Impact of anticyclonic eddy on fish distribution in Kuroshio-Oyashio transition area


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Conclusion 1: We observed an anticyclonic eddy originating from the Kuroshio extension with warm, saline water inside.

Conclusion 2: SV at 38 kHz showed peaks around 75 dbar & 400 dbar along isotherms and isopycnals both inside and outside eddy.

Conclusion 3: Fish within the eddy were located more than 13 dbar deeper in the surface and over 27 dbar deeper in the mid-depth.

Conclusion 4: Higher mid-depth SV inside the eddy suggested a potentially higher fish density.

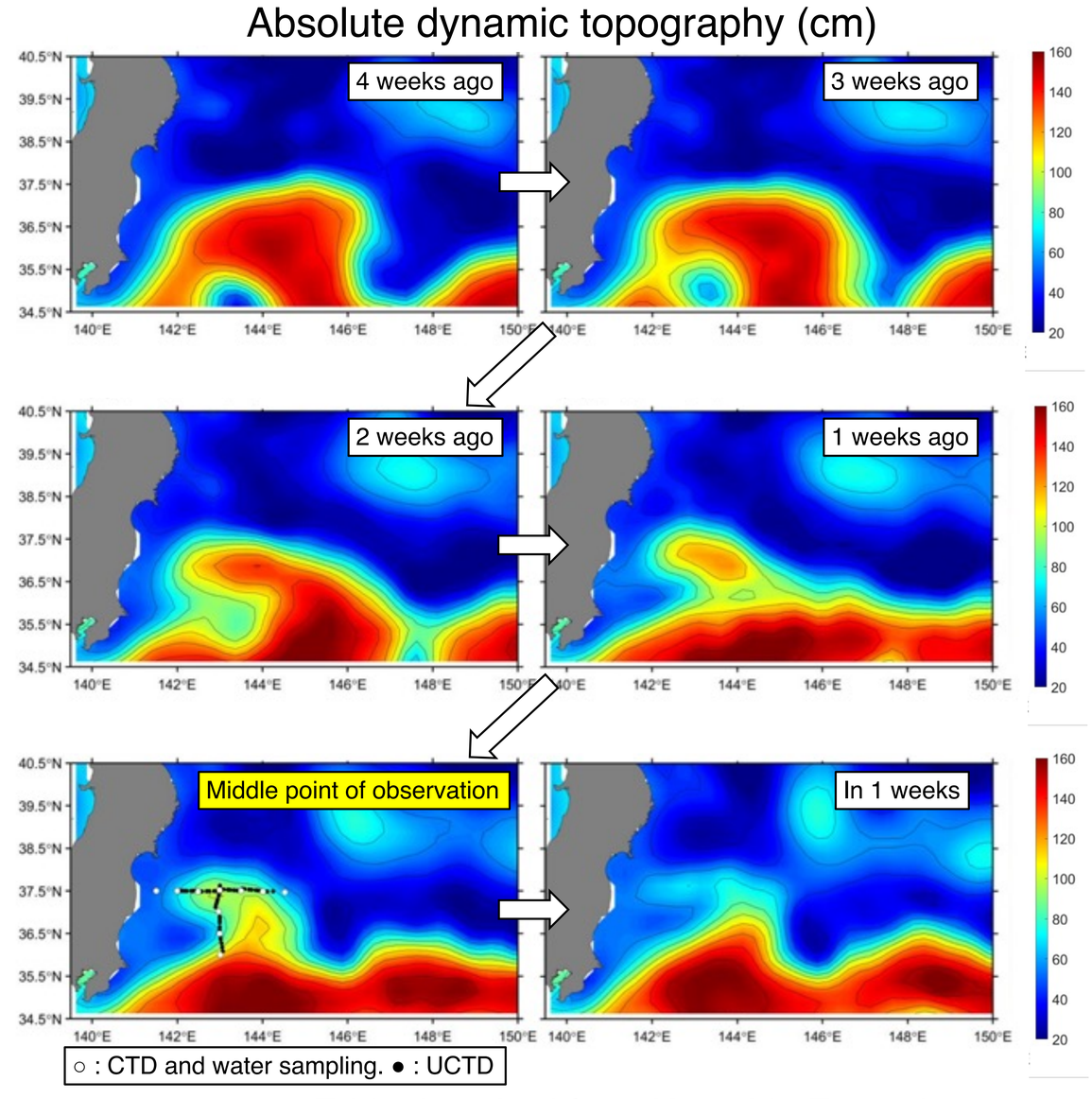
1. Introduction

Kuroshio-Oyashio transition area has water originating from subtropical and subarctic areas and forms productive ecosystems. Mesoscale eddies play important roles in these ecosystems, such as by transporting heat and organisms. Micronektonic mesopelagic fishes play crucial roles in biogeochemical cycles; however, further research is needed to understand the physical, chemical, and biological effects of mesoscale eddies on these fishes.

