CONVENTION ON INTERNATIONAL TRADE IN ENDANGERED SPECIES
OF WILD FAUNA AND FLORA

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CONSIDERATION OF PROPOSALS FOR AMENDMENT OF APPENDICES I AND II

Proposal to include Atlantic Bluefin Tuna (*Thunnus thynnus* (Linnaeus, 1758)) on Appendix I of CITES in accordance with Article II 1 of the Convention[*]

Summary

1. The Atlantic bluefin tuna is found in throughout the North Atlantic Ocean and its adjacent seas, particularly the Mediterranean Sea. It usually occupies the surface and subsurface waters of coastal and open-sea areas, between the surface and 200m in depth.

2. The species is managed by the International Commission for the Conservation of Atlantic Tunas (ICCAT) as two stocks (eastern and western), based on separate spawning grounds, genetic differentiation, differing ages for reaching sexual maturity, and the apparent absence of spawning in the middle of the North Atlantic. However, the migratory ranges of both stocks overlap considerably.

3. Maturity is reached at a mean age of 4-6 years of age in the East Atlantic and Mediterranean, and at 8-12 years of age in the West Atlantic. Spawning commences in March in the Gulf of Mexico. In the Mediterranean, it occurs during May-June in the east, and in June-July in the centre and west.

4. A recent genetic study by Riccioni et al. (2009) shows strong spatial genetic structuring in the Mediterranean, suggesting the existence of various reproductively isolated subpopulations. These subpopulations would be characterized by a low genetically effective population size (Ne = 400-700), with associated risk in terms of maintaining genetic diversity and evolutionary potential in the long-term.

5. A virtual population analysis of the East Atlantic and the Mediterranean stock conducted in 2008 by ICCAT scientists based upon estimated catches, which addressed the period 1955-2007, yielded an estimate for spawning stock biomass in 2007 of 78,724 tonnes. This contrasts with the biomass peak estimated for 1958 at 305,136 t, and with the 201,479 t estimated for 1997. The absolute extent of decline over the 50-year historical period ranging from 1957 to 2007 is estimated at 74.2%, the bulk of which (60.9%) was in the last 10 years.

6. The corresponding analysis for the West Atlantic stock yielded an estimate for spawning stock biomass in 2007 of 8,693 t, which contrasts with the 49,482 t estimated for 1970, implying an absolute extent of decline of 82.4% over the 38-year historical period. Overfishing during the 1970s and 1980s lead to the decline of the West Atlantic stock. Management efforts have yet to result in stock recovery. Since then, the spawning stock biomass has remained relatively stable at approximately 15-18% of its pre-exploitation biomass.

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7. A study by Taylor *et al*. (2009) shows that the historical extent of decline of both West and East Atlantic stocks might be even higher than estimated by ICCAT (with spawning stocks currently at less than 20% of the historical baseline).

8. Continued fishing at current fishing mortalities is expected to drive the spawning stock biomass in the East to very low levels; i.e. to about 18% of the 1970 level and 6% of the unfished level. This combination of high fishing mortality, low spawning stock biomass and massive fishing overcapacity results in a high risk of fisheries and stock collapse. A study by Mackenzie *et al*. (2009) concludes that even if a near-complete ban on all bluefin tuna fishing in the Northeast Atlantic and Mediterranean were implemented and enforced from 2008 to 2022, the population would still probably fall to record lows in the next few years.

9. There is great uncertainty about the potential recruitment to the West Atlantic stock. According to the last assessment by ICCAT scientists, under the most pessimistic scenario a closure of the fishery would not achieve the rebuilding of the stock by 2019. However, recovery is projected to occur within this timeframe under different assumptions of recruitment. Recently, there has been a decline of fishing mortality on large West Atlantic bluefin tuna. The TAC has not been taken primarily because of U.S. underharvest which has ranged from 40-80 percent of quota in 2006-2008. According to ICCAT scientists, there are two plausible explanations for the decline in U.S. harvest of large West Atlantic bluefin tuna; the first is that the availability of fish to the U.S. fishery has been abnormally low due to the change in the spatial distribution of the stock; the second is that the overall size of the population in the West Atlantic has declined substantially from the level of recent years. Safina and Klinger (2008) suggest that the West Atlantic bluefin tuna stock is currently in danger of extinction and that a moratorium on fishing the West Atlantic stock should be immediately implemented. In contrast, ICCAT scientists have not indicated that recent catches of the West Atlantic stock are indicative of a population collapse. They believe that there is uncertainty about the issue and that more research has to be carried out (Report of the Standing Committee on Research and Statistics, October 2008)

10. Atlantic bluefin tuna is traditionally consumed fresh in Mediterranean countries, and it is also one of the most appreciated species for the sashimi market in Japan and in the overall global market. Capture-based farming activities in the Mediterranean have exacerbated fishing pressure on the East Atlantic stock. There is a directed fishery on West Atlantic stock spawners along the coast of Canada. In addition, there is some mortality of the West Atlantic stock within the Gulf of Mexico through bycatch in other fisheries.

11. In the Mediterranean, bluefin tuna are mostly caught by purse seine vessels and then transported alive to tuna farms where the fish are fattened during a period of 6 to 8 months. Fishing vessels are usually from different countries than those where the tuna are later farmed, so this transfer of live fish to farms generally implies international trade. Estimated farming capacity is as much as twice the 2008 Total Allowable Catch (TAC), while estimates of fleet size indicate that there is sufficient active fishing capacity to fully supply the farms to their indicated limits.

12. After slaughter, the bulk of this production is exported to Japan as frozen products where it is consumed as sushi and sashimi. The total imports of 32,356 t of processed bluefin tuna reported by Japan to ICCAT for 2007 contrast with the Total Allowable Catch for that year of 29,500 t. This mismatch between ICCAT import records and the Total Allowable Catch is all the more evident when domestic consumption in European Mediterranean countries, intra-European trade, and catches by the national Japanese fleet operating in the East Atlantic and the Mediterranean Sea (reported at 2,078 t in 2007) are taken into account. All these elements taken together suggest catches significantly higher than the legal quotas, (up to 61,000 t in 2007, according to ICCAT scientists).

13. All bluefin tuna fishing and farming nations in the Mediterranean are Contracting Parties of ICCAT and thus obliged to comply with its legislation. However, ICCAT has consistently set catch quotas for the East Atlantic and Mediterranean stock above levels recommended by its scientists and the failure of its management measures is demonstrated by the continuously decreasing population. In 1992 ICCAT first adopted a recommendation requiring reporting of tuna imports; a more comprehensive Catch Documentation Programme replaced this in 2007 and entered into force in June 2008. However, it is difficult to evaluate the efficiency and effectiveness of this programme given that it entered into force only in June 2008 and that available data and information on its implementation are limited at this time.

14. In July 2008, the new stock assessment made by ICCAT Scientists advised that the maximum Total Allowable Catch for the East Atlantic and Mediterranean stock should be between 8,500 and 15,000 t and that fishing during the spawning season (May, June and July) should be banned. They went on to suggest a moratorium to increase the probability of rebuilding the stock. However, in November 2008, ICCAT failed to adopt any of the measures advised. The measure adopted by ICCAT in 2008 establishes Total Allowable

15. The listing of Atlantic bluefin tuna on Appendix I of the Convention is consistent with Resolution Conf. 9.24 (Rev. CoP 14),

Annex 1 A, i.e.:

The wild population is small, and is characterized by at least one of the following:

> *iii) a majority of individuals being concentrated geographically during one or more life-history phases; or*
>
> *v) a high vulnerability to either intrinsic or extrinsic factors.*

Annex 1 C, i.e.:

A marked decline in the population size in the wild, which has been ***either****: observed as ongoing or as having occurred in the past (but with a potential to resume); or inferred or projected on the basis of any one of the following:*

> *– levels or patterns of exploitation; or*
> *– a high vulnerability to either intrinsic or extrinsic factors; or*
> *– a decreasing recruitment.*

Even if the species is regarded as one of medium productivity, the projected decline falls within the range specified in footnote (2) to the Resolution concerning the appropriate levels of decline to consider for commercially exploited aquatic species.

16. It is further submitted that the current situation regarding the status of the species is past the stage where Appendix II listing would be sufficient, even if Article XIV of the Convention and the existence of ICCAT prior to the entry into force of CITES were not an issue.

17. Acknowledging that Parties may be apprehensive about the extreme consequences of an Appendix I listing in the longer term and the difficulty in getting such a listing reversed should the management regime improve. Accordingly, the listing proposal is accompanied by a draft Resolution which would mandate the Animals Committee, in consultation with ICCAT, to review the status of the East Atlantic and Mediterranean stock and West Atlantic stock of *Thunnus thynnus* in light of any intervening actions at ICCAT and, if warranted, to request the depositary Government to submit a proposal to a subsequent meeting of the Conference of the Parties to downlist the species to Appendix II of the Convention or to remove it from the Appendices.

18. Although Atlantic bluefin tuna resembles some related species, genetic techniques provide precise tools for identification purposes. The listing of the species could, however, pose implementation difficulties with regard to confusion with similar species until genetic testing techniques are easily available, expedient, and cost-effective. Current promising technical developments address these implementation challenges.

A. PROPOSAL

Inclusion of *Thunnus thynnus* (Linnaeus, 1758) in Appendix I in accordance with article II 1.

Qualifying criteria (Conf 9.24 (rev. CoP 14) Annex 1)

A. The wild population is small, and is characterized by at least one of the following:

iii) a majority of individuals being concentrated geographically during one or more life-history phases; or
v) a high vulnerability to either intrinsic or extrinsic factors

Recent evidence suggests that the Atlantic bluefin tuna population in the Mediterranean shows widespread and deep spatial genetic structuring, and challenge the hypothesis of a single panmictic population occurring in the basin (Riccioni *et al*., 2009). Estimates of the genetically effective population size (N_e) for single subpopulations yield values of 400-700 individuals, which would qualify as low values, straddling the minimum threshold (N_e = 500) related to the maintenance of genetic diversity and evolutionary potential in the long term (Frankham *et al*., 2002; Nelson and Soulé, 1987).

Additionally, the Atlantic bluefin tuna displays strong aggregating behaviour at the spatial scale relating to both feeding (Walli *et al*., 2009) and spawning (Rooker *et al*., 2007; Fromentin and Powers, 2005), which largely determines the exploitation pattern of fishing fleets. The latter concentrate their fishing activities in areas and seasons characterized by high concentrations of tuna and a related high vulnerability of stocks to the fishing gears (as for example baitboat fishing in the Eastern Atlantic and purse seining in the Mediterranean).

C . A marked decline in the population size in the wild, which has been **either:**

i) observed as ongoing or having occurred in the past … (but with a potential to resume)
ii) inferred or projected on the basis of any of the following:
- ***levels of patterns of exploitation; or***
- ***a high vulnerability to either intrinsic or extrinsic factors***
- ***a decreasing recruitment*** (only West stock)

In the case of commercially exploited marine species, a range of 5-20% of the baseline is deemed to constitute a marked decline in most cases, with a range of 5-10% being applicable for species with high productivity, 10-15% for species with medium productivity and 15-20% for species with low productivity. However, it is accepted that some species may fall outside this range. Low productivity is correlated with low natural mortality rate and high productivity with high natural mortality. One possible guideline for indexing productivity is the natural mortality rate, with the range 0.2-0.5 per year indicating medium productivity.

A general guideline for a marked recent rate of decline is the rate of decline that would drive a population down within approximately a 10-year period from the current population level to the historical extent of decline guideline (i.e. 5-20% of baseline for exploited fish species).

Atlantic bluefin tuna have shown massive declines in standing stock biomass, and the remaining populations represent 10-20% of virgin biomass.

Stock assessments made by the Standing Committee on Research and Statistics (SCRS) of ICCAT consider a range of natural mortality (M) for East Atlantic and Mediterranean bluefin tuna of 0.49, 0.24, 0.24, 0.24, 0.24, 0.20, 0.175, 0.15, 0.125, 0.10 for the years 1 to 10+ (age 10 and older), respectively. This means an average annual M for adults in the Eastern stock (ages 4 to 15, well represented in the fishery and the population) of 0.14. The same calculation for ages 1-15 yields a value of 0.18. For the West Atlantic stock, which is characterized by a higher age at first maturity, ICCAT scientists assume a constant natural mortality of 0.14 for all ages of the stock.

