

# Changes in the nutritional state of chum salmon fry during the outmigration in the river and nearshore ocean

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## Introduction

Approximately two billion chum salmon fry (*Oncorhynchus keta*) are released annually in northern Japan to provide for a stable fishery. However, the number of returning adults fluctuates widely between years. The variation is thought to be, in part, a function of the level of mortality during the downstream and coastal migrations. To isolate the factors contributing to this early mortality, we evaluated the nutritional status (lipid and carbohydrate levels) of fish during their outmigration in rivers and along the coast of Japan

## Conclusion

The nutritional condition of hatchery reared chum salmon fry decreases during downstream migration but recovers gradually after entry into the nearshore ocean. Furthermore, in the recovery appears to occur more rapidly in larger fish (>10 cm fork length).

## Results : downstream migration

- Following release from the hatchery, the juvenile fish migrated downstream to the river mouths within 7–10 d.
- The mean CF decreased ~10% from 8.2 to 7.5 and the stomach content was ~1.3% (Fig. 1).
- The mean Glyc decreased from 3.4% to 0.1% (Fig. 2).
- Levels of p-Glc, a metabolic product of glycogen breakdown, decreased by 40% during the migration, but were still high (90 mg/dL) (Fig. 4).
- The mean TG decreased by 40% from 1.3% to 0.8% (Fig. 3).
- The p-Glc may be derived from glycerol-mediated triglyceride.

Fig. 1. Changes in condition factor of chum salmon fry caught at hatchery and river mouth.

