SEAFISH
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Responsible Sourcing Guide: Tuna

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Thunnus albacares

IMAGE © Scandinavian Fishing Year Book

Tuna (1) are amongst the world's most lucrative and popular commercial fish with approximately four million tonnes (t) of tuna caught around the world each year. In the UK, we consume around 65,000 tonnes (t) of tuna product each year.

The key tuna species with annual catches are: skipjack tuna (*Katsuwonus pelamis*), 2.5 million tonnes; yellowfin tuna (*Thunnus albacares*), 1.1 million tonnes; bigeye tuna (*Thunnus obesus*), 0.35 million tonnes; albacore (*Thunnus alalunga*), 0.25 million tonnes; bluefin tuna (Atlantic bluefin *Thunnus thynnus*), Pacific bluefin (*Thunnus orentalis*), southern bluefin (*Thunnus maccoyii*) totalling 0.034 million tonnes (2010 ref 3).

The majority of tuna sold in the UK is yellowfin and skipjack tuna, from the Indian and Pacific Oceans. Fresh and frozen tuna was around 3% of the UK tuna market in 2010. Tuna stocks are highly migratory and range over large areas of ocean, passing through many nations' Exclusive Economic Zones (EEZs). Assessment and management requires international collaboration. Tuna stocks are managed under five international management commissions constituted under UN fishery conventions. Despite these international conventions, unregulated fishing does occur.

Skipjack tuna is highly productive and not prone to overfishing. Yellowfin, albacore and bigeye tuna are more vulnerable to overfishing. Bluefin tuna is a lucrative commercial species with very high prices paid on Japanese markets. However, all four stocks of this species are heavily overfished, with rebuilding plans aimed at recovering these stocks over decades.

The purpose of this guide is to outline the status of international tuna stocks and describe some of the measures being taken to protect them.

BUYERS' TOP TIPS

Know your tuna stocks

Tuna are managed across large ocean areas called 'management stocks' of each species. Find out the management stock and management commission for the area from which your tuna is sourced (see Table 1 p3).

Avoid illegally-caught tuna

Illegal, unregulated and unreported (IUU) fishing is a serious management problem for some tuna. It is possible to find out the name of the vessel or groups of vessels from which the fish was landed and batched and compare it with those on the appropriate management body's website (2). These sources of information are updated weekly but smaller coastal states may not have registered all vessels with the regional management body. In the meantime develop a certain level of trust in the supplier. Vessels under 24m and artisanal (local inshore) vessels may not appear on these lists, but must still report catches.

Understand environmental effects of tuna fishing

Some methods of tuna fishing have potentially serious effects on some species of seabird, dolphin and turtle, caught as unwanted by-catch. For some of these effects there are mitigating measures available. Buyers should have an outline understanding and know which measures are required in their suppliers' Fisheries (see p 7).

Status of tuna stocks

All tuna stocks are oceanic, with one or two stocks per species in each ocean. They migrate over vast distances following the oceanic circulation patterns, feeding on the relatively sparse productivity of deep sea ecosystems.

Tuna stocks are assessed every one to five years. The stocks are so wide-ranging that they demand considerable organisation to achieve the basic functions of stock assessment, such as data collation; this is aided by the existence of the regional management commissions (2). The assessors are usually groups of scientists brought together in working groups, to review the data and run the assessment models. Several models are usually used on each stock, depending on the availability of data.

The outcomes of this modelling process describes the status of the stocks in relation to the maximum sustainable yield (MSY) and other indicators of the stock status, such as spawning stock levels. Figure 1 is an example of a "Kobe plot"; (named after the city of Kobe in Japan) which describes the output of a model. Each location on this plot represents a description of the fish stock in terms or fishing mortality F (rate of removal of fish by fishing or exploitation rate) as a proportion of fishing mortality at MSY (F/FMSY) and Spawning Stock Biomass (SSB) or B as a proportion of Spawning Stock Biomass at MSY BMSY (B/BMSY). The intersection of the lines is the MSY level. The trajectory of the stock is shown year by year; each circle represents the stock status during one year.

