Digital solutions for IOTC species identification

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Abstract
OFCF Japan has launched a new project from JFY2024 called “WEB based tool development for identification of IOTC species” under the IOTC-OFCF project in JFY2024. In JFY2025, OFCF Japan has launched a website specialized to provide digital information and tools which enables less experienced enumerators/observers to correctly identify the IOTC species. This website contains; IOTC species description, IOTC species photo library, YouTube videos, and “ID tool for IOTC species.” By combining these digital solutions, enumerators/observers would be able to conduct species identification on landing sites using their smartphones/tablets.

1 Introduction

Species identification (species ID) of IOTC target species has long been an issue in the IOTC, preventing data collection of catch statistics by species (IOTC 2024). A major challenge is enumerators/observers to learn and memorize the key morphological characteristics to identify species and apply those knowledge onsite. To facilitate this process, a handy booklet (IOTC Species Identification Guides) has been developed so far. However, those booklets had constraints in translation to multiple languages and distribution (IOTC 2013, IOTC 2025). Workshops for training species ID have also been organized by the IOTC. However, there has been a limitation in the number of participants and dissemination of knowledge by the participants after the workshop. To overcome these difficulties confronted in the IOTC, a user-friendly species ID supporting tool which is low cost and available anywhere is anticipated.
Development of digital tools could be one of the solutions. Internet connection is becoming ubiquitous worldwide, even available offshore (Raman et al. 2023). Use of smartphones/tablets for fisheries data collection were confirmed in 80% of the coastal states at the point of 2023, which could become more common in the future (OFCF Japan 2023). If a user-friendly digital ID tool, practical and low cost for species ID would become available, it will make a significant improvement in the capacity to collect catch data by species in the IOTC. In this paper we present the concept and components of the digital tools that OFCF Japan had newly developed since JFY2024.

2 Concept and components of the Digital Tools

2.1 Essential steps in acquiring the ability to identify species

Fig. 1 shows the essential step in acquiring the ability to identify species, assuming enumerators/observers as a target. First, one must know the target species itself and understand the morphological characteristics that distinguish it from other species (knowledge of taxonomy). One must also know co-occurring species similar to the target species. Second, one must practice correct identification using the knowledge of taxonomy. Finally, by accumulating correct identification in different sizes and conditions, one will achieve a good ability to identify the target species correctly.
At present, constraints exist in each step. Cases may occur that one has difficulty in accessing an organized and comprehensive knowledge of the target species in the first place. Without referring to the correct knowledge, practicing species identification will be difficult, which makes the enumerators/observers unconfident on species identification. As a result, accumulating experience will take a long time or sometimes be difficult.

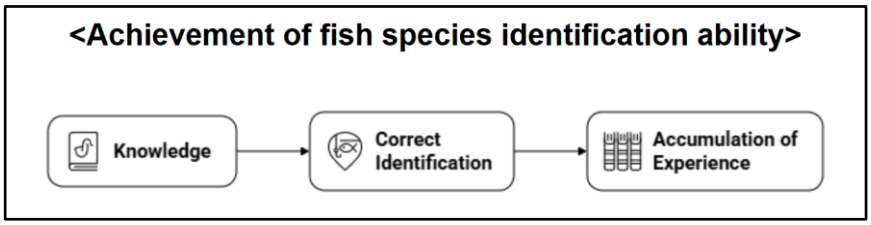

Fig.1 Essential steps in acquiring the ability to identify species

If knowledge and tools that support species identification become available regardless of location and time, acquiring the ability to identify fish species would be greatly facilitated. Digital information and tools are such means for improvement (Digital solutions), as most enumerators/observers are using smartphones/tablets during their onsite activities.

2.2 Components and concepts of Digital tools developed by OFCF Japan

Fig.2 shows the components and concept of the digital tool that OFCF Japan has developed in JFY2025. In consideration of the present constraints that enumerators/observers may face onsite, OFCF Japan has developed a Website, Web application and Photo library which supports species identification. Details of each component are given below.

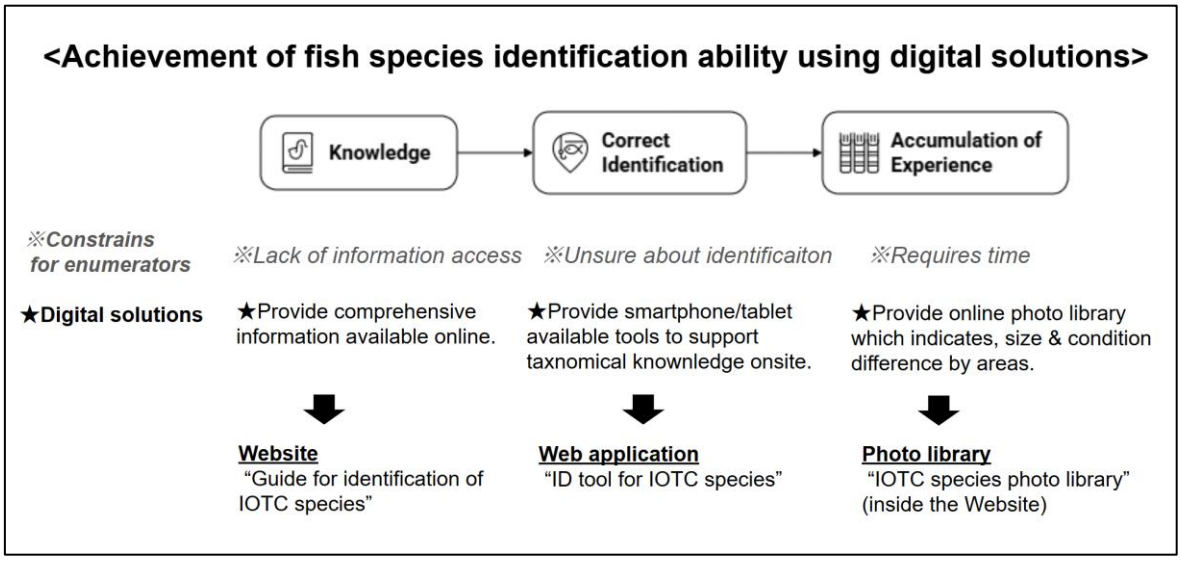

Fig.2 Components and concept of the digital tools that OFCF Japan has developed to support fish species identification by enumerators/observers.

2.2.1 Website - "Guide for identification of IOTC species"

The website "Guide for identification of IOTC species" contains the most comprehensive information among all digital tools. This website also functions as an information hub where all valuable content is consolidated in one location. Species targeted on the website is given in Appendix I. The main contents of the website are as follows.

