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Predator – prey relations between the Pacific lamprey *Lampetra tridentata* and Pacific salmon (*Oncorhynchus* spp).

by
Dmitriy Pelenev,
Alexei Orlov,
Nataliya Klovach

Russian Federal Research Institute of Fisheries & Oceanography (VNIRO), Federal Fisheries Agency of Russia, 17, V. Krasnoselskaya, Moscow, 107140, Russia

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The paper reviews the interspecific relations between the Pacific lamprey *Lampetra tridentata* and species of Pacific salmon (genus *Oncorhynchus*) during pre-spawning migrations in the northwest Pacific. Lamprey's parasitism in relation to salmons, its distribution, and physiological condition of the prey fish species are considered.

Introduction

The Pacific lamprey *Lampetra tridentata* is an andromous species of parasitic lampreys endemic for the North Pacific. Its range is between the North Bering Sea in the north and the central part of Honshu Island (Japan) and the Santo Domingo River (Mexico) in the south (Scott, Crossman, 1973; Ruiz-Campos, Gonzalez-Guzman, 1996; Fukutomi et al., 2002). It is one of the most abundant species of parasitic lampreys in the North Pacific, and it is the most dangerous species for other fish of all the North Pacific fish species (Richards et al., 1982; Orlov et al., 2007). Adult individuals of this species attack many other fish species and are quite detrimental to fishery resources. On the one hand, they cut down the number of fishable individuals in populations; on the other, they tamper with the outer appearance of the commercial catch which, as a rule, is discarded and is not delivered for processing.

One of the prey items of the lamprey in the North Pacific are salmon of the genus *Oncorhynchus*: pink *O. gorbuscha*, chum *O. keta*, coho *O. kisutch*, sockeye *O. nerka* and chinook *O. tshawyscha.* At the same time, the special features of the interspecific relations between lamprey and salmon including the extent and scale of the impact of lamprey on the prey populations remain virtually unexamined.

Material and methods

The material for this study was collected from medium trawler "*Sovremennik*" during the pre-spawning migrations of salmon in 2003-2005 and 2007 in the western Bering Sea and the Pacific waters off Kamchatka. The fish bearing marks of lamprey bites were selected from the catches taken by pelagic (drift) nets with mesh of 55 and 65 mm, 47 m long. The body weight and length were measured; gonadosomatic indices (GSI) and Clark's condition factor were calculated. A total of 114 specimens of Pacific lamprey – bitten salmon was examined. This included 7 pink, 43 chum, 7 coho, 38 sockeye and 19 chinook.

Results and discussion

The analysis of our data, as based on the results of fishing, showed that the lamprey – damaged individuals (example of chum) were most frequent where their concentration density was maximal (Figure 1, 2). Most fish with marks of lamprey bites were recorded in Navarin area, and off southeastern Kamchatka.

There is still no common view on the affect of lamprey bites on the physiological condition of the prey (Abakumov, 1959; Hart, 1973). Our data indicate that the individual salmon bearing traces of attacks from the lamprey were somewhat less fattened compared with the fish not hit (Table 1). However, in most cases the difference was not statistically significant which probably has to do with the small number of observations.

Consequently, the Clark's condition factor in the intact sockeye was 1.203, in the fish with bites it was 1.197; in chum it was 1.092 and 1.081 respectively.

The mean value of the Clark's condition factor for the unaffected salmon was 1.204 ranging from 1.094 to 1.285; in the lamprey-bitten individuals it was 1.173 with variation between 1.075 and 1.271. The data presented show the impact of lamprey bites on the prey's physiological condition. Besides, the fish damaged by lamprey, as a rule, showed smaller values of GSI as compared with healthy fish. The above point is true for sockeye, chum and chinook. As for pink and coho, the situation is uncertain because of the small number of bitten fish in the

sample. It might be assumed that lamprey bites slow down maturation in salmon. Additional data are needed for a more substantial judgement.

