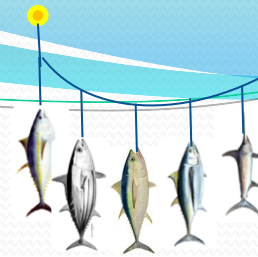# Input fishing capacity of vessels fishing for tropical tunas, albacore and swordfish in the IOTC Area of Competence
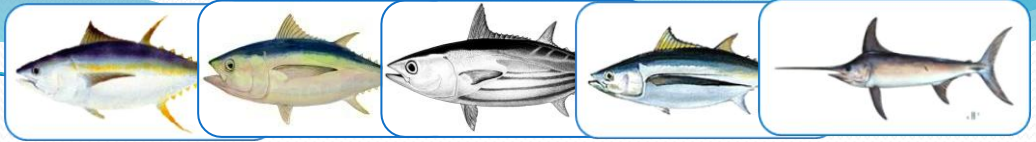
**IOTC Secretariat**

Outline

- Definitions

- Background information

- Planning

- Putting the pieces together

- Main results

- Problem areas

- Additional considerations

- Conclusion

Some definitions (i)

- **Input Fishing Capacity is the amount of fishing units/fishing effort devoted to catch a given resource over a period of time** (e.g. a year or a fishing season)

- **Output Fishing Capacity is the maximum amount of fish (or fishing effort) that can be produced over a period of time** (e.g. a year or a fishing season) **by a vessel or a fleet if fully utilized and for a given resource condition**

- **A ➔ excess capacity**

    (vis-à-vis observed production)

- **B ➔ size of landings**

- **A + B ➔ capacity output**

- **B/(A + B) ➔ capacity utilization** (CU < 1)
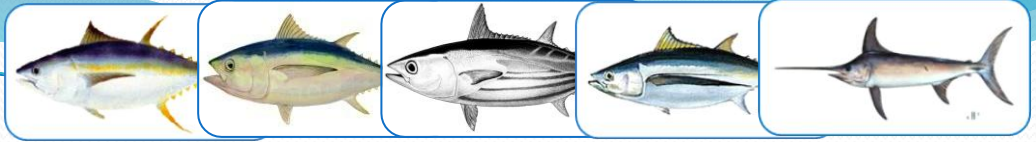

FIGURE 1
Data Envelopment Analysis
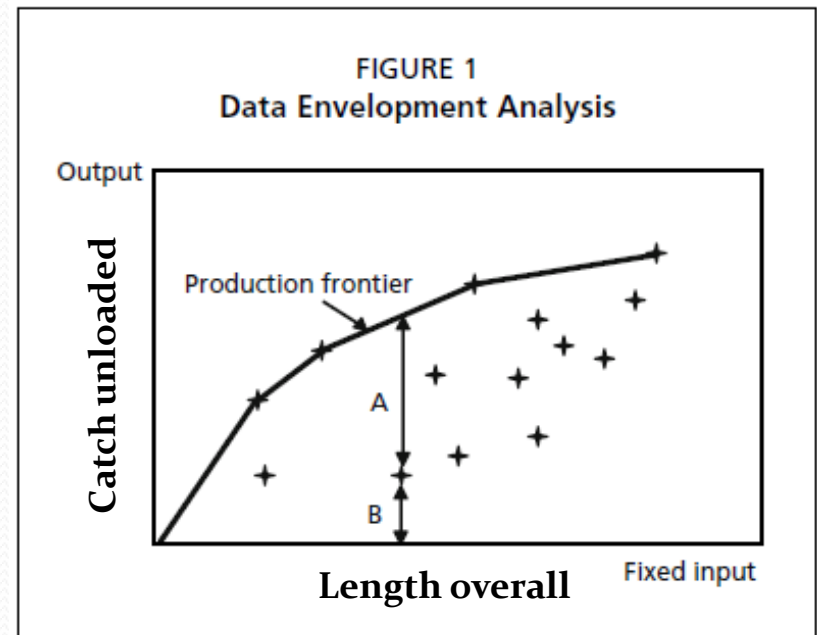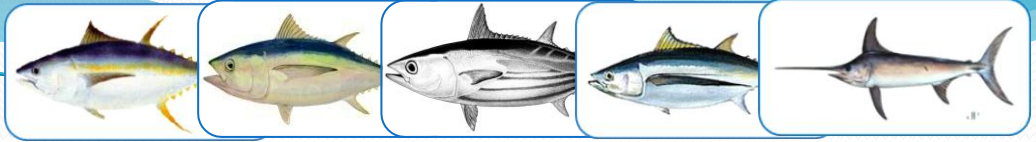
Some definitions (ii)

- **Capacity utilization** is actual output (e.g. Catch) divided by capacity output (maximum amount of fish that can be produced)
- **Target fishing capacity** is the maximum amount of fish over a period of time (year, season) that can be produced by a fishing fleet if fully utilized while satisfying fishery management objectives designed to ensure sustainable fisheries (Target fishing capacity Catch ≈ MSY)
- **Excess capacity** is the difference between capacity output and the target level of capacity output, such as maximum sustainable yield or the catch rate corresponding to the fishing mortality of an alternative harvest

- Types of vessels:
  - **Large scale**: tuna fishing vessels which usually have mechanical freezing and which are 24m or longer
  - **Medium scale**: tuna fishing decked vessels usually without mechanical freezing which are mainly between 12 and 24 m
  - **Small scale**: handlining, trolling from open fishing vessels, rod/reel fishing, sport fishing, and all kinds of tuna fishing from vessels usually under 12 m which are undecked, un-powered, or use outboard engines or sail
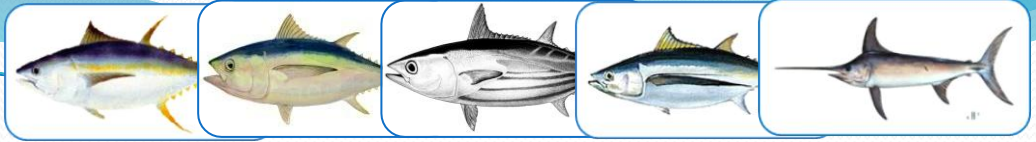
Background Information

How it all started

- 1998: The Commission adopts Resolution 98/04 (superseded by **Resolution 07/04**) calling for countries to report data on vessels that fished for tropical tunas, albacore or swordfish during the previous year, by year (**Active Vessels List**)

- 2002: The Commission adopts Resolution 02/05 (superseded by **Resolution 07/02**) calling for countries to report data on vessels under its flag that are authorized operate within the IOTC Area of Competence (**Record of Authorized Vessels**)

- 2005: **Australia allocates funds** (30,000 US$) for the estimation of fishing capacity of fleets operating within the IOTC Area, to be carried out in conjunction with the IOTC Secretariat

- 2006: Australia and the IOTC Secretariat prepare the **Terms Of Reference** for the **Capacity Study**

- 2009: The Secretariat hires a consultant to carry out the Capacity Study; results to be presented at the next Commission Meeting (Busan, 2010)
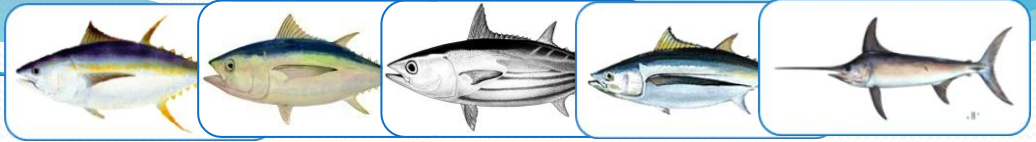
Planning

Terms Of Reference

- Objective: To **investigate and report on the level and type of regulated and unregulated fishing capacity within the IOTC Convention Area**

- Main contents:

    - Background review of the concept of "fishing capacity"

    - **Current level of active fishing capacity** for each State or fishing entity
        - IOTC member status (CPCs, non-CPCs, IUU fishing)
        - *Type of fleet (modern, aging or artisanal)*
        - *Area of operation*
        - *Ownership (whether foreign owned, etc)*
        - *Fishing method (purse seining, longlining, etc)*
        - *Analyse the possible transfer between species of fishing capacity through changes in targeting practices*