2.2.1-a Characteristics of species

Fig.3 shows an example of the "Characteristics of species" contents. The "Characteristics of species" page offers comprehensive information on the morphological and ecological characteristics of species. Prepared in a web-based format, it can integrate a wide range of information; size-related morphological variations, growth information, and identification notes on a single page.

Furthermore, this website specifies quantitative diagnostic features, such as number of fin spines and soft rays, which are not included in the current IOTC Species Identification Guides.

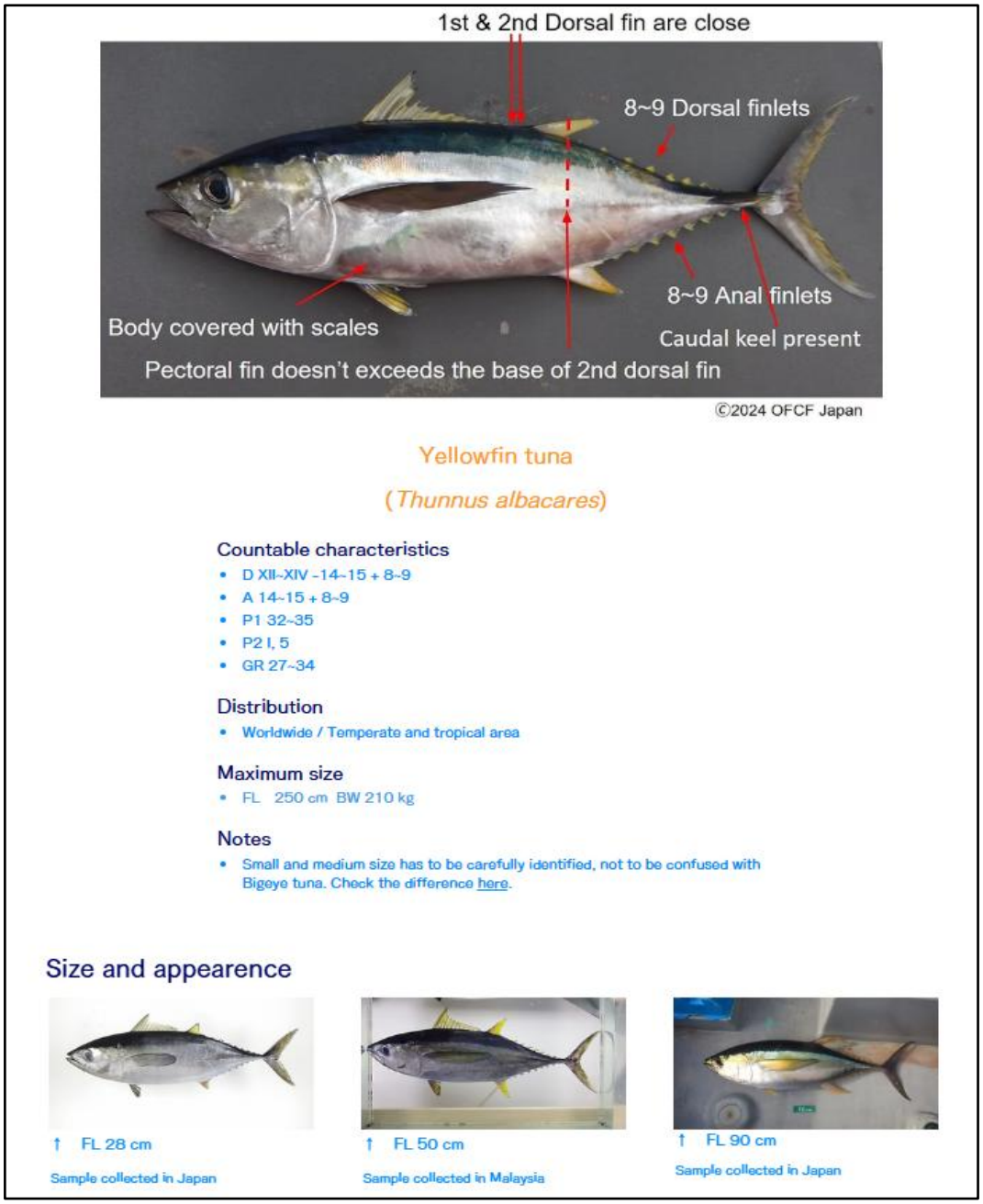

Fig.3 Example of the "Characteristics of species" page.

2.2.1-b Identification of confusing species

Fig.4 shows an example of the “Identification of confusing species” contents. Although the contents of the “Characteristics of species” explains well the species morphological characteristics, some species are similar in appearance. For these species, the differences between the two should be shown side by side and explained in a clear and easy-to-understand way. The “Identification of confusing species” page is specialized to give a special guidance shown side by side on how to distinguish species similar in appearance, such as Yellowfin tuna & Bigeye tuna, and Bullet tuna & Frigate tuna.

