Çanakkale Bölgesi'nde Kullanılan Fanyalı Dip Ağlarında Sübye (Sepia officinalis, L. 1758) Seçiciliği

Mustafa Emir CİLASIN, Adnan AYAZ, Alkan ÖZTEKİN*
Çanakkale Onsekiz Mart Üniversitesi, Deniz Bilimleri ve Teknolojisi Fakültesi, 1710
*e-posta: alkanoztekin@hotmail.com

Özet: Bu çalışma Aralık 2008 - Mayıs 2009 tarihleri arasında Gelibolu Yarımadası'nda 10 ile 60 m derinliklerde gerçekleştirilmiştir. Denemelerde Kuzey Ege Denizi'nde yaygın olarak kullanılan 36-42-46 mm göz genişliğine ve 160 mm fanya göz genişliğine sahip fanyalı uzatma ağları kullanılarak avcılığı yapılan sübyenin (Sepia officinalis, L. 1758) seçiciliğinin belirlenmesi amaçlanmıştır. Seçicilik parametrelerinin tespitinde, SELECT tahmin metodundan yararlanılmıştır. Beş farklı model kullanılarak (normal location, normal scale, gamma, log-normal, bi-modal) veriler analiz edilmiş ve eldeki verilere ait en uygun sonucu lognormal modeli vermiştir. 36-42-46 mm göz genişliğine sahip fanyalı ağlara yakalanan sübyenin optimum yakalama boyları sırasıyla 17.47 cm, 20.38 cm, 22.31 cm olarak hesaplanmıştır. Hesaplamalar sonucunda sübyeye ait seçicilik parametrelerinin, sübyenin ilk üreme boyundan büyük olduğu görülmüştür. Kullanılan ağların sübye avcılığı üzerinde bir av baskısı oluşturmadığı tespit edilmiştir.

Anahtar Kelimeler: Çanakkale, sübye (Sepia officinalis), marya ağı, seçicilik.

Abstract: This study was carried out between December 2008 and May 2009, in 10 to 60 m depth of Gallipoli Peninsula coasts. In order to estimate the selectivity parameters of cuttlefish (Sepia officinalis, L. 1758) three different mesh sizes as 36-42-46 mm nets have 160 mm mesh sized trammel have been used in trials. The SELECT method was used for the determination of the selectivity parameters. Data were analyzed by five different models (normal location, normal scale, gamma, log-normal, bi-modal) and the log-normal model has given the most appropriate result. Optimum catch lengths are were determined as 17.47-20.38-22.31 cm for 36-42-46 mm mesh sized nets, respectively. By the result of calculations, it is observed that the selectivity parameters are higher than first reproductive size of cuttlefish. It is determined that the nets used in study don't have catch pressure on cuttlefish fishing.

Keywords: Çanakkale, cuttlefish (Sepia officinalis), trammel net, selectivity.

Introduction

Cuttlefish is demersal species which ranges in the East Atlantic coasts and Mediterranean (Roper et al., 1984; Mangold and Boletzky, 1987; Nesis, 1987). The living area of cuttlefish is usually 0-100 m depths, also ranges till 200m depth from seaside. Cuttlefish are intensive caught cephalopod species due to its high nutritional value and commercial importance (Türeli et al., 2010). To know the size selectivity of a fishing gear and make a limitation for mesh sizes by comparing with first reproductive length is one of the most important management policies. Selectivity studies in trammel nets is anecessity for determination of stocks and fisheries management. These studies are highly important for determination of total mortality rates (Sparre and Venema, 1992) and benefit level from fish population (Cook, 1995) when considered in terms of determination of stocks. It is stated that; mesh size, hanging ratio, fishing method, the elasticity of nets, visibility of nets, body type and behavior of fish are effects the selectivity of trammel nets

