

Interannual fluctuations in recruitment of walleye pollock in the Oyashio region related to environmental changes

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Received in revised form 9 February 2007; accepted 13 August 2007

Available online 18 October 2007

Abstract

The Japanese Pacific walleye pollock (*Theragra chalcogramma*) stock is the largest stock of this species in Japanese waters. It is a key component of the Oyashio ecosystem. In southern Hokkaido waters, these fish spawn mainly during January and February near the mouth of Funka Bay (FB), and most eggs and larvae are transported into FB. During midsummer juvenile pollock migrate along the southern coast of Hokkaido to a nursery ground on the continental shelf off eastern Hokkaido (Doto area). However, some eggs and larvae are transported southward to the Tohoku region (TR). Transport depends largely on the Oyashio, which generally flows southward along the eastern coasts of Hokkaido and Tohoku. Thus, this stock has two different recruitment routes: FB–Doto and FB–TR. In the 1980s, when the southward flow of the Oyashio was strong, the number of age-2 pollock estimated from a virtual population analysis (VPA) indicated that recruitment to the entire stock remained at a medium level. In the 1990s, when the Oyashio weakened, strong year-classes occurred in 1991, 1994, and 1995, but not in the latter half of the 1990s. Juvenile catches in the TR by commercial fisheries, which can be taken as indices of recruitment level via FB–TR, were high during the 1980s and decreased in the 1990s. Although there was no significant difference in the average number of recruits between the 1980s and the 1990s as estimated from a VPA, the recruitment patterns differed between the two decades. Here, we propose that recruitment routes of this stock shifted in response to environmental changes.

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Keywords: Climate changes; Environmental conditions; Oyashio; Recruitment; Water temperature; Walleye pollock

1. Introduction

The Japanese Pacific walleye pollock (*Theragra chalcogramma*) stock is the most abundant stock of this species in the waters around northern Japan

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(Hamatsu et al., 2004). It is distributed off the Pacific coast of the Tohoku region (TR) and Hokkaido (Fig. 1; Tsuji, 1989) and is a key component of the Oyashio ecosystem, as well as an important target species for local fisheries (Sakurai and Miyake, 1994). Four walleye pollock stocks (the Japanese Pacific stock, the northern Japan Sea stock, the southern Okhotsk Sea stock, and the Nemuro Strait stock) occur in Japanese waters, and annual landings of these stocks, except for the Japanese Pacific stock, decreased dramatically from the late 1980s to the early 1990s (Honda et al., 2003). Recently, changes in pollock abundance correlated with fluctuations in the physical environment have been reported, and Oh et al. (2002) noted that changes in water temperature influenced reproduction in the northern Japan Sea walleye pollock stock and led to fluctuations in stock abundance. With respect to the Japanese Pacific stock, many scientists have discussed the

relationship between interannual variation in environmental conditions and pollock recruitment (e.g., Isoda et al., 1998; Suzaki, 2003). Hamatsu et al. (2004) also reported decadal-scale changes in environment conditions around the main spawning ground of the Japanese Pacific stock between the 1980s and 1990s. However, these studies did not explain why the abundance of the Japanese Pacific stock remained relatively stable over the last two decades. This paper reviews information on the Japanese Pacific walleye pollock stock and environmental conditions during the 1980s and 1990s. We focus on the early life stages because larval survival is important for determining the year-class strength of this stock (Kendall and Nakatani, 1992; Nishimura et al., 2002; Hamatsu et al., 2004). We discuss the relationship between interdecadal fluctuations in recruitment location and environmental changes, and we propose a possible mechanism.

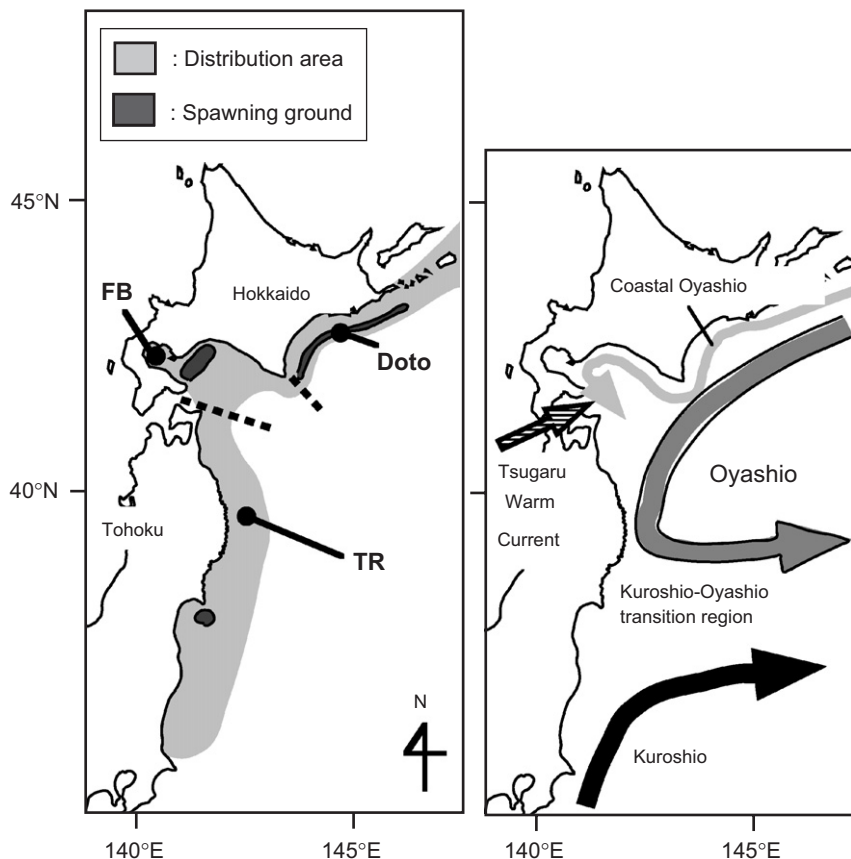


Fig. 1. The distribution and spawning grounds of the Japanese Pacific walleye pollock stock, and the main circulation features. The Dashed lines show the borders of the Doto area, Funka Bay (FB) area and the Tohoku region (TR).

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