FAO
FISHERIES AND
AQUACULTURE
TECHNICAL
PAPER

ISSN 2070-7010

543

Recent developments in the tuna industry

Stocks, fisheries, management, processing, trade and markets

Recent developments in the tuna industry

Stocks, fisheries, management, processing, trade and markets

FAO
FISHERIES AND
AQUACULTURE
TECHNICAL
PAPER

543

by

Makoto Peter Miyake
Visiting Scientist
National Research Institute of Far Seas Fisheries
Fisheries Research Agency
Shimizu, Japan

Patrice Guillotreau
Principal Lecturer
University of Nantes
Nantes, France

Chin-Hwa Sun
Professor
National Taiwan Ocean University
Keelung, Taiwan Province of China

and

Gakushi Ishimura
Assistant Professor
Hokkaido University
Sapporo, Japan

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Rome, 2010

ISBN 978-92-5-106620-1

Preparation of this document

The Fisheries and Aquaculture Resources Use and Conservation Division (FIR) of the Fisheries and Aquaculture Department of the Food and Agriculture Organization of the United Nations (FAO) is responsible for all programmes and activities relating to management and conservation of fisheries resources. This paper was prepared as part of the FIR work programme to enhance the understanding of the tuna industry, addressing the situation concerning tuna stocks, fisheries, management, processing, trade and markets. It provides an update of the earlier FAO Fisheries Technical Paper No. 467 (2004) on "Historical trends of tuna catches in the world", extending it substantially into subjects not dealt with in that earlier paper.

The paper was prepared under the direction of Jacek Majkowski, Senior Fishery Officer, Marine and Inland Fisheries Service, FIR. The authors are: Dr Makoto Peter Miyake, Visiting Scientist at the National Research Institute of Far Seas Fisheries, Fisheries Research Agency, Japan; Dr Patrice Guillotreau, Visiting Researcher in Fisheries Economics at the Institut de Recherche pour le Développement (IRD) and Principal Lecturer at the University of Nantes, France; Dr Chin-Hwa Sun, Professor at National Taiwan Ocean University, Taiwan Province of China; and Dr Gakushi Ishimura, Assistant Professor at Hokkaido University, Japan. Dr Shelley Clarke, Visiting Researcher at Imperial College in London, United Kingdom, edited the paper.

Abstract

This paper provides an updated review of world tuna fisheries. Previous studies (Miyake *et al.*, 2004) discussed the historical development of tuna fisheries, described current world tuna fisheries, and explained the technological developments that have affected fishing operations. The current paper expands the discussion to include socio-economic aspects of the tuna industry as a whole, specifically including recent changes in processing, trade, marketing and consumer preferences.

The first half of the paper introduces the conditions under which the studies were made and the data sources. It first provides caveats and assumptions which are designed to prevent misunderstanding or misinterpretation when using the data. It then reviews the world tuna stock status based on the results of Regional Fisheries Management Organizations (RFMOs) scientific reviews. Even though the biomass of most of the world's tuna stocks is generally above but close to the reference point, for a few stocks fishing mortality is above the maximum sustainable yield level indicating that the stock is being overfished. World tuna fisheries (mostly longline, purse seine and baitboat [pole-and-line] fisheries) are reviewed from the standpoint of catches, technological developments and economics. Finally, tuna management measures taken by RFMOs are reviewed, including those used to mitigate bycatch. Gear and species interactions are specifically discussed in terms of allocations of the stocks between fisheries.

