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IGNEADA FISHERY OF THE BLACK SEA, TURKEY: A REVIEW

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ABSTRACT: Igneada is a place with a very small population in the province of Kirklareli, where is located in the continent/region of Europe, and it is near the national border between Turkey and Bulgaria. Fisheries are an important sector in Igneada of the Black Sea. It provides employment to hundreds of people and contributes to food security of the country. The focus of the present review is on the governance of municipal fisheries in the Igneada coast of the Black Sea in view of the importance role they play in means of living of the coastal communities and in the nation as a whole. The focus of the present study is on the governance of municipal fisheries in the Igneada coast of the Black Sea giving stress to their present role towards the livelihood of the coastal communities and in the nation as a whole.

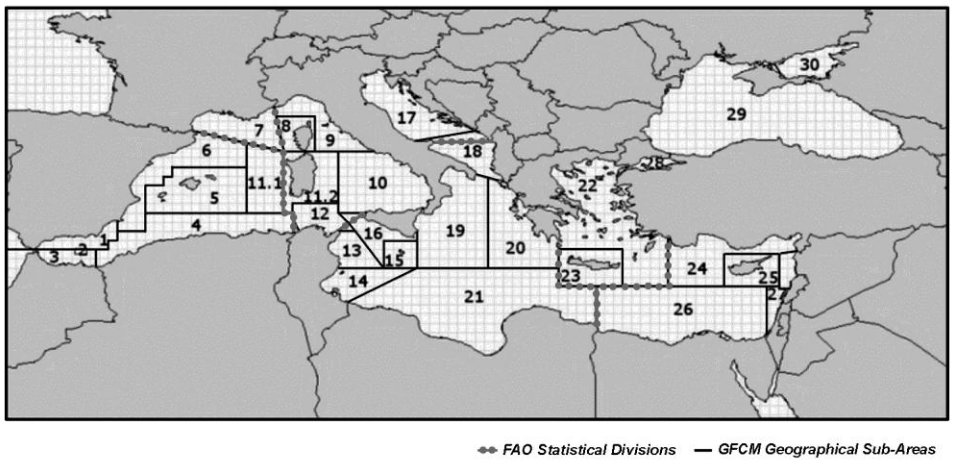
KEYWORDS: Black Sea, Igneada, Fishery.

INTRODUCTION

Black Sea is an inland sea, with a surface area of 413,360 sq. km, situated between 40°56’ - 46°33’N, and between SE Europe and W Asia, It is surrounded by land except for the Bosphorus, that leads to the Marmara Sea of a small sea between the Dardanelles and the Bosphorusshowing link with the Mediterranean Sea.Transport of the high salinity of the Marmara Sea water through the Bosphorus Strait states the density stratification of the Black Sea along the bottom of the strait. Unlike the Mediterranean, the Black Sea with a salinity of about 17‰ recognizes as an estuarine basin due to discharges of the large rivers. In NW side of the Black Sea Dnieper, Dniester, and Danube rivers are the main tributaries and the Don and Kuban rivers flow into the Sea of Azov. A major Danube River accounts for about 50% of the river freshwater influx; and the travel time needed for the movement of low salinity waters from the Danube River mouth to the Bosphorus Strait is about 1-2 months. The rivers flowing into the northern part of the Black Sea carry much silt, sandbars and lagoons and the southern part is steep and rocky. The low salinity surface waters reachup to the Anatolian coast and the dense saltedMediterranean waters sink in to the bottom layer which has very slow movement and accumulates hydrogen sulfide (H_2S); it has limited biodiversity and little tidal action (Anonymous, 2014).

The Black Sea is 1,210 km from eastern to western, up to 560 km broad and has a highest deep of 2,220 m. The Black Sea is enclosed by Bulgaria and Romania on west, Ukraine on north, Russia on north-east, Georgia on east and Turkey on the south.

The Black Sea is the largest Sub-Area (29) of the GFCM (General Fisheries Commission for the Mediterranean) and one of the most complex ecosystems in the Region (Fig. 1). It consists of six riparian countries. Romania, Bulgaria and Turkey are members of the GFCM.



01 - Northern Alboran Sea	07 - Gulf of Lions	13 - Gulf of Hammamet	19 - Western Ionian Sea	25 - Cyprus Island
02 - Alboran Island	08 - Corsica Island	14 - Gulf of Gabes	20 - Eastern Ionian Sea	26 - South Levant
03 - Southern Alboran Sea	09 - Ligurian and North Tyrrhenian Sea	15 - Malta Island	21 - Southern Ionian Sea	27 - Levant
04 - Algeria	10 - South and Central Tyrrhenian Sea	16 - South of Sicily	22 - Aegean Sea	28 - Marmara Sea
05 - Balearic Island	11.1 - Sardinia (west) 11.2 - Sardinia (east)	17 - Northern Adriatic	23 - Crete Island	29 - Black Sea
06 - Northern Spain	12 - Northern Tunisia	18 - Southern Adriatic Sea	24 - North Levant	30 - Azov Sea

Fig. 1. GFCM Geographical Sub-Areas (GSAs) map (GFCM, 2014).

