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TECHNICAL NOTES

from

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Title: Character Index for Pallid and Shovelnose Sturgeon.

Resource Objective: To provide a means to differentiate pallid sturgeon and shovelnose sturgeon using six morphological measurements. This would be used to quantitatively identify pallid and shovelnose sturgeon with distinctive species characteristics for culturing.

Methodology: Data was collected from a database of pallid sturgeon captures throughout the pallid sturgeon's range being maintained by the U.S. Fish & Wildlife Service. Data used for this index was supplied by researchers in Montana, North Dakota, and South Dakota. This character index was modified from work done by Keenlyne et al (1994) and Carlson (1981). Six measurements were used; fork length (FKL), head length (HDL), mouth to inner barbel distance (MTB), interrostral distance (INT), outer barbel length (OTB), and inner barbel length (INB).

The index is set up so sturgeon will score between 0 - 700. Pallid sturgeon will score on the upper end of the scale and shovelnose sturgeon will score on the lower end of the scale. Five morphological measurements were converted to a percentage of the fork length (PFLM) so that differences of individual fish sizes will be standardized and comparisons can be made regardless of size. Mouth to inner barbel and interrostral measurement ratio and the inner barbel to outer barbel ratio are also used in the calculation of the character index. The reciprocal value was used for mouth - inner barbel to fork length, inner barbel to

fork length, mouth - inner barbel distance to interrostral distance, and inner to outer barbel ratios. This was done to insure that the lower value of a pallid characteristic would score higher.

The minimum and maximum PFLM's and morphometric ratios were calculated from a sample of 167 pallid sturgeon and 95 shovelnose sturgeon. The pallid sturgeon were all from Montana and North Dakota. The data for shovelnose sturgeon was collected from North Dakota from below Garrison Dam on the Missouri River and above Lake Sakakawea on the Missouri River near the confluence of the Yellowstone River.

				PFLM values	
				<u>min</u>	<u>max</u>
HDL/FKL x 100	=	PHDFK		21.30	33.97
INT/FKL x 100	=	PINFK		6.22	17.86
MTB/FKL x 100	=	PMTFK		3.36	8.35
OTB/FKL x 100	=	POBFK		6.51	12.99
INB/FKL x 100	=	PIBFK		2.08	7.45
MTB/INT x 100	=	PMTIN		22.04	94.34
INB/OTB x 100	=	PIBOB		21.36	95.65

Figure 1. PFLM's and morphometric ratios are used in the calculation of the character index.

To calculate the character index, two calculations must be made for each of the morphological measurements. First convert morphological measurements to a percentage of the fork length (PFLM), then use those values to calculate the sturgeon character index (CI) using the formula in Figure 2. If any of the PFLM's fall outside those listed in Figure 1, the CI formula will need to be updated with the new min/max values.

Using the PHDFK as an example, character indexes are calculated with the following formula:

$$\text{CHFk} = \frac{\text{Observed PHDFK} - \text{min PHDFK}}{(\text{max PFLM} - \text{min PFLM})} \times 100$$

(PHDFK) - 21.3/12.66 x 100	=	CHFK
		+
(PINFK) - 6.22/11.63 x 100	=	CIFK
		+
100 - ((PMTFK) - 3.36/4.98 x 100)	=	CMFK
		+
(POBFK) - 6.51/6.47 x 100	=	COFK
		+
100 - ((PIBFK) - 2.08/5.36 x 100)	=	CNFK
		+
100 - ((PMTIN) - 22.04/72.29 x 100)	=	CMIN
		+
100 - ((PIBOB) - 21.36/74.28 x 100)	=	CIOB

Sturgeon CI

Figure 2. Formulas using the PFLM's to calculate the character index.

Example:

A sturgeon with the following morphometric measurements would have the Character Index calculated as follows.

FKL = 1240 mm

INT = 179 mm

HDL = 405 mm

OTB = 121 mm

MTB = 72 mm

INB = 46 mm

PHDFK = 405/1240 x 100 = 32.66	CHFK = 32.66 - 21.3/12.66 x 100	= 89.73
PINFK = 179/1240 x 100 = 14.44	CIFK = 14.44 - 6.22/11.63 x 100	= 70.68
PMTFK = 72/1240 x 100 = 5.81	CMFK = 100 - (5.81 - 3.36/4.98 x 100)	= 50.80
POBFK = 121/1240 x 100 = 9.76	COFK = 9.76 - 6.51/6.47 x 100	= 50.23
PIBFK = 46/1240 x 100 = 3.71	CNFK = 100 - (3.71 - 2.08/5.36 x 100)	= 69.59
PMTIN = 72/179 x 100 = 40.22	CMIN = 100 - (40.22 - 22.04/72.29 x 100)	= 74.85
PIBOB = 46/121 x 100 = 38.02	CIOB = 100 - (38.02 - 21.36/74.28 x 100)	= 77.57

CHARACTER INDEX = 483.5

This could be considered a pallid sturgeon suitable for propagation purposes.

Findings: Sturgeon from the current database that were assumed to be pallid sturgeon, scored on the character index (CI) from a low of 358 to a high of 636 with a mean of 509 and a median of 514. From the shovelnose sturgeon data, character indexes were calculated and ranged from 154 to 293 with a mean and median of 230 (Figure 3).

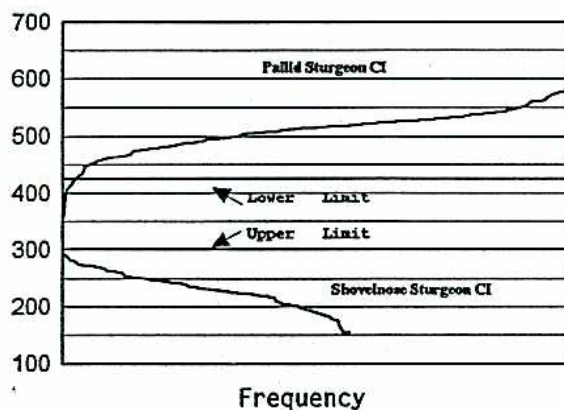


Figure 3. Pallid sturgeon and shovelnose sturgeon character index (CI) scores

Recommendations: This character index is meant to identify individuals that fulfill the characteristics of a pallid sturgeon or a shovelnose sturgeon to be used as broodstock. As more data is collected this index should be updated with current information. As hybrids are cultured for research purposes, morphological data should be calculated to determine the range of the character indexes.

Any pallid sturgeon or shovelnose sturgeon that are used for propagation purposes should be tested against this index to determine level of pallid characteristics before spawning. I am recommending that only pallid sturgeon that score above 425 and shovelnose sturgeon that score below 300 should be used for propagation purposes in North & South Dakota and Montana.

Contact Person(s): Steve Krentz or Mark Dryer

References:

Carlson, D.M. and W.L. Pflieger. 1981. Abundance and life history of lake, pallid and shovelnose sturgeons of Missouri. Endangered Species Project. SE-1-6. Sturgeon studies in Missouri, Job No. 1. Missouri Department of Conservation.

Keenlyne, K.D., C.J. Henry, A. Tews, and P. Clancey. 1994. Morphometric comparisons of Upper Missouri River sturgeons. Trans. Amer. Fish. Soc. 123:779-785.