Final Evaluation Report

Your Details	
Full Name	Kaan Kırşan
Project Title	The Status of Dusky Grouper in the Karaburun-Ildır Gulf Special Environmental Protection Area and Conservation Application
Application ID	40072-1
Date of this Report	10.02.2025

1. Indicate the level of achievement of the project's original objectives and include any relevant comments on factors affecting this.

Objective	Not achieved	Partially achieved	Fully achieved	Comments
Determining the presence/absence, abundance, and size structure of Mycteroperca marginatus (dusky grouper)				BRUVs (Baited Remote Underwater Video Systems) samplings will be carried out seasonally for a year to determine the presence/absence, abundance, and size structure of Mycteroperca marginatus in the Karaburun-Ildır Gulf Special Environmental Protection Area (SEPA). We planned a total of 80 successful BRUVs deployments. We achieved 50 successful BRUVs deployments. BRUVs deployments that fell upside down, tangled, or stuck in the grass were considered unsuccessful samplings. From the successful video records, we obtained the presence/absence data; however, we could not obtain satisfying abundance and size structure data. The reason is that the specimens of dusky grouper did not close the BRUVs systems to measure their total lengths.
Collecting local ecological knowledge (LEK) regarding the historical and current status of the dusky grouper				The knowledge was collected from the diving operators, divers, spear fishermen recreational fishers and commercial fishers via a face-to-face questionnaire survey. The spear fishers and commercial fishermen avoided joining the survey as we predicted. The respondents' answers to these two groups

	were too limited to analyse in this
	project. Future studies can be
	needed to detail with spear
	fishers and commercial fishers.

2. Describe the three most important outcomes of your project.

a) Abundance and Biomass of Dusky Grouper in the Karaburun-Ildır Gulf SEPA

In the Karaburun-Ildır Gulf Special Environmental Protection Area (SEPA), BRUVs technique was used to determine the abundance and biomass of Mycteroperca marginatus (Figure 1). The study was conducted between February 2024 and January 2025. After two months of BRUVs sampling, due to a lack of satisfying data, researchers began using underwater visual census by SCUBA divers. On fieldwork day, one hour after BRUVs sampling, two divers dived to the same location. BRUVs samplings were carried out between 11:00 and 13:00 h, and divers dived between 14:00 and 14:30 h. Underwater samplings were mostly conducted on rocky habitats. In total, 50 successful BRUVs deployments were completed during the study. The number of successful BRUVs sampling in Winter (w), Spring (sp), Summer (s), and Autumn (a) is 9, 12, 20 and 9, respectively. Dusky grouper was encountered in only 17 of these video records (Figure 2). The recorded individuals did not close the camera systems (min 3 meters), so it was not possible to estimate their sizes using the EventMeasure software program (Figure 3). At the records a total of 18 individuals were recorded during a year. In BRUVs sampling, the highest number of individuals were recorded in the spring season (N=8), and the lowest number of individuals were recorded in the winter season (N=1).

Although the highest number of successful video recordings was achieved in the Summer, only two dusky grouper individuals were recorded in the video samplings. This suggests that this is due to the high diving season and the increase in the number of divers. The lowest number of BRUVs deployments was performed in the Winter and Autumn seasons (9 deployments for each season). However, the highest number of individuals was recorded in the Autumn season proportionally.



Figure 1. Study site and stations of the BRUVs and UVC. Triangles show the sampling stations.



Figure 2. Dusky grouper on BRUVs sampling



Figure 3. Analysing video records on the EventMeasure Software Programme

In the study, 15 UVC samplings were conducted in a year. Each census could be standardized as 15 minutes between 25-35 m depth range. A total of 76 individuals were counted using the UVC technique (Figure 4). Divers estimated the approximate total length of dusky grouper during diving. The total length estimates were used for the calculation of biomass by length-weight equations (Harmelin-Vivien et al., 1985). Maximum and minimum individuals were counted in the summer and winter seasons, respectively. The mean abundance of dusky grouper was 2.33±0.58 in Winter and 14.00±9.54 in Summer season. Total biomass was estimated at 190.38 kilograms of dusky grouper in the SEPA during the study. The lowest biomass value was estimated in Winter (8.0%), and the highest biomass value was estimated in Summer (53.3%). Unlike BRUVs sampling, the highest number of grouper were encountered in visual census studies during the summer season (N=42). This could be caused by the difference between BRUVs and UVC techniques. In the UVC technique, the diver can freely swim and observe even the cyriptical fishes in holes of rocky habitats. However, BRUVs has no ability to record them. Additionally, the human eye has much better vision than cameras. While the diver can recognize a fish from a distance of more than 5 meters underwater, the camera does not have this ability, depending on the underwater visibility.



