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Research Article
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Using Smart Packaging in Fish and Fish Based Product

Akıllı Ambalaj Teknolojisinin Su Ürünlerinde Uygulanması

Türk Denizcilik ve Deniz Bilimleri Dergisi Cilt: 2 Sayı: 1 (2016) 8-18

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ABSTRACT

Food packaging have three main roles during protection, preservation and storage are still involved better continuance of food quality. Evolution of civilization and improvement of new kind of foodstuffs, packaging industry must create new possibilities for preventation of food quality during shelf-life. The quality and safety of perishable food is related to microbial quality has got a significance role. Fish is a very perishable food product. It is a very low acidic food and thus is very liable to the expansion of food poisoning bacteria. Also decomposition of fish can be by reason of enzymatic spoilage, oxidation and/or bacterial spoilage. Fish is an important resource of polyunsaturated fatty acids stated to have defensive effects in opposition to heart-connected diseases. Some smart packaging mechanisms liable to determine this break down incident thought storage. In this review, smart packaging technologies that could be used to detect breakdown compounds from packed fish and fish products.

Keywords: Smart packaging, fish, Storage, Quality

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ÖZET

Gıda ambalajlarının gıda kalitesinin korunmasında önleyici, koruyucu ve depolama süresinde kalitenin korunması gibi üç temel görevi vardır. Globalleşmenin artması ve yeni türlerde gıda maddelerinin gelişmesiyle birlikte, ambalaj endüstrisi gıda kalitesinin depolama süresi boyunca korunması için yeni uygulamalar araştırılmaktadır. Bozulmaya karşı hassas gıdalarda kalitenin korunmasında mikrobiyal kalite son derece önemli yer tutmaktadır. Balık eti bozulmaya karşı hassas gıdalar arasındadır. Düşük aside sahip bir gıda olması sebebiyle gıda zehirlenmelerine neden olan bakterilerin oluşumuna imkan sağlayacak gıdalar arasında yer almaktadır. Ayrıca balık ürünlerinin bozulması, enzimatik yıkım, oksidasyon ve/veya bakteriyel bozulma nedeniyle gerçekleşebilmektedir. Su ürünleri çoklu doymamış yağ asitleri kaynağı olması sebebiyle kardiyovasküler hastalıklara karşı etkili olabilmektedir. Bazı akıllı ambalaj uygulamaları su ürünlerinin depolanması sırasında meydana gelen bozulmalara karşı duyarlıdır ve belirlenmesinde görev almaktadır. Bu derlemede, akıllı ambalaj teknolojisinin su ürünleri sektöründe uygulama olanaklarını incelenmiştir.

Anahtar sözcükler: Akıllı paketleme, Su ürünleri, Depolama, Kalite

1. INTRODUCTION

Smart Packaging

Usual food packaging is supposed for defendion, communication, applience and containment (Paine, 1991; Robertson, 2006). The package is used to defend the product from the deteriorative effects of environmental factors like light, heat presence or absence of humidity, microorganisms, pressure and etc. The main safety purpose for traditional packaging items which comes in connection with food is to be motionless as possible. Smart packaging that include active and intelligent packaging systems, are based on the functional contact between packaging environment and food. Increased understanding of health and environmental consumer definitely contributed to the growing necessity for used food packaging. Novel food packaging applications are developing as a response to consumer requires and industrial production tendency towards gently preserved, fresh, tasty and appropriate food products with extended shelf-life and controlled quality parameters. In addition, variations in trading and consumers demands are present main challenges to the food packaging industry and perform as precursor for the development of innovative packaging thought that prolong shelf-life while keeping up and checking food safety and quality (Dainelli et al., 2008; Bilska 2011). Yam et al. (2005) explain a package is “smart” if it has the capability to trail the product, substance the nature in or out the package, and connect with the customer. For instance, an intelligent package is individual that can control the quality and safety of a food and give early caution to the customer or food producer. Intelligent packaging consigns to a package that can significance environmental variations. (Summers, 1992). Other researcher described smart packaging as having two groups: basic smart packaging (Summers, 1992) and interactional or receptive smart packaging (Rodrigues and Han, 2003).

New concepts of active and smart packaging are due to play an increasingly

significant role by offering numerous and innovative solutions for extending the shelf-life or maintain, improve or ensure food quality and safety (Gontard, 2006). Therefore, there is an exceptional interest among the food industry, trader, customer, and their related parties in developing a way that is easy, cheap, rapid, trusty and non-destructive to asses real-time freshness of food products (Kuswandi et al., 2012). An alternative application to attend to this necessity is the improvement of smart packaging in the form of a food spoilage indicator to observe freshness of products (Potyrailo et al., 2012).

For this purpose, various others concepts such as time/temperature and oxygen indicators ethanol emitters which was used for bakery products, ethylene absorbers (e.g. for climacteric fruits), carbon dioxide emitters/ absorbers, have been developed. Smart packaging is an up-coming technology that uses the interaction action of the package to promote judgment with purpose of provides the benefits of improved food safety and quality. Smart packaging is described as a structure that monitors the situation of packaged food to give information about the quality throughout storage, transport and marketing. (Yam et. al., 2005). The possibility of smart packaging technology is, ranging from food safety monitoring to reach the consumer. (Butler, 2004).

Principle of Smart Packaging

In packaging industry, “smartness” can have lot of explanations, and obscures some usefullies, based on the product being packaged – food, pharmaceutical, beverage and home product Examples of current and future functions that are considered to have “smartness” would be packages that: by prevent foods spoilage actively and extend shelf life of products, improve product look, aroma, taste characteristic. React dynamically to changes in product and/or in the package surroundings, for consumer give connect about product information, product history and other conditions (Han et al., 2005).

In smart packaging applications, indicators are described smart or interactive because they interrelate with components in the food. The smart packaging concentrate on sense and report the position of a product in term of its safety and quality Consumers increasingly need to know food security promise, particularly for perishable food products as fish. In the future, microbial augmentation and time–temperature optical indicators (TTIs) rooted on chemical, physical and/or enzymatic activity in the food products will provide an obvious, truthful and unmistakable suggestion of quality, protection and storage condition.

In this review, the importance of the application of smart packaging methods that provide communications between consumer and product, for fish and fish based products are described.

2. SMART PACKAGING IN FISH INDUSTRY

Fish is a highly vulnerable food which freshness and quality rapidly refuse post-mortem. Damage of freshness and spoilage of fish are complex processes, and several factors such as species and storage situations the spoilage pattern. For many years, the development of dependable methods to measure fish freshness and to determine quality parameter has been the aim of fish research (Di Natale et al., 2001; Gil et al., 2008). The present methods used in the food industry to control fish shelf life are founded on physical, chemical, microbiological and sensory parameters

(Ólafsdóttir et al., 2004). While, some of these methods are expensive, prolonged and need skilled personnel as an alternative, the development of rapid, cheap and easy quality control techniques, which can be applied at any period of the supply chain, is of much significance (Pons-Sánchez-Cascado et al., 2006). A possible resolution to this matter is to invent smart or intelligent packaging able to giving information about quality of fish and seafood products.

There are three types of indicators about smart packaging as external indicators, which are appended external the package, and contain time temperature indicators and physical disturb indicators. Secondly internal indicators, which are located inside the package-located in the headspace of the package or close to the lid as microbial indicators and oxygen leak indicators (Ahvenainen, 2003). Lastly, indicators that using special bar codes that stored food knowledge as use, consume during marketing (Coles et al., 2003).

2.1. Sensors

A sensor can be defined as a device used to find, place or measure energy or trouble provide a signal for the finding or dimension of a physical or chemical characteristic to which the equipment responds (Kress-Rogers, 1998; Kerry et al., 2006). Sensors give permanent output of indicator. Most of sensors include two major functional section, a transducer and a receptor.

2.1.1. Biosensor

Biosensors are generally worked to find, pick up and spread information pertaining to biological response (Yam et al., 2005). Biosensors include two parts as bio-receptors and transducers (Alocilja and Radke, 2003). The bio-receptor realize the goal analyze and the other part, transducer changes biochemical signals addicted on experimental electronic reaction (Yam et al., 2005). Transducers may be of visual, aural or electro-chemical. The bio-receptors may be both raw and natural materials like nucleic acid, enzyme, antigen, hormone, microorganisms.

Some researchers developed a biosensor for the detection of biogenic amines created owing to the by amination and transamination of aldehydes-ketones caused by microbial achievement or decarboxylation of amino acids. Pospiskova et al. (2013). This biosensor may useful for fish and fish-based products. The other biosensor that used in animal tissue for the finding of xanthine, as oxidation product was developed by Arvanitoyannis and Stratakos (2012) by check of xanthine oxide on the electrodes prepared of materials such as silver, platinum and pencil graphite (Devi et al., 2013; Dolmaci et al., 2012; Realini and Marcos, 2014).

Opto-chemical sensors are worked to detect the property of food products by impressioning gas analyte as volatile amines, hydrogen sulphide and carbon dioxide (Wolfbeis and List, 1995). The opto-chemical sensing process are of three types taking in fluorescence based structure with a pH susceptible pointer, absorption based colourimetric sensing and energy transport attitude using phase fluorimetric recongnition (Neurater et al., 1999; Mills et al., 1992). pH sensitive stains can be used to improve sensors for the finding of basic volatile amines in fish, meat and poultry. Using for this purpose using indicators based on methyl red/cellulose membrane, curcumin/bacterial cellulose membrane react during observable colourimetric variations to volatile amines relief during fish spoilage (Kuswandi et al., 2012,

2014). Ocular oxygen sensors are been explained by Papkovsky et al. (2002). Such systems are based on the theory of luminescence slaking or absorbance changes due to direct communication with the analyte.

Gas sensors are used for finding the existence of gaseous analyte in the package. It contains carbon dioxide sensors, oxygen sensors, water steam sensor, ethanol sensor, metal oxide semi-conductor ground effect transistors, organic handling polymers and piezoelectric crystal sensors (Kress-Rogers 1998, Kerry et al. 2006).

2.1.2. Chemical sensor

The chemical sensor or the receptor is a chemical sensitive covering ability of finding the incidence/ absence activity, structure, levels of specific chemical or gas through plane adsorption. Occurrence of specific chemicals are being monitored and changed into signals by transducer. Transducers are of both active and passive based on the exterior power necessity for controlling (Vanderroost et al., 2014). Nano- based sensors can be used to find chemical contaminants, product tampering, pathogens, spoilage, or track components during the processing chain (Nachay, 2007; De-Azeredo, 2009; Liu et al., 2007). Current develop in sensors are the use of visual transducers which do not require the electrical power and it can be state formally from an expanse by using visible or light. (Yebo et al., 2012).

2.1.3. Electronic nose

Electronic nose structure used to imitate the mammalian olfactory system within in a mechanism created to acquire repeatable dimension consenting to identification and categorization of aroma combination existing in the odour. It creates a single reply to each flavour or smell. Nose system include of a collection of both chemical and biosensors with limited specificity and statistical technique allowing the detection of simple of complex (Gardner and Bartlett, 1993; Vanderroost et al., 2014). Some researches using electronic nose structure to be successful in the quality assessment of fresh yellowfin tuna and vacuum packed beef (Blixt and Borch, 1999; Dobrucka and Cierpiszewski, 2014). Gomez et al. (2006) studied e-nose that determine the volatile compounds produced during tomato storage. Rajamaki et al. (2004) researched the quality of modified atmosphere packed broiler chicken cuts using electronic nose. The electronic nose results were compared with those obtained by the instrumental head space gas composition, microbiological analysis and sensory analysis. The e-nose could obviously different the chicken packages with decline from fresh packages.

2.2. Indicators

A part of smart packaging, fish freshness-meter is a system (or material) which general uses metabolites as “information” to monitor the position of fish freshness that can be completely related to fish spoilage. Currently, published work about fish freshness or fish spoilage indicators is limited even. Some publications have constructed indicators for the volatile compounds produced in microbial spoilage. For example, some researchers progressed a colorimetric dye-based sensor and marker for determining fish spoilage on the basis of the due to total volatile basic nitrogen (TVBN) by way of this on-package sensor envelops a pH responsive dye, bromocresol green, fall into a polymer medium (Byrne et al., 2002; Pacquit et al., 2006, 2007). General using of indicators which a part of smart

packaging, is develop to the preservation of packaged fish and extending shelf life involves oxygen removal, temperature control, moisture control, addition of chemicals as natural acids, salt, sugar and carbon dioxide or a combination of these with useful packaging (Robertson, 2006; Restuccia et al., 2010).

Using pH dye, it responses to the pH change is affected by temperature, mainly when it is used in a frozen stat. As such there is a need to explore alternative methods for detection of fish freshness using indicator/sensor that is free from leaching, accurate, simple, low-cost, rapid, reliable, consumer friendly and non-invasive to evaluate the real-time fish freshness. One way to meet this requirement is that of the improvement of an easy freshness colour indicator in the form of packaged sensor marks that determine spoilage in fish and seafood. Volatiles amines as ammonia (NH3), trimethylamine (TMA) and dimethylamine (DMA) give to a quantity known as total volatile basic nitrogen (TVB-N) and are the typical matter prone for the fishy odour and flavour (EU Directive 95/149/EEC). There are some main indicators using in smart packaged fish and fish-based products.

2.2.1. Time–temperature indicators

The temperature changes occur in a food can cause changes in product quality and safety. The time temperature integrator or indicator (TTI) can be described as an easy, cheap way that can demonstrate an easily quantifiable, based on time-temperature change that indicate the full or incomplete temperature record of a food product to which it is attached (Taoukis and Labuza, 1989).

