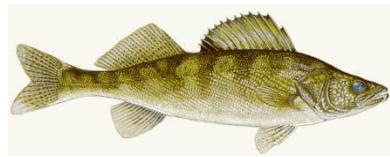
個體成長率提高、提早成熟、成熟體型變大



漁撈選擇捕大魚



漁撈會間接篩選族群基因庫，造成魚群提早成熟、成長率下降



Current problems in fisheries management

非法、未報告、未受規範的漁撈 (IUU fishing)



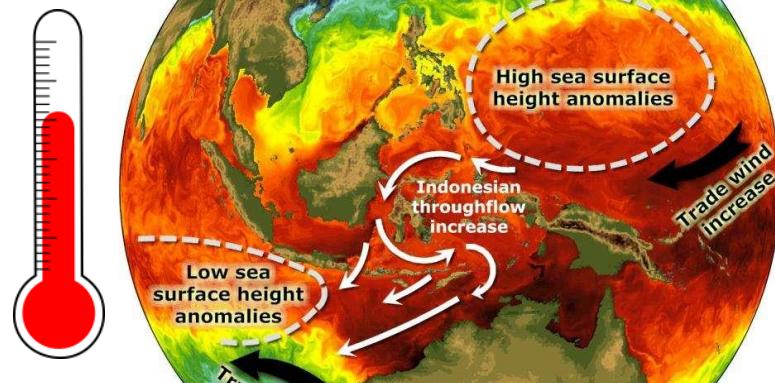
過漁



外來種



氣候變遷



Fishackathon 2018 challenge

- IUU (人權、溝通): Q1-2
- IUU (風險評估、監控): Q3-4, 9, 10
- Overfishing (魚種辨識): Q5, 7
- 永續認證: Q6, 8
- 環境監測: Q11

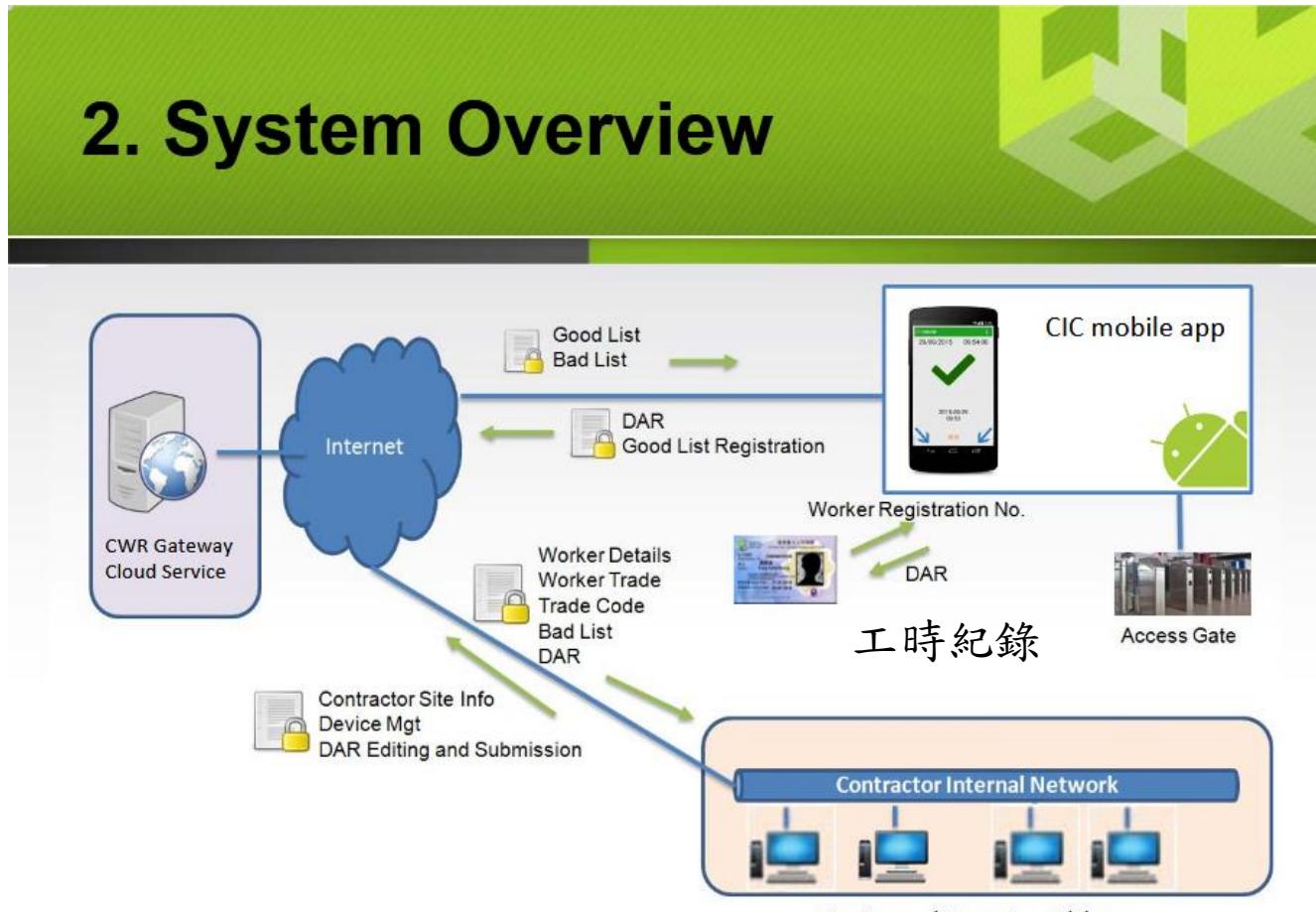
Q1:漁工註冊系統

- Goals: 幫助主管機關辨識漁工身份，以減少違法漁撈行為或剝削勞工之情事發生
- Potential solution: 智慧型的通用漁工註冊資料庫，可因不同國家的條件和需求進行調整，讓漁工持有身份證或將身份證的電子版可儲存在智慧型手機中。身分證明上必須有QR code以便稽查人員、雇主掃描辨識

Necessary elements (Q1)

- 卡片或電子版的身分證明，註載漁工的基本資料和個人照
- 內建的QR code或條碼，能夠掃描確認漁工身份
- 可透過簡訊或其他通訊器材發送的簡易漁工註冊號碼
- 雲端漁工註冊資料庫
- 可以進行數據分析的系統，以便得知漁工每月的工作時數，及偵測漁工過勞或遭受剝削的情況
- 記載漁獲情況，並且讓漁工了解自家漁船的漁獲情況

Example: 建造業議會 worker registration (Hong Kong)



Resources

- 身份證明卡和其他常用的漁工身份證明文件範本(<http://hckrn.st/2AGHdnO>)
- 國際勞工局 漁業強迫勞動和販運調查報告 (PDF:<http://hckrn.st/2iFFrwj>)
- 漁工身份證明卡範本和相關資訊(<http://hckrn.st/2jbb79Q>)
- 中小企業工作場所風險評估和管理訓練手冊(<http://hckrn.st/2kjbJgQ>)
- 泰國漁業安全和健康管理訓練手冊(<http://hckrn.st/2zIJIHU>)



