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Research Article

The feeding and reproductive habits of *Saurida tumbil* and *Rastrelliger kanagurata* in the northern Oman Sea

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Abstract

This study was conducted to determine the feeding and reproductive biology of *Saurida tumbil* and *Rastrelliger kanagurta* in the northern Oman Sea in 2020 -21. A total of 134 and 157 specimens of *S. tumbil* and *R. kanagurta* were collected from landing sites of Sistan and Baluchistan waters, respectively. The results of *S. tumbil* feeding analysis showed that the main diets of this species are fishes, mollusks and shrimps. Gastric emptying index (CV) indicated that this species was highly fed in winter and was identified as a gluttonous species. The results show the lowest value of Gonado-Somatic Index (GSI) in spring and the highest in summer. The reproduction of *S. tumbil* occurred after summer. Length (TL) at first maturity (LM50) for this species was estimated to be about 37.9 cm. The Food Preference (Fp) index showed that the main diets of *R. kanagurta* are phytoplankton and algae and CV reaches its maximum value in autumn. GSI of this species also shows the lowest level in spring and the highest in summer, which indicates that the peak of reproduction of *R. kanagurta* occurred after summer. Length (TL) at first maturity (LM50) for this species estimated to be about 25.2 cm.

Keywords: *Saurida tumbil*, *Rastrelliger kanagurta*, Feeding habits, Reproductive habits, Northern Oman Sea

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Introduction

Oman Sea connects with the Persian Gulf to the northwest through the Strait of Hormuz, which divides Iran and the Arabian peninsula and forms the link between the Persian Gulf and the Arabian Sea. It is 560 km long and at its widest point is 320 km wide (Azari, 2021) . Due to being connected to the open Ocean Waters, the sea benefits from high species diversity. Landings of these two species (*S. tumbil* and *R. kanagurta)* along coastal area of the Oman Sea, from 1997 to 2016 shows increasing trend of the landings for both species during past years (Taghavimotlagh, 2018) .

Greater lizardfish, a marine fish, scientifically known as *S. tumbil* belongs to the Synodontidae family that lives in tropical areas and depends on coral reefs (Sadeghi, 2001) . It is usually found at a depth of 20 to 60 meters. The fish has a small cylindrical body, a sharp and compressed head. Greater lizardfish feeds mainly on fish, crustaceans, and squid (Vahabnezhad *et al.*, 2012). This species caught by gillnet and trawl in the Persian Gulf and Sea of Oman. The total Catch of *S. tumbil* is more than 3000 tons and in Sistan and Baluchistan Province morethan 500 tons per year in 2020 . (IFO, 2020).

Indian mackerel *R. kanagurata*, is one of the important species of the Scombridae family and is a pelagic migratory species that has a wide range in the Indian Ocean and Pacific, west from South Africa, Seychelles, east Red Sea from all over Indonesia, north Australia to Malaysia, China and the Ryukyu Peninsula and enter the Mediterranean Sea via the Suez Canal (Broad, 2003). This species feeds on phytoplankton, zooplankton also larvae of fish and shrimp (Collette, 2001). The lifespan of this species is estimated to be at least 4 years (Romero, 2002). *R. kanagurta* is distributed in the waters of southern Iran (the Persian Gulf and Oman Sea) and caught mainly by gill net and purse seine fishing methods. The total Catch of *R. Kanagurta* is more than 3000 tons and in Sistan and Baluchistan Province more than 17000 tons per year in 2020 . (IFO, 2020).

Survey on feeding habits of marine species not only provides useful information on trophic relationship between species, but also revealed structure and functioning of ecosystems, by evaluating resource use efficiency (Chea *et al.,* 2017). Also, fish reproduction pattern is crucial for fisheries management (Jakobsen *et al.,* 2009) especially in developing countries such as Iran, where managers rely on size at first maturity and the onset and duration of spawning season for managing fisheries (Alimohammadi, 2022).

The present study aims to investigate the diet and reproductive behaviors of *S. tumbil* and *R. kanagurta* in the waters of Sistan and Baluchistan province.

Knowledge of fish feeding is fundamental to our ability to understand trophic modeling in future. On the other hand, the management of exploited fish population is possible only if basic

biological data particularly reproduction is available.

Materials and methods

The present study was conducted in the landing sites of Pozm, Konarak, Chabahar, Ramin and Beris that locate in the northern waters of the Oman Sea. Samples were colleced seasonally from April 2020 to April 2021 (Fig. 1).