2. Data and Methods :

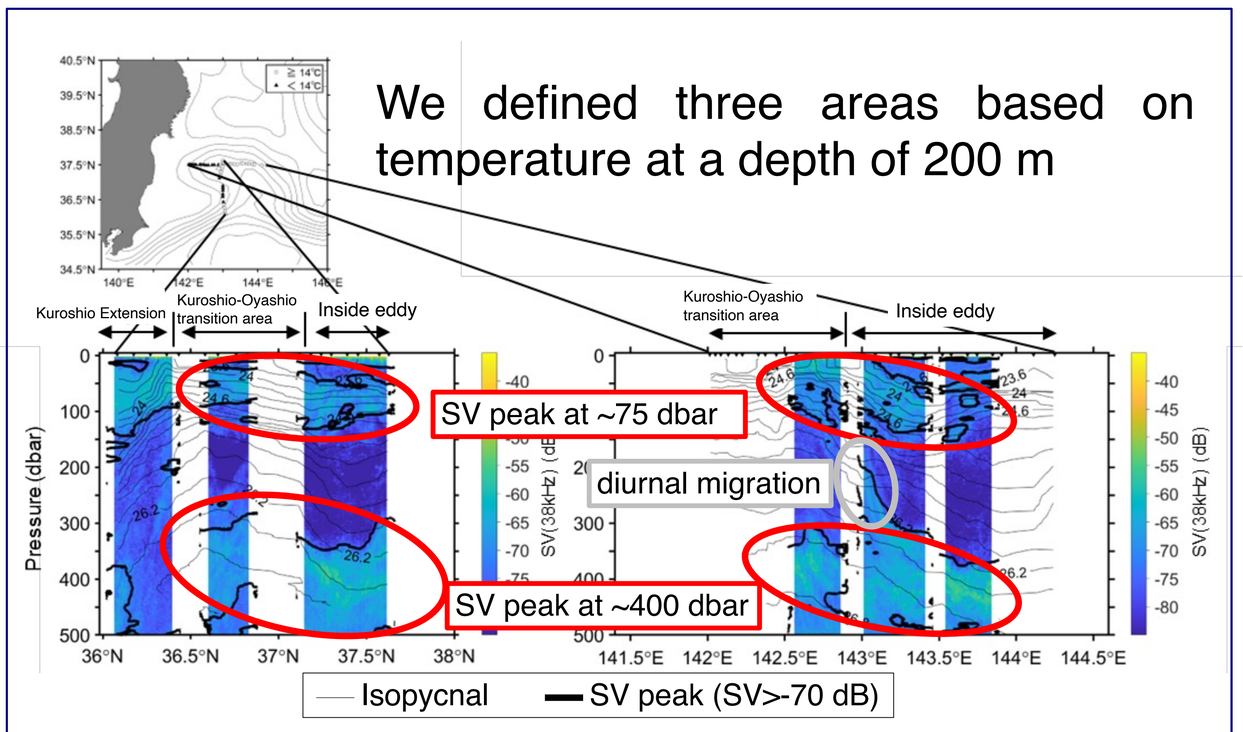
	Period	Parameters
Ship	June 13 – 22, 2019	Temperature, chlorophyll-*a* fluorescence: Underway CTD SV (Acoustic volume backscattering strength): Calibrated echosounder EK80
Ship	Sept. 24, 2019	Micronekton community: MOHT SV: Calibrated echosounder EK80
Satellite	May 1– July 1, 2019	Absolute dynamic topography: CMEMS, Horizontal resolution: 1/4 × 1/4°

Absolute dynamic topography (cm)



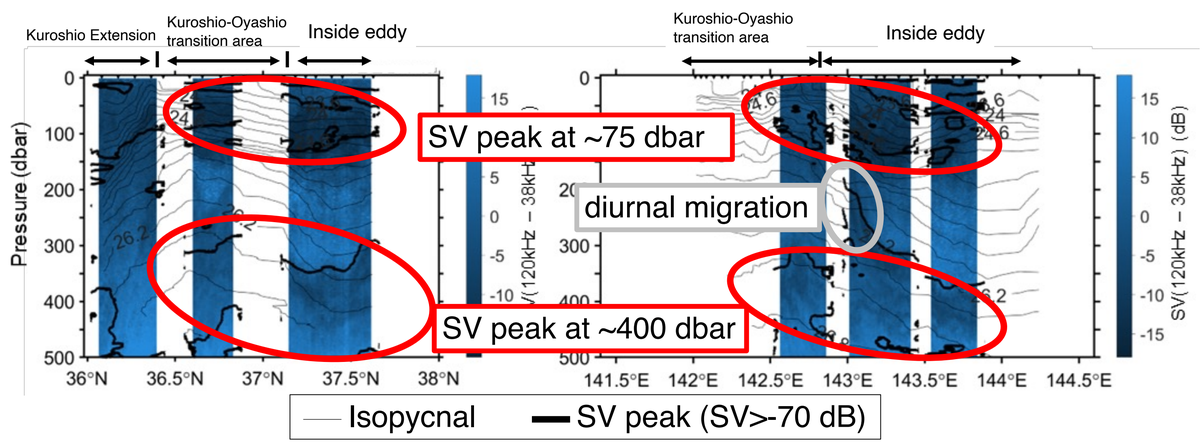
- Eddy detached from Kuroshio Extension.
- Eddy disappeared in 1 month

3. Results and discussion



$$SV = 10\log_{10}\rho + TS_{cm} + 20\log_{10}L$$

SV peaks were deeper inside eddy compared to outside, along with isotherms & isopycnals.



Organisms	SV difference (120 kHz – 38 kHz) (dB)
Euphausia pacifica (Nishioka et al. 1995; Taki. 1998)	around 15.0 (Fukuda. 2013)
Survey in September (Fish made up 53% of total 81.9 g)	7.9 ± 3.4
Swimbladderless myctophid species	–5.4–12.4 (Yasuma et al. 2008)
Swimbladder myctophid species	–1.3––0.1 (Yasuma et al. 2008)

According to SV difference, organisms associated with SV peaks would be fishes.

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Fishes were located 13–19 dbar & 27–37 dbar deeper inside the eddy than outside at surface and intermediate depths, respectively.

In N-S line, SV associated with fish btwn 250 & 500 m was –63.2±1.4 dB inside eddy: higher than –66.7±0.5 dB outside eddy, which maybe due to higher ρ.

Similarly, along E-W line, SV values were higher inside eddy; however, we were unable to eliminate the influence of diurnal vertical migration.