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Some Observations on the Morphometry of Kelee Shad *Hilsa Kelee* (Pisces: Clupeidae) from Pakistan Coast

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Abstract

Various parameters of morphometry of kelee shad *Hilsa kelee* was studied which indicates a strong relationship between total length and other parameters. The results obtained suggest that smaller sized specimens which local consider being different species are juveniles of *Hilsa kelee.* The paper also gives a brief account of fishery of kelee shad in Pakistan.

Keywords: Kelee shad, *Hilsa kelee,* morphometry, fishery

Introduction

Clupeiform fishes contribute substantially to the marine fish catch of Pakistan. Of a total of 499,159 m. tons and 430,579 m. tons of marine fish landings, clupeoids such as sardinellas, thryssas, anchovies, shads and wolf herrings contributed 166,509 and 74,983 m tons in 1993 and 1999 respectively (Anonymous, 2001). Kelee shad *Hilsa kelee* is an important clupeoid which is commercially harvested all along the Pakistan coast. Although separate statistics for this shad is not recorded but it is estimated that its annual contribution alone accounted for more than 15,000 m. tons. This species is economically important as it is not only consumed as food locally but also is used for production of fish meal.

Hilsa kelee is widely distributed in the Indo-Pacific area south to Durban to East African Coast, Gulf of Aden, Oman, Iran, Pakistan, India, Bangladesh, Myanmar, Thailand, Malaysia, Indonesia, Kampuchea, Vietnam, Hong Kong, Taiwan and Papua New Guinea (Whitehead, 1985). (Day (1878) was probably first to report this species from Sindh coast whereas Zugmeyer (1913) reported this species from Balochistan. This pelagic species is found in shallow coastal waters upto a depth of about 10 m also known to enter estuaries (Whitehead, 1985). This species is capable of tolerating quite low salinities upto 7 $^{o}/_{oo}$. Ahmad *et al* (1975) and Niazi and Moazzam (1999) have studied the fish fauna of Leth Nullah, its estuary and associated marine environment and found this species to be inhabitant predominantly of marine side of the estuary. According to Niazi (1976) this species is mainly caught in the summer months in Sindh creeks whereas young fishes are caught during winter months in creeks and brackish water channels in the area.

Kelee shad is mainly harvested with various types of castnets, gillnets, seines and estuarine set bag nets. However, drift gillnets ('Rach') and bottom set gillnet ('Thukri') are main fishing gears. Principal fishing grounds of this species are located along the entire coastline of Sindh and Balochistan especially in Indus creek areas, Bundewari, Sonmiani Bay, Miani Hor, Ormara (West Bay), Pasni Bay, Ras Shahid, Kappar, Sur and Gwader (East Bay) and Gwater Bay. However, Kapper and Sur located between Pasni and Gwader are the main fishing center for these species. This species is caught throughout the year especially during September to November and March to May with maxima in March. No data on its seasonal landings is available except for landing data of Balochistan coast for the year 1983 (Fig. 1). Small

quantities of this fish is wet salted and sent to hinterland area in Balochistan whereas bulk of the catch is sun-dried, cooked and then again sun-dried and pulverized to form meal which is used in poultry industry.