The second half of the paper analyses tuna trade, processing, markets, consumption, price and profits for *sashimi*, fresh tuna steak, *katsuobushi* (dried skipjack stick) and canned tuna. The marketing of *sashimi* has changed very substantially from an exclusive Japanese market to a global one. The marketing system is also changing, because instead of being sold in market auctions, entire catches are now bought by one dealer and sold to large supermarkets or other retailers. This trend has had a clear impact on price and has resulted in the reduction of landing values. In the fresh and frozen steak tuna industry, in general, the price of tuna per unit weight is far higher than for canned materials. Since the 1960s, the production of, and demand and market for, canned tuna has increased very rapidly, accompanied by the rapid development of purse seine fisheries in tropical waters. The largest consumer of canned tuna in the 1970s was by far the United States of America, but these levels have been exceeded by European Union markets in the last two decades. The relative importance of the major markets (the United States, the European Union and Japan) has been continuously declining as a percentage of the world market. These trends have been accompanied by the concentration of capital. Another major change has involved the relocation of tuna factories from developed countries to areas closer to raw materials. This also helped the industry by cutting labour and transshipment costs, and facilitated flexible export marketing. Production was formerly dominated by the United States but as production has declined, Thailand has become the top producer in the late 1990s, followed by Spain, as a result of newly developed canning materials in the form of loins.

In conclusion, because of the recent rapid increase in competition among fisheries, species, industries and even products (*sashimi*/fresh tuna vs. canned), the most important and most urgent issue is how to manage and allocate tuna resources among these competitors (e.g. using fishing capacity control measures and/or catch allocations). In order to achieve such an objective it is imperative that socio-economic and ecological considerations are integrated into decision-making processes alongside capacity and

allocation issues. This study does not address the broad socio-economic importance of the tuna industry to the countries in which it operates, but this type of research will be necessary in future in order to solve current fishery management problems.

Miyake, M.; Guillotreau, P.; Sun, C-H; Ishimura, G.
Recent developments in the tuna industry: stocks, fisheries, management, processing, trade and markets.
FAO Fisheries and Aquaculture Technical Paper. No. 543. Rome, FAO. 2010. 125p.

Acknowledgements

The authors wish to express their gratitude to many people for their assistance in the preparation of this paper, including: Alejandro Anganuzzi (Indian Ocean Tuna Commission [IOTC], Seychelles); Alex Aires-da-Silva, William Bayliff (Inter-American Tropical Tuna Commission [IATTC], United States); Fu-Sung Chiang (National Taiwan Ocean University); Guillermo A. Compeán (IATTC, United States); Philippe Cury (Institute of Research for Development [IRD], France); Juan José García del Hoyo (Modelización Económica y Matemática de Pesquerías [MEMPES], University of Huelva, Spain); John Hampton (Secretariat of the Pacific Community [SPC], New Caledonia); Minoru Honda (Japan Far Seas Purse Seine Fishing Association); David Itano (National Marine Fisheries Services [NMFS], University of Hawaii, United States); Francis Marsac (IRD, France); Mark Maunder (IATTC, United States); Kathleen Miller (University of California-Riverside, United States); Rémi Mongruel (French Research Institute for Exploitation of the Sea, France); Kuo-Tien Lee (National Taiwan Ocean University); Hiroaki Okamoto (National Research Institute of Far Seas Fisheries, Fisheries Research Agency, Japan); Tatsuo Ono (Japan Tuna, Japan); and Ramón Jiménez-Toribio (Modelización Económica y Matemática de Pesquerías [MEMPES], University of Huelva, Spain).

The authors' special gratitude goes to James Joseph (Consultant, United States), Dale Squires (NMFS, United States) and Robin Allen (Consultant, New Zealand) for critical review of the paper and their suggestions.

Valuable statistics and information were provided by Miguel Herrera (IOTC, Seychelles); Michael Hinton (IATTC, United States); Papa Kebe (International Commission for the Conservation of Atlantic Tunas [ICCAT], Spain); Carlos Palma (ICCAT, Spain); Tim Lawson (SPC, New Caledonia); Kazuhiro Oshima (National Research Institute of Far Seas Fisheries, Fisheries Research Agency, Japan); and Peter Williams (SPC, New Caledonia).

Our special appreciation for editing the entire report is extended to Shelley Clarke. As English is not the mother language of any of the authors, her editing was essential and she also gave many peer review comments on the draft. We also greatly appreciated the assistance given by Jacek Majkowski (FAO Fisheries and Aquaculture Department) in providing valuable advice and by Luca Garibaldi, Fishery Statistician, for furnishing statistics.

