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WORLD MARKETS AND INDUSTRY OF SELECTED COMMERCIALLY-EXPLOITED AQUATIC SPECIES WITH AN INTERNATIONAL CONSERVATION PROFILE

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WORLD MARKETS AND INDUSTRY OF SELECTED COMMERCIALLY-EXPLOITED AQUATIC SPECIES WITH AN INTERNATIONAL CONSERVATION PROFILE

by
Camillo Catarci
Consultant
FAO Fisheries Department

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
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Foreword

Purpose of the paper

Driven by world population growth and increased global demand for fishery products, fishing pressure has been rapidly increasing over the past years. Marine captures totalled 86.0 million MT in 2000, a level close to the historic peak of 86.4 million MT in 1997, following the decline to 79.2 million MT in 1998[1]. Capture of inland fish resources, in turn, increased from 7.5 million MT in 1997 to 8.8 million MT in 2000[2] (FAO 2002).

As the State of World Fisheries and Aquaculture (SOFIA) reports, only an estimated 25 percent of the major marine fish stocks or species groups for which information is available are underexploited or moderately exploited. About 47 percent of them are fully exploited and are therefore producing catches that have reached, or are very close to, their maximum sustainable limits. Another 18 percent are reported as overexploited. Ten percent of stocks have become significantly depleted, or are recovering from depletion through the implementation of drastic and long-term reductions in fishing pressure and other management measures (FAO 2002).

Over time, the international community has launched various international and regional conservation initiatives with the aim of improving the conservation status of commercially exploited aquatic species, with a particular focus on depleted and overexploited species. Such initiatives include:

- management measures by regional fishery bodies and arrangements (RFBAs)[3];
- international treaties; and
- soft law.

The commercial exploitation of aquatic species provides food and income in most areas of the world, and especially in developing countries and transition economies. This paper aims to assess the economic and social importance of selected fisheries targeting aquatic species with an international conservation profile. In order to ensure adequate representation, the following species were chosen:

- Sturgeons and paddlefishes (Acipenseriformes), large inland fish species of high commercial value, mainly occurring in the northern hemisphere. These species are highly threatened by legal and illegal overfishing. They have been listed as a genus in Appendix II to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), while some particular species have been listed in Appendix I.

[1] This decline was caused by the adverse impact of *El Niño* (FAO 2002).
[2] However, as the State of World Fisheries and Aquaculture (SOFIA) reports, there are significant problems concerning the accuracy of inland fishery statistics (FAO 2002).
[3] On the basis of scientific evidence, RFBAs recommend measures aimed at maintaining the natural resources under their mandate at levels allowing maximum sustainable catch.

- Caribbean queen conch (*Strombus gigas*), a mollusc of high commercial value, exploited by both artisanal and commercial fisheries in tropical areas. It is listed in Appendix II to the CITES Convention.
- Sharks (Chondrichthyes), widely distributed but still understudied animals, generally considered as “poor people’s fish”, but for their fins, which fetch high prices in world markets. Sharks are generally taken by commercial fisheries as bycatch, whereas targeted shark fisheries are largely artisanal. Sharks are protected by the CITES Convention, the Convention on Migratory Species of Wild Animals (CMS), the UNCLOS Convention and by the FAO International Plan of Action for the Conservation and Management of Sharks (IPOA-Sharks).
- Patagonian toothfish (*Dissostichus eleginoides*), a large oceanic species, particularly appreciated by North American, European and Japanese connoisseurs for its flesh, and exploited by commercial fisheries in the areas bordering the Antarctic. The Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR) has set up a sustainable management regime for this resource.

Another selection criterion has been the under-representation of the species in marketing and industry literature, historically focused on traditional commodities such as bivalves, cephalopods, crab, fishmeal and fish oil, groundfish of the genera *Gadhus* spp., *Merluccius* spp. and *Theragra* spp., lobster, salmon, shrimp, small pelagics and tuna.

Background to the international environmental legislation with an impact on the commercially-exploited aquatic species analysed in this paper

CCAMLR

The Convention on the Conservation of Antarctic Marine Living Resources came into force in 1982, as part of the Antarctic Treaty System. Outcomes of the Convention were the CCAMLR and its Scientific Committee. CCAMLR is a trans-oceanic RFBA whose mandate covers marine living resources in the Southern Oceans.

CCAMLR and its Scientific Committee pioneered the "ecosystem approach" to the management of fisheries. The ecosystem approach, according to CCAMLR, does not concentrate only on the species fished, but also seeks to avoid situations where fisheries have a significant adverse effect on dependent and related species.

CCAMLR set up measures to prevent and combat Illegal, Unreported and Unregulated fishing (IUU). In the case of Patagonian toothfish, the Commission established an International Catch Documentation Scheme (CDS) to track and monitor trade in *Dissostichus* spp. According to the scheme, Parties are required to document all toothfish landed in their ports, transhipped in their vessels or through their ports, in order to avoid IUU fishing.

CITES

The aim of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) is to ensure that international trade in specimens of wild animals and plants does not threaten their survival. CITES works by making international trade in selected animal and plant species conditional to certain controls. All import, export, re-export and introduction from the sea, of species covered by the Convention must be authorised through a licensing system. The species covered by CITES are listed in three appendices, according to the degree of protection needed:

- Appendix I includes species threatened with extinction. Trade in specimens of these species is permitted only in exceptional circumstances;

- Appendix II includes species not necessarily threatened with extinction, but in which trade must be controlled in order to avoid utilisation incompatible with their survival;

- Appendix III contains species that are protected in at least one country, which has asked other CITES Parties for assistance in controlling trade in such species.

Each Party to the Convention must designate one or more Management Authorities in charge of administering the licensing system and one or more Scientific Authorities to advise them on the effects of trade on the status of the species. A specimen of a CITES-listed species may be traded only if the appropriate document has been obtained and presented for clearance at the port of entry or exit.

Commercially-exploited aquatic species listed in CITES appendices include sturgeons and paddlefishes (Appendix II as a genus and Appendix I), three shark species (the basking shark *Cethorinus maximus* and the whale shark *Rhincodon typus* in Appendix II and the great white shark *Carcharodon carcharias* in Appendix III) and the Caribbean queen conch in Appendix II.

Other international legislation

The Convention on the Conservation of Migratory Species of Wild Animals (CMS) aims to conserve terrestrial, marine and avian migratory species throughout their range. Parties to CMS work together to conserve migratory species and their habitats by providing strict protection for the endangered migratory species listed in its Appendix I, by concluding multilateral Agreements for the conservation and management of migratory species listed in its Appendix II, and by undertaking co-operative research activities. The whale shark and the great white shark, plus several Acipenseriformes, are listed in Appendix II to CMS.

The United Nations Convention on the Law of the Sea (UNCLOS) establishes a comprehensive legal framework to regulate all ocean space, its uses and resources. It

contains provisions relating to the territorial sea, the contiguous zone, the continental shelf, the exclusive economic zone and the high seas. It also provides for the protection and preservation of the marine environment, for marine scientific research and for the development and transfer of marine technology.

Annex I to UNCLOS provides a list of highly migratory fish species, including tunas, bonitos, billfishes (Scombroidei) and many oceanic sharks[4]. The United Nations Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982, relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, was adopted in 1995 and entered into force in 2001. It sets out principles for the conservation and management of those fish stocks and establishes that such management must be based on the precautionary approach and the best available scientific information. The agreement elaborates on the principle of international cooperation, established in UNCLOS, as a means to ensure conservation and promote the objective of optimum utilization of fish resources. The agreement attempts to achieve this by providing a framework for cooperation in the conservation and management of those resources.

Soft law

The Code of Conduct for Responsible Fisheries (CCRF) is based on an approach to fisheries management embracing environmental, social and economic considerations. It sets out principles and international standards of behaviour for responsible practices in fisheries and aquaculture with a view to ensuring the effective conservation, management and development of living aquatic resources, with due respect for the ecosystem and biodiversity. The Code recognises the nutritional, economic, social, environmental and cultural importance of fisheries and the interests of all those concerned with the fishery sector. It takes into account the biological characteristics of the resources and their environment and the interests of consumers and other users.

The Code of Conduct was formulated in a way that that would allow it to be interpreted and applied in conformity with the relevant rules of international law, such as UNCLOS and the Fish Stock Agreement[5] of 1995. It also encompasses the principles of sustainability enshrined in the Cancún Declaration of Responsible Fishing[6] and by chapter 17 of Agenda 21.

The Code is voluntary, however, certain parts of it are based on relevant rules of international law. The Code also contains provisions that may be or have already been

[4]Oceanic sharks included in UNCLOS are: bluntnose sixgill shark *Hexanchus griseus*; basking shark *Cetorhinus maximus*; the whole family *Alopiidae*; whale shark *Rhincodon typus*; the whole family *Carcharhinidae*; the whole family *Sphyrnidae*; the whole family *Isurida*.

[5] The Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks.

[6] It represents one of the main outcomes of the International Conference on Responsible Fishing, held in Cancún in May 1992

given binding effect by means of other obligatory legal instruments amongst the parties. Examples include the Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas (Compliance Agreement), adopted in 1993 and forming an integral part of the Code.

The Code of Conduct for Responsible Fisheries has been recently integrated in four voluntary instruments, the International Plans of Action (IPOAs). Three IPOAs have been adopted by the FAO Committee on Fisheries (COFI) in 1999:

- The International Plan of Action for Reducing Incidental Catch of Seabirds in Longline Fisheries (IPOA-Seabirds);
- International Plan of Action for the Conservation and Management of Sharks;
- The International Plan of Action for the Management of Fishing Capacity (IPOA-Capacity).

A fourth IPOA has been adopted in 2001, i.e. the International Plan of Action to prevent, deter and eliminate illegal, unreported and unregulated fishing (IPOA-IUU).

The IPOA-Sharks is aimed at the conservation and sustainable management of chondrichthyans (sharks, rays and chimaeras) through national plans of action. These aim to, *inter alia*:

- ensure the sustainability of shark catches from species-specific and non species-specific fisheries;
- assess threats to shark populations;
- determine and protect critical habitats;
- involve all stakeholders in research, management and educational initiatives within and between States;
- minimize waste and discards from shark;
- encourage full use of dead sharks;
- facilitate improved species-specific catch and landings data and monitoring of shark catches;
- facilitate the identification and reporting of species-specific biological and trade data.

The Committee on Trade and Environment (CTE) of the World Trade Organization (WTO)

The World Trade Organization (WTO) is the institutional structure governing the current international trading system. It was established in 1994 as one of the main outcomes of the Uruguay Round of the General Agreement on Tariffs and Trade (GATT). The WTO system has three main purposes:

- **To help trade flow as freely as possible**, through removing obstacles such as tariff and non-tariff barriers and ensuring the transparency of trade rules;

- **To serve as a forum for trade negotiations**, since trade agreements and tariff concessions are negotiated multilaterally;
- **To settle trade disputes**, through trying to conciliate diverging interests between states and providing the interpretation of WTO agreements through its Dispute Settlement Body (DSB).

The core of the WTO system is the principle of non-discrimination. According to this principle, a member country should not discriminate between other WTO members, which are all given most-favoured nation (MFN) status, and between its own and foreign products, services and nationals, which are all given "national treatment". Under the MFN principle, if a country grants a special treatment to one or more of its trading partners, it has to extend the same treatment to all trading partners. Under the national treatment principle, products, services and nationals from one WTO member country should be treated in any other WTO member country as if they were domestic. Both principles meet some exceptions, due to the presence of organizations pursuing regional economic integration such as the EU (WTO 2001).

Trade measures aimed at the conservation of commercially-exploited aquatic species, to be consistent with the WTO framework, must be **non-discriminatory**, particularly with respect to their application against non-parties, **transparent** and **directly linked to a policy of conserving an exhaustible natural resource**. It is in the mandate of the WTO Committee on Trade and Environment (CTE) to:

- identify the relationship between trade measures and environmental measures in order to promote sustainable development;
- make appropriate recommendations on whether any modifications of the provisions of the multilateral trading system are required, compatible with the open, equitable and non-discriminatory nature of the system.

(WTO 2001).

The CTE is currently trying to address the trade provisions that several Multilateral Environmental Agreements (MEAs) contain. Problems are less likely to occur in the WTO between countries that have signed the relevant MEA and have therefore agreed to the trade measures prescribed in it. Problems are more likely to occur when the relevant MEA obliges its parties to apply trade measures to imports from non-parties (WTO 2003). However, thus far, no case has been brought to the WTO DSB against any of the trade measures aimed at the conservation of natural resources (OECD 2003).

Methodology and shortcomings

This report is composed of four separate studies covering Acipenseriformes, *Strombus gigas*, Chondrichthyes and *Dissostichus eleginoides*. The author has striven to provide a balanced evaluation resulting from the analysis of a series of cases, leaving room for future developments and re-evaluation of the conclusions of the studies.

The capture and trade statistics are mostly those collected by the Fishery Information, Data and Statistics Unit (FIDI) of FAO, and made available through the Fishstat Plus database (hereinafter: Fishstat +), complemented by other sources, such as EUROSTAT, CITES, and national statistics. National reports are the main, but not the only source of data used by FAO to maintain its fishery statistics database. In cases where data are missing or are considered unreliable, FAO includes estimates based on the best available information from any qualified source. International trade statistics are obtained from countries and supplemented through a comprehensive network of regional intergovernmental institutions created by FAO (the FISHINFOnetwork).

FAO's capture and trade statistics are global in coverage, have complete time series since 1950 and are regularly updated. However, during the last decade, financial support for the development and maintenance of national fishery statistical systems has decreased sharply in real terms, while information needs have been increasing dramatically. The outcome, reflected in the Fishstat + database, may present shortcomings in terms of coverage, timeliness, and quality. The result is that the general trends are probably reliably reflected by the available statistics but the annual figures and the assessments involve a certain degree of uncertainty.

FAO data on employment in fishing, provided by FIDI[7], are generally under-representative of the real extent of fishery employment in given countries. Data on employment in the secondary sector are very limited and generally provided without distinction between processing and marketing. Furthermore, gender breakdown is generally not provided by the references consulted (FAO FIDI data and the various FAO fishery country profiles). Last but not least, data on employment in selected fisheries (e.g. sharks, sturgeons, etc.) are very rarely provided, the paper mostly relying on estimates drawn on the basis of FAO data, following this methodology:

Number of sturgeon fishers in country X = (total inland fishers of X)*[(sturgeon catch of X)/(total inland catch of X)]

Number of queen conch fishers in country Y = (total marine fishers of Y)*[(queen conch catch by Y in the Western Central Atlantic area)/(total marine catch by Y in the Western Central Atlantic area)]

Number of Patagonian toothfish fishers in country Z = (total marine fishers of Z)*[(Patagonian toothfish catch of Z)/(total marine catch of Z)].

The analyses of the economic and social importance of the Caribbean queen conch *Strombus gigas* and on Acipenseriformes benefited the most from availability of data and literature. The regional concentration of the resources also allowed the formulation of more precise and reliable estimates. However, data on catch and trade of queen conch

[7] All employment data in this paper referenced as "FAO FIDI data" are provisional and due to be issued in a forthcoming FAO Fisheries Circular.

include other conchs and univalves. The sources consulted on sturgeons showed a lack of data on employment in caviar processing and marketing.

The study on the Patagonian toothfish *Dissostichus eleginoides* benefited from the geographic concentration of the resource and the availability of literature, but there are shortcomings in the quality of employment data. Also the existence of unresolved and sometimes unknown issues such as IUU fishing constitutes a constraint to a sound analysis.

The study on chondrichthyans was the most affected by data shortcomings. The general nature of catch and trade data provided did not allow a precise judgement of sustainability in the utilization of sharks, rays and chimaeras. Furthermore, the particular nature of the fishery, which is more linked to commercial bycatch than to a targeted fishery *per se*, does not allow assessment of its social relevance with a high degree of precision[8].

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[8] As a result, estimates on employment in shark fisheries have not been drawn, with the exception of China, the only case country which made available some data on targeted shark fisheries.

Main findings of the study

Introduction

This paper provides an overview of the market for selected non-traditional commercially-exploited aquatic species sharing an international conservation profile. Most of those species are important internationally traded fish commodities. Caviar, shark fins, queen conch meat and toothfish fillets are appreciated by connoisseurs as gourmet delicacies. Some shark fins and caviar in particular may be considered among the most expensive seafood commodities in the world.

Sturgeons, queen conch, sharks and Patagonian toothfish provide income and employment opportunities to fisheries in developing countries, in transition economies, and also among local and traditional communities in developed countries, such as shark fishers in Japan. Because of their high market value these species represent appealing targets for those fisheries. In particular, sturgeons, queen conch and Patagonian toothfish are traditionally valuable and demanded species also affected by poaching and smuggling. Historically sharks have been considered as cheap and abundant but the demand for shark fins has significantly increased the commercial interest in these animals, hence their conservation profile.

Sturgeons, queen conch and two shark species are listed in the appendices to the CITES Convention, while the Patagonian toothfish is managed by CCAMLR. A number of other binding agreements and soft law are aimed at the conservation of these species. Some of the internationally binding agreements listed in this paper entail trade restrictions for the species under their protection system. These trade measures can be considered compatible with the WTO system only when they are:

- non-discriminatory, particularly with respect to the application against non-parties,
- transparent, and
- directly linked to a policy of conserving an exhaustible natural resource.

Thus far, no case has been brought to the Dispute Settlement Body of the WTO against any of the trade measures aimed at the conservation of natural resources. However, some countries pointed out the presence of a grey area in the relation between WTO and international environmental law, particularly when international environmental law provides for import restrictions on WTO members which are not parties to the environmental agreement in question.

Therefore, commercially-exploited aquatic species with an international conservation profile entail a series of issues, such as the relationship between species conservation and income generation for developing countries, and between species conservation and trade liberalization.

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Further credits are given at the beginning of each study.

Camillo Catarci
Consultant
FAO Fisheries Department

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ABSTRACT

Over time, the international community has launched initiatives aimed at improving the conservation status of commercially-exploited aquatic species. The four separate studies in this report target four species or groups of species with an international conservation profile and which are traditionally under-represented in market and industry literatures. These species are sturgeons (Acipenseriformes), Caribbean queen conch (*Strombus gigas*), sharks (Chondrychthyes) and Patagonian toothfish (*Dissostichus eleginoides*). The sturgeon and caviar industry is a commercial one, with traditionally high capture and export patterns. The queen conch fishery is an important provider of employment and income among fishing communities in the Western Central Atlantic area. The shark fishery is a relatively large and financially important one. Sharks are mainly taken as bycatch of other commercial fisheries such as tuna and billfishes. The Patagonian toothfish is exploited by an industrial fishery which is concentrated in the southernmost areas of the Atlantic and the Pacific and in Antarctic waters.

List of abbreviations

CARICOM	Caribbean Community and Common Market
CCAMLR	Convention for the Conservation of Antarctic Marine Living Resources
CDS	International Catch Documentation Scheme
CFMC	Caribbean Fishery Management Council
CFRAMP	CARICOM Fishery Resources Assessment and Management Programme
CIA	United States Central Intelligence Agency
CIBPO	Caviar Caspian Balyk Industry Association
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CMS	Convention on the Conservation of Migratory Species of Wild Animals
COFI	FAO Committee on Fisheries
CoP 10	Tenth Conference of the Parties to the CITES Convention
CoP 12	Twelfth Conference of the Parties to the CITES Convention
CTE	Committee on Trade and Environment
DSB	Dispute Settlement Body
DSBB	Dissemination Standards Bulletin Board
EEZ	Exclusive Economic Zone
ESCAP	UN Economic and Social Commission for Asia and the Pacific
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FIDI	Fishery Information, Data and Statistics Unit
FII	Fishery Industries Division
FIIU	Fish Utilization and Marketing Service
FIR	Fishery Resources Division
FIRI	Inland Water Resources and Aquaculture Service
FIRM	Marine Resources Service
FOB	Free On Board
GATT	General Agreement on Tariffs and Trade
GDP	Gross Domestic Product
H&G	Headed and Gutted
HP	Horse Power
ILO	International Labour Organization
IMF	International Monetary Fund

INCOPESCA	*Instituto Costarricense de Pesca y Acuicultura*
IPOA-Capacity	International Plan of Action for the Management of Fishing Capacity
IPOA-IUU	International Plan of Action to prevent, deter and eliminate illegal, unreported and unregulated fishing
IPOA-Seabirds	International Plan of Action for Reducing Incidental Catch of Seabirds in Longline Fisheries
IPOA-Sharks	International Plan of Action for the Conservation and Management of Sharks
IQF	Individually Quick Frozen
ISOFISH	International Southern Oceans Longline Fisheries Information Clearing House
IUCN	The World Conservation Union
IUU Fishing	Illegal, Unreported and Unregulated Fishing
LIFDC(s)	Low-Income Food-Deficit Country(ies)
MEA(s)	Multilateral Environmental Agreement(s)
MAPA	*Ministerio de Agricultura, Pesca y Alimentación*
MEP	MacAlister Elliott and Partners Ltd.
MFN	Most-Favoured Nation
MT	Metric Tonne(s)
nei	not elsewhere included
NGO(s)	Non-Governmental Organization(s)
NIS	New Independent States
NMFS	National Marine Fisheries Service
OATA	Ornamental Aquatic Trade Association
OIT	*Organización Internacional del Trabajo*
RFBA(s)	Regional fishery body(ies) and arrangement(s)
SAGPyA	*Secretaria de Agricultura, Ganadería Pesca y Alimentación*
SOFIA	State of World Fisheries and Aquaculture
SSC	Species Survival Commission
TAC	Total Allowable Catch
TBT	Agreement on Technical Barriers to Trade
UN	United Nations
UNCLOS	United Nations Convention on the Law of the Sea
UNEP	United Nations Environment Programme
UNTS	United Nations Treaty Series
WCMC	World Conservation Monitoring Centre

Executive summary

Introduction

Driven by world population growth and increased global demand for fishery products, fishing pressure has been rapidly increasing over the past years. As the State of World Fisheries and Aquaculture (SOFIA) reports, about 47 percent of the main stocks or species groups are fully exploited and are therefore producing catches that have reached, or are very close to, their maximum sustainable limits.

Over time, the international community has launched various initiatives aimed at improving the conservation status of commercially-exploited aquatic species. These initiatives belong to the domain of both binding international law and soft law. The main conservation measures protecting, or aiming to protect, commercially-exploited aquatic species are:

- fishery and trade management measures by regional fishery bodies and arrangements (RFBAs), such as the Convention for the Conservation of Atlantic Marine Living Resources (CCAMLR);
- trade management measures applied to species listed in the three appendices to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES);
- international cooperation for the conservation and sustainable management of species listed in appendices to other international conventions such as the Convention on Migratory Species of Wild Animals (CMS) and the United Nations Convention on the Law of the Sea (UNCLOS);
- sustainable management recommendations contained in soft law instruments, such as the Code of Conduct for Responsible Fisheries (CCRF) and the International Plans of Action (IPOAs).

The Committee on Trade and Environment (CTE) of the World Trade Organization (WTO) is in charge of verifying the compatibility of multilateral environmental agreements (MEAs) with the WTO system. Some MEAs do pose trade restriction measures which can be considered compatible with the WTO system only when they are:

- non-discriminatory, particulary with respect to the application against non-parties,
- transparent, and
- directly linked to a policy of conserving an exhaustible natural resource.

Thus far, no case has been brought to the WTO Dispute Settlement Body (DSB) against any of the trade measures aimed at the conservation of natural resources.

This paper aims to assess the economic and social importance of selected fisheries targeting aquatic species with an international conservation profile. In order to ensure adequate representation, the following species were chosen:

- Sturgeons and paddlefishes (Acipenseriformes), large inland fish species of high commercial value, mainly occurring in the northern emisphere;
- Caribbean queen conch (*Strombus gigas*), a mollusc of high commercial value, targeted by both artisanal and commercial fisheries in tropical areas;
- Sharks (Chondrychthyes), widely distributed but still understudied animals, generally considered as "poor people's fish" with the exception of their fins;
- Patagonian toothfish (*Dissostichus eleginoides*), a large oceanic species, particularly appreciated by North American, Japanese and European connoisseurs.

This report is composed of four separate studies covering Acipenseriformes, *Strombus gigas*, Chondrichthyes and *Dissostichus eleginoides*. These species are generally under-represented in marketing and industry literature, which is historically focused on traditional commodities such as bivalves, cephalopods, crab, fishmeal and fish oil, of the genera *Gadhus* spp., *Merluccius* spp. and *Theragra* spp., lobster, salmon, shrimp, small pelagics and tuna.

The capture and trade statistics used are mostly those collected by the Fishery Information, Data and Statistics Unit (FIDI) of FAO, made available through the Fishstat + database, but are complemented by other sources, such as EUROSTAT, CITES, and national statistics. FAO data on employment in fishing are also provided by FIDI. Other sources include scientific reports, papers, articles, online publications and personal communications.

Sturgeons (Acipenseriformes)

The order Acipenseriformes belongs to the class Actinopterygii (ray-finned fishes) and encompasses two families: Acipenseridae (sturgeons) and Polyodontidae (paddlefishes). The sturgeon is one of the most ancient and valuable fish in the world. It usually lives in freshwater, coastal waters and inner seas throughout Azerbaijan, Bulgaria, China, the Islamic Republic of Iran, Kazakhstan, Romania, the Russian Federation, Turkey, Turkmenistan, Ukraine, other European countries and North America.

The sturgeon industry is a commercial one, with traditionally high capture and export patterns. Caviar, the unfertilized sturgeon roe, is the most important and expensive product from the sturgeon fisheries. The three traditional varieties of caviar are beluga, taken from the sturgeon bearing the same name, the osetra, taken from the Russian and the Persian sturgeon, and the sevruga, taken from the starry or stellate sturgeon. Also, some species of sturgeon kept in captivity (white sturgeon and Siberian sturgeon) provide appreciated caviar varieties.

Due to historically high patterns of both legal and illegal exploitation and habitat degradation, sturgeon stocks are seriously depleted, especially in traditional producing basins such as the Caspian Sea. Global sturgeon catch declined from the record peak of 32 078 MT in 1978 to 2 658 MT in 2000 (Fishstat + data). Nevertheless, exports of caviar in 2000 still represented a significant source of income for countries around the Caspian Sea (circa US$60 million) and in other parts of the world. However, the limited availability of data on employment in the fishery industry in the Caspian Sea limits the scope of any social analysis of the relative importance of the sturgeon and caviar industry.

The entire order Acipenseriformes was listed under the appendices of CITES in 1997. Some important aspects of the CITES regime on sturgeons and paddlefishes are still under development such as the universal labelling system, which is designed to halt poaching and smuggling.

Caribbean queen conch (*Strombus gigas*)

The Caribbean queen conch (*Strombus gigas*) is a gastropod belonging to the Strombidae family. It inhabits the Neotropical Atlantic waters of Bermuda, southern Florida, southern Mexico, the whole Caribbean region, Venezuela and Brazil.

Catch of stromboid conchs in the Western Central Atlantic increased from 1 200 MT in 1970 to 16 857 MT in 2000 (Fishstat + data), while exports of univalves from developing countries in the Western Central Atlantic area increased from 183 MT in 1979, for a value of US$689 000, to 545 MT, for a value of US$4.5 million in 2000 (Fishstat + data). Due to the generalized grouping of data, e.g. stromboid conchs and univalves, the above figures may not be fully representative of the queen conch industry.

The queen conch fishery is an important provider of employment and income for fishing communities in the Western Central Atlantic area. In the Bahamas queen conch represents the main source of food and income for 9 800 spiny lobster fishers, during the latter's closed season. In addition an estimated 400 fishers depend on conch fishing all year round. According to the Government and the Caribbean Community (CARICOM), queen conch landings generated income for 1 536 to 1 800 fishers in Belize. The conch industry in the Dominican Republic provides a livelihood for an estimated 1 530 fishers. CARICOM also estimates that the queen conch fishery provides employment and income for 332 industrial fishers and 50 to 100 artisanal fishers in Jamaica.

According to government sources 170 conch fishers work in the major harvest areas of Mexico, however this figure is only indicative due to the presence of conch fishermen who do not use their conch catch licenses, on the one hand, and the presence of unlicensed relatives fishing from licensed fishers' boats on the other. Among the case studies presented, the Turks and Caicos Islands appear the most dependent on the conch fishery in relation to their overall fishing population, but very small number of full time fishers. This largely export-oriented fishery provides food and income for the 1 561 part-

time and occasional fishers living and working in the archipelago and certainly for a number of full time fishers.

The listing of the queen conch *Strombus gigas* in Appendix II of the CITES Convention was decided during a period of expansion of conch fisheries (1992). Following the listing, range states[9] have been adopting various management and technical measures aimed at keeping queen conch stocks at sustainable levels. Currently, range states are preparing a regional management plan, which is expected to propose stricter measures to combat poaching and smuggling, and solutions to constraints to enforcement of CITES and national legislation.

Sharks (Chondrichthyes)

Sharks, rays and chimaeras belong to the class Chondrichthyes. They differ from Osteychthyes or bony fish as their skeleton is cartilaginous. The class Chondrichthyes or chondrichthyans is divided into two subclasses: Holocephalii (chimaeras, elephant fish) and Elasmobranchii (Elasmobranchs: sharks and batoids such as skates, rays, torpedoes and sawfish). The Checklist of Living Elasmobranchs reports 465 shark species, grouped into 35 families, widely diffused all over the world.

The shark fishery is a relatively large and financially important one. Catches of sharks and other chondrichthyans increased from 271 813 MT in 1950 to 828 364 MT in 2000. Developing countries share was worth an estimated US$515 million (Fishstat + data) and trade in shark products generated foreign exchange revenues for these countries of US$134.7 million in 2000 (Fishstat + data). Of this amount US$101.1 million came from exports of shark fins, the most expensive shark-based commodity (Fishstat + data).

Due to the large amount of unreported landings and trade, Fishstat + data may be under-representative of the total extent of shark catch and trade. Sharks are mainly taken as bycatch in other commercial fisheries (tuna and billfishes). They may be processed on board and sometimes the main body is discarded in favour of the most demanded and lucrative parts of the animal, i.e. its fins, without any reporting of its capture or of the sale of the fins. Most target shark fisheries, for example in countries such as China (estimated to employ some 1 500 shark fishers), Japan or on the African continent, are artisanal. .

Sharks are largely understudied animals, however available data show a high antropogenic pressure on them. Several international initiatives have been launched in order to protect these fishes:

- UNCLOS promotes international cooperation for the conservation and sustainable use of shark species, in particular those listed in its Appendix I;

[9] Range is defined as an area in which an organism operates, hence range states are the countries in which the species are found.

- CMS has the great white shark *Carcharodon carcharias* and the whale shark listed in its Appendix II;
- FAO launched the International Plan of Action for the Conservation and Management of Sharks (IPOA-Sharks) in 1999;
- the basking shark *Cetorhinus maximus* and the whale shark *Rhincodon typus* are listed in Appendix II to the CITES Convention, while the great white shark is listed in CITES Appendix III.

Patagonian toothfish (*Dissostichus eleginoides*)

The Patagonian toothfish or Chilean seabass (*Dissostichus eleginoides*) is a large, demersal fish growing to up to 2 metres in length and living for up to 50 years. It occurs in the Exclusive Economic Zones (EEZ) of southern Chile, Argentina, and sub-Antarctic islands under the sovereignty of Australia, France, New Zealand, South Africa and the United Kingdom.

The Patagonian toothfish is exploited by a large commercial fishing industry, which is concentrated in the southernmost areas of the Atlantic and the Pacific and in Antarctic waters. Catches of Patagonian toothfish in those areas increased from 1 096 MT in 1977 to 44 047 MT in 1995. They then declined to 37 435 MT in 2000 (Fishstat + data). Exports of toothfish products increased from 1 449 MT in 1985, corresponding to US$4 million, to 12 727 MT in 2000, corresponding to some US$83.8 million (Fishstat + data). Due to limited records of capture and, in particular, of trade, Fishstat + data may be, under-representative of the total extent of catch and trade of Patagonian toothfish.

Landings in Argentina are concentrated in the ports of Ushuaia, Puerto Madryn and Puerto Deseado in Patagonia. An estimated one hundred and five fishers are dependent on the fishery in the country, plus 100 fishers and office workers in the Falkland Islands/*Islas Malvinas*. In Chile, it is estimated that 150 persons work in this fishery.

The Patagonian toothfish fishery is affected by Illegal, Unreported and Unregulated Fishing (IUU Fishing). In view of this CCAMLR launched a Catch Documentation Scheme (CDS), which has been operational since 7 May 2000. Its implementation is thought to have reduced IUU catch of Patagonian toothfish by CCAMLR members to zero, and to have produced an associated reduction by non-members. However, the NGO TRAFFIC suggests that IUU fishing may have been relocated rather than eliminated.

Sturgeons (Acipenseriformes)

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Introduction

The order Acipenseriformes belongs to the Actinopterygii class (ray-finned fishes) and encompasses two families: Acipenseridae (sturgeons) and Polyodontidae (paddlefishes). The Acipenseridae family encompasses 25 species split among 4 different genera:

- 17 *Acipenser*
- 2 *Huso*
- 3 *Scaphirhyncus*
- 3 *Pseudoscaphihryncus*.

The Polyodontidae family encompasses two genera (*Polyodon* and *Psephurus*), each consisting of only one species (Josupeit 1994; Fishbase 2003; United Nations Environment Programme, UNEP-World Conservation Monitoring Centre WCMC data).

The sturgeon is one of the most ancient and valuable fish in the world, its first fossil record dating back to the upper Cretaceous[10] (Fishbase 2003). The sturgeon usually lives in freshwater, coastal waters and inner seas throughout Azerbaijan, Bulgaria, China, the Islamic Republic of Iran (hereinafter: Iran), Kazakhstan, Romania, the Russian Federation (hereinafter: Russia), Turkmenistan, Turkey, Ukraine, other European countries and North America. The sturgeon industry is extremely important for many of these countries in terms of income generation and employment opportunities.

The main processed product from the sturgeon fishery is the unfertilised sturgeon roe, caviar, a gourmet delicacy. The other important processed product is its meat, which may be sold smoked, frozen or marinated. Small quantities of caviar are used as ingredients in cosmetic products, such as facial creams (CITES 2000c). The swim bladders are dried, and then used to produce isinglass which is used to clarify wine and beer. Finally, live specimens, mainly of sterlet *Acipenser ruthenus*, are used for ornamental purposes (OATA, Pers. Comm.) and some companies have started marketing handicraft made of sturgeon leather (Chanco Co., Pers. Comm.).

The main producers of caviar on a world-wide level are four states bordering the Caspian Sea: Azerbaijan, Iran, Kazakhstan and Russia. The fifth Caspian State, Turkmenistan, is not a producer country; however Russia and Kazakhstan allocate to it a portion of their yearly sturgeon catch and export quotas[11].

The status of sturgeon resources in the Caspian Sea became particularly worrying after the break-up of the Union of Socialist Soviet Republics (hereinafter: the Soviet Union). As existing state management and control systems struggled to adjust to the changes,

[10] The first fossil records of *Acipenser spp.* dates back to 65 million years ago (New York State Department of Environmental Conservation 1999).
[11] See Table 3. In order to facilitate the reading of this study, the term “export” has been intended to include “re-export” as well.

increased illegal fishing and trade added further pressures to a resource already being threatened by overexploitation and habitat degradation.

According to FAO Fishstat + figures (see Figure 2), world catches of Acipenseriformes reached 21 265 MT in 1970 and peaked to 32 078 MT in 1977. In the following years they dropped from 29 076 MT in 1980 to 18 192 MT in 1990. From 1990 onwards catches have dropped constantly to reach 5 906 MT in 1995 and 2 658 MT in 2000. During this period catches of sturgeons from the Caspian States (including the former Soviet Union) experienced the following fluctuations: from 20 200 MT in 1970 to the highest peak of 30 959 MT in 1977 then down to 1 989 MT in 2000.

In order to prevent further decline of sturgeon resources, the whole Acipenseriformes order was placed under the species protection system of the CITES Convention in 1997. Since then CITES has set up a global initiative on sturgeons and paddlefishes based on the implementation of both trade and management measures.

The purpose of this study is to provide an overview of the world sturgeon and caviar industry, with a geographic focus on producing and exporting countries around the Caspian Sea.

Figure 1: The Caspian Sea, traditional home of sturgeons.

(Copyright: National Geographics)

Figure 2: The declining patterns of world Acipenseriformes landings and landings of Caspian Sea States, 1970-2000.

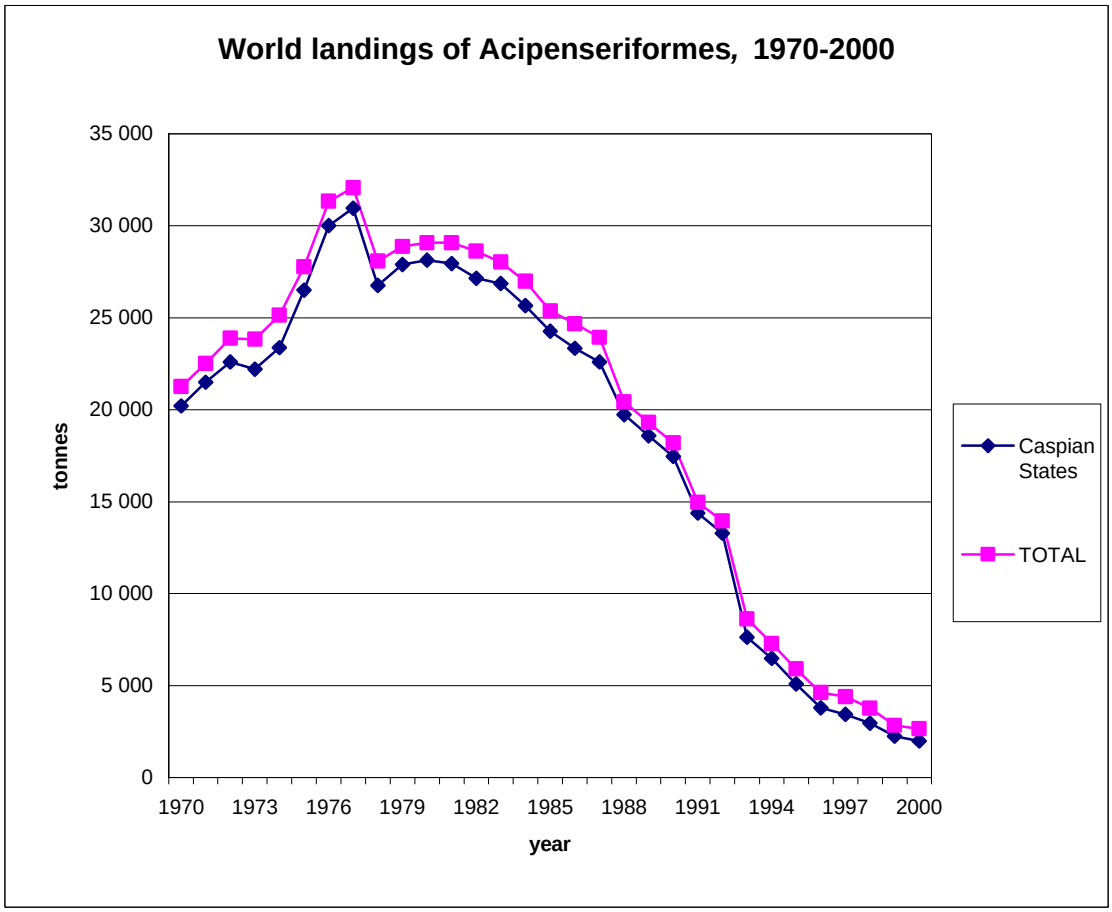


Table 1: **Acipenseriformes** ***(adapted from UNEP-WCMC data and Fishbase 2003).***

Legend:

- ex= extinct
- int= introduced
- x= crossing of different species (ex. *Acipenser baerii x gueldenstaedtii*)
- ?= outstanding query over status
- Country abbreviations: Iran (the Islamic Republic of Iran), Moldova (the Republic of Moldova), Russia (the Russian Federation), UK (the United Kingdom of Great Britain and Northern Ireland), USA (the United States of America).

Family	Genus	Species	Relevant subspecies or stock	Common name(s)	Distribution	Aquatic distribution	Synonyms
Acipenseridae							
	Acipenser						
		A. baerii		Siberian sturgeon	China, Kazakhstan (?), Russia		*Acipenser .stenorrhynchus*
			A. b. baerii	"	Finland, Latvia, Poland (int), Russia, Sweden (int)	River Ob, River Taz	
			A. b. baicalensis	Baikal sturgeon	Russia	Lake Baikal	
			A. b. stenorrhyncus	Lena River sturgeon	"	River Yenisei, River Lena and east Siberian rivers	
		A. brevirostrum		Shortnose sturgeon	Canada, USA	Atlantic – northwest and western central	
		A. dabryanus		Yangtze sturgeon	China	River Yangtze	
		A. fulvescens		Lake sturgeon	Canada, USA		*Acipenser rubicundus, Acipenser maculosus, Acipenser heptipus,*

Family	Genus	Species	Relevant subspecies or stock	Common name(s)	Distribution	Aquatic distribution	Synonyms
							Dinectus truncatus, *Sterletus serotimus*, *Sterletus macrostomus*, *Acipenser legenarius*, *Acipenser muricatus*, *Acipenser rupertianus*, *Acipenser laevis*, *Acipenser carbonarius*, *Acipenser rhynchaeus*, *Antaceus buffalo*, *Antaceus cincinnati*, *Acipenser liopeltis*, *Huso copei*, *Huso rauchii*, *Huso richardsonii*, *Huso anasimos*, *Huso paranasimos*, *Huso anthracinus*, *Huso lamarii*, *Huso atelaspis*, *Huso rafinesquii*, *Huso rosarium*, *Huso platyrhinus*, *Huso kirtlandi*, *Huso mertinianus*, *Huso honneymani*
		A. baerii x gueldenstaedtii					
		A. baerii x ruthenus					
		A. gueldenstaedtii		Danube sturgeon, Russian sturgeon	Azerbaijan, Bulgaria, Georgia, Iran, Kazakhstan, Romania, Russia, Turkey, Turkmenistan, Ukraine	Mediterranean and Black Sea	*Acipenser pygmaeus*, *Acipenser aculeatus*, *Acipenser medius*, *Acipenser tuecka*, *Acipenser macropthalmus*, *Acipenser rostratus*
			Caspian Sea		Azerbaijan,	“	

Family	Genus	Species	Relevant subspecies or stock	Common name(s)	Distribution	Aquatic distribution	Synonyms
			stock		Bulgaria, Georgia, Iran, Kazakhstan, Romania, Russia, Turkey, Turkmenistan, Ukraine		
			Sea of Azov stock		Russia	"	
			Black Sea stock		Hungary, Romania, Ukraine, Yugoslavia	"	
		A. gueldenstaedtii x baerii					
		A. gueldenstaedtii x ruthenus					
		A. medirostris		Green sturgeon	Canada, Mexico, USA	Pacific - northeast	
		A. mikadoi		Sakhalin sturgeon	China (?), Japan, Russia	Pacific - northwest	
		A. naccarii		Adriatic sturgeon	Albania, Croatia, Greece, Italy, Slovenia, Yugoslavia (ex)	Lake Skadar, River Po	*Acipenser sturionellus*, *Acipenser heckelii*, *Acipenser platycephalus*, *Acipenser nasus*, *Acipenser ladanus*, *Acipenser nardoi*
		A. nudiventris		Barbel sturgeon	Afghanistan (ex), Armenia, Azerbaijan, Bulgaria, Georgia (?), Hungary (ex), Iran, Kazakhstan, Moldova, Romania, Russian Federation,	Mediterranean and Black Sea, River Danube	*Acipenser shyp*, *Acipenser schypa*, *Acipenser shypa*, *Acipenser shipa*, *Acipenser glaber*, *Acipenser turritus*

Family	Genus	Species	Relevant subspecies or stock	Common name(s)	Distribution	Aquatic distribution	Synonyms
					Slovakia (ex), Turkey, Turkmenistan (?), Ukraine, Uzbekistan (ex)		
			Aral Sea stock		Kazakhstan, Uzbekistan	Mediterranean and Black Sea	
			Black Sea stock		Russia, Ukraine	"	
			Caspian Sea stock		Azerbaijan, Iran, Kazakhstan	"	
			River Danube subpopulation		Hungary, Romania	"	
		A. oxyrinchus		Atlantic sturgeon	Bermuda, Canada, Mexico, USA	Atlantic – northwest, western central	
			A. o. oxyrinchus	American Atlantic sturgeon	Canada, USA	"	
			A. o. desotoi	Gulf sturgeon	Mexico, USA	Atlantic – western central	
			A. o. spp.	Atlantic sturgeon	Canada, USA		
		A. persicus		Persian sturgeon	Azerbaijan, Georgia, Iran, Kazakhstan, Russia, Turkey	Mediterranean and Black Sea	
			Black Sea stock		Georgia, Russia, Turkey	"	
			Caspian Sea stock		Azerbaijan, Iran, Russia	"	

Family	Genus	Species	Relevant subspecies or stock	Common name(s)	Distribution	Aquatic distribution	Synonyms
		A. ruthenus		Sterlet (sturgeon)	Austria, Bosnia and Herzegovina, Bulgaria, Czech Republic, Georgia, Germany, Hungary, Kazakhstan (ex?), Latvia, Lithuania, Moldova, Republic of, Romania, Russia, Slovakia, Slovenia, Switzerland, Turkey, Ukraine, Yugoslavia		*Acipenser sterlet*, *Acipenser pygmaeus*, *Acipenser marsiglii*, *Acipenser kamensis*, *Acipenser obtusirostris*, *Acipenser gmelini*, *Acipenser dubius*, *Acipenser leucotica*, *Acipenser grisescens*, *Sterletus kankreni*, *Sterletus helenae*, *Acipenser jeniscensis*, *Acipenser primigenius*, *Acipenser ruzskyi*
			Caspian and Black Sea drainage stocks		Hungary, Romania, Russia, Ukraine, Yugoslavia		
			River Irtysh, Ob and Yenisei subpopulation		Russia	River Irtysh, Ob and Yenisei	
		A. ruthenus x H. huso		Bester			
		A. schrenckii		River Amur sturgeon	China, Japan (?), Russia	River Amur	*Acipenser multiscutatus*
		(synonym)	*A. multiscutatus*	Japanese sturgeon	Japan (?)		
		A. sinensis		Chinese sturgeon	China	River Pearl, River Yangtze	*Acipenser kikuchii*
		A. stellatus		Sevruga, Starry sturgeon	Azerbaijan, Bulgaria, Czech Republic, Georgia, Greece (?),	Mediterranean and Black Sea	*Acipenser seuruga*, *Acipenser helops*, *Acipenser ratzeburgii*, *Helops stellatus*,

Family	Genus	Species	Relevant subspecies or stock	Common name(s)	Distribution	Aquatic distribution	Synonyms
					Hungary, Iran, Italy (?), Kazakhstan, Moldova, Romania, Russian Federation, Slovakia, Turkey, Turkmenistan, Ukraine, Yugoslavia		*Gladostomus stellatus*
			Black Sea stock		Hungary, Romania, Ukraine, Yugoslavia	"	
			Caspian Sea stock		Azerbaijan, Iran, Kazakhstan, Russia, Turkmenistan	"	
			Sea of Azov stock		Russia	"	
		A. sturio		Common sturgeon, Atlantic sturgeon, Sea sturgeon	Albania, Algeria (ex?), Belgium (ex?), Bulgaria (ex?), Croatia (ex?), Czech Republic (ex), Denmark (ex), Estonia (ex?), Finland (ex?), France, Georgia, Germany (ex?), Greece (ex?), Hungary (ex?), Iceland (ex?), Ireland (ex?), Italy (ex?), Latvia (ex?), Lithuania (ex?),	Atlantic – northeast, Mediterranean and Black Sea	

Family	Genus	Species	Relevant subspecies or stock	Common name(s)	Distribution	Aquatic distribution	Synonyms
					Morocco (ex?), Netherlands (ex?), Norway (ex?), Poland (ex?), Portugal (ex?), Romania (ex?), Russia (ex?), Spain (ex?), Sweden (ex?), Switzerland (ex?), Turkey, UK (ex?), United Kingdom, Yugoslavia (ex?)		
		A. transmontanus		White sturgeon	Canada, USA	Pacific - northeast	*Acipenser aleutensis*, *Acipenser brachyrhynchus*, *Antaceus caryi*, *Antaceus ayresii*, *Antaceus putnami*
			River Kootenai subpopulation		USA	River Kootenai	
	Huso						
		H. dauricus		Kaluga	China, Japan (?), Russia	River Amur	*Acipenser dauricus*, *Acipenser orientalis*, *Huso kaluschka*, *Acipenser mantschuricus*
		H. huso		Beluga	Azerbaijan, Bulgaria, Croatia, Czech Republic (ex?), Georgia, Hungary, Iran, Italy (ex), Kazakhstan, Moldova, Romania, Russia, Slovenia	Mediterranean and Black Sea	*Acipenser huso*, *Acipenser albula*, *Acipenser husoniformis*, *Huso ichthyocolla*, *Acipenser vallisnerii*, *Acipenser brandtii*

Family	Genus	Species	Relevant subspecies or stock	Common name(s)	Distribution	Aquatic distribution	Synonyms
					(ex?), Turkey, Turkmenistan, Ukraine, Yugoslavia		
			Adriatic Sea stock		Italy	"	
			Black Sea stock		Hungary, Romania, Russia, Ukraine, Yugoslavia	"	
			Caspian Sea stock		Azerbaijan, Iran, Kazakhstan, Russia, Turkmenistan	"	
			Sea of Azov stock		Russia	"	
	Pseudoscaphirhynchus						
		P. fedtschenkoi		Syr Darya sturgeon	Kazakhstan, Tajikistan, Uzbekistan	River Syr Darya	*Scaphirhynchus fedtschenkoi*
		P. hermanni		Dwarf sturgeon	Afghanistan, Turkmenistan, Uzbekistan	River Amu Darya	*Scaphirhynchus hermanni*
		P. kaufmanni		Amu Darya Shovelnose sturgeon	Afghanistan, Tajikistan, Turkmenistan, Uzbekistan	"	*Scaphirhynchus kaufmanni*
	Scaphirhynchus						
		S. albus		Pallid sturgeon	USA	River Missouri-Mississipi	*Parascaphirhynchus albus*
		S. platorynchus		Shovelnose sturgeon, Hackeback	"	"	*Acipenser platorynchus*, *Acipenser cataphractus*, *Scaphirhynchus rafinesquei*,

Family	Genus	Species	Relevant subspecies or stock	Common name(s)	Distribution	Aquatic distribution	Synonyms
							Scaphirhynchus mexicanus
		S. suttsuki		Alabama sturgeon	"	Mobile Bay	
Polyodontidae							
	Polyodon						
		P. spatula		Mississipi Paddlefish	Canada (ex), USA	River Mississipi	
	Psephurus						
		P. gladius		Chinese Swordfish (Paddlefish)	China	River Yangtze	*Polyodon gladius*, *Polyodon angustifolium*

Sturgeons and caviar

Box 1: Background information on caviar

Caviar is prepared by removing the egg masses from the freshly caught fish (modern harvesting methods do not generally involve the killing of the animal) and passing them through a fine-mesh to separate the eggs and remove lumps of tissue and fat. Then 4 to 6 percent salt is added to preserve the eggs and bring out the flavour. The denomination *Malossol* ("little salt") in caviar packages indicates the low content of salt in high quality caviar. The caviar is then packed in cans, glass or porcelain. In some cases it is pasteurised to obtain longer term storage (US Customs Service 1997).

There are three types of caviar: Beluga (from *Huso huso*), Osetra (mainly from *Acipenser gueldenstaedtii* and *Acipenser persicus*) and Sevruga (*Acipenser stellatus*). They are all graded according to the size of the eggs and the processing method:

- grade one caviar, firm, large-grained, delicate, intact, of fine colour and flavour;
- grade two caviar is fresh caviar with normal grain size, of very good colour and flavour;
- pressed caviar (*Payusnaya*).

In the "pressed caviar" grade, external factors have caused the fracture of more than 35 percent of the roe skins before being removed from the fish. The product consists of blend of roes from Osetra and Sevruga, which is heated to 38º C in a saline solution and stirred until it has absorbed salt and regained its natural colour. Then it is put into "*talees*", fabric pouches in which it is pressed to remove excess salt and oil. The resulting pressed caviar appears as a dry, spreadable black paste. It contains four times more roe than fresh caviar of the same weight, as it takes four pounds of fresh caviar to prepare one pound of *Payusnaya*. Because of its strong taste it is favoured to grades one and two by some connoisseurs (US Customs Service 1997).

A cheaper caviar product is the *Jastichnaja*, from the Russian word *Jastiki* which is the unripe caviar which may be found closer to the ovaries of the fish. *Jastichnaja* is caviar obtained from roe that has not been properly separated from the connecting tissues. It is more salty in flavour and irregular in egg size than other caviar (Information Server Russian Caviar 2000).

Background information on sturgeon

The paper will focus its analysis on the *Acipenser* species combining commercial relevance with economic/social importance and endangered conservation status.

Russian sturgeon (*Acipenser gueldenstaedtii*) and Persian sturgeon (*Acipenser persicus*)

The Russian sturgeon and the Persian sturgeon are very similar from a morphological point of view, the species being mostly differentiated on the basis of immuno-biochemical characteristics. Both species are being used for the production of the variety of caviar called Osetra (CITES 2000b).

A. gueldenstaedtii reaches some 2 m length and can weigh 65 to 115 kg, with an average life expectancy of 38 years (CITES 2000b). Russian sturgeon inhabits temperate freshwater, brackish and marine waters, namely the basins of the Black Sea, the Sea of Azov and the Caspian Sea (Fishbase 2003). The female spawns in the tributaries of these seas, however the construction of dams has disrupted the spawning habitats of most rivers, with some isolated exceptions such as the Ural River (CITES 2000b). The spawning period occurs from May to June. Currently, the fish is propagated through artificial insemination in hatcheries. The Russian sturgeon mostly feeds on molluscs, crustaceans and some small fish such as anchovies, sprats and gobies (Fishbase 2003).

