

The Status of *Tenualosa toli* (Valenciennes, 1847) in the South-west Coast of Sarawak, Malaysia

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Abstract

The tropical shad of genus *Tenualosa* (family Clupidae) or locally known as Terubok, are important estuarine fishes, both commercially and culturally in many Asian countries including Malaysia. However, *Tenualosa* species are subject to heavy fishing pressure and have suffered major declines. The decline of *Tenualosa toli* catch landing since 1980's had urged the state government of Sarawak to view with serious concern regarding the problem and directed research and development project to be conducted for maintaining and replenish the natural stock of the species in Sarawak. Therefore, this study was designated to examine the current status on the population of *Tenualosa toli* within Batang Lupar, Batang Lassa and Batang Saribas in the south-west coast of Sarawak which is known as "core Terubok areas". The informations that generated from this research will be useful for further studies not only on the ecology, distribution of *Tenualosa* but also on the conservation and sustainable management of this commercial fish.

Key words: Terubok Sarawak, *Tenualosa toli*, Batang Lassa, Batang Saribas, Batang Lupar

Introduction

The tropical shad of genus *Tenualosa* (family Clupidae) or locally known in Malaysia as ikan Terubok, are important estuarine fishes, both commercially and culturally in many Asian countries including Malaysia. There are currently five clupeids of the genus *Tenualosa* described worldwide; *Tenualosa ilisha*, *Tenualosa macrura*, *Tenualosa revesii*, *Tenualosa thibaudaui* and *Tenualosa toli* (Blaber *et al.*, 2003). However, only *T. macrura* (Terubok Laut) and *T. toli* (Terubok Sungai) can be found in the Malaysian waters, both are confined along the coastal waters of Sarawak. These clupeids are unique because they are protandrous hermaphrodite (Blaber *et al.*, 1996). *Tenualosa toli* is currently found only in the estuaries and adjacent coastal areas of Sarawak (northern coast of Borneo) which comprises the estuaries of Batang Sadong, Batang Lupar, Batang Saribas and Batang Lassa in Sarawak (Rajali, 1991; Milton *et al.*, 1997; Phillip, 2001; Blaber *et al.*, 2003).

However, all *Tenualosa* species are subject to heavy fishing pressure and have suffered major declines. Although *T. toli* and *T. macrura* have a great cultural significance in Sarawak and Sumatra respectively, both are still commercially fished for their eggs, which command very high prices (Blaber *et al.*, 2003). Thus, a more effective management and conservation strategies should be implemented to protect and sustain the fisheries resources of *Tenualosa toli* in Sarawak. The decline of *Tenualosa toli* catch landing since 1980's had urged the state government of Sarawak to view with serious concern regarding on that problem to conduct a collaborative research with Commonwealth Scientific and Industrial Research Organization (CSIRO), Australia (Ministry of Agriculture and Community Development, 1994).

The estuaries of Lassa, Saribas, and Lupar River in Sarawak are known as the "core Terubok's areas" as the population of *Tenualosa toli* can only be found within these three water bodies (Fig. 1). The species has long been a prized target by local fishermen for the high price

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Fig. 1. Maps showing sampling location of the “core Terubok areas” in Batang Lupa, Batang, Lassa and Batang Saribas, Sarawak (<http://earth.google.com>, 2010).

commanded by the roe and the flesh. Since 1980's the total catch landing for the species has been reported to be at a very low level due to over-exploitation.

Several studies on the life history, biology, ecology and life cycles of *Tenualosa* species have been done in Sarawak for conservations, management and culture for the continuous maintenance of *T. toli* populations (Blaber *et al.* 1996; Milton *et al.* 1997; Pang and Teck, 2001; Philip, 2006). However, little information was known about the abundance and distribution of this fish. In fact the total number of catch landings is still decreasing. Thus, it is crucial to obtain the current status of *T. toli* population in the south-west coast of Sarawak for their sustainable management and conservation.