- Conclusions of the study to include:

    - **Recommendations** to the IOTC on **improving data management** with regard to monitoring capacity in the Indian Ocean
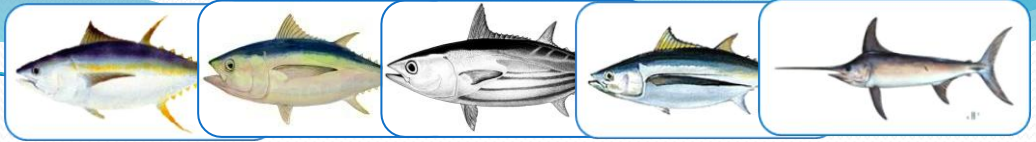
Preparation of the Report

- Consultant in cooperation with the IOTC Secretariat
  - Robert Gillet (Director Gillett, Preston and Associates): Main author; conducted a Capacity Study for the fleets operating in the WCPFC Area
  - Miguel Herrera (IOTC Data Coordinator): Compiled the data to be used in the report (IOTC databases plus other sources)

- Report in the making: to be released in January 2010, and presented at the next Commission Meeting (March 2010)

Putting the pieces together

Information used

- Lists of vessels actively fishing for tropical tunas, albacore or swordfish reported by **IOTC CPC's** in **2006-2008**, by flag country and year
  - **CPC** reports on **vessels under its flag**
  - **CPC** reports on **foreign vessels** having a **license** to operate within its **EEZ**
  - **CPC** reports on **foreign vessels** having **unloaded catches** of IOTC species **in ports** within its territory
- **Record of vessels authorized** to operate within the IOTC Area
- **Lists of foreign vessels** provided by **non-members**
- Vessels in the IOTC **IUU list**
- Numbers of vessels fishing for IOTC species provided by IOTC CPC's or other countries (**fishing craft statistics**)
- **Nominal catches** estimated for the above vessels
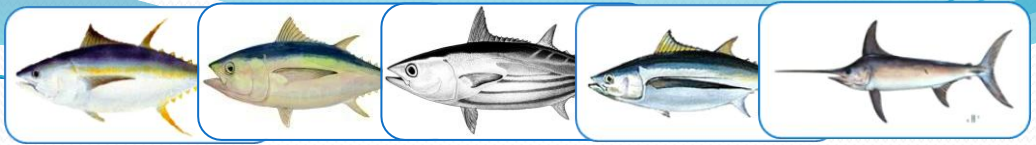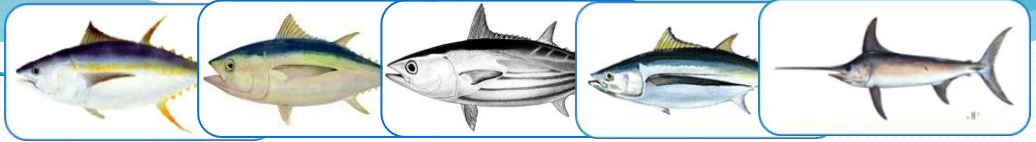
Main objectives of the study

- Main objective: obtain total fishing input capacity:

> Input **capacity in terms of number of vessels**[*] **fishing for tropical tunas, albacore, or swordfish by flag country and year, including:**
> - **All vessels having LOA 24m or greater (large-scale vessels)**
> - **Vessels which having LOA smaller than 24m (medium-scale vessels)** *operate beyond the EEZ of their flag countries*
>
> **For the years 2006-08**
>
> **[*] Irrespective of levels of activity (i.e. one day activity counts as 1 vessel and so does it 365 days)**

- If time allows:

  - assess the usefulness of extending the study to estimate output measures of fishing capacity
  - asses if the above could be achieved using the data currently available

Summarizing

- Fishing vessels:

    - All large scale fishing vessels (LOA 24m or higher)

    - Medium scale fishing vessels (LOA<24m) *operating outside the EEZ*

- Target species: Yellowfin tuna, bigeye tuna, skipjack tuna, albacore, swordfish

- Years: 2006, 2007 and 2008

- Fisheries:

    - Industrial purse seine

    - Industrial longline

    - Offshore gillnet

    - Offshore gillnet and longline combination
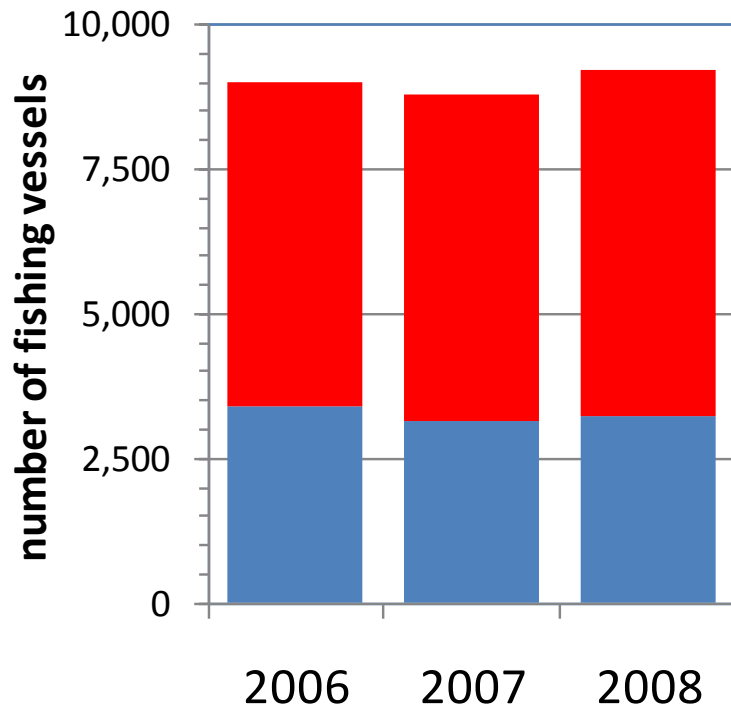
    - Offshore pole-and-line

Main Results
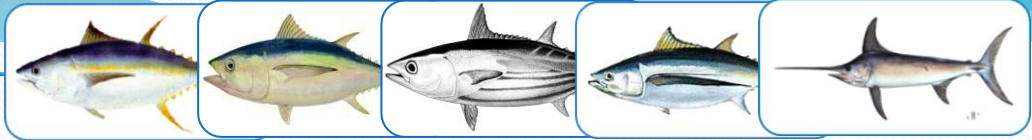
# General overview

no. vessels active 2006-08

Number of vessels active by fleet (2006-08)

Fleet	2006	2007	2008
Sri Lanka G/L	2,394	2,462	2,811
Pakistan GI	**2,295**	**2,308**	**2,308**
Indonesia LL	1,202	787	921
Maldives BB	926	888	867
China LL	67	67	69
Taiwan,China LL	784	782	783
Iran GI, PS	762	761	760
Japan LL, PS	190	250	212
India LL, PS	90	134	125
EC PS, LL	102	107	93
Malaysia LL	28	62	70
Seychelles LL, PS	50	44	46
Oman LL	24	30	36
Rep.Korea LL	29	31	24
Australia PS,LL	10	9	8
Belize LL	8	10	9
France (TAAF) PS	2	2	2
Guinea LL	3	3	3
Kenya LL	1	2	2
Madagascar LL	2	2	2
Mauritius LL	8	10	8
Philippines LL	18	17	17
Senegal LL	3	3	3
South Africa LL	13	14	20
Tanzania LL	3	3	3
Thailand PS, LL	9	9	10
Uruguay LL	1	0	0
NEI LL	**37**	**44**	**41**
TOTAL	9,061	8,841	9,253
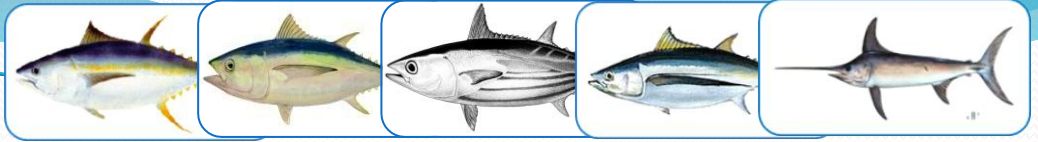
Total number of vessels by size