Figure 4. Dusky groupers on UVC samplings

b) Historical and Current Status of Dusky Grouper in the Karaburun-Ildır Gulf SEPA

A questionnaire survey was conducted in order to obtain more comprehensive information about the historical and current status of the dusky groupers in the Karaburun-Ildır Gulf SEPA between April 2024 and December 2024 (Figure 5). The survey was performed with SCUBA divers, spear fishers, recreational fishermen and commercial fishermen who came to the SEPA.

Surveys were prepared with separate questions for each participant group, consisting of a total of 21 questions. The surveys were grouped under three main headings in order to more accurately reflect the participants' demographics, experiences and general information and opinions regarding dusky grouper:

1- Demographic structure: Basic information about the participants (such as age, gender, profession) was collected in this section.

2- Experience: information was collected about the participants' diving or fishing experiences in the region and how often they dive or participate in fishing activities. This heading was prepared to understand the participants' relationship with the region and the level of experience they have regarding the ecosystem (Karaburun-Ildır Gulf SEPA).

3- Knowledge about the dusky grouper: In this section, the participants were asked about the information they had about the dusky grouper. In addition, questions such as whether they knew the species, in the past and present, whether they saw the grouper during dives or whether the grouper was caught with fishing gear or not were aimed to learn about the participants' direct interactions with this species.



Figure 5. Local Ecological Knowledge surveys with participants

A total of 195 SCUBA divers, 8 recreational fishers, 4 commercial fishers and 2 spear fishers participated in the questionnaire survey. Recreational, commercial and spear fishers' responses were not appropriate for the statistical analysis. Their experiences and opinions regarding dusky grouper were evaluated in the narrative.

SCUBA divers

We interviewed a total of 195 participants in SCUBA diving activities. Most participants were male (66.2%). More than half of divers were in their 20s (27.7%) and 30s (32.8%). All divers have consisted of Turkish participants. The divers were well-educated, with more than half (77.4%) holding a minimum of a bachelor's degree. The participants were primarily full-time workers (52.8% in the private sector and 17.9% in the public sector) and students (16.4%). Only 3.1% of the divers were unemployed.

All participants in the project have diver certificates obtained from different diving organizations (PADI, SSI, CMAS, etc.). The divers' certification levels ranged from beginner [CMAS 1 star (1*)] to master instructor [CMAS 3 star (3*) instructor]. With regard to diving-related characteristics, 30.3% of the respondents reported that their highest diving certification was advanced open water (2*). Only 9 participants stated that they had just started diving and had just joined 1* diver training. In this study, recreational divers were at various diving levels. Therefore, they were categorized into two groups, namely "experienced" and "inexperienced", for better

evaluation. Inexperienced divers included 1* and divers who were in training for 2* level (N=59), while experienced divers included 2*, 3* divers, dive masters, and instructors (N=136). The study showed that 46.2% and 17.9% of the divers had logged fewer than 20 dives and more than 81 dives per year, respectively. The experience duration of certified divers ranged from below 1 year (14.9%) and above 21 years (7.2%). Approximately half of the divers (44.1%) had between 1 and 5 years' experience in SCUBA diving.

At the beginning of the survey, a photograph of a dusky grouper was shown to the respondents, and they were asked to identify it. Most of the divers identified the species correctly (84.6%), but 14.4% of divers could not identified. Only two divers misidentified the dusky grouper as *Epinephelus aeneus* (white grouper) and *Muraena helena* (moray eel). In Turkey, dusky grouper is well known by divers. In the first year of the diving experience, confusing dusky grouper with white grouper is not an unexpected situation. There were no significant differences in dusky grouper identification according to divers' socio-demographic characteristics (gender, age and level of education). Female and male divers identified the species at similar rates, 84.9% and 84.5%, respectively. High-educated divers identified grouper as 83.9%, and low-educated divers identified it as 88.9%; it is not found significant differences in identifying grouper according to the level of education.

