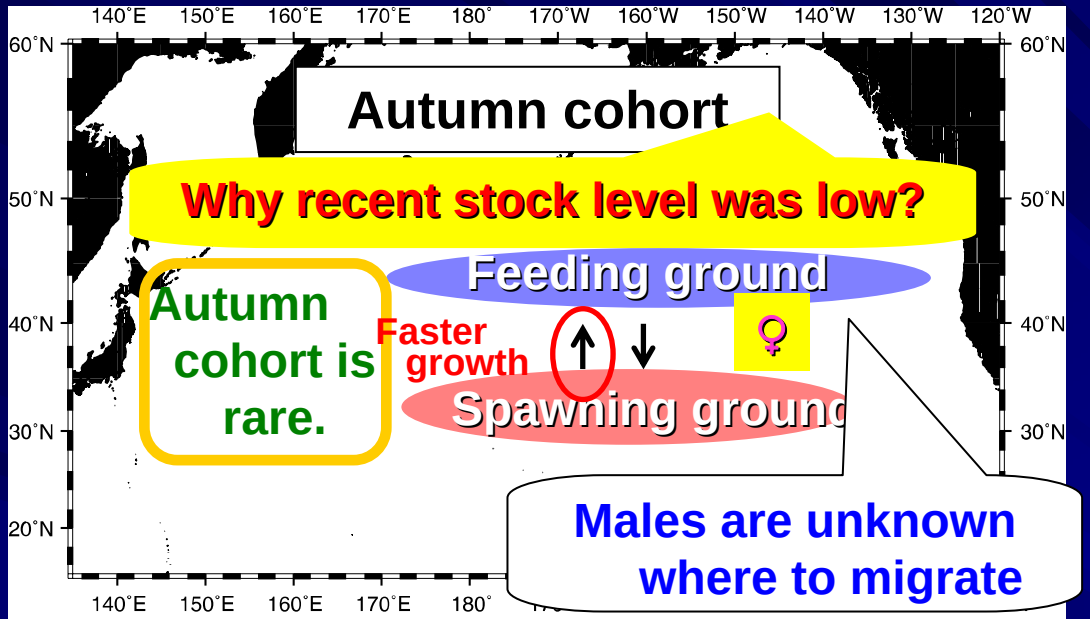
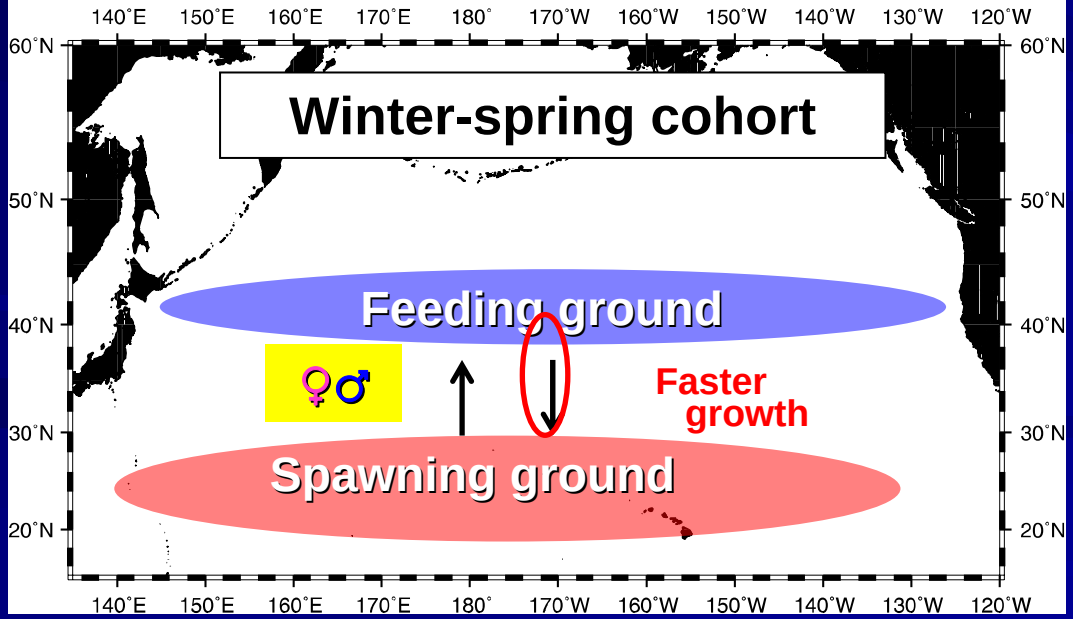
Life cycle characteristics of the neon flying squid associated with oceanographic regime in the North Pacific

T. Ichii, K. Mahapatra,
M. Sakai & D. Inagake





Mysteries

1. Why the autumn cohort is rare in the western North Pacific?

2. Why growth pattern is different between the two cohorts?

3. Where are males of the autumn cohort gone?

Migration of neon flying squid (Yatsu et al. 1998)

Materials

Research driftnet data

Murata & Hayase (1993)

Ichii et al. (2004)

Paralarvae survey data

Ichii et al. (2004)

Oceanographic data

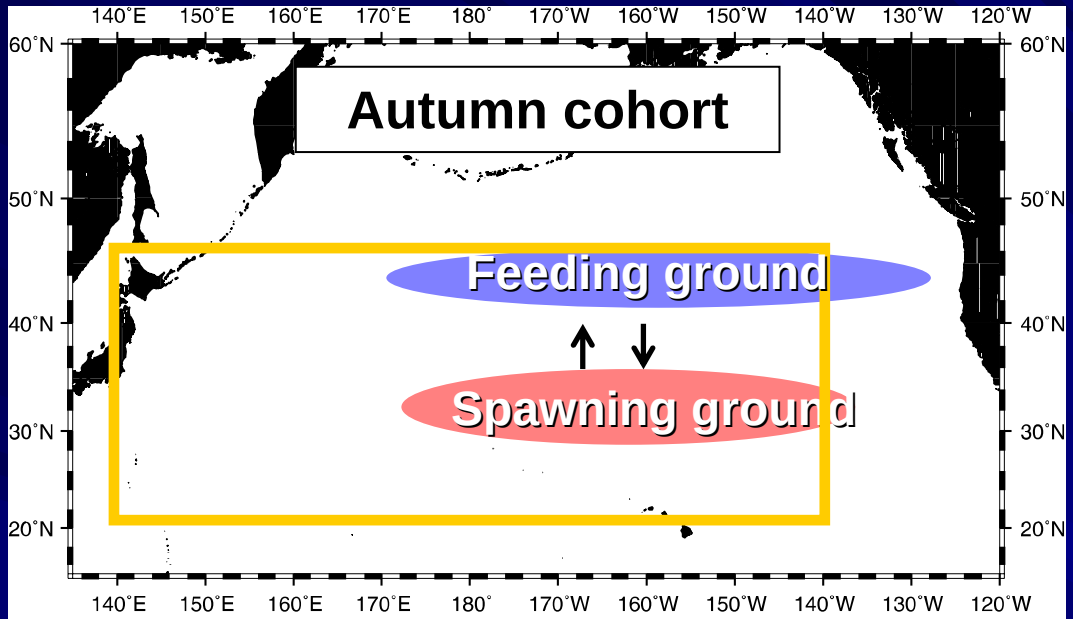
Chl-a : SeaWiFS data, SST:AVHRR Pathfinder data

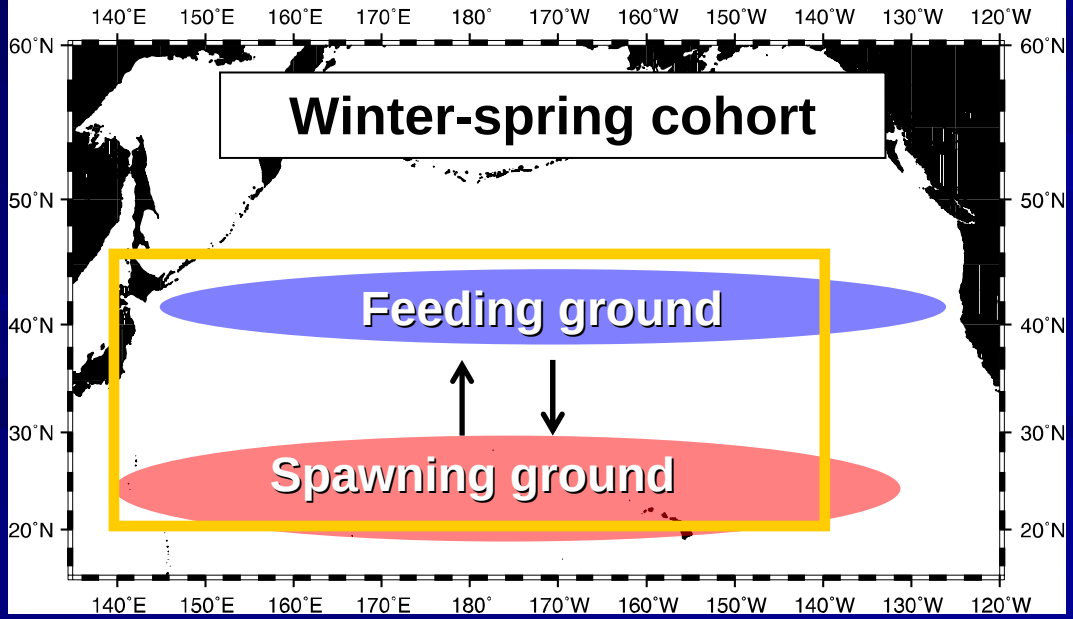
Climatological temperature, salinity and current data: (e.g. http://podaac.jpl.nasa.gov)

Growth of the neon flying squid

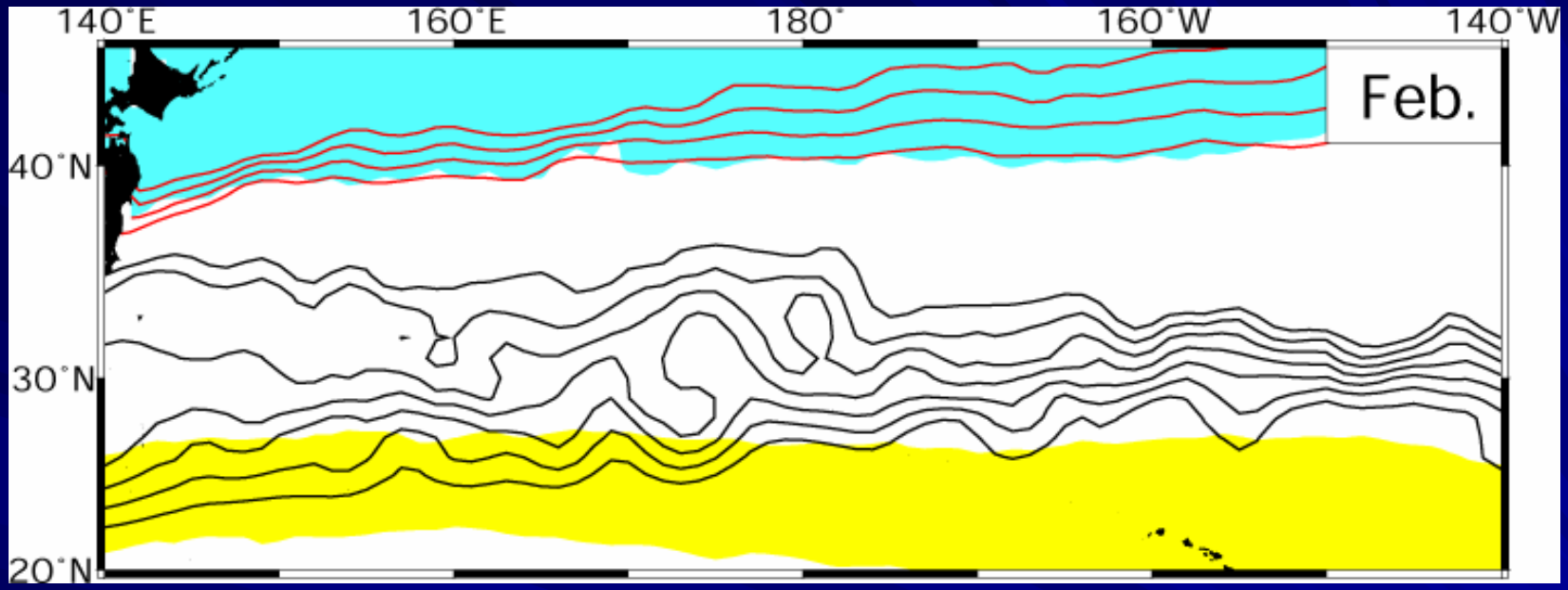
Chen & Chiu (2003) , Murata & Hayase (1993)

Study area



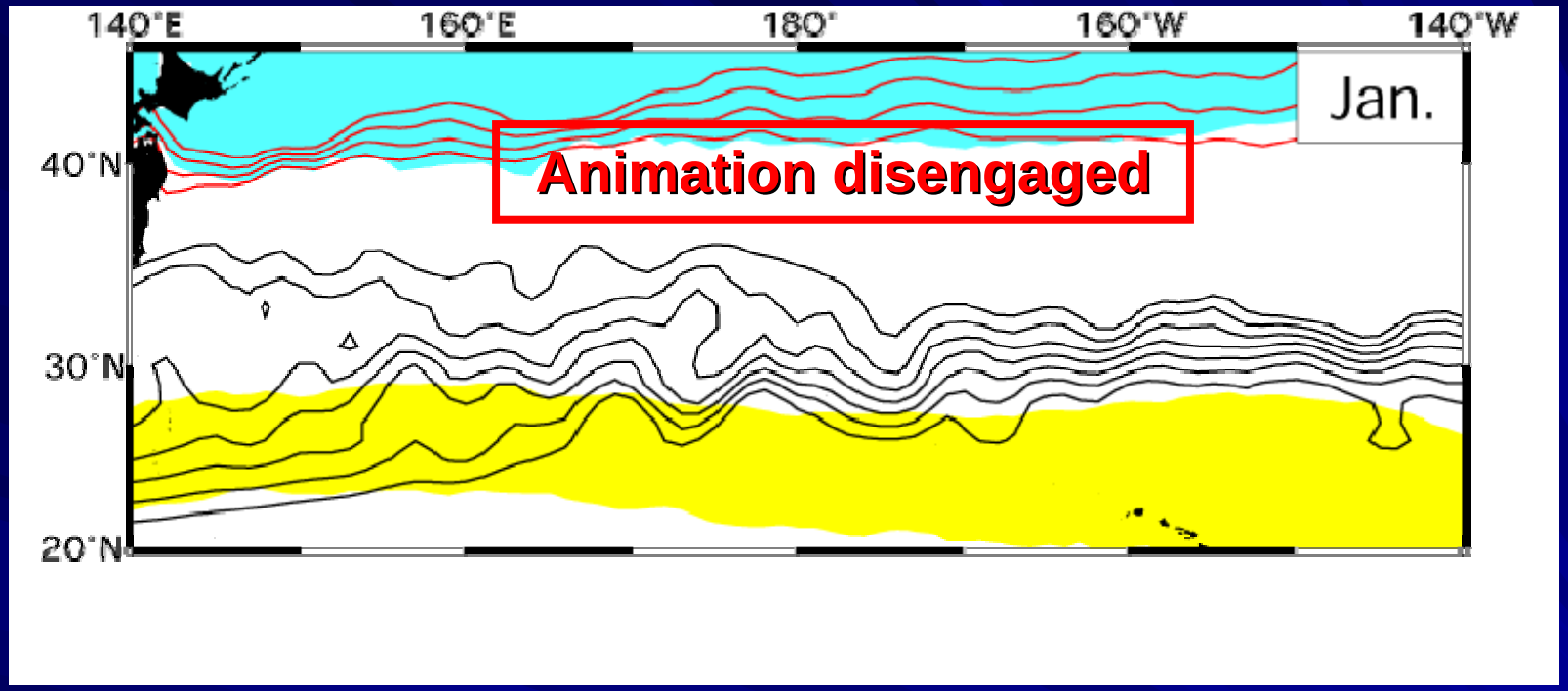


Migration of neon flying squid (Yatsu et al. 1998)