The eutrophic Black Sea ecosystem has been producing more biomass than its pre-eutrophication phase, whichever means rised levels of organic substance both in the water body and on the sea floor. But, it is mostly dominated by opportunistic species and gelatinous carnivores. The Black Sea has agonized over critical ecological changes since the 1970s (Oguz, 2005). They were caused by the concurrent effects of intense eutrophication due to excessive anthropogenic nutrient load and pollutants, trophic cascades from overfishing and outburst of the alien ctenophore species *Mnemiopsis leidyi* (top-down control) and natural climatic variations (Anninsky *et al.,* 2005; Finenko *et al.*, 2006). They have been particularly effective because of very limited water exchange through the Bosphorus Strait and across the permanent pycnocline.

The heavy, unregulated fishing during the early phase of the eutrophication introduced an additional anthropogenic forcing. Eutrophication, combined with differently severe faces of marine contamination has produced a decline in biologic diversification in seaside and the open sea, leading to a destabilization of the pelagic and benthic ecosystems. Based on the level of anthropogenic eutrophication and the biota response the time interval from the 50s to the late 80s has been subdivided into two periods (Moncheva and Krastev, 1997; Shtereva *et al.,* 1999). The initial one up to 1970 is contemplated a background in the ecological understanding, a consistently unspoilt period, with natural variability of the ecosystem. The second one (1970-1992), a period of intensive anthropogenic eutrophication, including dramatic biologic noise in the ecosystem - changes in the phytoplankton communities, structure and succession, an increment in the total phytoplankton biomass and blooms, resulting in the deterioration of the Black Sea ecosystem including mass mortality of bottom living animals (Konsulova *et al.,* 1991; Moncheva and Krastev, 1995). Small pelagic species become main predators in the

ecosystem. By the end of 1970s, exploited stocks reached 1.5 million tons. During the 80s (the period of high eutrophication), dramatic changes were observed in pelagic ecosystem (phytoplankton, zooplankton and fish resources) due to the penetration of new exotic species in the Black Sea (Zaitsev and Mamaev, 1997). They have been collapsed finally in 1989-1990.Abundance of predator fishstocks has sharply decreased during 1970s and 80s (Gordina *et al.,* 2005).

The recent period (after 1993) a priori is accepted as a term of diminish in the grade of human activity pressure mostly owing to the falling economy and contacted cutbacks in the industrial and agrarian output. Similar trends are marked in order to the Danube River inlet as the principal resource of anthropogenic eutrophication for noth-west and west of the Black Sea region (Cociasu *et al.,* 1997).

Typical representative of exotic fauna with negative effect on the Black Sea ecosystem is the ctenophore *Mnemiopsis leidyi*. It grows to a size of up to 10-15 cm. As a result of its development the biodiversity and biomass of the main zooplankton groups decrease during 90s and the same negative effect is shown also on zoobenthos decrease, as a result of active predatory press on the zoobenthos eggs and larvae during their planktonic stage. *Mnemiopsis* consumes up to 70% of the total ichthyoplankton stock in the coastal zone and it is a competitor for feeding of fish (Anninsky *et al.,* 2005; Finenko *et al.,* 2006). After dying it falls to the bottom and reflects negatively on the water quality and benthic fauna biodiversity, contributing to the oxygen depletion (hypoxia and anoxia) in the near bottom layers, followed by mass mortality of bottom living animals, including fishes (Zaitsev and Mamaev, 1997). The invasive Ctenophore *Beroe ovata* is acting as the only predator of *Mnemiopsis* and reduces its population (Finenko *et al.,* 2003; Svetlichny *et al.,* 2004).

The Black Sea ecosystem and biodiversity is one of the most studied marine systems in the world. At the end of the 1980s pelagic fisheries were collapsed and the unexpected shifts toward a biological community dominated by gelatinous carnivores. Several studies (listed by Bat and Sezgin, 2007) have been aimed at clarifying the circumstances that have been entailed in the Black Sea ecosystem changes.

Of 26 commercial fish species in the 1960s, only 6 remained in significant exploitable quantities. As the small pelagic species has been overfished, their niche has been replaced by gelatinous carnivores. When small pelagic stock was reduced to 300 tons, the gelatinous biomass reached its maximum value of 4 g C m^{-2}. Thus, the food web has been diverted from the classical phyto- mesozoo- fish, to an alternative chain of phyto- mesozoo- opportunistic species and gelatinous (Oguz and Gilbert, 2007).

Fisheries became such a vital part of the commerce of coastal towns in Turkey that their importance in conducive useful nutrition for people, supplying crude material for the industrial sector, composing the employment probabilities and upper back demand for exportation (OECD, 2014).

In 2012 there were 5.113 vessels operating in the Black Sea of which 289 trawlers, 181 purse seiners, 158 purse seiners-trawlers, 112 carrier vessels and 4.373 small-scale vessels (TUIK, 2012). The numbers of vessels between 12 and 19.9 m length and over 20 m length were 382 and 423, respectively (Table 1).

Fishing is done mainly near by coastal area in the Black Sea of Turkey, based on daily activity. Major types of fishing boats are seiners, trawlers and carriers. These boatsin the Black Sea have been arranged in two groups as industrial and operational (OECD, 2014).