A. persicus has been considered a synonym of *A. gueldenstaedtii* for a long time. Their form is very similar and their stocks coincide in some basins, such as the southern Caspian Sea. On several occasions, catch statistics and quotas for both species have been combined. However, in 2001 Iran started to separate its export quotas for these species. Persian sturgeon stocks occur in the Black Sea and in the Caspian Sea. The species is distributed throughout the Caspian Sea, but it mostly feeds and spends the winter in the southern areas of the basin. The spawning population also concentrates in the southern Caspian and ascends the rivers Kura, Sulak and Samur. No detailed information is available on *A. persicus* in the Black Sea (CITES 2002a).

Processed products from Russian and Persian sturgeon, such as caviar and meat, are mainly destined for international markets. Historically, Osetra caviar always provided a significant portion of global caviar production (CITES 2000b). In 1998, exports of Osetra caviar reached 95.3 MT, with Russia and Iran being the main exporters. (CITES 2000b). Osetra caviar grade one encompasses three varieties: royal caviar, the rarest, with a typical golden colour; colour A: grey gold, and colour B: dark grey. Grade two has smaller grains and a medium grey colour (US Customs Service 1997). Osetra caviar has a fruit-like, nutty flavour (Poseidon Fish Corporation 2002). Other processed products from Russian and Persian sturgeon include meat, fish glue and isinglass, the latter derived from the swim bladders which are exported from countries such as Iran and processed abroad (CITES 2000b).

The construction of dams affecting spawning sites, high levels of pollution and overfishing, including poaching, have been the main factors generating the decline of most sturgeon species, especially *A. gueldenstaedtii* (CITES 2000b). Catches of this species in the Caspian Sea dropped from 21 550 MT in 1977 to less than 1 000 MT in

1999 (CITES 2002a). On the other hand catch data for *A. persicus* show that this species did not follow the same declining trend. While catches of *A. gueldenstaedtii*, *A. stellatus*, *A. nudiventris* and *H. huso* declined seriously, catches of *A. persicus* peaked in 1991, declined until 1995 to rise again and fluctuate around an annual average of 475 MT. The reason may be the success of the restocking programme undertaken by Iranian hatcheries since 1992[12] (CITES 2002a).

A. gueldenstaedtii is listed in Appendix II of the CITES Convention and its Caspian Sea stock is under the Review of Significant Trade. Furthermore, it is classified as "endangered" in the Red List of the World Conservation Union (IUCN) Species Survival Commission (SSC). *A. persicus* is listed in Appendix II of the CITES Convention. More recently, it has been included in the progress report on the Review of Significant Trade for 2002 by the CITES Animals Committee (CITES 2002a). In the IUCN Red List of Protected Species, the Caspian Sea stock is classified as "vulnerable", while the Black Sea stock is classified as "endangered" (IUCN SSC 2000).

Starry sturgeon (*Acipenser stellatus*)

The starry, or stellate sturgeon reaches some 2 m length and a maximum weight of 80 kg. It may reach the age of 28 years. *A. stellatus* swims in temperate freshwater, brackish and marine waters. It feeds on fish, molluscs, crustaceans and worms (Fishbase 2003). It mainly inhabits the basins of the Black and Caspian Sea, and of the Sea of Azov (Fishbase 2003). The biggest population occurs in the Volga-Caspian region. There are two different spawning cycles for this species. Some fish spawn in the winter and some in spring (CITES 2000b).

The main processed products from starry sturgeon are the sevruga caviar and its meat, which is sold fresh and frozen, and eaten pan-fried, broiled and baked (Fishbase 2003). Sevruga caviar grade one is dark to light grey in colour, grade two is dark grey with smaller grains (US Customs Service 1997). It has the boldest flavour of the three types (Poseidon Fish Corporation 2002). Sevruga caviar has the largest market share of all internationally traded sturgeon products (CITES 2000b).

A. stellatus has also been threatened by the reduction of spawning habitats due to the construction of dams, overfishing (including poaching) and environmental pollution, thus the resource has experienced a significant decline. Catches in the northern Caspian Sea dropped from 4 600 MT in 1990 to some 1 600 MT in 1994 (CITES 2000b).

A. stellatus is listed in Appendix II of the CITES Convention and its Caspian Sea stock is subject to the Review of Significant Trade. It is listed as a "protected" species in Appendix III of the Convention on the conservation of European wildlife and natural habitats, also called the Bern Convention (Council of Europe 1979). It is also classified as "endangered" by the IUCN Red List (IUCN SSC 2000).

[12] See sections *Outlook of the modern sturgeon fishery industry (from the dissolution of the Soviet Union to present)* and *The Islamic Republic of Iran*.

Beluga (*Huso huso*)

Reaching 5 m length and more than 2 MT in weight, this impressive animal is the largest sturgeon and the largest European freshwater fish. Beluga swims in temperate freshwater, brackish and marine waters. It mainly inhabits the basins of the Black and Caspian Seas and the Sea of Azov[13]. It uses the tributaries of these seas, in particular the Volga, as spawning habitats. Beluga mostly feeds on fishes, crustaceans and molluscs. It is a long-lived species; in fact it may reach the age of 100 years (Fishbase 2003).

The main products obtained from beluga are caviar and, to a lesser extent, meat and skin. Beluga caviar is light to dark grey in colour. As a general rule the larger the grains and the lighter the colour the more valued this caviar will be. Grade one Beluga has large grains, the following categories applying: 000, light grey (the most expensive), 00, medium grey, 0, dark grey. Grade two Beluga has smaller grains, its colour ranging from light to medium grey (US Customs Service 1997). From centenary belugas come *Almas* (Persian name for diamond), white in appearance, the world's rarest and most expensive caviar, reaching some US$24 000/kg (inVogue 2002). Beluga caviar tastes more "like the sea" with a buttery aftertaste (Poseidon Fish Corporation 2002). Beluga meat is sold fresh, smoked and frozen; it may be served baked, boiled, broiled or fried.

Beluga is a threatened fish resource, mainly as a result of:

- overfishing, including poaching, which has, historically, been more intensive than for other sturgeon species due to the particularly high value of Beluga caviar;
- loss of spawning habitats due to the construction of dams;
- disruption of egg production, and of food availability due to pollution;
- its very low resilience to environmental change and overfishing thus amplifying the above threats.

According to CITES data, the catch of beluga in the northern Caspian Sea dropped from approximately 2 800 MT in 1970 to less than 300 MT in 1994 (CITES 2000b). In the middle Danube River, catches were reported to be an average of 23 MT per year from 1972 to 1976, dropping to an average of 7.5 MT per year over the period 1985-89, following the construction of the Djerdap dams I and II. Landings from the lower Danube River in Romania and Bulgaria, in turn dropped from 62.1 MT in 1997 to 42.7 MT in 1999. In the Caspian Sea, 90 percent of the spawning grounds have been lost and currently more than 90 percent of *H. huso* originates from hatcheries (CITES 2000b).

There are several international initiatives aimed at the recuperation of this valuable resource. *H. huso* is listed in Appendix II of the CITES Convention. Within the CITES regime, the beluga stocks in the Caspian Sea are among the resources under the Review

[13] And, to a lesser extent, the Adriatic.

of Significant Trade process. In addition, *H. huso* is listed as a "protected" species in Appendix III of the Bern Convention (Council of Europe 1979). It is also classified as "endangered" by the IUCN Red List of Threatened Species (IUCN SSC 2000).

Other significant Acipenseriformes

Fringebarbel or ship sturgeon *Acipenser nudiventris* mainly inhabits the Caspian and the Black Sea. It is listed in Appendix II of the CITES Convention and its Caspian Sea stock is subject to the Review of Significant Trade. Its products, such as caviar, are still traded commercially, but *A. nudiventris* is a highly endangered species, already extinct in the Aral Sea and critically endangered in the Danube River (IUCN SSC 2000).

Sterlet *Acipenser ruthenus* is the smallest sturgeon species, reaching 1 m length and 6.5 kg weight. It is a freshwater species inhabiting the rivers flowing into the Caspian, Black, Baltic, White, Barents, Kara seas and the Sea of Azov. The commercial relevance of *A. ruthenus* is related to international trade in its meat and in live juveniles for ornamental purposes (CITES 2000b).

River Amur sturgeon *Acipenser schrencki* and kaluga *Huso dauricus* are both endemic to the Amur River. In China, the whole production of caviar from sturgeon harvested in the wild, for both domestic consumption and export, comes from these species (CITES 2000b).

Shovelnose or hackleback sturgeon *Scaphirhynchus platorynchus* is a North American species, native to the Mississippi-Missouri system. Historically, this fishery has been of major importance for the area. Today, stocks have undergone severe reductions due to habitat degradation. Currently, reproduction takes place in hatcheries in North America, using wild brood stocks (Hochleithner and Gessner 2001). The shovelnose sturgeon gives an appreciated caviar variety.

White sturgeon *Acipenser transmontanus* is one of the most important sturgeon species in the American continent. It inhabits the whole Pacific Coast. Currently, its capture is prohibited in Canada and strictly regulated in the United States, with zero quotas allowed for the export of caviar from wild origin. Main marketed products are meat and caviar, both from farmed fish (Josupeit 1994; CITES 2002a). Caviar from white sturgeon resembles Osetra, in flavour and appearance (Harlow 2001). *A. baerii* is another sturgeon species bred in captivity for its meat, however consumption is limited within the European Union (EU). (CITES2000b).

American paddlefish (*Polyodon spatula*) is endemic to the American continent and widely distributed in the large river drainage systems of the eastern United States. Historically, overfishing and habitat degradation have been the main threats to this fish, listed under CITES Appendix II in 1992. American paddlefish is strictly managed in the United States, where only six States allow commercial catches. International trade is mainly in live specimens from aquaculture and fertilised eggs (CITES 2000b).

Nevertheless Paddlefish caviar is also traded internationally and resembles Sevruga in flavour and colour. Environmental groups in the United States are advocating the consumption of caviar from farmed American paddlefish, *P. spatula,* and farmed white sturgeon *A. transmontanus* as “environmentally friendly” alternatives to the caviar from the more threatened sturgeons from the Caspian Sea, *H. huso* in particular (Caviar Emptor 2002).

Box 2: Caviar, caviar substitutes and other fish roes

Roe coming from a fish other than *Acipenseriformes* is not caviar, and is often classified as "caviar substitute". Appreciated fish roes include those of salmon, trout, carp, pike, tuna, mullet, cod and other whitefish, lumpfish and flying fish (tobikko). Cavi*art is a caviar-like product made out of seaweed.

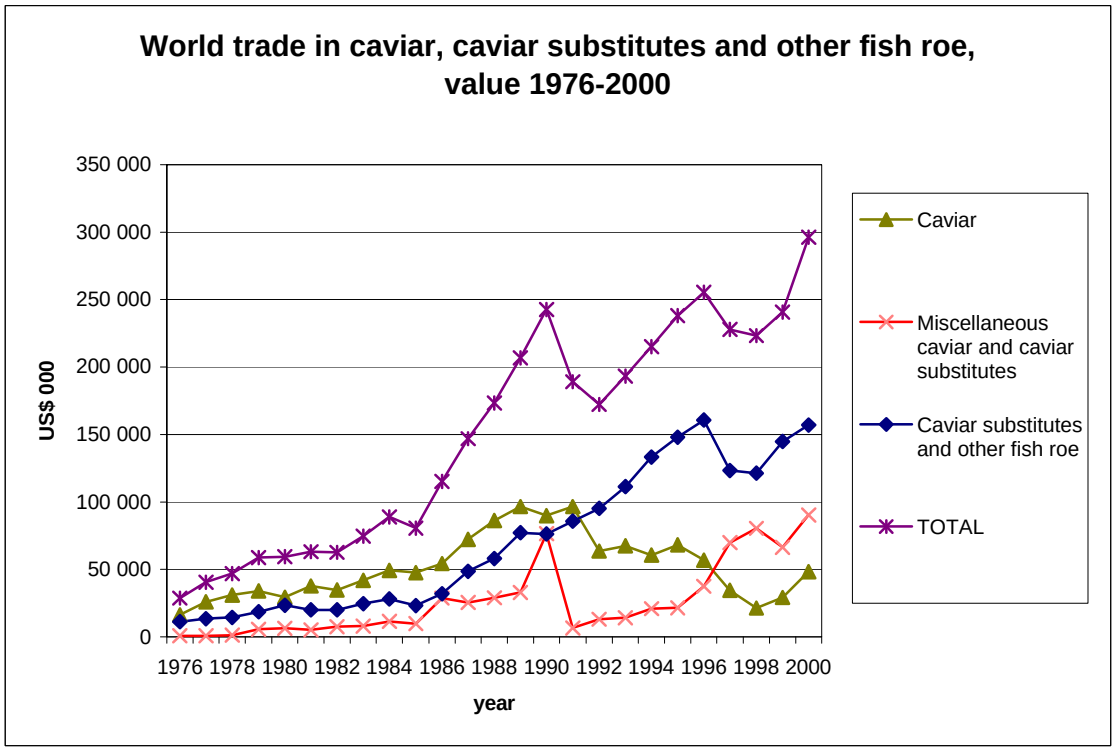
Cod roes are marketed fresh or smoked. Smoked cod roes are used to prepare *tarama*, which is a mixture of roes, oil and other ingredients (bread, garlic, lemon juice, pepper, etc.) and *kaviar*, e.g. cod roe in tubes. Lumpfish roe makes a cheap caviar substitute. Salmon and trout roes may also be considered as relatively upmarket caviar substitutes. Mullet and tuna roes are processed into a dried-salted paste called *bottarga* in Italy and *poutargue* in France, a gourmet delicacy. Herring roes are considered as a delicacy in Japan. Finally, fresh and frozen sea-urchin gonads are used to prepare a sauce or may be added to specialty recipes (Montfort 2002).

FAO Fishstat + data show a huge increase in revenues from exports and re-exports of caviar substitutes and other fish roes: in 1976 global trade in these products generated some US$11.4 million, while trade in caviar generated some US$16.5 million. Over the seventies and the eighties the value of trade in caviar, caviar substitutes and other roes followed an upward trend. In 1991 revenues from caviar exports reached the record sum of some US$96.7 million, while revenues from exports of caviar substitutes and other roes amounted to some US$85.9 million.

One of the consequences of the break-up of the Soviet Union in late 1991 has been the weakening of the long-established sturgeon and caviar management system. The Soviet Union used to produce and export some 90 percent of caviar entering international trade. Following the break-up, the value of world exports of caviar fell from US$96.7 million in 1991 to less than US$63.8 million in 1992. They continued to follow a constantly declining path until 1998, when export value was worth less than US$21.5 million. The depletion of the resource in its main production basin, the Caspian, was largely responsible for this. However, trade in caviar showed some recovery in 1999, when it totalled US$29.4 million, increasing to US$48.5 million in the year 2000.

At the same time trade in caviar substitutes and other fish roes expanded to reach the record value of US$160.8 million in 1996. Exports somehow declined in value in 1997 (US$123.4 million) and 1998 (US$121.4 million), to rise again in 1999 to a value of US$144.9 million and on to US$157.1 million in 2000. The scarceness of caviar and its rocketing prices led consumers to explore caviar substitutes and other roes, which are sometimes considered a delicacy in themselves. Fishstat + provides data for a mixed entry called "caviar and caviar substitutes". This showed an increase from US$869 000 in 1976 to circa US$90.6 million in 2000 (see Figure 3).

Figure 3: World trade in caviar, caviar substitutes and other fish roe, value 1976-2000.



The sturgeon and caviar industry

From the myth to the dissolution of the Soviet Union

The Persians were the first eaters of caviar. They called it *Chav-Jar*, which can be approximately translated into "Cake of Power". They believed that caviar cured a variety of diseases and used to eat it to improve their stamina. In the Middle Ages the English called sturgeon “the Royal Fish” since King Edward II (1307-27) had decreed that any sturgeon that was caught should be given to the Feudal Lords. French caviar production was controlled by Louis XIV's minister Jean Baptiste Colbert in the mid-17th century. Colbert placed his headquarters on the Gironde, at the time a major caviar production centre using the now critically endangered common sturgeon *Acipenser sturio*. In Russia, the caviar offered to the Tsars was the rarest: the small golden eggs of the sterlet *Acipenser ruthenus*, which have nowadays lost commercial interest (Bolourchi 1996).

Despite always being appreciated for its taste, caviar has not always been as rare or expensive as it is now. Until 1900 the United States produced about 68 MT of caviar per year. Most of this domestic caviar came from the Delaware River at Penns Grove, New Jersey. Caviar was also produced in impressive quantities in the Gironde estuary region, the North Sea, the Baltic and the Sea of Azov. In 1899 a kilogram of French caviar used to cost a mere 20 centimes. Just before World War 1, 40 centimes bought the same

kilogram, putting the price of caviar just slightly higher than that of bread (Bolourchi 1996).

In Russia the caviar industry had been a state monopoly since the reign of Peter the Great in the XVII century, but by the beginning of the XX century most of the enterprises were privatised. Following the Bolshevik Revolution, the Soviet State took control of the sturgeon fishery, which was then almost entirely located in the city of Astrakhan near the northern end of the Caspian Sea. Thus, between the Bolshevik Revolution and the break-up of the Soviet Union, only two states, the Soviet Union and Iran, controlled the sturgeon fisheries in the Caspian basin and therefore more than 90 percent of world caviar production.

In the Soviet Union, the construction of hydroelectric power dams on many rivers, such as the Volga in 1959, closed off 85 percent of the sturgeon's spawning grounds. In order to keep the sturgeon populations viable, the Soviet Ministry of Fisheries launched an intensive restocking programme along the Volga, Ural, Kura, and other Caspian tributaries. Eggs from gravid females were mixed in tanks with sperm to be fertilized. The resulting fry were then released into the Caspian to grow and mature: according to estimates, some 100 million fry have been released every year since the late 1950s (Tidwell 2001). The State company in charge of the entire caviar production chain, from catch to marketing, was CIBPO, the Caviar Caspian Balyk Industry Association (Russian Caviar 2000a). Iran's caviar was, and still is, controlled by *Shilat*, the state monopoly controlling the entire fishery industry and overseeing all activities related to caviar, including domestic and international sales (Javaudi and Sagheb 1994).

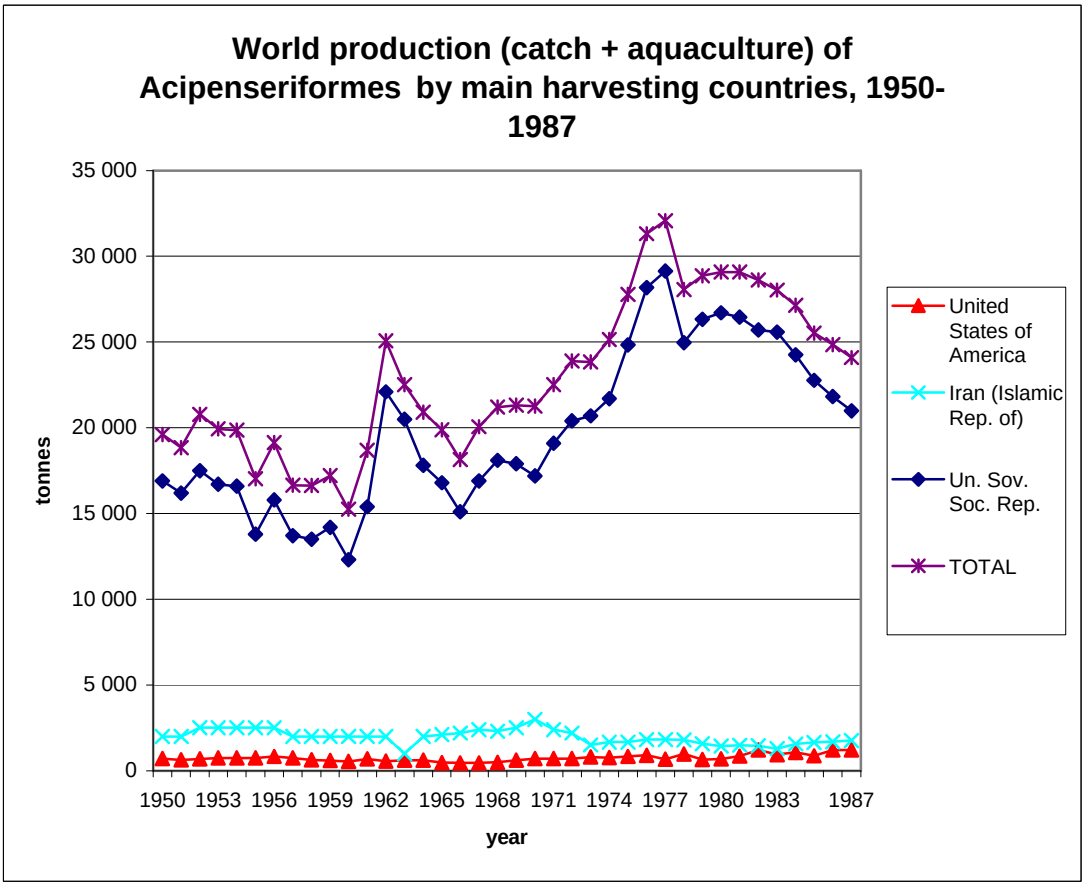
An agreement between the Soviet Union and Iran dating back to 1927 was aimed at ensuring a steady supply of caviar by guaranteeing the survival of sturgeon stocks in the Caspian. They prohibited the catch of sturgeons in the open sea and restricted fishing to the rivers where sturgeons returned to spawn. In this way newly-born sturgeons and survivors managed to come back to the safety of the open sea to subsequently spawn again in the river (Leutwyler 2002). Other conservation measures launched during the sixties by the Soviet Ministry of Fisheries included the banning of trawling in the Caspian with large, bottom-damaging nets, which destroy the sturgeon's food sources on the sea-bed, and limiting sturgeon fishing to spring and autumn (Tidwell 2001).

The importance of the Soviet Union as a sturgeon producer can be easily understood from Figure 4. Out of an average global production (catch and aquaculture) of 22 891 MT per year (1950-1987) the Soviet Union alone harvested an average of 19 857 MT over the period. Iran averaged 1 968 MT, with the United States ranking third with only 747 MT.

The strict environmental management of the Soviet regime outweighed the likely negative effects of pollution and damming from 1960 to 1977, when sturgeon production was following a constantly upward trend. In 1977 post-war sturgeon production reached its peak with world production at 32 078 MT and the Soviet Union 29 138 MT. The last record available for the Soviet Union is 20 991 MT produced in 1987: above the average of the period but considerably less than the record peak of 1977. The downward trend

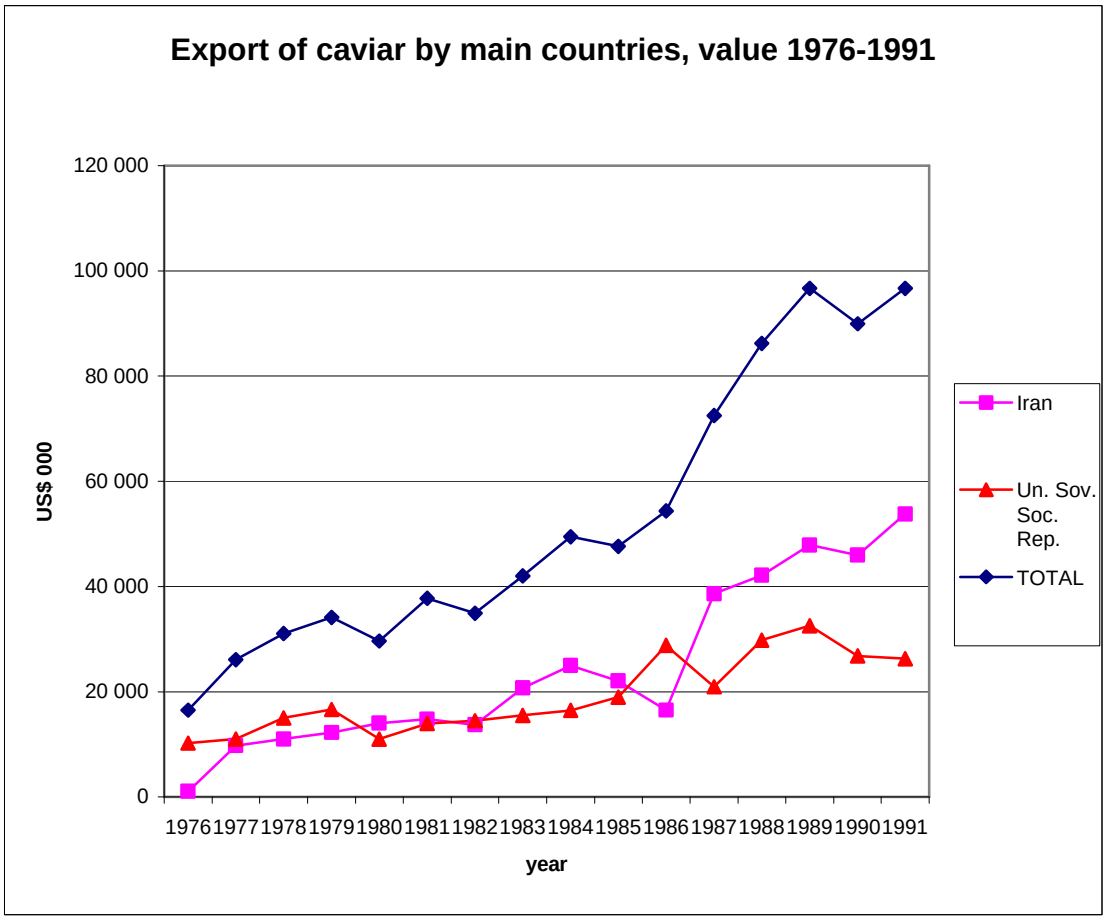
started at the end of the seventies. It was not contained and was dramatically aggravated in the following years (FAO Fishstat + data).

Figure 4: Total production of sturgeons by main harvesting countries, 1950-1987.



The production and export of caviar represented an important source of foreign exchange for both the Soviet Union and Iran. From 1976 to 1991 (Fishstat + data), exports of caviar generated average revenues of US$24 million for Iran and US$19 million for the Soviet Union (Figure 5). Both countries used to channel their exports through a small group of foreign partners. Before the end of the Soviet Union, the main western distributors of Soviet caviar were the French company Petrossian SA of Paris, practically holding a monopoly in Europe, and Romanov, a brand mainly distributed in the United States, and a competitor with Petrossian on the American market. Iranian caviar was mainly distributed by George Fixon Eagle's corporation (Javhaudi and Sagheb 1994).

Figure 5: Income generated from caviar trade in main exporting countries, 1976-1991.



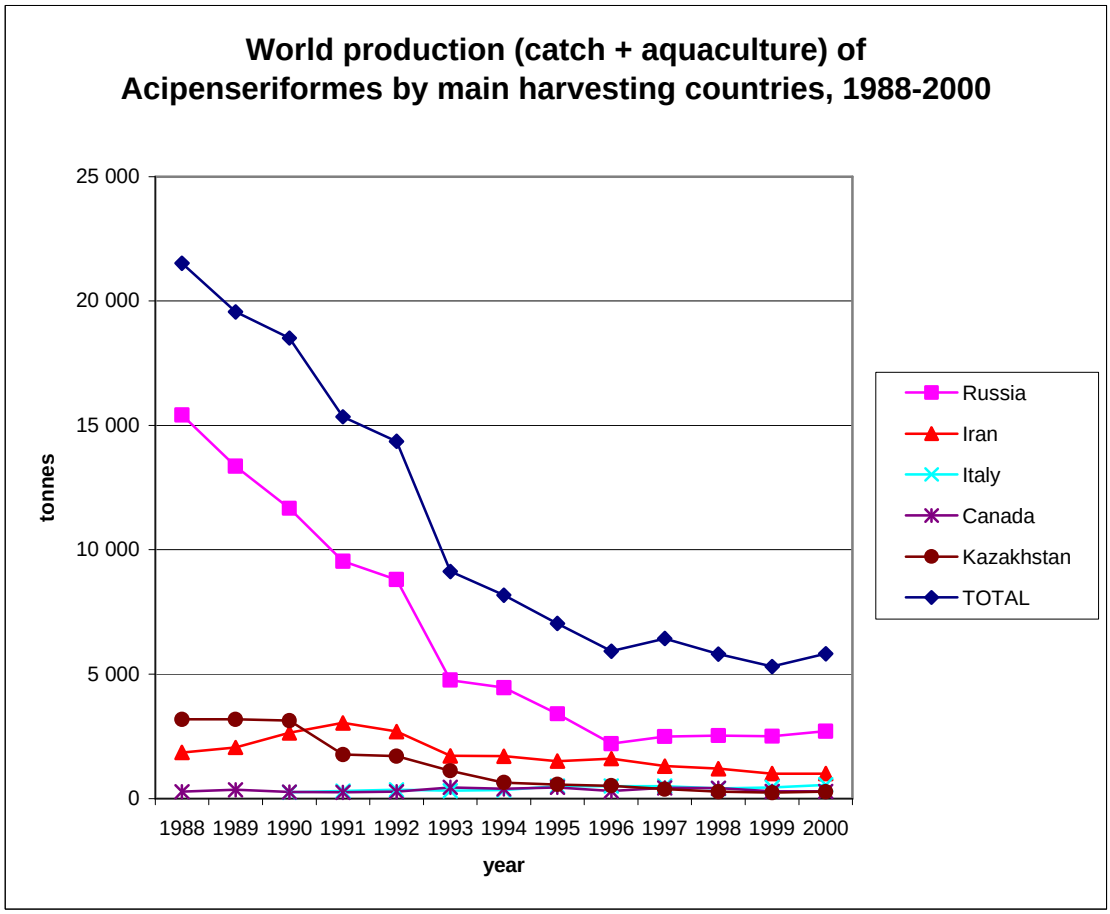
Overview of the modern sturgeon industry (from the dissolution of the Soviet Union to the present)

The decline of catches in the nineties

From 1988[14] to 2000, world production of sturgeons experienced a dramatic decline. In 1988 this was 21 518 MT, of which 15 420 MT were produced by Russia (Figure 6). It fell progressively from the 15 344 MT harvested in 1991 to 9 126 MT in 1993. Even sharper was the decline for Russia, which was undergoing the hardest period of institutional transition from the old Soviet Union. Russian production fell from 9 539 MT in 1991 to 4 751 MT in 1993. As a consequence of the decline in wild catches, production of farmed sturgeon started to increase. The steady development of aquaculture helped overall production to maintain an average of 5 858 MT per year in the 1996-2000 period (Fishstat + data).

[14] 1988 was the year when data for the Russian Federation and the New Independent States (NIS) started to be received by Fishstat +.

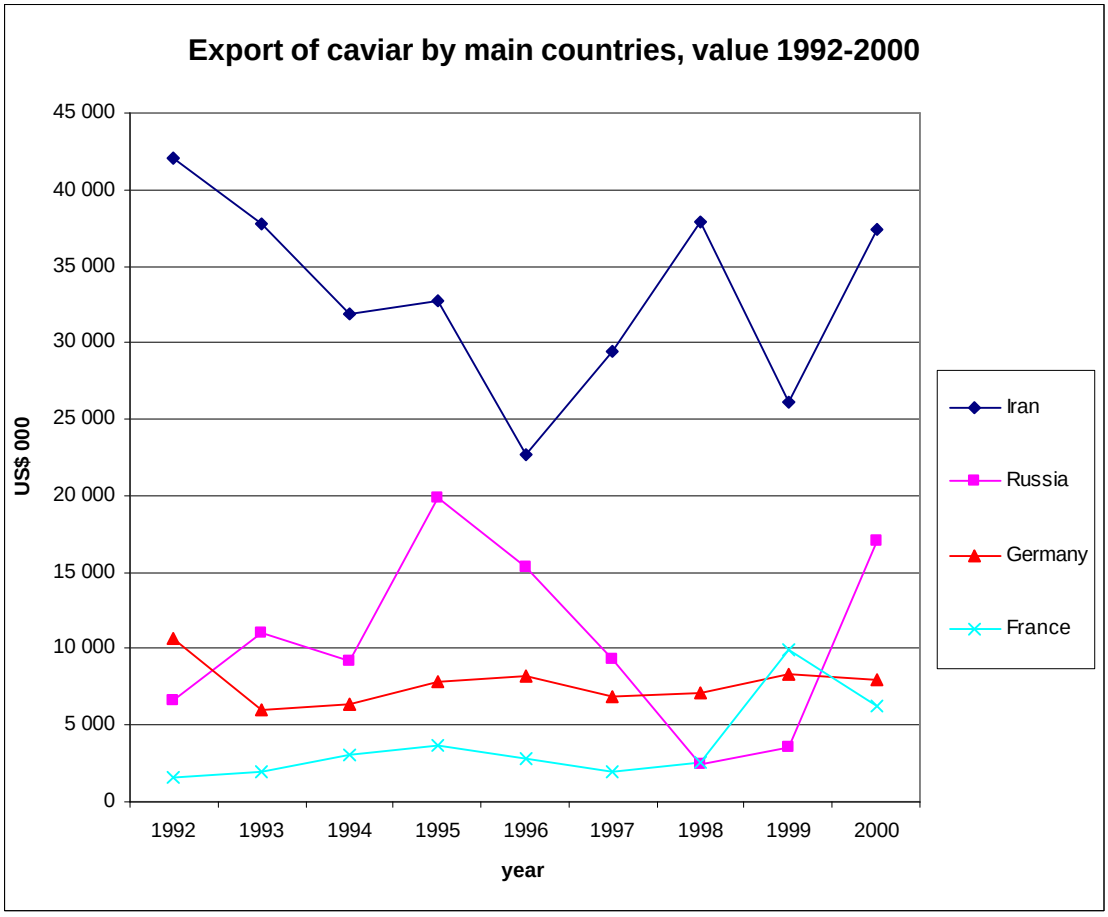
Figure 6: Total production of sturgeons by main harvesting countries, 1988-2000.



Trade figures for caviar show a decreasing trend for Iran[15] from the US$42 million worth of caviar exports in 1992 to US$22.7 million of "caviar and caviar substitutes" in 1996. These then recovered to reach US$29.5 million in 1997 and US$37.4 million in 2000 (Figure 7). Russian exports of caviar increased from US$6.6 million in 1992 to US$19.8 million in 1995, to fall back to US$3.6 million in 1999, and rise again to US$17 million in 2000. During this period, new players emerged among western distributors of Caspian caviar to counterbalance the quasi-duopoly of Petrossian and Romanov. These included the Swiss "Caviar House", and the US-based firms Caviarteria and Caviar Russ.

[15] Iranian export figures for the period 1992 to 2000 take into account the Fishstat + entries "caviar" and "caviar and caviar substitutes"; whilst figures for Russia, France and Germany relate solely to the "caviar" entry.

Figure 7: Income generated from caviar trade in major exporting countries, 1992-2000.



The dissolution of the Soviet Union in 1991 led to the creation of four new states bordering the Caspian Sea: Azerbaijan, Kazakhstan, Russia and Turkmenistan. In the three sturgeon producing countries of Azerbaijan, Kazakhstan, and Russia, large joint-stock companies[16] took over the activities of the former CIBPO:

- in Azerbaijan, the TIC UH, producing the brand "Azerbaijan Caviar" and "Aristocrat Caviar" (TIC UH 2000);
- in Kazakhstan, the Atyraubalyk Joint Stock Company (GLOBEFISH databank);
- in Russia, the Open Joint Stock Company "Russian Caviar" (Russian Caviar 2000b).

TIC UH is a Czech company which controls the supply of Azeri caviar worldwide. The caviar is sourced from the Caspian Sea and receives the first processing *in situ*: within a

[16] A joint-stock company is a voluntary association based on an agreement of legal and physical persons including foreigners to unite funds in order to carry out an economic activity figuring within the companies' charter, and not prohibited by law.

few hours it is transported to the Czech Republic for final processing and packaging (TIC UH 2000). The Open Joint Stock Company "Russian Caviar" controls all the activities of the sturgeon and caviar industry in Russia. Its shares are divided among 576 shareholders, the majority holder being the company "Mirchal". Russian Caviar channels its exports through US, Japanese and Slovakian partners (Russian Caviar 2000b).

The new states have been struggling to implement an effective management of sturgeon resources and to fight against caviar poaching and smuggling. According to Tayler (Tayler 2001), poachers collectively take some 8 000 MT of sturgeon per year, ten times the legally allowed catch quota for the Caspian basin in 2002[17]. The establishment of a large and structured parallel industry (TIC HU, Pers. Comm.) has been facilitated by:

- economic hardship in the region, which turned illegal activities relating to caviar into extremely lucrative options;
- difficulties in adapting to CITES enforcement legislation;
- assistance from structured criminal orgnizations.

A representative of the Joint Stock Company TIC HU was convinced that poaching and smuggling were the real issues behind the depletion of sturgeon stocks. The large presence of these activities limits the effectiveness of catch and export quotas as conservation measures (TIC HU, Pers. Comm.). CITES and its member states are tackling these issue through collaboration with Interpol, setting up a universal labelling system for caviar (CITES 2000d) and measures such as recommendations to suspend trade in CITES-listed specimens with countries involved in illegal trade of such specimens (CITES 2001c).

However, according to the CITES Secretariat and Interpol, the data available on poaching and smuggling in the Caspian are limited and existing legislation does not facilitate enforcement. The Secretariat believes that, despite improved communication between importing and exporting countries, more needs to be done. It emphasised the following requirements:

- modernize the traditional hunting and fishing legislation in force in most countries;
- include controls on domestic and international trade; and
- provide for economic incentives or other means to promote compliance.

The Iranian sturgeon industry seems to be the healthiest in the Caspian Sea area. It is still a state monopoly, held by the powerful *Shilat*, even if discussions for its privatization have been ongoing for some years. According to various sources (GLOBEFISH databank; *Shilat* 2002), sustainable management of sturgeon stocks and implementation of the CITES regime have proved to be effective for the conservation of sturgeon resources. Over the last ten to fifteen years, *Shilat* has been investing in the future sustainability of its sturgeon fisheries by:

[17] See Table 2.

- conducting extensive restocking programmes during the past decade to increase the population of *A. persicus*;
- banning the use of gill nets harming juvenile and immature sturgeon stocks;
- diversifying the income generating activities of fishermen using gill nets;
- releasing fingerlings of other commercially valuable species into the Caspian to encourage fishermen to diversify away from the exploitation of sturgeons;
- the development of aquaculture as a means to preserve wild stocks.

As a result of this extensive programme, the adult population of *A. persicus* was estimated to have reached 540 000 individuals in 2000 (Hosseini 2001). The export quota for *A. persicus* caviar was fixed at around 55 MT in 2002. This figure represents some 73 percent of the total caviar quota in Iran (see Table 3) while in 1992 caviar from this species represented some 23 percent of total production (Hosseini 2001). In 2000, exports of 72 MT of caviar and caviar substitutes generated some 37.4 million dollars[18] (Fishstat + data). The aim of the *Shilat* is to generate revenues of 57.5 million dollars from caviar exports by 2020 (Iranian Fisheries data).

The other producing areas in the world, in Europe, Asia, and North Ameria are affected by similar problems concerning their sturgeon populations. These areas are:

- the Black Sea basin, shared by Bulgaria, Georgia, Romania, Russia, Turkey and Ukraine;
- the Sea of Azov basin, shared by Russia and Ukraine;
- the Amur River, shared by China and Russia.
- the Great Lakes-Saint Lawrence drainage, whose resources are shared by Canada and the United States;
- the Mississippi-Missouri basin (United States).

In the Black Sea and Sea of Azov, the situation has been aggravated by a decrease in the production of fingerlings needed for restocking (Hochleithner and Gessner 2001).In the Amur River, Chinese catches[19] have, historically, been higher than Soviet catches, which were limited to 100 MT per year since the sixties. During the eighties and the beginning of the nineties, Chinese catches averaged 170-410 MT annually, with an annual production of 15-30 MT of caviar (Hochleithner and Gessner 2001). According to some sources, illegal catches are believed to make up some 50 percent of the total (Hochleithner and Gessner 2001). In 2003, China committed itself to catch quotas of 42 MT *A. schrencki* and 78 MT *Huso dauricus* and to export quotas of 2 510 kg of caviar from *A. schrencki* and 3 430 kg of caviar from *H. dauricus* (CITES 2003 and table 3). Chinese caviar is mainly sold to Japan and the United States, but is also consumed domestically (Hochleithner and Gessner 2001). Chinese exports of caviar and caviar substitutes increased from 5 MT in 1992, corresponding to US$324 000, to 2 962 MT in 2000, corresponding to US$30.4 million (Fishstat + data).

[18] Iran did not separate caviar from its substitutes when providing data to FAO in the 1997-2000 period.
[19] No data for China on sturgeons catch is available on Fishstat +.

In North America, sturgeons and paddlefish have been subject to large-scale exploitation over time. Total sturgeon catches in the United States amounted to 700 MT in 1970. They surpassed the threshold of 1000 MT in 1982, 1984, 1986 and 1987 then fell from 1 211 MT in 1987 to 314 MT in 1988. In 2000, catches amounted to 242 MT. In Canada they followed a moderately increasing trend, from 100 MT in 1970 to 283 MT in 2000 (Fishstat + data). Wild stocks of North American sturgeons and paddlefish are now under strict management regimes, and benefit from measures such as size limits, maximum catches, closed seasons or total bans on some fisheries (Hochleithner and Gessner 2001).

The emergence of a new player: the aquaculture industry

According to Fishstat +, the sturgeon farming industry has been constantly evolving from a total production of 150 MT in 1984 to 3 158 MT in 2000 (Figure 8) and in recent years has helped to compensate for the steady decline in wild catches. In 2000, 3 158 MT of total production came from aquaculture and just 2 658 MT from capture fisheries, in contrast to the first sturgeon aquaculture data released in 1984 showing 150 MT and the catch data for the same period, amounting to 26 986 MT (Fishstat + data).

The sturgeon farming industry is now a large-scale initiative. Its objective is not to release in the wild (as for the Caspian Sea hatcheries) but the marketing of meat, caviar and live specimens for ornamental trade. The latter is a relatively new phenomenon, for which the last available Fishstat + data relates to 1984. The *Acipenser* species more suitable for aquaculture are the sterlet *A. ruthenus*, the White sturgeon *A. transmontanus*, the Siberian sturgeon *A. baerii* and the American Paddlefish *P. spatula*. Other species, such as Adriatic sturgeon *A. naccarii* and Russian sturgeon *A. gueldenstaedtii*, tend to accumulate a yellowish fat which is not well-perceived by the consumer (Hochleithner and Gessner 2001). Out of these species, the most successful results concern the White sturgeon *A. transmontanus*.

Figure 8 shows the trend of the sturgeon aquaculture industry. According to Fishstat +, in year 2000, the main producers of farmed sturgeons were Russia (producing 2 050 MT), Italy (550 MT) and Poland (250 MT). Other relevant sturgeon farming countries are Spain, France and Uruguay (Fishstat + data).

The company *Agroittica Lombarda* is behind the success of sturgeon production in Italy. The species farmed is the White sturgeon *A. transmontanus* (Josupeit 1994). Agroittica is currently marketing some 3 MT per annum of a new variety of caviar called *Calvisius*, which is sold fresh and pasteurised. Agroittica also markets several other sturgeon products, such as fresh and smoked sturgeon meat (Agroittica Lombarda, Pers. Comm.).

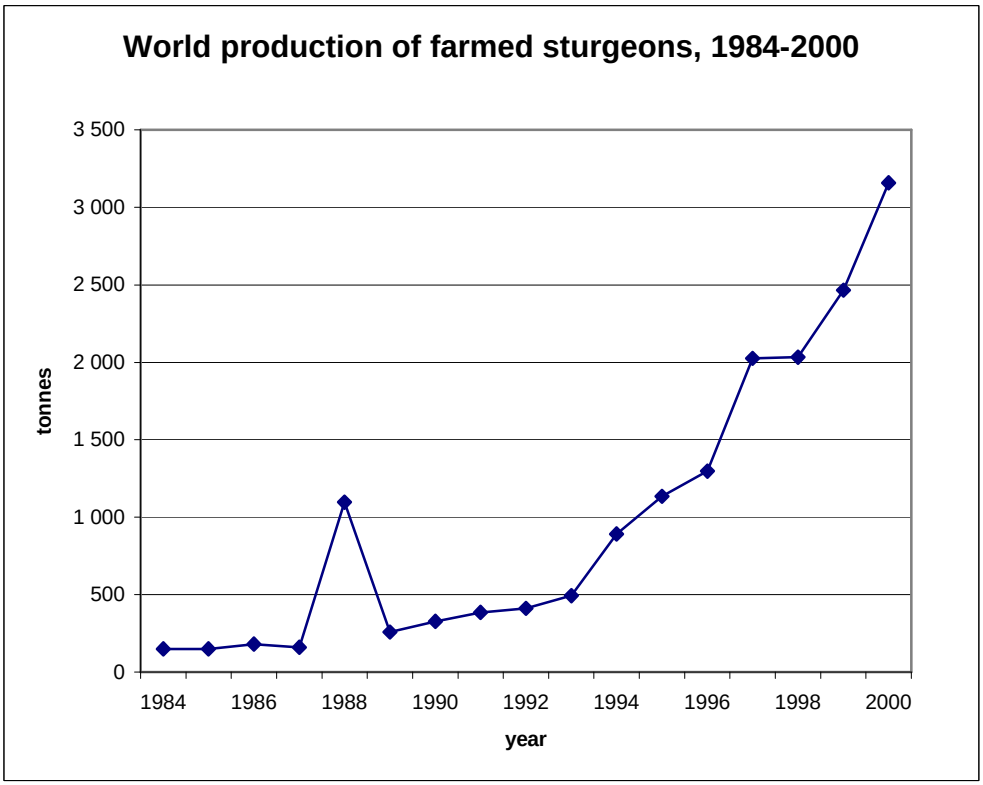
In France, sturgeon culture is widespread in the Aquitaine region. The Gironde Estuary in Aquitaine used to be one of the habitats of *A. sturio*, once distributed all over Europe, now almost entirely disappeared (Hochleithner and Gessner 2001). Nowadays, fish farmers in the Gironde successfully breed Siberian sturgeon *A. baeri* for its meat and to

re-launch the French caviar industry. In 2000 France produced 90 MT of farmed sturgeons (Fishstat + data).

In 2001, *Esturiones del Rio Negro*, the first ever farm specialising in sturgeon culture and caviar production in a MERCOSUR country opened in Uruguay (GLOBEFISH databank). In 2000 Uruguay ranked 10th among top sturgeon producers in the world (Fishstat + data), harvesting 75 MT. Another interesting development is in South Korea. This country is the top exporter of caviar substitutes on a global level, exporting 4 592 MT with a value of some US$86 million in 2000 (Fishstat + data). The Somijn River Cultured Fish Farm imported 600 sturgeon fingerlings from Japan in 1996, and is currently developing its own production of caviar from farmed fish, to be sold at US$596 per kg (GLOBEFISH databank).

In North America The US Stolt Sea farm merged with the sturgeon producing Sierra Aquafarm in 1994 and started producing caviar in 1997 (Sternlieb 2001). The group produces a variety of caviar named “Sterling” from cultured *A. transmontanus*. Stolt also produces sturgeon meat, whole fish and fillets. Its sturgeon farms are located in the Sacramento Valley of California. From the same area comes the “California Estate Osetra”, produced and distributed under the Tsar Nicoulai brand. This is a Californian brand also producing caviar from farmed white sturgeon *A. transmontanus* and importing caviar from Russia and China.

Figure 8: The growth of the sturgeon farming industry, 1984-2000.



The main caviar importing countries

According to Fishstat + data, in 2000, in value terms, the main importers of caviar (excluding caviar substitutes), were:

- the United States, with 90 MT, equivalent to US$22.1 million;
- France, with 36 MT, equivalent to US$15.9 million;
- Germany, with 34 MT, equivalent to US$15.7 million.

Despite its scarcity and high price, total imports of caviar increased from 243 MT (corresponding to a value some US$13.8 million) in 1976 to 488 MT (corresponding to some US$80.95 million) in 2000 (Fishstat + data)[20].

[20] Fishstat + data on export and import of caviar do not match.

The CITES regime on Acipenseriformes

Up to 1997, only few Acipenseriformes were listed in the appendices of the CITES Convention. The common sturgeon *Acipenser sturio* and the shortnose sturgeon *Acipenser brevirostrum* were listed in Appendix I, while the Atlantic sturgeon *Acipenser oxyrinchus* and the American paddlefish *Polyodon spatula* were listed in Appendix II (CITES 2000b; CITES Secretariat 2001). Acknowledging the widespread decline in sturgeon resources, Germany and the United States tabled a proposal at the Tenth Conference of the Parties of CITES (CoP 10)[21] to list all the remaining 23 species of the Acipenseriformes order under Appendix II.

The Non Governmental Organization (NGO) TRAFFIC reported that while 5 of the 23 species proposed for inclusion under CITES Appendix II in 1997 met the criteria for listing, the other 18 species were included for look-alike reasons. The species meeting criteria for listing include beluga *H. huso*, Russian sturgeon *Acipenser gueldenstaedtii*, Persian sturgeon *A. persicus*, starry sturgeon *A. stellatus* (TRAFFIC 1997). The listing proposal was adopted by consensus, and the listing came into force on 1 April 1998 (CITES Secretariat 2001).

The Conference of the Parties accompanied the listing with additional conservation and management requirements as described in Resolution 10.12 *Conservation of sturgeons* (CITES 1997). In particular, the Conference recommended the Secretariat, in consultation with the Animals Committee, to explore the development of a uniform marking system for sturgeon parts and derivatives and aquaculture stocks[22]. A framework resolution on conservation, management and trade in sturgeons and paddlefish, including the universal labelling system, was finally adopted during the Twelfth Conference of the Parties to CITES (CoP 12) as CITES Resolution 12.7 *Conservation of and trade in sturgeons and paddlefish* (CITES 2002b). Furthermore, it recommended that the Animals Committee consider trade in sturgeon specimens in the context of the Review of Significant Trade (CITES 1997)[23].

Conference Decision 11.58 (CITES 2000a) and Notification 2001/042 (CITES 2001b) instruct Parties that range states, starting from 1 January 2001, should declare annual export and catch quotas for all commercially traded specimens of Acipenseriformes originating in the same basin or biogeographical region:

- the Amur River (China and Russia);
- the Sea of Azov (Russia and Ukraine);

[21] Held in Harare, Zimbabwe, from 9 to 20 June 1997.
[22] The uniform labelling system was implemented through Resolution Conf. 11.13; a revised version was approved (ENB 2002) during CoP 12.
[23] Pursuant to Resolution Conf. 8.9 (Rev).

- the Black Sea (Bulgaria, Romania, Russia, Ukraine and Yugoslavia, the latter as from 2002[24]);
- the Caspian Sea (Azerbaijan, Iran, Kazakhstan, Russia, Turkmenistan);
- the Great Lakes-Saint Lawrence drainage (Canada and the United States).

States should inform the CITES Secretariat about their quotas prior to 31 December of the preceding year. Failure to do so would result in a zero quota for each non compliant party. Quotas for endemic species exploited by a country within its territorial waters and quotas for specimens bred in captivity are voluntary (CITES 2001b).

In 2001, the catch and export quotas for shared stocks of Acipenseriformes included in the Review of Significant Trade, such as the Caspian Sea stocks, were the result of an agreement between the CITES Standing Committee and the range states. Further to such agreement, catch and export quotas previously published in Notification 2001/005 (CITES 2001a), were substantially revised and published in Notification 2001/042 (CITES 2001b).

In the Caspian basin, the Review of Significant Trade led to, *inter alia*, the suspension, from spring to the end of 2001, of all harvesting operations of four sturgeon species in Azerbaijan, Kazakhstan and Russia. In 2002 and 2003, the catch and export quotas for Caspian Acipenseriformes were endorsed by the Secretariat within the framework of a coordinated sturgeon management system proposed by range states. The 2003 quotas per country are presented in Table 3 below, which includes both mandatory quotas for shared sturgeon resources and voluntary quotas for endemic species exploited by a country within its territorial waters and aquaculture stocks (CITES 2003).

The prices

Table 2 shows the retail prices of Caspian caviar.

Table 2: Retail prices of Caspian caviar. Prices for 1.1 lb (0.5 kg). Currency: US$ (adapted from Beluga Caviar Pricing Guide 2002).

Update	Supplier	Beluga 000	Beluga 00	Golden Osetra	Osetra	Sevruga
01/11/2002	Markys Caviar	781	639	781	507	445
01/11/2002	Paramount Caviar	N/A	1 188	N/A	792	660
01/11/2002	Seattle Caviar Company	N/A	1 496	N/A	880	704
01/11/2002	Dean & DeLuca	N/A	1 584	N/A	1 112	1 050
01/11/2002	Tsar Nicoulai Caviar	N/A	1 254	N/A	850	724
01/11/2002	Caviateria	1 950	1 463	1 850	850	812
01/11/2002	Petrossian Caviar	1 670	1 500	1 500	1 300	990

[24] The Federal Republic of Yugoslavia deposited its instruments of accession on 27 February 2002, its membership entering into force as from 28 May 2002. Before acquiring full membership, Yugoslavia agreed to commit itself to the sturgeon quotas for 2002.

Table 3: Catch and export quotas for Acipenseriformes (adapted from CITES 2003).