A thorough analysis further justifying the qualification of the Atlantic bluefin tuna as a low productivity species is included here as Annex 1, authored by Anders Silfvergrip, Swedish CITES Advisory Scientific Authority. The paper advocates using the harmonic mean to derive M values from the vector of natural mortalities per age classes, and computes M values of 0.18 for ages 1-10 and 0.13 for ages 1-20, well below the 0.2 threshold. The paper also analyses many other parameters relating to productivity and concludes that using the FAO scoring scheme for estimating productivity for exploited fish species (FAO, 2001) the Atlantic bluefin tuna scores as a strictly Low Productive species on 5 of 6 accounts, and a border case in 1, so demonstrating that it is a low productive species with high fecundity (a situation common among marine fish, even among some endangered ones).

These data qualify Atlantic bluefin tuna as a low productivity species (to be subject to the criteria of 20% of the baseline regarding marked decline).

The absolute extent of the decline of the East Atlantic and Mediterranean stock over the 50-year period from 1957-2007 was assessed by SCRS ICCAT at 74.2% in terms of biomass of the spawning population (meaning that 25.8% of the populations then remained). Additionally, SCRS ICCAT forecasted that current fishing mortalities were "expected to drive the spawning stock biomass to very low levels; i.e. to about 18% of the SSB (spawning stock biomass) in 1970 and 6% of the unfished SSB". The bulk of the historical decline has happened in the last 10 years, with a linear trend from 2003 to 2007 suggesting a rapid decline in biomass well below the 20% baseline within much less than 10 years (see SCRS, 2008a: Appendix 9, Table 4 corresponding to run 14, pp. 154-155). Based on an independent analysis, Mackenzie *et al*. (2009) concluded there is moderate probability that the expected decline in biomass between 1999 and 2010 would reach 90%. Finally, a new study by Taylor *et al*. (2009) using the MAST methodology -which integrates the effects of large-scale migrations by Atlantic bluefin tuna- suggests that the extent of the historical decline, particularly for the East Atlantic and Mediterranean stock, might be higher than that showed by SCRS (2008a), with current levels for both stocks below 20% of the historical baseline. In summary, the studies cited point to a high probability that the spawning stock biomass of the Eastern stock of Atlantic bluefin tuna is currently (2009) already below 20% of its historical baseline. Moreover, the best scientific information available points to the almost certainty that spawning stock biomass will be below the 20% historical baseline within the next 10 years, given the very high rate of decline estimated for the last years.

Concerning the West stock of Atlantic bluefin tuna, the stock assessment conducted by SCRS ICCAT in 2008 shows an absolute extent of decline of the spawning population of 82.4% over the 38-year historical period (meaning that just 17.6% of the spawning biomass in 1970 would remain). The sharp decline of the Western spawning stock biomass took place between 1970 and 1985 (SSB in 1985 was approximately 18.9 % of SSB in 1970). Since then, the stock has remained at relatively constant, but low levels. Additionally, a decrease in recruitment has been estimated for the West Atlantic stock in the historical series considered by SCRS (2008a).

Additionally, the strong aggregating behaviour of Atlantic bluefin tuna during the spawning season increases its vulnerability to fishing fleets, particularly large-scale purse seines operating on the main spawning grounds. In this regard, according to SCRS (2008a: page 8) the recent expansion of the purse seine fleet in the Mediterranean "*has further led to a quick and spatial expansion of the PS* (purse seine) *fleets in the Mediterranean … Consequently, the vast area of the Mediterranean nowadays were covered by BFT* (bluefin tuna) *fishing over its entire surface, a situation that has never been encountered in the past and that is of high concern since it appears to no longer exist any refuge for BFT in the Mediterranean during the spawning season*". This situation of <u>high vulnerability</u> of the Atlantic bluefin tuna to both <u>intrinsic</u> (aggregating behaviour increasing the vulnerability to fishing gears) and <u>extrinsic factors</u> (bulk of fishing activity occurring on high concentration areas in spawning and foraging grounds) further exacerbate the risk of a marked decline in the population size.

<u>Affected by trade</u>

A species "*is or may be affected by trade*" if :

I) It is know to be in trade and trade has or may have a detrimental impact on the status of the species

The Atlantic bluefin tuna is subject to a massive international trade, including a high incidence of illegal trade of the East Atlantic and Mediterranean stock. For 2007 Japan reported to ICCAT the import of 32,356 t of processed Atlantic bluefin tuna (ICCAT Circulars 1951/07 and 500/08). ICCAT SCRS estimated real catches of Atlantic bluefin tuna in 2007 potentially reaching 61,000 t, which contrast with the legal quota of 29,500 t for that year, and the maximum annual catch recommended by ICCAT SCRS to prevent collapse and initiate rebuilding for that stock, estimated at between 8,500 t and 15,000 t. Demand from international markets is considered to be the main driver of the fishery.

<u>Annotation</u>

Appendix I listing would be accompanied by a Conference resolution that would mandate the Animals Committee of the Convention to review the status of the East Atlantic and Mediterranean stock and the West Atlantic stock of *Thunnus thynnus* in light of any intervening actions at ICCAT and, if warranted, ask the

Depositary Government (Switzerland) to submit a proposal to a subsequent CoP to downlist the species to Appendix II or remove it from the Appendices. A ruling to this effect by the Animals Committee only requires a simple majority of the Committee members and CoPs have a high rate of acceptance of proposals submitted by the depositary Government at the request of a relevant CITES Committee.

B. PROPONENT

Principality of Monaco*

C. SUPPORTING STATEMENT

1. TAXONOMY

1.1 Class: Osteichthyes
1.2 Order: Perciformes
1.3 Family: Scombridae
1.4 Species: *Thunnus thynnus* (Linnaeus, 1758)
1.5 Scientific synonyms: none
1.6 Common names: Atlantic bluefin tuna, Northern bluefin tuna (English), Thon rouge de l´Atlantique (French), Atún rojo del Atlántico (Spanish)
1.7 Code numbers: none

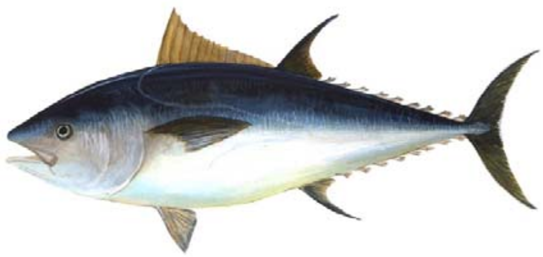

Figure 1. *Thunnus thynnus*
From fish2056, NOAA's Fisheries Collection

2. OVERVIEW

3. SPECIES CHARACTERISTICS

3.1 Distribution:

The Atlantic bluefin tuna is found throughout the North Atlantic Ocean and its adjacent seas, particularly the Mediterranean Sea, ranging from the southern boundary of the equator to the northern boundary of the north of Norway, and from the western boundary of the Gulf of Mexico to the eastern boundary of the Black Sea. (Fromentin, 2008).

3.2 Habitat:

Bluefin tuna mostly occupy the surface and subsurface waters of the coastal and open-sea areas, between the surface and 200m. However, both juvenile and adult bluefin tuna can dive to depths of 500m to 1000m. Juvenile and adult bluefin tuna also tend to aggregate along ocean fronts, such as upwelling areas and meso-scale oceanographic structures associated with the general circulation of the North Atlantic and adjacent seas (Rooker *et al.*, 2007; Fromentin, 2006).

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3.3 Biological characteristics:

Population Structure and Migration Patterns

The Atlantic bluefin tuna is currently managed by the International Commission for the Conservation of Atlantic Tunas (ICCAT) as two separate stocks – the eastern and the western - separated in the North Atlantic Ocean by the 45°W meridian. This separation between eastern and western populations was established from studies and observations that showed that: (1) Atlantic bluefin tuna have two separate spawning grounds on either side of the Atlantic Ocean - in the Mediterranean Sea on the eastern side, and the Gulf of Mexico on the western side, (2) there are distinct differences in the age at sexual maturity between western and eastern populations, (3) juveniles and adults are present on both sides of the Atlantic Ocean, and (4) there are no evidences of spawning in the middle of the North Atlantic Ocean (Fromentin, 2008).

However, this idea of two separate stocks on either side of the North Atlantic Ocean has been challenged by the transatlantic migrations of these tuna that have been demonstrated. Recent electronic tagging and chemical signature studies have revealed a greater mixing between eastern and western Atlantic stocks than previously believed. Atlantic bluefin tuna of mixed origins (both eastern and western) can be found all along the east coast of North America, as well as throughout the North Atlantic Ocean (Block *et al.*, 2005). The only regions that appear to be exclusively composed of tuna of either purely western, or purely eastern origins, are the spawning grounds in the Gulf of Mexico and the Mediterranean Sea (Rooker *et al.*, 2008; Block *et al*., 2005).

Nevertheless, despite this apparently high rate of mixing, the most recent study on mitochondrial DNA has revealed a significant population subdivision among the Gulf of Mexico, the western Mediterranean, and surprisingly, the eastern Mediterranean Sea (Boustany *et al*., 2008). These latest results indicate that although the distributions of tuna from different origins do overlap within the North Atlantic Ocean and adjacent seas, individuals show strong natal homing to their spawning grounds either in the Gulf of Mexico, or the Western or Eastern Mediterranean Sea. Other studies suggest a strong spatial genetic structuring within the Mediterranean, which challenges the principle of a single panmictic population occurring there (Riccioni *et al*., 2009).

Reproduction

Bluefin tuna are oviparous and iteroparous, as are all tuna species. They have asynchronous oocyte development and are multiple batch spawners. Egg production is age (or size)-dependent. Bluefin tuna once mature do appear from tagging studies to be able to spawn in consecutive years (Teo *et al*. 2007). Fertilization occurs directly in the water column and hatching takes place without parental care after an incubation period of 2 days (Fromentin, 2006). It is generally agreed that BFT spawning takes place in warm waters (> 24°C) of specific and restricted locations (around the Balearic Islands, Sicily, Malta, Cyprus and the northwestern Gulf of Mexico) and occurs only once a year (Fromentin, 2006). Spawning begins earlier in the Gulf of Mexico, in March. In the Mediterranean Sea, spawning is during May-June in the East, and June-July in the centre and West (Rooker *et al*., 2007).

Recruitment

Fish larvae (around 3-4 mm) are typically pelagic with a yolk sac and relatively undeveloped body form. The yolk sac is re-absorbed within a few days. Little is known about the effects of the age-structure of the spawning stock, as well as the condition of the spawners, on the viability of the offsprings. It was suggested that the North Atlantic Oscillation (NAO) might affect bluefin tuna recruitment success in the East Atlantic, but further statistical analyses did not confirm such hypothesis. The identification of the major abiotic and biotic forces controlling bluefin tuna recruitment therefore remains obscure (Fromentin, 2006).

Sex ratio and age at first maturity

The proportion of males appears to be higher in catch samples of large individuals, which could be due to a higher natural mortality or lower growth of females (SCRS, 1997). In contrast, higher or equal (depending on the year) proportions of females have been found for all size classes in the catches of purse seiners operating in the central Mediterranean (Hattour, 2003).

Various past studies showed that Atlantic bluefin tuna mature at 110-120cm (25-30kg) in the East Atlantic and Mediterranean Sea, hence at approximately 4 years of age (according to the East Atlantic and Mediterranean growth curve). The size of the fish spawning in the Gulf of Mexico has always been > 190cm, which would correspond to about 8 to 12 years of age (Fromentin, 2006). This disparity in age-at-maturity between West

Atlantic and Mediterranean bluefin tuna has been used as one major argument for separation into two stocks (Fromentin, 2006).