Table 1. Numberand sizevariation of fishing vessels used in the Black Sea regions in the year 2012 (TUIK, 2012).

Region	12-14.9 m	15-19.9 m	20-29.9 m	30-49.9 m	>50 m	Total
Eastern Black Sea	65	51	165	75	7	363
Western Black Sea	157	109	111	63	-	440
TOTAL	222	160	276	138	7	803

Source: Prime Ministry, State Statistics Institute

The total product may be separated into the major groups which are pelagic and benthic fish species, molluscs, shellfish and others. Total fisheries product of Turkey was 644.852 tons in 2012 in accordance with the Turkish Fishery Statistics. Among the total fish production, 61.5% was acquired mostly from sea fishing, 32.9% comes from aquaculture and lastly 5,6% from inland (TUIK, 2012).

In the period of 2002-2012, the Turkish fleet landed in the Black Sea between 380.381 and 589.129 thousand tons (see Table 2). This landing has contributed in a large proportion to the global value of capture fish production in Turkey which was about 981,464,136 TL (Turkish Lira) approximately 327,154,712 € in 2012. 413,914 and 863 $ were earned by exporting 74,006 tons sea food in 2012 (TUIK, 2012).

Table 2. Turkish fleet operating in the Black Sea landed between 2002 and 2012 (TUIK, 2012).

Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Tons	**522744**	**463074**	**504897**	**380381**	**488966**	**589129**	**453113**	**425046**	**445680**	**477658**	**396322**

The anchovy (*Engraulis encrasicolus*) was the furthest major species captured, with about 51% of total amount. The other significant little pelagic piscine species caught in the Black Sea area were European sprat (*Sprattus sprattus*), andhorse mackerels (*Trachurus* spp.) (Table 3). In 2012, anchovy cacthment was 104,738 tons for the Eastern Black Sea and 21,593.1 tons for the Western Black Sea.

Marine production of the Turkish Black Sea appeared a gradually increase until 1988. However, the amount of marine production started to decline as a result of collapsing pelagic fisheries (mainly anchovy stocks collapsed) in the late 1980s. Early 1990s, the catches has steady increased again to the level shortly prior to the crisis in 1988. It is seen that sea production in the Turkish Black Sea achieved a recession level of about 400,000-530,000 tons.

Table 3. Black Sea landing composition and species in Turkey (TUIK, 2012).

Quantity of caught sea fish (tons)										
Type of fish	**Years**									
	2003	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Anchovy	295000	340000	138569	270000	385000	251675	204699	229023	228491,4	163981,9
Horse mackerel	16400	18068	13540	14127	22991	22134	20373	14392	18072,7	24625,3
Scad	11600	9337	13978	11800	9030	10043	7895	6055	6937,3	6320,7
Sprat	6025	5411	5500	7311	11921	39303	53385	57023	87140,8	12091,7

Source: Data on sea products is compiled by the Marine Fishery Survey.

MATERIALS AND METHOD

Fisheries management:

The fishery interrelated monitoring check observation is entirely under the liability of the Ministry of Food, Agriculture and Livestock (prior Ministry of Agriculture and Rural Affairs). Fishery management, arrangement, conservation, introduction, development programs and technical support are carried out by General Directorates (Duzgunes and Erdogan, 2008; OECD, 2014). Overall fishery and aquaculture activities are attributed to the Fisheries Law No. 1380, legalized in 1971, is under amendments. Biannual circulars point out rules and regulations that implement to fishing in Turkey (General Directorate of Protection and Control).The Fisheries Law No. 1380 of 1971 was improved by law 3288 of 1986. In accordance with Laws 1380 and 3288 and Continental Waters Law No. 2674 of 1982, outsiders are not authorised to act a part in trading fishing activities. Licenses are required for all fishing boats and fishers. At present, there is no Total Allowable Catch or quota system in Turkey due to lack of fish stock assessments. Fleet registry, licensing and VMS (over 24 m vessels) have already been completed. Considering the Fisheries Law of 1971 and 1986, licensingof fishermen and their boats has legally happen mandatory (Duzgunes and Erdogan, 2008; OECD, 2014).

The major tasks of the Ministry of Food, Agriculture and Livestock on fishery are listed by OECD (2014) as follows:

a) to apply and to appoint the missions remarked in the Laws No. 1380 and 3288
b) to establish and perform the main fisheries policies (including aquaculture)
c) to help the services like the providing, procurement and deploy of the fisheries (including aquaculture) credits and other inlets that fish farmers and fishermen use)
d) to install and run the standard check systems and organisations needed to proovide and arrange that fish and other fishery products are seized, processed, store up, marketed and utilized in harmony with the international quality standards
e) to set up and work investigative activities on the progress, managing, production, processing units, agent, laboratories and institutions, and to make technical help to private sector organisations wishing to build and run such type of institutions
f) to equip and enforce extending and schooling systems, programs and projects for farmers and fishermen
g) to cooperate with the private agencies, universities, research institutions and international organisations to increase the productivity, protection of natural stocks and to save them from biotic and abiotic threats and
h) to support and help to fishery organisations (associations and co-operatives).