Q2: 沟通與翻譯工具

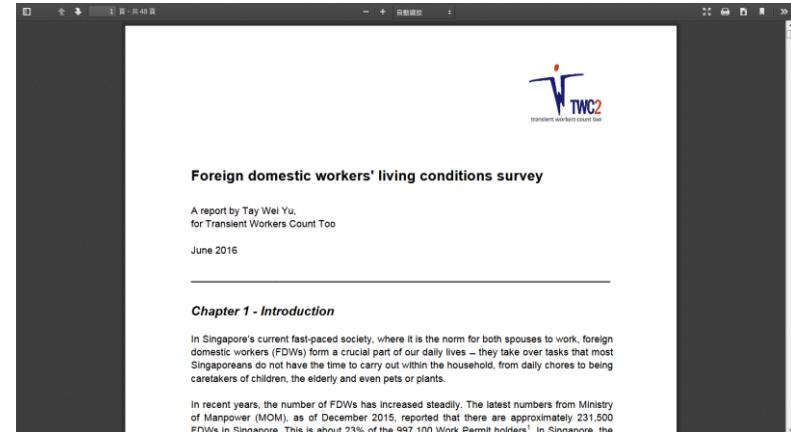
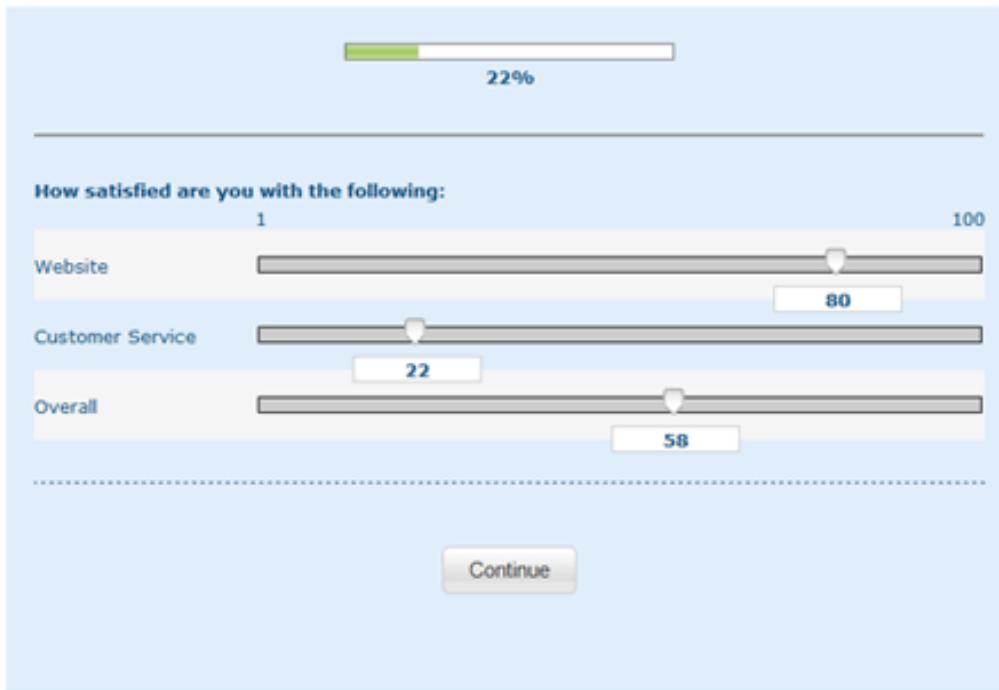
- Goals: 確保漁工和主管機關溝通無阻，讓主管單位能提供重要的資訊並詢問漁工的生活和工作狀況
- Potential solution: 一份調查問卷表單，以視覺或影像方式呈現，讓勞檢人員不須透過翻譯也能進行漁船檢查

Necessary elements (Q2)

- 可用現有智慧型手機或平板電腦下載
- 以視覺或影像方式呈現的介面，簡單易懂 (see example)
- 漁工可自行填寫，不須和稽查人員互動；數名漁工同時使用不同的裝置填寫調查表，節省勞檢人力
- 整合影音元素的方案，可迅速向漁工解釋勞檢內容
- 調查表單的選項可以拖曳滑桿的方式呈現，方便漁工作答 (see example)
- 具備即時數據分析功能，可立刻偵測並標記嚴重的違規情事，以便進行複查
- 具備警示系統，將嚴重的違規情事回報給稽查人員，或標記違規情事，以便日後再次進行勞動檢查時，加以留意

Example: Foreign worker living condition survey (Singapore)

Example of a slider question:



http://twc2.org.sg/wp-content/uploads/2016/07/FDW-Report_Final.pdf

Resources

- 視覺符號／標誌參考
(<http://hckrn.st/2kickKG2>)
- 泰國勞動部的問卷調查表範本(<http://hckrn.st/2Bxwed7>)
- 環境正義基金會對作業漁船上漁工的生活/工作情況調查表範本
(<http://hckrn.st/2zZkhAC>)
- 中小企業工作場所風險評估和管理訓練手冊
(<http://hckrn.st/2kjbJgQ>)
- 泰國漁業安全和健康管理訓練手冊(<http://hckrn.st/2zIJlHU>)



17 SDGs by the United Nations



SUSTAINABLE DEVELOPMENT GOALS



Q3: IUU 風險評估

- Keystone dialogue: 為了達到聯合國永續發展的目標(SDGs)，8個國際海鮮企業與科學家共同討論企業的社會責任
- Goals: 提供海鮮公司(買家)了解其漁獲來源是否來自 IUU 高風險區域，以避免從這些區域購買漁獲，進而減少IUU 行為
- Potential solution: 發展風險評估工具用以評估漁獲魚種來自非法捕魚、剝削勞工及貪腐區域之機率

8個跨國海鮮企業參與永續海鮮生產與健康海洋 議定

KEYSTONE DIALOGUES

Connecting science with industry leaders for biosphere stewardship

INITIATIVE STATEMENTS COMPANIES VIDEOS SCIENTIFIC BACKGROUND SONEVA DIALOGUE STOCKHOLM DIALOGUE

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Companies committed to the initiative

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THE INITIATIVE

Seafood Business for Ocean Stewardship

Seafood Business for Ocean Stewardship is an initiative that, for the first time, connects the global seafood business to science, connects wild capture

<http://keystonedialogues.earth/#initiative>

Necessary elements (Q3)

- 風險資料庫：非法捕魚、非法漁船、侵犯人權案件數量、貪腐指數的資料庫
- 海鮮公司(買家)資料：魚種名稱、漁獲位置、漁獲量、供應商名稱、船隻名稱、中盤商名冊
- 將以上兩個資料庫進行整合，以幫助買家了解購買風險，以減少風險；例如，判斷某魚種是否來自高或低 IUU fishing區域，某漁業產地是否曾發生人權侵害事件、缺乏管理、貪腐？

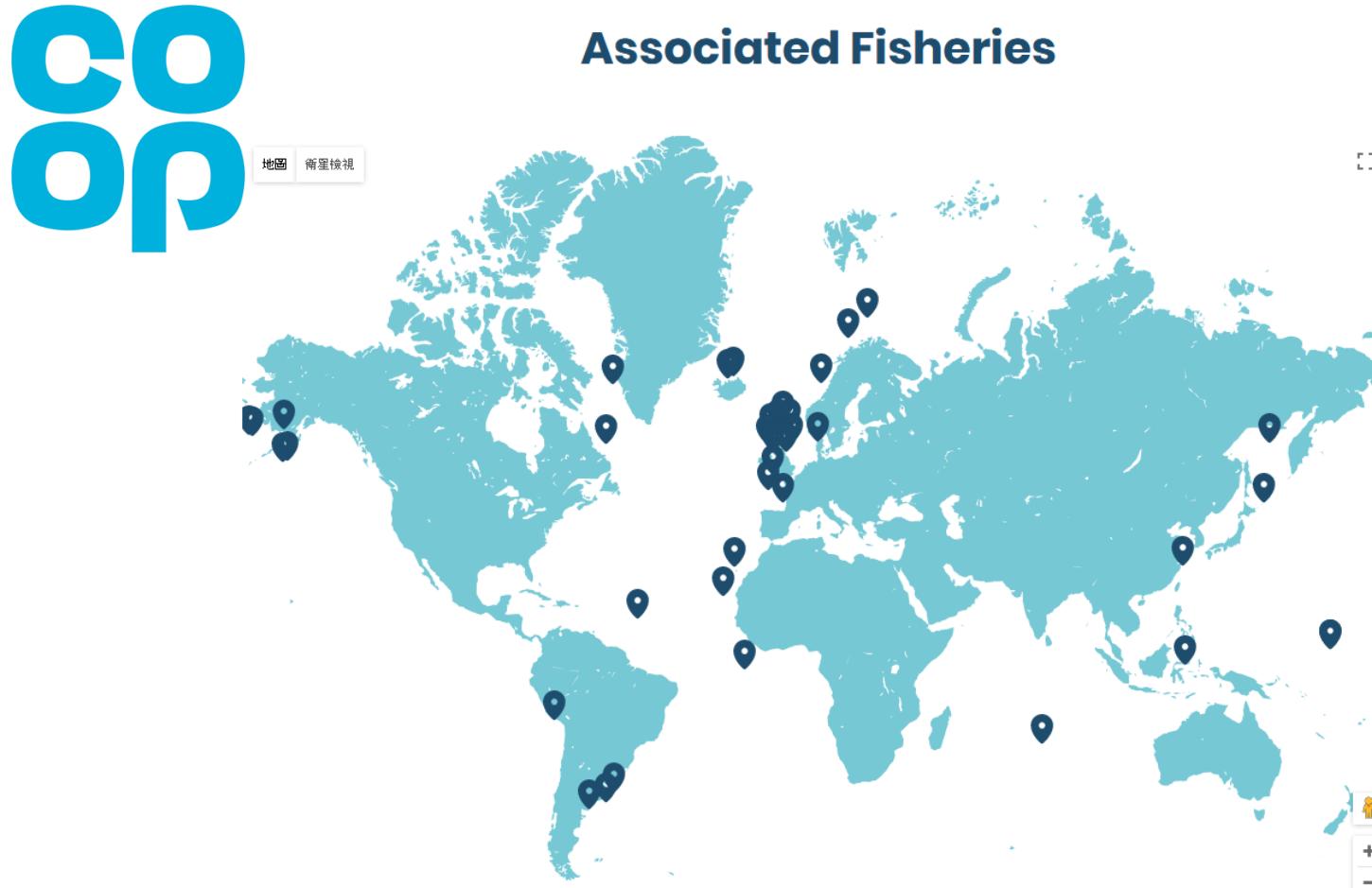
Example: 高風險非法漁撈的海洋區域

Table 1. Summary of regional estimates of illegal fishing, averaged over 2000–2003.

