WORLD SYMPOSIUM FOR THE STUDY INTO STOCK FLUCTUATION OF NORTHERN BLUEFIN TUNAS (THUNNUS THYNNUS AND THUNNUS ORIENTALIS) INCLUDING THE HISTORIC PERIODS. 22ND - 24TH APRIL 2008

Session 1

ATLANTIC BLUEFIN TUNA: AN OVERVIEW OF 100 CENTURIES OF MOVING FISHERIES

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Abstract:

This conference will make a global review of about 100 centuries of bluefin fisheries. It will start with a brief overview of the prehistorical bluefin fisheries active in the Mediterranean and North seas and of the major Greek and Roman fisheries. It will also examine the development of the beach seine and trap fisheries during the early middle ages, as well as the birth of the Bay of Biscay line fisheries in the 17th century. The main topic the conference will concentrated on the major changes of the various bluefin fisheries that have been observed during the 20th century, especially in the North Sea, in the Mediterranean Sea, off Brazil and recently in north Atlantic drift. The conference will make a detailed review at the 5°-month level of the excellent catches and effort data collected by Japan on its longline fleet, a fleet that has been continuously catching a large majority of the bluefin caught by longliners. In its conclusion, the conference will discuss the multiple changes in the bluefin geographical distribution and movement patterns, in relation with the bluefin behaviour, the oceanographical environment, and the heterogeneity of bluefin subpopulations.

Session 2

BLUEFIN FISHING IN LANNION BAY, NORTHERN BRITTANY, DURING THE 1946 - 1953 PERIOD

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Abstract:

This conference will describe and analyse the small seasonal sport fishery of giant bluefin tunas that took place in northern Brittany in the Bay of Lannion, during the post WW2 period 1946-1953. The seasonal presence of these giant bluefin in this area was link with a concentrations of sardines upon which these giant bluefin were actively feeding. The potential relationship between these tunas and the same sizes of bluefin

caught during these years in the North Sea (summer feeding) and in the Mediterranean Sea (late spring spawning) are examined in relation with the sizes taken and the seasons of these fisheries. Potential migratory routes involved in this Lannion fishery area are discussed as well as the concept of a feeding site fidelity, with the same group of bluefin back each year to feed in the Lannion Bay during 8 years, until 1954 when sardines vanished from this area.

Session 2

THE NORWEGIAN BLUEFIN TUNA FISHERY FOR THE PERIOD 1920-1986

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Abstract:

The Norwegian bluefin tuna fishery had a slow start in the beginning of the last century. The fishermen had problems finding a practical way to catch the large and fast swimming tuna. Several methods were tried out during the 1920's. A tuna seine inspired from American fishing gear technology was constructed and then modified several times. Smaller fishing boats were catching tuna in the beginning using large sized hooks or harpoon guns. The big breakthrough in the fishery came in the northern part of Norway in 1948 when a new type of purse seine was constructed. Within a few years the bluefin tuna fishery became an important fishery in Norway during the months of July-October when the tuna migrated to productive northern waters for active feeding. Large tuna up to 500 kg were caught in the north, while medium sized adult tuna (<100 kg) dominated further south. In the 1950's the southwestern part of the country became the major fishing area and the annual catches peaked up to 14 000 tons. In some years more than 350 seiners (max. 470) participated in this fishery along the Norwegian coast. These vessels cooperated with assistant vessels and vessels used as fish carriers. A total of 3500 - 4000 fishermen were then involved in the tuna fishery. During the 1960's and 1970's it became obvious that the tuna stock was overfished. The bluefin tuna had spent their summers in Norwegian waters for thousands of years. In 1986 only 70 tuna were caught, and the Norwegian tuna fishery was a part of the history. The last ten years a large number of historical photos, videos and other information such as extensive interviews with old tuna skippers, available logbooks and numerous contract receipts from the Norwegian tuna fishery have been collected. This presentation put alive with digitized historical photos and film footages the development of the Norwegian bluefin tuna fishery in the period 1920-1986.

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Session 2

POSSIBLE MECHANISMS AND EXPLANATIONS FOR THE DRASTIC DECLINE AND DISAPPEARANCE OF ATLANTIC BLUEFIN TUNA IN THE

NORWEGIAN FISHERIES SINCE THE EARLY 1960S: WHAT WENT WRONG AND WHAT CAN WE DO?