Species	Quotas/kg	Specimens/Remarks
Azerbaijan		
		Azerbaijan informed the Secretariat of specimens obtained for export in 2002 or previous years, but that will be authorized for export in 2003. Details on these specimens can be obtained from the Secretariat.
Acipenser gueldenstaedtii		Caspian Sea
Catch	46 390	Total (Kura River stock)
Export	4 200	Caviar
Acipenser nudiventris		
Catch	0	
Exports	0	
Acipenser stellatus		Caspian Sea
Catch	51 000	Total (Kura River stock)
Export	4 500	Caviar
Huso huso		Caspian Sea
Catch	7 200	Total (Kura River stock)
Export	400	Caviar
Bulgaria		
		Bulgaria informed the Secretariat of specimens obtained for export in 2002 or previous years, but that will be authorized for export in 2003. Details on these specimens can be obtained from the Secretariat.
Acipenser gueldenstaedtii		Danube River (Black Sea basin)
Catch	400	Total
Export	20 900 50 50 000* 5 000	Caviar Caviar from aquaculture Fertilized eggs from aquaculture Fingerlings from aquaculture (* specimens) Meat from aquaculture
Acipenser ruthenus		Danube River (Black Sea basin)
Catch	1 500	Total
Export	0	
Huso huso		Danube River (Black Sea basin)
Catch	21 000	Total
Export	1 720 5 000 5 5 000*	Caviar Meat Fertilized eggs Fingerlings from aquaculture

Species	Quotas/kg	Specimens/Remarks
		(* specimens)
Canada		
Acipenser fulvescens		Great Lakes-St Lawrence drainage
Catch	101 512	Total
Export	101 512	Meat
Acipenser oxyrhynchus		Atlantic coast
Catch	73 608	Total
Export	73 608	Meat
China		
		China informed the Secretariat of specimens obtained for export in 2002 or previous years, but that will be authorized for export in 2003. Details on these specimens can be obtained from the Secretariat.
Acipenser schrencki		Amur River
Catch	42 000	Total
Export	2 510	Caviar
Huso dauricus		Amur River
Catch	78 000	Total
Export	3 430	Caviar
Hungary		
Acipenser ruthenus		
Export	5 000*	Fingerlings (*specimens) from aquaculture (first-generation offspring [F1] e.g. specimens produced in a controlled environment from parents at least one of which was conceived in or taken from the wild.)
Islamic Republic of Iran		
		The Islamic Republic of Iran informed the Secretariat of specimens obtained for export in 2002 or previous years, but that will be authorized for export in 2003. Details on these specimens can be obtained from the Secretariat.
Acipenser gueldenstaedtii		Caspian Sea
Catch	18 18 200	Total
Export	1 950 9 100 2*	Caviar Meat Stuffed (*Specimens

Species	Quotas/kg	Specimens/Remarks
Acipenser nudiventris		Caspian Sea
Catch	13 000	Total
Export	0 2*	Caviar Stuffed (*specimens)
Acipenser persicus		Caspian Sea
Catch	526 200	Total
Export	63 000 263 100 4000* 2*	Caviar Meat Skins (*specimens) Stuffed (*specimens)
Acipenser stellatus		Caspian Sea
Catch	65 800	
Export	11 700 32 900 500* 2*	Caviar Meat Skins (*specimens) Stuffed (*specimens)
Acipenser gueldenstaedtii, ***A. nudiventris, A. persicus,*** ***A. stellatus, Huso huso****		Caspian Sea (*mixed)
Export	1 000 500	Pressed caviar Glue (derived from swim bladders, also known as isinglass)
Huso huso		Caspian sea
Catch	53 200	
Export	2 130 26 600 10 000 400* 2*	Caviar Meat Meat from aquaculture Skins (*specimens) Stuffed (*specimens)
Kazakhstan		
		Kazakhstan informed the Secretariat of specimens obtained for export in 2002 or previous years, but that will be authorized for export in 2003.
Acipenser gueldenstaedtii		Caspian Sea (Ural River stock)
Catch	40 000	Total (including 1 500 allocated to Turkmenistan)
Export	4 620.34 30 350	Caviar (including 150 kg allocated to Turkmenistan and 1 060.34 kg from the export quota for 2002) Meat (including 750kg allocated to Turkmenistan and 10 350 from the export quota for 2002)

Species	Quotas/kg	Specimens/Remarks
Acipenser nudiventris		Caspian Sea (Ural River stock)
Catch	3 000	Total
Export	0	
Acipenser stellatus		Caspian Sea (Ural River stock)
Catch	146 000	Total (including 24 910 allocated to Turkmenistan)
Export	26 233.72 109 270	Caviar (including 3 200kg allocated to Turkmenistan and 7 883.72 kg from export quota for 2002) Meat (including 12 455 kg allocated to turkmenistan and 36 270 kg from the export quota for 2002)
Huso huso		Caspian Sea (Ural River stock)
Catch	55 000	Total (including 1000 kg allocated to Turkmenistan)
Export	8 531.78 52 100	Caviar (including 100 kg allocated to Turkmenistan and 3 811.78 kg from the export quota for 2002) Meat (including 500 kg allocated to Turkmenistan and 24 600 kg from the export quota for 2002
Acipenser gueldenstaedtii, A. stellatus **and** ***H.huso****		Caspian Sea (Ural River stock) (*mixed)
Export	0.25	Hypophysis
Romania		
		Romania informed the Secretariat of specimens obtained for export in 2002 or previous years, but that will be authorized for export in 2003. Details on these specimens can be obtained from the Secretariat. Note: Romania has established a maximum number of individuals that may be caught, in addition to the maximum weight that may be caught.
Acipenser gueldenstaedtii		Danube River (Black Sea basin)
Catch	11 700*	Total (* 485 specimens, including 40 live specimens for aquaculture)
Export	900 5 000	Caviar Meat

Species	Quotas/kg	Specimens/Remarks
	10 100 000*	Fertilized eggs Fingerlings from aquaculture (*specimens)
Acipenser nudiventris		
Catch	200*	Total (* 20 live specimens for aquaculture)
Export	0	
Acipenser ruthenus		Danube River (Black Sea basin)
Catch	800*	Total (* 500 specimens, including 100 live specimens for aquaculture)
Export	10 100 000*	Fertilized eggs Fingerlings from aquaculture (* specimens)
Acipenser stellatus		Danube River (Black Sea basin)
Catch	14 000*	Total (* 2 000 specimens, including 80 live specimens for aquaculture)
Export	1 100 2 000 10 100 000*	Caviar Meat Fertilized eggs Fingerlings from aquaculture (* specimens)
Huso huso		Danube River (Black Sea basin)
Catch	28 500*	Total (* 220 specimens, including 28 live specimens for aquaculture)
Export	2 250 14 000 5 100 000*	Caviar Meat Fertilized eggs Fingerlings from aquaculture (* specimens)
Russian Federation		
		The Russian Federation informed the Secretariat of specimens obtained for export in 2002 or previous years, but that will be authorized for export in 2003. Details on these specimens can be obtained from the Secretariat.
Acipenser baerii		Siberian region
Export	500	Caviar

Species	Quotas/kg	Specimens/Remarks
Acipenser gueldenstaedtii		Azov Sea
Catch	35 000	Total
Export	0	
		Caspian Sea
Catch	230 000	Total (including 15 560 kg allocated to Turkmenistan)
Export	33 000 147 000	Caviar (including 1 600 kg allocated to Turkmenistan and 15 800 kg from the export quota for 2002) Food and canned products (including 8 000 kg allocated to Turkmenistan and 47 000 kg from the export quota for 2002)
Acipenser nudiventris		Caspian Sea, Azov Sea, Black Sea
Catch	0	
Export	0	
Acipenser ruthenus		Caspian Sea
Catch	3 000	Total (Volga River stock)
Export	100	Caviar
Acipenser schrencki		Amur River
Catch	3 000	Total
Export	350 1 500	Caviar Food and canned products
Acipenser stellatus		Azov Sea
Catch	22 000	Total
Export	0	
		Caspian Sea
Catch	180 000	Total (including 8 280 kg allocated to Turkmenistan)
Export	20 700 110 000	Caviar (including 800 kg allocated to Turkmenistan and 6 900 kg from the export quota for 2002) Food and canned products (including 4 000 kg allocated to Turkmenistan and 20 000 kg from the export quota for 2002)
Huso dauricus		Amur River
Catch	10 000	Total
Export	1 000 5 000	Caviar Food and canned products

Species	Quotas/kg	Specimens/Remarks
Huso huso		Caspian Sea
Catch	40 000	Total
Exports	2 500	Caviar
Serbia and Montenegro		
Acipenser ruthenus		Danube River (Black Sea basin)
Catch	1 500	Total
Export	50 000*	Fingerlings from aquaculture (* specimens)
Huso huso		Danube River (Black Sea basin)
Catch	8 500	Total
Export	700 0 90 50 000*	Caviar Meat Fertilized eggs Fingerlings from aquaculture (* specimens)
Ukraine		
Acipenser gueldenstaedtii		Azov Sea
Catch	10 000	Total
Export	300 5 000	Caviar Meat
Acipenser gueldenstaedtii		Black Sea
Catch	7 000	Total
Export	200 3 500	Caviar Meat
Acipenser stellatus		Azov Sea
Catch	3 000	Total
Export	100 1 500	Caviar Meat
Acipenser stellatus		Black Sea
Catch	3 000	Total
Export	100 1500	Caviar Meat
United States of America		
Acipenser medirostris		
Catch	600*	Total (* specimens)
Export	0	All specimens
Acipenser transmontanus		
Catch	12 000*	Total (* specimens)
Export	0 3 000	Caviar Meat

The sturgeon and caviar industry in selected producing and exporting countries

The following sub-sections will include analyses of the economic and social importance of the sturgeon and caviar industry for major producing and exporting countries. The selected countries are the Caspian states of Azerbaijan, Iran, Kazakhstan and Russia.

The main sources utilized for general data are the United Nations (UN), FAO, and the World Bank. The main source for fishery landings, trade and employment data is FAO, which relies on data provided by its Member States and Observers.

Azerbaijan

Background data and estimates

Status: low-income country (World Bank 2002a)
Population: 8.1 million in 2001 (World Bank 2002a)
Mean GDP per capita: US$655 in 2000 (UN Statistics Division 2002)
Total GDP: US$5.3 billion in 2000 and US$5.7 billion in 2001 (World Bank 2002a)
Number of employed people: 3 704 500 persons in 2000 (UN Economic and Social Commission for Asia and the Pacific, ESCAP 2001a)

Fishery data and estimates

Social:

Number of fishers: 1 500 unspecified inland fishers in 1991, estimate repeated up to 2000 (FAO FIDI data)
Employment in processing and marketing: N/A
Note: gender breakdown not provided by references

Economic:

Fisheries GDP: N/A
Total and inland landings: 18 797 MT in 2000 (Fishstat + data)
Aquaculture production and value: 120 MT in 2000, equivalent to US$330 600 (Fishstat + data)
Export quantity: 1 730 MT in 2000 (Fishstat + data)
Export value: US$272 000 in 2000 (Fishstat + data)

The Azeri caviar industry is mainly controlled by the Czech-Azeri consortium TIC HU. More information about this consortium is available under the section “the decline of the catch sector in the nineties”.

Azeri catches declined from 216 MT in 1988 to 61 MT in 1998. In 1999 they amounted to 65 MT, and increased to 71 MT in 2000 (Figure 9). Fishstat + data on caviar exports are available for the 1995-1999 period only. These totalled less than 1 MT in 1995 for a value of US$126 000; an estimated 2 MT in 1996, for a value of US$343 000, and 4MT in 1997, for a value of US$403 000. In 1997, 1998 and 1999, caviar exports were reported to FAO together with caviar substitutes (Fishstat + data). As limited quantities of “caviar and caviar substitutes” (1 MT in 1997 and 1998 and 6 MT in 1999) corresponded to relatively high values (US$118 000 in 1997, US$92 000 in 1998 and US$1.3 million in 1999), it seems probable that caviar made up most of this entry over that period (Figure 10). No data on this entry was available for the year 2000.

Figure 9: Landings of sturgeons in Azerbaijan, 1988-2000.

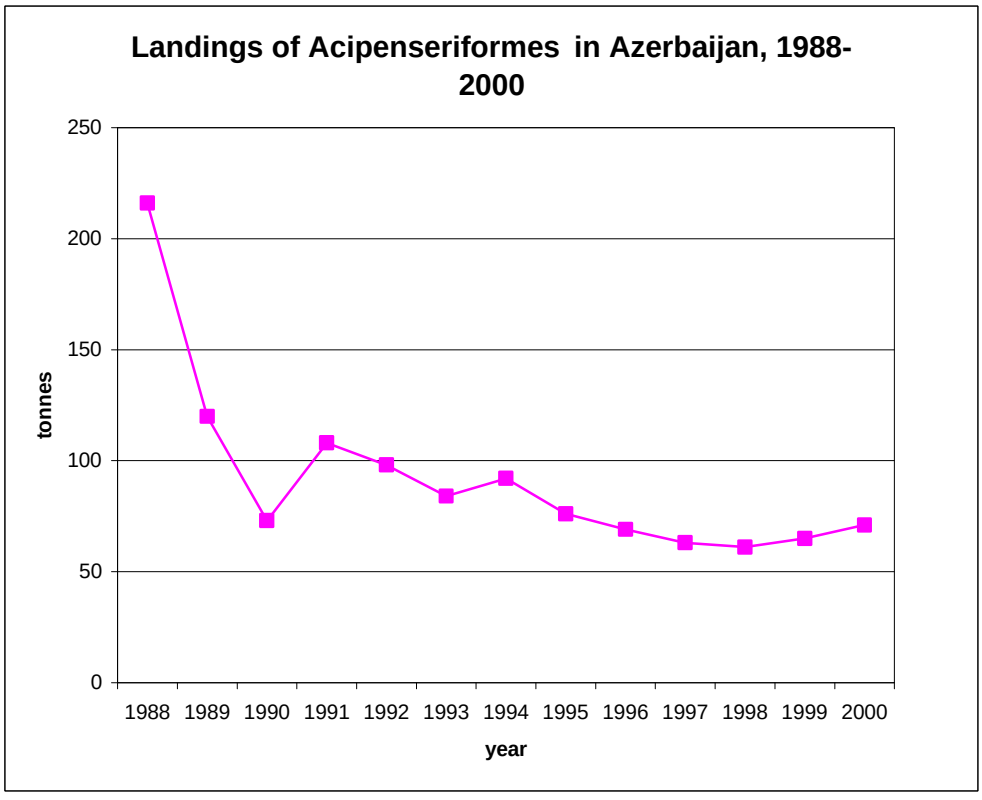
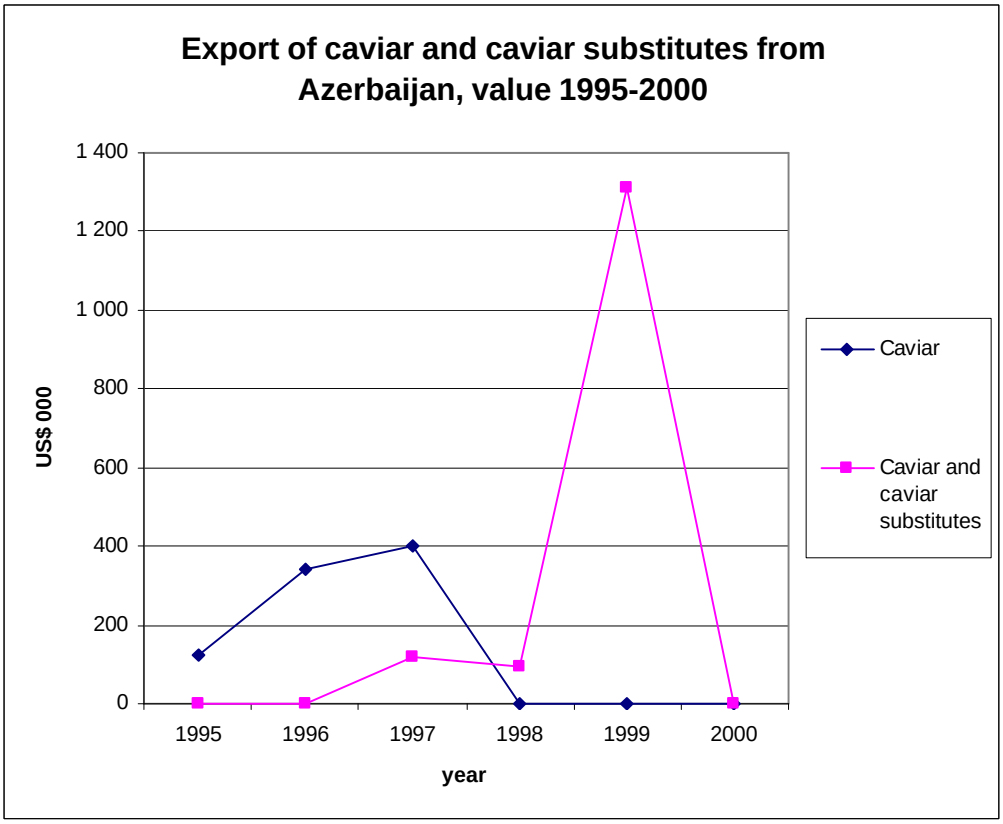


Figure 10: Exports of caviar and caviar substitutes from Azerbaijan, value 1995-2000.



18 797 MT of fish from inland waters were landed in 2000 by an estimated 1 500 fishers, of which 71 MT were sturgeons. Therefore, it may be estimated that some 60 fishers are dependent on the sturgeon industry in Azerbaijan. However, employment data are far too outdated to ensure a reliable estimate.

Iran

Background data and estimates

Status: lower-middle income country (World Bank 2002b)
Population: 65.1 million in 2001 (World Bank 2002b)
Mean GDP per capita: US$4 690 in 2000 (UN Statistics Division 2002)
Total GDP: US$101.6 billion in 2000 and US$114.1 billion in 2001 (World Bank 2002b)
Number of employed people: 11 817 000 persons in 1990 (ESCAP 2001b)

Fishery data and estimates

Social:

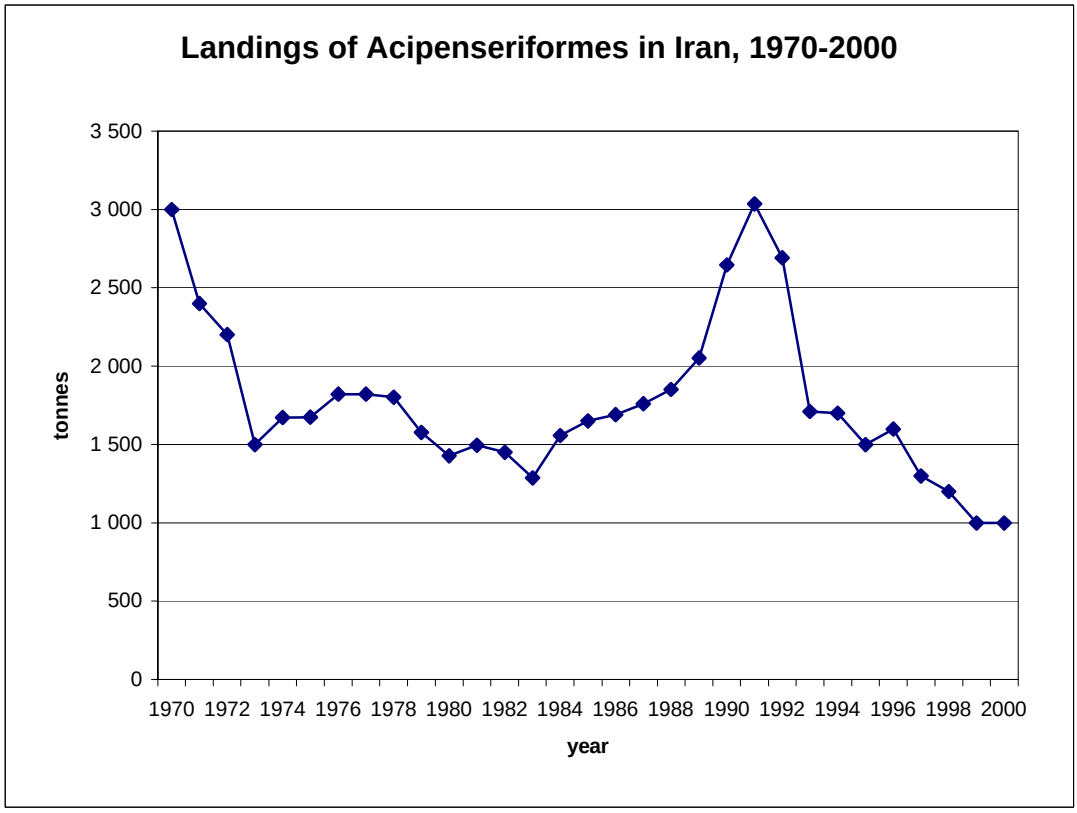
Number of fishers: 138 965 full-time, of which 14 857 aquaculture farmers, 19 099 inland fishers and 105 009 marine coastal fishers (FAO FIDI data)
Employment in processing and marketing: N/A
Note: gender breakdown not provided by references

Economic:

Fisheries GDP: N/A
Total landings: 411 500 MT in 2000 (Fishstat + data)
Total inland landings: 151 000 MT in 2000 (Fishstat + data)
Aquaculture production and value: 40 550 MT in 2000, equivalent to US$382 875 000 (Fishstat + data)
Export quantity: 6 771 MT in 2000 (Fishstat + data)
Export value: US$49 955 000 in 2000 (Fishstat + data)

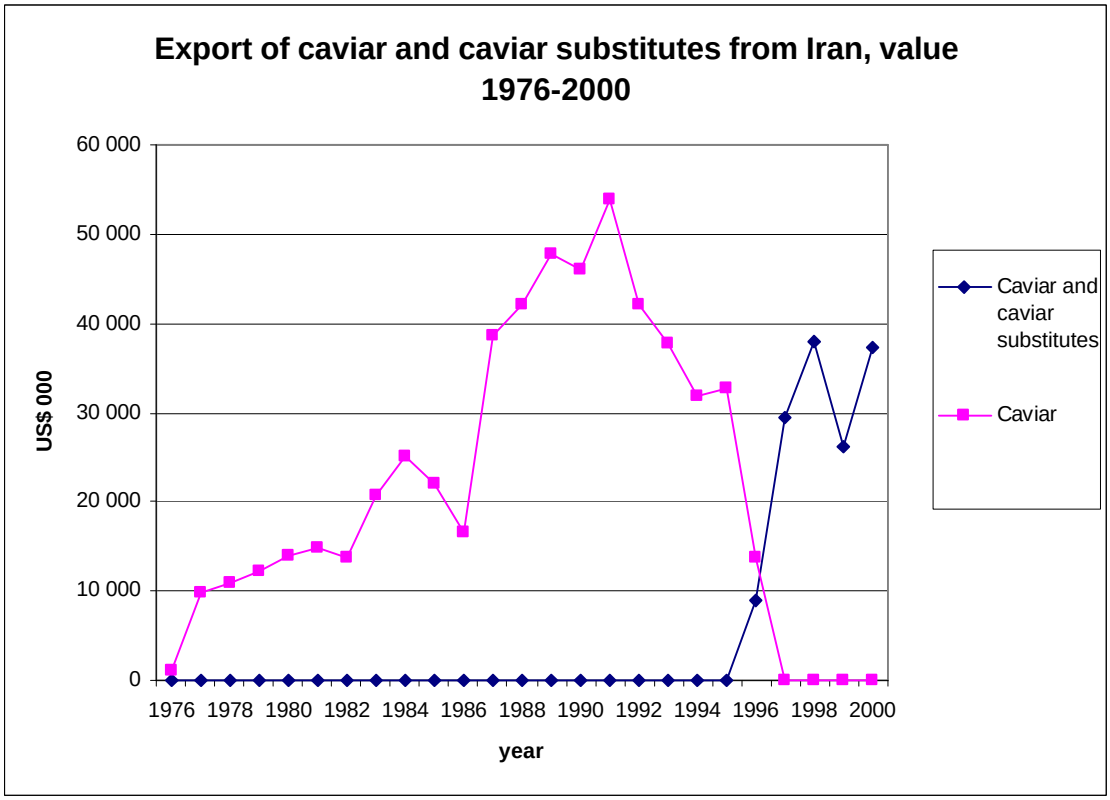
Catches of sturgeons in Iran decreased from 3000 MT in 1970 to 1 288 MT in 1983. In the following years they increased progressively reaching the record peak of 3 036 MT in 1991. In the nineties they decreased again to 1 000 MT in 1999 and 2000 (Figure 11).

Figure 11: Landings of sturgeons in Iran, 1970-2000.



Exports of caviar and caviar substitutes from Iran have been grouped together in statistics from 1997 onwards. According to Fishstat +, in 2000, these were worth US$37.4 million (Figure 12).

Figure 12: Exports of caviar and caviar substitutes from Iran, value 1976-2000.



By comparing the last data available on inland fisheries landings in Iran, 151 000MT in 2000, (of which 1 000 MT were sturgeons) with employment in the sector (19 099 inland fishers in 2000), it is possible to give a rough estimate of some 130 people being employed in the sturgeon fishery.

Iranian authorities appear to be positive about the contribution of CITES to the sturgeon and caviar industry. According to a *Shilat* representative, smuggling decreased dramatically as a consequence of the CITES listing and the tightening of controls on exports of caviar and other sturgeon products (*Shilat*, Pers. Comm.).

Kazakhstan

Background data and estimates

Status: lower-middle income country (World Bank 2002c)
Population: 14.8 million in 2001 (World Bank 2002c)
Mean GDP per capita: US$1 129 in 2000 (UN Statistics Division 2002)
Total GDP: US$18.3 billion in 2000 and US$22.4 billion in 2001 (World Bank 2002c)
Number of employed people: 6 201 000 persons in 2000 (ESCAP 2001c)

Fishery data and estimates

Social:

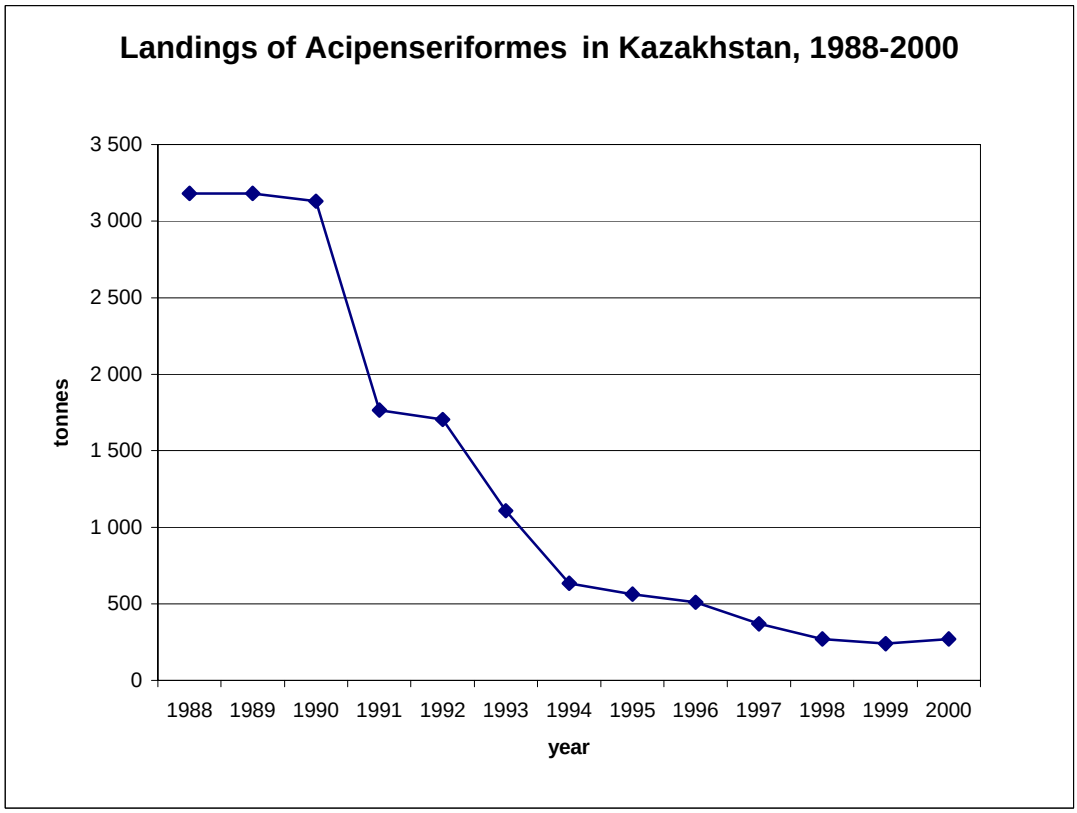
Number of fishers: 16 000 full-time inland fishers in 1994, data repeated up to 2000 (FAO FIDI data)
Employment in processing and marketing: N/A
Note: gender breakdown not provided by references

Economic:

Fisheries GDP: N/A
Total and inland landings: 25 774 (est.) MT in 2000 (Fishstat + data)
Aquaculture production and value: 1 153 (est.) MT in 2000, equivalent to US$2 469 500 (Fishstat + data)
Export quantity: 17 999 MT in 2000 (Fishstat + data)
Export value: US$12 280 000 in 2000 (Fishstat + data)

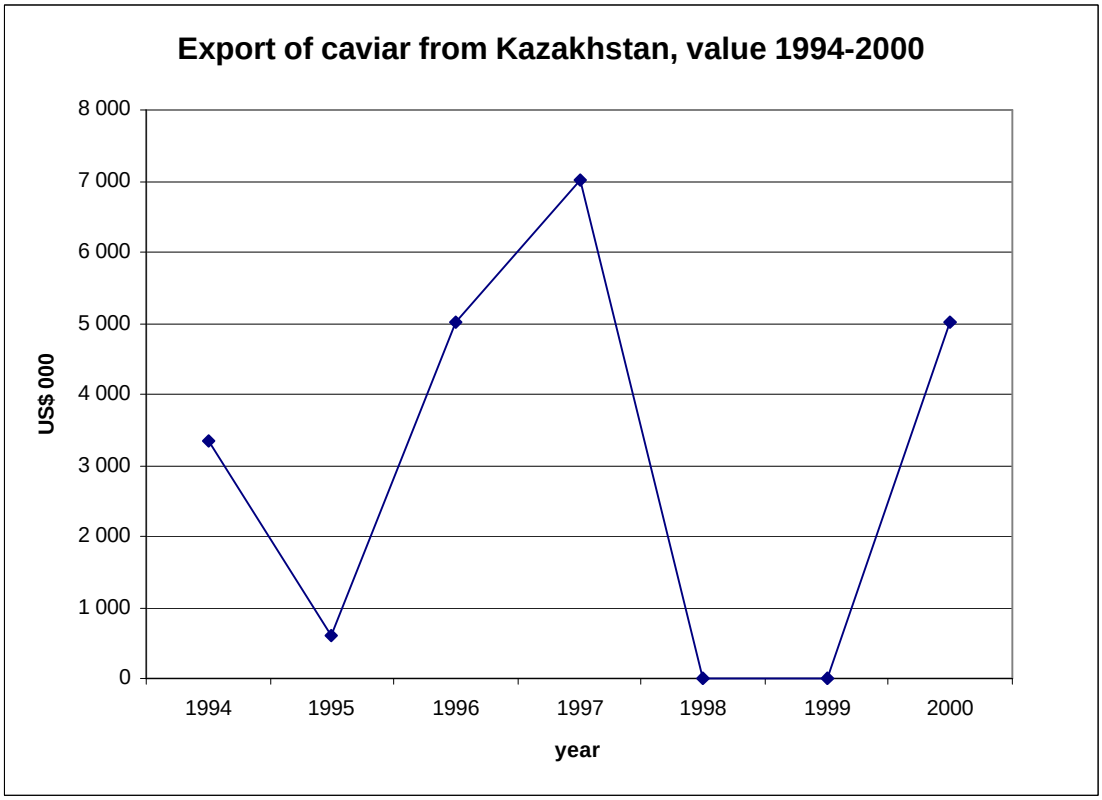
According to Fishstat +, catches of sturgeons in Kazakhstan have declined from 3 181 MT in 1988 to an estimated 270 MT in 1998, followed by 240 MT in 1999 and 270 MT in 2000 (Figure 13).

Figure 13: Landings of sturgeons in Kazakhstan, 1988-2000.



Exports of caviar generated an income of US$3.35 million in 1994, US$594 000 in 1995, US$5 million in 1996, US$7 million in 1997 and US$5 million in 2000. No data was available for 1998 and 1999 (Figure 14). The figure for 2000 is equivalent to roughly 41 percent of the total income generated by fish commodities exports (Fishstat + data).

Figure 14: Exports of caviar from Kazakhstan, value 1994-2000.



According to Fishstat + data on landings and FAO FIDI employment data, an estimated 16 000 fishers landed 25 774 MT in 2000, of which 270MT were sturgeons. This suggests an estimated 170 fishers are dependent on sturgeon fisheries in Kazakhstan

Russian Federation

Background data and estimates

Status: lower-middle income country (World Bank 2002d)
Population: 146.9 million in 1998 (World Bank 2002d)
Mean GDP per capita: US$1 726 in 2000 (UN Statistics Division 2002)
Total GDP: US$276.6 billion 1998 (World Bank 2002d)
Number of employed people: 64 327 000 in 2000 (ESCAP 2001d)

Fishery data and estimates

Social:

Number of fishers: 316 300 in 2000, of which 1 300 aquaculture farmers, 62 100 inland fishers and 252 900 marine fishers (FAO FIDI data)
Full-time: 5 900 women and 36 800 men in 2000 (FAO FIDI data)
Part-time: 38 700 women and 234 900 men in 2000 (FAO FIDI data)
Gender breakdown: 900 women employed as part-time aquaculture farmers, 30 300 women employed as inland fishers, 4 900 women employed as marine coastal fishers and 8 500 women employed as marine deep-sea fishers in 2000 (FAO FIDI data)

Number of inland fishers: 62 100 in 2000, of which 30 300 women and 31 800 men (FAO FIDI data)
Full-time: 3 900 women and 4 000 men in 2000 (FAO FIDI data)
Part-time: 26 400 women and 27 800 men in 2000 (FAO FIDI data)

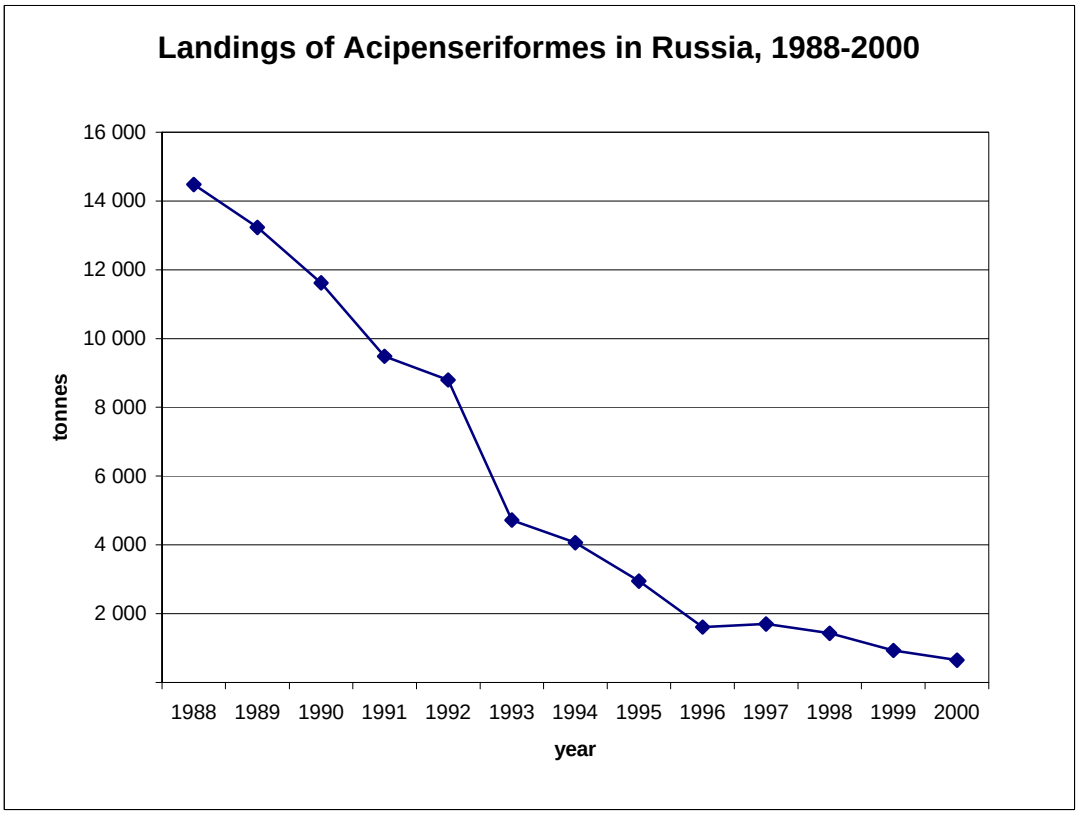
Employment in processing and marketing: N/A

Economic:

Fisheries GDP: N/A
Total landings: 4 027 370 MT in 2000 (Fishstat + data)
Total inland landings: 292 368 MT in 2000 (Fishstat + data)
Aquaculture production and value: 77 132 MT in 2000, equivalent to US$204 779 000 (Fishstat + data)
Export quantity: 1 045 025 MT in 2000 (Fishstat + data)
Export value: US$ 1 386 398 000 in 2000 (Fishstat + data)

In Russia, catches of sturgeons have seriously declined, however caviar exports, after the lows of the nineties, were estimated to have increased considerably in 2000 (Fishstat + data). According to Fishstat + data, landings decreased from 14 480 MT in 1988 to 648 MT in 2000 (Figure 15), of which 594 MT came from inland waters and 54 MT from the "Mediterranean and Black Sea" fishing area.

Figure 15: Landings of sturgeons in Russia, 1988-2000.

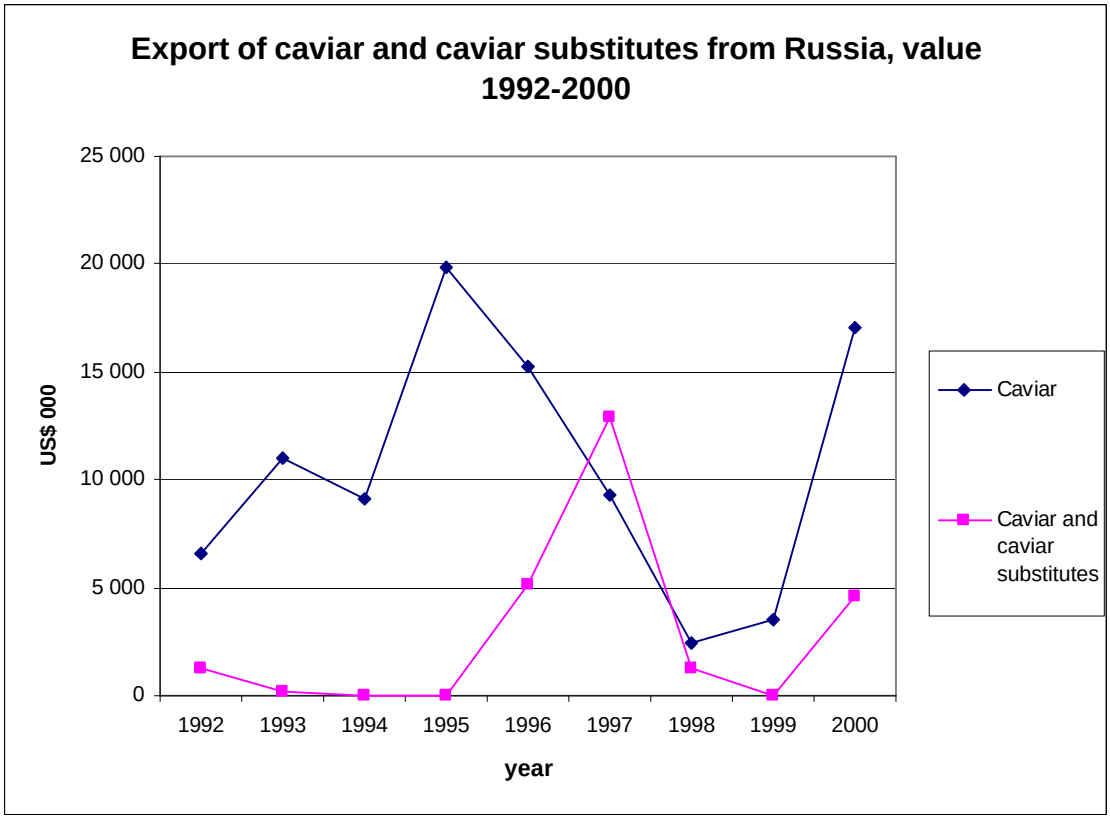


Sturgeon farming in Russia appears to be a viable activity with production reaching 2 050 MT in 2000 (Figure 16).

Figure 16: The sturgeon farming industry in Russia, 1988-2000.

Income generated from exports of caviar increased from some US$6.6 million in 1992 to US$19.8 million in 1995. It decreased again to US$2.4 million in 1998, recovered slightly to US$3.56 million in 1999 and on to US$17 million in 2000, (Fishstat + data). Exports of “caviar and caviar substitutes” followed a similar pattern over the same period (Figure 17).

Figure 17: Exports of caviar and caviar substitutes from Russia, value 1992-2000.



According to Fishstat + data on landings and FAO FIDI employment data an estimated 62 100 inland fishers landed 292 368 MT in 2000, of which 594 MT were sturgeons. This suggests 130 fishers would be dependent on sturgeon fisheries in Russia.

Conclusions

Sturgeon stocks are seriously depleted, especially in traditional producing basins such as the Caspian Sea. The main factors behind the depletion of Caspian stocks include illegal fishing and habitat degradation. This has generated an increase in official prices for caviar (TIC HU, Pers. Comm.) which in turn has led to a rise in demand for less expensive caviar from poaching and smuggling. However, in some countries, such as Iran, the strict implementation of the CITES regime and tightening of controls on poaching and smuggling have had a beneficial impact against illegal activities.

At the same time, aquaculture is gaining momentum as an alternative to sturgeon capture fisheries. Environmental groups advocate increased production of caviar and sturgeon meat from aquaculture to reduce pressures on wild stocks. However, a decline in the demand for Caspian caviar may also entail negative consequences for employment in the Caspian sturgeon industry and, paradoxically, negative consequences for Caspian sturgeon stocks.

Moving fishing effort away from the commercially exploited sturgeon species would lead to a reduction in investments in hatcheries and re-stocking programmes, which have been essential to preserve Caspian sturgeon stocks over time. Without them these stocks would be more prone to threats like pollution and habitat disruption. Thus an effective global conservation programme for sturgeons is necessary to promote sustainable management of both wild and farmed sturgeon as complementary and not alternative options.

According to Fishstat + data, exports of caviar in 2000 still represented a significant source of income for countries in the Caspian Sea and in other parts of the world. However, due to the implementation of stricter management measures and the ban on international trade in caviar in 2001, data for that year may show a significant decline.

The last available Fishstat + data for **Azerbaijan** (1999) indicate that the country earned US$1.3 million from the export of merely 6 MT of "caviar and caviar substitutes". This suggests that the entry included more sturgeon caviar than caviar substitutes.

For **Iran,** in 1997, exports of caviar and caviar substitutes generated US$29.45 million, in 1998 US$37.9 million, in 1999 US$26 million and in 2000 some US$37.4 million (Fishstat + data). Caviar and caviar substitutes are the most remunerative fish commodity exports according to Fishstat +. In 2000 they amounted to 75 percent of total revenues from exports of fishery products. The major part this data entry in Fishstat + consists of sturgeon caviar, due to the relatively small quantities (111 MT in 1997, 143 in 1998, 75 in 1999 and 72 in 2000) corresponding to the high values mentioned above. *Shilat's* relatively good adaptation to the CITES management and trade requirements has maintained the role of caviar as an important source of foreign exchange for the country

In **Kazakhstan**, exports of caviar generated US$5 million in 2000 (Fishstat + data), equivalent to 41 percent of total income generated by exports of fish commodities from that country.

In **Russia**, exports of caviar totalled US$17 million in 2000 and those of "caviar and caviar substitutes" some US$4.6 million. Caviar is still among the top 20 fish commodities in terms of foreign exchange earnings (Fishstat + data).

Finally **China** reported exports of 2 962 MT of "caviar and caviar substitutes", corresponding to an income of US$30.4 million. However, the relatively large quantity involved suggests a significant component of caviar substitutes.

The limited data available concerning the industry in the case countries does not allow a credible analysis of its social importance. In addition it has not been possible to make any estimate on employment in caviar processing and marketing. The social estimates of this study are limited to:

- 60 sturgeon fishers in Azerbaijan;
- 130 sturgeon fishers in Iran;

- 170 sturgeon fishers in Kazakhstan;
- 130 sturgeon fishers in Russia.

The very rough estimates on employment in fishing and the lack of data on employment in processing and marketing make these figures largely under-representative of the social importance of the sturgeon industry in the Caspian region.

Table 4: Economic and social aspects of the sturgeon and caviar industry in the Caspian Sea (2000 data, source FAO except when explicitly stated).

Country	Estimated employment (fishers)	Landings (MT)	Aquaculture production and value (MT)	Export value (US$)
Azerbaijan	60	71	N/A	403 000 in 1997 (caviar), 1 309 000 in 1999 (caviar and caviar substitutes)
Iran	130	1 000	N/A	13 785 000 in 1996 (caviar), 37 413000 in 2000 (caviar and caviar substitutes)
Kazakhstan	170	270 (est.)	N/A	5 020 000 (caviar)
Russia	130	648	2 050, equivalent to US$20 500 000	17 094 000 (caviar) 4 577 000 (caviar and caviar substitutes)

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Caribbean queen conch (*Strombus gigas*)

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TRAFFIC International

Background

The Caribbean queen conch (*Strombus gigas*) is a gastropod belonging to the Strombidae family. It inhabits the Neotropical Atlantic waters of Bermuda, southern Florida, southern Mexico, the whole Caribbean region, Venezuela and Brazil. The queen conch is easily recognizable by its large pinkish shell, reaching a length of 30 cm and weighing some 2 kg. Its favourite habitats are beds of Turtle grass (Thalassia) and of Manatee grass (Cymodocea) and sand flats at water depths from 1 to 30 m. *Strombus gigas* mainly feeds on algae, as adults, and plankton as larvae. It may reach some 7 years of age and its main predators include crabs, turtles, sharks, rays and humans (FAO 1977; Theile 2001).

Queen conch fisheries and the international regime

The *Strombus gigas* has been utilized by humans since prehistoric times. The slow movements of the conch, its pinkish-rose shell, and its frequency in shallow waters make this species an extremely easy target for fishers. Conchs are mainly taken by hand or by simple fishing gears, such as a long pole bearing two metal tines or forks. They are then taken ashore to be cleaned.

The meat is sold either fresh or dried, and used to prepare salads or chowder. The shells are utilized in pottery and jewellery. The queen conch fishery has a long tradition in the Caribbean region, however the commercial fishery has only been expanding since the mid-late seventies. This has been due to the relatively recent increase in demand for *Strombus* meat both within the Caribbean and in foreign markets. The growing tourism industry has also increased the demand for shells and jewellery.

TRAFFIC reports how the queen conch fishery has been expanding over the last ten years and even developed into a large-scale commercial fishery with almost industrial characteristics in some Caribbean countries (Theile 2002a). In 1992, continuing concerns over the species' overexploitation led the CITES Member States to list the Caribbean queen conch under CITES Appendix II.

In 1995 the CITES Animals Committee included *Strombus gigas* in the Review of Significant Trade process following concerns about the continuing growth of the industry, and problems with enforcement in several range states. The Review, performed by CITES and IUCN, concluded that local queen conch populations, and hence fisheries, were threatened, despite the survival of the species as a whole not being at risk. The Review concluded that illegal fishing and trade added pressures to this valuable resource. One of the main recommendations of the Animals Committee was to develop a regional management regime for the species.

On a regional level, the United States' Caribbean Fishery Management Council (CFMC) launched an "informal" regional management regime for *Strombus gigas*. The activities of CFMC and affiliated institutes include the preparation of studies and formulation of

recommendations, with information on these activities being available online at: http://www.strombusgigas.com. On a national level, several countries have been implementing management measures such as the introduction of export quotas and trade bans, and technical measures such as restrictions in the use of scuba and hookah gear by conch fishers.

Upon request of the Caribbean States, concerned about persistent illegal activities and enforcement problems, the CITES Animals Committee, at its 17th meeting (held in Hanoi, Vietnam, from 30 July to 3 August 2001) recommended the inclusion of the species in the Review of Significant Trade once again. The 2001 Review included the following priorities:

- gathering of information on queen conch management systems, national legislation and enforcement, trade control, and any relevant resource assessment;
- specialized training for CITES enforcement officers in the Caribbean sub-region in species identification, species labelling, legislative review, effective trade control, database administration;
- development of liaison between national and international authorities;
- improvement of communication between parties in the Caribbean sub-region;
- assistance to smaller states in resolving enforcement constraints.

The first phase of the Review of Significant Trade, completed in spring 2002, was aimed at providing an overview of current management practices for the species in the Caribbean. It has been partly funded by the European Commission and implemented with the assistance of TRAFFIC. One of the outputs has been the technical report "Queen conch fisheries and their management in the Caribbean", by Stephanie Theile, TRAFFIC Europe (Theile 2001).

During the second phase of the Review, TRAFFIC Europe, in cooperation with other international experts, has been compiling and analysing information on the biological and trade status of the species and circulated a draft report to all range states and experts for peer review. Once completed, the report will assist the CITES Animals Committee in formulating recommendations to help range states to improve the management of the species and comply with article IV of CITES on the regulation of trade in specimens of species listed in Appendix II (Theile 2002a). The ultimate aim would be to establish a regional conservation and management strategy (CITES 2002).

Table 1: CITES voluntary export quotas for queen conch[25].

Country	Quotas	
Colombia	148 000 kg (meat)	9 000 kg (shells)
Jamaica	in preparation	in preparation
Nicaragua	45 359 kg (meat), corresponding to 100 000 lbs	

NB: According to Notification 1999/19 (CITES 1999a), the 41st CITES Standing Committee agreed to recommend that Parties not accept imports of specimens of the species in question from Antigua and Barbuda, Barbados, Dominica, Saint Lucia and Trinidad and Tobago. Under the 2002 Review of Significant Trade, the recommendation has been withdrawn for Saint Lucia, provided the country establishes a cautious annual export quota (CITES 2002).

Queen conch landings and international trade

The FAO database Fishstat + has been the main data source used for the analysis of queen conch production and trade figures. However data on Belize have been provided by FAO FIDI. These data are still provisional and have not yet been registered in Fishstat + (March 2003).The database only provides data on landings of "Stromboid conchs nei (not elsewhere included)" and trade data on "Univalves", the latter being classified as "conch" by the national description of Fishstat + entries (FAO FIDI data). However, it can easily be assumed that "stromboid conchs nei" or "conch" data mostly overlap with queen conch data due to:

- the predominance of queen conch landings and trade in comparison to landings and trade of other conchs;
- the geographic provenance of data: traditional queen conch producing countries in the Western Central Atlantic.

Landings of stromboid conchs nei (*Strombus* spp.) in the Western Central Atlantic[26] increased from 1 200 MT in 1970 to the record peak of 16 857 MT in 2000, with fluctuations in the mid-eighties and at the beginning of the nineties (see Figure 1). However, Fishstat + data do not include conch landings in the United States, but according to the National Marine Fisheries Service (NMFS), United States' landings of "Snails (Conchs)" increased from 433.9 MT in 1970 to 1 292 MT in 2001, peaking in 1994 at 3 319 MT (NMFS landings data).

Countries should provide Fishstat + with live weight conch data, but many of them provide meat weight data. This complicates the analysis, as the meat content of the

[25] Available online at: http://www.cites.org/common/quotas/2003/2003latest.pdf (CITES 2003).
[26] Countries: Anguilla, Antigua and Barbuda, Bahamas, Belize, British Virgin Islands, Cuba, Dominican Republic, Grenada, Guadeloupe, Haiti, Honduras, Jamaica, Mexico, Netherlands Antilles, Nicaragua, Puerto Rico, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Turks and Caicos Islands, US Virgin Islands and Venezuela.

animal is only 7 to 8 percent of its total live weight. Cuban landings totalled 831 MT in 1999 and were estimated at 830 MT in 2000; these data are based on a live weight calculation. On the other hand, a note on the 2000 FAO Yearbook on Fishery Statistics – Capture production mentions that conch catch data in Jamaica were registered on a meat weight basis (FAO FIDI 2002).

Exports[27] of conch, whether fresh, frozen or chilled, from developing countries in the Western Central Atlantic area, followed an almost constantly growing trend from 183 MT, corresponding to US$689 000 in 1979, to 698 MT, corresponding to little less than US$5.4 million in 1997. In 1998 univalves exports declined to 351 MT, corresponding to circa US$3.87 million, to recover in the following years and reach 545 MT, equivalent to circa US$4.5 million in 2000 (see Figure 2 [a] and [b]).

Values in Figure 2 (a) and (b) were provided to Fishstat + by developing countries exporting conch in the Western Central Atlantic area[28], excluding Jamaica. The Jamaican Government had all its data on exports of molluscs merged under the general heading "molluscs nei". In the previous version of Fishstat +, containing data up to 1999, importers of Jamaican commodities had provided data on exports of processed univalves from Jamaica over the 1995-1999 period. These figures had to be substituted with the official data provided by the Jamaican Government in 2002 (FAO FIDI, Pers. Comm.).

The United States are the main world importer of conchs, recorded in Fishstat + as "univalves, fresh or chilled, nei". United States imports of fresh/chilled conch totalled 975MT in 2000, equivalent to US$5.9 million (Fishstat + data)[29] and 1 250 MT in 2001, equivalent to US$6.6 million (NMFS trade data).

[27] In order to facilitate reading of this paper, the term "export" includes "re-export" as well.
[28] It is important to mention that in 2000 the USA exported 635 MT of "univalves, fresh or chilled, nei", equivalent to an income of US$4 million and classified by national description as "conch" (Fishstat + data). In 2001, the USA exported 610.5 MT of conch, equivalent to an income of more than US$4 million (NMFS landings data).
[29] Fishstat + data on export and import of conch do not match.

Figure 1: Total landings of Strombus spp. in the Western Central Atlantic, 1970-2000.