- Unfavorable cold SST (<10˚C)
- Optimum spawning SST (21-25˚C)
- Transitional Domain (7-10˚C at 100m)
- Subtropical Frontal Zone (salinity 34.6-35.2 at 0m)

Oceanographic environment in winter



- Unfavorable cold SST (<10˚C)
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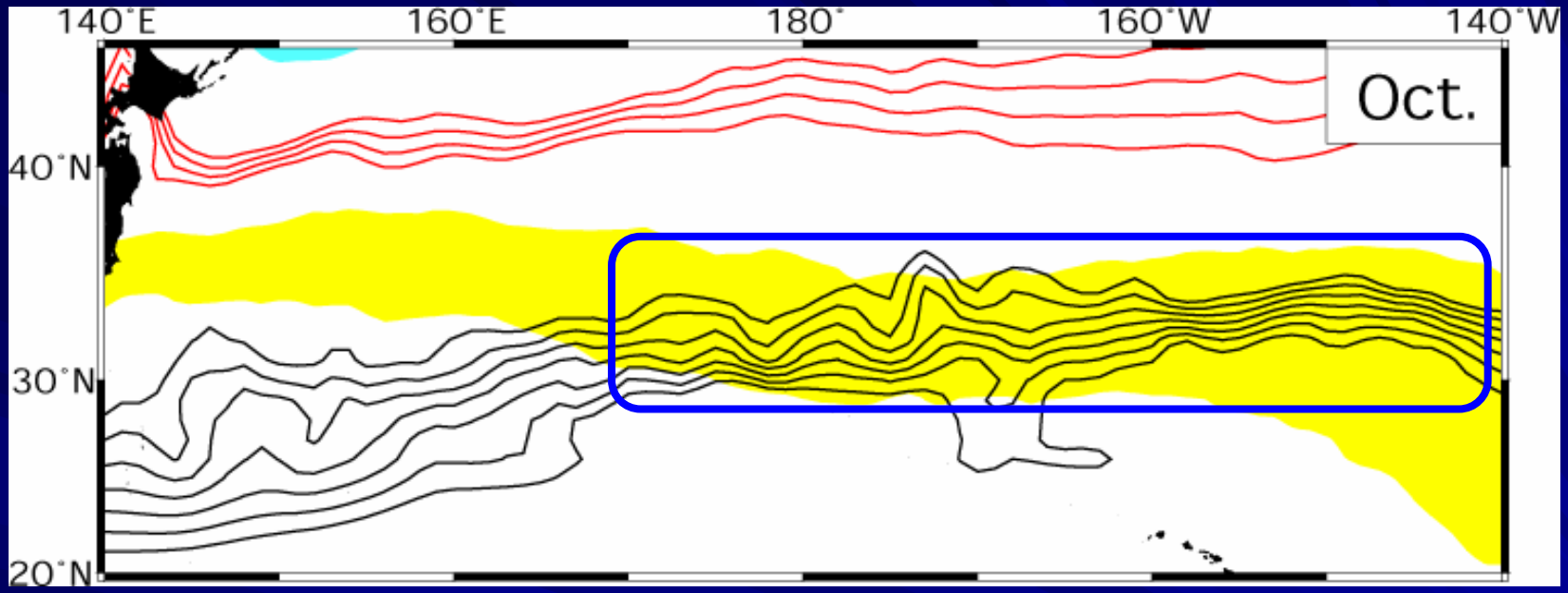
Monthly change in oceanographic environment



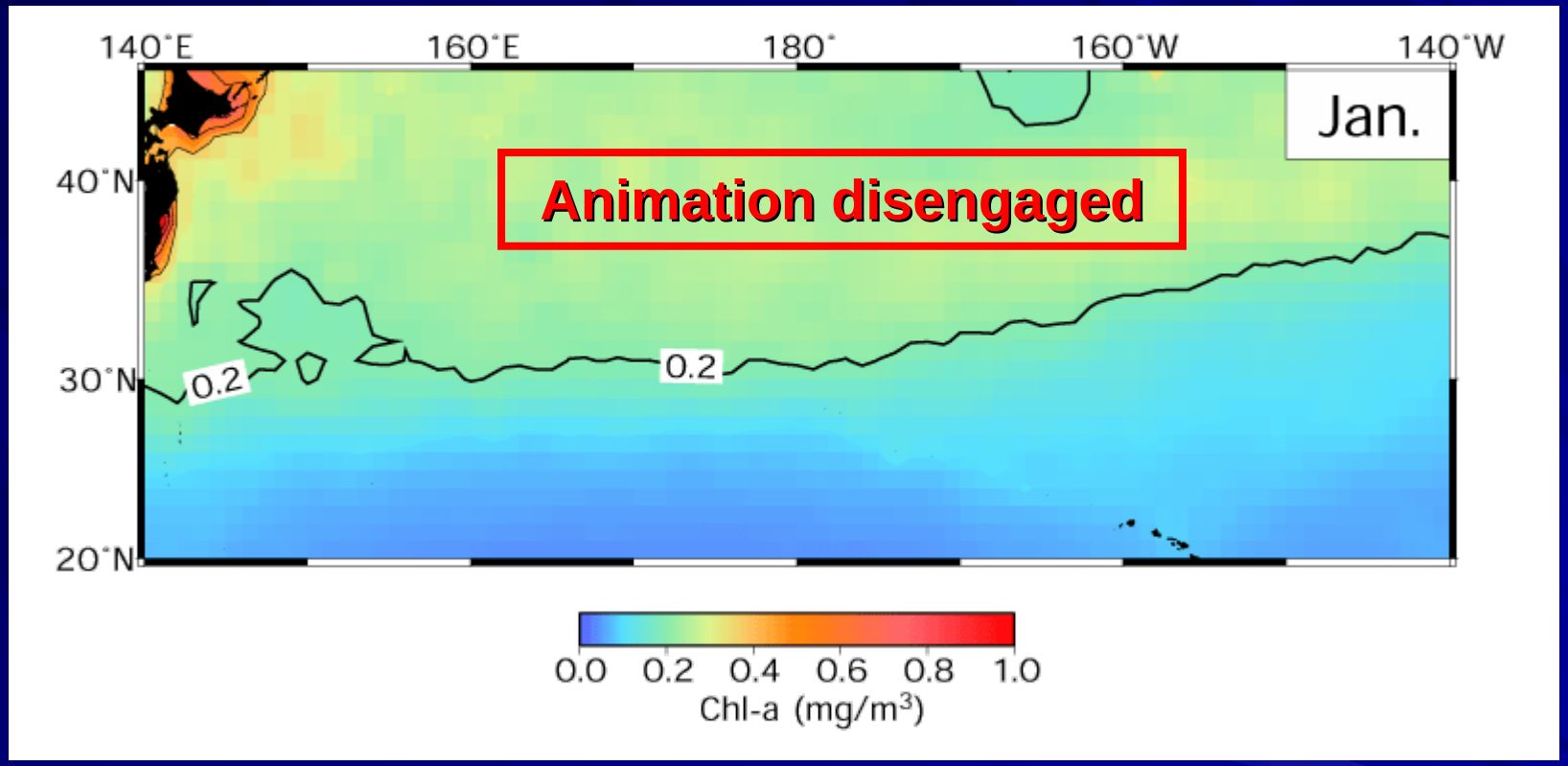
Unfavorable cold SST (<10˚C)

Optimum spawning SST (21-25˚C)

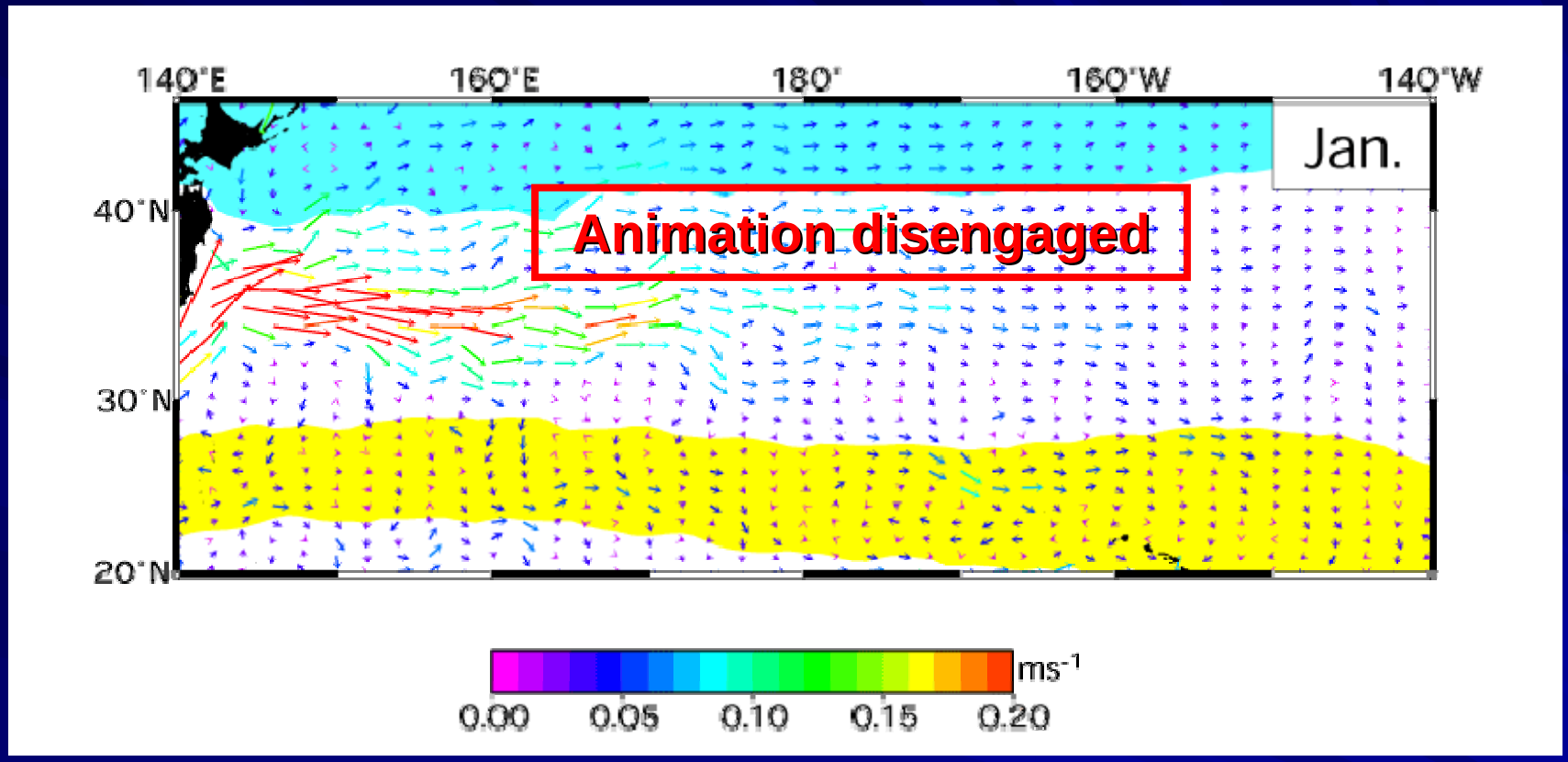
Transitional Domain (7-10˚C at 100m)

Subtropical Frontal Zone (salinity 34.6-35.2 at 0m)

In Autumn the optimum spawning SST coincides with Subtropical Frontal Zone in central and eastern NP



Monthly location of Transition Zone Chlorophyll Front

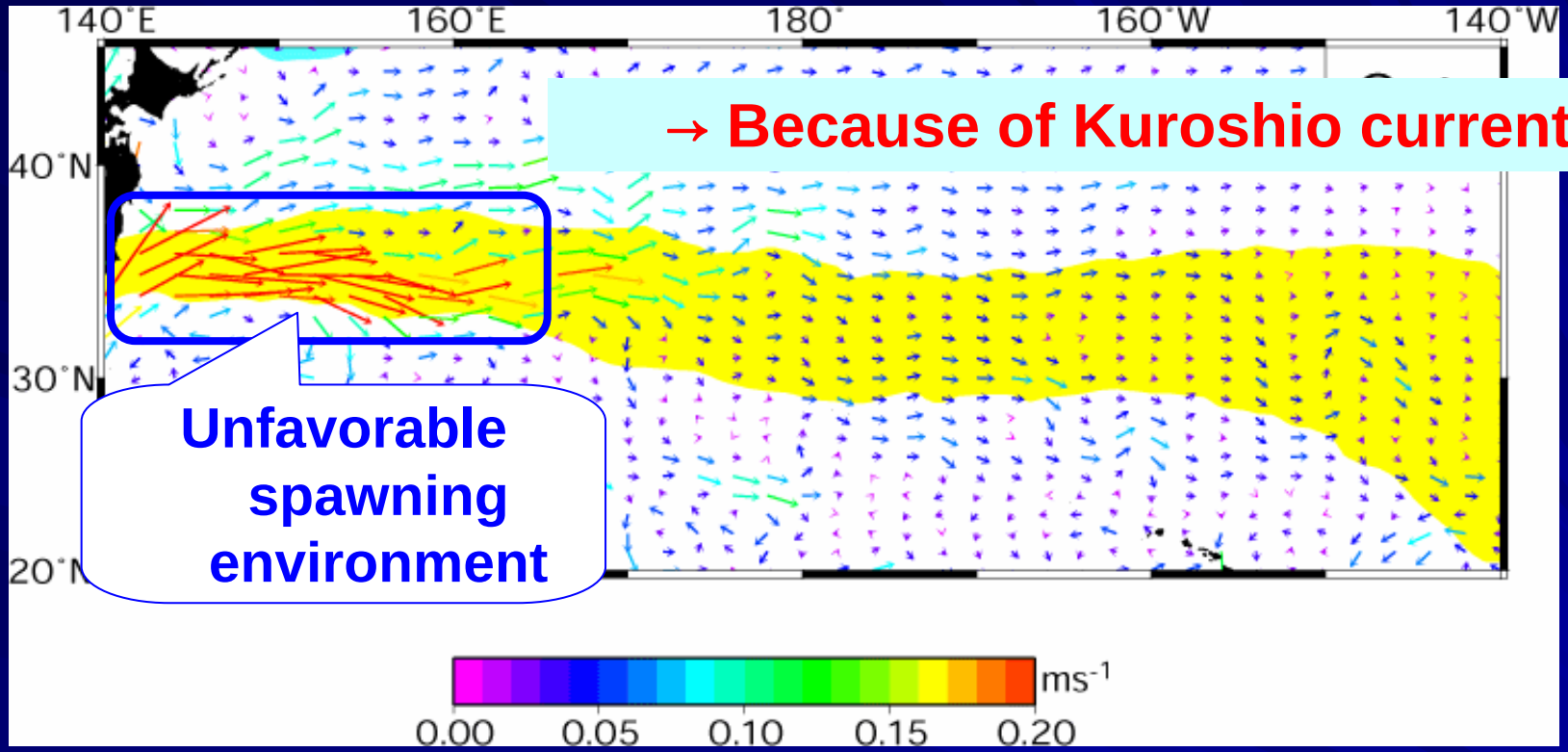


Unfavorable cold SST (<10˚C)