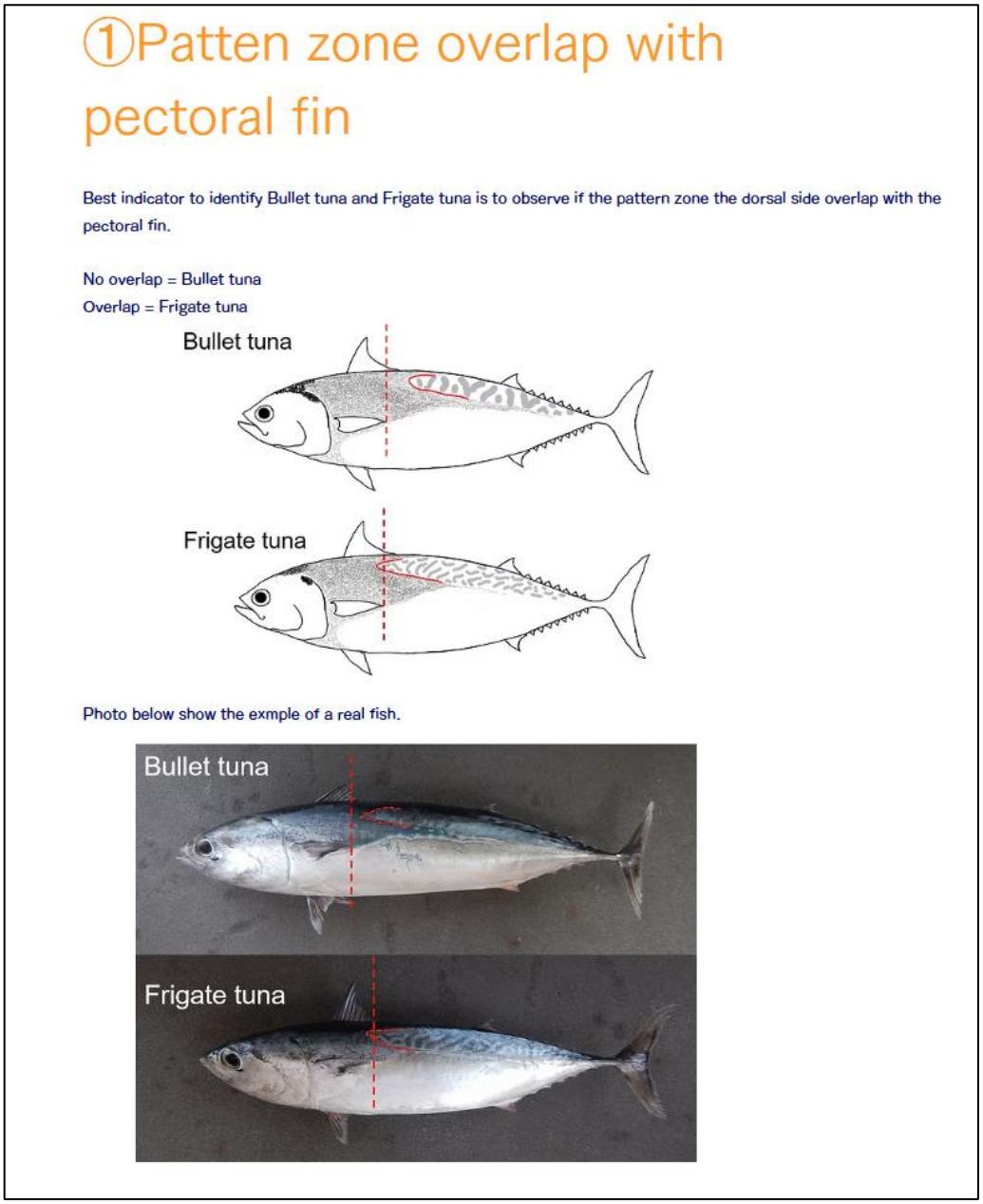

Fig.4 Example of the “Identification of confusing species” page. Overlap of the pattern zone with pectoral fin for Bullet tuna and Frigate tuna is shown by illustrations and photos.

2.2.1-c IOTC species photo library

Fig.5 shows the example of the “IOTC species photo library” contents. The “IOTC Species Photo Library” page provides a list view that displays all available photos by species, sizes, and oceans. Users can sort the photos by species and oceans to find the images they need. When selecting an individual photo, users are directed to an item page, where more detailed descriptions of the fish, as well as information on regulations for secondary use (copyright) and appropriate ways to acknowledge the photo owners are indicated. Fig.6 shows the example of the item page.

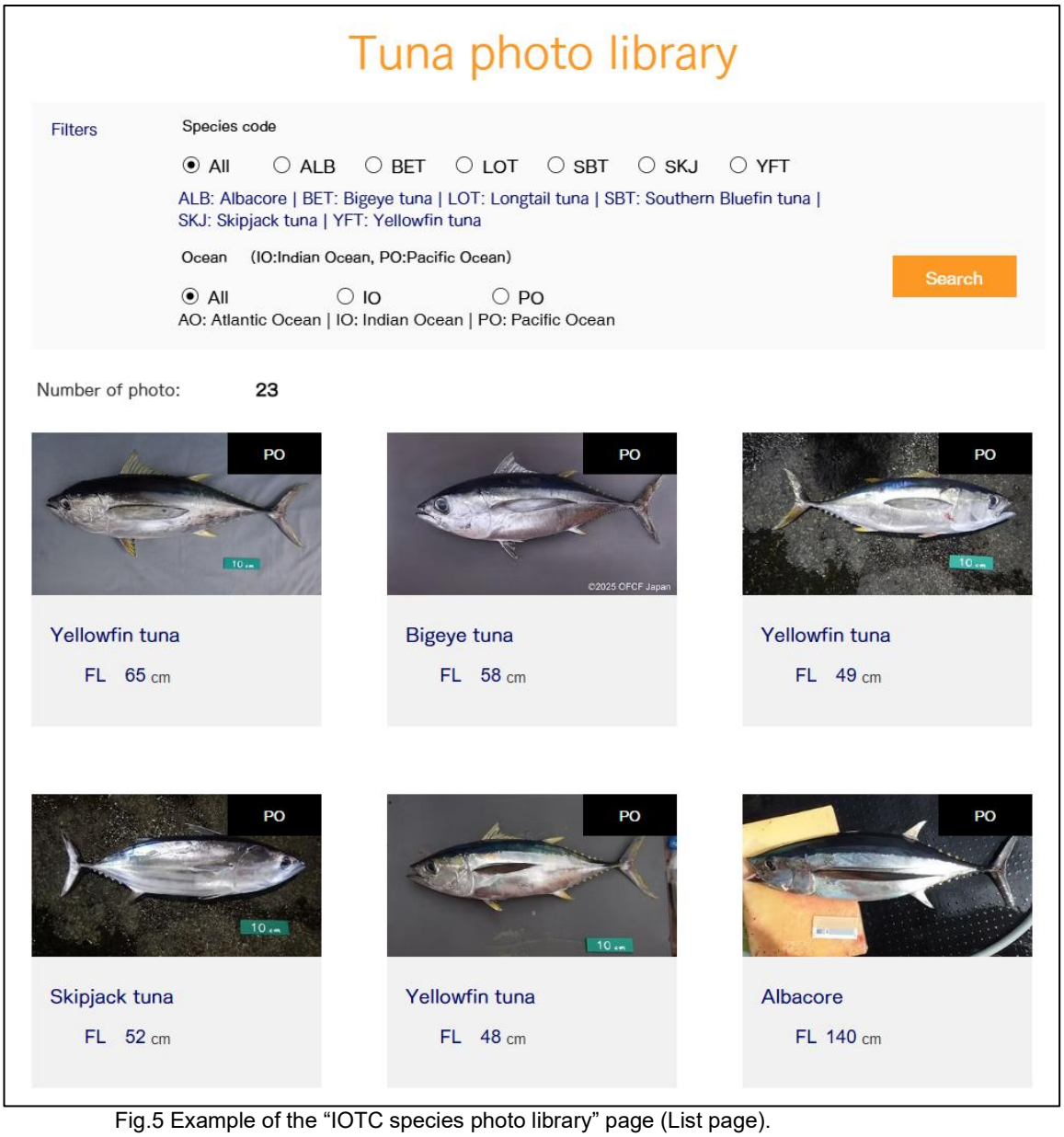

Fig.5 Example of the “IOTC species photo library” page (List page).

Yellowfin tuna

Thunnus albacares

Area of capture | Western Pacific Ocean
Year of capture | 2024

FL 65 cm

Condition of the fish: Approximately 1 day after catch. Kept in ice & seawater. Then landed.