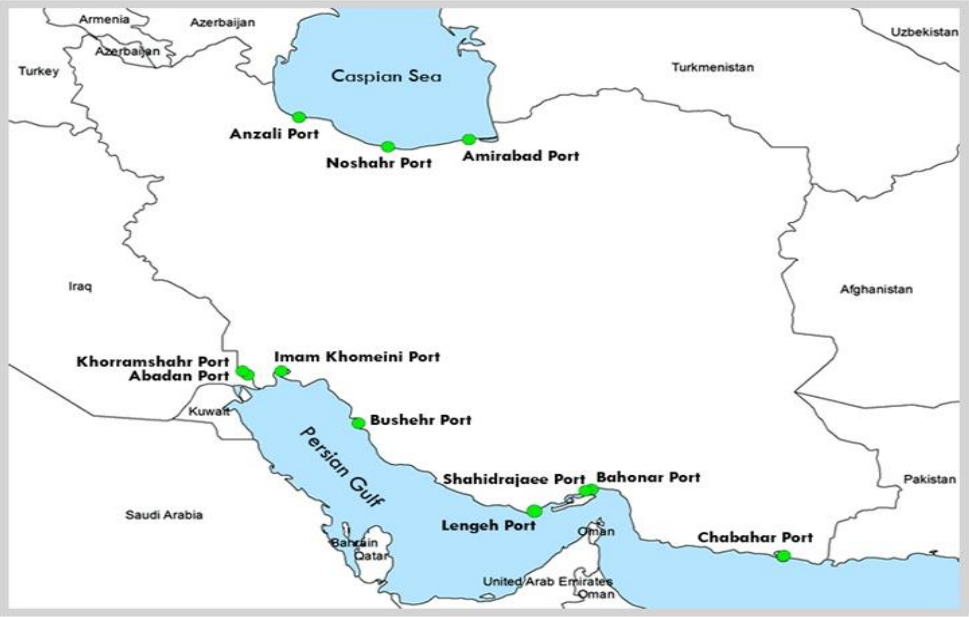

Figure 1: Landing sites in the northern waters of the Oman Sea

134 specimens of *S. tumbil* and 157 specimens of *R. kanagurta* were bio-assayed to examine stomach contents . The total length was measured using a biometric board (accuracy of 1 cm) and the weight was measured with a digital scale (accuracy of 1 g). Samples of stomach contents were identified using a digital camera microscope and weighed (Biswas, 1993).

Fp =Nsj /Ns*100

Where, Fp = food preference of fish, Nsj = number of stomachs that contain a specific prey (j), Ns = Number of stomachs containing food.

If Fp is less than 10, it means that the prey is random and that is not considered as the main food item. If it is between 10 and 50, it means that the prey has been eaten as a second-hand food, and the food eaten is a by-product of fish. Fp above 50 means that the prey has been eaten as the main food item (Biswas, 1993).

To calculate the CV, the following formula was used (Euzen, 1987):

CV= Es/Ts*100

Where, CV = gastric emptying index, Es = number of empty stomachs, Ts = total number of stomachs examined. (The value of the index: 0 -20: gluttonous; 20-40: relatively gluttonous; 40 - 60: moderate, 60 - 80: relatively under-feeding; 80-100: under-feeding).

The onset of the spawning season was explored by gonadosomatic index. To calculate the GSI, the following formula was used (Chrisafi *et al.*, 2007):
GSI= GW/TW*100
Where, GSI= Gonadosomatic Index, GW = Gonad weight, TW = Total body weight

Accurate estimates of size at first maturity (LM50) are useful for fish stock management. Total length used to estimate the size at first maturity (LM50). The proportions of mature fish were estimated at length classes of 2 cm, and the equation model to estimate size at first maturity is: (P=1/(1+exp[-r(L-Lm)]) (King, 2007).
Where, P is the proportion or ratio of reproductive females for each size class, L, is total length (cm) and Lm is the size at first maturity (cm), r is a rate parameter (slope) related the speed of size change from non reproductive to reproductive status The mature fish was considered from stage III.

Results

The Fp index of *S. tumbil* shows that 87.72% of the diet consists of fish, 7.02% of mollusks and 5.26% of shrimp, which can be concluded that mollusks and shrimp are among the random prey and fishes are part of the main diet (Fig. 2). In fact, this index is used to determine the type of food that fish prefer and showed that *S. tumbil* is a piscivorous fish.Three families including Sphyraenidae, Carangidae and Leiognathidae, and *Zannichellia palustris* were found to be as the main foods of *S. tumbil* (Fig. 3).

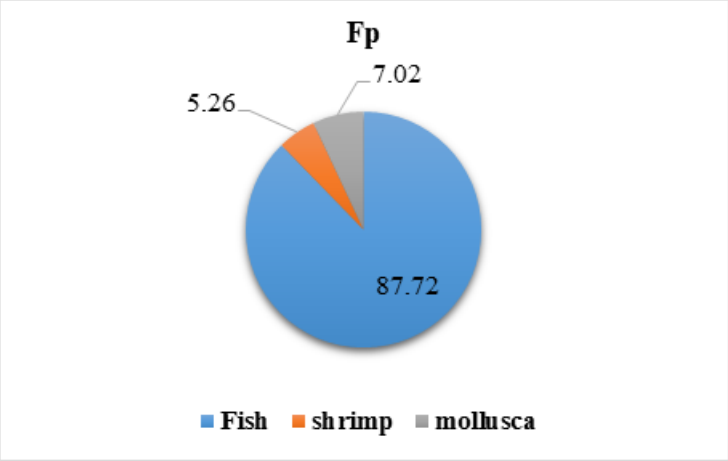

Figure 2: Food preference (FP) index for *S. tumbil* in the northern waters of Oman Sea, 2020-21

Gastric emptying index (CV) of *S.tumbil* showed the highest value in summer (80%) implying very low appetite and anorexia of this species in this season, which is coincided with its reproductive period time. However, this index was calculated 20% in Spring and Atumn and was relatively low (15%), implying over eating of this species in winter period (Fig. 4).