Optimum spawning SST (21-25 ˚C)

Monthly location of optimum spawning SST in relation to current

1. Why the autumn cohort is rare in western North Pacific?

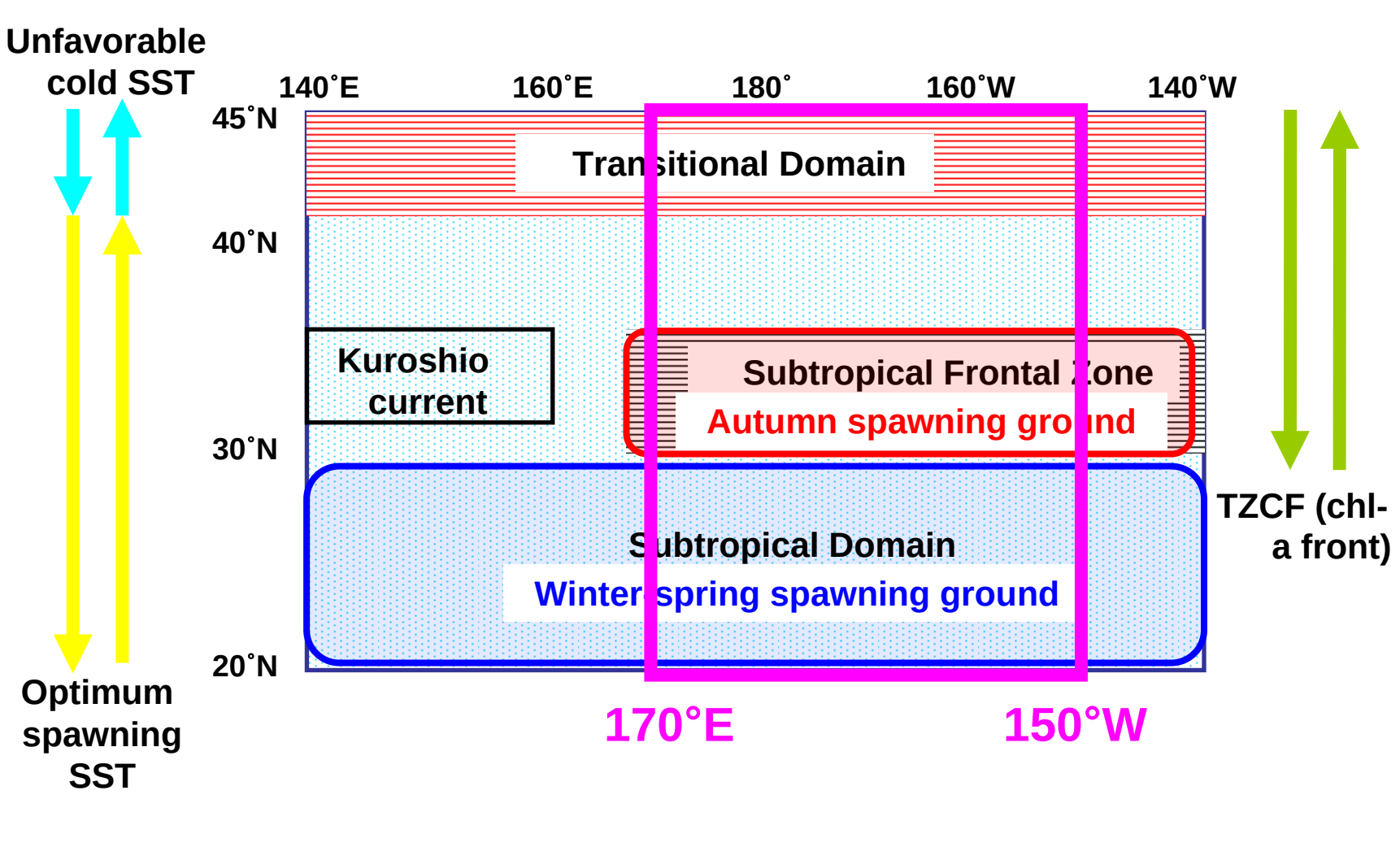


Unfavorable cold SST (<10˚C)

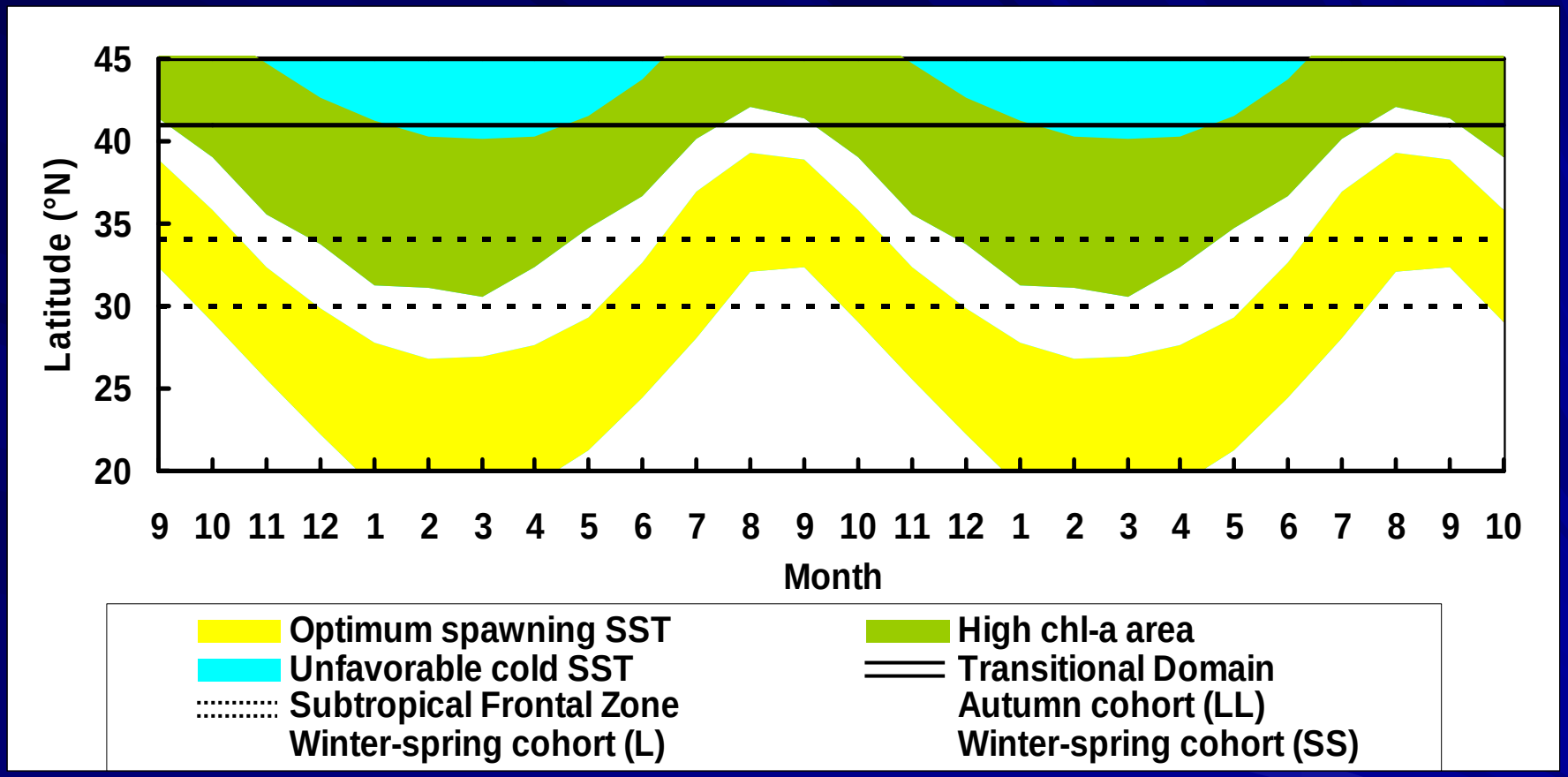
Optimum spawning SST (21-25 ˚C)

In Autumn the optimum spawning SST coincides with the Kuroshio current in western North Pacific

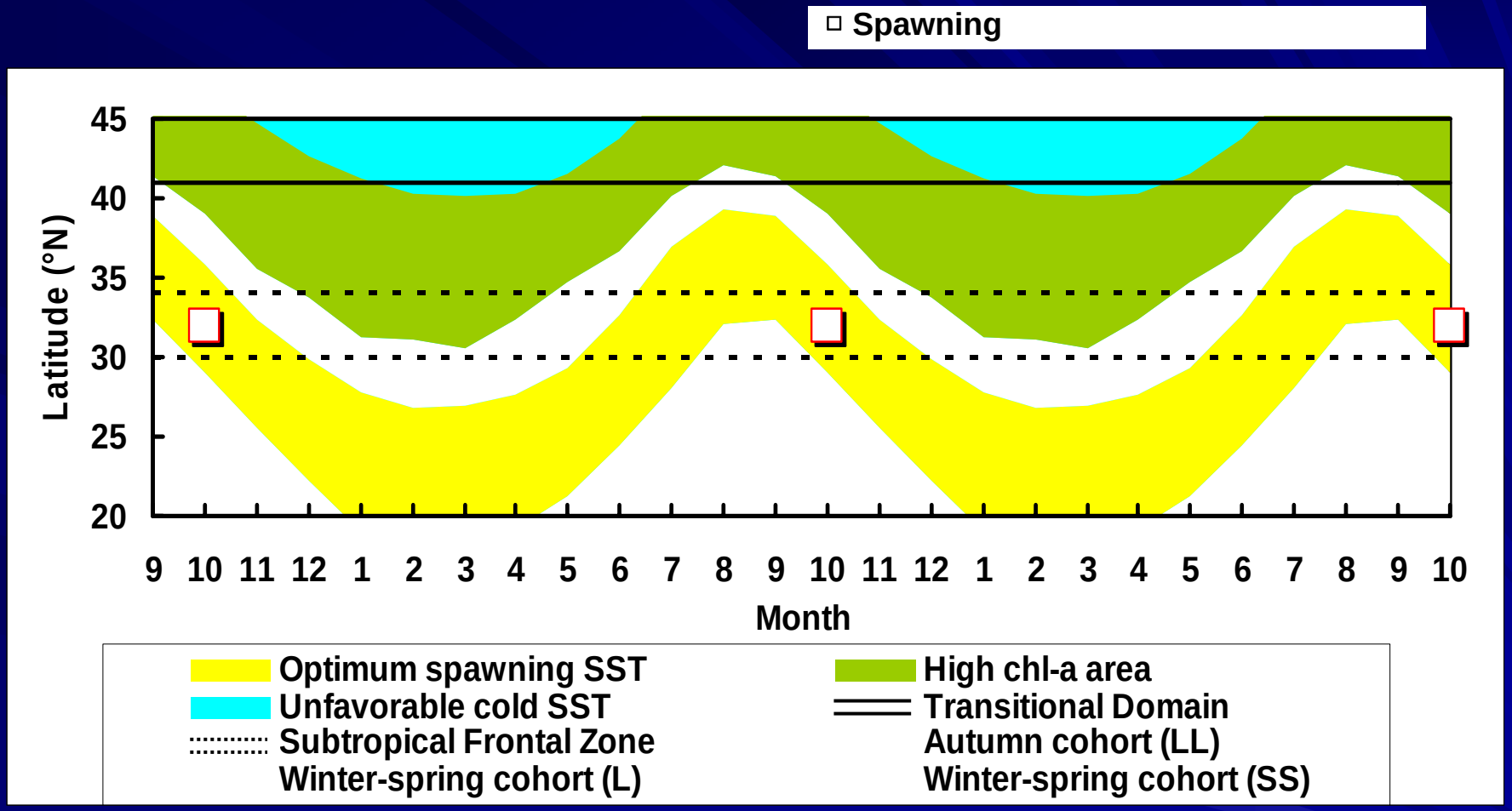
Oceanographic summary



North Pacific Oceanographic scheme

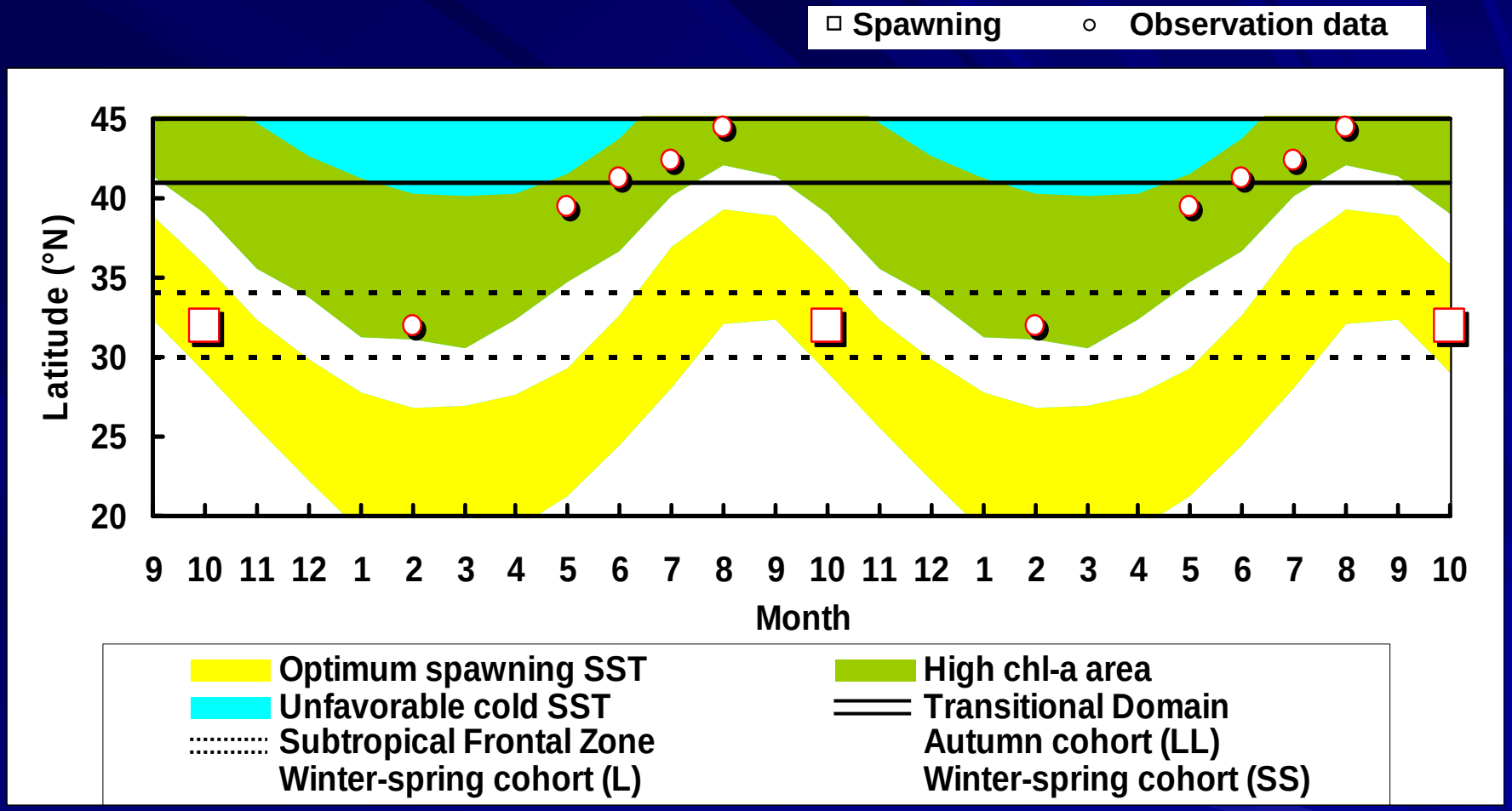


Seasonal meridional movements of oceanographic features averaged over the region bounded by 170°E - 150°W



