Seasonal occurrence of mesopelagic fish larvae on the onshore side of the Kuroshio off southern Japan

1. Introduction

Mesopelagic fishes (1) occur in all the world’s oceans, (2) have high species diversity, (3) numerically dominate in the oceanic fish assemblage, (4) have high biomass – global estimate of 10^10 t, and (5) act as an important link between secondary producers and upper trophic levels in the ecosystems. Thus, mesopelagic fishes are a key component of oceanic ecosystems.

In this study, to describe the reproductive seasonality, we examined the seasonal occurrence patterns of the mesopelagic fish larvae in Tosa Bay which is strongly influenced by the Kuroshio.

2. Sample collection

Samplings were carried out at monthly intervals during the daytime at a fixed station on the continental slope in Tosa Bay, from January 2001 to December 2004. A double-oblique tow of a Bongo net (78-cm mouth diameter, and 3.8-mm mesh) was conducted from the surface down to 500 m depth each month. Total number of tow tows was 5,480. A 0–500 m CTD cast was conducted each month.

3. Oceanographic conditions

The position of the Kuroshio is represented by the 16.5°C isotherm at 200 m depth. Temperature at 200 m depth ranged from 9.6 to 15.5°C throughout the sampling period. Thus, our sampling station was concluded to be located on the onshore side of the Kuroshio axis.

4. Monthly changes in larval abundance

In total, 2,558 mesopelagic fish larvae occurred with a peak abundance during May to June. This peak was due to extremely high abundance of Diaphus stubby spp.

The mean percentage of mesopelagic fish larvae to total abundance of fish larvae (including epipelagic and demersal fishes) ranged from 19.2% to 51.3%, except for March to April. The mean percentage was about 6% during March to April due to extremely high abundance of the Japanese anchovy (Engraulis japonicus) larvae.

5. Species composition

Larvae of the 12 dominant species (or types) belonging to 18 genera, 50 families, 135 genera, and 650 types were standardized for each month. The 12 species of larvae, with the highest abundance, were classified into five groups. The highest percentage of mesopelagic fish larvae occurred in the following five groups:

- **Gonostomatidae**: Cyclothyrididae, Stereoscopidae, Pholisochthyidae
- **Gonostomatidae**: C. punctatus, S. elongatum, D. gracile, D. asperum
- **Cyclothyrididae**: C. punctatus, D. gracile, D. asperum
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- **Cyclothyrididae**: C. punctatus, D. gracile, D. asperum

6. Grouping of seasonal occurrence

In the larvae of the 12 dominant mesopelagic fish species, mean abundances in each month for the four years were standardized as a percentage of summed mean abundance over 12 months. The Bray-Curtis similarity index was adopted to distinguish the seasonal occurrence patterns of the larvae. The group was divided into five groups: Winter, Spring, Early summer, Summer, and Autumn groups. However, there were no species that were grouped into the same category.

7. Reproductive seasonality

The seasonal occurrence patterns of the larvae were categorized into five groups in accordance with physical properties of the water column: Winter (Nototheniidae, Lipophyidae, Lipophyidae, and Stereoscopidae), Spring (Stereoscopidae and Diaphus), Summer (Gephyrocharacidae and Nototheniidae), Early summer (Nototheniidae), and Autumn (Nototheniidae). There were no species that showed peak abundance during August to September.

8. Interannual variations

No significant difference was observed in the monthly peaks of the dominant 12 mesopelagic fish larvae during 2001 to 2004, suggesting that each species has a fixed seasonal pattern of reproduction.

9. Conclusions

- To describe the reproductive seasonality, we examined the seasonal occurrence patterns of the mesopelagic fish larvae on the onshore side of the Kuroshio off southern Japan, based on monthly samples collected from January 2001 to December 2004.
- The samples included 26 mesopelagic fish species or types belonging to 13 genera. A peak abundance of the total mesopelagic fish larvae was during May to June.
- The dominant 12 taxa showed marked seasonality with high abundances in one particular period (i.e., Winter, Spring, Early summer, and Autumn groups), although year-round occurrence was also observed (i.e., Year-round group).
- No significant difference was observed in the seasonal occurrence patterns, suggesting that each species has a fixed seasonal pattern of reproduction.

References