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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PICES

ВНИРО

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.

MAIN PURPOSE

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.**

COMMERCIALLY IMPORTANT FLAT- AND ROCKFISHES STUDIED

Greenland halibut

Kamchatka flounder

Pacific halibut

Northern rock sole

Pacific ocean perch

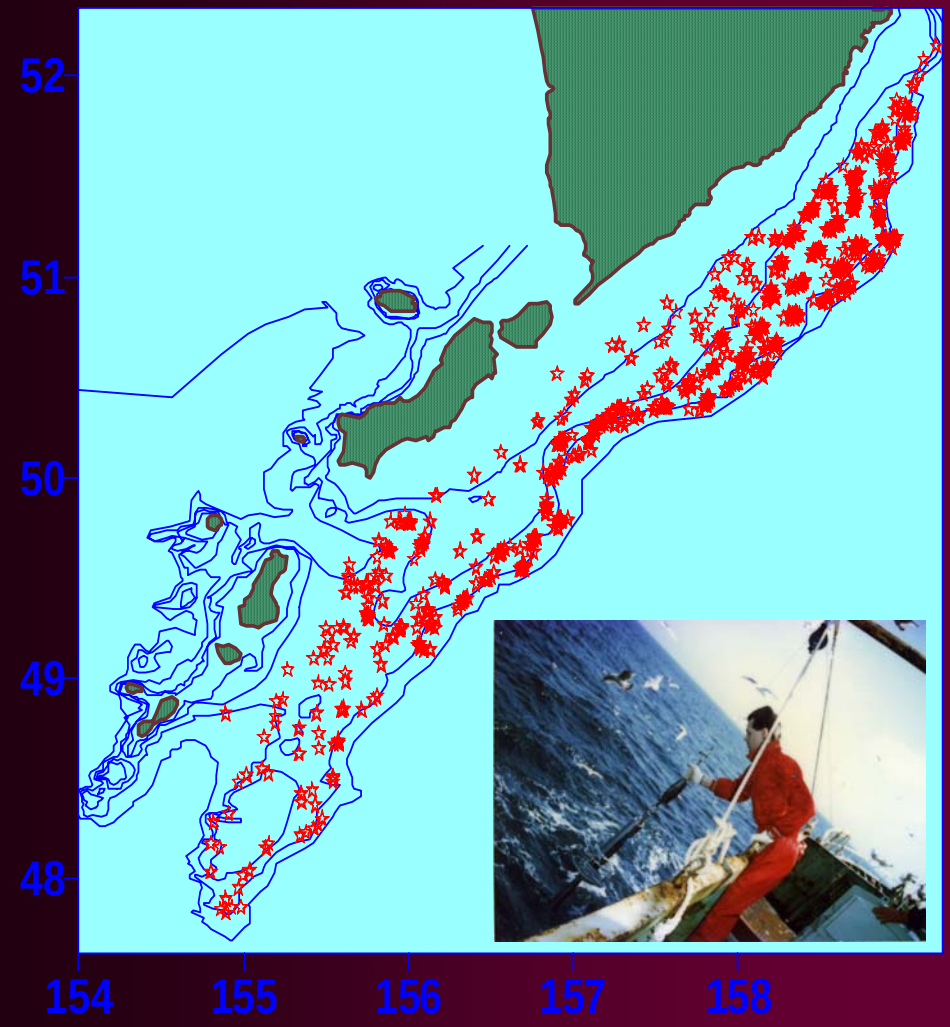
Shortraker rockfish

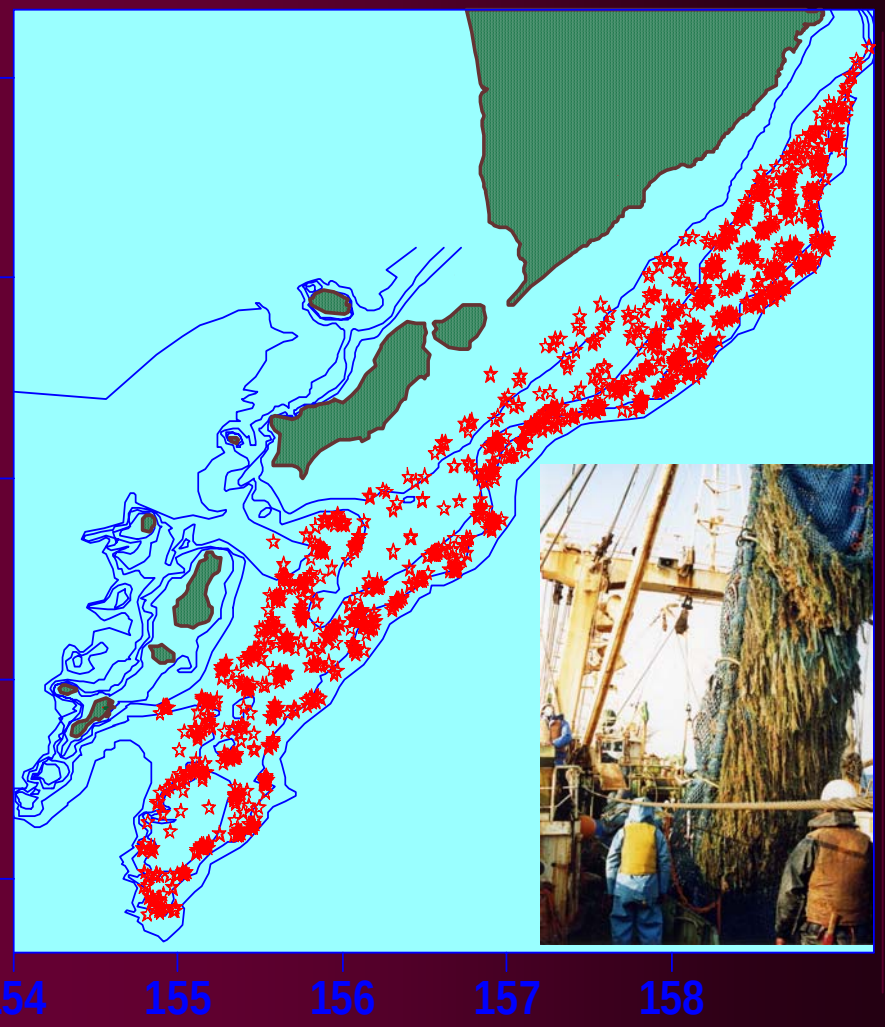
Broadbanded thornyhead

Shortspine thornyhead


RUSSIAN FEDERATION
Bering Sea
Sea of Okhotsk
Aleutian Islands
STUDY AREA
Kuril Islands
PACIFIC OCEAN

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

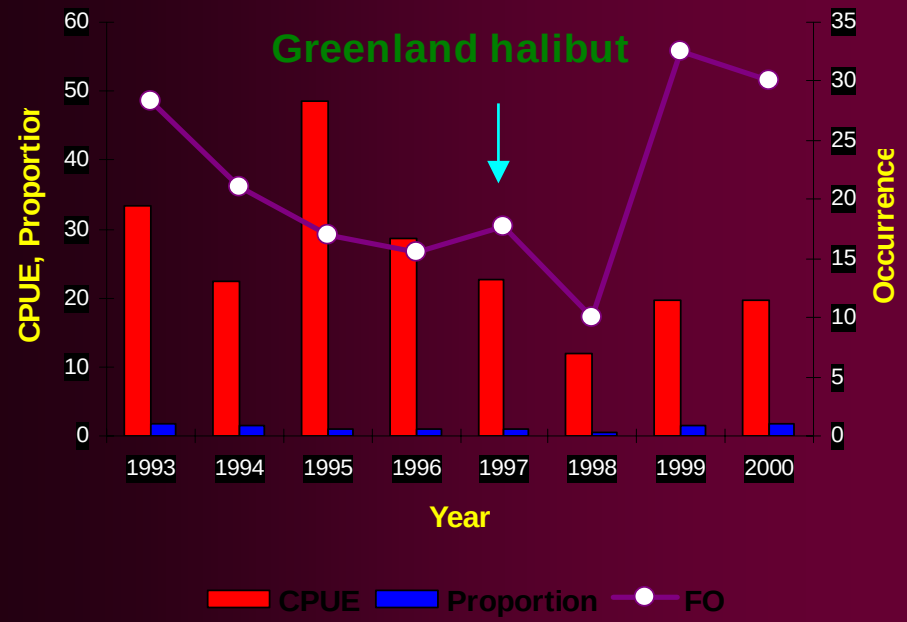
Fishing gear: bottom trawl with 5-7 m and ~25 m vertical and horizontal openings respectively

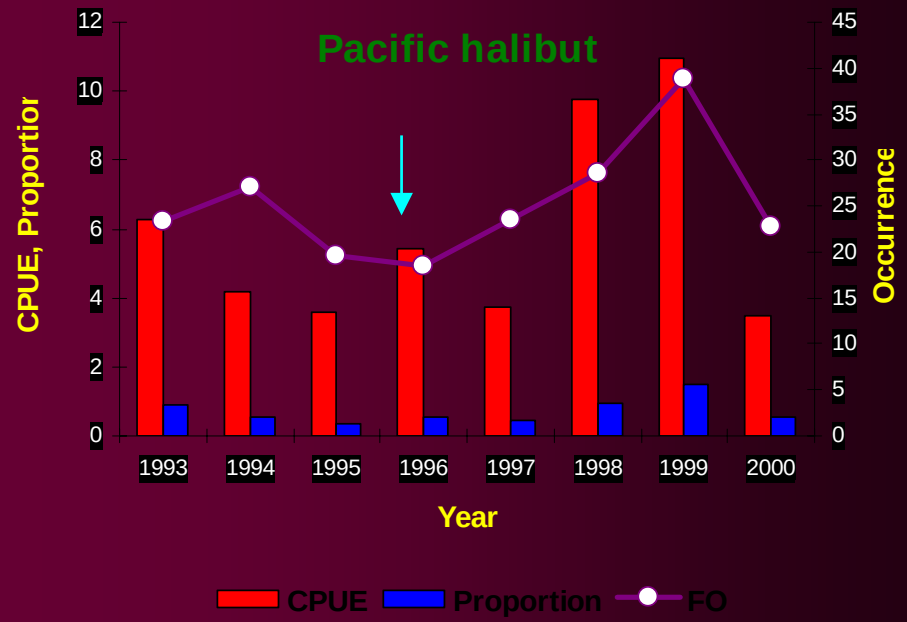
Number of bottom temperature measurements: 1608

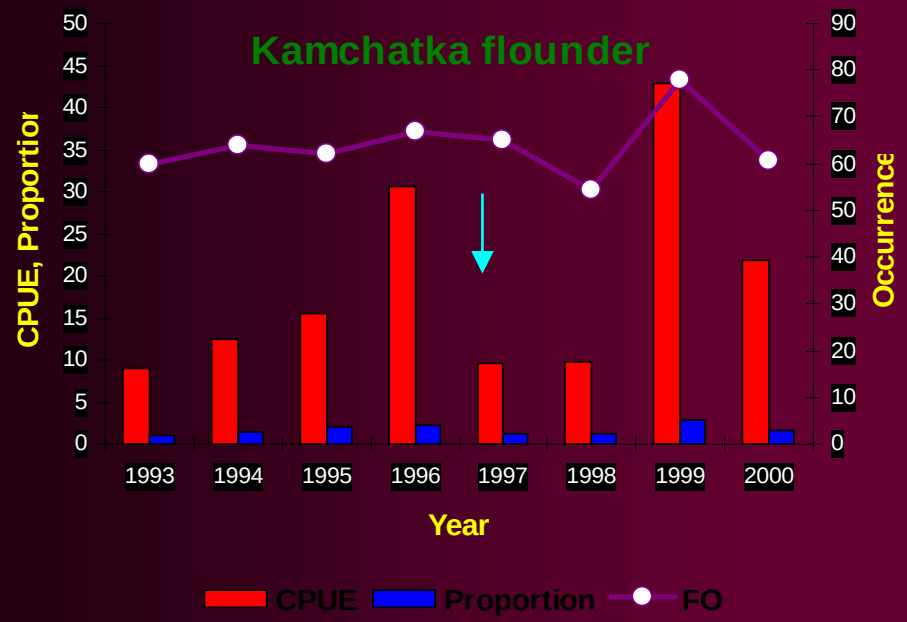
Number of bottom trawl stations: 1480

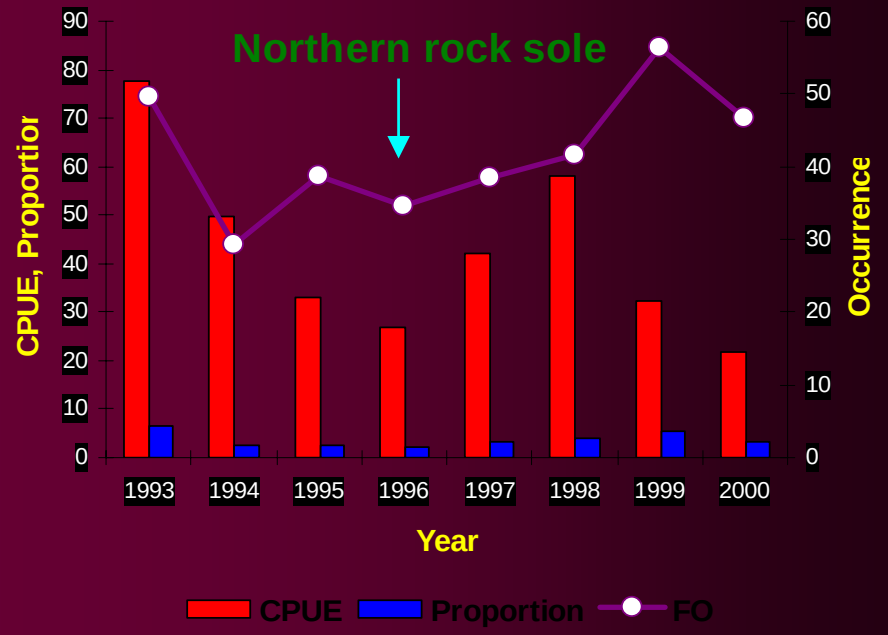
Maps: SURFER software package, Golden Software, Inc.

Multi-annual changes of occurrence (%), catch rate (kg per h) and proportion in catches (%) of flatfish species studied