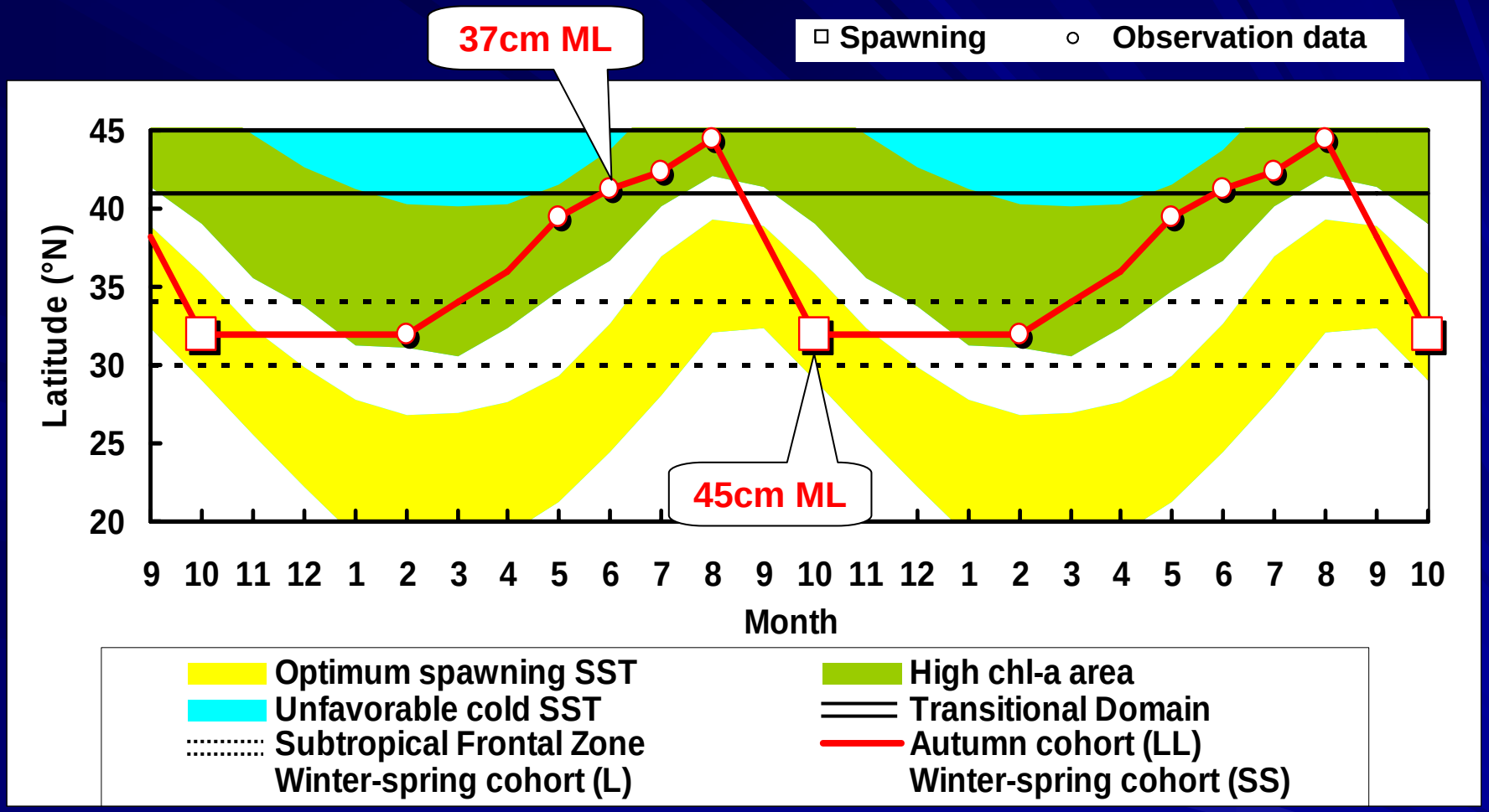
Female migration in relation to oceanographic environment

Autumn cohort



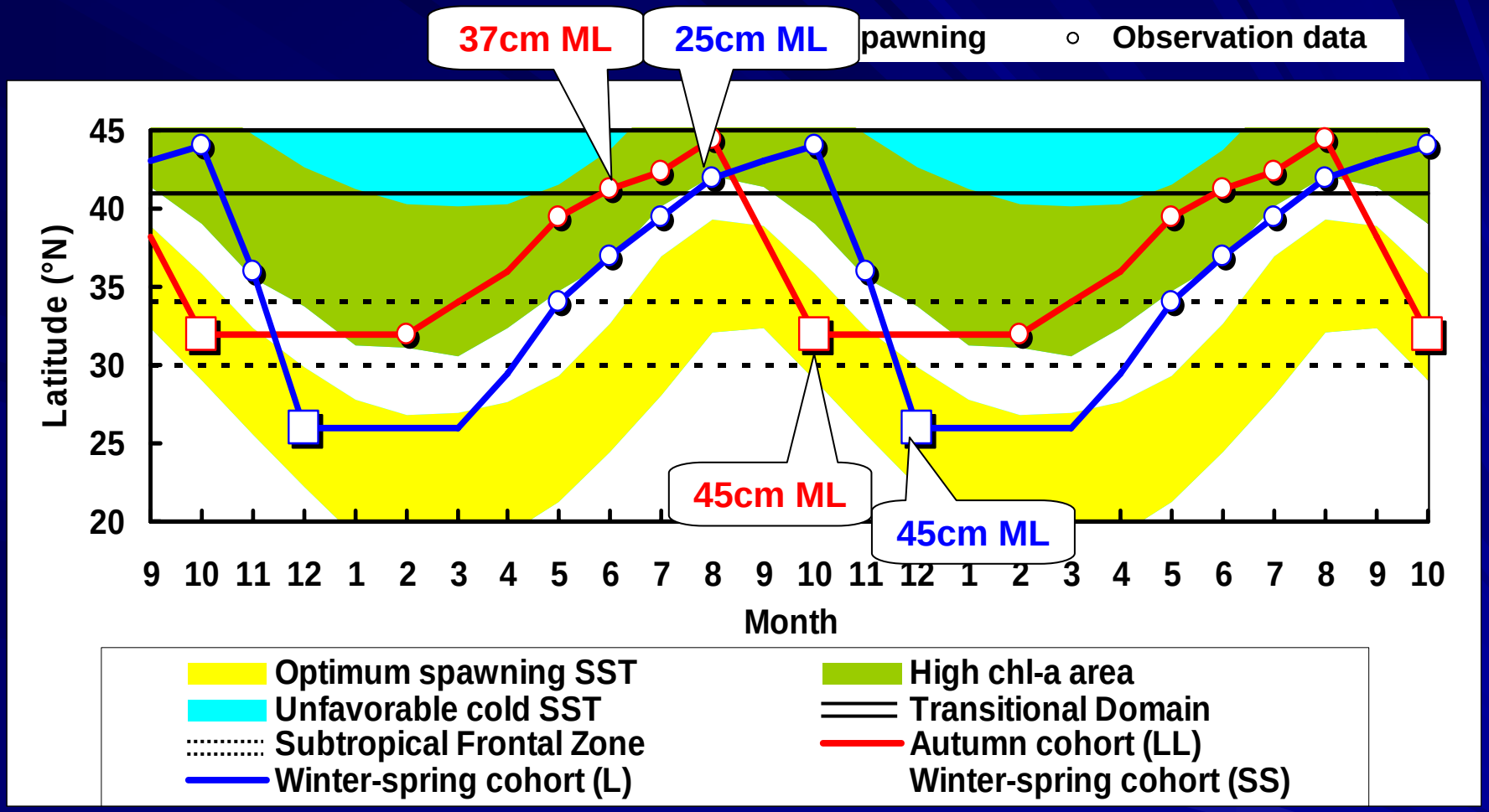
Female migration in relation to oceanographic environment