The lowest value of the GSI index was in spring (0.5%) and the highest value was estimated for summer (1.5%). (Fig. 5). According to GSI values, it could be concluded that the main reproductive season of *S. tumbil* is after summer . Length at first maturity (LM50) of this species was estimated at length of 37.9 cm (Fig. 6).

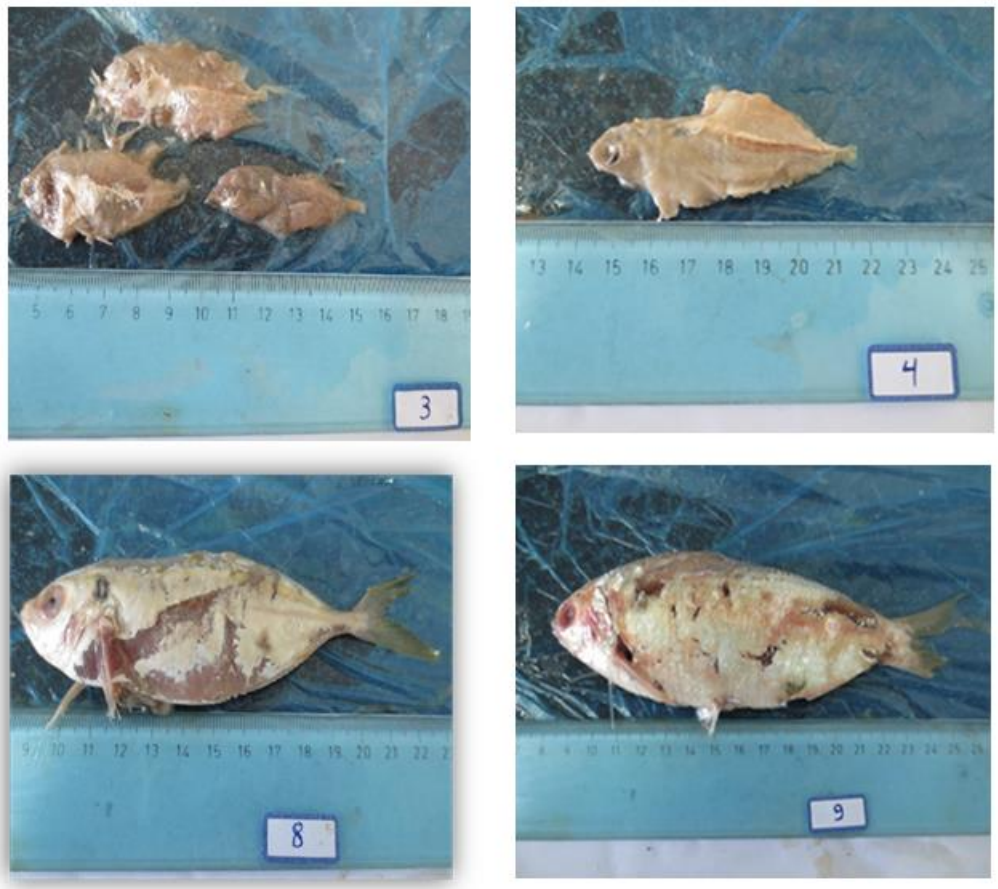

Figure 3 : Stomach contents of *S. tumbil* in the northern waters of the Oman Sea, 2020-21

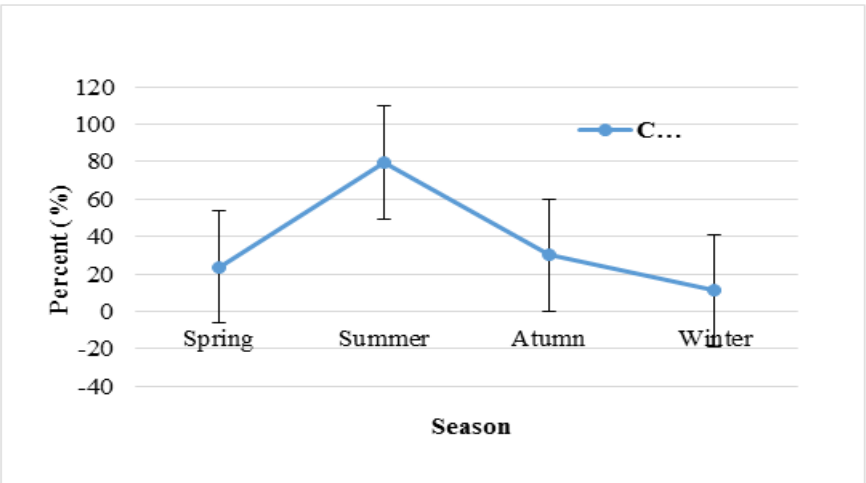

Figure 4: Gastric emptying index (CV) for *S. tumbil*, northern waters of the Oman Sea, 2020-21