Tuna stocks can be classified as:

1. Green area: Stocks with a viable spawning stock biomass (SSB) exploited at a rate (fishing mortality) which yields at or below MSY. Those stocks exploited at a rate below that which yields MSY, may offer scope for more fishing.
2. Orange area: Stocks able to reproduce and provide a yield to the fishery, but the stock is exploited at a rate above that which yields MSY.
3. Yellow area: Stocks with a SSB below that capable of sustaining an optimum yield to the fishery.
4. Red Area: Fishing mortality too high and SSB too low to achieve MSY.

For optimum fishing at MSY for stocks in the orange yellow and particularly red areas, corrective action is required to improve exploitation and reduce the risk of stock depletion; that is fishing stocks to a level which reproduction is impaired.

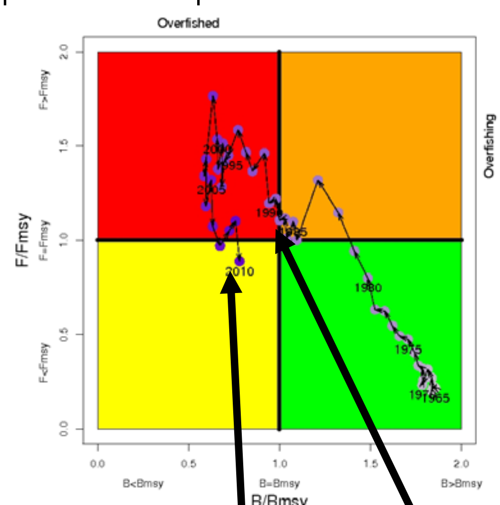


Figure 1 Kobe plot for Atlantic Ocean yellowfin tuna; Maximum Sustained Yield is here, stock location at 2010 is here.

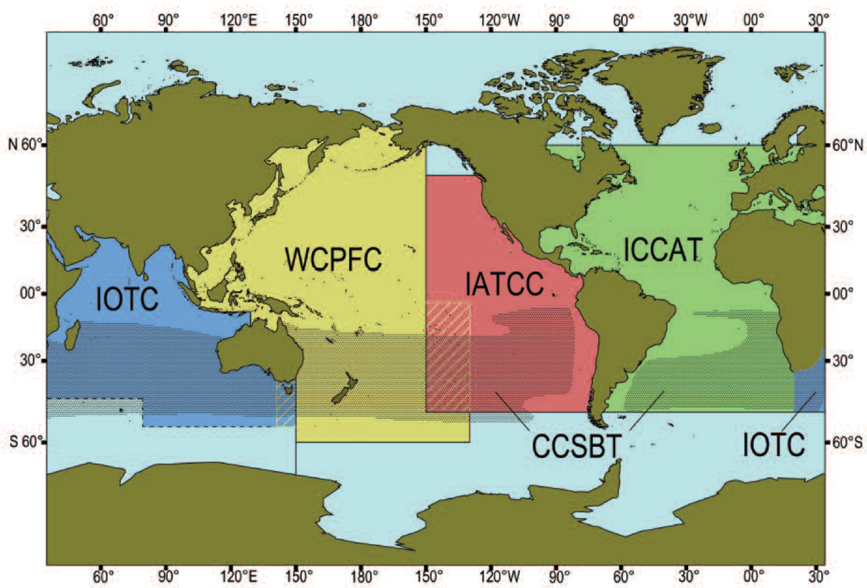
Table 1 Tuna stocks status; keyed by colour to Fig.1 (col1) and management commission to Fig. 2 (col3)