Notes: Sample was collected by pole and line.

Copyright of the photo

Follows "CC BY-NC-SA 4.0" in Creative Commons definition. Images can be copied and modified if necessary, with the following conditions; 1. Show the credit as indicated in "How to acknowledge the author" (in below). 2. Provide a link to the license (https://creativecommons.org/licenses/by-nc-sa/4.0/deed.en#ref-appropriate-credit) 3. Indicate if changes were made to the image. 4. Use for non-commercial purposes 5. Follow the same "CC BY-NC-SA 4.0" when redistributing the image.

Copyright holder

OFCF Japan

How to acknowledge the author

Describe the following sentence or sentence which meaning is same. "Photo provided by OFCF Japan".

Country

JAPAN

Copyright year

2025

ID code of the sample | JPN-I01-20241001-YFT002

Fig.6 Example of the "IOTC species photo library" page (Item page).

2.2.1-d ID tool for IOTC species

Fig.7 shows the “ID tool for IOTC species” contents. The “ID tool for IOTC species” page provides links to the smartphones/tablets available web application which supports species identification onsite. Details of the web application are indicated in 2.2.2.

Fig.7 The “ID tool for IOTC species” page.

2.2.1-e YouTube

The YouTube content links to “IOTC-OFCF Japan project channel” on the YouTube. The “IOTC-OFCF Japan project channel” (Fig.8) aims to help enumerators/observers to learn essential and useful knowledge quickly and easily through simple, easy-to-understand videos.

As of 2025, instructional videos on “ID tool for IOTC species” and identifying easily confused species (Yellowfin tuna & Bigeye tuna, and Bullet tuna & Frigate tuna) have been released.

Further videos, such as key morphometric characters to identify Scombridae species, sampling of otoliths from tuna species, are planned for release in the future.

Fig.8 The “IOTC-OFCF Japan project channel” on YouTube.

2.2.2 Web application - "ID tool for IOTC species"

The "ID tool for IOTC species" is a web application which was designed to enable enumerators/observers to easily and accurately identify fish species onsite using smartphones/tablets.

The "ID tool for IOTC species" identifies species based on the taxonomic keys used in taxonomy. Taxonomic keys is a classical approach which follows a step-by-step process of choosing between pairs of contrasting morphological characteristics, each referring to traits of the organism, which finally guides the species (Fischer 2013). This step-by-step process is available on smartphones/tablets using the data collection platform ODK (Open Data Kit, see the details in IOTC–2025–WPNT15–13). Using the ODK, offline usage of the "ID tool for IOTC species" is even available, which allows any enumerators/observers to utilize the tool in the poor data connection environment (only for android users, see details in Appendix II).

As of 2025, "ID tool for IOTC tuna and tuna-like species" which covers 19 Scombridae species (Table 1) has been released. Fig. 9 shows the QR code of the 21 Nov. 2025 version "ID tool for IOTC tuna and tuna-like species." Further ID tools on billfishes and swordfish are planned for release in the future.

Table 1 Scombridae species targeted for the development of the digital ID tool. The circle on the right indicates the IOTC target species.

English name	Species name	IOTC target species
Albacore	*Thunnus alalunga*	○
Bigeye tuna	*Thunnus obesus*	○
Yellowfin tuna	*Thunnus albacares*	○
Southern bluefin tuna	*Thunnus maccoyii*	○
Longtail tuna	*Thunnus tonggol*	○
Skipjack tuna	*Katsuwonus pelamis*	○
Bullet tuna	*Auxis rochei*	○
Frigate tuna	*Auxis thazard*	○
Kawakawa	*Euthynnus affinis*	○
Narrow-barred Spanish mackerel	*Scomberomorus commerson*	○
Indo-Pacific king mackerel	*Scomberomorus guttatus*	○
Wahoo	*Acanthocybium solandri*	
Striped bonito	*Sarda orientalis*	
Dogtooth tuna	*Gymnosarda unicolor*	
Double-lined mackerel	*Grammatorcynus bilineatus*	
Slender tuna	*Allothunnus fallai*	
Korean mackerel	*Scomberomorus koreanus*	
Blue mackerel	*Scomber australasicus*	
Indian mackerel	*Rastrelliger kanagurta*	

Fig.9 QR code of the 21 Nov. 2025 version “ID tool for IOTC tuna and tuna-like species”.

2.2.3 Photo library of IOTC species and related bony fish - “IOTC species photo library”

As explained in 2.2.1-c, “IOTC species photo library” is a content inside the “Guide for identification of IOTC species” website. “IOTC species photo library” enables less experienced enumerators/observers to compensate for their lack of experience by providing species-identified photos of different conditions and sizes.

This is important as enumerators/observers could encounter different conditions and sizes of fish at the field. For example, onboard observers may usually encounter fish just landed on the fishing vessel, while enumerators working at landing sites may encounter fish kept in the fish hold for ten several days. Appearance of the fish is also different by sizes. The “IOTC photo library” will be a good reference to confirm the difference of appearance depending on the condition and size.

Note that the establishment of a Photo library was defined in the program of work in WPDCS20 (IOTC-2024-WPDCS20-25_Rev1, 2.4), which means the development of the “IOTC species photo library” corresponds to the needs of IOTC member countries.

3 Advantages and challenges

3.1 Advantages

3.1.1 Information accessibility

Although useful information for fish species identification has long been available on specific websites, such information has been scattered and often difficult to view on smartphones/tablets. For example, in order to check information on a particular species, users had to open a PDF file and navigate to a specific page or zoom in on a smartphone screen. Similarly, video materials could not be easily accessed unless users searched for them and bookmarked them. As a result, it has been difficult for enumerators/observers to access practical, field-useful information when needed.

Through the “Guide for identification of IOTC species” webpage, knowledge necessary for identifying IOTC species has been systematically consolidated into a single location, which could be easily viewed not only on PCs but also on smartphones/tablets. The digital tools are interconnected, allowing users to move between them. Both the “ID tool for IOTC species” and YouTube contents are linked to the “Guide for identification of IOTC species” website. This improved information accessibility enables enumerators/observers to access practical, field-useful information when needed.

3.1.2 Effectiveness in short term capacity building

In a conventional approach, the ability of the identification of fish species has been acquired through workshop lectures or onsite training under the supervision of experienced specialists, with reference to printed materials in most cases. Because this process depends on personal memory, enumerators/observers could not be sure of their identifications when they were not sure of their memories, and considerable time was required to acquire reliable species identification ability.