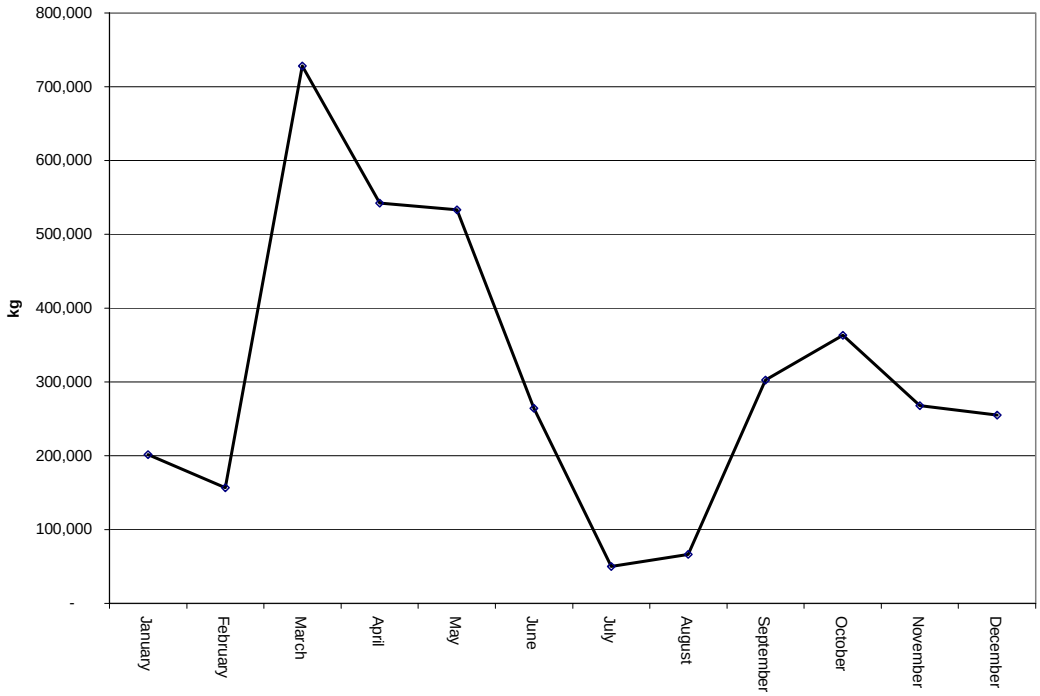

Fig. 1. Landings of *Hilsa kelee* along Balochistan coast during 1983 (source: Directorate of Fisheries, Government of Balochistan Pasni)

Kelee shad is locally known as 'Palli" in Sindh and 'Kolgar' in Balochistan. Juveniles and sub-adult are known as 'Bar-rag' in Balochistan. Fishermen of Balochistan are well known for their excellent folk taxonomy of the marine fishes. They generally regard 'Bar-rag' and 'Kolgar' as two separate categories. In order to verify that that these two categories belong to one species i.e. *Hilsa kelee* this study on morphometry was started and it deals with study of various morphometric parameters of juveniles and adults. Information about various aspects of biology of Hilsa kelee is limited to the work of Babu Rao (1964) and Reintjes (1974). Froese and Pauly (2003) has given a summary of information on this species including some information on morphometry obtained from a figure given in Whitehead (1985) and a photograph published by Gloerfelt-Tarp and Kailola (1984).

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Materials and Methods

Samples of kelee shad were collected from the commercial fish landings at various places along the coast of Pakistan in intermittently in 1984 and again in 1995-1996. Various parameters listed in Table-I were measured to the nearest millimeter. Since statistically insignificant differences were noted among various fishing centers and during different periods, therefore, data was pooled together. Statistical analysis of the data was carried out using Lotus 123 and graphs were plotted using Microsoft Excel.

Results and Discussion

A total of 322 specimens of kelee shad *Hilsa kelee* were analyzed for various parameters. Although no previous work on the relationship between such parameters of *Hilsa kelee* was available except Froese and Pauly (2003) who gave data of relationship between various parameters based on measurements made from a picture and a figure available in their record (Table-I). A comparison of the results from Pakistan with their results indicates almost similar relationship between various parameters, however, in case of pre-dorsal, pre-pectoral, dorsal fin and anal fin lengths the percentages are comparatively higher than those reported by Froese and Pauly (2003).

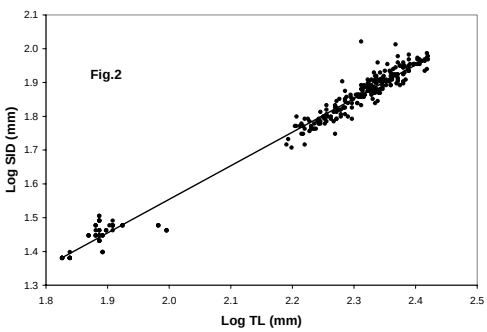
Table-I. Various morphometric parameters observed in kelee shad *Hilsa kelee* from Pakistan and its comparison with results of Froese and Pauly (2003)

PARAMETERS	FAO PICTURE**	GLOERFELT-TARP & KAILOLA (1984) PICTURE**	PRESENT STUDY
Snout to insertion of dorsal (SID)	34.2 % TL	35.2 % TL	49.0 % TL
Length of dorsal (LD)	11.8 % TL*	13.5 % TL*	16.5 % TL
Snout to end of dorsal (SED)	47.36 % TL*	49.3 %TL*	38.8 % TL
Snout to insertion of ventral (SIV)	40.13 % TL*	44.78 % TL*	41.9 % TL
Snout to insertion of anal (SIA)	57.9 % TL	61.5 % TL	55.5 % TL
Length of anal fin (LA)	12.5 % TL*	16.4 % TL*	21.9 % TL
Snout to end of anal (SEA)	69.1 % TL*	74.6 % TL*	57.9 % TL
Snout to insertion of pectoral (SIP)	22.1 % TL	22.8 % TL	33.1 % TL
Head length (HL)	24.0 % TL	23.8 % TL	23.7 % TL
Pre-orbitary distance (POD)	25.9 % HL	22.0 % HL	26.6 % HL
Post-orbitary distance (PsOD)	48.7 % HL*	53.1 % HL*	52.2 % HL
Diameter of eye (DE)	27.3 % HL	27.6 % HL	24.4 % HL
Interocular distance (IOD)	-	-	6.7 % TL
Greatest depth (GD)	29.0 % TL	32.7 % TL	31.2 % TL
Maximum thickness (MT)	-	-	11.1 % TL
Inter-nasal distance (IND)	-	-	3.3 % TL

