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Comparative Structural and Economic Analysis of Rainbow Trout (*Oncorhynchus mykiss*) Hatcheries with Different Production Capacities in Kahramanmaraş Province, Turkey

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Abstract

In this study, the structural and economic aspects of rainbow trout (*Oncorhynchus mykiss*) hatcheries with the different production capacities in Kahramanmaraş Province of Turkey were compared. The commercial structure of this enterprises was 60% person-family and 40% company-partnership. Statistically, the medium-sized (96.88%) hatcheries have higher capacity usage rate than the the small (69.98%) and large-sized (60.0%) hatcheries (P<0.01). However, the production efficiency of the small (64.50%) and medium-sized (63.99%) enterprises were higher (P<0.01) than the large-sized enterprises. Average active capital was US $181 165 in the small-sized, $436 147 in the medium-sized and $1 271 634 in the large-sized enterprises. Gross and net income values were $40 213 and $4 215 in the small-sized enterprises, $189 412 and $74 268 in the medium-sized enterprises and $901 961 and $69 074 in the large-sized enterprises. The medium-sized enterprises have highest economic rantability (17.03%) followed by the large (5.43%) and small-sized (2.33%) enterprises (P<0.01). Differences in the structural characteristics of existing enterprises directly affect their capacity usage rate and production efficiency.

Keywords: Capacity usage rate, comparative analysis, economic rantability, hatchery, Kahramanmaraş, productivity, Rainbow trout

Kahramanmaraş İlindeki (Türkiye) Farklı Kapasitelere Sahip Gökkuşağı Alabalığı (*Oncorhynchus mykiss*) Kuluçkahanelerinin Karşılaştırmalı Yapısal ve Ekonomik Analizi

Öz

Bu çalışmada, Kahramanmaraş ilindeki farklı kapasitelere sahip gökkuşağı alabalığı (*Oncorhynchus mykiss*) kuluçkahanelerinin yapısal ve ekonomik yönleri karşılaştırılıdı. Bu işletmelerin ticari yapısı %60 şahıs-aile ve %40 şirket-ortaklık şeklindedir. İstatistiksel olarak orta ölçekli kuluçkahaneler (%96,88), küçük (%69,98) ve büyük (%60,0) ölçekli işletmelerden daha yüksek kapasite kullanım oranına sahiptir (P<0,01). Bununla birlikte, küçük (%64,50) ve orta (% 63,99) ölçekli işletmelerin üretim verimliliği, büyük ölçekli işletmelerden daha yüksektir (P<0,01). Ortalama aktif sermaye, küçük ölçekli işletmelerde 181 165 $ (ABD doları), orta ölçekli işletmelerde 436 142 $ ve büyük ölçekli işletmelerde 1 271 634 $'dır. Brüt ve net gelir değerleri sırasıyla; küçük ölçekli işletmelerde 40 213 $ ve 4 215 $, orta ölçekli işletmelerde 189 412 $ ve 74 268 $, büyük ölçekli işletmelerde ise 901 961 $ ve 69 074 $'dır. Orta ölçekli işletmeler en yüksek ekonomik rantabiliteye (%17,03) sahip olup, bunu büyük (%5,43) ve küçük (%2,33) ölçekli işletmeler takip etmektedir (P<0,01). Mevcut işletmelerin yapısal özelliklerindeki farklılıklar bunların kapasite kullanım oranını ve üretim verimliliğini doğrudan etkilemektedir.

Anahtar Kelimeler: Ekonomik rantabilite, Gökkuşağı alabalığı, Kahramanmaraş, kapasite kullanım oranı, karşılaştırmalı analiz, kuluçkahane, karlılık, verimlilik

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INTRODUCTION

The most important aim of fish hatcheries is to produce the highest number and quality eggs and fry fish in the lowest cost from broodstock fish. For this reason, the structural and economic analysis of fish hatcheries is of great importance (Aydın et al., 2014; Gümüş and Şahin, 2015).

