SOCIAL, CULTURAL AND BASIC ECONOMIC ANALYSIS OF THE TRAP FISHERY OF SARDINIA: FIRST STEP TOWARDS PARAMETERIZATION

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SUMMARY

In this paper the economic, social and cultural factors engendered by the tuna-trap fishery of Sardinia are studied. To acquire quantitative data, questionnaires were disseminated to stakeholders of the trap fishery and in a sample of 200 inhabitants of the villages of Carloforte and Portoscuso. Results emphasized that some sub-sectors produced direct economic income; others produced an unquantifiable social capital highlighting a strong interdependence of the local community from the "trap network". We note that the vulnerability of the trap fishery is determined by two intimately related mechanisms: Risks of the fishing business (likely predictable) and uncertainty (unpredictable). The latter take account of the current management policy which generates "the quarrel for quotas", an unfavourable condition for traps. A review of the fishery policy considering the interconnection between socio-political and economics feedback is essential for the survival of the trap system and to preserve their cultural heritage.

RÉSUMÉ

Ce document présente une étude sur les facteurs économiques, sociaux et culturels découlant de la pêche à la madrague de thonidés de la Sardaigne. Afin d'acquérir des données quantitatives, des questionnaires ont été diffusés aux parties prenantes de la pêche à la madrague ainsi qu'à un échantillon de 200 habitants des villages de Carloforte et Portoscuso. Les résultats mettent en évidence que quelques sous-secteurs produisaient des revenus économiques directs et d'autres sous-secteurs généraient un capital social non quantifiable, ce qui indique clairement l'existence d'une interdépendance de la communauté locale et du « réseau madrague ». Il a été observé que la vulnérabilité de la pêche à la madrague est déterminée par deux mécanismes intimement liés : les risques du commerce de la pêche (relativement prévisible) et l'incertitude (imprévisible). L'incertitude prend en compte la politique actuelle de gestion qui donne lieu à « la querelle pour les quotas », ce qui ne favorise pas les madragues. Un examen de la politique de la pêche prenant en considération l'interconnexion entre le contexte sociopolitique et économique est crucial aux fins de la survie du système des madragues et de la préservation de leur héritage culturel.

RESUMEN

En este documento se estudian los factores económicos, sociales y culturales engendrados por la pesquería de almadrabas de túnidos de Cerdeña. Para obtener datos cuantitativos, se distribuyeron cuestionarios entre las partes interesadas en la pesquería de almadrabas y en una muestra de 200 habitantes de las ciudades de Carloforte y Portoscuso. Los resultados destacaron que algunos subsectores producían ingresos económicos directos, otros producían un capital social incuantificable poniendo de relieve una fuerte interdependencia de la comunidad local y la "red de almadrabas". Se ha observado que la vulnerabilidad de la pesquería de almadrabas está determinada por dos mecanismos estrechamente relacionados: riesgos del negocio pesquero (probablemente predecibles) e incertidumbre (impredecible). Este último tiene en cuenta la actual política de ordenación que genera la "pelea por las cuotas", una condición desfavorable para las almadrabas. Un examen de la política pesquera considerando la interconexión entre el contexto socio-político y el contexto económico es esencial para la supervivencia del sistema de las almadrabas y para preservar su legado cultural.

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KEYWORDS

Mediterranean Sea, trap fishing, socioeconomic aspects, conservation

1. Introduction

The trap fishery currently accounts for a relatively low number of active sites in both the Eastern Atlantic and Mediterranean Sea (Anon., 2009). In the Mediterranean only three traps are still active; they are settled in southern-west of Sardinia (Italy) where this gear has been working continuously since the 16th century (Cetti, 1777; Angotzi, 1901). In the Mediterranean region the trap fisheries and tuna products were essential because of their roles in providing "food security" and employment most of the year. Although this is a typically low yield activity in comparison with modern practices and techniques such as the purse seine and long-line fisheries, it does provide an excellent bio-economic "case-study" for a sustainable fishery. In south-west of Sardinia the relationships between the trap fisheries and the territory are so deep-rooted as to designate the area as a "trap-district", a point of reference for tuna wholesale dealers, sightseers, journalists, consumers, and scientists at national and international level. This district includes the villages of Portoscuso, Carloforte (on the Island of San Pietro) and Calasetta (on the Island of Sant'Antioco).