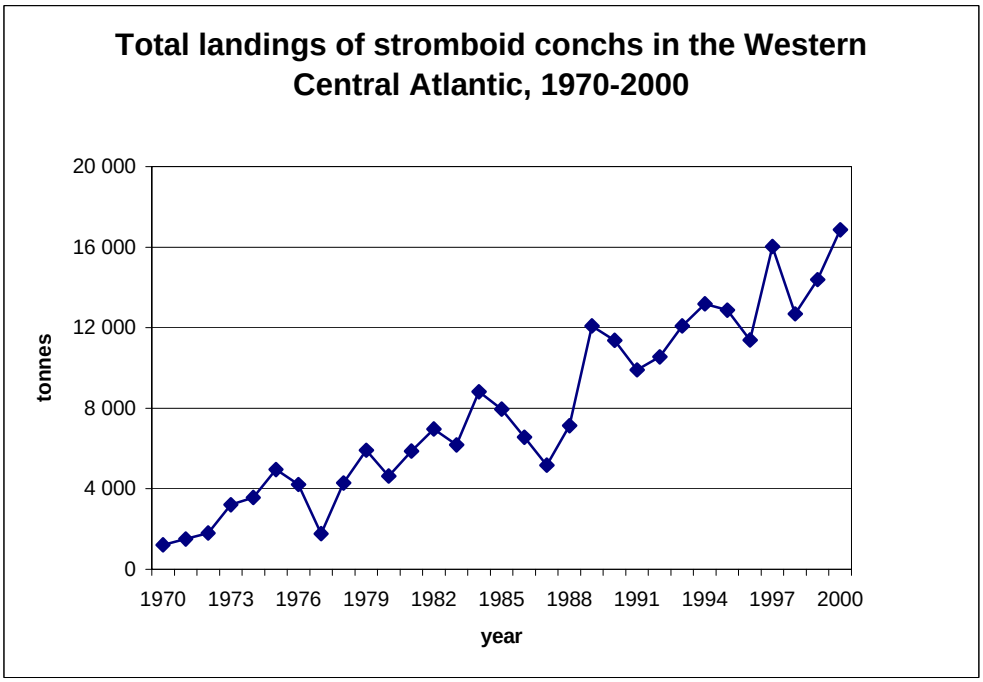
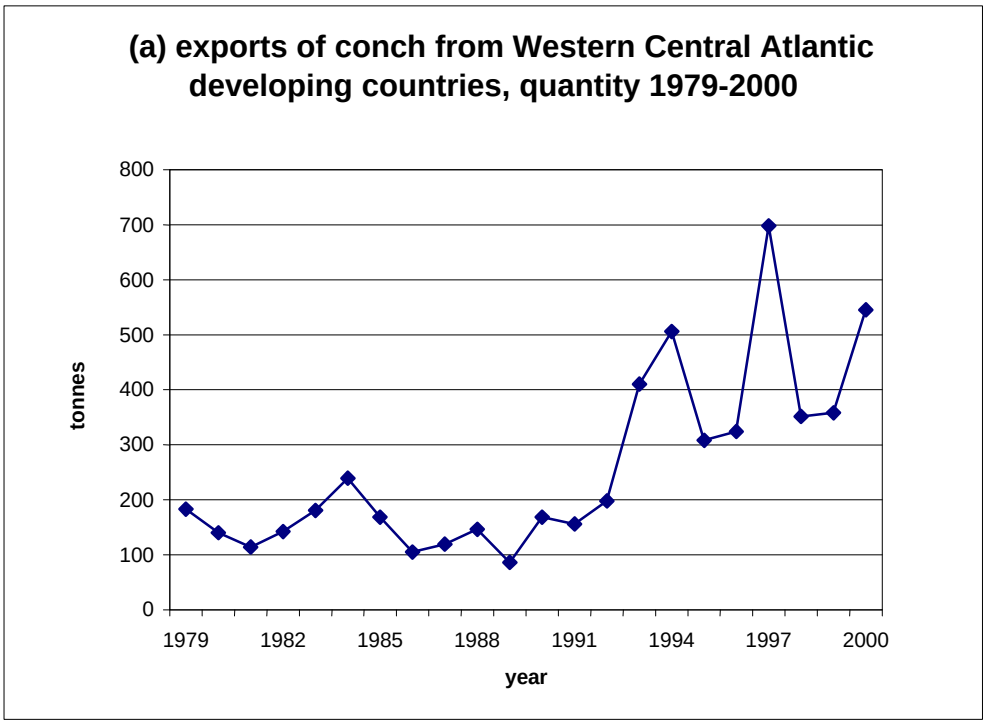
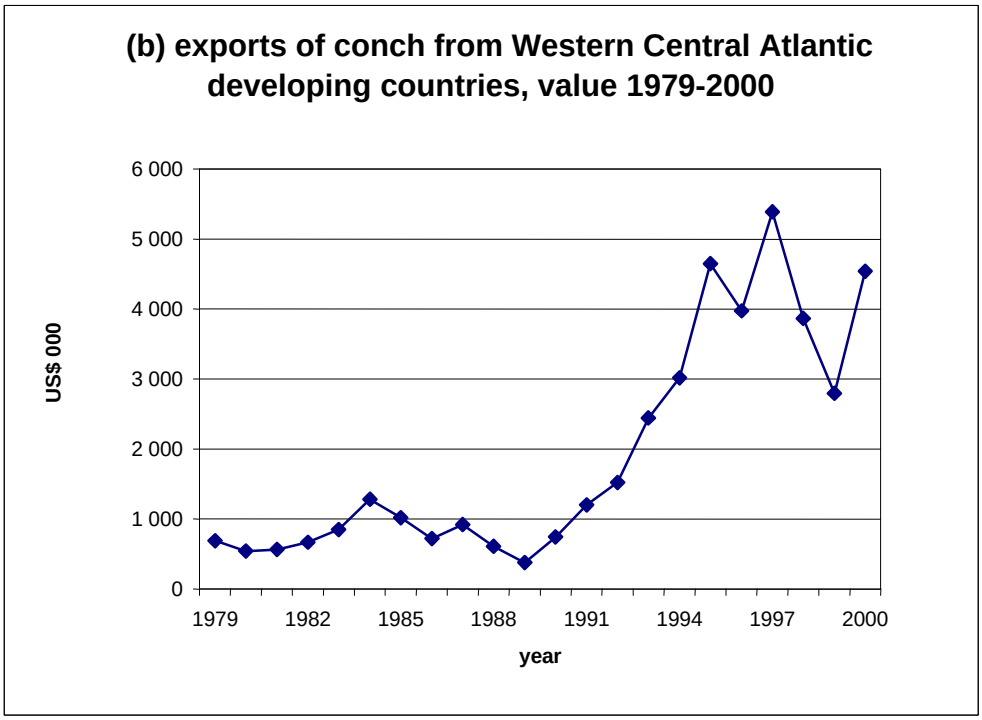


Figure 2 (a) and (b): Exports of conch from Western Central Atlantic developing countries, 1979-2000.





Captive breeding

Overexploitation of wild queen conch stocks led the United States, Mexican and Caribbean fishing industries to develop conch aquaculture strategies. In the Caribbean, queen conch culture has been practiced since 1984 at the Caicos Conch Farm in the Turks and Caicos Islands. In the United States, the Florida Straits Conch Company opened in Key West in 1999. The company performs both research and commercial activities. In Merida, Mexico, the Aquaculture Division of the Harbor Branch Oceanographic Institution performs aquaculture research and public education (Harbor Branch Oceanographic 2002).

Conch hatcheries

The United States Fish and Wildlife Conservation Commission is operating a stock rehabilitation hatchery for *Strombus gigas* at the Keys Marine Laboratory at Long Key, Florida. The first experimental releases of farmed specimens in the wild did not meet the expected results as released conchs were very vulnerable to predators. Further experimental releases in 1999 have been more successful as scientists introduced the timing factor as one of the variables to be considered prior to the release. Researchers at Long Key indeed estimated that juvenile conchs would have had more opportunities to survive if released during winter, when conch predators are scarcer, and prior to the new

moon, as the darker environment would have hidden the conch to predators. Survival during the tests that followed ranged from a low of 0 percent for small size juveniles during the spring season to a high of 49.7 percent of larger juveniles during autumn (Florida Keys National Marine Sanctuary 2001).

The queen conch fisheries in range states

This section aims to assess the economic and social value of queen conch fisheries for producing countries. The countries have been selected according to their developing country status[30] and the relative importance of conch fisheries and international conch trade for their economies.

The main sources utilized for general data have been the UN Statistics Division, the International Labour Organization (ILO), the United States Central Intelligence Agency (CIA), FAO and the World Bank. The main source for fishery landings, trade and employment data has been FAO, which relies on data provided by its Member States and Observers.

[30] With the exception of the Bahamas, a high income country and the Turks and Caicos Islands, a British Overseas Territory.

Bahamas

Background data and estimates

Status: high-income country (World Bank 2002a)
Population: circa 310 000 in 2001 (World Bank 2002a)
Mean GDP per capita: US$14 147 in 2000 (UN Statistics Division 2002)
Total GDP: US$4.8 billion in 2000 (World Bank 2002a)
Labour force: 157 640 according to 1999 estimates (ILO 2001)

Fishery data and estimates

Social:

Number of fishers: 12 600 marine coastal fishers in 1998, data repeated up to 2000 (FAO FIDI data)
Full-time: 8 800 fishers in 1998, data repeated up to 2000 (FAO FIDI data)
Part-time: 3 800 fishers in 1998, data repeated up to 2000 (FAO FIDI data)
Employment in processing: 500 persons in 1995 (Gascoigne 2002)
Employment in marketing: N/A
Note: gender breakdown not provided by references

Economic:

Fisheries GDP: BZ$61.67 million in 1995, equivalent to circa US$62 million (Gascoigne 2002)
Total and marine landings (Western Central Atlantic): 10 600 MT (est.) in 2000 (Fishstat + data)
Aquaculture production and value: 2 MT (est.) in 2000, corresponding to (est.) US$28 000 (Fishstat + data)
Export quantity: 3 440 MT (largely est.) in 2000 (Fishstat + data)
Export value: US$89 915 000 in 2000 (Fishstat + data)

In the Bahamas, the queen conch fishery represents a supplementary income-generating activity for fishers during the closed season for spiny lobster (the largest fishery in the archipelago), from 1 April to 31 July each year, particularly in the islands of Abaco, Grand Bahama and Andros. It is a largely artisanal activity, undertaken by small boats in shallow waters throughout the shallow banks (CARICOM Fishery Resources Assessment and Management Programme, CFRAMP, in press; Table 3). The level of harvest is determined by the export quota accorded by government. In reality once the quota has been exceeded, a meaningful market for the species ceases to exist (Department of Fisheries of the Bahamas, Pers. Comm.).

Spiny lobster fisheries make up some two thirds of total Bahamian landings and employ most of the fisheries workforce (Gascoigne 2002). Therefore, during the closed season queen conch fisheries provide the main source of income and employment for most commercial fishers.

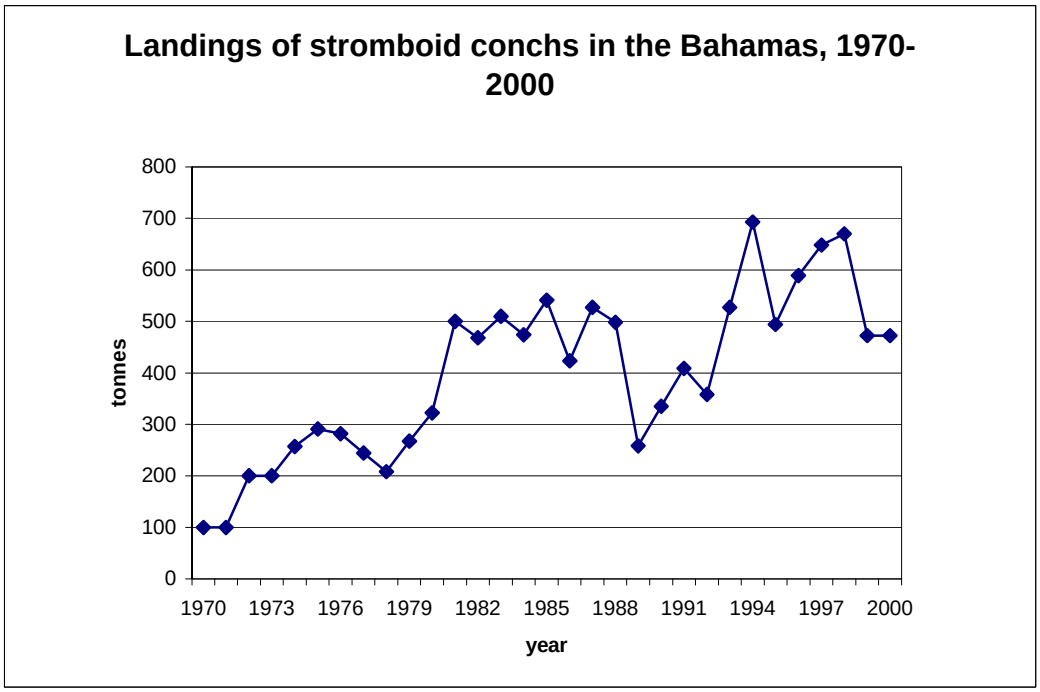
Using FAO (FAO FIDI data) it is possible to estimate the number of queen conch fishers both full time and during the spiny lobster closed season. The number of Bahamian fishers amounts to 12 600. In 2000, their estimated landings were 10 600 MT, of which 8 225 MT spiny lobster and 472 MT conchs (Fishstat + data). Thus one can estimate a number of 9 800 fishers being employed in the spiny lobster fishery (and in the conch fishery during the closure of the lobster fishery), and 400 fishers employed full time in the conch fishery. MacAlister, Elliott and Partners Ltd. (MEP) confirm that artisanal conch fishing is of great economic and social importance in all Bahamian islands and on the Family Island in particular (Gascoigne 2002).

Due to the limited period of intensive fishing, pressures on queen conch stocks are thought to be relatively sustainable. Recently, the Bahamian Fisheries Department assessed the stocks as healthy (CFMC and CFRAMP 1999).

Landings of stromboid conchs in the Bahamas increased from 100 MT in 1970, to 322 MT in 1980, 335 MT in 1990, and eventually reached 670 MT in 1998 followed by a decline to 472 MT in 1999 and 2000[31] (Fishstat + data), as shown in Figure 3. This also shows the peaks reached by conch landings in 1985 (541 MT) and 1994 (693 MT). Its contribution to total catch in the Bahamas has remained significantly stable over time, from 4.7 percent in 1970, to 6.4 percent in 1980, to 4.5 percent in 1990 and 4.45 percent in 2000.

[31] The 2000 figure is an estimated one, different from Bahamian Government's data (667 MT in 2000).

Figure 3: Landings of Strombus spp. in the Bahamas, 1970-2000.



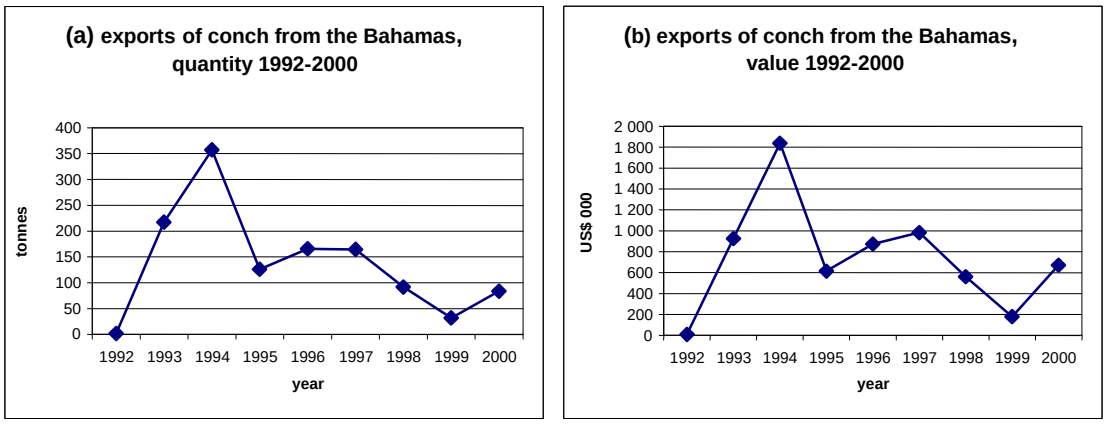
According to the Department of Fisheries of the Bahamian Ministry of Agriculture total conch landings in 2001 were 1 449 578 lbs (equivalent to 657.5 MT) for a value of BS$4.32 million, equivalent to US$4.37 million (see Table 2). They were second only to spiny lobster (Department of Fisheries of the Bahamas, Pers. Comm.).

Table 2: Bahamian production of conch, 1995-2001 (source: Department of Fisheries of the Bahamas, Pers. Comm.).

Year	**1995**		**1996**		**1997**		**1998**	
	lbs	**BS$**	**lbs**	**BS$**	**lbs**	**BS$**	**lbs**	**BS$**
Conch (fresh)	1 088 079	2 106 925	1 298 336	2 715 510	1 428 745	2 942 065	1 447 374	3 651 628
	MT	**US$ 000**	**MT**	**US$ 000**	**MT**	**US$ 000**	**MT**	**US$ 000**
Conch (fresh)	494	2 128	589	2 743	648	2 972	657	3 689
Year	**1999**		**2000**		**2001**		**2002**	
	lbs	**BS$**	**lbs**	**BS$**	**lbs**	**BS$**	**lbs**	**BS$**
Conch (fresh)	1 040 307	2 619 768	1 469 783	4 412 067	1 449 578	4 324 933	N/A	N/A
	MT	**US$ 000**	**MT**	**US$ 000**	**MT**	**US$ 000**	**MT**	**US$ 000**
Conch (fresh)	472	2 646	667	4 457	658	4 369	N/A	N/A

Export data for conch are only available from 1992. From 1992 to 1998 these were provided as "univalves, fresh or chilled, nei"and in 1999 and 2000 as "univalves nei, frozen" (Fishstat + data). According to Fishstat +, exports from the Bahamas increased from 2 MT for a value of US$9 000 in 1992, to 357 MT, for a value of some US$1.84 million in 1994. They subsequently fell to 32 MT in 1999 for a value of US$180 000. In 2000 exports started to grow again reaching an estimated 84 MT for a value of US$672 000 (Figure 4 [a] and [b]).

Figure 4 (a) and (b): Exports of conch from the Bahamas, 1992-2000.



Belize

Background data and estimates

Status: lower-middle income country (World Bank 2002b)
Population: circa 250 000 in 2001 (World Bank 2002b)
Mean GDP per capita: US$3 347 in 2000 (UN Statistics Division 2002)
Total GDP: US$790 billion in 2000 (World Bank 2002b)
Labour force: 89 210 persons according to 1999 estimates (ILO 2000)

Fishery data and estimates

Social:

Number of fishers: 1 872 full-time marine fishers nei in 2000 (FAO FIDI data) and 3 000 in 2001 (Belize Fisheries Department, Pers. Comm.)
Employment in processing: 500 persons in 2001 (Belize Fisheries Department, Pers. Comm.)
Employment in marketing: N/A
Note: gender breakdown not provided by references

Economic:

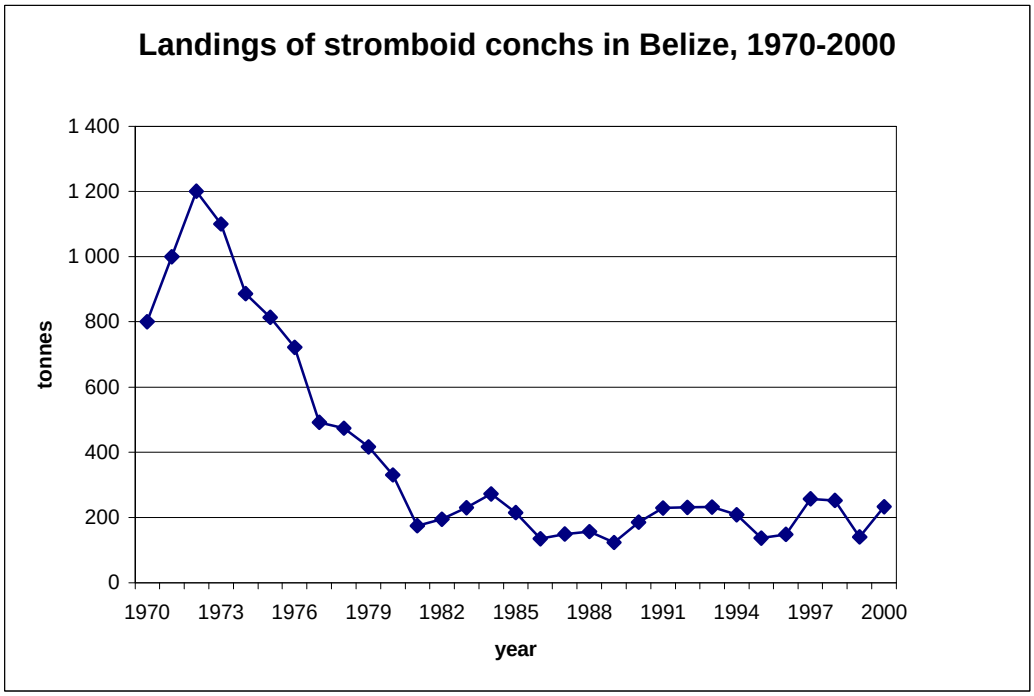
Fisheries GDP: US$9 million in 2001 (Belize Fisheries Department, Pers. Comm.)
Total and marine landings: 61 059 MT in 2000 (Fishstat + data)
Landings in the Western Central Atlantic: 886 MT in 2000 (Fishstat + data)
Aquaculture production and value: 2 648 MT in 2000, corresponding to US$12 710 400 (Fishstat + data)
Export quantity: 2 500 MT (est.) in 2000 (Fishstat + data)
Export value: US$30 930 000 in 2000 (Fishstat + data)

The *Strombus gigas* is an important source of food and income in Belize. Historically, it has been an important source of foreign exchange through large-scale export. However, conch fisheries in Belize have experienced a serious decline from the late seventies, mainly due to over exploitation. This led the government to set size and gear restrictions, closed seasons (from 1 July to 30 September), no-take areas and zones with carefully regulated fishing. However, these measures did not achieve the expected results, mostly because of the incidence of illegal harvesting and inadequate protection for juveniles[32] (Green Reef 2002).

[32] Data from a Hol Chan Marine Reserve report from 1992 shows that over 40percent of all legal sized conchs were immature.

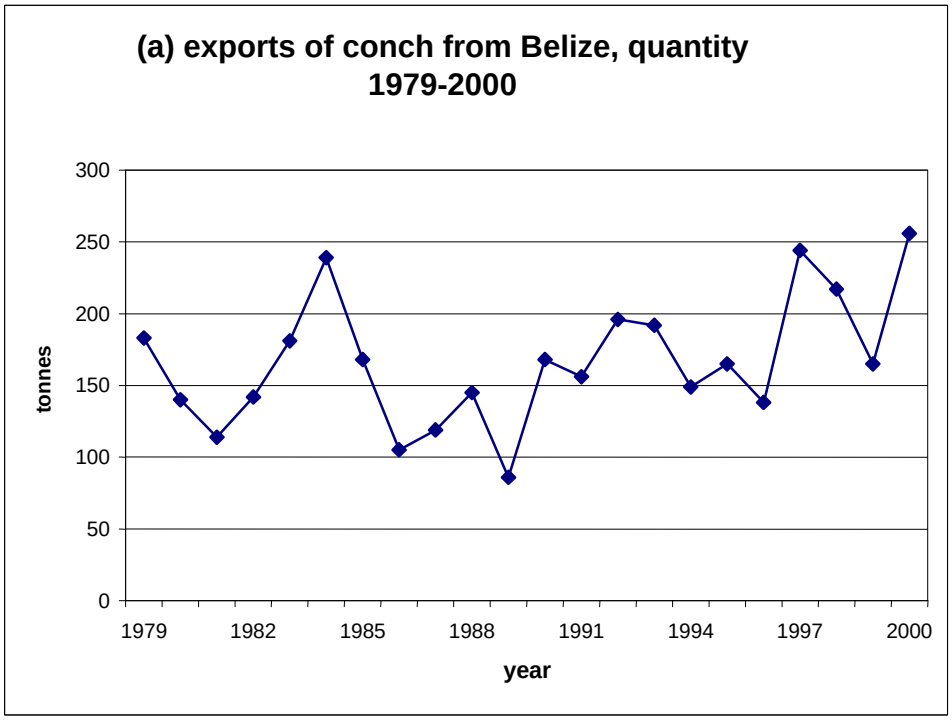
Catch data indicate a decrease in landings from 800 MT in 1970, to 330 MT in 1980, to eventually stabilize around an average of 195 MT per year in the following 20 years, then increase to 233 MT in 2000 (Figure 5). According to the Belizean Fisheries Department, the value of queen conch landings has been estimated at US$2.3 million, amounting to 26 percent of total fisheries GDP from Belize (Belize Fisheries Department, Pers. Comm.). The Department estimated that in 2001, 1 536 registered fishers out of 3 000 took part in the lobster and conch fisheries (Belize Fisheries Department, Pers. Comm.), therefore the reef fishery appears to be one of the most important in the country, at least from a social perspective. Alternative data provided by the Fisheries Unit of the Caribbean Community and Common Market (CARICOM) estimates 1 800 fishers and 550 shallow-water vessels (canoes) are employed in the Belizean queen conch fishery (CFRAMP, in press; Table 3).

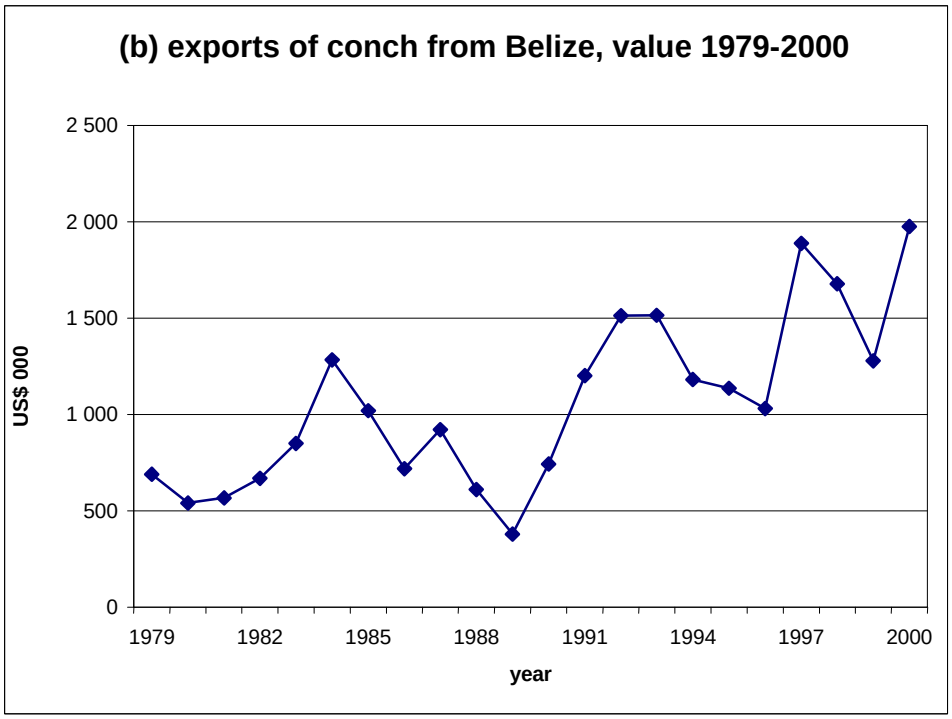
Figure 5: Landings of Strombus spp. in Belize, 1970-2000.



According to FAO FIDI provisional data, Belize is the main exporter of conch among developing countries in the Western Central Atlantic area. Exports, classified as “univalves nei, frozen”(Figure 6 [a] and [b]), increased from 183 MT in 1979, equivalent to US$689 000, to 256 MT in 2000, equivalent to almost US$2 million.

Figure 6 (a) and (b): Exports of conch from Belize, 1979-2000.





Cuba

Background data and estimates

Status: lower-middle income country (World Bank 2002c), Low-Income Food-Deficit Country LIFDC (FAO 1997)
Population: 11.2 million in 1999 (World Bank 2002c)
Mean GDP per capita: US$2 384 in 2000 (UN Statistics Division 2002)
Total GDP: N/A
Labour force: N/A

Fishery data and estimates

Social:

Number of fishers: 12 231 (est.) full-time in 2000, of which 366 aquaculture farmers and 11 865 marine fishers, nei (FAO FIDI data)
Employment in processing and marketing: N/A
Note: gender breakdown not provided by references

Economic:

Fisheries GDP: N/A
Total landings: 56 196 MT (est.) in 2000 (Fishstat + data)
Landings in the Western Central Atlantic: 51 550 (est.) MT in 2000 (Fishstat + data)
Aquaculture production and value: 52 700 MT (est.) in 2000, corresponding to (est.) US$46 911 000 (Fishstat + data)
Export quantity: 7 638 MT (est.) in 2000 (Fishstat + data)
Export value: US$78 350 000 in 2000 (Fishstat + data)

Queen conch occurs on the Cuban continental shelf, in keys and reef areas from shallow waters to the edge of the shelf, both in the north and on the south coast. Cuba has a long tradition of commercial conch fishing. However, due to over exploitation leading to a depletion of stocks, the queen conch fishery was closed from 1977 to 1982[33]. Currently, harvest takes place from small boats using free diving techniques. Compressors and scuba gear are prohibited, and the fishery is closed from May to September. Minimum size and depth limits regulations are aimed at avoiding catch of juveniles and deeper water reproductive individuals (Formoso Garcia 2001).

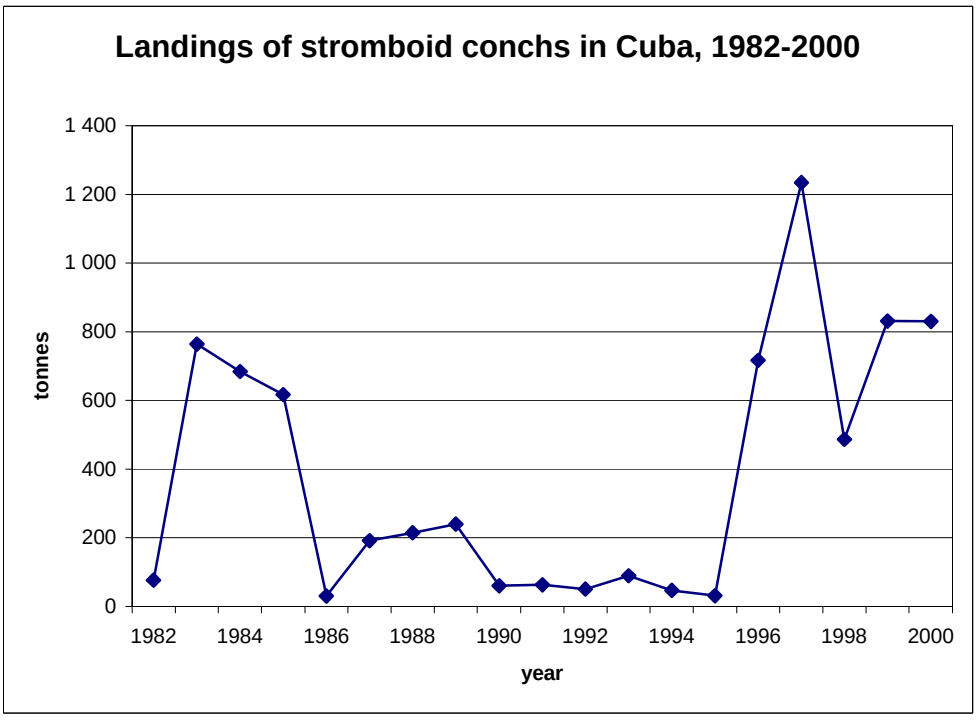
[33] Fishstat + does not provide any pre-1982 figures for Cuba.

Harvests of stromboid conchs increased from 77 MT in 1982 to 764 MT in 1983. In the following years, they declined reaching 31 MT in 1986. Catch recovered to 240 MT in 1989 followed by a new drop to 32 MT in 1995 and a sudden increase to a record production of 1 234 MT in 1997. In 1998 the queen conch fisheries were closed. Recorded landings totalled 487 MT that year, presumably from minor conch species. In 2000, conch landings were estimated as 830 MT (Figure 7). Over the last three years, they have averaged 1.1 percent of total Cuban catch.

However, as CFMC reports (CFMC and CFRAMP 1999), since the product is landed in the shell and the meat weight is approximately 7 to 8 percent of the total landed weight, it is likely that conch harvests for human consumption did not exceed 100 MT, even in 1997. In fact, the Cuban Government reported landings of 1 000 MT live weight, corresponding to some 75 MT of clean meat for human consumption (Formoso Garcia 2001). During the closed season of 1998, the *Strombus gigas* stock was assessed and the conch Total Allowable Catch (TAC) set at 800 MT live weight, equivalent to some 51 MT of meat. Illegal fishing was estimated at 50-60 MT live weight per year (Formoso Garcia 2001).

Fishstat + provides no data on the export of univalves from Cuba.

Figure 7: Landings of Strombus spp. in Cuba, 1982-2000.



Dominican Republic

Background data and estimates

Status: lower-middle income country (World Bank 2002d) LIFDC (FAO 1997)
Population: 8.5 million in 2001 (World Bank 2002d)
Population living below the poverty line: 25 percent of population in 1995-2001 (World Bank 2002d)
Child malnutrition: 6 percent of children below five years of age in 1995-2001 (World Bank 2002d)
Mean GDP per capita: US$2 982 in 2000 (UN Statistics Division 2002)
Total GDP: US$19.6 billion in 2000 and US$21.2 billion in 2001 (World Bank 2002d)
Labour force: 2.3 to 2.6 million persons estimated in 2000 (CIA 2002)

Fishery data and estimates

Social:

Number of fishers: 9 500 unspecified target fishers in 2000 (FAO 2001)
Employment in processing and marketing: 2 500 persons in 2000 (FAO 2001)
Note: gender breakdown not provided by references

Economic:

Fisheries GDP: US$12 628 892.40 in 1999 (FAO 2001)
Total landings: 11 029 MT in 2000 (Fishstat + data)
Total marine landings (Western Central Atlantic): 10 842 MT in 2000 (Fishstat + data)
Aquaculture production and value: 2 125 MT in 2000, corresponding to US$6 602 200 (Fishstat + data)
Export quantity: 346 MT (est.) in 2000 (Fishstat + data)
Export value: US$919 000 in 2000 (Fishstat + data)

The *Strombus gigas* fishery is a historically important resource for the Dominican Republic. In a series of studies in the Catalinita and Saona Islands (Vega 1987), Dominican archaeologists discovered and photographed great conch piles, called *conchales* or *concheros*, demonstrating the economic importance of *Strombus gigas* for the ancient populations inhabiting the island as well as for modern fishermen.

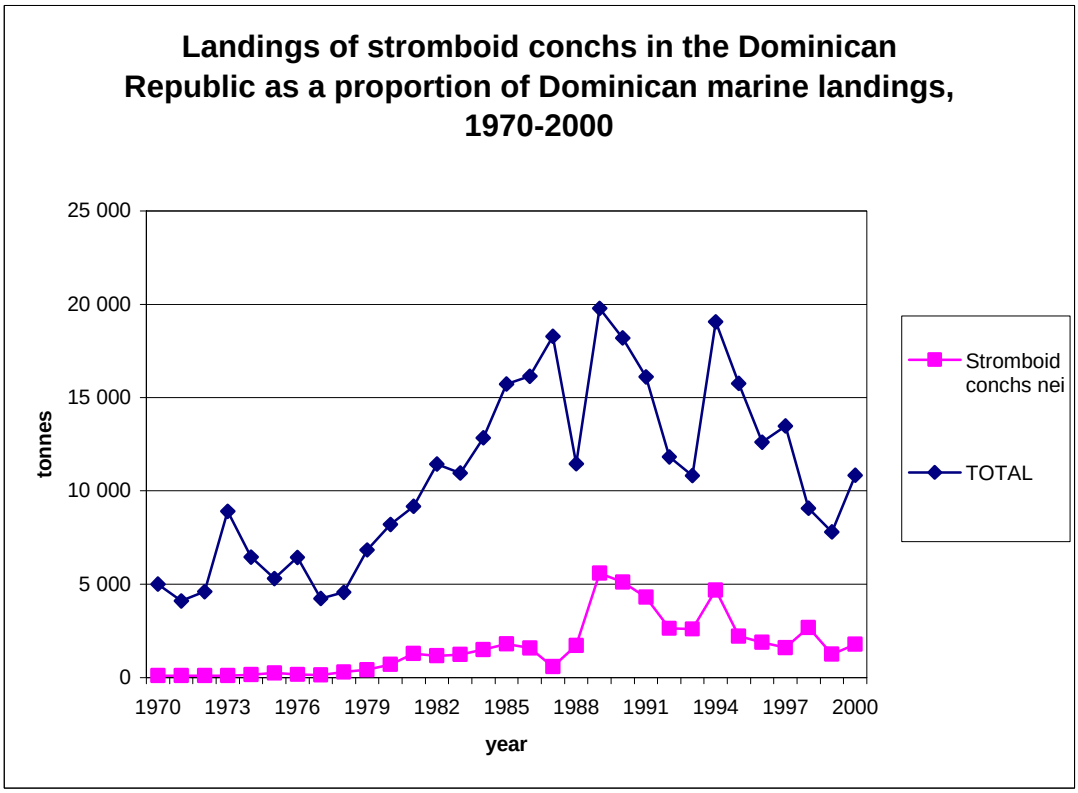
The queen conch is a commercial fishery. Landings are mainly processed for domestic consumption but also for export to the United States (Theile 2001). Considering that in

2000 Dominican landings totalled 11 029 MT, and the estimated number of fishers was 9 500, it can be estimated that some 1 530 fishers depend on conch landings.

According to the literature cited by Stephanie Theile in her technical report “Queen conch fisheries and their management in the Caribbean” (Theile 2001), the queen conch populations in the Dominican Republic are seriously overfished. Following the CITES listing, several conservation initiatives were launched, including a closed season over the period 1 July to 31 October, each year as from 1999 (CITES 1999b).

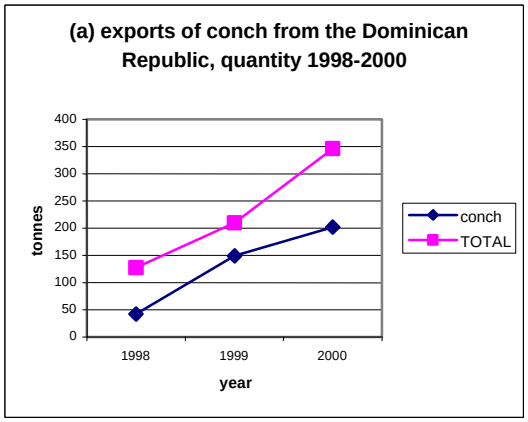
Stromboid conch landings in the Dominican Republic (Fishstat + data) averaged around 156 MT per year over the period 1970-1978. They increased to 1 798 MT in 1985, declined to 577 MT in 1987 and then grew to 5 583 MT in 1989. In the following years, with the exception of 1994 and 1998, catches followed a declining trend to 1 257 MT in 1999 and 1 778 MT in 2000 (Figure 8). In 1998 catches were 2 683 MT, equivalent to 29.6 percent of total marine production in the country, the highest percentage ever reached as against 16.4 percent in 2000. The average, during the period 1970-2000, was 12.4 percent (Figure 8).

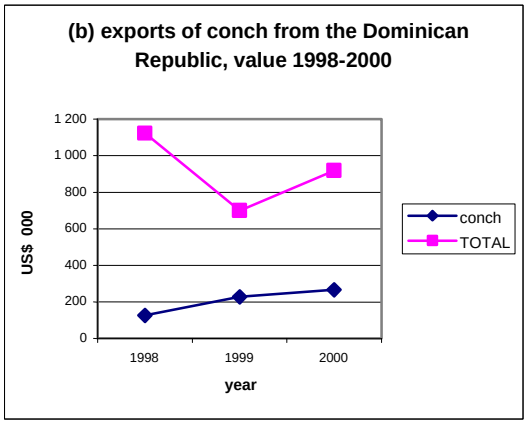
Figure 8: Landings of Strombus spp. in the Dominican Republic, a comparison with Dominican marine landings, 1970-2000.



The period 1998-2000 is the only one with relevant values or estimates on trade in conch from the Dominican Republic (Figure 9 [a] and [b]). Over this period "univalves, fresh or chilled, nei" were among the three most traded commodities (Fishstat + data). In 1998, conch represented 33 percent in quantity and 11 percent in value of total fisheries exports; equivalent figures for 1999 were, respectively, 71 percent and 33 percent and for 2000, 58 percent and 29 percent, which translates to an estimated 202 MT of conch, equivalent to US$266 000 (Fishstat + data)

Figure 9 (a) and (b): Exports of conch from the Dominican Republic, a comparison with total exports of fish commodities from the Dominican Republic, 1998-2000.





Jamaica

Background data and estimates

Status: lower-middle income country (World Bank 2002e) LIFDC (FAO 1997)
Population: 2.7 million in 2001 (World Bank 2002e)
Population living below the poverty line: 17 percent in 2001 (World Bank 2002e)
Child malnutrition: 4 percent of children below five years of age in 2001 (World Bank 2002e)
Mean GDP per capita: US$2 801 in 2000 (UN Statistics Division 2002)
Total GDP: US$7.6 billion in 2000 and US$8 billion in 2001 (World Bank 2002e)
Labour force: 1 104 800 in the first and second quarters of 2001 (ILO 2002)

Fishery data and estimates

Social:

Number of fishers: 24 365 in 2000, of which 22 726 marine fishers, nei and 900 (est.) aquaculture farmers (FAO FIDI data)
Full-time: 12 174 men and 539 women in 2000 (FAO FIDI data)
Part-time: 3 439 men and 165 women in 2000 (FAO FIDI data)
Occasional: 53 men and 35 women in 2000 (FAO FIDI data)
Unspecified: 7 960 persons in 2000 (FAO FIDI data)
Gender breakdown: 739 women employed as marine fishers, nei in 2000 (FAO FIDI data)
Employment in processing and marketing: N/A

Economic:

Fisheries GDP: N/A
Total landings: 5 676 MT in 2000 (Fishstat + data)
Total marine landings (Western Central Atlantic): 5 226 MT in 2000 (Fishstat + data)
Aquaculture production and value: 4 512 MT in 2000, corresponding to US$13 578 000 (Fishstat + data)
Export quantity: 811 MT in 2000 (Fishstat + data)
Export value: US$10 001 000 in 2000 (Fishstat + data)

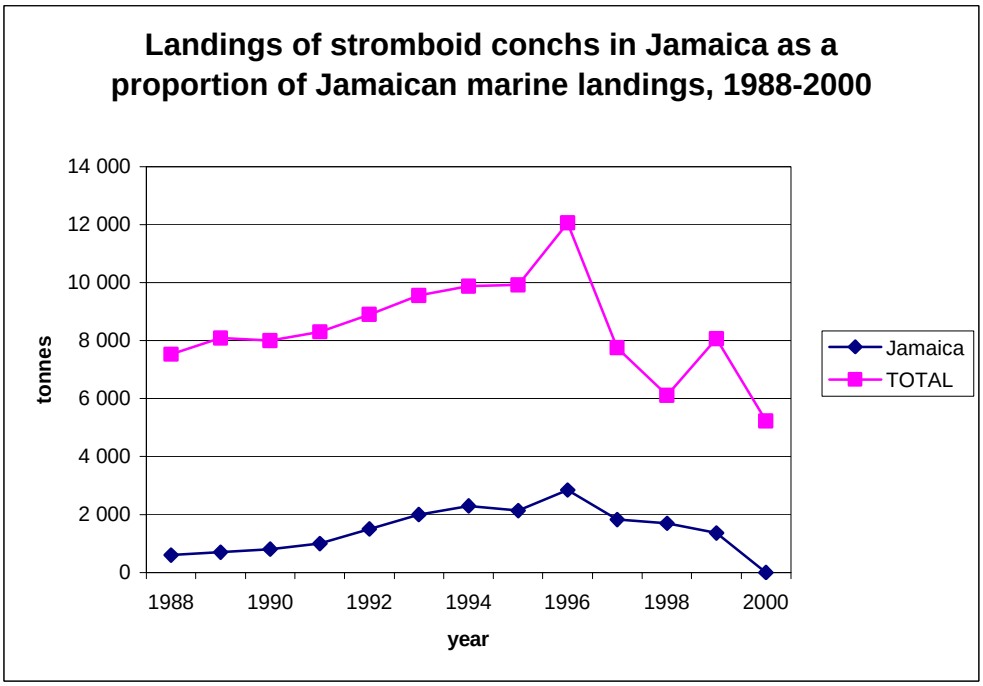
Historically the queen conch fishery has been the island's most important fishery, landing 2 850 MT in 1996 (Figure 10) and being a major source of foreign exchange. The principal actors in the Jamaican conch fishery are:

1. **Industrial fishers**, large producers using vessels of 25-30 m, mainly leased from other countries such as the United States, Nicaragua, Honduras and the Dominican Republic. Fishers use scuba/hookah diving to capture conch in depths of up to 25 m. Industrial fishers are allowed 80 percent of the annual TAC. They also process conch for the export market;
2. **Offshore artisanal fishers**, who use smaller boats and scuba/hookah diving equipments in depths of some 15 m. They sell conch to processors, local traders and, to a lesser extent, to local markets. They are allowed 20 percent of the annual TAC;
3. **Mainland artisanal fishers**, who dive for conch on the island shelf, where industrial fishing is not permitted. Their catch is mainly destined for local consumption. These landings are not included in the TAC.

(CFMC and CFRAMP 1999).

According to the CARICOM Fisheries Unit, in the industrial fishery 332 fishers are employed in 11 vessels of around 25m and 50 to more than 100 in the artisanal fishery (CFRAMP, in press). During the period 1988-1999, the conch fishery averaged 17.8 percent of Jamaican marine catch per year, becoming the most important single species fishery in the island (Figure 10) particularly since, according to the FAO Yearbook, catch data for stromboid conchs nei are expressed on a "meat weight" basis (FAO FIDI 2002), therefore net of the shell.

Figure 10: Landings of Strombus spp. in Jamaica, a comparison with Jamaican marine landings, 1988-2000.



FAO Fishstat + 1999 update suggests that trade in univalve products from Jamaica reached the peak of 1 205 MT in 1998 for a value of US$5.4 million. In 1999 exports totalled 904 MT, equivalent to US$3.8 million (FAO FIDI data).

In 2002, the Jamaican Government provided export data covering "molluscs nei, frozen" to the Fishstat + database. This substituted data on "univalves" which had been provided by the importing countries, not by the exporting country itself (FAO FIDI, Pers. Comm.). According to the new Fishstat + data, Jamaican exports of molluscs nei, frozen, totalled 2 133 MT, equivalent to US$9.3 million in 1995, 1 645 MT, equivalent to US$7.5 million in 1997, and 1 376 MT, equivalent to US$6.8 million in 1998. No data was provided for 1996, 1999 and 2000.

Before the listing of queen conch under CITES Appendix II, the conch fishery was unmanaged. In 1993, Jamaica established a quota system. In 1994, due to the high level of meat exported from Jamaica, the CITES Animals Committee requested the introduction of a management plan.

The Jamaican management plan for queen conch includes five objectives:

1. to monitor and control conch captures in order to ensure maximum sustainable yield;
2. to rehabilitate overexploited stocks;
3. to add value to conch through sophisticated processing;
4. to maximize foreign currency earnings from exports ;
5. to ensure adequate supply for local consumption by residents and tourists.

The plan's main elements provide for restrictions on the number of motor fishing vessels, an annual four-months closed season (1 July to 31 October), a quota management system and an exclusive fishing zone for artisanal conch fishers, i.e. the island shelf of Jamaica and the waters extending five nautical miles offshore. Further, the plan allows for restrictions on the importation of scuba and hookah fishing gears (CFMC and CFRAMP 1999).

In 1999, a dispute seriously threatened the Jamaican conch industry (resulting in the almost zero level of landings for the year 2000 as shown in Figure 10). Some large Jamaican fishing companies had sought extension to their 1998/99 TACs. However, the Natural Resources Conservation Authority[34] refused to follow up their request. The companies then retaliated by seeking court injunctions to force the government's agencies to permit continued conch harvesting.

However the Court of Appeal ordered the Minister of Environment to cancel the reopening of the conch season pending the enactment of new legislation to protect *Strombus gigas*. Subsequently, in December 1999, the Minister of Environment prepared the Inland, Marine Products and By-Products Act which included the provision for the granting of fishing licences and implementation of a quota system. Nevertheless on 1

[34] Now the National Environment and Planning Agency.

January 2000, the main fishing company of the island, not entirely satisfied with the proposed quotas, decided not to recommence operations. In the meantime though, the EU had approved the importation of conch and shrimp from Jamaica, thereby creating the conditions for an increase in demand and prices of these products. On 18 April the fishing companies withdrew their injunction, paving the way for the reopening of the industry. The industry accepted the quotas set under the framework of the new Act and the fishery was re-opened during the first week of May 2001 (ENS 2001).

Mexico

Background data and estimates

Status: upper-middle income country (World Bank 2002f)
Population: 99.4 million in 2001 (World Bank 2002f)
Child malnutrition: 8 percent of children below five years of age in 1995-2001 (World Bank 2002f)
Mean GDP per capita: US$5 805 in 2000 (UN Statistics Division 2002)
Total GDP: US$580.1 billion in 2000 and US$617.8 billion in 2001 (World Bank 2002f)
Labour force: 39.8 million persons according to 2000 estimates (CIA 2002)

Fishery data and estimates

Social:

Number of fishers: 262 401 in 2000, of which 18 270 aquaculture farmers, 60 171 inland fishers and 183 960 marine fishers (FAO FIDI data)
Full-time: 252 619 in 2000 (FAO FIDI data)
Part-time: 9 782 in 2000 (FAO FIDI data)

Number of marine fishers: 183 960, of which 156 011 marine coastal fishers and 27 949 marine deep-sea fishers in 2000 (FAO FIDI data)
Full-time: 174 178 fishers in 2000 (FAO FIDI data)
Part-time: 9 782 fishers in 2000 (FAO FIDI data)

Employment in processing and marketing: N/A
Note: gender breakdown not provided by references

Economic:

Fisheries GDP: US$541 million in 1996 (FAO 2001)
Total landings: 1 348 238.4 MT in 2000 (Fishstat + data)
Total marine landings: 1 421 241.4 MT in 2000 (Fishstat + data)
Landings in the Western Central Atlantic area: 274 576 200 MT in 2000 (Fishstat + data)
Aquaculture production and value: 53 802 **MT** in 2000, corresponding to US$207 795 800 (Fishstat + data)
Export quantity: 187 126 **MT** in 2000 (Fishstat + data)
Export value: US$706 547 000 in 2000 (Fishstat + data)

This Central American State has a long-established and important conch fishery. Up to 1986, stromboid catches encompassed several species, including queen conch, milk conch (*Strombus costatus*), Florida horse conch (*Pleuropoca gigantean*), West Indian chank (*Turbinella angulatus*) and lightning whelk (*Busycon contrarium*). The main producing States were Yucatan and Quintana Roo. From 1987 however, the only species fished is queen conch, on the Chinchorro and Cozumel banks.

TACs have been assigned in Quintana Roo since 1976 and since 1981 access to conch fishing has been restricted to fishers belonging to co-operatives. The steady decline in catch in the Yucatan led to the closure of commercial conch fisheries in the area as from 1987. The results of a stock assessment carried out in 1994 were not conducive to the re-opening of the fishery (Mexican Government through Chakalall, Pers. Comm.).

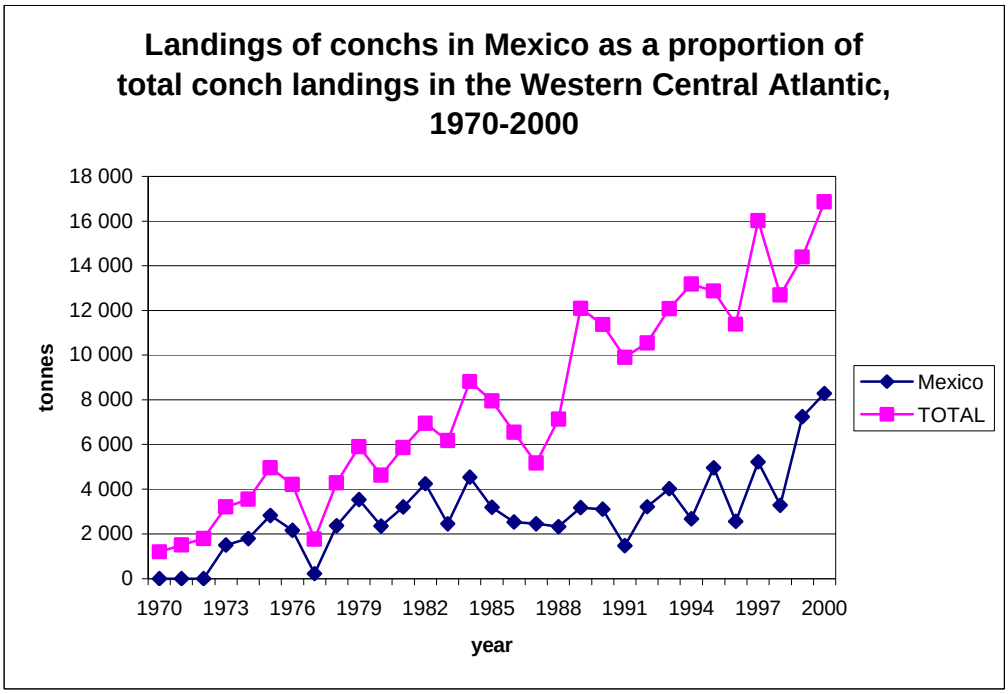
Queen conch fishers are grouped in co-operatives: in the 1996-1997 fishing year 94 fishers were grouped in the Chinchorro bank co-operative and 42 in the Cozumel bank co-operative. However, these numbers vary each year and estimates suggest the presence of 120 fishers in the Chinchorro bank and 50 in the Cozumel bank, all members of the co-operatives. These data are only indicative, as there are licensed conch fishermen who do not use their licenses and also the presence of unlicensed relatives of members fishing in the same boat. The Mexican government calculated the presence of 38 boats in the Chinchorro bank and 15 in the Cozumel bank. These boats are six to eight metres long, motorized, from 48 to 55 HP (Mexican Government through Chakalall, Pers. Comm.).

Mexican legislation established catch, size and gear limits for *Strombus gigas*. Authorized fishing gears are snorkelling and scuba. Currently, total queen conch landings should not exceed 57 MT per year, of which 45 MT should come from the Chinchorro bank and 12 MT from the Cozumel bank. The quotas are uniformly divided over the six months of the fishing season, lasting from November to April. Conch fishing takes place over 2 to 5 days per month (Mexican Government through Chakalall, Pers. Comm.).

The total volume of landings recorded in Fishstat + (Figure 11) does not seem compatible with the figures provided by the Mexican Government. Indeed Figure 11 suggests that Mexico has the highest landings of “stromboid conchs nei” in the whole Western Central Atlantic[35]. According to this data landings of *Strombus* spp. amount to 8 295 MT in 2000, making some one half of total stromboid conch production in the Western Central Atlantic for the same year (see Figure 11).