As expected, experienced divers identified dusky grouper more than inexperienced divers in this study. A big part of the experienced divers group (95.6%) and more than half of inexperienced divers (59.3%) identified grouper. A significant difference was found between the experience level of divers in identifying dusky grouper. In Karaburun-Ildır Gulf, the reason for this may be that groupers are generally not encountered within the dive limits of the group that includes inexperienced divers (1* training, 1*, 2* training). Their depth range of diving is limited to 0-18 meters for 1* divers and 0-30 meters for 2* divers. Additionally, in 2* training course, divers just dive only once to 30-40 meters depth. At the first touch of this depth (approx. 40 m), it is not expected that divers explore their environment. It was determined that as the average number of dives per year increased, species recognition also increased linearly. Participants who dived less than the average of 20 times annually were able to identify the species at a rate of 72.2%, while those who dived more than the average of 61 times per year were able to identify grouper one hundred per cent.

In the questionnaire survey, the information regarding dusky grouper was collected under two separate titles as "Past" and "Present". Here, "past" refers to data from the period before 2016. Before 2016, there were minimum landing size (45 cm), temporal closure (between 15th June and 31st July) and gear (tunnel, spear gun, etc.) restrictions for dusky grouper in Turkiye. Turkish Fisheries Regulations prohibited the catch of dusky groper permanently since 2016 (Notification number 2016/35). In order to understand the impact of this change in the law on the species, questionnaire survey participants were asked about their observations before 2016. The "present" section of the survey covers the period between 2016 and 2024.

In the Karaburun-Ildir Gulf SEPA, 33.8% of the divers stated that they had seen dusky grouper in the past (Table 1). Most of these participants indicated that they had seen dusky grouper in rocky habitats in the past (81%). Additionally, the divers encountered the species at depths between 21 and 40 meters (70%). In the past, the most common total length range was determined as 41-60 cm (28%). In the Karaburun-Ildir Gulf SEPA, dive sites where dusky groupers were most frequently encountered in the past were determined as "İrem&Mete" and "Aslan Kayası", both are rocky habitats.

In the present section of the survey, 75% of divers stated that they saw the dusky grouper while diving. More than half of divers stated that they had seen dusky grouper in rocky habitats (57%). In Karaburun, two ships were intentionally sunk as artificial reefs in 2016. A significant number of divers reported seeing dusky grouper in one of these wrecks called "Dokuz Eylül". Moreover, divers have stated that the dive site where they encounter dusky groupers the most is the "Dokuz Eylül" wreck. However, it is considered that this situation is due to the high number of dives carried out "Dokuz Eylül" rather than the large number of dusky groupers on the wreck. Today, the most common total length range of dusky grouper was determined as 41-60 cm by divers, as in the past.

Participants were asked two questions regarding catch regulations on dusky grouper in past and present to determine their attitudes toward conserving dusky grouper. The first question asked whether they agreed with the minimum landing size implemented before 2016, and the second question asked whether they agreed with the full fishing ban implemented after 2016. Respondents stated they either disagree or strongly disagree to minimum landing size restriction (82%). Their disagreement was also supported by their agreement (agree and strongly agree) of the full fishing ban regulation (91%). The answers to minimum landing size regulation have similar according to the level of education. While 85% of divers who have low education do not agree with the minimum landing size application, this rate was found as 82% among higher educational divers. Similar

to these results, 89% of the lower educational and 92% of higher educational divers agreed on the full fishing ban. According to the certification level of divers, 71% of inexperienced and 87% of experienced divers disagreed the minimum landing size legislation. The application of the full fishing ban was agreed by inexperienced and experienced divers, 88% and 93% respectively. Among the question options, there was also the option of "no idea". Twenty percent of inexperienced divers responded with "no idea" regarding the size restriction and 9% of them responded with "no idea" regarding the full ban. Among experienced divers, 7% of them chose "no idea" option for size restriction and 6% of them stated it for full fishing ban.