In the economic literature there are a large number of case-studies highlighting the synergy among products, industry and territory (Holmefjord, 2000; Kleppe and Mossberg, 2001). Local products and territory belong to the same *network* and thus are considered as nodes connected through a set of relational ties creating social capital. Among consumers the territory where a product originates is also a guarantee for its quality (*branding*), a feature explained by the model *Product-Country-Image* (Roth and Romeo, 1992).

The Sardinian trap fisheries have engendered a complex set of connections over time. Nevertheless, this does not guarantee the trap system's survival due to the strong dependence exclusively upon the tuna supply. The recent cut-back of quotas, unavoidable for the objective of rebuilding the stock, creates a dispute among fisheries sectors, namely a "tuna quota quarrel", where the trap fishery represents a minority group.

In this paper we attempt to categorize the factors which contribute to the trap fishery network, useful for future application of bio-economic models.

2. Material and methods

A multi-task questionnaire was designed and submitted to diverse stakeholders in the villages of Carloforte and Portoscuso. Stakeholders include: trap managers, fishermen, wholesalers, municipality, local tourism office, ferry companies, citizens, restaurateurs, artisans. The size of sample is two hundred persons (one hundred for each village).

We used direct individual interviews and both closed-ended questions (yes/no), open-ended questions and ranked questions. The questions had to be short, simple and easy to understand. We avoided the question of "not know" and "not reasonable", double negative questions and the use of ambiguous wording. Economic queries included general information on the trap companies, annual yields, personnel employed, as well as extracted directly from records of the trap organizations. The questionnaire form was designed for optical scanner reading, which used Microelector software (DataSis Group) for interpreting optical data, and was useful in reducing the time and potential bias of input of large numbers of data.

3. Discussion

We identify three main sectors related to the trap network: Economics, Social and Cultural. These were divided into in sub-sectors (**Figure 1**) and each is described in the following sections.

3.1 General features of the trap fishery

The Italian term "Tonnara" (trap in English) has diverse meanings. In *a strict sense* it includes exclusively the gear or the system of nets used to capture bluefin tuna; but broadly used it identifies the system of accessories, boats, the plant where fish are processed and stored, crew and ground staff.

From a legal point of view, the position of traps as fishing gear is ambiguous due to its intermediate position between open-water fishing and marineculture activities. In fact fishing by trap is subjected to the grant of a multiyear license for a body of water as is required for marineculture.

Currently the trap fishery of Sardinia accounts for three licenses: Isola Piana, Portoscuso and Porto Paglia traps. In 2011 due to the small Quota assigned to the trap fishery by the Italian Ministry for Agriculture Policy (82.2 tons), only two of the three traps were deployed.

The management consists of three separate companies: Isola Piana trap, managed by the Carloforte Tonnare PIAM Srl; Portoscuso trap, managed by the Tonnara Su Pranu Portoscuso Srl. These jointly formed the "Associate Consortium of Sardinian Traps" (Consociazione Consortile delle Tonnare Sarde).

Finally the Porto Paglia trap is managed by the Tonnare Sulcitane Srl. From 2010, in order to share operating costs, these traps operated jointly using the same logistic organization and fleet, landing dock, buildings for processing (cutting and cleaning, chilling and packing for shipping) and storage space for tonnara supplies.

As a business enterprise, traps are subjected at two main economic processes: *Risk* and *Uncertainty*. The *Risk* is referred to factors with a measurable likelihood, e.g., a broken piece of the gear (nets, engines, ropes, electrical, hydraulic and refrigeration systems) due to age. These are under the control of managers and crew. On the other hand, *Uncertainty* is dominated by unpredictable factors that don't have fixed patterns, e.g., adverse weather conditions or modifications of physical-chemical features of the ocean and an alteration in the migratory pathway of the tuna. These aren't under the control of managers and fishermen but in some cases can depend on other stakeholders. *Uncertainty* which a trap is subjected to can be categorised as follows: (1) Environmental conditions; (2) Control of supply/demand (market dynamics); (3) Conflicts with non-fisheries sector as stake-holders which use marine resources; (4) Working environment; (5) Fishery policy (management and control) and conflict between political priorities; (6) Conflicts within fisheries sector.