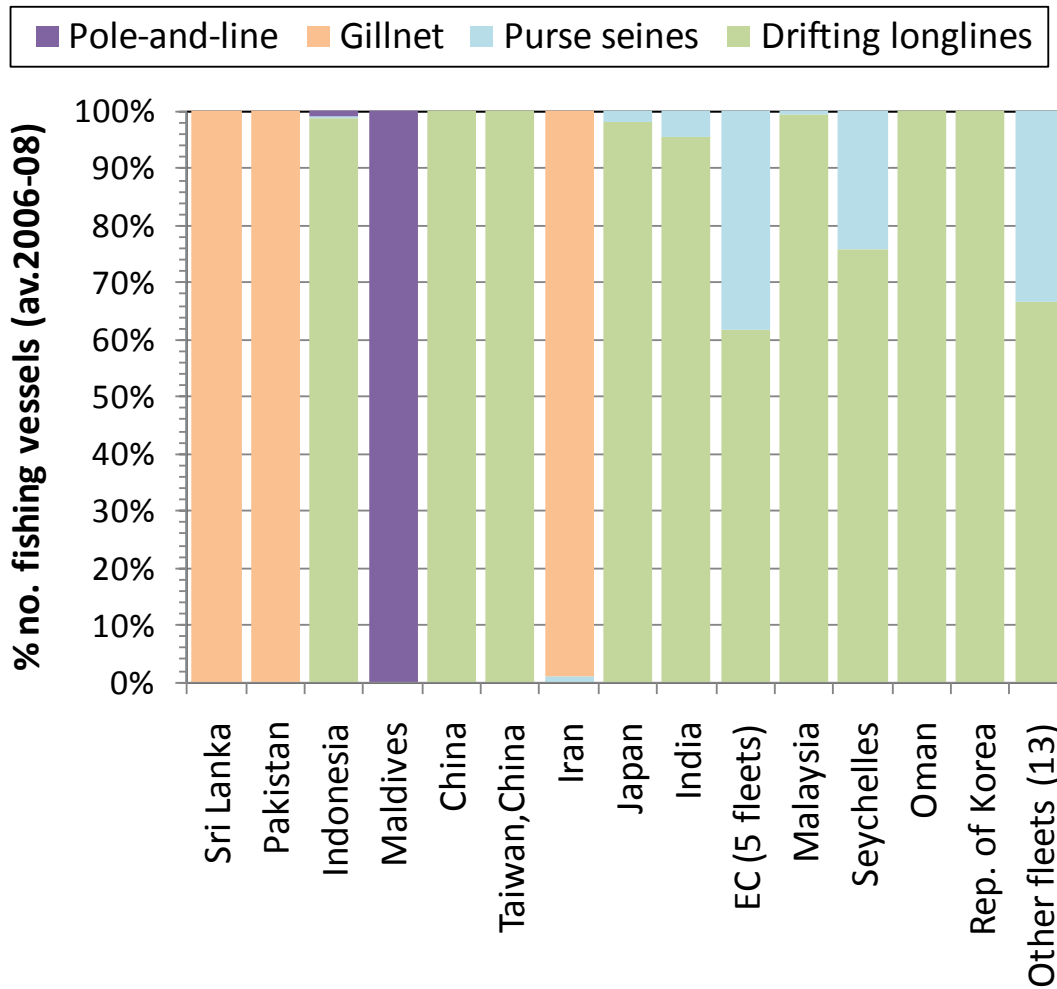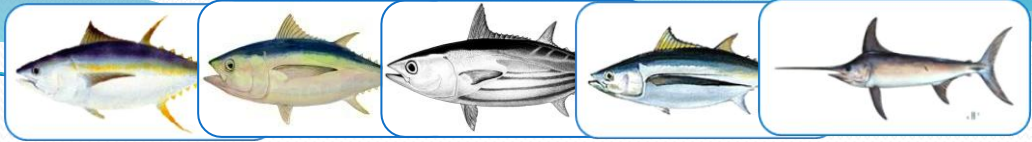| Type_Gear	SizeClass	2006	2007	2008
Drifting longlines	AllLOA	2603	2345	2427
Purse seines	AllLOA	79	80	82
Gill nets	AllLOA	5441	5520	5869
Pole and Lines	AllLOA	938	896	875
All gears	LOA_24>	1736	1638	1604
All gears	LOA_<24	3573	3469	3963
All gears	LOA na	3752	3734	3686
All gears	AllLOA	9061	8841	9253
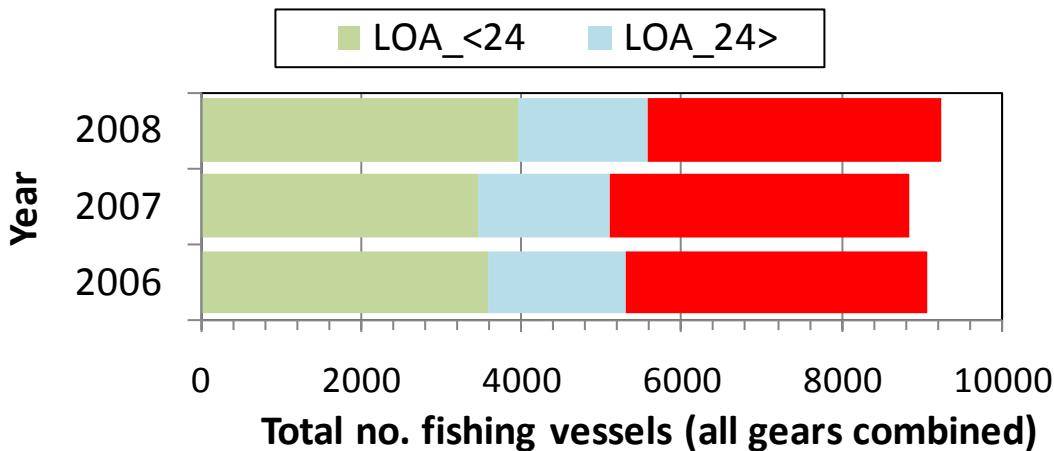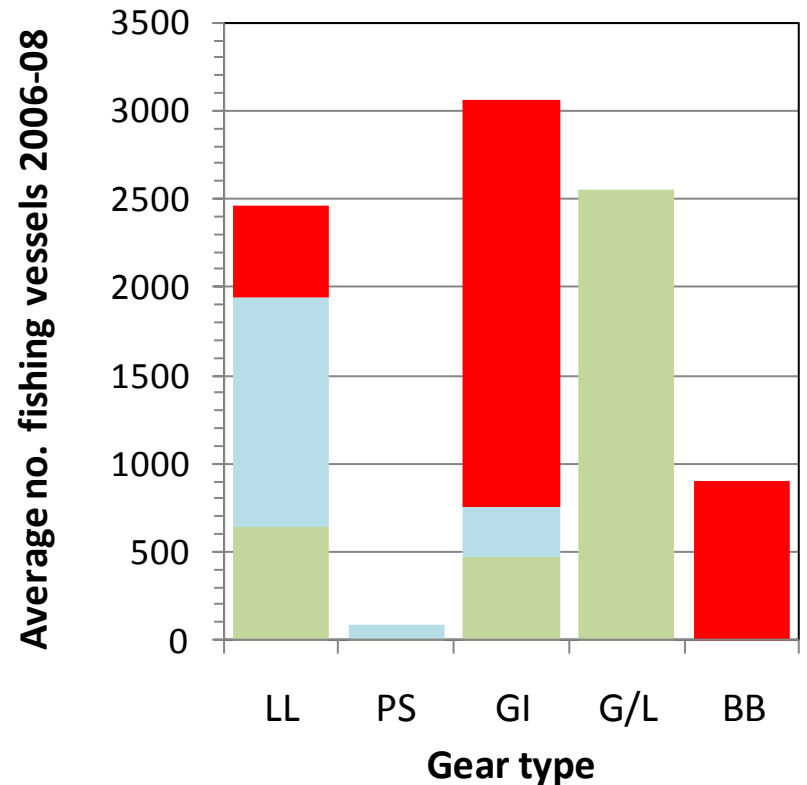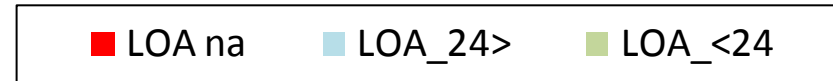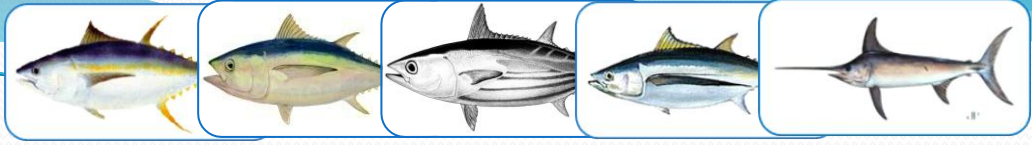
Main fleets (no. vessels by size class)
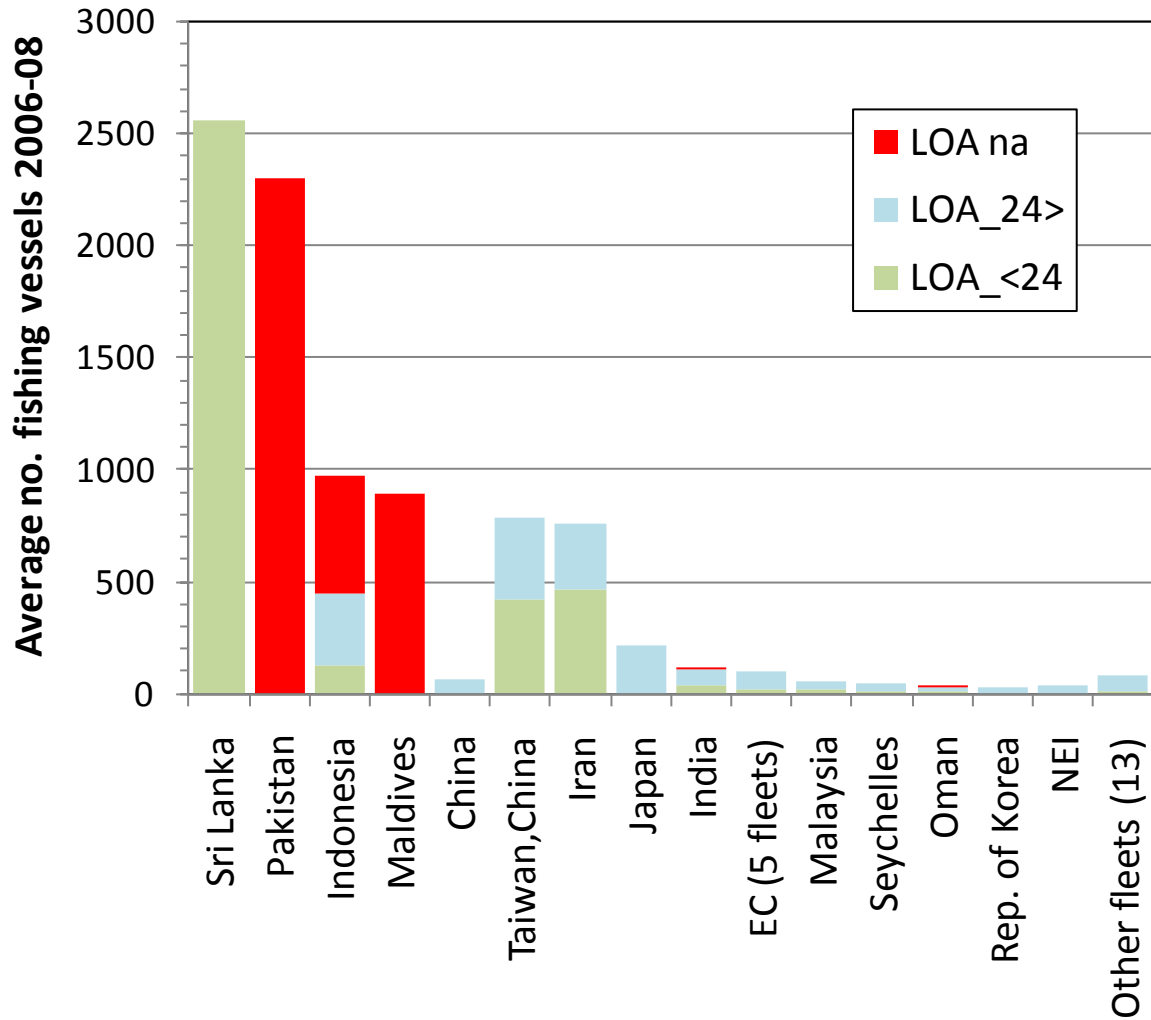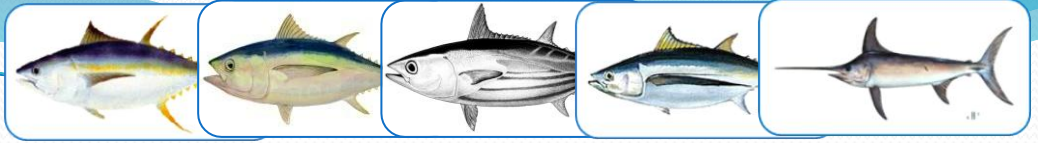
Main fleets (% vessels (no.) by gear type)