Abbreviations and acronyms

ACP	African, Caribbean and Pacific
ALB	Albacore (*Thunnus alalunga*)
AMSY	average maximum sustainable yield
ARA	Amsterdam-Rotterdam-Antwerp
ATL	Atlantic Ocean
B	biomass
BB	baitboat ("baitboat" is used exclusively for "pole and line")
BET	Bigeye tuna (*Thunnus obesus*)
BFT	(Atlantic) bluefin tuna (*Thunnus thynnus*); official FAO name is bluefin tuna but often referred to as Atlantic bluefin tuna
BFTSD	Bluefin Tuna Statistical Document
BFTSDP	Bluefin Tuna Statistical Document Program
BMSY	Biomass at MSY
CCSBT	Commission for the Conservation of Southern Bluefin Tuna
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CLIOTOP	Climate Impacts on Oceanic Top Predators
CLL	coastal small-scale longliners
CPCs	Contracting Parties, Cooperating non-Contracting Parties, Entities or Fishing Entities
CPUE	catch per unit of effort
CWP	Coordinating Working Party on Fishery Statistics
DLL	distant water longliners
E	East
EC	European Commission
EEZ	Exclusive Economic Zone
EPO	Eastern Pacific Ocean
EU	European Union
F	fishing mortality rate (or coefficient)
FAD	fish aggregating device
FAO	Food and Agriculture Organization of the United Nations
FAO/TAC	FAO Technical Advisory Committee on Fishing Capacity
FDA	Food and Drug Administration (United States)
FFA	Pacific Islands Forum Fisheries Agency
FOC	flag of convenience
GG	gilled and gutted
GILL	gillnet
GPS	Global Positioning System
GRT	gross register tonnage
GSP+	Generalised System of Preferences
HAND	handline
IATTC	Inter-American Tropical Tuna Commission
ICCAT	International Commission for the Conservation of Atlantic Tunas
IND	Indian Ocean
IOTC	Indian Ocean Tuna Commission
IPOA	International Plan of Action (adopted by FAO)
IRD	Institute of Research for Development

ISC	International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean
ISSF	International Seafood Sustainability Foundation
IUU	illegal, unreported and unregulated
JPY	Japanese yen
LL	longline
MED	Mediterranean Sea
MSC	Marine Stewardship Council
MSY	maximum sustainable yield
NMFS	National Marine Fisheries Service (United States)
N	North
NEI	nowhere else included (mostly "flag of convenience")
NGO	non-governmental organization
OPRT	Organization for the Promotion of Responsible Tuna Fisheries
OTH	other gears
PAC	Pacific Ocean
PBF	Pacific bluefin tuna (*Thunnus orientalis*)
PNA	Parties to the Nauru Agreement
PPM	parts per million
PS	purse seine
RFMO	Regional Fisheries Management Organization
RP	reference point
S	South
SBF	Southern bluefin tuna (*Thunnus maccoyii*); official FAO code is SBF but often SBT is used
SC	Scientific Committee
SKJ	Skipjack tuna (*Katsuwonus pelamis*)
SPC	Secretariat of the Pacific Community
SPRT	sport (or recreational)
SSB	spawning stock biomass
SURF	surface gears
SWO	Swordfish (*Xiphias gladius*)
T	metric tonnes
TAC	total allowable catch
TAE	total allowable effort
TPC	Taiwan Province of China
TRAP	trap (or set-net)
TROL	troll
UNCLOS	United Nations Convention on the Law of the Sea
VMS	vessel monitoring system
W	West
WCPFC	Western and Central Pacific Fisheries Commission
WCPO	Western and Central Pacific Ocean
WTO	World Trade Organization
WTPO	World Tuna Purse Seine Organization
Y/R	yield per recruit
YFT	Yellowfin tuna (*Thunnus albacares*)