[35] Countries: Anguilla, Antigua and Barbuda, Bahamas, Belize, British Virgin Islands, Cuba, Dominican Republic, Grenada, Guadeloupe, Haiti, Honduras, Jamaica, Mexico, Netherlands Antilles, Nicaragua, Puerto Rico, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Turks and Caicos Islands, US Virgin Islands and Venezuela.

Figure 11: Mexican landings of Strombus spp., a comparison with Strombus spp. landings in the Western Central Atlantic, 1970-2000.



Fishstat + does not provide any data for conch exports from Mexico.

Turks and Caicos Islands

Background data and estimates

Status:
Population: 18 738 according to 2002 estimates (CIA 2002)
Mean GDP per capita: US$7 300 according to 1999 estimates (CIA 2002)
Total GDP: US$128 million according to 1999 estimates (CIA 2002)
Labour force: 4 848 persons according to 1990 estimates (CIA 2002)

Fishery data and estimates

Social:

Number of marine fishers: 1 624 (est.) marine fishers, nei in 1993, data repeated up to 2000 (FAO FIDI data).
Full-time: 63 fishers in 1993, data repeated up to 2000 (FAO FIDI data)
Part-time: 70 fishers in 1993, data repeated up to 2000 (FAO FIDI data)
Occasional: 1 491 fishers in 1993, data repeated up to 2000 (FAO FIDI data)
Employment in processing and marketing: N/A
Note: gender breakdown not provided by references

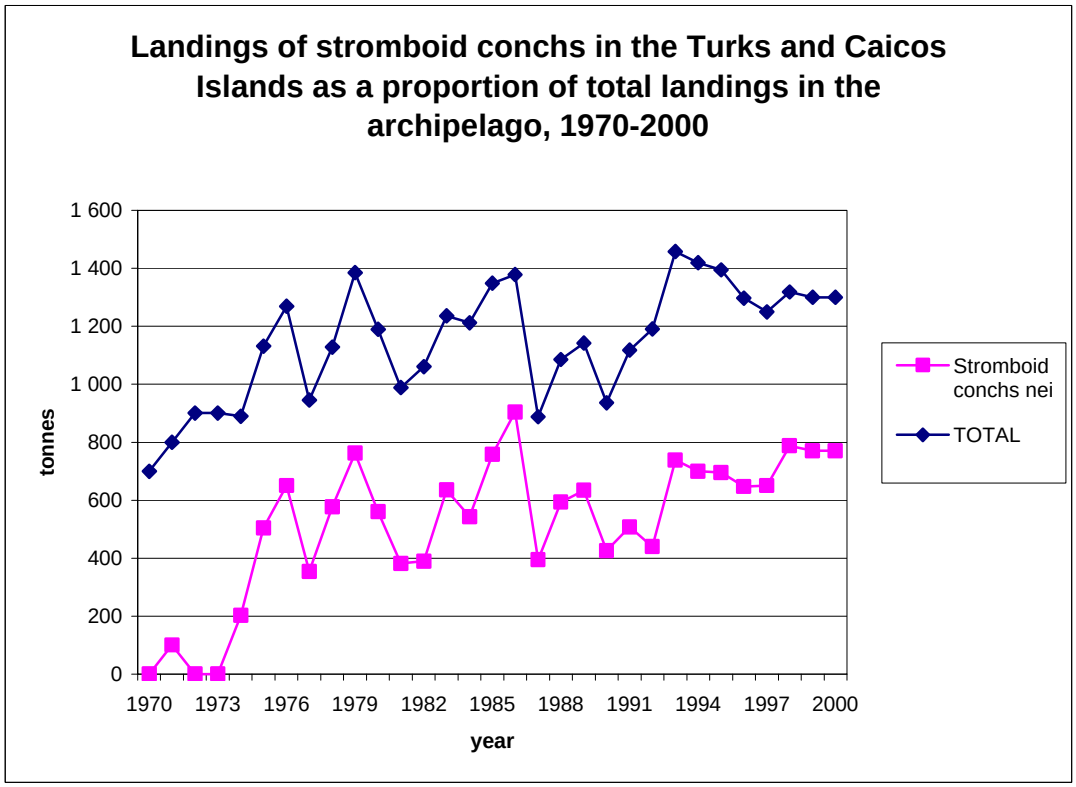
Economic:

Fisheries GDP: N/A
Total and marine landings (Western Central Atlantic): 1 300 MT (est.) in 2000 (Fishstat + data)
Aquaculture production and value: 5 MT (est.) in 2000, corresponding to (est.) US$55 000 (Fishstat + data)
Export quantity: 502 MT (est.) in 2000 (Fishstat + data)
Export value: US$3 879 000 in 2000 (Fishstat + data)

The conch industry in the archipelago dates back to last century when catch was mainly exported to Haiti. In the seventies the first fishing corporations started to export live and processed conchs to the United States. The status of the conch fishery partly reflects that of the spiny lobster fishery, as fishers have tended to switch to conch as a consequence of poor lobster catch rates (CFMC and CFRAMP 1999).

The conch fishery is the most important in the Turks and Caicos Islands, providing an average of around 49 percent of total catches over the period 1974-2000. In 1998 it reached a peak of around 60 percent (Figure 12). As the fishery sector on the islands is mostly artisanal and landings are mainly composed of conchs and other coastal species, queen conch fishing represents a source of food and income for the quasi totality of the 1 491 occasional fishers and 70 part-time fishers reported in 1993 and certainly a number of full time fishers.

Figure 12: Landings of Strombus spp. in the Turks and Caicos Islands, a comparison with marine landings in the archipelago, 1970-2000.

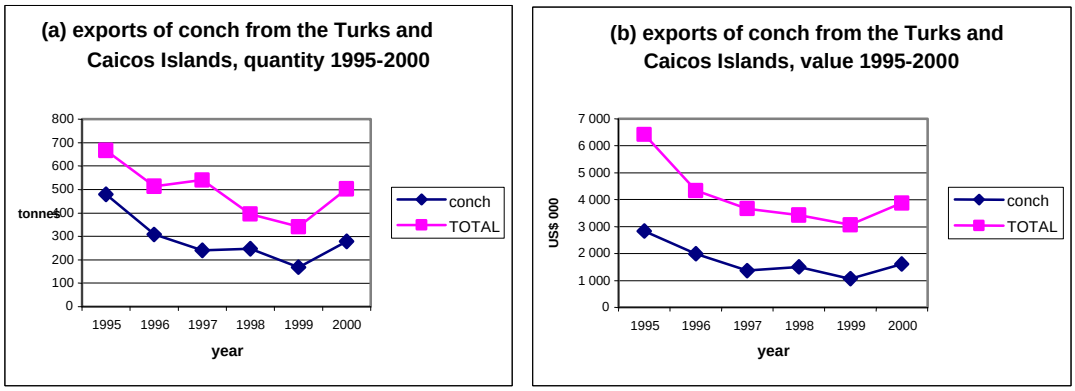


From a biological point of view, the conch fishery in the Turks and Caicos Islands appears to be in a good state. Following the CITES listing, and with assistance from the United States, the government implemented a series of initiatives including stock assessments and quotas (Medley, Pers. Comm.)

Available Fishstat + data on exports of univalves from the Turks and Caicos Islands[36] suggest that trade reached a peak of 480 MT for an estimated US$2.8 million in 1995, then declined slightly, recovering in 2000 (Figure 13 [a] and [b]). In 2000 exports were estimated at 279 MT, for a value of around US$1.6 million (Fishstat + data). As the figures below suggest, exports of univalve products from the Turks and Caicos made up 47.7 percent in quantity and 41.2 percent in value of fish commodities exported each year over the period 1995- 2000 (Fishstat + data).

[36] No data on export of univalves from the Turks and Caicos Islands are available for the 1976-1994 period.

Figure 13 (a) and (b): Exports of conch from the Turks and Caicos Islands, a comparison with total exports of fish commodities from the archipelago, 1995-2000.



"Stromboid conchs nei" also includes farmed conchs, certainly production from the Caicos Conch Farm (see the "captive breeding" section). However, farmed conch production declined from 360 MT in 1987, equivalent to US$864 000, to 5 estimated MT in 2000, equivalent to an estimated US$55 000 (Fishstat + data).

Conclusions

The literature and statistics consulted in the preparation of this paper show how, following the CITES listing, range states adopted management and technical measures aimed at keeping queen conch stocks at sustainable levels. However, implementation of the CITES regime and of subsequent national measures has been experiencing some difficulties, and a large element of illegal fishing and trade still persists (CFMC and CFRAMP 1999).

According to FAO FIDI data, prior to the nineties, Belize was the sole exporter of univalve products and received considerable revenues from this particular trade. From 1993 onwards, other exporters started to penetrate the markets: Bahamas from 1992, Turks and Caicos Islands and the Dominican Republic from 1995. World exports of univalves from developing countries in the Western Central Atlantic were worth some US$5.4 million in 1997 compared to US$ 742 000 in 1990. Revenues declined to some US$2.8 million in 1999 then recovered to US$4.54 million in 2000 (see also Figure 2 [b]). Belize, the Turks and Caicos Islands and the Dominican Republic have been the main exporters[37] among developing countries in the Western Central Atlantic area over the period 1995-2000.

In the Bahamas, for 9 800 spiny lobster fishers queen conch represents the main source of food and income during the spiny lobster closed season. An estimated 400 fishers depend on conch fishing all year round.

In Belize queen conch landings generate job and income opportunities for the 1 536 fishers involved in the spiny lobster and conch fisheries, while according to the CARICOM Fisheries Unit 1 800 fishers are in the conch fishery. Provisional FAO FIDI data report revenues of US$2 million generated conch exports in 2000.

Cuba and Mexico have large conch fishery industries. Cuban landings were estimated at 830 t in 2000 and Mexican landings at 8 295 t. However, no conch exports from these countries have been recorded in Fishstat +.

In the Dominican Republic the conch industry landed 1 778 MT in 2000, equivalent to 16.4 percent of total marine catch in the island. This generated income for an estimated 1 530 fishers. Conch exports were estimated at 202 MT, for a value of US$266 000. Revenues from conch exports comprised 29 percent of total export value of fish products in the year 2000.

Jamaica's overall fishery sector comprises 24 365 fishers, of which 332 industrial and between 50 and more than 100 artisanal operators depend on the queen conch fishery.

[37] Jamaica used to be the main exporter of univalves according to Fishstat + 1999, however Fishstat + 2000 does not report any export of univalves but just of "molluscs frozen nei" (see also the section "queen conch landings and international trade" and the section on Jamaica).

According Fishstat +, Jamaica had a largely export-oriented univalves production up to 1999, with an export value of US$5.4 million in 1998.

The Turks and Caicos Islands are, among the case studies presented, the most dependent on the conch fisheries. It is the most important fishery of the archipelago in terms of landings, generating an average of 50 percent of total catch every year. Exports of univalves made up 47.7 percent in quantity and 41.2 percent in value of total fish commodities exported annually from the archipelago over the period 1995-2000. The queen conch fishery represents the most important source of food and income for the 1 561 part-time and occasional fishers living and working in the archipelago and certainly a number of full time fishers.

The persisting difficulties in implementing the CITES regime, and the diffused presence of illegal fishing and trade, paved the way for a second Review of Significant Trade, recommended in 2001. The analytical stage of review has just been completed. During the next stage TRAFFIC Europe, IUCN and international and national experts will assist the CITES Animals Committee in formulating recommendations to help range states to improve the management of the species and comply with article IV of CITES (Theile 2002b).

Table 3 below presents further information on the queen conch fishery in the Caribbean. The table has been kindly provided by the CARICOM Fisheries Unit, and is an extract from the forthcoming final report of the CFRAMP Conch and Lobster Terminal Workshop, held in July 2001 (Mateo, Pers. Comm., CFRAMP, in press).

Table 3: Description of Fishing Fleet targeting Strombus gigas (adapted from CFRAMP [in press]).

Countries	Fishers	Vessels	Vessel type(s)	Gear type(s)	Diving range (m)	Main areas fished
Antigua and Barbuda	16-28	7	1 large (13 m) and 6 small (7 m)	SCUBA and free in shallow waters	to 33	Southwest shelf (traditional) and northeast shelf (developing)
Bahamas	N/A	N/A	Small boats	Free, compressor	Shallow	Throughout shallow banks
Belize	1 800	550	Canoes (10 m)	Free	3 to 18	Throughout shallow shelf and atolls
Dominican Republic	N/A	N/A	Small to larger (20 m) boats	Free, compressor	to 30+	Highest landings in Jarada, del Este Plata and Navidad Bank
Grenada	138-168	46-55	Small (5-8 m, 40-48 hp)	SCUBA (main), free	to 30+	Northern zones Grenada Grenadines
Haiti	N/A	17	5 large and 12 small boats	Compressor, free	N/A	North side, Gonaives, La Gonave, Rochelios Islands, western end
Jamaica	332 industrial, 50 to more than 100 artisanal	11 industrial vessels	25 m vessels	SCUBA, compressor	10 to 30+	Pedro and Morant Banks, southern shelf
St. Kitts and Nevis	30	10	Small boats (5 m)	SCUBA, free	18 to 36+	North and South Nevis
St. Lucia	40	12	Small boats (8 m, 115-250hp)	SCUBA (main), free	11 to 43	Northeast and southeast
St. Vincent and the Grenadines	500	160	Small boats (6 m)	SCUBA, compressor, free	10 to 30	Union Island, other areas during lobster closed season

Table 4: Economic and social aspects of the conch fishery in developing countries of the Western Central Atlantic area (2000 data and estimates, source FAO except when explicitly stated).

Country	Estimated employment (fishers)	Landings (MT)	Value of landings (US$)	Exports quantity (MT)	Export value (US$)
Bahamas	9 800 units during the spiny lobster closure season and 400 units all-year round	472 (est.)	4.457 million in 2000 and 4.369 million in 2001 according to the Department of Fisheries of the Bahamas	84 (est.)	672 000
Belize	1 536 (source: Belize Fisheries Department); 1 800 (source: CFRAMP, in press)	233	2 322 155 (source: Belize Fisheries Department)	256 (provisional FAO FIDI data, not matching with Fishstat + landings data)	1 976 000
Cuba	N/A	830 (est.)	N/A	N/A	N/A
Dominican Republic	1 530	1 778	N/A	202 (est.)	266 000
Jamaica	332 industrial and 50 to more than 100 artisanal fishers (source: CFRAMP, in press)	less than 0.5	N/A	N/A	N/A
Mexico	170 (source: Mexican Government)	8 295	N/A	170 (source: Mexican Government)	N/A
Turks and Caicos Islands	quasi totality of 1 561 artisanal fishers	770 (est.), an estimated 5 of aquaculture conch, equivalent to an estimated US$55 000	N/A	279 MT (est.)	1 613 000

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Sharks (Chondrichthyes)

Acknowledgements

Frans Teutscher, FAO

Background

Over time, sharks have been exploited by humans for various purposes, from food to medicine. However, they have often been considered as low-value fish, mainly landed as bycatch of other, more profitable species. Therefore, in the past, the incentive to collect biological, catch and trade data on sharks has been limited.

In terms of their biology, sharks remain largely under-studied animals and their conservation status has not been fully assessed. In commercial terms, data on shark landings are mostly mixed with that of skates, rays and chimaeras; data on shark trade are largely unrepresentative of the true extent of exports[38].

Over the last twenty years a number of states and the conservation movement in general, have been lobbying to draw increased attention to the overexploitation of shark resources, both as direct targets and as bycatch. As a consequence, the international community has launched several initiatives aimed at the protection of shark resources. The most recent has been the listing of the basking shark *Cetorhinus maximus* and the whale shark *Rhincodon typus* in Appendix II to the CITES Convention.

This study aims to provide an overview of shark fisheries in main shark producing and exporting countries from an economic and social point of view. The study has been prepared using, as main reference tools, the FAO Fishstat + data on fish landings and trade, FAO FIDI data on employment in fisheries and relevant publications such as the FAO Technical Papers 378/1-2 ("Case studies of the management of elasmobranch fisheries", edited by R. Shotton) and 389 ("Shark utilization, marketing and trade", edited by S. Vannuccini).

An introduction to chondrychthyans

Sharks belong to the class Chondrichthyes (chondrichthyans), which differ from Osteichthyes or bony fish as their skeleton is cartilaginous. The class Chondrichthyes or chondrichthyans is divided into two subclasses: Holocephalii (chimaeras, elephant fish) and Elasmobranchii (Elasmobranchs: sharks and batoids such as skates, rays, torpedoes and sawfish).

The Checklist of Living Elasmobranchs (Compagno 1999) reports 465 shark species, grouped into 35 families. The online Checklist of Living Sharks (http://www.reefquest.com/topics/checklist_res.htm), last revised on 28 March 2002, divides Elasmobranchs into 2 super orders (*Galea* and *Squalea*), 10 orders, 44 families, 108 genera and some 480 species.

[38] In order to facilitate the reading of this sudy, the term "export" includes "re-export".

There is great diversity among sharks. Some species reach their sexual maturity within one year, others may reach it within twenty or twenty-five years. Some species are very short-lived; others may reach up to 60 years. They inhabit a wide range of habitats. The majority of sharks are pelagic species; others reside in freshwater lakes and rivers. A half of all species are found up to a depth of 200 metres, another third inhabits deeper waters to 2 000 metres. Only 5 percent of shark species are truly oceanic (Weber and Fordham 1997).

Very little is known about sharks' population dynamics, in particular concerning their biology and stock assessment (Vannuccini 1999). According to the document submitted by the Australian government to the Twelfth meeting of the Conference of the Parties to the CITES Convention *Conservation and Management of Sharks* (CITES 2002c), most shark species are K[39]-strategist because of their life-history characteristics, including late attainment of sexual maturity, long life span, slow growth and low fecundity. These characteristics would make them susceptible to overfishing.

Shark meat has been consumed and traded since the IV century BC. However, despite the high value of some shark products such as fins, shark has been considered, historically, as a low-value fish. It has been mostly seen as a by-product of other more profitable fisheries, such as those of tuna and billfish. For this reason, the interest in collecting data on sharks has been limited (Vannuccini 1999). Although FAO data may be considered as the most reliable on a global level, production and trade data on chondrichthyans are far from being exhaustive.

According to FAO Fishstat +, 828 364 MT of chondrichthyans were landed in 2000; this figure mostly includes sharks and batoids (especially skates), and a small quantity of chimaeras. However the available data show poor distinction between chondrichthyans, and very limited identification of the species. In addition Fishstat + may not include full data on the quantity of sharks and skates taken as a bycatch, which were estimated at the end of the 1980s at 260 000 to 300 000 tonnes or 11.6-12.7 million fish, mainly blue sharks *Prionace glauca* (FAO 1998).

The main processed products from sharks include:

- meat, whether fresh, frozen, salted or in brine and smoked;
- fins, to prepare shark-fin soup;
- liver oil, for cosmetics and pharmaceuticals;
- skin, to prepare shark-skin soup, for leather and sandpaper;
- cartilage, ground to powder and used to produce a supposed anti-cancer cure;
- teeth and jaws, in jewellery and sold as curios.

[39] K strategist means adapted to limitation. Many organisms show extreme potential to survive and prosper at or near carrying capacity, though often at the expense of their ability to display rapid population increases under most circumstance (i.e., their intrinsic rate of population growth is small). Such organisms are called Kstrategists. The variable K refers to carrying capacity. Kstrategists tend to be very good at surviving in mature (climaxed) ecosystems.

The main commercially-exploited shark species are, according to Vannuccini (1999) and TRAFFIC (Weber and Fordham 1997):

- the silky shark *Carcharhinus falciformis*;
- the sandbar shark *Carcharhinus plumbeus*;
- the basking shark *Cetorhinus maximus*;
- the tope shark *Galeorhinus galeus*;
- the shortfin mako shark *Isurus oxyrinchus*;
- the porbeagle *Lamna nasus*;
- smooth-hounds *Mustelus* spp.;
- the blue shark *Prionace glauca*;
- the whale shark *Rhincodon typus*;
- the small-spotted catshark *Scyliorhinus canicula*;
- the piked dogfish *Squalus acanthias*.

Available data show a high anthropogenic pressure on sharks. However, due to the poor level of human knowledge of sharks, it is very difficult to calculate its true extent. Nevertheless, several international initiatives have been launched with the aim to preserve these extraordinary fish:

- The IUCN Red List of Threatened Species includes 79 shark species;
- UNCLOS promotes international cooperation for the conservation and sustainable use of shark species, in particular those listed in its Annex I[40];
- CMS has the great white shark *Carcharodon carcharias* and the whale shark listed in its Appendix II[41];
- FAO launched the IPOA-Sharks in 1999;
- The great white shark is listed in Appendix III to the CITES Convention;
- In November 2002, during CoP 12, proposed by the United Kingdom on behalf of the Member States of the European Union (CITES 2002b), the basking shark was listed in Appendix II to the CITES Convention (CITES 2002d). The whale shark was also listed in Appendix II (CITES 2002d) upon proposal of India, Madagascar and the Philippines (CITES 2002a).

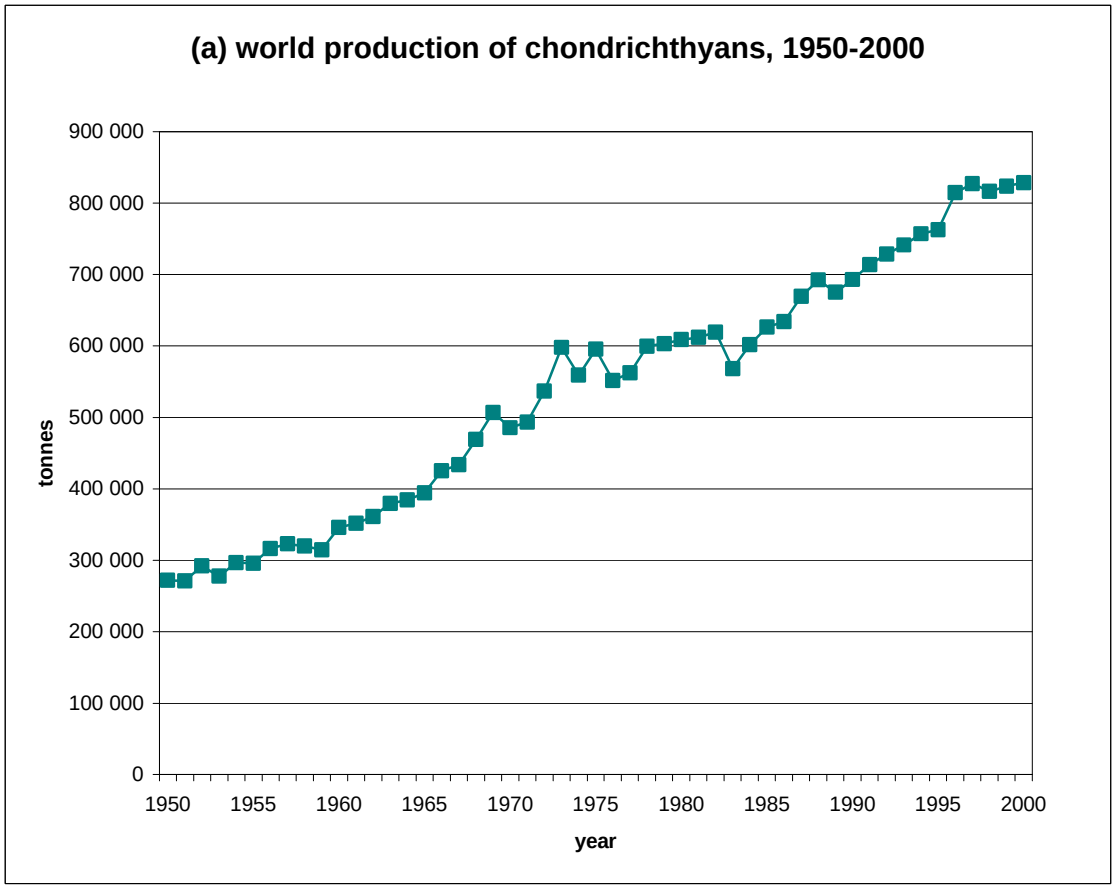
[40] According to article 64 of UNCLOS:
"*1. The coastal State and other States whose nationals fish in the region for the highly migratory species listed in Annex I shall cooperate directly or through appropriate international organizations with a view to ensuring conservation and promoting the objective of optimum utilization of such species throughout the region, both within and beyond the exclusive economic zone. In regions for which no appropriate international organization exists, the coastal State and other States whose nationals harvest these species in the region shall cooperate to establish such an organization and participate in its work.*
2. The provisions of paragraph 1 apply in addition to the other provisions of this Part." (UNCLOS 1982) Annex I to the UNCLOS Convention provides a list of such highly migratory species.

[41] Parties to CMS work together to conserve migratory species and their habitats by providing strict protection for the endangered migratory species listed in Appendix I, by concluding multilateral Agreements for the conservation and management of migratory species listed in Appendix II (CMS 2002).

World production of chondrichthyans

According to FAO Fishstat +, world catches of chondrichthyans increased from 271 813 MT in 1950 to 828 364 MT in 2000 (Figure 1 [a]). Figure 1 (b) shows the main species and groups of species landed over time: the vast majority of shark landings is recorded as "sharks, rays, skates, etc. nei" (370 187 MT landed). In 2000, requiem shark landings reached 38 045 MT and piked dogfish landings reached 33 061 MT. However, the former reached their peak in 1996 (52 477 MT landed) and the latter in 1973 (54 150 MT landed) followed by a decline in the following years (Fishstat + data). Table 1 shows landings for the top 20 species in 2000.

Figure 1 (a) and (b): World production of chondrichthyans and production by main species and group of species, 1950-2000.



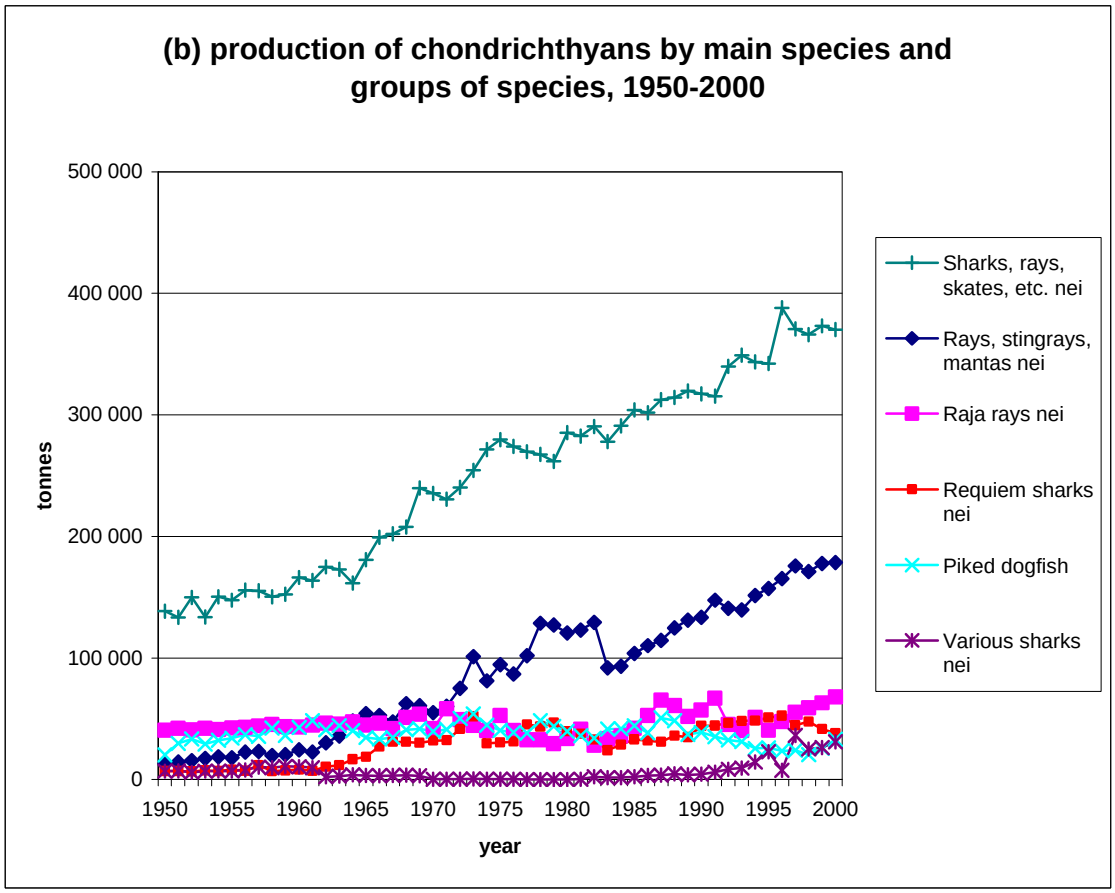
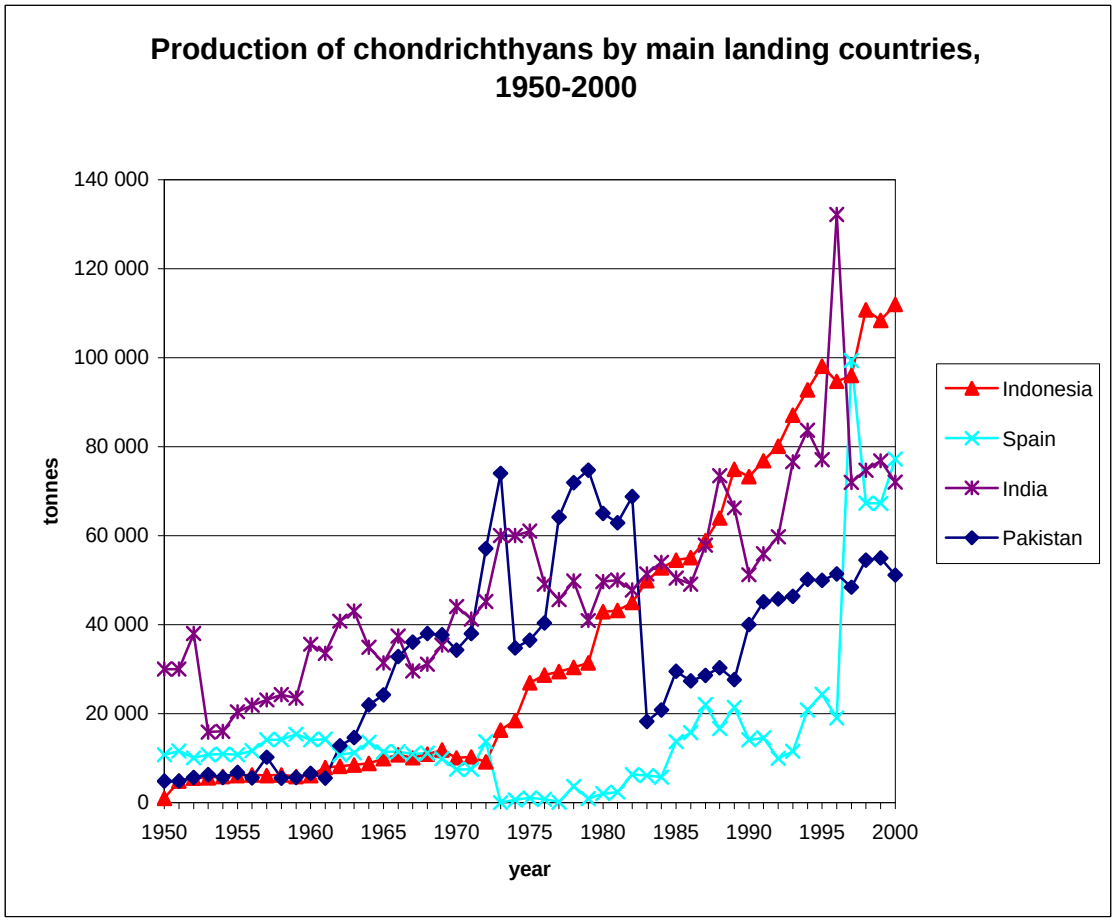

(b) production of chondrichthyans by main species and groups of species, 1950-2000
500 000
400 000
300 000
200 000
100 000
0
tonnes
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
year
Sharks, rays, skates, etc. nei
Rays, stingrays, mantas nei
Raja rays nei
Requiem sharks nei
Piked dogfish
Various sharks nei

Table 1: Top 20 landed chondrichthyan species in 2000 (Fishstat + data).

Common name	Scientific name	2000 landings (MT)
Sharks, rays, skates, etc. nei	*Elasmobranchii*	370 187
Rays, stingrays, mantas nei	*Rajiformes*	178 606
Raja rays nei	*Raja* spp.	67 981
Requiem sharks nei	*Carcharhinidae*	38 045
Piked dogfish	*Squalus acanthias*	33 061
Various sharks nei	*Selachimorpha(Pleurotremata)*	31 085
Silky shark	*Carcharhinus falciformis*	16 299
Smooth-hounds nei	*Mustelus spp*	12 368
Blue shark	*Prionace glauca*	8 186
Dogfish sharks nei	*Squalidae*	8 174
Narrownose smooth-hound	*Mustelus schmitti*	8 156
Small-spotted catshark	*Scyliorhinus canicula*	5 851
Whip stingray	*Dasyatis akajei*	5 388
Guitarfishes, etc. nei	*Rhinobatidae*	4 230
Tope shark	*Galeorhinus galeus*	3 853
Porbeagle	*Lamna nasus*	3 146
Dogfishes and hounds nei	*Squalidae, Scyliorhinidae*	3 032
Cuckoo ray	*Raja naevus*	2 909
Pacific guitarfish	*Rhinobatos planiceps*	2 624
Shortfin mako	*Isurus oxyrinchus*	2 084

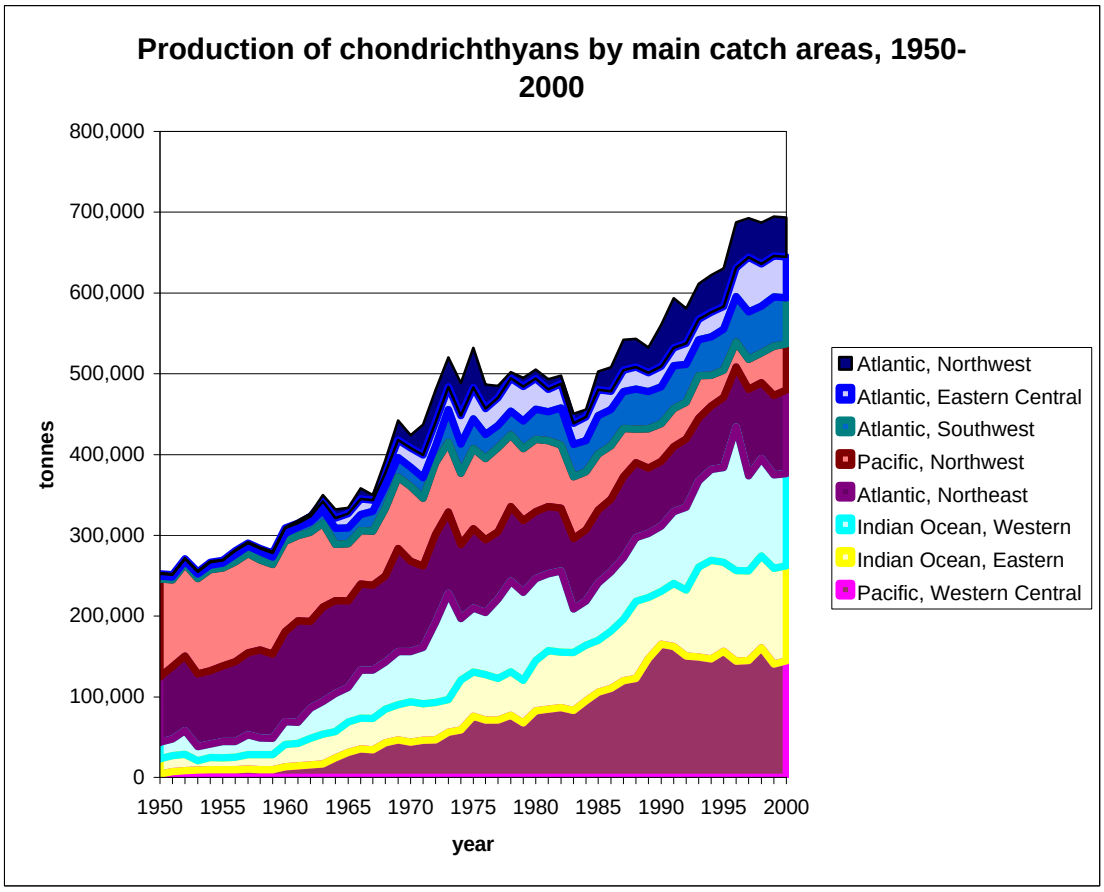
According to Fishstat + data, the world's top producers of sharks are Indonesia, Spain, India and Pakistan. Indonesia's chondrichthyan catch increased from 1 000 MT in 1950 to 111 973 MT in 2000. Spain's catches were relatively low in the past, averaging some 11 000 MT per year in the whole 1950-1996 period. But in 1997 they increased to 99 320 MT, declining to some 67 000 MT in the following two years and increasing again to 77 269 MT in 2000 (Fishstat + data). India's catch reached the unprecedented peak of 132 160 MT in 1996, to decrease to an average of some 74 000 MT thereafter. Pakistani shark catch increased from 4 800 MT in 1950 to 74 691 MT in 1979, declining to 18 243 MT in 1983 and recovering in the following years to reach 54 958 MT in 1999 and 51 170 MT in 2000 (Figure 2).

Figure 2: Production of chondrichthyans by main countries, 1950-2000.



The main catch areas are the Western Central Pacific (144 603 MT of landings in 2000), the Eastern Indian Ocean (117 562 MT), the Western Indian Ocean (114 126 MT) and the Northeast Atlantic (103 192 MT). The Northwest Pacific, once the most productive area of the world, declined from 121 700 MT in 1950 to 46 494 MT in 1990 recovering slightly to 57 103 MT in 2000 (Fishstat + data). This downward trend has been mainly due to the decrease in Japanese catch in the area, from 100 700 MT in 1950 to 39 400 in 1964 and fluctuating around similar values since then (Figure 3).

Figure 3: Production of chondrichthyans by main catch areas, 1950-2000.



The main producing countries by area are (Fishstat + figures for 2000):

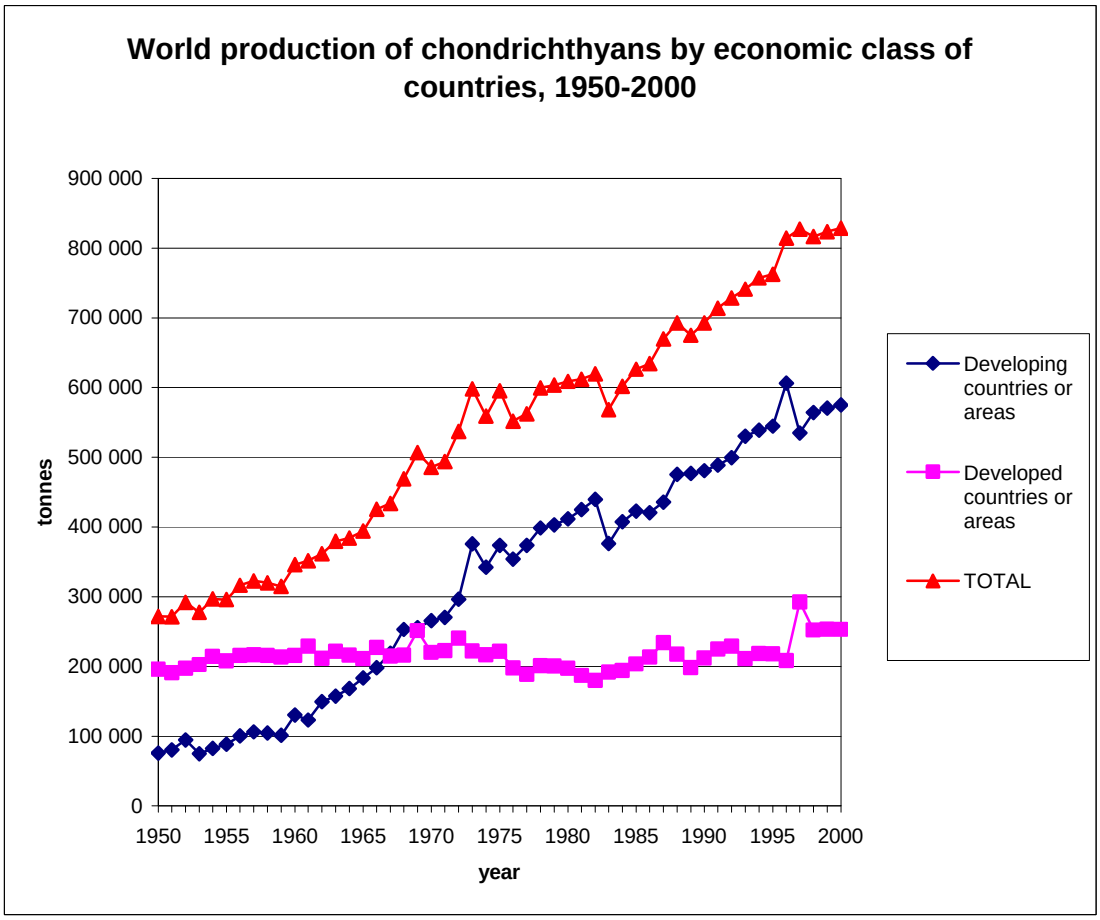
- In the Western Central Pacific, Indonesia with 88 130 MT landed out of 144 603 in the whole area;
- in the Eastern Indian Ocean, India with 42 264 MT, Sri Lanka 28 014 MT and Indonesia, 23 843 MT;
- in the Western Indian Ocean, Pakistan with 51 170 MT and India with 29 826 MT;
- in the Northeast Atlantic, Spain with 45 908 MT;
- in the Northwest Pacific, Japan with 29 409 MT.

According to the FAO Yearbook on Fishery Commodities (FAO FIDI 2002), the value of world chondrichthyan production was estimated as US$719 million in 1994, 747 million in 1995, 754 million in 1996, 755 million in 1997, 710 million in 1998, 746 million in 1999 and 742 million in 2000.

Chondrichthyans constitute an extremely important fishery resource for developing countries, as shown in Figure 4. Over the past twenty years they have gradually increased their role in terms of food and income generation, due to the increase in demand for shark

fins and the decline of landings in traditional species in other areas (Omopariola unpublished). While developed countries' catch remained relatively stable around an average of some 220 000 MT per year over the entire 1950-2000 period, developing countries' catches increased from 76 000 MT in 1950 to 575 031 MT in 2000 for a value of US$515 million.

Figure 4: World production of chondrichthyans by economic class of countries, 1950-2000.



Main commercially-exploited shark species

This section looks at a selection of shark species which are at the same time commercially important and (possibly) threatened from a conservation point of view.

Sandbar shark (*Carcharhinus plumbeus*)

This large, slow-growing, late-maturing and low-fecundity coastal species lives in subtropical marine and brackish waters up to 1 800 m depths, mainly in the Western Atlantic (Massachusetts, United States to Brazil, including the Gulf of Mexico) and Eastern Atlantic, from Portugal to the Democratic Republic of Congo, including the Mediterranean. Some scattered records are available for the Indo-Pacific and the Eastern Pacific areas. It feeds on bony fishes, also small sharks, cephalopods, shrimps, rays and gastropods. The sandbar shark is largely utilized for human consumption (meat and fins), leather and oil (Fishbase 2003). This species is overfished and classified as "Lower Risk/near threatened" (LR/nt) by the IUCN Red List 2000, with the exception of the Northwest Atlantic subpopulation which has been classified as "Lower Risk/conservation dependent (LR/cd)" due to the management scheme the United States have been implementing since 1993 (IUCN SSC 2000). Fishstat + contains very limited data on sandbar shark catch from the United States.

Basking shark (*Cethorhinus maximus*)

The second largest shark in the world after the whale shark, this impressive animal may reach 900 to 980 cm length and 4 000 kg in weight. A cosmopolitan, highly migratory species, it is found mainly in the temperate shallow waters of the Western Atlantic (Newfoundland, Canada to Florida, United States; southern Brazil to Argentina), Eastern Atlantic (Iceland, Norway and western Barents Sea to the Mediterranean and Senegal; also western Cape Province, South Africa), Western Pacific (Japan to New Zealand) and Eastern Pacific (Gulf of Alaska to Chile). It mainly feeds by filtering copepods, barnacles, decapods' larvae, and fish eggs from the water (Fishbase 2003).

The basking shark[42] is a large, slowly-maturing, low-resilience species[43] which is widely distributed but never abundant. These characteristics make it extremely vulnerable to overfishing. As a consequence, local populations of basking sharks have been rapidly declining in the short term due to intensive exploitation. The basking shark is in high demand due to its fins, used to prepare soup, its meat, which is sold fresh, frozen or dried, and its liver, used to produce oil. Very few countries have reported their basking shark catches to Fishstat +. World catch is reported to total 390 MT, according to 2000 figures.

[42] Its common name comes from its habit of "basking" by the surface.

[43] If a marine species has low resilience, it means that once having been overfished, it will take a long time before returning to previous population levels.

The main fishing nation for basking sharks is thought to be Norway, whose catch declined from 18 352 MT in 1975 to 77 MT in 1999 and recovered slightly to 293 MT in 2000 (Fishstat + data).

According to IUCN, the basking shark is a globally "vulnerable" species, while its North Pacific and the Northeast Atlantic sub-populations are considered as "endangered" and are following a declining conservation pattern (IUCN SSC 2000). Several international initiatives have been launched for the conservation of this resource, the latest being the listing of the species in Appendix II to the CITES Convention (CITES 2002d).

Tope shark (*Galeorhinus galeus*)

The tope, or school shark, is a large houndshark mainly inhabiting the continental and insular shelves of the Western Atlantic (southern Brazil to Argentina), Eastern Atlantic (Iceland to South Africa, including the Mediterranean), Western Indian Ocean (South Africa), Pacific Southwest (Australia and New Zealand), Central Pacific (Hawaii), Eastern Pacific (British Columbia, Canada to southern Baja California and the Gulf of California in Mexico; Peru and Chile). A highly migratory species, the tope shark lives in a depth range of 0 to 1100 m, mainly feeding on fish, crustaceans, cephalopods, worms and echinoderms (Fishbase 2003).

The tope shark is a large, slow-maturing, low-resilience species. It is also a highly commercial one, particularly appreciated for its meat, which is marketed fresh, dried-salted and frozen. Its fins are used for soup and the liver for oil. Its carcass is also used in fishmeal. The high exploitation of this shark is believed to have significantly reduced its stocks over the past 60 to 75 years. The tope shark is classified as "vulnerable" by IUCN in its Red List 2000. As Australia and New Zealand are currently implementing a management plan for this resource, the Australasian population has been assessed by IUCN as "lower risk – conservation dependent" (IUCN SSC 2000).

Available Fishstat + figures for the tope shark indicate that there was a first peak in landings in 1958 (4 300 MT), mainly due to the 4 000 MT harvested by Argentina. The decline experienced in the following years was also due to the decline in Argentine catch. In 1974, landings reached their lowest figure (667 MT). At the same time, New Zealand's catch had grown from 100 MT in 1950 to 1 100 MT in 1971 and made up 85 percent of the 1974 global landings. It was gradually filling the gap left by Argentina. In 1983, tope shark production reached the record peak of 5 683 MT, driven by landings in New Zealand. Declines in New Zealand and French catches brought the total production back to 2 877 MT in 1992, increasing in the following years to 4 259 MT in 1999 and 3 853 MT in 2000.

The above comments based on Fishstat + shark data apply only to those landings recorded as tope shark: It is possible that the majority of tope sharks caught have been registered within major groupings nei rather than under the entry "tope sharks". For instance, Fishstat + does not report that tope shark catch in Uruguay varied between 15.6 and 66.2 MT from 1975 to 1979 (Nion in Shotton 1999).

Shortfin mako (*Isurus oxyrinchus*)

This shark is a cosmopolitan species living in temperate waters from 0 to 740 m. The shortfin mako inhabits the Western Atlantic (Gulf of Maine, United States to southern Brazil, including the Gulf of Mexico and Caribbean), the Eastern Atlantic (Norway to South Africa, including the Mediterranean), the Indo-Pacific (East Africa to Hawaii, north to Primorsk Kray in the Russian Federation, south to Australia and New Zealand), and finally Eastern Pacific, south of Aleutian Is. and from southern California, United States to Chile. The shortfin mako feeds on bony fish, other sharks, and even small cetaceans. This shark is also responsible for attacks on humans (Fishbase 2003).

Meat from the shortfin mako is of an excellent quality, it can be utilized fresh, dried/salted, smoked or frozen, and consumed broiled and baked. Its liver oil is extracted to cure vitamin A deficiency and fins are removed to prepare shark-fin soup. Other shortfin mako-derived products include skin, jaws and teeth (Fishbase 2003).

The shortfin mako is a large species with a relatively low reproductive capacity, therefore susceptible to overfishing. However, this shark can count on a relatively fast growth rate and abundant distribution, which may soften the impact of overfishing on the viability of the species. Other than being a target species, the shortfin mako is subject to significant bycatch in tuna and swordfish fisheries. However, most catches are inadequately reported or unrecorded. The shortfin mako has been given the status “lower risk/near threatened” by the IUCN Red List (IUCN SSC 2000).

According to Fishstat +, shortfin mako catch increased from 255 MT in 1985 to 2 084 MT in 2000, peaking at 2 286 MT in 1998. In 2000, main producing countries were Portugal (658 MT), Chile (592 MT), Spain (264 MT) and New Zealand (208 MT). However these figures alone may be under-representative of shortfin mako catches worldwide.

Porbeagle (*Lamna nasus*)

The porbeagle is common in deep cold and temperate waters of the Western Atlantic (Canada and United States), Eastern Atlantic (Iceland and western Barents Sea to South Africa, including the Mediterranean), Pacific Southwest (Australia and New Zealand), Southeast Pacific (Chile), Antarctic and Southern Indian Ocean. It feeds on small pelagic fish, squids and other sharks. It is regarded as possibly dangerous to humans due to its size (350 cm) and hunting activity, however the recorded episodes of attacks on people and boats are very limited (Fishbase 2003).

An appreciated commercial species, the porbeagle is utilized fresh, dried/salted and frozen for human consumption and often prepared pan-fried or broiled; its fins are used for shark-fin soup. Its liver is used for oil and the carcass may be used for fishmeal. The

porbeagle is a wide-ranging species, but it has a very low reproductive capacity (Fishbase 2003). Its global population has been given the "low risk/near threatened status" by IUCN. However, the porbeagle's Northwest Atlantic sub-population is subject to the United States and Canadian management plans, making this particular stock "low risk/conservation dependent" according to the IUCN classification (IUCN SSC 2000).

World production of porbeagle sharks increased from 3 200 MT in 1950 to 9 674 MT in 1964. In the following years this dropped back to 1950 levels, with the exception of the 4 505 harvested in 1970 and 4 631 MT in 1971. According to 2000 data, production was 3 146 MT. The main producer countries are Spain (1 511 MT), Canada (902 MT) and France (367 MT). Again, these data are estimated to be largely under-representative of actual world catches (Fishstat + data).

Smooth-hounds (*Mustelus* spp.)

The genus *Mustelus g*roups several shark species, generally of a small size but of high commercial interest, for human consumption, shark oil and fishmeal. *Mustelus* species featured in the Red List are:

- the gummy shark (*Mustelus antarcticus*), distributed over the continental shelves of the Eastern Indian Ocean, Pacific Southwest and Western Central Pacific, defined as "lower risk/conservation dependent";
- the dusky smooth-hound (*Mustelus canis*), occurring in most of Western Atlantic, defined as "lower risk/near threatened";
- the rig (*Mustelus lenticulatus*), which is endemic to New Zealand.

(IUCN SSC 2000)

According to Fishstat +, world production of smooth-hounds *Mustelus* spp. increased from 2 400 MT in 1950 to 33 611 MT in 1973. It decreased in the following years to 22 519 MT in 2000. The main producing countries were Argentina (7 119 MT), Peru (4 042 MT) and Turkey (2 880 MT).

Blue shark (*Prionace glauca*)

Prionace glauca is the most widespread shark in the world: it inhabits temperate and subtropical waters of the Atlantic, Indian and Pacific oceans. It is one of the most fecund sharks, becoming sexually mature at 250 cm or 4 to 5 years old and giving birth to 4 to 135 pups per litter. The blue shark is highly overfished, especially as bycatch. Despite the low market value of its meat (which needs to be processed promptly to get rid of the ammonia content) and of its fins, the high quantity of blue shark bycatch in tuna and swordfish fisheries makes up for the low price (Vannuccini 1999). According to Fishstat + data, blue shark catch increased from 4 MT in 1978 to 8 186 MT in 2000, the main producers in the latter year being Portugal (3 083 MT) and Spain (2 803 MT). The

quantity of individuals taken as bycatch ranged from 6.2 to 6.5 million fish per year in the late eighties and early nineties (Bonfil 1994).

Whale shark (*Rhincodon typus*)

The world largest fish, this animal is a cosmopolitan, highly migratory species, mainly occurring in warm waters. It may be found in the Western Atlantic (New York, United States through the Caribbean to central Brazil), in the Eastern Atlantic (from Senegal to the Gulf of Guinea), in the Indian Ocean (throughout the region, including the Red Sea and the Arabian Gulf), in the Western Pacific (Japan to Australia and Hawaii), and in the Eastern Pacific (California, United States to Chile). The life history of this species is poorly understood. Catches have declined and populations apparently been depleted by harpoon fisheries in several countries targeting localised concentrations, and there is incidental capture in other fisheries. Targeted fisheries, high value in international trade (mainly due to its liver oil, fins, meat and cartilage), a K-selected life history, highly migratory nature, and low abundance make this species vulnerable to exploitation. Thus the whale shark has been classified as "vulnerable" in the Red List (IUCN SSC 2000) and listed in Appendix II to the CITES Convention on proposal by India, Madagascar and the Philippines (CITES 2002d). Currently, Taiwan Province of China is implementing the world's first whale shark harvest and trade monitoring system (Chen and Phipps 2002).

Piked dogfish (*Squalus acanthias*)

The piked dogfish, a small species (160 cm) is possibly the world's most abundant shark. It can be found in temperate waters of the following areas: Western Atlantic (Greenland to Argentina), Eastern Atlantic (Iceland and Murmansk Coast in Russia to South Africa, including the Mediterranean and Black Seas), Western Pacific (Bering Sea to New Zealand) and Eastern Pacific (Bering Sea to Chile). It is an inshore and offshore dogfish frequenting the continental and insular shelf and upper slopes, usually found near the bottom up to 1460 m, but also in midwater and near the surface. It is often found in enclosed bays and estuaries and reported to enter freshwater, although it cannot survive there for more than a few hours. It feeds on bony fish, molluscs, crustaceans and other invertebrates (Fishbase 2003).