The principle of TTI process is an unalterable mechanical, microbiological chemical or enzymatic change, usually articulated as an obvious reply in the way of a mechanical distortion, colour improvement or colour transfer (Taoukis, 2008). TTIs may be categorized as both incomplete and full history indicators, based on their reaction mechanism as Critical temperature indicators (CTI) show communication over or under a reference temperature. Time temperature integrators or indicators (TTI) give a permanent, temperature dependent reply during the product's past. Likely fish, having high protein rate denaturation is an important parameter and containing above the critical temperature or expansion of a pathogenic microorganism is other important cases where a CTI would be useful. Critical temperature/time integrators (CTTI) are practical in suggesting failure in the circulation chain and for products in which response, important to quality or security, are began or happen at quantifiable rates over a critical temperature. For instance, such reactions are microbial growth or enzymatic activity that is inhibited below the critical temperature. The response rate and temperature dependence is controlled by the tag configuration, the diff using polymer's concentration and its glass transition temperature and can be set at the desirable range (Ahvenainen and Hurme, 1997; Taoukis, 2008; Selman, 1995; Taoukis and Labuza, 2003)

For chemical or physical response, it is based on chemical reaction or physical change towards time and temperature, such as acid–base reaction, melting, polymerization, etc. While for biological response, it is based on the change in biological activity, such as microorganism, spores or enzymes towards time or temperature (Otles, Yalcin, 2008; Kuswandiet al., 2011). The rate of change is temperature dependent, increasing at higher temperatures similarly

to the deteriorative reactions responsible for product quality deterioration.

2.2.2. Freshness Indicators

Escaping indicator to package ensures package reliability during the production and marketing chain. Ocular oxygen indicators in MAP foods with low first oxygen are researched by Davies and Gardner (1996); Mattila-Sandholmand et al. (1995). Ocular oxygen indicators by means of redox dyes vary its colour with changes in oxygen level. Oxygen breaks through outflow may also be expend by the natural microorganism present in the food (Mattila-Sandholmand et al., 1998). A commercial oxygen indicator tablets which suggest the occurrence or nonappearance of oxygen by colour change. It implies the lack of oxygen (<0.01 %) by turning pink. At oxygen intensity of 0.5 % or further, the tablet turns blue. The occurrence of oxygen will be showed in a few minutes (Mitsubishi Gas Chemical 2014). The other commercial product has revealed reversible and non-reversible oxygen indicator brands for the optical suggestion of pack reliability (EMKO packaging, 2013).

2.3. Data Carriers

Data carrier, also recognized as mechanical detection devices, give information during food trade chain more efficient, to the advantage of food quality and protection (McFarlane and Sheffi, 2003). Furthermore, data carriers are more often locate on to tertiary packaging as multi-box containers, shipping, pallets, large packages. The most significant data carrier mechanism in the food packaging industry are barcode labels and RFID marks, which owned by the main group of expediency-enhancing intelligent systems (Robertson, 2012).

2.3.1. Barcodes

Because of their low cost and easily using, barcodes have been progressively used in the important trade and save to possible record control, stock rearrangement, and inspect (Manthou and Vlachopoulou, 2001). A barcode is a prototype of parallel areas and bars set up to represent 12 digits of data. The encoded information is read by an optical barcode scanner that sends the information to a system where it is stored and processed (Han, 2013). Reduced Space Symbology (RSS) barcodes were cultivated sequentially to encode more data in a smaller space.

2.3.2. Radio-frequency identification systems

An RFID structure contains three major components: a label formed by a microchip attached to a tiny antenna; a reader that emits radio indicator and receives answers from the label in return; (Kumar et al., 2009; Sarac et al., 2010). While RFID technology was well known extensively, the market diffusion has lagged following barcodes, cause of high cost (Preradovic and Karmakar, 2012). However, RFID technology should not be considered as a replacement for barcodes. Current applications of RFID tags, have different applications in the food industry, such as product classification and suggestionability (Hwang et al., 2015), cold chain observing (Badia-Melis et al., 2015), livestock administration (Ariff et al., 2014), and forecast shelf life of food product (Uysal et al., 2011). Using RFID technology for determine shelf life of fish and fish based product will significant invention in future.

3. CONCLUSION AND FUTURE DEVELOPMENTS

Changes in consumer favourites have cause to advances and improvements in novel packaging technologies. Smart packaging is useful for giving product information about quality during shelf life of treated or un-treated food products. Generally using sensors, biosensors, indicators as time-temperature and integrity, most preferable mechanisms. Use of time temperatures indicators can facilitate optimize product allocation, improve shelf life quality, monitoring and administration of food and thus decrease product waste from foodstuffs. With the aim of forward the attendance difference between potential and awareness of smart packaging applications is not well-known. Further modelling of the communications between foods and microorganisms under storage conditions. The potential advantages of smart packaging for muscle-based foods are changed. Imagining smart packaging can effectively supply solutions to current producer and costumer necessity, it emerges likely that smart packaging structure for muscle-based food as fish and fish based product will become more commercially feasible and common-place in future.

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Research Article
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Specialization and Flexibility in Port Cargo Handling

Liman Yük Elleçleme Donanımında Uzmanlaşma ve Esneklik

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ABSTRACT

Cargo handling appears to be the fundamental function of ports. In this context, the question of type of equipment and capacity rate need to be tackled with respect to cargo handling principles. The purpose of this study is to discuss the types of equipment to be used in ports, relating the matter to costs and capacity. The question is studied with a basic economic theoretical approach. Various conditions like port location, size, resources, cargo traffic, ships, etc. are given parameters to dictate the type and specification of the cargo handling equipment. Besides, a simple approach in the context of cost capacity relation can be useful in deciding whether to use specialized or flexible equipment. Port equipment is sometimes expected to be flexible to handle various types of cargo as many as possible and sometimes to be specialized to handle one specific type of cargo. The cases that might be suitable for those alternatives are discussed from an economic point of view in this article. Consequently, effectiveness and efficiency criteria play important roles in determining the handling equipment in ports

Keywords: Port, Flexibility, Specialization, Cargo handling equipment

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ÖZET

Yük elleçleme, limanların en temel fonksiyonu olarak karşımıza çıkmaktadır. Bu bağlamda, yük elleçleme ilkeleri doğrultusunda hangi donanımının, ne kapasitede ve ne tür olması gerektiği sorunsalı ise çözümü bekleyen bir konudur. Bu çalışmanın amacı, limanlarda ne tür yük elleçleme donanımı kullanılabileceği konusu; maliyetler ve kapasite ilişkisi kurularak tartışılmasıdır. Konu, temel ekonomik teorik bir yaklaşımla irdelenmiştir.Limanın yeri, kaynakları, yük trafiği, gemiler, vb. türlü koşullar, kullanılacak olan elleçleme donanımının tür ve özelliklerini dikte etmesi bakımından bir veridir. Öte yandan, kapasite-maliyet ilişkisi çerçevesinde uzmanlaşmış mı yoksa esnek donanım mı kullanılacağı konusuna yalın bir yaklaşım faydalı olabilir. Elleçleme donanımının kimi zaman esnek - olabildiğince farklı türdeki yükleri elleçleyebilen - kimi zaman da uzmanlaşmış – tek çeşit yüke hizmet veren – yapıda olması istenir. Hangi durumlar için bu seçeneklerin uygun olabileceği bu çalışmada ekonomik bir bakış açısıyla tartışılmaktadır. Sonuç olarak, donanımın belirlenmesinde etkililik ve etkinlik ölçütleri rol oynamaktadır.

Anahtar Kelimeler: Esneklik, Liman, Uzmanlaşma, Yük elleçleme donanımı

1. GİRİŞ

Küresel rekabet ortamında işletmelerde yürütülen faaliyetlerin etkin, yüksek verimlikte ve etkili bir biçimde sürdürülmesi kaçınılmazdır. Bu bağlamda, liman işletmeleri de en temel faaliyetleri olan yük elleçleme ve hareketlerinde kullandıkları donanımı; kendi iş hacimleri, gemi ve yük trafiği, iş emniyeti, maliyet, vb. başta olmak üzere çeşitli nedenlerle en uygun olanlarından seçerler. Böylelikle maddi kaynaklarını, faaliyet alanlarına ve kapasitelerine göre en uygun biçimde yatırıma ayırma ve tahsis etme olanağı bulabilirler. Donanım esnek yapıda seçildiğinde, farklı türde yükleri belli bir donanım ile etkili elleçleyerek tasarruf yapma olanağı bulunabilirken diğer yanda, uzmanlaşmış donanım ile yüksek miktarlarda tek tip yükte etkinlik ve ölçek ekonomileri sağlanmaktadır.

Kuşkusuz, ne tür yük elleçleme donanımının kullanılacağını dikte eden; liman ard bölgesi özellikleri ve doğal yapısı, makroekonomik koşullar, liman ve terminal türü, gemi ve yük trafiği, liman kapasitesi, sermaye, finansman, teknoloji ve yönetim yeterlikleri, politikalar gibi bazı etmenler bulunmaktadır.

Bu çalışmanın amacı, limanlarda ne tür yük elleçleme donanımının kullanılabileceği konusunu maliyetler ve kapasite ilişkisi kurularak teorik bir yaklaşımla irdelemektir. Çalışmada, hangi durumlar için hangi seçeneklerin uygun olabileceği ekonomik bir bakış açısıyla tartışılmaktadır. Ekonominin, kurumlardaki karar vericilerin ellerindeki kıt kaynakları amaçlarına azami fayda yaratacak şekilde nasıl tahsis ettiğini anlamaya çalıştığı (Cansen, 2015) gerçeğinden hareket edilmiştir. Uzmanlaşmış mı yoksa esnek donanım mı kullanılacağı konusuna kapasite-maliyet ilişkisi çerçevesinde yalın bir yaklaşım, ilgili alanda öğrenim görenler, yatırımcılar ile karar alıcılar açısından faydalı olabilir.

1.1. Yük elleçleme ve donanım

Yük elleçleme, terminallerde gemi ya da diğer taşıt araçlarına yapılan yükleme, araçlardan yük boşaltma ile liman istif

sahaları ile depolarına/depolarından gerçekleştirilen tüm yük hareketlerinin planlanması, örgütlenmesi, eşgüdümü, icrası ve denetimini kapsar. Etkili ya da etkin bir yük elleçleme için en uygun donanımın seçilmesi ve kullanılması aşağıda verilen elleçleme ilkeleri göz önüne alınarak gerçekleştirilebilir.

1.1.1. Yük elleçleme ilkeleri

Yük elleçleme ilkelerini dört temel ana başlık altında toplamak olasıdır. Bunlar; emniyet, güvenlik, etkinlik ve çevre duyarlılığıdır. Her biri için yapılması gerekenler aşağıda ayrıntılı olarak verilmiştir (Kişi, 2000 - 2014).

1.Emniyet

a.Yüke uygun ve yüke özel elleçleme donanımı kullanma
b.Donanımın kaldırma, uzanma ve salınım kapasitelerine dikkat etme
c.Ağırlık merkezi, ambalajının içeriği, vb hakkında yükün işaretlenmesi ve etiketleme
d.Yükün istifi sırasında kayma ve devrilmeleri önlemek için takozlama ve bağlama
e.Tehlikeli yüklerin taşınmasında IMDG vb kurallara uyma
f.Bozulma, kızışma, kimyasal tepkime olasılığına karşı yükün suyla temas etmemesine dikkat (örn. yağmur yağarken elleçlemenin durdurulması)
g.İstiflenen yüklerin ağır-hafif, kuru-ıslak, pis-temiz, kokulu-duyarlı şeklinde ayrılması (segregasyon)
h.Yük işlem alanlarının temizlik ve düzenliliği
i.Yangın söndürme donanımı vb diğer donanımın acil kullanıma hazır tutulması
j.Çalışanların iş başı eğitimi, sertifikalandırılmaları, özenli davranış ve iş ciddiyeti
k.Tüm personelin etkili iletişimi
l.Acil durumlar için hazırlıklılık ve tatbikatlar
m.Çalışma ve dinlenme zamanlarına gereken dikkat

2.Güvenlik

a.Çitler, kapılar ve güçlü aydınlatma gibi fiziksel engeller
b.İzleme ve gözetim
c.Kimlik kontrolü ve ziyaretçi defteri kayıtları
d.Bilgili, eğitimli ve donanımlı devriye örgütlenmesi
e.KDTV, detektör, x-ışını gibi teknolojik donanımdan yararlanma
f.Düzenli sayım ve Puantaj
g.Uluslararası Gemi ve Liman Güvenlik (ISPS) kurallarına uyum (Lloyd's Register / UK P&I Club, 2010).

3.Etkinlik

a.En uygun (optimal) donanım kullanımı ve teknolojiden yararlanma
b.Operasyon sürelerinin en aza indirilmesi ve yük hareketlerinin hızlandırılması için Uzmanlaşma
c.Verimliliğin sürekli geliştirilmesi ile ölçek ekonomileri yaratılması
d.Sadeleşme ve standardizasyon
e.Bakım-tutum programları
f.İş başı eğitimleri ve çalışanların motivasyonu
g.Doğru yükün doğru zamanda doğru yere teslimi için yüklerin hattına, ithal-ihraç oluşuna, gideceği yere, türüne, alıcısına-göndericisine göre ayrılması

4.Çevre duyarlılığı

a.Acil durum planlaması ve risk yönetimi
b.İlgili kamu ve özel kurumlarla eşgüdüm
c.Yerel, bölgesel ve ulusal acil müdahale planlarına uyum
d.Yükün etrafa yayılıp saçılmaması için doğru elleçleme donanımı kullanımı

e.Su üzeri petrol ve yağ yayılmasını engelleyen bariyerler, sıyırıcı ve çözeltici köpük ve kimyasalların hazır tutulması
f.Araçlar ve donanımın egzoz salım ölçümleri
g.Çevresel gürültünün değerlendirilmesi ve yönetimi yönetmeliğine uyum
h.Eğitimli, çevre duyarlılığı ve bilinci gelişmiş personel
i.Kirliliğin boyut ve türünü saptamada örnek inceleyecek Laboratuar
j.Yeşil liman olabilme ölçütlerini karşılayabilme (UDHB, 2015).