With the development of the “ID tool for IOTC species,” enumerators/observers can identify fish species in the field with greater confidence, supported by clear diagnostic criteria (taxonomic keys). In addition, by observing “Characteristics of species,”

"Identification of confusing species," and "IOTC species photo library," on the "Guide for identification of IOTC species" website, enumerators/observers can efficiently acquire the necessary knowledge and visual examples within a short period of time.
By combining the newly developed digital tools, enumerators/observers will be able to acquire accurate and consistent species identification abilities within a short training period. Moreover, enumerators/observers would eventually be able to identify species without relying on the assistance of these digital tools.

3.1.3 Effectiveness as training and educational material

Because of the information accessibility and user-friendly learning design, the digital tools would greatly assist those who conduct training and workshops on species identification. For example, lectures can use the "Characteristics of IOTC target species" contents to explain the species and use the "Identification of confusing species" contents and YouTube videos to draw attention to species well misidentified. Then, by practicing species identification using photos and verifying the result using "ID tool for IOTC species", the participants can learn the knowledge necessary for species identification.

Fig.10 Scene of "Capture fisheries statistics validation activity" held in Indonesia. Mr. Anang Wahyu Susilo from the Ministry of Marine Affairs and Fisheries of the Republic of Indonesia introduced the offline usage of "ID tool for IOTC species" on October 21, 2025.

Note that the "ID tool for IOTC species" can also be utilized as a simulator for fish species identification. By repeatedly practicing with the ID tool-selecting various morphological characteristics and observing which species each combination leads to-users can effectively learn and memorize the key diagnostic features for species identification.

3.1.4 Low running costs

The "ID tool for IOTC species" is deployed using the KoboToolbox service, which is based on the ODK for data submission purposes. As "ID tool for IOTC species" functions without data submission, no costs are incurred for using the KoboToolbox service.
Note that all Excel files used to design the ODK forms and all illustrations used in ODK have been created by OFCF Japan, and they can be provided free of charge to organizations with a public-interest purpose. Similarly, all YouTube content has been produced by OFCF Japan, and users do not incur any costs for accessing it.

The website "Guide for identification of IOTC species" was created using the website-building service WIX.com and is currently published for free. However, the free plan has a 500 MB data limit. As the photo library grows and the website exceeds this 500 MB limit, it will be necessary to switch to a paid plan (see Appendix III). Note that as long as WIX.com is used, the administrators do not need to implement their own security measures or set up a dedicated server.

3.2 Challenges

3.2.1 Identification of small tunas ("ID tool for IOTC tuna and tuna-like species")

For fish of the genus *Thunnus*, adult individuals (with a fork length of 40 cm or more) show clear species-specific differences, such as in the length of the pectoral fins. However, in individuals around FL 30 cm, such distinguishing characteristics are not apparent, making species identification difficult by appearance (See Fig.11).

Fig.11 Examples of small size a) Yellowfin tuna, b) Bigeye tuna, and c) Southern Bluefin tuna. Unlike medium or large size individuals, the pectoral fin length is similar, which makes the identification of each species difficult. Note that a) and b) were provided by The Kagoshima University Museum. c) was taken from the website "Atlas of Living Australia", which copyright belongs to Australian National Fish Collection, CSIRO.

The present "ID tool for IOTC tuna and tuna-like species" has limitations in showing a taxonomy key for distinguishing species based on clear external morphological characteristics for small tunas. Any insights or ideas for distinguishing small tuna species are welcome to OFCF Japan.

3.2.2 Identification of Indo-Pacific king mackerel and Korean seerfish ("ID tool for IOTC tuna and tuna-like species")

The Indo-Pacific king mackerel closely resembles the Korean seerfish in appearance, and distribution overlaps in the Indian Ocean (Collette and Graves, 2019). So far, the most clear and reliable taxonomy key is the difference in the number of intestinal bends which are only observable by dissecting. Any insights or ideas for distinguishing Indo-Pacific king mackerel with Korean seerfish from the appearance are welcome to OFCF Japan.

3.2.3 Collection of the photo of small size tuna

At present the most effective way to identify species of small tuna might be to display photographs of individuals of similar size, arranged by species. This approach will allow enumerators/observers to learn subtle morphological differences among species.

OFCF Japan is currently focusing on the collection and photographic documentation of small tuna; however, small individuals of Bigeye tuna, Albacore, and Longtail tuna are difficult to find around Japan. The provision of photographs of small tunas and information on their capture locations are welcome to OFCF Japan.

3.2.4 Multilingual support

The digital tool developed by OFCF Japan is currently provided in English. Given the significant advances in automatic translation functions in modern web browsers, OFCF Japan has no plans to translate the website to multiple languages. However, for YouTube content or the ID tool, OFCF Japan will respond to strong requests from specific coastal states if such translation is considered reasonable and expected to be effective.

3.2.5 Multinational support to the "IOTC species photo library"

Currently, the photo library contains photographs from Japan and Sri Lanka. For Japan, approximately 250 photos have been provided from FRA, and approximately 1,100 photos from have been provided Kagoshima University Museum. Also, around 4,300 photos have been taken independently by OFCF Japan. From Sri Lanka, OFCF Japan received 16 photos from NARA and 1,175 photos from DFAR. Since this photo library is intended to be utilized in the IOTC, contributions of photographs from IOTC coastal states are highly desirable.

3.2.6 Management of the website "Guide for identification of IOTC species"

The website "Guide for identification of IOTC species" is currently jointly managed by the IOTC Secretariat and OFCF Japan. As explained earlier in 3.1.4, if the data volume exceeds 500MB, a paid plan will be required. Ideally, this cost would be borne by IOTC; however, until discussions within IOTC are concluded, OFCF Japan will cover the necessary expenses and remain responsible for the website's management.

The IOTC website is scheduled to be renewed in the near future, and content related to species identification is expected to be organized as a separate, standalone section.

OFCF Japan has already agreed to transfer the current website content to the renewed platform; however, the management of the photo library may require a certain level of expertise and effort.

First, to ensure the reliability of the photo library, it is necessary to verify that the species identification of the submitted photographs is correct. This requires experts with a certain level of experience in species identification. In addition, when uploading photographs to the website, it is necessary to compress the image files and embed copyright marks. Furthermore, information from the photo provider must be organized and registered in the website's database (management of metadata). Currently, these tasks are carried out solely by OFCF Japan fisheries expert; however, if the photo library were to be managed by the IOTC, the cooperation of experts from member countries would be required, and a dedicated administrator for the photo library would likely need to be appointed.

Acknowledgement

This project is supported by the Fisheries Agency of Japan and conducted under the IOTC-OFCF Japan Project. We are grateful to the Seychelles Fisheries Authority (SFA), the National Aquatic Resources Research and Development Agency (NARA), and the Fishery Survey of India (FSI) for their sincere cooperation in testing the "ID tool for IOTC species" with their enumerators, officers, and researchers. We also thank the Department of Fisheries and Aquatic Resources, Sri Lanka (DFAR), for kindly providing more than one thousand photographs in response to OFCF Japan's request. DFAR has also made pilot introduction of the ID tool on their data input tablets to provide feedback to OFCF Japan.