Species and stock	Catches (t) From FAO for 2010 or (2)	M'ment Commi ssion	Scientific advice and management (Information from management commission (2) unless otherwise stated)
STOCKS EXPLOITED AT OR BELOW MAXIMUM SUSTAINABLE YIELD (fully or under exploited)			
West Pacific skipjack	1,540,189 (2011)	WCPFC	August 2012. Catch was lowest in the past 5 years, which peaked in 2009. Except for 2010, the biomass and recruitment have been relatively high over the past several years including 2011. There is no evidence that indicates a credible risk to the stock. There are a number of measures in place both in longline and purse seine fisheries to control by-catches of big-eye and yellow fin. Some pole and line fishing has MSC certification (4)
West Pacific yellowfin	430,506 (2011)	WCPFC	August 2012. The catch was lowest since 1996 with a record catch taken in 2005. Fishing mortality is estimated to be sustainable under present conditions.
East Pacific yellowfin	202,489 (2011)	IATTC	2012. Recent catches are below MSY. Current estimates of SSB are satisfactory, but there is a degree of uncertainty about future recruitment (of young fish) and biomass levels. Decreases of fishing effort is predicted to have only a minor effect on catches, but a major increase in biomass levels. Some pole and line fishing has MSC approval (4)
Indian Ocean bigeye	102,000 (2011)	IOTC	April 2012. Annual catches should not exceed 102,000t. If the recent decline in fishing effort continues, and catch remain substantially below MSY, then immediate management measures are not required. However improved data are required to reduce the uncertainty.
Indian Ocean skipjack	428,719 (2010)	IOTC	Apr 2012. Annual catches should not exceed 512,305t. If the recent declines in effort continue, and catch remains substantially below MSY, then immediate management measures are not required, although the stock will be closely monitored.
North Pacific albacore	70,000 (2010)	IATCC WCPFC	June 2011. Current fishing effort, using data through 2009, is below that of 2002-2004 and is considered that at this exploitation the spawning stock is able to fluctuate at its median level of 405,000t for the foreseeable future. Some experts have called for a review of the current reference points of the stock. Some US and Canada trolling and pole and line has MSC certification (4).
South Pacific albacore	80,000 (2010)	IATCC WCPFC	June 2011. The current fishing rate is considered to yield below MSY and the spawning biomass based on assessments in 2008 was greater than required for MSY. Some US and New Zealand trolling and pole and line has MSC certification (4).
East Atlantic skipjack	164,249 (2010)	ICCAT	July 2008. Some caution must be exercised in generalising on status, due to some unreported landings. However, it is unlikely that skipjack is over exploited above MSY in the eastern Atlantic. MSY = approx 143-170,000 t pa.
West Atlantic skipjack	18,140 (2010)	ICCAT	July 2008. It is unlikely that the current catch is larger than the MSY of approx 30,000-36,000 t pa.
Indian Ocean yellowfin	299,074 (2010)	IOTC	April 2012. Stock has reached sustainable levels, but for it to continue to be so it is recommended that annual catches should not exceed 300,000 t pa. No mandatory catch limits, but effort limits are in place in the industrial fishery (longline and purse seine) and recently seasonal closed areas have been introduced.

Species and stock	Catches (t) From FAO for 2010 or (2)	M'ment Commission	Scientific advice and management (Information from management commission (2) unless otherwise stated)
STOCKS EXPLOITED AT A RATE ABOVE MAXIMUM SUSTAINABLE YIELD (see page 2; point 2)			
East Pacific bigeye	83,000 (2010)	IATTC	2012. The spawning biomass is above the level which would support MSY but fishing mortality is slightly above FMSY. The stock is in danger of being overfished, unless are reduced in future. Since 2005 the spawning stock has increased following seasonal closures on larger purse seiners and long liners and catch limits introduced for longline caught big eye tuna.
West Pacific bigeye	151,533 (2011)	WCPFC	August 2012. The exploitation rate (fishing mortality) is higher than that associated with MSY, and the recommendation is for a 29% reduction in fishing mortality compared with the period 2004-2008. Latest results show fishing mortality has not been reduced to intended level. Further restrictions are being discussed.
Indian Ocean albacore	43,711 (2010)	IOTC	Apr 2012.The available evidence indicates considerable risk to the stock status at current effort levels The two primary sources of data, catches and CPUE, are highly uncertain and should be investigated further. Maintaining or increasing effort will probably result in further declines in the biomass.
STOCKS WITH A SPAWNING STOCK BIOMASS BELOW THAT REQUIRED FOR MSY (page 2; point 3)			
Atlantic bigeye	76,187 (2010)	ICCAT	May 2012. The stock was estimated in 2010 to be nearly 100% of the biomass required for MSY. Projections indicate that catches reaching 85,000 t or less will permit the stock to build further in the future. Although catches have generally not reached that level since 2004, the current TAC arrangements remain at 85,000t.
North Atlantic albacore	14,969 (2010)	ICCAT	May 2012. The stock is overfished and has probably been in this condition since the 1980s. The stock will not rebuild unless catches are 28,000 t pa or less. There is a TAC of 28,000 t pa set for 2011 and 2012. Catches have been decreasing over the years.
South Atlantic albacore	19,275 (2011)	ICCAT	May 2012. Although the stock is considered overfished the assessment indicates that the spawning stock will increase from the levels estimated in 2005 over the next years noting that the annual catches since 2004 have been below MSY. A TAC has been set at 24,000 t pa set for 2012 and 2013
Atlantic yellowfin	107,546 (2010)	ICCAT	Sep 2011. Catches and fishing effort have declined since 1992 and the yield corresponds closely to MSY for this stock. 2010 catches are estimated to be below MSY levels. A TAC has been set for 2012 at 110,000 t. However SSB is estimated to be 15% below that required for MSY. Continuation of current catch levels is estimated to bring biomass levels above that required for MSY by 2016

