



# Ontogeny of the digestive system in hatchery produced Beluga (*Huso huso* Linnaeus, 1758); a comparative study between Beluga and genus *Acipenser*

R. ASGARI<sup>1,2</sup>, G. RAFIEE<sup>1</sup>, S. EAGDERI<sup>1</sup>, R. SHAHROOZ<sup>3</sup>, H. POORBAGHER<sup>1</sup>, N. AGH<sup>4</sup> & E. GISBERT<sup>5</sup>

<sup>1</sup> Department of Fisheries, Faculty of Natural Resources, University of Tehran, Karaj, Iran; <sup>2</sup> Department of Fisheries, Faculty of Natural Resources, Urmia University, Iran; <sup>3</sup> Department of Comparative Histology & Embryology, Faculty of Veterinary Medicine, Urmia University, Urmia, Iran; <sup>4</sup> Artemia & Aquatic Animals Research Institute, Urmia University, Urmia, Iran; <sup>5</sup> Institut de Recerca i Tecnologia Agroalimentaries (IRTA), Centre de Sant Carles de la Ràpita, Sant Carles de la Ràpita, Spain

## Abstract

The study on histological characteristics of the digestive system of Beluga (*Huso huso*) was conducted from hatching until 50 days posthatching at 16.5 °C. Development of the digestive system in this species followed the general pattern described for other Acipenserids, although there were differences in the timing of organ development among species. At hatching, the mouth was opened and digestive system was represented by a gastric cavity filled with yolk and lined by endodermal cells, and a partially differentiated hindgut. Gastric glands started to differentiate at 46.5 degree-days posthatching (ddph), the earliest appearance time among sturgeon fishes studied to date. At the onset of exogenous feeding (144.9 ddph), yolk sac reserves were not completely depleted in the stomach, suggesting a period of mixed nutrition. The complete development of the digestive system was not accomplished until 235.2 ddph when it showed all histomorphological features typical of juvenile specimens. According to histological results, it seems advisable to start co-feeding *H. huso* larvae with inert diets at the onset of exogenous feeding, because exocrine pancreas and glandular stomach are fully differentiated, although the complete substitution of live prey by inert feed is not recommended until 235 ddph.

**KEY WORDS:** Beluga, co-feeding, digestive system, histology, *Huso huso*, ontogeny

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Correspondence: R. Asgari, Department of Fisheries, Faculty of Natural Resources, University of Tehran, 31585-4314 Karaj, Iran. E-mail: pikeperch@yahoo.com

## Introduction

Sturgeons are very important commercial fish because of their roe, which is made into caviar. The Caspian Sea contains large stocks of these species, but some of them are becoming extinct, resulting in the development of the intensive culture of different species of sturgeons in countries neighbouring the Caspian Sea basin. Sturgeons are a group of slow-growing fishes that mature very late in life, and consequently, they are particularly vulnerable to overfishing and to other threats, like the loss of their natural habitat, river damming and deterioration of water quality (Kynard 1997; May *et al.* 1997). As a consequence, wild stocks of sturgeons are decreasing dramatically during these last decades (Billard & Leconte 2001), and sturgeons are considered as one of the most threatened group of animals on the IUCN Red List of Threatened Species™ (IUCN 2013). The great sturgeon or Beluga, *Huso huso* Linnaeus 1758, is categorized as critically endangered fish species according to the IUCN. The Beluga, *H. huso*, is an important commercial species in the Caspian Sea and a good candidate for aquaculture because of their good growth performance, market price, propagation in captivity and high marketable value of their caviar, so it has been cultured for aquaculture and restocking purposes in Iran since 1991 (IFO 2002). The species was historically known from the Caspian, Black, Azov and Adriatic Sea basins. Based on fishery data and number of recorded spawning individuals, it has been estimated that the wild native populations of this species have declined over 90% in the past three generations (*ca.* 60 years), and overfishing for meat and caviar will soon cause global extinction of the remaining natural