Region	Reported catch of case study species	Catch of case study species as a percentage of total regional catch	Lower estimate of illegal catch (t)	Upper estimate of illegal catch (t)	Lower estimate of value (US\$m)	Upper estimate of value (US\$m)
Northwest Atlantic	557,147	25%	22,325	82,266	20	74
Northeast Atlantic	6,677,607	60%	364,908	842,467	328	758
Western Central Atlantic	390,942	22%	21,745	58,514	20	53
Eastern Central Atlantic	1,154,586	32%	294,089	562,169	265	506
Southwest Atlantic	1,403,601	65%	227,865	673,712	205	606
Southeast Atlantic	1,351,635	79%	52,972	139,392	48	125
Western Indian	2,165,792	52%	229,285	559,942	206	504
Eastern Indian	2,263,158	44%	467,865	970,589	421	874
Northwest Pacific	7,358,470	32%	1,325,763	3,505,600	1,193	3,155
Northeast Pacific	196,587	7%	2,326	8,449	2	8
Western Central Pacific	3,740,192	36%	785,897	1,729,588	707	1,557
Eastern Central Pacific	1,374,062	73%	129,772	278,450	117	251
Southwest Pacific	451,677	61%	5,227	32,848	5	30
Southeast Pacific	9,799,047	73%	1,197,547	2,567,890	1,078	2,311
Antarctic	136654	100%	9593	9593	9	9

Agnew et al. 2009 Estimating the Worldwide Extent of Illegal Fishing

Example: Co-op 公司的漁獲產地來源



Source: [Ocean Disclosure Project](https://oceandisclosureproject.org/companies/co-op),
<https://oceandisclosureproject.org/companies/co-op>

Resources

- 風險資料庫: (<http://hckrn.st/2zYcXoM>), FishWise 整理的漁業侵害人權資料(PDF: <http://hckrn.st/2zZ3r56>), 及其他 (see Google Sheet: <http://hckrn.st/2jGy8Rv>)
- 漁獲供應商資料(包括魚種名稱、漁獲地點、漁獲量、生產公司、船籍等:
<http://hckrn.st/2AE8kjh>、
<http://hckrn.st/2iFNF7F>
- keystone dialogues 漁業企業的海洋責任與管理
(<http://hckrn.st/2zYjPTi>)

Q4: 海洋保護區之漁業規範

- Goals: 讓漁民根據漁船的作業船位查詢該區域相關的捕撈規定，以文字和圖像呈現資訊
- Potential solution: 漁船上的定位系統需顯示海洋保護區的範圍，並且在船進入保護區後，定位系統會自動發出警示聲以及顯示漁業作業的限制或規定

Features of Marine Protected Areas Worldwide

No-Use Zone

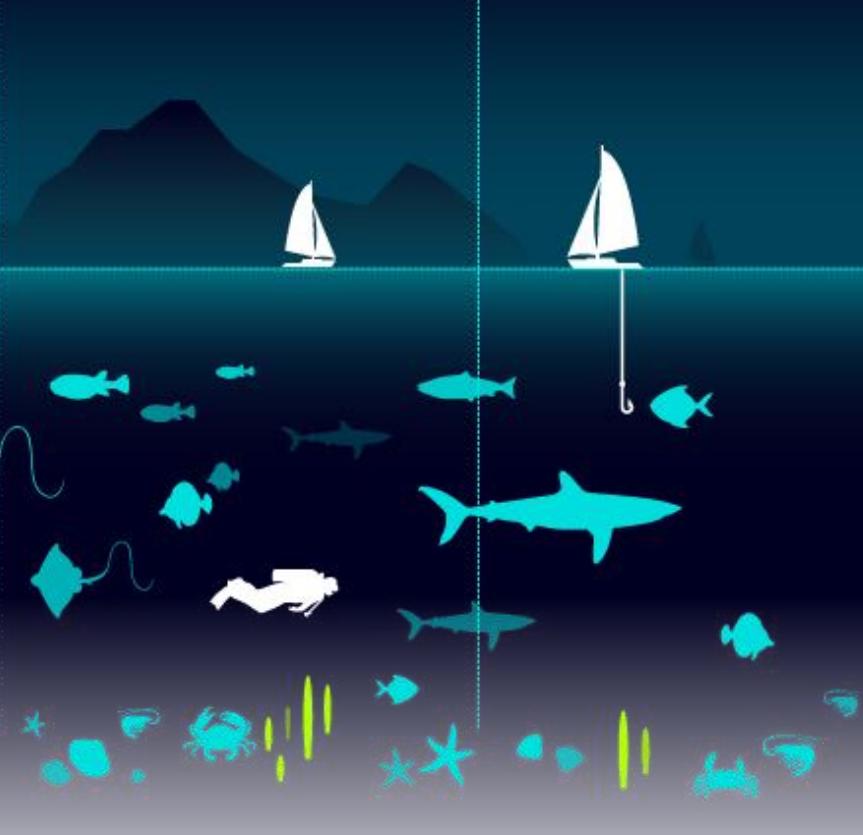
No activities permitted.



No-Take Zone

Measures are taken to protect species whose populations may be affected in other zones/areas. Examples include spawning and nursery grounds.

Non-extractive activities are permitted, such as diving and mooring.



Buffer Zone

Transitional zones from no-take zones to multiple-use zones.

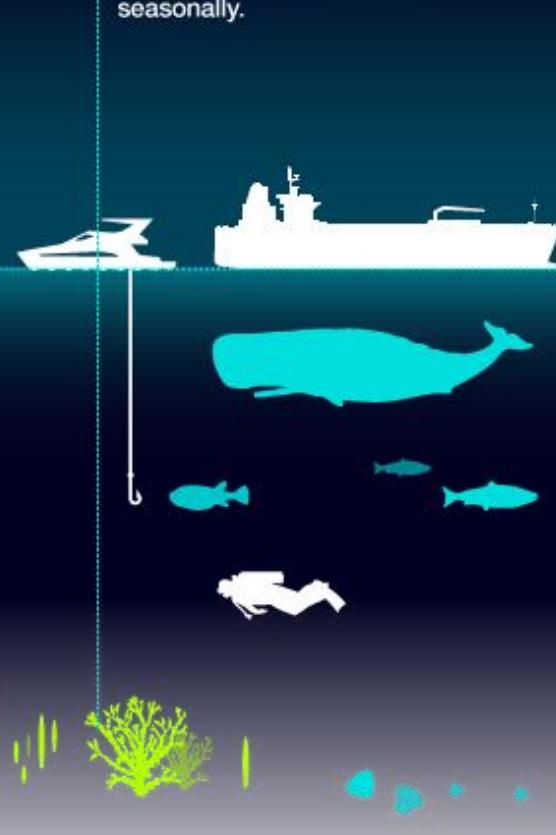
Moderate activities, such as hook-and-line fishing, limited aquaculture, and limited tourism are permitted.

Multi-Use Zone

All tourism, fishing and aquaculture activities permitted.

Permitted activities include diving and snorkeling, artisanal fishing, large-scale commercial fishing, and aquaculture.