(Clark, 1960; Hamley, 1975). However; the most important factor which affects the selectivity is mesh size (Brandt, 1975). Therefore, selectivity studies are mostly focused on the effect of mesh size on the size selectivity (Van Densen, 1987; Karunasinghe et al., 1991; Reis and Pawson, 1992; Santos et al., 1995; Purbayanto et al., 2000; Park et al., 2004; Özekinci, 2005; Revill et al., 2007; Karakulak and Erk, 2008). It is known that trammel nets with the range of 25-70 mm mesh size are commonly used in Aegean Sea and Mediterranean Sea. Cuttlefish (Sepia officinalis), European lobster (Homarus gammarus) and Spiny lobster (Panulirus vulgaris) which have commercial importance are commonly being caught by between 36-42 mm mesh sized nets especially in winter season. Cuttlefish are located on the top steps of the list of commonly caught commercially important species in our seas. Due to general fishing amounts; total amount of cuttlefish caught from our seas is 1244.1 tons in 2013. The largest share of this amount (947.8 tons) is caught from Mediterranean Sea, and

Mustafa Emir Cilasın, Adnan Ayaz, Alkan Öztekin

then followed by Aegean Sea (267.5 tons) and the Sea of Marmara (1.8 tons) (TUIK, 2013). Selectivity of fishing gears may be different for all species in different areas and habitats. Therefore, it has been aimed to define selectivity of cuttlefish, which has been commonly caught with 36-42-46 mm mesh sized trammel nets in North Aegean Sea.

Materials And Methods
This study has been conducted between December 2008 and May 2009 at 6 stations in the coasts of Gallipoli Peninsula in 10-60 m depths (Fig 1).
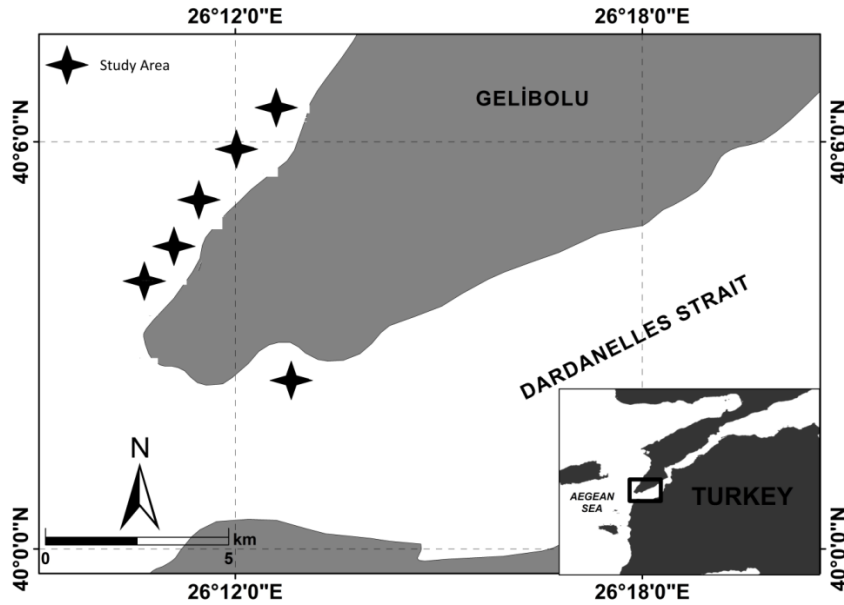

Figure 1. Study Area.

In trials, three different mesh sizes as 36-42-46 mm nets have 160 mm mesh sized trammel have been used. Number 2 plastic floats have been used on the float line and 50 gr sinkers have been used on the ground rope. The nets have 0.5 hanging ratio and have been used passively and leaved into sea as parallel to coast S shaped or according to bottom structure of fishing area.   The nets have been collected from sea after waited a day and 40 repetitions have been conducted. Length and weight measurements of cuttlefish which caught were recorded by 1 mm sensitive milimetric measurement board and 1 gr sensitive digital scales. Length and weight measurements of cuttlefish which caught were recorded by 1 mm sensitive milimetric measurement board and 1 gr sensitive digital scales. The SELECT (Share Each Lengthclass Catch Total) method was used to determine selectivity (Millar, 1992; Millar and Fryer, 1999; Millar and Holst, 1997). This method assumes that the number n_{lj} and length l of cuttle fish that caught with a j mesh sized net have a Poisson distribution, and defined by the following equation:

$n_{lj} \approx n_{lj} \approx \text{Pois} (p_j \, \lambda_l \, r_j(l))$

In this equation; λ_l is abundance of l length cuttlefish that encountered with net, p_j (l) is density of relative cuttlefish (abundance of l length cuttlefish which can catch by j mesh size). The Poisson distribution of the number of l length cuttlefish that contacts with j mesh sized fishing gear is $p_j(l)\lambda_l$. And $r_j(l)$ creates the selectivity curve for j mesh size. Log-likelihood of n_{lj} is as follows;

$$\sum_l \sum_j \{ n_l \log[\, p_j \, \lambda_l \, r_j \, (l)] - p_j \, \lambda_l \, r_j \, (l) \, \}$$

The data obtained from field study was analyzed with PASGEAR II version 2.5 (Kolding and Skalevik, 2011). The software calculates five selectivity model parameters (Normal location, normal scale, log-normal, gamma and bi-modal) in basis of the SELECT method (Millar, 1992; Millar and Fryer, 1999; Millar and Holst, 1997). By comparing the model deviances, the lowest one is chosen for the best model. The equations used in the SELECT models are given below;

$$\exp\left(-\frac{\left(L - k.m_j\right)^2}{2\sigma^2} \right)$$

Mustafa Emir Cilasın, Adnan Ayaz, Alkan Öztekin

Normal Scale ;

$$\exp\left(-\frac{\left(L-k_1.m_j\right)^2}{2k_2^2.m_j^2}\right)$$

Log-Normal ;

$$\frac{1}{L}\exp\left(\mu+\log\left(\frac{m_j}{m_1}\right)-\frac{\sigma^2}{2}-\frac{\left(\log(L)-\mu-\log\left(\frac{m_j}{m_1}\right)\right)^2}{2\sigma^2}\right)$$

Gamma ;

$$\left(\frac{L}{(\alpha-1).k.m_j}\right)^{\alpha-1}\exp\left(\alpha-1-\frac{L}{k.m_j}\right)$$

Bi-modal ;

$$\exp\left(-\frac{\left(L-k_1.m_j\right)^2}{2k_2^2.m_j^2}\right)+c.\exp\left(-\frac{\left(L-k_3.m_j\right)^2}{2k_4^2.m_j^2}\right)$$

Two-way Kolmogorov-Smirnov test was performed to analyze if length frequency distribution of cuttlefish that caught by nets is significantly different from each other or not.

Results

At the end of trials, 103 cuttlefish (54506 g) of which lengths ranges between 10-25 cm and weight ranges between 140 - 1900 g were caught. By the result; it is seen that 36 mm mesh sized net has the highest catch rate with 10-25 cm length range. 42 mm mesh sized net caught 10.8–22.5 cm length range and 46 mm mesh sized net caught 14.8 -23.5 cm length range. The length - frequency distribution of cuttlefish caught in trials is given table 1 and in figures 2, 3 and 4.

Table 1. The length - frequency parameters of cuttlefish (Sepia officinalis) caught in trials.