Material and Methods

Fish samples were collected from the south-west coast of Sarawak in estuaries of Batang Lupa and

Batang Saribas with the help of local fishermen. All sampling locations were determined and relocated with a differentially corrected Global Positioning System (GPS) receiver (Model Garmin, GPS 76, SN 80308437, Olathe USA). The fish was caught using 75 mm – 100 mm stretch mesh monofilament gill nets.

Length based stock assessment method were used for the study. For this purpose, length-frequency data of *T. toli* were collected monthly from the commercial catches at different fish landing sites including local fish market from May 2010 to April 2011. Total (TL) and standard (SL) fish length (to the nearest 0.1 cm) and total fish weight (TW) (to the nearest 0.01 g) were measured using a meter scale and a spring balance, respectively. The catch rates and catch per unit effort during the sampling trips was recorded. Local fishermen were also interviewed for additional information regarding on the fish landing.

Results and Discussion

A total of 147 fish specimens were collected. However, only 23 specimens were collected from the sampling sites and others 124 specimens were obtained from local fish market and fishermen. This included 117 individual specimens from the estuary of Batang Lupar and seven specimens from the estuary of Batang Saribas.

Most of fishermen in Batang Saribas areas sold their catches to the middle-men and they only kept several fish catches for their own consumption. However, the fishermen from Batang Lupar directly brought their *T. toli* catches to local fish market around Samarahan where they sold the catches to the local fishmonger or to the middle-men. In some cases, we also found that such *T. toli* specimens bought from local fishermen and at fish market in Kuching, was originally from Batang Lupar estuary. Nevertheless, the catches are usually mixed with *Tenulosa macrura*.

Smaller *T. toli* is locally known as Empirit in Sarawak, while the larger fish is commonly known as Terubok. Phillip (2006) stated that the male *T. toli* that are smaller in size usually change their sex to female at the size of 27 cm and weight of 600 g. It shows that the collected specimens less than 27 cm in length are classified as Empirit and the specimens having length that more than 27 cm are classified as Terubok. However, from 147 specimens collected, 65 individual or 45% are classified as Empirit and 82 individual or 55% specimens are Terubok. It is indicated that the fishing effort for smaller size of *T. toli* seems to be lower compared to that for the larger size. In addition, it also shows that most of the fishermen are following the rules and regulation pro-

vided by the government for using larger mesh size net to prevent from collecting smaller size of *T. toli*. Catches of Empirit should be avoided to ensure that the species could undergo sex change and spawning as female in the second year of their life cycle.

Fig. 2 shows the number of Empirit and Terubok specimens collected according to month from May 2010 to April 2011. The most of Terubok catches occurred from August 2010 to October 2010 while Empirit catches mostly occurred in April 2011. This figure shows similar trend of Empirit and Terubok catches recorded by MAFI and CSIRO, Australia ((Ministry of Agriculture and Community Development, 1994). Previous study showed that catches of Empirit from the estuary of Batang Lupar were at the peak from April to June 1997 while catches of Terubok are at the peak in November 1996, and from July to September 1997.

The overall weight of specimens collected was 42274.80 g (42 kg) with the mean weight of 287.58 g. The highest individual weight was 850.00 g and the smallest individual weight was 53.04 g, respectively. In 1993, MAFI and CSIRO, Australia recorded the weight ranged for *T. toli* collected from Batang Lupar between 46 g to 1650 g (Ministry of Agriculture and Community Development, 1994). However, the weight range of fish samples obtained in this study is lower and it shows that *T. toli* with higher weight (reaching 1000 g) is hard to obtain in the present days.