A general weakness of a trap fishery is the inability of the manager to improve the economic performance of the trap due to the biological limitation of fishing for bluefin tuna. Trap fishing occurs in a restricted range of time (utmost 40 days) corresponding to the genetic migration of bluefin tuna along migratory pathways fixed in the genes of the bluefin that have evolved over geological time. Missing the right time to deploy the trap or subjected to foul weather conditions, a manager has no option to enhance the fishing effort to meet the quota. Furthermore, traps are *passive gears* because they harvest the natural swimming of bluefin towards the system of nets and chambers. This attribute enhances the *sustainability* of the fishery in respect of the ecological approach of harvesting. Moreover traps don't use mechanized fishing guaranteeing fuel savings and reducing carbon emissions.

3.2 Economics

3.2.2 Tuna destination: local and Japanese market

In 2010 approximately 40% of Sardinian traps production was intended for the local fresh market, 30% for the European fresh market, 20% for canning, and 10% was exported to Japan (**Figure 2**). These patterns are quite different from the period 2003-2007 when the export to Japan accounted for about 50% of the overall production. Successively, in the period 2008-2010, as a consequence of the crisis in the world markets, increasing fuel and shipping costs, exports have stabilized at 9%. It must be pointed out that local and Italian market for fresh bluefin from Sardinian traps is mainly addressed for premium level catering and fine dining consumption.

3.2.3 Market price

Fresh bluefin from the Sardinian traps are regularly sold in the Japanese market at auction, mainly at the Tsukiji market. The price inventory for Sardinian bluefin varies widely from 5 to 45 €/kg depending upon factors such as the daily quantity/quality of bluefin tuna in the Japanese market.

Bluefin sold in the local market (Sardinia and the remainder of Italy) has prices varying from 7-9€/kg wholesale. Wholesale price for the local restaurants (sold without any intermediate steps) is 10 €/kg. Retail price on fish shops vary from 20 to 25 €/kg for the pricey flesh known as the "tarantello" (between the dorsal area and the belly, adherent to the spine) and the "ventresca" (the fatty and soft belly part, *toro* in Japanese and international

markets). As reported in another investigation (SCRS/2011/077), fishing techniques, handling and processing play an important role to get the highest market quotation.

3.2.4 Cannery

Historically, the trap fishery of Sardinia stored a large fraction of tuna production in olive oil in barrels. Beginning in 1860, the use of cans was launched thanks the technique of the French artisan Nicolas Appert (Appert, 1810). From early 1900, large investments were committed to cannery plants in Sardinia. Since 1950, registered trademarks existed with diverse labels: Pasquale Pastorino, Marchese di Villamarina and Tonno di Carloforte for the southern tuna district and the trademark Tonnara Saline in the northern (now dismissed).

In the case of a large supply of fresh product, the alternatives the manager has are limited to entering the fresh product market, reducing the selling price or storing the fish for canning. In this sense, in order to improve market diversification, a small cannery was developed in 2009 in the Isola Piana trap (Carloforte). The whole production was 5.000 cans (18 tons) in 2009 and increased in 2010 to 80.000 cans (50 tons). Production has been diversified by producing three types of tuna: "tuna in oil" (40.000 cans in 2010), "tarantello in oil" (25.000 cans) and "ventresca in oil" (15.000 cans). Retail prices of canned are 12 €/kg for tuna (18 €/kg wholesale), 14 €/kg for tarantello (22.50 €/kg) and 16 €/kg (25 €/kg) for ventresca.

3.3 Social

3.3.1 General information

According to the last population census (2010), the residential population of Carloforte was 6465 (3210 males, 3255 females) and 5280 (1423 males, 1496 females) in Portoscuso. The population surveyed (100 persons for each village, Carloforte and Portoscuso) is composed of 63% males and 37% females. More than 50% of the statistical population have relatives that are working or have worked in the trap fishery, including past generations (great grandfather and grandfather). Only 50% of population know of ICCAT and its conservation programs for bluefin tuna, and only the 12% know details of the regulations.