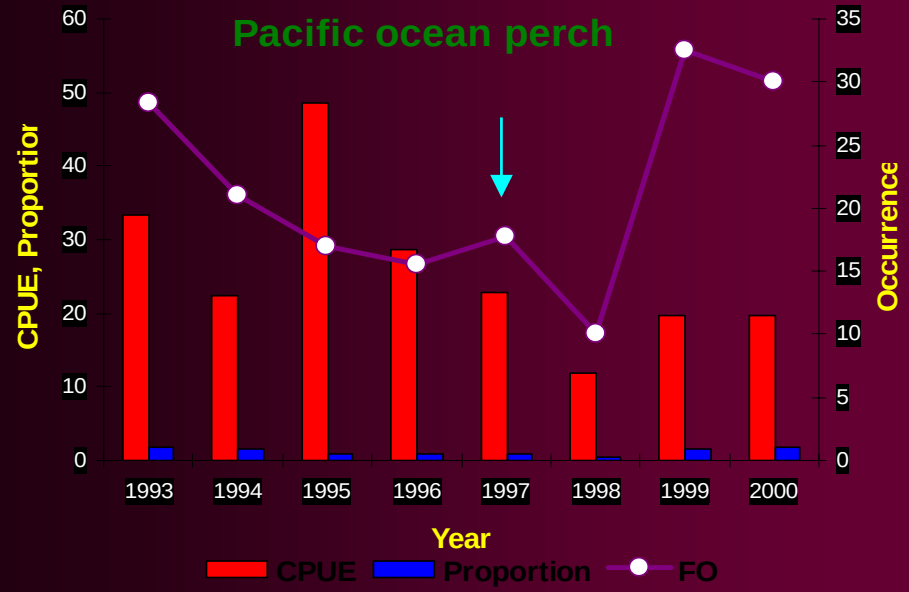


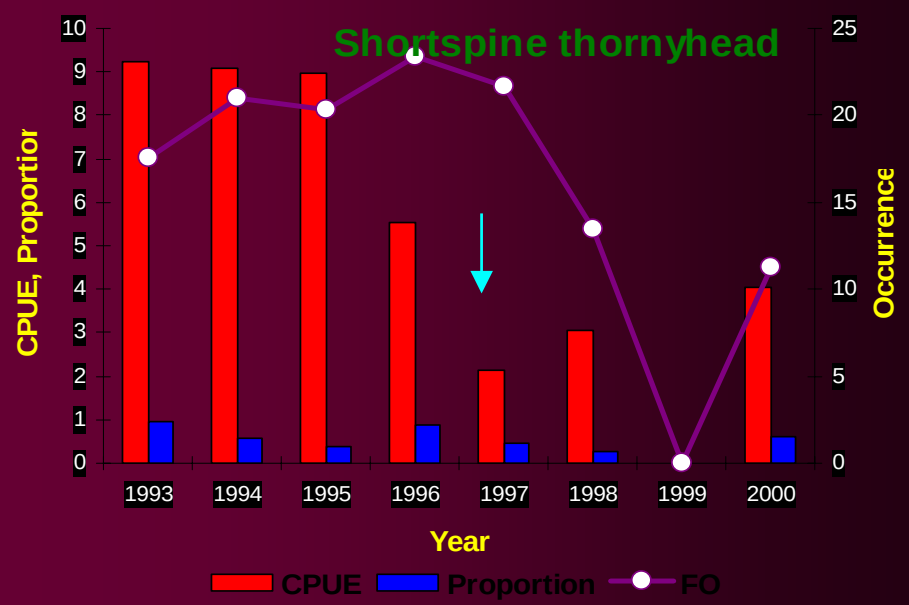


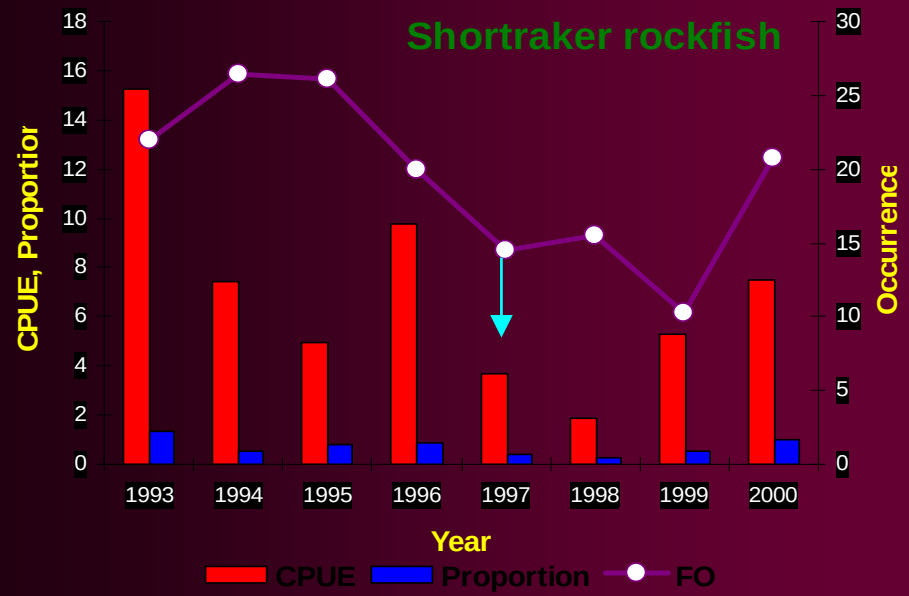


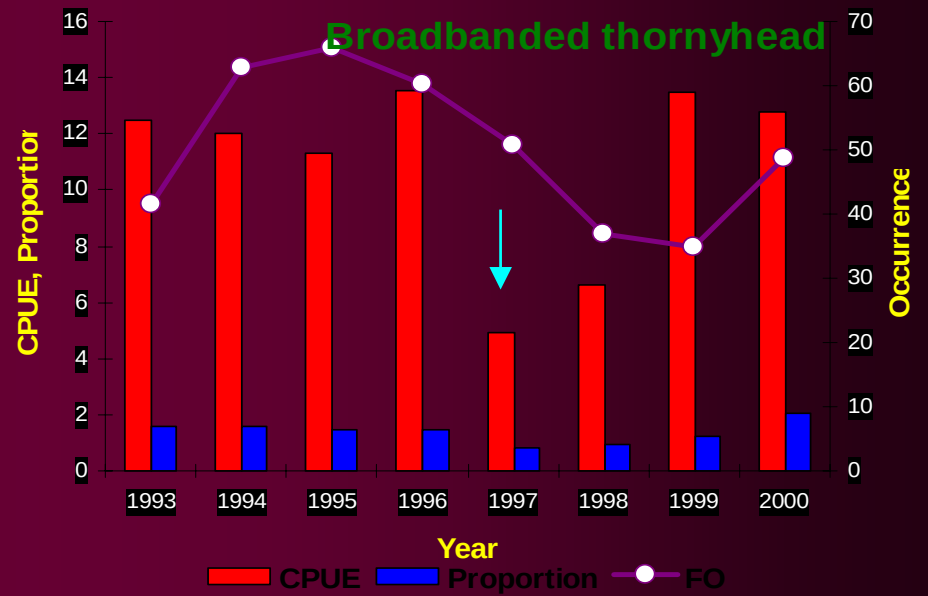


Multi-annual changes of occurrence (%), catch rate (kg per h) and proportion in catches (%) of rockfish species studied







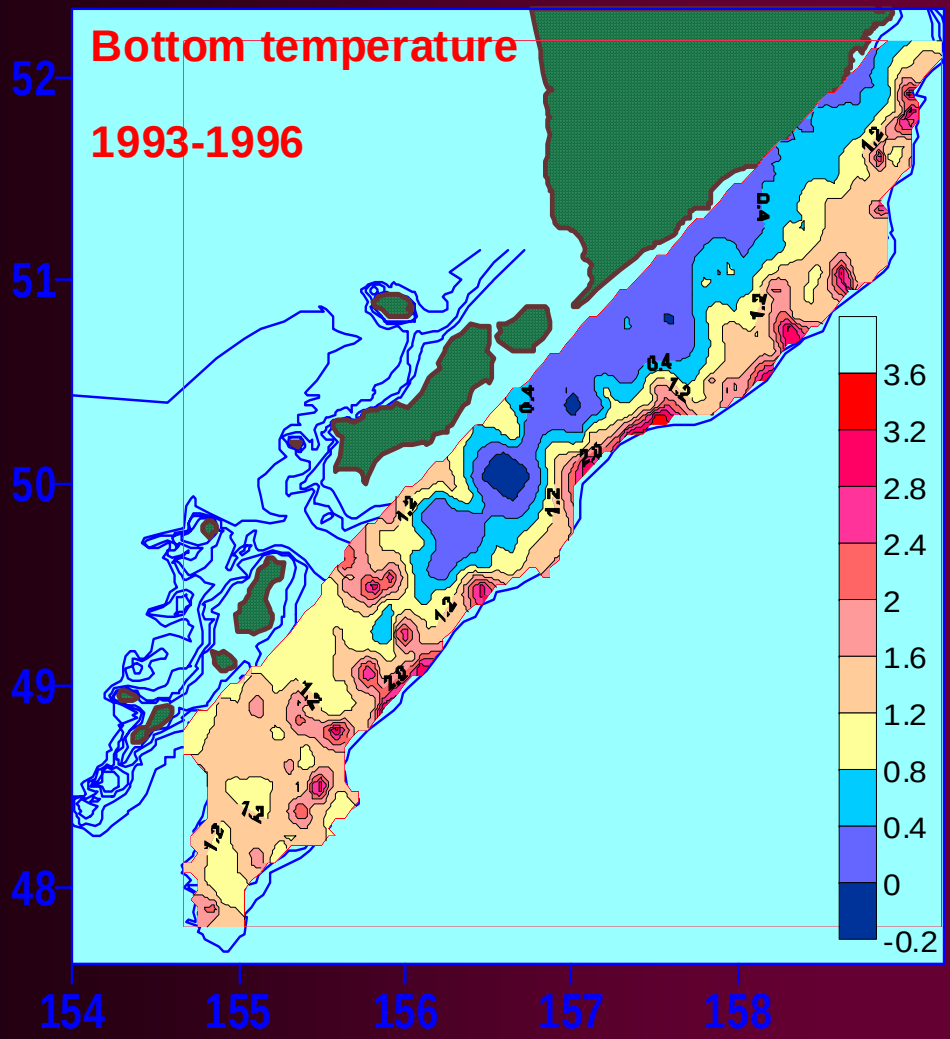


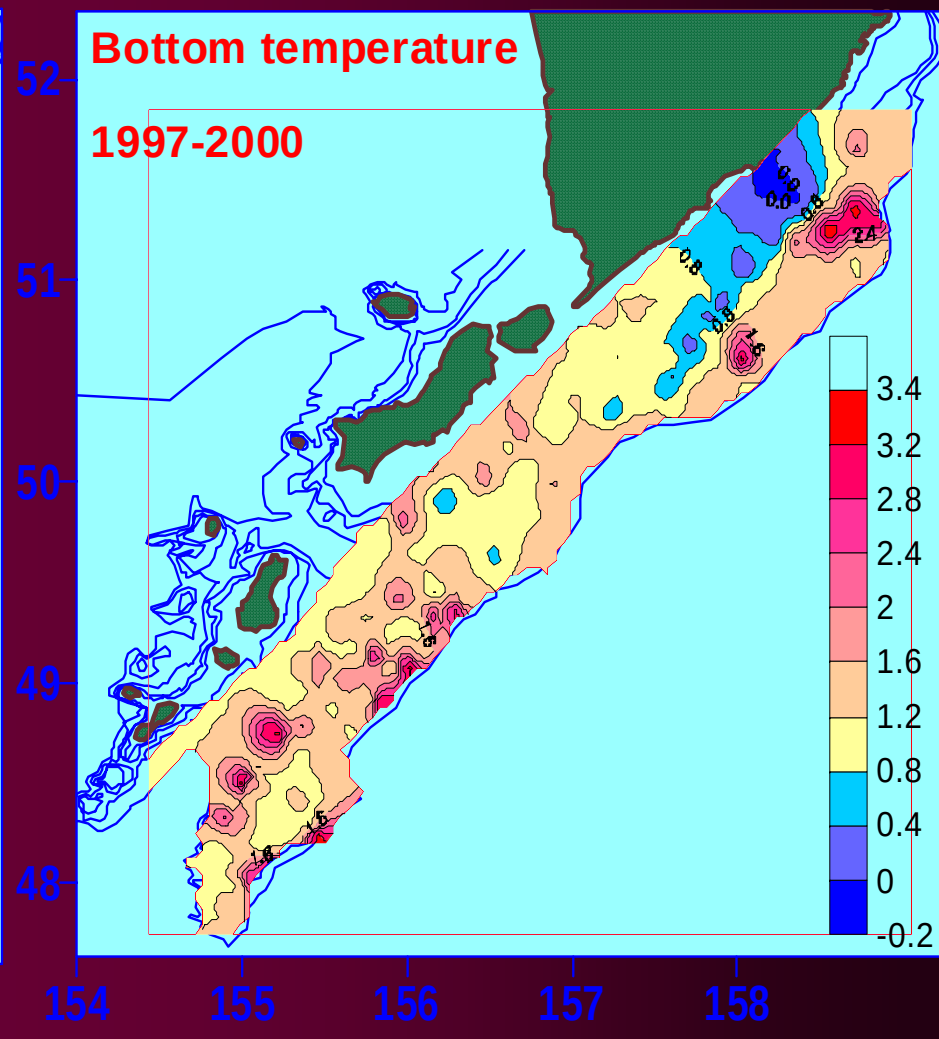
Survey indices (kg per hour trawling) of flat- and rockfishes in the Pacific waters off the northern Kuril Islands and southeastern Kamchatka during different time periods

SPECIES ---------- PERIOD	Green-land halibut	Kam-chatka flounder	Pacific halibut	Rock sole	Pacific ocean perch	Short-raker rockfish	Short-spine thorny-head	Broad-banded thorny-head
1993-1996 (783)	8.6	19.5	4.9	43.2	32.1	9.4	7.7	12.5
1997-2000 (697)	1.6	18.2	6.8	41.0	18.5	4.3	2.5	8.8
May – August (794)	7.0	19.2	8.5	42.4	29.6	7.6	5.1	10.8
September – November (686)	3.2	18.5	2.7	41.9	21.1	6.3	5.4	10.6

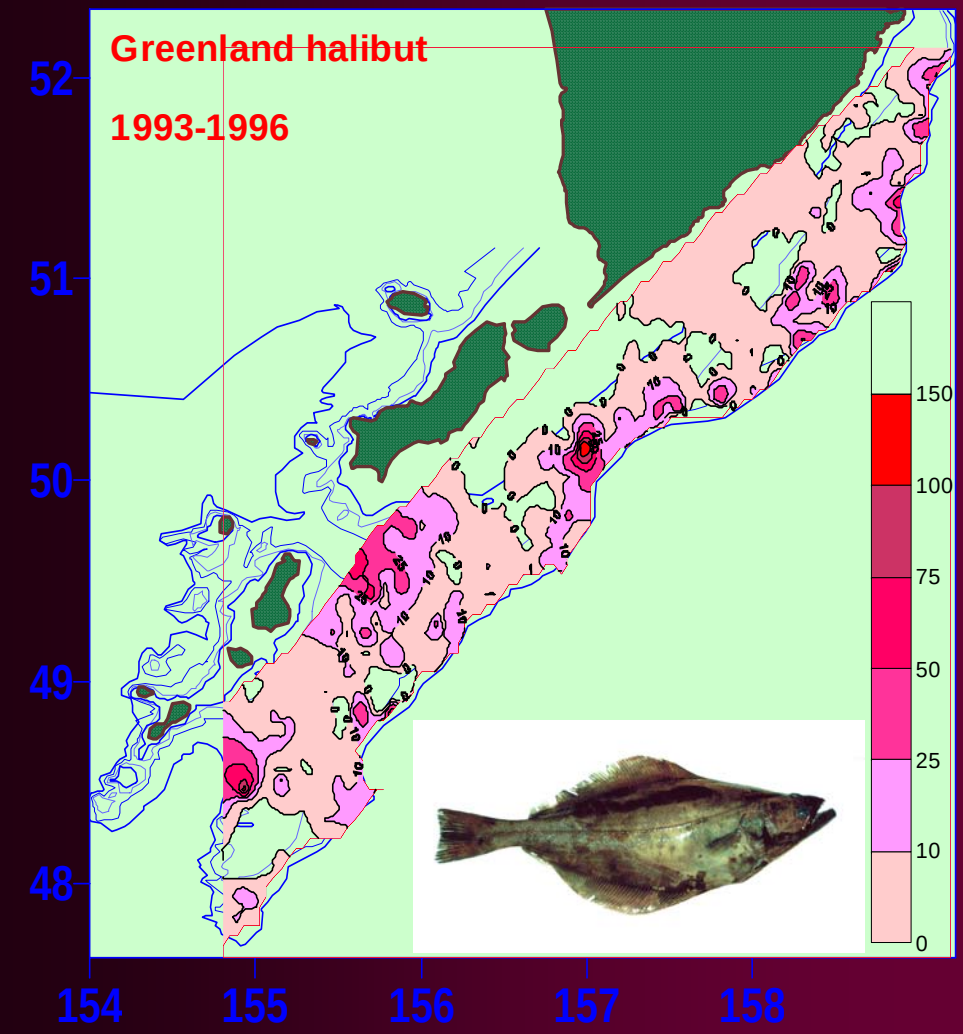
Note: number of hauls is shown in brackets

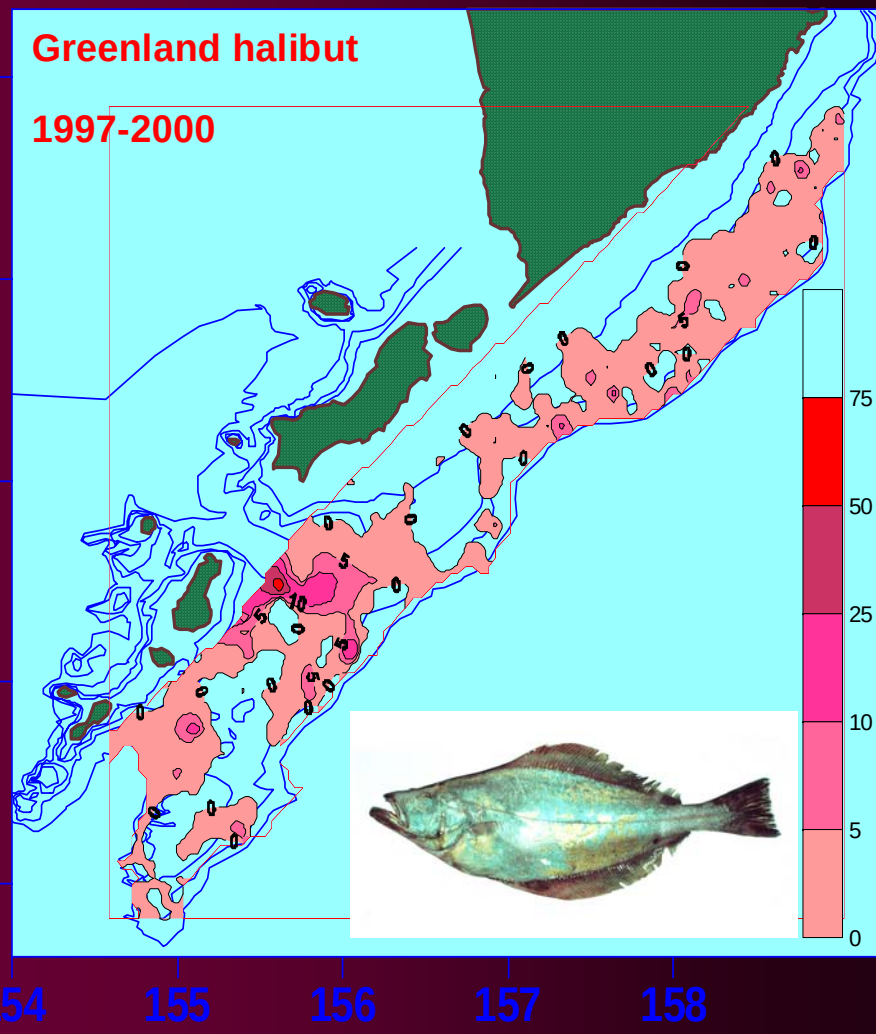
Distribution of bottom temperatures in the area surveyed in 1993-1996 and 1997-2000