1.2. Yük elleçleme donanımının sınıflandırılması

Limanda yük elleçlemede kullanılan donanım, belli özelliklerine ve kullanım alanlarına göre 4 ayrı sınıfa ayrılabilir (Kişi, 2000-2014). Bunlar; vinçler, istifleyici-yükleyici-taşıyıcılar, kesintisiz aktarma sistemleri ve diğer araçlardan oluşmaktadır.

Vinçler: Sahil vinçleri ve Maçuna-yüzer vinç gibi rıhtım ya da gemiye bitişik alanlarda yer alan, gemi ile kara ya da başka bir gemi arasında yükün aktarılmasında kullanılan, kaldırma, uzanma ve salınım yetenekleriyle öne çıkan donanımdır. Sahil vinci ve yüzer vinçler; sapan, kapma, kepçe vb gibi çeşitli eklentiler bağlanarak kuru dökme, karışık eşya, palet, varil, balya vb çok farklı türde yükü elleçleyebilen (Alderton, 1999) esnek yapıda donanımlardır. Ancak, yine bu grupta yer alan köprü vinçler (gantry crane) önlük (apron) denilen alanda etkin bir biçimde yüklük (konteyner) elleçleyebilen uzmanlaşmış donanımlardır.

İstifleyici - yükleyici ve taşıyıcılar: Ayrık bacak taşıyıcılar (stradle carrier), Saha köprü vinçleri, Çatal yükleyiciler, Üstten yükleyiciler (top lift), Çekici ve dorseler gibi özellikle yüklük istifleme ve saha içinde taşımada kullanılan donanımlardır. Bu gruptaki ayrık bacak taşıyıcı ve saha köprü vinci ve üstten yükleyiciler özellikle yüklük elleçlemesinde kullanılan uzmanlaşmış donanımlardandır. Çatal yükleyiciler, farklı boy ve kapasitede olanları bulunmakla kapalı depolarda ve ambarlarda hatta yüklük içinde de kullanılabilmesi ve paletli yükler, sandık, balya, paket vb yükleri elleçlemede yararlanılan çok amaçlı esnek donanımlardandır.

Kesintisiz aktarma sistemleri: Boru hattı, emici (pnömatik) sistemler ve yürüyen bant gibi daha çok akıcı maddelerin ve tahıl gibi taneli, kömür, cevher gibi parçalı dökme yüklerin belli noktalar arasında sürekli taşınması ve yığılmasında kullanılan donanımlardır. Emici sistem ve yürüyen bant; dozer, huni, kepçe gibi yardımcı donanım ile beslenme ve desteklenme gereksinimi duyar. Petrol, yağ ve çeşitli kimyasal sıvı yükler için kullanılan boru hatlarının ayrılmaz parçaları ise pompa ve vanalardır. Bu grup donanımın uzmanlaşmış, tek çeşit yüke hizmet veren yapıda olduğu görülmektedir.

Diğer araçlar: Çek-it (deniz römorkörü), dozer, çekici, römork, şase / dorse gibi liman içinde çeşitli yük ve araçların hareket ettirilmesinde kullanılan araçlardır. Elleçlenen yük çeşitliliği bakımından esnek türde donanımlardır. Dozerlerden gerek sahada, gerekse ambarlarda kuru dökme yüklerin yayılması yada yığın halinde toplanmasında yararlanılmaktadır.

1.3. Yük elleçleme donanımını belirleyen genel etmenler

Genel olarak, bir limanda kullanılacak olan yük elleçleme donanımının türünü belirleyecek olan etmenler iki grupta toplanabilir. Bunlar; ekonomiye ilişkin

olan ve ekonomiye ilişkin olmayan fiziksel ve diğer etmenlerdir (Kişi, 2009).
Ekonomik etmenler; yatırım maliyeti, işletme maliyeti, limanın finansal kaynakları, finansman biçimi, hükümetlerin ekonomi politikaları, sistem etkinliği, uzmanlaşma, kapasite ve rekabet koşullarıdır.
Diğer etmenler; limanın alan ve ard alan özellikleri, terminal tasarımı, yük türü, gemi türü ve geminin donanımı, teknoloji, fiziksel dağıtım biçimleri, iş emniyeti ve işçi sağlığı, güvenilirlik, güvenlik, esneklik, kullanım ömrü/dayanıklılık, bakım-tutum, servis, değiştirme olanağı, alternatif sistemler, gel-git ve hava koşullarıdır.

2. YÜK ELLEÇLEME DONANIMINDA ESNEKLİK VE UZMANLAŞMA

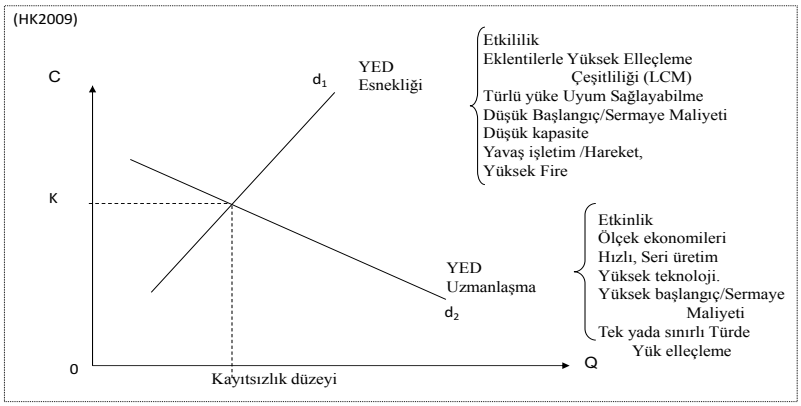
Etkinlik, ekonominin üç temel olmazsa olmazından biridir ve bunun kaynaklarından biri olan uzmanlaşma yoluyla verimlilikte büyük ilerlemeler elde edilebilir (Baumol ve Blinder, 1992). Seri üretim de uzmanlaşma ile başlar. Mekanizasyon ve standardizasyon ise seri üretimin diğer bileşenleri olarak verimliliğin arttırılmasına katkı sağlar (Boone ve Kurtz, 1996). Büyük hacimlerde işlem yapılan yüksek kapasiteli limanlarda yük elleçlemede düşük esneklik olanağı sunan uzmanlaşmış donanım kullanımı seri üretim – hızlı ve sürekli yük elleçleme için uygun olacaktır.
Öte yandan, esneklik ise işletmecinin işlem hacmi ve kapasitesinin düşük olması koşuluyla, farklı makinelere yatırım yapmadan ekonomi ve tasarruf yapılmasını sağlayacak maliyet etkili bir üretim biçimidir. Farklı bir üretim için mevcut sistemin hızla uyum sağlamasıdır (Boone ve Kurtz, 1996). Limanda belli bir donanımın farklı türlerde yükleri, gerektiğinde bazı eklentiler takılıp çıkarılarak elleçleyebilmesi esnekliği sağlamaktadır. Aşağıda da örnekleri verilen yüksek esneklik derecesine sahip genel ya da çok amaçlı liman elleçleme donanımı bu kapsamdadır.

Tablo 1. Gemi ve Donanıma Göre Yük Hareketleri/Elleçleme Esnekliği (Stopford, 2002).

GEMİ	YÜK	LİMAN DONANIMI
Tanker	Sıvı Dökme	Sahil Vinci
Kuru Dökmeci	Kuru Dökme	Yüzer Vinç (Maçuna)
Ro-Ro	Tekerlekli	Köprü Vinç
Araç Taşıyıcı	Büyük ve Ağır Proje Yükleri	Ayrıkbacak Taşıyıcı
Barç Taşıyıcı	Barç	Çatal Yükleyici, Üstten Yükleyici
Hücresel Yüklük (Konteyner)	Yüklük	Dorse, Çekici
Kombine Taşıyıcı (OBO)	Paletli	Yürüyen Bant
Açık Ambarlı Dökmeci (Conbulk)	Sapanlı	Boru hattı, Pompa
Geleneksel Yük Gemisi	Platform	Emici sistem

Yukarıdaki Tablo 1'de görüleceği üzere, bazı donanım türleri 1, bazıları da 2 veya daha çok yük türleriyle ile ilişkilendirilmiştir. Donanımın yük türleri ile ilişki düzeyi arttıkça esneklik katsayısı da artmaktadır. Burada en büyük esneklik değerinin sahil vincinde olduğu görülmektedir. Tabloda, gemi-yük hareketliliği esneklikleri, karışıklığı önlemek için verilmemiştir.

Kaynakların doğru, etkili ve verimli kullanılması açısından limanlarda yük elleçlemede yararlanılan donanımın esnek ya da uzmanlaşmış en uygun türünü belirlemede kullanılabilecek karşılaştırmalı ekonomik bir yaklaşım aşağıda Şekil 1'de grafik olarak verilmiştir. Tartışma bölümünde de konu ayrıntılı bir biçimde irdelenmiştir.



Şekil 1. Yük Elleçleme Donanımında ESNEKLİK ve UZMANLAŞMA: Donanım Türüne göre Yük Elleçleme Maliyeti & Miktarı İlişkisi

3. TARTIŞMA

Çeşitli yükleri elleçleyebilen '***esnek'*** yapıdaki donanım (sahil vinci, yüzer vinç, mobil vinç, çatal yükleyici, kapma, kepçe, vb) göreceli olarak yüksek bir ilk yatırım maliyeti gerektirmez. Ancak, verimlilikleri düşüktür. Elleçleme miktarı arttıkça bu gibi esnek donanımın eklenti - ataşman (sapan vb.) söküp takma nedeniyle zaman kayıpları, bazan da yüke uygun olmama nedeniyle yavaş kalması, hasar oranlarının artması ve fireler nedeni ile tazminat taleplerinin çoğalmasıyla maliyetleri yükselecektir. Esnek donanım ile elleçlenen yük miktarı arttırılmaya zorlandıkça maliyet artacaktır. Kapasitesi sürekli zorlanan donanım çabuk yıpranacak ve arızalar çıkaracaktır. Böylece işlerin aksaması, duraksamalar ve tamir için harcanan para ve zaman söz konusudur. Bu yüzden maliyet eğrisi şekil 1'de görüldüğü üzere oldukça dik bir pozitif eğime sahiptir. Dolayısıyla, esnek donanım maliyetiyle elleçleme miktarı doğru orantılıdır. Bu tür donanım, talebin

ve trafiğin az olduğu dolayısıyla fiili kapasitenin düşük olduğu tali limanlar için uygundur. Düşük kapasitedeki küçük liman veya terminallerde; yüksek elleçleme çeşitliliği ve farklı yük elleçlemelerine uyum sağlayabilmeleri nedeniyle, esnek donanım ekonomik ve etkilidir.

Sadece belli bir yük türü için tasarlanmış olan; örneğin, yalnız yüklükler (konteynerler) için köprü vinçler (gantry kreyn, transteyner), ayrık-bacak taşıyıcı (straddle carrier), yalnız tahıl için emici veya hava basınçlı (pneumatic) sistemler gibi '***uzmanlaşmış'*** donanım yüksek ve karmaşık teknolojileri ile yüksek başlangıç maliyetli sermaye yatırımları gerektirir. Hızlı, seri ve yüksek kapasitelerde çalışma olanağı ve yük hareketleri ile yüksek verimlilik sağlarlar. Söz konusu yükün trafiğinin yoğun olduğu limanlarda birim başına elleçleme maliyetini en düşük düzeylere çekerek *ölçek ekonomileri* sağlanır. Tüm bunların ışığında, donanımda uzmanlaşmanın maliyet eğrisi şekil 1'de gösterildiği gibi negatif bir eğime sahiptir. Uzmanlaşmış donanımın birim başına maliyeti ile elleçleme miktarı ters orantılıdır.

Kayıtsızlık düzeyi, esnek donanım kullanımı ile uzmanlaşmış donanım kullanımının maliyetlerinde ve elleçlenen miktarlarda eşitliğin olabileceği bir kapasite düzeyi olup, karar vericilerin bu noktada geleceğe yönelik gelişmeler ve eğilimler için öngörüleri ve kestirimleri yatırım konusunda rol oynayacaktır. Kayıtsızlık noktalarının altında bir liman kapasitesi ya da talep söz konusu ise uzmanlaşmış donanım için yüksek maliyete katlanmak akılcı olmayacaktır. Bu durumda esnek donanım kullanımı önerilir. Aksi halde, kayıtsızlık değerlerinin üzerindeki miktarlarda işlem hacmi bir liman için söz konusu ise uzmanlaşmış yük elleçleme donanımına yatırım akılcı olacak ve rekabetçi gücü pekiştirecektir.

4. SONUÇLAR VE ÖNERİLER

Yük elleçleme ilkeleri de gözetilerek, terminal kapasitelerine göre limanlarda yük işlemlerinin etkin, etkili ve ekonomik olarak yapılmasını sağlayacak donanımın, çok amaçlı esnek bir yapıda mı yoksa uzmanlaşmış türde mi olması gerektiği sorunsalı karar vericiler tarafından çözümü bekleyen bir konudur. Kaynakların doğru, isabetli, etkili ve verimli kullanılması açısından limanlarda yük elleçlemede yararlanılan donanımın yatırım ve işletim maliyetleri ile elleçlenecek yük türü ve miktarı arasındaki ilişki dikkate alınmalıdır. Aksi halde, atıl kapasite nedeniyle kaynak israfı ya da yetersiz kapasite ve yüksek fireler nedeniyle yüksek maliyet ve ciddi kayıplar söz konusu olabilmektedir.

Gelecekte yapılacak çalışmalarda, bir önerme olarak yukarıda ortaya konulmuş olan; limanlarda çok amaçlı esnek yapıda mı yoksa uzmanlaşmış yük elleçleme donanımından hangi türüne, ya da her ikisine birden hangi oranda yatırım yapılmasının uygun olabileceği konusunda matematiksel modeller oluşturulabilir. Alan çalışmaları ve uygulamalar yoluyla Şekil 1'de verilen eğrilerin eğimleri hesaplanabilir.