Some studies have been carried out on the structural and economic aspects of trout enterprises in Turkey (Kocaman et al., 2002; Adıgüzel and Akay, 2005; Karataş et al., 2008; Aydın and Sayılı, 2009; Dağtekin et al., 2011; Öztürk, 2011; Gümüş et al., 2013; Kocaman and Sayılı, 2014; Gümüş and Şahin, 2015; Gümüş et al., 2016; Gürçay et al., 2017; Karabulut ve Köprücü, 2019).

Kahramanmaraş Province shows a suitable structure for the production of aquatic products due to its rugged and mountainous geographical structure, richness of the forest cover and high rainfall and rich water resources (Bayraktar, 2004; Canyurt, 2004; Alp and Büyükçapar, 2006; İmert Aydogdu, 2015; URL-1, 2017). It is estimated that the total rainbow trout (*Oncorhynchus mykiss*) production in Kahramanmaraş Province is about 6000 tons per year and the water resources in the region can be used enough to exceed 12 000 tons per year (URL-2, 2017). Interviews with fish producers, observations in the region and results of literature search has shown that it must be investigated the structural and economical aspects of the fish hatcheries in Kahramanmaraş Province, which has an important place and potential in rainbow trout breeding.

For the first time in this study, the structural and economic aspects of rainbow trout (*Oncorhynchus mykiss*) hatcheries with the different production capacities in Kahramanmaraş Province of Turkey have beeen compared.

MATERIAL AND METHODS

The research material is the rainbow trout hatcheries in Kahramanmaraş Province border in the Mediterranean Region of Turkey. In this study, a total of 10 rainbow trout hatcheries (Figure 1) approved by the Kahramanmaraş Provincial Directorate of Food, Agriculture and Livestock were researched.

Figure 1. Distribution of the hatcheries that produce fry rainbow trout (*Oncorhynchus mykiss*) in Kahramanmaraş Province of Turkey (URL-1, 2017)

In this study, the annual project capacity (number of fry fish), number of fish egg use in fry fish production, number of produce fry fish, capacity usage rate (%), production efficiency (%), commercial structure, capacity usage rates according to commercial structure, capital structures, operating

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expenses, gross income, net income, gross income/active capital, operating expense/gross income, net income/gross income and economic rantability (%) or profitability (net income/active capital) values of this enterprises in Kahramanmaraş Province were determined. This enterprises were grouped according to their production capacities and the mean values of the above mentioned parameters were compared.

The fry fish hatcheries with the different production capacities in Kahramanmaraş Province are classified based on annualy production capacities. The enterprises that produce less than 2 million fry fish per year are classified as the small capacity enterprises (4 units), those that produce between 2-10 million are the medium capacity enterprises (5 units) and those who produce more than 10 million are classified as the large capacity enterprises (1 unit) (Karabulut 2016). Before starting to work, a survey was prepared containing questions about the structural and economical aspects of the hatcheries produced fry fish. In the preparation of this survey, Adıgüzel and Akay (2005), Karataş et al. (2008), Aydın and Sayılı (2009) and Öztürk (2014)'s works were used. This survey was administered face to face in the all hatcheries using the complete counting method. For the on-site detection and evaluation of the data, at least three times went to the enterprises for a period of 1 year starting from 01.10.2016. In addition, the statistics about the subject, various research results and Kahramanmaraş Provincial Directorate of Food, Agriculture and Livestock records also benefit.

Present enterprises have been classified according to their functions in order to disclose capital structures (Açıl and Demirci, 1984; Aras, 1988). Active capital of these enterprises consists of the land, land reclamation, building-pool, brood fish, instrument-machine, fry fish, material expense and money capitals. Passive capital is composed of the debt and equity capital. The equity capital was found by subtracting the debts from the active capital value. The assets of existing capital elements of the enterprises were determined according to the methods reported by Aydın et al. (2014). Average purchase-sale value in the research area was used for the land capital. Effective costs in new vehicle and equipments, and alternative costs according to their present condition and attrition in the old vehicle and equipments were used for the land reclamation and building-pool capitals. Purchase price in new materials, and purchase-sale value according to availability in the old materials was used for the material capital. Current market prices were used for the brood fish capital. Declaration of the enterprises for the money capital and debts was taken as basis.