Executive summary

TUNA STOCK STATUS AND CHANGES IN FISHERIES

World tuna fisheries are reviewed in terms of commercially important species, by ocean and by major fishing gear types. In volume, the most important catches[1] are of skipjack tuna at 50.7 percent of the global total, particularly in the Pacific Ocean, followed by yellowfin tuna at 31.7 percent and bigeye tuna at 10.8 percent. Albacore and bluefin tunas – Atlantic bluefin,[2] Pacific bluefin and southern bluefin – are caught in much smaller quantities. The Pacific Ocean yields more than half of the world's tuna production (64 percent), followed by the Indian (25 percent) and Atlantic (11 percent) Oceans. The catch by purse seiners has increased very rapidly and now forms the majority of the total yield (from 300 000 tonnes in 1970 to 2.8 million tonnes in 2006). Longline used to be the dominant gear type but it is now rapidly losing its share (from 500 000 tonnes, 34 percent of the total in 1970, to 650 000 tonnes, 15 percent of the total in 2005), though coastal small-scale longlining is increasing.

Stock status is reviewed according to the most recent, formal assessments by each of the tuna Regional Fisheries Management Organizations (RFMOs). The review is based on two aspects: whether the biomass (or spawning biomass) is above or below the reference point (RP); and whether fishing mortality is higher or lower than the level equivalent to the sustainable yield (as represented by the RP, which is generally the maximum sustainable yield [MSY]). Catches of bigeye and yellowfin have continuously increased in the Indian and Pacific Oceans, whereas in the Atlantic they peaked in the 1990s and thereafter decreased or stabilized. Stock biomass of tropical tunas (bigeye, skipjack and yellowfin) is generally above but close to the RP, and the exploitation level is close to the MSY, except for skipjack which still appears to be underexploited. Current fishing mortality coefficients for bigeye and yellowfin are generally below the level of the RP, except those for bigeye in the Pacific Ocean and yellowfin in the Indian Ocean which are above the MSY level. The temperate tunas (albacore, southern bluefin, Pacific bluefin and Atlantic bluefin) are more heavily exploited. In particular, southern bluefin and Atlantic bluefin are both in an overfished state and are currently being overfished.

The technological and physical development of fishing gear and its deployment is continuously progressing. The most recent change with the greatest impact on fisheries was the introduction of fish aggregating devices (FADs) by the purse seine fleet. The recent increase in purse seine catches is directly related to the increase of small-sized tropical tunas caught in association with FADs.

At present, sets on FAD schools take most of the fish in the habitat developed under the FAD, hence the species and sizes are highly variable, including many non-target small tunas and other species. Since the stock size of bigeye is small compared to yellowfin and skipjack, the capture of juvenile bigeye underneath FADs has a more substantial impact on the stock. This has significantly altered the yield per recruit

---

[1] Percentages represent the five-year average for 2001–2005 (see Section 4.1.2). Data for 2006–2007 were preliminary at the time this report was written.

[2] The formal taxonomical name is bluefin tuna. However, in order to avoid confusion with Pacific bluefin tuna, it is called "Atlantic bluefin" in this report.

(Y/R) of bigeye stocks as well as the allocation of stocks between longline and surface fisheries (particularly purse seine).

The greater use of at-sea transshipment (mostly by distant water longline fisheries) and increased use of supply vessels (by purse seine) have increased the fishing capacity of the fleets, even if the number and fish holding capacity of the fleet has been held constant.

The development of coastal fisheries, including coastal longline fisheries, is also an important feature of the last two decades. This is primarily related to the establishment of Exclusive Economic Zones (EEZs), but is also very closely linked to cost effectiveness and management schemes aimed at distant water fleets.

The establishment of tuna farms has also had a major impact on fisheries, particularly through changes in market price and trade and market structure. As a result of farming, fishing pressure has increased for both large and small fish.

TUNA MANAGEMENT

Scientists from the RFMOs use the most recent and best available data and information to evaluate the stocks and provide advice for management. Government representatives do not necessarily fully respond to such advice, but many actions have been taken including those responding to environmental or ecosystem concerns (mostly mitigation of incidental bycatch). The adoption and implementation of management measures has become more difficult in recent years due to the global excess fishing capacity. As tuna fisheries are multispecies and multigear, when a regulation is adopted spillover of fishing capacity inevitably occurs and thus global management of fishing capacity is an urgent need.