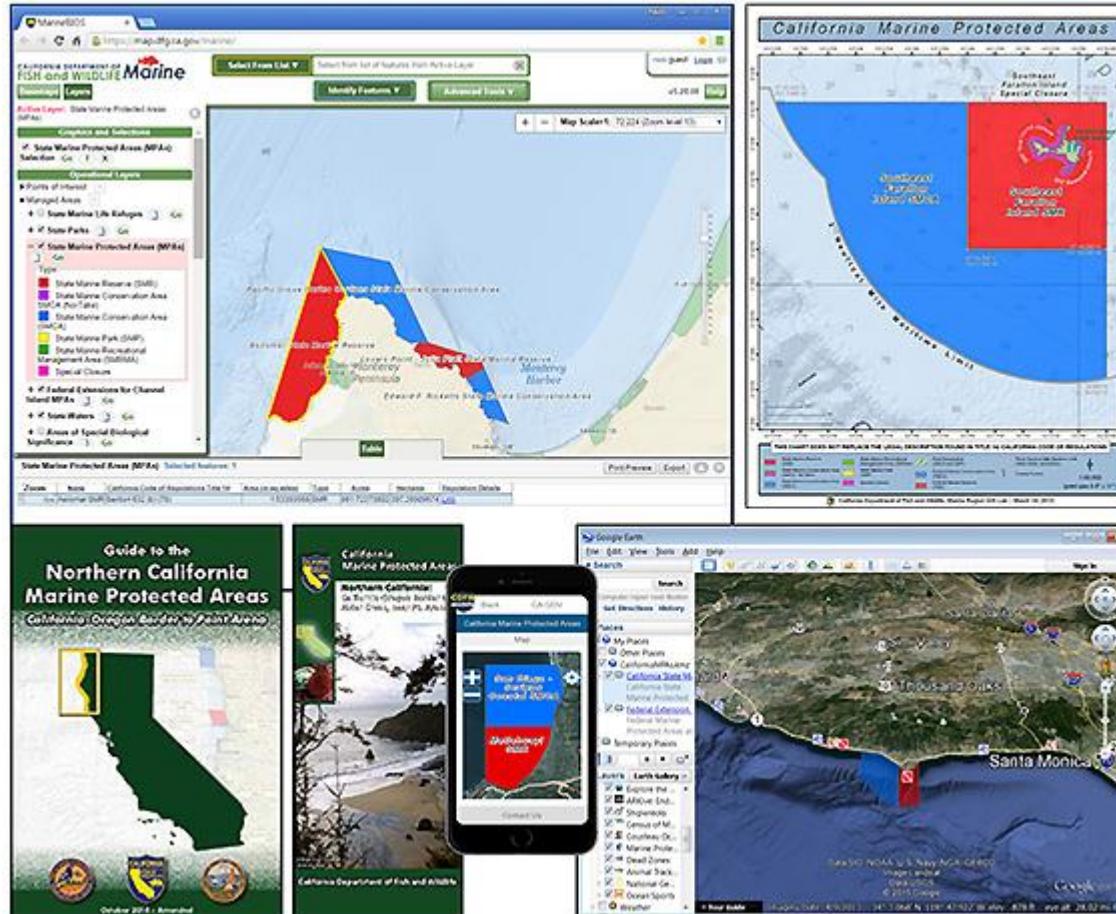
Activities may be restricted seasonally.



Necessary elements (Q4)

- 保護區管理須針對漁具，例如禁止底拖網，仍可進行中層拖網
- 沿近海漁業的船隻小，船上的電子設備也通常不太先進，但此工具仍需提供這些船隻保護區的管理規定
- 此工具必須可裝設在手機上，其GPS功能應該要能夠連結漁船上的GPS，顯示這台裝置在保護區域的位置。透過此裝置可驅動船上的警示系統來播放訊息：例如“您已經進入捕撈螯蝦禁區，請禁止使用撈網捕撈螯蝦。”

Example: A GPS with a map of MPA



<https://cdfwmarine.files.wordpress.com/2015/06/mpa-maps-cdfw1.jpg>

Resources

MPAtlas 全球海洋保護區
地圖，Marine
Conservation Institute:
[http://www.mpatlas.org/
data/download/](http://www.mpatlas.org/data/download/)

New marine protected area (MPA) mobile
website (CA, USA)



<http://www.dfg.ca.gov/m/MPA>

Q5: 魚種辨識

- Goals: 將臉部辨識技術應用在魚種辨識上，有助於提升魚種辨識的效率，幫助改善漁業管理和魚類保育
- Potential solution: 手機應用程式，結合手機相機進行魚隻照片的影像處理

Necessary elements (Q5)

- 能夠標示魚隻被捕獲的地理位置
- 根據魚隻出沒的地理位置，在進行辨識時，刪選出可能的魚種
- 利用影像辨識技術來辨認魚隻的科或種(正確率需達到80%以上)
- 影像辨識技術可用於所有照片品質(不受背景或照片處理的影響)
- 辨識結果輸出格式多元 (e.g., sql, json, etc.)
- 辨識結果可連結其他資訊 (e.g., 漁具使用或魚體長)

Example: Fish identification tool



<https://www.prnewswire.com/news-releases/new-app-identifies-fish-informs-of-regulations-in-seconds-300382321.html>

台灣白帶魚種類 (根據 DNA)

A) *Tentoriceps cristatus*



C) *Trichiurus japonicus*



B) *Trichiurus nanhaiensis*



D) *Trichiurus lepturus*



Wang et al. 2017



Resources

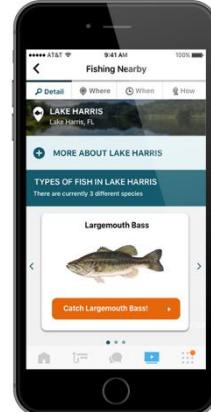
- FishBase

<http://www.fishbase.org/search.php>

包括 > 30000 魚種分布與 >50000 影像資料

- Test dataset: google images of fishes, ReelSonar Inc. NetFish app 提供超過 20000 漁獲照片

<https://reelsonar.com/pages/netfish>



臺灣魚類資料庫



魚類生態照片 (收錄已鑑定魚種照片 3862 張) 搜尋

顯示：科中文名 科名 中文名 學名 拍攝日

◀◀◀▶▶▶ 1 2 3 4 5 6 7 8 9 10 第 1 / 61 頁 8 行 8 列

Q6:永續漁業經營和認證

- Goals: 提供管道，促進研究人員和漁民合作與交流，幫助漁業進行永續認證
- Potential solution: 設計一個應用程式，媒合漁產業者和研究單位合作(類似交友軟體)

Marine Stewardship Council (MSC)

海洋管理委員會的永續認證

- MSC 認證標準：魚群永續、減少環境衝擊、有效管理
- 好處：永續漁業、Ecolabelling 潮流、開闢市場區位
- 評估流程(6-18 months): 包括與此漁業相關的個人或公司間的同儕評估
- 認證期限5年(每年需抽查)



Necessary elements (Q6)

- 研究人員可在應用程式中建立自己的個人檔案，內容包括自我介紹、推薦信函、經驗、研究經驗和方便聯絡的時間
- 漁產業者的簡介則可詳列捕撈魚種、作業地點、作業船型和研究需求等
- 雙方必須要“同意接受”配對才能開始聯絡和傳送訊息，以避免垃圾郵件
- 這個程式可以讓漁產業者認識海洋管理委員會的各項漁業的增能工具，業者可以利用這程式自主學習，逐漸升級達到永續經營(MSC)

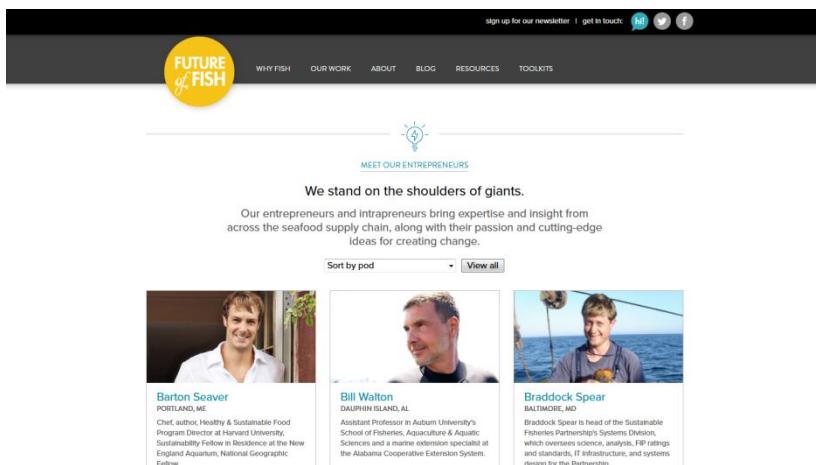
Resources (漁撈業者名單)

- *Fishery Progress* <https://fisheryprogress.org/> 包括各種正在進行永續認證的漁業及其研究需求
- <http://seafoodsustainability.org/fisheries/>

The screenshot shows the homepage of FISHERYPROGRESS.ORG. The header includes the site name, a sub-header 'Fishery Improvement Project Progress Tracking Database & Tools', and links for 'Create New Account' and 'Log In'. A prominent yellow button says 'Add or Update a FIP'. The main navigation bar has links for 'FIP Directory', 'How to Use This Site', 'Resources', 'About Us', and 'Contact'. Below the navigation is a large banner image of fish swimming in the ocean. The central content area is titled 'FIP Directory' and features a search bar with dropdown menus for 'Species', 'Gear Type', and 'Location', and input fields for 'FIP Name', 'Search', and 'Clear'. A section titled 'Recently Updated FIPs' lists several entries: 'PROSPECTIVE Irish prawn - otter trawl', 'Indonesia South Kalimantan shrimp - trammel net', 'Morocco sardine - pelagic trawl and seine / Maroc sardine - chalut pélagique et senne', 'Northern Brazil Caribbean red snapper - hook & line and pot/trap', 'PROSPECTIVE Mauritania octopus - bottom trawl/trap', 'PROSPECTIVE Shantou-Taiwan Chinese common squid - jigging/light-lift net/single trawl', 'Nicaragua Caribbean spiny lobster - trap', 'Mexican Pacific shrimp - bottom trawl', and 'Japan albacore tuna - longline'. The footer contains a copyright notice: '© 2010 Marine Photobank'.