3.4 Morphological characteristics:

The Atlantic bluefin tuna is the largest tuna species. It has an elongated fusiform body, being more robust at the front. Its maximum length can exceed 4 m. Its official maximum weight is 726 kg, but weights of up to 900 kg have been reported in various fisheries of the West Atlantic and Mediterranean Sea. The body of the Atlantic bluefin tuna is deepest near the middle of the first dorsal fin base. The back is dark blue, while lower sides and belly are silvery white, with colourless transverse lines alternated with rows of colourless dots. Bluefin tuna have 39 vertebrae, with 12 to 14 dorsal spines and 13 to 15 dorsal soft rays. The first dorsal fin is yellow or bluish; the second dorsal fin, which is higher than the first, is reddish-brown. The anal fin and finlets are dusky yellow and edged with black; the median caudal keel is black in adults. Swim bladders are present and the pectoral fins are very short, less than 80% of head length (Fromentin, 2006).

3.5 Role of the species in the ecosystem:

The Atlantic bluefin tuna is often regarded as a quintessential predator of pelagic ecosystems (Rooker *et al.*, 2007). Juveniles and adults are opportunistic; their diet consists mainly of crustaceans, fish and cephalopods during their early years, but centres primarily on fish such as herring, anchovy, sand-lance, sardine, sprat, bluefish and mackerel as adults. Their diet can also include jellyfish and salps, as well as demersal and sessile species such as, octopus, crabs and sponges (Fromentin, 2006). The ecological extinction of this species would thus have unpredictable cascading effects in the North Atlantic, Mediterranean and Gulf of Mexico ecosystems and entail serious consequences to many other species in the food web.

4. STATUS AND TRENDS

4.1. Habitat trends

Not applicable.

4.2. Population size

Atlantic Bluefin Tuna - East

A virtual population analysis (VPA) (Murphy, 1965; Gulland, 1965; Jones, 1964) conducted in 2008 by the Standing Committee on Research and Statistics (SCRS) of ICCAT, based upon estimated catches (including IUU), which addressed the period of 1955-2007 and included estimates of real catches, yielded an estimate for spawning stock biomass (SSB) for the East Atlantic and Mediterranean stock in 2007 of 78,724 t (SCRS, 2008a: Appendix 9, Table 4 corresponding to run 14, pp. 154-155). This contrasts with the biomass peak estimated for 1958 at 305,136 t, and with the 201,479 t estimated for 1997. The absolute extent of decline over the 50-year historical period ranging from 1957 to 2007 is, therefore, estimated at 74.2% of the spawning population level at the start of the series, indicating that the size of the current spawning stock is only 1/4 of that in 1957. The bulk of the spawning stock biomass loss has happened in the last 10 years. Indeed, the rate of decline in the last 10 years (1997-2007) is estimated at 60.9%, with a total loss of spawning biomass of 122,750 t from the 1997 estimate. Current fishing mortality (F) is at least 3 times the level that would result in Maximum Sustainable Yield (MSY), and SSB is most likely to be less than 20% of the level needed to support MSY; for 2007, it is estimated at only 14% of the level corresponding to maximum fishing mortality (F_{MAX}), even assuming the good recruitment typical of the 1990s (SCRS, 2008b).

A second virtual population analysis conducted in 2008 by ICCAT scientists, which was based upon reported catches for the period of 1955 to 2007, indicated a long-term rate of decline of 64% from the baseline spawning stock biomass (based upon reported catches, SSB in 2007 was 100,047 tons, and the SSB in 1955 was 281,954 t). This last analysis didn't account for the illegal over-quota catches, which were estimated by SCRS to roughly equal the reported catches in 2007 (real catches were estimated at 61,100 t for that year and at around 50,000 t per year in recent times).

A new study by Taylor *et al*. (2009) using the MAST methodology, which integrates the effects of large-scale migrations by Atlantic bluefin tuna, suggests that the extent of the historical decline, particularly for the East Atlantic and Mediterranean stock, might be much higher than that estimated by SCRS (2008a), with current levels for both stocks below the 20% of the historical baseline.

Atlantic Bluefin Tuna - West

The virtual population analysis (VPA) conducted by SCRS ICCAT in 2008 yielded an estimate for spawning stock biomass in 2007 of 8,693 t which contrasts sharply with the 49,482 t estimated for 1970, meaning an absolute extent of decline over the 38-year historical period estimated at 82.4% of the spawning population level at the start of the series (SCRS, 2008a: Appendix 9, Table 4, pages 167-168). Overfishing during the 1970s and 1980s led to decline of the West Atlantic stock. In 1998, ICCAT adopted a rebuilding program for the West Atlantic stock that called for rebuilding the spawning stock biomass to the levels needed to achieve maximum sustainable yield (MSY) with at least 50% probability. Since then, the spawning stock biomass has remained relatively stable at approximately 15-18 % of its pre-exploitation level biomass.

Assuming that average recruitment cannot reach the high levels recorded in the early 1970s, recent fishing mortality (2004-2006) is about 30% to 50% higher than the level required to achieve MSY and the SSB is about half the biomass level required to support MSY (SCRS, 2008b). Based on one assumption of recruitment, under more restrictive quota limits set in 2008 overfishing could end by 2010 and the West stock could be rebuilt by 2019 with greater than 75% probability, whereas no recovery would take place based on another equally probable hypothesis.

4.3. Population structure

Atlantic Bluefin Tuna - East.

See also sections 4.2. and 4.4.

The main pattern recorded by SCRS consists of the rapid decline in abundance of older spawners (8+) attributable to the dramatic increase of fishery mortality since 2000 in this segment of the population, driven by the booming demand from tuna farms in the Mediterranean. This fact has led to the strong overall decrease in spawning stock biomass (SCRS, 2008-a, b). According to Mackenzie *et al.* (2009), who used an age-structured stochastic modelling approach similar to that used in working groups of the International Council for the Exploration of the Sea (ICES), the mean age of mature bluefin tuna has declined since the mid-1980s, and the proportion of large spawners (age 8+) has declined especially since the late 1970s. The share of repeat spawners in the population has also declined and has remained generally low since the mid- to late 1980s. Based on these considerations, the authors conclude that “age structure and reproductive demographics for the population have shifted to configurations which likely reduce reproductive potential and increase vulnerability of the remaining population to additional stressors”.

4.4. Population trends

Atlantic Bluefin Tuna - East.

The last population assessment conducted by the ICCAT SCRS in 2008 was based on virtual population analysis (VPA) and shows that spawning stock biomass (SSB) has been declining rapidly in the last several years while fishing mortality (F) has been increasing rapidly, especially for large individuals (ages 8+; a 3 to 4-fold increase in F since 2000). Analyses show that recent (2003-2007) spawning stock biomass is less than 40% of the highest estimated levels (at the start of the times series 1970-1974 or 1955-1959, depending on the analysis). The decline in spawning stock biomass appears to be more pronounced after the year 2000. All the analyses indicate a general recent increase in fishing mortality for large fish and, consequently, a decline in spawning stock biomass (SCRS, 2008b). Continued fishing at the current fishing mortalities is expected to drive the spawning stock biomass to very low levels; i.e. to about 18% of the SSB in 1970 and 6% of the unfished SSB. This combination of high fishing mortality, low spawning stock biomass and severe fishing overcapacity results in a high risk of fisheries and stock collapse. (SCRS, 2008a,b).

According to Mackenzie *et al.* (2009), even if a near-complete ban on all bluefin tuna fishing in the NE Atlantic and Mediterranean were implemented and enforced from 2008 to 2022, the population would probably fall to record lows in the next few years, unless environmental conditions promote exceptionally high recruitment. The same authors estimate that there is moderate probability (25%) that the expected decline in biomass between 1999 and 2010 will reach 90%.

In October 2008 the SCRS advised ICCAT to adopt one of the following management approaches in its meeting of November 2008 in order to rebuild the East Atlantic bluefin tuna stock according to the objectives of the ICCAT Convention:

(i) $F_{0.1}$ or F_{MAX} strategies (implying short-term real catches at between 8,500 t and 15,000 t, or less),

(ii) (ii) a closure of the entire Mediterranean in May-June-July, or (iii) a moratorium over the East Atlantic and Mediterranean Sea during 1, 3 or 5 years followed by an $F_{0.1}$ strategy (SCRS, 2008b).

Instead, Total Allowable Catch limits were adopted by ICCAT for 2009 and 2010 at 22,000 t and 19,950 t respectively; in other words, between 2.34 and 2.58 times the precautionary $F_{0.1}$ quota advised by SCRS ICCAT.

Atlantic Bluefin Tuna - West.

The total catch for the West Atlantic BFT stock peaked at nearly 20,000 tons in 1964. Catches dropped sharply thereafter and after reaching a small peak in 2002, at 3,319 tons, they steadily declined to only 1,624 t in 2007. The United States was unable to catch its quota in 2004-2008 owing to the scarcity of fish available to the fleet. The SCRS assessment made in 2008 showed that spawning stock biomass declined steadily between the early 1970s and 1992; since then, it has fluctuated between 18% and 27% of the 1975 level. Even though fishing mortality on spawners (age 8+) declined since 2002, the stock does not show any signs of population recovery (SCRS, 2008b).

In spite of the overall negative status of the population, catch per unit effort (CPUE) values in the Gulf of St Lawrence have increased from 1997 to 2004, and have remained high since then. However, SCRS Atlantic bluefin tuna experts have hypothesized that this might reflect the passage of a single year class (SCRS, 2008a: pg. 14). There is strong uncertainty about the potential recruitment for this stock. According to the last assessment by the SCRS (SCRS, 2008a,b) under the most pessimistic recruitment scenario, closing the fishery would not achieve the rebuilding of the stock by 2019. However, recovery is projected to occur within this timeframe under different, but equally plausible, assumptions of recruitment.

4.5. Geographic trends

Historical analysis show Atlantic bluefin fisheries date back to ancient times. The species has been exploited for centuries in the Mediterranean Sea and at the entrance of the Gibraltar Straits. Since the 1920s, it has been increasingly exploited in the northeast Atlantic. Large changes have been observed since then and there were several extinctions/discoveries of important fishing grounds in the Mediterranean as well as in the Atlantic during the 20th century. Bluefin tuna are now absent or rare from formerly occupied habitats, such as the North Sea, Norwegian Sea, Black Sea, Sea of Marmara, off the coast of Brazil and Bermuda, and certain locations off the northeastern American coasts, whereas large catches have been recently made in new areas, such as the eastern Mediterranean, the Gulf of Sirte and the central North Atlantic. The reasons for these changes in spatial and temporal patterns remain unclear and are likely to result from interactions between biological, environmental, trophic and fishing processes (SCRS, 2008a).

In the Mediterranean, while traditional Atlantic bluefin tuna fisheries mostly operated along specific areas of the coasts until the mid-1980s (e.g. the Gulf of Lions, the Ligurian, Ionian and Adriatic Seas), the fisheries rapidly expanded over the whole Western basin during the late 1980s and early 1990s, and, more recently, over the Central and Eastern basins, so that bluefin tuna is now exploited over the whole Mediterranean Sea for the first time in the millennia of its fisheries history (Fromentin, 2006). The SCRS expresses concern because this situation means that no refuge appears to exist any more for Atlantic bluefin tuna in the Mediterranean during the spawning season (SCRS, 2008a).

5. THREATS

The main threat for the Eastern Atlantic and Mediterranean stock of the species is overfishing, including both legal overfishing – meaning unsustainable catch limits set well above levels recommended by scientists- and illegal, unregulated, and unreported (IUU) fishing activities. Overfishing may also be impacting the West Atlantic stock. Atlantic bluefin tuna are traditionally consumed fresh in Mediterranean countries, and they are also one of the most sought after species for the sashimi market in Japan and globally. The booming capture-based farming activities that started in the Mediterranean (the main spawning and fishing ground for the species) in 1996 have exacerbated fishing pressure over the East Atlantic stock, to the point that 61% of the spawning biomass has disappeared in the last 10 years (see section 4.2.). In 2009 fishing continues in excess of scientific recommendations for East Atlantic and Mediterranean bluefin tuna, since the 2008 ICCAT meeting failed to adopt the measures advised by scientists to recover the stock. The Western stock has not recovered as expected, in spite of the low catch quotas. There is still substantial mortality on spawners as a result of a directed fishery along the coast of Canada. In addition, there is some mortality of the West Atlantic stock within the Gulf of Mexico due to bycatch in other fisheries.