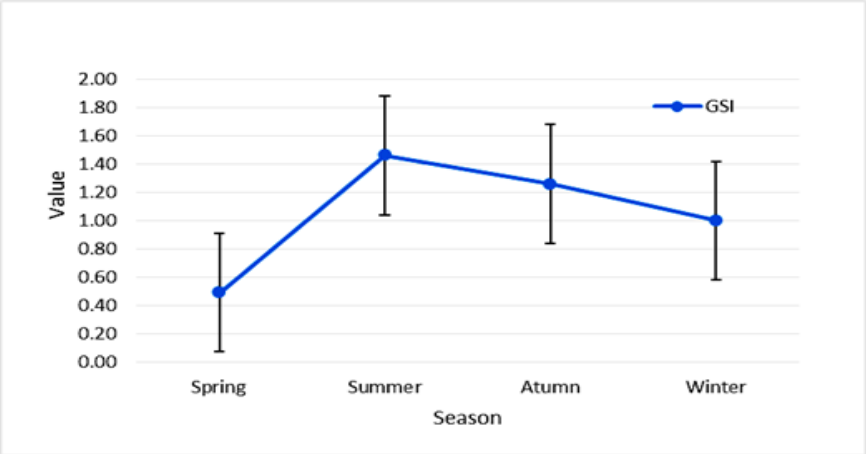

Figure 5: GSI of *S. tumbil* in the northern waters of the Oman Sea, 2020-21

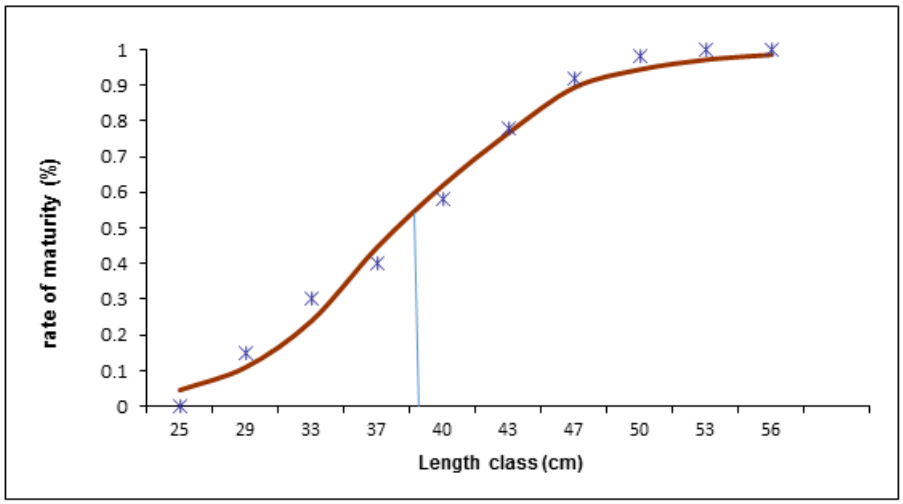

Figure 6: Proportion of mature female of varying body lengths of *S. tumbil*, showing length at first maturity (LM50=37.9 cm), 2020-21

The Fp index for *R. kanagurta* showed that 68.3% are phytoplankton , Algae and Sea weeds, 30 % mollusks and 1.6% fish (Fig. 7). Therefore it could be concluded that, phytoplankton is the main food for this species, mollusks and fish are considered as random food items. The figure also shows the stomatch contents of this species which include algae and sea weeds. (Fig. 8).

Calculation of CV index shows increasing trend from spring (50%) and reaches to its lowest level in winter 10% , which is a sign of overeating. The highest amount of CV occurred in autumn (98%) (Fig. 9).

Figure 10 illustrated seasonal variation of GSI for *R. kanagurta* in northern waters of the Oman Sea , which showed the lowest value of GSI in spring (1.0%) and the highest in summer (3.0%). Length at first maturity (LM50) for this species was estimated to be 25.2 cm. Based on calculated GSI, it can be concluded that peak of reproduction for

R. kanagurta was occurred after summer (Fig. 10).

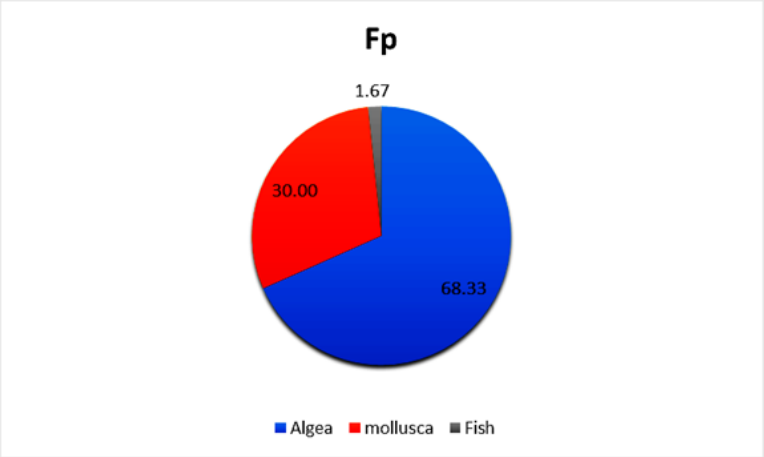

Figure 7: Food preference index for *R. kanagurta*, northern waters of the Oman Sea, 2020-21