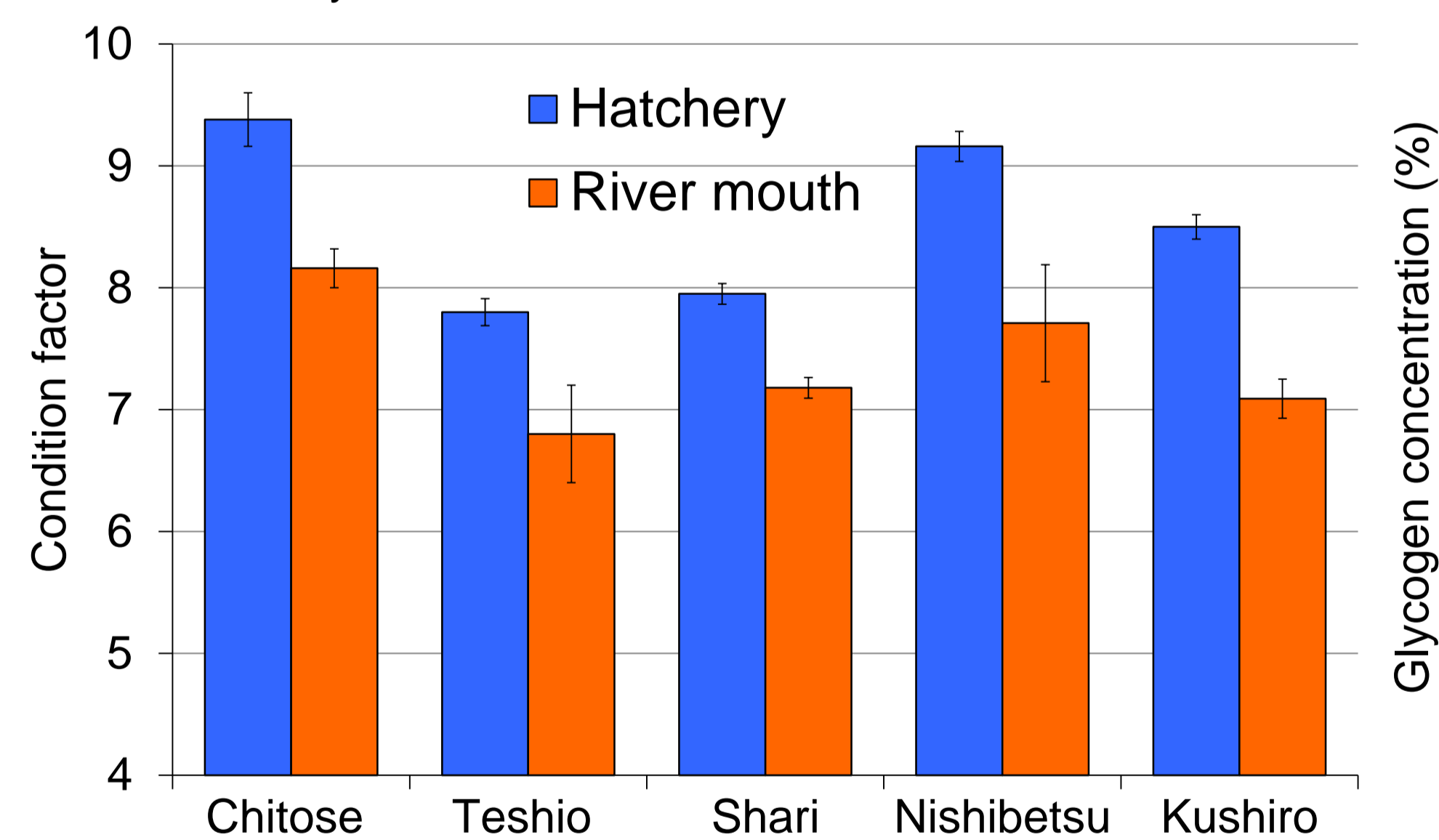


Fig. 2. Changes in liver glycogen concentration of chum salmon fry caught at hatchery and river mouth.