There is a view that larger fish are hit by lamprey more often that smaller individuals (Royce, 1949; Farmer, Beamish, 1973; Farmer, 1980). Our observations do not confirm such a conclusion. However, we should note that gillnet is a selective fishing gear which fails to capture the smallest and the largest fish in a concentration.

Not so much does the analysis of the small material which we collected provide an unambiguous answer as it puts several questions. On the other hand it allows us to conclude that salmon are not indifferent to lamprey bites. One might assume that some individuals repeatedly bitten by lamprey die (our samples did contain fish bearing multiple marks of bites). Other fish become less fatty, and their maturation becomes slower.

Table 1. Comparative characteristics of biological condition of salmon in the northwestern Bering Sea (2003-2007).

Parameter		Sockeye	Pink	Chinook	Chum	Coho
Length (cm)	1	53.3±1.05 38-67	46.9±0.86 43-50	61.6±2.15 44-78	58.5±0.80 40-70	59.6±1.49 53-64
	2	54.2±0.08 29-71	45.9±0.05 38-61	62.1±0.41 34-100	58.2±0.08 34-77	57.9±0.19 43-72
Weight (g)	1	2132.0±134.9 695-4200	1280.0±77.59 1020-1570	3462.6±337.27 1085-6390	2602.3±117.47 680-4120	3105.7±192.55 2170-3700
	2	2242.4±10.46 270-5050	1328.9±4.89 800-2785	3549.3±81.26 550-14600	2607.7±11.49 430-6560	2964.5±29.44 1180-5315
Gutted weight (g)	1	1946.0±120.94 635-3820	1072.1±68.19 840-1345	3143.2±301.87 1020-5820	2238.9±107.87 610-3735	2637.9±161.52 1840-3090
	2	2006.8±9.29 250-4610	1139.5±4.36 680-8800	3202.2±69.69 500-11785	2215.5±9.99 370-5880	2538.9±25.33 1010-4790
Condition factor (Clark)	1	1.197±0.016 1.023-1.483	1.075±0.037 0.914-1.216	1.271±0.019 1.171-1.537	1.081±0.021 0.592-1.390	1.241±0.029 1.158-1.355
	2	1.203±0.002 0.423-1.717	1.159±0.002 0.639-1.606	1.273±0.006 0.745-1.562	1.092±0.002 0.480-1.969	1.281±0.005 0.776-1.772
Gonado-somatic index	1	1.69±0.34 0.04-7.97	10.60±0.64 7.21-11.90	0.64±0.21 0.03-3.75	3.29±0.45 0.04-12.98	8.40±0.80 5.43-11.97
	2	2.28±0.03 0.01-17.83	6.90±0.07 0.20-20.56	1.12±0.11 0.02-13.65	3.96±0.06 0.03-25.78	7.71±0.12 1.45-31.69
Number	1	38	7	19	43	7
	2	5696	2563	418	4724	650

Nominator is mean value, denominator is range; 1 – those attacked by lamprey; 2 – those without marks of lamprey attacks.