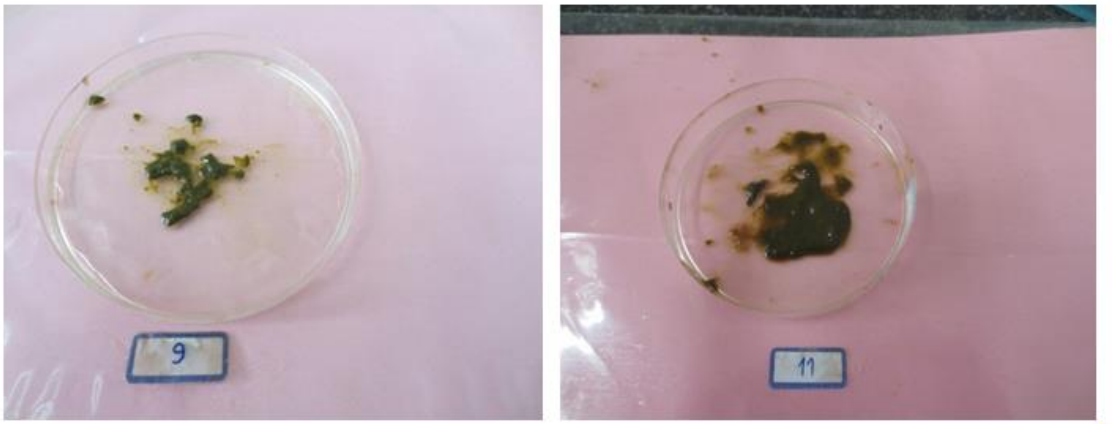

Figure 8: Stomach contents of *R. kanagurta* in the northern waters of the Oman Sea, 2020-21

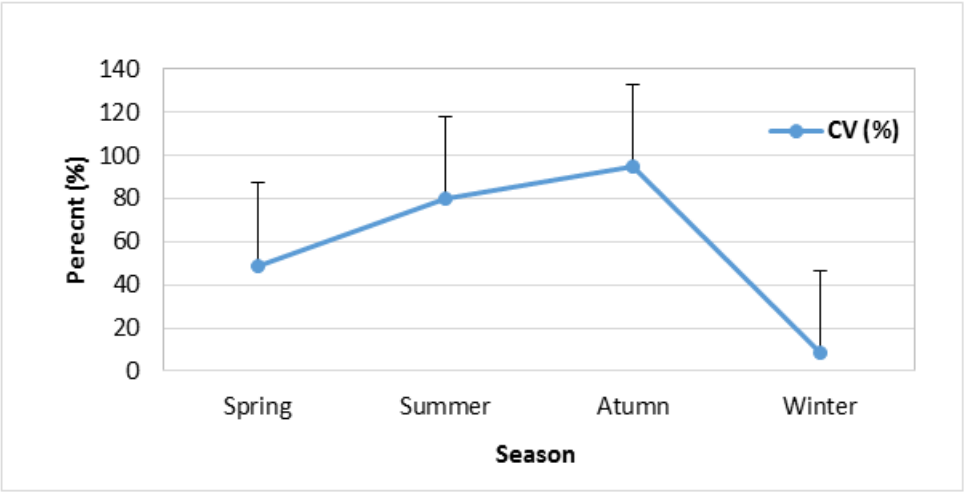

Figure 9: Gastric emptying index for *R. kanagurta*, northern waters of the Oman Sea, 2020-21

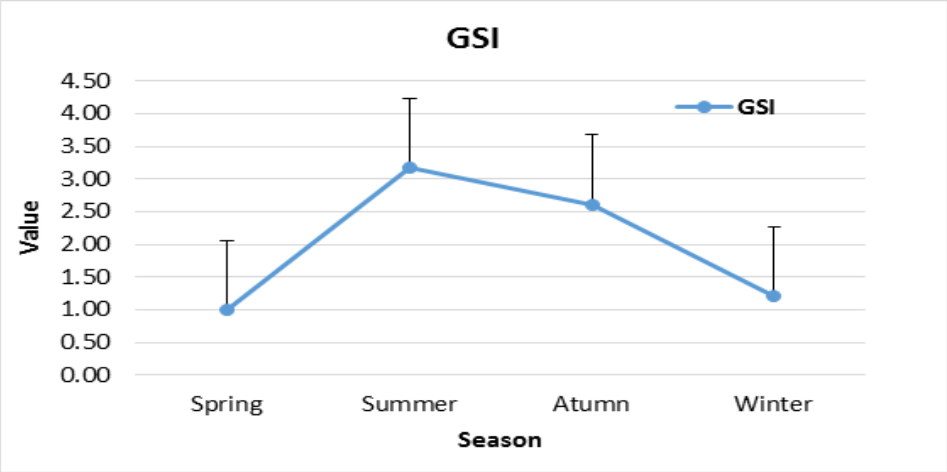

Figure 10: GSI for *R. kanagurta* in the northern waters of the Oman Sea, 2020-21

Discussion

The study of food and feeding habit of different species is a subject of continuous research because it constitutes the basic information for the development of a successful fisheries management programme on fish capture and culture (Oronsaye and Nakpodia, 2005). Dietary variation is due to the coexistence of life with fluctuations in food sources, and the main determinants of diet can be considered as fish size, food preference, and frequency of hunting (Link and Garrison, 2002). According to Barakzai *et al.* (2011), *S. tumbil* in the Oman Sea, is carnivorous, and prey on mullusk, Flathead, *Leiognathus*, Sardine, Belonidae, shrimp larvae, squid, Barracudas, and *Uroteuthis duvaucelii* .

