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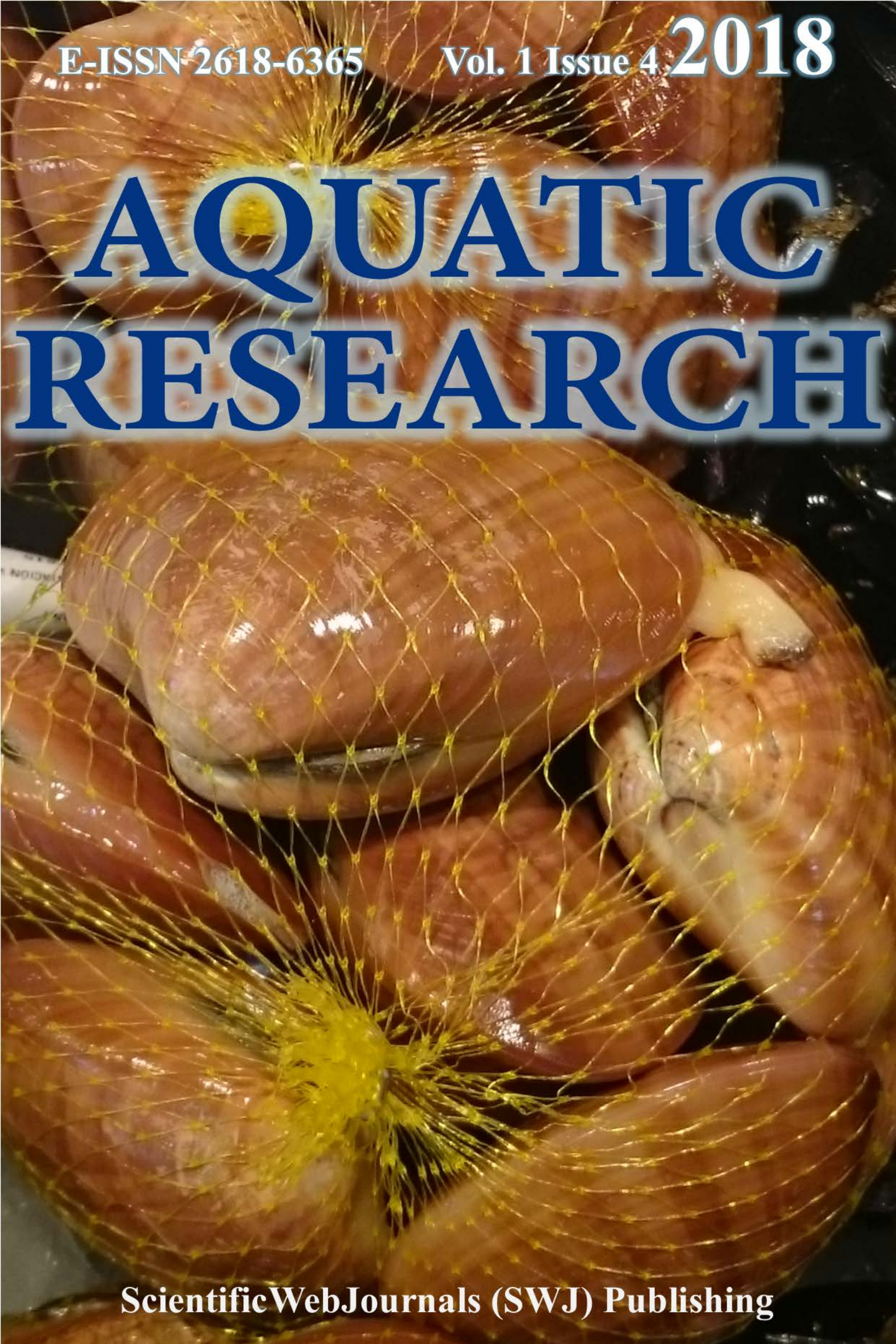

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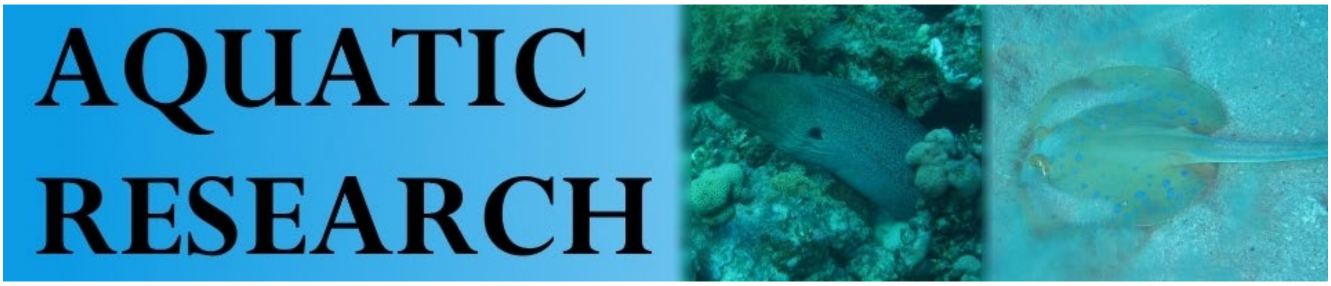

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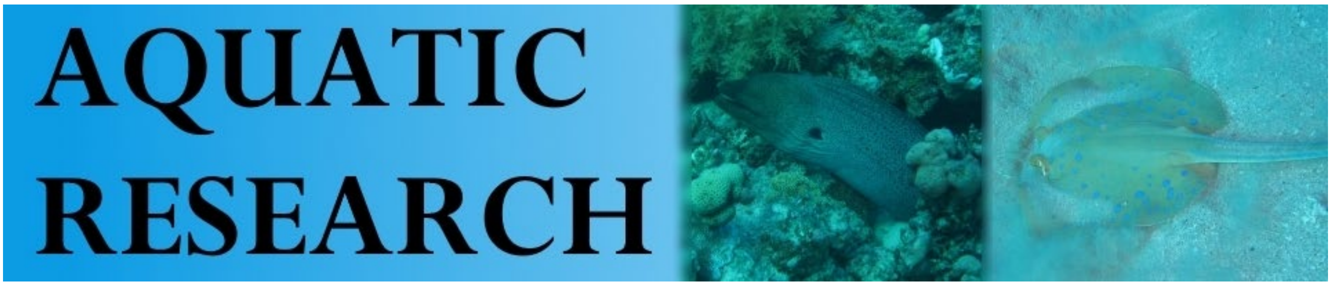

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AQUATIC RESEARCH

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Original Article/Full Paper

DETERMINATION OF PARASITIC TRANSMISSIONS BETWEEN JAPANESE FISH (*Carassius auratus*, GOLDFISH) AND FROGS (*Rana ridibunda*, *Rana viridis*)

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ABSTRACT

This research conducted ectoparasite scans from frogs (*Rana ridibunda*, *Rana viridis*) caught from the same pool as Japanese fish (*Carassius auratus*) reared in Dr.Nazmi TEKELIOGLU Freshwater Research Station of Cukurova University between April-July 2016 periods. Ectoparasite examinations were performed on a total of 120 fish and 60 frogs a monthly basis April, May and June. For protozoans in stationary preparation; formal acetic acid, Battin's fluid, Carry's fluid, Schaudinn fixative and glycerin were used. Klein's silver impregnation method was used to prepare trichodina preparates. Materials taken by scraping the gills and skin tissues of the fish and the skin tissues of the frog larvaes were examined, and metazoan and protozoan parasites were observed. All Parasites were photographed and identified to the genus level. In all of the study periods, parasites of the genera *Dactylogyrus* and *Thricodina* were detected in both fish and frog larvaes. These results indicate that ectoparasite transmission between goldfish and frog larvae was observed.

Keywords: Goldfish, Frog larvae, Parasitic transmissions

Introduction

The Japanese fish (*Carassius auratus*) is a fish that is generally used for hobbyist aquaria and pools for visual aesthetics and therefore is important in aquaculture. Aquarium fish cultivated in developed and developing countries are commercially important, and the cultivation of tropical species, which have economical benefits, constitutes the income source of families in these regions. In terms of the aquarium industry, fish are treated in three groups as tropical freshwater fish, tropical marine and brackish water species, and cold water species (Hekimoğlu, 2006). Furthermore, 90% of these commercial fisheries are provided through aquaculture (Hekimoğlu, 2006; Whittington and Chong, 2007). Freshwater fish comprise nearly half of all aquarium fish. However, 30-35 fish species in the international market have a great importance on trade. One of the most important of these species are the Japanese fish. Cultivation of these species occurs throughout the year in pools where the temperature is warm (Gümüş et al., 2014). Additionally, the true frogs have commercial importance in aquaculture, similar to fish, and frogs are important exports. Ever-declining amphibian populations have led to the need for more studies on the ecology of amphibian species (Alfold and Richards, 1999; Blaustein and Wake, 1990; Houlahan et al., 2000; Meyer et al., 1998; Pechmann and Wilbur, 1994; Wake, 1998). Although monitoring and experimental studies have been attempted, the ecology of these species is not fully understood to date (Green, 1997). Many researchers argue that individual studies must be based on long-term monitoring in order to understand amphibian ecology (Beiswenger, 1986; Brooks, 1991; Freedman and Shackell, 1992; Freda et al., 1991). Frogs are creatures with variable body temperature (poikilotherms) and are not resistant to drought and saline conditions. Frogs hibernate during cold seasons by burying themselves under the ground of lakes and rivers. Amphibians serve as a food source for some freshwater fish, turtles, snakes, birds and mammals. It has also been observed that certain insects use larval frogs as nutrients (Budak and Göçmen, 2005). Through these species interactions, amphibians can transfer disease agents to other creatures. Due to their metamorphosis in their morphological development, their developmental process varies according to species, temperature and other environmental conditions (Başoğlu et al., 1994). In the aquatic environment there is a continuous interaction between vertebrates and invertebrates in terms of infection and parasites. Frequently encountered frogs in aquaculture pools may be hosts for some fish parasites in larval and adult stages. This case causes difficulty in eradication of fish parasites. Similarly, erratic-incidental parasites can be observed in fish. These parasites need to be identified for effective parasite control. A study has shown that *Bufomorinus* may be infected with 75 helminths, 36 nematodes, 29 digenia, 6 cestodes, 1 monogean, 3 acanthocephala (Barton, 1997). Therefore, it is not desirable to have other vertebrate or invertebrate organisms in aquaculture pools. However, many undesirable vertebrate and invertebrate organisms are present in aquaculture pools as pathogen carriers. If the role of these creatures in contamination is known, the more successful treatments will be. Therefore, this research was conducted with the aim of revealing the ectoparasite interactions between the frog larvae and goldfish observed in the same pools.

Materials and Methods

This research contains ectoparasite examinations of frogs (*Rana ridibunda* and *Rana viridis*) caught from the same pool as Japanese Fish (*Carassius auratus*) grown in Dr.Nazmi TEKELIOGLU Freshwater Research Station of Cukurova University. The research began in April 2016 when frog larvae emerged. Materials were sampled from frogs larvae (*Rana ridibunda* and *Rana viridis*), and Japanese fish (*Carassius auratus*). The fish and frogs were searched for ectoparasites a monthly basis April, May and June. A total of 120 fish and 60 frogs were examined. Frogs have soft skin and no scales. Therefore, mucus secretion and extremity soles in the skin were specifically scanned. In the samples taken by scraping, X4 and X10 magnifications were first performed, then X40 magnifications for protozoa were performed and the parasites encountered in the field of view were determined and recorded. Fish were examined by fresh preparation using Klein's silver impregnation method in the samples taken by scraping from the gill tissue, mouth, eyes, skin tissue, fins and fin bases (Lom and Dykova, 1992). For protozoans in stationary preparation; formal acetic acid, Battin's fluid, Carry's fluid, Schaudinn fixative and glycerin were used (Forbes et al., 2007; Garcia, 2007; Girginkardeşler and Ok, 2011).Klein's silver impregnation method was used to prepare trichodina preparates (Lom and Dykova, 1992).The frogs were also examined and recorded in the same way as the fish, and pictures of the parasites were taken. For frogs, separation of species and gender were ignored. The water temperature in the pool was also measured and noted. Bauer (1969), Gussev, A. V. (1985), Kabata (1985), Lom (1958) and Lom (1977) were used in the genus-level determination of the parasites observed.

Results and Discussion

The pool, where the fish and frogs forming the research material were taken from, can be seen in Figure 1. The average water temperature measured in the pool was measured as 21.4 °C in April, 24.3 °C in May and 27.1 °C in June. Ectoparasites detected during each month are presented below.

Figure 1. Pool from which research material was taken

April Findings

A total of 40 fish and 20 frogs were included in the screenings performed between April 1 and April 15. The fish and frog larvae used are shown in Figure 2a and 2b.In April, *Trichodina* sp., *Dactylogyrus* sp., *Chilodenalla* sp. parasites were found in both frog larvae and fish. Out of 40 fish, 6 had *Trichodina* sp. (Figure 3a), 2 had *Dactylogyrus* sp. (Figure 4a) and 1 had *Chilodenalla* sp.. From the twenty frogs in the same pool 5 were found to have *Trichodina* sp. (Figure 3b), 2 *Dactylogyrus* sp. and 1 *Chilodenalla* sp. (Figure 4b). These data are presented in Table 1.

May Findings

In May, goldfish and frog larvae (Figure 5a) were found to have *Trichodina* sp. and *Dactylogyrus* sp., however *Epistylis* sp. parasite was only observed in the frog larvae. From 40 fish, 6 had *Trichodina* sp., and 2 had *Dactylogyrus*. In the examinations made on 20 frog larvae in the same pool, 5 had *Trichodina* sp., 2 had *Dactylogyrus* and 2 had *Epistylis* sp. (Figure 5b). These data are presented in Table 2.

June Findings

In June, *Trichodina* sp., *Dactylogyrus* sp. parasites were found in both goldfish and frog larvae however *Gyrodactylus* sp. parasites were only found in goldfish. From the 40 fish, 8 had *Trichodina* sp., 2 had *Dactylogyrus* sp. and 2 had *Gyrodactylus* sp. (Figure 6a). Examinations made on 20 frog larvae in the same pool showed that 4 had *Trichodina* sp. (Figure 6b) and 2 had *Dactylogyrus* sp.. These data are presented in Table 3.

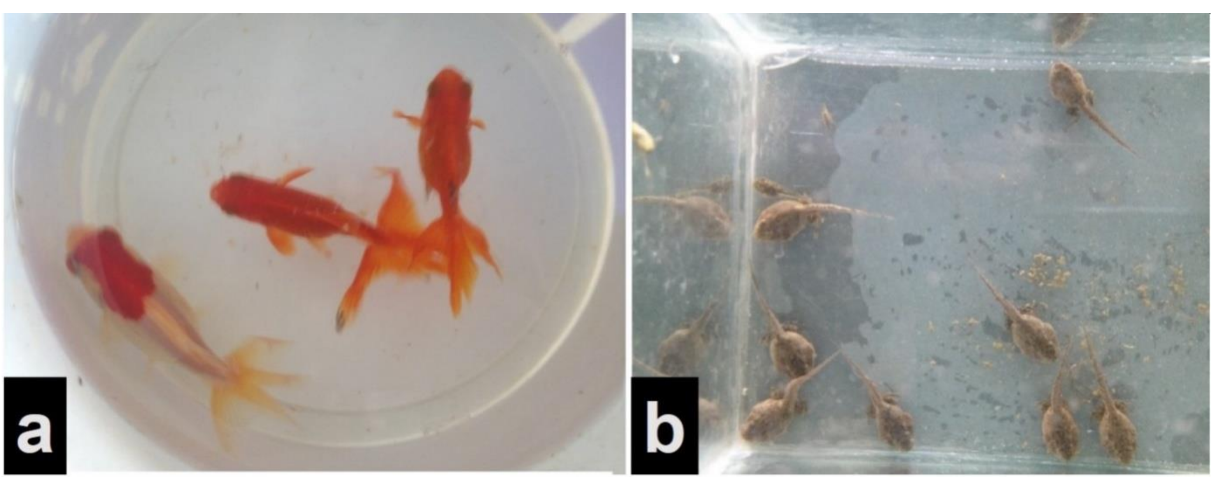

Figure 2. (a), Goldfish used in the research and **(b),** Frog larvae found in the same pool

Table 1. Counts of ectoparasites encountered in April

Ectoparasite	Number of Fish	Number of Frogs	Fish with Parasites	Frog larvae with Parasites	F.V.Pa.A.
*Trichodina*sp.	40	20	6	5	Fi;4-5
					Fr;1-3
Dactylogyrus sp.	40	20	2	2	Fi;1-2
					Fr;1-2
*Chilodenalla*sp.	40	20	1	1	Fi;1
					Fr;1

F.V.Pa.A.: Total parasites detected in a field of vision (X100). Fi: fish, Fr: frog larvae

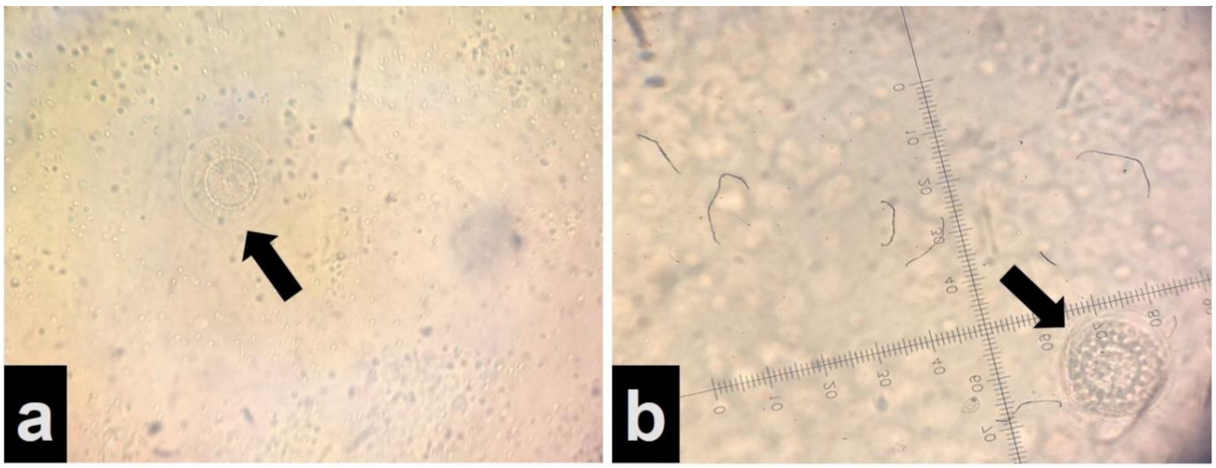

Figure 3. (a) *Trichodina* sp. From the skin of goldfish and **(b)** Frog larvae (bottom) (X40)

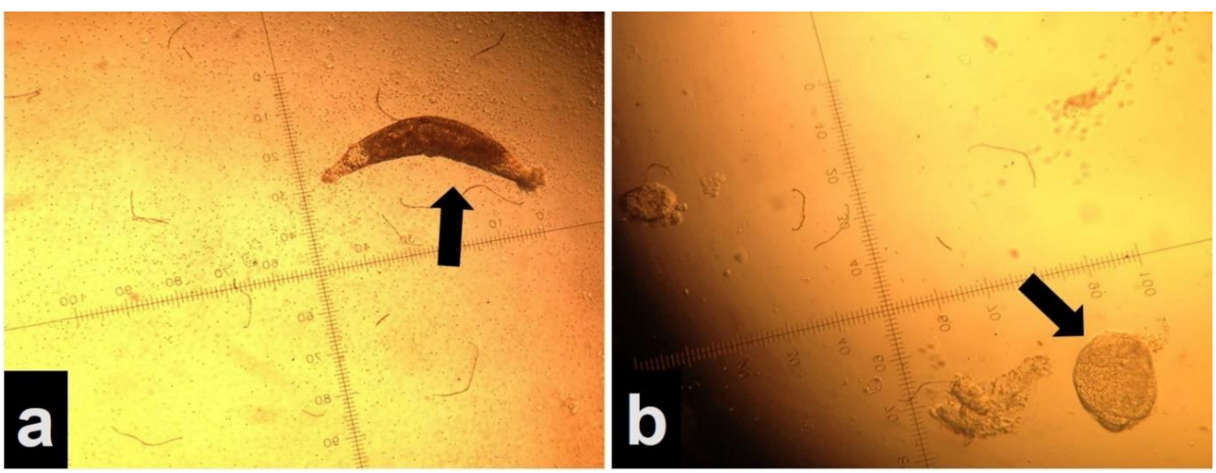

Figure 4. (a) *Dactylogyrus* sp. in the goldfish (X40) and **(b),** *Chilodanella* sp. in the frog larvae (X40)

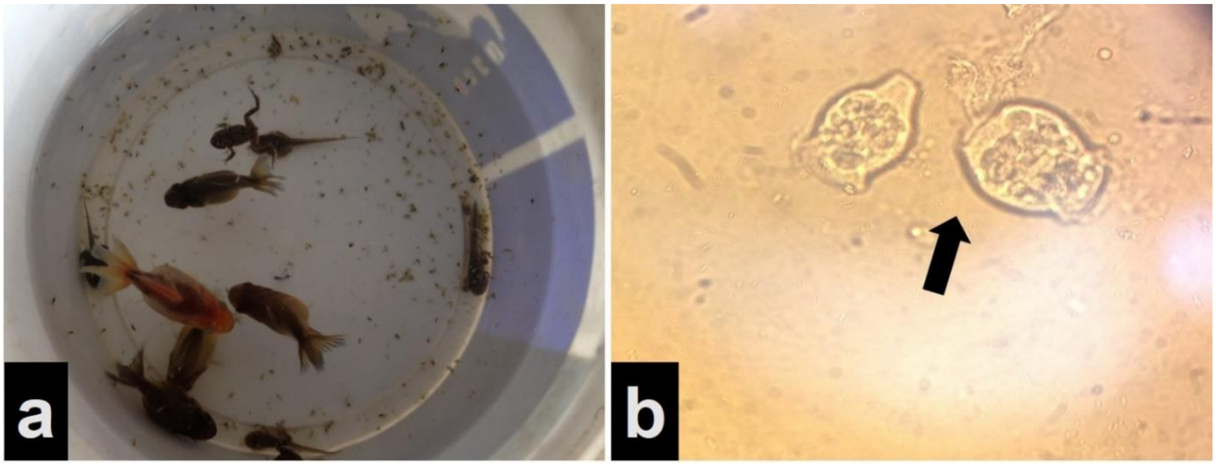

Figure 5. **(a)** Goldfish and frog larvae samples of the research material**.** **(b)** *Epistylis* sp. found in frog larvae in the same pool (X40).