Species and stock	Catches (t) From FAO for 2010 or (2)	M'ment Commi ssion	Scientific advice and management (Information from management commission (2) unless otherwise stated)
STOCKS WITH SPAWNING STOCK BIOMASS BELOW AND FISHING MORTALITY ABOVE THAT REQUIRED FOR MSY; AT HIGHEST RISK OF DEPLETION (see page 2; point 4)			
East Atlantic and Mediterranean bluefin	11,417 (2010)	ICCAT	Oct 2012. The spawning biomass in 2010 indicate that it was between 19% and 51% of what would yield MSY, an improvement on the position determined in 2007. Recent SSB tendency has shown signs of increase or stabilization in some model runs, while it continues to decline in others. ICCAT has advised a 15 year recovery plan which the EU has taken steps to implement (5) to increase the probability of stock recovery by 2022. A TAC of 12,900 t pa was introduced in 2011 to be evaluated on scientific advice, together with closed fishing seasons and vessel restrictions
West Atlantic bluefin	1,637 (2010)	ICCAT	Oct 2012. There appears to have been a gradual increase in spawning stock from 23% of 1970s levels in 2003 to 29% in 2009. A total catch of 2,500 t pa is predicted to have more than 50% chance of achieving the Convention's objective of avoiding over fishing and maintaining the stock above the current MSY level. Catches of 1,100t pa or less are predicted to have a 60% chance to immediately end overfishing and initiating rebuilding. A TAC of 1,750t pa has been set for 2011-12 inclusive of dead discards. In addition, fish size and catch area restriction are in place.
Southern bluefin	9,547 (2010)	CCSBT	Oct 2011. The spawning stock was assessed in 2009 as 15% of the SSB which would result in MSY. The low spawning stock biomass meant that recovery of the stock was at risk. A reduction of 20% of catch from 11,810 t in 2009 to 9,449 t in 2010 and 11 was agreed in 2009, resulting in improvements in the breeding stock, allowing an increase in the TACs set at 10,449t (2012),and 10,949 (2013) as part of a plan to continue to rebuild SSB to an interim target of 20% of the original SSB size by 2035.
Pacific bluefin	12,156 (2010)	ISC	June 2012. Assessments have indicated that if fishing mortality were reduced to the average level of 2002-4 this would improve the spawning stock: latest data indicated that the spawning stock continues to decline. Also it has been recommended that the fishing mortality is reduced particularly on the juvenile fish in this stock. Management and reporting measures are being improved by Japan, Korea and Taiwan.
STOCK STATUS UNCERTAIN			
East Pacific skipjack	280,000 (2011)	IATTC	March 2012. MSY is difficult to define for skipjack stocks due to their high and variable productivity. Stock health indicators such as catch per effort and exploitation rate have been used. Main concern for this stock is increasing exploitation rate (rate of removal of the stock by fishing; Fishing mortality). However, no adverse consequences of this increase have been detected. Some pole and line has MSC certification (4)
Mediterranean albacore	2,852 (2010)	ICCAT	July 2011. Available information on biomass indicates a relatively stable pattern over the recent past. Recent fishing mortality indicates that it might be about or lower than MSY. However the information is insufficient to undertake robust Kobe plots. Management measures are suggested to hold the fishing at present levels, but no formal levels have been set.