Total catch (,000 t)

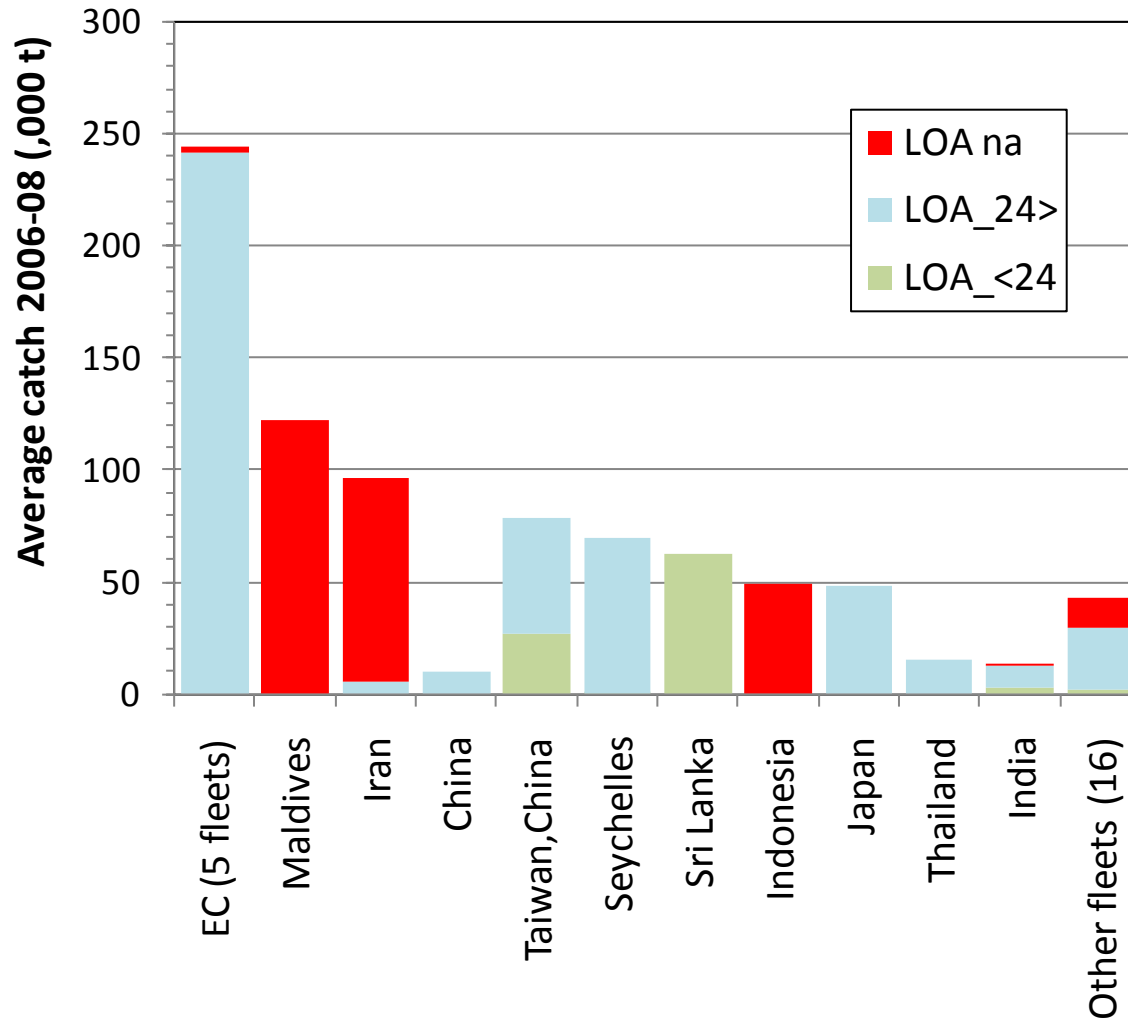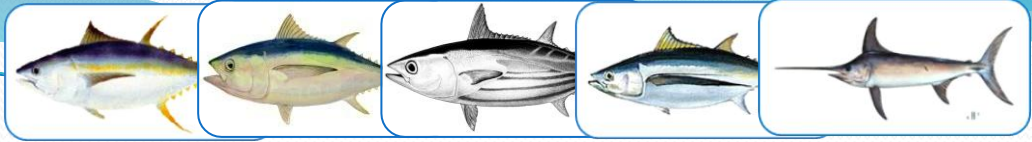| Type_Gear	SizeClass	2006	2007	2008
Drifting longlines	AllLOA	*239*	*243*	*189*
Purse seines	AllLOA	*435*	*272*	*296*
Gill nets	AllLOA	*182*	*160*	*140*
Pole and Lines	AllLOA	*158*	*123*	*116*
All gears	LOA_24>	*606*	*430*	*403*
All gears	LOA_<24	*244*	*236*	*213*
All gears	LOA na	*163*	*133*	*125*
All gears	AllLOA	*1014*	*798*	*741*