Table 2. Counts of ectoparasites encountered in May

Ectoparasite	Number of Fish	Number of Frogs	Fish with Parasites	Frogs with Parasites	F.V.Pa.A.
*Trichodina*sp.	40	20	6	5	Fi;4-5
					Fr;1-3
Dactylogyrus sp.	40	20	2	2	Fi;1-2
					Fr;1-2
*Epistylis*sp.	40	20		2	Fi;
					Fr;1-2
F.V.Pa.A.: Total parasites detected in a field of vision (X100). Fi: fish, Fr: frog					

Table 3. Counts of ectoparasites encountered in June

Ectoparasite	Number of Fish	Number of Frogs	Fish with Parasites	Frogs with Parasites	F.V.Pa.A.
*Trichodina*sp.	40	20	8	4	Fi;4-5
					Fr;1-3
Dactylogyrus sp.	40	20	2	2	Fi;1-2
					Fr;1-2
Gyrodactylus sp.	40	20	2		Fi;1-2
					Fr;1-2
F.V.Pa.A.: Total parasites detected in a field of vision (X100). Fi: fish, Fr: frog larvae					

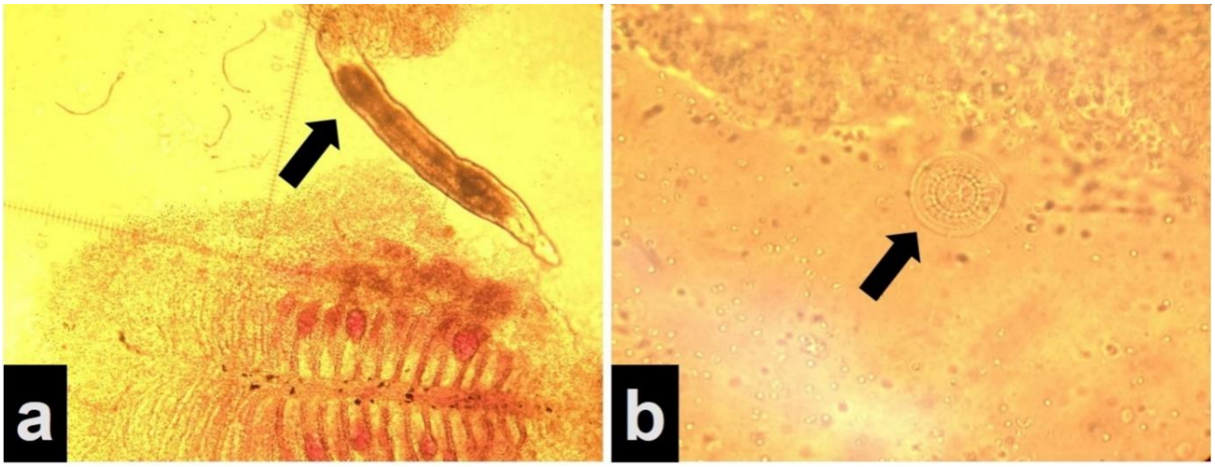

Figure 6. (a) *Gyrodactylus* sp. found in the fish gill (X40) and **(b)** *Trichodina*sp. found in the frog (X40).

Vertebrate and invertebrate animals co-occur in aquatic environments. While this coexistence is often harmless, it can become harmful at times when pathogens are transferred. Especially in aquaculture areas, frogs and fish may coexist together. However, there is an ectoparasitic interaction between frogs and fish. Prior research discovered 9 Diegena, 4 Nematoda, 2 Acenthocephala and 1 Hirudinea in *Rana ridibunda* (Yıldırımhan et al., 2005). In studies carried out by Yıldırımhan et al., (2005) to investigate the metazoan parasites of marsh frogs (*Rana ridibunda pallas 1771; Anura*) collected from the different regions of Turkey, juvenile individuals of *Hiruda medicanalis* from the Annelida filumu, Hirudinea class were found on the backs and between the legs of the frogs. Kır et al., (2001) did not encounter any Hirudinae in *Rana ridibunda pallas 1771; Anura: Radinae* frogs they caught from Eğirdir lake. Most of these parasites can also infect fishes and survive. Infestation caused by protozoan parasites play an important role in fish diseases (Cengizler, 2000; Schäperclaus, 1991). There are many studies on protozoan parasites in fishes. Studies on parasites observed in some aquarium fish species by Doganay, (1994) revealed that 26.6% had *Trichodina* sp. and 33% had the *Chilodonella cyprini* parasite. Lom and Dykova (1992), reported that *Oodinium pillularis* grows in tropical aquarium fish under favourable environmental conditions and causes deaths in a short period of time. Koyuncu and Cengizler (2002), detected protozoan ectoparasites living in the skin, fin and gill tissues of some aquarium fishes (*Poecilia reticulata, Poecilia latipinna, Xiphophorus helleri, Xiphophorus maculatus*) cultivated in the Mersin region. 950 fishes were examined between January 2001 and January 2002 for their seasonal distribution and 720 of them were found to be infested with protozoan parasites. In our research, ectoparasites found in frogs and fishes taken from the same pool were identified to the genus level. In our research, in which we conducted an ectoparasitic study in fish and frogs according to months, we discovered that *Trichodina* sp., *Dactylogyrus* sp. and *Chilodenalla* sp. parasites were living in both frog larvae and goldfish in April. However, in May, *Trichodina* sp. and *Dactylogyrus* sp. parasites were detected in frog larvae, as well as in goldfish, and the *Epistylis* sp. parasite was only found in frog larvae. In June, *Trichodina* sp., *Dactylogyrus* sp., parasites were found in both goldfish and frog larvae and *Gyrodactylus* sp. parasites were only found in goldfish samples. Our findings differ from the results of other researchers in terms of ectoparasites we detected in frog larvae (Yıldırımhan et al., 2005; Kır et al., 2001, Doganay, 1994). Four new parasite species were found in frogs, *Trichodina* sp., *Dactylogyrus* sp., *Chilodenalla* sp. and *Epistylis* sp.. Moreover, ectoparasites species *Trichodina* sp., *Dactylogyrus* sp., *Chilodenalla* sp., and *Gyrodactylus*sp. have been identified in fish. In our findings *Trichodina* sp. encounters are consistent with the findings of Doğanay et al., (1983).In our study, parasites of the genus *Dactylogyrus* and *Thricodina* were found in both fish and frogs taken from the same pool during all examination periods. The presence of frogs in the aquaculture environment will usually carry out parasitic interactions. Therefore, frogs need to be removed from the aquaculture environment. It has been reported that in carp under one year old, if there is an average of 5 to 25 parasites treatment should be undertaken (Schaperclaus, 1991). Thus, the number of parasites observed in each field of view were presented in this study. However, according to these findings, there is no infestation that requires treatment. According to our results, the occurrence of *Dactylogyrus* and *Thricodina* parasites of the same species in both frog larvae and goldfish is an example of parasite interactions.

Conclusions

Consequently, keeping the frogs away from aquaculture pools may prevent infectious and infestation sources from infecting the fishes. *Rana ridibunda* and *Rana viridis* type frogs, which are also used as food, have economic value, and more comprehensive parasitological studies on human health impacts are warranted.

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AQUATIC RESEARCH

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Review Article

ACOUSTIC NOISE POLLUTION FROM MARINE INDUSTRIAL ACTIVITIES: EXPOSURE AND IMPACTS

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ABSTRACT

The improvements in marine technological developments propagate urbanization in the ocean environment. The construction or operational activities of marine structures such as energy plants, oil platforms, pipe-lines, sea-tunnel passages, or cable-stayed suspension bridges, and vessel traffic are sources of underwater noise pollution. How underwater sounds such as piling, pole drilling, or machinery noises may affect the marine live is mostly ignored in marine construction, and there is lack of information regarding underwater sound effects on marine live in the oceans. Recently, a remarkable interest is developing concerning underwater sound effects, especially in aquaculture facilities, with experimentation of musical stimuli or various noises caused by pumps or filter systems on behavior and stress responses of fish in culture conditions. With the increase of urbanization and progressive development of marine industries, more and more pressure from human-generated (anthropogenic) underwater sound pollution may threaten marine mammals, fish species and invertebrates from underwater noises that in terms might be called as “Underwater Noise Pollution”. The future of marine life and that of human being, and the dramatic increase of underwater sound pollution is a new debate that needs to be controlled in a sustainable way with environment-sound approaches. Therefore the potential effects of various sound sources derived from marine industrial activities have been reviewed in this study.

Keywords: Marine industry, Underwater sound, Noise pollution, Anthropogenic noise, Fish behavior

Introduction

Acoustic noise pollution generated by marine industrial activities such as the construction of wind energy plants, oil or –gas explorations, cable-stayed suspension bridge, sea-tunnel passage etc. has been increasing in the oceans around the world. The rapid increase of industrialization introduces more and more anthropogenic sounds such as pile driving, pole drilling, dredging, or trenching during the construction works in the marine environment. Not only marine mammals but also a variety of marine living animals is under thread of noise pollution (Popper & Hawkins 2012). There are several reports on sounds affecting marine mammals (Andrew et al., 2002; Southall et al., 2007), however still many questions remain regarding the hearing capabilities, stress or sound-responses of fish (Kusku et al., 2018) and invertebrates (André et al., 2011), and understanding the potentials of human-made acoustic noise pollution in marine environment. Further, underwater noises from international vessels traffic or coastal fishermen's boats are further sources of acoustic noise to consider. The effects of the shipping industry or recreational boat noises on fish behavior are reported in limited documents related to population assessment or fisheries management, indicating that acoustic noises by ships might influence fish behavior and welfare of fish.

Fish in mass production conditions are often exposed to stress, and is an important criterion for fish welfare, and an important consideration for the assessment of best practice in aquaculture facilities. The most regularly encountered stress conditions such as irregularities in water temperature (Hsieh et al., 2003); fish stocking and hierarchy of dominance (Clement et al., 2005; Gilmour et al., 2005), coloration in culture tanks (Kesbiç et al., 2016), photoperiod regimes (Ergün et al., 2003), or fish transport, handling and husbandry (Kayali et al., 2011), have had limited studies performed to evaluate the effect of such stresses in aquaculture conditions.

Mass production in intensive culture conditions may lead to reduced fish welfare because of a stressful environment that in terms might affect fish health (Hoseinifar et al., 2017; Yousefi et al., 2012). Earlier studies revealed that fish exposed to stressful conditions may alter their physiological conditions such as haematological parameters, which are important criteria for the determination of stress, disease and organ health status in fish (Yilmaz et al., 2013; Yilmaz et al., 2018a,b). Also Barton et al. (1988) reported that blood plasma cortisol and glucose levels are useful indicators for primary or secondary stress conditions in fishes. In goldfish exposed to short-term underwater white noise transmission with a bandwidth ranging from 0.1 to 10 kHz at 160–170 dB re 1 μPa SPL, plasma cortisol levels were significantly affected by the noise exposure, which was not the case for plasma glucose levels (Smith et al., 2004). The authors found that especially mean cortisol levels tripled over the controls after 10 min of noise exposure and thereafter declined back to control levels after 60 min of exposure period. In the long-term noise exposure tests however, the authors underlined that noise exposure did not significantly affect cortisol or glucose concentrations, likely an indication of stress recovery in the long exposure period. Even though, haematological and physiological response parameters could be useful indicators of stress conditions in fish exposed to acoustic noise pollution generated by marine industrial activities. However, there is lack of information regarding haematological and physiological responses in marine animals exposed to stressors of marine industrial noise sources, hence these types of investigations are encouraged in future studies. Furthermore, effects of sounds generated by pumps or filter systems in intensive production such as recirculating aquaculture systems (RAS) are mostly disregarded, and is likely to affect fish welfare and behavior as a response to stressors from noise (Galhardo & Oliveira, 2009).

Studies on anthropogenic noise effects on marine life are of increasing interest recently (Popper, 2003), and is reported to cause inconsistencies of behavior or habitat selection of marine animals in the natural environment (Popper, 2003; Tolimieri et al., 2002). Further, earlier studies Scholik & Yan (2001) and Smith et al. (2004) reported that human-made underwater sound can cause stress and reduce fish welfare (Wysocki et al., 2006). In our recent study (Kusku et al., 2018) we noticed that underwater transmitted sounds such as urban noise may effect fish growth and cause inconsistencies of fish behavior, whereas underwater transmitted musical stimuli was reported to affect fish growth and welfare in a positive manner in common carp (Papoutsoglou et al., 2007; Papoutsoglou et al., 2010), in gilthead sea bream (Papoutsoglou et al., 2008), in turbot (Catli et al., 2015), and in koi fish (Kusku et al., 2018).

There are investigations on-going in the monitoring of the underwater sounds made by marine mammals in the oceans via recording their natural calls with Passive Acoustic Monitoring (PAM) systems, which is also commonly used for the detection of marine mammals (NAI, 2012). The so called PAM system may help to gather information regarding habitat selection or behavior of marine animals in their natural environment. However, in other marine animals such as fish or invertebrates, these systems are not currently in use, since the PAM systems are not capable of identifying or detecting the presence of fishes and invertebrates, probably due to the much lower amplitudes of their calls compared to that of marine mammals (NAI, 2012). Considering that radar or sonar systems are capable of detecting a variety of fish species or invertebrates, the use of acoustic monitoring techniques to follow their habitat selection behavior might be feasible without causing any disturbance to their population. The future health of our oceans depends on the rational use and control of human-made effects on the marine environment. Therefore, intensive investigations on the effects of various kinds of industrial sounds such as underwater drilling, piling noises, or dredging on different fish or invertebrate species as well as active acoustic monitoring studies are encouraged for further investigations.

Sources of Underwater Noise Pollution

Sounds in the marine acoustic environment can be sourced as both natural and human-generated sounds. Human-generated (anthropogenic) sounds other than natural sources can be accepted as the main source of underwater sound pollution. Anthropogenic sounds have a potential threat to marine live and are increasing drastically in recent years (Andrew et al., 2002; Slotte et al., 2004; Tyack, 2008) with the development of marine technologies and growth of maritime industrial activities. Therefore, the level of underwater background noise is becoming a significant problem that threatens the oceans worldwide due to the growing anthropogenic activities in the oceans.

There are several types and sources of underwater noises that might affect marine living organisms in different ways. Pile driving activities are one such source and intensively used in marine constructions and industrial facilities. The effects of pile driving on marine life may vary from size of pile to depth of pile driving. The impacts of industrial noises and underwater sounds on marine organisms can vary based on the metrics for describing the sounds. The type of sound as well as description of sound metrics is necessary to establish information for regulating sound effects on marine life. Further, the size or material used in piling and the bottom substrate might differ in the hydraulic hammer impact necessary for effective piling. Therefore, the methods for measuring sound intensities and impacts of underwater sound generated by pile driving activities are wide areas of study. In the reduction of their environmental impacts, it might be a positive approach to find methods which could minimize the sound level produced during the pile driving work. Since type and size of piles used, as well as the equipment used in piling vary, investigation for measuring sounds the different underwater pile driving approaches might be important for standardization and prediction of their effects on marine life.

Further, pile driving or other sources of underwater noise generated by marine construction industries might cause different levels of noise pollution. Effects of underwater sound generations from construction works such as suspension bridge, ports and piers, including sounds of pile driving, dredging, vibro-densification, or other marine industrial activities such as underwater explosions, can cover an impact area from 100 m to 1000 m, or even more farther distances from the main sound source (Williams et al., 2014). It is obvious that there is a reduction in sound level with distance (sound transmission loss) as also reported by Bailey et al. (2010). Bailey et al. (2010) investigated underwater sound transmission losses from 0.1 km (maximum broadband peak of 205 dB re 1 μPa SPL) to 80 km, and found that these levels of SPL were not any more distinguishable at a distance of 80 km from the sound source, possible due to a reduction in sound level below the background noise. Additionally, the authors reported that pile driving sound could be detected from a distance of up to 70 km horizontal range, and their measurements indicated that behavioral disturbance in bottlenose dolphins might have occurred up to a distance of 50 km from the pile driving sound source. Hence, recorded levels of SPL from underwater field testing and their spectral contents at various distances from the sound source could be evaluated by considering the hearing thresholds of the target marine living organisms in accordance with the ambient noise levels of the specific area. These data together could help to evaluate and predict possible impacts of the sound sources in a horizontal effect-zone.

Marine industrial activities such as pile driving and pole hammer platform at operation for a cable-stayed suspension bridge legs in the Strait of Canakkale are given in Photos 1 and 2. Marine industrial activities such as international shipping lines near cage aquaculture operations and urbanized areas and nearshore ferry lines between two industrial piers are presented in Photos 3 and 4.

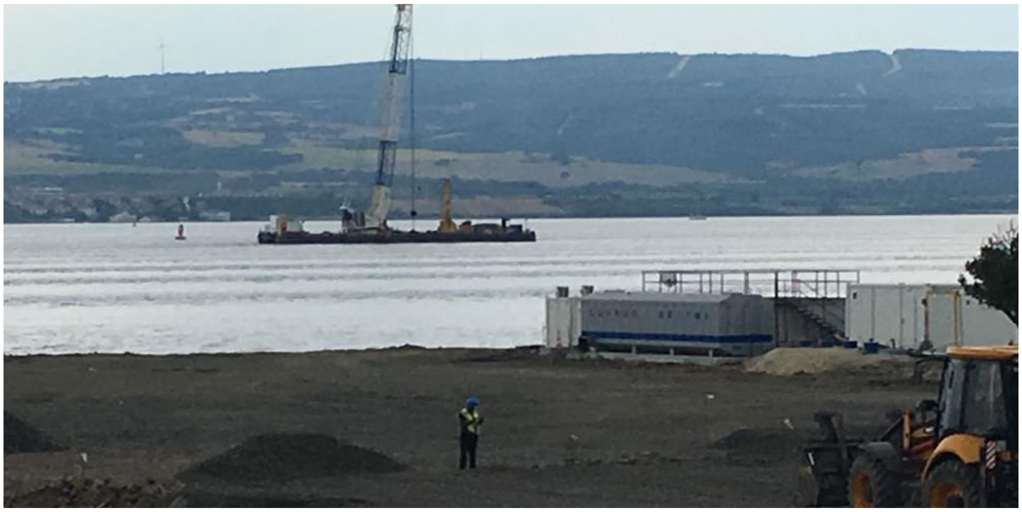

Photo 1. Pile driving platform at operation for suspension bridge construction (original)

Photo 2. Piling of poles for a suspension bridge legs in the Strait of Canakkale (original)

Photo 3. Cage Aquaculture Operations near International Shipping Lines (original)

Photo 4. Nearshore Ferry Lines between two industrial piers (original)

Other sources of underwater sound pollution could be attributed to wind energy farms or oil platforms in their construction and operation, these power plants which are deployed on water surface require intensive pile driving during the construction work but also produce a variety of noises during their day to day operation. Commonly they produce different sound pollution spectrums than that produced by drilling for gas explorations of offshore oil or -gas platforms. Wind farms are typically deployed in relative shallow waters, where numerous other sources of underwater sound pollution such as local fishermen boats, coastal ship traffic, touristic activities of motor-boats, surf noises, seismic air-guns used for geophysical studies and sonar systems are available. Among these sources, ships are permanent underwater sound sources which increase the background sound levels.