Figure 2: Management areas for tuna stocks (colour keyed by area column 3 to table)



All high seas tuna fisheries – those beyond the coastal states' juristictional seas—are covered by the regional mamagement organisations but not all states are signitorys; see p 9

Organisation key

FAO: The Food and Agriculture Organisation of the United Nations acts as a neutral forum where all nations meet as equals to negotiate agreements and debate policy.

EU: The European Union manages fisheries within European the European Economic Zone, in cooperation with Norway for certain stocks.

IOTC: Indian Ocean Tuna Commission.

WCPFC: Western and Central Pacific Fishery Commission.

IATTC: Inter-American Tropical Tuna Commission.

ICCAT: International Commission for the Conservation of Atlantic Tuna**.**

CCSBT: Commission for the Convention of Southern Bluefin Tuna. (The shaded area in Figure 1 corresponds approximately to the range of the species and hence the CCSBT's management area.)

ISC: International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean

All high-seas tuna fisheries — those beyond coastal states' jurisdictional seas — are covered by the regional international management commissions established the UN Law of the Sea.

Fishing methods and environmental effects

Three methods supply most of the world's tuna: traditional trolling and pole and line; long-line; and purse seine.

Line caught methods supply most of the fresh and frozen tuna in the UK. Other methods include handlines, drift nets and gill nets, which are used in artisanal fisheries. In some areas, most notably the Indian Ocean, where around 400,000 t pa of tuna is caught by these methods; these can be very important fisheries.

Pole and line and trolling

The vessels search for shoals of tuna, using surface observations of tuna feeding on small pelagic fish, water clarity and temperature. Trolling vessels (Figure 2) catch the tuna by towing several hooks with lures on them astern of the vessel. Pole-and line (or 'baitfish'; Figure 3) vessels remain stationary alongside a shoal and excite the tuna into a feeding frenzy using a combination of live bait and water jets played on the sea surface. The tuna are captured on barb-less hooks with lures dangled into the feeding shoal of tuna. These methods can be regarded as low impact fisheries, with little by-catch or other ecological effect apart from the harvesting of the tuna. However, care has to be taken to avoid overfishing of bait fish stocks in sensitive coastal areas.

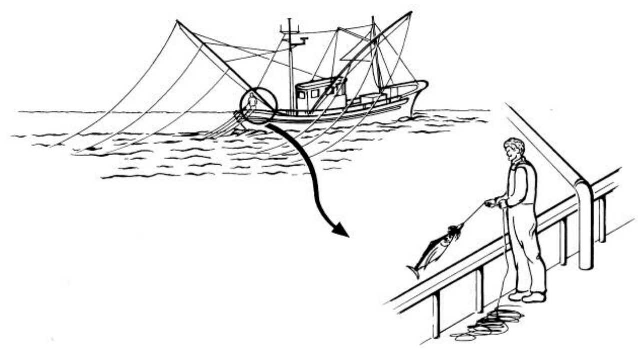


Figure 2: Trolling for tuna

Figure 3: Pole and line

Purse seining

Schools of tuna are impounded by means of a large net which surrounds the school. The net is then 'pursed' when the purse line which closes the bottom of the net, after which the net is gradually brought aboard. The fish are then lifted out of the net using mechanical grabs.

Tuna purse-seine fisheries are dominated by the use of drifting Fish Aggregation Devices (FADs). Typically these are bamboo rafts of about 3 x 1.5m under which the fish tend to congregate; the purse seine is shot around the FAD which increases capture efficiency.