6. UTILIZATION AND TRENDS

6.1 National utilization

Bluefin tuna in the Mediterranean is mostly caught by purse seiners (nearly 70 % of the catch – SCRS, 2008b). Fish caught by purse seiners are then transported alive to tuna farms where they are fattened during a period of 6 to 8 months. Fishing vessels are usually from different countries than those where the tuna are later farmed, so this transfer of live fish to farms often constitutes international trade. After slaughter, the bulk of this production is exported to Japan and other markets as frozen products where it is consumed as sushi and sashimi. The main types of products exported are belly meat, dressed fish (headless, whole), fillets, loins, and gilled and gutted fish. Tuna farming in the Mediterranean started in 1997. Farming capacity abruptly increased from a few hundred tons in 1997 to 30,000 tonnes in 2003 (WWF, 2006) and around 64,000 t in 2008, representing approximately 51,000-57,000 t round weight of (large) fish at time of capture (SCRS, 2008a). This estimated farming capacity represents a capacity excess of more than 32,000 t - as much as twice the 2008 Total Allowable Catch (TAC). In addition, the estimates of fleet size indicate there is sufficient active fishing capacity to fully supply the farms to their indicated limits (SCRS, 2008a). In recent years an array of Japanese restaurants in Europe have also contributed to the demand for this farmed bluefin tuna. Catches by longliners and tuna traps are also partly exported to Japan as wild fish products. The rest of their catch, together with tuna caught by handlines and other gear, is consumed domestically in the main producer countries (Spain, France and Italy) as a fresh product, usually from small size fish.

Stockpiles of frozen bluefin tuna exist in Japan and some other Asian countries. The quantity in Japanese cold stores of bluefin tuna reported by NOAA in November of 2008 was 21,783 t[1]. Additional stores of frozen bluefin tuna are known to exist in other Southeast Asian nations and in reefer vessels[2].

6.2. Legal trade

The most comprehensive sources of information on international trade of Atlantic bluefin tuna are the Eurostat database (Statistical Office of the European Communities) and the ICCAT database of the Bluefin Tuna Statistical Document (BFTSD) Program. While Eurostat provides information on all trade flows legally recorded on bluefin tuna involving the 27 member states of the European Union (the main quota holder of Atlantic bluefin tuna and the entity concentrating the bulk of capture-based farming production of this species), the ICCAT BFTSD (which lasted until 2008, when it was replaced by the new Bluefin Tuna Catch Document scheme) records all imports of processed bluefin tuna into ICCAT contracting Parties, which include all major producers and consumers of the species.

Tables 1 and 2 summarize the information available on the Eurostat database on external trade for 2007 (Eurostat Traditional external trade database access, ComExt; Eurostat id. Code of extraction: k2832469.xls 1), referring to the following CN8 TARIC codes identifying Atlantic bluefin tuna products:

03019400	LIVE BLUEFIN TUNAS "THUNNUS THYNNUS"
03023510	FRESH OR CHILLED BLUEFIN TUNAS "THUNNUS THYNNUS", FOR INDUSTRIAL PROCESSING OR PRESERVATION
03023590	FRESH OR CHILLED BLUEFIN TUNAS "THUNNUS THYNNUS" (EXCL. TUNAS FOR INDUSTRIAL PROCESSING OR PRESERVATION)
03023911	BLUEFIN TUNAS "THUNNUS THYNNUS", FRESH OR CHILLED, FOR INDUSTRIAL PROCESSING OR PRESERVATION
03023991	BLUEFIN TUNAS "THUNNUS THYNNUS", FRESH OR CHILLED (EXCL. TUNAS FOR INDUSTRIAL PROCESSING OR PRESERVATION)
03034511	FROZEN BLUEFIN TUNAS "THUNNUS THYNNUS" FOR INDUSTRIAL PROCESSING OR PRESERVATION, WHOLE
03034513	FROZEN BLUEFIN TUNAS "THUNNUS THYNNUS" FOR INDUSTRIAL PROCESSING OR PRESERVATION, GILLED AND GUTTED
03034519	FROZEN BLUEFIN TUNAS "THUNNUS THYNNUS" FOR INDUSTRIAL PROCESSING OR PRESERVATION, WITHOUT HEAD AND GILLS, BUT STILL TO BE GUTTED

[1] National Marine Fisheries Service, Southwest Regional Office, NOAA http://swr.nmfs.noaa.gov/fmd/sunee/coldstor/jcsnov08.htm
[2] El triunfo de la barbarie, published in Ruta Pesquera (Spain), January 2009

03034590	FROZEN BLUEFIN TUNAS "THUNNUS THYNNUS" (EXCL. FOR INDUSTRIAL PROCESSING OR PRESERVATION)
03034921	BLUEFIN TUNAS "THUNNUS THYNNUS", FROZEN, FOR INDUSTRIAL PROCESSING OR PRESERVATION, WHOLE
03034923	BLUEFIN TUNAS "THUNNUS THYNNUS", FROZEN, FOR INDUSTRIAL PROCESSING OR PRESERVATION, GILLED AND GUTTED
03034929	BLUEFIN TUNAS "THUNNUS THYNNUS", FROZEN, FOR INDUSTRIAL PROCESSING OR PRESERVATION (EXCL. WHOLE AND GILLED AND GUTTED)

Data on live Atlantic bluefin tuna in Tables 1 and 2 refer to trade on live specimens caught by industrial purse seine fleets for farming purposes. Information on EU countries is segregated between those member states involved in the catch and farming of bluefin tuna (Spain, France, Italy, Cyprus, Greece and Malta), and the rest, which are net consumers. Eurostat information mainly refers to external trade involving EU member states and third countries, which means that data on intra-EU trade might be incomplete.

It should be pointed out, however, that the main domestic markets for bluefin tuna at EU level are found in the main harvesting nations - notably Spain, France and Italy. No information is available on the size of this domestic market for Atlantic bluefin tuna, although it is thought to be very important, given the long tradition of bluefin tuna consumption in those countries. The lack of information on the magnitude of domestic markets in the Mediterranean means that the picture provided by the available official data on international trade presented here only provides a partial overview of the European market (and this without considering the huge estimates of Illegal, Unreported and unregulated, or IUU, fishing described in section 6.4).

Table 3 shows the information on imports of processed Atlantic bluefin tuna during 2007 by ICCAT Contracting Parties (East Atlantic stock), as available on the ICCAT register of the Bluefin Tuna Statistical Document (BFTSD) Programme. Total imports of 32,356 t of processed bluefin tuna reported by Japan to ICCAT for 2007, (total Japanese imports in Table 3 from East Atlantic and Mediterranean; see ICCAT Circulars 1951/07 and 500/08), contrast sharply with the legal Total Allowable Catch for that year (29,500 t). This mismatch between ICCAT import records (BFTSD) and the TAC is all the more evident when the unquantified levels of domestic consumption in European Mediterranean countries are taken into account, together with the real magnitude of the intra-European trade and the catches by the national Japanese fleet operating in the East Atlantic and the Mediterranean Sea (reported at 2,078 tons in 2007). All these elements taken together suggest significant catches over the legal quotas (IUU), in line with ICCAT SCRS estimates of possible real catches (61,000 t in 2007). These comparisons, however, should be made with caution since trade data for 2007 includes some farmed fish caught in 2006, and trade information refers to processed presentations (to which adequate conversion factors need to be applied -including appropriate growth rates during the farming period - in order to yield estimates of round weight at the moment of catch). Indeed, bluefin tuna import records available at the ICCAT BFTSD database include the following: dressed, gilled and gutted, filleted, round and others (such as belly meat), which can bias the original round weight of the fish at the moment of harvesting.

Table 1. Exports of processed and live Atlantic bluefin tuna from EU27 countries in 2007 based on Eurostat database. Shaded cells indicate intra-EU trade. EU27 BFT producers include Spain, France, Italy, Cyprus, Greece and Malta. Volume of trade is given in tonnes.

	IMPORTING ENTITIES											
	EU27 BFT producers	**EU27 others**	**Croatia**	**Israel**	**Japan**	**Korea**	**Switzerland**	**Thailand**	**Tunisia**	**Turkey**	**USA**	**Others***
processed												
EU27 BFT producers	3937.55	300.3		31.3	13837.1	203.9	34.3	49.8			492.1	11.2
EU27 others	3.4	46.1	0.05		0.1					1		0.1
live												
EU27 BFT producers	1571.25	10.65	557.8		900				229			1
EU27 others	53.5	1.3										0.8

* includes Bahrain, Kuwait, Russia, UAE, Canada and Norway

Table 2. Imports of processed and live Atlantic bluefin tuna into EU27 countries in 2007 based on Eurostat database. Shaded cells indicate intra-EU trade. EU27 BFT producers include Spain, France, Italy, Cyprus, Greece and Malta. Volume of trade is given in tonnes.

	EXPORTING ENTITIES								
	EU27 BFT producers	**EU27 others**	**Croatia**	**Libya**	**Morocco**	**Tunisia**	**Turkey**	**USA**	**Oman**
processed									
EU27 BFT producers	5784.7	329	19.8		413	70.1	18.6	1.9	0.5
EU27 others	88.4	86.05				1.7			
live									
EU27 BFT producers	10345.9	1		340	210				
EU27 others	3.3	56.25				1.4	1.9		

Table 3. Imports of processed Atlantic bluefin tuna (East Atlantic stock) in 2007 based on ICCAT database (records of the Bluefin Tuna Statistical Document –BFTSD- Program). EU27 BFT producers include Spain, France, Italy, Cyprus, Greece and Malta. Volume of trade is given in tonnes.

	Fishing and primary exporting country										
	EU27 BFT producers	**Algeria**	**China**	**Croatia**	**Guinea**	**Korea**	**Libya**	**Morocco**	**Taiwan**	**Tunisia**	**Turkey**
EU27 BFT producers		14.92		16.07		345	771.19	416.9		10.29	37.18
China	39.36										9.04
Japan	21711.70		88	2853.16	12	724.81	1010.95	2025.67	14.38	2702.76	1203.17
USA	99.23							38.75		2.08	

6.3. Parts and derivatives in trade

See section 6.2 above.

6.4 Illegal trade

A catch assessment produced by Advanced Tuna Ranching Technologies (ATRT) for WWF, based on trade statistics of bluefin tuna products was presented by WWF scientists in the last SCRS meeting (SCRS, 2008a). For 2006, the study relied on complete official statistics on international trade for the year, including ICCAT Bluefin Tuna statistical documents (BFTSD) supplemented with Eurostat trade data. Trade figures were cross-checked against databases from national trade and custom agencies in Spain, France, Malta, Italy, United States, Japan, Korea and Tunisia, and fine-tuned with reliable catch and caging data when appropriate. Total estimated catches of Atlantic bluefin tuna (wild round weight) in the east Atlantic and the Mediterranean amounted to 58,681 t. For 2007, this study was based on direct field assessments of Mediterranean tuna farms in 2006 and 2007, supplemented with Eurostat trade data (from January to July 2007) and official reports of catches and industry estimates collected until August 30, 2007. Total estimated catches of Atlantic bluefin tuna (wild round weight) in the East Atlantic and Mediterranean amounted to 56,149 t for the year 2007. Spreadsheets supporting these calculations are held at the ICCAT Secretariat as part of the record of the 2008 bluefin tuna stock assessment. The results of this study were endorsed by the SCRS and coincided in general with that made by the Group on the basis of active capacity (SCRS, 2008a) – i.e. 61,000 t (SCRS, 2008b). Consequently, the difference between the estimated catch of 61,000 t and the legal quota of 29,500 t for 2007 can be attributed to illegal trade, most of which is happening at an international level.

6.5 Actual or potential trade impacts

The current exploitation of bluefin tuna in the Mediterranean is mainly driven by the international market for sushi and sashimi (to a large extent, Japanese). This Japanese market is responsible for the growth of bluefin tuna farming activities and the associated purse seine catches in recent years in the Mediterranean. This use of bluefin tuna production has become the main threat to its sustainable exploitation, because it is responsible for the bulk of the catch. The inclusion of Atlantic bluefin tuna in Appendix I of CITES would allow only domestic consumption or consumption within the European Union, which could, in all likelihood, result in harvest levels that are consistent with the Total Allowable Catch advised by SCRS scientists for the East Atlantic and Mediterranean stock - i.e. between 8,500 to 15,000 t or less.