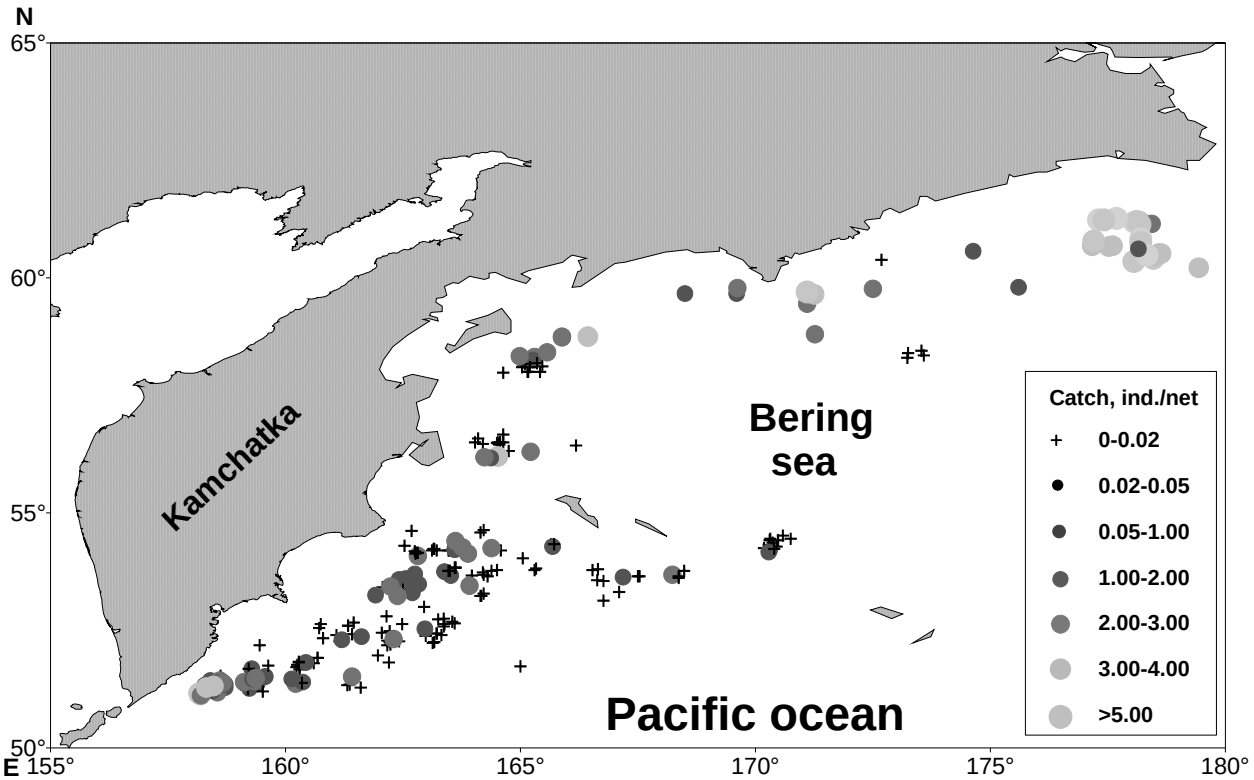

Figure 1. Catches of chum in the northwestern Pacific, 2003-2007

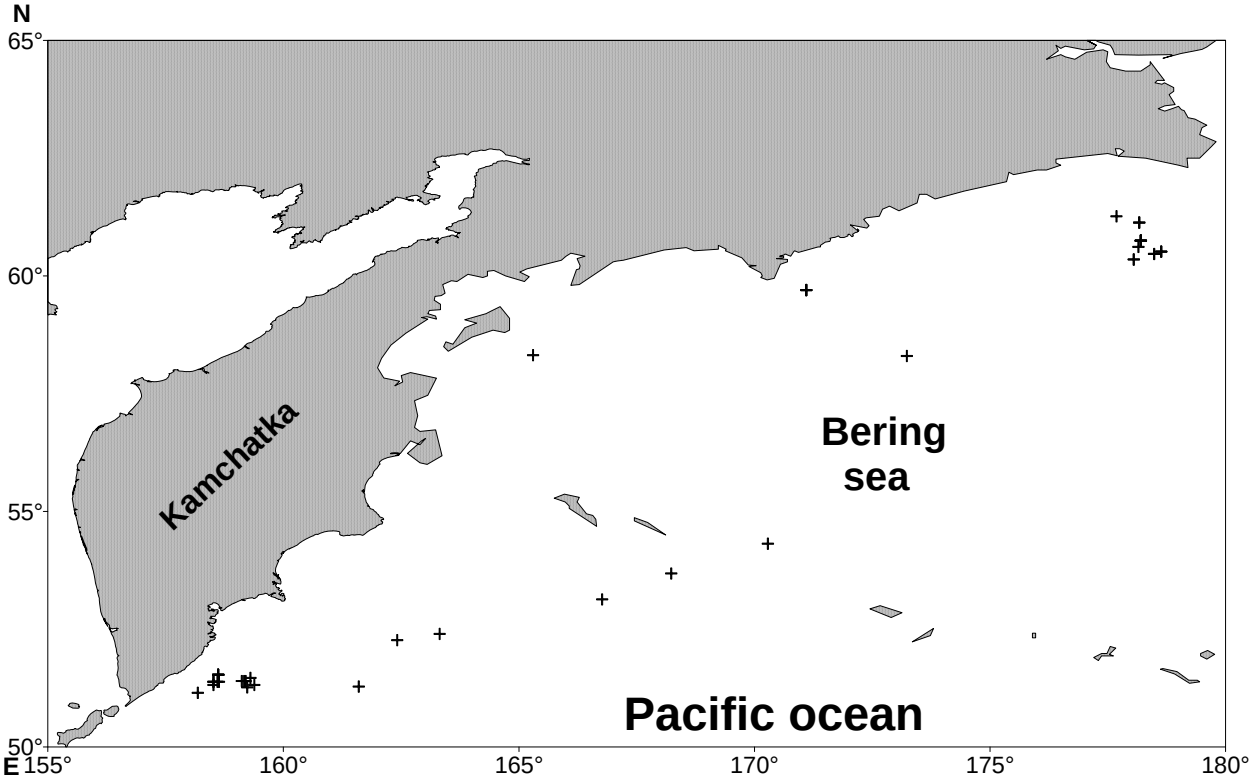

Figure 2. Chum capture sites with marks of lamprey's attacks, 2003-2007.

References

Abakumov V.A. Harm inflicted by lampreys to fish stocks //Rybnoye Khoziaistvo. 1959. №4. P. 32-33 (In Russian).

Farmer G.J. Biology and physiology of feeding in adult lampreys // Can. J. Fish. Aquat. Sci. 1980. Vol. 37. P. 1751-1761.

Farmer G.J., Beamish F.W.H. Sea lamprey (*Petromyzon marinus*) predation on freshwater teleosts // J. Fish. Res. Board Can. 1973. Vol. 30. №5. P. 601-605.

Fukutomi N., Nakamura T., Doi T., Takeda K., Oda N. Records of *Enthosphenus tridentatus* from Naka River system, central Japan; physical characteristics of possible spawning redds and spawning behavior in the aquarium // Japanese Journal of Ichthyology. 2002. Vol. 49, No. 1. P. 53-58.

Hart J.T. Pacific fishes of Canada // Bull. Fish. Res. Board. Can. 1973. №180. P. 1-740.

Orlov A.M., Vinnikov A.V., Pelenev D.V. Principles of studies of the sea period of anadromous parasitic lampreys (example of Pacific lamprey *Lampetra tridentata* (Gairdner, 1836) Petromyzontidae family) // Vorposy Rybolovstva (Problems of fisheries). 2007. Vol. 8, №2(30). P. 287-312 (In Russian).

Richards J.E., Beamish R.J., Beamish F.W.H. Descriptions and keys for ammocoetes of lampreys from British Columbia, Canada // Canadian Journal of Fisheries and Aquatic Sciences. 1982. Vol. 39. P. 1484-1495.

Royce W.F. The effect of lamprey attacks upon lake trout in Seneca Lake, New York // Trans. Am. Fish. Soc. 1949. Vol. 79. P. 71-76.

Ruiz-Campos G., Gonzalez-Guzman S. First freshwater record of Pacific lamprey, *Lampetra tridentata*, from Baja California, Mexico // California Fish and Game. 1996. Vol. 82. No. 6. P. 144-146.

Scott W.B., Crossman E.J. Freshwater fishes of Canada // Bulletin of Fisheries Research Board of Canada. 1973. No. 184. P. 1-966.