The piked dogfish is largely used for human consumption, to prepare liver oil, vitamins, sand paper, leather, fertilizer. It is generally eaten fried, broiled and baked. Due to its late maturity and low resilience, this fish is considered susceptible to overfishing. The Red List 2000 classifies it as "lower risk/near threatened" (IUCN SSC 2000).

According to Fishstat +, landings of dogfish[44] (*Squalus* spp.) increased from 35 945 MT in 1950 to a record 75 864 MT in 1972. They decreased to 51 151 MT in 1980, recovered gradually to 66 710 MT in 1996 then declined again to 46 364 MT in 2000. The main

[44] This figure also includes the Fishstat + entry "dogfishes and hounds nei".

producers are the United States, the United Kingdom, Canada and New Zealand. Recorded piked dogfish landings have been totalling some 70 percent of total dogfish landings over the 1950-2000 period; however, this percentage may be higher as some countries did not identify *Squalus acanthias* as a specific species and sometimes reported it as "dogfish sharks nei" (see Vannuccini 1999, p. 4 on this issue). Fishstat + also provides some data on trade in dogfish *Squalus* spp. It shows exports of dogfish *Squalus* spp. increasing from 2 999 MT in 1976, equivalent to US$3.7 million, to 17 426 MT in 2000, equivalent to US$29.5 million.

Main shark commodities

This section covers the the general market for shark products and in particular the market for shark fins. Shark fins are the most valuable of all shark products and therefore the main source of income for developing countries. Fishtat + data may be under-representative of the real extent of trade in dogfish and other shark products due to limited recording of this trade in many countries.

The commercial exploitation of sharks started after the First World War. The belly flaps of piked dogfish started to be marketed in smoked form in Germany and shark meat was introduced into the "fish and chips" trade in the United Kingdom. Despite its nutritional content and appreciable taste, shark meat was considered a poor person's food and sharks were mainly caught, in the fifties, for their vitamin A-rich liver oil. However, the waste of up to 75-80 percent of raw material led businesses and countries to improve fishing/processing technologies and marketing/distribution strategies, in order to generate a wider acceptance of shark meat. Since the late fifties a wider acceptance has been achieved due to better handling, the use of ice and freezing, the awareness of widespread malnutrition and thus the need to fully utilize all available protein for human nutrition, the contemporary shortage of bony fish in some areas and the marketing efforts to promote shark meat (Vannuccini 1999).

Shortfin mako shark is considered the world's best quality shark meat; it is marketed fresh in the United States and in Europe. Other largely appreciated species are thresher (*Alopias* spp.) and porbeagle. The meat of smaller species like dogfish is also appreciated as it contains smaller amounts of urea and mercury than other species and is also easier to process. The backs of these sharks are are marketed in Europe and Australia as fillets, steaks, portions and used in the "fish and chips" trade. The fresh whole carcasses are marketed in South America as *cazon*. Other important sharks for the production of meat are requiem sharks (Vannuccini 1999).

Non-food uses of sharks include shark liver oil products, cartilage, skin and teeth. The shark's liver is saturated with oil to maintain its buoyancy in water. Shark liver oil has been traditionally used as a lubricant in the tanning and textile industry, in cosmetics, skin healing and other health products, as a preservative against marine fouling of wooden boats, as fuel for street lamps and to produce vitamin A, before synthetic vitamin A was discovered. Currently, demand is mainly for squalene, a highly unsaturated

aliphatic hydrocarbon, present in certain shark liver oils (mainly of the family *Squalidae*). Squalene is used as a bactericide, organic colouring matter, rubber, chemical, aromatics, in the textile industry, as an additive in pharmaceutical preparations, cosmetics and health foods. A related compound of squalene is squalane, a saturated hydrocarbon obtained by hydrogenation of squalene. Squalane is used in skin care products, as it is a natural emollient (Vannuccini 1999; Kuang in Vannuccini 1999).

Shark cartilage, processed into powder and tablets, is used as a health supplement and alternative cure for several diseases, and beneficial in inhibiting the growth of tumours by impeding the vascularization of malignant tissues (angiogenesis). Cartilage from blue sharks is believed to be of the best quality as it is believed to be richer in chondroitin than other species. Chondroitin is an acid mucopolysaccharide used for various health problems (Vannuccini 1999; Kuang in Vannuccini 1999).

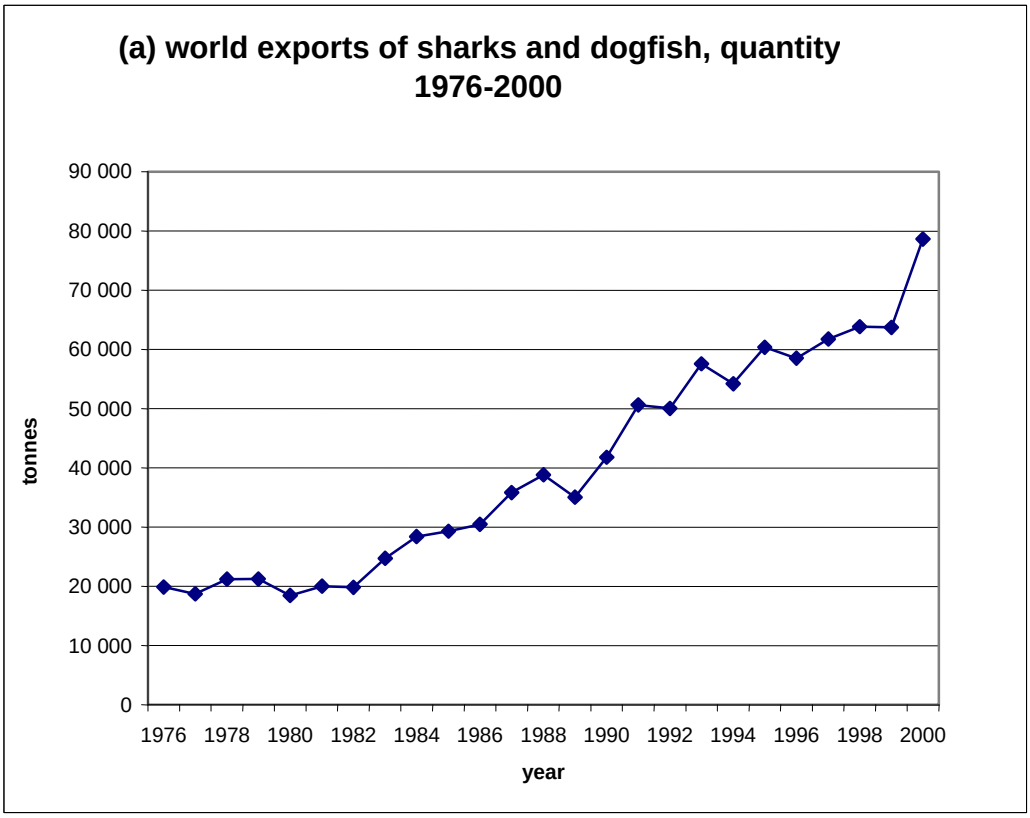
Shark skin is used to produce leather. The market was buoyant until a few years ago, when leather from shark was used to produce handbags, shoes, wallets, cigarette cases, watch straps, coin and key fobs. With the increase in the market for shark meat, shark skin lost its niche. In fact, shark carcasses are sold with the skin intact in order to protect the meat and prevent oxidation. Furthermore, sharks have to be bled, dressed and iced immediately after catch to prevent urea from contaminating the meat, but exposure to fresh water or ice damages the skin. Therefore, nowadays the market for shark leather is limited (Vannuccini 1999; Kuang in Vannuccini 1999).

Other non-food uses of shark include the sale of teeth and jaws in jewellery and as curios, the use of certain shark parts in traditional medicine, aquarium trade, production of fishmeal and glue (Vannuccini 1999; Kuang in Vannuccini 1999).

Exports of shark commodities

World trade in sharks and dogfish increased from 19 908 MT in 1976, for a value of US$34.7 million, to 78 652 MT in 2000, equivalent to some US$269.6 million (Figure 5 [a] and [b]). Main exported products are (Figure 6 [a] and [b]) shark fins in terms of value (US$88.45 million in 2000) and frozen sharks in terms of quantity (37 259 MT in 2000); main exporters are (Figure 7 [a] and [b]) Spain in terms of quantity (16 539 MT exported in 2000) and China in terms of value, with US$55 million worth shark exports (Fishstat + data).

Figure 5 (a) and (b): World exports of sharks and dogfish, 1976-2000.



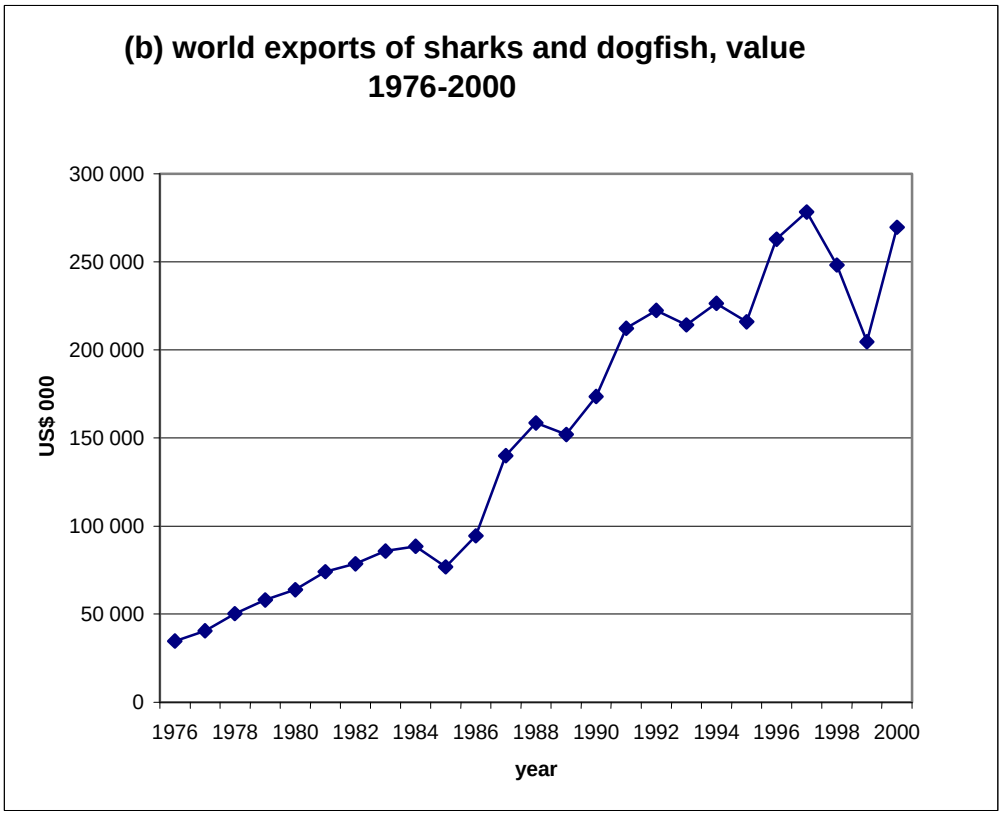
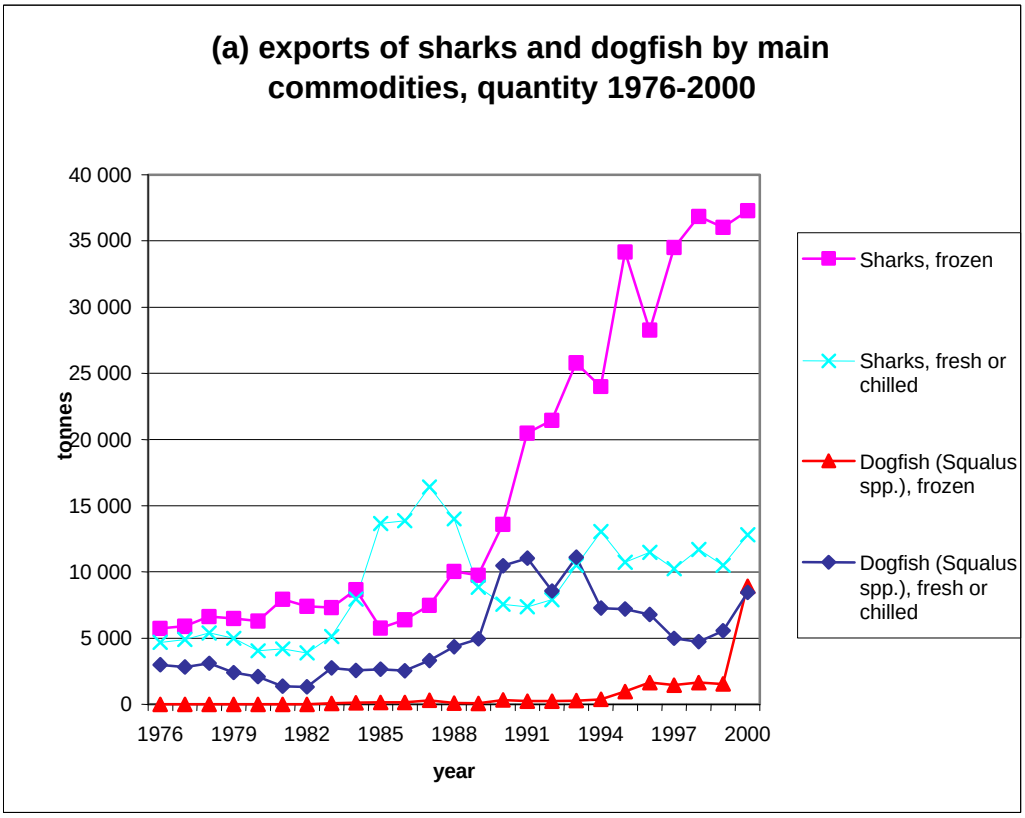

(b) world exports of sharks and dogfish, value 1976-2000
300 000
250 000
200 000
150 000
100 000
50 000
0
US$ 000
1976 1978 1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000
year

Figure 6 (a) and (b): World exports of sharks and dogfish by main commodities, 1976-2000.



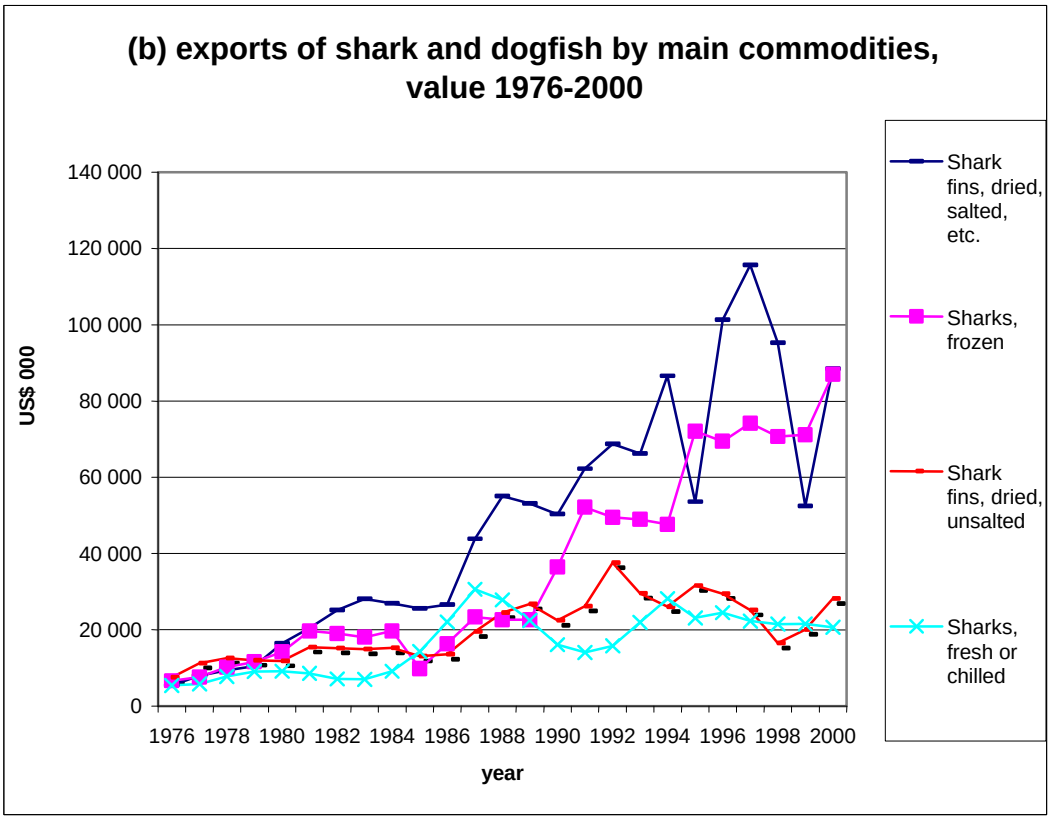
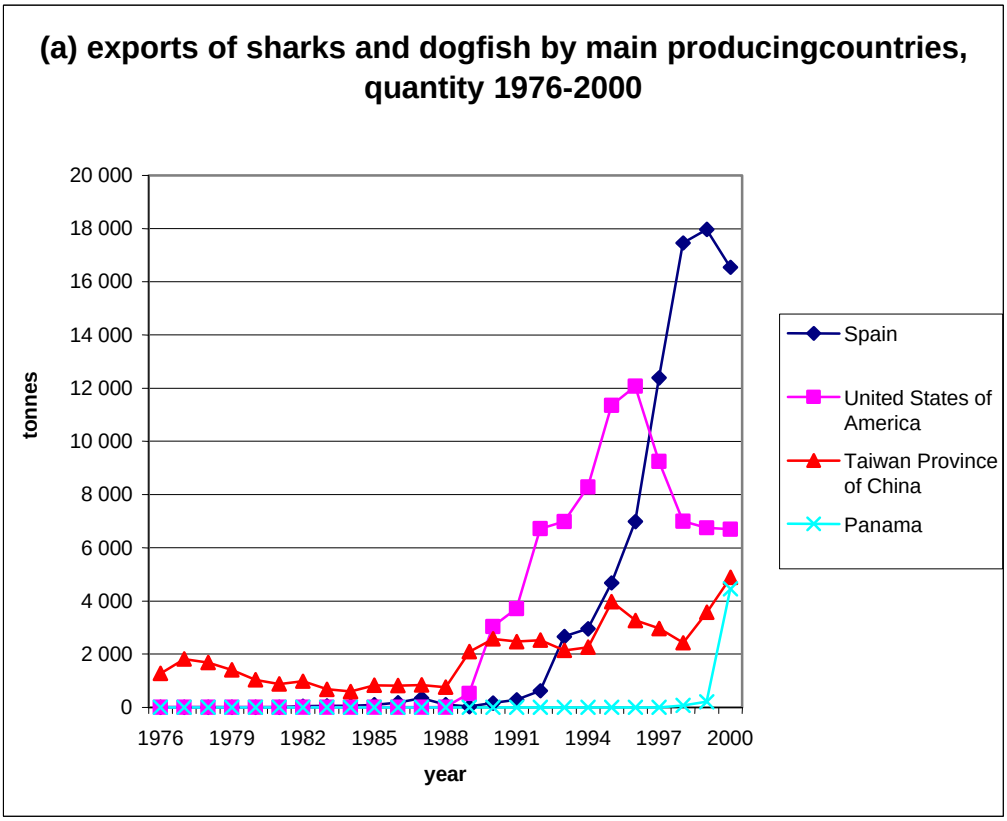
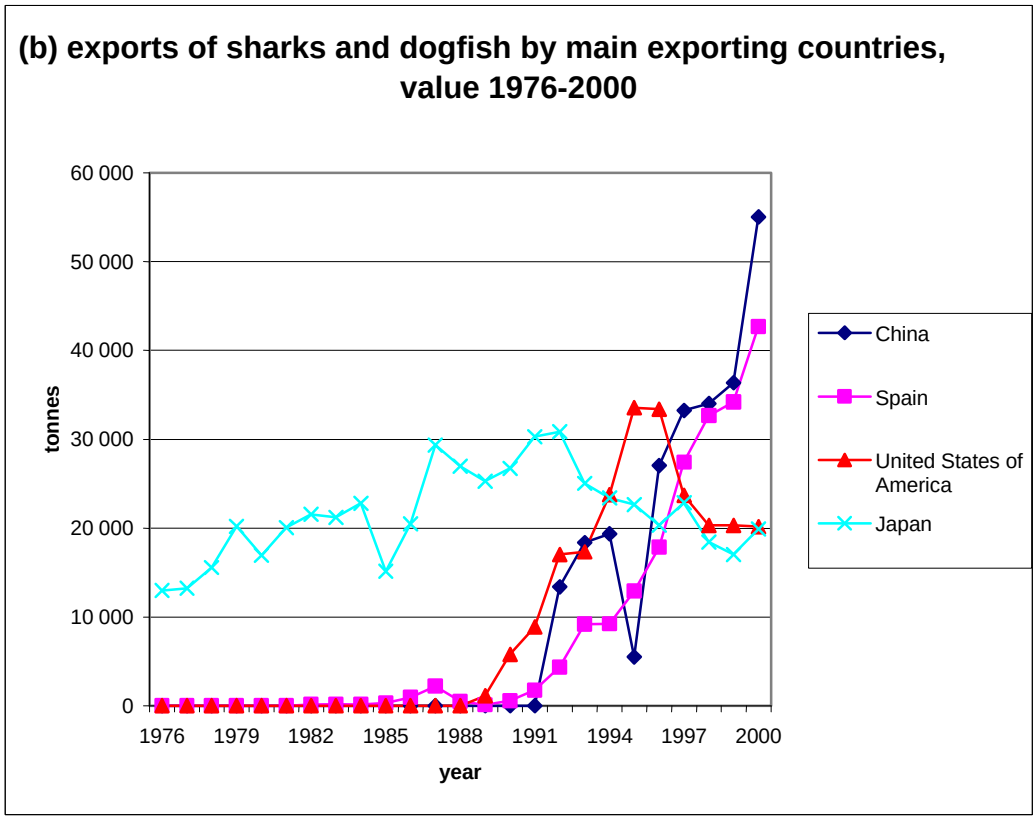

(b) exports of shark and dogfish by main commodities, value 1976-2000
US$ 000
140 000
120 000
100 000
80 000
60 000
40 000
20 000
0
1976 1978 1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000
year
Shark fins, dried, salted, etc.
Sharks, frozen
Shark fins, dried, unsalted
Sharks, fresh or chilled

Figure 7 (a) and (b): Exports of sharks and dogfishby main producing countries, 1976-2000.





The export of shark commodities in 2000 generated revenues of US$134.8 million for developed countries and US$134.7 million for developing countries (Fishstat + data).

Imports of shark commodities

According to Fishstat +, total imports of shark and dogfish commodities increased from 24 228 MT in 1976, equivalent to US$47.6 million, to 76 253 MT in 2000, equivalent to US$182 million. The main importers in volume terms in the year 2000 were Spain, with 13 913 MT, Italy, with 13 708 MT, and China, with 8 599 MT. The main importers in terms of value were China[45], with US$35.5 million, Italy, with US$ 35 million, and Spain, with US$23.9 million. The main product was frozen shark, (45 839 MT worth US$86.7 million (Fishstat + data). The lack of cohesion between figures for export and import of shark commodities, especially in terms of value, confirms the shortcomings in data collection in the countries concerned.

[45] China normally imports higher valued shark products (Josupeit, Pers. Comm.), such as fins, whose imports in China were worth some US$25.5 million in 2000 (Fishstat + data).

Fins

Shark fins are among the most expensive fish products in the world, with prices quoted from US$45 to US$88/kg in the Singapore market (INFOFISH 2003). They are processed and marketed in various ways:

- wet (fresh, chilled and unprocessed);
- dried, complete with denticles and cartilaginous platelets);
- semi-prepared (with the skin being removed but the fibres still intact);
- fully prepared, frozen, in brine and as fine nets, i.e. with the cartilaginous fin needles being boiled, separated, re-dried and packaged in loose groupings.

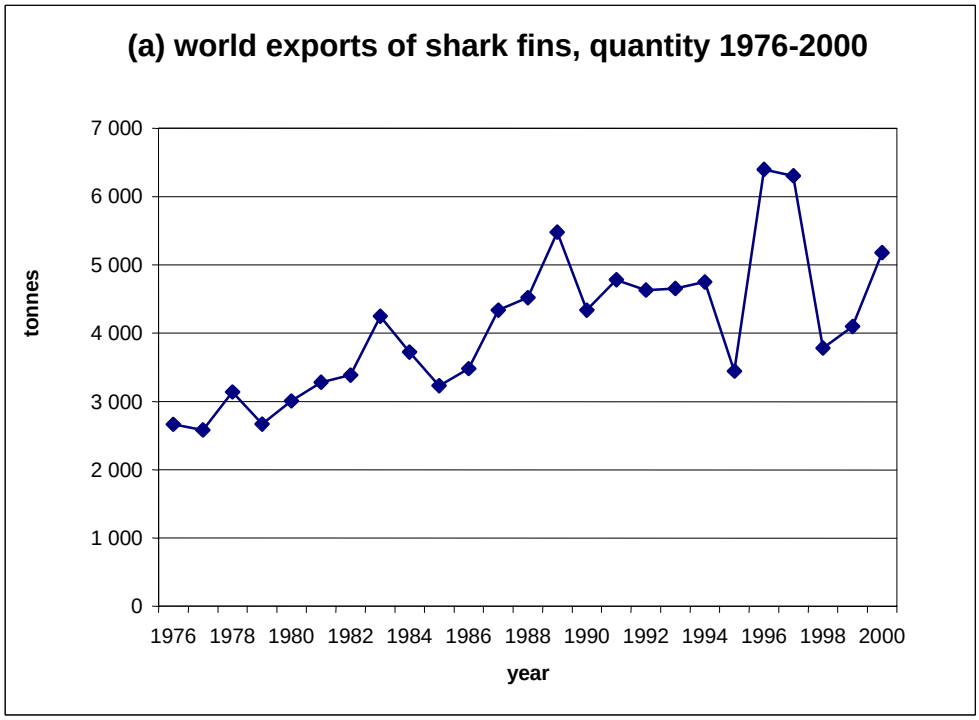
(Kreuzer *et al.* 1978 and Lai Ka-Keong E. 1983).

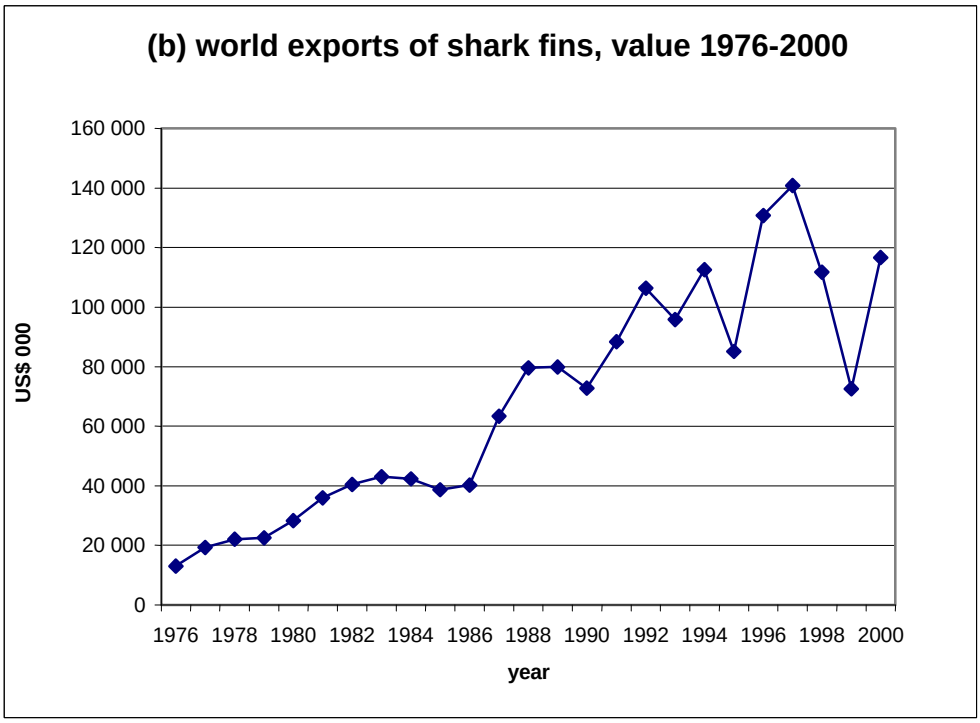
Shark fins are classified as “black” or “white”. There are no unitary criteria of distinction between black and white. Some traders say that it is a description of the colour of the fin, other that it depends on the depths in which the sharks live. However, it is generally acknowledged that fins of the white group give a higher percentage of fin needles and have a better flavour (Vannuccini 1999).

The world market for shark fins

World trade in shark fins increased from 2 666 MT in 1976, equivalent to some US$13 million, to 5 181 MT in 2000, equivalent to US$116.6 million. Exports peaked, in terms of quantity, in 1996 (6 396 MT), and in value terms in 1997 at US$140.8 million (see Figure 8 [a] and [b]). The relatively low figures for 1998 and 1999 may have been a result of the financial crisis which hit Southeast Asia over that period.

Figure 8 (a) and (b): World exports of shark fins, 1976-2000.

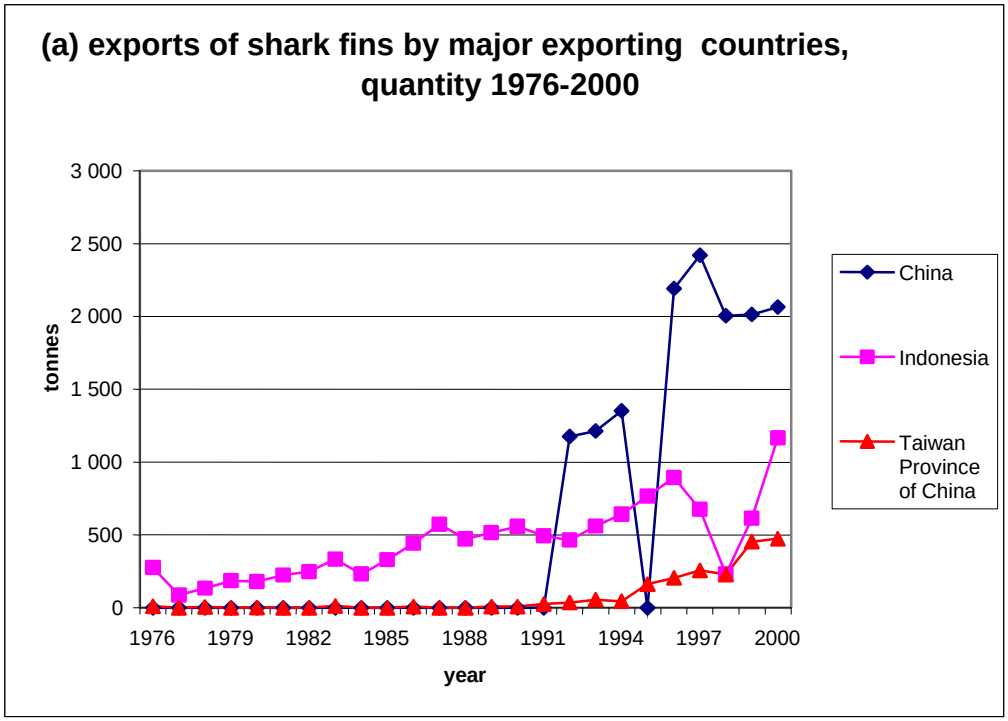


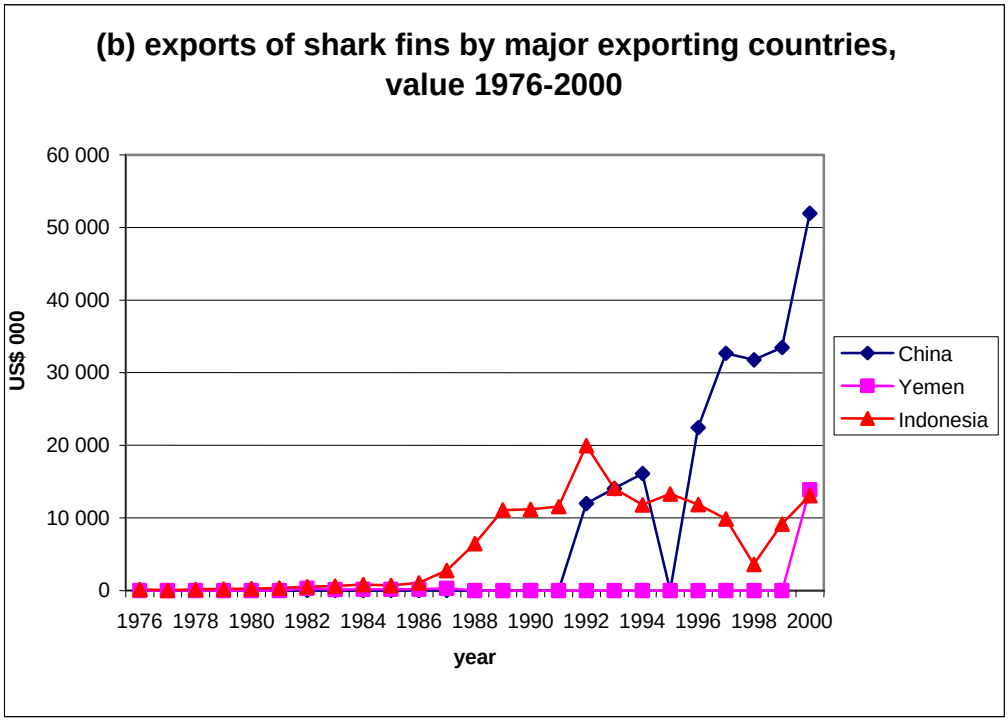


According to Fishstat + the main exporter of shark fins is China, whose exports increased from 1 177 MT, valued at a little less than US$12 million in 1992, to an estimated 2 065 MT, equivalent to US$51.95 million, in 2000 (Figure 9 [a] and [b]). Exports from Indonesia increased from 277 MT in 1976, equivalent to US$177 000, to 1 166 MT in 2000, equivalent to US$13 million. Globally, Yemen reported the second highest income

from export of shark fins in 2000, equivalent to US$13.86 million. Other important exporters are Taiwan Province of China, the United States, Japan and Costa Rica.

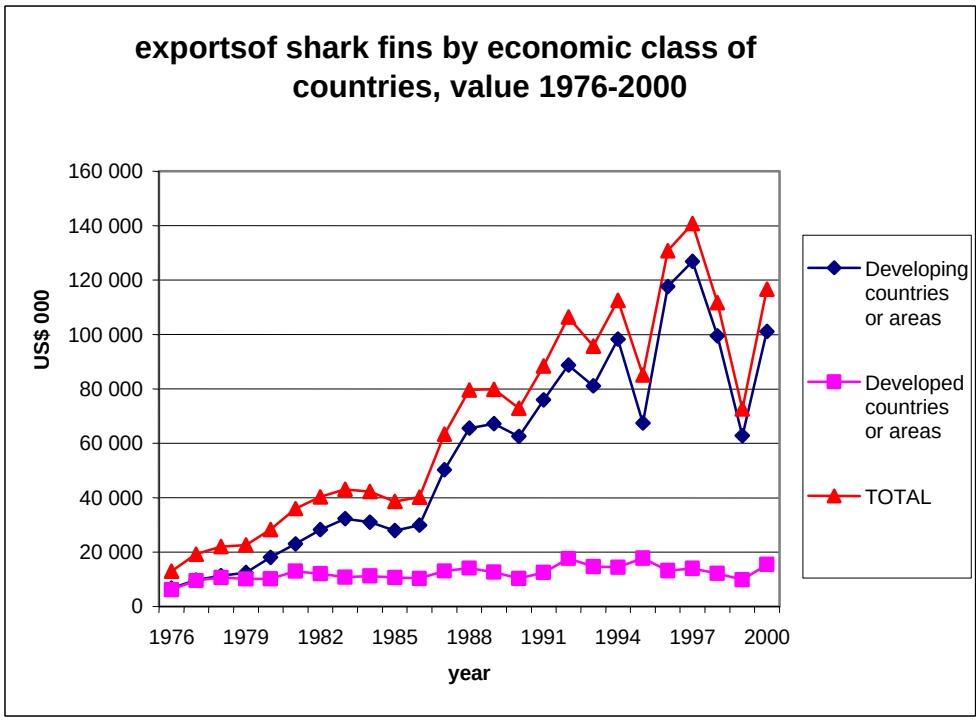
Figure 9 (a) and (b): Exports of shark fins by major exporting countries, 1976-2000.





As noted earlier the shark fin industry is an important source of foreign currency in many developing countries (Figure 10). In 1976 trade in shark fins generated less than US$6.8 million for developing countries and less than US$6.2 million for developed countries: the situation changed dramatically over time and in 1997 developing countries exports and re-exports of shark fins reached US$126.9 million, compared to just US$13.9 million for developed countries. The figure for developing countries in the year 2000 was US$101.1 million. Over the period 1976-2000 developing countries' exports of shark fins averaged 76% of world trade in this product, in value terms. In 2000 the main developing country exporters were China, with US$51.95 million, Yemen US$13.86 million (Fishstat + data), and Indonesia with US$13 million.

Figure 10: Exports of shark fins by economic class of countries, value 1976-2000.



In most cases, selling shark fins represent an important income generating activity for fishers themselves. For example tuna fishers in Southeast Asia who take sharks as bycatch from large purse seine operations, process them on board and sell their fins on return to port. The resulting income is then divided between each member of the crew. Due to the high price of shark fins and the tax-free nature of this activity, the individual returns from that activity may be higher than their month salary (Josupeit, Pers. Comm.).

Prices of shark commodities

The price for headed and gutted chilled shark is US$0.50 to 1.25 per pound i.e. circa US$1.10 to 2.75 per kg, at the Honolulu market in the Hawaii (INFOFISH 2003).

Concerning shark fins (Singapore market):

- a full set of oceanic whitetip (*Carcharhinus longimanus*) fins, half-moon cut, from the South Pacific sells at US$57/kg wholesale;
- a full set of blue shark fins tip, half-moon cut, from the South Pacific, sells at US$47/kg wholesale;
- a full set of mako shark fins tip, half-moon cut, from the South Pacific, sells at US$45/kg wholesale;
- a whole set of white shark fins from Australia sells at US$88/kg wholesale.

(INFOFISH October 2003).

An analysis of main shark exporting countries

This section includes an analysis of the shark fisheries of China, Costa Rica, Indonesia, Japan, Senegal, Spain and Yemen. These countries have been selected on the basis of the importance of their shark fisheries and the income generated by their exports of shark products, taking into account an appropriate regional balance. The main sources used for the preparation of this section have been the UN, FAO, ILO and the World Bank.

China

Background data and estimates

Status: lower-middle income country (World Bank 2002a) LIFDC (FAO 1997)
Population: 1.27 billion in 2001 (World Bank 2002a)
Population living below the poverty line: 5 percent of the population in 1995-2001 (World Bank 2002a)
Child malnutrition: 10 percent of children below five years of age in 1995-2001 (World Bank 2002a)
Mean GDP per capita: US$853 in 2000 (ESCAP 2001a)
Total GDP: US$1 077.5 billion in 2000 and US$1 150.1 billion in 2001 (World Bank 2002a)
Number of employed people: 711 500 000 persons in 2000 (ESCAP 2001a)

Fishery data and estimates

Social:

Number of fishers: 12 233 128 in 2000, of which 3 722 349 aquaculture farmers and 8 510 779 unspecified capture fishers (FAO FIDI data)
Number of capture fishers: 8 510 779 unspecified capture fishers in 2000, of which 1 861 942 full-time and 6 648 837 part-time (FAO FIDI data)
Employment in processing and marketing: N/A
Note: gender breakdown not provided by references

Economic:

Fisheries GDP: N/A
Total landings: 17 191 615 MT in 2000 (Fishstat + data)
Total marine landings: 14 958 385 MT in 2000 (Fishstat + data)
Aquaculture production and value: 32 444 211 MT in 2000, equivalent to US$28 117 045 400 (Fishstat + data)
Export quantity: 1 458 510 MT in 2000 (Fishstat + data)
Export value: US$3 605 838 000 in 2000 (Fishstat + data)

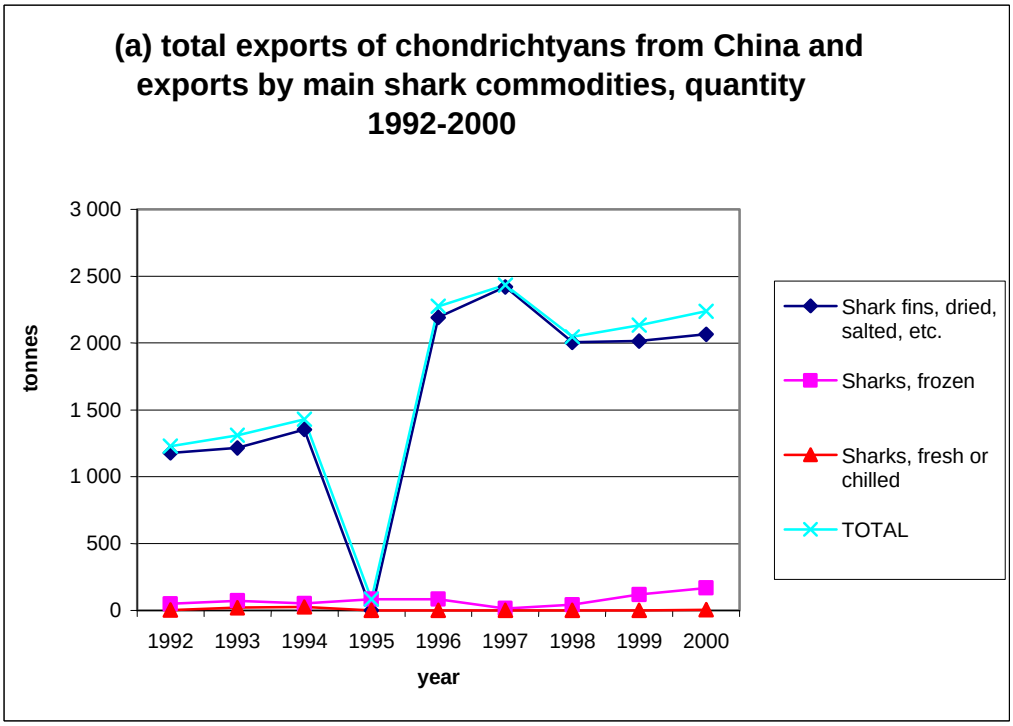
There are about 110 shark species in China, of which 27 are found in the Yellow and Bohai Seas, 80 in the East China Sea and 94 in the South China Sea. The important target species are the silky shark *Carcharhinus falciformis*, the spottail shark *Carcharhinus sorrah*, the spadenose shark *Scoliodon laticaudatus*, the hardnose shark *Carcharhinus macloti*, the spinner shark *Carcharhinus brevipinna*, hammerhead sharks *Sphyrna* spp., the basking shark *Cetorhinus maximus* and the whitespotted bambooshark *Chiloscyllium plagiosum*. The area of Yangjiang is the traditional shark fishing ground, harvesting 1 to 2 000 MT annually (INFOYU in Vannuccini 1999).

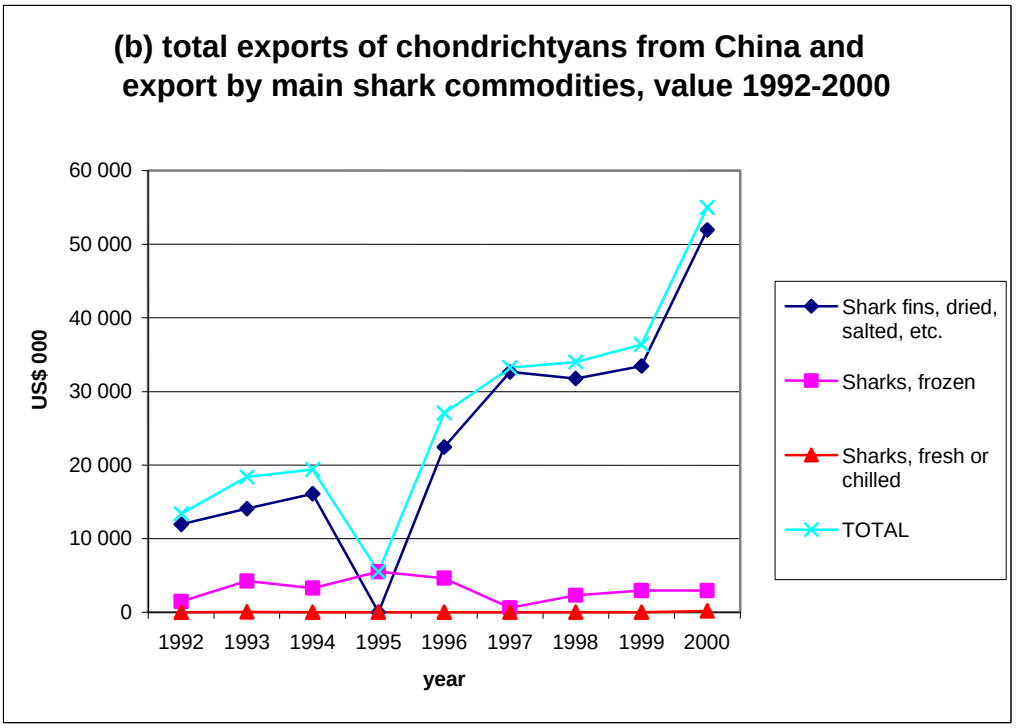
In terms of recorded landings, the only possibly relevant figures amount to 378 MT in 1999 and 252 MT in 2000, shortfin mako being the main landed species. However, statistics from the Fujian Provincial Fishery Bureau (INFOYU in Vannuccini 1999) show that catch increased from 4 160 MT in 1990 to 4 608 MT in 1999, and experts quoted by INFOYU estimated that the annual shark catch is between 10 000 and 15 000 MT, 80 percent coming from longline and trawling bycatch and 20 percent from targeted shark fisheries, the latter operated by some 50 boats (INFOYU in Vannuccini 1999).

Shark has been consumed by the Chinese people since ancient times. In ancient China shark was used as a medicine and a nourishing food. Currently, the main processed products from shark are shark fin, dried shark skin, extruded shark skin, shark leather, shark meat and fillets in fresh and frozen form, shark meatballs, dried shark meat floss, shark cartilage powder, shark cartilage chondroitin, shark liver oil, vitamin A and D capsules and dogfish alkene (INFOYU in Vannuccini 1999). Most shark food products provide ingredients for a relatively cheap meal when consumed locally. In contrast, shark fins are exported as a luxury delicacy.

Figures on exports of shark commodities are limited to the 1992-2000 period (Figure 11 [a] and [b]). They mainly cover shark fins. Exports of shark commodities increased from 1 228 MT, for a value of US$ 13.4 million in 1992, to 1 429 MT, corresponding to US$19.4 million in 1994. In 1995 they declined to a mere 83 MT of frozen shark meat, for a value of US$5.5 million. In the following years trade recovered, reaching 2 237 MT, equivalent to US$55 million in 2000 (Fishstat + data).

Figure 11 (a) and (b): Total exports of chondrichthyans from China and exports by main shark commodities, 1992-2000.





The shark fishery is a relatively minor activity in China, landing a maximum of 15 000 MT per year (of which 80 percent is bycatch). Target shark fisheries employ some 50 boats (INFOYU in Vannuccini 1999). As the total number of motorized fishing boats in China is 280 000 (INFOYU in Vannuccini 1999) and, according to 2000 data, the total number of Chinese capture fishers corresponds to circa 8.5 million (FAO FIDI data), fishers employed in target shark fisheries may be estimated to total some 1 500. Shark fisheries enjoy a localized importance in the areas of Guangdong and Fujian (representing 80 percent of national shark production).

Despite the relatively small size of the Chinese shark fishery, export of shark commodities generated US$55 million in 2000, equivalent to 1.5 percent of the total value of fish exports for that year with the export value of shark fins alone reaching just under US$52 million (Fishstat + data).

Costa Rica

Background data and estimates

Status: upper-middle income country (World Bank 2002b)
Population: 3.9 million in 2001 (World Bank 2002b)
Population living below the poverty line: 21 percent of the population in 1995-2001 (World Bank 2002b)
Child malnutrition: 5 percent of children below five years of age in 1995-2001 (World Bank 2002b)
Mean GDP per capita: US$3 964 in 2000 (UN Statistics Division 2002)
Total GDP: US$15.9 billion in 2000 and US$16.1 billion in 2001 (World Bank 2002b)
Labour force: 1.9 million persons in 1999 (CIA 2002)

Fishery data and estimates

Social:

Number of fishers: 8 995 (est.) in 2000, of which 710 (data repeated since 1999) aquaculture farmers and 8 285 (data repeated since 1998) marine fishers (FAO FIDI data)
Full-time: 8 325 men and 60 women in 1999, both data repeated up to 2000 (FAO FIDI data)
Part-time: 10 women in 1998, data repeated up to 2000 (FAO FIDI data)
Occasional: 600 men in 1998, data repeated up to 2000 (FAO FIDI data)
Gender breakdown: 10 women employed as aquaculture farmers in 1999, data repeated up to 2000, 60 women employed as marine coastal fishers in 1998, data repeated up to 2000 (FAO FIDI data)

Number of marine fishers: 8 285 in 1998, of which 6 960 marine coastal fishers and 1 325 marine deep-sea fishers, data repeated up to 2000 (FAO FIDI data)
Full-time: 7 675 in 1998, data estimated up to 2000 (FAO FIDI data)
Occasional: 610 in 1999, data repeated up to 2000 (FAO FIDI data)

Employment in processing and marketing: 3 500 in 1992 (FAO 1996)

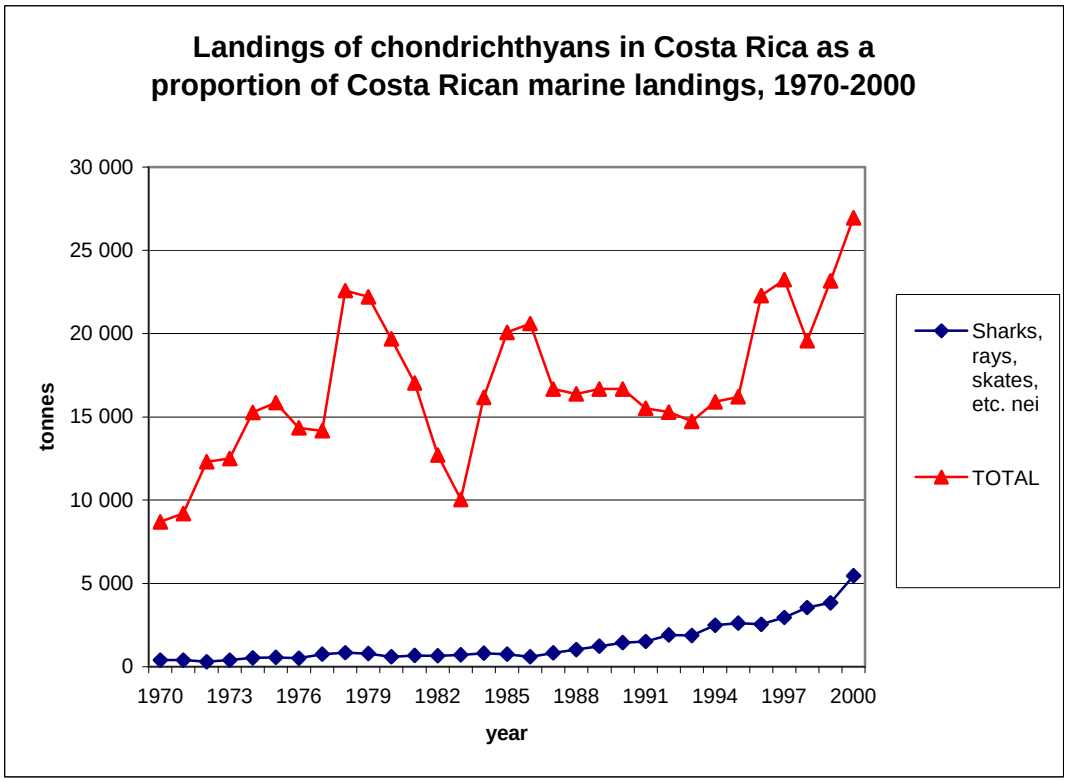
Economic:

Fisheries GDP: US$40 million in 1996 (FAO 1996)
Total landings: 27 950 MT in 2000 (Fishstat + data)
Total marine landings: 26 950 MT in 2000 (Fishstat + data)
Aquaculture production and value: 9 708 MT in 2000, equivalent to US$32 715 000 (Fishstat + data)
Export quantity: 33 331 MT in 2000 (Fishstat + data)
Export value: US$117 750 000 in 2000 (Fishstat + data)

The main species found in Costa Rica are the silky shark *Carcharhinus falciformis*, the blue shark *Prionace glauca*, the bigeye thresher *Alopias superciliosus*, the oceanic whitetip shark *Carcharinus longimanus*, the scalloped hammerhead *Sphyrna lewini*, and the basking shark *Cetorhinus maximus* (Camhi 1996). Other important species include the nurse shark *Ginglymostoma cirratum*, smooth-hounds *Mustelus* spp., the tiger shark *Galeocerdo cuvieri*, the shortfin mako *Isurus oxyrinchus* and the bonnethead *Sphyrna tiburo* (Caro Ros in Vannuccini 1999).

Costa Rica increased its chondrichthyan landings (which are mainly artisanal) from 400 MT in 1970 to 5 453 MT in 2000. According to Fishstat +, these accounted for some 15 percent of the total Costa Rican catch over the period 1970-2000 (Figure 12). According to the Statistics Department of the *Instituto Costarricense de Pesca y Acuicultura* INCOPESCA, catches of sharks and rays increased from 1 620 MT in 1990 to 3 109 in 1995, to decrease to 1 948 MT in 1996. The main species landed are thought to be smooth-hounds *Mustelus* spp. (Caro Ros in Vannuccini 1999).