The highest total weight of specimens was recorded in February 2011 (8536.90 g) and the lowest total weight of specimens is in November 2010 (0 g). Number of specimens collected in February 2011 is only 19, and no specimen was collected in November 2010. This

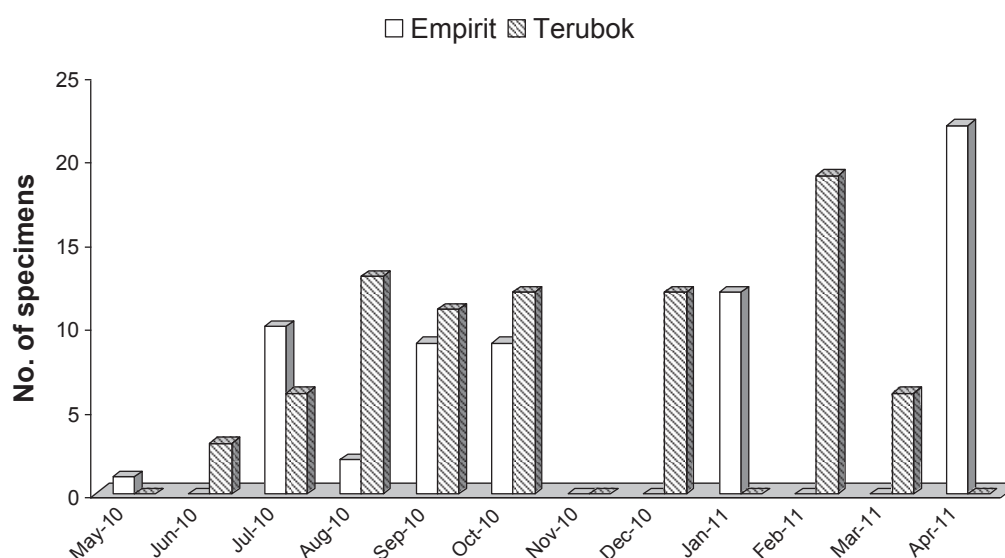


Fig. 2. Number of Empirit and Terubok (*T. toli*) specimens collected according to month.

is due to the low fishing effort during the period of adverse weather condition that caused by north-east monsoon season. The weight of the specimens collected in February 2011 is ranged from 295.66 g to 766.85 g which explained the highest total weight of the specimen value (Fig. 3).

Fig. 4 shows the mean total weight of specimens collected following the month from May 2010 to April 2011. It shows that the highest mean total weight value was recorded in June 2010, where all three individuals collected within this month having weight more than 500 g, respectively. Based on these figures, bigger sizes of *T. toli* were dominated the catches during their spawning season from June 2010 to October 2010 and also in early 2011 from February to March. This is because most

of the fishermen are targeting the female *T. toli* which are bigger in their size. Furthermore, it also shows that most of the larger sizes *T. toli* are abundant within those months.

The total length and the standard length of specimens collected were ranged from 19.6 cm to 44.6 cm and from 12.9 cm to 36.5 cm, respectively. However, MAFI and CSIRO recorded that the range of standard length for *T. toli* collected from Batang Lupar was from 14.0 cm to 45.0 cm (Ministry of Agriculture and Community Development, 1994). The shorter fish length recorded in the current studies compared with the previous survey probably has indicated that the sizes of the species are getting smaller and larger individuals are hard to obtain. Fig. 5 show the frequency of specimens collected