In calculation of the depreciation shares of the fixed capital elements of the examined entities; 5% for the land reclamation, 3% for the building and pool capital, 25% for the brood fish capital and 10-25% for the instrument and machine capital (Açıl and Demirci, 1984). Actual costs are used to calculate the annual maintenance and repair costs of the buildings, pools and materials in the enterprises. In the calculation of general administrative expenses, 3% of the gross income was taken as basis. As the revolving fund interest, half of the interest rate applied to agricultural loans by Agriculture Bank of Republic of Turkey was used. The interest rate of the active capital was taken as 5% (Aydın et al., 2014).

In additon, the operating cost, gross income, net income and economic rantability values for the operating period of the enterprises were calculated.

Operating Cost: Sum of the costs incurred by the enterprise, excluding the interest of the active capital invested in the operation to obtain the gross income value (Erkuş et al., 1995). In this study, in order to compare enterprises to each other, all enterprises were considered to be economically non-indebted and active in its own territory, and debt interests and land lease expenses were not included in operating expenses.

Gross Income: It is expressed as the total value of the final goods and services obtained in an enterprise in a production period (Aras, 1988; İnan, 2006). The gross income of enterprises is derived from the sale of fish eggs and fry. In addition, the ratio of gross income value to active capital (The gross income for an each US $ capital) was also calculated.

Net Income: It is calculated by subtracting the operating expenses from gross revenue (Aydın et al., 2014).

Economic Rantability (Profitability Ratio): The ratio of an enterprise's profit (net income) over a certain period of time to the active capital used to make that profit (Açıl and Demirci, 1984). Economic rantability is an important economic parameter that indicates the year-end operating

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results of businesses and is used comparison with the enterprises (Aydın et al., 2014).

STATISTICAL ANALYSIS

The results provided from the experiments were given as mean. The datas were analysed using "One-way ANOVA" and "Kruskal-Wallis H" tests (significance level $P<0.01$). The IBM SPSS 23.0 software package program (SPSS Inc., Chicago, IL, USA) was used to the statistical analysis.

RESULTS

Project Capacity, Capacity Usage Rate and Production Efficiency of Fish Hatcheries

When the hatcheries produced fry rainbow trout in Kahramanmaraş Province of Turkey are examined according to the project capacities (Appendix 1), it has been seen that four (40%) of these enterprises are small-sized (<2 million fry fish year^{-1}), five (50%) medium-sized (2-10 million fry fish year^{-1}) and one (10%) large-sized (>10 million fry fish year^{-1}).

In 2016 year, annual total project capacity of the rainbow trout hatcheries in Kahramanmaraş Province was 90 360 000 fry fish. However, the annual total production capacity was found as 66 850 000 fry fish. The total project capacities (number of fry fish year^{-1}) for the small, medium and large-sized enterprises were determined as 8 360 000, 32 000 000 and 50 000 000 fry fish, respectively. However, the annual total production capacities of this enterprises were found as 5 850 000, 31 000 000 and 30 000 000 fry fish, respectively. The average capacity usage rate in this hatcheries was calculated as 73.98%. Capacity usage rate of the medium-sized (96.88%) enterprises was significantly higher than the values of the small (69.98%) and large-sized (60.0%) enterprises ($P<0.01$, Appendix 1). The production efficiency of the small (64.50%) and medium-sized (63.99%) enterprises were found significantly ($P<0.01$) higher than the large-sized enterprises. The average production efficiency of the fish hatcheries in Kahramanmaraş Province was determined as 60.49% (Appendix 1).