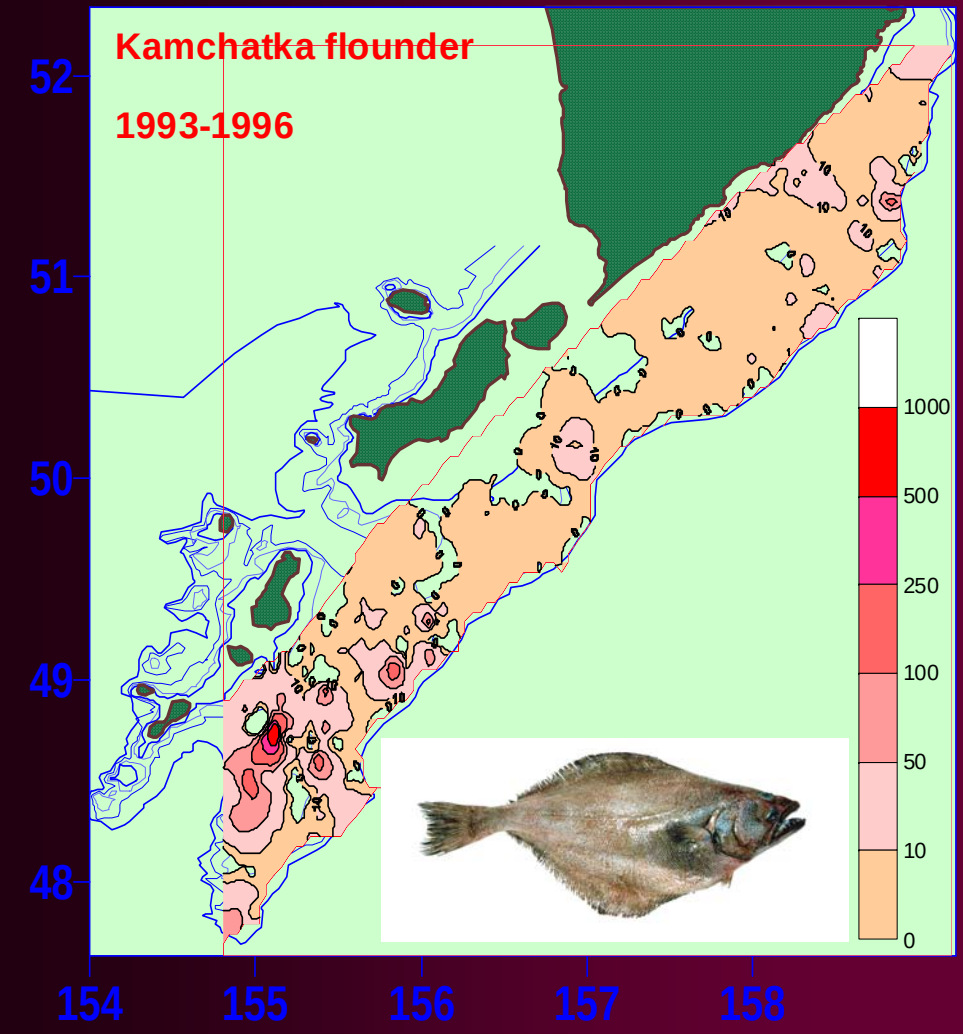


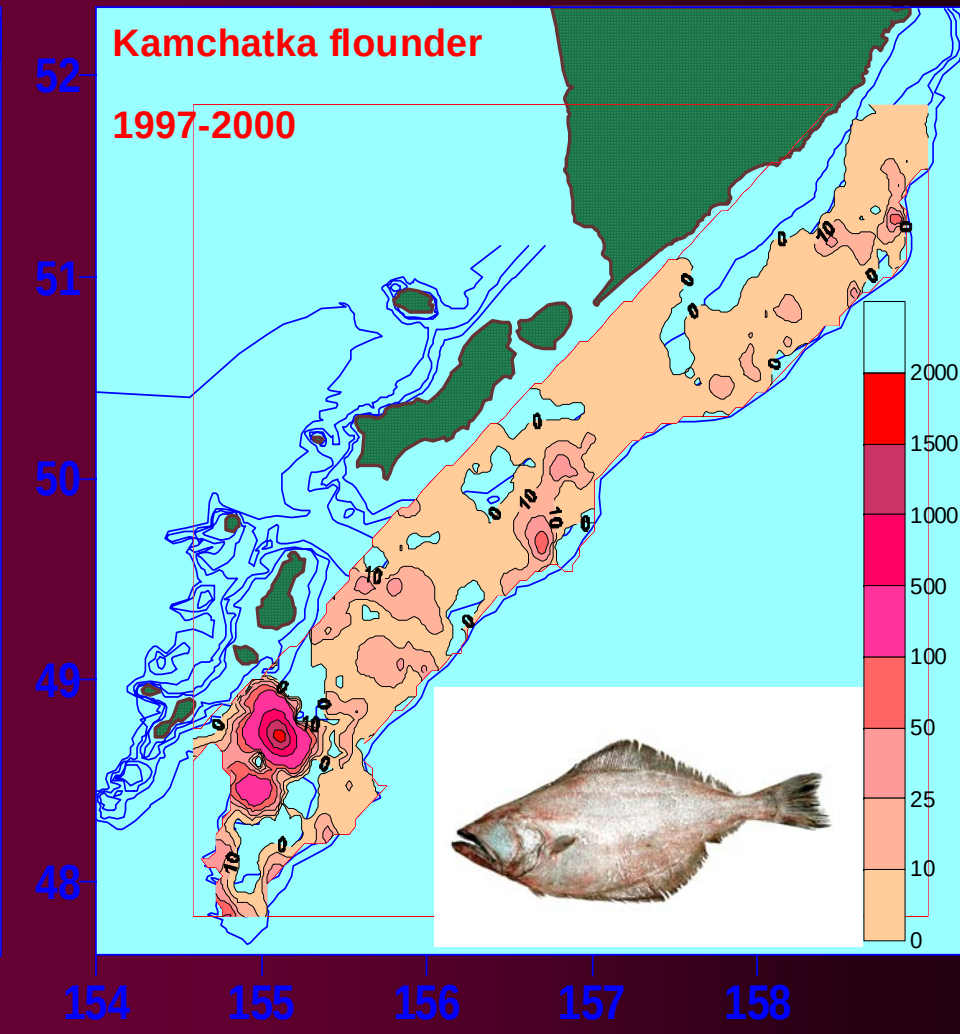
Patterns of spatial distribution of Greenland halibut in 1993-1996 and 1997-2000



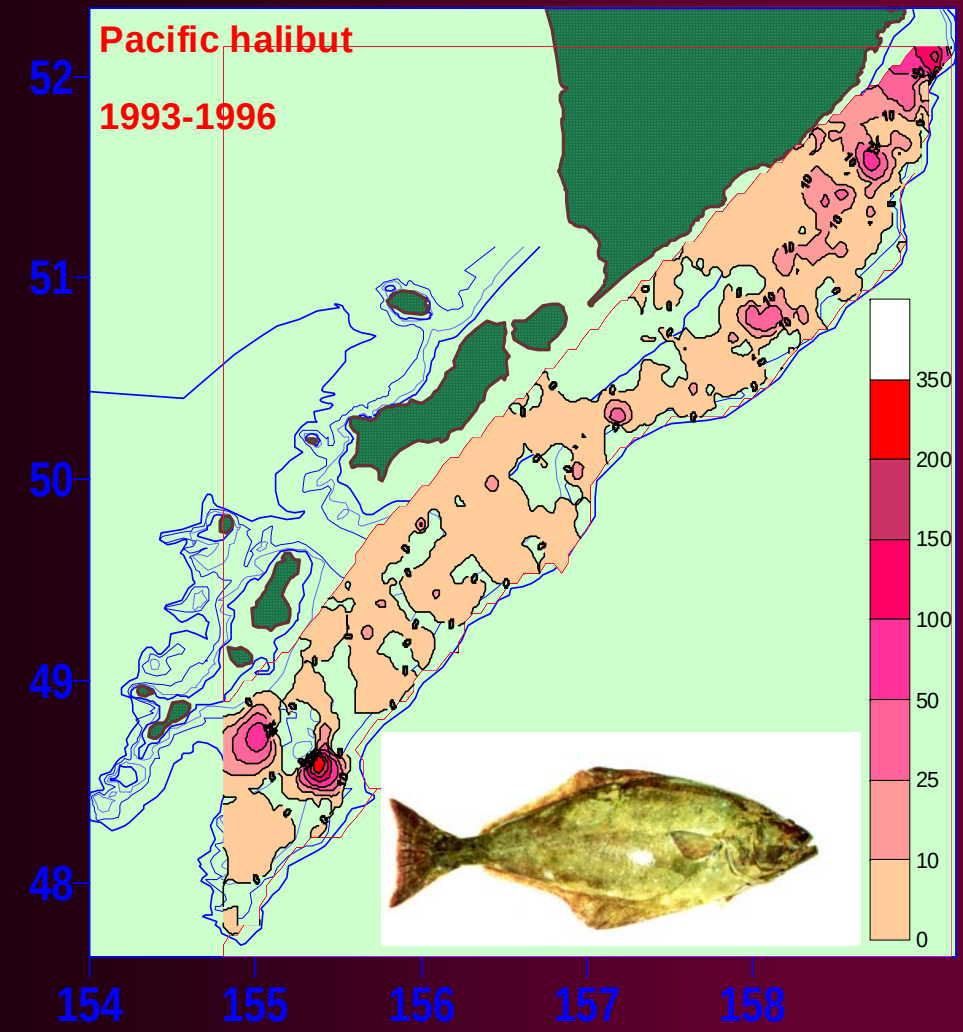


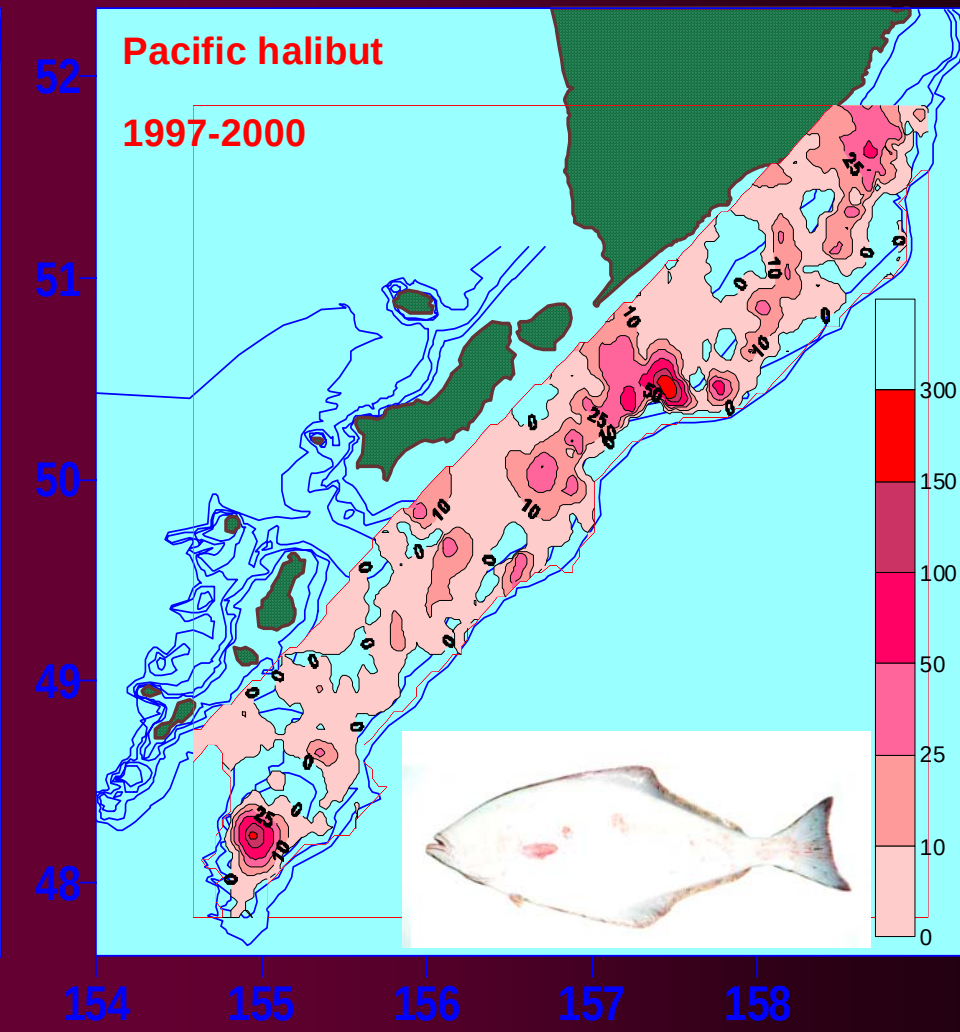
Patterns of spatial distribution of Kamchatka flounder in 1993-1996 and 1997-2000



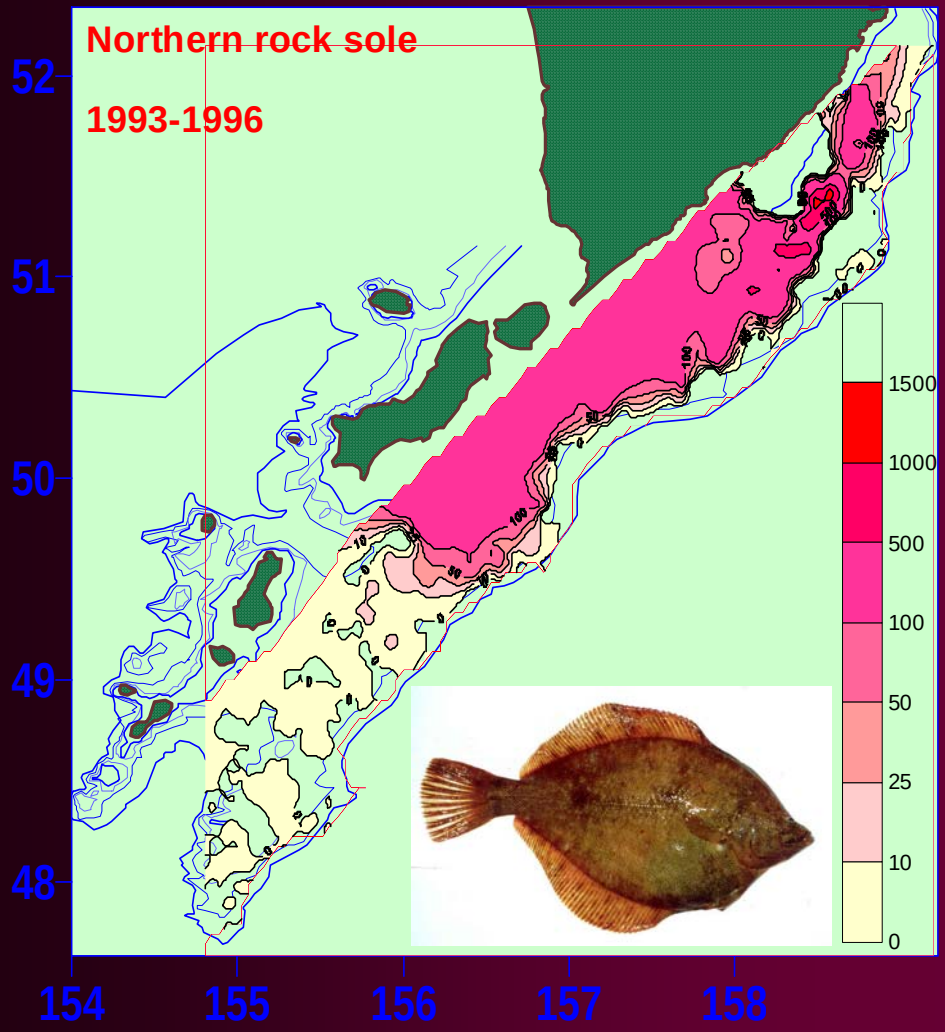


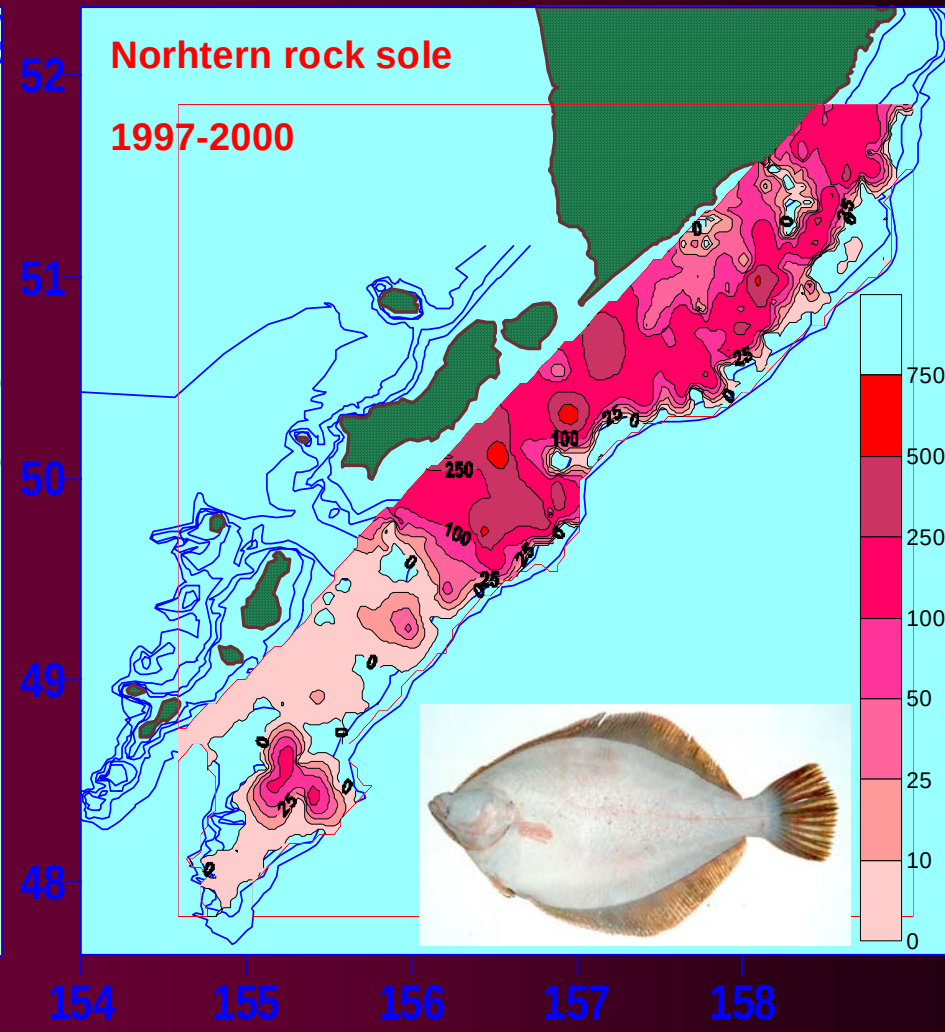
Patterns of spatial distribution of Pacific halibut in 1993-1996 and 1997-2000