Sound Pressure Limits, Exposures and Impacts

The SPL (sound pressure limit) was estimated around 128 dB (decibel), 1 m from the sound sources of a wind farm (NAI, 2012). Ambient noise levels in a natural marine environment may differ according to the environmental conditions such as weather state, waves, tidal and anthropogenic impacts of the marine site, as well as depth and bottom conditions. The ambient sound level ranged between 5 and 50 dB in a natural marine environment (Wenz, 1962). SPLs of 50 to 95 dB where measured in shallow waters, 1 m above the sediment (Lagardère, 1982). However, in this discussion, the effect of these noise levels is difficult to determine because of a lack of specific criteria for comparison.

In land-based aquaculture facilities, a significant level of noise are generated due to water pumps, aerators, selection or harvesting machinery, automatic feeding machinery and also various sounds of facility management (Bart et al., 2001). SPLs of 153 dB re 1 μPa (Bart et al., 2001), and 160 dB re 1 μPa (Clark et al., 1996) have been reported, which are 100-110 dB higher compared to those in the natural water environment (5-50 dB). An alarm reflex or involuntary response of fish to un-expected underwater sound might be induced when the average SPL is much higher than the sound level in the background. Neo et al. (2014) reported that an acoustic noise of 165 dB re 1 μPa SPL could be high enough in level to start the alarm reflex of fish. However, much more information is needed for the evaluation of underwater sound effects on various marine animals with lower or higher SPLs.

Offshore marine fish farms however provide significant benefits due to their location off the coast, reducing visual impacts (Byron & Costa-Pierce, 2010; Byron et al., 2011), and conflicts with coastal zone users such as tourism (Yigit et al., 2006; Yigit, 2007). Further, improve fish welfare could be expected in cage farms due to better water quality in offshore conditions (Pelegri et al., 2006) with less influence terrestrial effluents and coastal acoustic sounds. Despite the fact that fish in land-based farms are exposed to a wide range of noise, fish in offshore cage systems are subject to sounds caused by machineries used for fish selection, harvesting, or feeding, and the acoustic background noises generated by marine shipping lines and boats.

It is likely that un-expected acoustic noise might induce a reaction in the Mauthner cells, which are responsible of initiating alarm reflex in fish, this was reported earlier in seabass (*Dicentrarchus labrax*) juveniles (Spiga et al., 2017) or koi fish (*Cyprinus carpio*) (Kusku et al., 2018). An involuntary alarm reflex is mediated by a pair of hindbrain Mauthner neurons (Szabo et al., 2006). Physiological stress responses in marine animals to unusual surrounding noises generally appear as stimulation of nervous activity, increase in metabolism, and decreased immune system. When sound pressure levels similar or less than the background acoustic conditions are provided by human activities, it is likely that marine animals may not be disturbed, possible due to the less and insufficient level of sound to trigger alarm reflex (Spiga et al., 2017; Kusku et al., 2018).

Diminishing effects on foraging behavior in marine animals have been recorded as a fear-response when exposed to underwater noise, unusual to their natural ambient. This lowered feeding and increased metabolic rate lead to a reduction in growth performance (Kusku et al., 2018). The disturbance of voluntary feeding caused by anxiety or predator reflex of juvenile Atlantic salmon has also been reported by Metcalfe et al. (1987). The loss of appetite is an expected response of physiological stress (Wendelaar Bonga, 1997), possibly caused by the induced alarm reflex of fish exposed to underwater noise (Kusku et al., 2018). Fish growth, feeding efficiency and behavior in fish were negatively affected by underwater transmission of urban noise playback at 67 dB re 1 μPa SPL compared to those held under ambient-noise playback of 57 dB re 1 μPa SPL (Kusku et al., 2018), also an indication of incline in metabolic rate.

More information on behavioral responses of various marine organisms to anthropogenic underwater noise exposures are presented in Table 1.

White whales (*Delphinapterus leucas*) are reported to present significant increase of norepinephrine, epinephrine and dopamine levels when exposed to high level (>100 kPa) of sound exposure near a seismic water gun. In this study, Romano et al. (2004) recorded peak pressure levels of impulse between 198 and 226 dB re 1 μPa peak pressure (8-200 kPa) than those in a non-noise polluted area without sound exposure or exposures of lower than 100 kPa, which could be attributed to a possible reflection of nervous activation effect of noise exposure. The authors (Romano et al., 2004) also reported an important increase in aldosterone and significant decline in monocytes in bottlenose dolphins (*Turiops truncates*), after exposure to seismic air-gun noise at 213–226 dB re 1 μPa peak pressure (44–207 kPa). A shore crab (*Carcinus maenas*) was reported to require higher levels of dissolved oxygen when exposed to ship-noise playback in a controlled environment compared to those held under ambient-noise, showing a sign of increased metabolic rate (Wale et al., 2013). Increased physiological activity was also reported in white whales (*D. leucas*) after exposure of underwater noise from shipping industry (Lyamin et al., 2011).

Richardson et al. (1995) reported different typologies of acoustic noises generated by the marine industry. An oil-gas exploration activity might generate SPLs between 119-127 dB re 1 μPa from oil drilling, and 131-135 dB re 1 μPa from pile driving activities. A drill vessel could generate an acoustic noise of 174-185 dB re 1 μPa SPL, whereas seismic air-guns could even cause higher levels of SPLs over 240 dB re 1 μPa (Richardson et al., 1995). A gross tonnage tanker or container vessel could generate an acoustic noise of 130-205 dB re 1 μPa SPL (Gisiner et al., 1998; Williams et al., 2014), while less SPLs of 150-175 dB re 1 μPa are recorded for small or medium size ships (ferry) or motor boats in the near shore area (Richardson et al., 1995).

Anthropogenic underwater noises show differences in terms of frequency, sound pressure level (SPL) and duration of exposure. Some of the acoustic sounds generated by several marine industrial activities have been given in Table 2.

There are evidence that hearing capabilities differ among marine species and the influence of human-made acoustic noises on behavior or welfare of marine animals are species specific (Smith et al., 2004; Davidson et al., 2009; Voellmy et al., 2014). Hence, this needs to be considered in the investigations on natural marine life as well, with the consistent monitoring of sound effects on behavior and distribution of the populations for a comprehensive understanding of acoustic ecology and assessing potential noise impacts on marine animals.

Some earlier studies have underlined that fish may attune to environmental conditions of long-term exposures to high levels of underwater sound pressure limits (149 dB re 1 μPa - 160 dB re 1 μPa SPL) in aquaculture facilities (Wysocki et al., 2007; Davidson et al., 2009). Fish could even develop tolerance to repeated exposure to underwater sounds such as motorboat-noise, and behavioral and physiological responses of fish decreased after a certain time, even a week after sound exposure (Nedelec et al., 2016). Since it is almost impossible to discourage human beings from urbanization or industrialization, it seems to be important to figure out the “threshold limit” of sound that is acceptable by -or less harmful to -marine living organisms.

Table 1. Behavioral effects of human-generated acoustic noise exposures on marine animals

Species name	Scientific name	Human-generated Noise	Impacts	Reference
Atlantic salmon	*Salmo salar*	predetor risk effect	disturbance of voluntary feeding	Metcalfe et al., 1987
Rockfish	*Sebastes* sp.	air-gun sound	induced alarm reflex	Skalski et al., 1992
Sockeye salmon	*Oncorhynchus nerka*	pinger sound	no reaction	Gearin et al., 2000
Sturgeon	*Acipenser sp.*	pinger sound	no reaction	Gearin et al., 2000
Herring	*Clupea harengus*	pinger sound	no reaction	Culik et al., 2001
Bottlenose dolphin	*Tursiops truncatus*	experimental sound	shift of hearing threshold	Nachtigall et al., 2004
Lusitanian toadfish	*Halobatrachus didactylus*	ship and boat noise	shift of hearing threshold	Vasconcelos et al., 2007
Squid	*Loligo pealeii*	playback killer whale sound	no reaction	Wilson et al., 2007
European seabass	*Dicentrarchus labrax*	experimental sound	induced alarm reflex	Kastelein et al., 2008
European eel	*Anguila anguila*	experimental sound	induced alarm reflex	Kastelein et al., 2008
Pink snapper	*Pagrus auratus*	seismic air-gun	damage of hearing sensory epithelia	Kastelein et al., 2008
Marine mammals		ship traffic noise	induced anti-predatory behavior	Tyack, 2008
European squid	*Loligo vulgaris*	experimental sound	damage of hearing sensory epithelia	André et al., 2011
Common Cuttlefish	*Sepia officinalis*	experimental sound	damage of hearing sensory epithelia	André et al., 2011
Common octopus	*Octopus vulgaris*	experimental sound	damage of hearing sensory epithelia	André et al., 2011
Ommastrephid squid	*Illex coindetii*	experimental sound	damage of hearing sensory epithelia	André et al., 2011
Shore crab	*Carcinus maenas*	ship and boat noise	loss of defense capability	Wale et al., 2013
European seabass	*Dicentrarchus labrax*	experimental sound	induced alarm reflex	Spiga et al., 2017
Koi fish	*Cyprinus carpio*	experimental sound	induced alarm reflex	Kusku et al., 2018

Table 2. Sound pressure levels (SPL) of human-generated acoustic noise exposures in marine environment

Human-generated Acoustic Noise	Sound Pressure Limit (SPL) (*from highest to lowest range*)	Reference
Seismic air-guns	240-250 dB re 1 µPa	Richardson et al., 1995
Seismic air-guns	195-210 dB re 1 µPa	Wardle et al., 2001
Seismic air-guns	186-191 dB re 1 µPa	Skalsky et al., 1992
Drill vessel	174-185 dB re 1 µPa	Richardson et al., 1995
Ship noise (dynamic sea conditions)	173-185 dB re 1 µPa	Chen et al., 2017
Piling noise	164 dB re 1 µPa	Spiga et al., 2017
Small or medium size vessels (ferry & motorboat)	150-180 dB re 1 µPa	Richardson et al., 1995
Ship noise (engine exhausts, in port)	135-142 dB re 1 µPa	EPA, 2010
Pile driving, pole hammer	131-135 dB re 1 µPa	Richardson et al., 1995
Ship noise (Marine tanker or container vessel)	130-205 dB re 1 µPa	Gisiner et al., 1998; Williams et al., 2014
Ship noise (cruise line)	130 dB re 1 µPa	Williams et al., 2014
Oil-gas drilling exploration	119-127 dB re 1 µPa	Richardson et al., 1995
Research boat (whale-watching)	108–116 dB re 1 µPa	Williams et al., 2002a,b
Ship noise (ventilation fans, in port)	81-110 dB re 1 µPa	EPA, 2010
Ship noise (mean annual basis)	80-135 dB re 1 µPa	Merchant et al., 2014

Among various kinds of sound sources as of acoustic noise, ships are permanent underwater sound sources which increase the background sound level. Considering that fish can develop tolerance to repeated exposure to underwater motorboat-sounds after a certain time of sound exposure (Nedelec et al., 2016), or even might acclimatize to environmental conditions in long-term when exposed to high levels of SPLs (149 dB re 1 µPa - 160 dB re 1 µPa) (Clark et al., 1996; Wysocki et al., 2007; Davidson et al., 2009), the long-term effect from the shipping industry is likely to be acceptable by marine animals. However further research is necessary to collect more precise information. Moreover, all the underwater noises from different industrial sources in coastal marine environment over a long-time might produce a cumulative effect that needs to be considered in general.

It is likely that short term marine operations such as construction works of piers, cable-stayed suspension bridge or sea-tunnel passage are of significant concern with acoustic sound pollution through pile driving, pole drilling, dredging, or trenching during the construction works trigger considerable biological impacts on marine life such as exclusion or loss of habitat, incoherencies of behavior of marine animals. The noise pollution generated during the operational phase of wind farms is probably not a significant problem for marine life since fish might adapt to environmental noises in a long-term (Wysocki et al., 2007; Davidson et al., 2009; Nedelec et al., 2016). However, the sounds generated during the construction phase of the industrial plants are already serious problems to be considered.

Some earlier studies reported underwater noise from pile driving in marine constructions (Nedwell et al. 2003, Blackwell et al. 2004, Rodkin & Reyff, 2004). During construction, not only the size of the pile or hammer, but also the characteristics of the sea bottom are important that influence the noise level and the strength of the frequency of the sounds generated (Rodkin & Reyff, 2004). In wind farm constructions, large pile driving units are used because of the large foundations size. The frequency can be around 500 Hz, and the SPL can reach more than 200 dB re 1 µPa at a distance of 100 m (PIDP, 2001; Madsen et al., 2006), which seems to be much higher than the acoustic noise of 165 dB re 1 µPa SPL, a level that is high enough to start an alarm reflex of fish (Neo et al., 2014). Due, it is a clear evidence that more research is necessary in order to assess and evaluation underwater noise effects in marine living organisms exposed to different SPLs at changing frequencies.

Once the wind turbines are deployed in a wind energy farm, the noise from a wind turbine during operation is generated through vibrations which are transferred in to the water ambience and the sea bottom via the turbine foundations. The sound intensity may differ according to size of the wind turbine and the foundation, as well as function of direction from the wind turbine, but it was reported that the directionality has not been assessed or taken into account so far in earlier studies conducted on wind turbine noise influences (Madsen et al., 2006). Therefore, it is important to perform experimentations on underwater noises and biological responses of fish and invertebrates, to be able to focus on possible path to minimize the influences of underwater sounds produced during the construction works of marine structures.

Regarding the use of acoustic monitoring and electronic devices for the detection of the presence of fish and invertebrates, such as sonar or radar systems it is probably feasible to develop equipment that produces a reasonable SPL lower than the thresholds without disturbing marine live. Therefore, the application of active acoustic monitoring is an issue for further exploration.

Even if some kinds of acoustic noises can be tolerated by marine animals as far as they do not exceed the hearing thresholds of the animals, as noted also by Neo et al. (2014) who reported an acoustic noise level of 165 dB re 1 µPa as a SPL high enough to trigger the alarm-reflex of fish as a fear response to predator attack. For highly sensitive species such as Lusitanian toadfish (*Halobatrachus didactylus*) and goldfsh (*Cyprinus carpio*), relatively lower hearing thresholds of SPL below 100 dB re 1 µPa and less than 75 dB re 1 µPa were reported by Vasconcelos et al. (2007) and Gutscher et al. (2011), respectively. Iversen (1967) reported that yellowfin tuna (*Thunnus albacares*), another sound-sensitive species is capable to detect sounds of 89 dB re 1 µPa.

Since it is almost impossible to discourage human beings from urban life or industrialization, it seems to be important to calculate the “threshold limits” of sounds that are acceptable by -or less harmful to -marine living organisms.

Earlier studies, described above, present findings of effects from stressors, however, “what are the environmental impacts of these stressors?” This is the main question to be considered as a whole, since the impacts can emerge either within a population or a community of a species, in terms of migration, habitat change or even loss of the population due to diminishing effects on foraging behavior of the species, as also reported as a fear-response in earlier studies (Metcalfe et al., 1987; Wendelaar Bonga, 1997; Kusku et al., 2018). This type of impacts on marine living organisms can occur either through direct or indirect differentiation of biotic or physical conditions. Even if there are no significant evidences on population changes in the environment, any other likely alterations in the ecological processes, such as altered primary production, or increased nutrients in a trophic chain. Even though these kinds of secondary effects might be difficult to conceive in a total ecosystem, they are important to consider when assessing environmental impacts in long-term especially when cumulative effects are the interest of research.

Conclusions

As a conclusion, in order to research any potential landmarks for novel procedures to attenuate marine noise pollution, reliable information on acoustic noises needs collected from ongoing marine industry activities. An important question remains as to "how much is the noise impact of the industrial activity" and "what is the additional sound pressure level generated by the industry?" In order to understand the environmental effects of these kinds of marine industrial construction works, information on the natural back-ground noise is necessary prior to establishment of the power plants. Therefore, researchers are encouraged to work directly with the counterparts from the marine industries such as bridge construction, wind energy farms, oil or -gas exploration, which are responsible for generating a significant level of acoustic noises. This might be a successful start for the criteria to be considered in future decision-making path.

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Original Article/Full Paper

A SURVEY ON MONITORING SYSTEM REQUIREMENTS OF TURKISH AND GREEK MARICULTURE INDUSTRY WITH ASSESSMENT OF PRODUCTION COMPLICATIONS

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ABSTRACT

The use of monitoring systems in Mariculture industry in Turkey is limited. Main monitoring effort is directed towards physical and chemical properties of aquatic environment such as O2 / CO2 content, pH, temperature and ammonia (NH3). This survey is aimed to understand current problems faced by Turkish and Greek Mariculture industry to identify threats that can be monitored by the means of monitoring technologies. Sea bass, sea bream and Blacksea trout farms were targeted as these were the major fish species cultured in Turkey and Greece. A total of 30 Mariculture companies took part in face-to-face survey representing 75 % and 90 % of all production in Turkey and Greece respectively. The survey was conducted during months September till November, 2014.

Keywords: Mariculture, Egean Sea, Monitoring System, Turkey, Greece

Introduction

Seafood is a desired protein source and growing world population puts pressure on the existing resources. Aquaculture, the husbandry and farming of aquatic animals and plants is a fast growing food production industry which has expanded more than any other livestock sector in the recent decades with an annual 7-5 % growth rate between 1990 and 2009 (Buck et al. 2018, FAO 2016, Little et al. 2015). As the global demand increases, more intensified production is needed and is seen as a solution to high demands for fish (Simbeye et al. 2014). The growth of the aquaculture industry is foreseen to continue its growth in the near future (Pauly & Zeller 2017, Eguiraun et al. 2015). According to FAO (2016), world wild fishery stocks are overexploited with 31.4 % overfished, 58.1 % fully fished and 10.5 % with remaining capacity. As of today, one out of two fish consumed is farmed (Little et al. 2015).

Turkey is third in the world in terms of aquaculture production growth and has a 25 % market share in Europe in seabass and seabream. The share of Turkey in global aquaculture production has increased from 0.03 % to 0.3 % in 10 years. Turkey is the leading country in Trout (fresh water) production in Europe. Turkey also has marine trout farms along the shore line of Blacksea. During 2006 to 2010, aquaculture production has increased 30 %, production capacity increased 128 % and value of the production increased 39 %. Many producers established processing plants for value adding. There are challenges that should be noted; instability of prices, prejudiced approach to aquaculture products by the domestic consumer, bureaucracy which consumes time, conflict with tourism. There are approximately 2200 farms (167 marine) in Turkey with a total of 405.000 tonnes capacity. More than half of this production comes from fresh water production (56 %). Marine production is supported by 20 hatcheries with 330 million fry production annually. There are 160 licensed fish processing establishments nationwide and 101 of these are approved for EU. There are 23 feed plants of which 7 produce only fish feed (FAO 2005-2018)

The intensification of production results in different complications throughout the production (Granada 2018). Cage culture struggles with eutrophication of the water body where mooring system is installed. Eutrophication may be the result of self-pollution or environmental factors and is a threat for aquaculture establishments (Edwards 2015). Farms near shores are under the influence of coastal waters where dramatic changes and rapid changes may occur due to winds and tidal currents. Especially shellfish farms which are potential supply of high quality proteins are under the pressure of pollution in coastal waters (Schmidt et al. 2017). Fish are more susceptible to pollutants in comparison to crops and terrestrial animals because they ingest water for respiration directly therefore aquaculture is directly affected by the adverse effects of environmental conditions (Simbeye et. al. 2014). Ferreia et al. (2011) mentions that monitoring environmental conditions in shrimp farms results in better control and good management of water quality in the ponds by avoiding the occurrence of unfavorable conditions. According to Harun et al. (2012) some species are more sensitive to low oxygen, temperature, salinity and pH requiring better monitoring practices.

Both in developing countries and developed countries there is a big problem of contamination of water resources with bacteria (Florentin et al. 2016, Hancock et al. 1998, Lemarchand and Lebaron, 2003)

Industrialization and increasing chemical products use in daily life led to the permeation of chemicals and toxic compounds into the aquatic systems threatening the safety of aquatic life and food safety (Lagarde et al. 2011). Safe evaluation for water toxicity has limited methods. Detection of chemical oxygen demand (COD) and biological oxygen demand (BOD) and laboratory analysis of samples are the main water safety assessment techniques which are mostly not adequate for real time protection in aquaculture establishments (Hsieh et al. 2004, Ma et al. 1999). It is difficult to measure all possible toxicants contained in the water although there are methods that can detect the toxicants qualitatively and quantitatively they are time consuming, sophisticated detection procedures and needs well trained personnel (Rodriguez-Mozaz, 2005) Bioassay tests can be an alternative technique to obtain real time results for water quality assessment. They can be used to evaluate bio toxicity levels of environmental and industrial water. They can be electrochemical methods or optical methods.

In this study our aim was to evaluate monitoring system requirements of Turkish and Greek fish farmers to identify their needs based on the problems they are facing through production periods. We hope our results will provide a database for monitoring technology developers to steer their efforts to the needs of aquaculture producers that would benefit for both parties.