Average catch 2006-08 (,000 t)

Gear type

Year

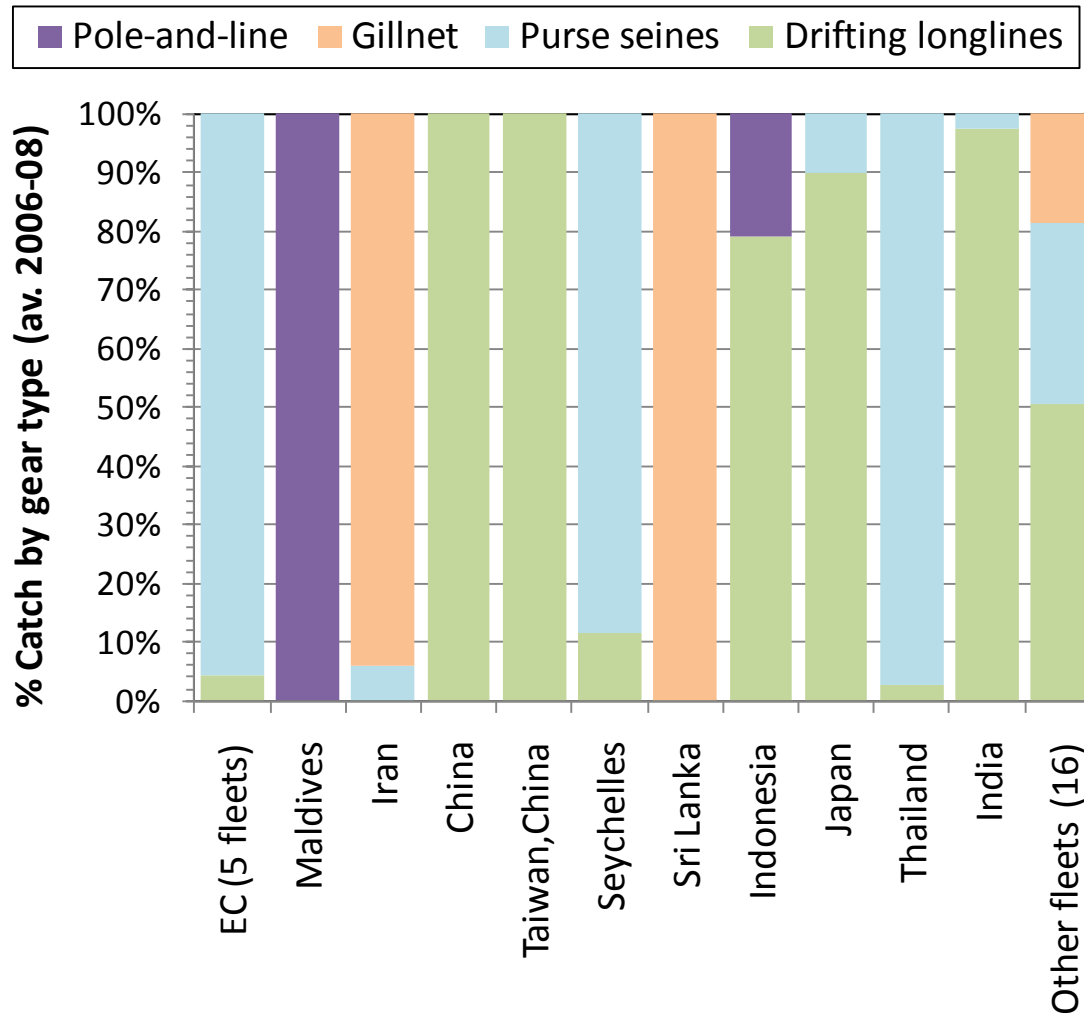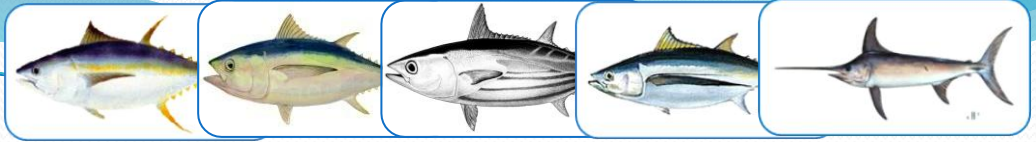Total catch (,ooo t; all gears combined)
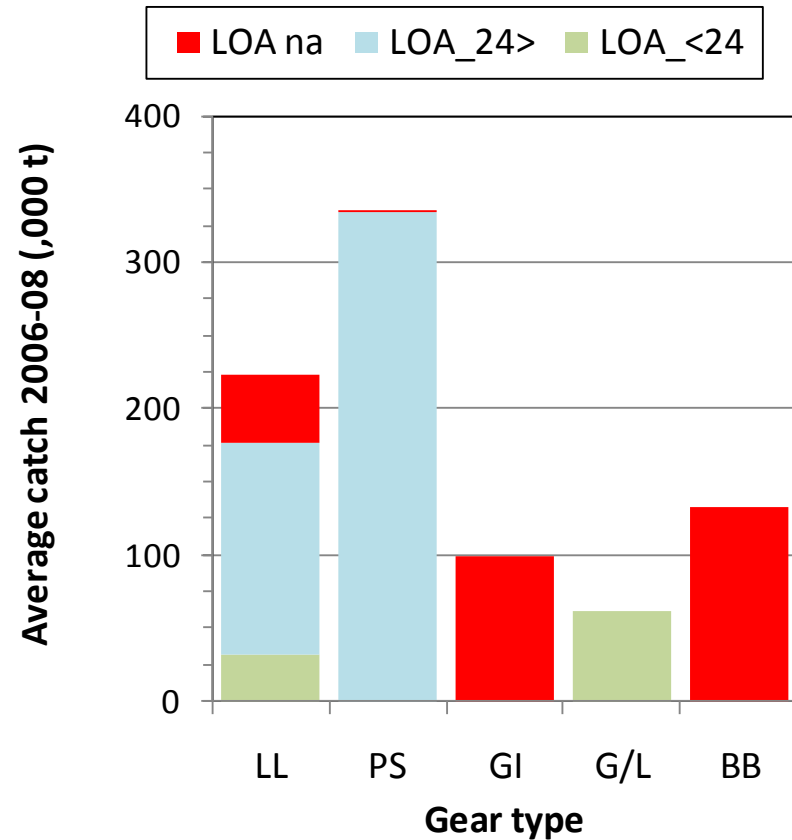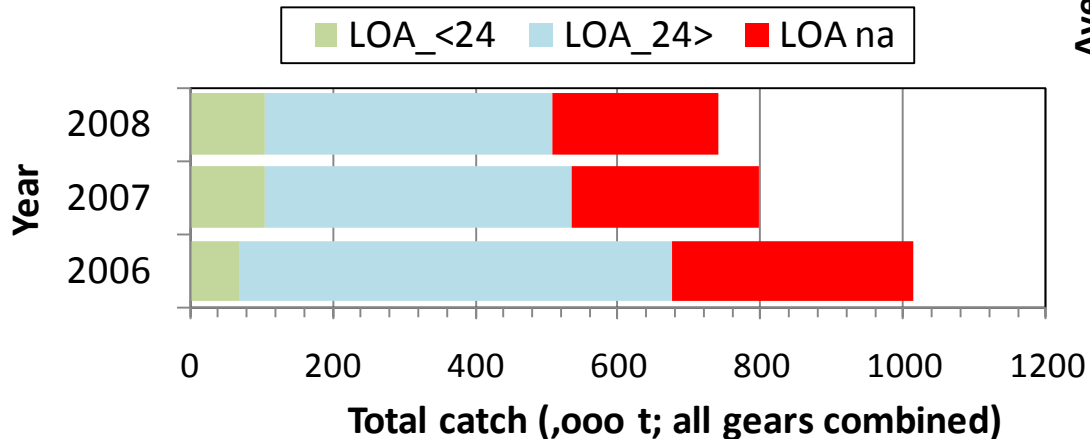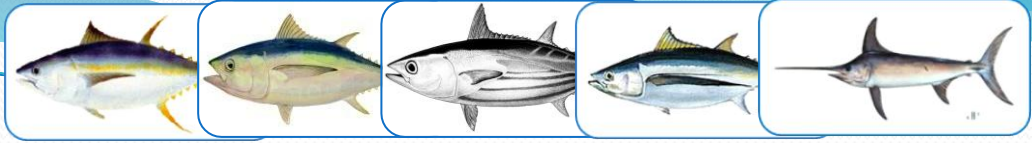
Main fleets (catch by fleet by vessel size class)