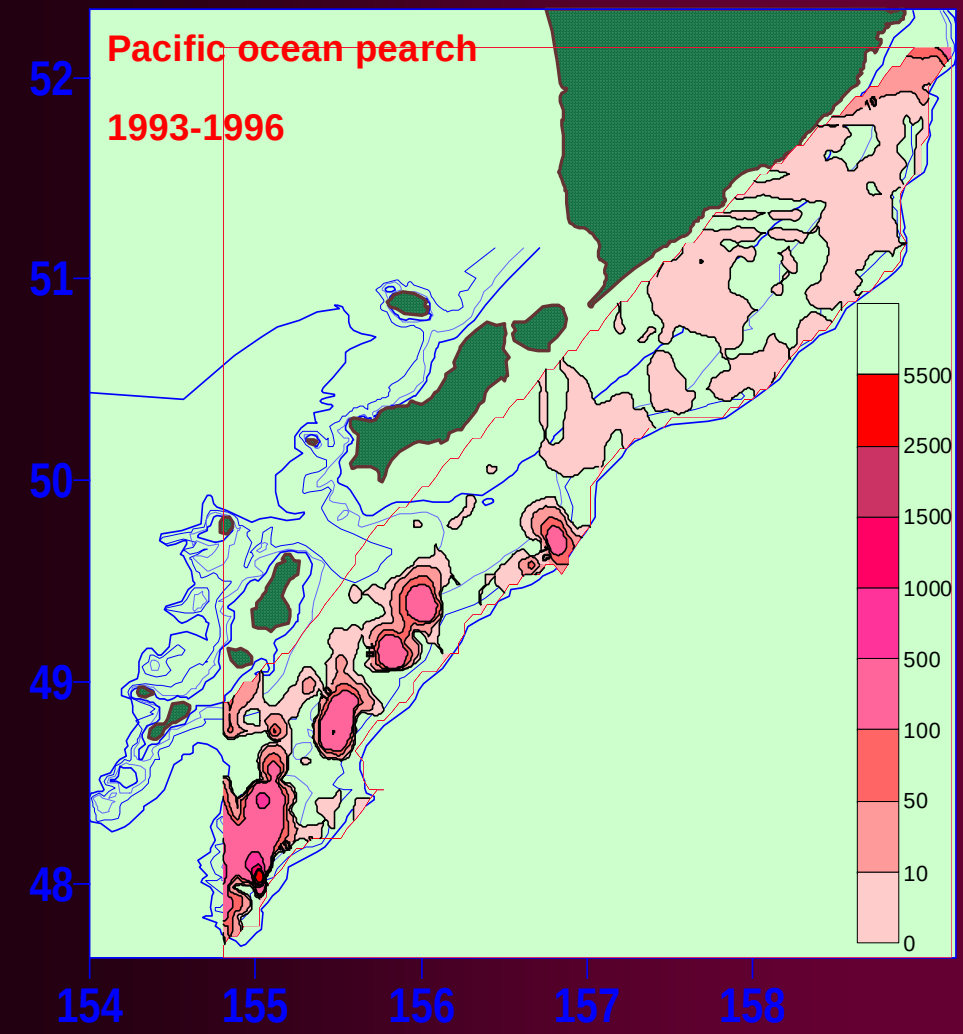


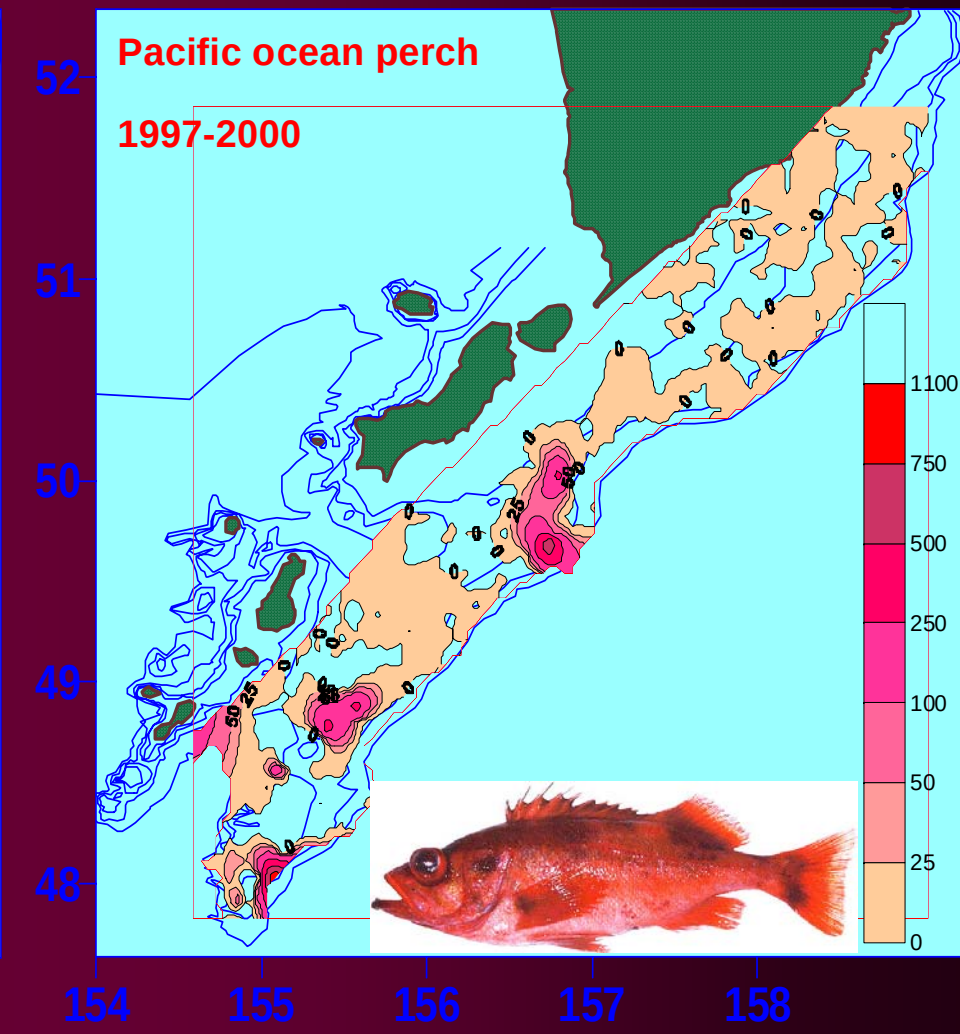
Patterns of spatial distribution of northern rock sole in 1993-1996 and 1997-2000



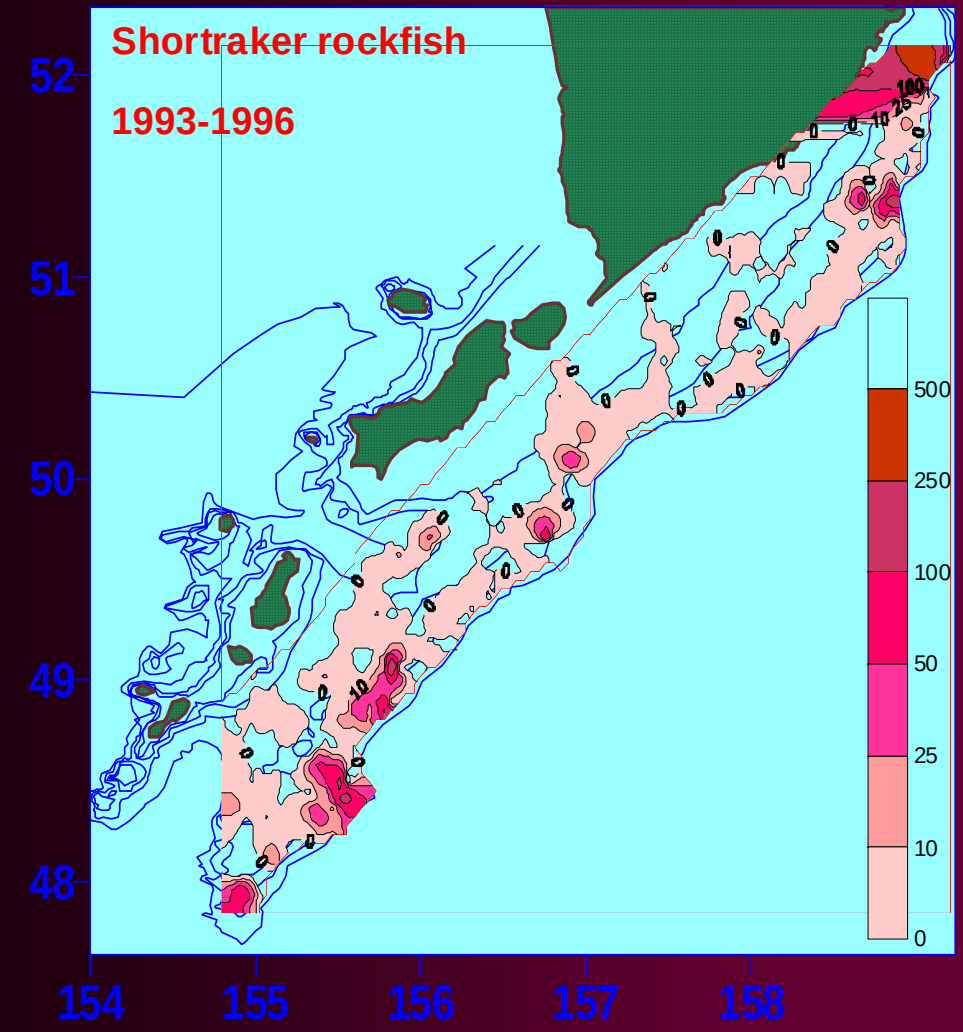


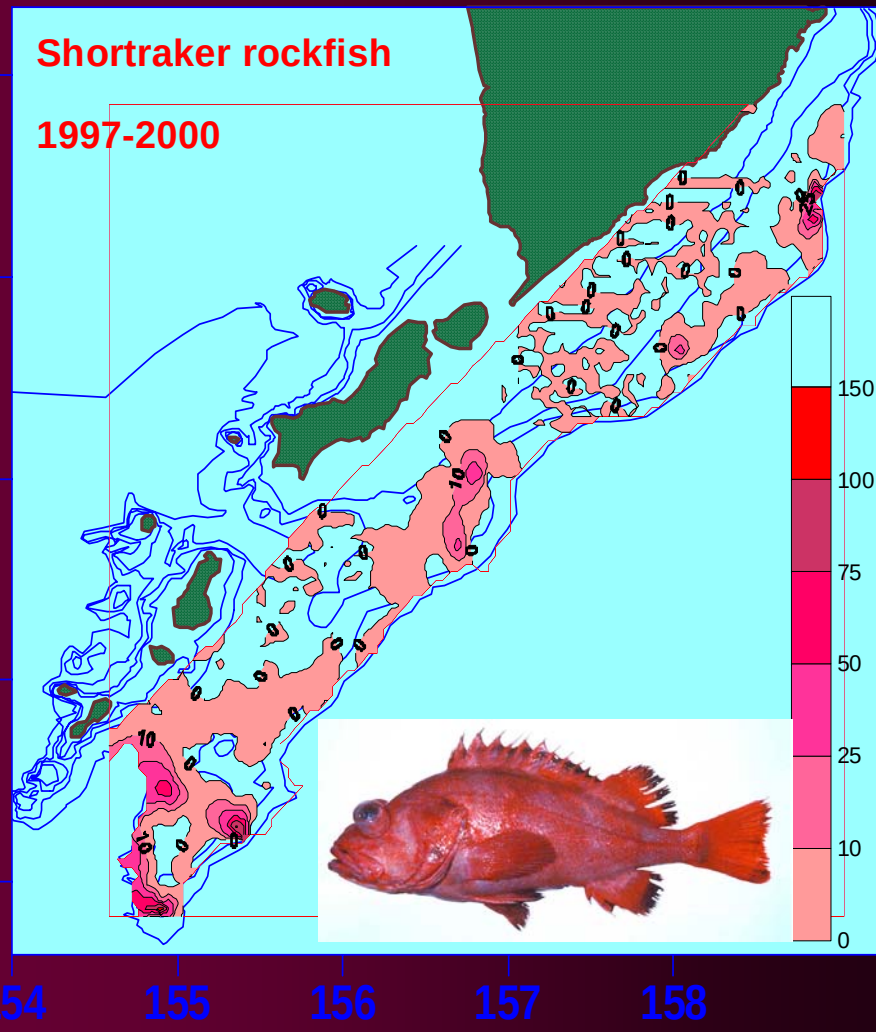
Patterns of spatial distribution of Pacific ocean perch in 1993-1996 and 1997-2000



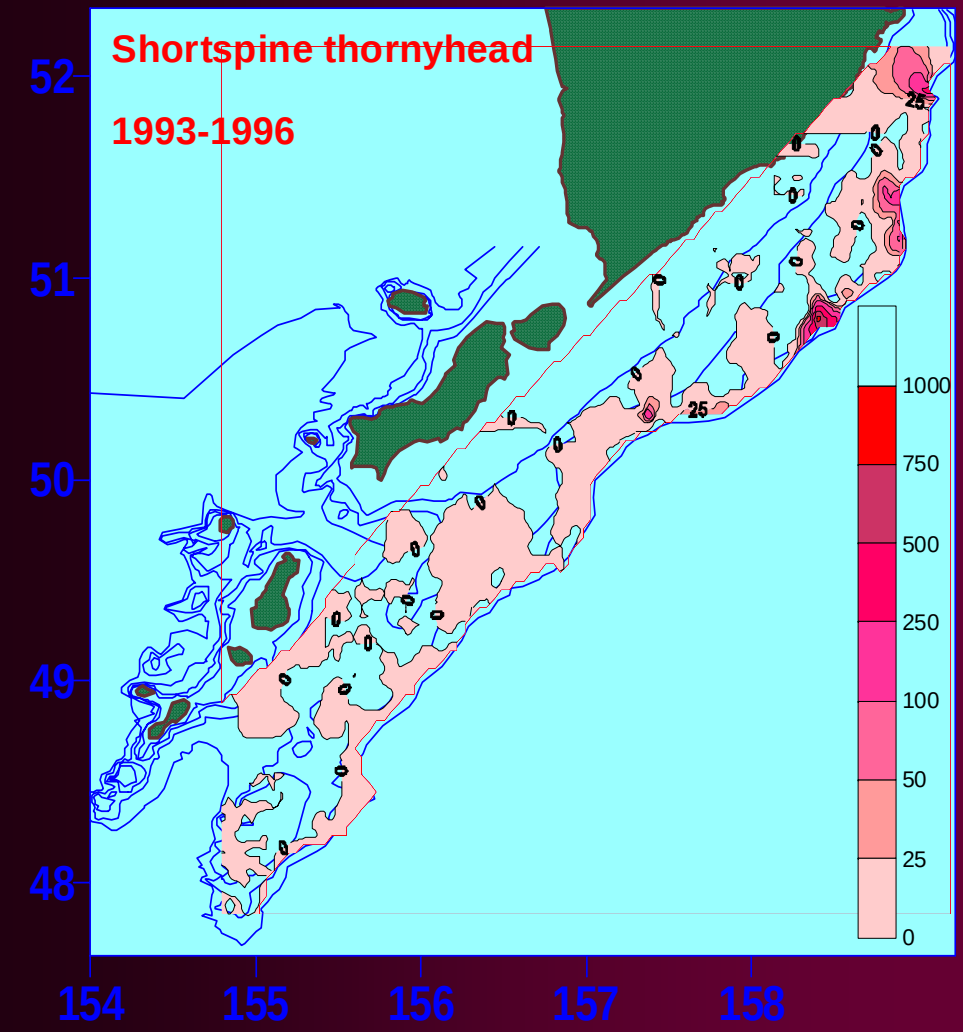


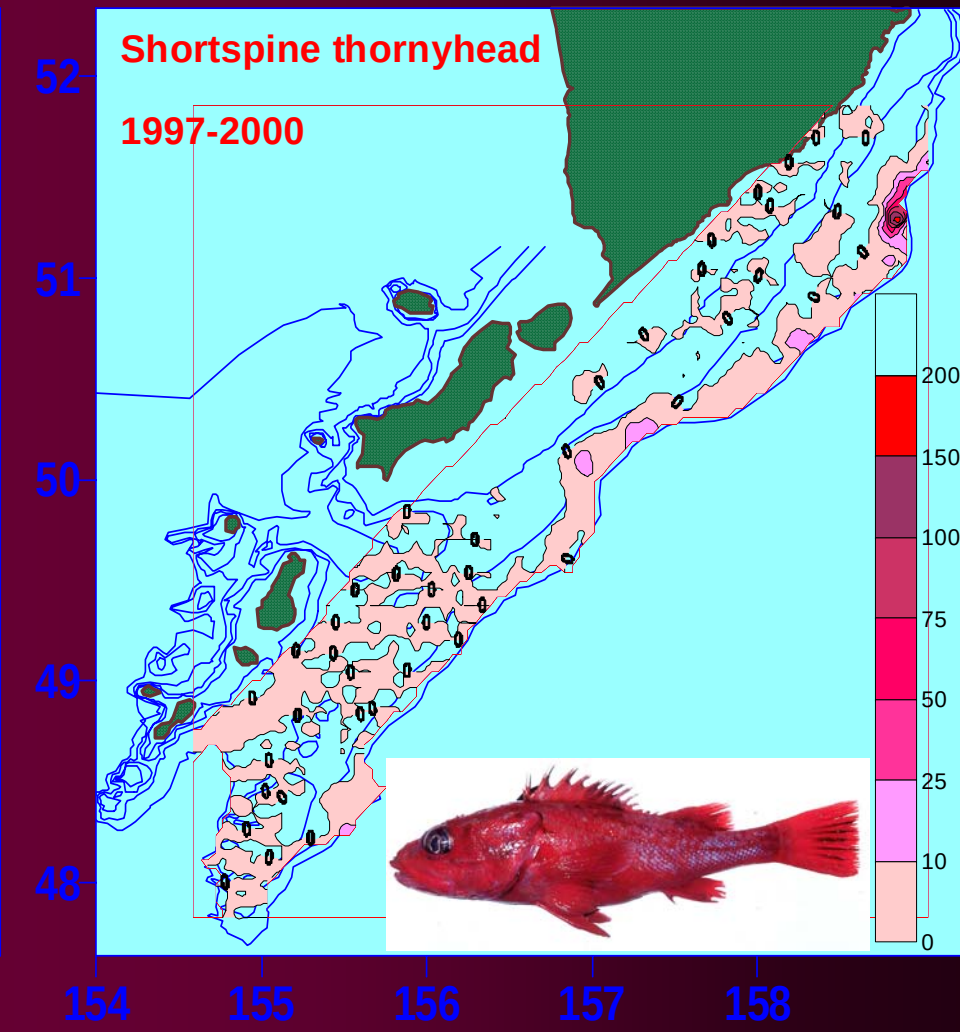
Patterns of spatial distribution of shortraker rockfish in 1993-1996 and 1997-2000