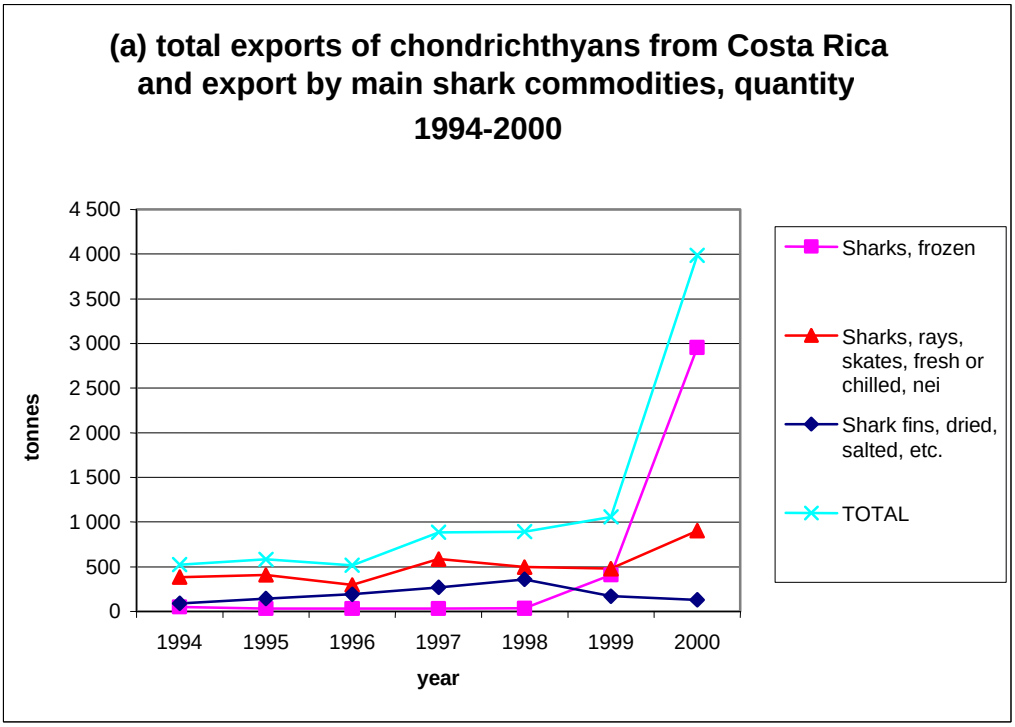
Figure 12: Landings of chondrichthyans in Costa Rica, a comparison with Costa Rican marine landings, 1970-2000.

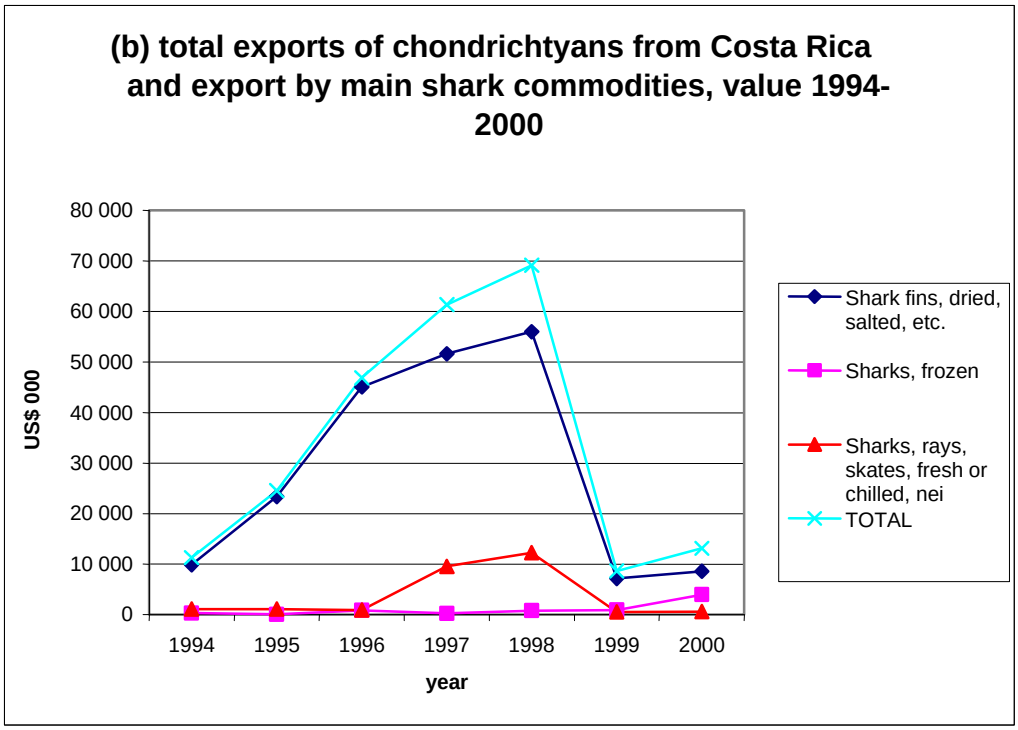


Costa Rica increased its exports of shark products from 522 MT in 1994 to 3 987 MT in 2000 (Figure 13 [a]). In terms of value this increased from US$11.28 million in 1994 to US$69.1 million in 1998. It then declined to US$8.6 million in 1999, recovering to US$13.1 million in 2000. According to Fishstat +, Costa Rica was the seventh biggest exporter of shark products in 2000 in value terms. The main exported products (see

Figure 13 [b]) are whole frozen shark in terms of quantity (2 956 MT) and shark fins in terms of value (US$8.55 million). Exports of shark products are mainly destined to the United States, Canada and Hong Kong (Caro Ros in Vannuccini 1999).

Figure 13 (a) and (b): Total exports of chondrichthyans from Costa Rica and exports by main shark commodities, 1994-2000.





The main processed shark product is known as *posta de tiburòn*, which, according to the terminology used in the country, represents the fish with its head and fins removed. The meat is considered as the most important item, while cartilage and fins are thought to be of lesser importance. Teeth, skin and liver are not utilized on an industrial scale (Caro Ros in Vannuccini 1999). Other sources report that Costa Rica is a major provider of shark cartilage to be processed into “anti-cancer” pills in the United States (Camhi 1996).

Indonesia

Background data and estimates

Status: low-income country (World Bank 2002c) LIFDC (FAO 1997)
Population: 213.6 million in 2001 (World Bank 2002c)
Population living below the poverty line: 13 percent of population in 1995-2001 (World Bank 2002c)
Child malnutrition: 24 percent of children below five years of age in 1995-2001 (World Bank 2002c)
Mean GDP per capita: US$723 in 2000 (UN Statistics Division 2002)
Total GDP: US$152.2 billion in 2000 and US$145.3 billion in 2001 (World Bank 2002c)
Labour force: 99 million persons in 1999 (CIA 2002)

Fishery data and estimates

Social:

Number of fishers: 5 118 571 in 2000, of which 2 099 880 aquaculture farmers (data repeated since 19962), 479 913 inland fishers, and 2 538 778 marine fishers, nei (FAO FIDI data).
Full-time: 1 370 696 in 2000 (FAO FIDI data)
Part-time: 1 128 024 in 2000 (FAO FIDI data)
Occasional: 519 971 in 2000 (FAO FIDI data)
Unspecified: 2 099 880 in 2999, data repeated up to 2000 (FAO FIDI data)

Number of marine fishers: 2 538 778 in 2000 (FAO FIDI data)
Full-time: 1 231 706 in 2000 (FAO FIDI data)
Part-time: 920 301 in 2000 (FAO FIDI data)
Occasional: 386 771 in 2000 (FAO FIDI data)

Employment in processing and marketing: N/A
Note: gender breakdown not provided by references

Economic:

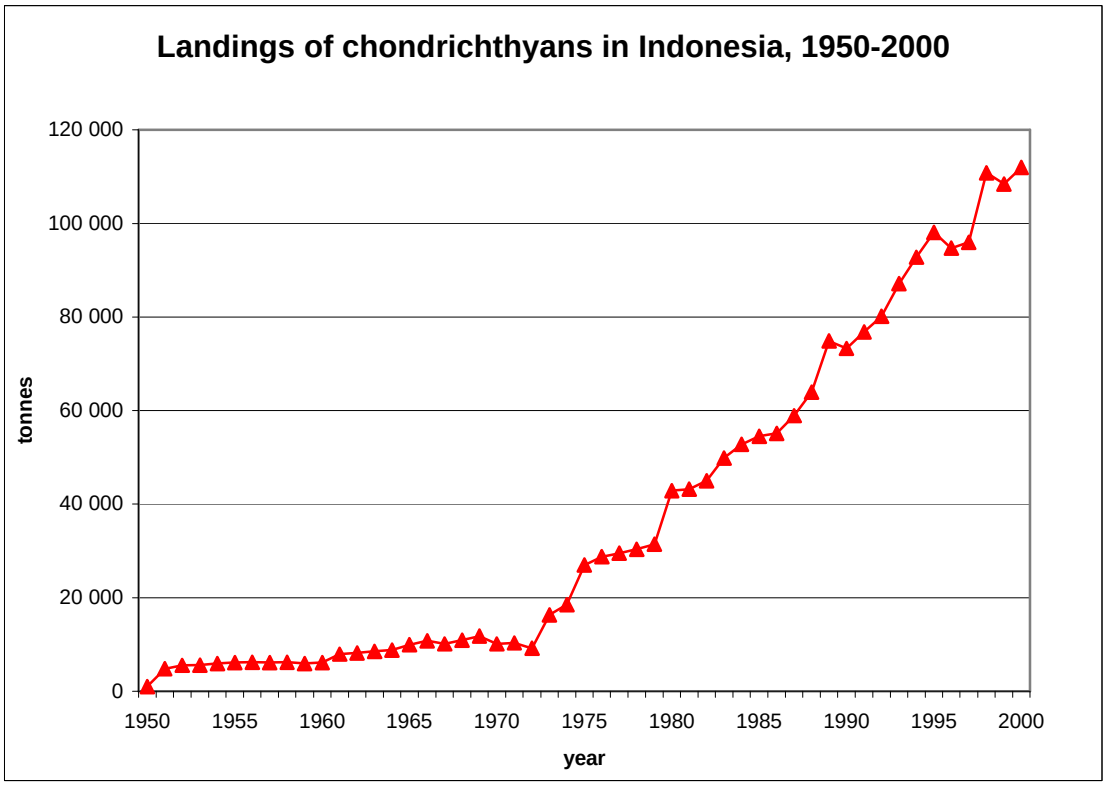
Fisheries GDP: N/A
Total landings: 4 159 161 MT in 2000 (Fishstat + data)
Marine landings: 3 830 491 MT in 2000 (Fishstat + data)
Aquaculture production and value: 993 727 MT in 2000, corresponding to US$2 268 269 800 (Fishstat + data)
Export quantity: 461 151 MT in 2000 (Fishstat + data)
Export value: US$1 584 454 in 2000 (Fishstat + data)

The shark fishery in Indonesia is largely artisanal. Sharks and rays are generally caught as bycatch when using set gillnets, longlines and handlines to catch groupers and snappers. These activities occur mostly in shallow water coral reef and coastal environments. Also, several shark species are targeted for their fins. Examples include the white-spotted guitarfish *Rhynchobatus djiddensis* in the eastern provinces of Maluku and Irian Jaya and carcharinids in Nusa Tenggara and the Timor Sea. Fishers sometimes face long and expensive journeys to catch sharks for their fins; however, the reward can be 100 to 200 kg of fins, worth at least US$6 500 (Bentley 1996).

Bentley reports evidence of a fishery for deep sea shark species, for their liver oil and squalene. Processing companies pay local fishers to catch these in depths of 300 and 1000 metres, but authors are uncertain about the particular species being targeted in this fishery (Bentley 1996).

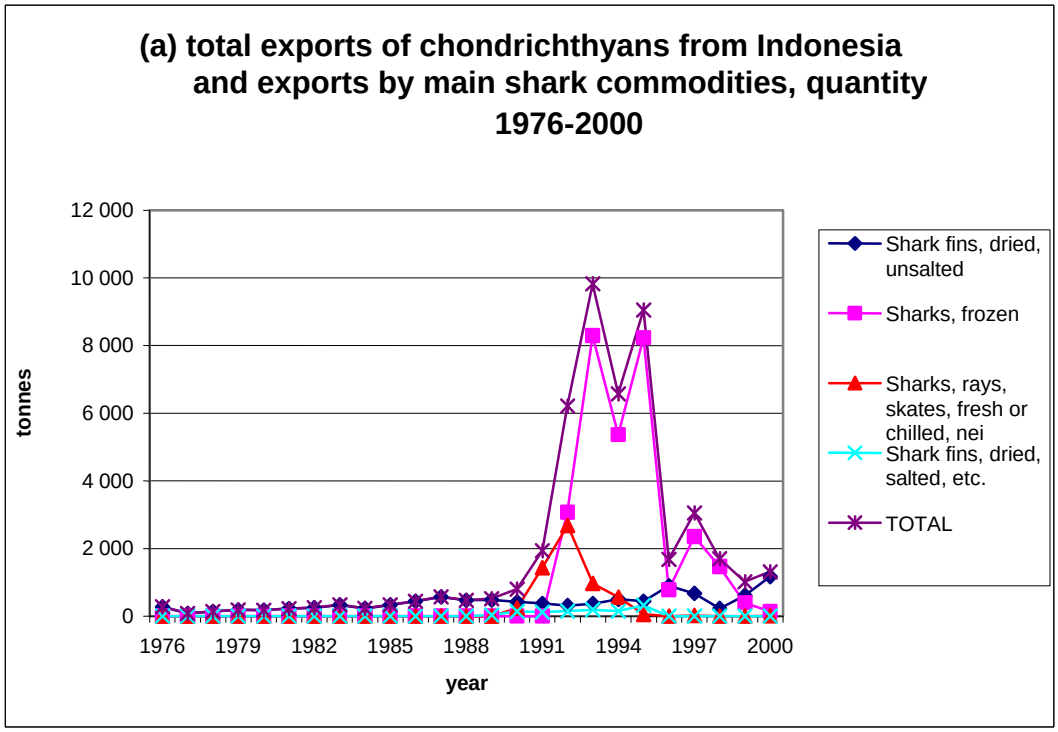
According to Fishstat + (see Figure 14), total landings of chondrichthyans in Indonesia increased from 1 000 MT in 1950 to 111 973 MT in 2000. Catches are concentrated in the The Western Central Pacific area and provided an average of 85 percent of Indonesian landings over the period 1950-2000 period. This data does not identify the precise species of sharks, skates and rays being concerned, but, according to S. P. Chen (Chen in Vannuccini 1999), the key species are the white-spotted guitarfish, requiem sharks, hammerhead sharks, the tiger shark and the blue shark.

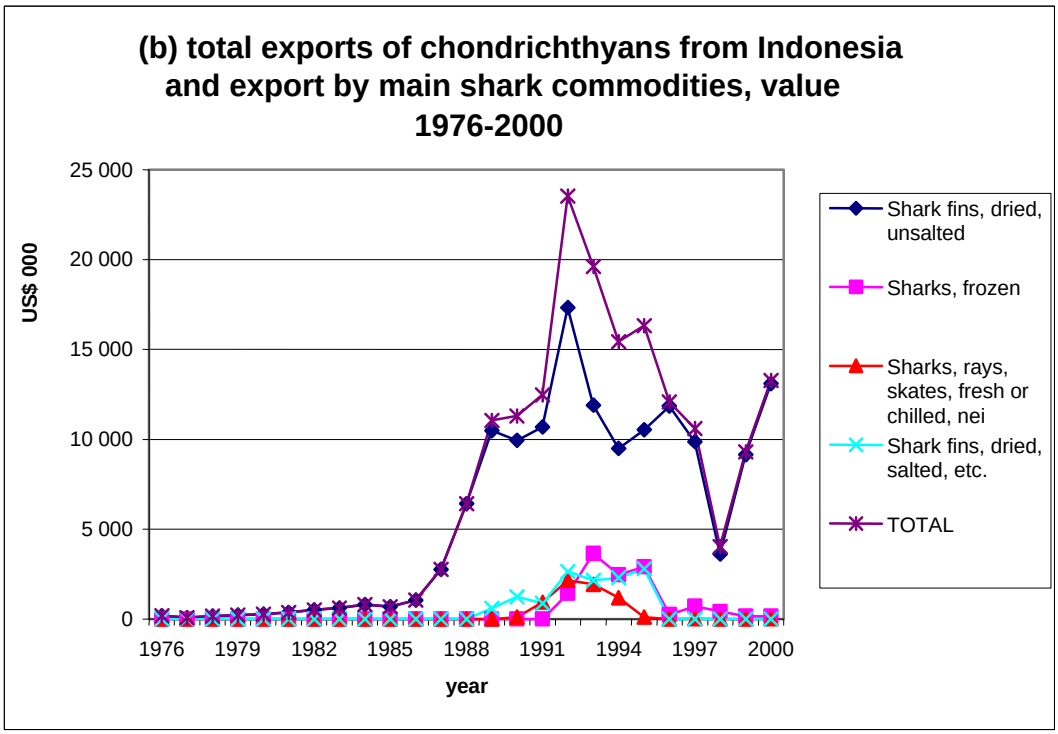
Figure 14: Landings of chondrichthyans in Indonesia, 1950-2000.



In terms of quantity exports of shark products increased from 277MT in1976, to 9 824MT in 1993 and 9 049MT in 1995 (Fishstat + data). But by 2000, they had fallen to 1 313 MT. In terms of value, exports peaked in 1992 with a value of US$23.5 million. In the following years the value declined, down to US$4 million in 1998, but recovering to US$13.3 million in 2000 (see Figure 15 [a] and [b]). Shark fins, dried and unsalted, represent the main export product, making up some 89 percent of shark exports from Indonesia in terms of quantity and 99 percent in value (Fishstat + data).

Figure 15 (a) and (b): Total exports of chondrichthyans from Indonesia and exports by main shark commodities, 1976-2000.





Japan

Background data and estimates:

Status: high-income country (World Bank 2002d)
Population: 127.5 million according to 2002 data (International Monetary Fund Dissemination Standards Bulletin Board, IMF DSSB 2003a)
Mean GDP per capita: US$37 494 in 2000 (UN Statistics Division 2002)
Total GDP: US$4 841.6 billion in 2000 and US$4 245.2 billion in 2001 (World Bank 2002d)
Number of employed people: some 63.5 million persons (IMF DSSB 2003a)

Fishery data and estimates

Social:

Number of fishers: 574 676 in 2000, of which 23 000 (est.) aquaculture farmers, 21 486 inland fishers (data repeated since 1998) and 530 190 marine fishers (FAO FIDI data)
Full-time: 23 000 in 2000 (FAO FIDI data)
Unspecified: 95 663 women and 456 013 men in 2000 (FAO FIDI data)
Gender breakdown: 5 963 women employed as inland fishers in 1998, data repeated up to 2000, 45 240 women employed as marine coastal fishers in 1999, data repeated up to 2000, 360 women employed as marine deep-sea fishers and 44 100 women employed as marine fishers, nei in 2000 (FAO FIDI data)

Number of marine fishers: 530 190 unspecified marine fishers in 2000, of which 229 390 marine coastal fishers, 40 600 marine deep-sea fishers and 260 200 marine fishers, nei (FAO FIDI data)

Employment in processing and marketing: 206 201 persons in 1998, excluding fishmeal and fish oil companies (FAO 2000)

Economic:

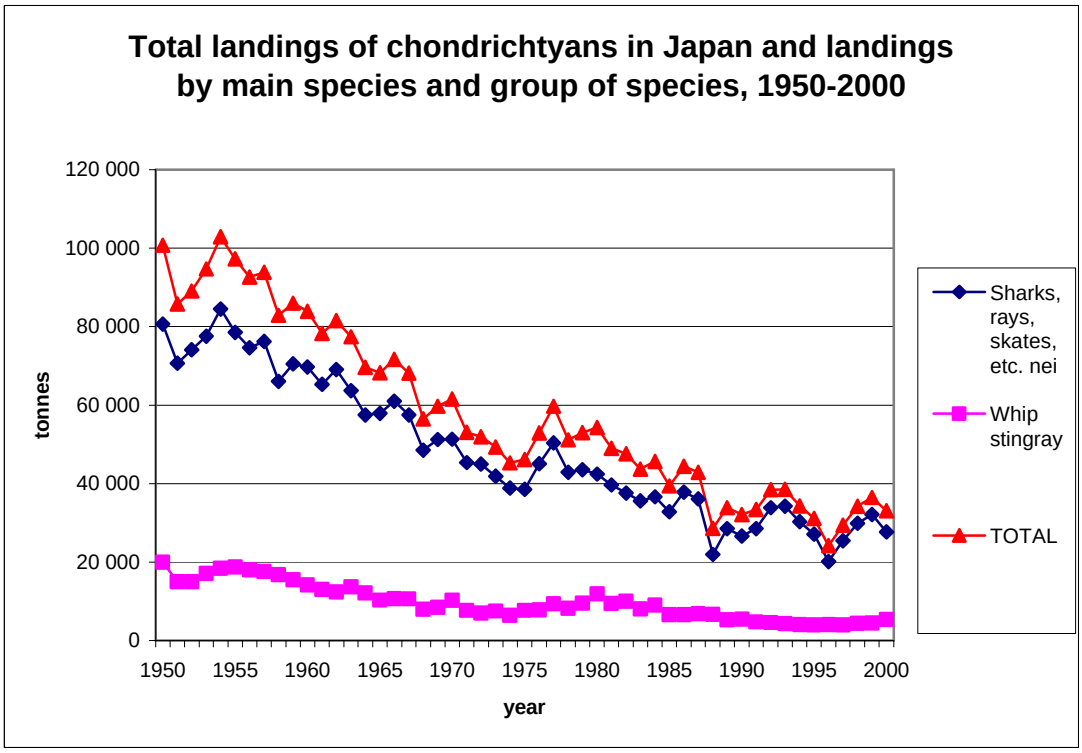
Fisheries GDP: US$16 910 million in 1998 (FAO 2000)
Total landings: 5 110 194.1 MT in 2000 (Fishstat + data)
Total marine landings: 5 039 438 MT (Fishstat + data)
Aquaculture production and value: 1 291 705 MT in 2000, equivalent to US$4 449 752.200 (Fishstat + data)
Export quantity: 208 958 MT in 2000 (Fishstat + data)
Export value: US$801 580 000 in 2000 (Fishstat + data)

The main commercial shark species in Japan are the blue shark, the longfin mako shark *Isurus paucus*, the thresher shark, the salmon shark *Lamna ditropis*, the shortfin mako, the starspotted smooth-hound *Mustelus manazo*, the piked dogfish and the Japanese tope shark *Hemitriakis japonica* (Chen in Vannuccini 1999). Sharks are mainly landed as bycatch, principally in the tuna longline and trawl fisheries (Nakano in Shotton 1999).

As regards the target shark fishery, boats normally use 14 km longlines with some 300 baits. Weaker gears are more likely to be easily destroyed by the animal (National Geographics information). The Japanese shark fishery is a very old and traditional one, involving several ancient rituals. Prior to the catch, the fishers pour sake (a traditional hot alcoholic beverage) on the sea, on the boat and the fishing gears, and drink the remainder to keep their spirits high. Then, fishers beat a wooden pole on the hull as a good luck ritual and to lure the shark. The catch of a hammerhead (*Sphyrna* spp.) is believed to be a good luck charm from the God of the Sea. The opening of the fishing season is celebrated by a banquet entirely based on shark meat. As families of shark fishers are gradually disappearing, the few that are left are taken in high consideration by the population (National Geographics information).

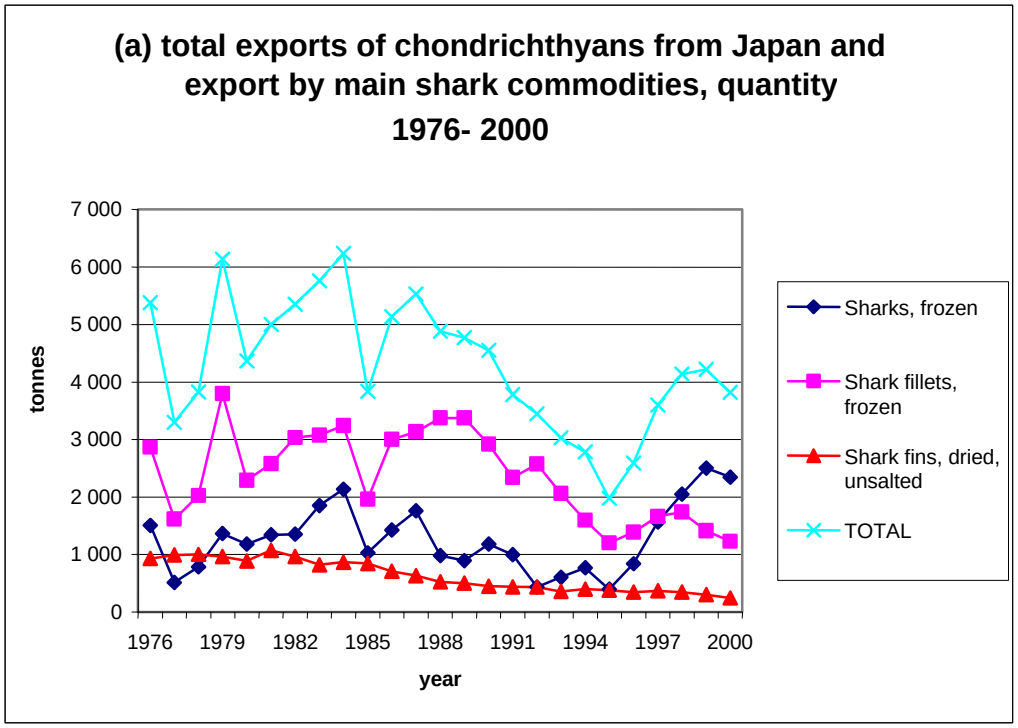
According to Fishstat + 2000 data, chondrichthyan landings from Japan declined from 100 700 MT in 1950 to 33 072 MT in 2000 (Figure 16).

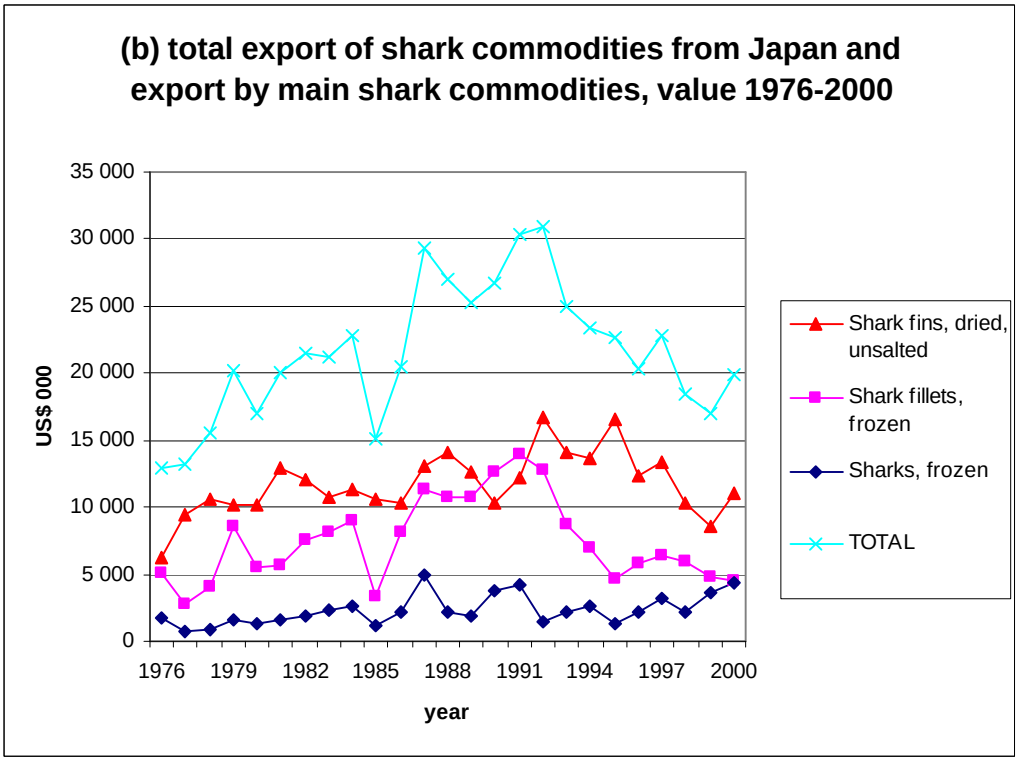
Figure 16: Total landings of chondrichthyans in Japan and landings by main species and group of species, 1950-2000.



According to Fishstat + data exports of shark products from Japan declined, in terms of quantity, from 5 382 MT in 1976 to 3 818 MT in 2000(Figure 17 [a]) however they increased in value terms from circa US$13 million to circa US$20 million over the same period, peaking at around US$30.86 million in 1992 (Figure 17 [b]). The main exported products were shark fins, frozen shark fillets and frozen sharks

Figure 17 (a) and (b): Total exports of chondrichthyans from Japan and exports of main shark commodities, 1976-2000.





Japan is a traditional producer and consumer of many shark products. The meat and cartilage of sharks are used to prepare dishes, the liver oil is used in medicine and the skin is processed into leather. Shark meat is generally marketed fresh or frozen and is consumed boiled or processed as *sashimi* and *surimi* paste (Vannuccini 1999). Makos, threshers and requiem sharks (*Carcharhinidae* spp.) command higher prices in the Japanese market. The mako is considered as the best quality shark; it is marketed frozen, its meat is used for *sashimi* and the fins are considered of a good quality (Vannuccini 1999).

Fins from Japanese vessels are considered to be of a better quality than those from Korean vessels as Japanese fishers cut differently, to include the meat at the base of the tail. However, the bulk of shark fin production is exported as shark fins are not widely used in Japanese cuisine (Vannuccini 1999).

Senegal

Background data and estimates:

Status: low-income country (World Bank 2002e) LIFDC (FAO 1997)
Population: 9.8 million according to 2001 estimates (World Bank 2002e)
Population living below the poverty line: N/A
Child malnutrition: 13 percent of children below five years of age in 1995-2001 (World Bank 2002e)
Mean GDP per capita: US$468 according to 2000 estimates (UN Statistics Division 2002)
Total GDP: US$4.4 billion in 2000 and US$4.6 billion in 2001 (World Bank 2002e)
Labour force: N/A

Fishery data and estimates

Social:

Number of fishers: 55 547 full-time in 2000, of which 7 940 inland fishers and 47 607 marine fishers (FAO FIDI data).
Number of marine fishers: 47 607 in 2000, of which 44 257 marine coastal fishers (data repeated since 1997) and 3 350 marine deep-sea fishers, the latter data repeated since 1996 (FAO FIDI data).

Employment in processing and marketing: N/A
Note: gender breakdown not provided by references

Economic:

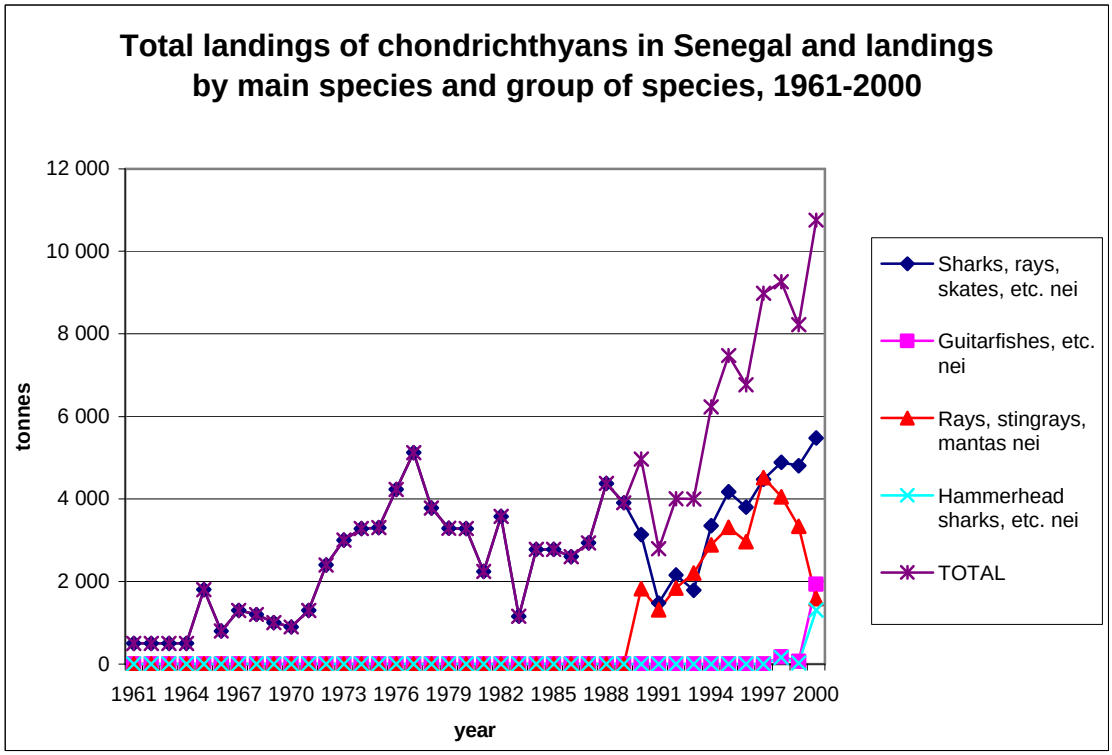
Fisheries GDP: N/A
Total landings: 402 047 MT in 2000 (Fishstat + data)
Marine landings: 379 597 MT in 2000 (Fishstat + data)
Aquaculture production and value: 155 (est.) MT in 2000, corresponding to an estimated US$854 800 (Fishstat + data)
Export quantity: 88 001 MT in 2000 (Fishstat + data)
Export value: US$260 327 000 in 2000 (Fishstat + data)

Chondrichthyan landings in Senegal increased from 500 MT in 1961 to 10 757 MT in 2000, the main statistical classification being “sharks, rays, skates, etc. nei”, totalling 5 473 MT and “guitarfishes nei”, totalling 1 930 MT in 2000 (see Figure 18).

Total marine landings in Senegal in 2000 were 379 597 MT (Fishstat + data). Considering that the number of marine fishers in 1997 was estimated at 47 607 (FAO

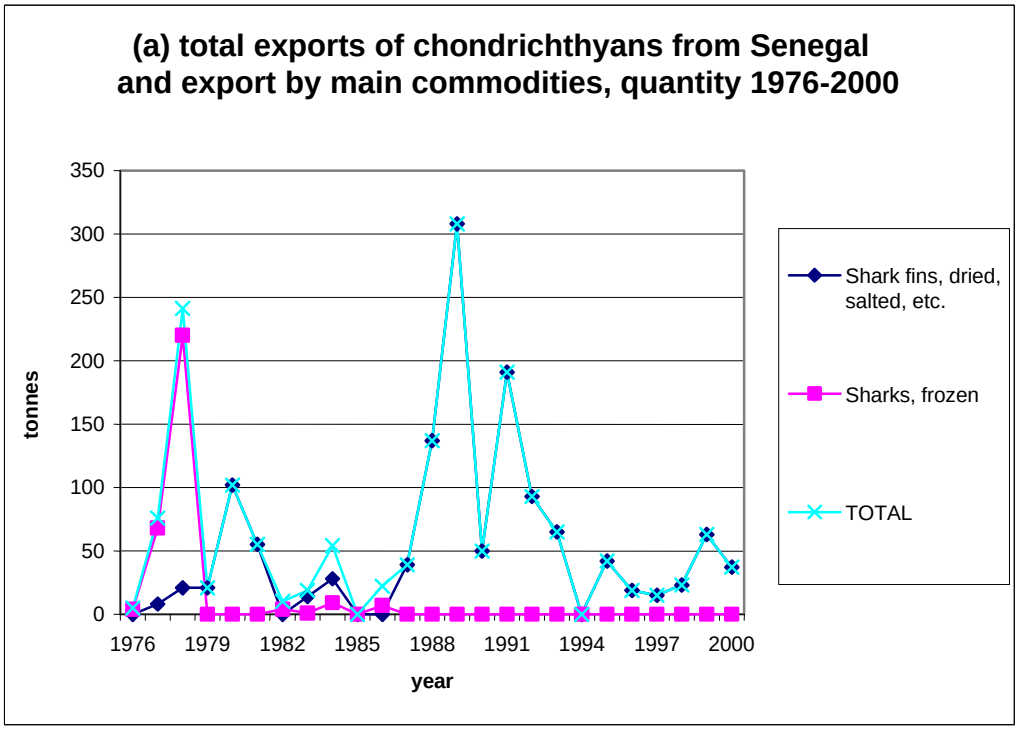
FIDI data) and shark landings amounted to 10 757 MT (Fishstat + data), one can estimate that some 1 350 Senegalese fishers depend on the shark fishery.

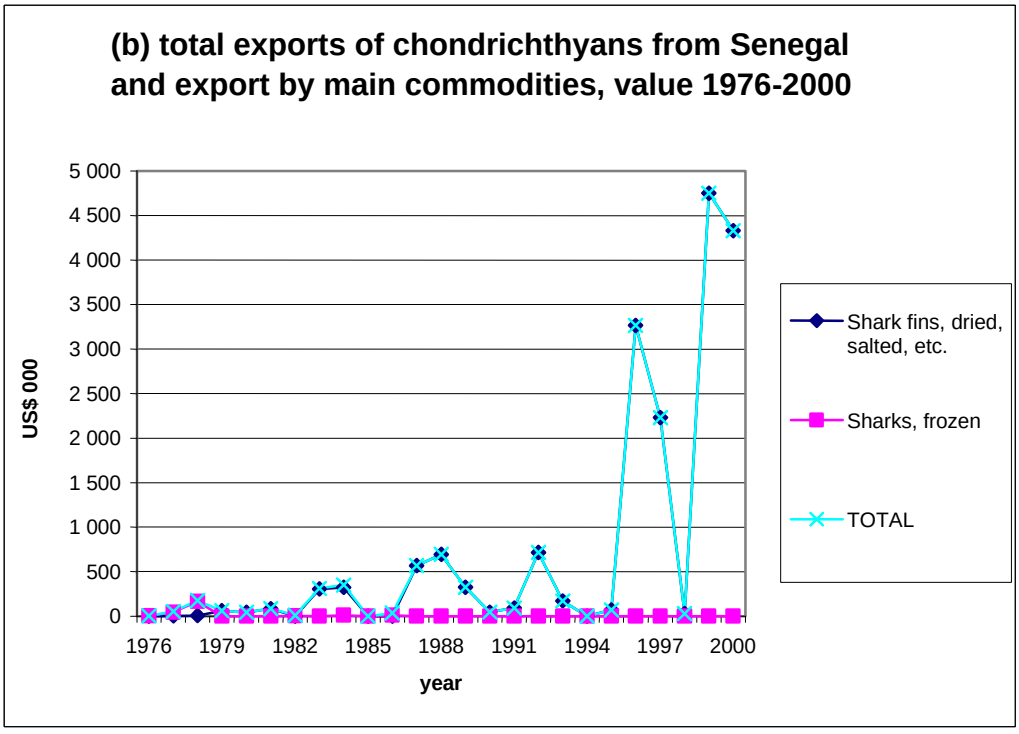
Figure 18: Total landings of chondrichthyans in Senegal and landings by main species and groups of species, 1961-2000.



In 2000 Senegal exported 37 MT of shark fins which were worth US$4.3 million (Figure 19 [a] and [b]). Senegal is the 15th exporter of shark products in the world and the main African exporter in terms of value (Fishstat + data).

Figure 19 (a) and (b): Total exports of chondrichthyans from Senegal and exports by main shark commodities, 1976-2000.





Spain

Background data and estimates:

Status: high-income country (World Bank 2002f)
Population: 41 million according to 2002 data (IMF DSSB 2003b)
Mean GDP per capita: US$14 054 in 2000 (UN Statistics Division 2002)
Total GDP: US$558.5 billion in 2000 and US$577.5 billion in 2001 (World Bank 2002f)
Number of employed people: more than 16 million persons in 2003 (IMF DSSB 2003b)

Fishery data and estimates

Social:

Number of marine fishers: 75 434 marine fishers nei in 1996, data repeated up to 2000 (FAO FIDI data)
Full-time: 67 137 in 1996, data repeated up to 2000 (FAO FIDI data)
Part-time: 8 297 in 1996, data repeated up to 2000 (FAO FIDI data)
Employment in processing and marketing: N/A
Note: gender breakdown not provided by references

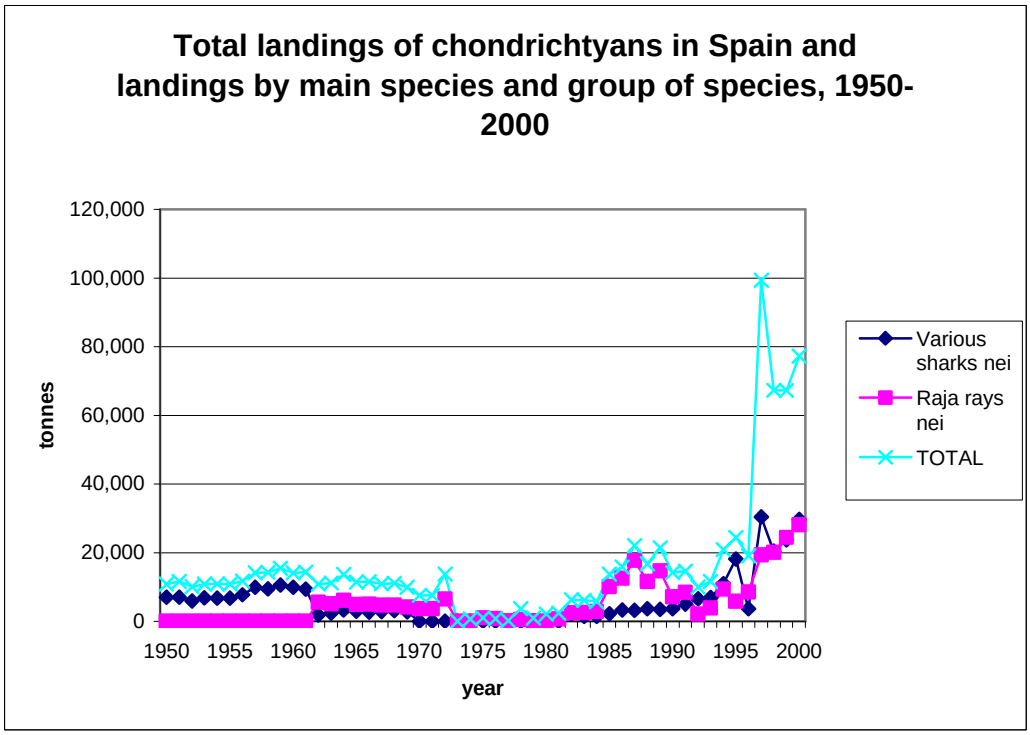
Economic:

Fisheries GDP: US$2 265 900 000 in 2000 (FAO 2002)
Total landings: 991 132 MT in 2000 (Fishstat + data)
Total marine landings: 982 422 MT in 2000 (Fishstat + data)
Aquaculture production and value: 312 171 MT in 2000, equivalent to US$382 392 500 (Fishstat + data)
Export quantity: 795 335 MT in 2000 (Fishstat + data)
Export value: US$1 599 631 000 in 2000 (Fishstat + data)

The main commercial shark species in Spain are the blue shark, smooth-hounds, the tope shark and the shortfin mako. Shark is mostly caught as a bycatch of tuna and swordfish fisheries. The most remunerative shark species is the shortfin mako, even if smooth-hounds and piked dogfish can fetch high prices too. Spanish consumers tend to appreciate both fresh and frozen shark meat, even if the prices for fresh products are higher (Spagnolo in Vannuccini 1999).

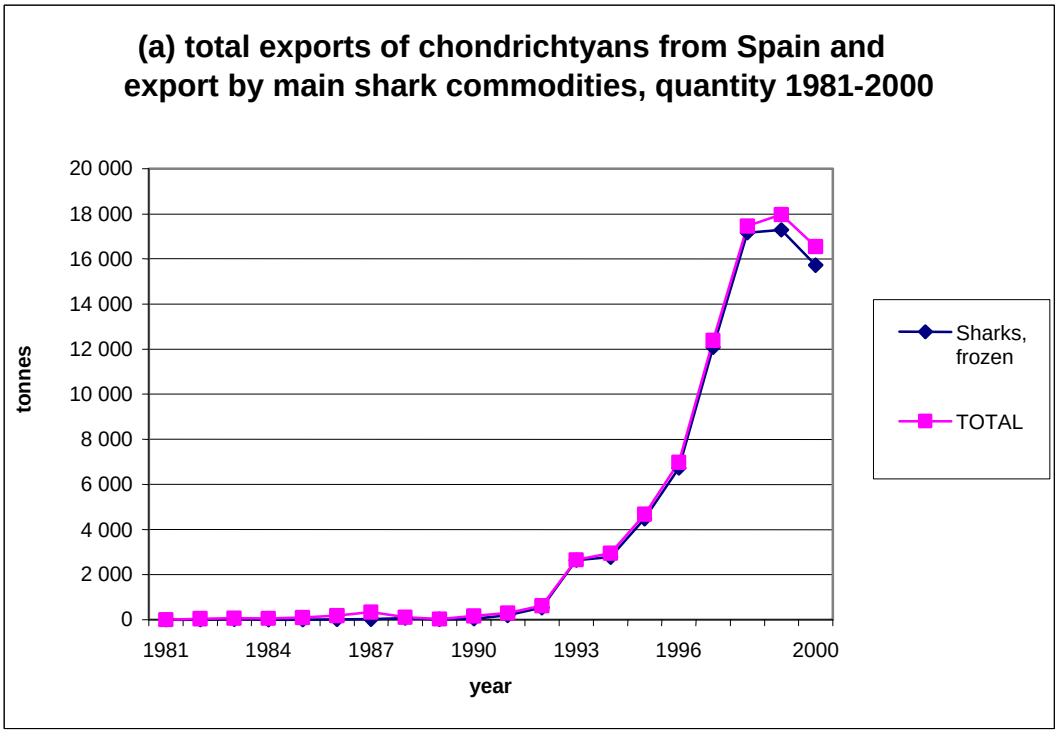
According to Fishstat + data for the year 2000, Spain is the world's second largest producer of sharks after Indonesia. Landings increased from 10 800 MT in 1950, to 77 269 MT in 2000, reaching their lowest in 1977 (149 MT) and peaking at 99 320 MT in 1997 (Figure 20).

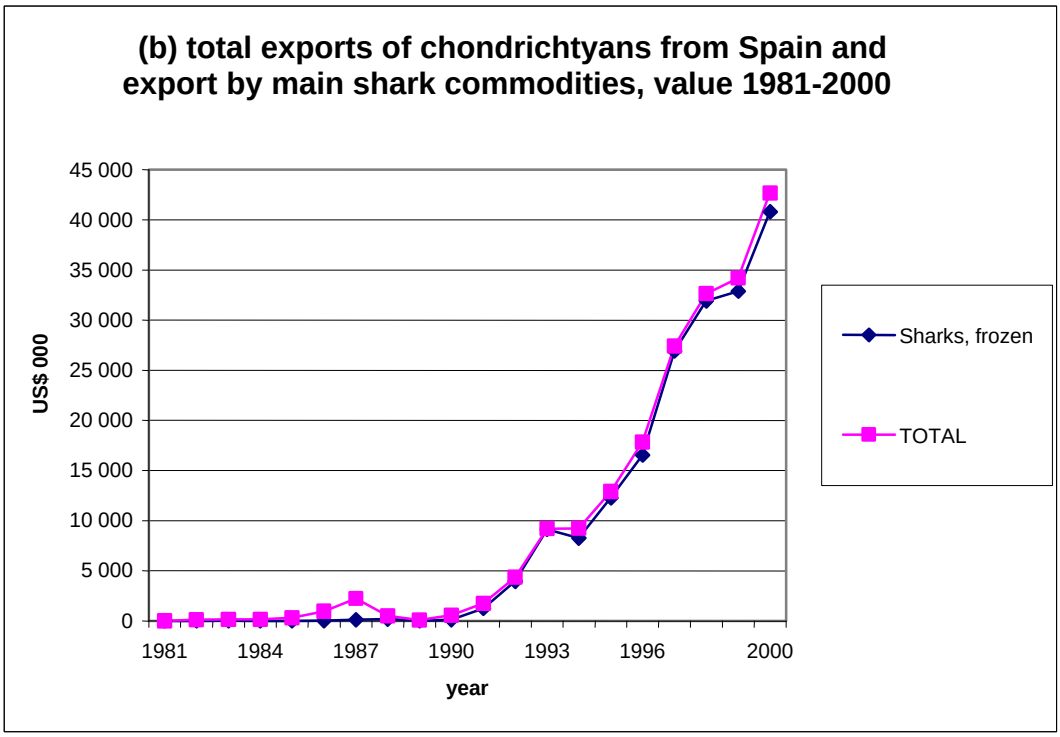
Figure 20: Total landings of chondrichthyans in Spain and landings by main species and groups of species, 1950-2000.



Reliable figures on Spanish exports of shark products are limited to the 1992-2000 period (Fishstat + data). Exports of shark products, mainly frozen sharks, increased from 618 MT, equivalent to some US$4.3 million in 1992, to 16 539 MT in 2000, equivalent to some US$42.7 million (Figure 21 [a] and [b]).

Figure 21 (a) and (b): Total exports of chondrichthyans from Spain and export by main shark commodities, 1981-2000.





Yemen

Background data and estimates:

Status: low-income country (World Bank 2002g)
Population: 18 million according to 2001 estimates (World Bank 2002g)
Population living below the poverty line: 42 percent of the population in 1995-2001 (World Bank 2002g)
Child malnutrition: 46 percent of children below five years of age in 1995-2001 (World Bank 2002g)
Mean GDP per capita: US$465 according to 2000 estimates (UN Statistics Division 2002)
Total GDP: US$9.2 billion in 2000 and US$9.3 billion in 2001 (World Bank 2002g)
Labour force: N/A

Fishery data and estimates

Social:

Number of fishers: 41 000 unspecified fishers in 1999, data repeated in 2000 (FAO FIDI data).
Employment in processing and marketing: N/A
Note: gender breakdown not provided by references

Economic:

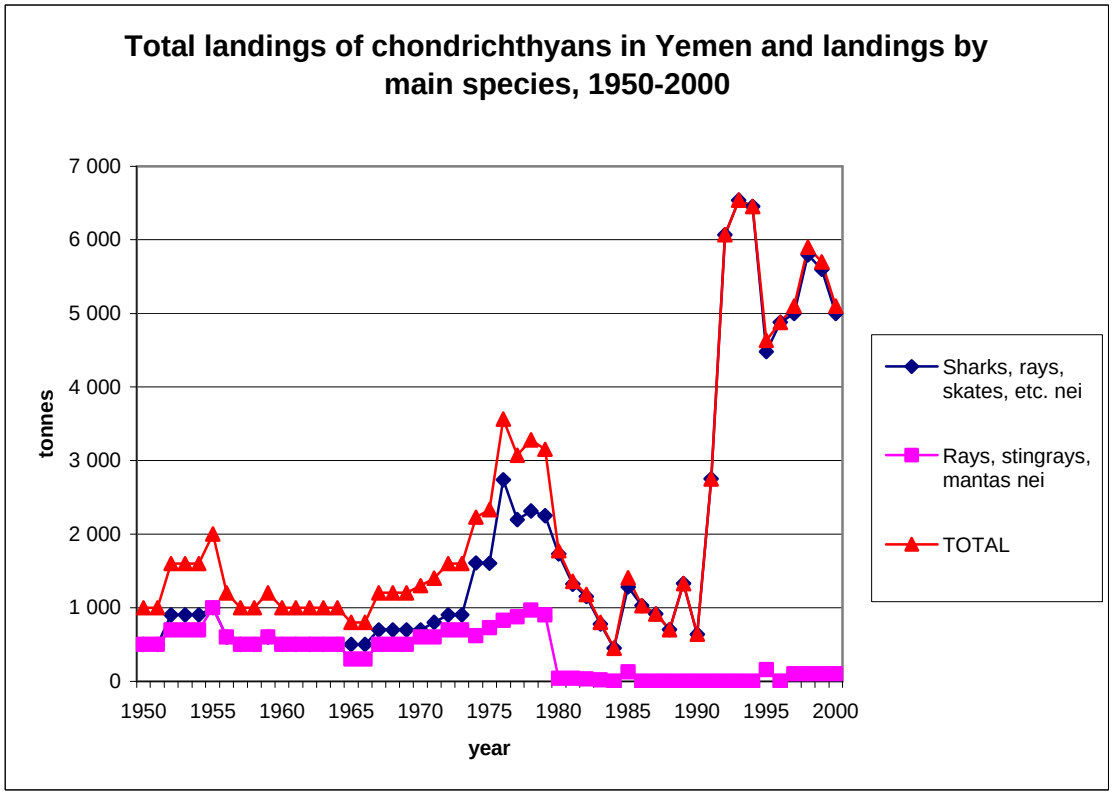
Fisheries GDP: N/A
Total and marine landings: 114 751 MT, largely estimated in 2000 (Fishstat + data)
Aquaculture production and value: N/A
Export quantity: 10 927 MT estimated in 2000 (Fishstat + data)
Export value: US$40 907 000 in 2000 (Fishstat + data)

Shark has always been a traditional protein supplement in the diet of the populations of the countries bordering the Gulf of Aden, including Yemen. Yemeni shark fisheries are generally artisanal and following the increase in price of shark fins, more fishing effort has been placed on large offshore species whose fins are high demand in international markets (Hariri 2002).

Total Yemeni landings of chondrichthyans, mainly “sharks, rays, skates nei”, increased from 1 000 MT in 1950 to 3 564 MT in 1976 but decreased in the following years to a low of 448 MT in 1984. After a period of stability around relatively low values, they started to increase again from 1991 (2 749 MT landed). In 1993, they hit a peak of

6 537 MT (Fishstat + data). More recently they have fluctuated around an average of 5 450 MT and were estimated at 5 100 MT in 2000 (Figure 22).

Figure 22: Total landings of chondrichthyans in Yemen and landings by main species and group of species, 1950-2000.



Trade data are available for 2000 only, with exports of an estimated 366 MT of shark fins, dried and salted (equivalent to US$13.86 million), 4 MT of frozen sharks (equivalent to US$ 4 000) and 1 MT of frozen shark fillets, equivalent to US$ 2 000 (Fishstat + data).