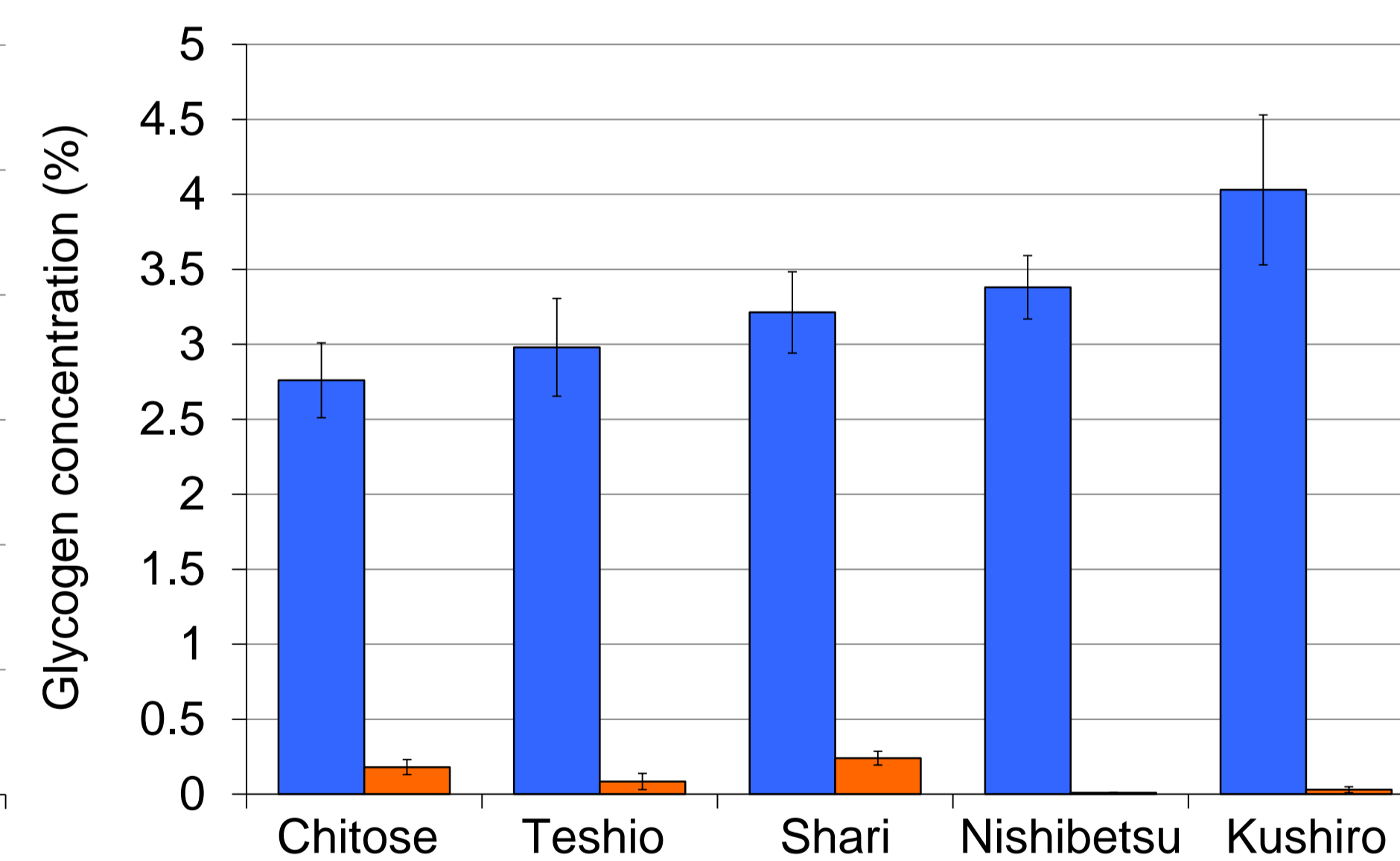


Fig. 3. Changes in muscle triglyceride concentration of chum salmon fry caught at hatchery and river mouth.