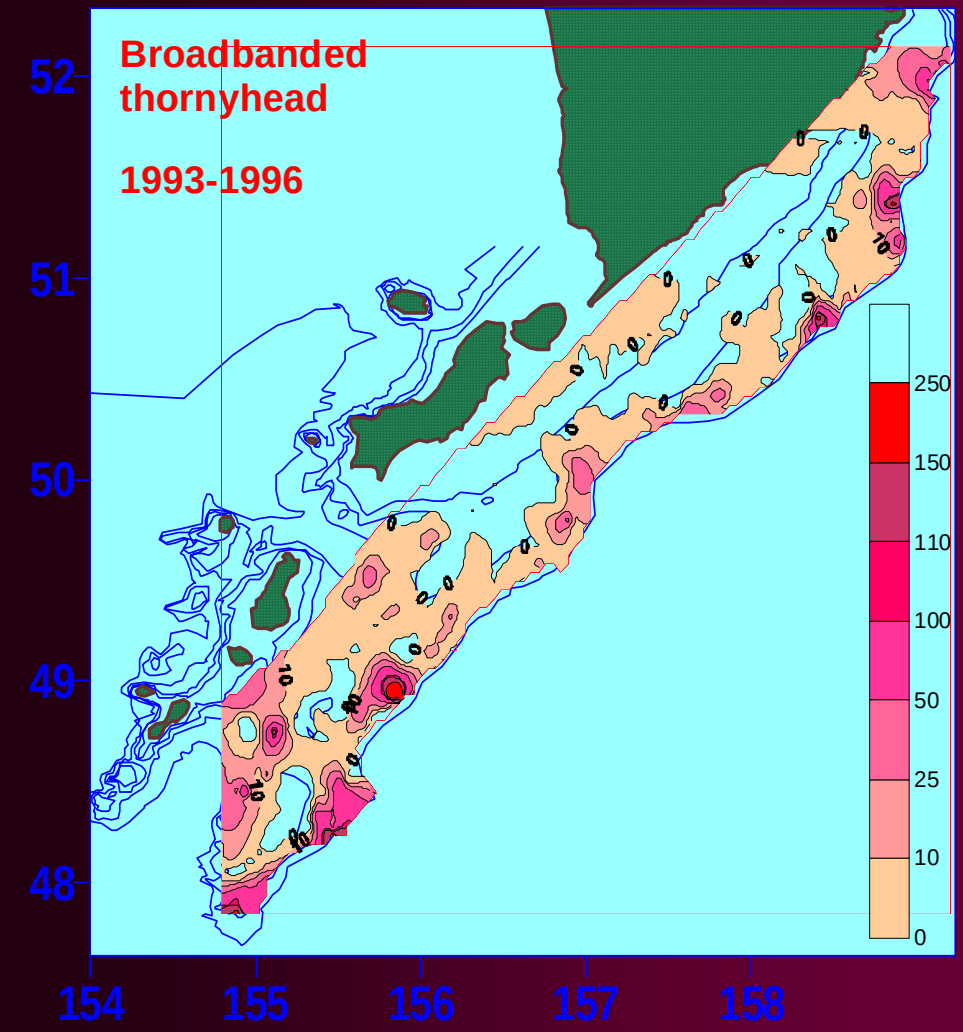


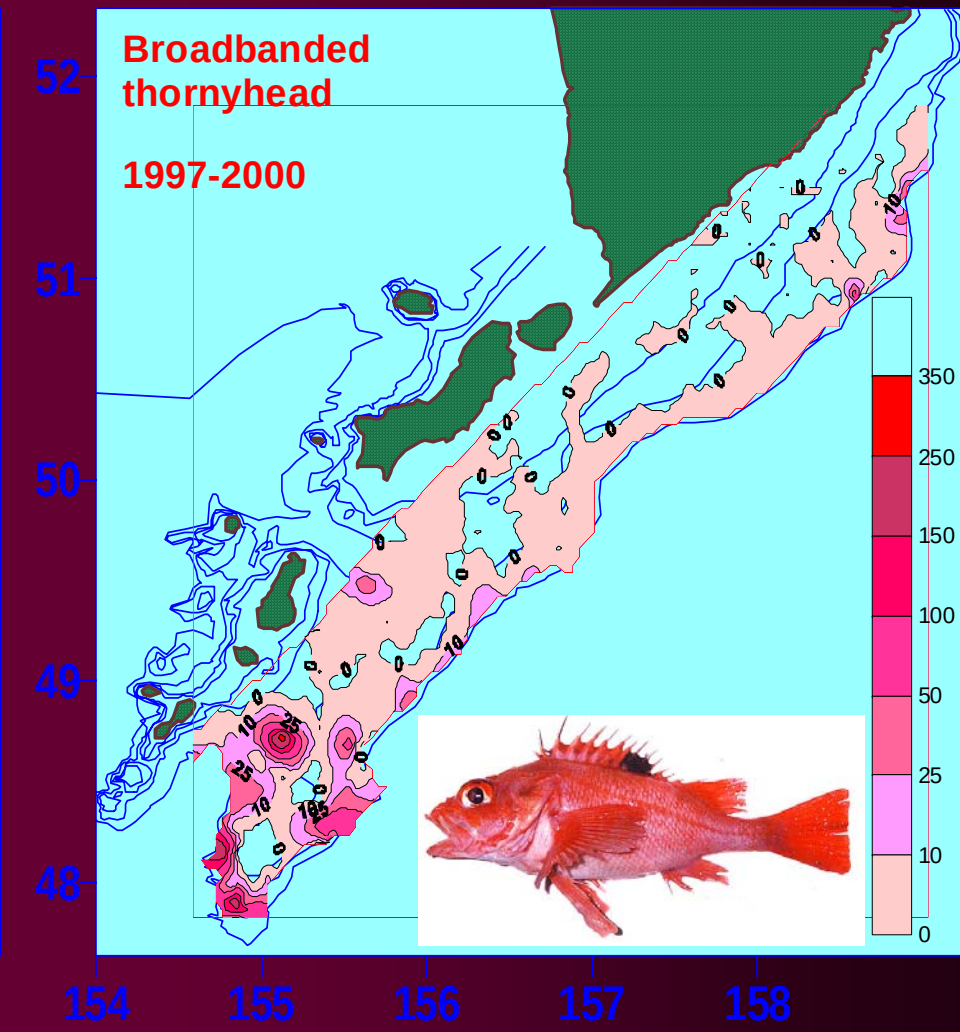
Patterns of spatial distribution of shortspine thornyhead in 1993-1996 and 1997-2000



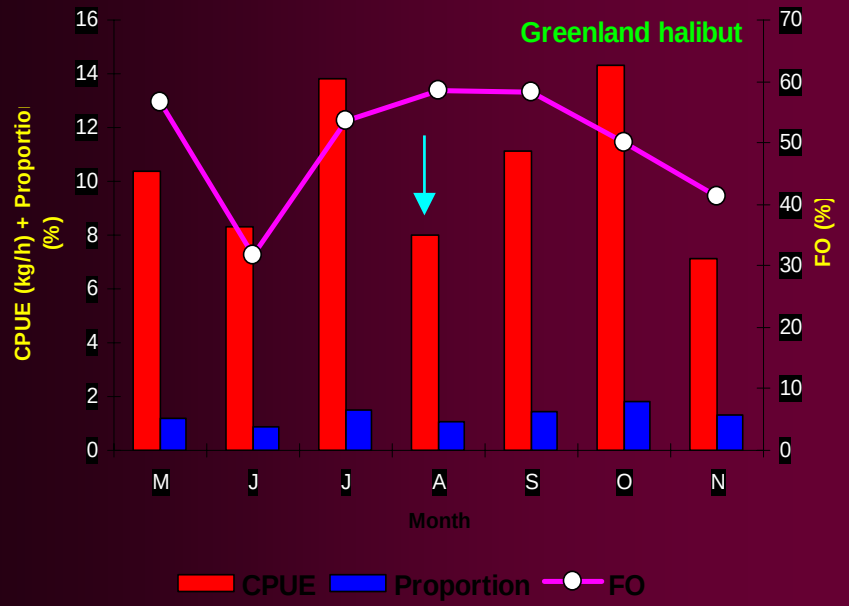


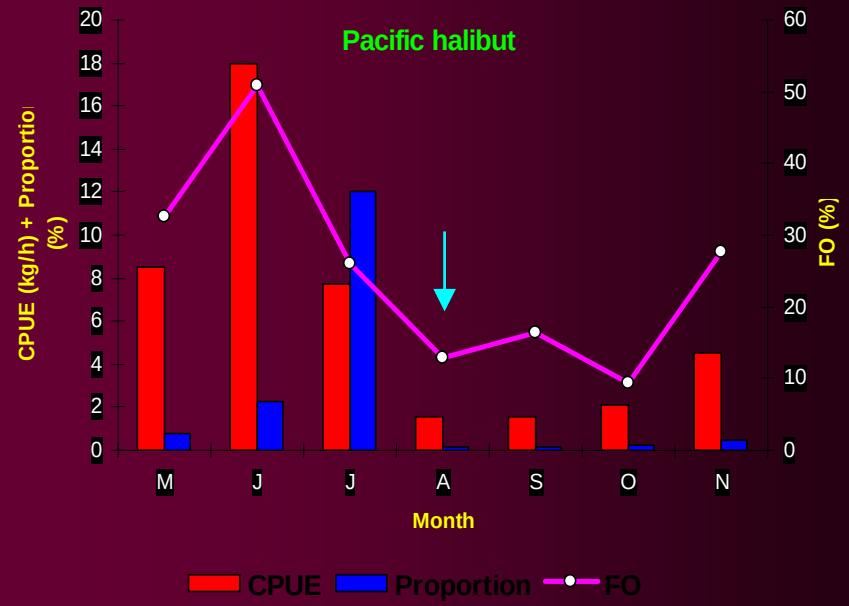
Patterns of spatial distribution of broadbanded thornyhead in 1993-1996 and 1997-2000

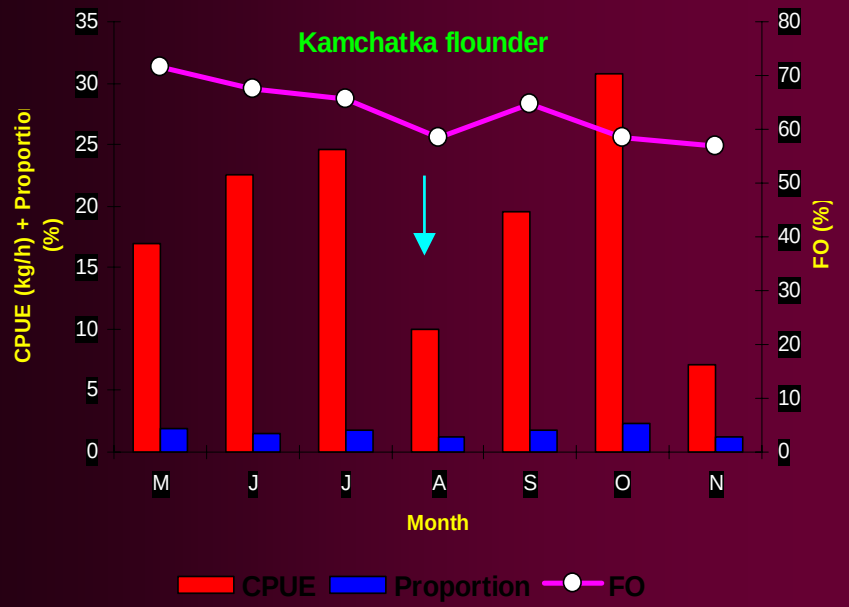


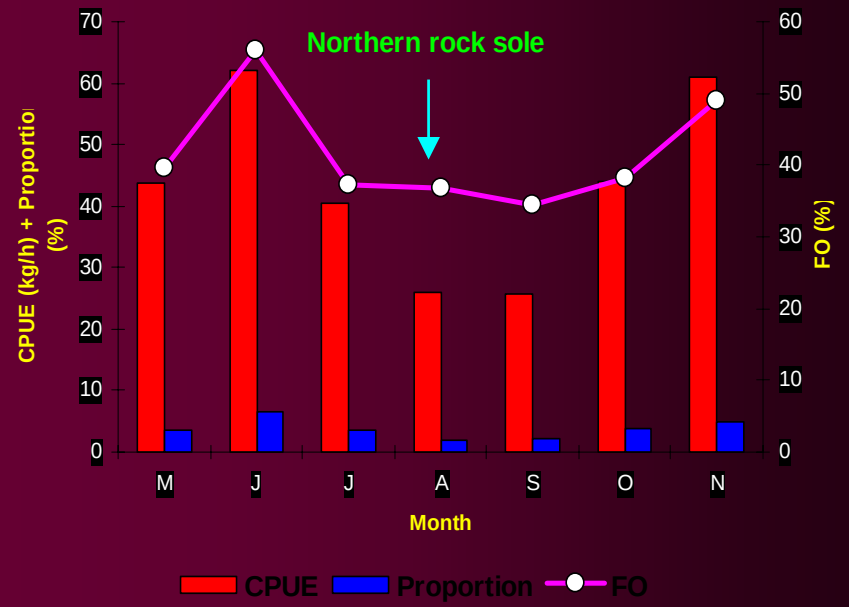


Seasonal changes of occurrence (%), catch rate (kg per h) and proportion in catches (%) of flatfish species studied

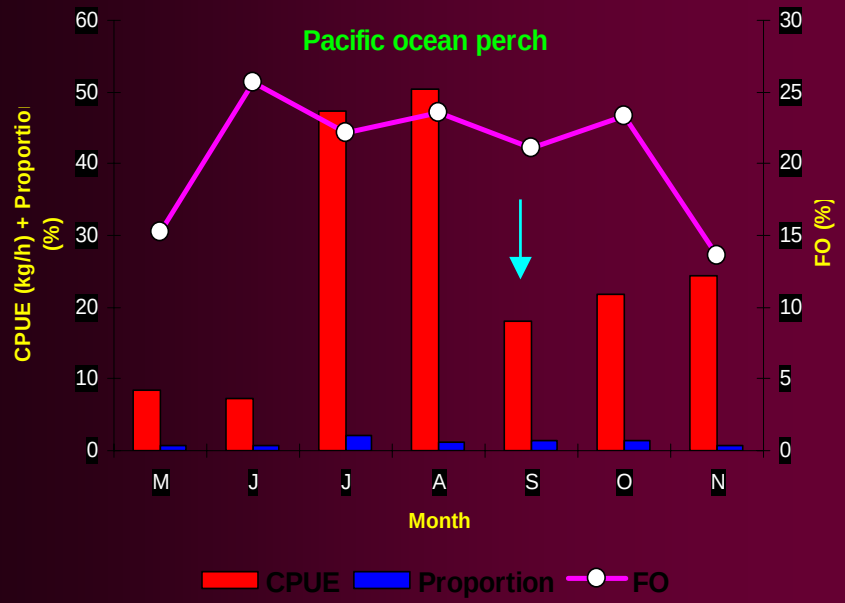


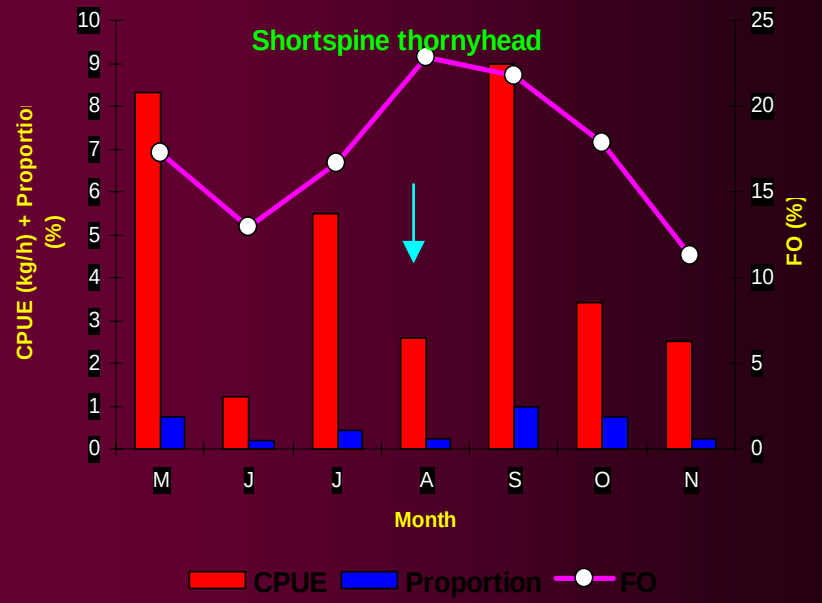


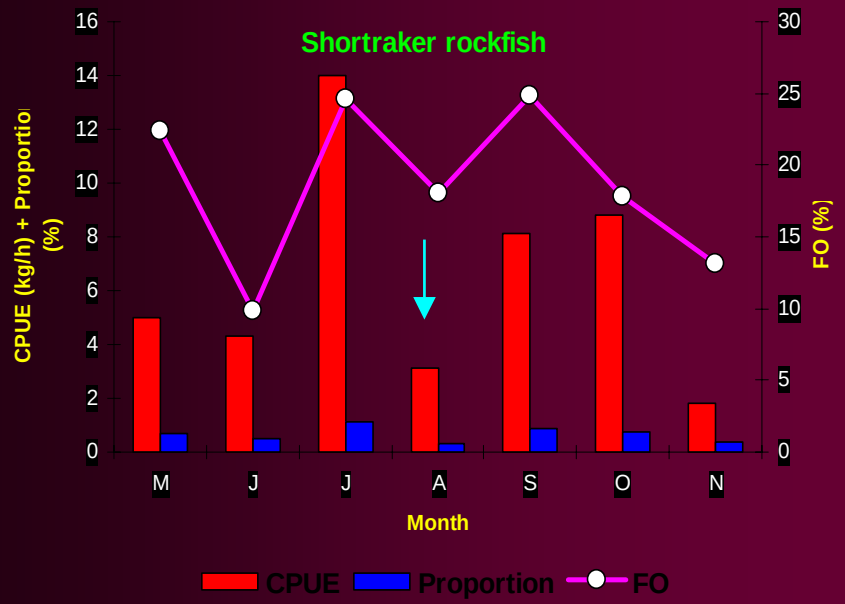


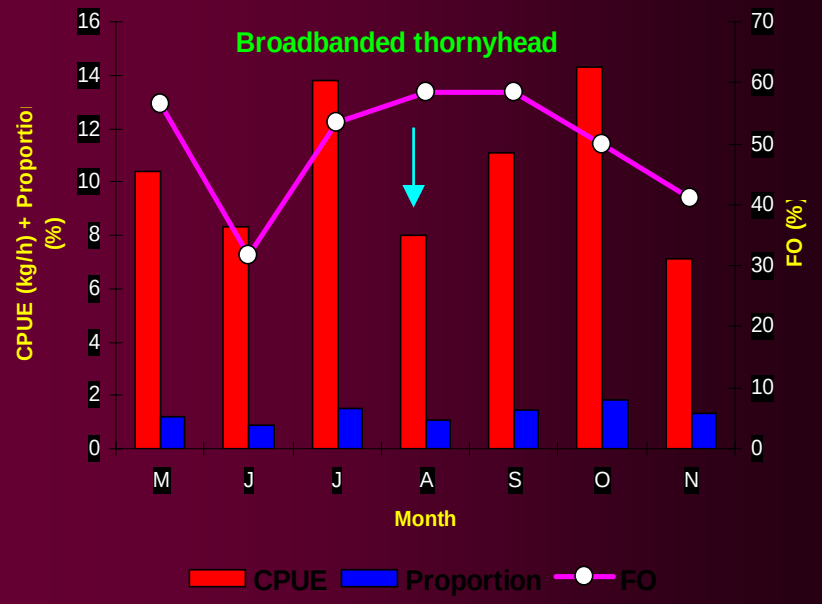


Seasonal changes of occurrence (%), catch rate (kg per h) and proportion in catches (%) of rockfish species studied