Resources (研究人員名單)

- Ecologists Without Borders
<http://ecowb.org/the-team/>
- Future of Fish
<http://futureoffish.org/entrepreneurs>

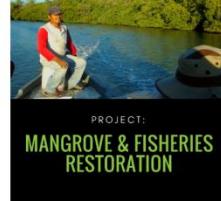
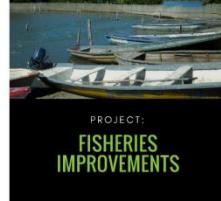


The screenshot shows the homepage of Future of Fish. At the top, there's a navigation bar with links for 'sign up for our newsletter' and 'get in touch' along with social media icons for LinkedIn, Twitter, and Facebook. Below the navigation is a yellow circular logo with the text 'FUTURE of FISH'. The main content area features a section titled 'MEET OUR ENTREPRENEURS' with the tagline 'We stand on the shoulders of giants.' It explains that entrepreneurs and intrapreneurs bring expertise and insight from across the seafood supply chain. A dropdown menu allows users to 'Sort by pod' or 'View all'. Below this, there are three columns of profiles:

- Barton Seaver** (PORTLAND, ME)
Chief Advisor, Healthy & Sustainable Food Program Director at Harvard University, Sustainability Fellow in Residence at the New England Aquarium, National Geographic Fellow.
- Bill Walton** (BIRMINGHAM, AL)
Assistant Professor in Auburn University's School of Fisheries, Aquaculture & Aquatic Sciences and a marine extension specialist at the Alabama Cooperative Extension System.
- Bradford Spear** (BOSTON, MA)
Bradford Spear is head of the Sustainable Fisheries Partnership's Systems Division, which oversees science, analysis, FIP ratings and standards, IT infrastructure, and systems design for the Partnership.

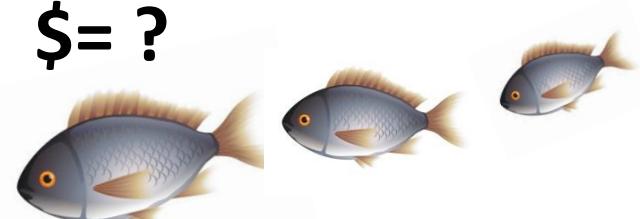


The image displays a grid of six project cards, each featuring a small thumbnail image, the project name, and a brief description.

 PROJECT: AMAZON MEGAFISH MIGRATION	 PROJECT: BELIZE LIONFISH	 PROJECT: KENYA WATER HYACINTH
 PROJECT: SANTA ROSALIA FISHERIES	 PROJECT: MANGROVE & FISHERIES RESTORATION	 PROJECT: FISHERIES IMPROVEMENTS

Q7: 市場價格透明

- Goals: 幫助漁民取得市場的成交價格資訊，以確保價格公平穩定
- Potential solution: 手機程式讓漁民能夠即時回報魚價並比較買方價格，將買賣雙方的獲利最大化

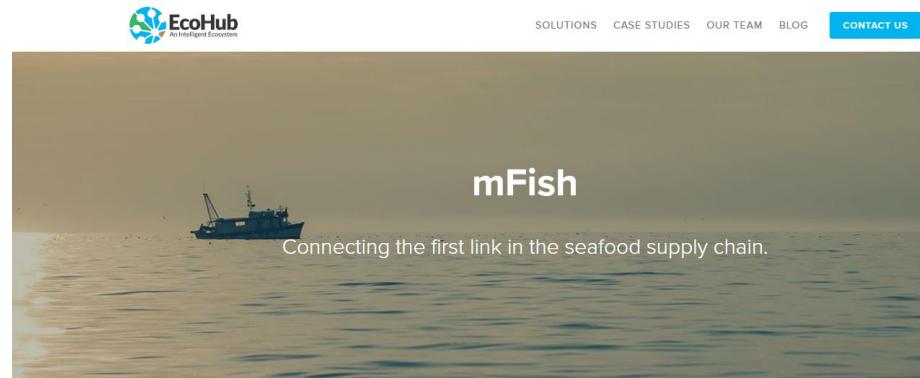


Necessary elements (Q7)

- 此程式必須適用於智慧型裝置和傳統手機的作業環境
- 可提供個人化功能設定提高用戶(尤其是漁夫)的使用率，例如增加天氣預報、海象圖、求救快速鍵、燃料價格等選項
- 能透過標記地理位置、魚種照片、魚種名稱(學名或普通名)以辨識交易魚種
- 可精確地掌握特定區域的魚市走向，提供買家詳細的漁獲資料，並可追蹤魚種產銷鏈

Resources

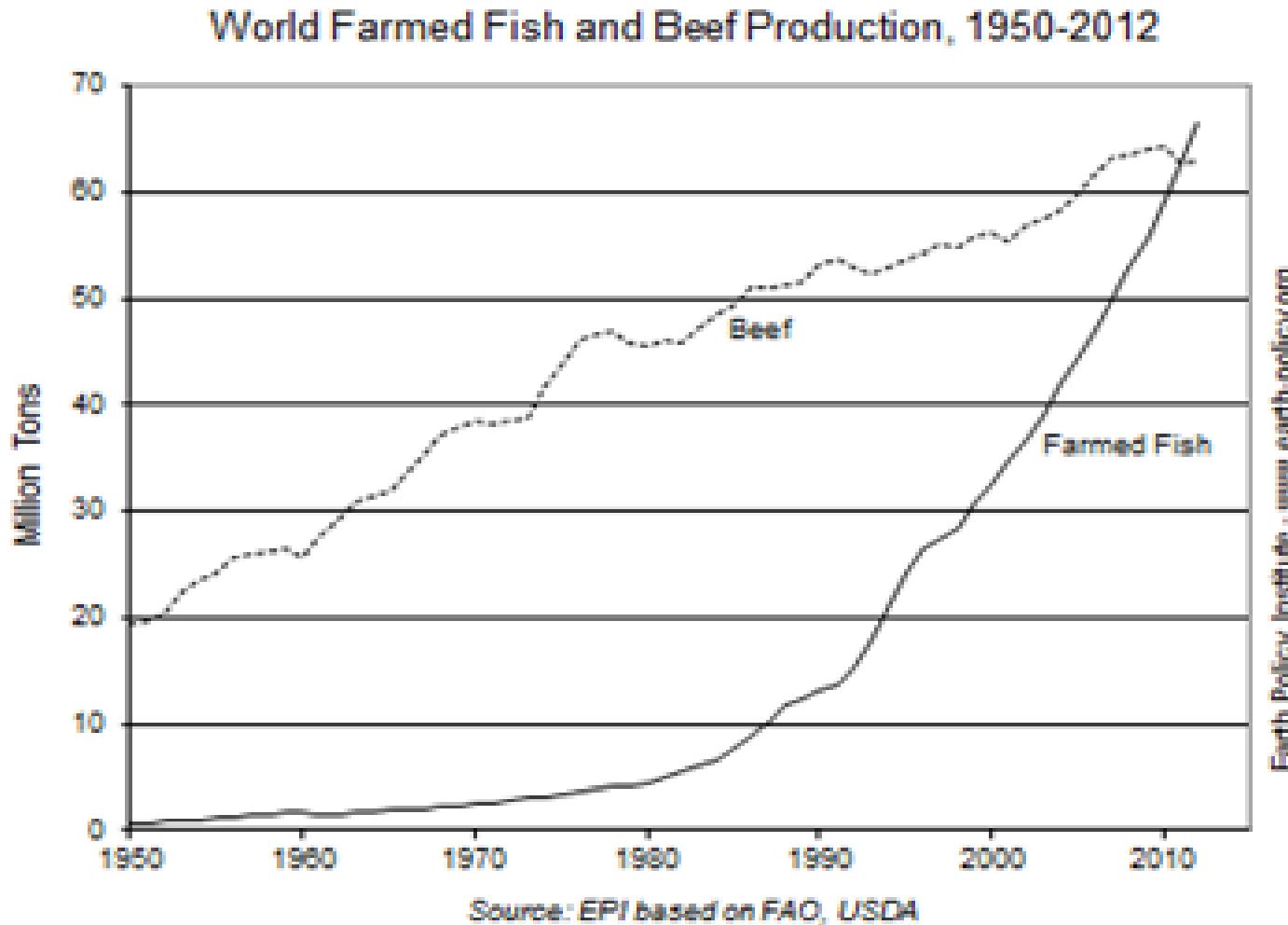
- EcoHub mFish:
<https://ecohub.global/mfish>
- Abalobi 資訊平台提供消費者及漁民交流
<http://abalobi.info/app-suite/>
- 魚種名稱: (Google Sheet:
<http://hckrn.st/2AqnITm>)



In order to trace our seafood back to the source and gather the necessary data to ensure it is safe, legal and sustainable we need to connect directly with those at the point of harvest.