Autumn cohort



Female migration in relation to oceanographic environment

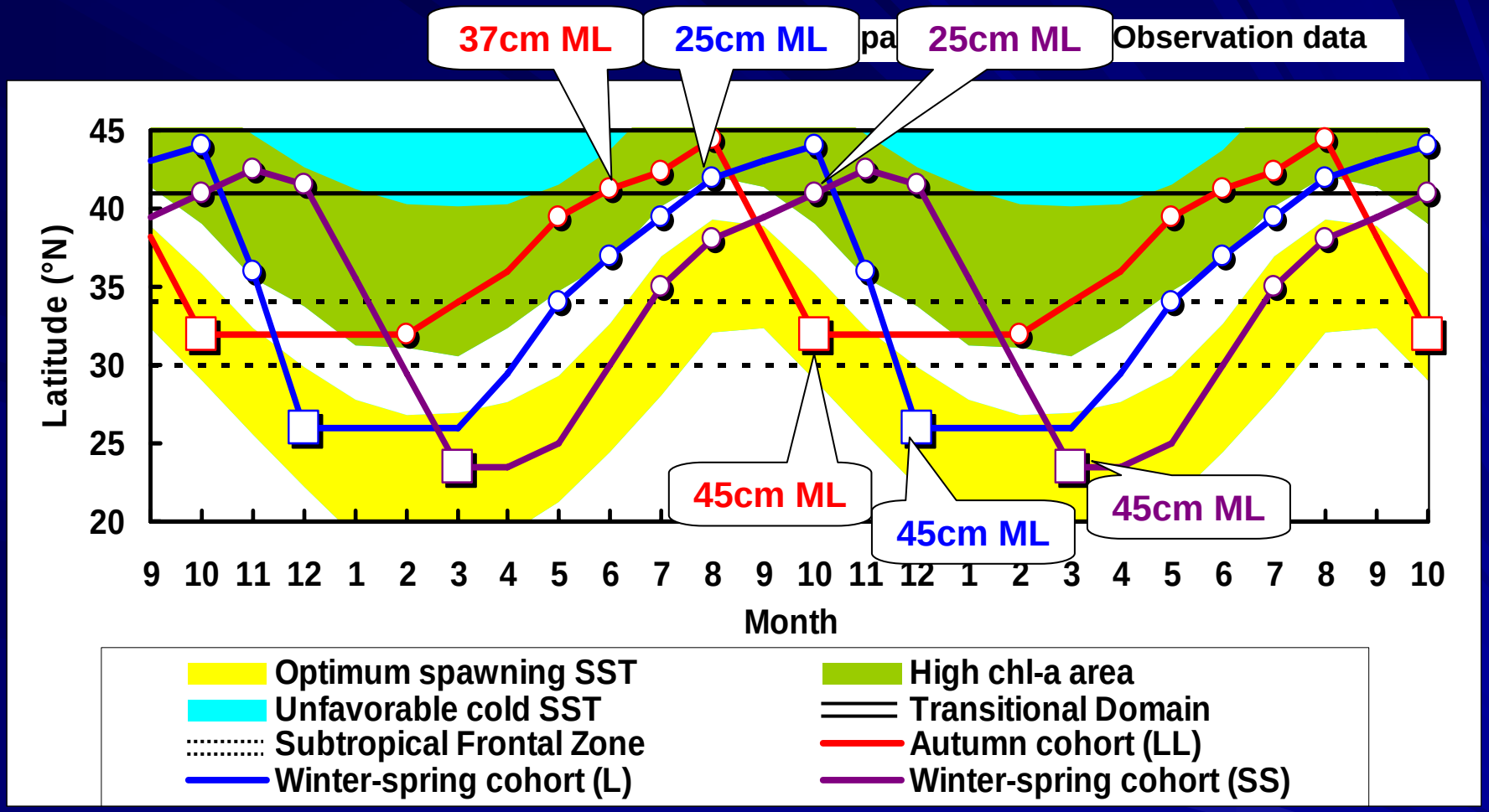
Autumn cohort



Female migration in relation to oceanographic environment

Autumn cohort

Winter-spring cohort

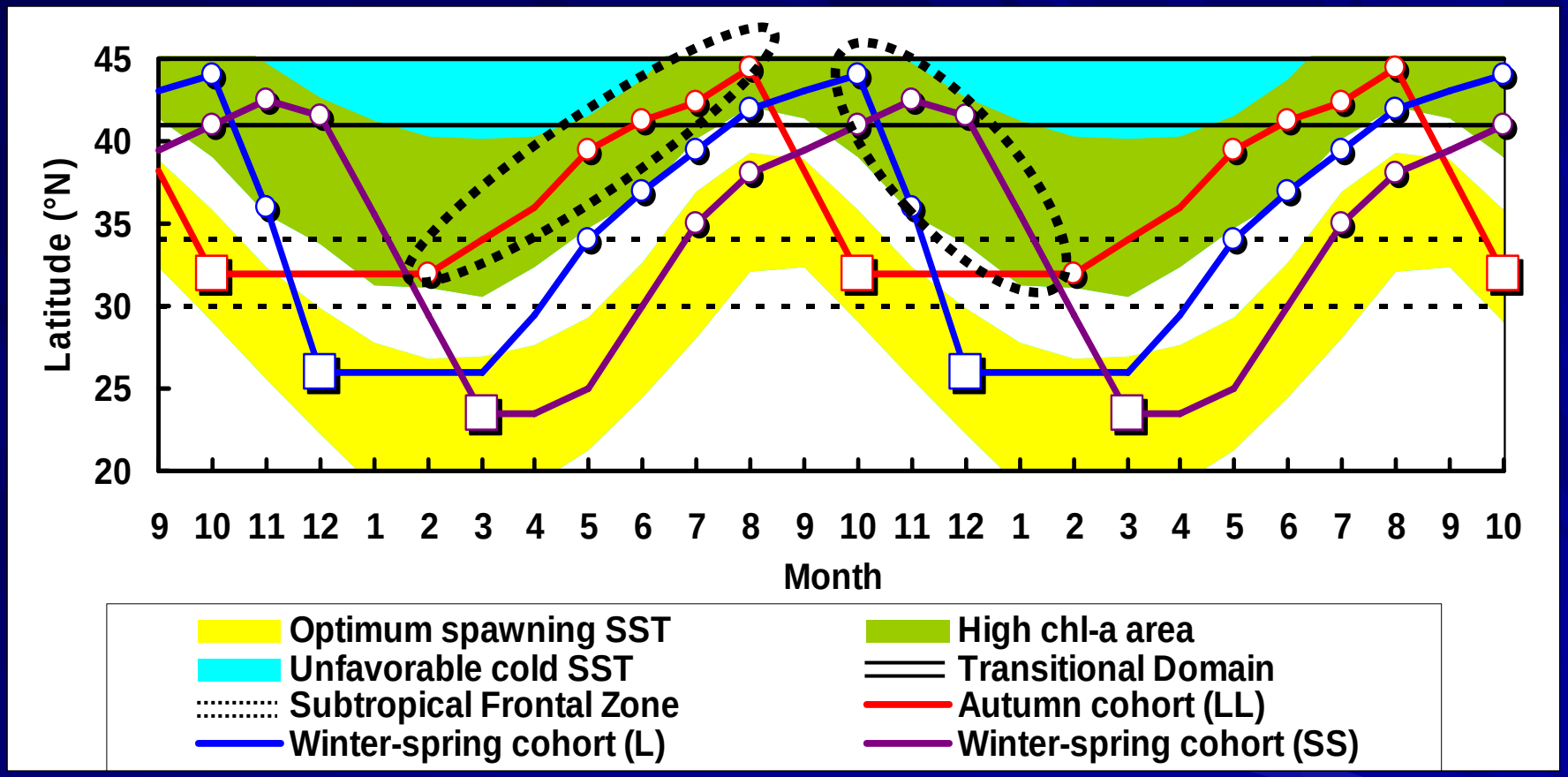


Female migration in relation to oceanographic environment

Autumn cohort

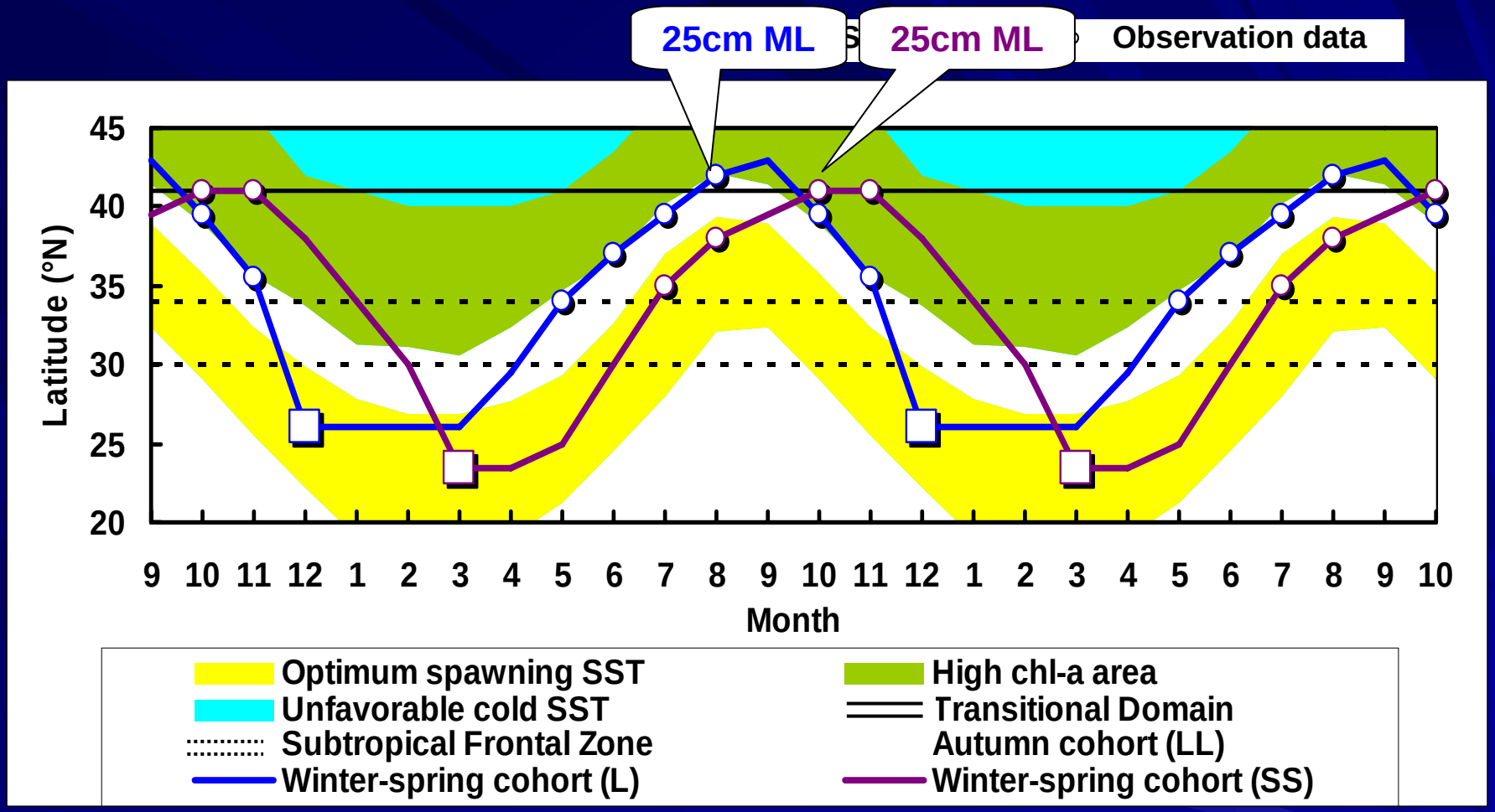
Winter-spring cohort

2. Why growth pattern is different between the two cohorts?



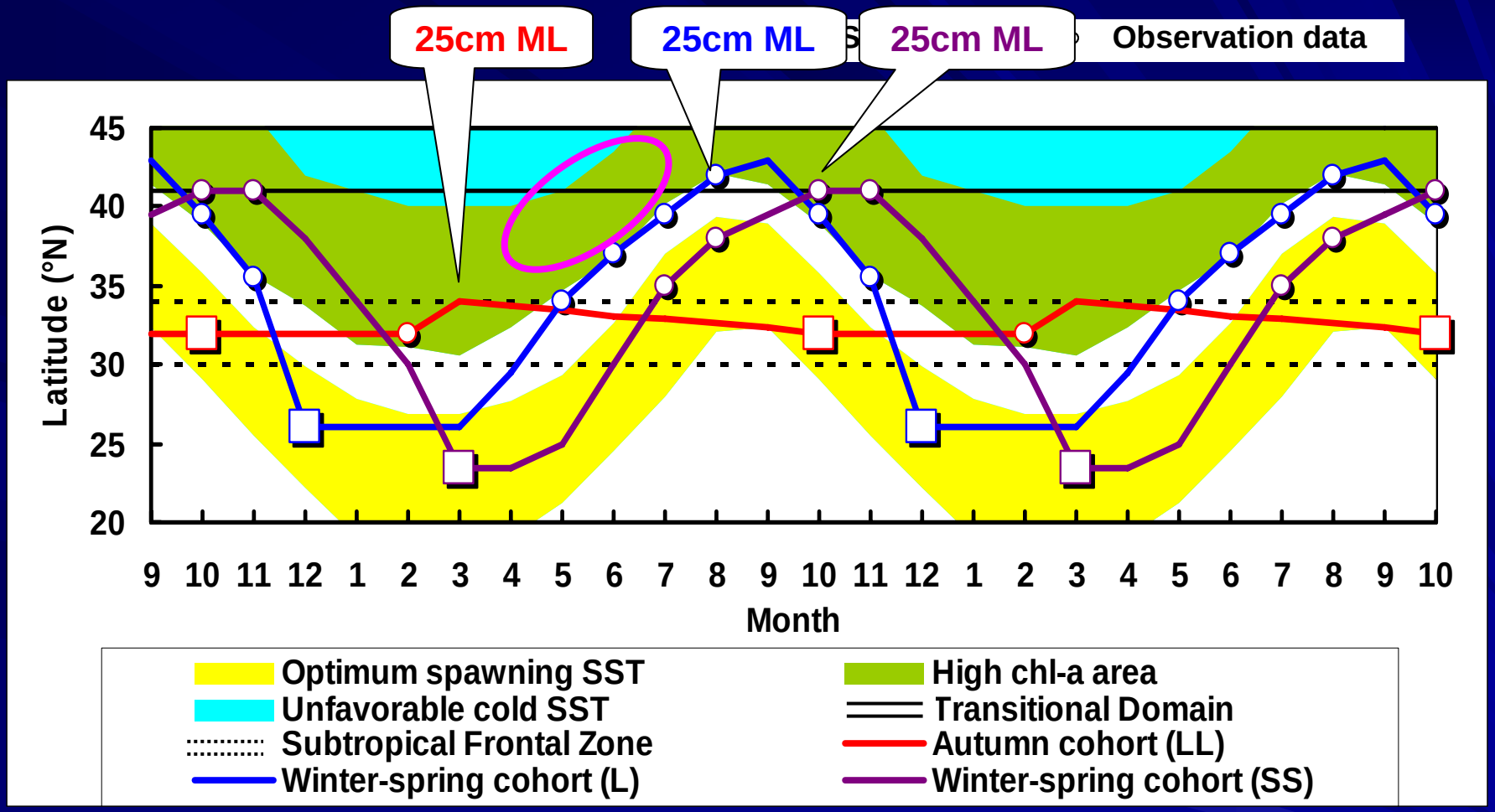
→ The autumn cohort utilizes food rich area in spawning ground and northward migration whereas the winter-spring cohort does so in southward migration