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Relationship Between Green Logistics Tendency and Logistics Performance: A Comparative Case Study on Logistics Service Providers

Yeşil Lojistik Eğilimi ve Lojistik Performans İlişkisi: Lojistik Hizmet Sağlayıcılar Üzerine Karşılaştırmalı Bir Vaka Çalışması

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ABSTRACT

Increasing concerns related to environmental side effects of the logistics services and competition between the logistics service providers are two pressuring factors on logistics service providers. This study seeks to explore the relation between green logistics tendency and logistic performance from the perspective of logistics service providers. In order to reach this aim, two logistics service providers are investigated by comparative case study method. Findings showed the effects of green logistics services on logistics performance components.

Keywords: Green Logistics, Logistics Performance, Logistics Service providers, Comparative case study

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ÖZET

Lojistik hizmetlerin çevresel yan etkileri ile ilgili artan endişeler ve lojistik hizmet sağlayıcılar arasındaki rekabet lojistik hizmet sağlayan işletmeler üzerinde baskı yaratan iki faktördür. Bu çalışmada, yeşil lojistik eğilimi ile lojistik performans arasındaki ilişkinin lojistik hizmet sağlayıcılar açısından ortaya koyulması amaçlanmıştır. Bu amaca yönelik olarak, iki lojistik hizmet sağlayıcı işletme karşılaştırmalı vaka analizi yöntemi ile incelenmiştir. Sonuçlar yeşil lojistik hizmetlerinin lojistik performans bileşenleri üzerindeki etkilerini göstermektedir.

Anahtar sözcükler: Yeşil Lojistik, Lojistik Performans, Lojistik Hizmet sağlayıcılar, Karşılaştırmalı Vaka Analizi

1. INTRODUCTION

As foreseen by Kirkpatrick (1990) environmentalism is one of the most important issues that shape up the businesses. At last decades, tremendous economic growth of the world provides new opportunities to humanity, enhance new technologies and increase global trade. However, it also causes serious environmental problems as global warming, ozone depletion, pollution of air and water ect. (Wu and Dunn, 2006). Meanwhile with the increasing environmental awareness by governments, policy makers, business and public all over the world, some methods have been defined in order to weaken these problems. This growing environmentalism trend reflect the industries (Banerjee, 2001).

Logistics industry also effected by environmentalism trend- as in every industry- and scope of the logistics have been diversified. Logistics service providers (LSP) also had to expand their services (Murphy and Poist, 2003). Therefore, logistics is a missing link of providing green products and services to customer with value adding logistics activities (Wu and Dunn, 2006) as cooperation with customer's company and its customer, green government regulations, environmental management system, green process design, reduction in energy consumption and green network design (Celik et al., 2016). With these capabilities, LSP achieves higher performance (Lai, 2004).

Major challenges of the global era stresses on LSP to survive and remain their competitiveness (Liu et al., 2010). Logistics performance measurement facilitates managing logistics operations under this conditions and provides information and good communication (Gunasekaran and Kobu, 2007). Likewise, green logistics services are contributing the competitive awareness of LSP (Isaksson and Huge-Brodin, 2013). There is a lack of knowledge and research on the link between the adoptions of green logistics services and logistics performance (Lin and Ho, 2008). Therefore, this paper contributes to a causal phenomenon between the impacts of green logistics services on LSP's performance. The paper is comparative case study of two LSP in the process of providing green logistics services based on logistics performance components.

Following this introduction, reviews of the logistics performance measures and green logistics in terms of the adoption decision, performance innovation and practices are presented. The research objectives and details of methodology used are discussed

in section 3. The results of the case study reported on section 4. The concluding section discusses the main findings and offers some further research and limitations.

2. LITERATURE REVIEW

Performance measurement systems (PMS) has broadened in the literature and practice in many forms as measures, metrics, indicators, and methods of measurement and performance measurement until 1960s (Choong, 2014). Therefore, performance measurement is a way of being successful through providing competitive advantage, modifying behavior and creating intelligence (Fawcett and Cooper, 1998). Although variety of PMS are proposed there is still no agreement in a common conceptualization (Choong, 2014).

Logistics performance is made up of many and different elements because of this complex nature it is too compelling to measure (Cagliano et al., 2009). Therefore, logistics performance measurement is regarded as complicated and challenging in spite of the importance attached (Forslund, 2011). Logistic performance measurement has indicated various indicators, attributes and measures in terms of different aspects and purposes (Wang et al., 2015). Several models and metrics have been presented in the literature. Cost, customer, information, time, resource, availability, productivity quality, utilization are some of the examples of these metrics (Najmi et al., 2013). Some of the widely used models are presented in Table 1.

Table 1. Summary of some important logistics performance measurement models.

Logistics Performances	**Items**	**Origin of the model**	**References**
Beamon's model	Resources, flexibility, output	Beamon, 1999	Beamon and Balcik, 2008
Caplice and Sheffi's model	Utilization, productivity, effectiveness.	Caplice and Sheffi, 1994	
Töyli et al.,' s model	Service level, operational metrics, logistics cost	Töyli et al., 2008	Muslimin et al., 2015
Aramyan et al.,'s model	Efficiency, flexibility, responsiveness, and quality	Aramyan et al., 2007	Bourlakis et al., 2014
Fugate et al.,'s model	Efficiency, effectiveness, and differentiation	Fugate et al., 2010	
Logistigual	Tangible components, ways of fulfillment, informative actions	Rafele, 2004	Leeuw and Beekman, 2008
Balance Scorecard	Financial perspective, Internal business perspective, customer perspective, innovation and learning perspective	Kaplan and Norton, 1992	Bhagwat and Sharma., 2007; Brewer and Speh 2000; Chia et al., 2009
SCOR	Reliability, responsiveness, agility, costs, asset management efficiency	Supply Chain Council	Lockamy and McCormack, 2004, Huan, Sheoran and Wang, 2004
Performance Prism	Stakeholder satisfaction, strategies, processes, capabilities, and stakeholder contribution.	Neely et al., 2002	Shaik and Abdul-Kader, 2013

Besides of the shown logistics performance references in above table, there are several studies that examined logistics performance including fast fashion industry (Cagliano et al., 2014), wine industry (Garcia et al., 2012), automotive industry, automotive and one in the chemical industry (Zimmermann and Seuring, 2009). When the related literature is considered, it is found that review of the logistics performance models and metrics are the mostly encountered studies (e.g. Gunesekaran and Kobu, 2007; Taticchi et al., 2014; Shepherd and Günter, 2006; Estampe et al., 2013).

Traditional logistics performance measurement models as Beamon's model, Aramyan et al.,'s model (2007) evaluate the effect of complexity of logistics system and they capture the general overview of these complex systems (Cagliano et al., 2009). In order to portray the effects of green logistics services on logistics performance, one of these models were used. Therefore, preliminary evidence of this relationship was tried to examined.

Despite the increasing concern on environment, there have been relatively few studies dealing with the environmental aspects of logistics (Murphy and Poist, 2003). Within this study green logistics literature reviewed in terms of the adoption decision, performance innovation and practices. Zhang et al., (2014) investigated the green logistics activities in China and describe the impact factors of the adoption of green logistics in truck fleets. The results suggested the adoption of green logistics practices. Additionally, Lin and Ho (2008) examined the influencing factors of adoption decision of green logistics practices. Explicitness and accumulation of green practices, organizational encouragement, quality of human resources, environmental uncertainty and governmental supports significantly guide to adopt green practices. Murphy and Poist (2003) compared the US and non-US firms' green logistics practices. Therefore, green logistics practices also investigated by Eltayeb et al., (2011), Isaksson and Huge-Brodin, (2013). Green logistics literature also composed of green logistics performance (Hung Lau, 2011, Björklund and Forslund, 2013), barriers of green logistics (Wooi and Zailani, 2010), green innovation (Zailani et al., 2011, Ho et al., 2009).

3. RESEARCH METHODOLOGY

This paper is based on comparative case studies concerning two LSP that provide green transport solutions. Case study provides a research strategy based on the notion of understanding the dynamics within single environment (Eisenhardt, 1989). Comparative case study contributes the richness of case study and compare the phenomenon in a systematic way (Ghauri, 2009). The research question "What is the relationship between the tendency of adopting green logistics and logistics performance" has been tried to answered by structured interviews based on the Aramyan model. Consistent with this aim, the case study method, which is useful for "why" and "how" questions (Lin and Ho, 2008), was found suitable for this study.

The responses were analyzed through cross case analysis which enhance generalizability and deepen the understanding and explanation (Miles et al., 2014).

3.1. Data Collection

Judgmental sampling, which is based on researcher's experience (Gofton and Ness, 1997), technique was used to select logistic companies that are successfully

implementing green practices. In order to determine sample, first the relevant logistics and transportation journals and websites on green logistic practices were reviewed and logistic service providers were compiled and analyzed. Within this list, two companies were selected which meet the aim of this study and they are especially known with their green logistics services in Turkey. Data collection details and case study details in terms of green logistics services of provided by the companies summarized in the Table 2.

These two cases were first examined independently and then compared. The data of the cases gathered by the semi structured face to face interviews based on the Aramyan model in April 2016.

The fictional names "A Logistics" and "B Logistics" are used because of the anonymity reasons. The details of the respondents, company name, some identical details were not disclosed in the study. However, it is intended to explain the nature of the sampling. Both companies operate as pioneering LSP have reputation with offering green services in logistics industry. A Logistics provides logistics solutions as road transport with a large fleet, air cargo transportation, maritime transportation, railway transportation, intermodal transportation, distribution, warehousing. B Logistics offers flexible solutions to customers as road transportation with road fleet of self-owned vehicles, maritime transportation, rail transportation with rail fleet of swapbodies, wagons and containers, air cargo transportation, intermodal transportation and warehousing and distribution centers. Besides, value added logistics services also provided by the company.

Table 2. Data Collection and Case Study Details

Data Collection	**A Logistics**	**B Logistics**
Time	April, 2016	April, 2016
Respondents	Sales manager	Customer representative
Conducted by	First author	First author
Analyzed by	First author + second author	First author + second author
Case Study Details	• Driver trainings • Efficient fleet • Offering intermodal solutions • Reduction of carbon dioxide emission, • Advanced tracking devices, • Fuel consumption and use of Euro 5 compliant vehicles • Green office practices	• Driver trainings • Efficient fleet • Offering intermodal solutions • Energy management • Advanced tracking devices, • Safety Management system • Reduction of water consumption • Waste management

4. RESULTS

- **Reasons of adopting green logistics services**

Although increasing affords to adopt green logistic practices, there is still long way to interiorize these practices. This adoption is a compelling innovation process for logistic service providers (Lin and Ho., 2008). It is started to be a criterion for the customer's selection of logistic service providers. In two cases, company's environmental awareness is one of the main reasons for adopting green logistics activities. The missions and values of both companies emphasizes the environmental awareness. Additionally, environmental programs of LSP are expected to have high standards and technology.

At both cases, adoption of green logistics practices also directed by the customer's demand. By this adoption they created superior customer value. Based on this result, customer satisfaction has increased and customer loyalty positively has influenced. Additionally, At B Logistics, besides of the protection of natural resources financial supports and grant programs are another reason for the adoption of green logistics services.

- **Effects of green logistics services on costs**

From the point of view A Logistics, green logistics have several impacts on costs. Nowadays, green logistics solutions are compulsory for global shippers. LSP are required to invest in these solutions to be able to fulfill the demand of their shippers and attract new shippers. However, these solutions as renewing the fleet, carbon footprint calculations, worker trainings, are accomplished with an increase in overall cost.

Both cases indicated that green logistics practices have an advantage over fuel costs. According to the B Logistics also depreciation costs and maintenance costs are decreasing because of the technically equipped vehicles. Additionally, model shift to rail and sea provides freight advantage. This results as a win-win situation in the sense that greener solutions both protect environment and provide advantage to logistic service providers.

- **Effects of green logistics services on flexibility**

In terms of the flexibility of green logistics services to respond to a changing environment, A Logistics reported that green logistics activities do not effected by changing environment such as changing routes and cargo volumes. With a proper planning of logistics operations, many restrictions can be handled most conveniently. However, B Logistics responded from the broader point of view. The adoption of greener logistics services depended on logistic service provider' s individual concern and it causes slow progress in Turkey. Therefore, various determinants effect the green logistic services as, costs, freight, technology, changing routes and cargo volume.

Additionally, customer complaints as a flexibility indicator was examined and both cases emphasized that there is no cause of complaint arouse from green logistics services.

- **Effects of green logistics services on responsiveness**

Considering the loss of time, A Logistics describe the modal shift to rail and sea gives a chance to reduce the total logistics lead time. Especially, intermodal transport provides shippers great advantage to increase their competitiveness. As for, B Logistics, loss of time depends on the planning of logistics operations. Right

planning and right equipment prevents the loss of time and that results in decrease at cost.

Examples from the both cases posit that shippers positively reacts to green logistics solutions. Such value added services also helps to gain new customers while avoiding losing already established shippers. On the other hand, sometimes shippers show some hesitations to adopt these greener solutions.

- **Effects of green logistics services on quality**

Obviously, both cases confirmed that green logistics activities positively affect the quality of the LSP. A Logistics mentioned the direct effect with easy access of information, time and cost savings, while B Logistics specified the use of advanced equipment.

5. DISCUSSION AND CONCLUSION

Strict competition in logistics industry directs LSP to offer new services and with the increasing environmental awareness green logistics services were initiated as a new competitive power. Under this circumstances, measurement of the performance gains importance because of the need to understand the current power of the LSP.

Logistics performance measurement models was examined briefly in this study and Aramyan's performance measurement model (2007) was considered to reveal the relationship between green logistics services and LSP performance. Although there are some negative implications on costs, green logistics services can improve the performance of the LSP based on key performance indicators as, quality, flexibility, cost and responsiveness. This provides an answer to research question of this study. Findings are consistent with the conclusions of Lin and Ho (2008) which expresses the perception of green innovations positive effect on performance.

