LONG-TERM AND SEASONAL SHIFTS OF DISTRIBUTION OF COMMERCIALLY IMPORTANT FLAT- AND ROCKFISHES IN THE PACIFIC OFF THE NORTHERN KURIL ISLANDS AND SOUTHEASTERN KAMCHATKA: PROBABLE AFFECTING OF CHANGES IN CLIMATIC AND TEMPERATURE CONDITIONS?

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BACKGROUND

The most abundant and commercially important flatfish and rockfish species in the Pacific waters off the northern Kuril Islands and southeastern Kamchatka are Greenland halibut *Reinhardtius hippoglossoides matsuurae*, Kamchatka flounder *Atheresthes evermanni*, Pacific halibut *Hippoglossus stenolepis*, northern rock sole *Lepidopsetta polyxystra*, Pacific ocean perch *Sebastes alutus*, shortraker rockfish *S. borealis*, shortspine thornyhead *Sebastolobus alascanus*, and broadbanded thornyhead *S. macrochir*. These species comprised about 10% of total catch in the area only (according to multi-annual data of bottom trawl surveys, 1993-2000). However, they are in great demand and have high market price that makes their fishery very profitable. One of the little-studied life history aspects of species in question are long-term and seasonal changes of their distribution and factors affecting such changes.
The aim of this contribution is:

- to analyze multi-annual and seasonal changes of occurrence and catch rates of species considered;
- to determine critical periods (seasons and years) of species’ occurrence and catch rates;
- to analyze bottom temperature distribution in the area surveyed during different periods (seasons and years);
- to compare specific features of species’ and bottom temperature distributions and to conclude their possible relationships.
COMMERICALLY IMPORTANT FLAT- AND ROCKFISHES STUDIED

- Greenland halibut
- Pacific ocean perch
- Kamchatka flounder
- Shortraker rockfish
- Pacific halibut
- Broadbanded thornyhead
- Northern rock sole
- Shortspine thornyhead
Localities of oceanological (left) and bottom trawl stations (right) in the Pacific waters off the Northern Kuril Islands, 1993-2000
MATERIALS AND METHODS

Data source: oceanological and bottom trawl surveys

Period of study: May-November, 1993-2000

Vessels: 3 chartered Japanese trawlers

Oceanological equipment: STD-1000 sensor

Fishing gear: bottom trawl with 5-7 m and ~25 m vertical and horizontal openings respectively

Number of bottom temperature measurements: 1608

Number of bottom trawl stations: 1480

Maps: SURFER software package, Golden Software, Inc.
Multi-annual changes of occurrence (%), catch rate (kg per h) and proportion in catches (%) of flatfish species studied.

- **Greenland halibut**
- **Pacific halibut**
- **Kamchatka flounder**
- **Northern rock sole**
Multi-annual changes of occurrence (%), catch rate (kg per h) and proportion in catches (%) of rockfish species studied

Pacific ocean perch

Shortraker rockfish

Shortspine thornyhead

Broadbanded thornyhead

Variations in occurrence, catch rate, and proportion in catches for the Pacific ocean perch, Shortraker rockfish, Shortspine thornyhead, and Broadbanded thornyhead.
Survey indices (kg per hour trawling) of flat- and rockfishes in the Pacific waters off the northern Kuril Islands and southeastern Kamchatka during different time periods

<table>
<thead>
<tr>
<th>SPECIES</th>
<th>Greenland halibut</th>
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<th>Rock sole</th>
<th>Pacific ocean perch</th>
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Note: number of hauls is shown in brackets
Distribution of bottom temperatures in the area surveyed in 1993-1996 and 1997-2000

Bottom temperature
1993-1996

Bottom temperature
1997-2000

Shortspine thornyhead
1993-1996

Shortspine thornyhead
1997-2000
Seasonal changes of occurrence (%), catch rate (kg per h) and proportion in catches (%) of flatfish species studied.
Seasonal changes of occurrence (%), catch rate (kg per h) and proportion in catches (%) of rockfish species studied
Survey indices (kg per hour trawling) of flat- and rockfishes in the Pacific waters off the northern Kuril Islands and southeastern Kamchatka during different time periods

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Distribution of bottom temperatures in the area surveyed in 1993-1996 and 1997-2000

Bottom temperature
May - August

Bottom temperature
September - November

Patterns of spatial distribution of Greenland halibut in spring-summer and autumn periods.
Patterns of spatial distribution of Kamchatka flounder in spring-summer and autumn periods.
Patterns of spatial distribution of Pacific halibut in spring-summer and autumn periods

Pacific halibut
May-August

Pacific halibut
September - November
Patterns of spatial distribution of northern rock sole in spring-summer and autumn periods

Northern rock sole
May - August

Northern rock sole
September - November
Patterns of spatial distribution of Pacific ocean perch in spring-summer and autumn periods

Pacific ocean perch
May - August

Pacific ocean perch
September - November
Patterns of spatial distribution of shortraker rockfish in spring-summer and autumn periods

Shortraker rockfish
May - August

Shortraker rockfish
September - November
Patterns of spatial distribution of shortspine thornyhead in spring-summer and autumn periods.

May - August

September - November
Patterns of spatial distribution of broadbanded thornyhead in spring-summer and autumn periods
CONCLUSIONS:

- many flatfishes and rockfishes, inhabiting the Pacific waters off the northern Kuril Islands and southeastern Kamchatka, exhibit long-term and seasonal shifts of spatial distribution;

- some groundfishes do not demonstrate any seasonal or long-term shifts of spatial distribution due to their flexibility of temperature preferences;

- long-term changes are probably associated with climate shift (considerable warming in the area surveyed) occurred in the mid-1990s;

- seasonal shifts are related to seasonal changes of bottom temperature distribution.
Thank you for your attention