We are especially grateful to Dr. Tetsuji Nakabo for providing the foundational structure of the taxonomic keys used in the ID tools, and to Professor Hiroyuki Motomura of the Kagoshima University Museum for supporting OFCF Japan with his expertise and sincere cooperation in the initial establishment of the photo library.

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Appendix I: Target species

Table 2 shows the 26 species targeted in the website “Guide for identification of IOTC species”. Besides the 16 IOTC species, 10 species were added to ensure the identification of IOTC target species, as identification of other co-occurring species of the same family is important.
The added species are as follows. Striped bonito (*Sarda orientalis*), Dogtooth tuna (*Gymnosarda unicolor)*, Slender tuna (*Allothunnus fallai*), Blue mackerel (*Scomber australasicus*), and Indian mackerel (*Rastrelliger kanagurta*) considering the miss-identification risk with tuna like IOTC target species. Wahoo (*Acanthocybium solandri*), Korean mackerel (*Scomberomorus koreanus*), Double-lined mackerel (*Grammatorcynus bilineatus*), and Streaked seerfish (*Scomberomorus lineolatus*) considering the miss-identification risk with seerfish. Short-billed spearfish (*Tetrapturus angustirostris*) was also added considering the miss-identification risk with billfish.

Table 2 26 species targeted in the website “Guide for identification of IOTC species.”

English name	Species name	IOTC target species
Albacore	*Thunnus alalunga*	○
Bigeye tuna	*Thunnus obesus*	○
Yellowfin tuna	*Thunnus albacares*	○
Southern bluefin tuna	*Thunnus maccoyii*	○
Longtail tuna	*Thunnus tonggol*	○
Skipjack tuna	*Katsuwonus pelamis*	○
Bullet tuna	*Auxis rochei*	○
Frigate tuna	*Auxis thazard*	○
Kawakawa	*Euthynnus affinis*	○
Narrow-barred Spanish mackerel	*Scomberomorus commerson*	○
Indo-Pacific king mackerel	*Scomberomorus guttatus*	○
Black marlin	*Istiompax indica*	○
Blue marlin	*Makaira nigricans*	○
Striped marlin	*Kajikia audax*	○
Indo-Pacific sailfish	*Istiophorus platypterus*	○
Swordfish	*Xiphias gladius*	○
Short-billed spearfish	*Tetrapturus angustirostris*	
Wahoo	*Acanthocybium solandri*	
Striped bonito	*Sarda orientalis*	
Dogtooth tuna	*Gymnosarda unicolor*	
Double-lined mackerel	*Grammatorcynus bilineatus*	
Slender tuna	*Allothunnus fallai*	
Korean mackerel	*Scomberomorus koreanus*	

Streaked seerfish	*Scomberomorus lineolatus*
Blue mackerel	*Scomber australasicus*
Indian mackerel	*Rastrelliger kanagurta*

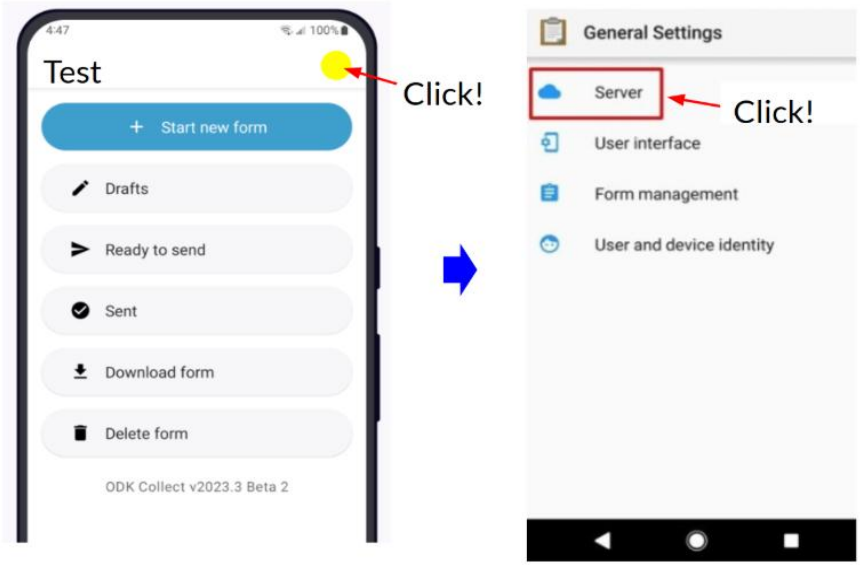
Appendix II: Offline usage of the ID tool for IOTC species

ID tool for IOTC species was developed on ODK (Open Data Kit), and ODK is available offline once an application “ODK collect” is installed and the ID tool form is downloaded to the smartphones/tablets through the “ODK collect”. Note that this is only available for Android, as for 2025. The required steps are as follows.

1. Install “ODK collect” and move it on your home screen

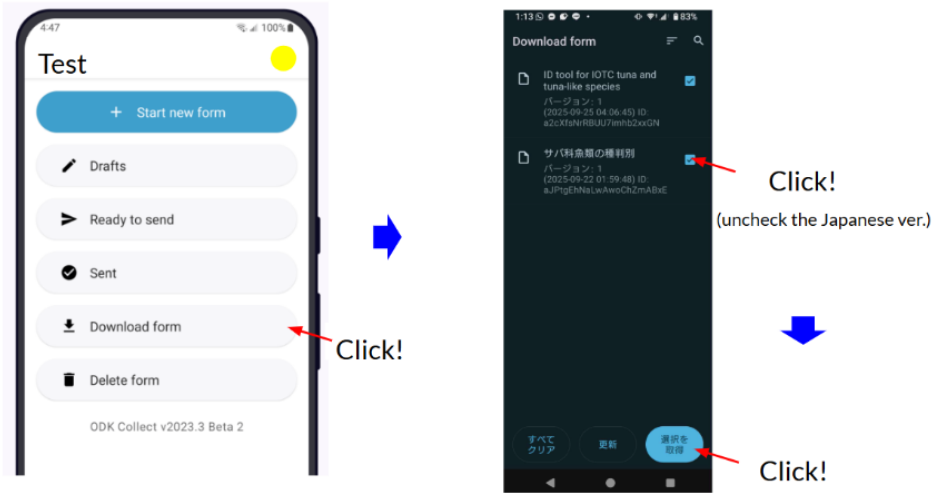
https://play.google.com/store/apps/details?id=org.odk.collect.android&pcampaignid=web_share