The majority of divers identified dusky grouper when we showed the photograph of it, while 15% of them did not. In this project, a significant relationship was found between species identification and agreement in regulations applied to conserve dusky grouper. Divers who identified the species (95%) agreed with the fishing ban on the species at a higher rate than those who were unidentified the species (73%). This shows that the first step to help a living creature survive is to know it. In the basic courses of diving organizations, there is no section regarding marine living life. However, diving instructors may, on their own initiative, provide information about sea creatures, especially those that need protection, in the form of short briefs throughout the courses. We believe that these short (3-5 minute) briefs will have effective results in protecting the species. We also consider that educational materials such as posters to be hung in diving centres and boats will help divers get to know the species.

Almost half of the divers (48%) who had seen dusky groupers in the Karaburun-Ildur Gulf in the past stated that there had been an increase in the habitats, abundance and size of dusky groupers. However, a significant number of divers (32%) have also reported a decrease in the habitat, abundance and size of groupers. The difference between this two assessments is considered to be related to the experience of the divers. The group stating that the number of groupers has decreased has been diving in the region for many years compared to the other group. In addition, this group has a higher average number of dives per year. Our personal interviews with the owner of Karaburun Diving Center, Hamdullah Aras, also confirmed this information. Aras stated that the number of dusky groupers in the past (herein 20 years) was higher than now. However, he also stated that since 2016, with the start of the fishing restrictions, there has been an increase in the abundance and size of groupers in Karaburun-Ildır Gulf SEPA.

Recreational, Commercial and Spear Fishers

All three fishing groups (recreational, commercial and spear fishers) correctly identified the dusky grouper from the photograph shown.

During the study, the questionnaire survey was conducted with 8 recreational fishers. All participants had high school graduation, and their ages ranged from 50 to 65 years. The participants reported that they had been recreational angling for over 20 years and participated in this activity approximately 60 days per year. These men, who fish from the shore with angling, have never caught a dusky grouper in the past or today, and only one person stated that he caught a grouper weighing approximately 2 kg today (2024) and released it back into the sea. Even though they had not caught it in the past or today, eight anglers also stated that there was a decrease in the abundance of dusky grouper in Karaburun Ildır Gulf.

The questionnaire survey was conducted with 4 small-scale fishers. Two of the fishermen are primary school graduates and the other two are high school graduates, and all of them are full-time fishermen. All of them, aged between 55 and 65 years, have been fishing for more than 20 years. The number of days they go to fishing is approximately 250 days per year. All four fishermen stated that they use gillnets and/or longlines depending on the target species. In the 1990s, two of the fishermen stated that they had deliberately caught dusky grouper weighing 0.5-30 kg in the Gulf. They had caught them between 0-50 meters in depth in the summer months. Only one fisherman reported that he had accidentally caught a grouper after 2016. The fisherman reported that the fish, caught with a longline from a depth of 50 meters, weighed approximately 15 kg. Commercial fishermen agree that the abundance of the species has decreased considerably compared to the past. When fishermen talk about the past, they stated that dusky grouper was caught on order, like buying fish from the market. Depending on how many kilograms of grouper were needed for how many people, a net would be used somewhere and fish would be taken. Today, fishermen agree on the full fishing ban on the species, but they state that the penalties have no force of action and illegal fishing continues, especially by spear fishers.

Only two spear fishermen agreed to participate in the questionnaire survey. Both are male high school graduates and between the ages of 25-30 years. They stated that they have been spearfishing for approximately 15 years and joining fishing activity on average 150 days a year. One of the spear fishers stated that they caught dusky grouper in Karaburun-Ildır Gulf. This fish (approx.. 1 m) was caught in a rocky habitat at a depth of 15-20 meters. The other spear fisher stated that he accidentally caught dusky grouper today (in 2024). He had caught this fish, thinking it was a goldblotch grouper (*Epinephelus costae*), and it was taken from a rocky habitat at 15 meters

depth. These participants, who stated that the abundance of grouper has decreased compared to the past, stated that they disagreed with the minimum landing size restriction that was implemented in the past, and they strongly agreed with the current full fishing ban. However, after the questionnaire surveys, it was concluded that both spear fishers were continuing to shoot the species intentionally. One spear fisher even showed us a photo of a dusky grouper that he had recently caught.