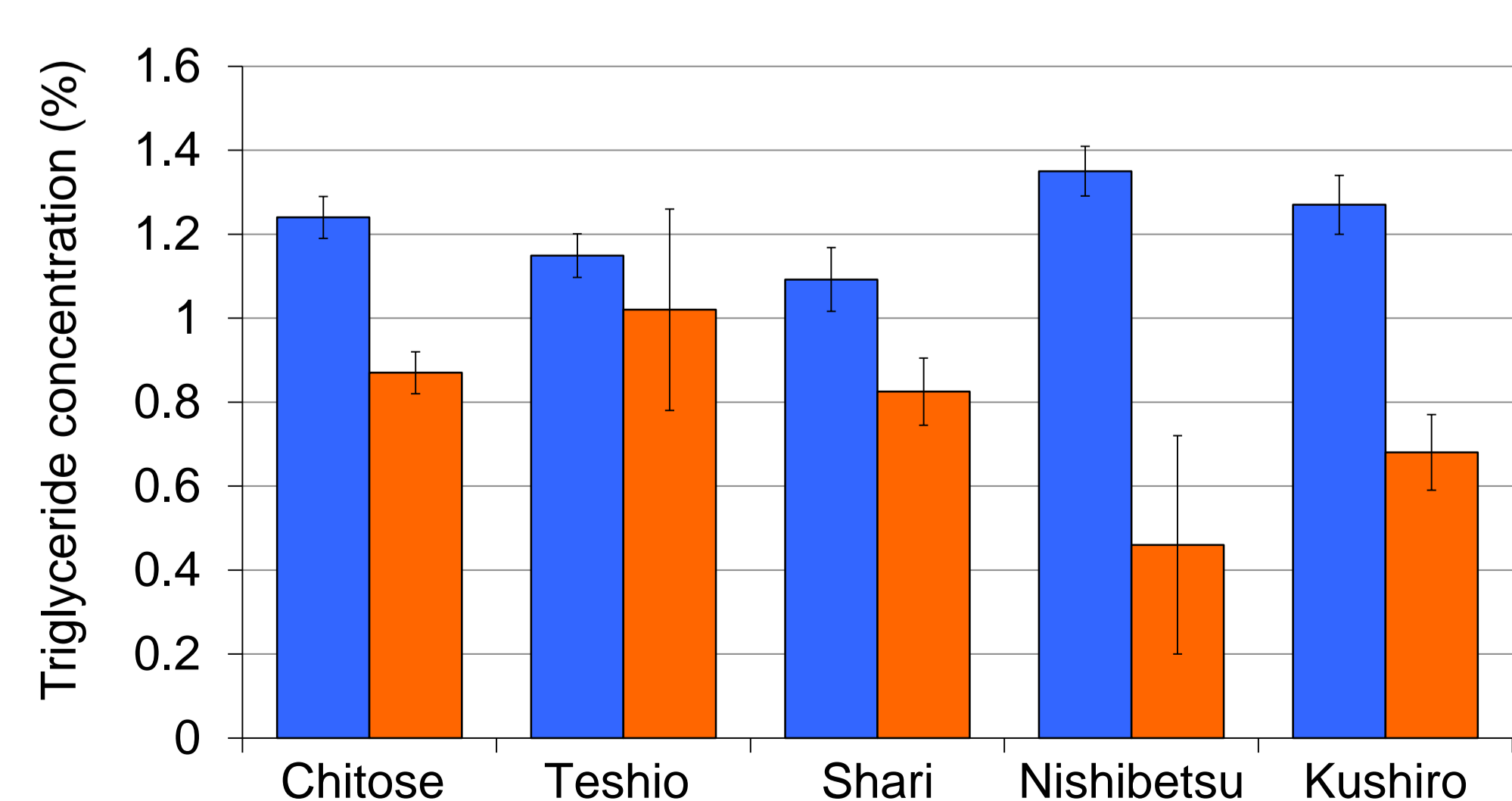
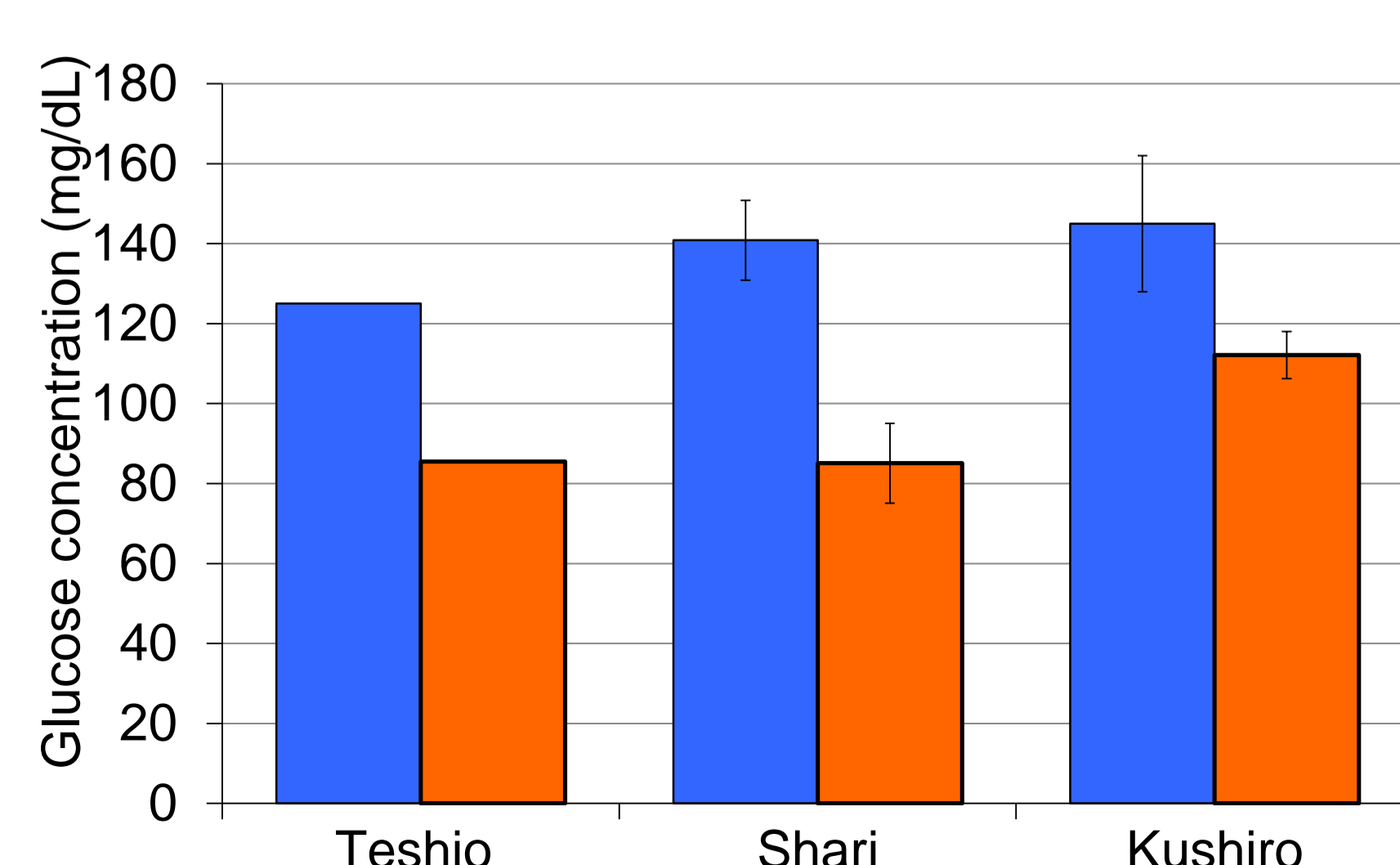