Mesh Size (m)	Total Length (cm)			Weight (g)		
	N	Min.	Max.	Ort.	Min.	Max.	Ort.
36 mm	49	10	25	14.5±0.5	140	1900	429.33±52.6
42 mm	36	10.8	22.5	16.1±0.6	180	1210	505.59±48.4
46 mm	18	14.8	23.5	19.4±0.7	300	1520	848.4±80.8
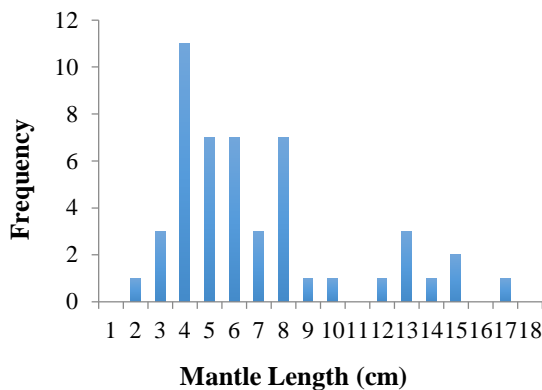
Figure 2. The mantle length – frequency parameters of cuttlefish caught with 36 mm mesh size
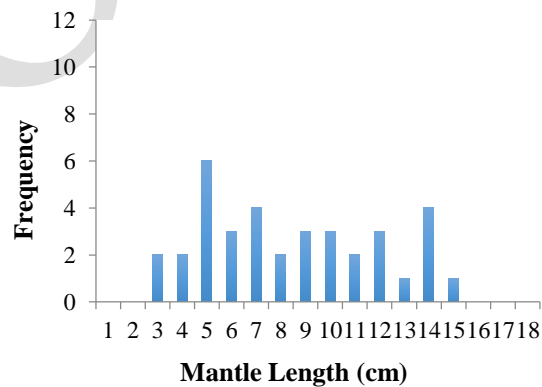
Figure 3. The mantle length – frequency parameters of cuttlefish caught with 42 mm mesh size.

Lognormal model has the lowest deviance due to calculations and the deviation of log-normal model is 21.046 (Table 2). Optimum catch lengths of cuttlefish are 17.47 - 20.38 - 22.31 cm for 36 - 42 - 46 mm mesh sized nets, respectively. And mantle lengths and spreads are 4.1 - 4.78 - 5.23 cm (Table 3).

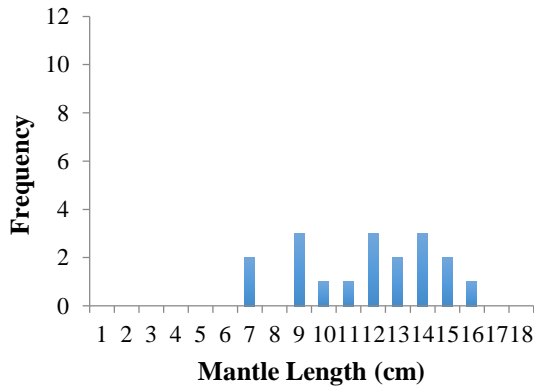Selectivity curves according to log-normal model is given in Figure 5.

Mustafa Emir Cilasın, Adnan Ayaz, Alkan Öztekin

Figure 4. The mantle length – frequency parameters caught with 46 mm mesh size.
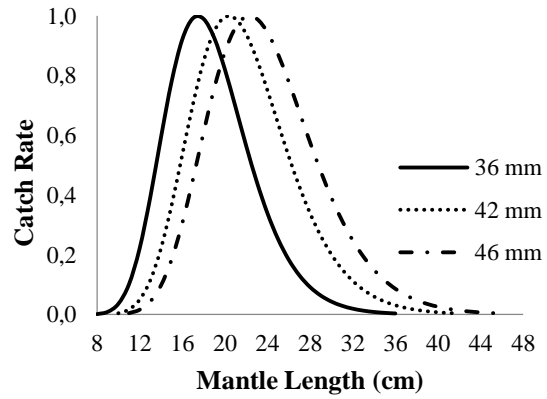

Figure 5. Selectivity curves of cuttlefish of cuttlefish (*Sepia officinalis*).

Table 2. Selectivity parameters of cuttlefish (Sepia officinalis).

Model	Parameter	Model Deviation	P Value	Degree Of Freedom (d.f)
Normal location	$(k;\sigma)=(2.457; 4.006)$	21.615	0.95084	34
Normal Skala	$(k_1;k_2)=(2.566; 0.471)$	23.973	0.89943	34
Log Normal	$(\mu_1;\sigma)=(2.907; 0.216)$	**21.046**	**0.95973**	**34**
Gamma	$(k;\alpha)=(0.104; 24.795)$	21.837	0.94700	34
Bimodal	$(k_1;k_2;k_3;k_s;w)=$ (2.566; 0.471; 18.645; 3.954;0.013)	23.973	0.81163	31

Table 3. Optimum length and spread of c according to log-normal model.