3. Where are males of the autumn cohort gone?



Male migration in relation to oceanographic environment

Winter-spring cohort

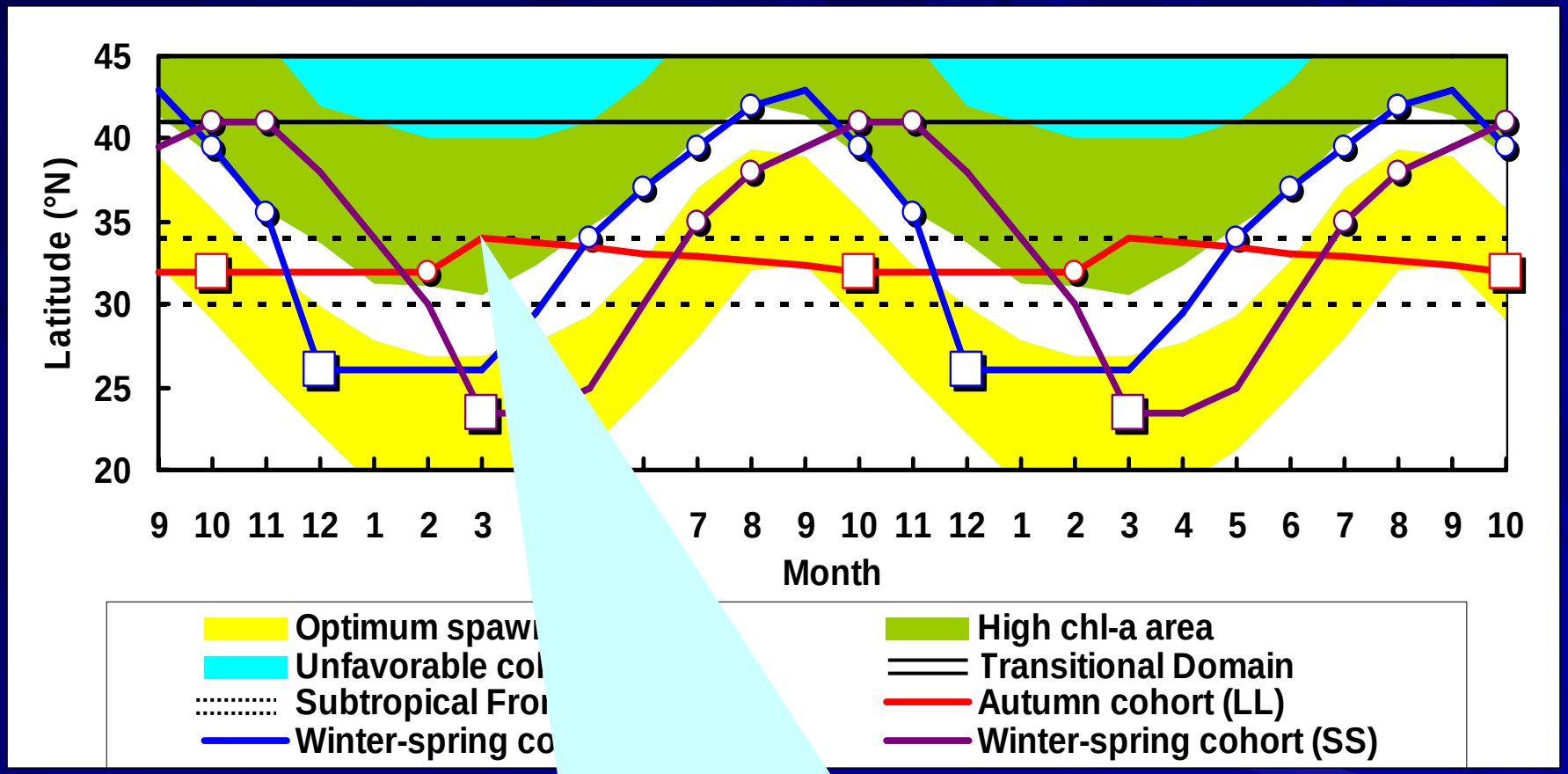


Male migration in relation to oceanographic environment

Autumn cohort

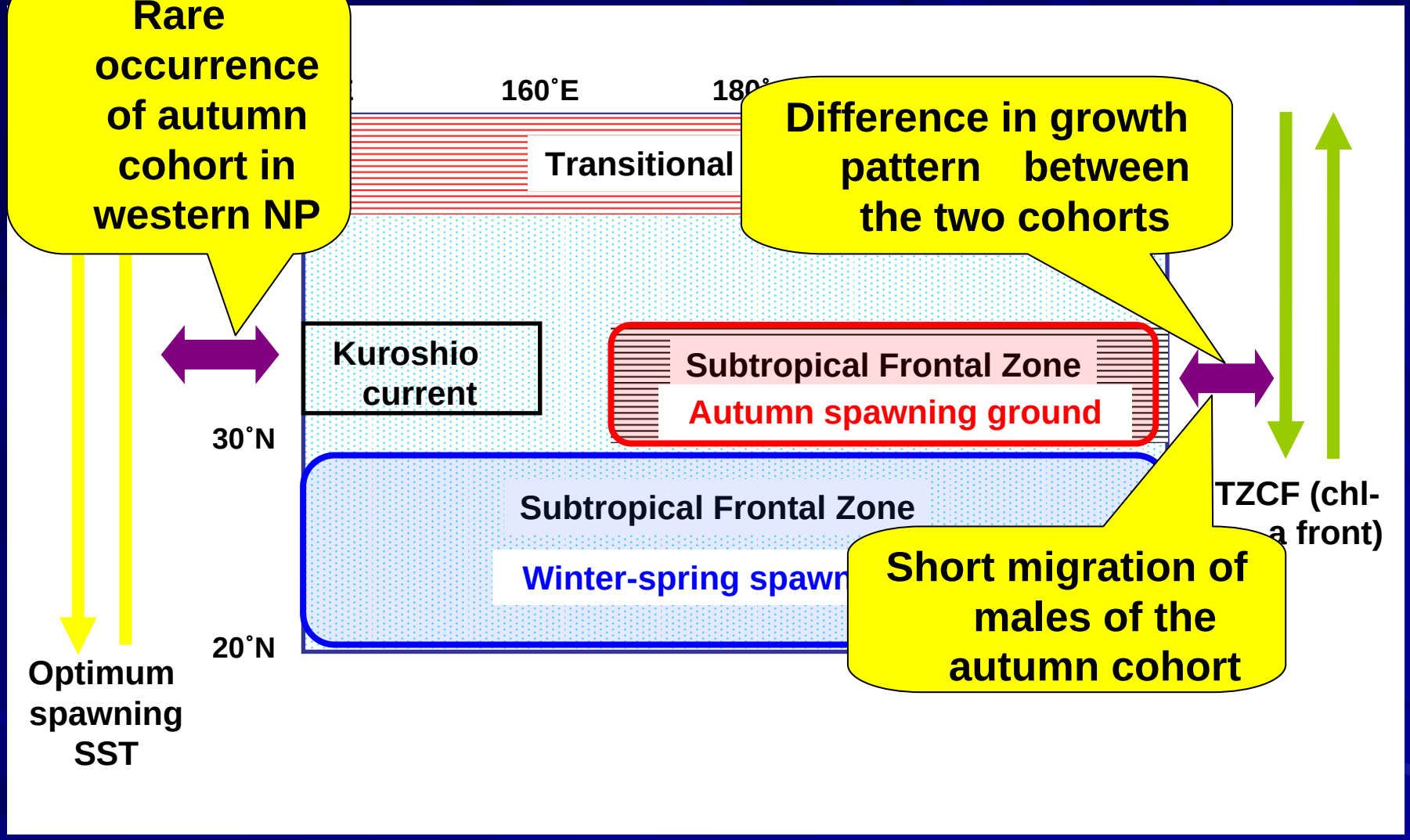
Winter-spring cohort

3. Where are males of the autumn cohort gone?



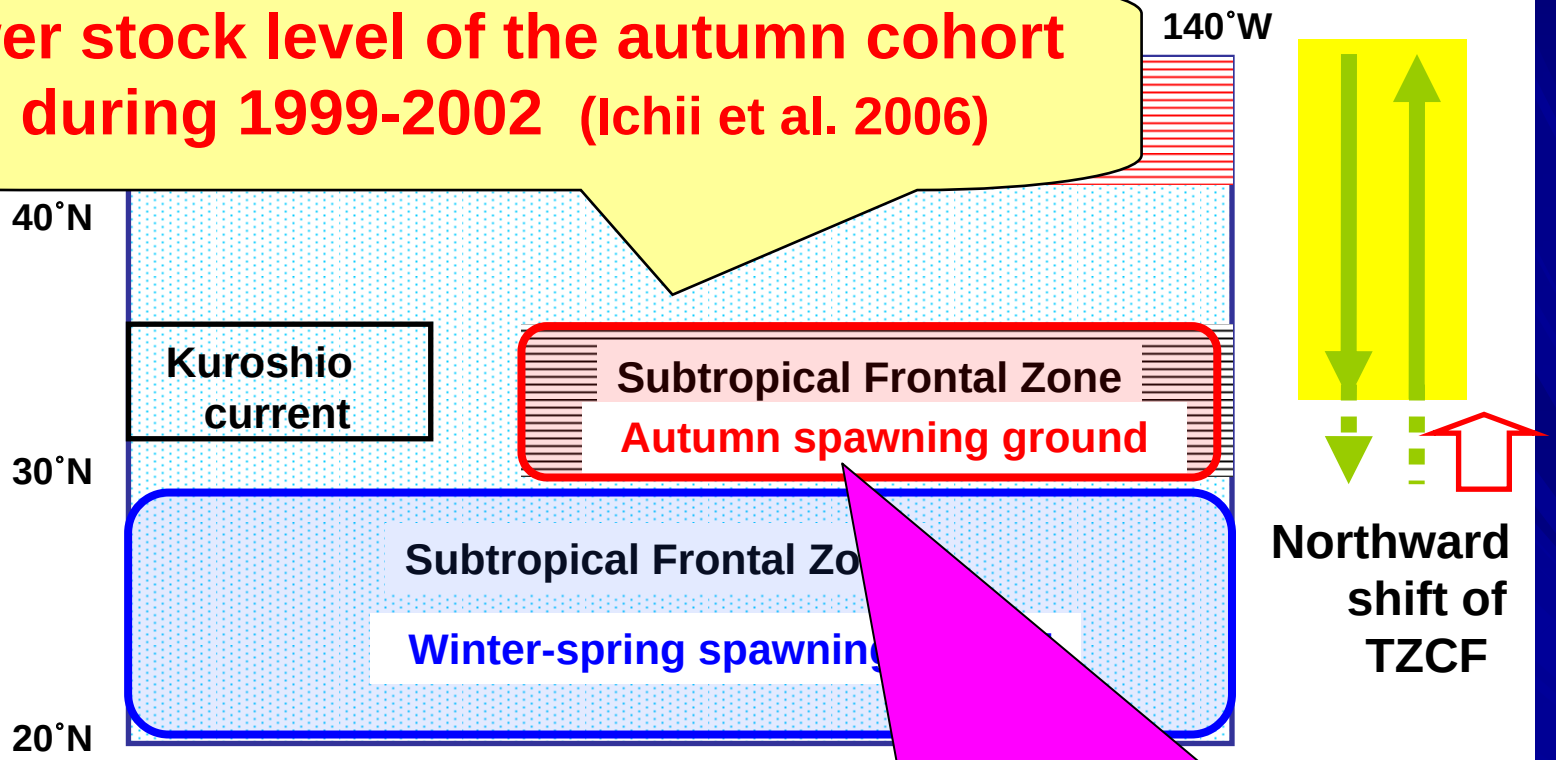
They grow faster to size at maturity, leading to a very short migration

Summary

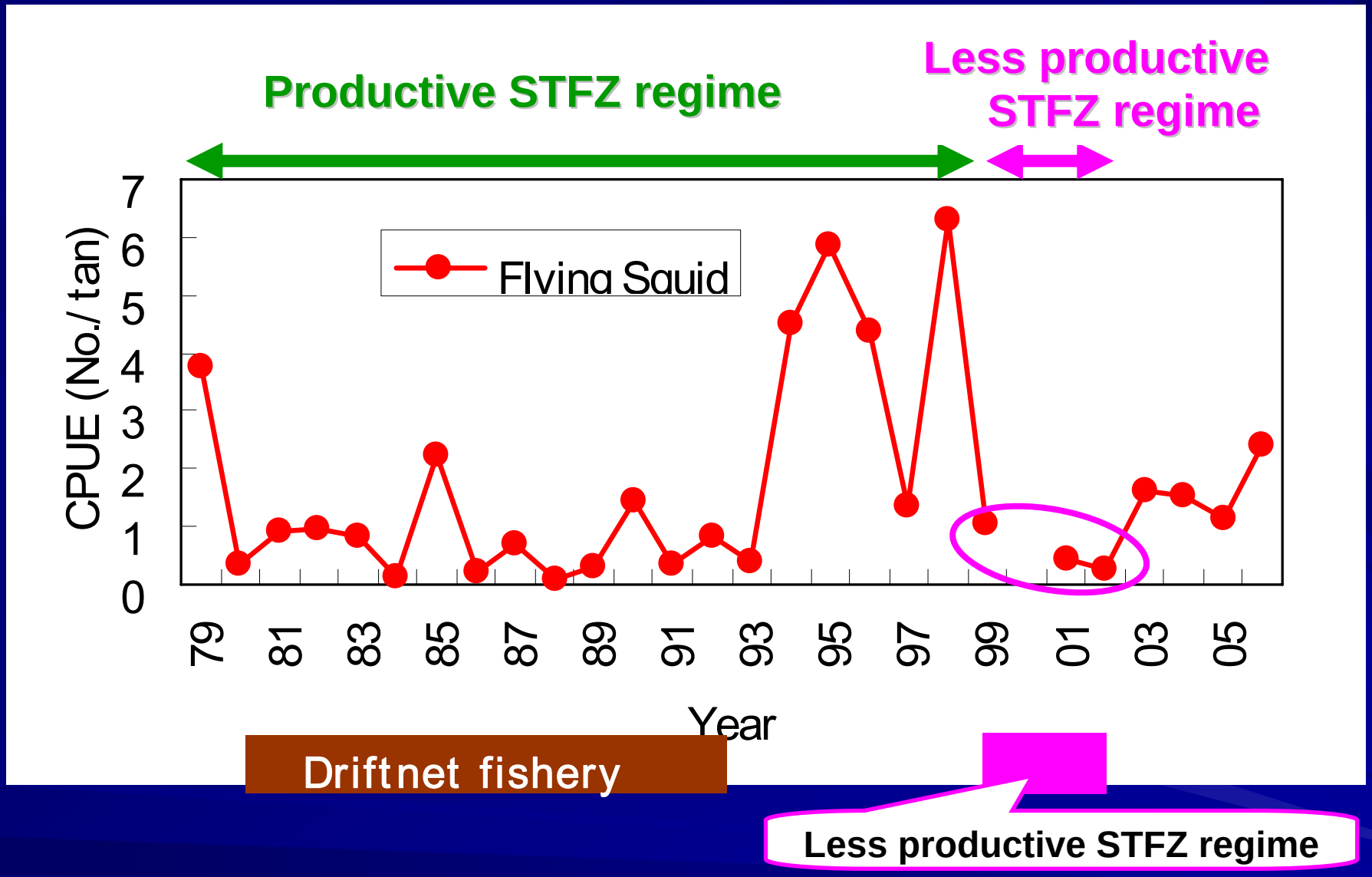


North Pacific Oceanographic scheme

Lower stock level of the autumn cohort during 1999-2002 (Ichii et al. 2006)

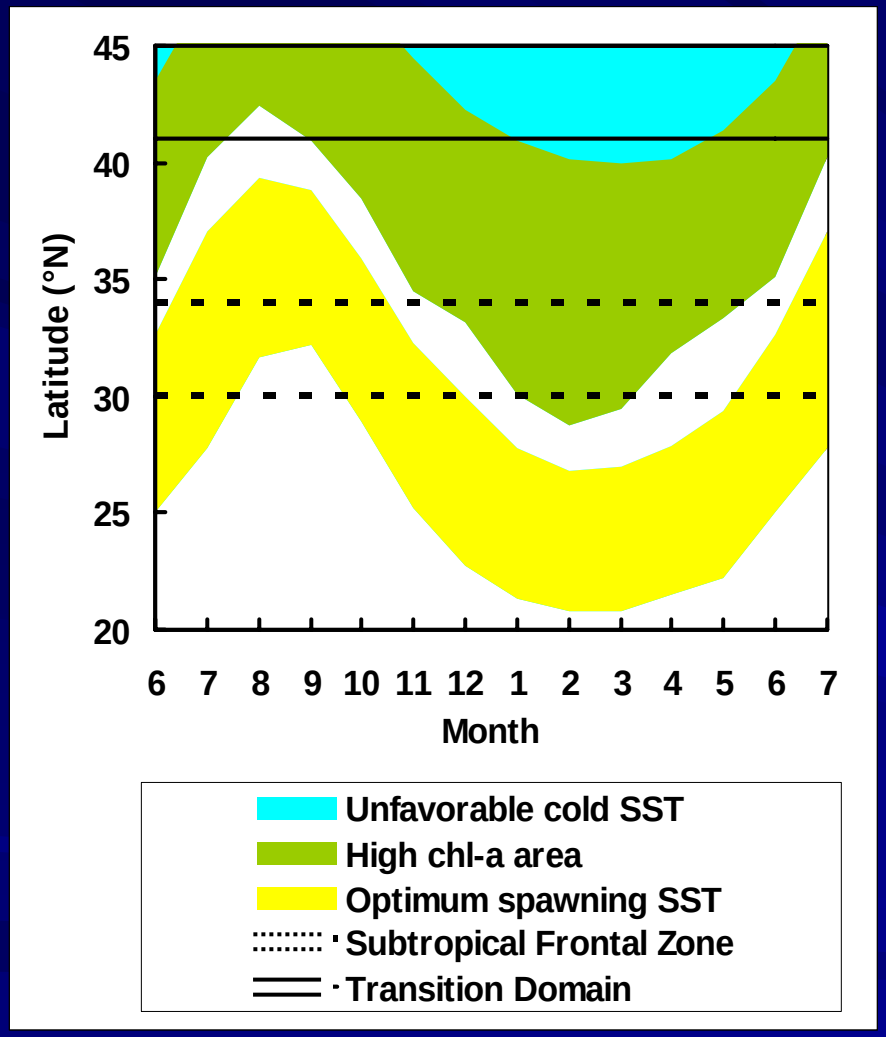


Reduced primary production in STFZ during 1999 – 2002 (Bograd et al. 2004)

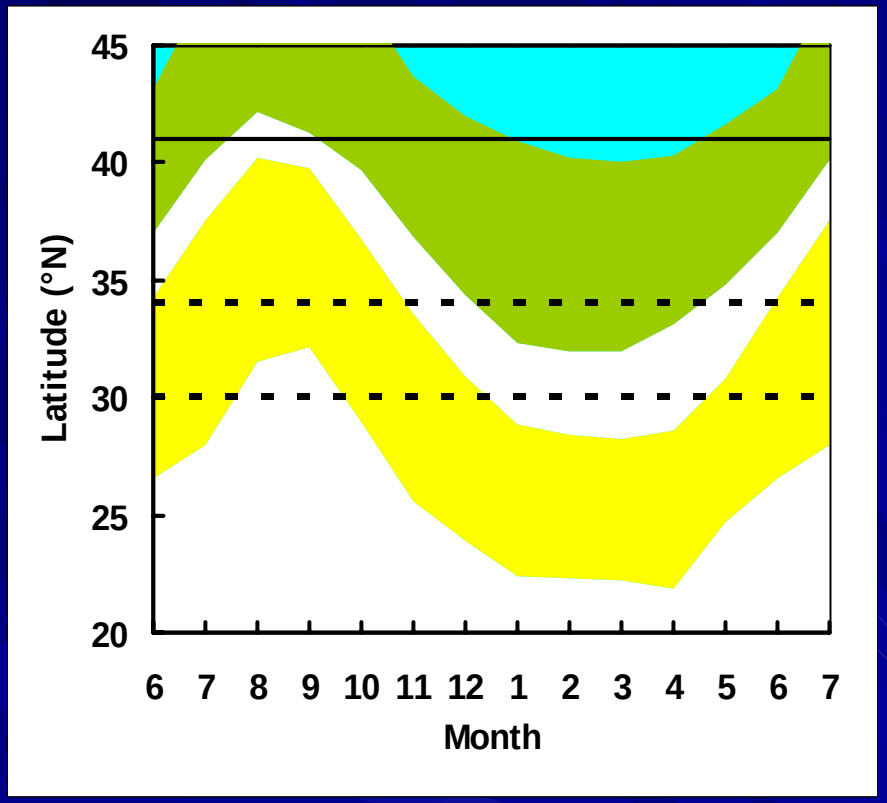


Interannual variations in stock level (research driftnet CPUE) of the autumn cohort