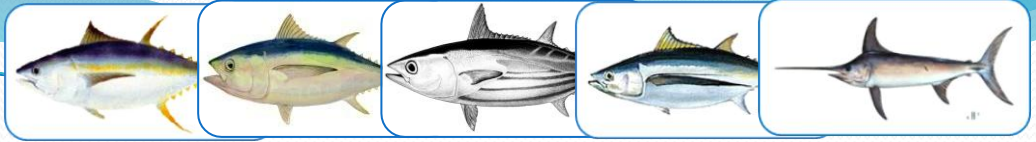# Main fleets (% catch by fleet by gear type)

Summary of main facts

- Around 9,000 vessels fishing for tunas or swordfish in the IOTC Area
    - Large scale: longline, purse seine and some gillnet and pole-and line
    - Medium scale: gillnet, gillnet/longline, pole-and-line, longline
- Overall number of vessels appears to be stable, but:
    - Numbers of large scale vessels seem to be decreasing (in particular longline)
        - Main fleets are Indonesia, Taiwan,China, Iran and Japan
    - Increasing numbers of medium scale vessels (in particular gillnet and longline)
        - Main fleets are Sri Lanka, Pakistan, Maldives, Iran and Indonesia
- Catches amounting to around 900 thousands tons, significantly lower in 2008
    - Most catches come from purse seine and longline vessels
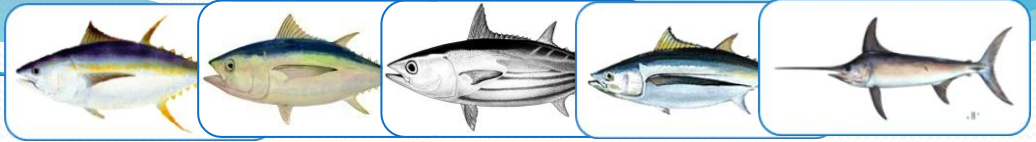   - Gillnet and pole-and-line catches are also significant

Problem Areas

Main limitations to estimate capacity

- Number of vessels fishing is uncertain for some important fleets (GI, LL)

- Incomplete information available by vessel, in particular:

  - Incomplete information on the type of fleet involved: modern, aging, artisanal

  - Incomplete information on vessel ownership (national or non-national)

  - Incomplete information on area of operation

  - Incomplete information on target species:

    - Information not available for most fleets

    - Multi-species fisheries: target is all species

  - Incomplete information on vessel dimensions (length, tonnage, fish carrying capacity)

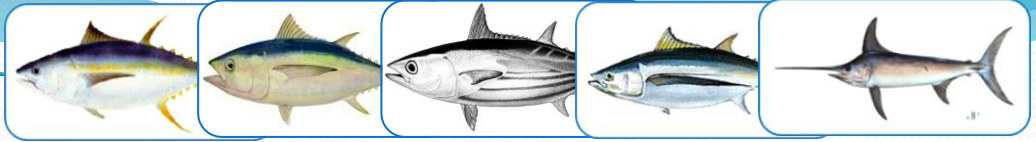- Catches not always available by gear/vessel size class

Large-scale vessels (≥24$_m$): main issues

- **Completeness of data**:
  - Active Vessel Lists not available: *India*, **Pakistan**, **Maldives**, **NEI**
  - Vessel details not fully available: **Indonesia**

- **Data quality**:
  - Inconsistent use of vessel tonnage (GRT/GT): **Indonesia**
  - Length overall inconsistent
  - Vessels using two flags: parallel registration; concurrent registration
  - Countries not reporting catches at all: **India** (longline)
  - Catches of medium scale and large scale vessels aggregated: **Maldives, Iran, Indonesia, Pakistan, Malaysia**

Medium scale vessels(<24ₘ): main issues

- **Operating area** (EEZ flag country or else):

  - Area of operation of individual vessels not known: all fleets from coastal countries in the IOTC Region, in particular **Pakistan**, **Sri Lanka**, **Indonesia, India**

- **Completeness of data**:

  - Active Vessel Lists not available: *India*, **Pakistan**, **Maldives**, **NEI**

  - Vessel details not fully available: **Indonesia**

- **Data quality**:

  - Inconsistent use of vessel tonnage (GRT/GT): **Indonesia**

  - Length overall inconsistent

  - Countries not reporting catches at all: **India** (longline)

  - Catches of medium scale and large scale vessels aggregated: **Maldives, Iran, Sri Lanka, Indonesia, Pakistan, Malaysia**

Additional considerations
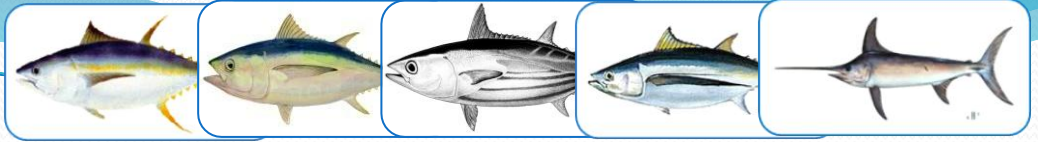
Changes in target species

- Initially, fishing vessels have to be classified by target species:

  - Target is one of the tropical tuna species / Target is albacore or swordfish

- But this information is seldom available as most tuna fisheries are multi-species: no target known for 99% of the vessels
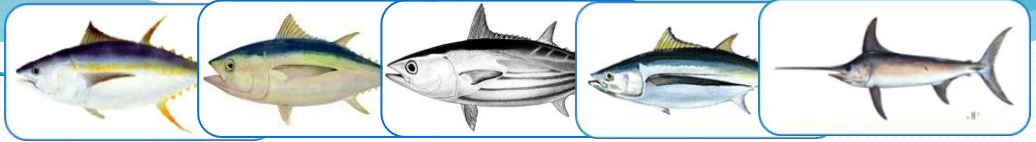
- LL can easily change target