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Abstract:

Norway became a full member of ICCAT in March 2004. It had a central role in science and fishing of Atlantic bluefin tuna up until around 1970; providing detailed weekly catch statistics starting in 1950 comprising of individual fish weight and total numbers caught by purse seine set in each fishing region around the Norwegian coast for the period. During the last decades very few adult Atlantic bluefin tuna has been migrating and feeding in the highly productive northern ecosystems such as the Norwegian Sea and along the Norwegian coast. This situation is clearly indicative of the present unhealthy state of the bluefin tuna population, represents long-term sign of considerable growth over-fishing, signalling that the bluefin tuna population is not managed in a sustainable way.

The largest and oldest individuals of the Altantic bluefin tuna used to migrate furthest to the north and performed the longest feeding migrations. This is also evident in other pelagic species. The Norwegian coast and the Norwegian Sea used to be very important feeding grounds for adult Atlantic bluefin tuna for decades (e.g. 1920's to 1960's) and possibly for centuries due to high biomasses of main pelagic prey species (e.g. Norwegian spring spawning herring (Clupea harengus) and Northeast Atlantic mackerel (Scomber scombrus)) for bluefin tuna. The overall abundance and number of year classes in the fishery were drastically reduced in Norwegian waters after mid 1960s.

We propose possible mechanisms and explanations of why we do not observe any bluefin tuna anymore in highly productive Norwegian waters. Factors discussed and evaluated include overfishing, recruitment and year class strength, distribution and migration patterns, learning processes and information transfer between tuna year classes, prey abundance and feeding opportunities, as well as physical driving forces such as decadal climate variability and temperature fluctuations in Northeast Atlantic ecosystems. Furthermore, we emphasise how the overall population size, health and production for a future sustainable and viable fisheries of the East Atlantic bluefin tuna stock can be improved by; 1) significantly reduce overall fishing effort and quotas in the short term, especially on the vulnerable spawning grounds, to benefit a much higher sustainable medium- and long-term yield, 2) increase minimum landing size to protect juveniles, and 3) reduce transfer of old and large bluefin tuna to large pens for fattening in order to protect individuals with the highest reproduction potential and spawning success within the population.

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Session 2

THE DEVELOPMENT OF THE NORTHERN EUROPEAN FISHERY FOR NORTH ATLANTIC BLUEFIN TUNA *THUNNUS THYNNUS* DURING 1900-1950

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Abstract:

North Atlantic bluefin tuna, *Thunnus thynnus*, used to migrate to northern European waters (Norwegian Sea, North Sea, Skagerrak, Kattegat, and Øresund) where it supported important commercial and sport fisheries. The species disappeared from the region in the early 1960s and the species is now still extremely rare. The factors which led to the development of the fishery and its subsequent decline remain unclear and poorly documented. This investigation documents the development of the fishery in terms of landings, effort, and gears with focus on the time period from 1900-1950 when landings were increasing. The species was frequently sighted while fishermen were targeting other species (herring, mackerel) and occasionally was caught as bycatch with these and other species. Information from scientifically trained observers demonstrate that tuna schools were common in the North Sea for 2-3 months during the summers of 1923-31. As fishermen realized that the species had market value, new catch methods were developed and employed. These included harpoon-rifle, improved hook and line methods, and hydraulically operated purse seines. Landings rose sharply as did the number of vessels and the capacity of processing facilities for bluefin tuna. Bluefin tuna in this area were generally medium-large (> 50 kg whole weight). The most important countries which participated in bluefin tuna fisheries in this period were Norway, Denmark and Sweden, but bluefin tuna were also exploited by France, Germany, the Netherlands and the United Kingdom. Similarly sportfishing increased in popularity in some of these countries and attracted many foreign participants. The increase in landings between 1900-1950 was driven particularly by an increase in fishing effort and technology. We found no evidence that the increase was due to a temperature-related shift in habitat into the region. Our results demonstrate that the species was an important part of the ecosystem at least back to the early 1900s and that commercial and recreational fisheries were well established in northern European waters before official ICCAT records.

Keywords: bluefin tuna, *Thunnus thynnus*, fishery, North Sea, Norwegian Sea, temperature.