Mesh size	Optimum length (cm)	Spread (cm)
36 mm	17.47	4.1
42 mm	20.38	4.78
46 mm	22.31	5.23

In the study, Kolmogorov-Smirnov test was performed to analyze if length frequency distribution of cuttlefish that caught by nets is significantly different from each other or not. The test results indicated that distribution of length–frequency difference is important for the cuttlefish caught with 36 mm and 46 mm mesh sized nets (P<0.05). Other comparisons were found statistically unimportant (P>0.05) (Table 4)

Mustafa Emir Cilasın, Adnan Ayaz, Alkan Öztekin

Table 4. Selectivity comparison according the Kolmogorov-Smirnov test.

NET 1		NET 2		Kolmogorov Smirnov Test		
Mesh size	N	Mesh size	N	D_{max}	Critical value(α=0.05)	Decision
36 mm	49	42 mm	36	0.181406	0.298538	H_0 Accept
36 mm	49	46 mm	18	0.428571	0.374837	H_0 Reject
42 mm	36	46 mm	18	0.277778	0.392598	H_0 Accept

It is observed that length ranges between 10 - 25 cm and weight ranges between 140 - 1900 g when length - frequency distribution of cuttlefish was analyzed. Optimum catch sizes of cuttlefish which is one of the most economic species were found as 17.47 - 20.38 - 22.32 cm total length, caught with 36 - 42 - 46 mm nets have 160 mm mesh sized trammel that commonly used in Northern Aegean Sea. It is determined in a study that carried out in Portugal, first reproduction size is 8 cm, and 5.9 cm mantle length for the males. It is not found that any study carried out in the coast of Turkey about the selectivity of this species. The parameters calculated in this study are far above than the first reproduction parameters found in Portugal. Therefore; it is observed that the trammel net has not any catch pressure risk to cuttlefish stocks. There is not any size limitation for cuttlefish in legislation. There is mesh size limitation for only three species and trammel block for only one species in legislation. It is important to focus on selectivity and first reproduction size studies of species caught with trammel nets that commonly using in Turkey. These nets are being waited nearly one week in sea to catch some lobster species. In this period; nets are using for a controlled ghost fishing with caught fishes and cuttlefish in order to catch lobster species. Another fishing methods should be developed to catch lobster species, instead of this controlled ghost fishing method. Nets should not be left more than one day in the sea. It is quite important to use more specific and selective gill nets instead of trammel nets; especially in coastal and rocky areas where the abundance of fish is high.

References

Brandt, A. V., 1975. Enmeshing Nets: Gillnets and Entangling nets - the Theory of Their Efficiency. Proc. EIFAC Symp.

Clark, J. R., 1960. Report on Selectivity of Fishing Gear. Fishing Effort, and Effect of Fishing on Resources and the Selectivity of Fishing gear. ICNAF Spec. Publ., 2: 27-36.

Cook, R., 1995. The Use of Selectivity Data in Stock Assesment. ICES FTTB Working Group Paper, Aberdeen: 12.

Hamley, J. M., 1975. Review of Gillnet Selectivity. Journal of the Fisheries Research Board of Canada, 32(11): 1943-1969.

Karakulak, F. S. ve Erk, H., 2008. Gill Net and Trammel Net Selectivity in The Northern Aegean Sea, Turkey. Scientia Marina, 72(3): 527-540.

Karunasinghe, W. P. N. ve M.J.S. W., 1991. Selectivity Estimates for Amblygaster Sirm (Clupeidae) in The Small Meshed Gill Net Fishery on The West Coast of Sri Lanka. Fisheries Research , 10: 199 - 205.