% Catch by target group (av. 2006-08)
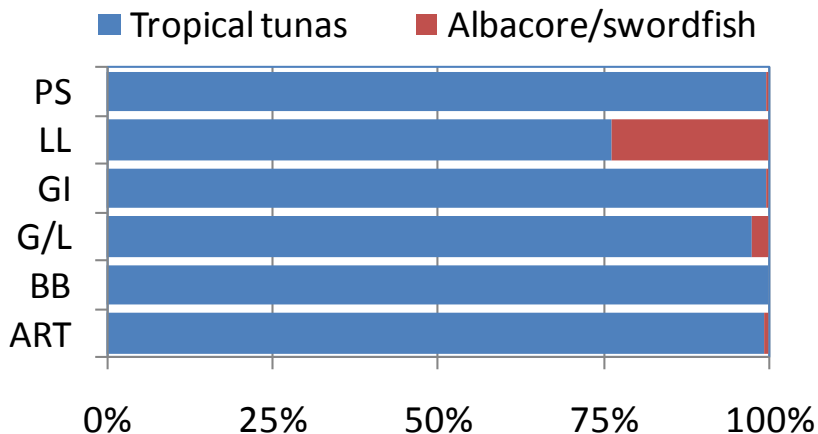
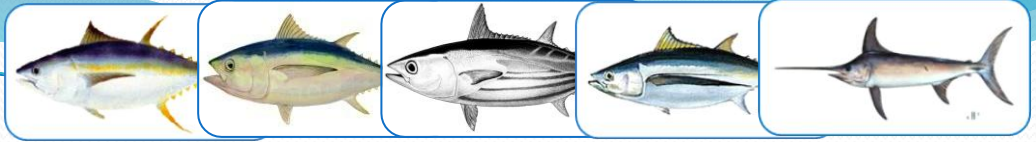

 # fishing vessels by target species group
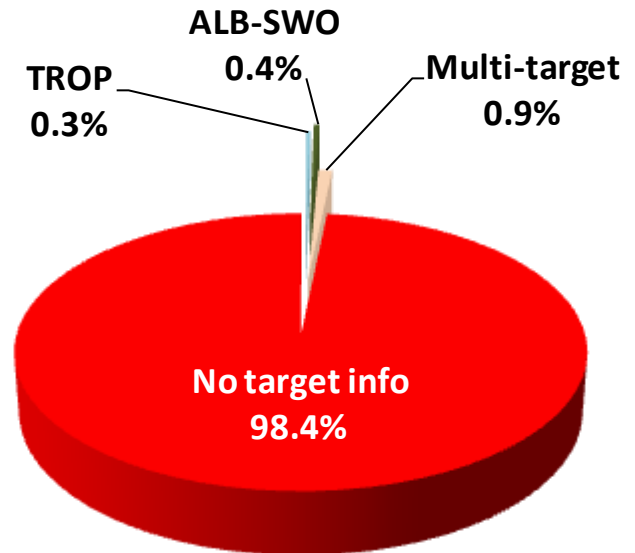
Information from IOTC List of Active Vessels

Changes in fishing efficiency

- The capacity of individual vessels does not remain static over time:

    - Tuna fleets suffer from increases in efficiency of individual vessels that result in increased fishing effort for a given vessel size: significant consequences for capacity and other effort-based management systems

    - Changes in gear configuration / fishing area / environmental conditions may lead to changes in the efficiency of individual vessels over certain species (e.g. Increased catch rates, changes in selectivity, etc.), especially in the case of multi-species fisheries
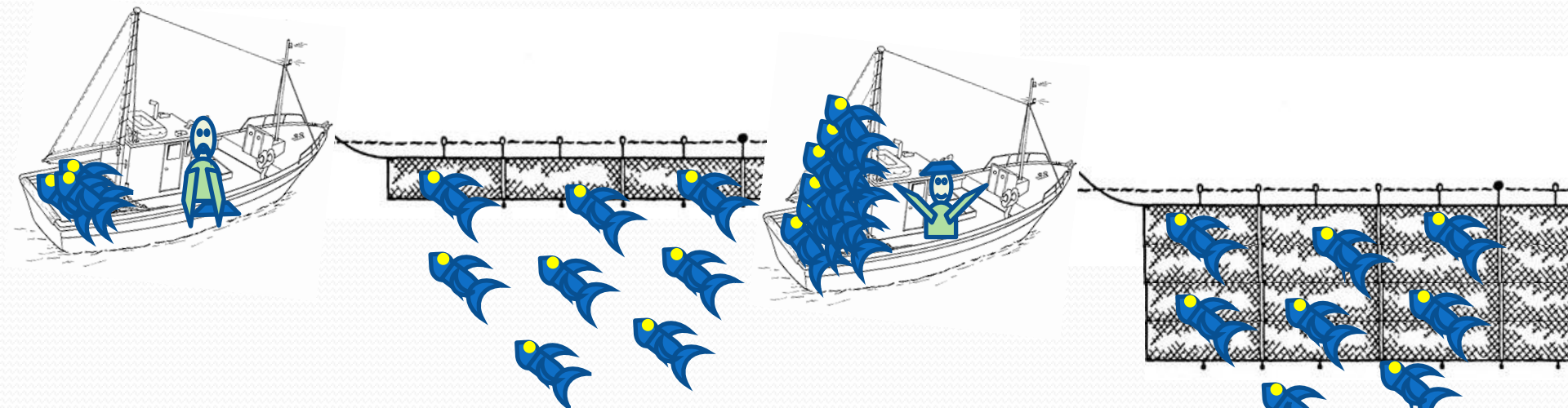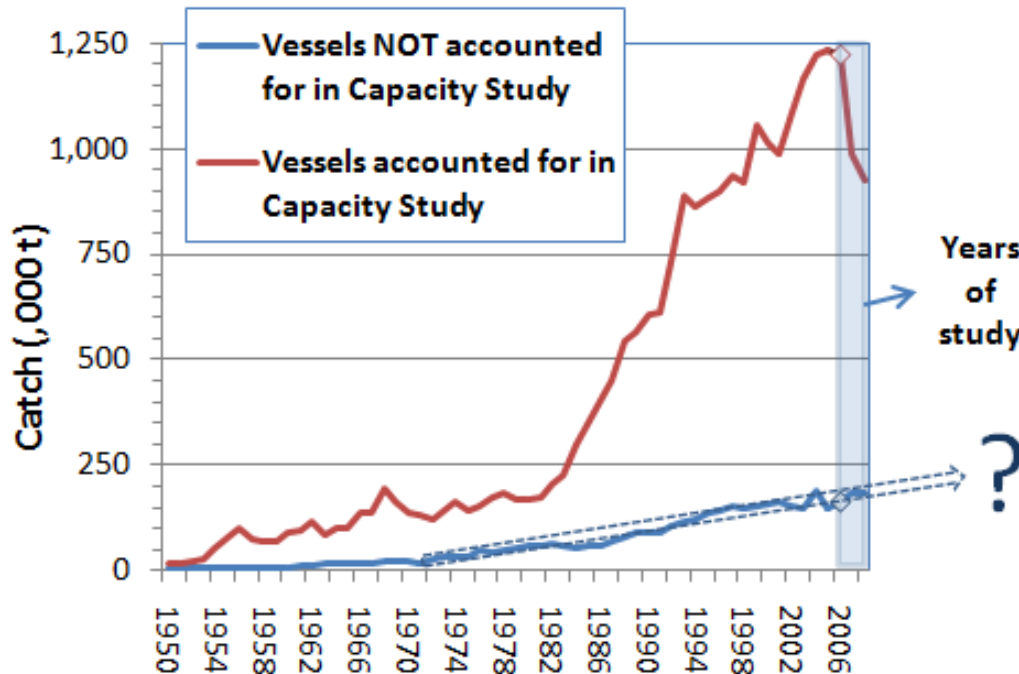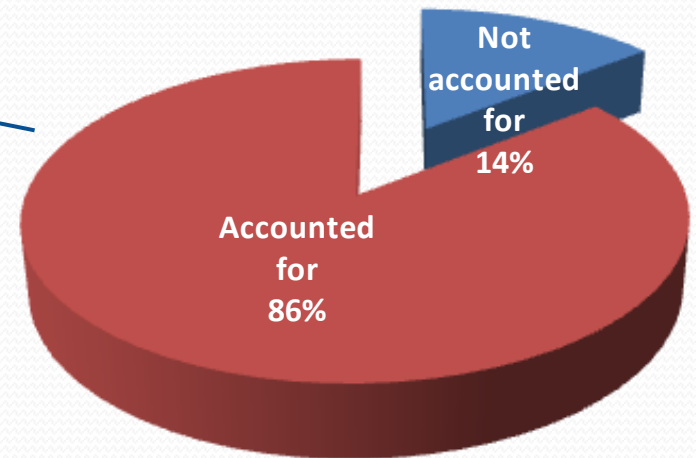
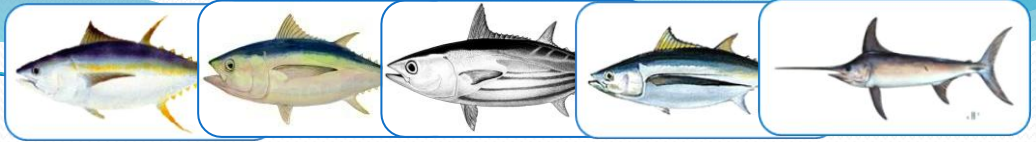# Potential development of fisheries: Artisanal