Session 2

ECOLOGICAL AND FISHING INFLUENCES ON PRESENCE OF BLUEFIN TUNA IN NORTHERN EUROPEAN WATERS

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Abstract:

North Atlantic bluefin tuna, *Thunnus thynnus*, used to migrate to northern European waters (North Sea, Norwegian Sea, Skagerrak, Kattegat) where it supported important commercial and sport fisheries (*1-4*). The species disappeared from the region in the 1960s and has been rare ever since. The reasons for the disappearance are unclear and have not been investigated in detail. Here we review literature hypotheses for the disappearance and investigate whether it is associated with changing ecosystem conditions and fishing patterns. We compile and analyse hydrographic, biological and fishing related variables for much of the 20th century for possible effects on presence of bluefin tuna in these waters. Ecosystem conditions (e. g., temperatures, North Atlantic inflow intensities, food abundance) in last 5-10 years in the area appear suitable for the species, but abundance is remains low. Absence from the area may be due to overall decreased abundance associated with long-term changes in fishing pressure and selection pattern or low recruitment, or to density-independent changes in migration patterns. Return/recovery in the area could probably be promoted by changes in fishing regulations.

Session 3

THE BLUEFIN TUNA (*Thunnus thynnus*) FISHERY IN THE BAY OF BISCAY

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ABSTRACT

Curricán (troll line) and "chapa" (silver plated spoon) were the gears used in the Bay of Biscay bluefin tuna fishery up until the middle of the twentieth century, when the first experiments with baitboat were made. The introduction of this new fishing system was a very important development in the region.

The fishery is mainly made up of juveniles (<30 kg), but there was a constant presence of adults (group 5+) on the trophic migration towards northern European waters in the past.

From observations on board fishing vessels at the beginning of the seventies, the importance in this fishery of age 5+ fish groups is confirmed; but since then this group has practically disappeared from the fishery. The current length composition reveals the absolute dominance of juveniles.

Session 3

THE BLUEFIN TUNA (*Thunnus thynnus*) FISHERY IN THE BAY OF BISCAY. EVOLUTION OF 5+ GROUP SINCE 1970

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Abstract:

This study analyzes the evolution of the abundance of bluefin tuna spawners (group 5+) in the Bay of Biscay since the beginning of the 1970s.

Using information since 1970, a sharp fall is observed in the abundance of group 5+ fishes (mainly age 5+, 62 kg mean weight), in a fishery in which there has been a clear dominance of juveniles over the last three decades.

Session 3

ANALYSIS OF THE NORTHEAST ATLANTIC JUVENILE BLUEFIN TUNA (*Thunnus thynnus*) POPULATION BETWEEN 1949 AND 1960

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Abstract:

The results of an analysis of the juvenile bluefin tuna population of the fisheries of the Atlantic part of Morocco; Portugal and the Bay of Biscay between 1949 and 1960 are presented. In order to do so, the catches at age of these fisheries were estimated.

The results show that, under different scenarios, the high fishing mortality exerted on the juvenile fish groups (< 5 years) in the years studied may be one of the reasons for the later decline in the Northeast Atlantic spawner fisheries from 1963.

With the aim of justifying the hypotheses underlying the analysis, the study concludes with a presentation of the current advances in the knowledge of *Thunnus thynnus* biology in the Mediterranean Sea.

Session 3

FOLLOWING BLUEFIN TUNA COHORTS FROM EAST ATLANTIC SPANISH FISHERIES SINCE 1980s

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Abstract:

Length distributions of baitboat fisheries, both in the Bay of Biscay and areas close to the Strait of Gibraltar, as well as trap catches from Spanish Atlantic coast were converted to age distributions using age length keys from calcified structures. Data from both fisheries covered ages ranging from juvenile to adult bluefin tuna. Relative abundance and mean size by age analyses were accomplished in search of an exceptionally abundant cohort. The 1994 cohort, which strong signal was detected for east and west populations, was clearly followed in the Bay of Biscay baitboat catches, but "disappeared" in the Strait of Gibraltar baitboat and traps fisheries data. Some of the difficulties to follow the annual progression of a strong year class in bluefin tuna are discussed. In addition, the metapopulation hypothesis is proposed as fairly consistent with the observed data.