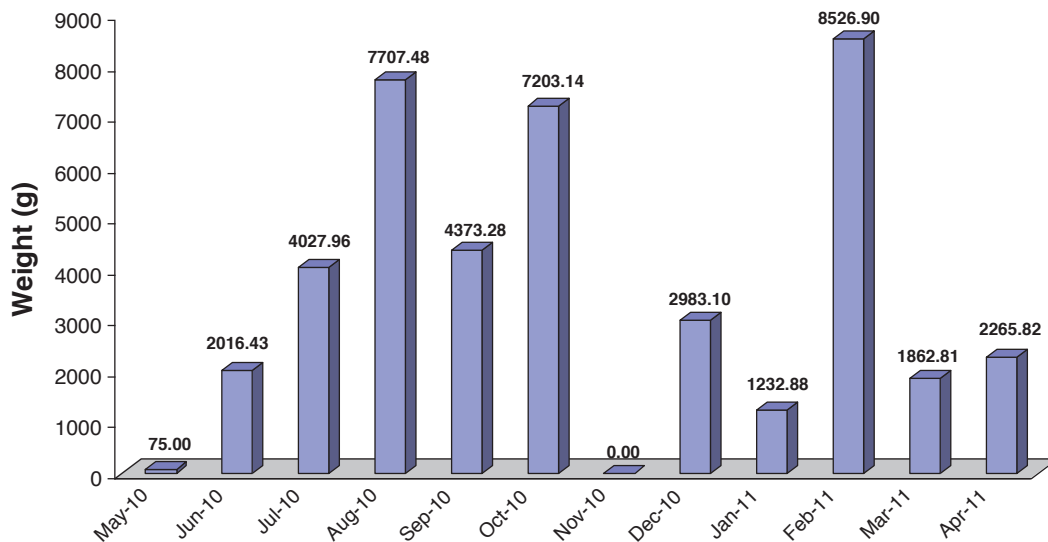


Fig. 3. Total weight of specimens (± 0.01 g) collected according to month.

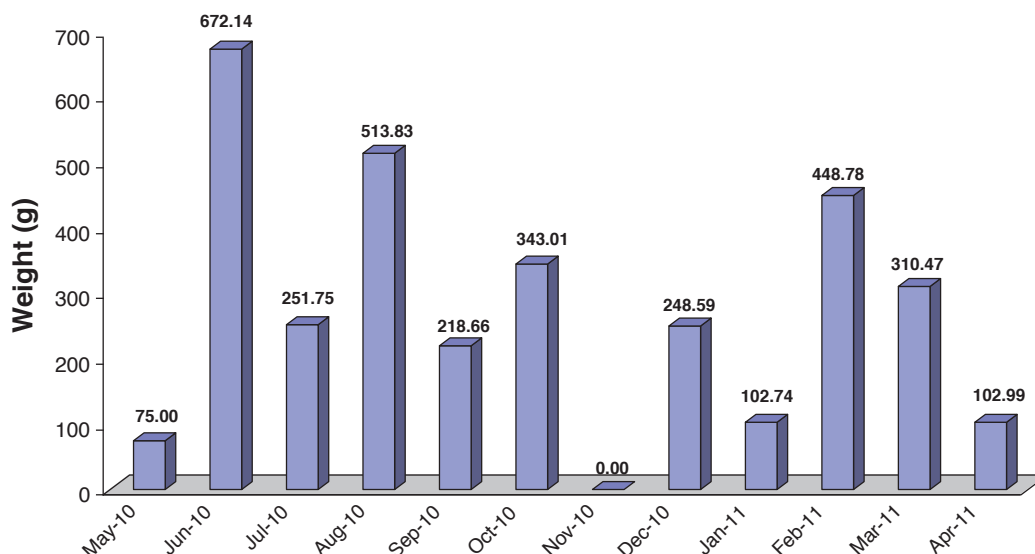


Fig. 4. Mean total weight of specimens collected according to month.