Commercial Structure of Fish Hatcheries

The commercial structure of this enterprises was 60% person-family and 40% company-partnership (Appendix 2). The share of person-family enterprises within the total capacity was 21.43% (19 360 000 fry fish year^{-1}). The share of company-partnership enterprises in the total capacity was determined as 78.57% (71 000 000 fry fish year^{-1}). Capacity usage rates of the hatcheries produced fry rainbow trout in Kahramanmaraş Province were also examined according to their commercial structures. Capacity usage rate (76.71%) of the person-family enterprises was found significantly higher than the value of company-partnership enterprises (73.24%) ($P<0.01$).

Capital Structure of Fish Hatcheries

Active capital of the fish hatcheries consists of the land, land reclamation, building-pool, brood fish, instrument-machine, material expense and money capitals. Passive capital consists of the debts and equity capitals (Appendix 3). The average active capital value for the per business was calculated as $417 703. Largest share in the active capital was the fry fish capital (47.82%). This was followed by the building-pool (23.21%), instrument-machine (10.36%), land (6.47%), money (4.42%), brood fish (4.06%), land reclamation (2.55%) and material expense (0.49%) capitals. While 97.26% of the passive capital was composed of the equity capital, the ratio of the debts was as low as 2.74%. The average active capital was $181 165 in the small-sized enterprises, $436 147 in the medium-sized enterprises and $1 271 634 in the large-sized enterprises. It has been determined that the active capital increases according to the size of the enterprises.

Operating Cost of Fish Hatcheries

Operating expenses of the enterprises that produce fry rainbow trout in Kahramanmaraş Province was shown in Appendix 4. The average operating expense of the enterprises was calculated as $155 259. According to the capacities of the enterprises, this value was determined as $35 998 for the small-sized enterprises, $115 144 for the medium-sized enterprises and $832 887 for the large-sized enterprises. Within the operating expenses, the first order received food expense at 35.04%. After the food expense, the workmanship expense was the highest with 27.72%. The total variable expense was accounted as 89.58% of the total operating expense. However, the fixed

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expenses was counted as 10.42% of the total operating expenses.

Gross Income of Fish Hatcheries

In 2015-2016 years, fry fish sales constitute the sole source for the gross income (Appendix 5). Gross income value was $40 213 in the small enterprises, $189 412 in the medium-sized enterprises and $901 961 in the large enterprises. The ratio of gross income value to active capital was calculated as 22%, 43% and 71% for the small, medium and large enterprises, respectively (P<0.01). This ratio was determined as 48% on the average for Kahramanmaraş Province. In the enterprise groups, the gross income value provided for $100 of the active capital varies between a minimum of $22 and a maximum of $71. In addition, the ratio of operating expense to gross income was calculated as 89.52%, 60.79% and 92.34% for the small, medium and large enterprises, respectively (P<0.01).

Net Income of Fish Hatcheries

Net income value was found as $4 215, $74 268 and $69 074 in the small, medium and large enterprises, respectively. The general average of this enterprises was calculated as $45 728 (Appendix 5). The ratio of net income to gross income was 10.48% in the small enterprises, 39.21% in the medium-sized enterprises and 7.66% in the large enterprises (P<0.01). The fact that the gross income value was greater than the operating costs indicates that the net income was positive.

Economic Rantability of Fish Hatcheries

The medium-sized enterprises have the highest economic rantability value (17.03%) followed by the large (5.43%) and small (2.33%) sized enterprises, respectively (P<0.01). The average economic rantability value (profitability ratio) in Kahramanmaraş Province of Turkey was calculated as 10.95% (Appendix 5).