Global production of farmed fish exceeds that of beef in 2011



Q8:永續水產養殖

- Goals: 從飼料價格、環境衝擊和營養成分的比較找出適當的飼料，提升水產養殖永續性
- Potential solution: 設計工具幫助水產養殖業者了解各種魚飼料（例如黃豆、魚粉、海藻、昆蟲等）的營養價值、適用魚種及區域、對環境的影響、以及鄰近的供應商名冊。

Necessary elements (Q8)

- 這項工具可以供養殖業者、消費者或其他關心魚飼料影響的民眾使用
- 列出不同魚飼料(如黃豆或魚粉)，提高對環境友善的魚飼料的能見度(海藻、昆蟲等)
- 飼料對環境的影響須包括多種面相(例如土地使用、溫室氣體排放等)，並考慮原物料的價格、不同飼料的健康影響／營養
- 全球水產養殖的80%來自亞洲的養殖業者，因此此產品需考慮這些使用者
- 這項工具可讓使用者存取資料，並且這些資料是對外公開的。您必須思考要如何呈現這些資料（例如如何為每項飼料或水產品的環境衝擊評分以及推廣策略）

Resources

Sustainability of raw animal material
of aquatic origin



Sustainability of vegetable materials
of terrestrial origin



Sustainability of Fish Feed
in Aquaculture:

Reflections and Recommendations

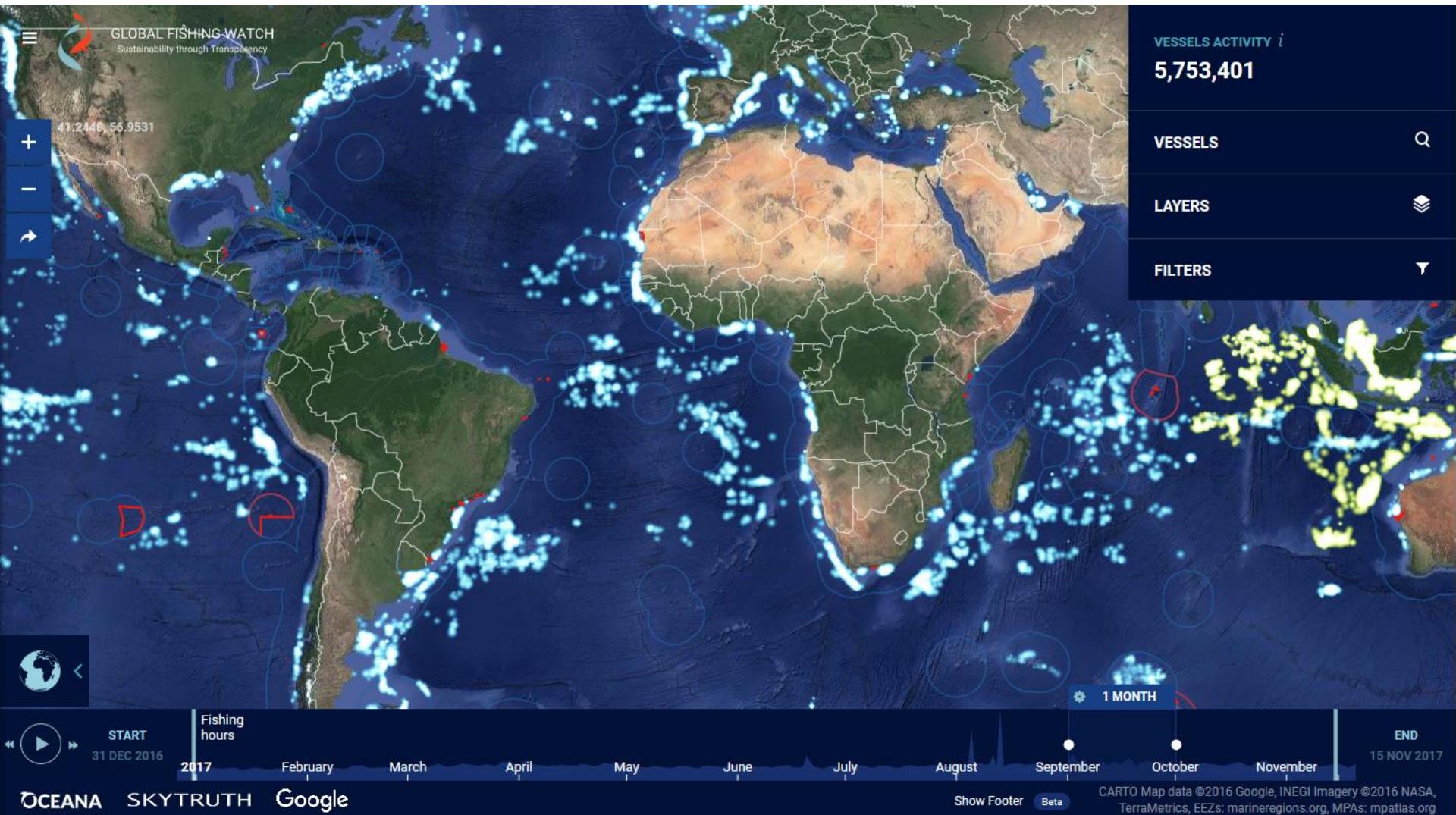


<https://portals.iucn.org/library/sites/library/files/documents/2017-026-Summ.pdf>

Sustainability of raw materials
produced from algae



Global Fishing Watch: expand transparency in commercial fishing



Q9. 港埠識別

- 港埠為 “漁船船隻頻繁出沒地區”
- Goals: 識別、追蹤和監控 “港埠” 將能掌握漁船的漁獲卸貨地點，為相關單位、購買方和供應商強化供應鏈的透明度
- Possible solution: 利用 Global Fishing Watch 的 AIS 及 VMS 資料庫設計一項程式，根據船位置、離岸距離、停泊船隻類型、基礎設施、船隻活動等，將漁船下錨地串聯歸類，辨識出可能的“港埠” 並且標記，以追蹤船隻的作業活動

Necessary elements (Q9)

- 港埠的形成可能為：捕魚熱點，船員靠岸休息，漁船裝卸漁獲，天候不佳時船隻進港避風等。錨地則是船隻停止移動，泊錨之處。
- 需要確認港埠或錨地的正確名稱並顯示於地圖上(例如根據鄰近城鎮的名稱)
- 從錨地資料庫辨識出港埠並將其分類：例如捕魚熱點，外籍漁船停泊港，轉運船停靠港(可能與IUU活動有關)，具基礎設施或僅供下錨，並找出錨地數量和港埠的關係

Resources

- Global Fishing Watch 錨地資料庫 (<http://hckrn.st/2iFPnpH>), 包括2012-2016自動辨識系統資料
- 全球港埠索引(已更新)
<http://hckrn.st/2khEKcW>
- 網站城市資料庫，用於港埠標籤使用(Pop. > 1000) (<http://hckrn.st/2ADDrvh>)
- Sentinel-1 衛星資料：可辨識海上船隻



Q10. 被動式IUU偵測

- Goals: 偵測保護區內的捕撈活動，幫助相關單位有效地進行監控
- Possible solution: 一套平價的被動式裝置，能夠架設在限捕區水域，協助監控該區域的漁業活動。這套裝置可利用聲納”監聽”限捕區水域的聲音，判別是否為漁業活動。漁業活動的聲音(包括引擎的噪音和絞盤的機械聲響) 頻率可達1kHz，在開放海域中可傳很遠

Necessary elements (Q10)

- 此裝置可用於海洋保護區監控或隨可預測之洋流施放
- 這套裝置必須防水，可用防水橡膠或塑膠製成
- 裝置可以利用電池式的微電腦或微控制機制來執行程式，以長時間偵測漁船及其各種作業活動（捕撈、撒網或只是單純路過）的頻率模式
- 這裝置需有錄音功能，例如利用壓電盤（水中麥克風），可用於監聽水中聲響，在各式新穎的聲音製造儀器上都可以找到它
- 團隊亦可挑戰設計一套通訊網絡，讓數個裝置同時偵測並彼此通報，找出疑似漁業活動的出沒地點
- 裝置的涵蓋範圍越大越好，硬體設備的造價則是越低越理想

Resources

- Sound samples: <http://hckrn.st/2AqNlO>

The screenshot shows a digital interface for managing sound samples. At the top, there is a search bar with a magnifying glass icon. Below it are three filter buttons: "Most recent", "Any Length", and "All libraries".