7. LEGAL INSTRUMENTS

7.1 National

It has already been noted that management of the Atlantic bluefin tuna is under the competence of ICCAT (see 7.2), the international Regional Fisheries Management Organization in charge of the conservation of tuna and tuna-like fishes in the Atlantic Ocean (ICCAT, 2007). ICCAT, in its annual meeting, adopts legislation with management measures that are binding for its 48 contracting Parties. All bluefin tuna fishing and farming nations in the Mediterranean are contracting Parties of ICCAT and thus obliged to comply with its legislation. The legislation is, therefore, then adopted by the GFCM (General Fisheries Commission for the Mediterranean), the Regional Fisheries Management Organization managing the fisheries in the Mediterranean, where the East Atlantic bluefin tuna stock is heavily exploited. The European Union (EU), a contracting party of ICCAT, makes a transposition annually of the ICCAT management measures into the EU legislation, which then become binding for its Member States. The main tuna producing countries in the Mediterranean are members of the EU, which holds nearly 60 % of the annual TAC for bluefin tuna established by ICCAT.

In 2009, on the basis of voluntary action, trade and consumption of bluefin tuna was totally removed from the territory of Monaco.

7.2 International

ICCAT was established at a Conference of Plenipotentiaries, which prepared and adopted the International Convention for the Conservation of Atlantic Tunas signed in Rio de Janeiro, Brazil, in 1966. After a ratification process, the Convention entered formally into force in 1969.

As already stated, ICCAT currently manages Atlantic bluefin tuna as two stocks, the western and the eastern stocks, with the boundary between the two spatial units being the 45°W meridian. This delimitation was established for management convenience (SCRS, 2002). Starting in 1974 ICCAT adopted a series of recommendations on management measures concerning both stocks. Initially, the main measures were related to a minimum landing size and fixing of a catch quota. More recently, recovery plans were adopted for the species. However, ICCAT has consistently set catch quotas for the East Atlantic and Mediterranean stock above levels recommended by its scientists (SCRS). The continuously decreasing population trends of the East Atlantic and Mediterranean stock are evidence of the failure of ICCAT's management measures to date. ICCAT´s own scientific committee (SCRS) estimated that the eastern bluefin tuna catch in 2007 was twice the current total allowable catch (TAC), and four times the sustainable level, and highlighted the ineffectiveness of the adopted TAC in controlling the catch (SCRS, 2008). SCRS' scientists continually advise that the current management measures will lead to a further reduction in spawning stock biomass of the eastern stock, with a high risk of stock collapse.

In 2007 ICCAT, in common with many other regional fisheries bodies, agreed to conduct an independent review of its own performance against its objectives (Hurry *et al.,* 2008). For this purpose, it appointed an independent panel consisting of Glenn Hurry, Chief Executive Officer of the Australian Fisheries Management Authority (AFMA) and the current Chairman of the Western and Central Pacific Fisheries Commission, Moritaka Hayashi, Professor (now *emeritus*) of International Law, Waseda University in Japan, and Jean-Jacques Maguire, a well known and respected international fisheries scientist from Canada. The review, delivered in September 2008, stated that:

> "ICCAT contracting parties' performance in managing fisheries on bluefin tuna particularly in the eastern Atlantic and Mediterranean Sea is widely regarded as an international disgrace …".
>
> "The Panel found the management of fisheries on bluefin tuna in the eastern Atlantic and Mediterranean and the regulation of bluefin farming to be unacceptable and not consistent with the objectives of ICCAT. This finding coupled with the published statements from the European Community (EC) has prompted the Panel to recommend to ICCAT the **suspension of fishing on bluefin tuna** in the eastern Atlantic and Mediterranean until the CPCs fully comply with ICCAT recommendations on bluefin."
>
> "The Panel further recommends that ICCAT consider an **immediate closure of all known bluefin tuna spawning grounds** at least during known spawning periods. Referring to illegal fishing pushing annual catches to twice the quota levels and four times scientific recommendations."
>
> The report concluded that "It is difficult to describe this as responsible fisheries management."

The introduction of bluefin tuna farming activities in the Mediterranean in 1997 exacerbated the problems with management of the fisheries. The first recommendation related to farming activities was adopted in 2002 and subsequent recommendations were adopted in subsequent years. However, the resulting reported information is unreliable, due to non-compliance, misreporting, and doubtful growth rates for the fish. As previously noted, the current farming capacity in the Mediterranean is estimated by the SCRS to be around 64,000 t (SCRS, 2008a), more than double the Total Allowable Catch adopted for past years.

In 1992 ICCAT first adopted a recommendation requiring trade tracking and reported. Following this recommendation, all bluefin tuna imported into the territory of a Contracting Party or at the first entry into a regional economic organization, had to be accompanied by an ICCAT Bluefin Tuna Statistical Document. The information required in the document included the name of the exporter country, the area of harvest, the type of product and weight, and the point of export. As proven by the high estimates of illegally caught bluefin tuna, this recommendation failed to quantify the real amount of traded bluefin tuna.

In 2007, ICCAT adopted a more complete programme, the Bluefin Tuna Catch Documentation Programme, which entered into force in June 2008. This included not only trade information but also catch, transfer, transhipment, and farming information. Although the program just entered into force, its efficiency is open to discussion. Available data and information on its implementation is limited at this time, in spite of clear legal deadlines for the official reporting of the information.

8. SPECIES MANAGEMENT

8.1 Management measures

Atlantic Bluefin Tuna – East stock.

In October 2006 the SCRS stock assessment revealed that the fishing mortality for the eastern stock of Atlantic bluefin tuna was more than three times the level that the stock could sustain, and that this trend was expected to drive the spawning biomass to very low levels, giving rise to a high risk of fishery and stock collapse (SCRS, 2006). Scientists advised that the only scenarios which have the potential to address the decline and initiate recovery are those which include, among other measures, the closure of the Mediterranean to fishing during the spawning months (May, June, and July) and a Total Allowable Catch of 15,000 t or less. The SCRS estimated that catches were 56% over the legal TAC. However, in November of the same year, ICCAT, in its plenary session, adopted the first "Recovery plan for bluefin tuna in the Eastern Atlantic and Mediterranean" which did not take into account any of the mentioned essential requirements for rebuilding the stock. The TAC was fixed at 29,500 t for 2007, decreasing gradually to 25,500 t by 2010; and the seasonal closure included only one month of the three month spawning season advised.

In July 2008, the new stock assessment for the East Atlantic and Mediterranean stock made by the SCRS (SCRS, 2008a) indicated that the spawning stock biomass continues to decline (calculated as 30-40% of the levels in the 1970's), and that fishing mortality was increasing rapidly, especially for large fish. Again scientists warned that continuing fishing at this level is expected to drive the spawning stock biomass to 18% of that in 1970, which, combined with the current high fishing mortality and severe overcapacity, results in a high risk of fisheries and stock collapse (SCRS, 2008a). At this time the SCRS advised that the maximum Total Allowable Catch should be between 8,500 and 15,000 t, and that fishing should be banned during the spawning season (May, June and July). They went on to suggest the benefits of establishing a moratorium to increase the probability to rebuild the stock - an option that was reinforced during the meeting by the estimate of catches for 2007 of 61,000 t (more than double the TAC - see 8.3).

In September of the same year, the ICCAT performance review (see 7.2) (Hurry *et al*., 2008) stated:

> "…the Panel (to) recommend to ICCAT the **suspension of fishing on bluefin tuna** in the eastern Atlantic and Mediterranean until the CPCs fully comply with ICCAT recommendations on bluefin." "The Panel further recommends that ICCAT consider an **immediate closure of all known bluefin tuna spawning grounds** at least during known spawning periods."

In October 2008 the IUCN World Conservation Congress adopted, by majority, a recommendation on the species. Those voting in favour included Spain, a key fishing nation, and Japan, the most important market country. In the recommendation IUCN asked ICCAT, at its next meeting of November 2008, to establish a science based recovery plan according to SCRS advice, including the closure of the fishery during the crucial months of May and June and a Total Allowable Catch of less than 15,000 t. It also asked ICCAT to establish immediately a suspension of the fishery until it can be brought under control, and to establish protected areas on the main spawning grounds[3].

Two weeks before the ICCAT plenary session in November 2008, ICCAT's chairman sent a letter[4] to the head delegates of ICCAT contracting Parties urging to take science seriously into account, stating that:

> "…there will be no future for ICCAT if we do not fully respect and abide by the scientific advice. If we do not follow the instructions science is giving us, our credibility will be irreversibly jeopardized and the mandate to manage tuna stocks will be surely taken out of our hands".

Despite all these recommendations, ICCAT again failed in November 2008 to adopt any of the measures advised, and, therefore, to bring about a change in the current rapid deterioration of the stock, or to forestall prevent its imminent collapse. The measure adopted by ICCAT established Total Allowable Catches for the East Atlantic and Mediterranean stock that decline annually. Specifically, the measure establishes Total Allowable Catch limits of 22,000 t, 19,950 t, and 18,500 t for the years 2009, 2010, and 2011 respectively. The fishery was left open during the first half of the spawning season, when the bulk of the catches are usually made. The

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[3] See resolution 4.028 in http://www.iucn.org/congress_08/assembly/policy/index.cfm
[4] ICCAT circular #2146/08

season is open from 15 April to 15 June, with the possibility of extending the season to 20 June based upon weather conditions.

The first ever real estimate of the actual catch capability of the Mediterranean purse seine fleet targeting bluefin tuna revealed that this fleet alone has a yearly catch potential of 54,783 t (WWF, 2008), almost double the annual total TAC set for 2008 and more than three and a half times the maximum catch level advised by scientists to avoid stock collapse (between 8,500 and 15,000 t). This figure does not take into account the catch potential of the rest of the bluefin tuna fleet, such as longliners, traps, bait boats, pelagic trawlers and hand line boats. This result was then publicly endorsed by the European Commission who welcomed the report and shared the analysis highlighting that "…the whole fishery is plagued by overfishing by a fleet that keeps growing in size and efficiency..."[5]. The SCRS, in its stock assessment meeting of 2008, found similar results: "In view of the assessment of stock status, this level of *active* capacity, leading to estimates of 2007 catch level on the order of 60,000 t, is at least 3 times the level needed to fish at a level consistent with the Convention objective." (SCRS, 2008a). However, despite these figures, the 2008 ICCAT meeting could only agree to "freeze" the bluefin tuna fishing capacity at the 2007 level through 2008 with reductions in the ensuing years.

8.2 Population monitoring

ICCAT requests statistical information from its contracting Parties strictly for scientific purposes. This information allows its scientific committee (SCRS) to perform the bluefin tuna stock assessment when required by the Commission. This information includes detailed data on fleets, catches, temporal and spatial distribution of catches by fishing gear, and size frequencies of the catches. Although this requirement is binding for ICCAT contracting Parties, scientists carrying out the stock assessment repeatedly complain of data limitations due to substantial under-reporting of catches and other relevant information. Moreover, in June 2008 during the session dedicated to the assessment of the stock, the chairman of the SCRS wrote a letter to the Commission explaining the difficulties of carrying out the stock assessment with the scarce data reported up to the start of the meeting for the East Atlantic and Mediterranean stock; only 15% of the total TAC for that stock (SCRS, 2008a: Appendix 6). The letter added that:

> "It is also disappointing that such a large group of scientists and international experts meets during two weeks at a considerable expense to their organizations and is unable to complete the work required because of a (chronic) lack of data being transmitted in time. This situation is even more incomprehensible given the high international concern about bluefin tuna stock status" (SCRS, 2008a: Appendix 6).

8.3 Control measures

8.3.1 International

The only existing control of movement of bluefin tuna products across international borders is carried out by ICCAT through the new Bluefin Tuna Catch Documentation Programme (Recommendation 07-10[6]) which includes trade information and also catch, transfer, transhipment, and farming information. This recommendation was adopted in 2007 and entered into force in June 2008. The programme has limitations. It addresses the tagging of the fish, but the use of the tags is left optional for the contracting Parties and the timing of their application to bluefin tuna is specified as "preferably at the time of kill". As most of the East Atlantic and Mediterranean harvested bluefin tuna are transferred live to tuna farms (usually located in a different country) for fattening and then, after slaughter, to reefer vessels to be immediately processed and frozen, this measure, even if applied, would have very little effect on verification of bluefin tuna movement across international borders.