Session 4

BACK TO THE FUTURE: INVESTIGATING HISTORICAL DATA OF BLUEFIN TUNA FISHERIES.

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Abstract:

In 1963, the leading bluefin tuna fisheries which took place in the Norwegian Sea and North Sea suddenly collapsed without any warning. Little is known about this collapse while several hypotheses can be put forward, i.e. changes in bluefin tuna migratory routes, recruitment failure or eradication of a sub-population (all three hypotheses could being due to natural causes and/or overfishing). To try to clarify this mysterious event, an original dataset of the main bluefin tuna fisheries of the 20th century, including total catch and size composition of the catch, has been built up and analysed. The results display a strong and unambiguous link between the Nordic and Spanish trap fisheries during the 1950s and 1960s which, however, vanished during the 1970s. In addition, the Northwest Atlantic and Mediterranean trap fisheries appeared also partially connected with the Nordic fisheries. All together, the results give strong support to the hypothesis of changes in bluefin tuna migration patterns that could have resulted from both the collapse of the Northeast Atlantic herring stocks on which bluefin tuna fed and the

cooling of the Northeast Atlantic of the early 1960s. From this perspective, current overexploitation in the Mediterranean Sea could explain why bluefin tuna did not come back massively in the Northeast Atlantic since the 1990s. This retrospective analysis further leads to an original, albeit more speculative, hypothesis on Atlantic bluefin tuna population structure, herein conjectured as an assemblage of three interacting sub-populations.

Session 4

ANALYSIS OF THE MOROCCAN TRAP FISHERY TARGETING BLUEFIN TUNA (*Thunnus thynnus*) DURING THE PERIOD 1986-2006.

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Abstract:

The analysis of the Moroccan tuna trap fishery targeting bluefin tuna shows that in general the CPUE decreased from 1986 to 1995, increased during the period 1996 to 2001, since then the CPUE have showed a downward trend. There is no strong correlation between the BFT catches and the fishing effort
targeting this species, the catch level is rather determined by the abundance of the spawners migrating every year along the Moroccan Atlantic coast. The mean weight of the individuals caught also shows a decreasing trend during the period 1997-2005.

Session 4

POSSIBLE SST AND NAO INFLUENCES ON THE EASTERN BLUEFIN TUNA STOCK - THE INEXFISH APPROACH.

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Abstract:

Through the auspices of the EU-Project IN-EXFISH an analysis of historical data sets on catch and also model generated data on SSB and recruitment have been used to look for possible influences of the NAO on the eastern Bluefin Tuna stock. Initial evidence has shown that total catch can be correlated to the Winter NAO but only after a lag of 2 years. A further analysis of remote sensing SST data for the main spawning areas in the Mediterranean (Balearic, Tyrrhenian, Ionian and Levantine seas) revealed a SST anomaly which is increasing and already indicates values in summer during the spawning season of up to +3° C. These changes in SST anomaly do not appear to be correlated with changes in the NAO. The influence of SST on SSB and recruitment will be discussed and their possible influence on short and long terms stock changes.

Session 4

REMARKS ON THE FLUCTUATIONS OF BLUEFIN TUNA CATCHES IN TURKISH WATERS

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Abstract:

The history of the bluefin tuna fishery with traps dates back to XV century. Fish traps used to be set in the Sea of Marmara, Bosphorus and in the Black Sea from April/May to late August. Formerly, Filburnu, Çankaya, Beykoz, Bülbülsokak, Anaşya, Küçükçekmece, Salistra and Karamanoğlu fish traps were the most important ones.

The dimensions of some of these fish traps are around; 112-113 fathoms length, 33 fathoms width and 9-22 fathoms depth. Crews of 20-25 persons were employed in each of these fish traps. The number of the bluefin tunas captured in a single fish trap in one fishing season varied between 100 to 150 bluefin tunas, each weighing 100 to 450 kg.

With the decrease of fish stocks, marine pollution, urbanization , fish traps lost their importance in the bluefin tuna fishery. Recent studies show that the bluefin tunas have not been migrating to and from the Black Sea, since 1986. Most probably, due to this reason the fish traps have lost their effectiveness in the bluefin tuna fishery. Today, the former bluefin tuna traps like; Filburnu, Beykoz and Anaşya, are utilized to capture small pelagic fishes, such as horse mackerel and silversides.