Dolphins are not usually found in association with FADs but catches of undersize tuna and other pelagics can be higher using FADs. As there are about 10,000 of these devices in use worldwide there is a need to understand more of the ecological effects of this type of fishing (6).

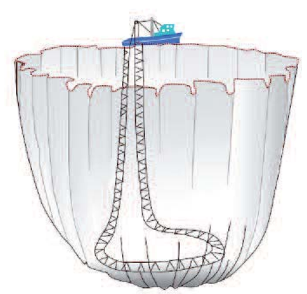


Figure 4: Purse seining

Pelagic long-lining

Long-lines for tuna are deployed horizontally, suspended from floats. Their position in the water column is controlled by weights and floats.The baited hooks are on short lines, or snoods, clipped on at intervals. There is risk of by-catch of albatross and other oceanic seabirds, due to the birds diving after the bait while the lines are being shot.

This risk can be minimised by the use of bird scaring flag lines (‘tori lines’) (Figure 5); concealing the baited hooks by shooting them underwater (7,8) or at night; or making the hooks less visible by dyeing the bait blue or setting from the side of the vessel; distracting the birds (strategic offal discards); and reducing the opportunity for birds to seize the baited hook by sinking baited hooks faster (8,9). Pelagic long-line gear has been found to catch sharks (10,11), swordfish, marlin, turtles (12). Circular hooks (Figure 6) can reduce the probability of fish and sea turtles swallowing hooks, so they can be released on capture (9,12). In addition to tuna, pelagic long-lines are used to catch swordfish and sharks. Other species caught incidentally are marlins, sailfish and sea turtles. These ecosystem effects are the subject of ongoing work by the RFMOs see reference 2.

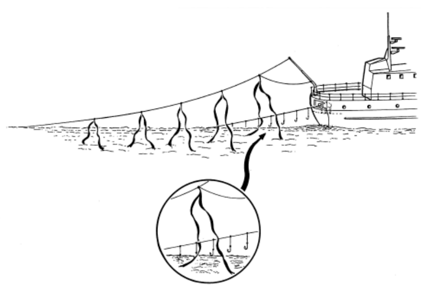


Figure 5: Bird scarers or ‘tori’ line

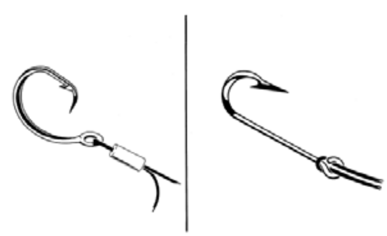


Figure 6: Circular hook (left) and ‘J’ type hook (right)

Management and conservation

Because of the highly migratory and oceanic nature of tuna, they do not remain in the Exclusive Economic Zone of any particular country for long, inhabiting international waters. This makes conservation and fisheries management difficult.

The main management concerns for tuna stocks and fisheries are:

Stock status

A number of tuna stocks are assessed as overexploited, sub-optimum, or of uncertain status. Although stocks may be overexploited they can remain sustainably productive at yields lower than the maximum sustainable yield (MSY).

The key element is whether the fisheries on these stocks are being managed to minimise the risk of further depletion and optimise the potential for growth in yield to MSY. Of greatest concern are the four bluefin tuna stocks (Table 1) at risk of depletion to levels below which the stocks would be able to sustain commercial harvesting. There is a clear management imperative to bring the stocks of these species back to a robust and productive state and the management commissions are playing an important role in these efforts.

In general,yellowfin and bigeye are considered more vulnerable to overfishing than skipjack and this can result in risks of overfishing in fisheries where these three species are caught in mixed fisheries. Whilst many fisheries on have up until now only been managed by controling effort levels in the industrial fisheries, some RFMOs use catch limits and discard bans to limit catches thus reducing overfishing on the more vulnerable stocks see reference 2.

Jurisdiction and management

Tuna can be fished under the following jurisdictions:

- High seas fisheries both from states which are parties and those which are not parties to the appropriate conventions. Some states are ‘co-operating non parties’; they have not signed but have agreed to abide by the convention.
- Fisheries from within nations’ jurisdictional waters (usually the EEZ[1]). Within these waters, states are able to impose additional management measures - ban certain types of gear and engage in licensing agreements with other parties. Some of these fisheries can be described as ‘artisanal’ fisheries; small scale localised fisheries, operating relatively close inshore.