Lin and Ho (2008) also presented the intentions to adopt green logistics services in Taiwan sample as explicitness and accumulation of green practices, organizational encouragement, quality of human resources, environmental uncertainty and governmental supports. However, in this study, it is suggested that customers' demand, environmental awareness and financial support are the reasons of adopting green logistics services.

This study is preliminary evaluation and has several limitations. Sampling of the study is restricted only two company and two interviewees. Wider sample can be preferred for the future studies. Additionally, existing explanatory model for performance measurement was used this study. It is recommended that future studies can developed through the use of more extensive measurement model and effect of green logistics services can be measured quantitatively.

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Comparing Collision Avoidance Systems of Different Type of Transportation Mode

Farklı Taşıma Modlarının Çatışmadan Kaçınma Sistemlerinin Karşılaştırılması

Türk Denizcilik ve Deniz Bilimleri Dergisi Cilt: 2 Sayı: 1 (2016) 37-48

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ABSTRACT

Different modes of transportation are often used in our daily lives. Therefore, how safe these modes are commonly researched by researchers. Many models and methods are developed to avoid collision with the development of technology. This development is aimed to improving the safety of life and property. The technological developments also aim to reduce the minimum level of the human error. Technological devices developed to prevent collision are applied in systematic way according to type of transportation mode. When comparatively examined, it is similar to each other technology used in different modes. In this respect, proposed model and methods are similar in general. These approaches are generally based on position of vehicles relative to each other and also rules have been developed taking into consideration the possibilities that may occur. Real-time sensors used to avoid collision in vehicles reduce risk of collision and provide significant achievements on behalf of avoiding collision. Besides this, it has been considered important a communication network between vehicles. As a result, the importance of the technological devices developed to ensure collision avoidance is increasing in our life. Thus, the study aims to explain and compare the methods, models and techniques used in the different transportation modes so as to avoid collision.

Keywords: Collision avoidance, Transportation mode, Autonomous systems, Artificial intelligence

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ÖZET

Günlük hayatımızda farklı ulaşım modları sıklıkla kullanılmaktadır. Bu sebeple bu modların ne kadar güvenli olduğu sıklıkla araştırılmaktadır. Teknolojinin gelişmesi ile birlikte çatışmadan kaçınma amacıyla birçok model ve metot geliştirilmektedir. Bu gelişmeler can ve mal güvenliği arttırmayı amaçlamaktadır. Teknolojik uygulamaların amacı insan hatasını en az seviyeye indirmektir. Çatışmayı önlemek için geliştirilen teknolojik donanımlar önem sırasına göre farklı ulaşım yollarında sistematik bir şekilde uygulanmaktadır. Karşılaştırmalı olarak incelendiğinde ise farklı ulaşım modlarında kullanılan teknolojiler birbirlerine benzemektedir. Bu bakımdan, önerilen model ve metotlar birbirine benzer niteliktedir. Genel olarak bu hesaplamalarda ulaşım araçlarının birbirlerine göre konumları baz alınmış, oluşabilecek ihtimaller göz önüne alınarak kurallar geliştirilmiştir. Ulaşım araçlarında çatışmayı önlemek için kullanılan gerçek zamanlı sensörler riski azaltarak, çatışmadan kaçınma adına önemli ölçüde başarılar sağlamaktadır. Bunun yanında araçlar arası bir iletişim ağı ile doğrudan haberleşmeye de önem verilmiştir. Sonuç olarak çatışmadan kaçınmayı sağlamak için geliştirilen teknolojik donanımların hayatımızdaki önemi gün geçtikçe artmaktadır. Buradan hareketle, bu araştırmada günümüz teknolojileri ile farklı ulaşım modlarındaki çatışmadan kaçınma amacıyla kullanılan metotlar, teknikler ve yöntemlerin açıklanması ve karşılaştırılması hedeflenmektedir.

Anahtar sözcükler: Çatışmadan kaçınma, Ulaşım modları, Otonom sistemler, Yapay zeka

1. INTRODUCTION

Collision avoidance systems are believed to reduce the risk of accidents, improve safety, increase capacity, enhance overall comfort and performance for drivers or navigator. There has been enough reason to assume that more automated vehicles relieve the driver from many undesirable routines of driving or navigation task. It has also been known that many of the vehicles accidents are due to human errors. Therefore, the conclusion has been that with robust automated systems, artificial intelligent systems and real time systems the chance of vehicle accidents can be reduced. Future system devices aim to provide decision-making, instead of the decision of the people (Vahidi and Eskandarian, 2003).

Collision avoidance is a crucial issue in most transportation systems as well as many other applications. The task of any collision avoidance system is ultimately to avoid two or more objects from colliding. In today's world, in addition to meeting high standards of safety, environmental conservation and performance, transportation industry has to meet the demands of enhanced safety. Collision avoidance systems are being used in a wide range of different areas and under very different circumstances (Jansson et al., 2002; Tamura et al., 2001 as cited in Jannson and Gustafsson, 2008). The collision avoidance systems show a very rapid development in recent years. Detecting and avoiding a possible collision have been studied for several different fields of application such as maritime collision avoidance, aviation collision avoidance, road collision avoidance, railway collision avoidance (Jansson, 2005).

2. MARITIME COLLISION AVOIDANCE SYSTEMS

Nowadays, maritime collision avoidance and its optimization have been researched frequently. The topic become a hot topic within the researchers. The reason substantially is accidents such as meteorological conditions, collisions or groundings, traffic density, navigator experience/skill and condition of ship. This can substantially threaten crew safety and impact the marine environment. Statistical analysis indicates that accidents of ship collisions at sea are 80% because of human factors (Li et al., 2006 as cited in Tsou and Hsueh, 2010). This refers inaccuracy of navigator assessments in respect to collision avoidance timing, ship movement, favorable avoidance strategies and collision risk prediction.

Nowadays, because of technological development and the new maritime regulations, novel types of navigational equipment are being developed. This may cause navigational information data overload, that may affect a navigator or operator with inadequate knowledge and experience when make a decision. For this reason, by making the ship more intelligent via technology in order to decrease manual operations and subjective decision, ship collision avoidance becomes more intelligent and a navigator's burden is reduced. This can be solution for human-based problems (Tsou and Hsueh, 2010). For this reason, many methods were researched for solving the human-related problems.

There have been many methods, techniques and models proposed for solving maritime collision avoidance. These approaches can be divided into three main categories as deterministic approaches (Szłapczyński, 2007; Perera and Soares, 2015; Chang and Jan, 2003; Zhang et al., 2015; Itoh et al., 2003), artificial intelligent approaches (Tsou and Hsueh, 2010; Lazarowska, 2012; Zhu et al., 2001; Zeng, 2003; Smierzchalski and Michalewicz, 1998; Hwang, 2002) and hybrid systems (Harris et al., 1999; Chohra et al., 1997; Borenstein and Koren, 1989; Lee at al., 2015).

Deterministic approaches refer to the certain mathematical definition of navigation environment. This type of approaches utilizes a precise description for solving collision avoidance problem. These algorithms are important in terms of providing exact solutions compared to heuristic algorithms, but the solution time may take a long time.

Artificial intelligent approaches comprise primarily of fuzzy logic (Zadeh, 1965) heuristic approaches, neural networks and etc. These type of algorithms can make easier complicated problem by means of its high computational competence and learning capacities.

Hybrid systems propose a combination of all mentioned above.

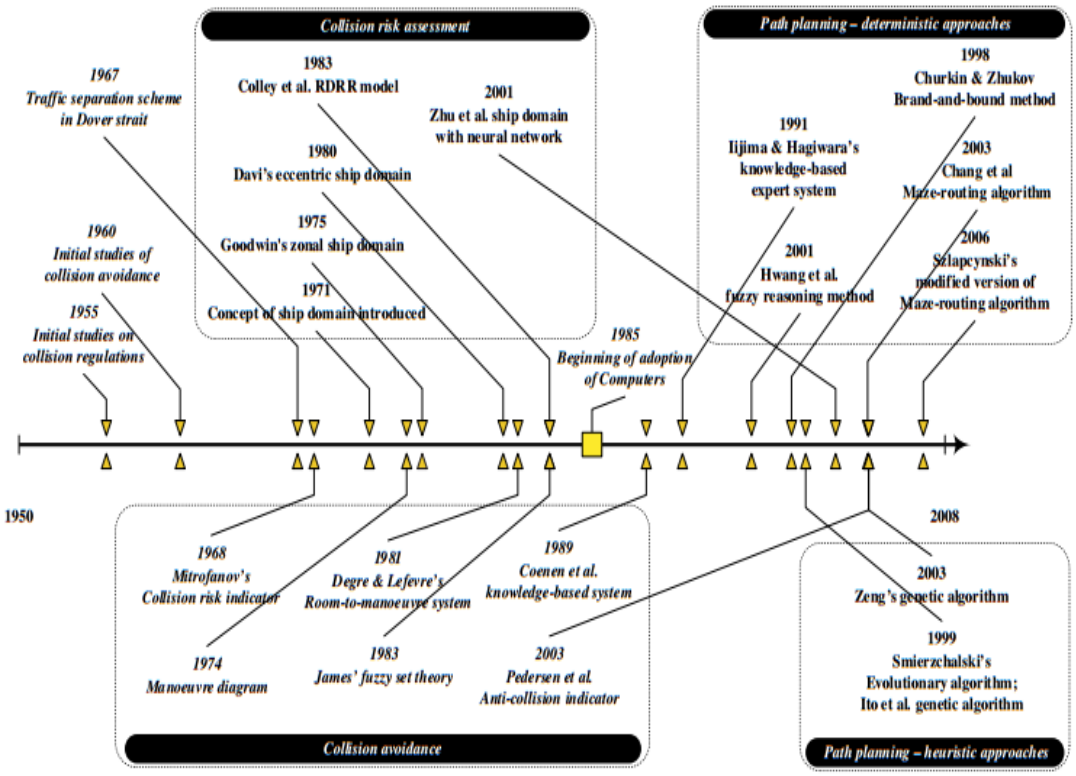

Figure 1. Timeline development of maritime collision avoidance models (Tam et al., 2009).

3. AVIATION COLLISION AVOIDANCE SYSTEMS

A collision between aircraft is one of the most catastrophic transportation accidents (Kuchar and Drumm, 2007). In spite of the aviation travel is incredibly safe, plane failure or mistake are not possible to repair in the air and terrifying prospect of a mid-air collision. This collision causing the death of human life. So collision avoidance system for aviation are developed continuously. The most important collision avoidance system is TCAS (Traffic Alert and Collision Avoidance System). TCAS is the aviation community to develop a viable collision avoidance system to complement the Federal Aviation Administration's (FAA) ground-based air traffic control (ATC) system (Williamson and Spencer, 1989). TCAS is an airborne system used for detecting and tracking aircraft near your own aircraft. The Traffic Alert and Collision Avoidance System has been shown to significantly reduce the risk of mid-air collision and is currently mandated worldwide on all large transport aircraft (Kochenderfer et al., 2011). Even though there are different theories for collision avoidance for aviation, most of theories based on Traffic Alert and Collision Avoidance System.

TCAS was defined by Kuchar and Ann Drumm (2007). It is a kind of a multi-layered avoidance system for mid-air collisions. Aircraft are generally engaged 1000 ft vertically and three to five miles laterally so as to ensure satisfactory margin of safety. In some cases, if there is a traffic procedure fall down, the guidance from TCAS system helps pilots for

possible dangers. An air collision occurred between two U.S. air carrier aircraft over the Grand Canyon is the beginning historical development of aviation collision avoidance (1950s). After for a while, several approaches and models proposed for collision avoidance. The Federal Aviation Administration (FAA) focused its attention to the Beacon Collision Avoidance System (BCAS) a transponder-based airborne collision avoidance system until 1974. Another air collision happened near San Diego between air carrier and aircraft in 1978. The incident lead to development of BCAS. The developed version of it was named as Traffic Alert and Collision Avoidance System (TCAS) in 1981.The other mid-air collision in 1986 near Cerritos, California, prompted Congress in 1987 to pass legislation requiring the FAA to conduct an aircraft collision avoidance system by the end of 1992. The force performed to all large turbine powered aircraft in the US. An ensuing law expanded the original deadline by one year to the end of 1993. The first merchant TCAS systems commenced flying in 1990. After, TCAS has become changes, referred to as Version 7, or the Airborne Collision Avoidance System (ACAS). ACAS was forced by The International Civil Aviation Organization for all turbine powered aircraft capacity of more than 19 or maximum take-off weight above 5,700 kg in January 2015. TCAS is commonly being used approximately 25,000 aircraft over the world, today.

TCAS includes different elements. The first one is that surveillance sensors collect state information as to the intruder aircraft and second set of threat-resolution algorithms designates a favorable response. The response is coordinated via a data link to provide that each aircraft maneuvers in a compatible direction. TCAS gives advisories to flight crews about threats. TCAS methods are surveillance, threat detection, and threat resolution. Observation of the air traffic is corresponded to air-to-air inquiries broadcast once per second from antenna on the TCAS aircraft using the same frequency and waveform as ground-based air traffic control sensors (Park and Tomlin, 2012). TCAS has menace fixing algorithms commenced by classifying intruders into one of four divide levels. The algorithm manages various key metrics to confirm whether an intruder is a threat, involving the estimation vertical and slant-range separations between aircraft. TCAS's threat-resolution algorithms confirm that maneuver is appropriate to avoid collision. First, the algorithm decides the vertical sense of the maneuver such as climb or descend. Second, the plane needs to modify its altitude.

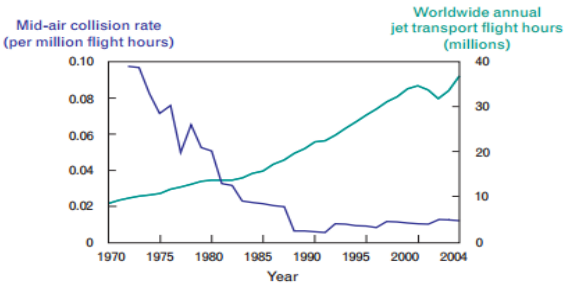

Figure 2. Worldwide annual flight hours and mid-air collision (Kuchar and Ann Drumm, 2007).