8.3.2 Domestic

Different control schemes are applied in ICCAT contracting parties with different degrees of success. Canada, for instance, has a comprehensive management, monitoring, control and surveillance programme on its Atlantic bluefin tuna fishery on the western stock, with a high level of compliance. In that fishery tuna are caught through tended line or rod and reel and every fish is tagged on board. All tags are individually numbered and are entered into a computer tracking system, so at any given moment is possible to know the tags that have

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[5] Press Release from the European Commission, March 2008: http://ec.europa.eu/fisheries/press_corner/press_releases/2008/com08_27_en.htm
[6] http://www.iccat.int/en/RecsRegs.asp

been issued, their numbers and owners. When the fish is landed it has a tag affixed to it which allows tracking of the fish to the marketplace. Then, every single bluefin tuna landed in Canadian waters is verified by an independent dockside monitor, who checks the number of fish, individual weight, tag number and other vital statistics. All this information is entered into a database that is accessible in real time to fisheries managers, scientists and enforcement officers. Verification is undertaken by an at-sea surveillance programme, which patrols the waters 120 days per year, and from the air about 300 missions per year. Strong penalties are also in place[7]. The United States has a tagging programme similar to Canada's.

On the other hand, compliance of the rules in Mediterranean waters is considered poor. The EU, which holds nearly 60% of the TAC of the eastern stock of bluefin tuna, carried out an unprecedented verification scheme in 2008 through the newly established Community Fisheries Control Agency (CFCA), whose role is to organize operational coordination of fisheries control and inspection activities by Member States. The Joint Deployment Plan for the bluefin tuna fishery carried out by the CFCA revealed that purse seiners and tug boats, that together are responsible for the bulk of the catches, were involved in a considerable number of infringements. Most infringements were related to catch documentation and the Vessel Monitoring System (VMS). The use of spotter planes searching for bluefin tuna, forbidden by ICCAT, was found to be "quite widespread" and infringements related to the bluefin tuna minimum landing size were also discovered. Finally, the report of the CFCA states:

> "It can be concluded that despite all meetings with the stakeholders convened by the Commission and Members States before the start of the season, it has not been a priority of most operators in the fishery to comply with the ICCAT legal requirements. As regards the recording and reporting of bluefin tuna catches and the use of tugs and spotter planes the ICCAT rules have not been generally respected."[8]

Canada, in the Compliance Committee session of the ICCAT meeting in November 2008, reported cases of alleged non-compliance in ICCAT fisheries. Of the 44 reported cases of alleged non-compliance by ICCAT contracting Parties, 40 were related to the bluefin tuna fisheries in the Mediterranean[9].

In January 2009, NOAA (the US National Oceanic and Atmospheric Administration) reported to the U.S. Congress on the "Implementation of Title IV of the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006"[10]. In the report NOAA identified 6 nations whose fishing vessels were engaged in illegal, unreported, and unregulated fishing in 2007 or 2008. Vessels from 4 of those nations were committing infringements in relation to the bluefin tuna fishery in the Mediterranean.

These examples corroborate the poor control and compliance in relation to the Mediterranean bluefin tuna fishery already mentioned by several independent reports.

8.4. Captive breeding and artificial propagation

Atlantic Bluefin Tuna – East stock.

Most tuna caught by the industrial purse seine fleets operating in the Mediterranean are transferred live to farms for farming/fattening purposes (usually for a period of a few months). This activity qualifies as capture-based aquaculture according to FAO standards (Ottolenghi *et al.*, 2004), but does not involve the breeding in captivity of the animals. A similar species, Pacific bluefin tuna (*Thunnus orientalis*), is subject to true, closed lifecycle captive breeding in Japan, where a small production is entering the local market and known as *kindai*. The EU-funded project SELFDOTT is currently investigating the breeding of Atlantic bluefin tuna in captivity.

Atlantic Bluefin Tuna – West stock.

No harvesting for captive raising, captive breeding, or artificial propagation is currently taking place from West Atlantic stock.

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[7] Fisheries and Oceans Canada, http://www.dfo-mpo.gc.ca/tuna-thon-video-eng.htm
[8] Specific Report regarding the implementation of the Joint Deployment Plan for bluefin tuna fishing activities in 2008 in the Mediterranean Sea and Atlantic (preliminary version, November 2008) submitted by the CFCA to the Fisheries Commission of the European Parliament.
[9] ICCAT document Doc. COC-318/2008
[10] http://www.nmfs.noaa.gov/msa2007/intlprovisions.html

8.5. Habitat conservation

There are no protected areas within the Mediterranean of relevance for the protection of Atlantic bluefin tuna. The report of the independent review of ICCAT of September 2008 (Hurry *et al.*, 2008) recommended that ICCAT "consider an immediate closure of all known bluefin tuna spawning grounds at least during known spawning period". Furthermore, in October 2008, the World Conservation Congress (WCC), through CGR4.MOT038 "Action for recovery of the East Atlantic and Mediterranean population of Atlantic bluefin tuna" requested ICCAT "to set up protection zones for spawning grounds in the Mediterranean including the waters within the Balearic Sea, Central Mediterranean, and Levant Sea, during the spawning season." The ICCAT meeting of November 2008 failed to implement the above requests and postponed any decision on this issue two more years, to the annual meeting of ICCAT in 2010 (ICCAT Recommendation 08-05).

In October 2008, the Meeting of the Working Group on Marine Protected Areas, Species and Habitats (MASH) of the OSPAR Convention for the Protection of the Marine Environment of the North-East Atlantic formally identified Atlantic bluefin tuna as a species "requiring urgent action". The species is listed in the OSPAR List of Threatened and/or Declining Species and Habitats.

In the Western Atlantic, ICCAT adopted a prohibition on the direct catch of bluefin tuna in the main spawning area of the Gulf of Mexico in 1982 (ICCAT Rec. 1982-01), which has been implemented by the United States and Mexico. In addition, fishermen reported a harvest of approximately 81 t of bycatch in 2007 from the western stock in the Gulf of Mexico through bycatch in other fisheries.

9. Information on similar species

Different tuna species are widely traded at the international level, including Atlantic bluefin tuna *Thunnus thynnus,* Pacific bluefin tuna, *Thunnus orientalis*, Southern bluefin tuna, *Thunnus maccoyii*, bigeye tuna, *Thunnus obesus*, yellowfin tuna, *Thunnus albacares*, albacore, *Thunnus alalunga*, and skipjack, *Katsuwonus pelamis*. Trade in these species involves different kinds of presentation: typically dressed, gilled and gutted, or transformed into loins or belly meat. All of these might be fresh/chilled or frozen. Morphologically, all 3 bluefin tuna species look similar, particularly Atlantic and Pacific bluefin tuna. As whole adult fish, bigeye, yellowfin, albacore and skipjack are easily identifiable from bluefins based on external attributes (body shape and other morphometrics, characteristics of the fins, etc.), but, depending on the type of presentation (i.e. dressed, or deep frozen), this might not always be easy. Once transformed into loins or belly meat, the 3 bluefin species, bigeye and yellowfin are very difficult, if not impossible, to distinguish from each other visually.

Genetic techniques provide precise tools to identify Atlantic bluefin tuna from any other tuna species, including the other two bluefin tuna species that are morphologically similar. Species identification can be undertaken with almost any samples, including tissue from fresh or frozen whole individuals, fin clips and even dried tissue and larvae. Genetic identification of tuna species can be undertaken using several genetic markers that have been used in species relationships studies (Alvarado Bremer *et al.*, 1997, 2005, Block and Finnerty, 1994, Chow and Kishino, 1995, Chow *et al.*, 2006, Ward *et al.*, 2005. As concluded by the recent study by Viñas and Tudela (2009) sequencing a fragment of the mtDNA genome (particularly combining the analysis of the control region and the cytochrome-oxidase – COX I) constitutes a powerful technology that allows one to distinguish among the eight species of the genus *Thunnus*.

10. CONSULTATIONS

This proposal has been improved with comments received from the Canada, United States of America, European Commission, Japan, Serbia and Turkey, which were received in the framework of the range state consultation. An explanation on how comments have been taken into account in this final version is given in Annex 2.

11. ADDITIONAL REMARKS

In view of some opinions stressing the great uncertainty of some of the data available, particularly of fisheries-dependent data for the East Atlantic and Mediterranean stock and of some related outputs, the proponents wish to emphasize the particular relevance of Annex 4 of Resolution Conf. 9.24, of which Paragraph A reads: "*When considering proposals to amend the appendices, the Parties shall, in the case of uncertainty, either as regards the status of a species or as regards the impact of trade on the conservation of a species, act in the best interest of the conservation of the species*". The history of the Atlantic bluefin tuna fishery in the last decades reflects a clear case of market-driven fishery; the benefits for the wild bluefin tuna populations of eliminating the main driver for precipitous population decline –international trade- are obvious.

This document is based on the latest scientific information available up to October 2009, and takes into account new relevant information submitted by scientists to the ICCAT SCRS at the 2009 Bluefin Tuna Species Group Meeting. The Principality of Monaco wishes to remind that no new stock assessment of the Atlantic bluefin tuna was performed by ICCAT SCRS in 2009.

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13. RANGE STATES

The following countries are those who have reported bluefin tuna catches after 1983 (source: http://www.iccat.int/Documents/SCRS/ExecSum/BFT_EN.pdf) and/or whose territory (EEZ or territorial waters) are within the natural range of distribution of the species, according to ICCAT maps on distribution range of the species.

Albania
Algeria
Antigua and Barbuda
Argentina
Barbados
Belize
Brazil
Canada
Cape Verde
Colombia
Costa Rica
Croatia
Cuba
China P.R.
Chinese Taipei
Dominica
Dominican Republic
EC. Belgium
EC. Germany
EC. Netherlands
EC. Cyprus
EC. Denmark
EC. Spain
EC. France
EC. Greece
EC. Ireland
EC. Italy
EC. Malta
EC. Portugal
EC. Sweden
EC. United Kingdom
Egypt
Faeroe Islands
FR. St Pierre et Miquelon
Grenada
Guatemala
Guinée Conakry
Guyana
Haiti
Honduras
Iceland
Israel
Jamaica
Japan
Korea Rep.
Lebanon
Libya
Morocco
Mexico
Monaco
Montenegro
Nicaragua
Norway
Panama
Serbia
Sierra Leone
Slovenia
St. Kitts and Nevis
St. Vincent and the Grenadines
Sta. Lucia
Syria
Trinidad and Tobago
Tunisia
Turkey
U.S.A.
UK. Bermuda
Uruguay
Venezuela

Annex 1 to the Proposal to include Atlantic Bluefin Tuna (Thunnus thynnus Linnaeus, 1758) on Appendix I of CITES in accordance with Article II 1 of the Convention, submitted by the Principality of Monaco: Analysis of productivity

Supplementary information to the draft proposal to CoP15 to include bluefin tuna *Thunnus thynnus* on Appendix I of CITES as proposed by Monaco

18 September 2009

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> **The main points of information provided here are:**
>
> **All available data concordantly demonstrate that the Atlantic bluefin tuna is a low productive species, with high fecundity.**
>
> **The Atlantic bluefin tuna scores as a Low Productivity species using the criteria set up by the American Fisheries Society and/or the criteria of FAO.**
>
> **The convention text suggesting that "More-productive species tend to have high fecundity, rapid individual growth rates and high turnover of generations" is misleading and needs to be re-evaluated.**

Regarding the proposal to CoP15 to include the Atlantic bluefin tuna *Thunnus thynnus* on Appendix I of CITES as proposed by Monaco, we herewith submit supplementary information which should be read in conjunction with the proposal by Monaco and the information submitted by the UK. The focus is on the information needed for a species to fulfill the criteria set by Conf. 9.24 (Rev. CoP14) and its annexes, and in particular the footnote "Application of decline for commercially exploited aquatic species":

> "*In marine and large freshwater bodies, a narrower range of 5-20% is deemed to be more appropriate in most cases, with a range of 5-10% being applicable for species with high productivity, 10-15% for species with medium productivity and 15-20% for species with low productivity. Nevertheless some species may fall outside this range. Low productivity is correlated with low mortality rate and high productivity with high mortality. One possible guideline for indexing productivity is the natural mortality rate, with the range 0.2-0.5 per year indicating medium productivity.*"

The productivity is important in determining which range of population size decline to use. There have been many view-points on what "productivity" is and how it is measured, and Conf 9.24 (rev. CoP 14) gives some guidance:

> "*Productivity is the maximum percentage growth rate of a population. It is a complex function of reproductive biology, fecundity, individual growth rates, natural mortality, age at maturity and longevity. More-productive species tend to have high fecundity, rapid individual growth rates and high turnover of generations.*"

Analysis

Here we examine whether the productivity of the Atlantic bluefin tuna can be classified as low, medium, or high. Specifically, we look into maximum age, natural mortality rate, age at maturity, turnover over generations, fecundity, individual and population growth rates, longevity, and other variables.