Based on the present study, The Gastric emptying index (CV), which measures appetite of fish to eat for *S.tumbil* showed that the highest value in summer (amount 80%) implying very low appetite . The lowest value of CV was detected in winter (15%), which shows high appetite behaviors in winter time. The result of CV analysis for this species in the Oman Sea is in line with the results explored by Barakzai *et al.* (2011). In the present study, the dietary preference index (Fp) revealed, mollusks and shrimp are among the random prey and fishes are the main diet for *S.tumbil* in the Oman Sea, which concurred with the results of *S.tumbil* feeding studies in Kerala (southwest coast of India), that concluded, this species is exclusively carnivorous and after fish, mollusks and crustaceans are the second food items, that prefer to feed (Manojkomara *et al.*, 2016). According to Soofiani *et al*. (2006) the highest CV index of *S. tumbil* was 45.4% in August and the lowest 6.2% in February , which is in line with the present study results. The average amount of CV in the present study estimated 36.16% , which was lower than the value calculated by Norouzi *et al.* (2012), 60.2% and this might be related to the number of specimens for

each season. Izadian *et al.* (2006) also concluded that *S. tumbil* is low to moderate feeder.

The results of GSI analysis in the current study, showed the lowest value in spring and the highest in summer. According to the study conducted by Mirzaei *et al.* (2015) on the reproduction of *S. tumbil* in the northeast Persian Gulf, the spawning season of this species was begun from September to November, which coincides with the empty stomachs. Furthermore, in the study conducted from 2010 to 2014 on the GSI of *S. tumbil* in the northwest coast of the Indian Ocean, the highest value was determined to be in October and its average was 0.38 to 4.32 (Kiran *et al.*, 2017).The results of Taghavimotlagh *et al.* (2012) on gonad development stages showed that *S. tumbil* is synchronous spawner. Monthly distribution of GSI values demonstrated that the main peak of GSI was in June and then decreased gradually in July and again increased in September. it is apparently clear that *S. tumbil* stock in the northern part of the Persian Gulf has seasonal fluctuations in the gonadosomatic index confirmed recent findings that the spawning periods have a higher peak in May and a lower peak in October that sounds similar to the range of GSI values found in our study. Soofiani *et al*. (2006) reported the maximum value as 4.2 in March and the minimum as 0.26 in December, in the present study, length at first maturity (TL) for *S. tumbil* was estimated to be 37.9 cm, which is much higher than the value estimated by Mirzaei *et al*. (2015), 25.3 cm for males and 27.4 cm for females in the Persian Gulf (Hormozgan waters).

Based on the results of the present study, the Fp index for *R. kanagurta* showed that algae and aquatic plants are the main foods and mollusks and fish are considered as random foods. In other words the main food for *R.kanagurta* was phytoplankton, algae, and aquatic plants. The study conducted by Bagheri *et al.* (2013) in the waters of Hormozgan province on *R. kanagurta*, has revealed that this species feeds mainly on phytoplankton and zooplankton in the early life stages and on fish and shrimp larvae in mature stages . In fact, the diet of *R. kanagurta* includes plankton and with a small fraction, tiny pelagic. According to Bagheri et al. (2013), *Acartia tonsa* is constituted the major percentage (71%) of food composition, and phytoplankton (29%) as the lowest percentage. However, in the study conducted on the shores of the Red Sea, the main and predominant diet of *R. kanagurta* was considered zooplankton, mainily *Acartia tonsa* (Nath *et al.*, 2015). Diatoms and dinoflagellates were identified as the most intake foods (72%), followed by phytoplankton and zooplankton in the southern part of Qeshm Island in the Persian Gulf in 2016 (Hakimelahi *et al.*, 2020).

The results of the present study show the highest value of GSI in summer and the lowest in spring, Therefore peak of reproduction of *R. kanagurta* occurred after summer. According to Bagheri *et al*. (2013), Maximum and minimum of

GSI were calculated 2.15 and 1.12 in autumn and winter, respectively. In the southern coast of Maharashtra (India) the highest value of GSI was reported for females in spring and for males in summer (Mukesh *et al*., 2018). Seifaddini Pour (2014) investigated the reproduction biology of *R. kanagurta* based on monthly rate of GSI, concluded that the spawning of this species occurred in the Persian Gulf and Oman Sea in the spring.

It was reported that *R. kanagurta* spawned in summer in the west coast of India but found the spawning time of this species in winter months in Andaman Islands. The season of spawning for *R.kanagurta* was presented in north Australian water in June and July (Bulletin of the central marin fishes, 1970). Since spawning of *R. kanagurta* is mostly done in summer, a lack of feeding in this season is evident, which after spawning, there is an increase in feeding and weight of fish. In fact, what is certain is that most fish generally do not feed at the time of spawning or at least minimize the feeding (Daghoghi , 2009).