The criteria of fishing regulation are recorded by OECD (2014), Duzgunes and Erdogan (2008) and GFCM (2012) as follows:

a) Minimal mesh size (for instance trawl net 20 mm at the Black Sea)
b) Minimal fish length (cm) and/or weight (g)
c) Closed zone and conditions for specified gears and/or boats
d) Closed season and area
e) Species under complate protection (i.e. sturgeons)
f) Fully prohibit fishing methods and fishing gears
g) Gear limitation for identified species

h) Gear or fishing method restrictions
i) Some restrictions concerning contaminants.

OECD (2014) reported that the fishing boats in Turkey indicate many type of seaside or close coastal fishing vessel features in large scale. It is mentioned in the same report (OECD, 2014) that "next 1980, much refinements have been seen in the fishing fleets of Turkey in terms of the capabilities and engine powers, but yet there are not any fishing fleet on the open seas and oceans. However, this favorable improving has got to problems of over-fishing, hence axtra licensing of over 12 m fishing boats was stopped in 1991". Moreover, all licensing was stopped for new one in 1997 (OECD, 2014).

The use of trawl and purse seines between May and September are forbidden to save spawning stocks (Duzgunes and Erdogan, 2008; GFCM, 2012; OECD, 2014). Similarly fishing within 24 meter depth from the coastline are prohibited by the law (Official Gazette of Republic of Turkey, 2012). Coast Guard Command makes controls for application having the tools to implement penalties and reporting criminal cases to the sue authorities. Fig. 2 shows fishing area regulations in Turkish Black Sea coasts.

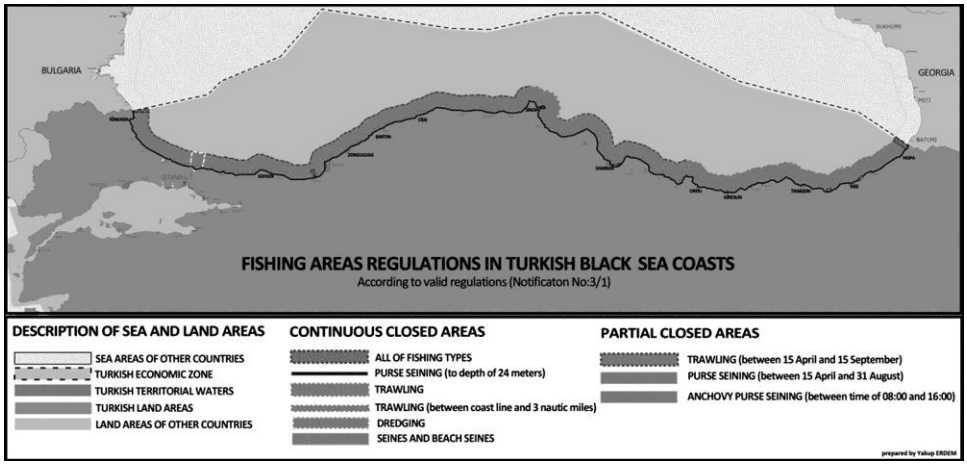


Fig. 2. Fishing area regulations in Turkish Black Sea coasts (Drawn by Y. Erdem).

Fisheries of the Turkish Black Sea Coast:

Researches on the specifications of the fish biodiversity in the Black Sea beganat the end of 1940's (Bat *et al.*, 2011). The Black Sea fishes have come from different origins and divided into four major categories, attributing with their bionomics. They were identified by Rass (1949) as follow:

a) limnetic species;
b) salty Ponto-Caspian relicts;
c) cold water species with Boreal-Atlantic origin; and
d) warm water species with Mediterranean origin. The later two groups (c and d) contain the furthest greatly extended and commercially main species in the Black Sea.

Öztürk (1999) stated the presence of 140 fish species of the Turkish Black Sea. Bilecenoglu *et al*. (2002) reported a check-list of the sea fish fauna of Turkey and gave a

list of 151 fish species of the Black Sea. So far very little work has been published on the fish fauna of the Turkish Black Sea coast (Slastenenko,1956; Aksiray, 1987; Bilecenoglu *et al.,* 2002). Bat *et al.* (2005) established 94 fish species concerning 44 families in the Sinop and Samsun coasts of the Black Sea. Keskin (2010a) presented 161 fish species in the Black Sea coast of Turkey. They belong to 62.73% Atlanto-Mediterranean species, 6.83% cosmopolitans, 28.57% endemics (which are of 18.01% Black Sea endemics, 10.56% Mediterranean endemics) and 1.86% introduced species (Indo-Pacific and Atlantic origins) like *Liza haematocheila*, *Sphraena obtusata* and *Salmo sala*. BSC (2010) also reported a checklist of the Black Sea fishes and Red Data Book Black Sea, published by Turkish Research Foundation (Öztürk *et al*., 2013).

Zaitsev and Mamaev (1997) informed that 3,800 fauna and flora were identified in the Black Sea, 52.5% belongs to invertebrates, 42.9% to fungi, algae and higher plants, 4.5% to fishes and 0.1% marine mammals.

Some commercialfishes have been significantly declined due to overfishing, industrialisation and urbanisation which have created fishery the much specific species to reduce in the Turkish Black Sea coast (Kideys, 1994; Bat *et al*., 2007). As a result solely a litte species of economical significance are obtained. Specifically, the stocks of anchovy and turbot have been diminished over the last decades (Bat *et al*., 2011).