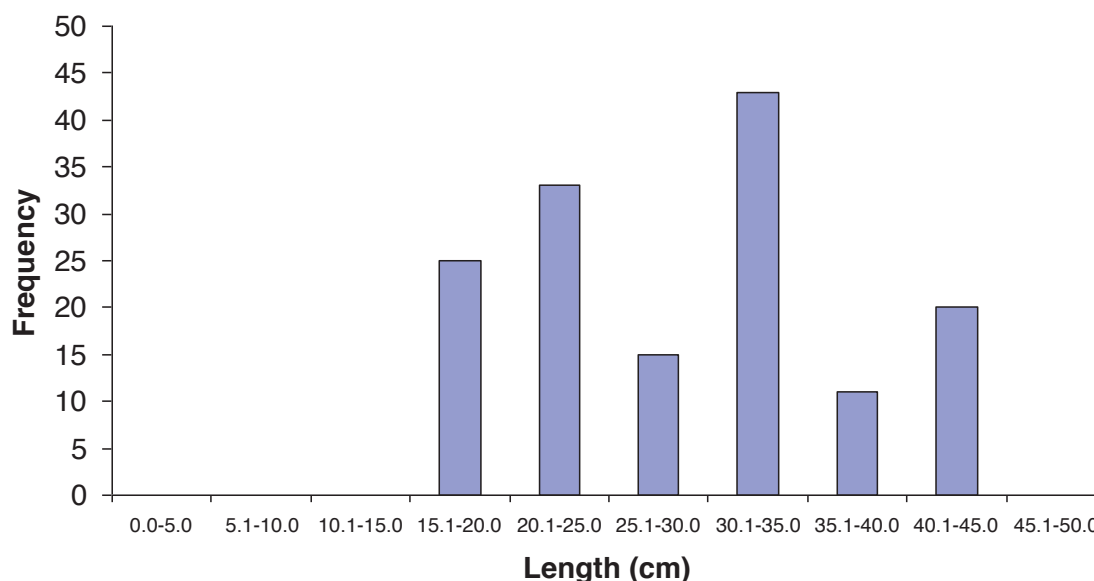


Fig. 5. Frequency of specimens collected according to length classes (cm).

according to the length classes. It showed that *T. toli* with average total length are dominating the specimen collected and the same reason for the number of Empirit and Terubok collected can be applied for this data.

Table 1 shows the sampling data recorded in the Batang Lupar and Batang Saribas at southwest coast of Sarawak. The specimens collected from Batang Saribas in October 2009 were not included for the analyses of the catch rates (number of fish/person/hour) and catch per unit effort (CPUE) (number of fish/1000 m net/ hour). It shows that catch rates and CPUE of *T. toli* for both sampling locations was low. However, local fishermen mentioned that the number of catches during the fishing season of *T. toli* is varied depending on the weather and water quality. Usually the number of catches is lower during rainy days and less muddy water condition. This condition is probably explained the difficulty to obtain the fish samples at Batang Lupar and Batang Saribas in May and August 2010 where the water temperature low due to rain. *Tenuialosa* fish species are mainly found in large and turbid estuary (Mohsin and Ambak, 1996) where rich with zooplankton community that have provided the food source for the population of this species (Mohammad Hambali *et al.*, 2011). Thus, the low number of fish catches probably is correlated with the

water is less muddy during the sampling.

Since 1980's the total catch landing for the *Tenuialosa* species has been reported decline due to over-exploitation. Due to this condition, the rule and regulations such as closed season, types of fishing gear, and number of fishing vessels to manage and sustain the fisheries resources particularly on *Tenuialosa* sp have been started since 1993 (Mohammad Hambali *et al.* 2011). For instance, most of the fishermen are using monofilament gillnet with 75 mm to 100 mm mesh to avoid the catch of smaller *T. toli* or Empirit. Furthermore, as a results of the culture and re-seeding program by the state and private agency more than one million *Tenuialosa* species fries was released into Lupar River from 1996 to 2006 (Phillip, 2006). However, the data collected in the present survey have shown that Empirit are abundance in the areas where fishery of *T. macrura* largely occurs, particularly at the large estuary embayment formed by the mouth of Batang Sadong, Batang Lupar, and Batang Saribas. Some of local fishermen usually are using smaller mesh size (50 mm to 100 mm) of net for *T. macrura* fishery. This probably is the main reason for the higher catches of Empirit in early 1996, 1997, and 2011 where during this particular period the fishery of *T. macrura* is at the peak season. Thus, the use of mesh

Table 1. The sampling data recorded in the Batang Lupar and Batang Saribas at southwest coast of Sarawak.