Materials and Methods

Questionnaire

A questionnaire was produced with AquaBioTech Group to collect data on various problems from fish farmers. This questionnaire was designed after the meeting held at the AquaBioTech Group premises in Mosta, Malta, March

2014. The questionnaire was carefully designed so as to serve the purpose of the study. The team of people worked together to develop that questionnaire consisted experts in aquaculture, project management and market research. The survey was designed, worded and formatted in such way to be acceptable to respondents and to be a clear and interpretable. The questionnaire was developed with multiple-choice answers, easy to be answered in less than fifteen minutes. The questionnaire was developed in such way that pre-coded responses were proposed but an option for open answers was also provided so as to give the participant the chance to elaborate on the answer or propose another answer.

Layout

The survey is composed by forty (40) questions. The questions are grouped in eight (8) sections based on the subject of the question. These sections include general information of the participant and background questions, diseases, chemical pollutants, reducing risks, dealing with diseases, algal blooms and chemical pollutants, further communication and participants' information.

Online Survey

The survey was disseminated online in various websites both with the use of social networks and use of the media so as to reach as much stakeholders possible. The participants were invited to visit the webpage of the EnviGuard project and fill in the on-line questionnaire. As feedback received from different participants we are in a position to say that due to the confidentiality of the data requested in this survey the participants are reluctant to hand over sensitive information online without having some sort of personal relationship or face to face contact.

Face-to-Face Survey

The survey was conducted face-to-face to support online survey system with the fish farmers on site. Both Aegean and Blacksea fish farmers were visited to conduct the survey in Turkey. Face-to-face survey had given the opportunity to get more details from the fish farmers. The response rate to online system was not as appreciated as anticipated.

Results and Discussion

Site visits in the Aegean region and Black Sea where the biggest Turkish production is allocated covered seventy-five (75%) percent of the total marine aquaculture production of 110.520 tons in Turkey, collecting surveys from cage farmers and hatcheries. At the end of the survey, data collected were processed and conclusions reached both on national level and as a total from all surveyed countries so as to provide a better understanding of the similarities and the differences of all surveyed markets.

Turkish producers showed their interest in problems like birds and theft during surveys. Black sea farmers reported instantaneous oxygen and current changes to be harmful against the farms. Aegean farmers had important parasite issues during production cycles. Most important questions about the monitoring sensor modules were about the possible price range. Some farmers were concerned about the usefulness of the monitoring module in terms of possible actions to be taken after the modules threat assessments. Another concern about the modules was about the implementation of the modules to the farms. Farmers requested the modules to be mountable or similar to buoys used in cage farms.

Farm characteristics that took part in the survey for both countries are composed of grow-out farms with marine cages, hatcheries, nurseries and broodstock nurseries. In addition to seabass, sea bream and Blacksea trout, mussel, red porgy, dentex, sharp snout sea bream, meagre were also reported as species produced by the participants. Sea bass and sea bream were the major species with approximately %60 of the production.

Survey results showed that Turkey had more medium sized farms with 250-500 metric tons production compared to Greece with small sized farms with 150-300 metric tons production capacity.

In both countries, most important problems encountered were reported as diseases (bacterial, viral, fungal and parasites), predators (birds, fish, mammals etc.), sudden temperature changes, heavy bio fouling and theft. These problems concern all farmers with more than fifty per cent to identify them as regular and severe in many cases. The importance level for the mentioned problems changed from farm to farm with changing geographical location.

A more detailed analysis on the diseases and pathogens challenges derived from the survey indicates that viral diseases, bacterial pathogens and hazardous parasites are all of high importance with the most severe to be the hazardous parasites (Figure 1 & 2).

Farmer's opinions about several disease outbreaks were identified as transfer from hatcheries, wildlife, ballast waters, high stocking, low water quality, and stress from handling and natural occurrence (Figure 3).

The farmers' opinions about reducing environmental hazards were as follows; development of new technologies and products, hatcheries with health certification, state compensation, low stocking densities, regulation of other activities close proximity to the farm (Figure 4).

Farmers listed their current methods for avoiding harmful environmental effects as monitoring of fish mortality, visual changes in fish and their behavior, water quality monitoring, regular laboratory analysis of fish/mussel, information sharing with other farms in proximity, information by government entities (Figure 5).

At this point of the survey, farmers expressed their need for better monitoring technologies which would allow the farmer to act much faster before the problem even starts. Preventive action is desired instead of corrective actions. Although they are confident that their experience lets them to identify the problems, they would like to take action beforehand, 83 % of the farmers answered that all disease, algal or pollutant caused problems has to be identified in very early stage, only 22 % of them think that they are able to recognize these problems on time (Figure 6).

Participants of the survey expressed relatively high interest on monitoring technologies with concern regarding high capital investment and operational costs. Farmers were interested in monitoring technologies but there was doubt on the efficiency of the applications and lack of field experience (Figure 7).

As mentioned before, each farm has different needs according to their production systems, choice of species, geographical characteristics and etc. This brings out different monitoring needs as we can see from the answers of the participants in the survey. Farmer's demands monitoring systems for environmental pollution, weather conditions, natural events, predators, pathogens, parasites, diseases and algal blooms (Figure 8).

Figure 1. Importance of parasites as a problem for fish farmers

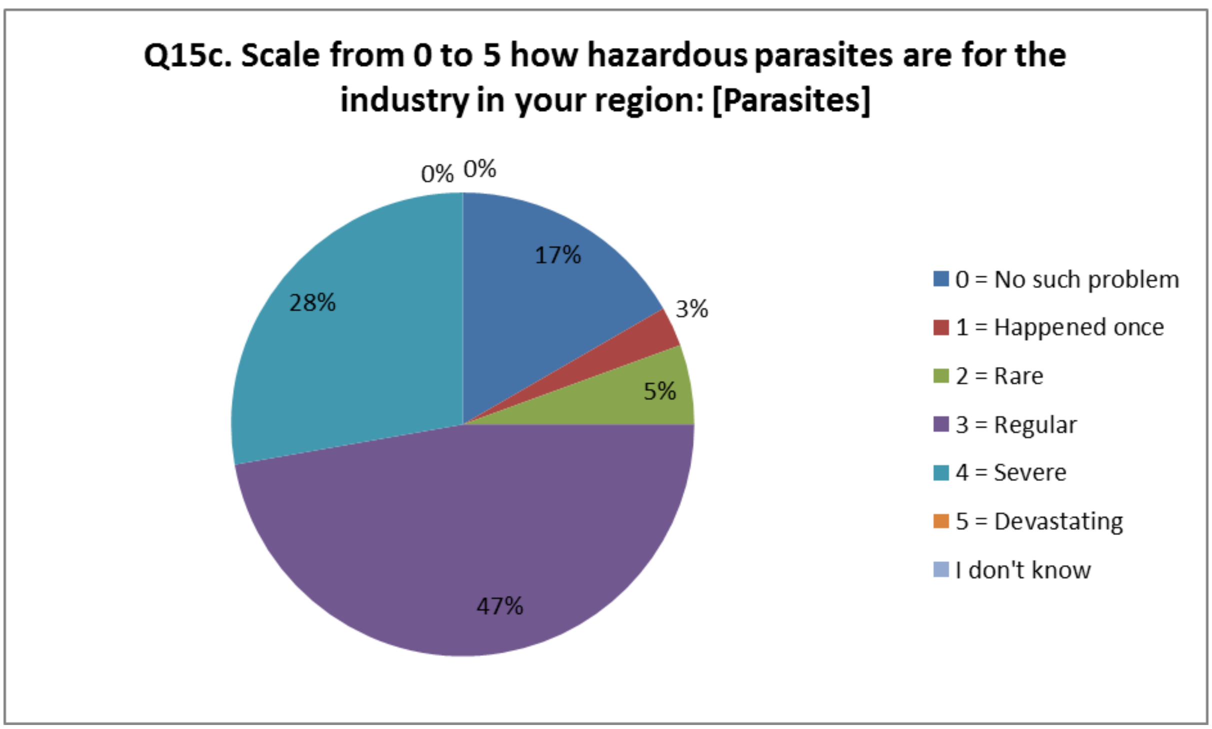


Figure 2. Importance of viral diseases as a problem for fish farmers

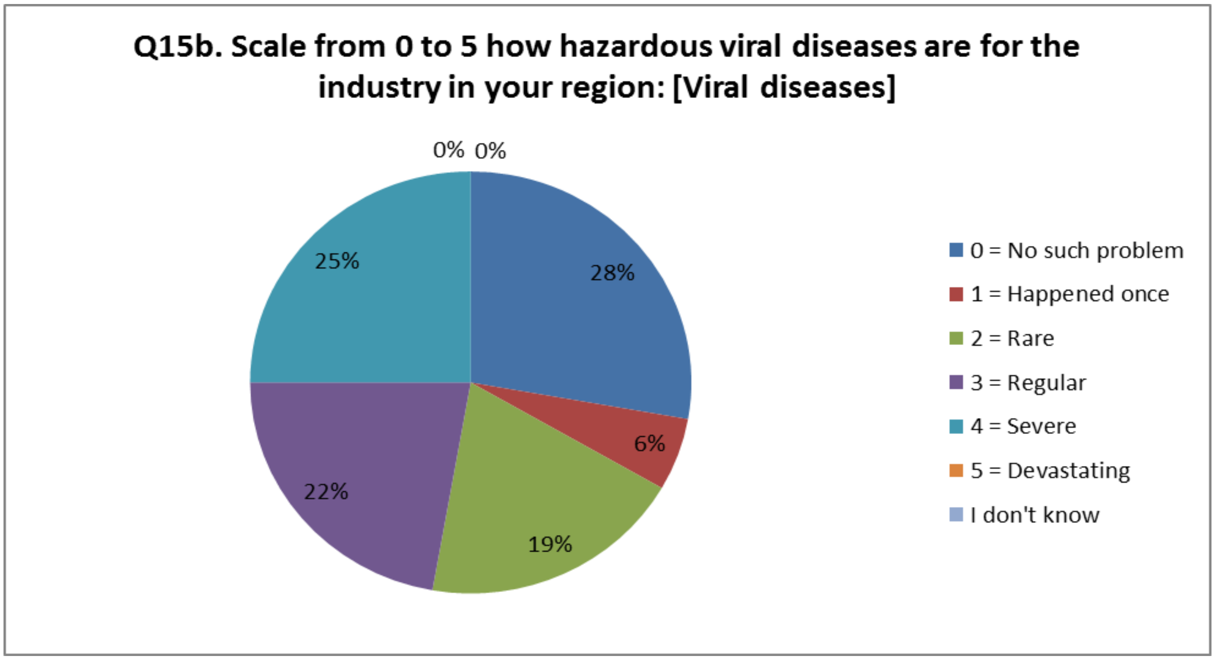


Figure 3. Farmer's opinion about the main reasons of disease outbreaks

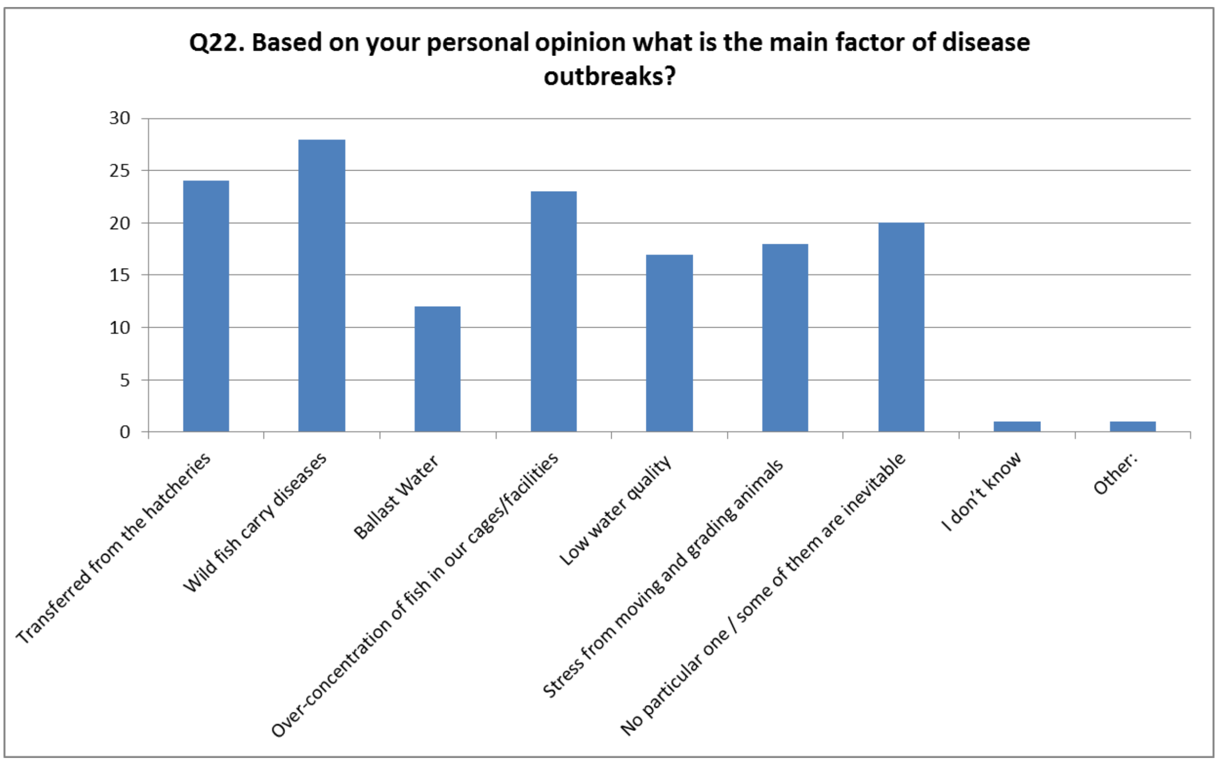


Figure 4. Farmer's opinion about the reducing environmental hazards of aquaculture

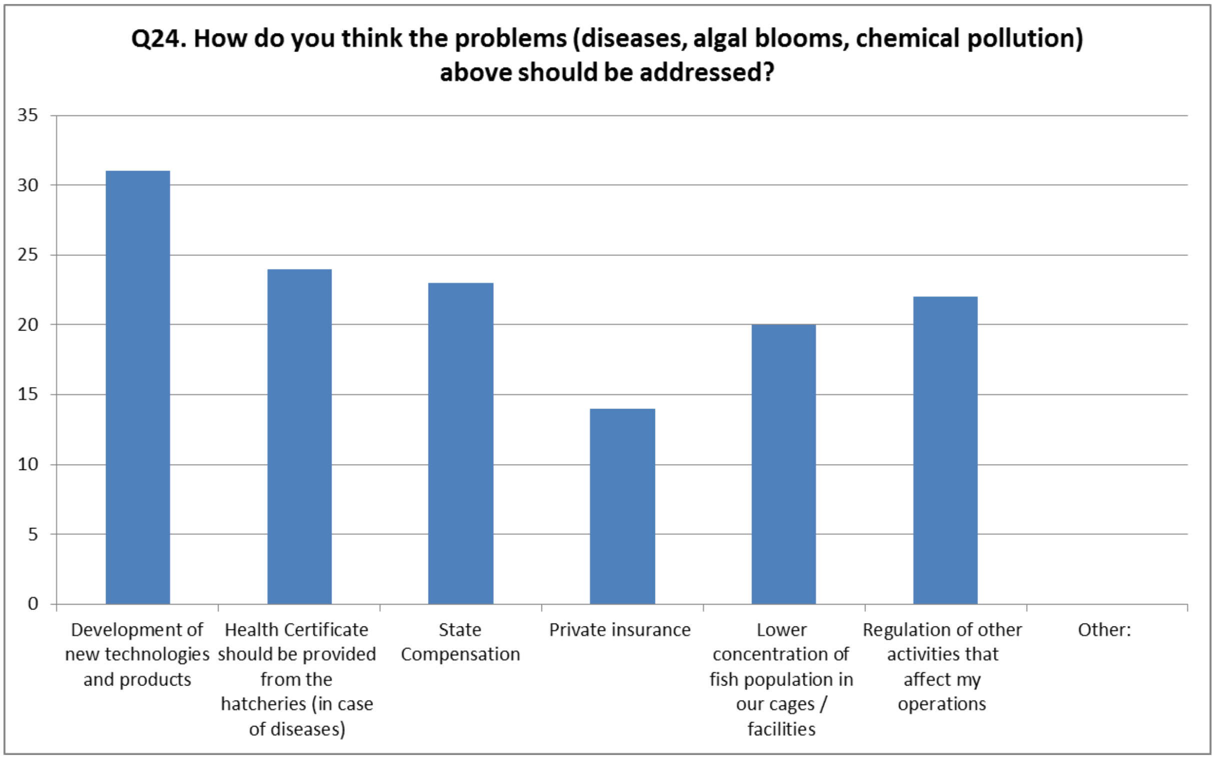


Figure 5. Distribution of answers regarding the existing methods used to avoid harmful environmental effects

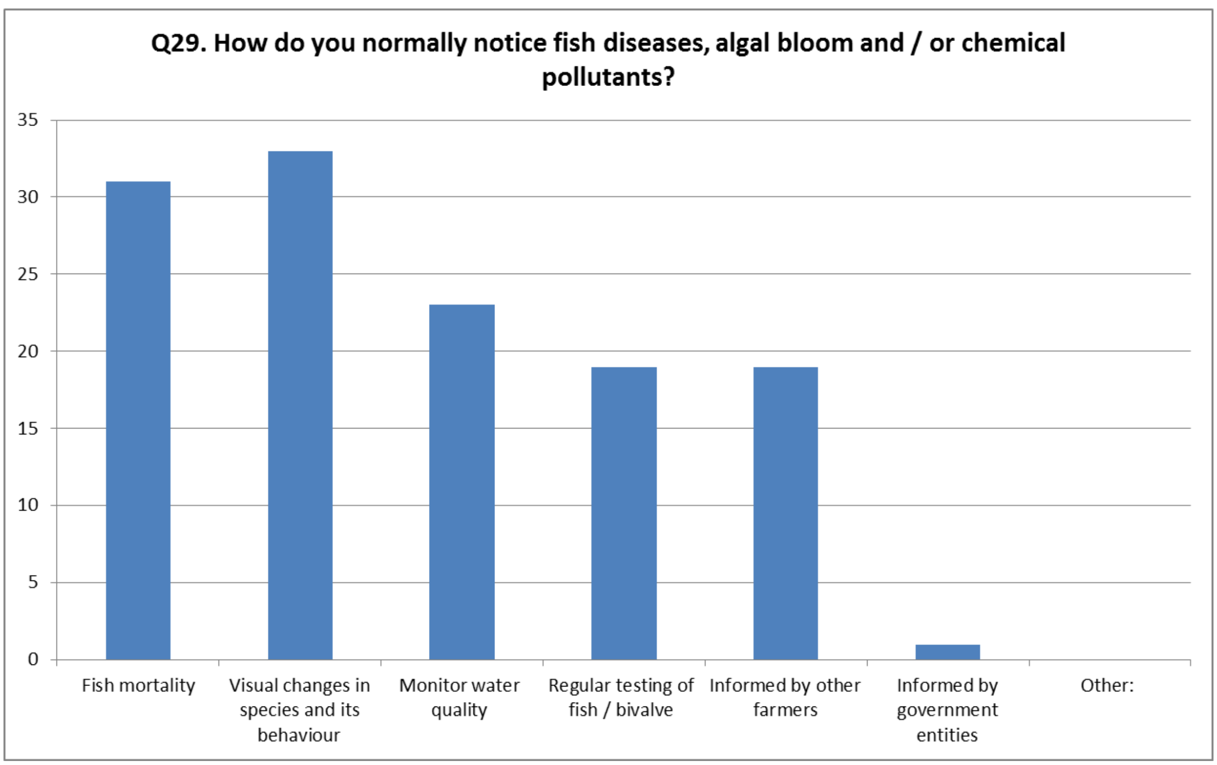


Figure 6. Farmer's opinion about their capability to identify any environmental problem in time

