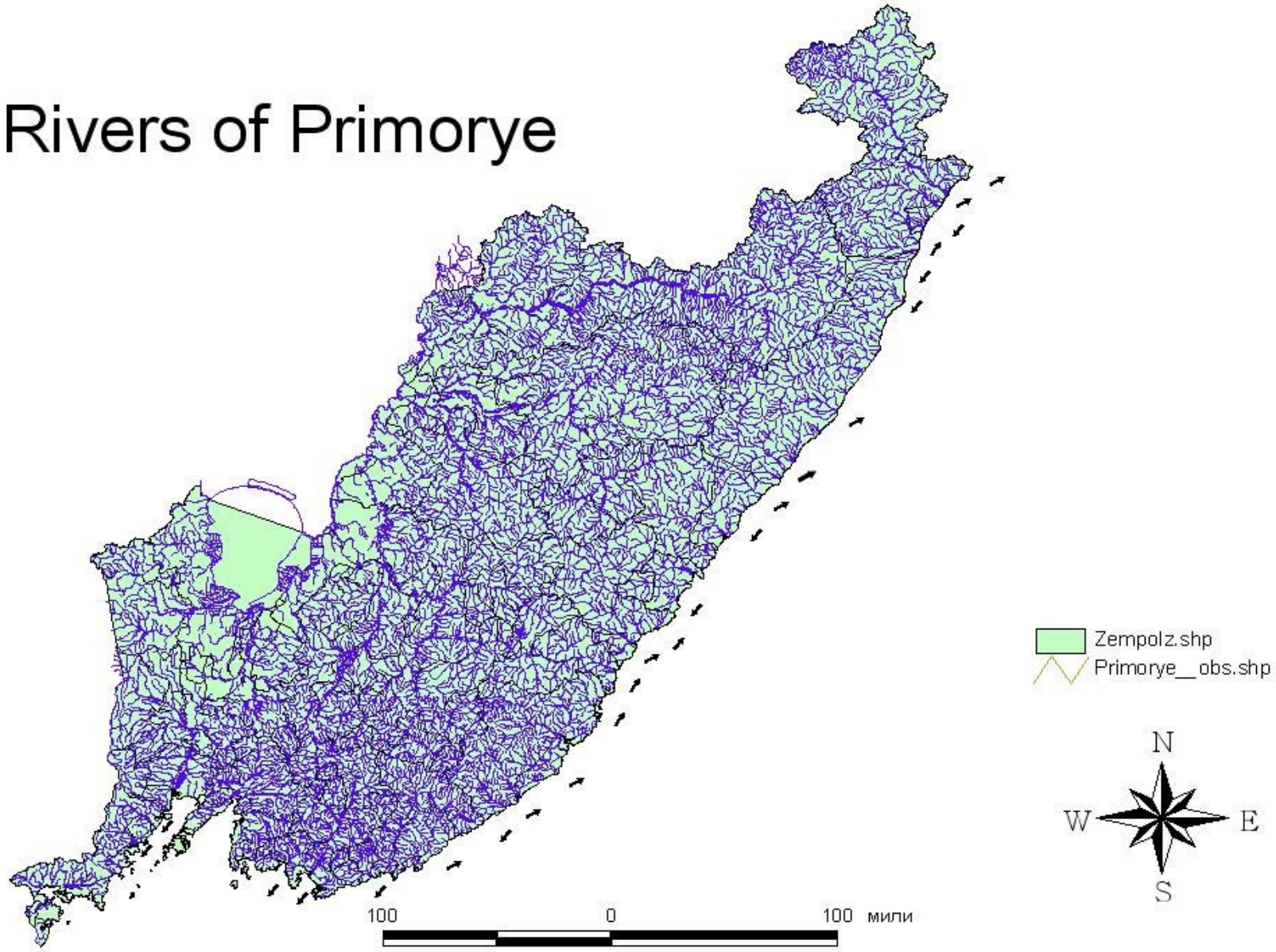
Functional role of coastal waters for salmon: is it an adaptation zone or a transit way?

Anatoly Semenchenko

TINRO-center, Vladivostok, Russia

ansemench@mail.primorye.ru

View of typical seaside coast with not indented coastline. Coast Abrazive alternate with bays where run a mouth of the rivers.