All the population sampled is seriously worried about the possible disappearance of the "tonnara" because of the damage to the local economy in general, the uncertainty of supply of tuna in the future and for the loss of a deep-rooted tradition.

3.3.2 Trap employees

Historical information reported by Angotzi (1901), Maurandi (1989) and Conte (1985), underline the separation of the whole trap personnel into two staffs: fishing crew (tonnarotti), which number varying from 70 to 100 depending upon the importance of the trap, and a ground crew formed of 20 permanent personnel and at least 20 seasonal staff. Up to 1960 all personnel lived in the trap plant to form a small fishing village. Data on personnel directly employed in the trap fishery in the period 2007-2010 are reported in **Table 2**. In 2010, the direct employees were 44 fishermen to which must be added 10 dock and cannery staff, 4-6 Scuba divers and 10/17 occasional personnel (**Tables 2-3**). Indirect employees identified by management are about 100 people (including: transport companies, maintenance craftsmen, local auction seller, etc.).

3.3.3 Eating habits: fresh tuna

The production of fresh parts (generally managed and processed directly by fisherman "tonnarotti") are gonads of males (lattume), stomachs (bele), and throat muscle (barabassali). These pieces of the tuna play an important role in the local consumption as they are deeply embedded in the local culture and in the local niche market that supply premium restaurants. The prices of these precious parts vary from 7 €/kg for the stomachs and fresh male gonads to 10 €/kg for the throat.

A specific enquiry on local eating habits was part of the survey. Less than 7% of the interviewees do not eat bluefin tuna. The remaining 93% eat bluefin tuna at least once a week in the period April-August. And, among the 7% that consume tuna twice per week, another 7% eat tuna more than 3 days per week. Mostly the quantity of tuna per-capita/week does not exceed 1kg (80%), while 20% of the citizens surveyed have a consumption of 1.5-2 kg/week. Consumption occurs mainly at home (73.4%) and the 26.6% in restaurants. Secondary valuable fresh parts are eaten by 75% of the sample. These parts include the "barbassali" (throat) with the highest

preferences (93%), followed by the gonads of males “lattume” (66%), fresh stomachs “bele” (42%) and the ventral part “biddiu” with a 33% preference.

3.3.4 Eating habits: processed tuna

Similarly, the production of salted parts is managed by local fishermen who use traditional systems. The estimated weights of fresh gonads for the period 2007-2010 are reported in **Table 4**. Locally, salted products are eaten by 94% of the population. The highest consumption is for the salted ovary “bottarga” (93%), followed by the salted heart “cö” (73.3%), salted muscle “tunina” (66.6%) and “mosciame” (60%) (from the Arabian word *mushamma*). Tuna in olive oil is consumed by 87.5% of the sample. Only the 21.4% of the tuna in oil is derived from the local cannery, while the highest percentage (78.6%) of interviewees have the tradition of preparing home-made product from fresh tuna they have stored for part of the year. The salted bottarga in the local market is very expensive, from 100-150 €/kg, and salted heart is 60 €/kg.

3.4 Culture and tourism trap-related activities

We analyzed diverse activities in the tourism chain (**Table 3**). A brief description of the sub-sectors follows.

3.4.1 Gourmet tuna festival

The “Girotonno” (http://www.girotonno.org/) is an international gourmet festival to celebrate high quality tuna and the trap fishery (**Figure 3**). The event includes two main activities: a popular event with tuna tastings at multiple sites in the village of Carloforte and a gourmet contest. In the latter, a selected group of international chefs are invited for a three day competition based on tuna food preparation. Afterward, a jury of professional food and wine journalists select the winner on the basis of tasting. The event is successfully celebrating its ninth year. According to the data recorded by the local tourist agency (based on the tickets sold by the ferry companies that manage the transport to/from the island of San Pietro) in 2010 the “Girotonno” attracted 40.000 visitors/day. The event involved at least the 40% of the local businesses.