Maximum age

The maximum age (Tmax) of the Atlantic bluefin tuna is known to be well over 20 years (Kawasaki 1980, 1983, Fromentin and Restrepo 2001) and the maximum age determined by examination of a large number of actual specimen is 27 years (Nichy and Berry 1975).

Natural mortality rate

It is standard practice to make use of the harmonic mean for rates such as birth and mortality rates (e.g. Chitnis *et al*. 2008, Parsons *et al* 2008, Patwa and Wahl 2009), and not the arithmetic mean as applied by Monaco. The harmonic mean of the natural mortality rates (M) provided by the SCRS ICCAT for different age classes of the eastern population is 18.5% for all age classes (1-10 yrs), 16.7% for the “adult” age class (3-10 yrs; and as used by Monaco), and as low as 16.0% for sexually mature age classes (4-10 yrs).

Age classes	1	2	3	4	5	6	7	8	9	10	**Harmonic mean**
All	0.49	0.24	0.24	0.24	0.24	0.20	0.175	0.15	0.125	0.10	0.1849
“Adults”			0.24	0.24	0.24	0.20	0.175	0.15	0.125	0.10	0.1671
Sexually mature				0.24	0.24	0.20	0.175	0.15	0.125	0.10	0.1601

Inclusion of age-classes up to 20 in the calculation (using M=0.10 for age-classes 11-20) lowers the harmonic mean natural mortality rate (M) even further, to 13.0, 12.2, and 11.8% for the abovementioned groups respectively. Increasing beyond that to the maximum age, 27 years, lowers the mortality very little. Regardless of which age-classes are included, the natural mortality rate is well below 0.2-0.5, i.e. below the lower range value given for medium productivity species. <u>The natural mortality rate of the Atlantic bluefin tuna is strongly indicative of a low productivity species</u>.

Age at maturation

The estimated ages for sexual maturity of the Atlantic bluefin tuna varies from 4-12 years, depending method of age estimation and population (e.g. Rooker *et al*. 2007). As Monaco notes, there has been a suggested decrease in the age at maturation since the 1980s, a trend which then also has abnormally increased the mortality rate at maturation. Further, it is known that declining maturation trends preceded the collapse of the northern cod (*Gadus morhua*) in Canada (Olsen *et al*. 1994), which has not since recovered. <u>The age at maturation, 4-12 years, of the Atlantic bluefin tuna is typical for low productivity species</u>.

Turnover of generations

While the first age at maturation (Tmat) may vary between 4 and 12 years of age, it is not the proper measure of generation time for iteroparous organisms with a long reproductive period relative to their life-span (Tmax) and does not describe the turnover rate of generations (e.g. Vranken and Heip 1983, Franco and Silvertown 2004, Coulson *et al*. 2006). The mean generation time of the Atlantic bluefin tuna is therefore invariably over 10 years as the maximum age of 27 years also is considered. The absolute fecundity is also increased with age which gives large females a relative advantage in reproductive success; however, and as Monaco notes, the proportion of large spawners (age 8+) has declined especially since the late 1970s. The share of repeat spawners in the population has also declined and has remained generally low since the mid- to late 1980s. In the absence of harvesting, <u>the Atlantic bluefin tuna has about 6 to 9 generations per 100 years which is a very strong indication of a low productivity species</u>.

Growth rate of a population

Using ICCAT Task records of catch biomass, McAllister and Carruthers (2007) fitted various combinations of fishery-independent and fishery-dependent stock trend indices for bluefin tuna to evaluate the sensitivity of intrinsic rate of natural increase, r, to different datasets. <u>The r value was centred around 0.03-0.06 which is a strong indication of low productivity of the Atlantic bluefin tuna</u>.

Growth rate of an individual

Restrepo *et al*. (2007) reanalysed older data sets used in recent literature to estimate the growth rate of individual Atlantic bluefin tunas. While they used different subsampling criteria, the 18 resulting von Bertalanffy growth parameter K varied from 0.003-0.120; i.e. all low or very low and only one over 0.10. Using literature data, Coan (1976) estimated the K parameter to 0.053. The harmonic mean of the 22 von

Bertalanffy K-values provided in FishBase (www.fishbase.org; from 23 sources, but 1 suspect removed) is 0,081. All available data on individual growth rate point to a von Bertalanffy K-value below 0.10 which is an indication of both slow growth and low productivity.

Fecundity

One of the main components of the reproductive success is the number of eggs per female per reproductive effort, fecundity (Lambert 2008), even if it may not be a general pattern (Mertz and Meyers 1996). Many marine vertebrates have much higher fecundity than is technically possible for land vertebrates, with millions of fertilized eggs, and which is higher than for most freshwater vertebrates too. Data by Rooker *et al*. (2007) show that the Atlantic bluefin tuna has a fecundity with more than 90 oocytes (unfertilized eggs) per gram of body weight, whereas other tuna species typically have less than 70 oocytes per gram of body weight. The arithmetic mean size of ripe eggs collected just before spawning was 1.11 mm with a range of 0.851-1.258 mm (Rodríguez-Roda 1967). For perspectives, smaller fish species have more oocytes per gram body weight, often much higher than that of the Atlantic bluefin tuna: Baltic cod (*Gadus morhua*): 1000 oocytes (Bleil and Oeberst 2005), Octopus (*Octopus vulgaris*): 100-400 oocytes (Hernández-García *et al*. 2002), Mojarra (*Gerres abbreviatus*): 7000 oocytes (Sivashanthini *et al*. 2008). Due to the size of the Atlantic bluefin tuna those number translate to large numbers for each female, depending on size and population (Rooker *et al*. 2007):

> "*Reported estimates of mean fecundity of large T. thynnus (>205 cm fork length (FL)) from the western Atlantic ranged from 30–60 million eggs (Baglin, 1982), which is considerably greater than estimated fecundity values of spawning T. thynnus from areas in the western Mediterranean and Strait of Gibraltar (ca. 13–15 million eggs, Medina et al., 2002). Maximum mean fecundity reported by Baglin and Rivas (1977) was approximately 45 million eggs, albeit that study predicted fecundity could reach 75 million eggs for a 25-year-old female.*"

Rodríguez-Roda (1967) presented the formula F = 2.29245·L 3.01256 for calulating fecundity (F) using length (L) in centimeters and F = 53451·W 1.159489 using weight (W) in kilograms.

Kawasaki (1980, 1983) analysed the various life histories of numerous fish species regarding their reproductive strategies and suggested two main types of life histories, Type I and Type II. He noted that these were similar to the classical "r-" and "K-selected" strategies respectively. He concluded that the bluefin tuna (*Thunnus thynnus*) is a low productive species and uses the Type II strategy. The Type II fish life history is characterized by:

1. a stable and predictable environment
2. stable recruitment
3. resources are put into growth and maintenance
4. long life
5. large size
6. high age at first maturity
7. low growth parameter
8. stable early survival
9. high trophic level position
10. high fecundity

The high fecundity of the bluefin tuna is here not an indication of r-selection but is one of two alternative strategies for retaining a low r-value (Kawasaki 1980). A low r-value and long life is a strategy found in iteroparous fishes, which require repeated reproductive success (Schultz 1989). Caddy and Sharp (2004) write:

> "*There are numerous examples of rapid changes in state occurring in marine biology: the abrupt transition of larval forms seen in many marine organisms at various stages in development is one example. Most fish start life as an independent egg adrift in an uncertain environment with few adaptations other than physiological for survival; therefore, their common "objective", expressed anthropomorphically, is to become independent of local environmental limitations by becoming mobile. This requires that they proceed as rapidly as possible through the developmental stages leading to increased mobility. This is classic r selection. Some other fish bear live young, which are already quite mobile at birth: a classic K selected process. However, fish that grow to large sizes from small eggs often become characteristically K strategists to the point of expending far more of their energy in activity than in reproduction. The oceanic nomad species are good examples (e.g., tunas, dolphin fish, billfishes).*"

High fecundity coupled with low productivity is not uncommon among marine fishes and several of these species are endangered (e.g. Leaman 1991, Sadovy & Cheung 2003, Porch *et al*. 2003, Porch 2004).

In conclusion, even with its modifier, “tend to have”, the Conf. 9.24 (Rev. CoP14) text “*More-productive species tend to have high fecundity, rapid individual growth rates and high turnover of generations*” is misleading for many aquatic organisms. The inclusion of that guidance in the convention text needs to be re-evaluated.

Population doubling time

The population doubling time tells us how long it will take for a population to double in individuals in the absence of exploitation and is used widely in demographic analyses and conservation issues. For example, the population doubling time of the bald eagle (*Haliaeetus leucocephalus*) varied from less than six years in favorable habitats, to above 16 years for some unsuitable habitats (Watts *et al*. 2006).

FishBase (www.fishbase.org) has assembled population doubling times for numerous species. Some examples of commercially important fish with very short population doubling time, less than 15 months, includes e.g. sardines (*Sardinops* spp.), jack mackerels (*Trachurus* spp.), and anchovies (*Engraulis* spp.). The Atlantic cod (*Gadus morhua*) is classified as Medium, with a minimum population doubling time at 1.4 - 4.4 years. The hammerhead shark (*Sphyrna zygaena*) is classified together with the Atlantic bluefin tuna (*Thunnus thynnus*) as Low, with 4.5-14 years in doubling time.

The Atlantic bluefin tuna in Norwegian waters was for all practical purposes fished to extinction in little more than a decade. Tangen (2009) writes:

- “*By 1961 most seiners had got power block and purse seines made of nylon. In 1961 and 1962 large catches of tuna were taken, and this inspired more seiners to participate in the tuna fishery. More than 8000 tons of tuna were caught each of these years. In spite of a new indication of a large spawning stock no young tuna < 5-10 years old migrated to the Norwegian coast in the 1960s.*”
- “*In 1965 only 35 seiners participated. It was clear that the tuna stock was overfished.*”
- “*In 1970 only 11 purse seine vessels participated in the tuna fishery. The result was 205 tons of tuna. It was clear to everyone that the tuna adventure in Norway was over.*”

Likewise, the Atlantic bluefin tuna previously found off Brazil were also fished to extinction in about a decade (Takeuchi *et al*. 2009). These two example demonstrate that the doubling time figures for the Atlantic bluefin tuna are gross underestimates, as these two populations four decades later still have not recovered. The lack of recovery in two distinct areas is very strong evidence that the Atlantic bluefin tuna is a low productive species.