Therefore, the management regime, to which tuna stocks are subjected, is variable across the range of the stocks. Also in some cases the management measures implemented might be different for industrial (such as purse seine and long line) and artisanal vessels. This implies that limitations imposed on one gear type could result in switches to other gear types and/or for vessels to switch registration to states that are not parties to

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[1] Exclusive Economic Zones

the conventions. Fortunately, more states are becoming parties or ‘co-operating non parties’ to these agreements.

Illegal, unregulated and unreprted (IUU) fishing

To reduce IUU fishing, the management commissions have set up lists of authorised vessels accessible online (2) and also lists of vessels which are presumed to be engaged in IUU fishing. Interestingly the list of IUU vessels was first published in 2005 with 76 listed, and published annually therafter with decreasing number of vessels listed. Currently there are only 14 vessels listed.

Conservation of discarded by-catch species

Sustainable yields and risks can be assessed for target populations, provided reliable catch data is available. For discarded by-catch species, which may have a very different capacity to withstand fishing mortality due to fishing than the target species, information usually is only available for a sample of boats from wide-ranging fisheries.

Previously, there was concern about by-catch of dolphins in purse-seine fisheries. However, by-catch of dolphins has decreased to less than 1% of the 1970s level by avoiding setting purse-seine gear on tuna associated with dolphins.

The main concerns are the effects of pelagic long-lining on seabirds, turtles and other fish populations. Pelagic longline fisheries are considered a factor in the decline of 61 species of seabird, some of which are considered as endangered (13) but most of these effects are in temperate, as opposed to tropical, seas. There are also catches of sharks, swordfish, marlin, turtles and also other species of tuna (most notably bluefin) for which vessels have limited or no quota (8). The sustainability of shark populations under fishing pressure is giving rise to serious concern amongst many tuna fisheries worldwide.

Technical solutions are available to reduce some of these by-catch problems (see page 6). Time and area closures have been used in Australian waters to reduce by-catch mortality on depleted bluefin tuna stocks (14).

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Product characteristics

Tuna are large, distinctive, pelagic fish, with dark coloured oily flesh. They are used in a variety of products (Table 2) and fresh or frozen tuna, is considered an 'oily fish', rich in omega 3 (15). Temperature control throughout the supply chain is critical to avoid poisoning as a result of histamine formation. Fishing, icing and storage and display practices are important, since once histaimine has formed it cannot be removed (16). Direct contact between tuna flesh and ice can result in discoloration, so display requirements must be considered carefully.

Histamine levels in the product are controlled by law (18). In addition, the potential for tuna accumulate metals and other contaminants has led the Food Standards Agency to make recommendations concerning tuna consumption (15).

Table 2: Main food products of the main species of tuna

Common name	Typical capture size		Main food products
	Length (m)	Weight (kg)	
Yellowfin	0.3–1.5	5-20	Canning, fresh, frozen
Skipjack	0.35	3	Canning, fresh, frozen, dried
Bigeye	0.9	15-20	Sashimi, fresh, frozen
Albacore	0.6-1.2	9-20	Canning, sashimi, fresh, frozen
Atlantic bluefin	1.3	50+	Sashimi, fresh, frozen
Pacfic bluefin	1.3	50+	Sashimi, fresh, frozen
Southern bluefin	1.3	50+	Sashimi, fresh

Supply chain standards

Responsible practice in the chilled and frozen supply chain depends on correct catching, gutting, washing, chilling or freezing, processing and handling practices throughout the chain. There are standards which cover these aspects from capture to retailer: **Seafish Responsible Fishing Scheme.** Sets best practice standards for fishing vessels, based on British Standards Institution specifications (BSi: PAS 72:2006); and **British Retail Consortium (BRC) Global Standard & Safe & Local Supplier Approval (SALSA) certification.** Designed to raise standards in the seafood processing and wholesaling sectors.

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