2. Settle the server setting in the “ODK collect” as below



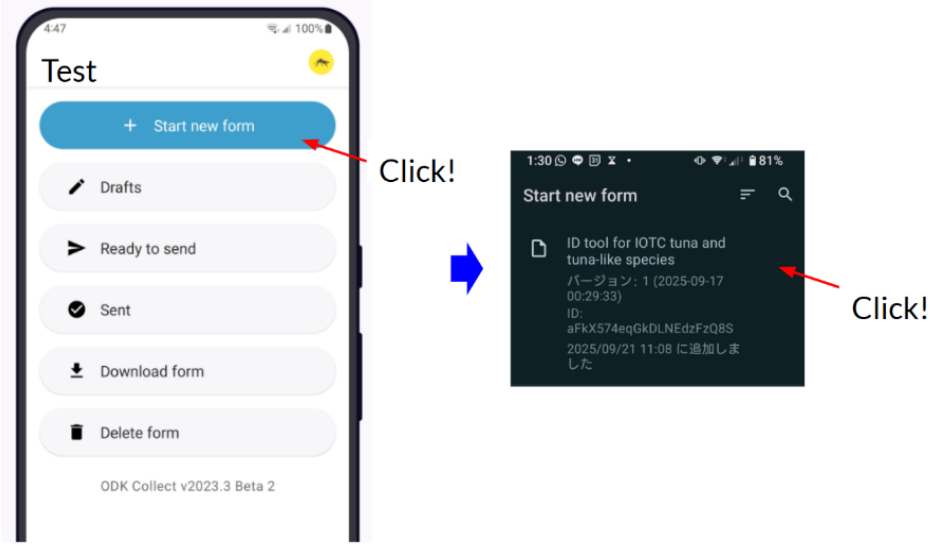
URL	https://kf.kobotoolbox.org
Username	iotcofcf
Password	iotcofcf

4. Download the latest ID tool form



Note that “ODK collect” will start downloading data necessary for offline usage. This may take several minutes.

5. Start the downloaded ID tool form (Final step)



Appendix III: Paid plan for the WIX service

To maintain the website “Guide for identification of IOTC species,” WIX service should be upgraded to a paid plan if the data quantities exceed 500MB. Fig.12 shows the option of paid plan in WIX.com. The paid plans cost from $204 to $1,908 per year. The “Core” plan, which offers 50GB of storage and costs $348 per year, would be the most suitable option for maintaining the photo library in the initial stage.

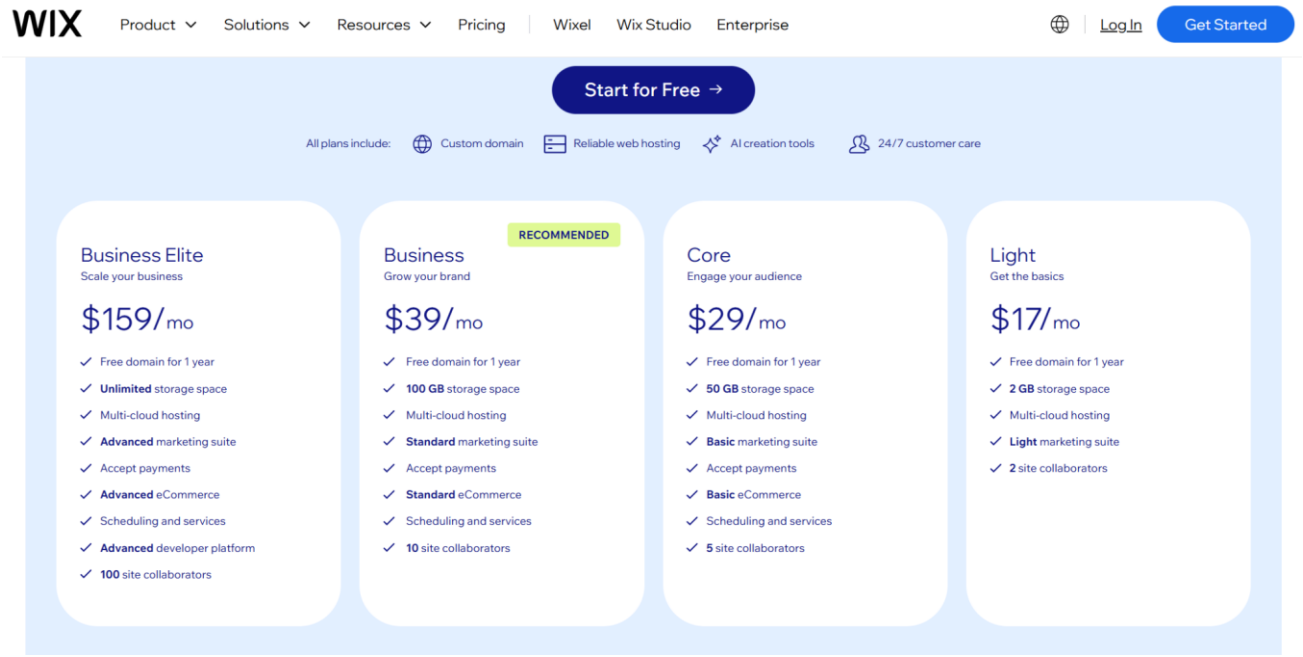


Fig.12 Paid plan indicated on WIX.com website.

Appendix IV: Copyright protection policy (IOTC species photo library)

Regarding the photo library, OFCF Japan plans to protect the copyrights of cooperating organizations and individuals through the following measures.

1. **Embedding a copyright mark in each photograph.**

   All copyrighted photographs have a copyright mark embedded in the image to alert users to copyright protection. The copyright mark consists of the symbol "©", the copyright year, and the name of the photograph holder; for example, ©2025 OFCF Japan（See Fig.13）.

   Fig.13 Example of the copyright mark (right below) embedded in the photo.

2. **Allowing contributors to choose an appropriate *Creative Commons* license and displaying the selected license on the corresponding photo library item page.**

   Creative Commons (CC) is a globally recognized licensing framework that enables creators to grant certain usage rights to the public while retaining others. By selecting a specific *CC* license, creators can specify conditions such as attribution, non-commercial use, and the sharing of derivative works.

   Regarding the photographs included in the photo library, we place particular emphasis on the following points: first, users should be able to reuse the photographs in their own materials and reports; and second, such use is restricted to non-commercial purposes. Regarding the reuse of photographs, users may crop or adjust the colors of the images; however, they must clearly acknowledge the original creator and provide proper attribution when using the photographs. The restriction to non-commercial use assumes that most of the photographs are provided by public institutions in various countries for public purposes. This restriction is intended to prevent specific private companies from using photographs for profit-making activities.

