

Abstract

Downstream fish migration were studied in two Czechoslovakian reservoirs. The Mostiště reservoir is of a submontane type, the depth near the dam being about 30 m and the coefficient of water exchange about 5. The Věstonice reservoir is situated on a plain, the depth at the dam being some 3.2 m and the coefficient of water exchange 50.

In the deep reservoir the frequent migrants were those fish species inhabiting the pelagic and profundal-pelagic complex (perch, pike-perch, ruffe and eel). The highest migration occurred in the cool seasons of the year. The sharp decrease of hydrostatic pressure inflicted injuries or death of practically all migrants. In the shallow reservoir with a large discharge stream originating in the sublittoral zones the migration intensity was much higher in both fish larvae and older specimens. White bream, common bream, bleak, perch, *etc.*, presented the most frequent migrants. Mass migrations fell in spring and summer months.

Downstream fish migration showed diel changes. During spring and summer the migrants exhibited a twilight to nocturnal rhythm with one mode in night hours. In the autumn this pattern is less evident, the night activity being split into two modes, at twilight and at night.

The species composition differed in the reservoir and among the migrants. This phenomenon is explained by the horizontal and vertical distribution of fishes in the proximity of outlet currents. The fish's ability to overcome these currents grows with increasing fish size and declines with decreasing water temperature.

In general, the downstream fish migration from the deep reservoir cannot cause any substantial impoverishment of fish populations in the reservoir. On the contrary, in shallow reservoirs with a large water discharge this influence is considerable. To diminish the fish losses it is suggested to check the ecological measures, *i. e.*, to use outlets in different depths, and to install other devices, *i. e.*, fish screens.

Contents

Introduction	4
Methods	7
Fishing gears	7
Fish sampling	8
Laboratory examination	9
Downstream fish migration from the Mostiště reservoir	10
Region of investigations and material	10
Composition of fish species in the reservoir and among the migrants	13
Fish distribution in the reservoir	15
Larvae	15
Fry and fish of older age groups	18
Migration of sac fry and larvae	20
Perch	20
Pike-perch and other species	23
Migration of fry and fishes of older age groups	23
Perch	23
Migration of eel, ruffe and other species	26
Traumatic changes in migrants	28
Downstream fish migration from the Věstonice reservoir	30
Study area and material	30
Species composition of fishes in the reservoir and of the migrants	32
Migration of sac fry and larvae	33
Perch	35
Pike-perch and other species	35
Migration of fry and other age groups	37
Silver bream	38
Common bream	40
Bleak	43

Perch, roach, rudd and other species	44
Comparative analysis of downstream fish migration from deep and shallow reservoirs	45
Species composition of migrants	45
Size and age structure of migrants	46
Concentration of migrants	47
24-hour dynamics of fish migration	50
Seasonal dynamics of intensity of fish migration	52
Ecological conditions of the discharge currents and its importance for downstream fish migration	54
Conclusion and summary	58
Резюме	59
Literature	60

Introduction

Fish migrations are usually related to or dependent upon the utilization of systems of water currents within the area of distribution of particular populations. The downstream migration of fishes presents an important period of their life cycle. The downstream migration manifests itself in mass movement of fishes and is characteristic not only of diadromous and semi-diadromous fishes, but also of a number of typical stream dwellers.

According to the character of movements it is possible to distinguish the following forms: (i) a passive drift downstream with the water current in a non-oriented position of fish with regard to the current; (ii) an active drift, the fish move active downstream; (iii) an active-passive drift, the fish are oriented by their heads against the current and are drifting downstream in spite of their (weak) resistance. The importance of these three forms of behaviour differs in particular species and changes during their ontogenesis. The passive migration is usually characteristic of prolarvae (sac fry), postlarvae (alevins) and young in the early stages of development, and occurs, to some extent, in most species. The active and active-passive migrations are characteristic of young and fishes of older age groups. The latter migrations occur rarely (Pavlov 1979).

The fishes migrate downstream with the current in all streams and rivers and from all inland reservoirs. The best knowledge of these migrations is available from streams in fry of families *Acipenseridae*, *Clupeidae*, *Salmonidae*, *Cyprinidae*, *Percidae*, etc. The main characteristics and manifestations were studied in the family of *Salmonidae*, i.e., McDonald (1960), Horman & al. (1967), Harden Jones (1968), Bakštanskij (1970), etc., in fishes of other systematic groups, e.g., Pavlov (1979) and Pavlov & al. (1981).

The adaptive importance of downstream migration of fish fry lies in the dissemination and utilization of trophic parts within the distribution area. Downstream migration presents the first link of the migratory cycle of fishes which, to a great extent, determinates the range and the character of migrations in the following periods of their life as well as several other aspects of fish ecology.

The phenomenon of downstream fish migration from the reservoirs has been studied by Golovkov & Kožin (1939), Tichij & Viktorov (1940), Volodin (1958), Dr'agin (1953), Potechina (1956), Syrovatskij (1954), Mel'nikov (1956), Mokr'ak (1958), Nusenbaum (1961), Popova (1962), Ždanova (1963), Trofimova & Sosnov (1965), Ši-

CONTENTS

of the Volume XXI (1987)

- No. 1 J. LIBOSVÁRSKÝ & N. F. BISHARA: Biometrics of Egyptian Tilapiine Fishes 1—46
- No. 2 J. PIKULA & M. BEKLOVÁ: Ecological Distribution of *Phasianus colchicus* in Czechoslovakia 1—47
- No. 3 J. PIKULA & M. BEKLOVÁ: Bionomics of Species of the Family *Hirundinidae* 1—39
- No. 4 M. BEKLOVÁ & J. PIKULA: Bird Populations of some Biotops of South Moravia 1—39
- No. 5 V. RŮŽICKA: An Analysis of Spider Communities in the Meadows of the Třeboň Basin 1—39
- No. 6 J. GAJDŮSEK, A. ASTRAUSKAS, J. VIRBICKAS, D. LUKŠENE, D. MISJUNENE: The Ecology of the Bream in the Cooling Reservoir of a Lithuanian Thermal Power Station 1—36
- No. 7 I. GRULICH: Variability of *Cricetus cricetus* in Europe 1—53
- No. 8—9 Z. KRATOCHVÍL: Tierknochenfunde aus der Siedlung Mikulčice (II) . . 1—67
- No. 10 J. TOUFAR, I. KOŽENÁ, C. FOLK: The Diet of the Mallard (*Anas platyrhynchos*) in the CSR 1—32
- No. 11 Z. KRATOCHVÍL: Tierknochenfunde aus der Siedlung Mikulčice (III) . . 1—50
- No. 12 D. S. PAVLOV — VI. BARUŠ — V. K. NEZDOLIJ — J. GAJDŮSEK: Downstream Fish Migration from Mostišťe and Věstonice Reservoirs 1—64