Productive STFZ regime (pre-1999)

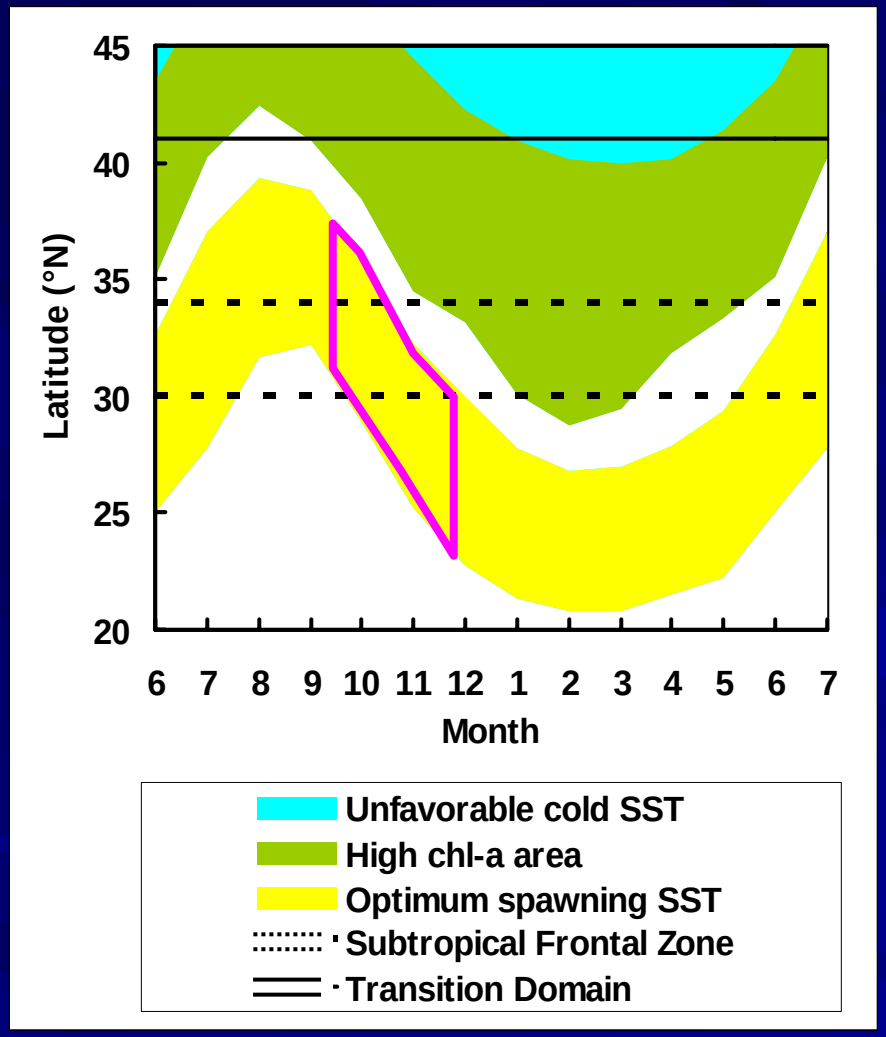


Less productive STFZ regime (1999-2002)



Comparisons in high chl-a area and SST between two regimes

Productive STFZ regime (pre-1999)



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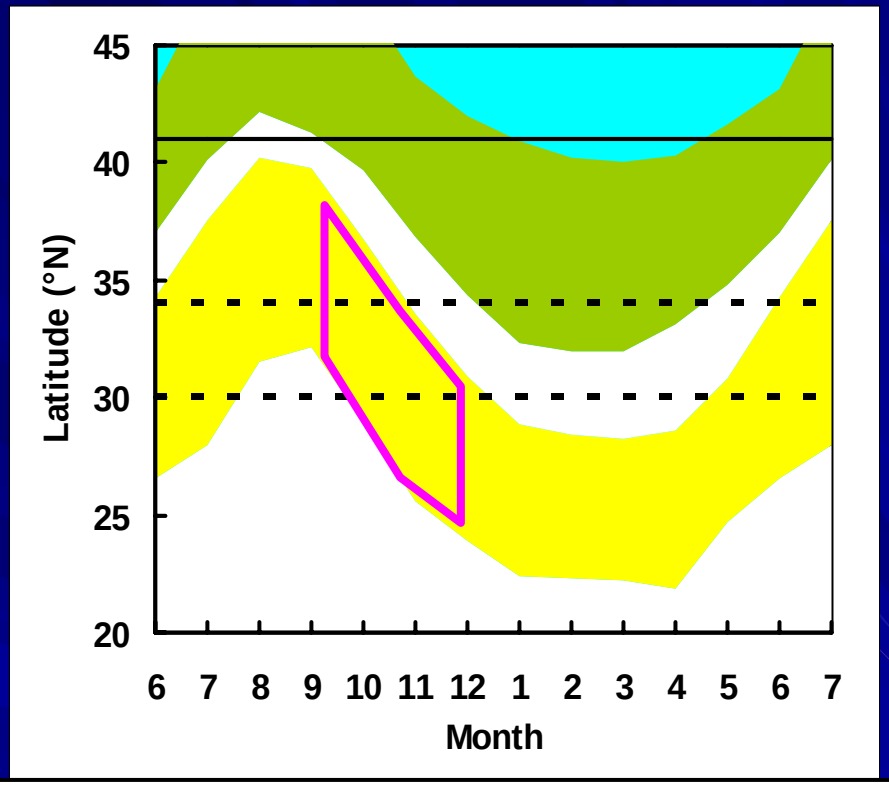
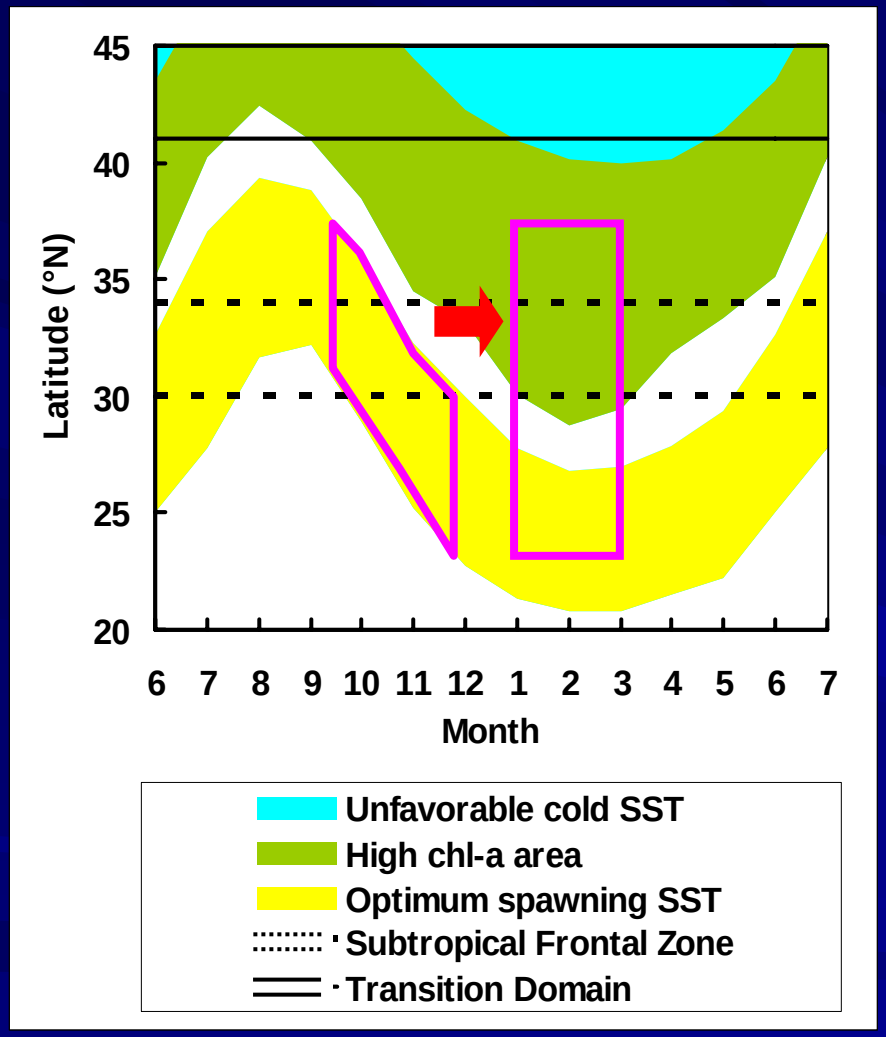


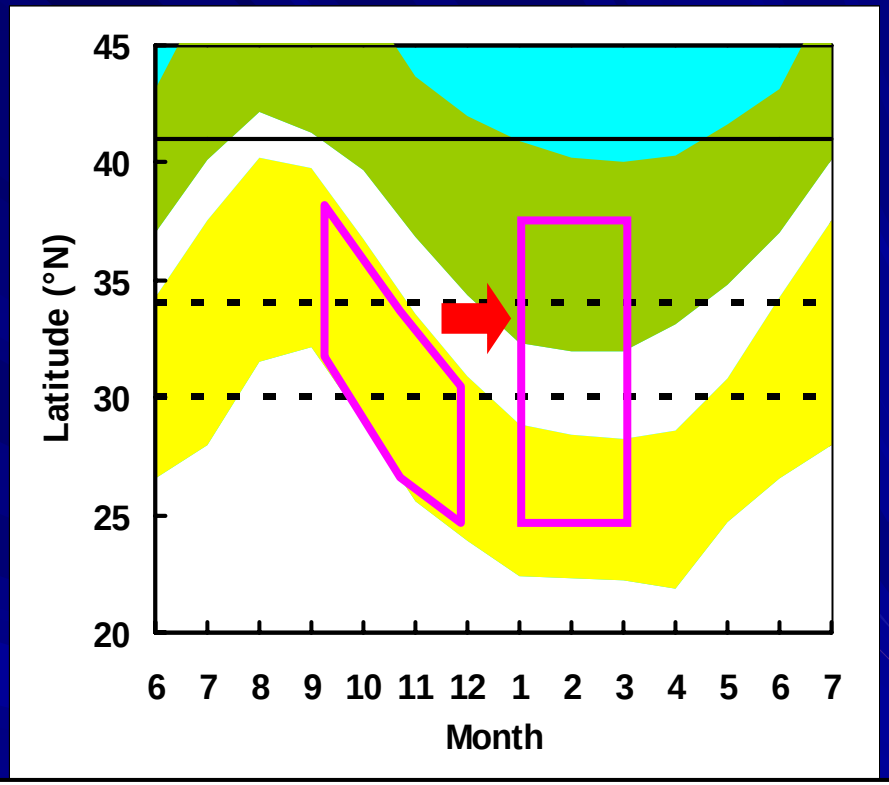
Extent of autumn spawning ground

Comparisons in high chl-a area and SST between two regimes

Productive STFZ regime (pre-1999)



Less productive STFZ regime (1999-2002)



Extent of autumn spawning ground

Comparisons in high chl-a area and SST between two regimes

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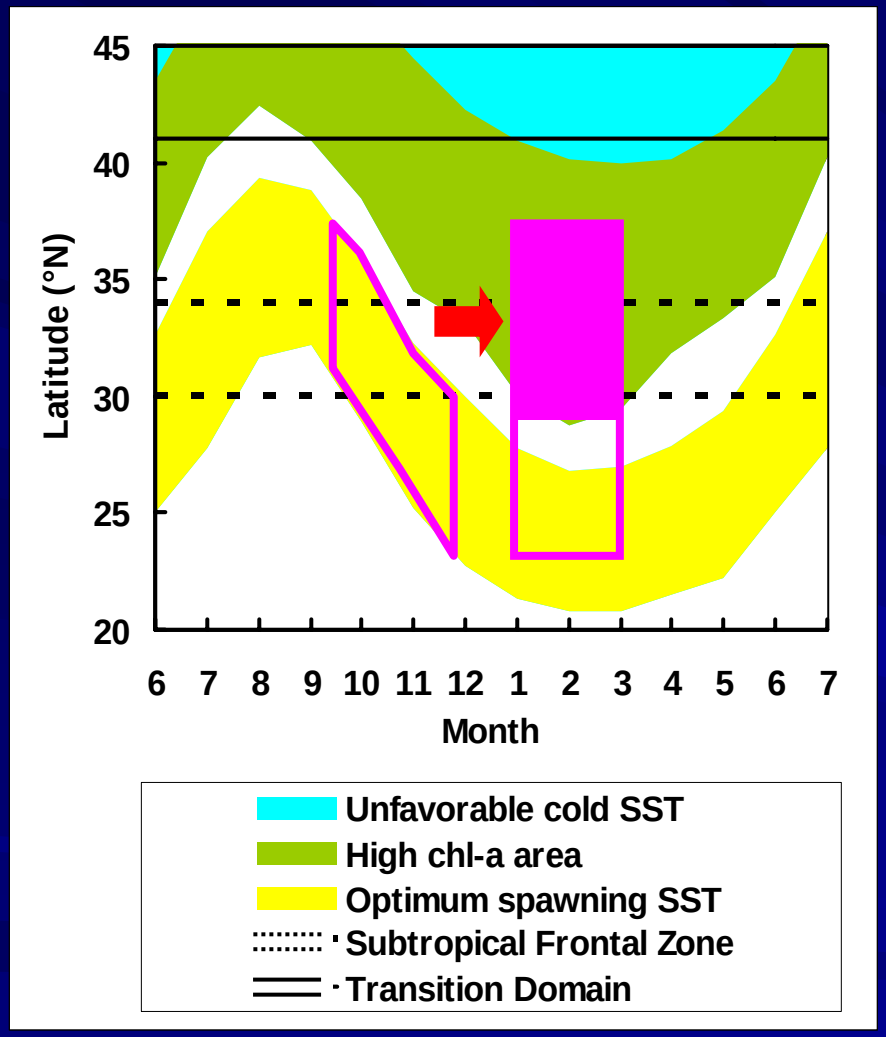
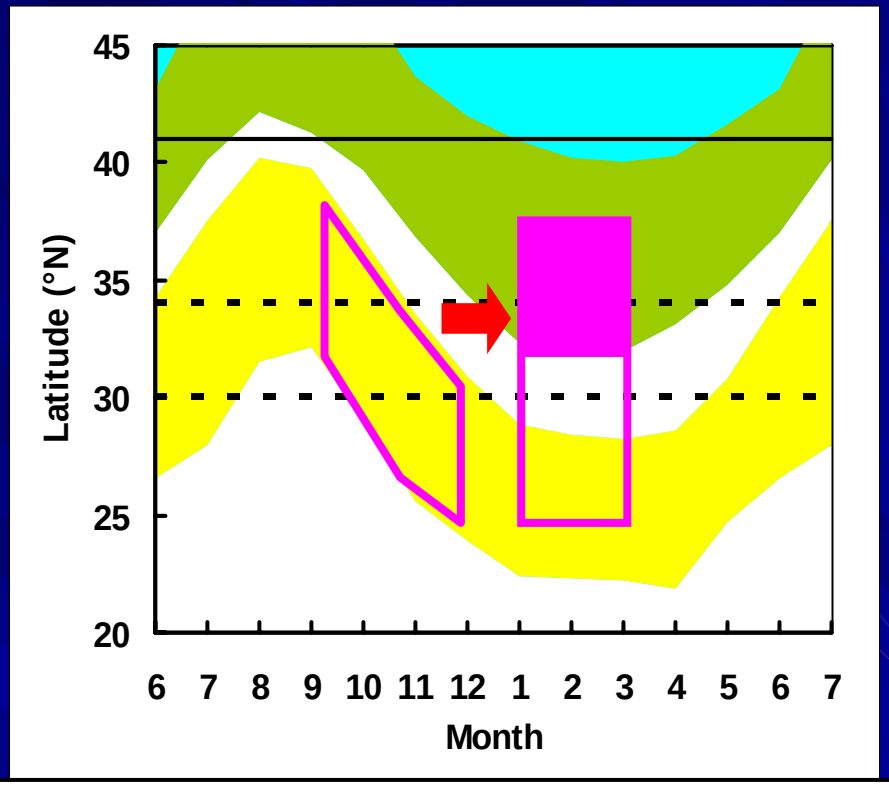