Below these filters, there are six entries, each representing a sound sample:

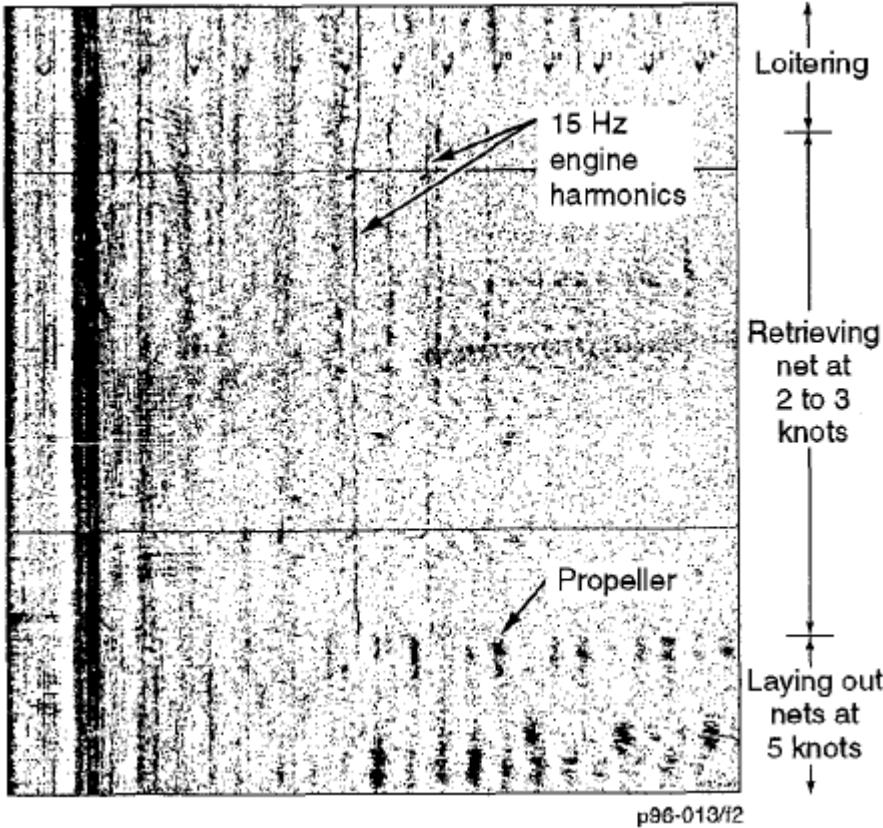
- Fishing lure impacts water - splash and thud.** (0:03) [+ more info](#)
- Boats clinking with pier fishing and seagulls, Coastal Ireland.** (2:54) [+ more info](#)
- Outboard motor revs.** (0:13) [+ more info](#)
- Fishing reel. Various speeds of unreel 3** (0:03) [+ more info](#)
- Fishing reel. Various speeds of unreel 1** (0:19) [+ more info](#)
- Fishing reel. Slower less steady unreel** (0:03) [+ more info](#)

Each entry includes a play button icon, a waveform preview, the file length, a star icon for favoriting, and download buttons for "mp3" and "wav".

Additional papers

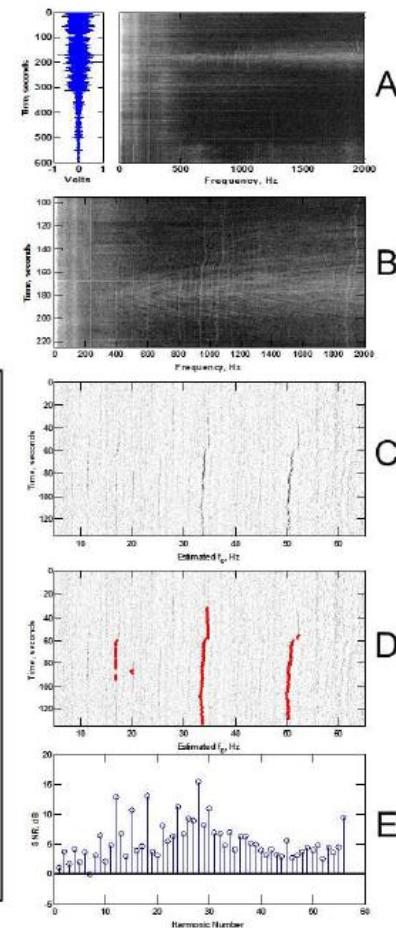
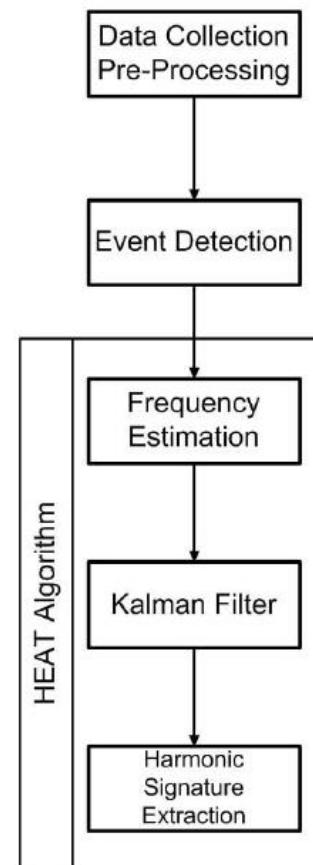
Monitoring High-Seas Fisheries With Long-Range Passive Acoustic Sensors

Ronald Abileah and David Lewis



Extraction of Small Boat Harmonic Signatures From Passive Sonar

George Lloyd Ogden
Portland State University



Q11. 內陸水域監測與通報

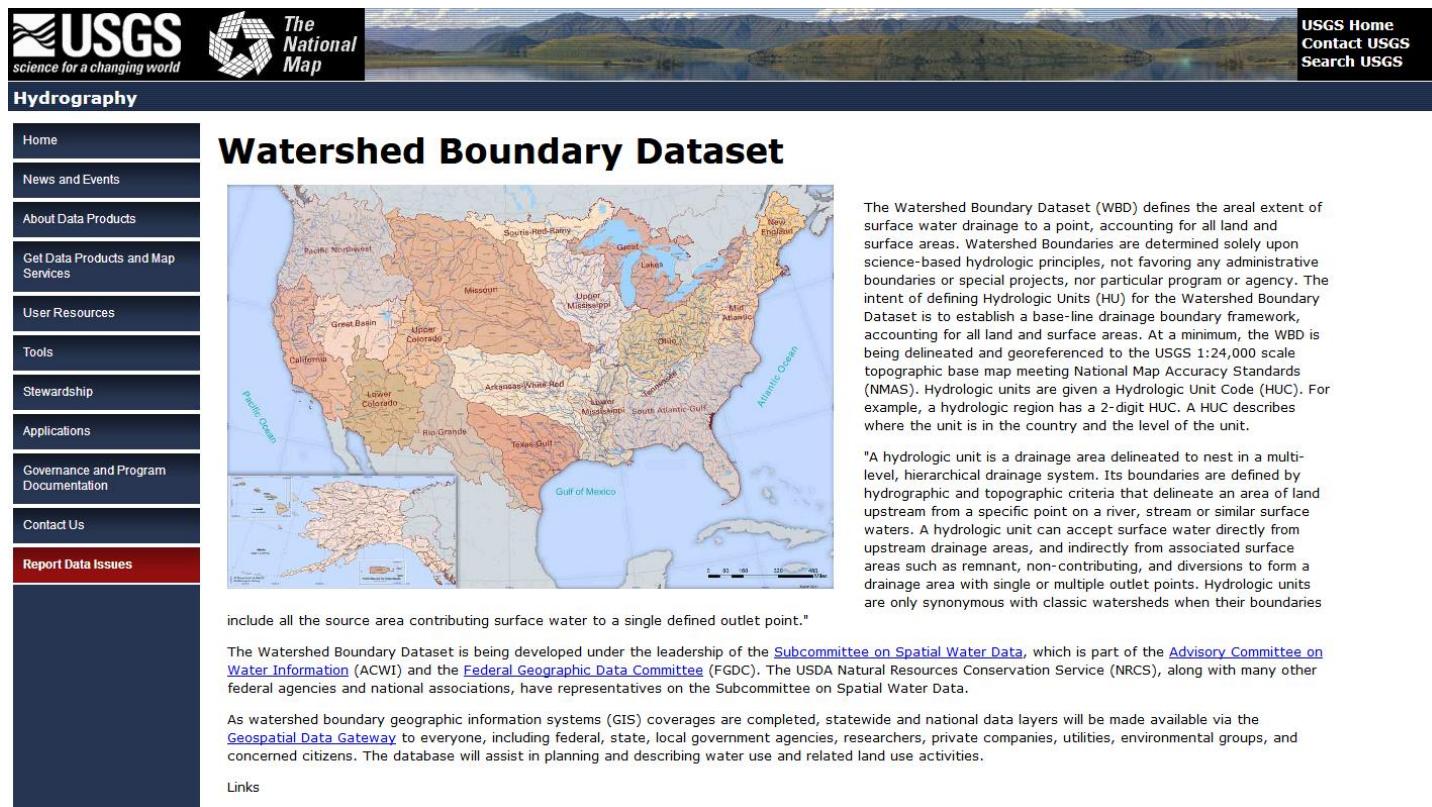
- Goals: 即時監測、發布內陸水域的環境情況(例如水面冰層厚度、藻華現象等)和魚種的出沒，以提高淡水生態系統的養護與管理
- Potential solution: 建立開放式的溝通平台，讓在淡水水域作業的船隻和漁夫即時通報環境或生物狀況(類似空氣品質監測系統)