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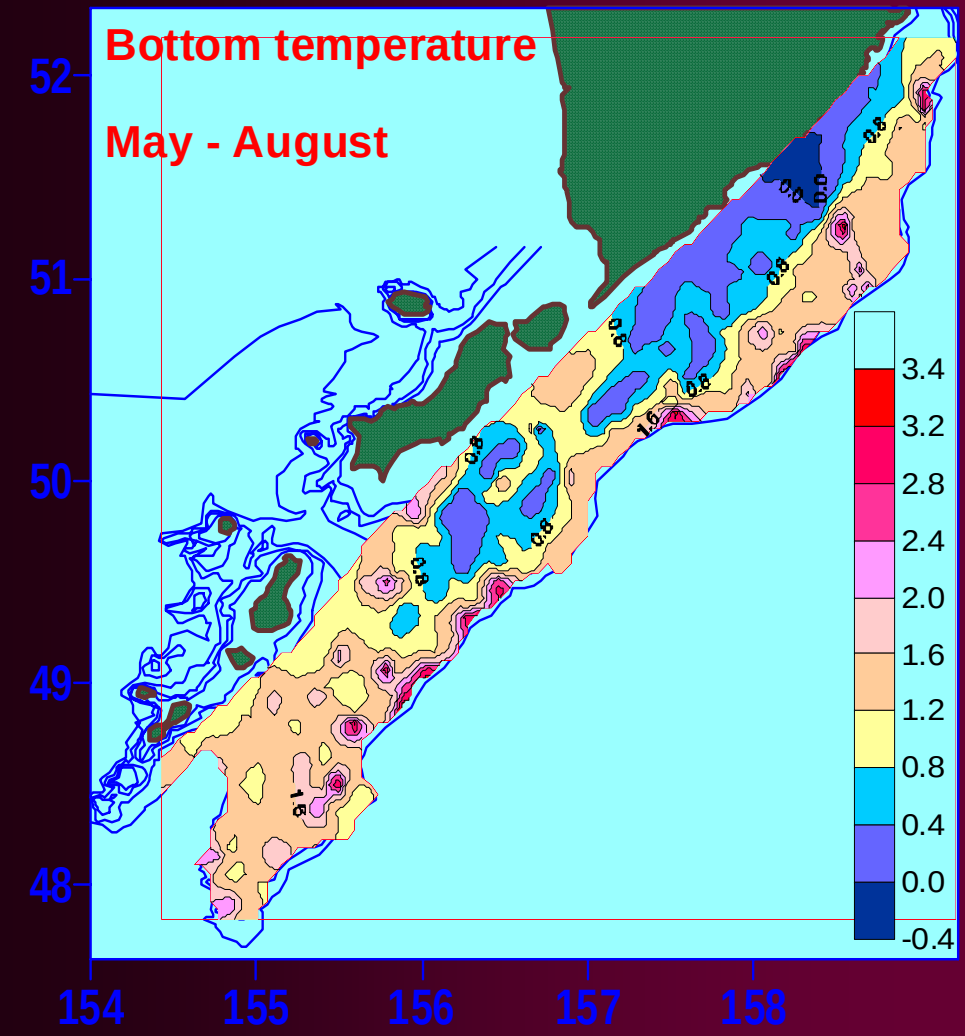
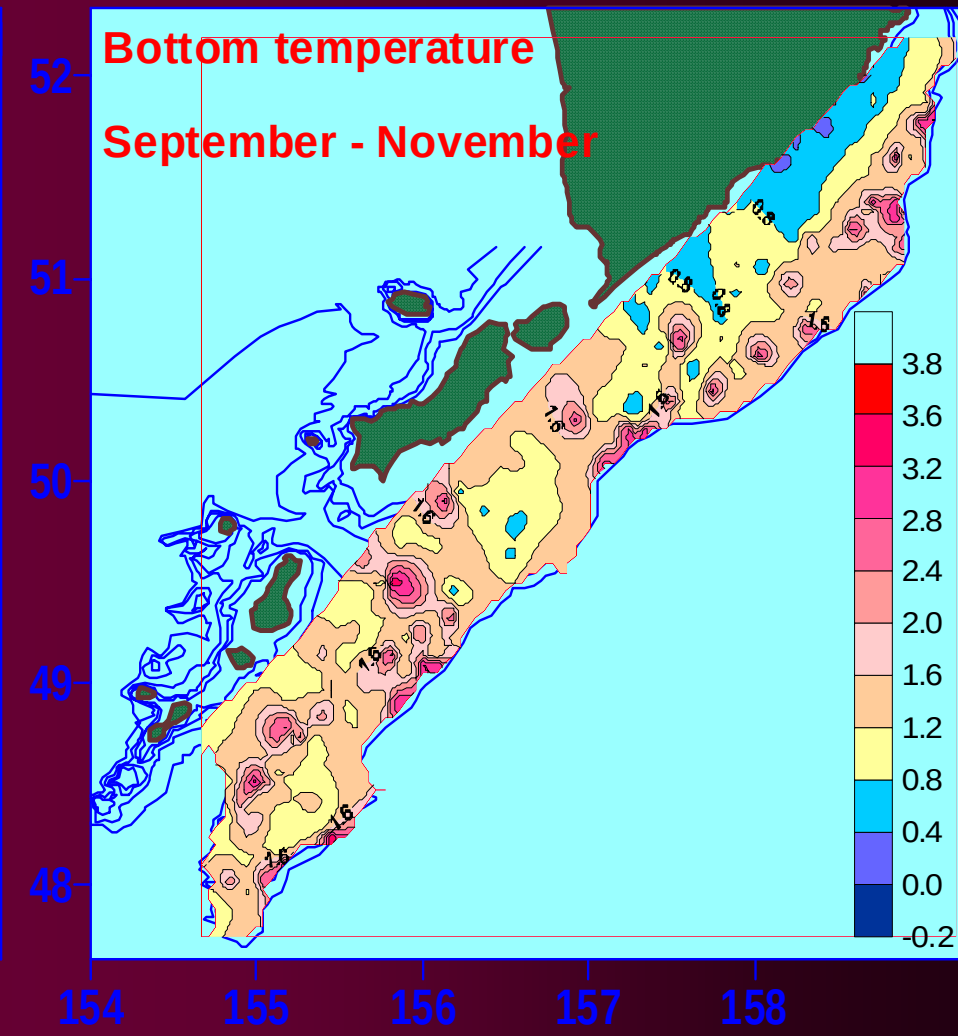
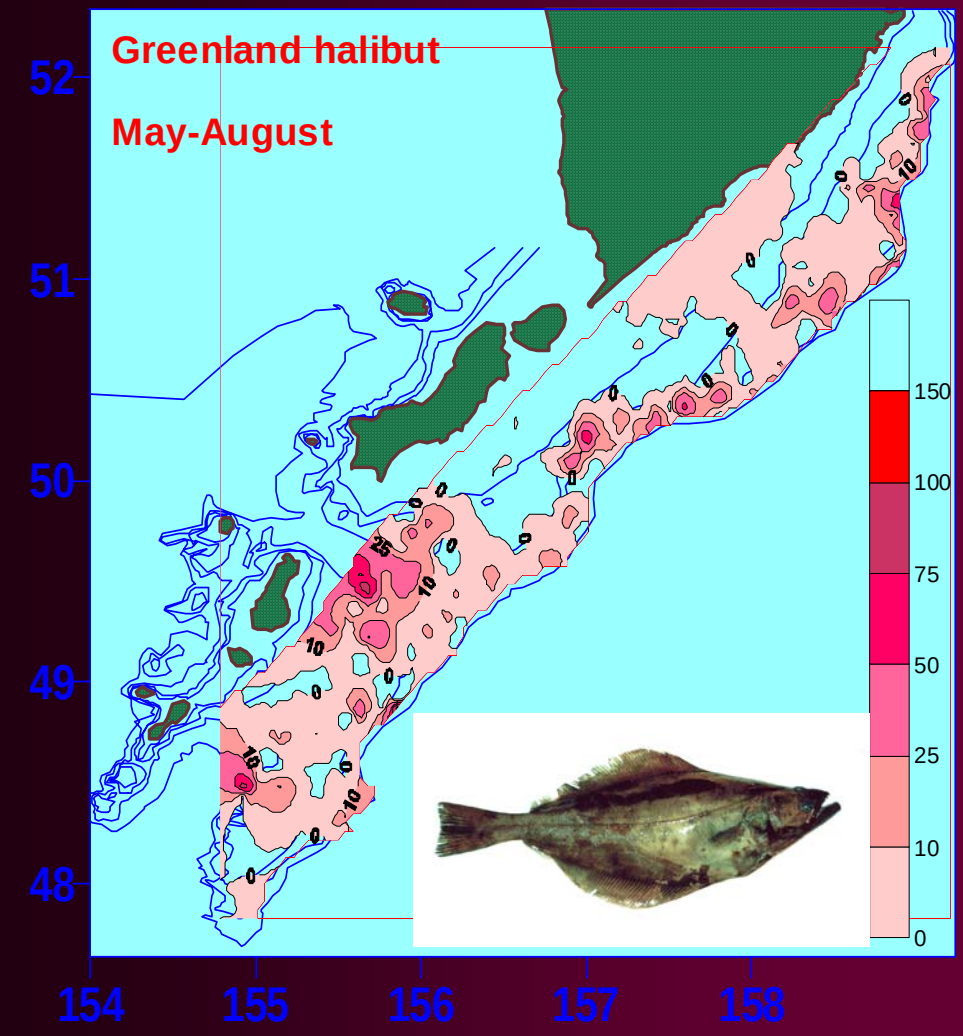
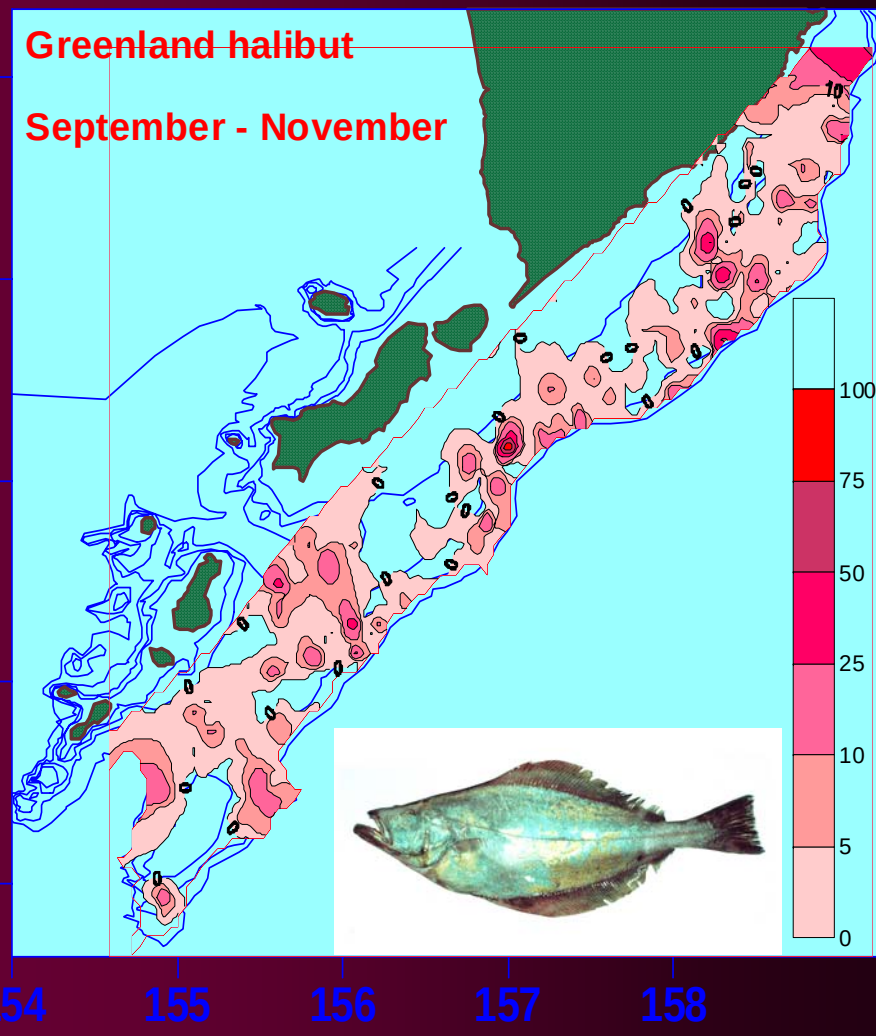


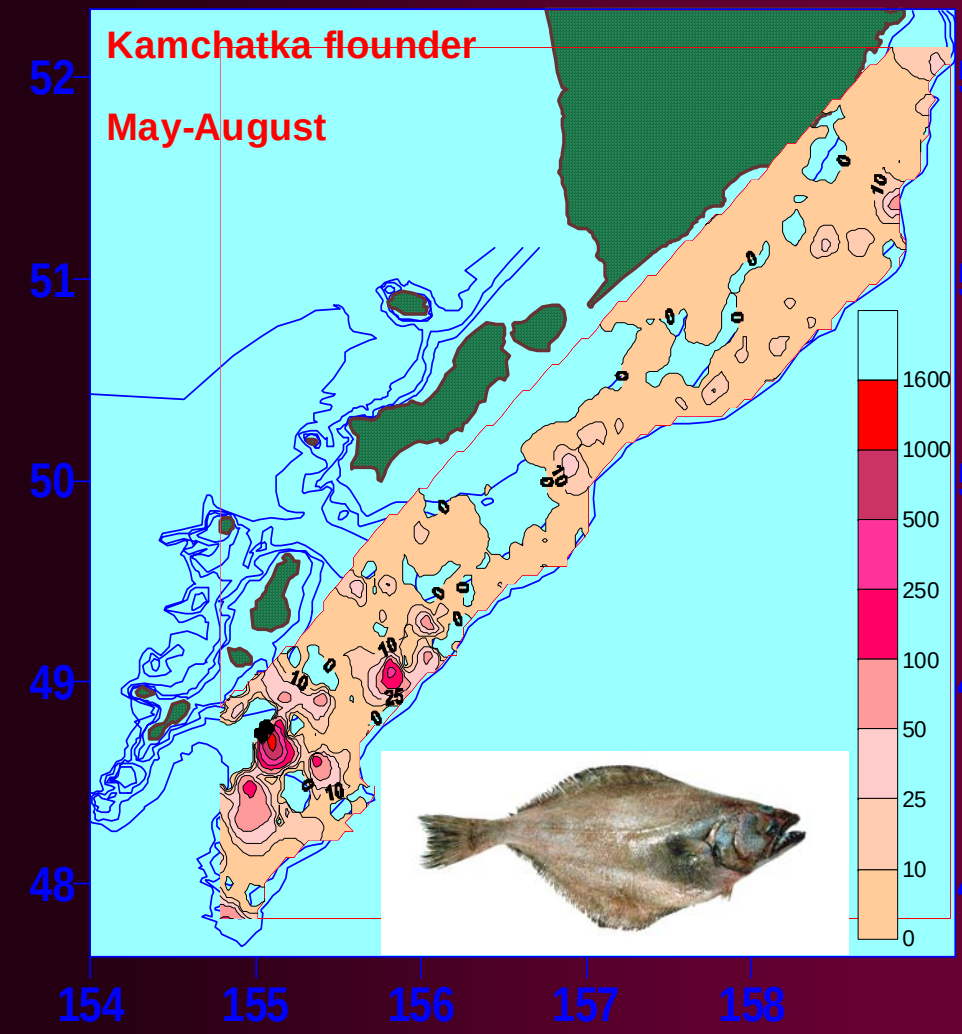


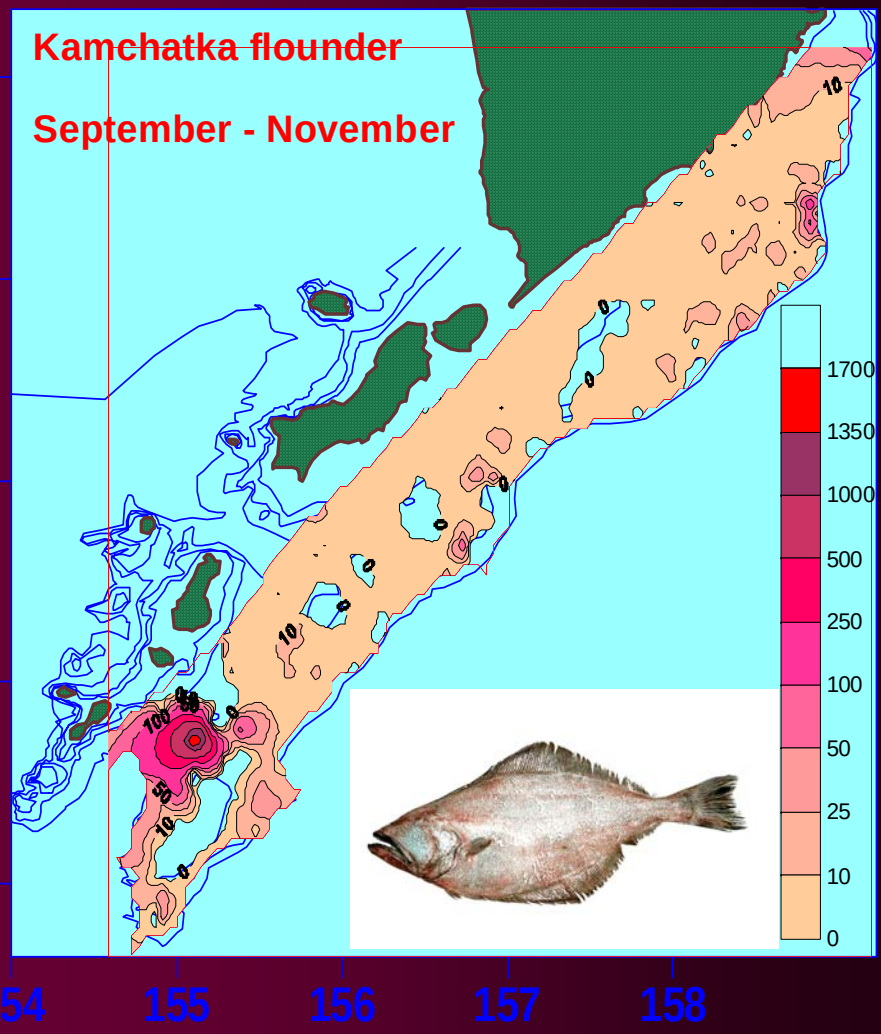
Patterns of spatial distribution of Greenland halibut in spring-summer and autumn periods