3.4.2 Tonnara Museum

The cultural heritage of trap fishing is also appreciable in small museums and expositions. We surveyed a few trap museums in the whole of Italy: Pizzo Calabro (Calabria), Bonagia (Sicily), Carloforte, Portoscuso and Stintino (Sardinia). In these places people can observe models of trap gear that make it possible to understand how the trap works, see original equipment, and examine historical documents, old photos and movies in detail. The museum in Carloforte accounts for an average of 1500 visitors/year since 2008. The museum has only one employee who works all the year long. The greatest attendance is in April-May (during the fishing season) and August-September.

3.4.3 Trap visit and mattanza watching

The visits at the historical trap buildings (stabilimento) and the attendance at fishing operations of a *mattanza* (final phase of the fishing during which tunas are harvested from the trap, landing and processing of tunas, have always been events which attract tourists.

It has been possible to visit the “Trap plant” of the Isola Piana trap (dating back to the 16th century) since 2006 and participate in *mattanza watching* in structured tours on boats to the Portoscuso and Isola Piana traps. According to results of the interviews, the visitation days at the Isola Piana plant ranged from 200±30 days/year in the period 2008-2010. Visits are possible all year long with the peak during May-August. The average number of visitors per week to the Isola Piana plant varies from 20 (autumn-winter months) to 50 visitors/week (spring-summer months).

The number of sightseers for each mattanza ranged from 30 to 50, with an overall number/year of 520±130 in 2008 (13 *mattanzas*), 440±110 in 2009 (11 *mattanzas*) and 680±170 in 2010 (17 *mattanzas*).

3.4.4 Tuna watching: Scuba and free diving

Tuna watching, diving within the trap chambers started in 2000. At present there are three Diving Centres that offer particular dives inside the trap chambers. It is possible to dive with scuba gear and free dive. Employees

involved in each visit to the trap vary from 3-5 persons. We estimate an average of 100 divers/year (including May and June only) in a single trap.

3.4.5 Education and research

Traps have consistently proven they are excellent facilities and are favourable conditions to be involved in scientific programs. It is possible to conduct biological sampling for otoliths, various tissues such as gonads, and carry out tagging operations on bluefin tuna. Annual scientific programs carried out in the trap fishery of Sardinia began in 1990 as a part of a national project financed by the Italian Ministry of Mercantile Marine and successively by the Ministry of Agriculture Policy and Forestry. The main goals of these activities have been the assessment of the pelagic resources around Italian seas and the pelagic fisheries in Italy. Recently the Sardinian traps have been involved in several national and international scientific projects, such as: "SESAME - Southern European Seas: Assessing and Modelling" co-funded by the European Commission within the Sixth Framework Programme (FP7, 2006-2010); "PARATUN – Parasites from wild and farmed Atlantic bluefin tuna from the eastern stock" funded by the Spanish Ministry of Innovation and Science (2011); Italian Project of National Interest "Disentangling ecological and evolutionary dynamics in the Mediterranean bluefin tuna" financed by the Italian Ministry of University and Research; "Study of primary and secondary physiological responses of the bluefin tuna caused by fishing stress in the Sardinian traps" by Academic funds from the University of Cagliari. Finally, Sardinian traps were included in the sampling design within the last ICCAT-GBYP (2011) program for biological samplings.

Since early 1990, the University of Cagliari has conducted a specific educational program for graduate students in cooperation with the trap fishery. Practical classes are held at the Isola Piana trap once a year for students of the Marine Biology Program of the Faculty of Science. Students attend specific lectures on bluefin tuna biology and ecology and participate in different phases of fishing, observe the processing of bluefin for diverse markets and acquire knowledge of sampling techniques for scientific programs. Since 1995, at least eight students have completed graduate theses on specific research topics on bluefin tuna from the trap fishery. The Sardinian traps have also hosted foreign students from the Fulbright Program (University of California) and visiting faculty researchers from the University of South Carolina, University of Illinois, University of Sidney, University of Bologna and University of Bari.

4. Conclusion

In this paper we attempted to evaluate basic economical, social and cultural indicators of the tuna-trap network. Apart from the direct economic impact and the extra profits that benefits society, it is clear that the intangible capital enhanced by the trap network can be identified, but is at present unquantifiable. As previously mentioned, the Product-Country-Image sequence resulting in a brand or "trap fishery district" as has been done for wine and Pecorino cheeses.