Figure 3 shows that TCAS relies on a combination of surveillance sensors to gather dataset on the state of intruder aircraft and a set of algorithms that confirm the best maneuver that the pilot ought to conduct to avoid a mid-air collision (Kuchar and Ann Drumm, 2007).

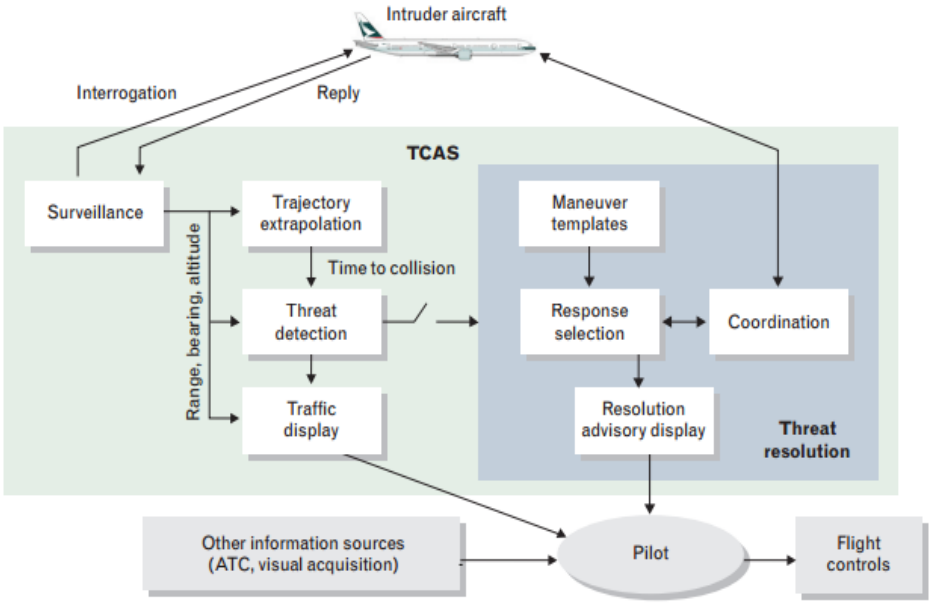

Figure 3. TCAS relies on a combination of surveillance sensors (Kuchar and Ann Drumm, 2007).

4. ROAD COLLISION AVOIDANCE SYSTEMS

Traffic accidents are the major reason for fatal accident nowadays. Automotive producers have begun to establish much more driver support systems to prevent accidents. Passenger car safety is a matter that has received enhancing attention over the last few decades. Over the last decades, automobile crashworthiness has developed severely. The rate of fatal accident in a car has diminished by 90% compared to an early car (Jansson, 2005). The automobile industry made an effort to develop anti-collision systems. In 1959, the first three-point seat belt was developed by Volvo. The first driver assist system was also developed in the 1980s. Following anti-blockier system (ABS) brake system was introduced. In the 1990s more driver support systems became common, such main systems are yaw control systems, traction control systems, roll stability systems, ABS brake systems. The first adaptive cruise control (ACC) system was developed in 1999 by Mercedes. Nissan developed the first lane-keeping assist system. It is also the first a collision mitigation by braking (CMbB) system, in 2002. Another primary trend through the last twenty years is the using of airbag systems. The system is the major reason for enhancing crashworthiness of contemporary cars (Jansson, 2005).

Automatic Pre-Crash Collision Avoidance Strategy: Ferrara and Paderno (2006) presented general automatic pre–crash collision avoidance strategy. There are two type systems for collision avoidance and mitigation of injury: a driver assistance system for cars manage to conducting a decision between an emergency braking and a collision avoidance maneuver. If the collision risk occurs, driver assistance system will be suitable for automatic action, in a time shorter than a favorable lower bound of the human reaction time. If velocity had controlled in real sense, accidents and injuries would have reduced.

Wireless Sensor Networks and Laser Sensors: Ramesh et al. (2012) presented the vehicle collision avoidance system using wireless sensor networks. In this study, main idea is using wireless sensor networks, and these sensors contain Laser sensor. Car anti collision system could be defined by using Laser rays with the laser transmitter and laser receiver. Laser transmitter is fastened to the laser sensor. CAN controller is connected to the all sides of the nodes and send the data via Zigbee (kind of wi-fi) and transmit the message to the LCD output on the driver side. Laser receiver is connected to the CAN controller. Controller area network (CAN or CAN-bus) is designed to let microcontrollers and tools to communicate with each other. CAN is a message based protocol, designed particularly for automotive implementations. Lasers using in variety areas such many academic, military, medical and merchant laser applications. A laser is a tool that emits electromagnetic radiation via a progress of optical elevation based on the emission of photons. Stands for laser is Light Amplification by Stimulated Emission of Radiation. A liquid crystal display (LCD) is used for monitoring of message. A wireless sensor network (WSN) comprises of spatially distributed autonomous sensors to monitor physical or environmental conditions, such as sound, pressure, temperature etc. and to cooperatively pass their data via the network to a main place. Sensor network node has some parts: an electronic circuit for interfacing with the sensors, a microcontroller, a radio transceiver with an internal antenna or connection to an external antenna, and an energy source, usually a battery or an embedded form of energy harvesting.

Automotive Collision Warning/Avoidance System (ACWAS): Mahmud and Shanker (2003) presented the applicability of using Bluetooth or wireless devices along with GPS receivers to develop an Automotive Collision Warning/Avoidance System (ACWAS). A vehicle gathers information from the GPS receiver, accelerometer, electronic compass, speed sensor, etc., and then exchanges that set of data with other neighboring vehicles so as to alarm drivers about possible collisions. This operation of a Collision Warning / Avoidance system will depend upon how rigorously the distance between vehicles can be measured and how fast the set of data can be exchanged among the vehicles. If Bluetooth technology is used for the inter-vehicle wireless links, then each vehicle could hold track of another seven vehicles in real-time. The bandwidth serviceable from Bluetooth devices is adequate to exchange all vehicle definite information in real-time. If the subject vehicle and all object vehicles around it use the same set of satellites, then distance between the vehicles can be determined with a greater accuracy.

5. RAILWAY COLLISION AVOIDANCE SYSTEMS

Railway is an economic mode of transport in cities of the world. Train is widely used and comfortable nodes of transportation system. The railway is considered to be the safest and easiest network. Approximately 10 billion people and 1050 million freight are transported by train annually. Railway transport is necessary in modern day life, both for occupation and private users. Todays, railways in worldwide are getting busier with trains travelling at higher speeds and carrying more passengers and heavier axle loads than ever before. The integration of the

factors has put significant pressure on the existing substructure, leading to increased demands in supervision and overhaul of rail assets (Saijyothsna and Umamaheswari, 2014).

Strang et al. (2011) introduced three main systems for collision avoidance of trains. The model consists of three basic technologies: a direct train-to-train communication system, a certain localization system and a cooperative situation analysis and decision support system. This system has been also applied with real trains and it is rather well for saving lives and avoiding collision. The trains could attain their topological and geographical position, speed and the planned route using direct train-to-train communication as soon as they are within radio range of one another. The system alarms train operator and guides them with a pre-assessment of the present condition. The first base constituent of RCAS is a short range communication system for being used in a railway environment with its spesific characteristics. It is used on favorable frequency band and proper signal propagation channel modeling. The second significant constituent of RCAS is its localization system. The system provide position of each train on the track network is an important data for the situation analysis. For supporting the system, using a set of functional complemental position sensors such as RADAR, cameras, GPS, odometer, eddy current sensors. The data from all the sensors are assessed for consideration of anti-collision. The third significant constituent of the RCAS is its internal situation prediction and analysis algorithm. A probabilistic situation prediction algorithm has been used, considering all data as to the trains in a zone of at least 10 km in diameter, and their movements across the track topology in the next minutes. The algorithm increases an alarm level depending on the probability of a collision and the remaining time to this event.

Saijyothsna and Umamaheswari (2014) proposed a model for railway collision avoidance by creating mutual communication using Zigbee. In the system insure communication between trains to prevent in same track, every train send its track id to other trains, if the one train goes in a first track, the signal is applied to the another train, if any other train get in same track and it also send out first track to other, then two trains gets same track id then alert two train operators and stop train at a distance to avoid collisions, which can urgently stop the train. The proposed system uses with buzzers, microcontroller, switches, LCD, Bomb detectors, MAX-232 Serial communication, DC Motor, Temperature Sensor, Zigbee transmitter, Motor drive and receiver. Zigbee is an IEEE 802.15 - based specification for a suite of high-level communication protocols used to generate personal area networks with small, low-power digital radios. Zigbee tools could convey information over long distances by passing information via a network of intermediate tools to get more distant ones. Zigbee is ordinally used in low data ratio applications that require long battery life and secure networking. ZigBee has an identified ratio of 250 kbit/s, best suited for intermittent data transmissions from a sensor or input tool. Characteristics of the system are well sensitivity, perfect determination, well localized ability, loudspeaker output, ordinary construction and set up, tuning lets for ground and low cost.

6. COMPARISON OF COLLISION AVOIDANCE SYSTEMS

Collision avoidance systems are simulated in various type of situations and these situations ordinarily are encounter situations and obstacle avoidance situations. In recent years, it is observed that advances in technological studies has been came into use. Also, collision situations play a significant role in the development of the systems. As seen in all means of transportation, after major accidents and loss of life or property create rules, regulations and collision avoidance systems.

In marine implementations, radar systems with ARPA are widely used to specify other vessels or objects. Radar provides significant guide for encounter situations. But in the near future, artificial intelligent systems and collision avoidance of autonomous ships will join in the maritime industry. In aviation applications, Radar-based air traffic control (ATC) systems have been being used for last decades. Traffic alarm and collision avoidance system (TCAS) has been being used on aircraft since 1990s. The systems generally aim at guiding pilots and traffic controllers in keeping a regulated minimum separation between any two aircraft. Nowadays, researches are developed base on TCAS. In road applications, long range radar or optical sensors, a lane detection system, lidar, ABS brake systems, yaw control systems, traction control systems, roll stability systems and adaptive cruise control commonly used. Also the proposed system vehicle to vehicle communication is important for road collision avoidance system. Driver can learn the other driver's intention with this system and we can avoid instability (Jansson, 2005). In rail applications, most of the current work in collision warning systems are GPS based Cab Signaling, Block Signaling, Automatic Train Control, Railway Collision Avoidance System (RCAS) Train Collision Avoidance System (TCAS). Today railway industry focuses on communication between trains with zigbee protocol and their devices. (Saijyothsna and Umamaheswari, 2014).

This study shows that the majority of researches is observed that a human error. Therefore, the majority of researches are intended to eliminate the human error factor. Authorities has concentrated on the research of unman vehicles with collision avoidance systems. There are plenty of applications with unmanned autonomous vehicles. It tries to reach the goal in an effective manner and at the same time avoid collisions with any obstacle.

Most of the work was accomplished, but there are a real-time systems problem due to complicated algorithmic calculations and long duration of calculation. Some proposed systems have been applied for collision avoidance system in heavy traffic area. These systems will have a wide field when finding a solution for the real-time problems.

Table 1. Comparison of Collision Avoidance Systems

Maritime Collision Avoidance Systems	• Path planning with ant colony, Genetic algorithm for safe path • Determination of safe optimal trajectory of ship with COLREG • Safety domain model, EP/N (evolutionary planner / navigation) • H_∞ - autopilot on ships, Collision avoidance of autonomous ships • Visualization-based collision avoidance support system • A multi-ship anti-collision decision support formulation • Optimal routes with collision avoidance on raster charts • Collision risk detection and quantification in ship navigation with integrated bridge systems • Real-time ship obstacle avoidance and clearance
Aviation Collision Avoidance Systems	• Three dimensional audio display system • Traffic alert and collision avoidance system (TCAS I, TCAS II and TCAS III) • The traffic alert and collision avoidance system • Autonomous flight systems • Pseudo code and evaluating the system in encounter models • Variable autonomy ground collision avoidance system • Autonomous formation control for unmanned aerial vehicles • Probabilistic Collision Avoidance in Air Traffic Control
Road Collision Avoidance Systems	• Application to automotive collision mitigation • Automotive collision avoidance system (ACAS) • Strategies and coordinated control of passenger vehicles • Application of switching control for automatic pre-crash • Integrated collision avoidance systems • Wireless vehicular networks
Railway Collision Avoidance Systems	• Train collision avoidance system using vibration sensors • Zigbee technology and Microcontroller based model • Rail scout • Mutual communication using embedded system • Railway collision avoidance system (RCAS)

7. CONCLUSIONS

In this study, collision avoidance system was studied on different transportation modes. There are similarities and differences of collision avoidance systems. All systems' aim is to prevent the collision, moral and material losses, also collision warning. All transportation modes generally attach importance to communication, detection systems, real-time systems and artificial intelligent systems. In the future, these systems will be integrating and they are intended to be used more effectively.

Artificial intelligence studies are carried out intensively in the maritime sector. Intensive data transfer of the current systems is forcing people in decision-making. Computers with artificial intelligent systems facilitate the decision-making as optimal and safe path planning,

collision avoidance and collision warning systems in aviation, road and rail transportation modes. So, collision avoidance system which takes control of the vehicle when drivers give no response to warnings given by warning system and applies emergency maneuver to avoid possible collision risk were designed, during complex traffic environments. In particular, road and rail systems focused on communication and real-time obstacle avoidance. There is TCAS for aviation and most of the work is being developed through this system. In recent years, especially in highways intensive research is carried out on collision avoidance systems due to the increase in the human population and traffic.