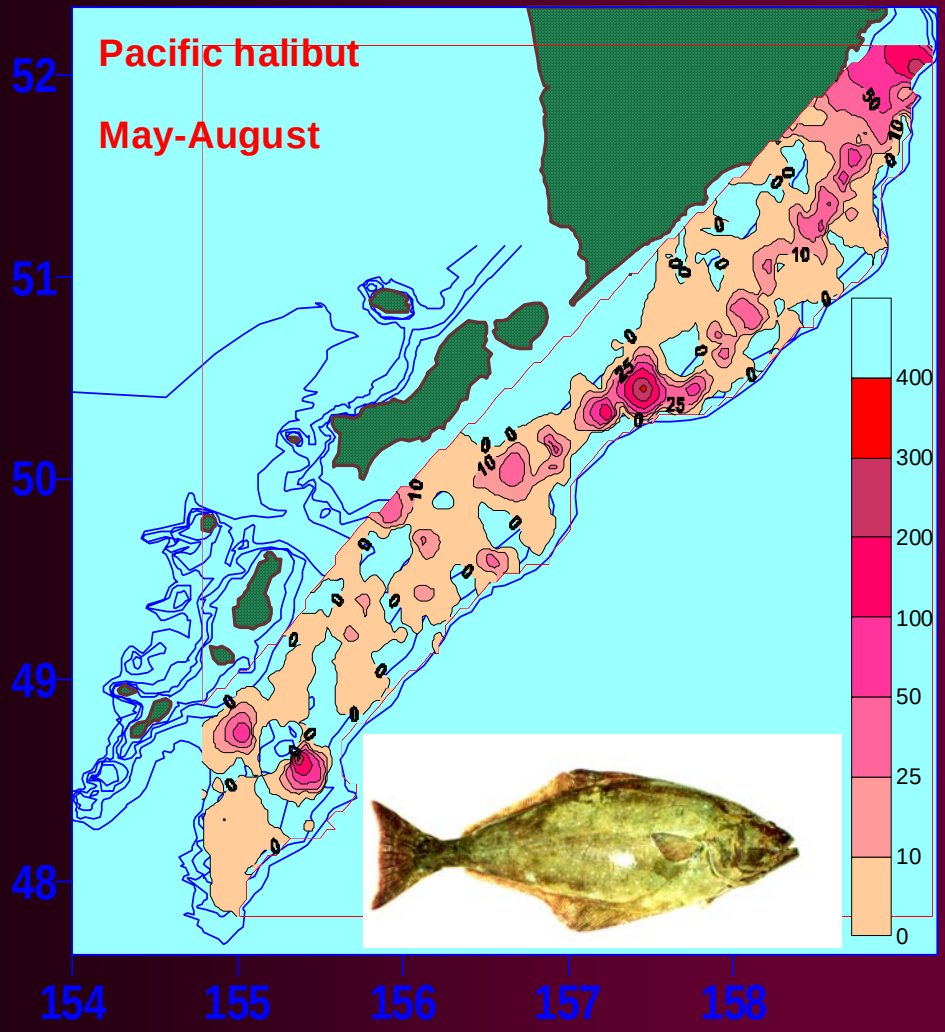


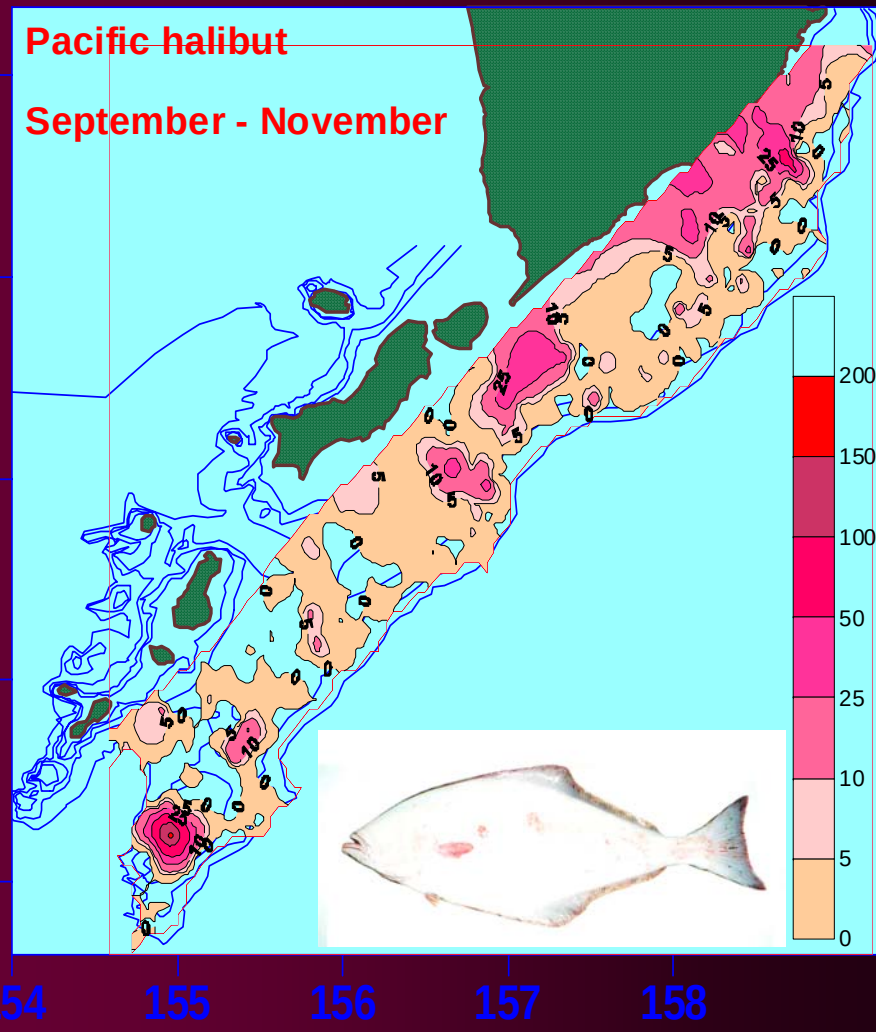
Patterns of spatial distribution of Kamchatka flounder in spring-summer and autumn periods



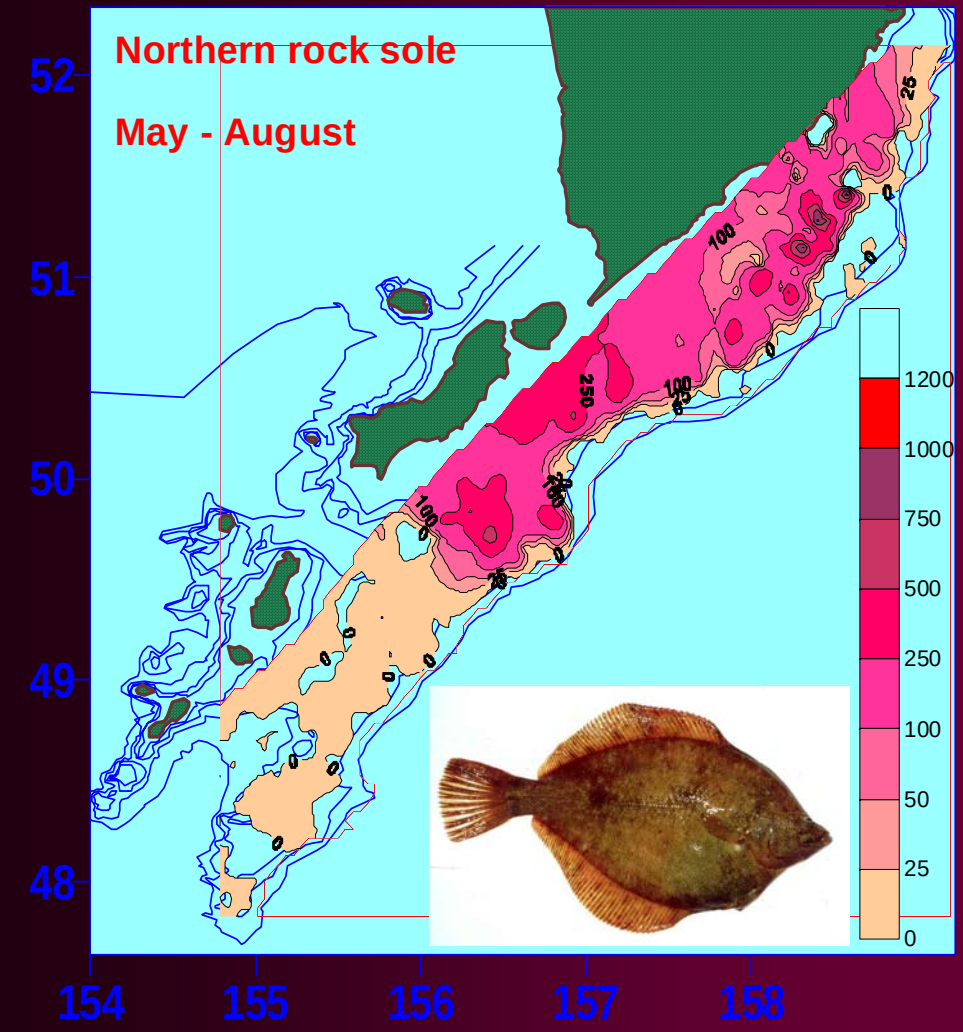


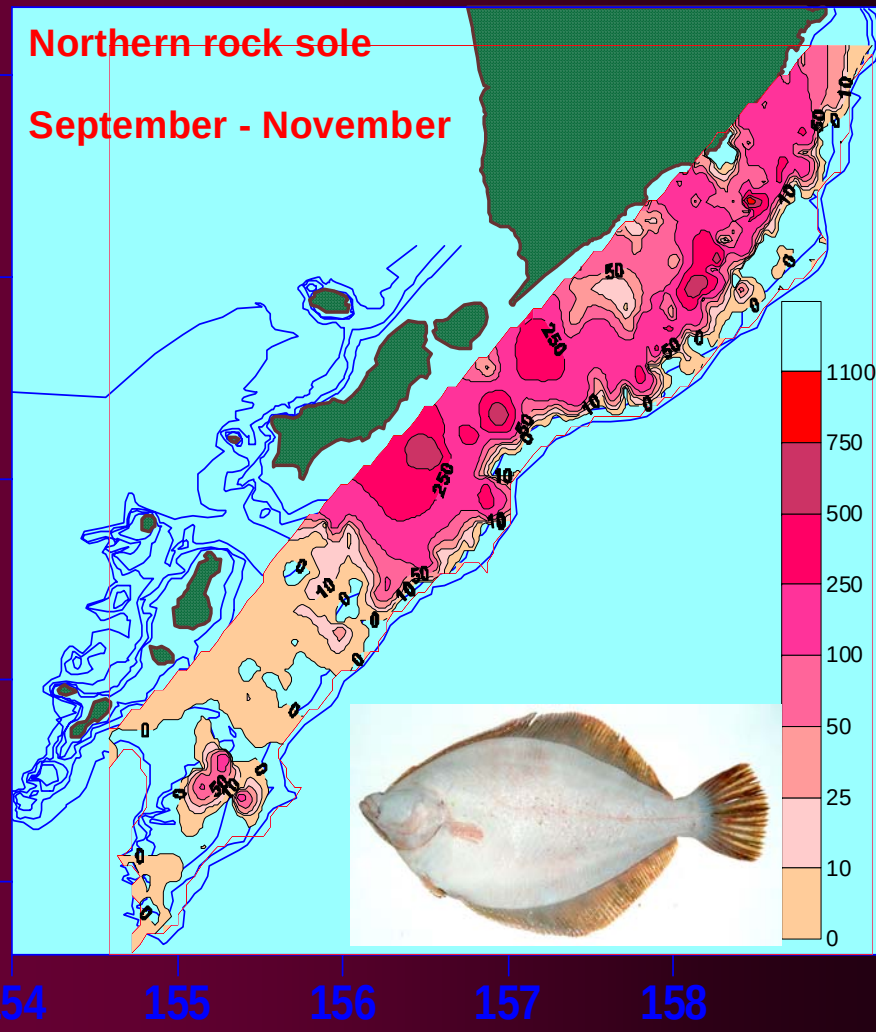
Patterns of spatial distribution of Pacific halibut in spring-summer and autumn periods



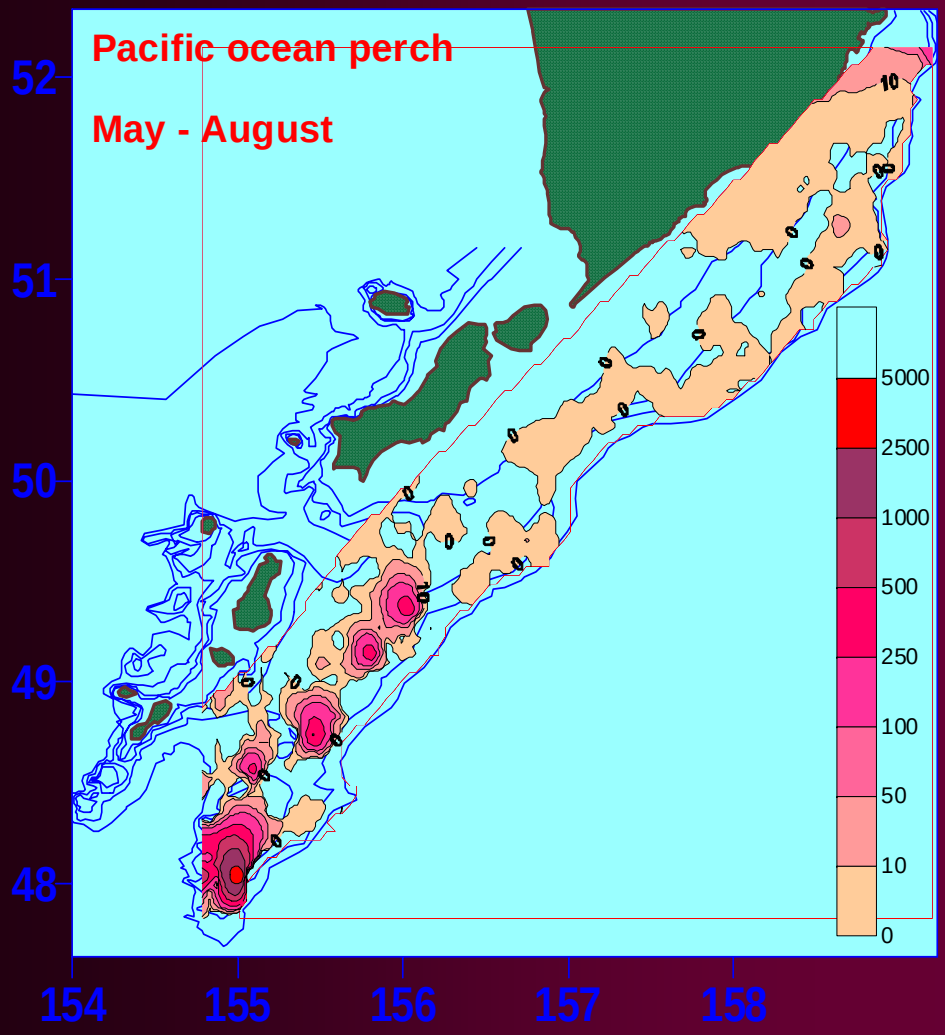


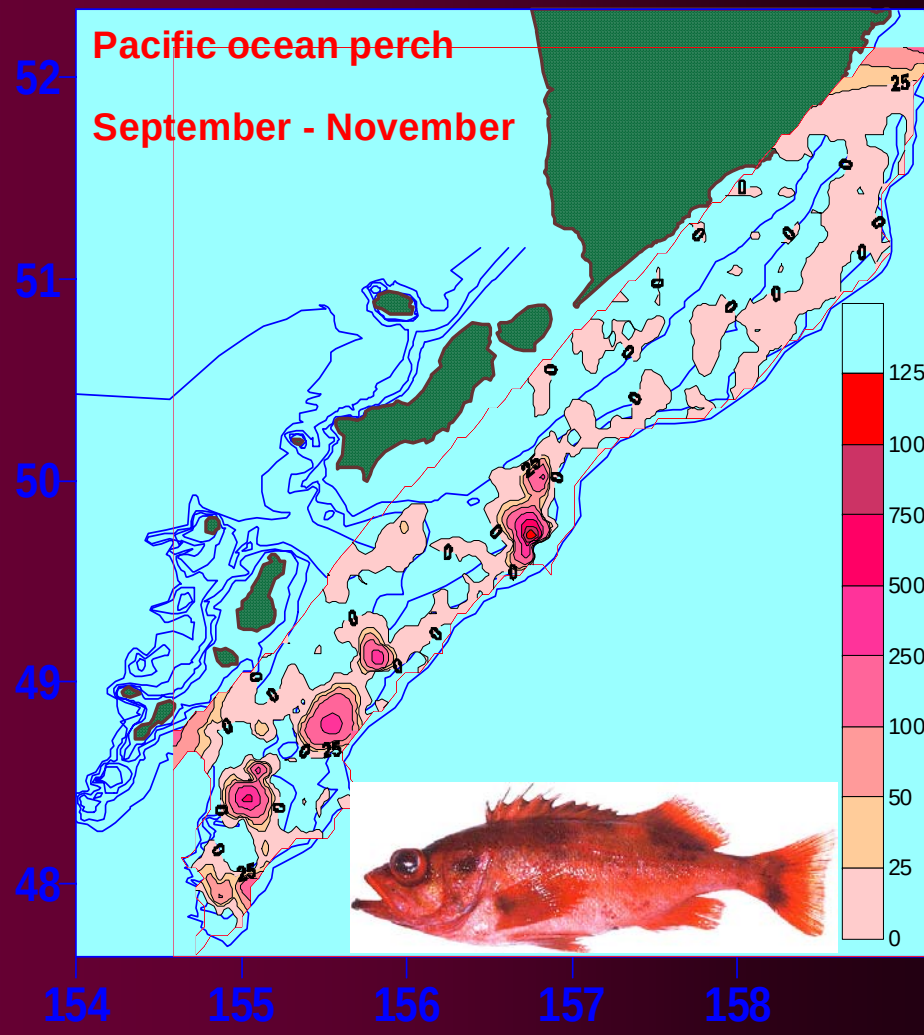
Patterns of spatial distribution of northern rock sole in spring-summer and autumn periods