Management measures, including those to combat and eliminate illegal, unreported and unregulated fishing and other unauthorized activities, can have a negative effect on fishing efficiency. In particular, recent bycatch mitigation measures have had a major impact on fisheries in general, especially longliners. As a result, gains in fishing efficiency have slowed. This is important since it may cause scientists to overestimate increases in catchability, fishing efficiency and fishing capacity for recent years.

In conclusion, most of the long-term changes in the fisheries have acted to increase the fishing efficiencies of all fleets. However, many of the recent changes, particularly for longline fisheries (i.e. tuna stocks are approaching or exceeding their full exploitation level; Y/R is reducing due to increasing juvenile catches; the number of regulations is growing; obligations for bycatch mitigation are expanding; competition among gear types has been accentuated; and both global fishing capacity and operational costs have risen) have had a negative impact on tuna fisheries (e.g. reduced efficiency) and, if not decreased, at least slowed down the trend of increasing catchability.

OPERATING COSTS AND REVENUE

Fishery operating costs were analysed by expenditure item. Case studies for Japanese distant water longline, baitboat and purse seine fleets; the Japanese near-coastal longline fleet; and the Seychelles-based large-scale purse seine fleet were assessed. In general, the average purse seine operation produces a profit; however, the other distant water fisheries are operating almost at a loss. Even purse seine profits are shrinking due to the increasing cost of fuel, labour and materials, while landing values (revenue) cannot be increased. The fuel costs are significant and widely fluctuating. The recent rise in fuel prices did not have as large an effect on the European fleet as on other fleets, due to the favourable monetary exchange rates for euros (because oil prices are generally quoted in United States dollars). In the case of the Japanese fleets, labour costs are very substantial. Replacement of national crews by foreign crews, mostly Indonesian, provides some cost relief.

TUNA MARKET – *SASHIMI*

Tuna trade, processing, markets, consumption, price and profits are discussed for *sashimi*, fresh tuna steak, *katsuobushi* (dried skipjack stick) and canned tuna.

The *sashimi* market was almost exclusively centred in Japan, but it has recently expanded worldwide. The Japanese domestic supply is slightly above 200 000 tonnes (all tuna combined but excluding skipjack, in round weight), while about 400 000 tonnes of tuna are imported. (These figures are in round weight and thus different from most recorded trade or market statistics.) Except for small amounts of albacore, these fish are usually consumed in fresh form. Slightly less than 300 000 tonnes of skipjack are caught by national vessels and 100 000 tonnes are imported. More than a half of the skipjack are either for canning or *katsuobushi*. Both catch and imports of skipjack have decreased in recent years.

One major problem is that the statistics for markets, trade and production are generally in terms of processed products and it is difficult to relate these to round weight. The decrease in Japanese imports may well be due to the nature of the products imported: in recent years, more and more processed (reduced in volume) products have been imported, for example, *sashimi* sliced blocks rather than gilled and gutted fish.

The marketing of *sashimi* has changed significantly as well. Concentration of trade within a smaller number of dealers (traders), wholesalers and retailers is commonly occurring in parallel with a reduction in trade intermediaries. Instead of fish being sold in market auctions, entire catches are now bought by one dealer and sold by large supermarkets or other retailers. This trend has had a clear impact on price and has resulted in the reduction of landing values.

TUNA MARKET – FRESH AND FROZEN TUNA (NON-*SASHIMI*)

Many parts of the world, including southern Europe, Asia, the Pacific Island States and Japan, have a long tradition of consuming non-canned tuna. Recently, this type of consumption has expanded throughout the world, particularly in North America. One of the difficulties in assessing statistics for non-canned tuna is separating these quantities from canned materials and from *sashimi*. Uncertainty in product weights due to different processing forms is also a major issue for this review.