In the current study, LM 50 for *R. kanagurta* was estimated 25.2 cm (TL) for female which is in conformity with the results of Eleanor *et al.*(2017) which estimated length at first maturity, 25.5 cm for male and 24.5 cm for female in the Manila Bay of Philippine.

References

Abbaszadeh, A., Keyvani, Y., Mahbobi Soofiane, N. and Falahati Marvast, A., 2010. Biology of the female Lizardfish, *Saurida tumbil* Reproductive from the Persian Gulf (Bushehr province). *Journal of Fisheries*, 4, pp. 9-22. DOI:10.3906/ZOO-1301-23

Alimohammadi, M., Valinassab, T. and Ramezani-Fard, E., 2022. Feed Comparison and feeding ecology in five Sympatric teleost Species of the northern Oman Sea. Iranian Journal of Fisheries Sciences. 21(2) 463-479. Doi: 10.22092/ijfs.2022.350961.0

Azari, A., Shamsaie Mehrgan. M., Tatina, M. and Rajbai Islami H., 2021. Effect of feeding with different levels of trisodium citrate on growth performance, immunocompetence traits and digestive enzymes in goldfish (*Carrassius auratus*). *Iranian Journal of Fisheries Sciences*, 20(**4**), 1192-1205. Doi: 10.22092/jifs.2021.124569.

Bagheri, A. Saddat Sadeghi, M. and Daghooghi, B., 2013. Feeding Biology of Indian Mackerel (*Rastrelliger kanagurta*) in Hormozgan Province waters (Persian Gulf), Islamic Azad University. *Journal of Marine Biology.I.A.U.Ahvaz-Summer*, 18, 5(**2**), 35-46.

Barakzai, A., Valinassab, T. and Shamsai Mehrjan, **M., 2011.** Investigation of natural feeding status of *Saurrida tumbil* in Gulf of Oman waters. Journal of Renewable Natural Resources Research, Second Year, First Issue, Third Consecutive, pp. 17-24.

Biswas, S.P., 1993. Manual of Methods in fish biology. South Asian publishers PVT Ltd. New Delhi.157 P.

Broad, G., 2003. Fishes of the Philippines. Anvil Publishing, Inc., Pasi City. 510 P.

Bulletin of the Central Marine Fisheries Research Institute marine fisheries, 1970. The Indian Mackerel. No 24. 141 P.

Chea, R., Lek, S., Ngor, P. and Grenouillet, G., 2017. Large-scale patterns of fish diversity and assemblage structure in the longest tropical river in Asia. *Ecology of Freshwater Fish*, 26, 575-585. DOI:10.1111/eff.12301.

Chrisafi, E., Kaspiris, P. and Katselis, G., 2007. Feeding habits of sand smelt *Atherina boyeri,* Risso ,1810 in Trichonis lake(Western Greece). *Journal of Applied Ichthyology*, 23, 209-214. DOI:10.1111/j.1439-0426.2006.00824.x.

Collette, B.B., 2001. Scombridae. Tunas (also, albacore, bonitos, mackerels, seerfishes, and wahoo). p. 3721-3756. In K.E. Carpenter and V. Niem (eds.) FAO species identification guide for fishery purposes. The living marine resources of the Western Central Pacific. Vol. 6. Bony fishes part 4 (Labridae to Latimeriidae), estuarine crocodiles. FAO, Rome.

Daghoghi, B., 2009. Final Report of the Tuna and Sardine Diet Survey of Dominant Fish in the West of the Gulf of Oman (Jask Region). Final report of the project, Iran Fisheries Research Institute Publications, 117 P. (in Persian).

Eleanor, R., Adonis, B., Eunce, D.C., B,. Gonsales, F., Torres, F.J.S, Santos, M.D. and Lopez, G.F., 2017. Reproductive Biology of Common Small Pelagic Fishes in Manila Bay, Philippines. *The Philippine Journal of Fisheries*, 24(**1**), 47-60. DOI: 10.31398/tpjf/24.1.2016A0003

Euzen, E., 1987. Food habits and diet composition of some fish of Kuwait. *Bulletin Science*, 9, pp. 65-86.

Hakimelahi, M. Savari, A., Doustshenas, B., Ghodrati Shojaei , M. and Lewis, K.A., 2020. Food and feeding habits of Indian mackerel *(Rastrelliger kanagurta*) in the Southern part of Qeshm Island Persian Gulf. *Iranian Journal of Fisheries Science*, 19(**2**), 563-573. DOI: 10.22092/ijfs.2018.120058.

Izadian, M., Seifabadi, J. and Valinassab, T., 2006. Study of *Saurida tumbil* diet in coastal waters of Hormozgan province. *Iranian Journal of Biological Knowledge* , 3, 23-33, (in Persian).

Iranian Fisheries Organization(IFO). 2020. Statistical Yearbook of Iran Fisheries Organization. Iran Fisheries Organization, Vice President of Planning and Management Development, Program and Budget Office. 60 pages.