- Catches of tunas and swordfish by small scale fisheries have been increasing since the mid-1980's

- 14% of the catches of tropical tunas, albacore and swordfish for 2006-08 were taken by artisanal fisheries (for which no input capacity was estimated)
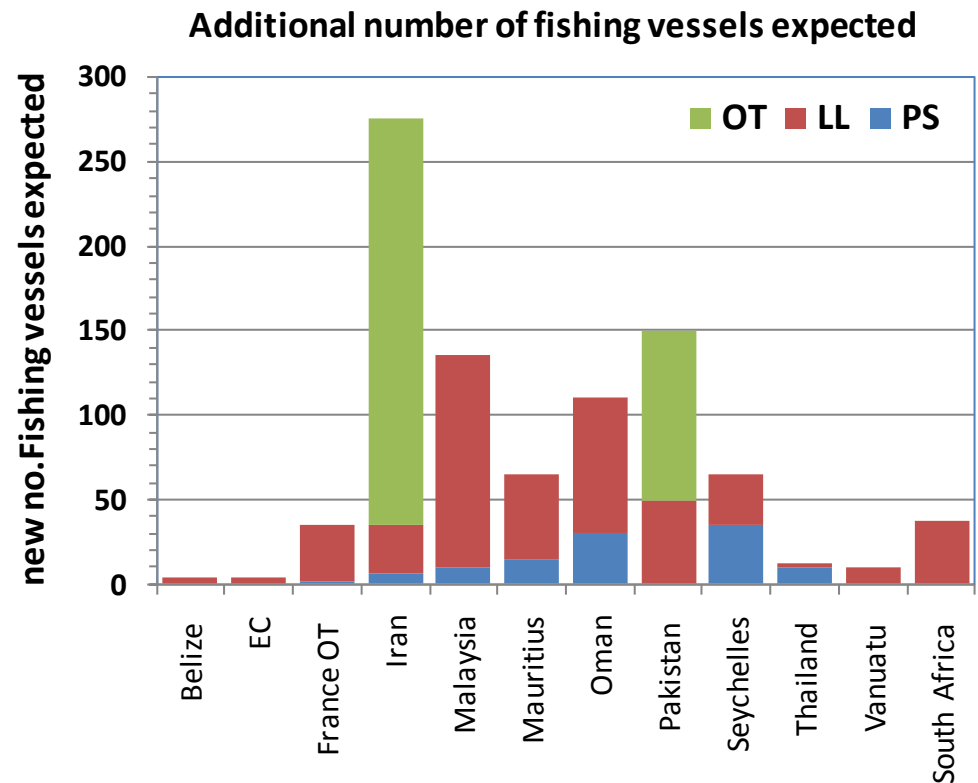
Catch by type of fishery (1950-2008)

% Catch by type of fishery (av. 2006-08)

Potential development of fisheries: Industrial

- Some countries planned for fleet increases in 2006-08 (Fleet development plans) but in most cases these increases have not materialized

- 900 vessels will be added in the case that the existing plans are fully implemented

% that the new vessel additions will make once added to the no. vessels active in 2006

Legend: ■ no.2006 ■ no.FDP

	no.2006	no.FDP
OT	6379	340
PS	79	108
LL	2603	454

(0% — 25% — 50% — 75% — 100%)

Additional number of fishing vessels expected

new no.Fishing vessels expected

Legend: ■ OT ■ LL ■ PS

(Countries: Belize, EC, France OT, Iran, Malaysia, Mauritius, Oman, Pakistan, Seychelles, Thailand, Vanuatu, South Africa)

Input *versus* output capacity measures

- As measures of output capacity are based on the best conditions experienced by the fishery, it is difficult to base management on output capacity.

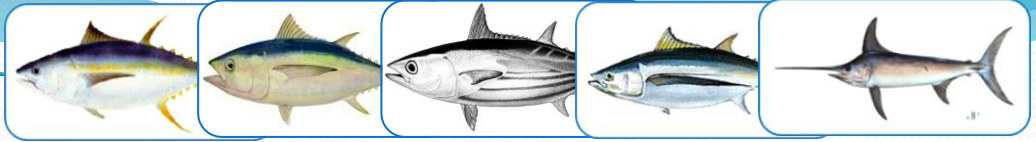- In order to estimate output-based measures of capacity, the following information is usually required:

    - Information required: name of vessel and/or register number, flag, type of vessel, length and gross tonnage (GT), hold capacity in cubic meters and/or carrying capacity in tonnes and, area and time in which the vessel was actively fishing

    - Other information desired: target species, landings, crew, capacity utilization etc. would be desired

- Estimates of output capacity may be affected by the levels of aggregation in the data. In general, increased aggregation should result in lower estimates of output capacity.
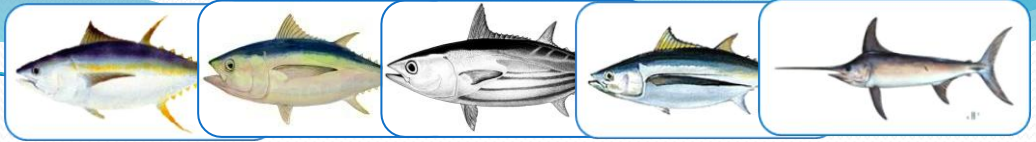
Conclusion

Need to improve current estimates

- The **present study** has to be considered as a preliminary attempt to estimate input fishing capacity in the Indian Ocean

- Improvements in certain areas are required for it to be possible to obtain more precise estimates of input fishing capacity, in particular:

    - **Pakistan**, **Sri Lanka** and **Maldives** providing lists of active vessels, including information about medium scale vessels (<24m) that operate outside its EEZ

    - **India** providing lists of active vessels

    - **Indonesia** identifying which of its medium scale vessels (<24m) operate outside its EEZ

    - **Indonesia** to verify vessel tonnage measurements and to provide length measurements for all of its vessels

    - All countries having large scale and medium scale vessels to provide separate catches by vessel size class, in particular **Indonesia, Iran**, **India** and **Malaysia**

Need to explore ?

- How the results of an assessment can be translated into estimates of optimum fishing capacity

- Do we need output capacity ? If it is the case there is need to explore...
  - The relationship between output based measures of capacity and input based measures, e.g. amount of vessels fishing or fishing effort
  - Availability of information for the estimation of output based measures of capacity

- Potential effects that changes in levels of activity / targeting practices / gear selectivity / fishing area / environment may have over estimates of capacity

- Whether all medium-scale vessels (12m≤LOA<24m) should be accounted for in future estimates of fishing capacity

- How to account for the effect of small scale fleets (or medium scale fleets not accounted for in the estimates of capacity) when estimating fishing capacity

Thanks for your attention

For more information
secretariat@iotc.org