Purse seining of the bluefin tuna began in the 1950's, primarily in the Sea of Marmara. The purse seine fisheries in the mid-1980s were limited to the Sea of Marmara catching large fish (even over 300 to 400 kg per fish), the fishing season being the winter months. Many tuna purse seiners replaced their old boats, utilizing the special government credits and improved their fishing power considerably. Since 1989, the fishery has developed in the North Aegean Sea, expanding gradually to the South Aegean Sea, catching small to medium sized fish (25 to 45 kg) from winter to early spring, and later from early spring to the end of May.

Between 1988 and 1990, the expansion of the bluefin tuna fishery was accelerated with the low production of anchovies. When the catch of anchovies declined, the effort of the purse seiners went to targeting more bluefin tuna. In 1994, the purse seiners started operating in the Mediterranean Sea.

Since 2000 the Turkish bluefin tuna fishery is conducted in May and June, in the eastern Mediterranean Sea in the international waters off Northern Cyprus and in the waters between North Cyprus and Turkey.

Session 4

BLUEFIN TUNA (*Thunnus thynnus*) FISHERIES OF THE MALTESE ISLANDS IN THE CENTRAL AND SOUTHERN MEDITERRANEAN SEA.

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Abstract:

Tuna has been caught in the Maltese Islands with traps since 1748 reaching a stable usage around 1948, however this fishing method was finally replaced by long-line, initially as a by-catch in the swordfish fisheries prior to focusing on the blue fin tuna long-lining in 1995 when the Japanese opened the doors to Blue fin tuna trade caught by the Maltese. Thus looking back at historic data with changing efforts and gear may not be the only single method to understand the causes for Bluefin tuna decline in certain regions, where a variety of environmental and fishing gear changes leading to fishing intensification has been taking place.

Total bluefin tuna catch in kg in the Maltese Islands, in the centre of the Mediterranean Sea, have followed an over all decline from its peak of 353,014kg in 1995 to 227,008kg in 2006. This in itself may be expected when one considers the increasing number of fishing vessels in the same area during this timeframe. However as the Maltese fishermen have been increasing their effort in time and gear this decline may also be considered a serious signal of blue fin tuna stock depletion in this Mediterranean region during its spawning season between April and July.

The ecological considerations of this study, side by side with the population's DNA study targets a more detailed picture of the blue fin tuna species spawning in the Mediterranean. Blue fin tuna stock and its viability and genetic diversity: fisheries landing statistics; blue fin tuna biogeography and; tuna molecular genetics in this fishing area are being considered in detail. Over 300 blue fin tuna specimens caught offshore were sampled since 1998 in order to study variations in sizes, sex ratios, biogeographical setting and molecular genetic identity. With such detail in number sampled and period covered, this study was a necessary first in order to obtain an important indication of the conservation management needs of this highly valued and exploited species.

With increasing purse-seining and the advent of tuna penning (cage storage of live tuna for a number of months after the fishing season has come to an end) and the greater interest in this same species with poor off shore monitoring tools, the results of this study assists in better understanding the impacts and extinction risks of this species in one of its important spawning areas.

Session 4

ANTHROPOGENIC IMPACTS ON THE BLUEFIN TUNA (*Thunnus thynnus* L.) TRAP FISHERY OF SARDINIA (WESTERN MEDITERRANEAN)

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Abstract:

Traditional traps (tonnara) harvest the ancestral migratory flow of the Atlantic bluefin tuna at a fixed site. Therefore it is reasonable to consider local perturbations generated by social and economic events and environmental changes, as disruptive to the pathways of bluefin tuna schools and thus account for variability in the Mediterranean trap captures.
The documentation of anthropogenic perturbations on trap landings on a small geographical scale is rather scant, with the exception of the micro scale effect of boat noise on the BFT behaviour in the trap of Favignana (Sicily, Italy).
We think this knowledge gap should be filled in order to better understand the relationship between this fishery resource and the costal zone development.
The south-western region of Sardinia (Western Mediterranean) has been the location of one of the most important Mediterranean trap fisheries since the late 15th century. Fishing continues to this day with four active traps (Isola Piana, Portoscuso, Porto Paglia and Cala Vinagra).
This region, for at least two thousand years (since Cartage and Roman domination), was historically important also for lead, silver and copper mining. The cumulative impacts of environmental hazards resulting from historical mining and recent industrial activities is well documented: on land, in the coastal zone and in human health risk factors. However, there is little information available on the impact of such factors on pelagic fisheries.
In order to verify the effects of some anthropogenic perturbations on trap landings, we analyse catches variability in the period 1825-1973 for three traps deployed next to each other.
We applied an asymmetrical design using a Before/After and Control/Impact location approach (BACI) to test the perturbations due to mining processes. Moreover, time series analysis techniques, i.e. Auto Correlation Functions and Spectral Analysis, were used to verify patterns of trap landings and the explorative variables.
Our results showed that the effect of run-off from watershed mine tailing dams, creates a pulsing boundary 'reflective' effect for tuna migration schools in one *in-shore* trap, resulting in a periodic oscillation of captures.

Session 5

INFERENCE ON NATURE OF ATLANTIC BLUEFIN TUNA OFF BRAZIL CAUGHT BY JAPANESE LONGLINE FISHERY AROUND THE EARLY 1960S

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Abstract:

Available literatures and relevant data were reviewed and analyzed to make insight on nature of the bluefin captured by the Japanese longline fishery which appeared suddenly and virtually disappeared in about 10 years with a substantial catch around the early 1960s. Among several hypotheses that were proposed to explain this event, temporal distribution hypothesis (similar to the concept of meta-population) seems to be most viable one. Comparative investigation with Pacific bluefin fisheries shows that the similar events seem to have occurred also in the Pacific. For further investigations with this hypothesis data mining of the old Japanese longline fishery around this time period should be made, especially for size data. If this hypothesis is proven valid, there could be a significant consequence of this nature both to scientific investigation and management of bluefin tuna.

Session 6

PACIFIC BLUEFIN TUNA FISHERIES IN JAPAN AND ADJACENT AREAS BEFORE THE MID-20TH CENTURY

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Abstract:

[Objective] The purpose of this study is to estimate roughly the long term level and trend of catch of Pacific bluefin tuna (PBF). Japan has been taking annual tuna catch statistics since 1894, and the complete species specific catch statistics has been available since 1951. This study is trying to estimate the catch of PBF around Japan before 1951.
[Materials and Methods] We have been searching for archival materials on Japanese tuna fisheries from public archives in Japan and Taiwan. Other materials are also searched and requested through web online systems. Traditional units of weights are converted into metric tons. In cases of catch data appeared as for "all tuna species," the PBF ratio is estimated by using species-gear catch composition in 1951 for 7 areas around Japan.
[Result and Discussion] For years 1894 – 1950, the annual PBF catches in Japan and adjacent areas are tentatively estimated as 1,600 – 25,000 metric tons (mt). For Japan the catches are estimated as at least 1,600 – 23,000 mt for this period. Other catch details are; in Taiwan 473 – 3,300 mt for years 1935 – 1943; in the South Sakhalin 0.2 – 7.9 mt for years 1928 – 1934 and about 250 mt in 1935. The annual amounts of catch in this period are comparable level to the present. Also shown was a large fluctuation. The majority of catch in Japan is considered to come from set net before 1920's, and later come from drift net and longline. Catch in Taiwan mainly came from longline based in Takao (=Kaohsiung) fishing port. Several records show clear double peaks of catch in the Sea of Japan, but the first peak is not observed in the southern part of this area.
For years before the start of tuna fisheries data collection in Japan in 1894, we are mainly examining 2 series of hand-written literatures. One series contains 88 records for set net catch in Toyama Bay in the Sea of Japan, for years 1848 – 1921. In these records we recognize Pacific bluefin tuna and other teleosts (6 order 13 families 26 species), elasmobranches (sharks and rays, 3 orders 6 families 8 species), 5 species of whales,

and 3 species of squids. The other series of records from Motoyoshi, near Kesen-numa in the northeastern Honshu Island for years from 1804 mainly contain catches of Pacific bluefin tuna. The records also contain catch data of Salmon Shark and Basking Shark.
Considering historical account of tuna fishery in Japan, the catch level in this period is considered to be almost the same level as for years 1894 – 1920 with similar fluctuation, between 1,000 and 5,000 mt presumably.
The ultimate goal of this study is to provide some historical long-term trend of stock size of Pacific bluefin tuna as was demonstrated by Ravier and Fromentin (2001) in the case of Atlantic bluefin tuna with catch data of trap fishery in the Mediterranean Sea. Our study may be at the starting point towards this direction.