** From Froese and Pauly (2003)

* Calculated from pictures given in Froese and Pauly (2003)

In some previous studies on morphometry of fishes from Pakistan such as Hoda (1979), Hussain and Hasan (1975), Naeem *et al* (2000), Qureshi and Hoda (1995), Sheri and Jafri (1977, 1978), Sheri and Janjua (1991) and Sheri and Saied (1976, 1977a, 1977b) it was observed that various morphometric parameters have a exponential relationship of the general form $Y = aX^b$. When such data is transformed into logarithmic form, a liner relationship fitting the formula $Log_{10}Y = Log_{10}a + bLog_{10}X$ is obtained. The data of *Hilsa kelee* was, thus, transformed in logarithmic form and analysis of coefficient of correlation and regression equation was obtained (Fig. 2-15). Regression analyses were made between total length (TL) with all other parameters mentioned in Table-I.



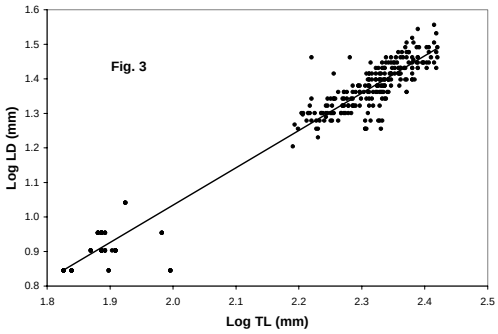
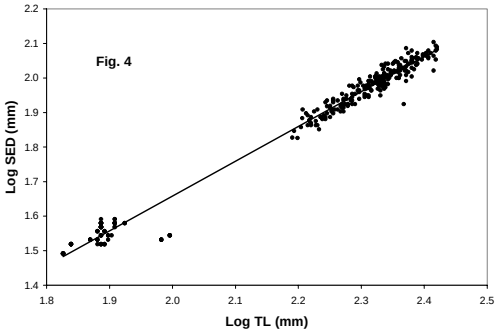


Fig. 2. Relationship between log TL and log SID
Fig. 3. Relationship between log TL and log LD



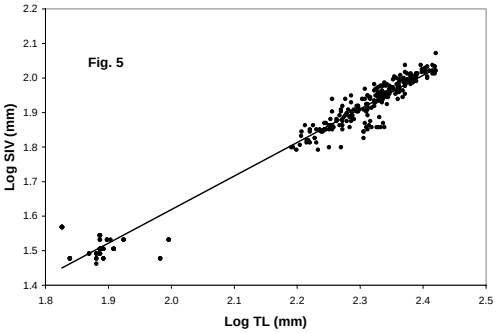
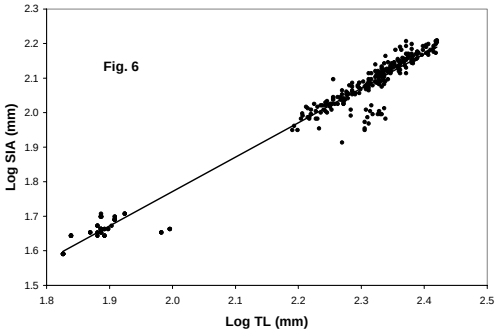


Fig. 4. Relationship between log TL and log SED
Fig. 5. Relationship between log TL and log SIV



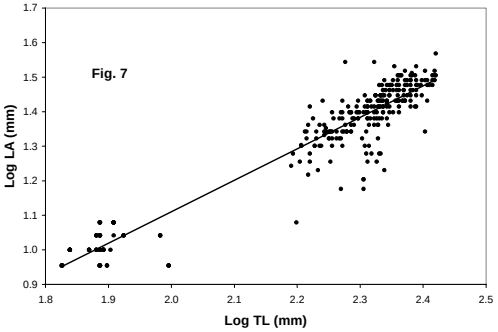


Fig. 6. Relationship between log TL and log SIA
Fig. 7. Relationship between log TL and log LA