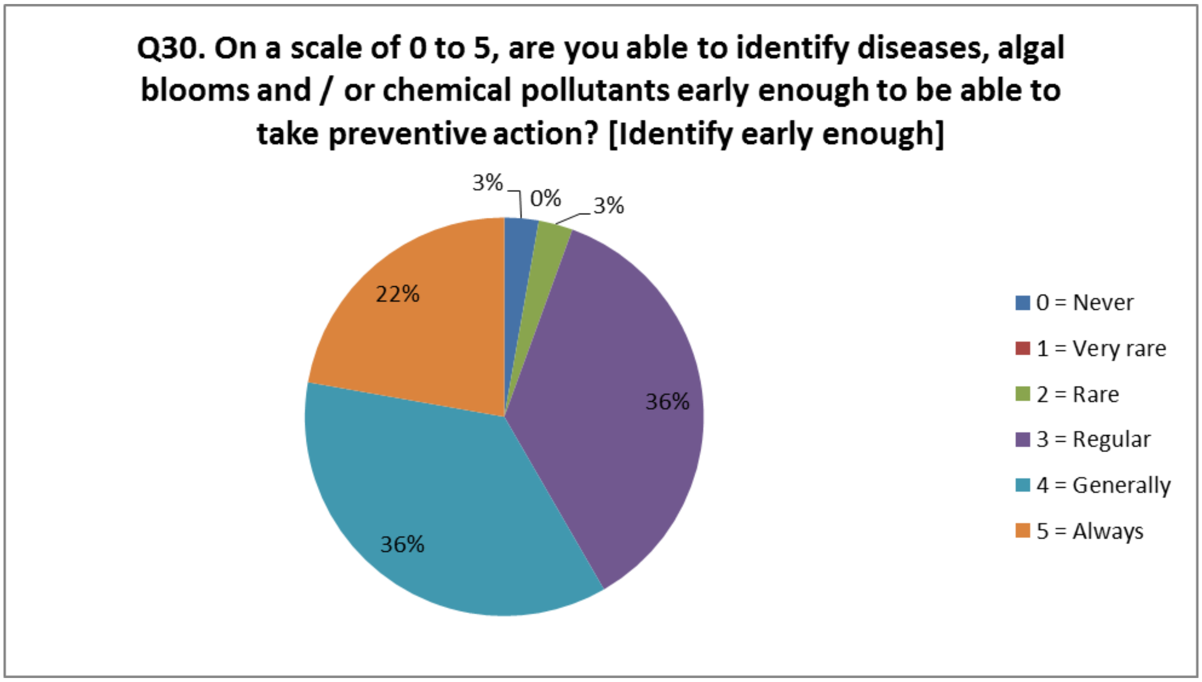


Figure 7. Farmer's interests in early-warning monitoingsystems

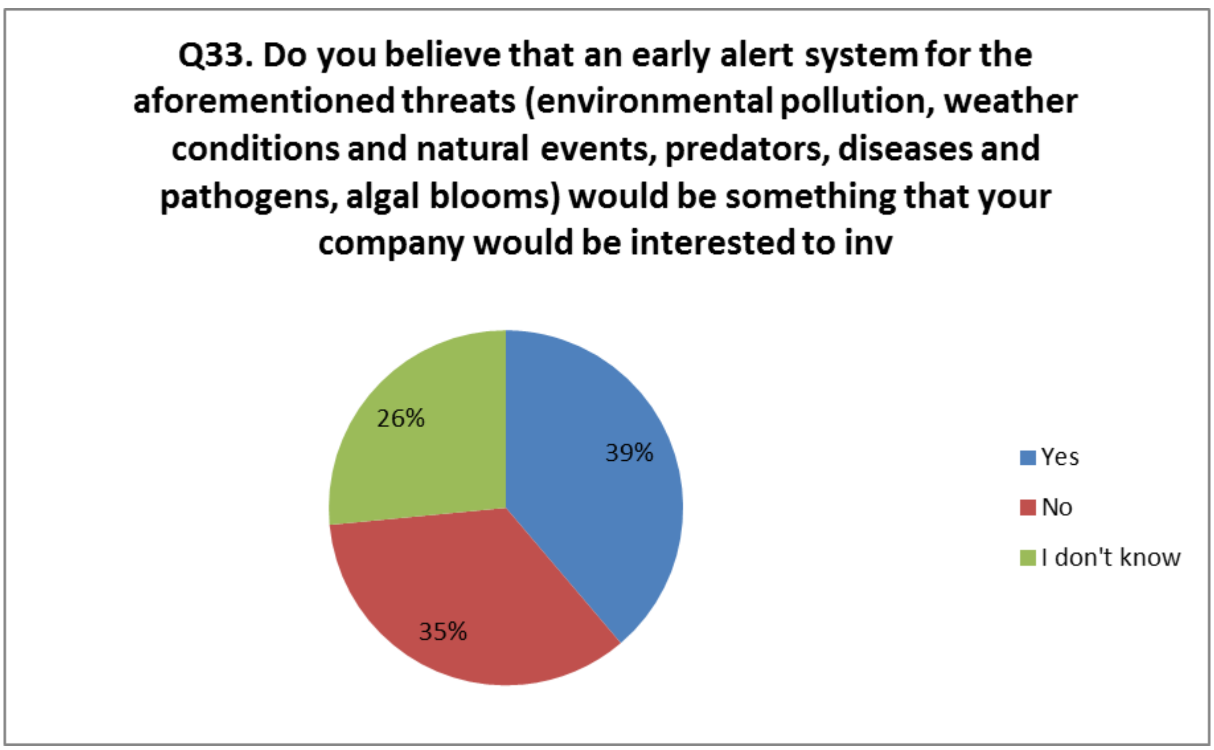
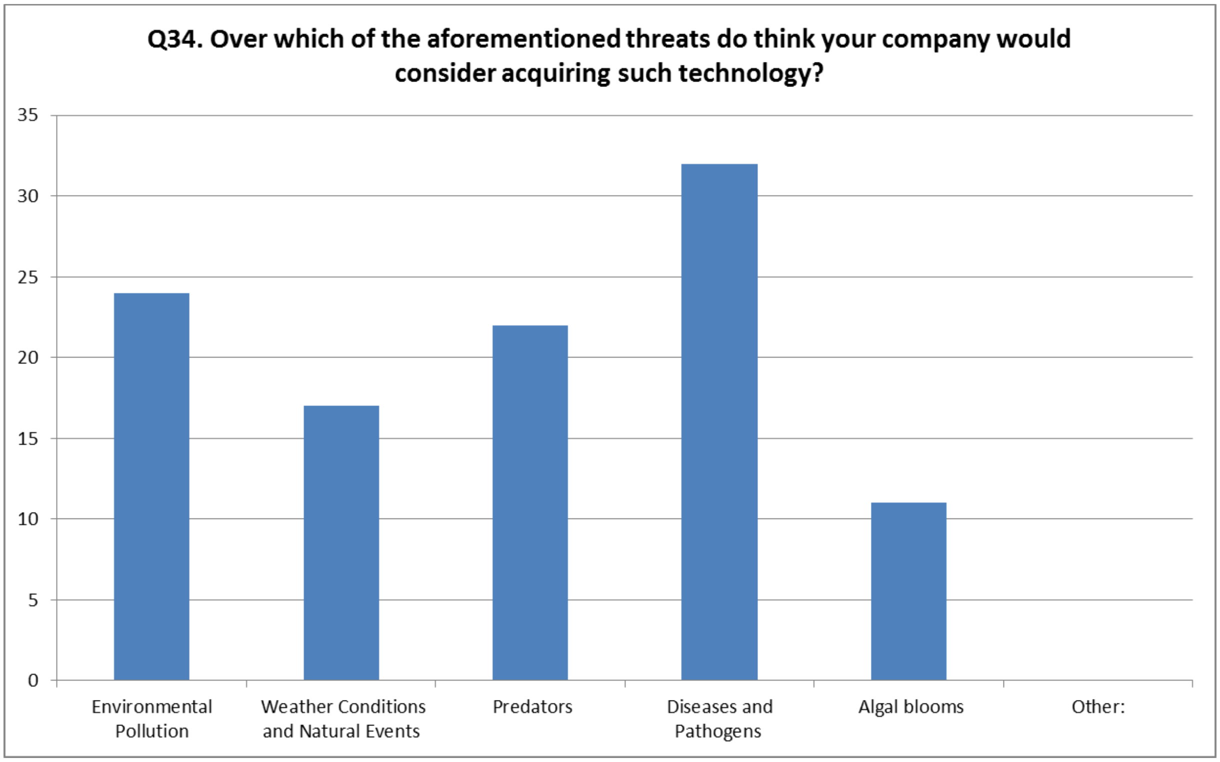


Figure 8. Farmer's interests in different types of early-warning monitoring systems



Conclusions

Early warning is a very important concept for livestock production. Early warning systems provide relevant and timely information in a systematic way during production that lets the producer make informed decisions and take preventive actions before upcoming problems. A farmer must know the risks of their establishment to choose best monitoring practices and parameters that would result in efficient responses to brewing problems. Monitoring technologies are needed for increased control in aquaculture industry. Presently, the occurrence of microalgae, pathogens, toxins and chemicals in the aquatic environment may lead to contaminated end products which may be rejected by the market for not being fit for human consumption resulting in economic losses. A better marketable product is possible with early knowledge of any problem that can be prevented by early precautions. Modular systems using different types of sensors depending on the choice of the farmers for microalgae, pathogens, predators, toxins and chemicals as well as temperature, salinity, dissolved oxygen, turbidity and weather patterns would benefit aquaculture industry. These monitoring systems use geographical information systems (GIS) to capture, store, manipulate, manage, analyze and display spatial and geographic data. Information is gathered and shared in real time, using mobile data transmission through the internet to a dedicated server. Processed data can be used to make decisions related with both production and upcoming problems that can be foreseen within the data received. Although farmers are concerned with capital investments, it would be advisable for any aquaculture establishment that monitoring systems would benefit in the long term for a much profitable business.

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Original Article/Full Paper

ASSOCIATION OF TOTAL MERCURY AND CADMIUM CONTENT WITH CAPTURE LOCATION AND FISH SIZE OF SWORDFISH (*Xiphias gladius*); INDIAN OCEAN

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ABSTRACT

Mercury (Hg) and cadmium (Cd) are non-essential trace elements that transfer through the trophic chain which ultimately bio-accumulate and biomagnify in the upper trophic level. The total Hg (THg) and Cd levels of the muscle tissues of swordfish, *Xiphias gladius* caught in three different areas in the Indian Ocean around Sri Lanka were determined. THg and Cd levels were <0.07-4.30 mg/kg and <0.006-0.180 mg/kg, (wet weight basis) respectively. Of the analyzed samples, 13.3% fish were over 1 mg/kg for THg while not any single sample exceeded 0.30 mg/kg for Cd which is EU, and FDA action limits. The results indicate that the catching locations do not govern the THg and Cd levels and it showed a weak positive relationship between the length and weight of the fish.

Keywords: Atomic Absorption Spectrometer, Catching location, Length-Weight relationship, Indian Ocean

Introduction

Contamination of the marine ecosystem by non-essential trace metals is a worldwide problem because they can be toxic even at a very low concentration (Le Croizier *et al.*, 2018). Mercury (Hg) and cadmium (Cd) are well known global environmental pollutants which occur naturally and also released to the marine environment by anthropogenic activities such as coal combustion, mining industry by-product, agriculture fertilizer and waste incineration (Jinadasa *et al.*, 2013, Nicklisch *et al.*, 2017).

Mercury exists in the environment in several chemical forms including elemental Hg (Hg°), inorganic Hg (Hg^+ and Hg^{2+}) and organic Hg ($MeHg^+$, $EtHg^+$, $PeHg^+$ *etc.*) (Zhu *et al.*, 2017). The adsorption, transport, bioaccumulation, metabolism, and toxicity of Hg are governed by its speciation form (Arroyo-Abad *et al.*, 2016). All forms of Hg can bio-accumulate and biomagnify through the food chain; $MeHg^+$ has a greater ability than other forms (Jia *et al.*, 2013). The microorganisms convert elemental Hg to $MeHg^+$ through the methylation process in the marine environment (Morrissey *et al.*, 2005). Methylmercury is a known neurotoxin and currently considers that fish is the main path for the Hg exposure to human. In the pelagic, highly migratory, slow growing and apex predator fish such as swordfish (SF), yellowfin tuna and a shark, about 90% of total Hg (THg) are in $MeHg^+$ chemical form (Silvia *et al.*, 2010).

Cadmium occurs in the marine environment as cadmium chloride ($CdCl_2$) (Engel and Fowler, 1979). The International Agency for Research on Cancer (IARC) categorized Cd as a group 1 human carcinogen (Guan *et al.*, 2015). In addition, Cd toxicity is responsible for various impairment of organisms such as kidney disorder, osteoporosis, damages of the liver, the central and peripheral nervous systems (Pastorelli *et al.*, 2018, Al-Saleh and Abduljabbar, 2017). There is an evidence to support that Cd might be related to hypertension, stroke, and heart failure which is counter to the cardio defensive property of eating the fish (Guan *et al.*, 2015).

The Food and Agriculture Organization (FAO), European Union (EU) and Food and Drug Administration of United States (USFDA) regulations stipulate the maximum level for THg and Cd for SF as 1 mg/kg and 0.30 mg/kg respectively (Jinadasa *et al.*, 2014, Bosch *et al.*, 2016). The THg and Cd levels in fish depend on numerous factors including species, body size, sex, migratory biology, trophic position, foraging behavior and environmental factors such as pH, salinity, water temperature and dissolved oxygen (Guan *et al.*, 2015, Ray, 1984).

In the Indian Ocean, SF is primarily caught from the area off Somalia and from the southwest Indian Ocean by longline fisheries. Recent years, this fishery has moved towards off Sri Lanka (IOTC, 2014). Several studies carried out of SF have revealed that there is a relationship of THg and Cd with the body size (length and weight) (Jinadasa *et al.*, 2013, Mendez *et al.*, 2001, Kojadinovic *et al.*, 2007), however, few studies are reported about the relationship with capture location. Among the large pelagic fish species in the marine environment, SF is of primary importance, as they are the important export fish species from Sri Lanka (Jinadasa *et al.*, 2014). Therefore, it is appropriate to evaluate the THg and Cd content of SF with the capture location.

This paper reports, THg and Cd level of SF caught in three main areas in the Indian Ocean around Sri Lanka and the relationships of THg/Cd concentration with catching location, length, and weight.

Materials and Methods

Sample Collection

A total of 75 SF samples were collected from commercial seafood exporter during Jan-Dec 2017 caught from the Indian Ocean. The capture coordination (latitude and longitude), capture dates, vessel number were taken from fisherman logbook and confirmed from the satellite-based vessel monitoring system (VMS). Then the coordination was fed into the Google map software (online) for clustering. The total dressed weight (kg) and dressed length (cm) were recorded (without sword-like snout) and 250 g of muscle tissues were separated and transported to the laboratory under chilled condition.

Mercury and Cadmium Analysis

Analytical and general laboratory procedure was based on Jinadasa *et al.* (2014) with slight modification. Briefly, all glassware used was decontaminated 24 hrs with 10% HNO_3, washed with ultrapure water and dried properly. All the standards and reagents were prepared using ultrapure water (Barnstead, Easy pure LF system, Dubuque, USA). All the chemicals were analytical reagent grade or better (Sigma Aldrich, USA). The standard solutions of Hg and Cd at 1,000 mg/L (Fluka, Switzerland) were used for the construction of calibration curves. Approximately 1 g of homogenized samples were accurately weighed and pre-digested by treating with 10 mL of 65% (v/v) HNO_3 acid for 15 min at room temperature. Pre-digested samples were digested using a microwave accelerated system, MARS-6 (CEM, Matthews, USA). The digested samples were used to prepare 50.00 mL aqueous solutions. All the experiments were carried out in duplicate. Atomic absorption spectrophotometer (AAS) (Varian240 FS, Varian Inc., Mulgrave, Victoria, Australia) equipped with vapor generation accessory (Varian VGA 77) with closed end cell was used for determination of THg while AAS with Varian graphite tube atomizer (GTA-120) was used for determination of Cd.

The accuracy of the analytical procedure for THg and Cd was determined by analyzing certified quality control material (CQM), the samples (n=10) were analyzed in the same manner (canned fish offal, T/07243, and canned crab meat, T/07279QC from Food Analysis Performance Assessment Scheme, FAPAS, Sand Hutton, York, UK). The average field blank, derived from sample field blanks, and three times of its standard deviation were used to evaluate the limit of detection (LOD). The limit of quantification (LOQ) was 3 × LOD.

Data Analysis

All THg and Cd results were reported in a wet weight basis. To measure the correlation between THg and Cd content with length and weight of SF, linear regression analysis and Pearson correlation coefficient applied. To find out the metal content among the different locations, we used one-way analysis of variance (Anova) followed by Levene's test. All the data were analyzed using SPSS software version 17 (SPSS Inc., Illinois, United States).

Results and Discussion

The suitability of the method was evaluated in terms of their respective LOQ, recovery value using CQMs. As the standard operating procedure, the recoveries were maintained between 80-120% and the relative standard deviation value (RSD) was less than 15%. The accuracy of the analytical procedures was verified through the CQM values (Table 1). The method quantification limit (reporting level) for THg and Cd was 0.07 and 0.006 mg/kg in wet weight basis respectively.

Table 1. Obtained and certified concentrations (µg/kg, wet weight) in CQM

CQM		THg	Cd
T/07243	Certified	707 (469-946)	800 (535-1065)
	Obtained	722.55±50.58	782.40±70.41
T/07279	Certified	106 (59-152)	7.55 (5.76-9.33)*
	Obtained	107.48±6.45	7.40±0.59*

*mg/kg

Overall, the length value ranged from 40.0-200.0 cm (mean 103.5 cm, median 101.0 cm) while the weight ranged between 13.3-92.6 kg (mean 42.4 kg, median 39.9 kg).

In our study, the muscle parts of swordfish were used to detect the THg and Cd levels. The literature reveals that the liver tissues usually contain a higher value of THg and Cd (Damiano *et al.*, 2011), Our analysis, focused on the muscle part only because the liver is usually not an edible part of the fish. On the other hand, muscle act as a good reservoir for accumulation of environment contaminants (Damiano *et al.*, 2011).

Three clusters were identified as areas of Bay of Bengal (B), off Dondra (D) and Arabic sea (A) (Figure 1) when the catching locations were fed into Google map. Based on the map 27, 39 and 9 fish belonged to the Bay of Bengal, off Dondra and Arabic sea areas. The THg concentration in swordfish caught in off Dondra area (average: 0.69 mg/kg and the range <0.06-4.30 mg/kg) show a difference than other two capture areas, Bay of Bengal (average 0.55 mg/kg and the range <0.06-2.73 mg/kg) and Arabic sea area (average 0.51 mg/kg and the range 0.21-1.10 mg/kg), that is however not the statistically significant difference ($p>0.05$). Esposito *et al.* (2018), analyzed THg level of swordfish from 11 FAO fishing areas and observed the highest THg levels in fish from the Indian Ocean (0.955±0.118 mg/kg from West Indian Ocean; FAO 51 and 0.604±0.082 mg/kg East Indian Ocean; FAO 57). Further, it is generally believed that the THg concentration in fish from the Mediterranean Sea area is higher than in other oceans, because of the numerous deposits of Hg ore found in the surrounding countries (Esposito *et al.*, 2018, Storelli *et al.*, 2005). However, Esposito *et al.* (2018), reported a comparatively lower THg level in this area. Damiano *et al.* (2011), studied the THg, Cd and Pb level of SF from the Mediterranean Sea and Atlantic areas, observing a significant difference between the values in these two areas. The same kind of difference was observed in SF caught from two Atlantic Ocean areas by Branco *et al.* (2007) and highlighted that the most plausible reasons for this difference as the quantity and type of food eaten. Mendez *et al.* (2001), were highlighted that the THg level of SF depends not only on the size of fish but also the Hg content of the diet.

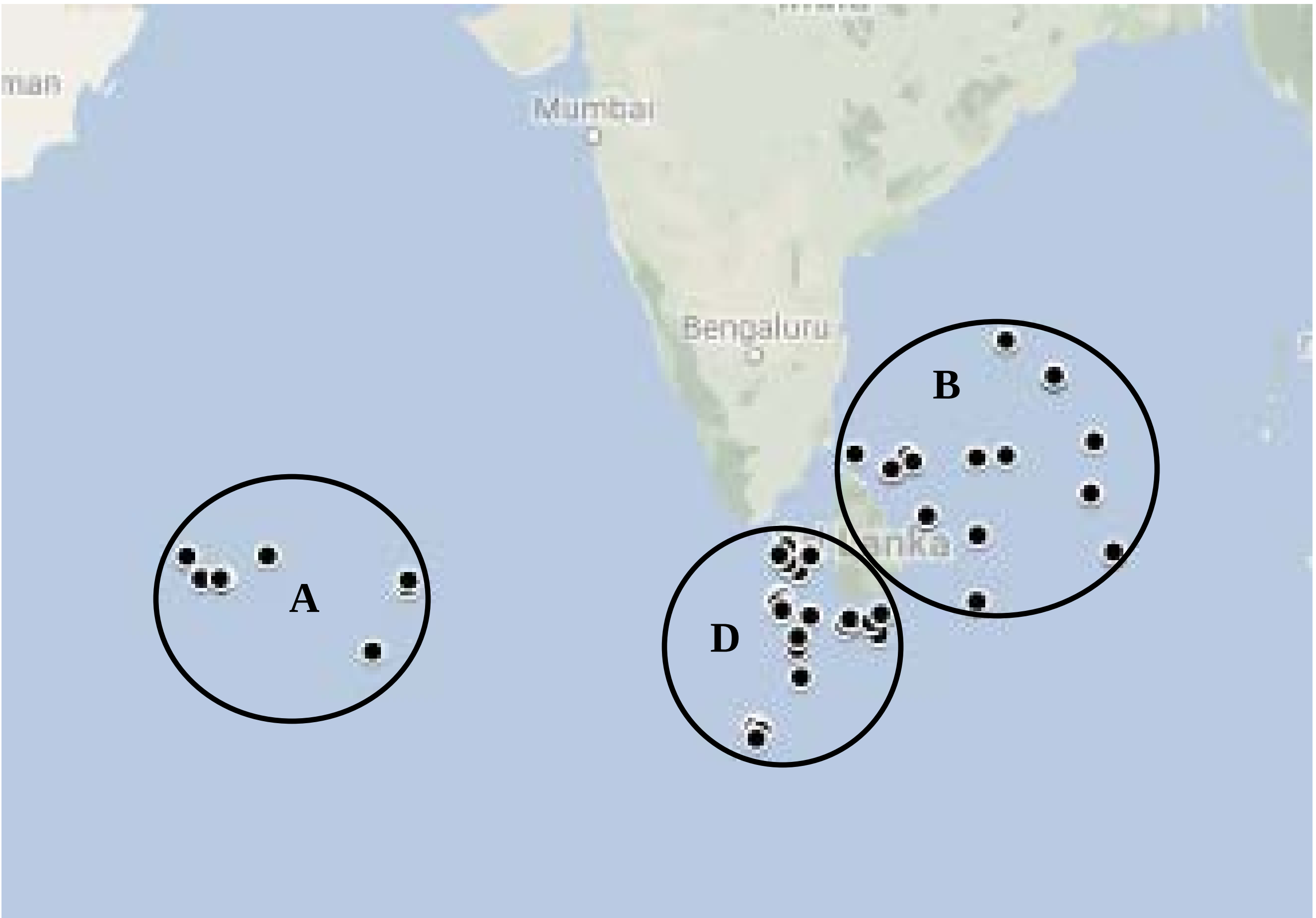


Figure 1: Location of sampling; D-off Dondra sea, B-Bay of Bengal sea, A-Arabic sea

Even though the results point to high variability, the statistical analysis showed that there is no significant difference in THg and Cd levels of SF muscle tissue in this 3 location ($p>0.05$). The THg level ranged from <0.07-4.30 mg/kg while the mean and median values were 0.62 and 0.50 mg/kg respectively. The highest value of THg (4.30 mg/kg) was from the off Dondra area, which was from a 28 kg, 64 cm weight fish. Furthermore, the THg found in this work are similar to those reported in the literature for swordfish of various origins (**Table 2**). The high bioaccumulation of the Hg in swordfish is generally endorsed by their top position in the food web and long lives (Branco *et al.*, 2007).