Jakobsen, T., Fogarty, M. J., Megrey, B.A. and Moksness, E., 2009. Fish Reproductive Biology: Implications for Assessment and Management. Oxford: Blackwell.

King, M., 2007. Fisheries biology, assessment and management. Oxford, UK: Blackwell Publishing, 2nd ed, pp. 289-294.

Kiran, S., Mali, M. Vinod Kumar, M. K. Farejiya, K. Rama Rao and A. K. Bhargava., 2017. Reproductive Biology of *Saurida tumbil* (Bloch 1795) and *Saurida undosquamis* (Richardson 1848) Inhabiting North West Coast of India. *International Journal of Pure & Applied Bioscience*, 5(**6**), 957- 964. DOI:10.18782/2320-7051.6080

Link, J.S. and Garrison, L. P., 2002. Trophic ecology of Atlantic cod Gadus morhua on the northeast US Continental shelf. *Marine Ecological Progress Series*, 227, 109-123

Manojkumar, P. and Pavithran, P.P., 2016. Diet and feeding habits of *Saurida tumbil* (Bloch, 1795) from Northern Kerala, South-west Coast of India. *Indian Journal Fish*, 63(**4**),41-47. DOI: 10.21077/ijf.2016.63.4.60208-07.

Mirzaei, M., Valinassab, T., Khalil, M. and Mirzaei, S. 2015. Reproductive cycle and spawning patterns of Lizardfish, *Saurida tumbil* (Bloch, 1795) in southern water of Iran. *International Journal of Biosciences*, 6, 6, pp. 110-118. DOI: 10.12692/ijb/6.6.110-118

Mukesh, P., Bhendarkar, Rajiv, H., Rathod Harshavardhan, D., Joshi. and Upsana S., 2018. Study on the fecundity and Gonadosomatic index of *Rastrelliger kanagurta* (Cuvier, 1817) of Southern Coast of Maharahtra. *India Journal of Applied and Natural Science*, 10(**1**),107-110. DOI:10.31018/jans.v10i1.1588

Nath, SR., Beraki, T., Abraha, A., Abraham, K. and Berhane Y., 2015. Gut Content Analysis of Indian Mackerel (*Rastrelliger kanagurta*). *Journal Aquaculture Marine Biology*. 3(**1**). DOI: 10.15406/jamb.2015.03.00052

Norouzi, H., Valinassab, T., Kamali, A., Kaymaram, F.and Shamsaei, M., 2012. Evaluation of some feeding Indices of *Saurida tumbil* in the Northern Persian Gulf and Oman Sea. *Ecology, Environment and Conservation Journal*,18 (**4**), 54-57. DOI: 10.31398/tpjf/24.1.2016A0003

Oronsaye,C.G. and Nokpodia, F.A., 2005. A comparative study of the food and feeding habits of Chrysichthys habit and reproductive characteristics of the Pok. *J. Sci* . *Ind. Res*, 48, 118-121.

Romero, P., 2002. An etymological dictionary of taxonomy. Madrid, unpublished.

Sadeghi, N., 2001. Biological and morphological characteristics of fish in southern Iran (In Persian) . Naghsh Mehr Publications, 438 P.

Seifaddini Pour, M., Malekian, N., Khayatzadeh, J. and Kamali, I., 2014. Reproductive cycle of the female Indian mackerel, *Rastrelliger kanagurta* in the northern Persian Gulf and Oman Sea (Histological and Biometrical studies). *SG. Res.*, 5(**4**) 150-157.

Soofiani, N.K., Keivany, M.Y. and Shooshtari, i.m., 2006. Contribution to the biology of the Lizardfish, *Saurida tumbil*, from the Persain Gulf. *Zoology in the Middle East*, 38, 49-56.

Taghavimotlagh, S.A., Vahabnezhad, M.J. Shabani, M.A. Nazari and Hakimelahi, M., 2012. Studies on the Reproductive Biology of the Female *Saurida tumbil* in the Persian Gulf (Bushehr Province, Iran). *World Journal of Fish and Marine Sciences*, 4(**4**), 400-406, DOI: 10.5829/idosi.wjfms.2012.04.04.62191.

Taghavimotlagh, S.A., 2018. Commercial Fishes of the Persian Gulf and Oman Sea and Prediction of their Sustainable Yield (In Persian). Iranian Fisheries Science Research Institute, 660 P**.**

Taghavimotlagh, S.A., Ghodrati shojaei, M., Vahabnezhad, A., 2021. Life history of ribbonfish *Trichiurus lepturus* (Linnaeus,1758) in the Persian Gulf and Oman Sea. Iranian Journal of Fisheries Sciences. *Iranian Journal of Fisheries Sciences*. 20(**2**) 298-312. Doi: 10.22092/ijfs.2021.123623.

Vahabnezhad, A., Taghavimotlagh, S.A. and Shabani M.J., 2012. Investigating food habits, estimation trophy level and food consumption rate of *Saurida tumbil* in the Persian Gulf (Bushehr Province. *Iranian Fisheries Journal*, 21, 4, pp. 139-150, (in Persian). DOI:10.5829/idosi.wjfms.2012.04.04.62191