Preliminary Studies of Metazoan Parasites of Chum Salmon (*Oncorhynchus keta*) in Korea

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Abstract: The parasites of chum salmon (*Oncorhynchus keta*) in Korea have not been described. We investigated metazoan parasites of 80 adult chum salmon caught in 2004 in the Namdae River, Korea. Parasite species found were 1 digenea (unidentified), 3 cestodes (*Eubothrium* sp., *Nybelinia* sp. plerocercoid, 1 unidentified), 3 nematodes (*Anisakis simplex* larva, *Contracaecum* sp. larva. *Hysterothylacium* sp. larva), and 1 copepod (*Lepeophtheirus salmonis*). All fish examined had at least 1 parasite species. The most abundant parasite was *Eubothrium* sp. (93.8% of fish examined were infected), and the number of *Eubothrium* sp. from infected fish ranged from 29 to > 100 per individual fish. An unidentified digenean species was recorded in 25 fish. Similarly, the precise identification of some nematode species was not possible. The prevalence of infection by *L. salmonis* was low (6%). More detailed and larger-scale studies should be conducted in order to provide important and precise information on the parasitic fauna of chum salmon in Korean waters.

Keywords: *Oncorhynchus keta*, adult chum salmon, metazoan parasites, Korea

INTRODUCTION

By investigating parasitic fauna of fish species, much information for studying population structure, stock identification, migration routes, and diet can be obtained. Although there are limitations on using parasites as biological tags for population studies of marine fishes (see Arthur 1997), there are also advantages over other tagging methods. In particular, such techniques are less expensive and more appropriate for investigating small delicate fish and invertebrates (MacKenzie and Abaunza 1998).

Knowing the geographical origin of salmonid fishes caught in the North Pacific is helpful in developing fish stock management programs. Since Margolis (1963) published the first report on the oceanic distribution of western Alaskan and Kamchatkan sockeye salmon (*Oncorhynchus nerka*) by using parasites as biological tags, many researchers have applied this technique to clarify the geographical distribution and stock identification of salmonid fishes (see a review by Urawa 1989).

Korea has active salmon enhancement operations and fisheries. Most of the catch consists of chum salmon (*O. keta*). To date, no systematic efforts have been made to investigate either migration routes or migration rates.

The present study was undertaken to identify metazoan parasites of chum salmon in Korean waters and to examine the potential use of these metazoan parasites for studying salmon biology.

MATERIALS AND METHODS

We investigated metazoan parasites of 80 adult chum salmon (fork length 56.2–70.5 cm; body weight 2.35–6.67 kg) returning to the Namdae River along the northeast coast of Korea in October and November of 2004. They were captured by a river-blocking set net at the mouth of the river. Whole fish were frozen and transported to the laboratory, where they were measured, thawed and examined for metazoan parasites. External parasites were fixed in either 10% buffered formalin or 70% ethanol, and identified. Gastrointestinal tracts were opened longitudinally, and the contents rinsed into beakers and examined for endoparasites. These parasites were fixed in ammonium picrate-glycerin or 10% buffered formalin, and stained when necessary. All parasites found were identified to the lowest taxon possible, and the prevalence of infection (percentage of hosts infected with a particular parasite) was determined. Intensity is the number of a particular parasite species in an individual infected host.

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Table 1. Prevalence of infection (%) and mean intensity (± S.D.) of metazoan parasites from adult chum salmon (n = 80) in the Namdae River, Korea.

	Prevalence of infection (%)	Mean Intensity	Infection Site
Unidentified Digenea sp.	31.3%	6.08 ± 3.74	Gastrointestinal tract
Eubothrium sp.	93.8%	71.2 ± 23.9	Intestine
Nybelinia sp. plerocercoid	28.8%	2.82 ± 1.99	Musculature
Unidentified Cestoda sp.	NC[1]	NC	Intestine
Anisakis simplex larva	17.5%	1.36 ± 0.63	Body cavity, musculature
Contracaecum sp. larva	8.8%	1.13 ± 0.35	Body cavity, musculature
Hysterothylacium sp. larvae	5.0%	1.25 ± 0.50	Body cavity, musculature
Unidentified Nematoda sp.	NC	NC	Body cavity
Lepeophtheirus salmonis	6.3%	2.40 ± 1.14	Skin, fin

[1]NC, Not counted.

RESULTS

Parasite species found were 1 digenea (unidentified), 3 cestodes (*Eubothrium* sp., *Nybelinia* sp. plerocercoid, 1 unidentified), 3 nematodes (*Anisakis simplex* larva, *Contracaecum* sp. larva, *Hysterothylacium* sp. larva), and 1 copepod (*Lepeophtheirus salmonis*) (Table 1). All fish examined had at least 1 parasite species. The most abundant parasite was *Eubothrium* sp. (93.8% of fish examined were infected), and the number of *Eubothrium* sp. from infected fish ranged from 29 to > 100 per individual fish. Due to difficulties in the identification of intestinal cestodes, the data recorded may possibly be changed by further investigation. An unidentified digenean species was recorded in 25 individual fish. Similarly, the identification of some nematode species was not possible. The unidentified digeneans, cestodes and nematodes await further identification. Sea lice (*L. salmonis*) were recorded from the skin of fish and despite the low prevalence with a mean intensity of 2.4 (Table 1).

DISCUSSION

More than 60 species of parasites have been used as biological tags for studying salmon biology (see Urawa 1989). The ocean distribution determined by parasite studies of Pacific salmon has been frequently studied (see review by Margolis 1992). However, studies of the parasitic fauna of chum salmon are uncommon.

We found 9 species of parasites from adult chum salmon in this study. Most of them are parasites frequently found in Pacific salmon. The prevalence of infection of *Anisakis simplex* larvae was unexpectedly low, compared with the prevalence of this parasite in chum salmon in Japan (Urawa and Fujisaki 2006). There is no clear explanation for the low prevalence at the present time. However, the insufficient effort in investigating nematodes, especially in musculature, may be one possible reason.

In this study, chum salmon were collected from only one location so direct comparisons with other stocks were not possible. More detailed and larger-scale studies, involving the precise identification of parasites found and comparing them with those of other stocks, are necessary for providing useful information on chum salmon populations in Korea. Myxosporean parasites have been used successfully as biological tags in salmonid fishes (Awakura et al. 1995; Urawa et al. 1998), and should be included in future surveys of parasites of chum salmon in Korea.

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