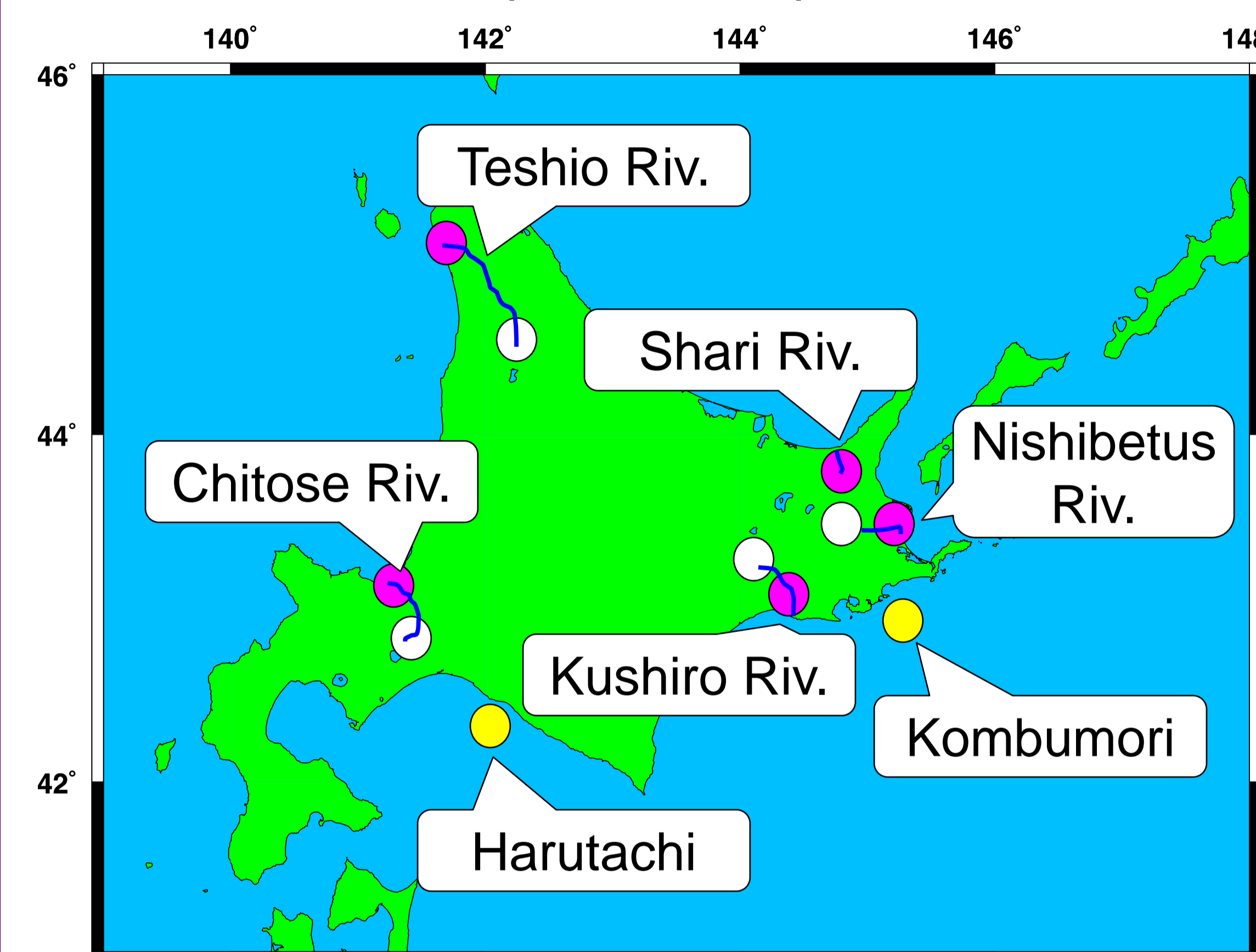