Among the analysed samples, 10 individuals (13.3%) exceeded the THg maximum allowable value set by EU and USFDA (1 mg/kg). Considering the number of fish exceeding 1 mg/kg level in 3 locations, 3 (11.1%), 6 (15.38%) and 1 (11.1%) represented in order B, D and A. The 31 individuals (41%) contained 0.50-1.00 mg/kg, 20 individuals (27%) 0.25-0.50 mg/kg while only 14 individuals (19%) below 0.25 mg/kg.

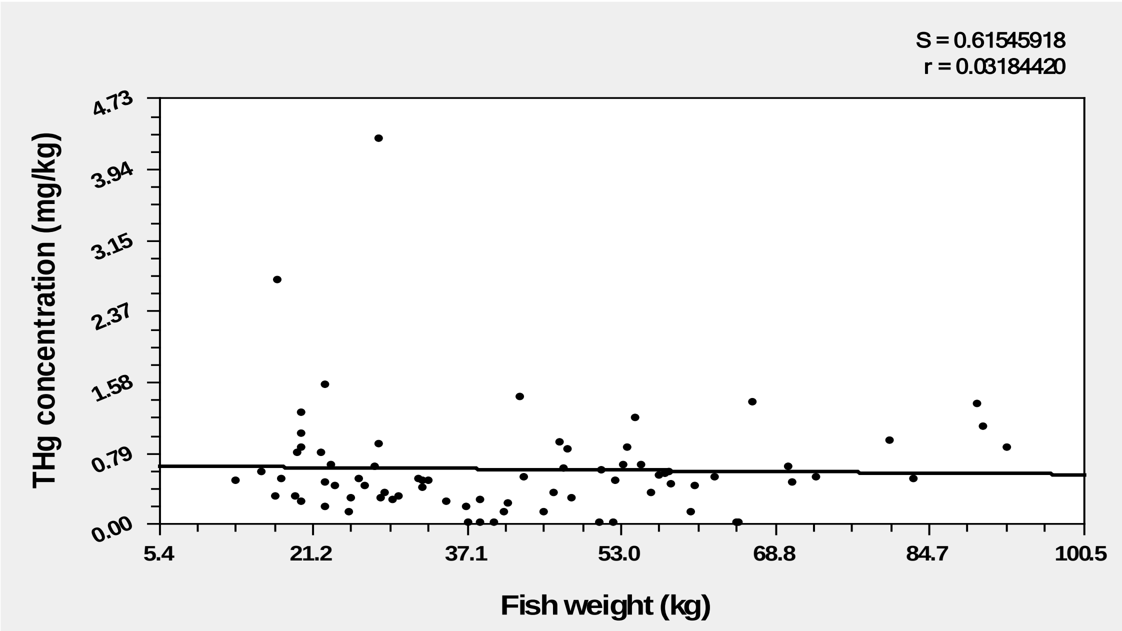
Cadmium in SF measured in muscle tissues ranged from <0.006-0.180 mg/kg (mean; 0.044, median; 0.033 mg/kg), Not a single individual exceeded the EU or USFDA maximum allowable level (0.30 mg/kg). The highest concentration of Cd (0.180 mg/kg), was recorded in a fish caught from the Bay of Bengal area and the size was 65.1 kg and 137.0 cm These results are consistent with the other study conducted in the Indian Ocean reported by Jinadasa *et al.* (2014) and with the other studies reported by Damiano *et al.* (2011) considering Mediterranean and the Atlantic Ocean with respect to the same species.

The concentrations of THg and Cd in muscle tissues of SF were investigated (fig. 2 and table 3). The linear fit models were run (y=a+bx) while the positive correlation of the metal concentration with the size of the fish was observed (x is fish weight or length and a, b are a parameter related with the fitted equation and the value given in Table 3). The fish length and weight were weakly associated with THg. A similar weak relationship has been observed between the edible part of swordfish and weight of fish (Mendez *et al.*, 2001), muscle tissue with length of the swordfish (Kojadinovic *et al.*, 2006) while strong relationship observed the THg and Organic Hg with the fish length (Chen *et al.*, 2007) and the dorsal muscle tissue THg and with the length and weight of swordfish (Jinadasa *et al.*, 2013).

In the study of Gewurtz *et al.* (2011), showed that the independent variables such as fish length and weight did not impact of their analysis and they highlighted that model fit typically get worse for larger sized fish, in general, there was a similar probability of under- and over-prediction.

Table 2: Summary of THg levels, origin, and a number of samples (n) in swordfish reported in the literature.

Origin	THg (mg/kg), wet weight			n	Reference
	Minimum	Maximum	Average		
Western Indian Ocean	0.241	1.880	0.955±0.118	21	Esposito *et al.* (2018)
Eastern Indian Ocean	0.091	1.400	0.604±0.082	19	Esposito *et al.* (2018)
Mediterranean and Atlantic ocean	0.66	2.41	__	56	Damiano *et al.* (2011)
Atlantic Ocean	0.031	9.8	__	52	Branco *et al.* (2007)
Sri Lanka, Indian Ocean	0.18	2.58	0.90±0.52	176	Jinadasa *et al.* (2013)
Indian and Atlantic Oceans	0.56	3.97	1.30±0.97	56	Chen *et al.* (2007)
Mediterranean Sea	0.02	0.15	0.07±0.04	58	Storelli *et al.* (2005)
Spain	0.177	1.227	__	__	Olmedo *et al.* (2013)
Spain	0.413	2.110	0.958±0.475	27	Torres-Escribano *et al.* (2010)
USA	0.15	3.07	1.40±0.18	18	Burger and Gochfeld (2006)
Mediterranean Sea	0.30	1.80	0.78±0.48	30	Barone *et al.* (2018)
Sri Lanka, Indian Ocean	<0.07	4.30	0.62±0.61	75	This study



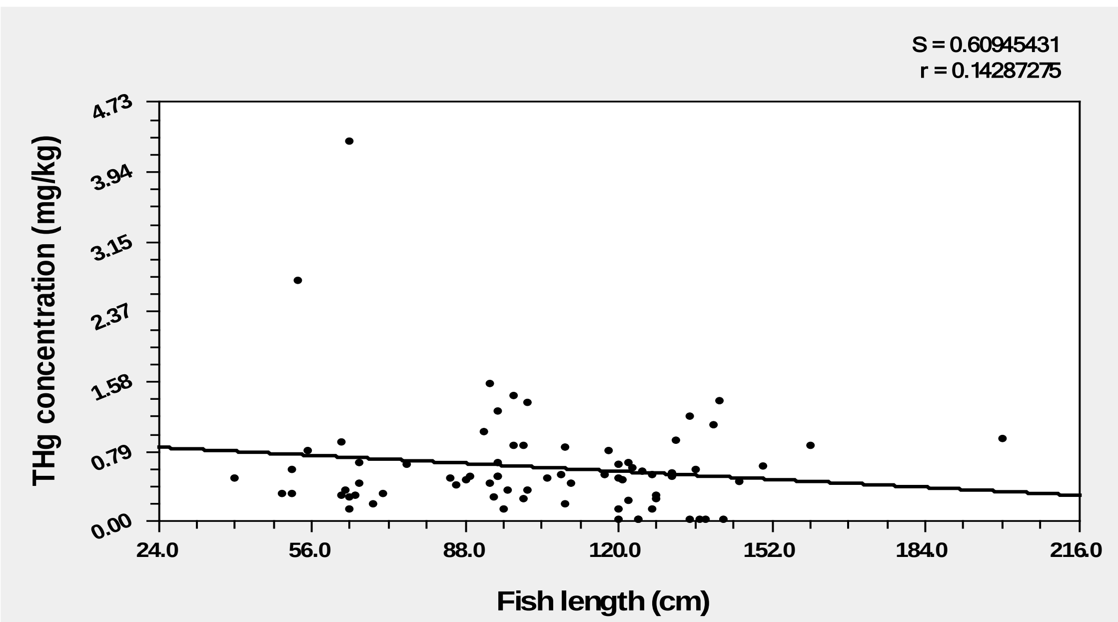


Figure 2. Relationship between THg and Cd concentration and length and weight of swordfish (part 1)

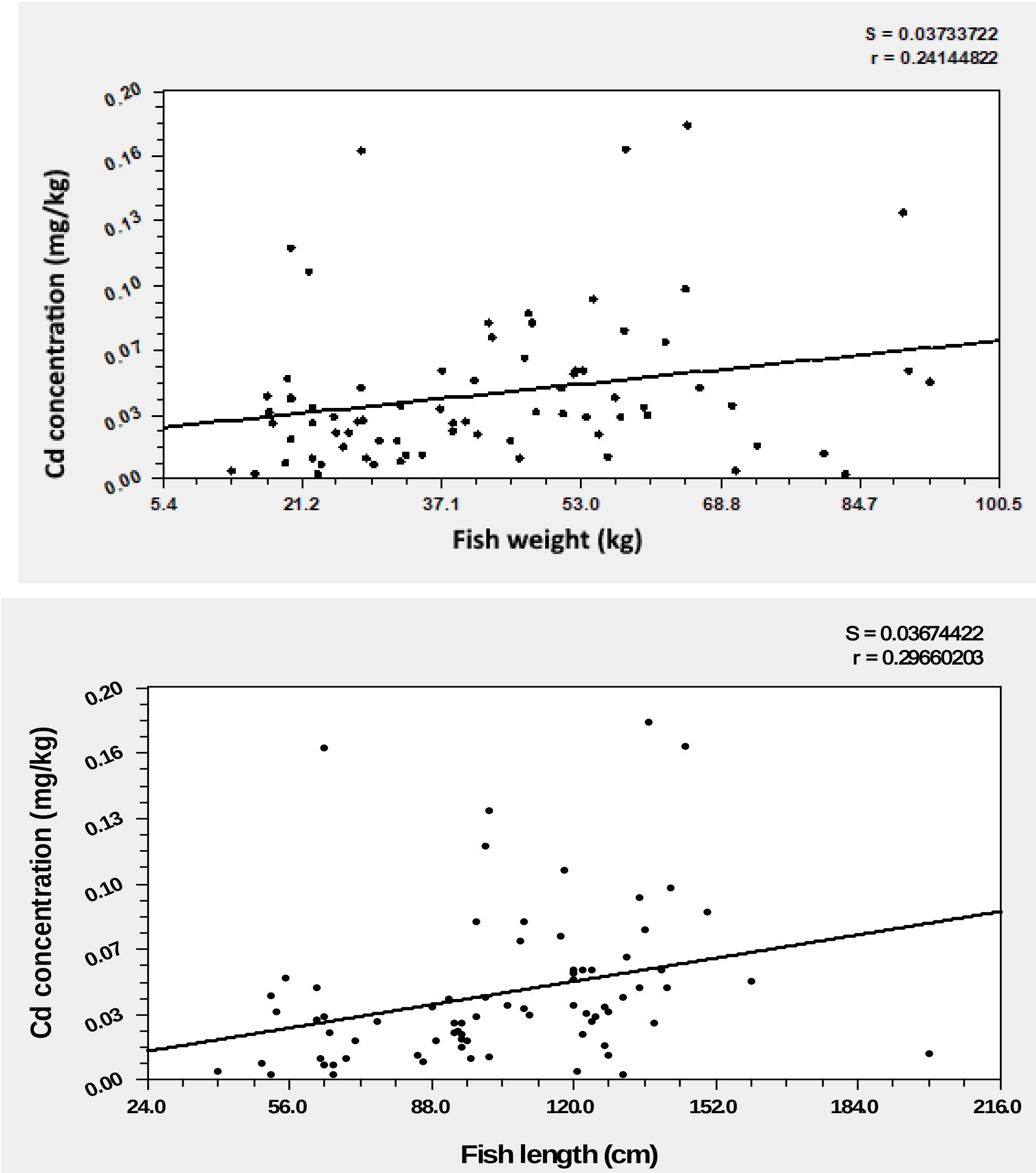


Figure 2. Relationship between THg and Cd concentration and length and weight of swordfish (part 2)

Table 3. Numerical value, standard error and correlation coefficient of the model run

Metal	Parameter	Standard Error	Correlation Coefficient	a	b
T-Hg	Weight	0.6155	0.0318	6.6013E-001	-9.8108E-004
	Length	0.6094	0.1429	9.1047E-001	-2.8197E-003
Cd	Weight	0.0373	0.2414	2.4306E-002	4.6480E-004
	Length	0.0367	0.2966	6.1452E-003	3.6576E-004

Conclusion

This study provided the picture of THg and Cd level of swordfish in the Indian Ocean around Sri Lanka. The mean THg and Cd level of swordfish were <0.07-4.30 mg/kg and <0.006-0.180 mg/kg respectively. The results indicated that the catching position is not a critical factor to estimate the THg or Cd level of swordfish. The weak positive significant relationship was observed with both studied metals with the length and weight of the fish.

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Original Article/Full Paper

İSTANBUL İLİ SU ÜRÜNLERİ KOOPERATİFLERİNİN TİCARİ OLANAKLARI VE SORUNLARININ İNCELENMESİ

Kadir Doğan

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ÖZ

Bu çalışmada balıkçılığın önemli merkezlerinden olan İstanbul ilindeki su ürünleri kooperatifleri araştırılmıştır. Kooperatifler mekânlarında ziyaret edilerek araştırmanın amacına göre hazırlanan anket formları tam sayım yöntemine göre kooperatif yöneticileriyle yüz yüze görüşme ile doldurulmuş ve orijinal veriler elde edilmiştir. Elde edilen verilere göre Marmara Denizi, Karadeniz ve İstanbul Boğazı'na kıyısı olan 21 ilçede 48 su ürünleri kooperatifinin faaliyet gösterdiği, kooperatiflere ortak toplam 3.716 balıkçının, 2.698 balıkçı teknesinin olduğu saptanmıştır. Kooperatiflerin ilçelere göre dağılımında 7 kooperatif ve 781 ortak balıkçısıyla Sarıyer ilçesinin ilk sırada yer aldığı tespit edilmiştir. Balıkçılık ve ticari açıdan önemli olan balık satış yeri, çekek yeri, soğuk hava tesisi, kooperatif bürosu ve sosyal tesise sahipliği ilçelerin fiziki yapısına göre değişiklik gösterdiği saptanmıştır. İncelenen kooperatiflerden %87.5'inin büro ve sosyal tesise, %33.3'ünün balık satış yerine, %65.3'ünün çekek yerine sahip olduğu ve %52.1'inin balık nakil belgesi verdiği saptanmıştır. Sonuç olarak İstanbul su ürünleri kooperatifleri ülke balıkçılığına üretim yaparak ekonomik ve ticari olarak önemli katkılarda bulunmaktadır.

Anahtar kelimeler: Balıkçılık, İstanbul, Kooperatifçilik, Ticaret, Su Ürünleri Kooperatifi

ABSTRACT

TRADE FACILITIES OF ISTANBUL FISHERIES COOPERATIVES AND INVESTIGATION OF THEIR PROBLEMS

In this study, fisheries cooperatives of Istanbul, an important center for fisheries sector, were investigated. Cooperatives were visited in their offices and survey forms that were prepared according to the aim of the study were filled with the interviews of the cooperative managers according to the complete inventory method and original data were collected. As a result of the study, it was determined that in 48 fisheries cooperatives are operating in 21 districts in the shores of the Sea of Marmara, Black Sea and the Istanbul Strait and there is a total of 3.716 fishermen as cooperative society and 2.698 fishing boats. Sarıyer district takes the first place with 7 cooperatives and 781 cooperative society. It was determined that some facilities that have importance in means of fishing and fish trade such as the fish market place, boat yard, cold-air storage places, cooperative offices and amenity-oriented greenery zones show some differences depending on the physical structures of the districts. It was determined that 87.5% of these cooperatives have offices and amenity-oriented greenery zones; 33.3% of them have fish markets; 65.3% of them have boat yards and 52.1% of them can issue fish-transportation document. In conclusion, Istanbul fisheries cooperatives makes important economic and commercial contribution into Turkey's fisheries sector by means of production.

Keywords: Fisheries, Istanbul, Cooperation, Trade, Fisheries Cooperatives

Giriş

Bugün büyük işletmelere sahip olan ülkemizde balıkçılıkla ilgili ulusal ve uluslararası yapı içerisinde sektörel boyut kazanmış çok sayıda işletme bulunmaktadır (Küçükoğlu, 2012, Anonymus 2018a).

Balıkçılık sektörü tarım sektörü içerisinde; başta gıda olmak üzere sağlık, çevre, turizm, imalat ve lojistik sektörleri ile yakın ilişkileri nedeniyle ekonomik büyümede dolayısıyla ülke kalkınmasında stratejik bir öneme sahiptir (Boran, 2016). Balıkçılık sektörü, tarım sektörü içerisinde besin kaynağı olmanın yanında istihdamdaki işlevinden dolayı ekonomik ve toplumsal alanda da katkıları bulunan, uluslararası alanda en çok ticareti yapılan gıda maddesine sahip bir sektör konumundadır (Özdemir ve Aras, 2005, Küçükoğlu, 2012).

Dünya ve ülkemizde toplumsal ve ekonomik kalkınmada özellikle tarım amaçlı kooperatifler etkin görevler üstlenmişlerdir. Aynı şekilde balıkçılık sektörü içerisinde de deniz ve iç su avcılığında su ürünleri kooperatiflerinin işlevleri yoğun olarak görülmektedir. Türkiye'de su ürünleri kooperatifleri sivil toplum örgütleri olarak öncelikle balıkçılık sektörünün geliştirilmesi, ortaklarının ekonomik kazanım ve ihtiyaçlarını sağlama yolunda örgütlenerek sayısal açıdan yıllar itibarıyla belirli bir seviyeye ulaşmış, ekonomik ve ticari alandaki yerini almıştır.

Ülkemizde balıkçılık konusunda 1943 yılında İstanbul'da ilk olarak kurulmuş olan *"İstanbul Balık Avcıları İstihsal ve Kredi Satış Kooperatifi"* (Özbilge, 1946; Doğan, 2017b) ile başlayan kooperatifçilik yapılanması, sonraki yıllarda balıkçıların bir araya gelerek kurdukları kooperatif sayısı yıllar itibarıyla istikrarlı bir şekilde artış eğiliminde olmuştur. 1943 yılında bir adet olan kooperatif sayısı, 1965 yılında 36, 1967 yılında 44, 1969 yılında 88 ve 1970 yılında ise 112 seviyesine ulaşmıştır (Uras, 1972; Arpa, 2015; Doğan, 2017a).