DISCUSSION

In this study, structural and economic data obtained from the survey of rainbow trout hatcheries with the different production capacities in Kahramanmaraş Province of Turkey were evaluated. In this province, the total project capacity for 2016 year was 90 360 000 fry fish. However, the annual total production capacity was found as 66 850 000 fry fish. The average capacity usage rates of the present fish hatcheries have been found to be high (73.98%). When the project capacity and capacity usage rates were examined, it was seen that the medium-sized (96.88%) enterprises have significantly higher capacity usage rate than the small (69.98%) and large-sized (60.0%) enterprises (P<0.01). However, the production efficiency of the small (64.50%) and medium-sized (63.99%) enterprises were found significantly (P<0.01) higher than the large-sized enterprises (55.65%). It was seen that the average production efficiency of the hatcheries in Kahramanmaraş Province was low (60.49%). In addition, it was seen that the commercial structure of this hatcheries was 60% person-family and 40% company-partnership. Capacity usage rate (73.24%) of the company-partnership enterprises was found significantly higher (P<0.01) than the value of the person-family enterprises (76.71%).

Adıgüzel and Akay (2005) reported that the company structure of trout producing enterprises in Tokat Province is 68.42% person-family, 26.32% company-partnership and 5.26% state enterprises. According to Karatas et al. (2008), 85.72% of the fish enterprises in Sivas Province are person-family, 7.14% company-partnership and 7.14% state enterprises. Silver et al. (2016) determined that the majority (62,31%) of fish producing enterprises in Antalya Province were composed of person-family enterprises. Similar to the results of these investigators, it was found that the majority of the trout hatcheries in Kahramanmaraş Province was a person-family enterprise. The reason for this situation can be bound to the ownership of the land in which the enterprises are established, the low water flow rate used in production, the low production capacity and the lack of the obligation of the small enterprises to employ the fisheries engineer.

In a study conducted by Karabulut and Köprücü (2019), the capacity usage rate of rainbow trout hatcheries in Malatya Province of Turkey has been determined as 40.6%. This rate for the small, medium and large-sized hatcheries has been calculated as 59.85%, 42.22% and 38.34%, respectively (P<0.05). Average production efficiency value for this enterprises has been counted as 74.44%. However, the production efficiency (76.7%) of the large-sized enterprises has been

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found significantly higher than the values of the medium (70.2%) and small (63.61%) sized enterprises (P<0.05). In addition, it has seen that the commercial structure of this hatcheries was 50% company-partnership, 40% person-family and 10% cooperative. According to their commercial structures, the capacity usage rates of the company-partnership (50.79%) and cooperative (50%) enterprises has been found significantly higher (P<0.05) than the value of the person-family enterprises (27.50%). The average capacity usage rate (73.98%) of the fish hatcheries in Kahramanmaraş Province were found to be higher than the value (40.6%) in Malatya Province. But, the average production efficiency of fish hatcheries in Kahramanmaraş (60.49%) was found to be lower than the value in Malatya Province (74.44%).

However, the capacity usage rates of the person-family (76.71%) and company-partnership (73.24%) enterprises has been found higher than the values of the company-partnership (50.79%) and person-family (27.50%) enterprises in the Malatya Province. Karabulut and Köprücü (2019) has been reported that the low capacity usage rate of the fish hatcheries in Malatya Province was due to reasons such as the insufficient knowledge about the hatchery management, low fertilization rate of fish eggs, high loss rates in larval and juvenile stages, lack of qualified workers, lack of the capital, equipment and infrastructure.

In Kahramanmaraş Province, the largest share in active capital of the fish hatcheries was the fry fish capital (47.82%). This was followed by the building-pool (23.21%), instrument-machine (10.36%), land (6.47%), money (4.42%), brood fish (4.06%), land reclamation (2.55%) and material expense (0.49%) capitals, respectively. In addition, it has been found that the active capital increases relative to the size of the enterprises. However, Adıgüzel and Akay (2005) reported that the largest share of active capital in rainbow trout enterprises in Tokat Province of Turkey constitutes the building-pool capital (40.91%). Similarly, the building-pool capital (51.88%) of rainbow trout enterprises in Samsun Province of Turkey also constitute the largest share in active capital (Aydın and Sayılı, 2009).