In general, the price of tuna per unit weight is far higher for fresh consumption than for canned products. In the United States, recent tuna imports for non-canning purposes ranged from 60 000 to 90 000 tonnes with an increasing trend, while domestic landing of such products ranges from 20 000 to 30 000 tonnes with a declining trend. Total consumption in the United States is estimated at 80 000 to 110 000 tonnes per year

TUNA MARKET – CANNED GOODS

Canning of tuna began as early as the late nineteenth century. Tuna was once a low-value substitute for other fish (e.g. salmon, sardines), but since the 1960s the production, demand and market increased very rapidly, accompanied by the rapid development of purse seine fisheries in tropical waters. World canned tuna production increased from about 200 000 tonnes (net weight) in the mid-1970s to over 1 million tonnes by the early 2000s. The United States was the largest producer in the 1970s, but now only American Samoa is still producing on United States soil, and there is no canning taking place in the mainland United States. As United States production has declined, Thailand, since the late 1990s, has become the top producer and is now responsible for almost 46 percent of the world production, followed by Spain (nearly 10 percent). The Spanish canning industry has been maintained through shipping of newly developed canning materials in the form of loins (cleaned, boiled and prepared, and ready for canning).

The largest consumer of canned tuna in the 1970s was by far the United States, followed by the European Union and Japan. Both the number of countries importing

and exporting canned tuna has increased and the cumulative market share of the top three importing countries (North America, European Union and Japan) has dropped from 96 percent to 74 percent over the last three decades. The gradual expansion of the European Union has allowed it to maintain its market share at above half of the worldwide market; however, the relative importance of the United States market has been reduced by half over time.

The globalization of the canning industry in the last three decades is strikingly apparent. It has been accompanied by the concentration of capital into a small number of operators, in the form of fishing vessels, traders, wholesalers, canneries and/or retailers. This represents one method of reducing the costs of production. Another major change has been the relocation of tuna factories from developed countries to areas closer to raw materials. This has also helped the industry by cutting labour and transshipment costs and facilitated flexible export marketing. In some cases, the establishment of a canning industry has been a condition for obtaining fishing access to the EEZ. Also, the development of products with reduced transshipment costs for materials and lower production costs for industry has also been important (e.g. vacuum-packed *sashimi* blocks and loins).

On the part of retailers, there is a trend toward separation into two product classes of canned tuna, i.e. cheap private brands and expensive, sophisticated products. Naturally, the large wholesalers and retailers depend primarily on private brands. As a result, the value chain flows in reverse to the product flow, i.e. consumers decide the price and industry has to meet this requirement. Because of the globalization of the industry (market, processing and fishery), the key to its existence lies in trimming production costs at each stage and reducing margins between stages of the value chain as much as possible. In order to achieve this, the concentration of capital is occurring at each stage, including retail, wholesale, cannery, cannery supply, fresh fish markets, and the fishing industry itself. Cutting margins between these stages or skipping some of the stages has occurred in both the *sashimi*/fresh tuna and the canning industry. Development of private brands (labels) also serves this purpose.

The consumer market is susceptible to many factors. It can be easily influenced by the mass media or by public concerns at the time. The impact on the market can be unpredictably positive or negative. Therefore, there is always some risk involved for the entire tuna industry. Recently, there are fewer tariff-type trade barriers. This helps to cut production costs and increases the fluidity of trade in tuna products.

CONCLUSIONS

In conclusion, while tuna fisheries' efficiencies are being reduced by many new elements, the market is becoming increasingly dynamic. This results in higher competition among the fisheries, species, industries, and even between products – *sashimi* and fresh tuna vs canned. This scenario is analogous to that of a pie that has already expanded dramatically to its maximum but for which the number of pie consumers has also increased and is still increasing. At present, the most important issue is how to manage the number of potential pie consumers and how to distribute the pie among them (e.g. using fishing capacity control measures and/or catch allocations). In order to achieve such an objective, it is imperative that socio-economic and ecological considerations are incorporated into decision-making processes alongside capacity and allocation issues. This study does not address the socio-economic importance of the tuna industry as a whole to the countries in which it operates, but this type of research will be necessary in the future in order to solve current fishery management problems.

Contents

BOXES

FIGURES