Session 6

OVERVIEW OF THE PACIFIC BLUEFIN TUNA FISHERIES

Abstract

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Abstract:

Geographical distribution of Pacific bluefin tuna is Pacific-wide, but most of the population exists in the north-west Pacific near Japan. Another significant distribution is known in the area off Baja California and west coast of USA. Other minor distribution occurs around New Zealand as well as eastern coast of Australia.

Pacific bluefin tuna has been exploited by the various Japanese fisheries in the near shore waters around Japan. Traditional gears were trap, pole-and-line and various types of angling. During 18**s, longline and gillnet fisheries commenced their activities. Catches by Purse seine have been the largest component, followed by troll, longline, trap and pole-and-line in this order. In general, longline operates in the southwestern Japan from Okinawa to off Taiwan, specifically targets on adult fish in the spawning grounds in April to June. Purse seine operates mostly off Tohoku (north east of Honshu Islands) during summer to fall. At the beginning of 1980s, some boats started fishing in the South China Sea, and then expanded its fishing for smaller fish in the Strait of Tsushima and the Sea of Japan off San-in district during the early 1990s. Fishing grounds expanded further north in recent years as far north as 39ºN. Troll fishery has also operated mostly both sides of western Japan. Pole-and-line catches have declined recently. Longline are mostly composed of large adult fish while other fisheries catch mostly small fish less than 100 cm in fork length except for purse seine fishery, which takes both small and large fishes. In the western Pacific, Korea catches smaller fish by purse seine gear, and Taiwan has longline fishery targeting on large fish in the spawning area.

It is well known that the young fish of age 1 and two make trans-Pacific movements from western to eastern Pacific, and then go back to the western Pacific after staying there for two to three years. In the eastern Pacific, US caught significant amount of catches of young fish (sometimes more than 10,000mt) by purse seine, but there are

nearly no catches since 2001 due to the decline fishing effort. On the other hand, Mexico increased its catch since about 10 years ago, and reached a high peak of nearly 10,000mt in 2006. Most catches were made by purse seiners. Fish were kept live and sent to the cages for farming use.

The total catch in the Pacific Ocean also indicated some fluctuation between 9,400 mt in 1988 and 34,000 mt in 1956. The average catch during the past 10 years was 22,500 mt. The share of the annual Japanese catch fluctuated between 50 % and 90 %. Recent year's share was about 70% of the total catch.

Session 6

BIOLOGICAL INFORMATION FROM PACIFIC NORTHERN BLUEFIN TUNA IN CAPTIVITY

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Abstract:

Over the past three decades, the industrial farming of the Pacific northern bluefin tuna (PNBT) Thunnus orientalis in captivity has developed mainly around southern Japan. Farming of PNBT in a pen made it easy to observe the behavior, growth, biological development of them until harvesting. Fisheries Laboratory of Kinki University began to research about the technical improvement for broodstock rearing PNBT in a pen over a long term of years since 1970's and succeeded in the spawning of PNBT in captivity for the first time in the world in 1979.

Fisheries Research Agency (FRA) started researches on the developing techniques of seedling production as objectives enhancing the PNBT resources in the Pacific Ocean by releasing the artificial seedlings, at the island on the Nansei Archipelago: Amami Ooshima and Ishigaki. These techniques have included the researches of broodstock and embryonic and larval stages of PNBT. To date these researches have met many biological findings of PNBT in captivity, such as behavior, growth at age and with water temperature (WT), maturation and spawning at age and size etc., though there may be differences in the findings between wild and captivity.

Growth of bluefin tuna in captivity can exceed that in the wild. The differences in WT (annual average) at bluefin growout sites in Japan can make a difference in weight gain, though there seem to be no difference over about 23°C. It appears that the growth of PNBT is dependent on annual WT: WT strongly affects feeding activity.