According to the capacities of the enterprises, the total operating expense was $35 998 for the small-sized enterprises, $115 144 for the medium-sized enterprises and $832 888 for the large-sized enterprises in Kahramanmaraş Province. In parallel with the increase in the size of the production capacity of the enterprises, the operating expenses have also increased. The average operating expense of the enterprises was $155 259. The largest part of the operating costs of the rainbow trout hatcheries was found to be food costs (35.04%), followed by the workmanship expenses (27.72%), chemical and disinfectant substance expenses (11.60%). Adıgüzel and Akay (2005) reported that the largest part of the operating costs in the fish producing enterprises in Tokat Province (27.98%) was the food costs. Dağtekin et al. (2011) determined that the largest operating expense for fry fish-producing enterprises in Ordu Province was feeding cost (47.83%). Aydın et al. (2014) also found that feed costs of fish hatcheries in Antalya Province had the highest share (47.83%) in total operating costs. In the fish hatcheries in Kahramanmaraş Province, it was determined that the fry fish sales constitute the sole source for the gross income, because there was no sale of fish eggs in these establishments in 2016-2017 years. The average gross income value was counted as $200 987. This value changed as $40 213 in the small enterprises, $189 412 in the medium-sized enterprises and $901 961 in the large enterprises. In addition, the ratio of operating expense to gross income was found as 89.52% in the small enterprises, 60.79% in the medium-sized enterprises and 92.34% in the large enterprises (P<0.01). The ratio of gross income value to active capital was calculated as 22%, 43% and 71% for the small, medium and large-sized enterprises, respectively (P<0.01). This rate was found to be 48% for Kahramanmaraş Province. In the enterprise groups, the gross income value provided for $100 of active capital varies between a minimum of $22 and a maximum of $71. Öztürk (2011) reported that the ratio of gross income to active capital in the rainbow trout enterprises in Elazig Province of Turkey is 111% for the small enterprises, 197% for the medium enterprises and 154% for the large enterprises. The ratio of gross income to active capital in the rainbow trout hatcheries in Kahramanmaraş Province was found to be lower than the values in fish enterprises in Elazig Province.

Açıl and Demirci (1984) reported that the economic rantability is the ratio of an enterprise's profit over a certain period of time to the active

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capital used to make that profit. In other words, the economic rantability is an important economic parameter that indicates the year-end operating results of businesses and is used comparison with the enterprises. For this reason, the economic rantability (profitability) of the hatcheries produce fry rainbow trout in Kahramanmaraş Province was evaluated according to their capacities. According to the results in the study, the lowest economic rantability value belongs to the small-sized enterprises (2.33%) followed by the medium (17.03%) and large-sized (5.43%) enterprises respectively (P<0.01). In Kahramanmaraş Province, this value was calculated as 10.95% on average. These results show that the most profitable businesses are the medium-sized enterprises. In similar studies conducted in different regions of Turkey, the average profitability ratios; 24.7% in Erzurum Province (Yavuz et al., 1995), 13.03% in Tokat Province (Adıgüzel and Akay, 2005), 5.85% in Sivas Province (Karataş et al., 2008) and 11.18% in Samsun Province (Aydın and Sayılı, 2009) calculated at very different values. The average profitability ratio (10.95%) of the rainbow trout hatcheries in Kahramanmaraş Province was found to be lower than the profitability ratios of the rainbow trout enterprises in Erzurum (Yavuz et al., 1995), Tokat (Adıgüzel and Akay, 2005) and Samsun (Aydın and Sayılı, 2009) Provinces of Turkey. However, the fish hatcheries in Kahramanmaraş Province have a higher average profitability ratio (10.95%) than the value (5.85%) of fish enterprises in Sivas Province (Karataş et al., 2008)

The most important factor that ensures the continuity and development of the enterprises is efficiency (Açıl and Demirci, 1984; Erkuş et al., 1995). The balance between the cost of the business inputs and the return of the product presented to the market affects the rantability either positively or negatively. For this reason, business owners must be constantly looking for ways to increase productivity and reduce production costs. In the study, the causal factors in the formation of this equilibrium have been determined by the questions posed to the existing enterprises in Kahramanmaraş Province. Today, the majority of operators have stated that they complain that only the food is so expensive that they do not have a problem with the quality and availability of the food used.