Fig. 4. Changes in plasma glucose concentration of chum salmon fry caught at hatchery and river mouth.



## Materials and Methods

Map of studied places



- Fish were captured in the Chitose, Teshio, Shari, Nishibetsu, and Kushiro Rivers (red circles). Each river has a hatchery that is operated by the Hokkaido National Fisheries Research Institute (white circles).
- Additionally, fish were collected from the coasts of Harutachi and Kombumori on the Pacific side of Hokkaido (yellow circles).
- After capture, the fish were transported live to our laboratory and sampled for plasma, muscle, liver, and otoliths.
- We quantified the condition factor (CF), liver glycogen concentration (Glyc), muscle triglyceride concentration (TG), and plasma concentrations of glucose (p-Glc) and triglyceride (p-TG).

## Results : coastal migration

- The CF of fish caught off Harutachi and Kombumori was 7.5 and 9.1 (Fig. 5)
- The TG of fish caught off Harutachi and Kombumori was 0.2% and 0.4–0.8% (Fig. 6).
- There appeared to be a general increase in CF and TG following ocean entry.
- This tendency was especially evident in fish larger than 10 cm fork length (Fig. 7, Fig. 8).

Fig. 5. Condition factor of juvenile chum salmon caught around coasts.

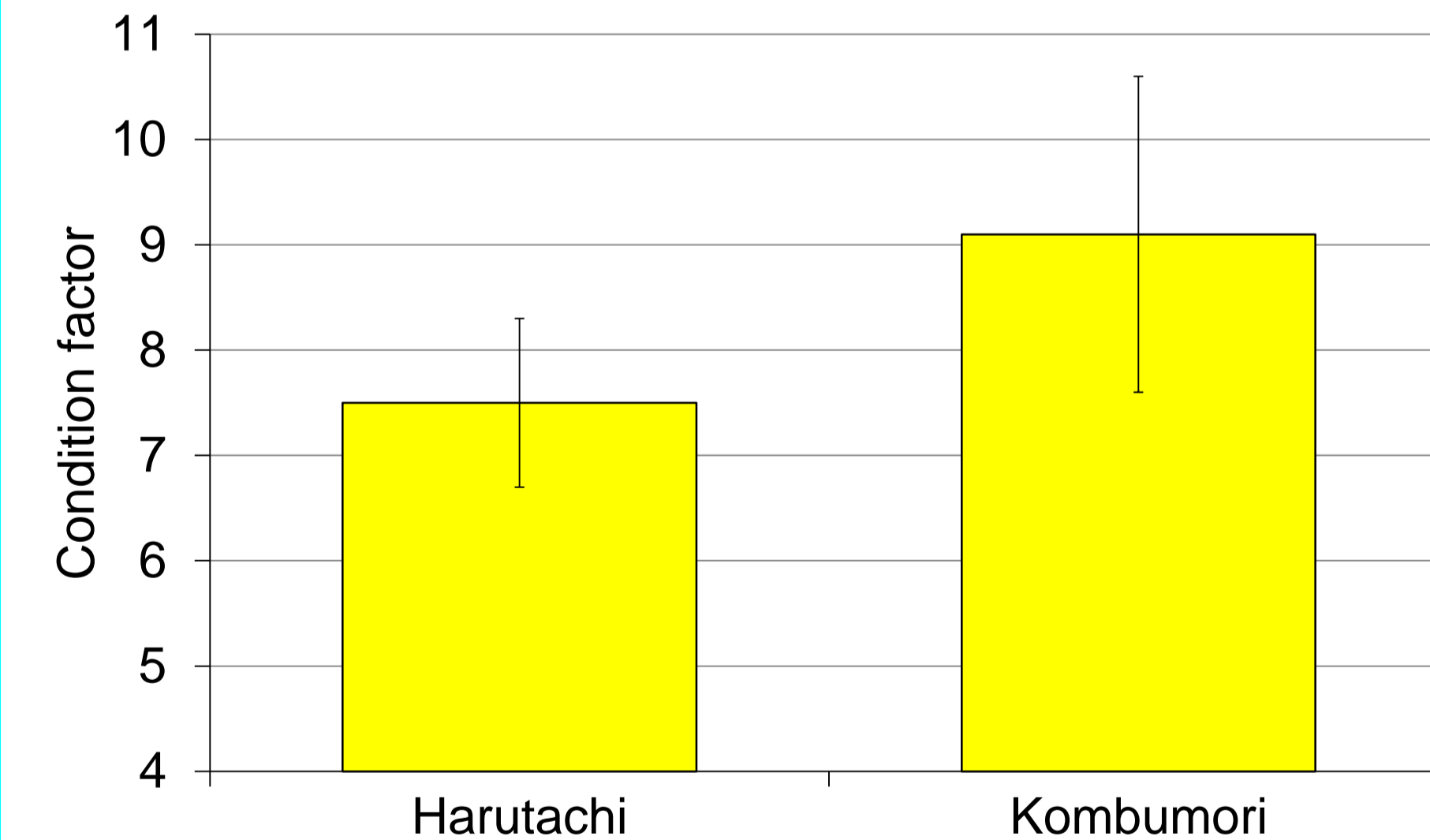


Fig. 6. Muscle triglyceride concentration of juvenile chum salmon caught around coasts.