Balıkçılık kooperatiflerindeki örgütlenme ve sayısal artışlar 1163 Sayılı Kooperatifler Kanunu ve 1380 Sayılı Su Ürünleri Kanununun çıkması ve kanunda kooperatifleşme konusunda yer alan destekleyici hükümleriyle su ürünleri kooperatiflerinin kurulmasını hızlandırmıştır. Su Ürünleri Kanunu, deniz ve iç sulardaki avlak alanlarını kiralama hakkını pazarlık usulüyle öncelikle su ürünleri kooperatiflerine tanımıştır. Ayrıca Ziraat Bankası'ndan kredi kullanımında gösterilecek teminatlarda, su ürünleri yatırımlarında, ithal edilecek istihsal vasıtalarından alınacak vergilerde, balıkçı barınaklarının kiralanmasında teşvik, himaye ve muafiyetler getirilmiştir. Kanun kapsamında verilen destekler sonucu 1973 yılında 133 olan birim kooperatif sayısı 1980 yılında 227, 1989 yılında 421, 1995 yılında 312, 2000 yılında 379, 2005 yılında 479, 2010 yılında 550, 2015 yılında 547, 2016 yılında ise 552 seviyelerine ulaşmıştır (GTHBSÜGM, 1975; TOBSÜDB, 1982; Doğan ve Timur, 2010; Doğan, 2016; Doğan, 2017b). Günümüzde 2018 yılı 31.05.2018 tarihi verilerine göre halen kıyılarımız ve iç su kaynaklarımızın bulunduğu yörelerimizdeki 68 ilimizde örgütlenmiş 551 birim kooperatif ve 30.871 ortağı bulunmaktadır (Anonymus 2018b).

Balıkçılığın önemli merkezlerinden olan İstanbul, dünya deniz ve kara ticareti işletmeciliğinde çok önemli bir ilimizdir. İstanbul, sürekli artan ticari kapasitesi, yüksek nüfus yoğunluğu, uluslararası pazar hareketleri, ülke ekonomisin merkezi olma özelliği ve Karadeniz'den Ege ve Akdeniz'e olan pelajik balık göçlerinin gerçekleştiği İstanbul Boğazı üzerinde yer alması ve balıkçılık potansiyelinin yüksek olması sebebiyle su ürünleri kooperatifi olarak balıkçıların örgütlenmesinde öncü il konumundadır.

İstanbul, 2017 yılı verilerine göre faal su ürünleri kooperatif sayısı diğer illere göre 48 kooperatif ve dört bine yakın ortak balıkçısıyla ilk sırada yer almaktadır (Anonymus 2018c). İstanbul ilinde günümüzde balıkçılık faaliyetini sürdüren kooperatiflerden en eskisi 1949 yılında kurulmuş 98 ortaklı *"İstanbul Balık Müstahsilleri Su Ürünleri Kooperatifi*, en yenisi ise 2009 yılında kuruluş işlemlerini tamamlayan 37 ortaklı *"Anadolufeneri Köyü Su Ürünleri Kooperatifi'*dir (Doğan, 2017b).

Kooperatifler kar amacı gütmeyen sivil toplum örgütü olarak 1163 sayılı Kooperatifler Kanunu çerçevesinde faaliyet gösterseler de kanunda düzenleme bulunmayan durumlarda kooperatiflerin ticaret işlemlerinde 6102 sayılı Türk Ticaret Kanunu ve 7061 sayılı kanunla değişik 5520 sayılı Kurumlar Vergisi Kanununa tabidirler. Kooperatiflerin yaptığı ticari işlemlerle ilgili bilgiler adı geçen kanunların etkileri bulgular ve tartışma bölümünde ayrıntılı olarak verilecektir.

Bu çalışmada, balıkçılık sektörü ve ticaretin önde gelen merkezlerinden biri olan İstanbul ili su ürünleri kooperatifleri araştırılmıştır. Çalışmada öncelikle kooperatiflerin ilçelere göre dağılımları, balıkçılık açısından önemli olan fiziksel ve ticari imkânları, fiziksel imkânlarının balık avcılığı ve ticaretine etkileri, kooperatiflerin genel sorunları ve ileriye yönelik projelerinin olup olmadığının ortaya çıkarılması amaçlanmıştır. Çalışmada elde edilecek sonuçlar balıkçılık kooperatifleri ile ilgili yapılacak benzer çalışmalara faydalı olacağı ve ışık tutacağı düşünülmektedir.

Materyal ve Metot

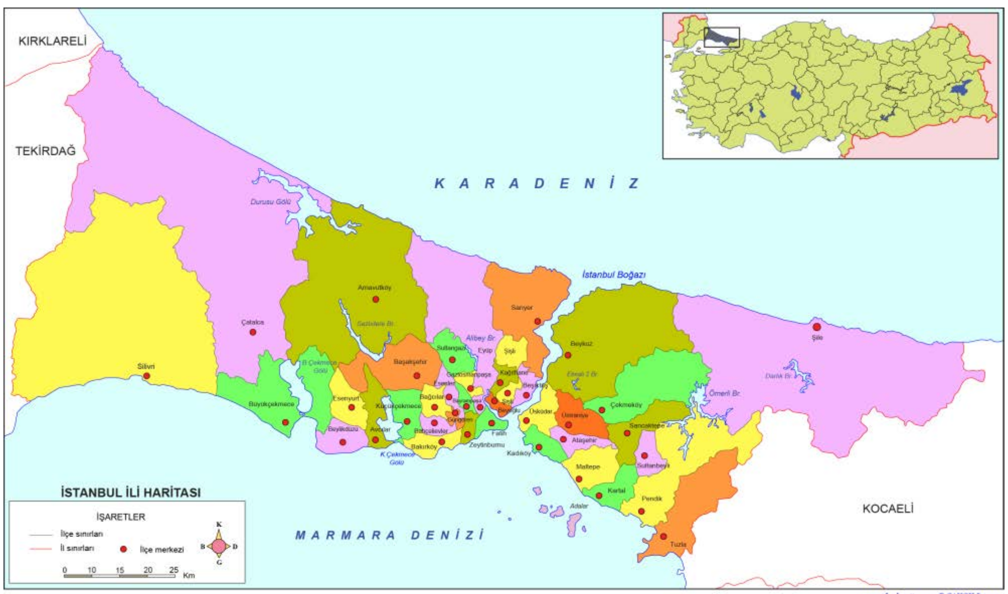
Araştırmanın ana materyalini İstanbul ilinde balıkçılık faaliyetini sürdüren su ürünleri kooperatifleri oluşturmaktadır (Şekil 1, Tablo 1). Kooperatiflerin listesi Gıda, Tarım ve

Hayvancılık İstanbul İl Müdürlüğünden alınmıştır *(Bakanlığın adı 09.07.2018 tarihli 703 numaralı KHK ile Orman ve Su İşleri Bakanlığı ile birleştirilerek yeni ismi "Tarım ve Orman Bakanlığı" olmuştur.*

Araştırmada, hazırlanan ankette açık ve kapalı uçlu 34 soru sorulmuş anket formunda kooperatiflerin genel yapısı, kooperatif yöneticilerinin sosyo-ekonomik ve demografik yapıları, av teknelerinin fiziksel, teknik ve ticari özellikleri, kooperatiflerin ileriye yönelik projeleri ve sorunları ana başlıklar olarak belirlenmiştir. Bu makalenin konusunu oluşturan fiziki ve ticari imkânları, kooperatiflerin ileriye dönük projeleri ve sorunları başlığı altında çekek yeri, balık satış yeri, sosyal tesis ve kooperatif bürosu, kooperatifin balık nakil belgesinin verip vermediği, kooperatifin fiziki ve ticari faaliyetlerini geliştirmek için ileriye dönük projelerinin olup olmadığı soruları yer almıştır.

Çalışma, av sezonunda Kasım 2016- Nisan 2017 tarihleri arasında belli aralıklarla kooperatiflerin faaliyet gösterdikleri mekânlarında ziyaret edilerek araştırmanın amacına göre hazırlanan anket formları tam sayım yöntemine göre kooperatif yöneticileri ve kooperatife ortak balıkçılarla yüz yüze görüşme ile doldurulmuş ve orijinal veriler elde edilmiştir.

Yapılan anketlerden elde edilen veriler, Microsoft Office Exel paket programına aktarılarak çeşitli istatistikî yöntemler kullanılarak çizelgeler ve şekiller oluşturulmuştur. Verilerin analizi sonucu oluşturulan çizelge ve şekiller yorumlanarak kooperatifler arasındaki farklılıklar ortaya konmuştur.



Şekil 1. Çalışmanın yapıldığı kooperatiflerin yerleri (cografyaharita.com, 2017)

Figure 1. Study site of the cooperatives

Tablo 1. Su ürünleri kooperatiflerinin ilçelere göre dağılımları

Table 1. Distribution of fisheries cooperatives by district

İlçeler	Kooperatif Sayısı	İlçeler	Kooperatif Sayısı
Adalar	4	Kartal	1
Arnavutköy	1	Küçükçekmece	1
Avcılar	1	Maltepe	1
Bakırköy	2	Pendik	1
Beşiktaş	1	Sarıyer	7
Beykoz	6	Silivri	2
Beyoğlu	1	Şile	2
Büyükçekmece	3	Tuzla	1
Eyüp	1	Üsküdar	3
Fatih	5	Zeytinburnu	1
Kadıköy	3	**TOPLAM**	**48**

Bulgular ve Tartışma

İstanbul, bulunduğu tarihi ve coğrafi konumundan dolayı sosyo-kültürel ve sosyo-ekonomik bakımdan önemli bir yerleşim yeridir. İstanbul ili kuzeyinde Karadeniz, güneyinde Marmara Denizi ve şehri ikiye bölen İstanbul Boğazının her iki yakasında yer alan idari açıdan 39 ilçeye sahip üç tarafı denizlerle çevrili bir yarım ada konumundadır. Bu açıdan yüksek balıkçılık potansiyeline sahiptir ve balıkçılığı geliştirmek için 39 ilçenin 21'inde kurulmuş ve faaliyetine devam eden 48 su ürünleri kooperatifi olduğu tespit edilmiştir (Tablo 2). Kooperatif yöneticilerinden alınan verilere göre İstanbul ilindeki kooperatiflerin, ilçelere göre dağılımları, kooperatiflerin, fiziksel ve ticari imkanları, kooperatiflerin temel sorunları ve ileriye yönelik projeleri alt başlıklar halinde analiz edilmiştir.

İstanbul ilindeki birim kooperatiflerden %54.2'si Avrupa Yakası'nda, %45.8'i Anadolu Yakası'nda; kooperatiflere ortak balıkçılarınsa %61.8'i Avrupa Yakası'nda, %38.2'si Anadolu Yakası'nda faaliyet gösterdiği saptanmıştır. Elde edilen verilere göre balıkçılık yapan ortak sayısının 3.716, av aracı olarak kullandıkları çeşitli boylarda 2.698 adet balıkçı teknesinin olduğu, ortaklardan %57.8'inin balıkçılığı aktif olarak yaptığı tespit edilmiştir (Tablo 3). Yapılan çalışmada kooperatiflerin dağılımı, örgütlenmesi ve balıkçılığın ekonomik anlamda sürdürülebilir olması bulundukları ilçenin coğrafi yapısı ve balıkçılık potansiyeline göre değiştiği sonucuna varılmıştır.

İstanbul ilinde balıkçılık kooperatifleri üzerine yapılan çalışmalarda yıllar itibariyle değişikliklerin olduğu görülmüştür. (Timur ve Doğan, 2003) İstanbul'da su ürünleri kooperatifleri ile ilgili 2002 yılında yaptıkları çalışmada Avrupa Yakası'nda 18, Anadolu Yakası'nda 16 olmak üzere toplam 34 birim kooperatif, 2.427 balıkçı ortağı ve çeşitli boylarda 2.170 adet balıkçı teknesinin olduğunu bildirmişlerdir. İstanbul ili sınırları içerisinde farklı yıllarda balıkçılık kooperatifleri ile yapılan çalışmalarda 2009 yılında 50 birim kooperatif ve 3.793 ortak balıkçı (Doğan ve Timur 2010), 2013 yılında 50 kooperatif ve 3.793 ortak balıkçı (Karademir ve Arat, 2014), 2014 yılında 50 kooperatif ve 4.049 balıkçı ortağın (Doğan, 2015a; Doğan 2015b) olduğunu rapor etmişlerdir. Yapılan bu çalışmada ise 2017 yılı itibariyle faal olan 48 birim kooperatif ve 3.716 balıkçı ortağın olduğu tespit edilmiştir. Daha önceki yıllarda yapılan çalışmalar ile yapılan bu çalışma karşılaştırıldığında İstanbul'da su ürünleri kooperatifleri ve balıkçı ortak sayısında yıllar itibariyle değişimlerin olduğu ancak çok fazla düşüş ve yükselişin olmadığı söylenebilir.

İstanbul Su Ürünleri Kooperatiflerinin İlçelere Göre Dağılımı

İstanbul ilinde faal olarak balıkçılık yapan kooperatiflerin ilçelere göre dağılımı farklılıklar göstermektedir. Kooperatif ve ortak sayısı olarak ilk sırayı 7 kooperatif ve 781 balıkçı ortağıyla Sarıyer ilçesi almaktadır. Sarıyer ilçesini 6 kooperatif ve 419 balıkçısıyla Beykoz, 5 kooperatif ve 312 balıkçısıyla Fatih, 4 kooperatif ve 246 balıkçısıyla Adalar, 3 kooperatif ve 199 balıkçısıyla Büyükçekmece, 3 kooperatif ve 149 balıkçısıyla Kadıköy, 3 kooperatif ve 161 balıkçısıyla Üsküdar ilçesinin takip ettiği tespit edilmiştir. İstanbul ili su ürünleri kooperatiflerinin ilçelere göre dağılımları Tablo 2'de verilmiştir.

Tablo 2'de görüldüğü gibi kurulmuş ve balıkçılık faaliyetine devam eden kooperatiflerin ilçelerin fiziki yapısı ve balıkçılık açısından potansiyelinin yeterli olduğu ilçelerde yoğunlaşmıştır. Örnek olarak Sarıyer ve Beykoz ilçesi sınırları içerisinde balıkçılık yapan kooperatif ortakları hem Karadeniz, hem de İstanbul Boğazı'nda avlanırken Beyoğlu ilçesi sınırları içerisinde balıkçılık yapan kooperatif ortaklarının avlanma sahası Haliç içerisinde kaldığı için daha kısıtlıdır.

İstanbul Su Ürünleri Kooperatiflerinin Ticari Önemi

Kooperatifler; kar amacı gütmeyen kuruluşlar olarak ekonomik faaliyetlerini sürdüren, özel yapıya sahip ekonomik ve sosyal amaçlı kuruluşlardır. Türkiye ekonomisinin her sektöründe faaliyet gösteren ticaret ve ekonomik hayatın vazgeçilmez aktörü olan kooperatifler, 1163 sayılı Kooperatifler Kanunu'na tabi olsalar da özel kanunlarında düzenleme bulunmayan durumlarda faaliyetlerini Türk Ticaret Kanunu (TTK) kapsamında sürdürmektedirler. TTK 124'üncü maddesinde ticaret şirketlerinin; kolektif, komandit, anonim, limited ve kooperatif şirketlerden olduğunu ve 16'ncı maddesinde tacir sayılacağını hüküm altına almıştır (Anonymus 2014). Ne kadar TTK kapsamında olsa bile kooperatiflerin tanımından ve kanundaki özelliklerinden dolayı çeşitli vergi muafiyetleri ve istisnalardan yararlanmaktadırlar. Kooperatiflere tanınan vergisel istisnaların bir kısmı doğrudan doğruya Kooperatifler Kanunu'ndan bir kısmı da (Kurumlar Vergisi Kanunu, Katma Değer Vergisi Kanunu, Gelir Vergisi Kanunu, Gider Vergisi Kanunu, Damga Vergisi Kanunu, Emlak Vergisi Kanunu ve Belediye Gelirleri Kanunu) diğer vergi ve harç yasalarından kaynaklanmaktadır. TTK'de da yer alan hükümler çerçevesinde kooperatiflere bazı vergi, ekonomik istisnalar ve muafiyetler sağlanmaktadır. Kooperatifler kar amacı gütmeden ekonomik faaliyetlerini sürdüren, özel yapıya sahip ekonomik ve sosyal amaçlı kuruluşlar olarak görülse de ekonomik kazanç sağlayan tacir sayılmaktadır. İstanbul su ürünleri kooperatifleri de faaliyet gösterdikleri ilçelerde istihdamın artırılması, yoksulluğun azaltılması, girişimciliğin desteklenmesi gibi ticari faaliyetlerde bulunurken kooperatiflere sağlanan bazı istisnalardan yararlanarak faaliyetlerini sürdürmektedirler. İstanbul ili su ürünleri kooperatiflerinin fiziki ve ticari imkânları Tablo 2'de ilçelere ve birim kooperatiflere göre ayrıntılı olarak verilmiştir.

Tablo 2. İstanbul su ürünleri kooperatiflerinin ilçelere göre dağılımları

Table 2. Distribution of Istanbul fisheries cooperatives by district

İlçeler	Kooperatif Sayısı	Ortak Sayısı	Tekne Sayısı
Sarıyer	7	781	391
Beykoz	6	419	290
Fatih	5	312	264
Adalar	4	246	154
Küçükçekmece	1	217	350
Büyükçekmece	3	199	160
Üsküdar	3	161	119
Şile	2	154	153
Kadıköy	3	149	74
Zeytinburnu	1	144	144
Arnavutköy	1	138	40
Silivri	2	130	75
Avcılar	1	125	60
Bakırköy	2	121	108
Tuzla	1	102	55
Kartal	1	85	55
Pendik	1	53	48
Beyoğlu	1	52	45
Maltepe	1	50	45
Beşiktaş	1	40	30
Eyüp	1	38	38
TOPLAM	**48**	**3716**	**2.698**

Tablo 3. Kooperatiflerin fiziki konum ve ticari imkânları

Table 3. Physical locations and commercial facilities of the cooperatives

İlçesi	**Kooperatif Adı**	**Kuruluşu**	**Ortak Sayısı**	**Tekne Sayısı**	**Balık Satış Yeri**	**Çekek Yeri**	**Sosyal Tesis ve Büro**	**Nakil Belgesi**
	Adalar Su Ürünleri	1972	45	45	-	+	+	-
Adalar	Burgazada Su Ürün.	1997	54	24	-	+	+	-
	Büyükada Su Ürün.	1995	61	65	-	+	+	+
	Kınalıada Su ürün.	1979	86	20	-	+	+	-
Arnavutköy	Karaburun Köyü Su	2001	138	40	-	+	-	+
Avcılar	Avcılar Su Ürünleri	1999	125	60	+	+	+	+
Bakırköy	Yeşilköy Su Ürünleri	1991	82	82	+	+	+	+
	Zeytinlik Su Ürüleri	2002	39	26	+	+	+	+
Beşiktaş	Ortaköy Su Ürünleri	1978	40	30	-	-	-	-
	Anadoluhisarı Su Ürün.	1978	36	25	-	+	-	-
Beykoz	Anadolukavağı Su	1972	40	35	-	-	-	+
	Beykoz Su Ürünleri	1993	66	60	+	+	+	+
	Riva Su Ürünleri	2006	94	90	-	+	+	-
	Anadolufeneri Su Ürn.	2009	37	22	-	+	-	
	Poyraz Su Ürünleri	1960	146	58	+	+	+	+
Beyoğlu	Beyoğlu Su Ürünleri	2005	52	45	+	-	+	-
	Büyükçekmece Su	1968	112	80	-	+	+	-
Büyükçekmece	Güzelce Su Ürünleri	2004	50	50	+	+	+	+
	Mimarsinan Su Ürün.	2004	37	30	-	+	+	+
Eyüp	Eyüp Su Ürünleri	2005	38	38	-	+	-	-
	Ahırkapı Su Ürünleri	2007	13	26	-	-	-	-
	Eminönü Su Ürünleri	2001	78	63	-	-	-	-
Fatih	Fatih Su Ürünleri	1997	87	60	-	+	+	+
	İstanbul Balık Müstahsilleri Su Ür.	1949	98	70	-	+	-	-
	Küçükmustafapaşa Su	2005	36	45	-	+	-	-
	Bostancı Su Ürünleri	1988	34	22	+	+	+	+
Kadıköy	Caddebostan Su Ürün.	2007	42	25	-	+	+	-
	Kadıköy Su Ürünleri	1982	73	27	+	+	+	-
Kartal	Kartal Su Ürünleri	1985	85	55	-	+	+	+
Küçükçekmece	Küçükçekmece Su Ürünleri	1965	217	350	-	+	+	-
Maltepe	Küçükyalı Su Ürünleri	2002	50	45	+	+	+	+
Pendik	Pendik Su Ürünleri	1979	53	48	+	-	-	-
	Garipçe Su Ürünleri	1971	108	56	-	+	-	-
Sarıyer	İstinye Su Ürünleri	2006	36	36	-	+	-	-
	Kireçburnu Su Ürünleri	1999	31	52	-	+	+	+
	Rumelifeneri Su Ürün.	1971	316	150	-	+	+	+
	Rumelikavağı Su Ürün.	1971	174	60	-	+	+	+
	Sarıyer Su Ürünleri	1971	83	20	-	+	-	+
	Yeniköy Su Ürünleri	1999	33	17	+	+	+	+
Silivri	Selimpaşa Su Ürünleri	2005	70	35	+	+	+	+
	Silivri Su Ürünleri	1982	60	40	+	+	+	+
Şile	Ağva Su Ürünleri	2006	70	45	-	+	-	-
	Şile Su Ürünleri	2000	84	108	-	+	+	+
Tuzla	Tuzla Su Ürünleri	1995	102	55	-	+	+	+
Üsküdar	Çengelköy Su Ürünleri	2003	52	35	-	+	-	-
	Selimiye Su Ürünleri	2003	44	40	-	+	+	-
	Üsküdar Su Ürünleri	1982	65	44	+	+	+	+
Zeytinburnu	Zeytinburnu Su Ürünleri	1999	144	144	+	+	+	-
	Oransal Değerler (%)	-	-	-	**33.3**	**87.5**	**65.3**	**52.1**

(+): var, (-): yok

İncelenen kooperatifler içerisinde balıkçılık potansiyelinin olduğu ilçelerde balıkçı barınaklarının işletilmesi, balık satış yerinin olması, balık nakil belgelerinin verilmesi, pişirilmiş olarak kendi ortak aileleri ve dışarıya balık satışının yapılması gibi ticari işlemlerin yapıldığı saptanmıştır. Kurumlar Vergisi Kanunu'na göre kooperatiflerin ortakları dışındaki kişilerle yaptıkları işlemler ile kooperatif ana sözleşmesinde yer almayan konularda ortakları ile yaptıkları işlemler "ortak dışı" işlemler olarak tarif edilmektedir. Bu yüzden İstanbul su ürünleri kooperatiflerinin yaptığı bu tür ticari işlemler kurumlar vergisine tabidir. .Balıkçıların mensubu olduğu kooperatif hizmetlerinden yararlanması ortaklar açısından önemlidir.