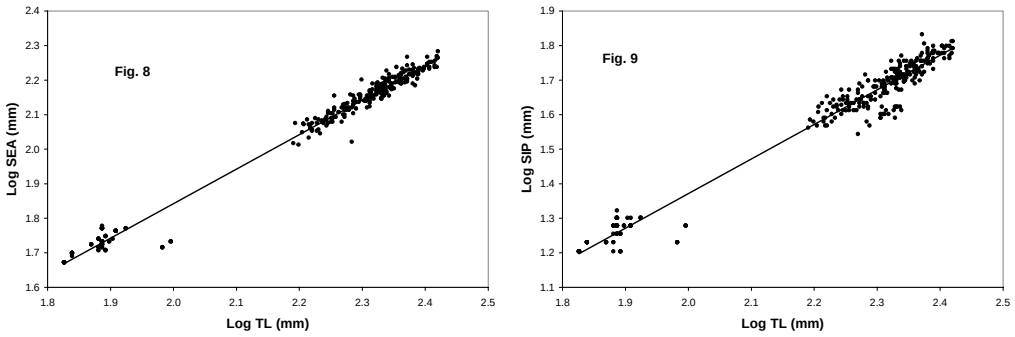


Fig. 8. Relationship between log TL and log SEA
Fig. 9. Relationship between log TL and log SIP

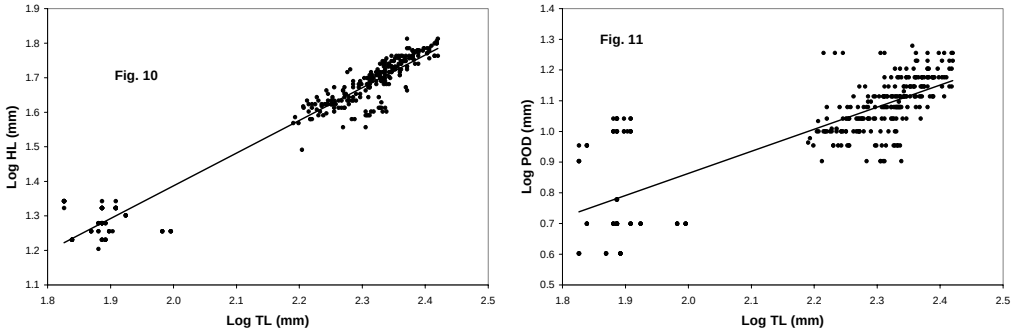


Fig. 10. Relationship between log TL and log HL
Fig. 11. Relationship between log TL and log POD

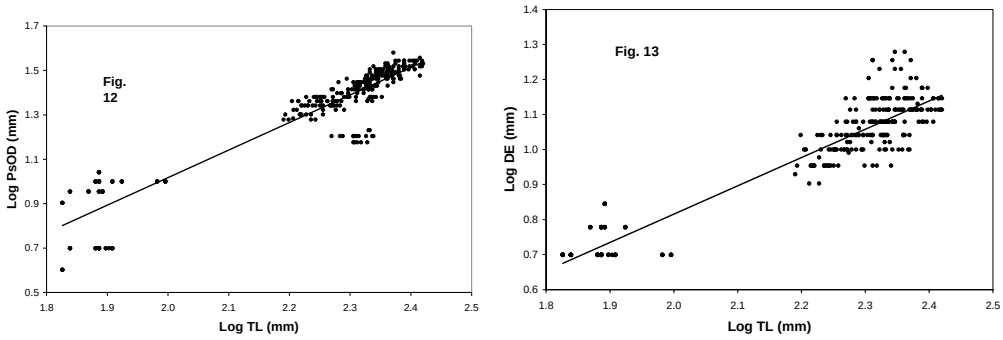


Fig. 12. Relationship between log TL and log PsOD
Fig. 13. Relationship between log TL and log DE