Conclusion and Suggestions

In Kahramanmaraş Province of Turkey, the highest capacity usage rate was obtained from the medium-sized (96.88%) fish hatcheries that followed by the small (69.98%) and large-sized (60.0%) hatcheries (P<0.01). However, the production efficiency of the small (64.50%) and medium-sized (63.99%) enterprises were found significantly (P<0.01) higher than the large-sized enterprises. In addition, the medium-sized enterprises have the highest economic rantability (17.03%) that followed by the large (5.43%) and small-sized (2.33%) enterprises (P<0.01).

This province has a great potential for aquaculture with its abundance of water resources and water quality. The fact that the production of rainbow trout, a very important source of income for Kahramanmaraş Province, has increased at a very high rate of 220% over the past five years, has provided a great economic return to the region. The fact that the production of fish grows rapidly increases the importance of the work to be done especially for the economy of these activities. Until today, the operators have increased the production of fry fish in order to be able to meet the intense demand for fry rainbow trout in this region. However, scientifically, this rapid increase has to be analyzed and a more conscious step should be taken in the following stages.

The results in this study can provide a motivation for the existing or newly established businesses in Kahramanmaraş Province. The precautions to be taken for the production of fry fish that can provide high quality and high yield are important for the future of the aquaculture sector in the region. For this purpose, it is of great importance that some existing enterprises which are in a position to facilitate the procurement of quality fry fish should be directed only to the production of fry fish. In this way, sufficient number and quality of fry fish can be met in the region. In addition, problems that may occur or become widespread during the production of fry fish can be monitored more easily and measures can be taken on time.

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Appendix 1. Project capacity, capacity usage rate and production efficiency of the enterprises that produce fry rainbow trout (*Oncorhynchus mykiss*) in Kahramanmaraş Province of Turkey

Enterprises	**Enterprises**		**Annual Project Capacity** (number of fry fish)	**Total Number of Fish Egg Used in Production**	**Total Number of Produced Fry Fish**	**Average Capacity Usage Rate** (%)	**Average Production Efficiency** (%)
	Number	%					
Small-Sized (<2 million fry fish year^{-1})	4	40	8 360 000	9 056 700	5 850 000	69.98 [b]	64.50 [b]
Medium-Sized (2-10 million fry fish year^{-1})	5	50	32 000 000	47 545 500	31 000 000	96.88 [c]	63.99 [b]
Large-Sized (>10 million fry fish year^{-1})	1	10	50 000 000	53 906 250	30 000 000	60.00 [a]	55.65 [a]
Total	10	100	90 360 000	66 850 000	66 850 000	73.98	60.49

[a, b, c] Values within the same column with different superscripts are significantly different (P<0.01)

Appendix 2. Capacity usage rates according to commercial structure of the enterprises that produce fry rainbow trout (*Oncorhynchus mykiss*) in Kahramanmaraş Province of Turkey

Commercial Structure	**Enterprises**		**Total Project Capacity**		**Total Number of Produced Fry Fish**	**Average Capacity Usage Rate** (%)
	Number	%	(Number of fry fish year^{-1})	%		
Person-Family Enterprises	6	60	19 360 000	21.43	14 850 000	76.71 [b]
Company-Partnership Enterprises	4	40	71 000 000	78.57	52 000 000	73.24 [a]

[a, b] Values within the same column with different superscripts are significantly different (P<0.01)

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Appendix 3. Capital structures of the enterprises that produce fry rainbow trout (*Oncorhynchus mykiss*) in Kahramanmaraş Province of Turkey