Kolding, J. ve Skålevik A. 2011. PasGear 2 A Database Package for Experimental or Artisanal Fishery Data Version 2.5. available at http://www.imr.no/forskning/bistandsarbeid/nansis/pasgear_2/en

Mangold, K., Boletzky, SV., 1987. Cephalopodes. Fiches FAO d'identification des escapes pour les besoins de la peche, (Revision 1) Mediterranee et Mer Noire, Zone de peche, France. 633-714.

Millar, R. B., 1992. Estimating the Size-Selectivity of Fishing Gear by Conditioning on the Total Catch. Journal of the American Statistical Association, 87(420): 962-968.

Millar, R. B. ve Fryer R. J., 1999. Estimating The Size-Selection Curves of Towed Gears, Traps, Nets and Hooks. Reviews in Fish Biology and Fisheries, 9(1): 89-116.

Millar, R. B. ve Holst R., 1997. Estimation of Gillnet and Hook Selectivity Using Log-

Mustafa Emir Cilasın, Adnan Ayaz, Alkan Öztekin

Linear Models. Ices Journal of Marine Science, 54(3): 471-477.

Nesis, K.N., 1987. Cephalopods of The World, Senior Scientis, Department of Nekton, P.P. Shirshov Institute of Oceanology, USSR Acedemy of Sciences, Moscow.

Özekinci, U., 2005. Determination of The Selectivity of Monoflament Gillnets Used for Catching The Annular Sea Bream (Diplodus annularis L., 1758) by Length-girth Relationships in Izmir Bay (Aegean Sea). Turkish Journal of Veterinary & Animal Sciences , 29(2): 375-380.

Park, C. D., Jeong E. C., Shin J. K., An H. C. ve Fujimori, Y., 2004. Mesh Selectivity of Encircling Gill Net for Gizzard Shad Konosirus Punctatus in The Coastal Sea of Korea. Fisheries Science, 70(4): 553-560.

Purbayanto, A., Akiyama, S., Tokai, T. ve Arimoto, T., 2000. Mesh Selectivity of a Sweeping Trammel Net for Japanese Whiting Sillago Japonica. Fisheries Science, 66(1): 97-103.

Roper, CFE., Sweeney, MJ., Nauen, C., 1984. Cephalopods of the world, An annotated and illustrated catalogue of species of interest to fisheries. FAO Fish. Synop. No. 125.

Reis, E. G., Pawson M.G., 1992. Determination of Gill-Net Selectivity for Bass (Dicentrarchus-Labrax L) Using Commercial Catch Data. Fisheries Research, 13(2): 173-187.

Revill, A., Cotter, J., Armstrong, M., Ashworth, J., Forster, R., Caslake, G. ve Holst, R., 2007. The Selectivty of The Gill-Nets Used to Target Hake (Merluccius merluccius) in the Cornish and Irish offshore fisheries. Fisheries Research, 85: 142-147.

Santos, M. N., Monteiro, C. C. ve Erzini K., 1995. Aspects of The Biology and Gillnet Selectivity of The Axillary Sea Bream (Pagellus acarne, Risso) and Common Pandora (Pagellus erythrinus L., 1758) from Algarve (South Portugal). Fish. Res, pp 23: 223-236.

Sparre, P. ve Venema, S. C., 1992. Introduction to Fish Stock Assesment Part 1, Manual. FAO Fisheries Technical Paper No:306.1(Rev.1): 376.

Türeli, Bilen. C, Duysak. Ö, Akamca, E. Kiyağa, V., 2010. Karataş Açıkları (Kuzeydoğu Akdeniz) Mürekkep balığının (Sepia officinalis L., 1758) Bazı Biyolojik Özellikleri, Jounal of FisheriesSciences.com, 4: 400-411.

TUİK, 2013. Türkiye İstatistik Kurumu. TUİK Rapor. http://www. tuikrapor.tuik.gov.tr/reports (Ziyaret tarihi: 12 Ocak 2013).

Van Densen, W. L. T.,1987. Gillnet Selectivity to Pikeperch, Stizostedion lucioperca (L., 1758) and perch, Perca fluviatilis (L., 1758) Caught Mainly Wedged. Aquaculture and Fisheries Management, 18: 95-106..