Information on local fish fauna in the Thrace region is scarce, the recent information on sea fish fauna in the course of the Kirklareli coasts were made by Yildiz Mountains Biosphere Project Report (YMBP, 2010).

Description of the Igneada area:

Igneada is a peninsula located the following hillsides of Istranca Mountains. It is sited northeast of the Kırklareli municipality district,. The Black Sea close the eastern way and Bulgaria placed north of Igneada. The alluvial forests contain an exceptional diversity of habitats, with a wide range of coastal and marine ecosystems, and nature and wildlife conservation areas on the Thracian region (Fig. 3). Theyare considered to be of high environmental value, although the considerable changes as anthropogenic activities, which is threatening certain habitats and species. In the nearness of these forests to the marine coasts provides good opportunity for ecological interpretation and facilities for the education and public awareness to this very special environment (World Bank, 2000). In Igneada these forests are covered by fresh water and the flora are rich. It is called "Longos" in Turkish and covers a total of 1536 ha.

Igneada and its environment is well-beloved location concerning connect ecosystem chains. Igneada contains rivers, both fresh and salt water lakes, sand dunes, fresh and salty swamps, deep spot in a sea forest and varied kind of longest trees.

In Igneada the main economic sector is forestry and the most promising sector is fishing, livestock and tourism. However the tourism sector is limited in June and August. An estimation of 30,000 visitors per year along the Igneada coasts is visited (Ok, 2006).

Fishing of Igneada:

It is known that thirty fish speciesare available in the marshy areas such as lagoon, lake and brook.Among them 8 species have been proclaimed as "the type needs to be protected" in Bern Contract. They are monkey goby, sand goby, asp, chub, schneider, European bitterling, spined loach and common nase. These fishes are mainly available as host fishes in the lagoons like Mert, Erikli and Saka. Crayfish live in Hamam Lake.

However, *Salmo trutta* is found in the brooks during springs which come out of Istranca Mountains. Igneada marshy region is concerned with the sustained tourism which may be useful for substantial sport fishing. This region may be considered for preservation and conservation of the fish species in requirement without destroying the nature.

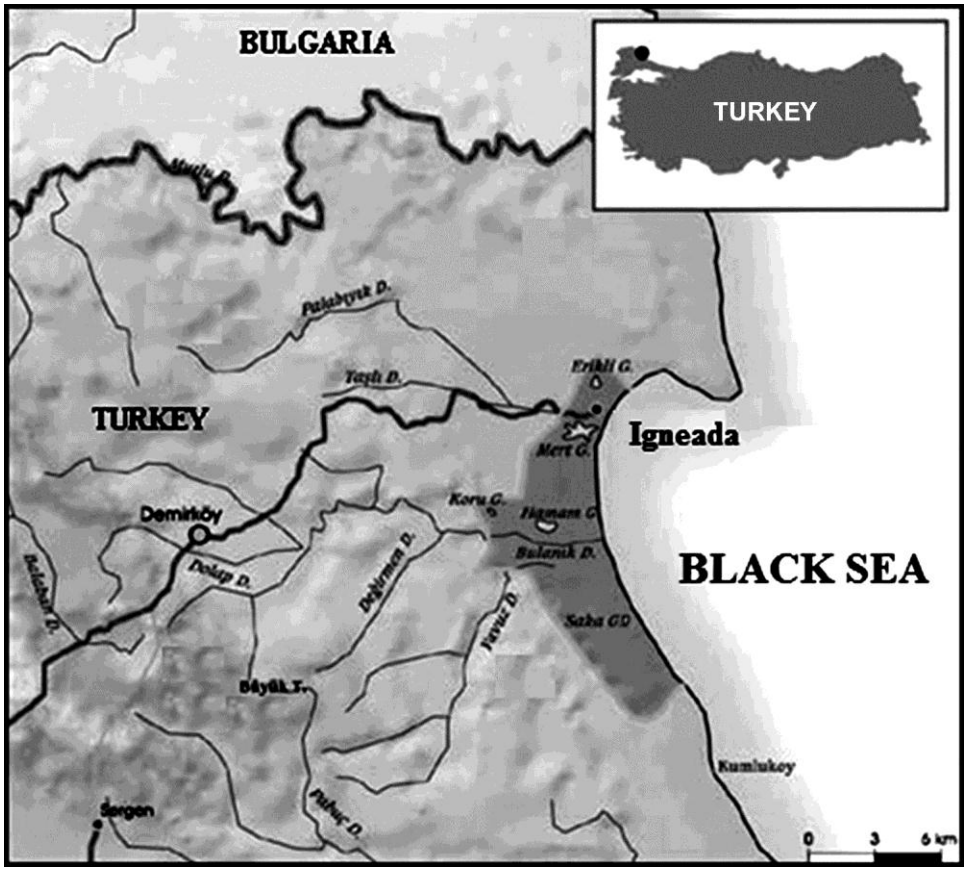


Fig. 3. Location of Igneada

The lakes in the region is also prospective to research area respecting the fish species. In particular Mert, Erikli and Saka Lakes have a connection to the sea in some periods of the year. The lagoons are much important for fish species which immigrate off the sea to the freshwater or the freshwater to the sea for reproduction, concervation and food (Ozyavuz, 2008).