Classification of productivity

The American Fisheries Society (AFS) has suggested range values for several biological parameters that allow score a fish population or species into categories High, Medium, Low and Very Low resilience or productivity (Musick 1999). This categorization has been used in CITES context (e.g. for the listing of the whale shark). AFS stressed the importance of the “intrinsic rate of increase, r” but acknowledged that in the absence of an estimate of r, the DPS (“Distinct Population Segment”) should be classified according to the lowest productivity category for which data are available. AFS exemplified with a fish with high fecundity (>104), but late maturity (5-10 yr), and long life span (>30 yr), which then would be classified under the Very Low Productivity Category using the table (from Musick 1999, Table 3) below:

			Productivity			
	High	*Medium*	*Low*	*Very Low*	*Atlantic bluefin tuna*	*Score*
r (an-1)	>0.50	0.16-0.50	0.05-0.15	<0.05	0.03-0.06	Low
K	>0.30	0.16-0.30	0.05-0.15	<0.05	0.081	Low
Féc. (year-1)	>104	102-103	101<102	<101	>107	High
Tmat (year)	<1	2-4	5-10	>10	4-12	Low
Tmax (year)	1-3	4-10	11-30	>30	>20	Low

Using the AFS scoring scheme for productivity and the data presented above, the Atlantic bluefin tuna would be classified as a Low Productivity species on 4 out of 5 accounts. Later, the FAO Secretariat (FAO 2001) writes:

"The FAO Secretariat *analysed the appropriateness of the existing CITES listing criteria and guidelines for resources exploited by fisheries in marine and large freshwater bodies with particular emphasis on Appendix II. It concluded that several important improvements could be made and that, in particular, quantitative guidelines could and should be developed*".

and recommends:

"The FAO Secretariat *analysed the appropriateness of the existing CITES listing criteria and guidelines for resources exploited by fisheries in marine and large freshwater bodies with particular emphasis on Appendix II. It concluded that several important improvements could be made and that, in particular, quantitative guidelines could and should be developed*".

and recommends:

"*Assuming that productivity can be considered a reasonable surrogate for resilience, it must be taken into account when attempting to define a `small' population or a `marked' decline. Musick (1999) proposed several indices of productivity and guideline ranges of values for these indices as a means of classifying species as having very low, low, medium or high productivity. The Secretariat supports the general concept of this classification scheme and agreed that "r", the intrinsic rate of increase of a species, is the best indicator of productivity amongst these and should be used as such whenever available. The Secretariat chose to use three categories, low, medium and high productivity rather than the four categories proposed by Musick (1999). The von Bertalanffy growth rate (K), age at maturity (tmat) and maximum age (tmax) were also considered appropriate indices, but fecundity by itself was not." […]*

"The Secretariat recommends the productivity guidelines shown in Table 1. With the exception of r, none of these parameters are satisfactory indicators of productivity by themselves. However, in data-poor situations, they may have to suffice. In general, the guidelines in Table 1 will result in species of fisheries interest being allocated to the same class or one more productive than would result from Musick's guidelines."

It is important to note that the FAO Secretariate does not consider that fecundity by itself constitutes an appropriate index for productivity, which is in line with the results presented here. The FAO Secretariate (FAO 2001, Table 1) proposed guideline indices of productivity for exploited fish species are:

			Productivity		
	Medium	*High*	*Atlantic bluefin tuna*	*Score*	*Medium*
M	<0.20	0.20-0.50	>0.50	<0.17	Low
r (year^{-1})	<0.14	0.14-0.35	>0.35	0.03-0.06	Low
K	<0.15	0.15-0.33	> 0.33	<0.10	Low
t_{mat} (years)	>8	3.3-8	< 3.3	4-12	Low/Medium
t_{max} (years)	>25	14-25	<14	27	Low
G (years)	>10	5-10	<5	>10	Low

Using the FAO scoring scheme for estimating productivity and the data presented above, the Atlantic bluefin tuna scores as a strictly Low Productivity species on 5 out of 6 accounts, and a border case in 1.

Implementation issues

As noted by Monaco, positive identifications of fish samples have in recent years become reliable using DNA. That is now true even when the morphology or the origin of the sample is unknown (for an overview of recent advances, see Sevilla *et al*. 2007, Yancy *et al*. 2007, Deeds *et al*. 2007, Costa and Carvalho 2007, Rock *et al*. 2008, Rasmussen and Morrissey 2008, Wong and Hanner 2008, Hubert *et al*. 2008). Suggested protocols for Customs officers routine inspection of fish samples is available in Silfvergrip (2009) which also details aspects like sampling procedures, choice of accredited institutions for species identification, and gives a comprehensive overview of alternative methods for fish identification.

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Annex 2 to the Proposal to include Atlantic Bluefin Tuna (*Thunnus thynnus* (Linnaeus, 1758)) on Appendix I of CITES in accordance with Article II 1 of the Convention, submitted by the Principality of Monaco: results of range state consultation

Discussion by the Principality of Monaco on main comments received from range states.

As of 7th of October 2009, five CITES range states –The Unites States of America, Canada, Japan, Turkey and Serbia - plus the European Commission have formally submitted comments to the Principality of Monaco. In its letter addressed to range states posted on the 15th of July, the Principality of Monaco requested comments by the deadline of the 31st August.

Main technical issues raised by CITES range states, along with an explanation on how the Principality of Monaco has addressed them in the final version of the proposal, are detailed below.

<u>Unites States of America</u>

On August 28 the US Government sent specific comments and suggested changes to the proposal, mostly addressing 1) the need to better clarify the situation regarding the West Atlantic stock of bluefin tuna, and 2) the availability of genetic tools to discriminate between tuna species.

Monaco has amended the proposal according to US suggestions. Particular attention has been devoted to:

a) Better estimate the natural mortality (M) of the East Atlantic stock. M has now been computed for both the adult fraction of the population (ages 4-15) and for the total population (ages 1-15). Also, new estimates are included based on the harmonic mean, and a thorough analysis on productivity of the species is included as Annex 1. The characterization of the species as a low productivity species is now more clearly justified.

b) Some opinions on the status of the West Atlantic stock have been attributed more clearly to the original authors (Safina & Klinger, 2008), and more details on the current status and management measures in force for this stock have been included.

c) Comments on the performance of the ICCAT Catch Document Scheme have been modified, accounting for the short time it’s been in force.

d) Discussion on genetic methodologies available to identify tuna species has been improved, including a new key reference (Viñas & Tudela, in press on PLoS ONE).

Monaco also welcomes the comments on the apparent discrepancies between some of the data on trade in the proposal (US imports) and other official sources. The exercise contained in the proposal aims at highlighting the relevance of international trade to the species using a well-known official source (Eurostat database). We are well aware that a detailed cross-check with other official sources would likely raise discrepancies (some potentially serious) and we have consciously avoided this option, to avoid a discussion that would go beyond the purpose of the current exercise.

<u>Canada</u>

On September 1 the Government of Canada has sent some comments addressing the situation of the West Atlantic stock and its fishery. Concretely, Canada:

1) Requests Monaco to clarify why the proposal takes the year 1970 as reference year to assess the extent of decline of the West Atlantic stock.

2) Requires clarification on authorship of the study claiming the West Atlantic Stock is in danger (see similar comment above by US)

3) Suggests clarifying the magnitude of fishing mortality on the West Atlantic stock spawners in Canada.

Regarding the first item, Monaco agrees with Canada that SCRS ICCAT uses the spawning stock biomass (SSB) level of 1975 as reference for the rebuilding plan, but as explained in the 2008 Stock Assessment (pg. 34) they do so only because "it has been assumed as the rebuilding target in several previous assessments, where it had been suggested as a proxy for B_{MSY}". Monaco understands that from this argument it doesn't derive at all that the population level of 1975 is more adequate than that of 1970 as a baseline against which to assess the extent of decline, as required under CITES. On the contrary, we understand that from a historical perspective the 1970 figure captures better the real extent of decline, and we believe this is completely compatible with SCRS taking SSB 1975 as reference to assess potential rebuilding –both analysis being qualitatively different.

Items 2 & 3 have been fully taken into consideration in the final version of the proposal (see section above on US comments regarding item 2).

Japan

The official comment from the Government of Japan to the draft proposal by the Principality of Monaco is structured around 3 main issues: 1) fulfillment of criteria for listing in Appendix I of CITES, 2) role of ICCAT and 3) adequacy of the Atlantic bluefin tuna as a species that can be "effectively addressed" by CITES.

On issue 1, Japan questions the eligibility of the Atlantic bluefin tuna for listing in Appendix I of CITES, arguing that it is a medium productivity species and that it would not meet the decline criteria. As explained above (see point *a)* of US section), we have now computed natural mortality for the East Atlantic stock for ages 1-15, and the results, including those of the comprehensive analysis included as Annex 1, clearly confirm that natural mortality (M) for the stock and other biological parameters do fall within the range of low productive species. It's the view of the Principality of Monaco that the proposal already deals in high detail with the analysis of the fulfillment of the listing criteria and that the concerns raised by Japan are amply covered in our scientific argumentation. Indeed, on the grounds of the formal scientific information available it is clearly demonstrated in the proposal that a marked decline in the population size of the Atlantic bluefin tuna has indeed occurred, and that such decline has been both observed as on-going and inferred or projected by the levels of patterns of exploitations, and that it is being exacerbated by a high vulnerability of the species to intrinsic factors such as migration and strong aggregative behavior, particularly during spawning.

On the second issue ("role of ICCAT"), Monaco fully concurs with Japan that irrespective of the status of the Atlantic bluefin tuna under CITES, the International Commission for the Conservation of Atlantic Tunas (ICCAT) should continue to have a role in the management of Atlantic bluefin tuna. Actually, it couldn't be otherwise because the two organizations –CITES and ICCAT- address completely different issues, those being: international trade and fisheries management respectively. In this regard, Monaco doesn't see any contradiction in both organizations playing a role in creating the conditions to ensure the recovery and the sustainable use of the Atlantic bluefin tuna; on the contrary, Monaco believes that CITES and ICCAT working cooperatively on this file will reinforce each other's performances and will create, for the first time, a real chance for the recovery of the species.

Regarding the third issue, Japan argues that the fact that the Atlantic bluefin tuna is subject to large scale international trade (with 20,000 tonnes mentioned to be annually imported by Japan) should discourage a CITES listing of the species. The Principality of Monaco holds the opinion that it is precisely this high incidence of the international trade which justifies the paramount relevance of CITES in contributing to improve the status of the species.

European Commission

On October 7 the European Commission (Directorate-General Environment) has sent the assessment by the European Community regarding the range state consultation process launched by Monaco. The European Community considers that the criteria supporting CITES Appendix I listing may be met, and also refers to the possibility that "updated scientific evidence may be forthcoming". Concretely, the EC:

1) Suggests Monaco to clarify the section on biological criteria, particularly the issue of the determination of the productivity of the species.

2) Suggests Monaco to give recognition to the uncertainty in some projections for decline of the species, and to refer explicitly to guidance given in Res. Conf. 9.24 regarding uncertainty and the need to act in the best interest of the species.

3) Advices that the proposal is based on the latest scientific information available, including possible new data issued after the advice by the ICCAT SCRS issued in October 2008.

On issue 1, Monaco has amended the relevant section of the proposal accordingly. Concretely, and as explained above (see section above on US comments), the proposal now integrates the excellent analysis on Atlantic bluefin tuna productivity authored by the Swedish CITES Scientific Authority (duly referred in the text and included as Annex 1). On the second issue, mention to Res. Conf. 9.24. is made under section 11 of the proposal ("Additional Remarks"), and Monaco provides its interpretation of what "acting on the best interest of the species" would mean in the current situation.

Finally, section 11 of the proposal ("Additional Remarks") also refers to the use of the best available scientific information. Regarding this issue, Monaco doesn't fully understand the expectations by EC in the sense that "updated scientific evidence may be forthcoming". In this regard, the Principality of Monaco wishes to emphasize that no new stock assessment of Atlantic bluefin tuna stocks has been in the agenda of the ICCAT SCRS for the current year 2009, meaning that the right official reference on the status of the stocks within the framework of ICCAT remains the results of the stock assessments carried out in 2008. This has been clearly reflected in the outcome of the 2009 SCRS Meeting. Even so, Monaco has made the effort to include in the proposal relevant information presented as contributions to the 2009 Bluefin Tuna Species Group Meeting of the SCRS –held in October 2009 (i.e. Riccioni *et al*., 2009; Taylor *et a*l., 2009). Also, other very recent scientific data published in international peer-reviewed journals –independent from ICCAT- are considered in the proposal (see, for example, MacKenzie *et al*., 2009).

Concerning the accompanying resolution, a new version of the document has been prepared, taking into account most of the comments and suggestions received.

Turkey

Turkey believes that the scientific recommendations made by the Standing Committee on Research and Statistics of ICCAT should immediately and effectively be implemented by all concerned Parties.

As such Turkey believes that at this stage it is early for BFT to be included in annex I in CITES, considering the fact that recent efforts and initiatives by ICCAT should give another chance to BFT stocks.

Serbia

Following consultation between the Ministry of Environment and Spatial Planning and scientific experts, the Republic of Serbia expresses its strong support to the proposal.