Nevertheless, there is a paradox for the trap fishery in Sardinia: an apparent conflict exists between the economic, cultural heritage, development sectors and resource conservation sectors.

The social, economic and ecological objectives of the Common Fisheries Policy, CFP, (EU, 2009) is far from being achieved (Osterblom, 2011) and far to be helpful for the remnant trap fisheries. Neither the living aquatic resources nor the profits of the fishing industry have benefited from CFP policies. Currently, 88% of the stock is subjected to overfishing and being overfished as profit margins of fishermen continuously decline (EU, 2009). Perverse incentives have contributed to failures in the world fisheries policies (World Bank, 2008). The policy of increasing fishing capacity, encouraged a few years ago for the tuna fisheries, is now in countertrend. The restrictive policy of quotas is forcing many countries to re-examine fisheries management at local levels. As a consequence there is a conflict between diverse tuna fisheries which results in a debate on quotas, namely the "Quarrel for tuna quotas" (**Figure 4**). This issue contains inequities for socio-economic and cultural criteria raising many concerns within the trap companies and indirectly in the local communities. We raise concerns on the high risk of the potential disappearance of Sardinian traps and their social capital. Are the current management measures for the trap fishery adequate for the local conditions and actual economic reality?

Considering the preliminary findings of this investigation, we recommend the following actions to be taken:

- Test and implement an adequate bioeconomic model for the management of the trap fishery, e.g., trap quotas based on a Minimum Economic Yield.

- Review the current management practices and examine the state-of-the-art of the biological, socio-economic models relevant to local realities;
- Make ICCAT aware of the need to conduct bioeconomic studies to enlarge the knowledge on tuna fisheries management;
- Engage and sustain traps within scientific monitoring programs in order to evaluate the effectiveness of the bluefin tuna rebuilding plan;
- Promote educational programs for new generations of students and scientists in cooperation with trap companies:
- Promote a Trap Heritage Preservation Program aimed at helping and conserving the cultural, historic architectural and customs, of the trap. Such action should involve the public sectors, private corporations, tourist boards and non-profit organizations;
- Make use of and communicate the existing know-how among countries to promote and sustain harmonizing activities which can generate other revenue streams from the trap fishery (e.g., the "Tuna Gourmet Exhibition" is an activity that can be replicated anywhere);
- Promote an international consortium or association between Atlantic and Mediterranean trap industries.

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Table 1. Absolute and percentage distribution of the trap Quota in the period 2003-2011.

Year	*IT-Trap tons*	*IT-Trap %*	*IT quota tons*	*TAC tons*
2003	237	4,5	5.264	19.200
2004	221	4,5	4.920	18.400
2005	220	4,5	4.888	18.331
2006	220	4,5	4.880	29.500
2007	195	4,5	4.336	25.000
2008	187	4,5	4.162	28.500
2009	146	4,6	3.176	22.000
2010	249	12,8	1.938	13.500
2011	82.2	4.6	1.788	12.900

Table 2. Human resources directly occupied in the trap fishery of Sardinia in the period 2007-2010.

Direct employees	*2007*	*2008*	*2009*	*2010*
Crew (2 traps)	40	35	44	44
ock staff	8	10	10	10
Cannery staff (permanent)	-	2	5	10
Cannery staff (seasonal)	-	18	5	5
Professional trap divers	4-6	4-6	4-6	4-6
Occasional personnel	10/15	10/15	10/15	10/17

Table 3. List of the trap-related activities registered in the period 2008-2010.