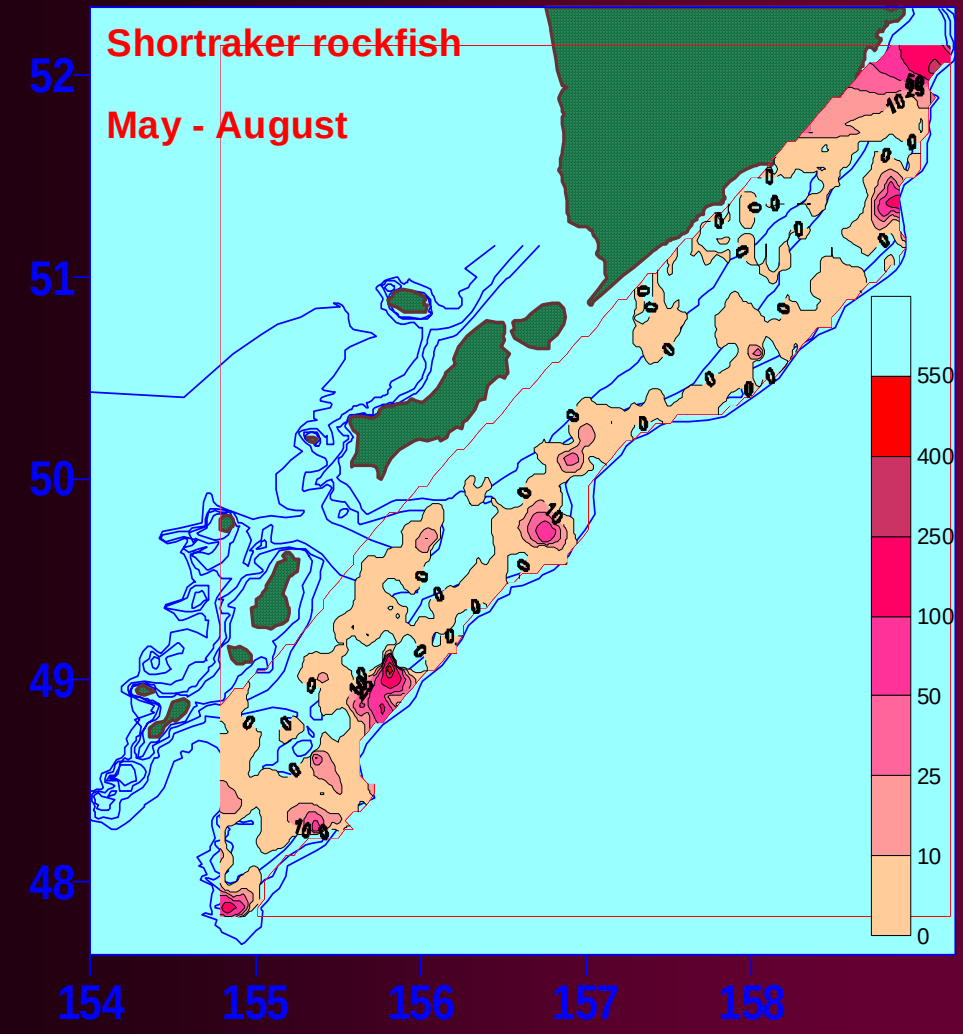


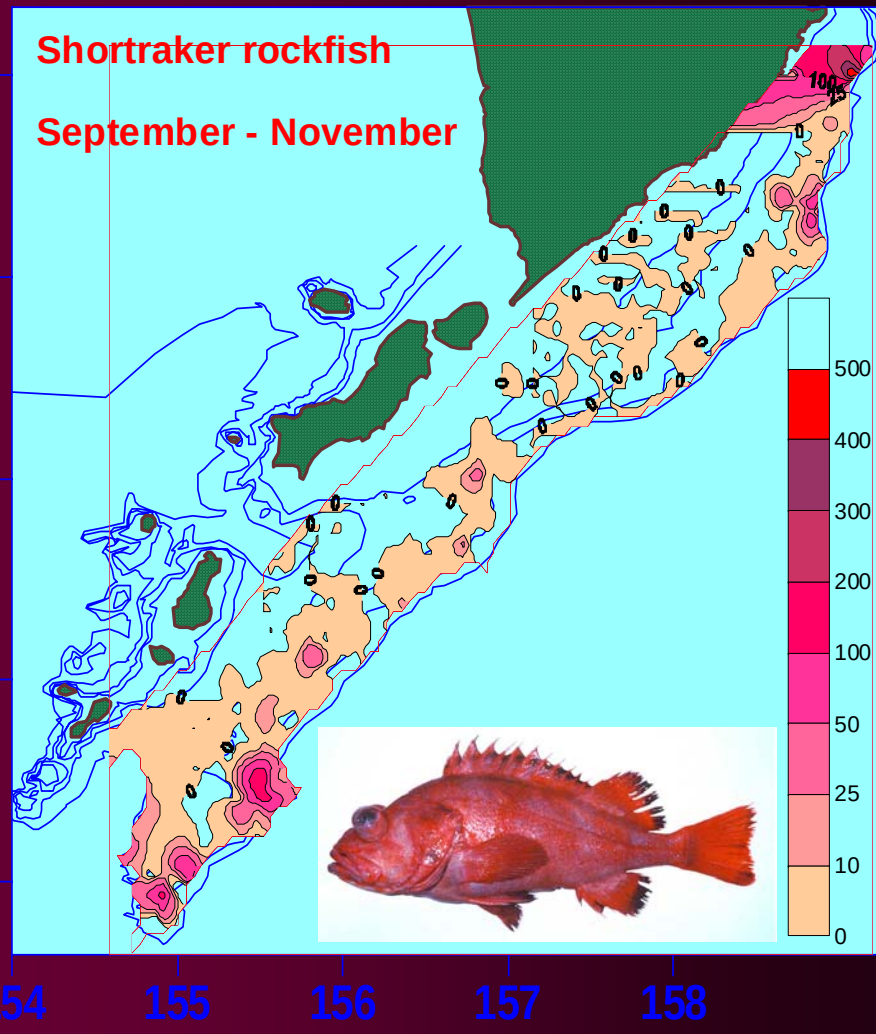
Patterns of spatial distribution of Pacific ocean perch in spring-summer and autumn periods



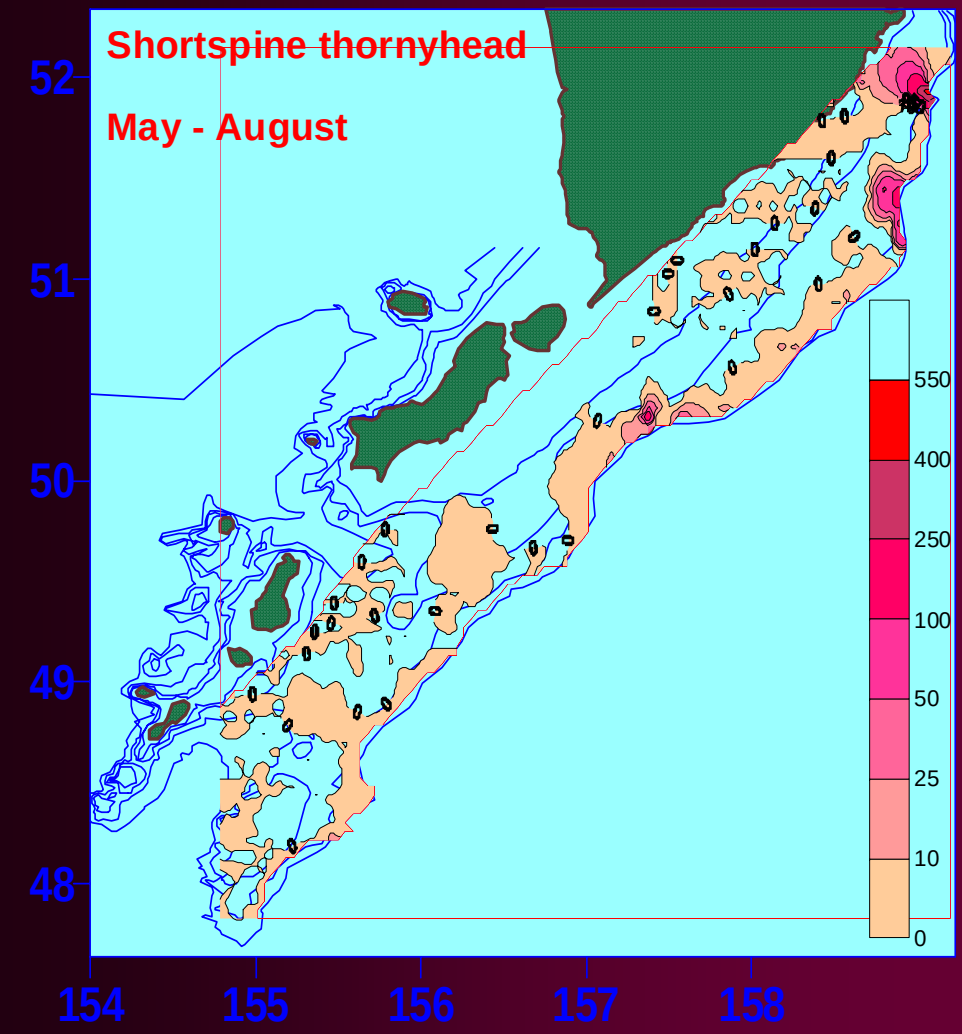


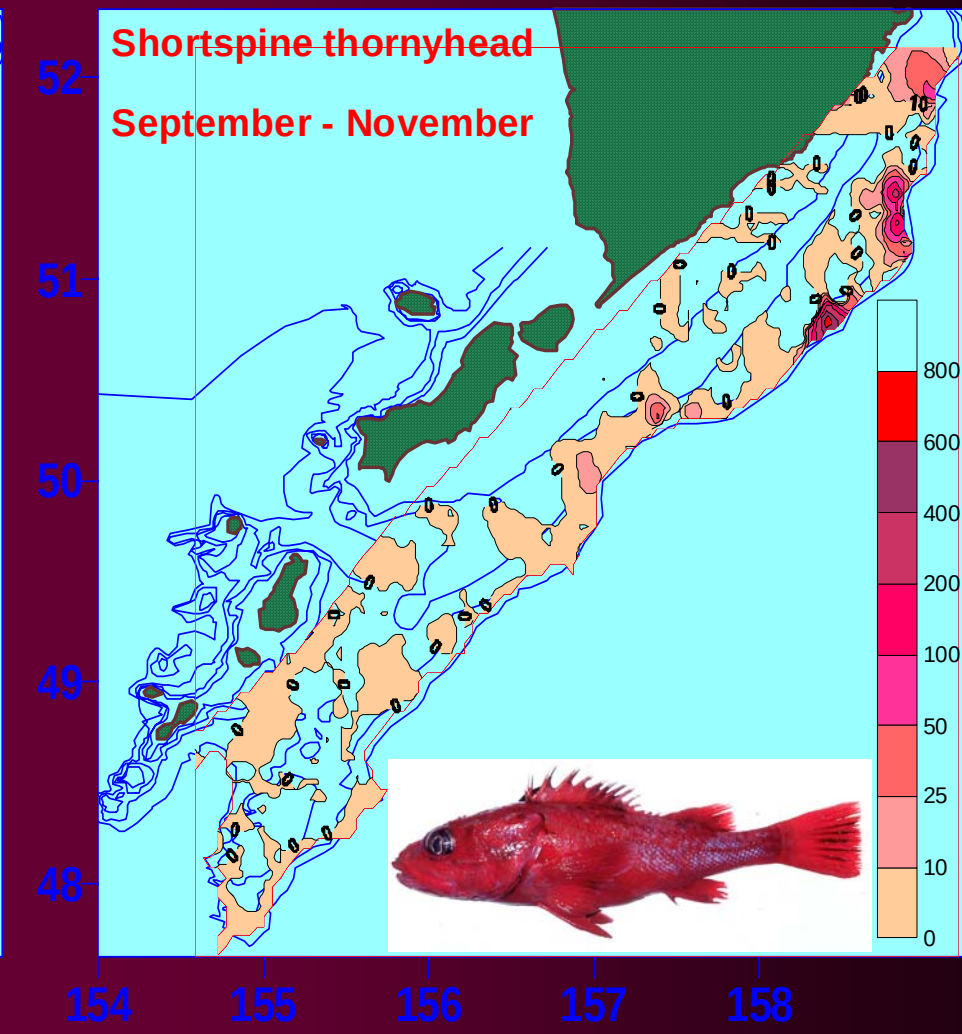
Patterns of spatial distribution of shortraker rockfish in spring-summer and autumn periods



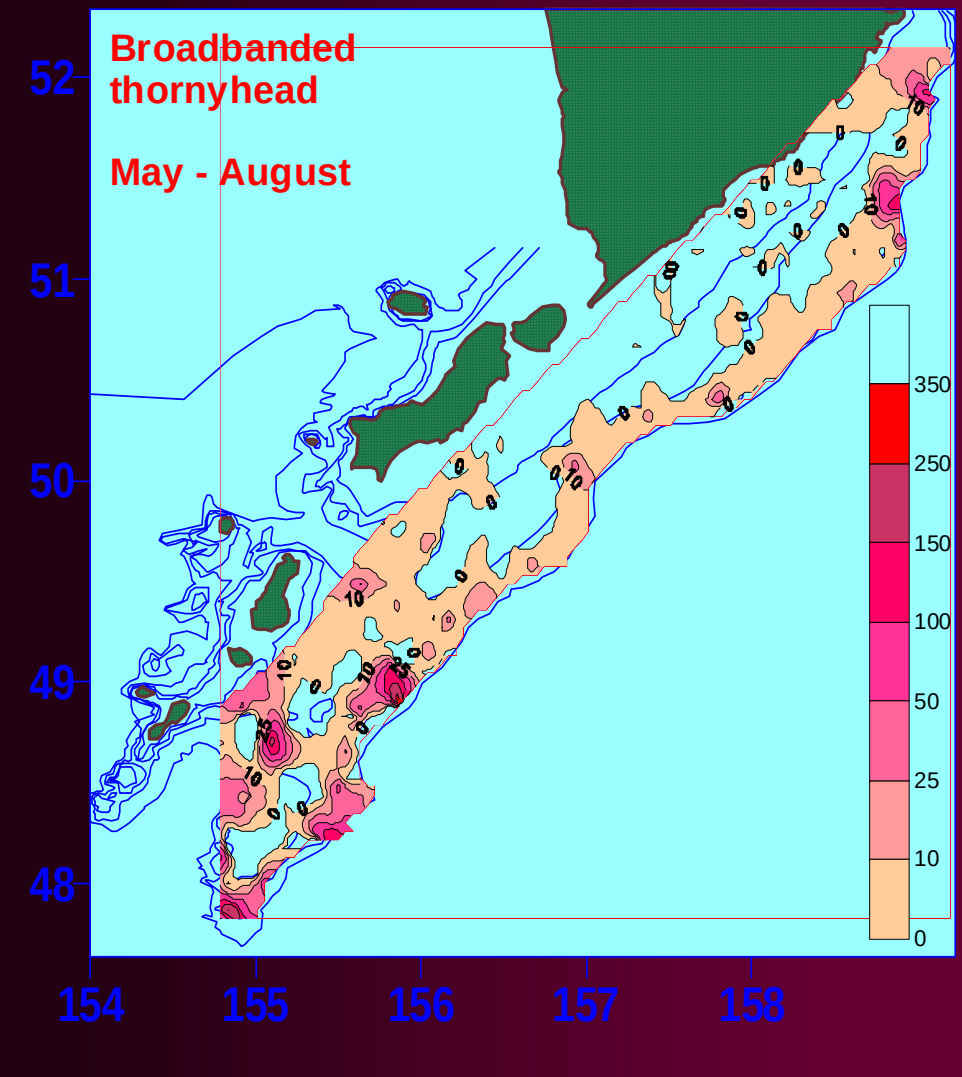


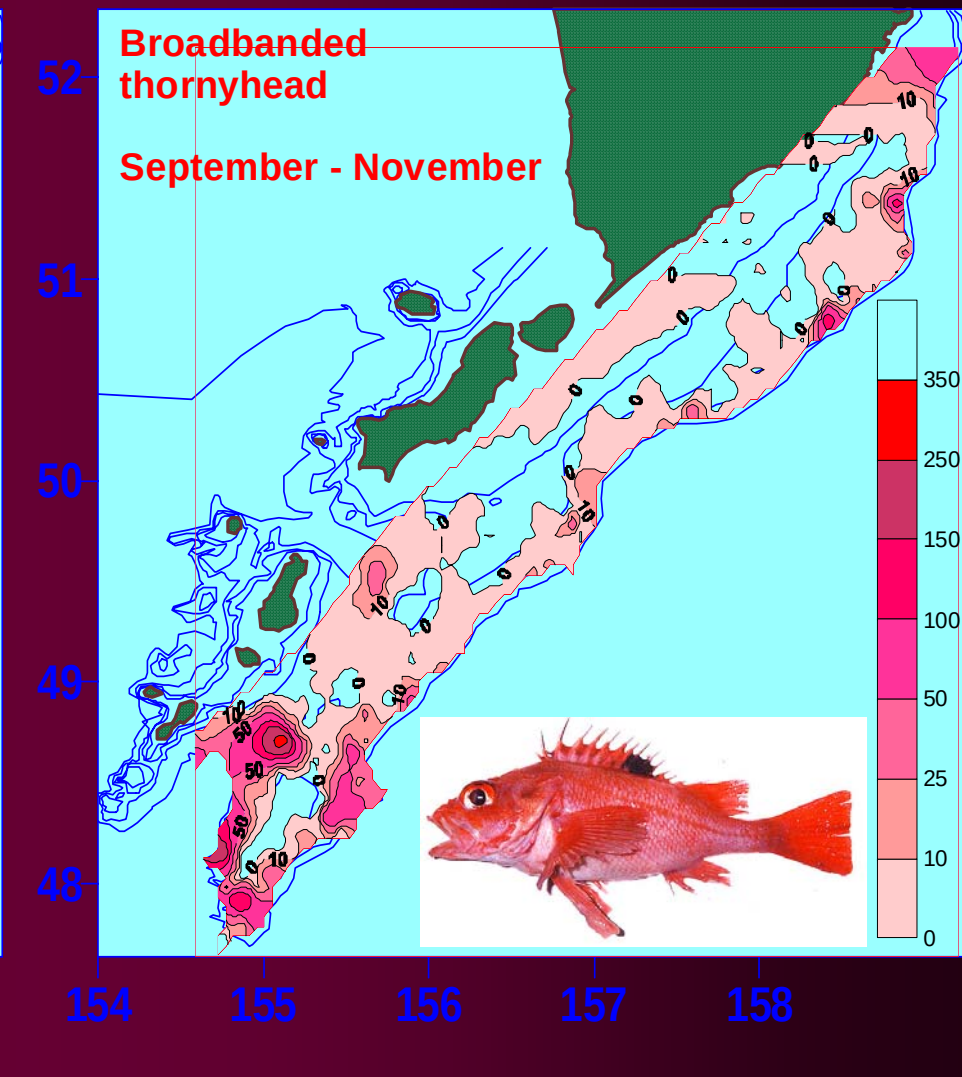
Patterns of spatial distribution of shortspine thornyhead in spring-summer and autumn periods





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