The gonad of PNBT among the broodstock in captivity starts to develop from 2 years old of male and 3 years old of female. The actual evidences of spawning of PNBT in captivity at specific areas in Japan occur from 3 years old. Spawning sites appear to spread widely with age around Japan with different environment, though need the appropriate condition for spawning at least.

Spawning occurs intermittently from mid-May to early November at the latest case, with a peak during June–July, similar to the spawning period reported previously for wild bluefin around Japan. It was suggested that the start of spawning might be influenced by rising ambient temperatures. The number of eggs varies greatly by year and broodstock. Some findings, such as individual spawning frequency and fecundity, for spawning ecology of PNBT in captivity got clear by the mitochondrial DNA analyses. In addition to spawning ecology, many data sets related with egg size of PNBT also have been stored under the captive condition so far.
These findings extracted from tuna farming in a pen, including findings impossible to obtain from the wild researches, must help to increase scientific understanding and management of wild resources of PNBT as well as the other bluefin resources.

Session 6

AN HISTORICAL OVERVIEW OF THE BLUEFIN FISHERY IN THE EASTERN PACIFIC OCEAN

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Abstract:

The fishery for bluefin tuna (*Thunnus orientalis*) in the eastern Pacific Ocean (EPO) exploits a juvenile (mainly age-1 and age-2 fish) segment of what seems to be a highly-migratory northern Pacific wide bluefin stock. Purse seining for bluefin tuna in the EPO was initiated in about 1914. Prior to 1930 fishing took place only off California, from about 1930 to 1948 there was considerable fishing effort off both California and Baja California, Mexico, and since about 1948 fishing has taken place mostly off Baja California. The catches were taken predominantly by U.S. and Mexican purse seiners. Annual catches have fluctuated considerably since the early days of exploitation, with an historical peak at about 16,000 mt in 1966.

Two major historical events occurred in the fishery. First, beginning during the early 1980s, increasingly effective measures by the Mexican government to enforce its Economic Exclusive Zone resulted in a gradual exodus of U.S. boats from the fishery. Second, beginning in 1996, bluefin farming innitiated in northern Baja California, and some Mexican vessels began to direct their effort toward bluefin off Baja California during the summer and early fall. The fish are transported to holding pens, where they are fattened for several months before being slaughtered for the production of sashimi, considered to be a delicacy in Asia and other parts of the world. During recent years (1999-2006), the catches of bluefin by Mexican vessels have averaged about 4,500 mt, and peaked at about 9,800 mt in 2006.

Session 7

CHANGES IN ABUNDANCE AND SPATIAL DISTRIBUTION OF SOUTHERN BLUEFIN TUNA

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Abstract:

The population of southern bluefin tuna (SBT) is estimated to have undergone continuous decline since the development of large scale commercial fisheries in the late 1950s. Accompanying this decline, major changes appeared to have occurred in distribution, habitat uses and migration patterns. Evidence for these changes is reviewed for various components of the stock based on catch, CPUE and tagging data. The evidence for the post juvenile component of the stock (i.e. ages 5+) is compromised by recent revelations of large scale under-reporting of longline catches for the last 15-20 years. The best documented of the distributional changes are for the juvenile component of the stock (ages 2-4), in which the major changes occurred after periods of high levels of localized exploitation. The most dramatic example of this is the collapse of the surface fishery off the New South Wales (NSW) coast of Australia in the late 1970s. There is no indication of juvenile returning to this area in the subsequent 28 years despite increased escapement of juveniles from areas that were known previously to be sources for the fish in the NSW area. More recently, tagging data indicate very high levels of exploitation of juvenile fish in the Great Australian Bight (GAB) off the coast of South Australia. Large number of juvenile SBT use the GAB as a summer feeding ground, migrating into oceanic waters during the winter. Concurrent with the recent exploitation high rates, tagging data indicates major changes have occurred in the migration and the winter habitat of the juveniles currently found in the GAB compared to those in 1990s. Additionally, tagging data suggest that a substantially smaller proportion of the age 1 fish found in Western Australia are now going to the GAB at ages 2-4. As frequently the case, interpretation of the fishery effects on the observed distributional changes can be confounded by potential environmental variability. Nevertheless, high levels of exploitation would appear to be at least a contributing factor to the observed changes. Implications of these changes for the assessment and management of bluefin stocks are discussed.