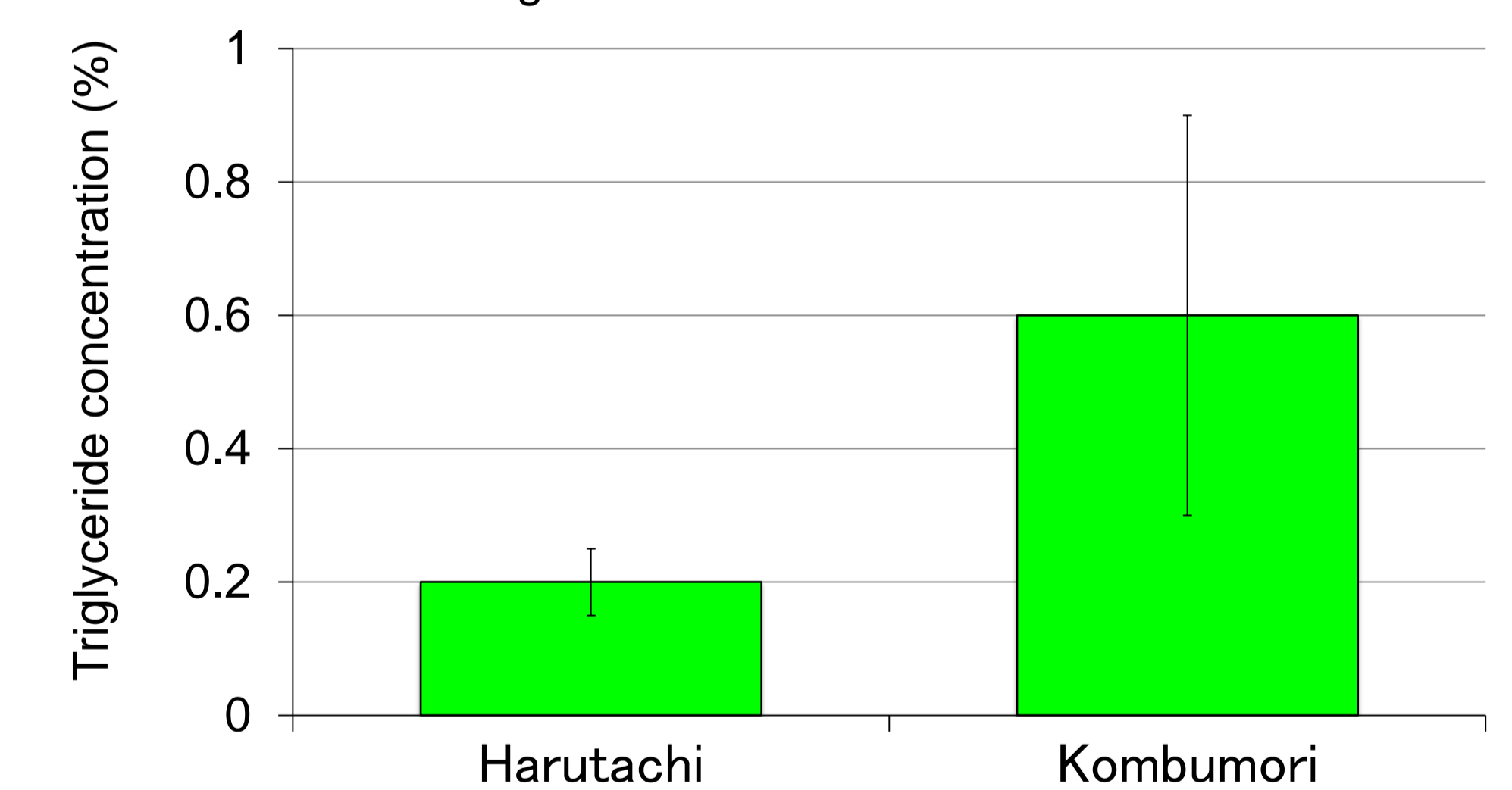


Fig. 7. Relationships between fork length and condition factor of chum salmon during nearshore migration.