Collecting reliable data from fishermen is an important issue. People hesitate to speak up, especially if it is an illegal species. They either prefer to provide misleading information or remain silent. For example, although commercial fishermen and spearfishers are mostly familiar with dusky grouper much better than recreational divers and recreational fishermen, they stated that they sometimes catch the species by confusing it with another species, such as white grouper and gold blotch grouper. We believed that their 15 years fishing experience do not allow to do this fault. Thus, it is considered that both commercial fishermen and spear fishers continue to catch dusky groupers in Karaburun-Ildır Gulf SEPA.

c) BRUVs alone are not enough tool for monitoring dusky grouper:

The baited remote underwater video (BRUV) system is a non-destructive, nonextractive, and cost-effective fish sampling method. BRUVs are also less labourintensive and more economical. Furthermore, BRUV systems produce standardized and statistically robust data and measurements. These features of the BRUV system have made them widely used in many parts of the world as fishery-independent data collection tools for marine protected areas. Despite these advantages, BRUVs have disadvantages in sampling some fish species, such as reef-associated and cryptic species in crevices and cavities. In this study, we understood that since dusky grouper is a reef-associated species, grouper was not able to record during BRUVs sampling unless the cameras were towards the reef. In BRUV systems, the only attraction tool is bait. However, since the grouper is a predator, the passive bait bag was not sufficient to attract the species. The feeding behaviour of the grouper occurs in three different ways: ambushing, drift feeding and rowing or patrolling. In all three feeding types, the prey is active, and the predator is almost passive. Due to the behaviour of the dusky grouper, passive bait was not enough to attract the grouper to the camera in this study. Despite the limited time and depth of the underwater visual census technique, it is one of the most preferred sampling techniques. The UVC method is more successful in detecting species that live in cavities of rocks and complex habitats than BRUVs. Therefore, in this project, both methods are used together for the detailed observation of the dusky grouper.

3. Explain any unforeseen difficulties that arose during the project and how these were tackled.

At the beginning of the project, there were four action cameras for use in two BRUVs systems. In the March sampling, two camera cases were waterlogged and were broken. To continue the project, we started to use one camera instead of two per BRUVs system. We purchased an action camera within the budget for this project. However, losing both cameras prevented us from using stereo BRUVs. During the study, three BRUV frames were used for each sampling.

Another unforeseen difficulty of BRUVs sampling is the underwater position of the system. When the system was positioned towards the rocky area, it caught dusky grouper, but if the rocks remained behind the system, even bait (sardine) did not attract the fish to the front of the camera. As a solution, we tried to use different bait (homemade bread, boiled egg mix etc.), but it did not work. As another solution, we dived and fixed the position of the system, but no dusky grouper entered those records, although we saw them along the dive. These records are failed deployments. In the end, we tackled the difficulty by preferring very rocky areas for BRUVs sampling.

Before this project, we saw dusky groupers in our dives in the region. Dusky grouper individuals did not show escape performance unless we got very close (approx.. 1 meter). Therefore, we considered that they would not avoid the BRUVs frames either. However, it did not work out as we planned and the groupers did not approach the system at all during the recording period. As a result, we were not able to estimate the size using the EventMeasure software program. To compensate for this, visual census samplings were performed by two divers approximately one hour after the BRUVs deployment at each sampling site. Divers counted the fish and noted the total lengths on whiteboards.

The biggest difficulty of the study was experienced in purchasing a product from abroad. When you purchase a material, equipment or device to use in scientific studies in Turkey, you are exempt from customs duty. Especially if this purchase is made through a university, things get a little easier. However, these improvements are only valid for European Union projects. As a result of our intensive and persistent work, we were able to obtain the products. I recommend that researchers who will make purchases from abroad in the future have solid information on this subject.

4. Describe the involvement of local communities and how they have benefitted from the project.

In the project, recreational fishers, commercial fishers and spearfishers who participated in the questionnaire survey were all local people of Karaburun. This group believe that they know it all about the grouper, and therefore, they are quite close to getting information regarding the species. However, members of this group who poached the grouper may have been influenced by our sensitivity to protect the species.

The majority of recreational divers are not locals of Karaburun-Ildır Gulf. However, this group regularly visits Karaburun for diving activities. Recreational divers, especially those who are unfamiliar with the dusky grouper, have shown great interest in all the information we have provided about the species. We believe that these divers who participated in the survey will share the information they have gained about the dusky grouper in other dive sites besides Karaburun-Ildır Gulf SEPA.