Aviation collision avoidance systems firstly began to be researched after that respectively marine, rail and road collision avoidance systems were researched. But in the 20th century, it is observed that all collision avoidance system in different transportation modes developed as parallel. It is observed that the transportation systems more similarities than differences. These systems are used extensively such as RADAR, laser, obstacle detection systems, communication systems, network systems, path planning systems, optimal and safe tracking sensor. It is certain that this future technology will greatly influence Collision Avoidance System which is dependent to artificial intelligent systems and hybrid systems.

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Sea Cucumber (Holothuroidea) Species of Turkey

Türkiye Denizlerindeki Deniz Hıyarı (Holothuroidea) Türleri

Türk Denizcilik ve Deniz Bilimleri Dergisi Cilt: 2 Sayı: 1 (2016) 49-58

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ABSTRACT

There are nearly 1200 sea cucumber species in the world oceans, while only 37 species from Holothuroidea class lives in the Mediterranean Sea. This preliminary study aims identification sea cucumbers species of the Turkish waters. The sea cucumber samples used in this study were obtained from a series of different studies between the years of 2008 and 2014. Identification of the species are mainly based on the morphometric characteristics while some of species are determined from their calcareous spicules. Eight sea species were identified in this research which are; *Holothuria tubulosa*, *Holothuria polii, Holothuria mammata, Holothuria (Platyperona) sanctori*, *Holothuria forskali, Stichopus regalis*, *Synaptula reciprocans* and *Stereoderma kirschbergi.* There are limited number of studies in the literature focusing on the identification of the sea cucumber species spread in our seas. Therefore, this study is believed to play an important role in guiding future researches.

Keywords: Sea cucumber, Holothuroidea, Turkish seas

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ÖZET

Dünya denizlerinde 1200'e yakın deniz hıyarı türü bulunmaktadır. Akdeniz'de Holothuroidea sınıfında 37 tür dağılım göstermektedir. Bu ön çalışmada Türkiye karasularındaki deniz hıyarları türleri tespit edilmeye çalışılmıştır. Karasularımızda dağılım gösteren deniz hıyarı türlerinin örneklemeleri, 2008-2014 tarihleri arasında deniz hıyarı için yapılan farklı araştırmalardan elde edilmiştir. Tür tanımlamaları morfometrik karakterlerden ve bazı türlerin kalkerli spikül yapılarından yararlanarak gerçekleştirilmiştir. Araştırma sonucunda 8 deniz hıyarı türü tespit edilmiştir. Bu türler *Holothuria tubulosa*, *Holothuria polii, Holothuria mammata, Holothuria (Platyperona) sanctori*, *Holothuria forskali, Stichopus regalis*, *Synaptula reciprocans* ve *Stereoderma kirschbergi*'dir. Karasularımızdaki deniz hıyarı tür tanımlamaları ile ilgili yapılmış çalışma çok az sayıdadır. Yapılan bu çalışma, gelecekte yapılacak çalışmalara referans olması açısından önemlidir.

Anahtar Sözcükler: Deniz hıyarları, Holothuroidea, Türkiye denizleri

1. GİRİŞ

Deniz hıyarları, omurgasız deniz hayvanlarıdır. Hemen hemen her deniz ekosisteminde yayılış göstermesine rağmen daha çok tropikal sığ sularda ve mercan resif alanlarında bulunurlar. Sığ sulardan derin okyanus tabanlarına kadar yayılış gösterirler (Gilliland, 1993). Deniz dibinde çökelti halinde bulunan ölü organik madde ya da organik atıklarla beslenerek doğal bir dönüşümü gerçekleştirirler (González-Wangüemert ve ark., 2014; Purcell ve ark., 2012). Dünya denizlerinde 1200'e yakın deniz hıyarı türü olmasına rağmen ticari avcılığı yapılan yaklaşık 60 tür bulunmaktadır (Conand, 1990; González -Wangüemert ve ark., 2014). Deniz hıyarlarının avcılığı, Doğu ve Güney Afrika ülkeleri, Orta Amerika ülkeleri, sıcak Akdeniz ülkeleri, Kuzey Pasifik ve Kuzey Atlantik Okyanuslarına kadar, özellikle tropikal sularda olmak üzere tüm dünya ülkelerinde yapılmaktadır (Conand ve Byrne, 1994; Conand, 2006; Toral-Granda ve ark., 2008). Avcılığın büyük bir kısmı ise Asya ülkeleri (Choo, 2008), Pasifik Adaları (Kinch ve ark., 2008) ve Hint Okyanusu'nda (Conand, 2008) gerçekleştirilmektedir. Daha çok Orta-Batı Pasifik ve Asya ülkelerine kurutulmuş olarak ihraç edilmektedir. Deniz hıyarları bir çok dünya ülkesinde yüzyıllardır besin olarak tüketilmektedir (Choo, 2008; Aydın, 2008). Deniz hıyarları çok zengin miktarda mucopolysaccharides ve chondroitin sulphate içerirler. Ayrıca protein, vitamin A, thiamin, riboflavin, niacin, calcium, iron, magnesium ve çinko bakımından zengindirler (Choo, 2008; Aydın, 2008; Aydın ve ark., 2011). Kuzey Akdeniz'de besin maddesi olarak tüketilmeyip, olta balıkçılığında yem olarak değerlendirilen bu türlerin tamamı ihraç edilmektedir.

Holothuriidae ailesinin Holothuroidea sınıfı 185 tür ile temsil edilmektedir. Akdeniz'de bilinen 5 takım 9 familyaya ait 37 tür bulunmaktadır (Fischer ve ark., 1987). Ülkemiz denizlerinde yapılan bir derleme çalışmasında 22 tür (Öztoprak ve ark., 2014) olarak verilmiştir. Aydın (2015) yapmış olduğu çalışmada ise tüm denizlerimizde 8 tür tespit etmiştir. Türkiye'de 1996 yılından itibaren ihracatı yapılmaktadır. Ticareti yapılan türlerden yoğun olarak karasularımızda *Holothuria tubulosa, Holothuria polii, Holothuria*

mammata, Stichopus regalis bulunmaktadır. Dondurulmuş veya kurutulmuş olarak ihraç edilen deniz hıyarlarının Türkiye'deki üretimi son yıllarda 500 tona kadar ulaşmıştır (González-Wangüemert ve ark., 2014, 2015). Bu ön çalışmada Türkiye karasularındaki deniz hıyarları türleri ve bazı tanımlayıcı özellikleri tespit edilmeye çalışılmıştır.

2. MATERYAL VE METOT

Karasularımızda dağılım gösteren deniz hıyarı tür örneklemeleri, 2008-2014 tarihleri arasında deniz hıyarı için yapılan farklı araştırmalarda elde edilen örnekler kullanılmıştır. Örneklemelerde farklı derinliklerde (0-40m) dalışlar (SCUBA veya nargile sistemi) yapılmıştır. Bu kapsamda farklı habitatlarda 300'den fazla dalış gerçekleştirilmiştir. Daha derinlerdeki örnekler ise ticari amaçla kullanılan trol veya dreçlerden elde edilmiştir. Tür tanımlamaları morfometrik karakterlerden ve bazı türlerin kalkerli spikül yapılarından yararlanarak gerçekleştirilmiştir (Cherbonnier, 1960; Fischer ve ark., 1987; Gustato ve Villari, 1977; Koehler, 1921; Reyes-Leonardo, 1984; Rowe, 1969; Tortonese, 1965).

3. BULGULAR

Araştırma sonucunda 8 deniz hıyarı türü tespit edilmiştir. *Holothuria tubulosa*, *Holothuria polii, Holothuria mammata, Holothuria (Platyperona) sanctori*, *Holothuria forskali, Stichopus regalis* ve *Synaptula reciprocans* Ege, Akdeniz ve Marmara Denizleri'nde, *Stereoderma kirschbergi* ise Karadeniz'de örneklenmiştir.

3.1. *Holothuria tubulosa*

Alem: Animalia
Şube: Echinodermata
Sınıf: Holothuroidea
Takım: Aspidochirotida
Aile: Holothuriidae
Cins: Holothuria
Tür: *Holothuria tubulosa* Gmelin, 1790

Holothuria tubulosa Ege sahillerinde sık görülen türlerden biridir (Şekil 1). Daha çok yumuşak, kum ve çamur zeminlerde, posidonia topluluklarının kenarlarında ve azda olsa sert kayalık zeminlerde bulunurlar. 0-50 m derinlikteki sularda yaşayabilmekle birlikte 0-20 m derinliklerde yoğun olarak yaşarlar. Zemindeki organik partiküllerle beslenen bu canlıların karın bölgeleri daha açık renkte olmakla birlikte koyu kahverengidir. Rahatsız edildikleri anda diğer deniz hıyarları gibi hemen kasılırlar (Fischer ve ark.,1987). Yaz aylarında (özellikle haziran-temmuz- ağustos - eylül) sığ sularda ürerler. Larvalar 7-13 haftalık planktonik dönemden sonra dibe yerleşir. Bir yılda 5-20 milimetreye 5-6 yılda cinsi olgunluğa ulaşırlar. 8 yıldan daha uzun yaşarlar. Dorsal yüzeyi kahverengi ve kalın çıkıntılarla kaplı, ventral yüzeyi ise daha açık renkli ve çok sayıda tüp ayaklar (podia) mevcuttur.

Şekil 1. *H. tubulosa*

3.2. *Holothuria (Platyperona) sanctori*

Alem: Animalia
Şube: Echinodermata
Sınıf: Holothuroidea
Takım: Aspidochirotida
Aile: Holothuriidae
Cins: Holothuria
Tür: *Holothuria (Platyperona) sanctori* (Delle Chiaje, 1823)

Holothuria sanctori, Marmara, Ege ve Akdeniz'de kayalık bölgelerde bulunan bir türdür (Şekil 2). Daha çok karanlık kayaların arasında, mağaralarda ve oyuklarda yaşarlar. Cuvier organları vardır ve kendilerini tehlikede hissettiklerinde ortama ağ şeklinde salgı yayarlar. Diğer türlere göre oldukça az miktarda bulunan bu tür, ticari olmakla birlikte popülasyonu az olduğundan ve toplama zorluğundan (salgılarından) dolayı balıkçılar tarafından toplanması tercih edilen bir tür değildir.
H. sanctori türünün baskın rengi kahverengi olup üzerinde boyuna dizilmiş sarı renkli ortaları kahverengi konik şekilli papillalar vardır ve bu dış görünüş özelliği ile diğer türlerden çok kolaylıkla ayırt edilebilirler. Canlının karın kısmı sarımtırak renkte olup sırt kısmından daha açıktır. Sert yüzeylerde, kayalık bölgelerde, kaya oyuklarında ve mağaralarda yaşarlar. Yaygın bir tür değildir.

Şekil 2. *H. sanctori*

3.3. *Synaptula reciprocans*

Alem: Animalia
Şube: Echinodermata
Sınıf: Holothuroidea
Takım: Apodida
Aile: Synaptidae
Cins: *Synaptula*
Tür: *Synaptula reciprocans* (Forsskål, 1775)

S. reciprocans türü daha çok sert yüzeyleri ve kumluk zeminleri tercih ederler. Akdeniz'in lessepsiyen bir türü olup kıyısal alanda yayılım gösterir. İnce uzun bir yapısı vardır. Et kalınlığı yok denecek kadar az ve çok incedir. Ağız kısmındaki tentaküller uzundur. Koyu siyah veya koyu kahverengindedir. Ticari olarak tüketilen bir tür değildir.

Şekil 3. *S. reciprocans*

3.4. *Holothuria polii*

Alem: Animalia
Şube: Echinodermata
Sınıf: Holothuroidea
Takım: Aspidochirotida
Aile: Holothuriidae
Cins: Holothuria
Tür: *Holothuria polii* (Delle Chiaje, 1823)

H. polii, özellikle Kuzey Ege Denizi'nde en yaygın bir türdür. Ege Denizi'nde yoğun olarak bulunan *H. polii* çamurlu yumuşak zeminleri ve deniz çayırlarının etraflarını yaşam alanı olarak tercih ederler (Şekil 4). *H.tubulosa* türü ile aynı ortamları paylaşırlar. Kahverengi veya siyah renkte olup ventral yüzeyinde çok sayıda tüp ayaklar (podia) mevcuttur ve büyük bireylerin uç kısımları beyazdır. Dorsal bölgesinde çıkıntılar yoktur. Diğer türlere oranla etin içerisinde kalkerik yapıların çok olmasından dolayı ticari olarak az tercih edilirler. Ülkemizde bulunan ticari türler arasında en küçük olan türdür.

Şekil 4. *H. polii*

3.5. *Holothuria mammata*

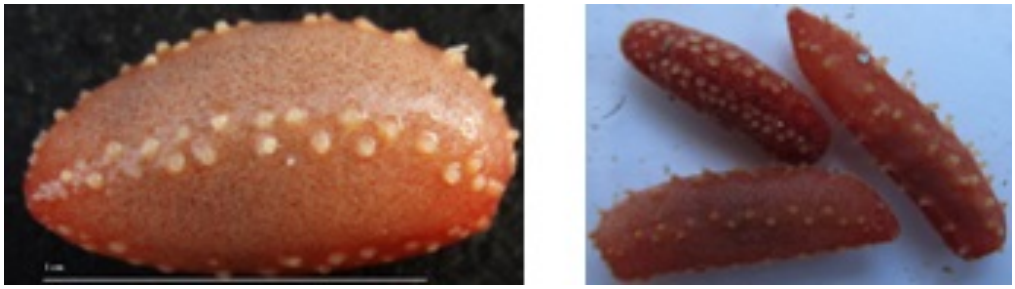
Alem: Animalia
Şube: Echinodermata
Sınıf: Holothuroidea
Takım: Aspidochirotida
Aile: Holothuriidae
Cins: Holothuria
Tür: *Holothuria mammata* Grube, 1840

Şekil 5. *H. mammata*

Ege denizinde *H.tubulosa* ve *H.polii* kadar yoğun olmamakla birlikte *Holothuria mammata* ticari olarak çok tercih edilen bir türdür (Şekil 5). Derinin üzerinde kalın ve çok sayıda çıkıntılar vardır. Rengi kırmızımtırak eflatunidir. Et kalınlığı fazladır. Diğer türlerle birlikte yaşamalarına rağmen, onlara nazaran daha sert zeminleri tercih ederler. *H. tubulosa* türüne çok benzer ve tür ayrımı yapmak zordur.