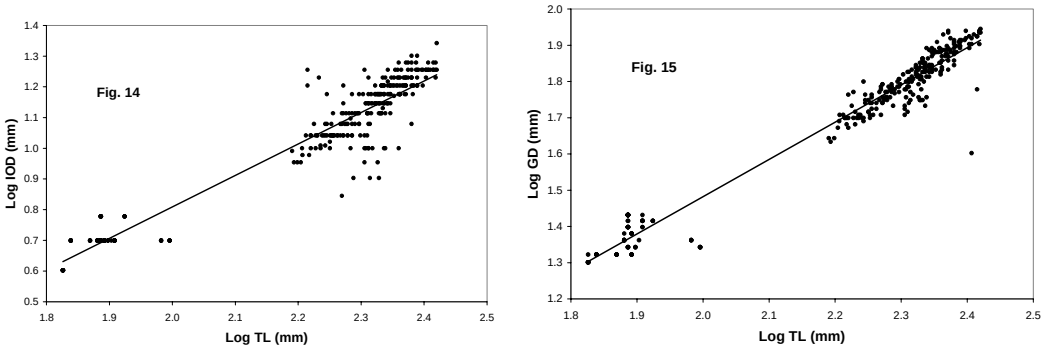


Fig. 14. Relationship between log TL and log IOD
Fig. 15. Relationship between log TL and log GD

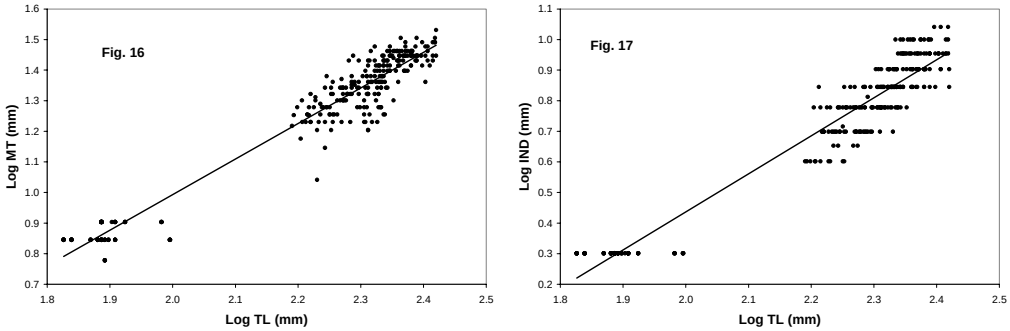


Fig. 16. Relationship between log TL and log MT
Fig. 17. Relationship between log TL and log IND

The results of regression and coefficient of correlation revealed that various parameters have positive correlation with the total length of the fish. In almost all cases the values of coefficient of correlation (r^2) is higher than 0.624 (Table-II). Such relationship is highest between total length (TL) with pre-anal length (SIA) i.e. 0.948. Strong correlation was also found between total length and all other parameters except in case of pre-orbital distance (POD). Fig. 2 to Fig. 15 also depict such positive correlation between total length and other parameters which is indicated by trend lines.

Fig. 2 to Fig. 15 also show two separate group of *Hilsa kelee* i.e. the small sized juveniles well separated from adult size category in all graphs. In almost all cases the relationship between various parameters fits the regression equation on both groups (juveniles and adults) and thus data of both group lies on same trend lines in the graphs. This also tends to suggest that the small sized specimens (locally called 'bar-rag') belonged to same species and local believe of them being a separate species is not correct.

Table-II. Regression equation, standard errors and coefficient of correlation between total length and other morphometric parameters of *Hilsa kelee.*

REGRESSION EQUATION	SE (b)	SE (a)	r^2
Log SID = -0.384 + 0.974 Log TL	0.051	0.014	0.935
Log LD = -1.088 + 1.063 Log TL	0.061	0.017	0.923
Log SED = -0.307 + 0.985 Log TL	0.055	0.015	0.928
Log SIV = -0.277 + 0.951 Log TL	0.051	0.015	0.931
Log SIA = -0.141 + 0.962 Log TL	0.045	0.013	0.948
Log LA = -0.626 + 0.871 Log TL	0.061	0.017	0.888
Log SEA = -0.114 + 0.981 Log TL	0.055	0.015	0.926
Log SIP = -0.570 + 0.974 Log TL	0.053	0.015	0.931
Log HL = -0.489 + 0.939 Log TL	0.049	0.014	0.935
Log POD = -0.531 + 0.698 Log TL	0.011	0.030	0.624
Log PsOD = -1.366 + 1.197 Log TL	0.096	0.027	0.861
Log DE = -0.702 + 0.762 Log TL	0.063	0.018	0.853
Log IOD = -1.191 + 1.002 Log TL	0.093	0.026	0.819
Log GD = -0.577 + 1.028 Log TL	0.054	0.015	0.935
Log MT = -1.400 + 1.189 Log TL	0.067	0.019	0.925
Log IND = -2.002 + 1.189 Log TL	0.073	0.021	0.916

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