Location	Sampling date	Hour of fishing trip	No. of fishermen	Length of net	Specimen collected
Batang Lupar	May 2010	8	2	1000 m	0
	October 2010	6	2	1000 m	12
Batang Saribas	October 2009	8	2	1000 m	2
	August 2010	7	2	1000 m	4

size which less than 75 mm for fishery activity within the core Terubok areas such as in Batang Lupar, Batang Saribas and Batang Lassa should be prohibited to sustain and to increase the number of *Tenualosa toli* population. Indeed, by examining on the population, ecology, habitat preference, distribution, abundance and correlation with physicochemical parameters may contribute to the understanding of the current status and the population dynamic of this species in natural habitat throughout Borneo.

Conclusion

Tenualosa toli is one of the most important species of for commercial fisheries in Sarawak. However, the species is subject to heavy fishing pressure due to overfishing. Although the data on the population of *T. toli* obtained in this study is still inadequate to provide the specific status of the fish population, it show that the population of *T. toli* in Batang Saribas is moving toward depletion. Similarly, *T. toli* population in Batang Lupar and Batang Lassa is also showing the similar trend. Based on the smaller size fish caught, overlapping with other species fishery, small mesh size nets used and fishermen targeting the female fish with roe, are among the main reasons for the depletion of the species. In addition, the anthropogenic activities also will affect the habitat of *T. toli* population. Thus, a more effective management and conservation strategies should be implemented to protect and sustain the fisheries resources of *Tenualosa toli* in Sarawak.

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References

- Blaber, S.J.M, Milton D.A, Pang J., L.Vong P. Ong B.T, Nyigo L, Lubim, D.1996. The life history of the tropical shad *Tenu alosa toli* (Valenciennes 1847) from Sarawak: first evi dence of protandry in the Clupeiformes. Environ. Biol .Fish, 46:225-242.
- Blaber, S.J.M. 2000. Tropical estuarine fishes; ecology, exploitation and conservation. Fish and Aquatic Resource Series 7. Blackwell Science Ltd.
- Blaber, S.J.M., Milton, D.A., Chenery, S.R., Fry, G., 2003. New insights into the life history of *Tenualosa ilisha* and fishery implications. Am. Fish. Soc. Symp. 35, 223–240.
- Milton, D.A, Simon R.C, Margaret J and Blaber, S. J. M. 1997. Identifying the spawning estuaries of the tropical shad, terubok *Tenualosa toli*, using tolith microchemistry. Marine Ecology Progress Series, 153: 283-291.
- Ministry of Agriculture and Community Development. 1994. The biology, ecology and life cycle of Terubok (*Tenualosa toli*) with recommendations for the conservation, management and culture of the species. Phase 1 Final Report.
- Mohamad Hambali Bin Tumiran, Khairul Adha A. Rahim, Shabdin Mohd. Long, Yuzine Esa, Awang Ahmad Sallehin Awang Husaini. 2011. Environmental Parameters of “core Terubok areas” and the Relationship with Terubok Sarawak Population. *International Fisheries Symposium 2011*, UMT-October 2011.
- Mohsin, A. K. M., & Ambak, M. A., 1996. Marine fishes & fisheries of Malaysia and neighbouring countries. Universiti Pertanian Malaysia Press.
- Pang, J. and Teck B 2001. The Culture and Re-Seeding of Terubok (*Tenualosa toli*) in Sarawak, Malaysia. *Proceedings of the International Terubok Conference Sarawak, Malaysia*. Sarawak Development Institutes (SDI). 1:100-111.
- Phillip, W. P. H. 2001. The Status of Terubok (*Tenualosa toli*) fishery in Sarawak. International Terubok Conference. *Proceedings of the International Terubok Conference Sarawak, Malaysia*. Sarawak Development Institutes (SDI). 1:91-99.
- Phillip, W. P. H. 2006. Working Paper on The Efforts In Conservation & Management of Terubok (*Tenualosa toli*) Fishery In Sarawak, Malaysia. Seminar on Terubok Conservation 2006.
- Rajali, H., 1991. Perikanan Terubuk (*Tenualosa toli*) di Sarawak, Malaysia. Jabatan Perikanan Kementerian Pertanian Malaysia.