Öztürk *et al.* (2013) informed that "Igneada region where stuation on a coastal plain on the European and Turkish distric of the Black Sea is stated to be the maximum suitable place in order to trans-boundary protected zone. The probable region committed includes Igneada coastal inshore sea area and a terrestrial component, Strandja between Bulgaria and Turkey. The terrestrial part of Igneada is anyway under protection by virtue of its unique watery forests, wetlands on alluvial soils and coastal sands. The area is of eventual

stature for biodiversity procuring a habitat to plenty flora and fauna species. The man population density in the region is much small not only for Turkey but also for Bulgaria, so the anthropogenic stress is too restricted on the coastal ecosystem.

Keskin (2012) mentioned that turbot, red mullet and whiting were target species in the coasts of Igneada. Moreover, coastal water of the zone is used for the nursery grounds of these fish species as well as forthe juveniles of bonito which have been bycaught in trawl fishing. Biodiversity of Igneada coast is plenty with regard to endemism, like knout goby and rare species, such as the horse pipefish (Keskin, 2010b; 2012). Igneada coasts also serve as a laying and feeding floor of turbot which is under risk in the entire Black Sea owing to overfishing and IUU fishing (Öztürk *et al.*, 2013). Uyanık (2007) reported many fishes bearing sturgeon and turbot in Igneada coasts, to be under hazard, as well.

Furthermore, Öztürk *et al.* (2013) pointed out that "the Igneada region lie down near to formerly set up Bulgarian Marine Protected Areas, like the Ivan and Peter Islands, thence it may ensure connectivity among two Marine Protected Areas and may be able to simplify common action and management". Additionally, Trayanov *et al*. (2007) recommended Marine Protected Areas from Chernomorets to Resovska River close to the border of Turkey.

Kirklareli Province has 60 km of coastline and effectuates merely 4.3% of the whole Turkish Black Sea coast, the local ichthyofauna is wealthy and takes proper management surveys to save biodiversity and maintain its usage as fisheries. *Salaria pavo*, *Parablennius zvonimiri* and *Parablennius incognitus* were found with the first time in the Igneada coasts of Kirklareli from Turkish Thrace (YMBP, 2010). In the project 121 marine fish species were recorded whereangel shark was critically endangered, three sturgeons namely fringebarbel sturgeon, Danube sturgeon, starry sturgeon and beluga were endangered, and picked dogfish, spiny butterfly ray and pontic shad were vulnerable at global level; and 54 species are nationally threatened (YMBP, 2010).

In the same project the Pacific mullet (*Liza haematocheila*) was recorded in Kirklareli coast as an only non-indigenous species which eats little benthic organisms and, therefore, does not seem to compete with native grey mullet. It is captured by regional fishermen from Kirklareli but has nominal commercial amount (YMBP, 2010). In the same study it was reported that a single specimen of *Hexanchus griseus* was caught by a fishing vessel, in Igneada coasts (YMBP, 2010).

In Yildiz Mountains Biosphere Project (YMBP, 2010) bottom trawl surveys were performed depths of between 25 m and 52 m on sandy/muddy sea bed and dense the Mediterranean mussel beds (*Mytilus galloprovincialis*). A few target species have been recorded by bottom trawlers fishing throughout the Kirklareli coast. The maximum commercial fish is turbot then red mullet and whiting. In spite of these, sharks and rays caught are normally counted as a by-catch. These species are frequently exported owing to their rare consumption in the internal market. Several pelagic fishes for instance bluefish and horse mackerels seem accidentally in the trawl catch but they are largely discarded except big sufficient to be commercially marketed. A total of 20 fish species was sampled by bottom trawling (YMBP, 2010).

Diving survey was also performed in Yildiz Mountains Biosphere Project (YMBP, 2010). It was reported that visibility was generally very low, because of turbidity induced by wave impact on the side, the fine sand convert to floors of shoaly shores. Total rocky

substrates were either covered by intensive algal mussels or vegetation, apart from naked rocks faced in the vicinity of Igneada harbour. It is pointed out that among the seagrasses was observed in a few localities, together with sparse patches of eelgrass, which supplies refuge especially to family Labridae wrasse species. A total of 25 species observed during dives (YMBP, 2010).

RESULTS AND DISCUSSION

Shulman *et al*. (2008) emphasized that many studies related to the Black Sea fishery problems started in 1950s and became more intensive to the next years. Presence of excessive nutrient inflow via major north-west rivers during the few decades resulted of eutrophication in the Black Sea which has been come up again drastic changes in recent years (Bat *et al.,* 2007). Adverse alterations due to ruined nutrient balance were returned in the quantitative and qualitative composition of phytoplankton and zooplankton (Bat *et al.,* 2007). As a result, fish species have happened significant alterations in the Black Sea, frequently qualified by a substantial diminish in abundance of trading species. Further, many species have evanesced off the fishery, resulting in alters to the formerly dominant species. Bat *et al*. (2011) emphasize that the Black Sea biodiversity is for some reason different when compared to the other seas. Seawater temperature and salinity are very important because of emergence and deploy of species in the Black Sea are initially stated by them. Consisting in the temperature rise Mediterranisation of the Black Sea fauna is in progress and takes owing to immigration of new species (Sezgin *et al.,* 2010). It was reported that one non-native species (*Liza haematocheila*) captured in the Kirklareli coast. This species of eastern Asian origin was introduced for aquaculture in the Sea of Azov and the Black Sea (YMBP, 2010).