Less productive STFZ regime (1999-2002)



Extent of autumn spawning ground

Extent of productive autumn spawning ground

Comparisons in high chl-a area and SST between two regimes

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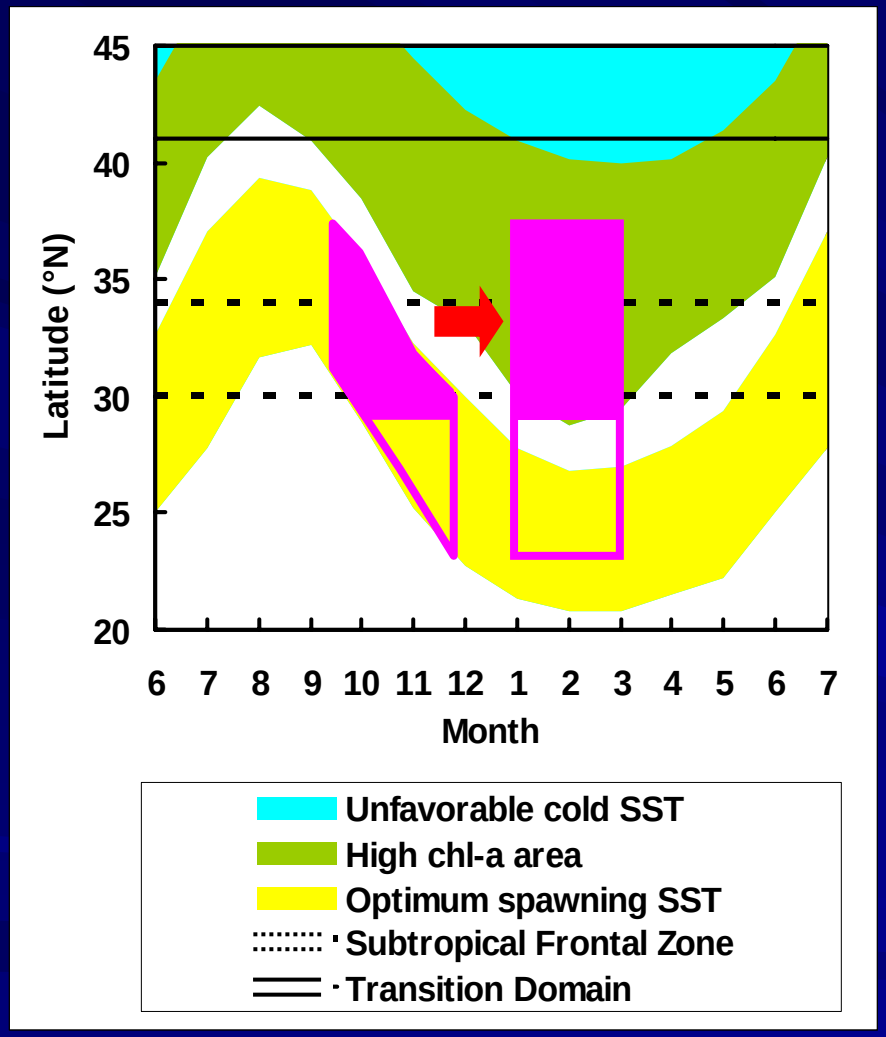

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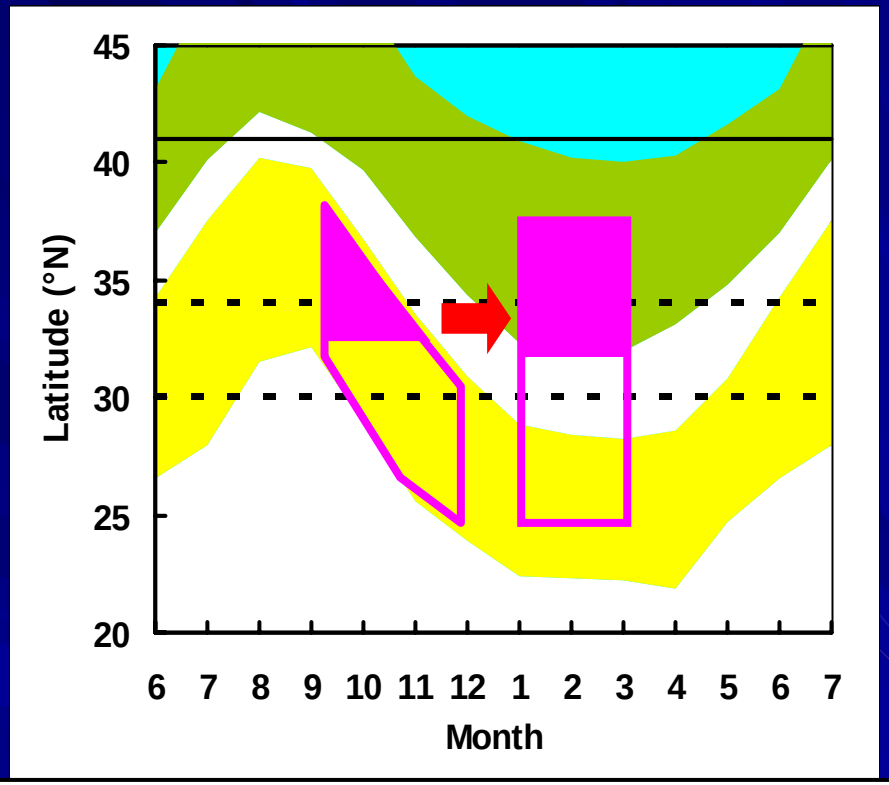

Extent of autumn spawning ground

Extent of productive autumn spawning ground

Comparisons in high chl-a area and SST between two regimes

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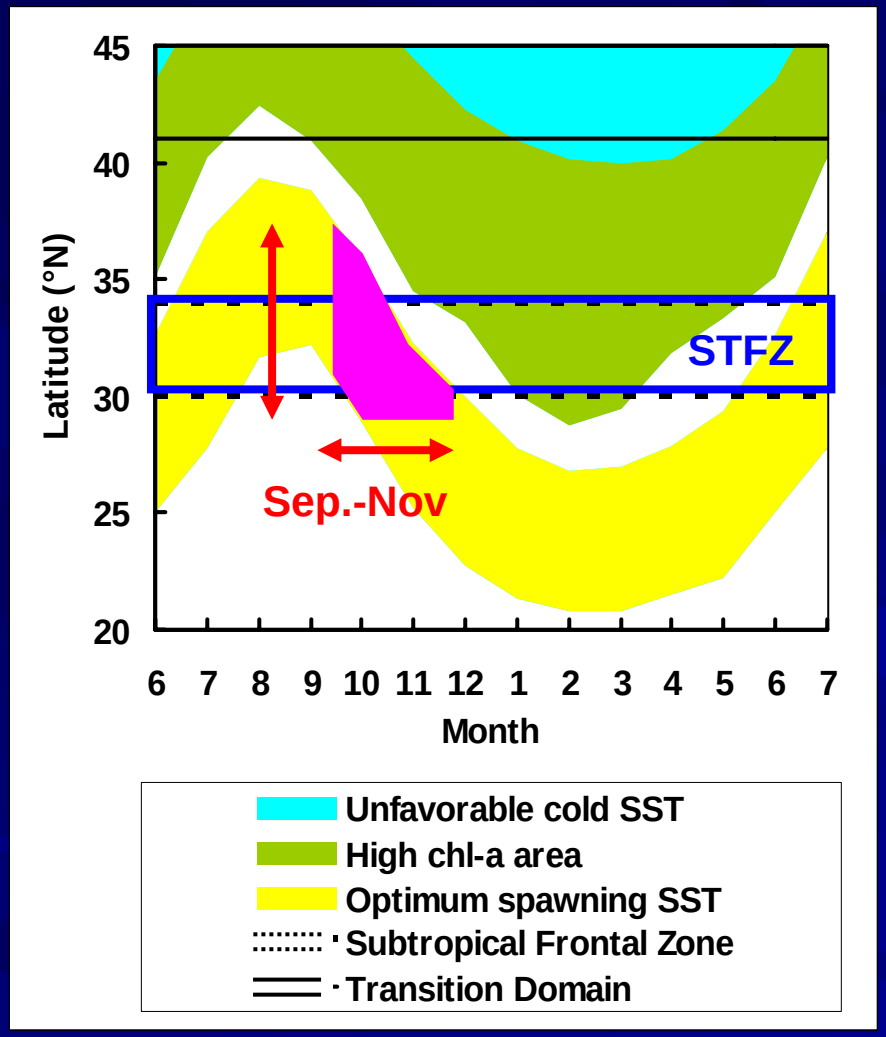

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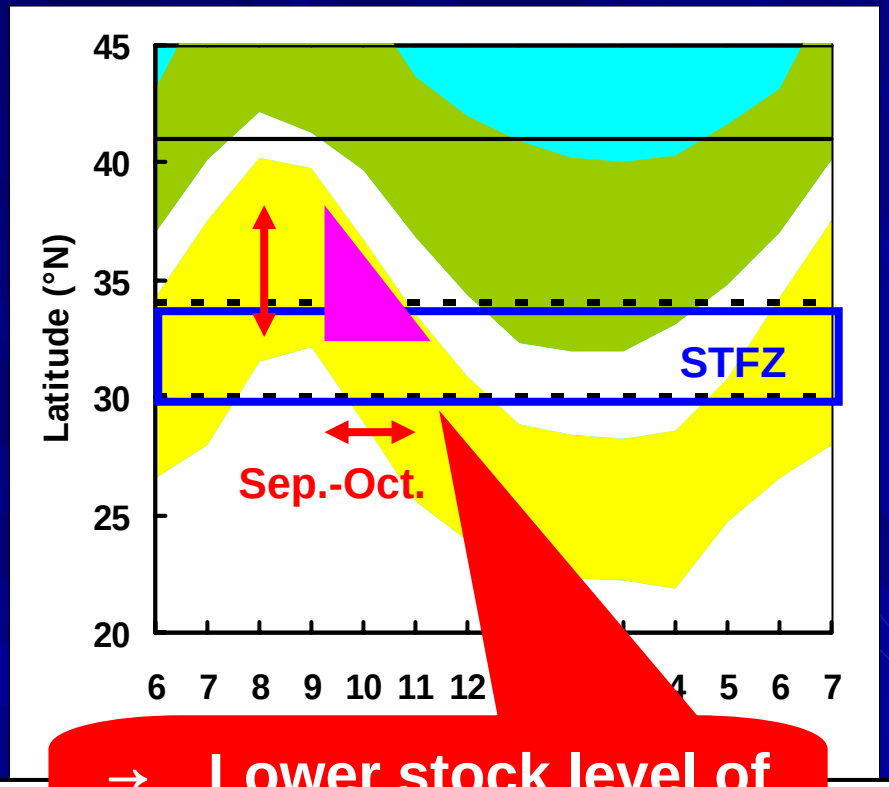
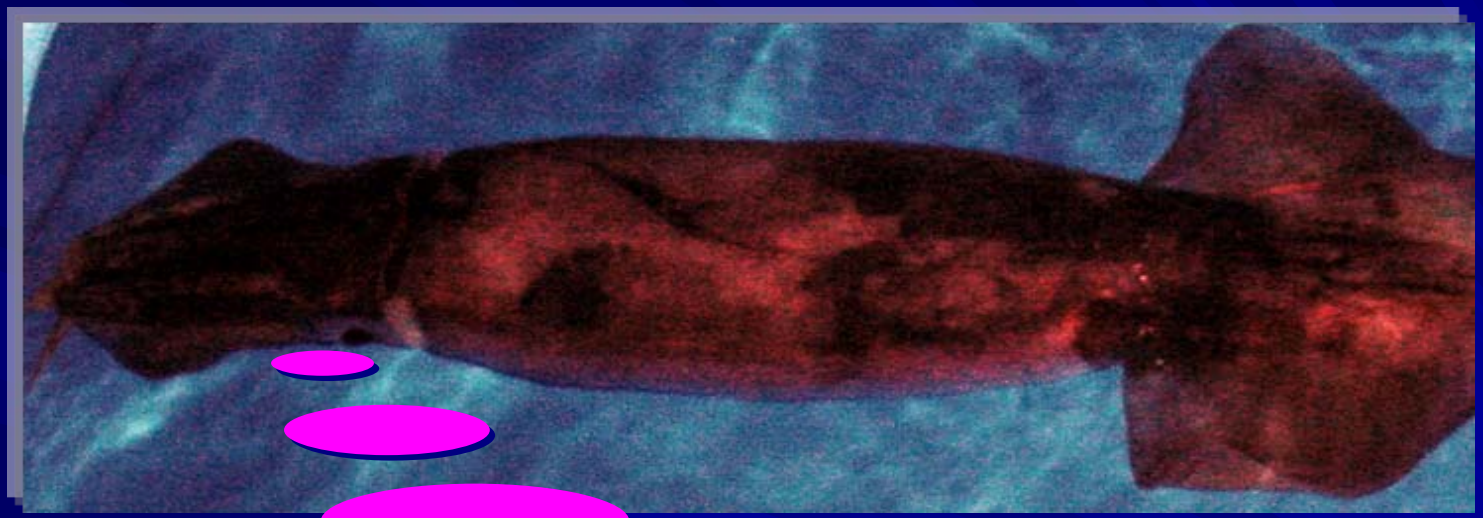


→ Lower stock level of the autumn cohort

Extent of productive autumn spawning ground

Comparisons in high chl-a area and SST between two regimes



Interannual variations in TZCF position could have important implications for stock level of the autumn cohort.