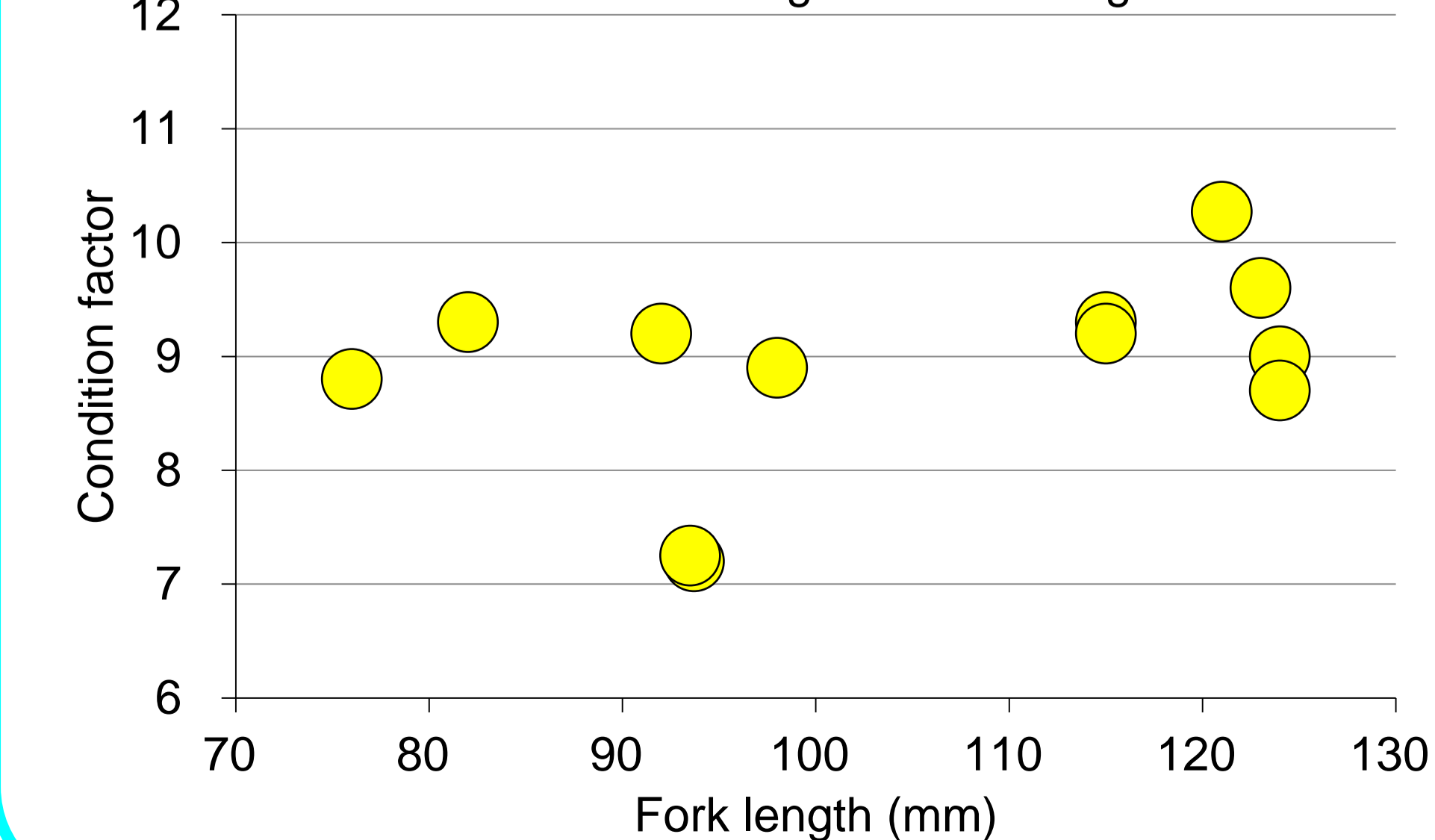


Fig. 8. Relationships between fork length and muscle triglyceride of chum salmon during nearshore migration.