No data are available on the situation of fish species and fisheries in the course of the Kirklareli coast except Yildiz Mountains Biosphere Project YMBP, 2010. Total of 121 fish species throughout the Kirklareli coasts pending the Yildiz Mountains Biosphere Project represents a relatively important diversity of marine fish (YMBP, 2010).

Because of trading value, turbot is the maximal important fish but the local stock appears to be overfished (YMBP, 2010). However, in the western Black Sea, there are simply a number of commercial species, largely anchovy, whiting, Atlantic bonito, bluefish and red mullets.

Maximum production of turbot occurred in 2006 (807 tonnes) between 2003 and 2012 in Turkish Black Sea. Quantity of caught turbot productions were 295 tonnes in 2010 and 166.4 tonnes in 2011. In 2012, Turkey produced 202,7 tonnes of turbot (117 tonnes from the western Black Sea), frankly displaying the outcomes of overfishing. Kirklareli seaside is one of the common feeding and spawning areas of turbot species (Fig. 4) and protection preventions should be taken to enable the population to recover(YMBP, 2010).

Slastanenko (1956) mentioned that the western shelf of the Black Sea region is of particular stature as the major spawning and nursery grounds for superior worth commercial fish species, like *Engraulis encrasicolus*, *Psetta maeotica* and *Sarda sarda*. Anchovy spawning grounds were changed in 1990s (UNEP/GRID, 2013). Changes in the spawning grounds of anchovy are shown in Fig. 5.

Anchovy, the dominant commercial catch along the Black Sea coast of Turkey, demonstrates undulating yield amounts over the last decades.

Fig. 4. Feeding and spawning areas of turbot (UNEP/GRID, 2013).

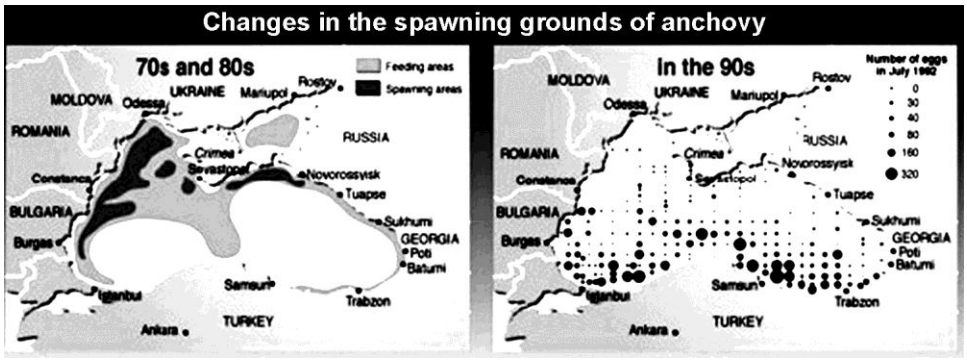


Fig. 5. Changes in the spawning grounds of anchovy (UNEP/GRID, 2013).

A strong decline emerged in 2005 (4,947 tonnes) in the western Black Sea, but the yearly product has driven up to 52,644 tonnes in 2007. And then decreased in 2008 (9,805 tonnes) again. Between 2009 and 2012, it can be seen that anchovy production in the western Black Sea reached a level of around 20,249-29,967 tons (TUIK, 2012). It is indicated that the overfishing of anchovy in the western Black Sea, was expressed

throughout the starting of the fishing season (September) when a few purse seine vessels off the central and the eastern Black Sea come to the Kirklareli coast (YMBP, 2010).

However, Shulman *et al*. (2008) clarified that various issues of the Black Sea fishery cannot be referred without physiological and biochemical approaches. They were listed by Shulman *et al*. (2008) as follow:

a) short-term prediction of time and character of wintering migrations of the Black Sea anchovy
b) long-term prediction fishery perspectives
c) consideration about probable transformation of biota (including ichthyofauna) in shelf (first of all coastal) zone
d) estimation of condition (degree of well being) of commercial stocks
e) influence on this condition by climatic and regional biological and anthropogenic factors
f) determination of population structure, distribution and localization of commercial stocks.

Another commercial fishes such as Atlantic bonito has decreased from 70,797 tonnes in 2005 to 35,764.2 tonnes in 2012 and bluefish has decreased from 22,000 tonnes in 2003 to 7,389.5 tonnes in 2012. Minimum productions of Atlantic bonito and bluefish were 5,965 tonnes in 2007 and 3,122 tonnes in 2011 in Turkish Black Sea, respectively (TUIK, 2012). It is suggested that this kind of unfavourable alterations are owing to the complex effects of overfishing and inappropriate management of available stocks (YMBP, 2010).