   Taking these factors into account, OFCF Japan currently recommends that data providers adopt the *"CC BY-NC-SA 4.0"* license under the Creative Commons framework.

   In this license, **CC** stands for *Creative Commons*; **BY** means that the author must be credited in the manner they specify when the work is reused; **NC** restricts the use to non-

commercial purposes; and **SA** requires that any derivative works be distributed under the same conditions.

Fig. 14 shows an example of how the copyright conditions are displayed on the item page of the photo library. The copyright definition under *Creative Commons* is displayed at the lower left of the photograph, under the label “Copyright of the photo,” together with a brief description. In the section displayed below titled “How to acknowledge the author,” the specific form of acknowledgement preferred by the creator is indicated. At the lower right of the photograph, the name of the copyright holder, the nationality, and the year of creation are indicated. By referring to this information, users can properly credit the creator in the manner they desire when using the photograph, without confusion.

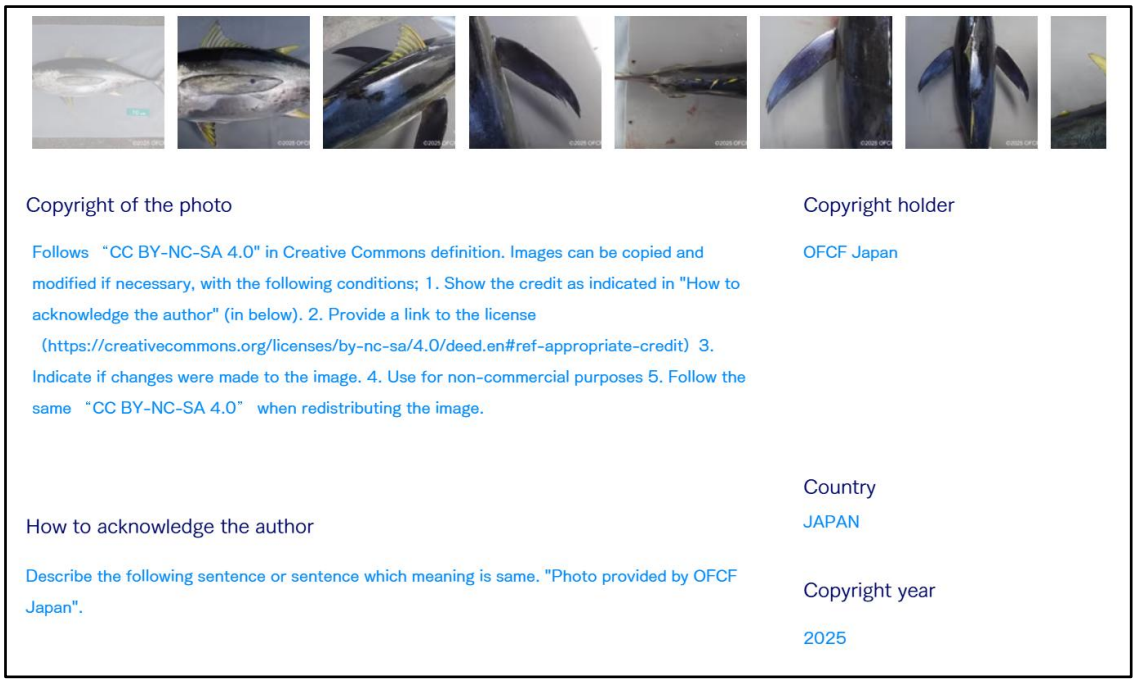


Fig. 14 Example of copyright conditions displayed on the item page of the photo library.

In cases where a photograph is privately taken and shared by an individual, choosing not to apply any copyright protection can also be an option. This corresponds to “*CC0*” in the *Creative Commons* framework, which allows creators to waive their copyright and place their works in the worldwide public domain. *CC0* permits users to distribute, remix, adapt, and build upon the material in any medium or format, without any conditions.

Appendix V: Information required for providing photographs (IOTC species photo library)

Table 3 shows the information required from photograph holders who intend to contribute to the IOTC Species Photo Library. Details of each item are summarized below.

Essential items

- Species: Species could be provided in either scientific name or English name.
- Size: Size should be provided with units (cm, m), and which body measurements were used, such as fork length (FL), total length (TL), and standard length (SL). In case accurate measurement was difficult, any rough numbers are acceptable if they provide meaningful insight. (e.g., TL 30-40 cm, Over TL 1 m, BW around 3 kg）
- Year of capture: Considering that future fishing bans or other regulations may be imposed, photograph holders are asked to provide the year of capture. This may help to prevent unnecessary compliance issues or misunderstandings that may arise from the publication of photographs.
- Area of capture: Regarding the fishing area, we intentionally indicate only whether it is in the eastern or western Indian Ocean. This is intended to avoid any potential international disputes over territory or territorial waters that could arise from the publication of photos.
- Copyright definition: To protect copyright, photo providers are asked to select a copyright definition in accordance with *Creative Commons*. Refer to the Appendix IV for specific recommended copyright options.
- Acknowledgement: In principle, users of the photo library are requested to acknowledge the photograph holders when reusing photos. To ensure that users can accurately express the form of acknowledgment desired by each provider, photograph holders are asked to specify how they wish to be acknowledged at the time of photo submission.

Optional items

- Condition of fish: The storage condition of the fish serves as a valuable indicator for users to assess how freshness affects the appearance of the fish. Even rough estimates of the time since the catch and the storage environment would be appreciated. (e.g., Stored in the fish hold for several days, Kept in air temperature, Defrosted）
- Related information: “Related information” is any useful information that the photograph holder can disclose to users to access the fish appearance. Other than the condition of the fish, there are several pieces of information that can help the users to assess the appearance of the fish. For example, the fishing method can affect the appearance of the fish. When the fish is processed after being caught, if this is noted, users can recognize that the fish’s appearance differs from its original form (e.g., Bill removed billfish). Such information is preferable to be provided by the photograph holders.

Table 3 Information required for the IOTC Species Photo Library

Essential	Item	Content and Required Information	Example
○	Species	Either in scientific name or English name	Skipjack tuna
○	Size	Fork length preferred. Any size information or unit is acceptable.	FL 35 cm
○	Year of capture	In Gregorian year	2025
○	Area of capture	Eastern or Western Indian Ocean, following the definition of IOTC	Eastern Indian Ocean
○	Copyright definition	*Creative Commons* definition	CC BY-NC-SA 4.0
○	Acknowledgement	How to acknowledge the author	Photo provided by DFAR, Sri Lanka
Optional	Condition of fish	Storage condition or status of the Photographed Fish	Just after capture
Optional	Related information	Additional details on the Photographed Fish	Sampled by pole and line