3.6. *Stereoderma kirschbergi*

Alem: Animalia
Şube: Echinodermata
Sınıf: Holothuroidea
Takım: Aspidochirotida
Aile: Cucumariidae
Cins: Stereoderma
Tür: *Stereoderma kirschbergi* (Heller, 1868)

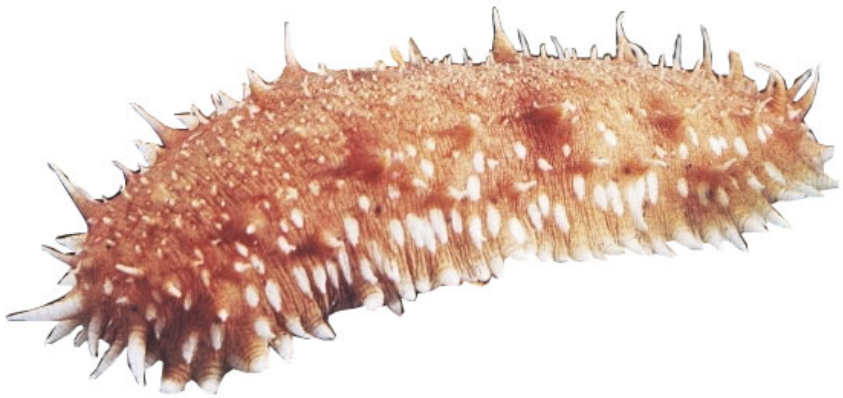


Şekil 6. *S. kirdchbergi*

S. kirdchbergi Karadeniz'in Türkiye kıyılarında rapor edilmiş tek deniz hıyarı türüdür. 1-2 cm uzunluğunda kırmızımtrak renkte olup en küçük deniz hıyarı türüdür (Şekil 6). Boydan boya uzanan çift sıra halinde dört sıra papillaları vardır. Ticari bir tür değildir.

3.7. *Stichopus regalis*

Alem: Animalia
Şube: Echinodermata
Sınıf: Holothuroidea
Takım: Aspidochirotida
Aile: Stichopodidae
Cins: Stichopus
Tür: *Stichopus regalis* (*Parastichopus regalis* Cuvier, 1817)



Şekil 7. *S. regalis*

Stichopus regalis, Ülkemizde yapılan çalışmalara göre daha çok Marmara Bölgesi'nde ve derin sularda bulunmaktadır (Kınacıgil ve ark., 2003) (Şekil 7). Çamurlu ve parça taşlı zeminlerde 5-800 m derinliklerde yaşarlar. Ağız kısmında 18-20 adet tentakül bulunur ve gonadları 2 hat şeklinde dorsalde yer alır. Dorsal-ventral arasında uzun çıkıntılar bulunur. Spiculler düz kule şeklinde ve geniş tabanlıdır (Fischer ve ark.,1987). *S. regalis* turuncu sarı renktedir. Ticari değeri olan bir türdür fakat sudan çıkarıldıktan sonra, diğer türlere nazaran çok hızlı bir şekilde deforme olmaktadır.

3.8. *Holothuria (Panningothuria) forskali*

Alem: Animalia
Şube: Echinodermata
Sınıf: Holothuroidea
Takım: Aspidochirotida
Aile: Holothuriidae
Cins: Holothuria
Tür: *Holothuria (Panningothuria) forskali* **(**Delle Chiaje, 1823)

Şekil 8. *H. forskali*

H. forskali türünün üst kısmı çok sayıda ince uzantılarla kaplıdır. Üst kısmı koyu kahverengi-siyah alt kısmı sarımtıraktır (Şekil 8). Cuvier organları vardır ve etkili bir şekilde salgı yayarlar. Karasularımızda ender görülen bir türdür.

3.9. Cuvier organı

Tür tespitlerinde ayırt edici özellik olarak kullanılan cuvier organı ülkemizdeki türler içerisinde *H. sanctori* ve *H. forskali* türlerinde mevcuttur. Bu cuvier tüplerin içerisinde kendilerini tehlikede hissettiklerinde ortama ağ şeklinde

bıraktıkları, yapışma gücü çok yüksek tübüller salgılamaktadırlar (Şekil 9,10). Savunma mekanizması olarak kullandığı ağ şeklindeki bu sıvı bir balığı veya yengeci etkisiz hale getirecek kadar güçlüdür. Ayrıca bu hayvanlar yine kendilerini tehlike içerisinde hissettiklerinde, savunma mekanizması olarak iç organlarını dışarıya atarlar ve kısa bir süre sonra da rejenerasyon özelliğiyle tekrardan bu organlarını oluştururlar.

Şekil 9. Savunma amaçlı salgılanmış cuvier organı (*H. sanctori*)

Şekil 10. Cuvier organı (*H. forskali*)

4. TARTIŞMA VE SONUÇ

Ülkemizde deniz hıyarları tür tespitleri ile ilgili çok az sayıda çalışma vardır. Aydın (2008) yılında yapmış olduğu çalışmada 5 tür tespit etmiştir. 2015 yılında yapmış olduğu çalışmada ise 8 tür tespit etmiştir (Aydın, 2015). Öztoprak ve ark., (2014) yapmış oldukları derleme çalışmasında 22 tür tespit etmişlerdir. Aydın (2013), *Holothuria sanctori* türünün, Aydın ve Erkan (2015), *Holothuria tubulosa*, *Holothuria polii* ve *Holothuria mammata* türlerinin, González-Wangüemert ve ark., (2015) *Holothuria tubulosa* ve *Holothuria polii* türlerinin, Sezgin ve ark., (2007), *Stereoderma kirschbergi* türünün tanımlayıcı özelliklerini vermişlerdir. Bu çalışmada ise önceki çalışmaları da içeren 8 türün tanımlayıcı özellikleri verilmiştir. Biyoçeşitlilik ve ülkemiz fauna

zenginliklerinin belirlenmesi açısından önemli bir çalışma olmakla birlikte, Türkiye karasularındaki deniz hıyarlarının tür tayin anahtarı niteliğinde daha detaylı bir çalışma yapılması gerekmektedir. Yine de yapılan bu çalışma, gelecekte yapılacak çalışmalara referans niteliğinde olacaktır.

5. TEŞEKKÜR

Bu araştırma Ordu Üniversitesi, Bilimsel Araştırmalar Koordinasyon Birimi tarafından, AR-1501 proje numarası ile desteklenmiştir.

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Short Communication
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Additional Records of Two Rare Crabs, *Ilia nucleus* (Linnaeus, 1758) and *Ethusa mascarone* (Herbst, 1785) from Izmir Bay, Aegean Sea, Turkey

İki Nadir Yengeç Türünün, *Ilia nucleus* (Linnaeus, 1758) ve *Ethusa mascarone* (Herbst, 1785), İzmir Körfezi'nden (Ege Denizi) İlave Kaydı

Türk Denizcilik ve Deniz Bilimleri Dergisi Cilt: 2 Sayı: 1 (2016) 59-62

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ABSTRACT

One specimen of *Ilia nucleus* and one specimen of *Ethusa mascarone* were collected from Urla coasts, Izmir Bay, Aegean Sea. Up to now, both rare species are being reported for the three and four times from Izmir Bay, respectively.

Keywords: Brachyura, *Ilia nucleus, Ethusa mascarone,* Izmir Bay, Aegean Sea.

ÖZET

Bir *Ilia nucleus* ve bir *Ethusa mascarone* bireyi İzmir Körfezi Urla kıyılarından toplanmıştır. Şimdiye dek her iki nadir tür İzmir Körfezi'nden sırasıyla üç ve dört kez kaydedilmiştir.

Anahtar sözcükler: Brachyura, *Ilia nucleus, Ethusa mascarone,* İzmir Körfezi, Ege Denizi.

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1. INTRODUCTION

Izmir Bay, one of the largest bays in the eastern Aegean Sea, is a very productive area due to discharging of Gediz River. At the same time, the bay is semi-closed with L-shape, about 20 km wide and 40 km long (Sayın, 2003) and relatively shallow (maximum depth is 77 m in outer part). Because of being closed area for the large scale fishery and having sufficient hydrological conditions, this bay has good species richness.

Although, there have been some intermittent studies on the crustacean species in Izmir Bay since the late 1960s, recently, a total of 444 crustacean species were listed in an updated checklist for Izmir Bay's crustacean fauna (Bakır and Çevirgen, 2010). Both species, mentioned in the title, were listed as rare species. Thus, this short note presents the additional records of *Ilia nucleus* and *Ethusa mascarone*, collected from the new localities of Izmir Bay.

Ilia nucleus (Linnaeus, 1758)

Material examined: Iskele, Urla, Izmir Bay (38°22.687 N - 26°45.994 E; Figure 1), sandy bottom with *Posidonia* meadows, 20 m depth, trammel net, 27 August 2013, 1 ♂ (Figure 2), Carapace length (CL) 22 mm.

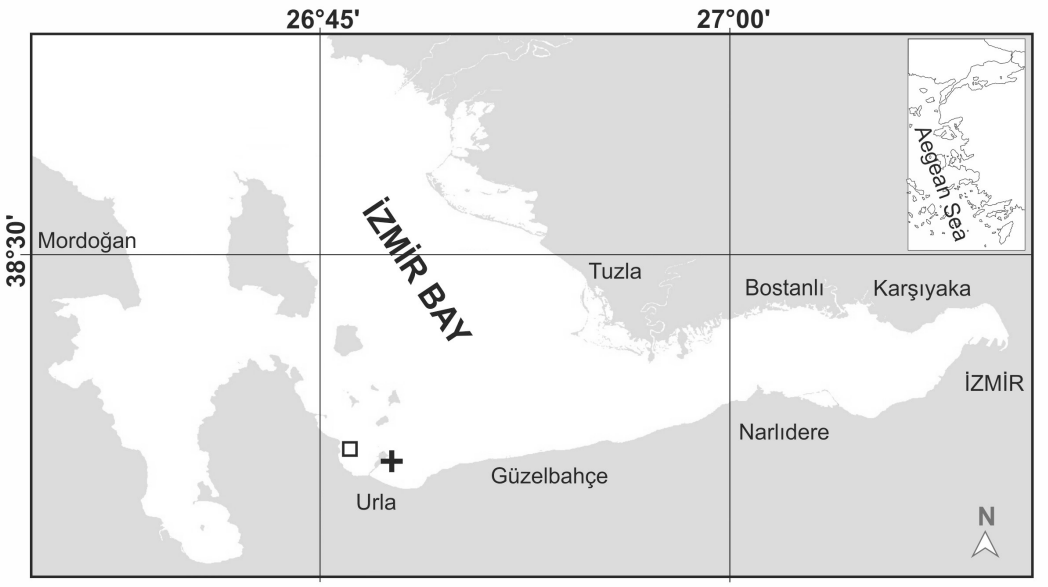

Figure 1. The sampling locations of *Ilia nucleus* (□) and *Ethusa mascarone* (+) in Izmir Bay, Aegean Sea.

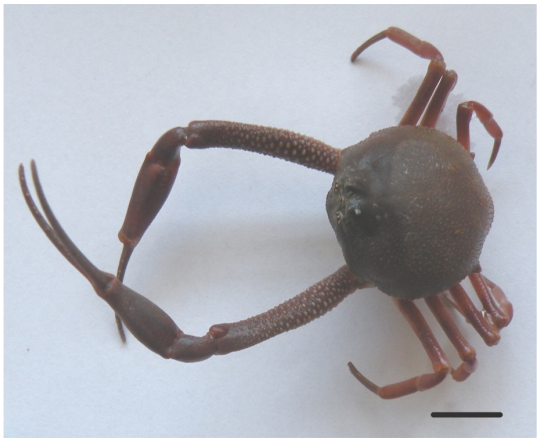

Figure 2. *Ilia nucleus*, caught from Izmir Bay, Aegean Sea (Horizontal bar: 10 mm) (Photograph: O. Akyol)

Remarks: *Ilia nucleus* was first mentioned from Izmir Bay by Kocataş (1971), who collected this species from Karaçamur (between former Ragıppaşa Lagoon and Tuzla) by scoop net and beam-trawl during the expeditions between 1967 and 1970. After a quarter century, *I. nucleus* was being recorded from Foça, located at the outermost portion of the Bay of Izmir during 1995-1996 (Kırkım et al. 2005).

***Ethusa mascarone* (Herbst, 1785)**

Material examined: East of Karantina Island, Urla, Izmir Bay (38°22.202 N - 26°47.270 E; Figure 1), sandy bottom, 3 m depth, trammel net, 10 May 2016, 1 ovigerous ♀ (Figure 3), 11 mm CL.

Figure 3. *Ethusa mascarone*, caught from Izmir Bay, Aegean Sea (Horizontal bar: 10 mm) (Photograph: O. Akyol)

Remarks: *Ethusa mascarone* was also first mentioned from Izmir Bay by Kocataş (1971). Kocataş (1971) collected *E. mascarone* from the coast of Foça during the beam-trawl surveys between 1967 and 1970. Any specimens of *E. mascarone* were not ovigerous. Later, Ozel and Mavili (1990) obtained a total of 9 zoea larvae of *E. mascarone* from Izmir Bay at depths of 29-110 m in both 1977 and 1987. Between 1995 and 1996, a total of 4 specimens were collected from the outer part of Izmir Bay (Doğan et al. 2008).
In conclusion, occurrence of *E. mascarone* indicates an established population in the area in terms of ovigerous females and its zoea larvae. On the other hand, *Ilia nucleus* is also established due to different locality and collected dates. Moreover, there is a necessity on further studies about these poorly known species in the Bay of Izmir.

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