Necessary elements (Q11)

- 用戶可回報多種事件，包括環境、生物、或釣客密度等，用戶可使用照片或簡訊通報
- 可將用戶的位置和特定的水域(或許是湖泊、河流或溪流)進行連結
- 程式可把所有回報的情況標誌並呈現在地圖上，並具備篩選功能，讓使用者自行選擇顯示或隱藏哪些情況
- 可供資源管理單位操作使用，記錄各項環境狀況，這些單位也可以自行設定其所希望使用的空間圖層(例如湖泊的多邊圖層)
- 可讓用戶訂閱通知

Resources

- 國家水道測量資料庫的水域名稱:
<http://hckrn.st/2Bt0Mws>



The screenshot shows the USGS Hydrography website. At the top, there are logos for USGS ("science for a changing world") and The National Map. To the right are links for "USGS Home", "Contact USGS", and "Search USGS". Below the header, a large banner image shows a scenic landscape of a lake surrounded by mountains. The main content area has a dark blue sidebar on the left with links to "Home", "News and Events", "About Data Products", "Get Data Products and Map Services", "User Resources", "Tools", "Stewardship", "Applications", "Governance and Program Documentation", "Contact Us", and "Report Data Issues". The main content area features a title "Watershed Boundary Dataset" above a map of the United States. The map displays various hydrologic regions color-coded by basin, including the Pacific Northwest, Great Basin, Colorado, Missouri, Mississippi, Ohio, Atlantic, California, Lower Colorado, Rio Grande, Arkansas, Texas, and South Atlantic-Gulf. The map also shows major rivers and lakes. A detailed description of the Watershed Boundary Dataset follows the map, explaining its purpose and definition. Below the map, there is a note about source areas contributing to outlet points, information about the development of the dataset, and details about GIS coverage availability.

Watershed Boundary Dataset

The Watershed Boundary Dataset (WBD) defines the areal extent of surface water drainage to a point, accounting for all land and surface areas. Watershed Boundaries are determined solely upon science-based hydrologic principles, not favoring any administrative boundaries or special projects, nor particular program or agency. The intent of defining Hydrologic Units (HU) for the Watershed Boundary Dataset is to establish a base-line drainage boundary framework, accounting for all land and surface areas. At a minimum, the WBD is being delineated and georeferenced to the USGS 1:24,000 scale topographic base map meeting National Map Accuracy Standards (NMAS). Hydrologic units are given a Hydrologic Unit Code (HUC). For example, a hydrologic region has a 2-digit HUC. A HUC describes where the unit is in the country and the level of the unit.

"A hydrologic unit is a drainage area delineated to nest in a multi-level, hierarchical drainage system. Its boundaries are defined by hydrographic and topographic criteria that delineate an area of land upstream from a specific point on a river, stream or similar surface waters. A hydrologic unit can accept surface water directly from upstream drainage areas, and indirectly from associated surface areas such as remnant, non-contributing, and diversions to form a drainage area with single or multiple outlet points. Hydrologic units are only synonymous with classic watersheds when their boundaries

include all the source area contributing surface water to a single defined outlet point."

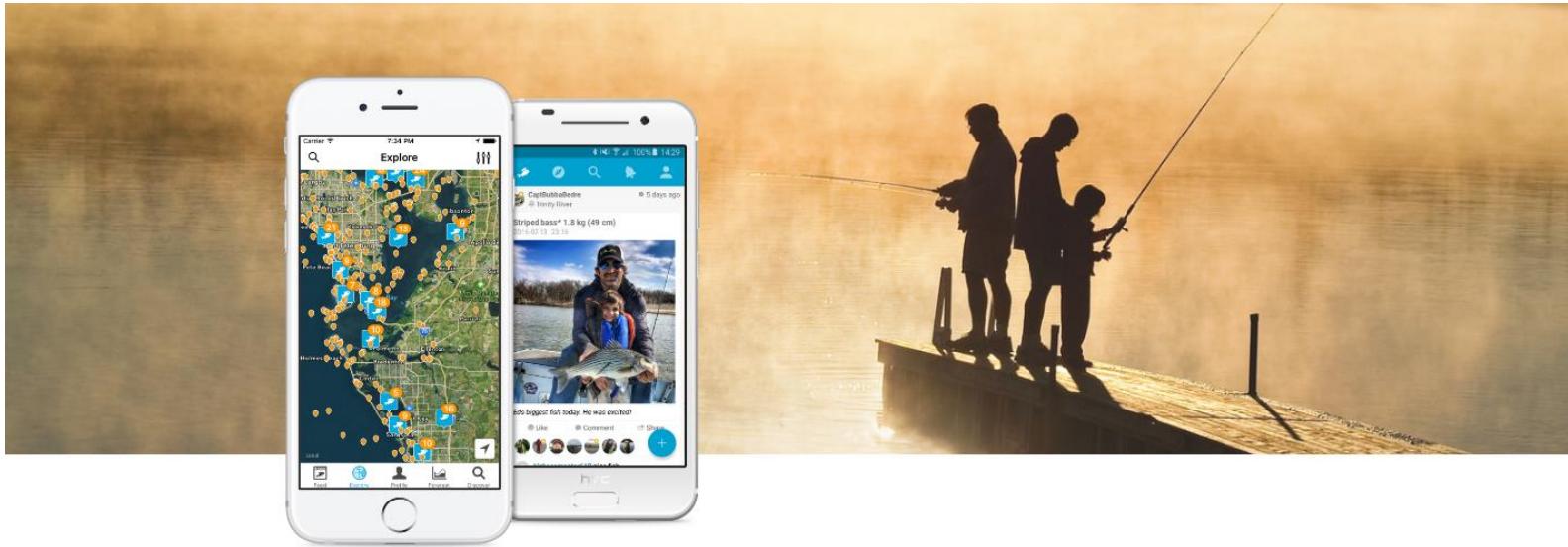
The Watershed Boundary Dataset is being developed under the leadership of the [Subcommittee on Spatial Water Data](#), which is part of the [Advisory Committee on Water Information](#) (ACWI) and the [Federal Geographic Data Committee](#) (FGDC). The USDA Natural Resources Conservation Service (NRCS), along with many other federal agencies and national associations, have representatives on the Subcommittee on Spatial Water Data.

As watershed boundary geographic information systems (GIS) coverages are completed, statewide and national data layers will be made available via the [Geospatial Data Gateway](#) to everyone, including federal, state, local government agencies, researchers, private companies, utilities, environmental groups, and concerned citizens. The database will assist in planning and describing water use and related land use activities.

Links

Additional resources

- Fishbrain釣客漁汛分享程式:
<http://hckrn.st/2kihYSa>



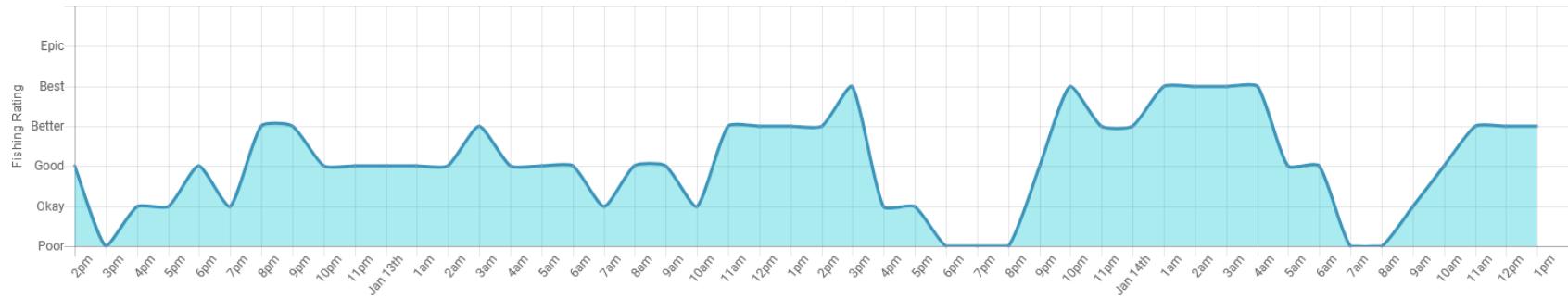
LOVE FISHING MORE

Discover 1.7 million fishing locations - at home and around the world.



Another app for tracking catch history

釣客程式，可記錄歷史漁獲量



<https://www.myfishingforecast.net/>

Tools for stable & sustainable fisheries

預祝 大家比賽順利 加油 \^-\^/

fishackathon ><>