The Gulf of Oman and the Arab Sea are traditionally important areas for shark fishing (Josupeit, Pers. Comm.). As can be seen Yemen reported some significant figures to Fishstat +. Oman and Somalia are the two other main shark producers in the area. Oman reported landings of 3 891 MT in the year 2000 (with a declining pattern from the 8 313 MT in 1988) but no data on trade. Somalia did not provide any data on landings or trade. These omissions may be due to the absence of reporting of shark bycatch, or by inclusion of sharks within looser groupings, such as “marine fish nei”.

Conclusions

The countries[46] proposing the listing of *Cetorhinus maximus* and *Rhincodon typus* in Appendix II to the CITES Convention were motivated by the high level of utilization of the species, their vulnerability to exploitation and the lack of a global legislative framework for their conservation and sustainable exploitation (CITES 2002a; CITES 2002b). This situation is now common to many chondrichthyan species with 79 of them appearing in the IUCN Red List of Threatened Species (IUCN SSC 2000).

Biological and population dynamics data on sharks are very limited, therefore the conservation status of shark species is very difficult to assess with a reasonable degree of accuracy. In addition, available catch and trade data, such as those provided by Fishstat +, do not allow for a detailed analysis of patterns of exploitation of shark species.

FAO data and relevant literature may however justify a series of conclusions on the importance of shark fisheries for developing countries, as presented below.

The developing countries' landings of chondrichthyans climbed from 76 000 MT in 1950 to 575 031 MT in 2000 for an estimated value of US$515 million. According to Fishstat + data, their trade in shark products generated foreign exchange revenues of US$134.7 million in 2000, of which:

- US$55 million to China;
- US$13.86 million to Yemen;
- US$ 13.3 million to Indonesia;
- US$13.1 million to Costa Rica;
- US$4.3 million to Senegal.

Spain and Japan, the only developed countries analysed in this paper, generated revenues of US$42.7 million and circa US$20 million respectively from the export of shark products. Furthermore, world export of shark fins, the most expensive sharked based product, generated export revenues of US$101.1 million to developing countries.

Despite giving a general idea of the increasing importance of shark fisheries worldwide, these socio-economic data and estimates are rather under-representative of the full extent of the sector. This is due to the high volume of unreported shark bycatch which is nevertheless processed and traded both domestically and internationally.

[46] United Kingdom (*Cetorhinus maximus*), India, the Philippines and Madagascar (*Rhincodon typus*).

Table 2: Economic and social aspects of the shark fishery in the case countries (2000 data, except when explicitly stated, source FAO, except when explicitly stated).

Country	Estimated employment (fishers)	Landings (MT)	Export quantity (MT)	Export value (US$)
People's Republic of China	1 500	10 to 15 000 (based upon collection of data by INFOYU in 1998 and 1999)	2 237	55 020 000
Costa Rica	N/A	5 453	3 987	13 125 000
Indonesia	N/A	111 973	1 313	13 280 000
Japan	N/A	33 072	3 818	19 890 000
Senegal	N/A	10 757	37	4 331 000
Spain	N/A	77 269	16 539	42 675 000
Yemen	N/A	5 100	371 (est.)	13 855 000

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Patagonian toothfish (*Dissostichus eleginoides*)

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Consolidated Fisheries Ltd

Background

The Patagonian toothfish or Chilean seabass (*Dissostichus eleginoides*) is a large, demersal fish species growing to up to 2 metres in length and living for up to 50 years. It becomes sexually mature when it reaches 70 to 95 cm, e.g. from 6 to 9 years of age. The species has relatively low fecundity, ranging from 48 000 to 500 000 eggs per fish per spawning season. Its resilience is very low, the minimum population doubling time being 4.5 to 14 years. It inhabits temperate deep water (28º to 55º South), from 50 down to 2 500-3 000 metres (Fishbase 2003).

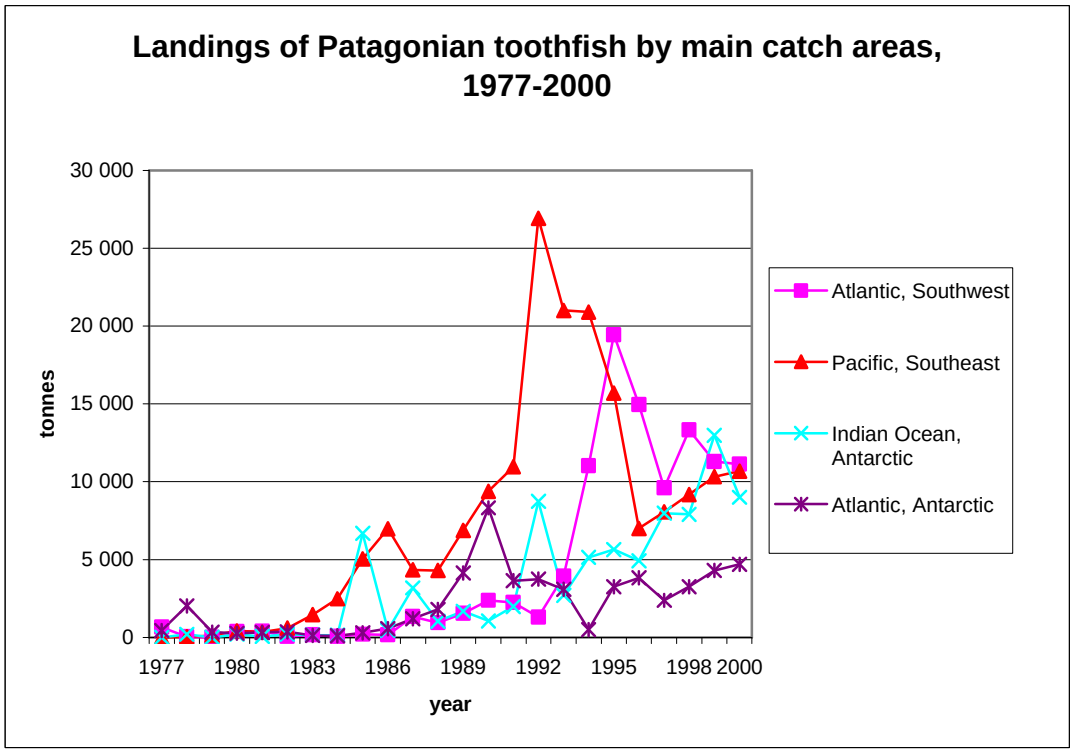
The Patagonian toothfish occurs in the Exclusive Economic Zones (EEZ) of southern Chile and Argentina, and sub-Antarctic islands under the sovereignty of Australia, France, New Zealand, South Africa and the United Kingdom. These areas correspond to the following FAO major fishing areas:

- Atlantic, Southwest;
- Pacific, Southeast;
- Indian Ocean, Antarctic;
- Atlantic, Antarctic;
- Indian Ocean, Western;
- Atlantic, Southeast;
- Pacific, Antarctic;
- Pacific, Southwest.

The main catch areas of the Patagonian toothfish are reported in Figure 1. The most important being the Atlantic Southwest which produced 11 122 MT in 2000, followed by the Southeast Pacific, which generated 10 676 MT. Other important catch areas are the Indian Ocean Antarctic with 8 996 MT followed by the Atlantic Antarctic with 4 693 MT (Fishstat + data).

According to Fishstat + data (2000), the main fishing nations in the Atlantic Southwest are Argentina (7 771 MT) and the Republic of Korea (1 292 MT); in the Pacific Southeast area, Chile (10 676 MT); and in the Indian Ocean Antarctic area, France (5 503 MT) and Australia (2 579 MT). In the Atlantic Antarctic area the main fishing nations are Chile (1 609 MT), the United Kingdom (1 221 MT) and Uruguay (767 MT); in the Western Indian Ocean area it is Uruguay (1 628 MT).

Figure 1: Landings of Dissostichus eleginoides by main catch area, 1977-2000.



The long life span and late sexual maturity of the Patagonian toothfish make it highly vulnerable to overfishing. The resource has been experiencing high levels of exploitation due to high international demand for what is considered to be luxury seafood in the USA, the Japan and the EU. Figure 1 shows that landings of Patagonian toothfish in its main catch areas, experienced their peaks in 1992 (Pacific Southeast, 26 918 MT) and 1995 (Atlantic Southwest, 19 442 MT) to decline in the following years.

Threats to *Dissostichus eleginoides* are enhanced by IUU, the extent of which has been estimated in Figure 4. The fishery has been subject to an International Catch Documentation Scheme (CDS), set up by CCAMLR. The scheme, included in Conservation Measure 170/XX, became binding for all CCAMLR Members on 7 May 2000. Its aim is to track the landings and trade flows of Patagonian toothfish caught in the Convention area and adjacent waters. This enables CCAMLR to identify the origin of toothfish entering the markets of all Parties to the Scheme, and help determine whether toothfish taken in the Convention Area were caught in a manner consistent with CCAMLR's conservation measures. These include exploratory catch quotas, control of fishing effort and other management measures (Lack and Sant 2001)[47].

[47] In June 2002 (CITES 2002), Australia proposed the inclusion of both the Patagonian toothfish and the Antarctic toothfish *Dissostichus mawsonii* in Appendix II to CITES. The proposal was, however, withdrawn by the proponent country during CoP 12.

The Patagonian toothfish industry

The Patagonian toothfish fishery represents the most lucrative fishery in Antarctic and Subantarctic waters. Patagonian toothfish is marketed under a variety of other names, including *bacalao de produndidad* (Chile), butterfish (Mauritius), Chilean sea bass (the United States and Canada), *merluza negra* (Argentina), *mero* (Japan) and *ròbalo* (Spain). An indicative price for Chilean and Peruvian product, frozen, H&G, ex-warehouse Miami, USA is US$5.75 per lb. (INFOFISH 2003).

The NGO ISOFISH (International Southern Oceans Longline Fisheries Information Clearing House)[48] listed 231 companies engaged in the fishery on its web page. Some key operators are:

Argenova, an Argentine company belonging to the Spanish group **Pescanova**, started its operations in 1988 and was one of the first companies engaged in fishing Patagonian toothfish, marketed as Sea bass, in 1989. The company operates 15 vessels, mostly jiggers, long liners and trawlers.

ASC South America, an Argentine company financed with Norwegian capital. It has three longliners operating in the fishery (Josupeit, Pers. Comm.)

Austral Fisheries is the main licensed toothfish company in Australia. In August 1998, its vessel "the Austral Leader" became the first to be licensed to supply toothfish to the United States' market. Austral Fisheries is one of the main sponsors of ISOFISH.

Consolidated Fisheries Limited (Ltd.) was established in 1994 as a joint initiative by the Falkland Islands/*Islas Malvinas* Government and Development Corporation and a consortium of local fishing companies. Currently, Consolidated Fisheries Ltd. is one of the most important fishing companies in the Falkland Islands/*Islas Malvinas* and makes an important contribution to the local economy.

Pesca Chile is the Chilean branch of the Spanish group **Pescanova**. Pesca Chile owns and operates a fleet of 12 fishing vessels. Pesca Chile's landings are processed in its own plants before being distributed to Japan, Spain, and the USA.

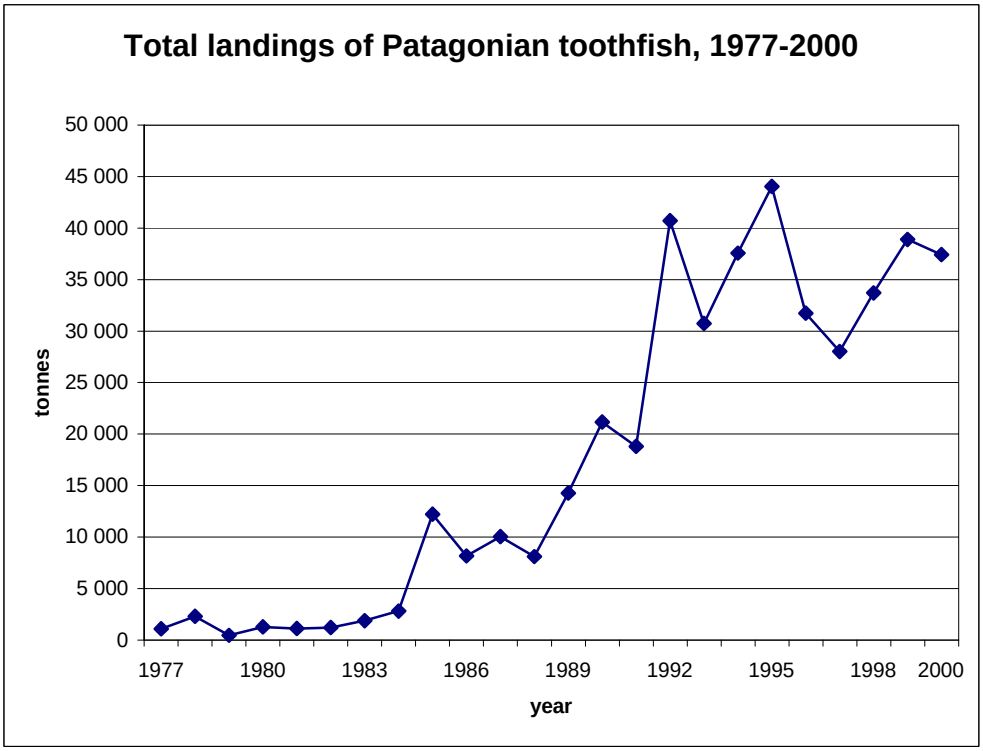
Kailis and France is an Australian trawler authorized to catch Patagonian toothfish off the Macquarie Island, south of Tasmania.

Other important companies include South African **Bato Star**, **Irvin and Johnson** and **Suidor.**

[48] ISOFISH is a non-governmental joint venture between conservation organizations and licensed fishing companies. It became operational at the beginning of January 1998. The organization focuses on collecting, collating, analysing, verifying and disseminating data, information and reports on longline fishing in the southern oceans. Through this work, ISOFISH assists governments in preventing IUU fishing and the incidental mortality of albatrosses and other seabirds in these fisheries. Its web page is http://www.isofish.org.au/companies/index.htm

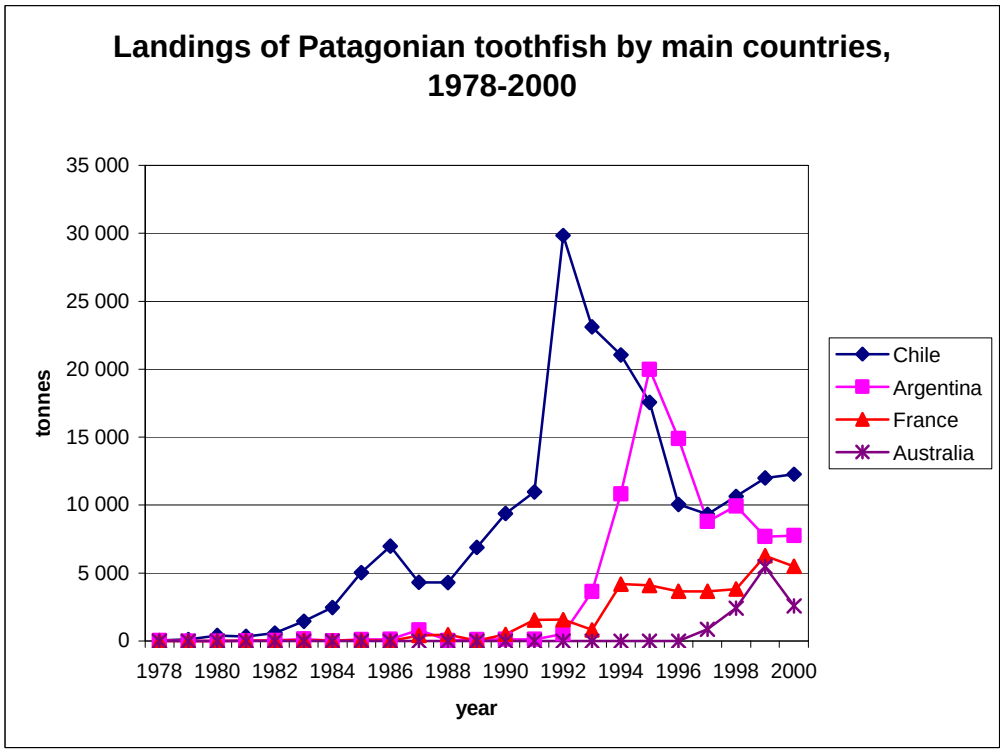
It is suggested that many industrial fishing companies, including large-scale operators, have been or (presumably) may still be engaged in IUU fishing of Patagonian toothfish. According to FAO Fishstat +, landings increased from 1 096 MT in 1977 to 37 435 MT in 2000. In 1995, they reached a record 44 047 MT (Figure 2).

Figure 2: Total landings of Dissostichus eleginoides, 1977-2000.



The fluctuations in landings in the nineties may be better understood if total landings are disaggregated into figures for the main producing countries. In fact Chile increased its toothfish production from 10 969 MT in 1991 to 29 838 MT in 1992. It then declined to 9 334 MT in 1997. Landings then increased again to reach 12 285 MT in 2000 (Figure 3). Argentine landings also increased from 10 840 MT in 1994 to 19 996 MT in 1995, then declined in the subsequent years to stablize at 7 771 MT in 2000 (Figure 3).

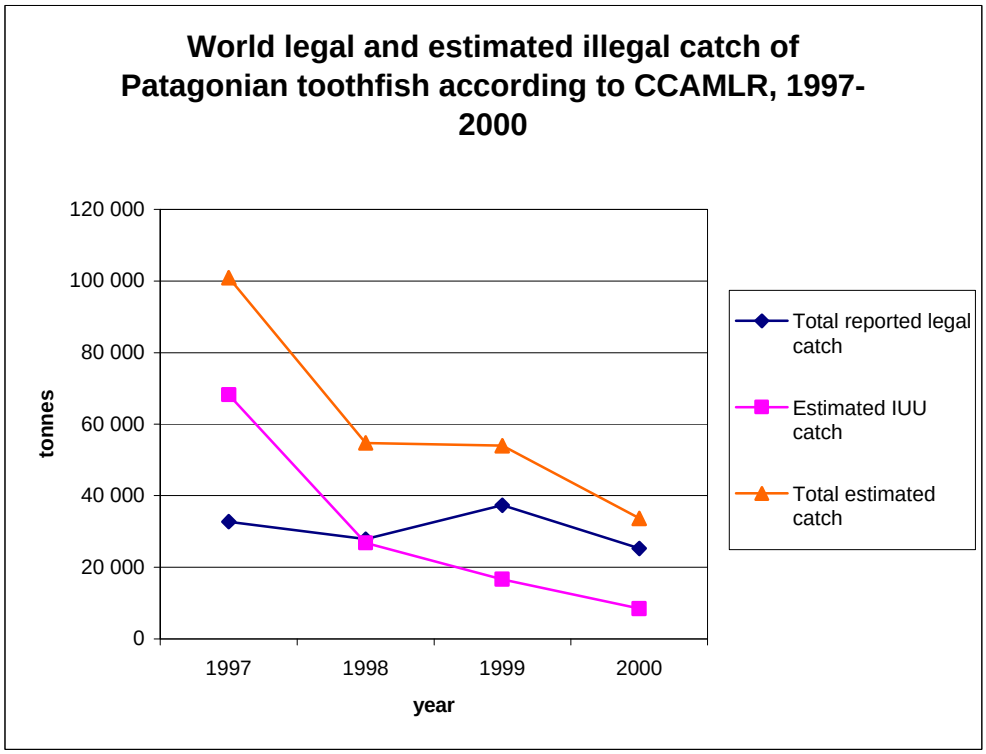
Figure 3: Landings of Dissostichus eleginoides by main countries, 1978-2000.



CCAMLR shows separate figures for legal and illegal catches of Patagonian toothfish over the period 1996-2000 (Lack and Sant 2001). The legal, reported catch declined from 32 736 MT in 1996/97 to 25 242 MT in 1999/2000. IUU fishing of Patagonian toothfish is estimated to have fallen from 68 234 MT in 1996/97 to 8 418 MT in 1999/2000. Total catch (legal and illegal) is estimated to have fallen from 100 970 MT in 1996/97 to 33 360 MT in 1999/00 (Figure 4).

According to CCAMLR, the implementation of the CDS is thought to have reduced IUU catch of Patagonian toothfish to zero in states that are signatories to the convention and to have produced an associated reduction of IUU catch by non-members. However, the NGO TRAFFIC suggests that IUU fishing may have been relocated rather than eliminated (Lack and Sant 2001).

Figure 4: Total legal and illegal landings of Dissostichus eleginoides according to CCAMLR, 1997-2000.

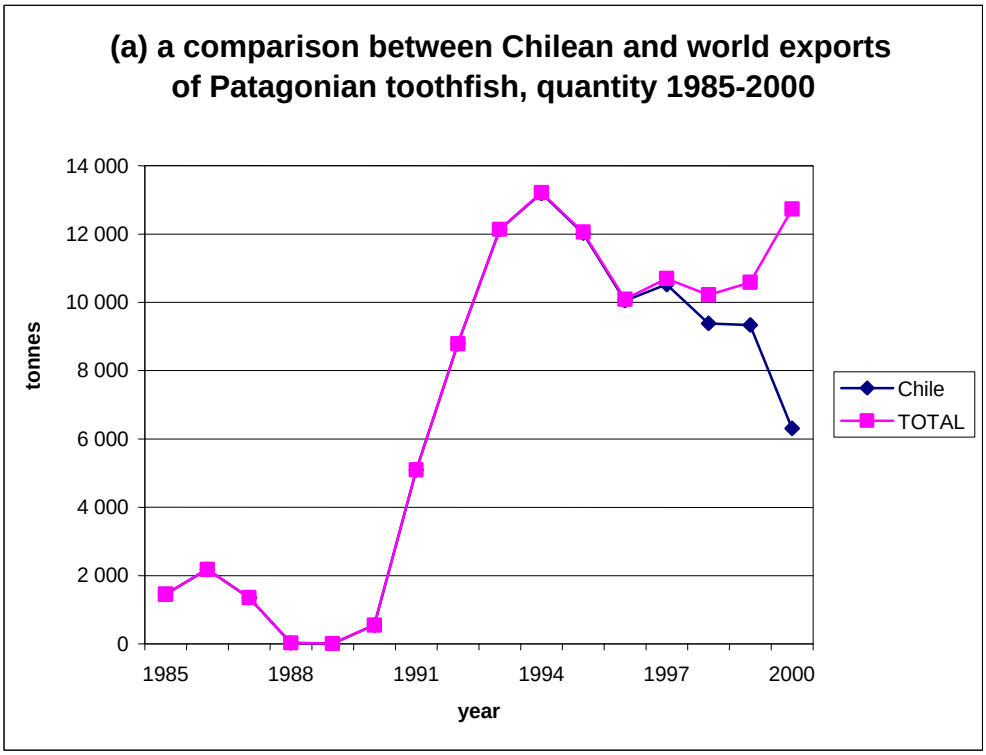


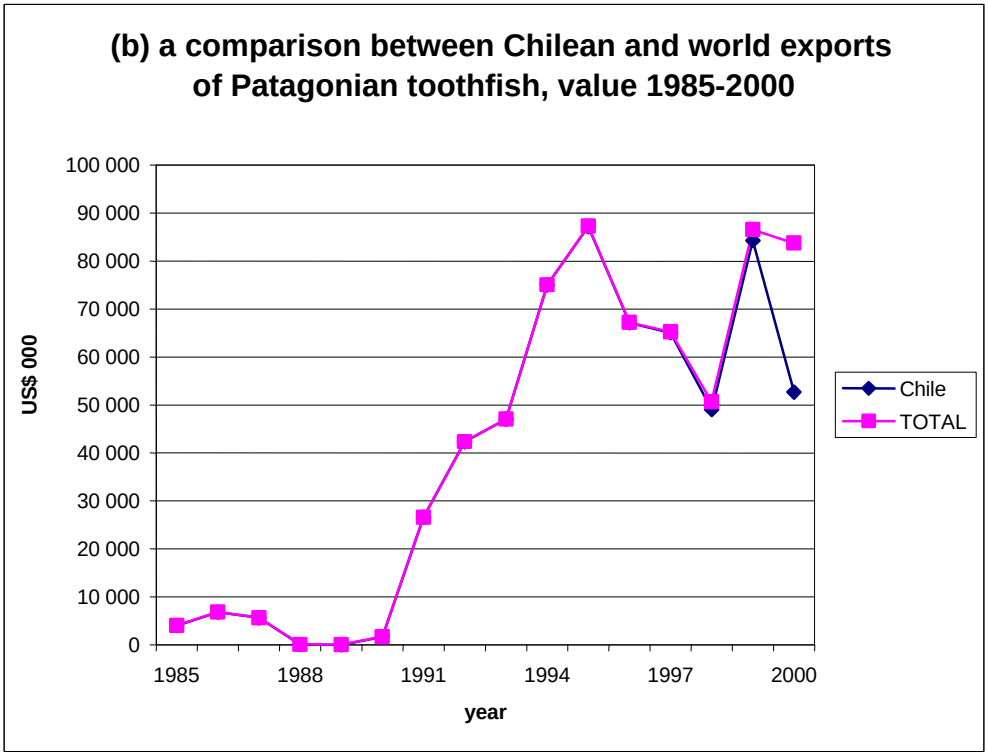
Concerning trade, Fishstat + provides data on toothfish exports[49] and imports in two forms: whole, frozen, and frozen fillets. Exports increased from 1 449 MT in 1985, for a value of US$4 million, to 12 727 MT in 2000 for a value of some US$83.76 million. In 1994, they reached a peak in quantity, with 13 214 MT exported, worth US$75 million and in 1995, in value, with catches of 12 060 MT being sold for US$87.2 million. The main exporter has always been Chile, who accounted for almost 100 percent of toothfish exports, both in terms of quantity and value, until 1996. On average, Chilean exports accounted for 95.4 percent of world exports in terms of quantity over the period 1985-2000, and 97.3 percent in value[50] (Figure 5 [a] and [b]).

[49] In order to facilitate the reading of the study, the term "export" has been intended to include "re-export" as well.

[50] This is mainly due, however, to the lack of data provided to Fishstat + by other main *Dissostichus* exporting nations, such as Argentina.

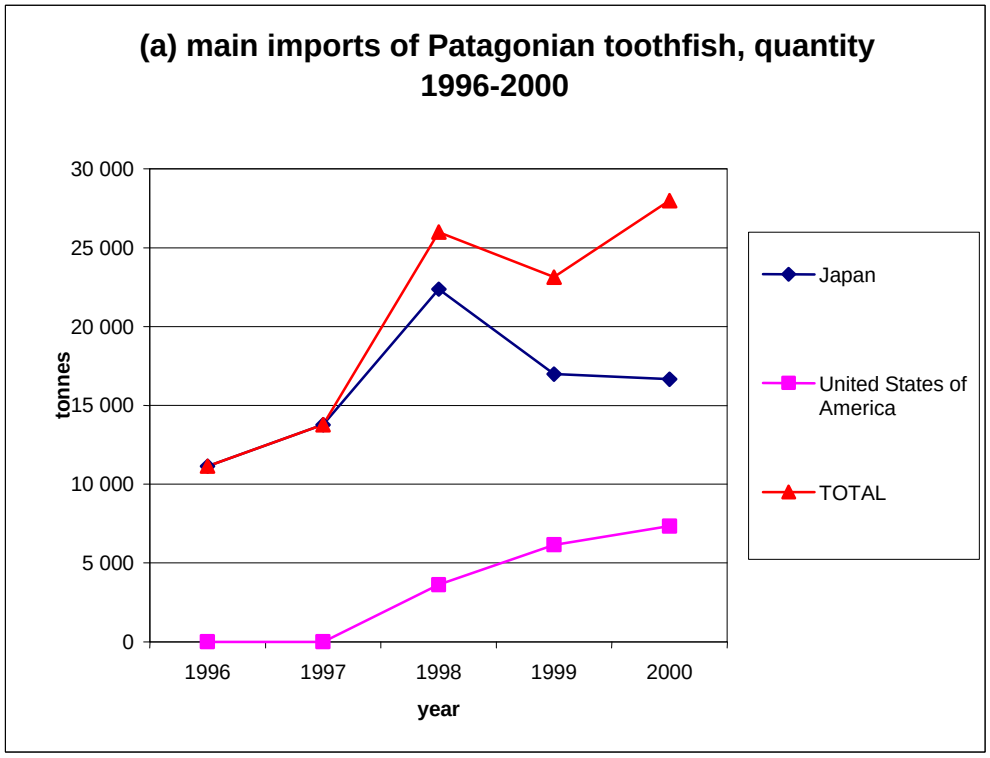
Figure 5 (a) and (b): Chilean and world exports of toothfish, 1985-2000.

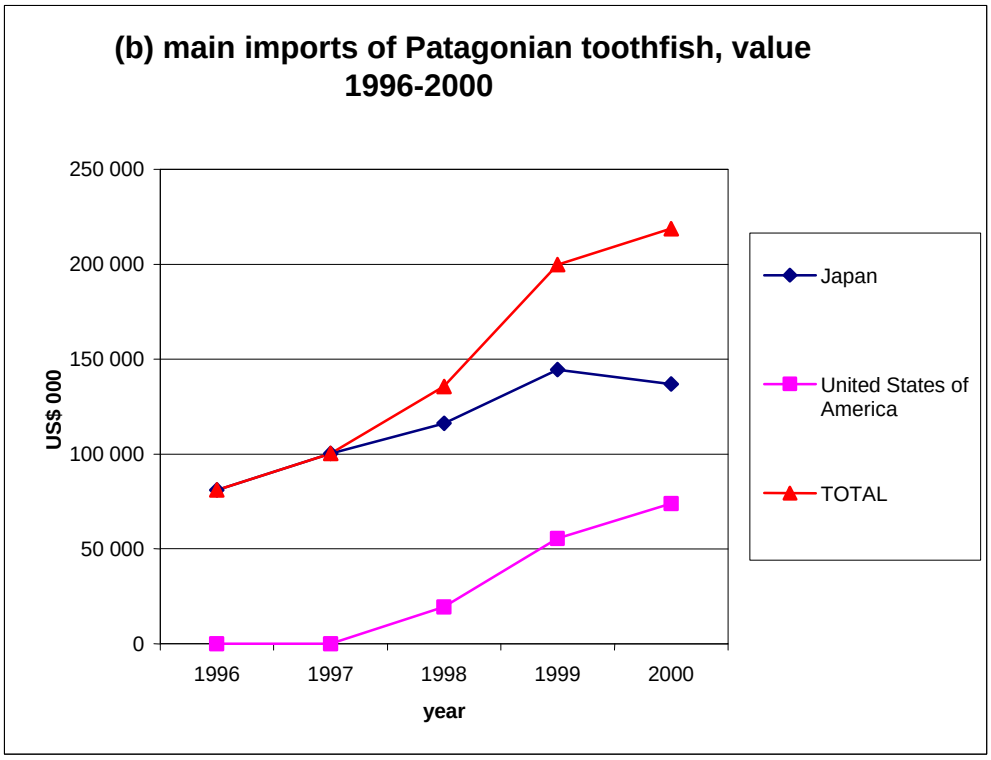




Fishstat + data on toothfish imports are available from 1996 only, and show an increase from 11 141 MT in 1996, corresponding to US$81 million, to 27 976 MT in 2000, corresponding to US$218.8 million. Main importers are Japan and the USA (Figure 6 [a] and [b]). These values do not correspond to those on exports provided by the same database.

Figure 6 (a) and (b): Main imports of toothfish, 1996-2000.





A different set of data is provided by EUROSTAT. According this database the EU exported 3 668 MT of frozen toothfish (*Dissostichus* spp.) to third countries, equivalent to €26.15 million in 2000 and 28 MT of frozen fillets worth €61 000. It also imported 830 MT of frozen fish for a value of €1.9 million, and 224 MT of frozen fillets worth €639 000 (EUROSTAT data).

The range states

This section of the paper aims to assess the economic and social value of toothfish fisheries for range states. States have been selected according to the relative importance of the fishery and trade in toothfish products for their economies. The main data sources used for general information are the UN Statistics Division, FAO and the World Bank. The main source for fishery landings, trade and employment data is FAO, which relies on data provided by its Member States and Observers.

Argentina

Background data and estimates:

Status: upper-middle income country (World Bank 2002a)
Population: 37.5 million in 2001 (World Bank 2002a)
People living below the poverty line: 18 percent of population in 1995-2001 (World Bank 2002a)
Child malnutrition: 5 percent of children below five years of age in 1995-2001 (World Bank 2002a)
Mean GDP per capita: US$7 678 in 2000 (UN Statistics Division 2002)
Total GDP: US$283.1 billion in 2000 and US$268.5 billion in 2001 (World Bank 2002a)
Labour force: 23 million persons according to 1999 estimates (World Bank 2001)

Fishery data and estimates

Social:

Number of fishers: 13 787 (est.) in 2000, of which 1 467 (est.) inland fishers and 12 320 (est.) marine fishers nei, the latter data repeated up to 2000 (FAO FIDI data)
Full-time: 12 320 in 1996, data repeated up to 2000 (FAO FIDI data)
Unspecified: an estimated 1 467 fishers (FAO FIDI data)
Estimated employment in processing and marketing: 12 000 persons in 1998 (FAO 2001)
Note: gender breakdown not provided by references

Economic:

Fisheries GDP: US$500 million in 2000 (FAO 2001)
Total landings: 917 728 MT in 2000 (Fishstat + data)
Marine landings: 890 728 MT in 2000 (Fishstat + data)
Aquaculture production and value: 1 784 MT in 2000, corresponding to US$10 430 000 (Fishstat + data)
Export quantity: 493 680 MT in 2000 (Fishstat + data)
Export value: US$747 630 000 in 2000 (Fishstat + data)

Dissostichus is an important commercial species for Argentina. It is targeted by large industrial fishing companies such as **Argenova,** using bottom trawls and longlines. 54.2 percent of catch is landed in Ushuaia, 17.3 percent in Puerto Madryn and 15.8 percent in Puerto Deseado (Josupeit, Pers. Comm.). The main product forms are fillets and whole fish headed and gutted (H&G), frozen on board (Josupeit, Pers. Comm.). The *Ministerio de Economía, Secretaria de Agricultura, Ganadería Pesca y Alimentación* (SAGPyA) is

responsible for implementing the CCAMLR conservation policy for Patagonian toothfish (SAGPyA 2002).

Fishstat + data suggest that following neglible catches reported in the period 1978-1992, landings started to increase in the following years, due to enhanced market demand and the need for the Argentine fishery industry to find alternative sources of income, following the steady decline in Argentine hake (*Merluccius hubbsi*) landings (see Figure 8). In 1995, Patagonian toothfish landings reached a peak of 19 996 MT, equivalent to 1.7 percent of total Argentine landings for that year (1 162 324 MT). Catches then declined steadily, reaching 7 702 MT in 1999 and 7 771 MT in 2000 (Figure 3). The quasi totality of Argentine production comes from the Atlantic Southwest (Figure 7). Landings of toothfish made up some 0.8 percent of total catch in 2000.

By comparing FAO data on employment in fisheries (FAO FIDI data) and 2000 data on marine landings (Fishstat + data), one can estimate that 110 fishers depend on the Patagonian toothfish fishery in Argentina.

Figure 7: Landings of Dissostichus eleginoides in Argentina by production area, 1978-2000.

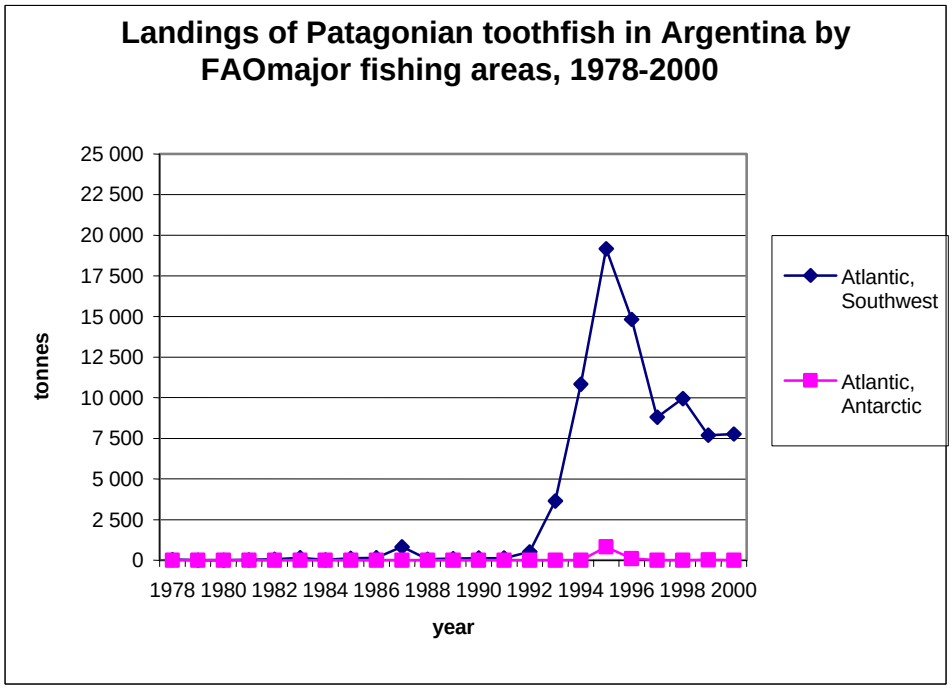
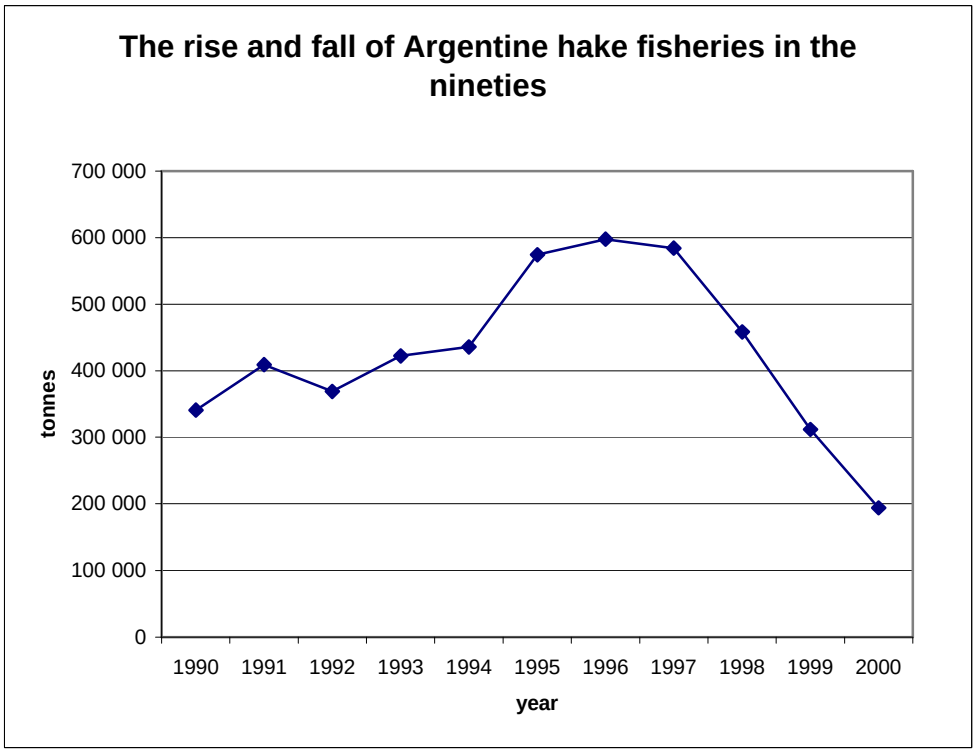


Figure 8: The rise and fall of the Argentine hake fisheries, 1990-2000.



Fishstat + does not provide data on toothfish exports from Argentina. However, its importance can be drawn from other data sources.

EU imports of frozen toothfish from Argentina totalled 117 MT in 2000, equivalent to €213 000. According to the same source, EU imports of frozen fillets totalled 4 MT in 2000, corresponding to €9 000 (GLOBEFISH databank).

According to the Japan Marine Products Importers Association, Japanese imports of frozen toothfish from Argentina increased from 745 MT in 1998, equivalent to some US$3.2 million to 1 217 MT in 2000, equivalent to US$5.8 million. Imports of frozen fillets decreased from 1 644 MT, equivalent to some some US$10.4 million, in 1996 to 704 MT in 2000, equivalent to circa US$5.7 million (GLOBEFISH databank).

United States' imports of fresh whole toothfish from Argentina totalled 24.26 MT in 2000 whilst imports of frozen whole fish decreased from 2 292 MT in 1998 to 1 246 MT. At the same time, imports of frozen fillets increased from 39.4 MT in 1998 to 461.7 MT in 2000 (GLOBEFISH databank).

The Dissostichus fishery in the Falkland Islands/Islas Malvinas[51]

Background data and estimates

Population: 2 967 (est.) in 2002 (CIA 2002)
Mean GDP per capita: US$19 000 in 2000 (CIA 2002)
Total GDP: US$52 million (est.) in 2000 (CIA 2002)
Labour force: 1 100 persons (est.), of which agriculture constitutes 95 percent, mostly engaged in fishing and, to a lesser extent, shepherding (CIA 2002)

Fishery data and estimates

Social:

Number of fishers: 808 in 2000, of which 799 marine deep-sea fishers and 9 marine coastal fishers (FAO FIDI data)
Full-time: 802 in 2000 (FAO FIDI data)
Occasional: 6 in 2000 (FAO FIDI data)
Estimated employment in processing and marketing: N/A
Note: gender breakdown not provided by references

Economic:

Fisheries GDP: US$55 million in 2000 (Fishstat + data)
Total landings: 62 928 MT in 2000 (Fishstat + data)
Total marine landings: 62 927 MT in 2000 (Fishstat + data)
Aquaculture production and value: N/A
Export quantity: 62 928 MT in 2000 (Fishstat + data)
Export value: US$55 020 000 in 2000 (Fishstat + data)

The *Dissostichus* fishery is an important fisheries in the Falkland Islands/*Islas Malvinas*. Catches of Patagonian toothfish are entirely exported, in frozen form (Fishstat + data). The only company which owns licenses to fish Patagonian toothfish is Consolidated Fisheries Ltd., which employs 100 people comprising fishers and office staff, and two vessels (Consolidated Fisheries, Pers. Comm.).

Landings for the period 1988-1993 were too marginal to be taken into consideration as a separate entry in Fishstat +. Landings (and export quantity) of this fishery then increased from 18 MT in 1994 to 1 113 MT in 1999, before declining slightly to 927 MT in 2000 (Figure 9). The export value of the fishery, increased from US$17 000 in 1994 to more than US$1 million in 1999, then fell slightly to US$890 000 in 2000 (Figure 10).

[51] A dispute exists between the Governments of Argentina and of the United Kingdom of Great Britain and Northern Ireland concerning sovereignty over the Falkland Islands/*Islas Malvinas*.

Figure 9: Landings and export quantity of Dissostichus eleginoides in the Falkland Islands/Islas Malvinas, 1994-2000.

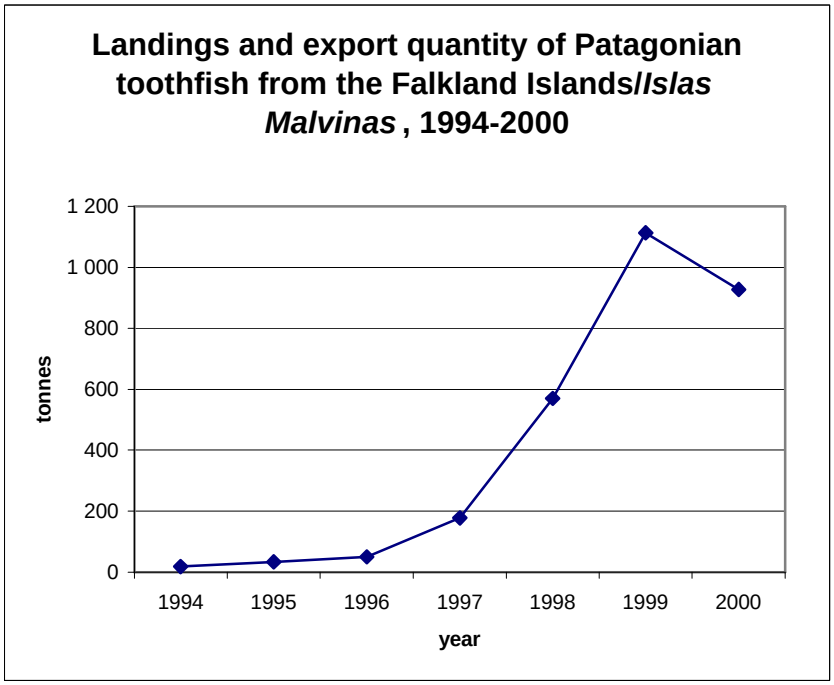
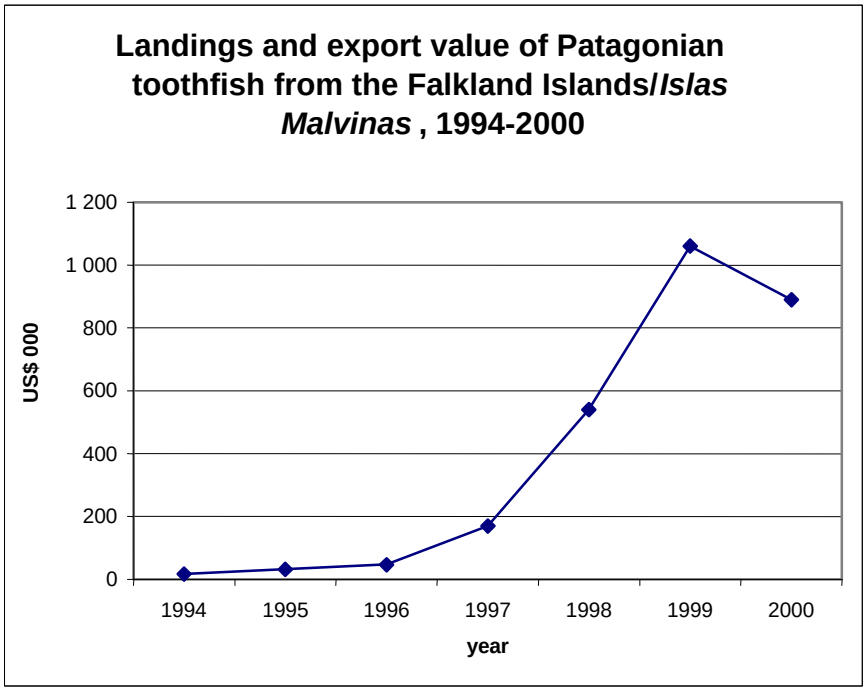


Figure 10: Landings and export value of Dissostichus eleginoides in the Falkland Islands/Islas Malvinas, 1994-2000.



The Patagonian toothfish fishery accounted for more than 1 percent of total landings and value of the Falkland Islands/*Islas Malvinas* fishery over the period 1994-2000.

Chile

Background data and estimates

Status: upper-middle income country (World Bank 2002b)
Population: 15.4 million in 2001 (World Bank 2002b)
People living below the poverty line: 21 percent of population in 1995-2001 (World Bank 2002b)
Child malnutrition: 1 percent of children below five years of age in 1995-2001 (World Bank 2002b)
Mean GDP per capita: US$4 669 in 2000 (UN Statistical Services 2002)
Total GDP: US$75.5 billion in 2000 and US$66.5 billion in 2001 (World Bank 2002b)
Labour force: 10 million persons according to 1999 estimates (World Bank 2001)

Fishery data and estimates

Social:

Number of fishers: 91 402 in 2000, of which 11 850 (est.) aquaculture farmers (data repeated from 1998), 11 299 inland fishers (data repeated from 1986), 68 253 marine fishers (FAO FIDI data).
Full-time: 79 552 in 2000 (FAO FIDI data)
Unspecified: an estimated 11 850 in 2000 (FAO FIDI data)

Number of marine fishers: 68 253, of which 50 873 marine coastal fishers and 17 380 (est.) deep-sea fishers, the latter data being repeated from 1998 (FAO FIDI data)
Full time: 68 253 in 2000 (FAO FIDI data)

Estimated employment in the secondary sector: 27 000 persons in 1998 (FAO 2000)
Note: gender breakdown not provided by references

Economic:

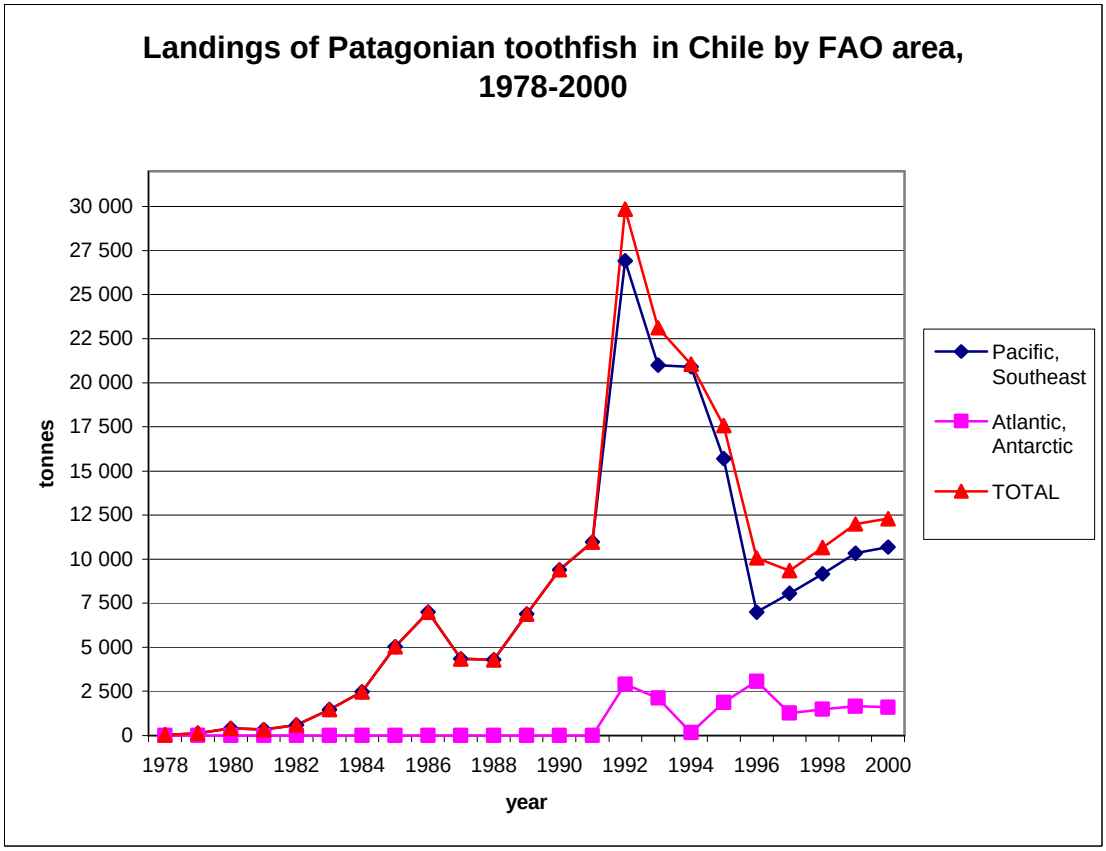
Fisheries GDP: US$1 104 million in 2000 (FAO 2000)
Total and marine landings: 4 547 536 MT in 2000 (Fishstat + data)
Aquaculture production and value: 425 058 MT in 2000, corresponding to US$1 266 241 200 (Fishstat + data)
Export quantity: 1 069 696 MT in 2000 (Fishstat + data)
Export value: US$1 784 560 000 in 2000 (Fishstat + data)

Chile is the world's largest producer of Patagonian toothfish (Figure 3). The principal landings come from the Pacific Southeast (Figure 11). It is a highly commercial resource

mostly exploited by industrial fishing companies such as **Pesca Chile**. Based on Fishstat + data on landings for 2000 and FAO FIDI data on employment in marine fisheries, it is estimated that 200 fishers depend on this fishery.

Landings of toothfish from the Pacific Southeast increased steadily from 37 MT in 1978 to 26 918 in 1992. The catch then started to decline, reaching 6 993 MT in 1996. Eventually it recovered, reaching 10 676 MT in 2000. Landings from the Atlantic Antarctic averaged some 1 800 MT per year over the 1992 to 2000 period (Figures 3 and 11). Total landings of toothfish rose to a high of 29 838 MT in 1992, then declined to 9 334 MT in 1997. They recovered to 12 285 MT in 2000 (Figures 3 and 11).

Figure 11: Landings of Patagonian toothfish in Chile by production area, 1978-2000.



Chilean exports accounted for an average of 95.4 percent of world exports of toothfish over the period 1985-2000 in terms of quantity and 97.3 percent in value (Figure 5 [a] and [b]) increasing steadily from US$4 million in 1985 to some US$87.2 million in 1995, declining to US$49 million in 1998, before recovering to US$84.2 million in 1999. In 2000 however they dropped to US$52.7 million (Figure 5 [b]). In terms of quantity, during the period 1994 – 2000, exports declined steadily, from 13 196 MT to 6 302 MT (Figure 5 [a]).

Conclusions

The international regime for Patagonian toothfish is a politically sensitive issue, with several controversial matters associated with it, including:

- longline fishing and bycatch;
- the relation between fishing corporations and emerging economies; and
- the sovereignty over Antarctic resources.

In 2000, Argentine exports of toothfish to Japan alone totalled more than US$11.5 million. Assuming similar unit prices, imports to the United States would be approaching a value of US$10.0 million. Landings of Patagonian toothfish are concentrated in the Patagonia area, where 110 fishers are estimated to be dependant on the fishery.

The Falkland Islands/*Islas Malvinas*, toothfish fishery employs 100 fishers and office workers and exports its total production. These exports account for around 1 percent of the Islands' GDP.

Chile exported 63 percent of its toothfish landings during the period 1990-2000. These exports represent an important source of foreign exchange averaging more than US$54 million per year during that period. It is estimated that 200 fishers depend on the toothfish fishery in Chile.

Other countries which benefit from *Dissostichus* fisheries in terms of income and employment opportunities are Uruguay and the Republic of Korea. Uruguay landed 3 273 MT and the Republic of Korea 2 579 MT in 2000 (Fishstat + data). However, neither country provided Fishstat + with trade data on toothfish.

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