



Title	Trophic ecology of Pacific cod <i>Gadus macrocephalus</i> off the southern and northeastern coasts of Hokkaido [an abstract of dissertation and a summary of dissertation review]
Author(s)	王, 荣夫
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学位論文内容の要旨

博士の専攻分野の名称：博士（水産科学）

氏名：王 榮 夫

学 位 論 文 題 目

Trophic ecology of Pacific cod *Gadus macrocephalus* off the southern and northeastern coasts of Hokkaido

（北海道南岸および北東岸沖合におけるマダラ *Gadus macrocephalus* の栄養生態に関する研究）

Feeding habits and nutritional condition of Pacific cod *Gadus macrocephalus* were investigated based on the 1,893 specimens collected in the waters off the southern coast of Hokkaido (SCH) during 2016–2020 and off the northeastern coast of Hokkaido (NCH) during 2018–2020. The results of stomach contents analyses indicated that Pacific cod ingest a variety of prey species, comprising 60 and 45 species in SCH and NCH, respectively. Fish was the most important prey in SCH (95.3%, %IRI; relative important index) and NCH (68.6%, %IRI), respectively. The dominant fish prey were Japanese sardine *Sardinops melanostictus* in SCH (36.7%, %IRI) and walleye pollock *Gadus chalcogrammus* in NCH (35.1%, %IRI). Pacific cod also preyed highly on decapod crustaceans, mainly snow crab *Chionoecetes opilio* (44.2%, %IRI) in NCH. In SCH, the predominance of walleye pollock in 2016 (48.5%, %W; percentage of wet weight) was replaced by Japanese sardine in 2018–2020 (36.3–65%, %W). Such temporal and spatial variations in the diets suggest that Pacific cod is a generalist and opportunistic feeder. The variation of prey species was great in the cod measured 300–500 mm SL, whose main diet gradually shifted from decapods to fish as they grow. The stomach fullness index was higher in the individuals feeding on Japanese sardine (SCH) and walleye pollock (NCH). In SCH, the maximum length of Japanese sardine found in a stomach was 220 mm SL, which is likely close to the asymptotic body length of the species. Walleye pollock ranging 37–390 mm and 55–331 mm SL were ingestible prey for Pacific cod in SCH and NCH, respectively. The results of quantile analysis indicated that SL of walleye pollock was positively correlated with SL of Pacific cod. The carapace width of snow crab consumed by Pacific cod in NCH ranged from 5.5 to 61.3 mm.

The nutritional condition of Pacific cod was evaluated by means of length–weight relationship (LWR), condition factor (CF), and hepatosomatic index (HSI). Pacific cod generally exhibit an isometric growth pattern in the areas investigated, as the slopes in the LWRs approximated the value of 3. CF ranged from 0.84 to 1.66 for Pacific cod in SCH and from 0.91 to 1.6 in NCH. HSI ranged from 0.26% to 12.83% for Pacific cod in SCH and from 0.85% to 15.76% in NCH. HSI was positively correlated with SL in all seasons surveyed. In SCH, HSI of Pacific cod with Japanese sardine in the stomachs was significantly high (1.58–11.27). In NCH, Pacific cod those consumed snow crab usually had lower HSI values than those consumed other prey species. Female and male Pacific cod showed similar nutritional conditions in both areas. CF and HSI of mature Pacific cod were higher than immature individuals in NCH during autumn. Individuals sampled from shallow water had higher HSI in SCH, but those sampled in high temperature had higher HSI in NCH. Results presented herein will advance our understanding of the trophic ecology of Pacific cod and enhance our ability to make ecosystem-based management strategies.