Capital Components	**Small-Sized Enterprises** (<2 million fry fish year^{-1})	**Medium-Sized Enterprises** (2-10 million fry fish year^{-1})	**Large-Sized Enterprises** (>10 million fry fish year^{-1})	**Average Value**	**%**
Active Capital ($)					
Hatchery Capital					
Land Capital	29 739	30 588	-	27 190	6.47
Land Reclamation Capital	3 922	13 072	26 144	10 719	2.55
Building-Pool Capital	79 837	101 046	150 980	97 556	23.21
Operating Capital					
Fixed Operating Capital					
Brood Fish Capital	5 441	15 425	71 895	17 078	4.06
Instrument-Machine Capital	16 183	52 387	108 889	43 556	10.36
Revolving Operating Capital					
Fry fish Capital	40 213	189 412	901 961	200 987	47.82
Material Expense Capital	928	1 014	11 765	2 055	0.49
Money Capital	4 902	33 203	-	18 562	4.42
Total Active Capital ($)	181 165	436 147	1 271 634	417 703	100
Passive Capital ($)					
Debts	-	23 007	-	11 503	2.74
Equity Capital	181 131	291 692	1 271 634	408 763	97.26
Total Passive Capital ($)	181 131	314 699	1 271 634	420 266	100

Appendix 4. Operating expenses of the enterprises that produce fry rainbow trout (*Oncorhynchus mykiss*) in Kahramanmaraş Province of Turkey

Operating Expenses ($)	**Small-Sized Enterprises** (<2 million fry fish year^{-1})	**Medium-Sized Enterprises** (2-10 million fry fish year^{-1})	**Large-Sized Enterprises** (>10 million fry fish year^{-1})	**Average Value**	**%**
Food	9 673	21 072	400 000	54 405	35.04
Workmanship	12 549	41 527	172 549	43 038	27.72
Chemical-Disinfectant Substance	556	11 503	120 261	18 000	11.60
Heating-Lighting	1 601	4 288	6 275	3 412	2.20
Repair-Maintenance of Buildings and Facilities	1 497	3 660	6 536	3 082	1.98
Instrument-Machine Repair Care	984	3 414	28 758	4 977	3.20
Other Expenses	2 876	13 673	41 830	12 170	7.84
Total Variable Expenses (1)	29 736	99 137	776 209	139 084	89.58
Revolving Fund Interest	-	641	-	320	0.21
General Administration Expenses	884	3 093	23 286	4 228	2.72
Amortization of Buildings and Facilities	2 400	3 188	4 529	3 007	1.94
Instrument-Machine Depreciation	1 618	5 229	10 889	4 350	2.80
Brood Fish Depreciation	1 360	3 856	17 974	4 270	2.75
Total Fixed Expenses (2)	6 262	16 007	56 678	16 175	10.42
Total Operating Expenses (1+2)	35 998	115 144	832 887	155 259	100

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Appendix 5. Gross income, net income and economic rantability (profitability) values of the enterprises that produce fry rainbow trout (*Oncorhynchus mykiss*) in Kahramanmaraş Province of Turkey

Parameters	**Small Enterprises** (<2 million fry fish year^{-1}) (N = 4)	**Medium Enterprises** (2-10 million fry fish year^{-1}) (N = 5)	**Large Enterprises** (>10 million fry fish year^{-1}) (N = 1)	**Average Value** (N = 10)
Gross Income Sources				
Fry Fish Sales (**$**)	40 213	189 412	901 961	200 987
Fish Egg Sales (**$**)	-	-	-	-
Gross Income Value (**$**)	40 213	189 412	901 961	200 987
Operating Expense (**$**)	35 998	115 144	832 887	155 259
Net Income Value (**$**)	4 215	74 268	69 074	45 728
Gross Income/Active Capital (%)	22 [a]	43 [b]	71 [c]	48
Operating Expense/Gross Income (%)	89.52 [b]	60.79 [a]	92.34 [c]	77.25
Net Income/Gross Income (%)	10.48 [b]	39.21 [c]	7.66 [a]	22.75
Economic Rantability (Net Income/Active Capital) %	2.33 [a]	17.03 [c]	5.43 [b]	10.95

[a, b, c] Values within the same line with different superscripts are significantly (P<0.01)