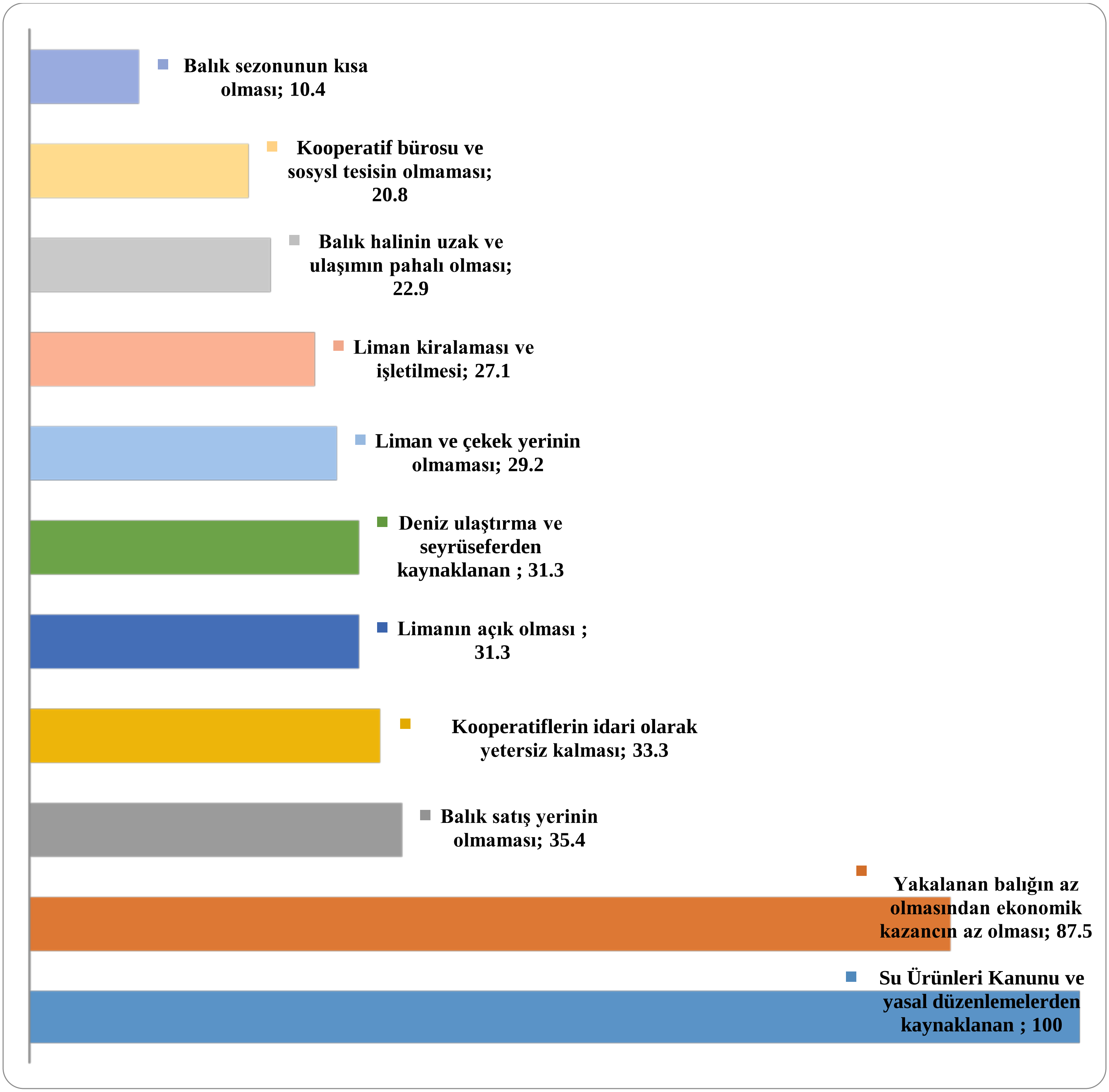
Tablo 3'den görülebileceği gibi incelenen kooperatiflerden %87.5'inin sosyal tesis ve dinlenebilecekleri mekana, %65.3'ünün çekek yerine, %33.3'ünün yakaladıkları balıkları satabileceği balık satış yerine sahip oldukları tespit edilmiştir. Ayrıca karaya çıkış bölgelerinde Gıda Tarım ve Hayvancılık Bakanlığı, Su Ürünleri Genel Müdürlüğü tarafından su ürünleri nakil belgesi düzenleme yetkisi verilen kooperatif sayısı toplam kooperatifler içerisinde %52.1 oranında yer almaktadır (Anonymus 2018d). Kooperatiflerin bulunduğu ilçe ve balıkçılık potansiyelinin olduğu bölgelere göre altyapı ve ticari olanaklarında farklılıklar görülmektedir.

Tablo 3'den görülebileceği gibi şehir içinde kalan kooperatiflerin fiziki yer darlığı nedeniyle balık satış yeri, çekek yeri, sosyal alanlarını geliştirememişlerdir. Su ürünleri kooperatiflerinin fiziki varlıkları bulundukları ilçenin coğrafi yapısı, arazi durumu ve kooperatifin balıkçılık potansiyelinden elde ettiği ekonomik gelire göre değiştiği söylenebilir.

İstanbul Su Ürünleri Kooperatiflerinin Temel Sorunları

İncelenen kooperatiflerin sorunları her kooperatif için ayrı ayrı değerlendirilmiş ve temel sorunlar tespit edilmiştir. Bütün kooperatiflerin ortak olduğu sorunlar içerisinde en önemli ve yüksek oranda (%100) su ürünleri kanunu ve kooperatifler kanunundan kaynaklanan yasal düzenlemenin ve koruma-kontrol hizmetlerinin gerektiği şekilde uygulanmadığından kaynaklanan temel sorun olduğu saptanmıştır. Çalışmada tespit edilen diğer temel sorunların %87.5'i kooperatif ortaklarının yakaladıkları su ürünlerinin az olmasından dolayı ekonomik kazancın düşük olması, %35.4'ü kooperatiflerin kendilerine özgü balık satış yerinin olmaması, %33.3'ü sorunların çözümlenmesinde ve balıkçılık yönetiminde kooperatiflerin yetersiz kalması, %31.3'ü deniz ulaştırma ve seyrüseferden kaynaklanan sorunlar ve kooperatifin balıkçı barınağının korunaklı olmadığı için sorun yaşamaları, %29.2'si kooperatifin balıkçı barınağı ve çekek yerinin olmaması, %27.1'i balıkçı limanı kiralanması ve işletilememesi, %22.9'u kooperatifin merkezinin su ürünleri haline uzak olması ve balık naklinin pahalı olması, %20.8'i kooperatif bürosunun ve balıkçıların kullanabileceği sosyal tesisin olmaması ve %10.4'ü av sezonunun kısa olması gibi sorunlardır (Şekil 2).

Ünal ve diğ., (2009) tarafından Ege kıyılarında faaliyet gösteren su ürünleri kooperatifleri üzerine yapılan bir çalışmada kooperatiflerin temel sorunları olarak: %79 su ürünleri kooperatifleri konusunda yetersiz politikalar, %75 yasa dışı avcılık, %68 sınırlı finansal kaynaklar, %65 pazarlama problemleri, %60 ticari avcılığı düzenleyen sirküler, %54 sınırlı av sahası, %42 koruma ve kontrol hizmetleri olduğu rapor edilmiştir. İstanbul'da 2013 yılında yapılan farklı bir çalışmada kooperatiflerin temel sorunları olarak: Yönetim, pazarlama-satış, faaliyet ortamı, yasal düzenlemeler ve muhasebe-finansman başlıkları altında toplamış (Karademir ve Arat, 2014), 2010 yılında Marmara Denizi su ürünleri kooperatifleri ile yapılan bir çalışmada ise kooperatiflerin temel sorunları: %69.8 balıkçılık ve kooperatif eğitiminin yetersizliği, %41.9 illegal avcılık ve denetimin yetersiz oluşu, %34.9 karaya çıkışta yeterli veri kaydının yapılmadığı, %32.6 kooperatiflerin kurumsal olarak yetersiz oluşu ve %25.6 kooperatiflerin gelir kaynaklarının yetersiz olduğunu (Zengin ve Güngör, 2017) bildirmişlerdir. Bu konuda yapılan farklı çalışmalarla karşılaştırıldığında İstanbul ili su ürünleri kooperatiflerinin ve balıkçıların yaşadığı temel sorunlar arasında benzerlikler görülmüş ve sorunların yoğunluklu olarak karar verici otoriteler tarafından çözümlenebileceği, sorunların çözümünde kooperatifler ve balıkçıların yetersiz kalacağı görüşü hakim olmuştur.



Şekil 2. İstanbul su ürünleri kooperatiflerinin temel sorunlarının yüzde dağılımı

Figure 2. Percent distribution of main problems of Istanbul fisheries cooperatives

İstanbul Su ürünleri Kooperatiflerinin İleriye Dönük Projeleri

İncelenen İstanbul su ürünleri kooperatiflerinin %85.4'ünün ileriye dönük projelerinin olduğu bildirilmiştir. Kooperatiflerin ileriye dönük projeleri içerisinde tüm kooperatiflerin katıldığı sürdürülebilir balıkçılığı devam ettirebilme olanaklarının bilimsel olarak araştırılıp uygulamanın sektördeki tüm paydaşlarla paylaşılmasının sağlanması isteklerinin olduğudur.

Bireysel olarak kooperatiflerin projeleri içerisinde ilk sırayı %45.8'lik oranla balık satış yerine sahip olmak ve satış yerinin ruhsatlandırılması için gereken çabayı gösterme eğiliminde olmalarıdır. Balıkçı kooperatiflerinin yapmak istedikleri diğer projeler balıkçı limanı, mendirek, çekek yeri yapımı ve uzatılması (%43.8), balıkçı ortakların sosyo-ekonomik durumlarını düzeltmek ve yükseltmek (%43.7), limanda balıkçıların av araç ve gereçlerini koymak için bir fiziksel mekana sahip olmak ve buzhanenin yapılması (%29.2), liman yapımı ve tadilatı (%27.1), mevcut limanların kiralanması ve işletme ruhsatının kooperatif tarafından alınması (%22.9), koruma kontrol hizmetlerinin yapılması (%20.8), balık satış yerinin olması, balıkçıların yakaladıkları balıkları işleyerek ve pişirerek pazarlamak (%16.7), limanda balıkçıların dinlenmesi ve zaman geçirecekleri sosyal alanlara sahip olmak (%12.5), balık, midye yetiştiriciliği ve turistik olta balıkçılığı yapmak (%10.4) şeklinde sıralanmaktadır. İncelenen kooperatiflerin ileriye dönük projeleri Tablo 4'de verilmiştir.

Tablo 4'den görülebileceği gibi incelenen kooperatiflerin temel sorunlarının giderilmesi ve var olan imkanları ölçüsünde ileriye yönelik projelerinin olduğu görülmektedir. Kooperatifler projelerini uygulayabilmeleri için fiziki, maddi ve kamu tarafından verilmesi gereken izinlere sahip olmaları gerekmektedir. Kooperatiflerin %85,4'ünün ileriye dönük projelerinin olması sürdürülebilir balıkçılık açısından arzu edilen bir durumdur. Ege bölgesi içsu ürünleri kooperatiflerinde yapılan bir çalışmada ileriye dönük projeleri %41 oranında bulunmuştur (Ünal ve diğ., 2011). Ege Bölgesi'nde yapılan çalışma ile İstanbul ilinde yapılan çalışmada kooperatiflerin ileriye dönük projelerinin olması sürdürülebilir balıkçılık ve kooperatif organizasyonunun iyileştirilmesi açısından anlamlı kabul edilmektedir.

Sonuç

Yapılan çalışmada İstanbul ilinde balıkçılık sektörü için su ürünleri kooperatiflerinin dört bine yakın balıkçısı, üç bine yakın çeşitli boylarda teknesi ile ekonomik faaliyette bulunmaktadır. Ayrıca imalat ve lojistik sektöründe görev yapanlar, tekne ve kooperatiflere malzeme sağlayan firmalar tedarikçi yan sektörde ve kooperatif bünyesinde çalışanlarla birlikte ülke ekonomisi ve İstanbul ekonomisine sağlayacağı ticari katkısı azımsanmayacak düzeydedir. Çalışmada incelenen kooperatiflerin sorunları yanında avantajlı durumları da gözlemlenmiştir. Bazı kooperatifler sorunlarını çözme yolunda atılımlar yaparken bazıları ise yasal mevzuat, ekonomik ve fiziksel yetersizliklerden dolayı sorunlar yaşamaya devem etmektedir.

Balıkçılık sektörü ve su ürünleri kooperatiflerinin ticari ve ekonomik verimliliğini artırabilmek için kısa, orta ve uzun vadeli stratejilerin geliştirilmesi ve sorunların çözümü konusunda yasal düzenlemelerin bir an önce yapılması kaçınılmazdır. Balıkçılığın ticari ve ekonomik olarak sürdürülebilir olması açısından yasal düzenlemelerin yapılması, kooperatifler ve balıkçılıkla ilgili temel problemlerin kamu otoritesi tarafından çözümlenmesi, doğal stokların ve balıkçılık kaynaklarının iyi yönetilmesi, kooperatiflerin ve balıkçıların kullandıkları av araç-gereçlerinin konuşlandığı yer olan balıkçı limanı ve liman içinde kullanacağı fiziki alanların düzeltilmesi öncelik taşımaktadır.

Şüphesiz kooperatifçiliğin ve balıkçılığın gelişmesinde devletin sağladığı desteğin önemli bir payı vardır. Bu desteklerin başında da koruma-kontrol ve balıkçılıkla ilgili altyapı yatırımlarının yapılması, vergi muafiyeti ve istisnaları gelmektedir. Ülkemizde kooperatiflere Kurumlar Vergisi ve Katma Değer Vergisi kanunlarında çeşitli istisnalar sağlanmakta olup bunun sürdürülebilir hale getirilmesi ekonominin kayıt altına alınmasına da yardımcı olacaktır.

Sıralanan bu sorunların giderildiğinde kooperatif organizasyonu ile avcılıktan elde edilen su ürünlerinin pazarlanması sonucu balıkçı açısından elde edilen ekonomik kaynak ticari olarak değerlendirilecek ve ülke, bölge ve İstanbul ili ve balıkçılıkta istihdam edilenlerin sosyo-ekonomik gelişmişliğine katkı sağlayacaktır.

Teşekkür

Bu çalışmanın yapılması esnasında anketleri doldurarak kooperatifleri ile ilgili bilgileri verip çalışmanın yapılmasına katkı sağlayan İstanbul su ürünleri kooperatifleri başkan ve yöneticilerine teşekkür ederim.

Tablo 4. İstanbul İli su ürünleri kooperatiflerinin ileriye dönük projeleri.
Table 4. Prospective projects of the cooperatives of Istanbul province.

Kooperatif Adı	Liman ihtiyacı	Mendirek ve çekek yeri yapımı ve uzatılması	Limanın Kiralanması	Av araç gereç yerinin ve buzhane yapımı	Balık satış yeri yapımı ve ruhsat alımı	Balıkçılar için sosyal alan yapmak	İşleyerek ve pişirerek balık satmak	Ortakların sosyo-ekonomik durumunu düzeltmek	Koruma kontrol hizmetlerini geliştirmek	Balık yetiştiriciliği, turistik olta balıkçılığı ve dalyan kurma
Adalar Su Ürünleri	+	+	-	-	-	-	-	-	-	-
Ağva Su Ürünleri	-	-	-	-	+	+	-	+	-	-
Ahırkapı Su Ürünleri	+	+	+	-	+	-	-	+	-	-
Anadolufeneri Su Ürünleri	+	+	-	+	+	-	-	-	-	-
Anadoluhisarı Su Ürünleri	-	-	-	-	-	-	-	-	-	-
Anadolukavağı Su Ürünleri	+	+	-	-	+	-	-	-	-	-
Avcılar Su Ürünleri	-	-	-	-	-	-	-	-	-	-
Beykoz Su Ürünleri	-	-	-	-	-	-	-	+	-	+
Beyoğlu Su Ürünleri	-	-	-	-	-	-	-	-	-	-
Bostancı Su Ürünleri	-	-	+	-	-	-	-	+	+	-
Burgazada Su Ürünleri	-	-	+	-	-	-	-	-	-	-
Büyükada Su Ürünleri	-	-	-	-		-	-	-	-	-
Büyükçekmece Su Ürünleri	+	+	+	-	+	-	-	-	-	
Caddebostan Su Ürünleri	-	-	-	-	-	-	-	-	-	-
Çengelköy Su Ürünleri	+	+	+	-	-	-	-	+	-	-
Eminönü Su Ürünleri	+	+	-	-	+	-	-	-	-	-
Eyüp Su Ürünleri	-	+	-	-	-	+	+	-	-	-
Fatih Su Ürünleri	-	+	-	+	+	-	-	-	-	-
Garipçe Su Ürünleri	-	-	-	-	-	-	-	-	-	-
Güzelce Su Ürünleri	-	-	-	-	-	-	+	-	+	+
İstanbul Balık Müstahsilleri Su	-	+	+	+	+	+	+	+	-	-
İstinye Su Ürünleri	-	-	-	-	+	-	-	+	+	-
Kadıköy Su Ürünleri	-	-	-	-	-	-	+	-	+	+
Karaburun Köyü Su Ürünleri	-	+	+	-	+	-	-	+	-	-
Kartal Su Ürünleri	-	-	-	-	-	-	-	-	-	-
Kınalıada Su Ürünleri	+	+	-	-	-	-	-	+	-	-
Kireçburnu Su Ürünleri	+	+	-	-	+	-	-	-	+	-
Küçükçekmece Su Ürünleri	-	+	+	+	+	-	-	+	-	-
Küçükmustafapaşa Su Ürünleri	-	-	-	+	+	+	-	+	-	-
Küçükyalı Su Ürünleri	-	-	-	+	-	-	-	+	-	-
Mimarsinan Su Ürünleri	-	-	-	-	-	-	-	+	-	-
Ortaköy Su Ürünleri	+	+	+	-	+	-	-	-	-	-
Pendik Su Ürünleri	+	+	-	-	+	-	-	-	+	-
Poyraz Su Ürünleri	-	-	-	-	+	+	-	+	-	-
Riva Su Ürünleri	-	-	-	-	+	+	-	-	-	-
Rumelifeneri Su Ürünleri	-	-	-	-	-	-	-	-	-	-
Rumelikavağı Su Ürünleri	-	-	-	+	-	-	-	+	-	+
Sarıyer Su Ürünleri	+	+	-	+	+	-	-	+	-	-
Selimiye Su Ürünleri	-	+	+	-	+	-	-	-	+	-
Selimpaşa Su Ürünleri	-	-	-	+	+	-	-	+	+	-
Silivri Su Ürünleri	+	+	+	+	-	-	-	+	-	-
Şile Su Ürünleri	-	-	-	+	+	-	+	+	-	-
Tuzla Su Ürünleri	-	+	-	+	-	-	-	+	+	-
Üsküdar Su Ürünleri	-	-	-	-	-	-	-	-	+	+
Yeniköy Su Ürünleri	-	+	-	+	-	-	-	+	-	-
Yeşilköy Su Ürünleri	-	-	-	-	-	-	+	-	-	-
Zeytinburnu Su Ürünleri	-	-	-	+	+	-	+	-	-	-
Zeytinlik Su Ürünleri	-	-	-	-		-	+	-	-	-
Oransal Değer (%)	**27.1**	**43.8**	**22.9**	**29.2**	**45.8**	**12.5**	**16.7**	**43.7**	**20.8**	**10.4**

(+): var, (-): yok

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