5. Are there any plans to continue this work?

Our study results and FAO statistics show that dusky groupers continue to be caught illegally by all fishing groups (recreational fishers, commercial fishers and spearfishers). The difficulty of collecting reliable and accurate data from fishers has been understood throughout the study. However, accurate information could even be obtained by interviewing only two spearfishers. Therefore, a more extensive questionnaire survey study covering the Mediterranean and Aegean coasts of Turkiye is planned to be conducted, especially with spearfishers.

6. How do you plan to share the results of your work with others?

We have already shared project information in national main stream media (Figure 6). It can be reached from the following link <u>https://www.aa.com.tr/tr/yasam/nesli-tehlike-altindaki-orfoz-izmir-aciklarinda-su-alti-cihazlariyla-izleniyor/3345147</u> We have been preparing an article for a journal indexed in SCI or an international peer-reviewed journal about the status of dusky grouper.



Figure 6. Sharing project information in News in the Turkish National Channel (TRT)

7. Looking ahead, what do you feel are the important next steps?

In the project, our main aim was to determine the status of dusky grouper and then make suggestions for the conservation strategy in the Northeastern Aegean Sea. The questionnaire survey study shows that there has been an increase in the abundance of dusky groupers after 2016. However, the stock status of the species needs to be examined in detail. In particular, determining the spawning areas and times of the species is very important.

The most critical threat to the dusky grouper seems to be small-scale fishermen and spear fishermen. Detailed studies need to be conducted with this group, which disregards the management measures applied to the species. However, the important point here is to obtain accurate information. Contacting more people in a wider area (the Aegean and Mediterranean Coasts of Turkiye) can help to reach reliable information.

8. Did you use The Rufford Foundation logo in any materials produced in relation to this project? Did the Foundation receive any publicity during the course of your work?

We used The Rufford Foundation logo on the first page of the questionnaire (Figure 7). We also share the name of the foundation on the Internet news (Figure 8). We will acknowledge the Rufford Foundation in all published works.

IZMIR KĂTIP ÇELEBI UNIVERSITESI	Rufford Foundation www.rufford.org
Sizi "Karaburun-Ildır Özel Çevre Koruma Alanım (<i>Epinephelus marginatus</i>) Farklı Yöntemlerle İzlenm davet ediyoruz. Bu araştırmaya katılıp katılmama ka nasıl yapılacağını bilmeniz gerekmektedir. Bu neden taşımaktadır. Eğer anlayamadığınız ve sizin için açı isterseniz bize sorunuz.	da Nesli Tehlike Altındaki Orfoz Balığının nesi" başlıklı <u>yüksek lisans tez çalışmasına</u> urarını vermeden önce, araştırmanın neden ve le bu formun okunup anlaşılması büyük önem k olmayan şeyler varsa, ya da daha fazla bilgi
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Bu çalışma İzmir Katip Çelebi Üniversitesi Bilimsel 2023-TYL-FEBE-0031) ve The Rufford Four desteklenmektedir.	Araştırma Proje Koordinatörlüğü (Proje No: dation (Proje No: 40072-1) tarafından
Demografi	

Figure 7. The Rufford Foundation logo on the questionnaire form



Figure 8. The name of the foundation given in the internet news.

9. Provide a full list of all the members of your team and their role in the project.

Project leader Kaan Kırşan actively joined all work packages of the project and made underwater samplings and face-to-face questionnaire surveys. BRUVs frames were made by Adnan Çağlar Oruç. SCUBA dives were performed by Kaan Kırşan, Tuğçe Şensurat Genç and Adnan Çağlar Oruç. BRUVs settlements were performed by all project members (Kaan Kırşan, Tuğçe Şensurat Genç, Adnan Çağlar Oruç and Uğur Özden). Kaan Kırşan and Tuğçe Şensurat Genç did data analysis and prepared the original draft of the final evaluation report of the project.

10. Any other comments?

It is certainly possible to help a species continue to exist by conducting scientific research. However, sharing the known facts about that species and its environment with the public also helps to preserve the species. Even in 20s, it can be too late to change what people know, what people do, and even what people think. Therefore, establishing environmental ethics in childhood may be the most valid action to take to protect a species. We aim to work on this topic in our next the Rufford Grant application.