It can be said that commercial fisheries among the Igneada coasts are intensified on a few trading species; namely turbot, red mullet and whiting are fished by bottom trawlers; and anchovy, Atlantic bonito and bluefish are major fish caught in purse-seine nets. Onwards a few schooling fishes migrate from the northern Black Sea to the southern coasts, big numbers of fishery vessels equipped with hi-tech instruments congregate about the ports pending the fishing season (YMBP, 2010).

Figure 6 shows threats in the Black Sea for fisheries. At the global level anthropogenic activities have induced and will continue to lead a casualty in biodiversity through, water and air pollution, habitat fragmentation, overfishing and the introduction of non-native species (UNEP/GRID, 2013).

CONCLUSIONS:

Coastal ichthyofauna and other marine biodiversity in Igneada are rich (unpublished data of four surveys in Igneada coasts for MISIS Project during 2012-2013) and Igneada coasts serve as a spawning and/or feeding ground of turbot and sturgeon (UNEP/GRID, 2013). It is reported that in Igneada and its adjacent waters, several fish species are to be under threat due to overfishing and worth convenient management measures to save biodiversity and keep its utilisation as a fisheries (YMBP, 2010). This kind of studies will be required to be rather understood by upward detailed taxonomical and ecological studies to assure datum for protection planning.

There are a total of 62 recorded fishery boats in Igneada fishing ports and this number has been increased more than hundreds at beginning of the fishing season to catch commercial stocks (YMBP, 2010).This situation has created problem for local fishermen forwhy much purse seine boats originating from the eastern Black Sea access high technological instruments for fishing anchovy, Atlantic bonito, bluefish etc., as a result of

the existence of hundreds of fishing vessels at fishing season reasons very big fishing pressure (YMBP, 2010).

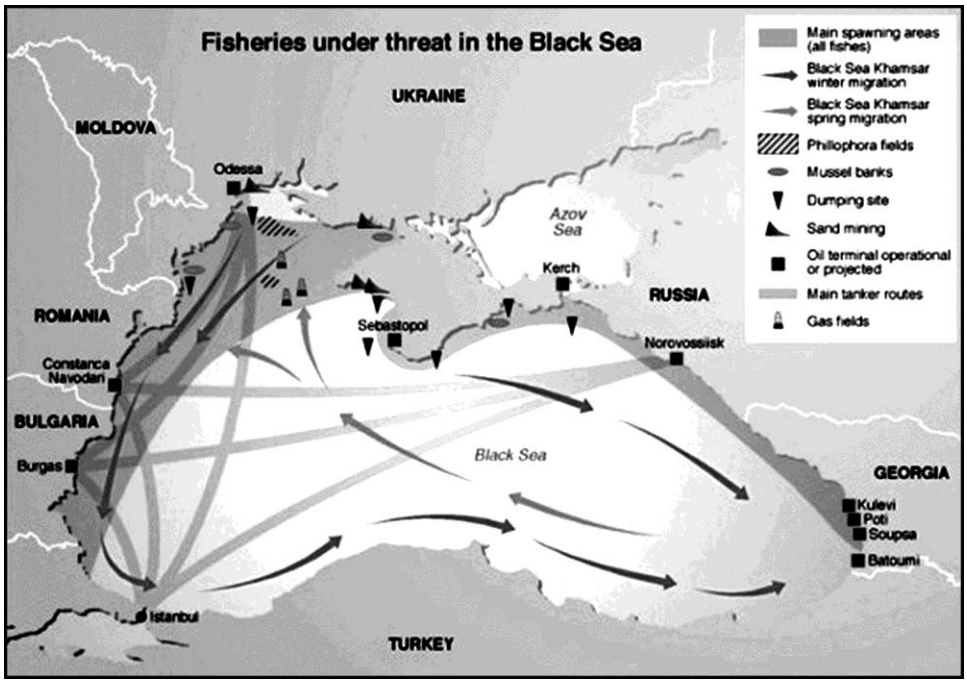


Fig. 6. Fisheries under threat in the Black Sea (UNEP/GRID, 2013).

Solution of this problem is a quota system, which is likely to be the best way to protect available trading stocks as suggested in Yildiz Mountains Biosphere Project. However, acceptable datum are needed to arrange local fisheries and the population dynamics of trading species should be worked, seeing state utmost sustainable yields and allowable off takes. The least landing sizes given in the decision-making authority should also be revised consequently in the light of scientific investigate outcomes (YMBP, 2010). Major gaps are still present in the field of fishery and habitats protection; a quota is allocated in EU waters of the Black Sea (Bulgaria and Romania). No fishery management agreement exists among other Black Sea countries; however, monitoring, control and surveillance are well advanced, as demonstrated for the fishery sector.

It is recommended that special emphasis should be given to ecological studies of threatened species, especially for those commercially exploited and subjected to fishing pressure. Understanding the bio-ecological characteristics of threatened fish will enable appropriate conservation parameters to be taken (YMBP, 2010). Beyond improving of real-time operational observing systems and networks in the Black Sea is considerable requisited to preferable address diagnosis and prognosis of circulation and ecosystem state, mostly, under climate and anthropogenic forcing of varied temporal and spatial scales.

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