Trap-related activities	**2008**	**2009**	**2010**
Trap tours			
Crew (2 traps)	2	2	2
Months x year	12	12	12
Days x year	200±30	200±30	200±30
Visitors x week	20-50	20-50	20-50
Estimated visitors	1015±430	1015±430	1015±430
Mattanza tours	**2008**	**2009**	**2010**
Months x year	2	2	2
Employees	1	1	1
Number mattanza (lift)	13	11	17
Visitors x mattanza	30-50	50-80	50-80
Estimated visitors x year	520±130	440±110	680±170
Tuna watching	**2008**	**2009**	**2010**
Number diving centers	2	3	3
Employees x Diving Center	3-5	3-5	3-5
Months x year *	1.5	1.5	2
n. scuba dives	150	180	200
n. snorkeling dives	-	100	100
Trap Museum	**2008**	**2009**	**2010**
Carloforte (n. visitors)	1500	1500	1500
Stintino (n. visitors)**	800-1000	900-1000	900-1000
Restaurants (serving tuna products)	**2008**	**2009**	**2010**
Carloforte	10	10	10
Others (trap district)	10	10	10
Not-local (north Italy)	~200	~300	~300

* Only referred to 2 months of trap fishing.
** Only 2 months of opening.

Table 4. Estimated production of gonads used for salt processing in the traps of Isola Piana and Portoscuso.

	2007		*2008*		*2009*		*2010*	
	kg	sd	kg	sd	kg	sd	kg	sd
Female	1209	121	1077	127	1064	137	2520	423
Male	1700	479	1783	414	1979	995	4415	765

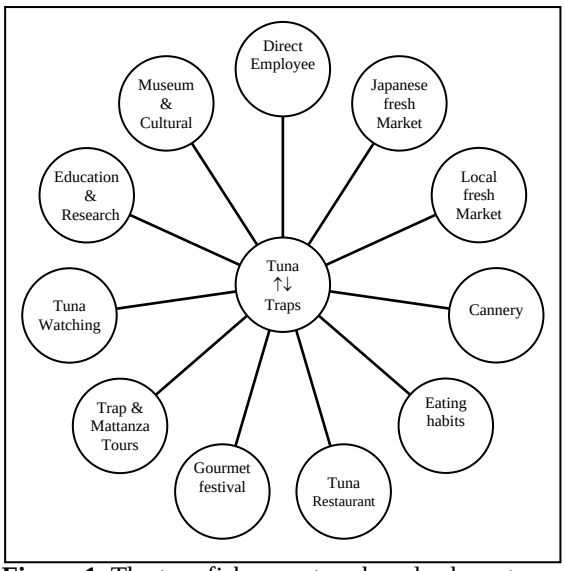

Figure 1. The trap fishery network and sub-sectors which engenders.

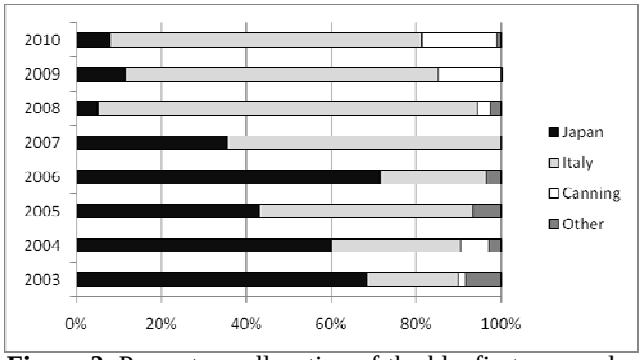

Figure 2. Percentage allocation of the bluefin tuna production from the trap fishery of Sardinia (Isola Piana and Portoscuso).

Figure 3. Drawing appeared on the newspaper *Le Monde* for the tuna exhibition "Girotonno" in 2007.

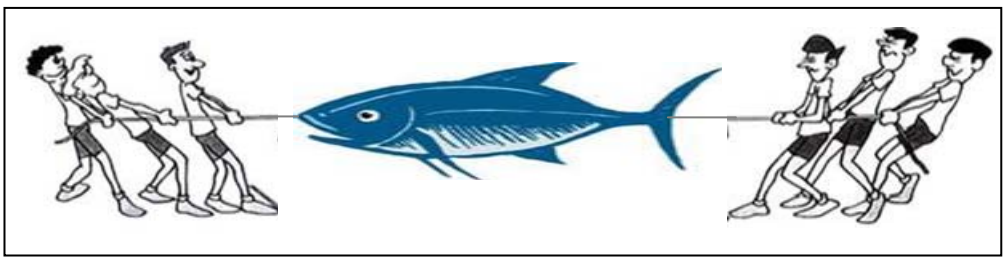

Figure 4. The quarrel for bluefin tuna quota.