Direction of a river stream in the basic rivers

Continental coast of Primorye Krai. Rias type

The highland is dismembered by valleys of the rivers

In the north of region the width of river valleys reaches several kilometers (Samarga River)

Estuary is formed on the place of flooded river valley (Edinka River)

The list of freshwater and anadromous fishes of Samarga River

Fam. Petromyzontidae	13. *Osmerus mordax* (Mitchill) – Asiatic smelt
1. *Lethenteron japonicum* (Martens) - Pacific river lamprey	**Fam. Cyprinidae**
2. *Lethenteron reissneri* (Dybowski) – Pacific brook lamprey	14. *Phoxinus lagowskii* Dybowski – Lagowski`s minnow
Fam. Salmonidae	15. *Tribolodon brandti* (Dybowski) – Pacific redfin
3. *Brachymystax lenok* (Pallas) - lenok	16. *Tribolodon hakonensis* (Günther) – Big-scaled redfin
4. *Oncorhynchus keta* (Walbaum) – chum salmon	**Fam. Cobitidae**
5. *Oncorhynchus gorbuscha* (Walbaum) - pink salmon	17. *Barbatula toni* (Dybowski) – bearded stone loach
6. *Oncorhynchus masou* (Brevoort) – cherry salmon	
7. *Oncorhynchus kisutch* (Walbaum) - coho salmon	**Fam. Gasterosteidae**
8. *Parahucho perryi* (Brevoort) – Sakhalin taimen	18. *Gasterosteus aculeatus* (Linnaeus) – three-spined stickleback
9. *Salvelinus leucomaenis* (Pallas) – East Siberian char	19. *Pungitius sinensis* (Guichenot) – Amur stickleback
10. *Salvelinus malma kraschenninnikovi* (Walbaum) – Dolly varden trout	
Fam. Thymallidae	**Fam. Mugilidae**
11. *Thymallus arcticus grubei* Dybowski – amur grayling	20. *Mugil cephalus* Linnaeus – gray mullet
Fam. Osmeridae	**Fam. Cottidae**
12. *Hypomesus olidus* (Pallas) – pond smelt	21. *Cottus poecilopus* Heckel – spotted sculpin

Minnow – typical specimen in internal estuaries

Role of the salmon in fish communities

The review of the fish community structure shows prevalence of salmon fishes. The fish community is exposed to large seasonal changes and long-term cycles. The most simple two-year-old cycle of the number is observed for pink salmon. The difference in number of pink salmon generations of even and odd years during its approaches from the sea can change in tens times. Sometimes global changes of oceanic conditions are capable to render appreciable influence on return of pink salmon generation and the pink salmon course appears very weak instead of expected numerous approach.

Cherry salmon has more complex long-term dynamics of number, it is noticed, that it's approaches from the sea are lower in productive for pink salmon years.

SALMON UNDER THEIR RELATION TO ECOSYSTEM CAN BE DIVIDED INTO THREE GROUPS:

- ***Independent*** **Anadromous chum and pink. Ecological strategy - search of spawning substratum and concealment in the main river channel and additional system. Mass group spawning. Juveniles soon after the leaving from spawning redds migrate into the sea passively using the river stream. They do not use feeding resources of the river.**

- ***Dependent*** **Anadromous cherry, taimen, chars. Ecological strategy – search of spawning substratum and concealment in additional system, sometimes in the main channel or add channels. Chars has spawning between small groups of individuals, cherry and taimen - pair-territorial one. Juveniles after leaving spawning redds actively settle on the river system. These species juvenile are active predators and dominate in the river ecosystem and fish communities.**

- ***Resident*** **Resident species: lenok, greyling. All life cycle passes without change of the habitat of the river and sea waters. Greylings make seasonal migrations inside river system. Ecological strategy - search of spawning substratum and concealment in the main channel of the river. Streems are used for the feed of the juvenile at early stages of development. Juvenile and adult fishes polifag-predators. Juvenile eat fries of other fishes and larvaes of water insects. The zone of the habitat is narrowly specific. Lenok resides rarefy.**

Fishes of the Salmon rivers

Cherry Salmon. Fry

Cherry salmon, stream type. Parr – age 1+

Cherry salmon, smolt type. Age 1+ - 2+

Cherry salmon, spawning male

Cherry salmon, spawning female

Pink Salmon. Fry

Pink Salmon. Spawning male

Pink Salmon. Spawning female

Chum Salmon. Fry

Chum Salmon. Adult male

Juvenile Sakhalin taimen

Head of Sakhalin taimen

Adult Sakhalin taimen (23 kg)

Juvenile Dolly Varden (running form)

Adult Dolly Varden (Dolly Varden char)

Adult Dolly Varden (Local form)

Siberian char

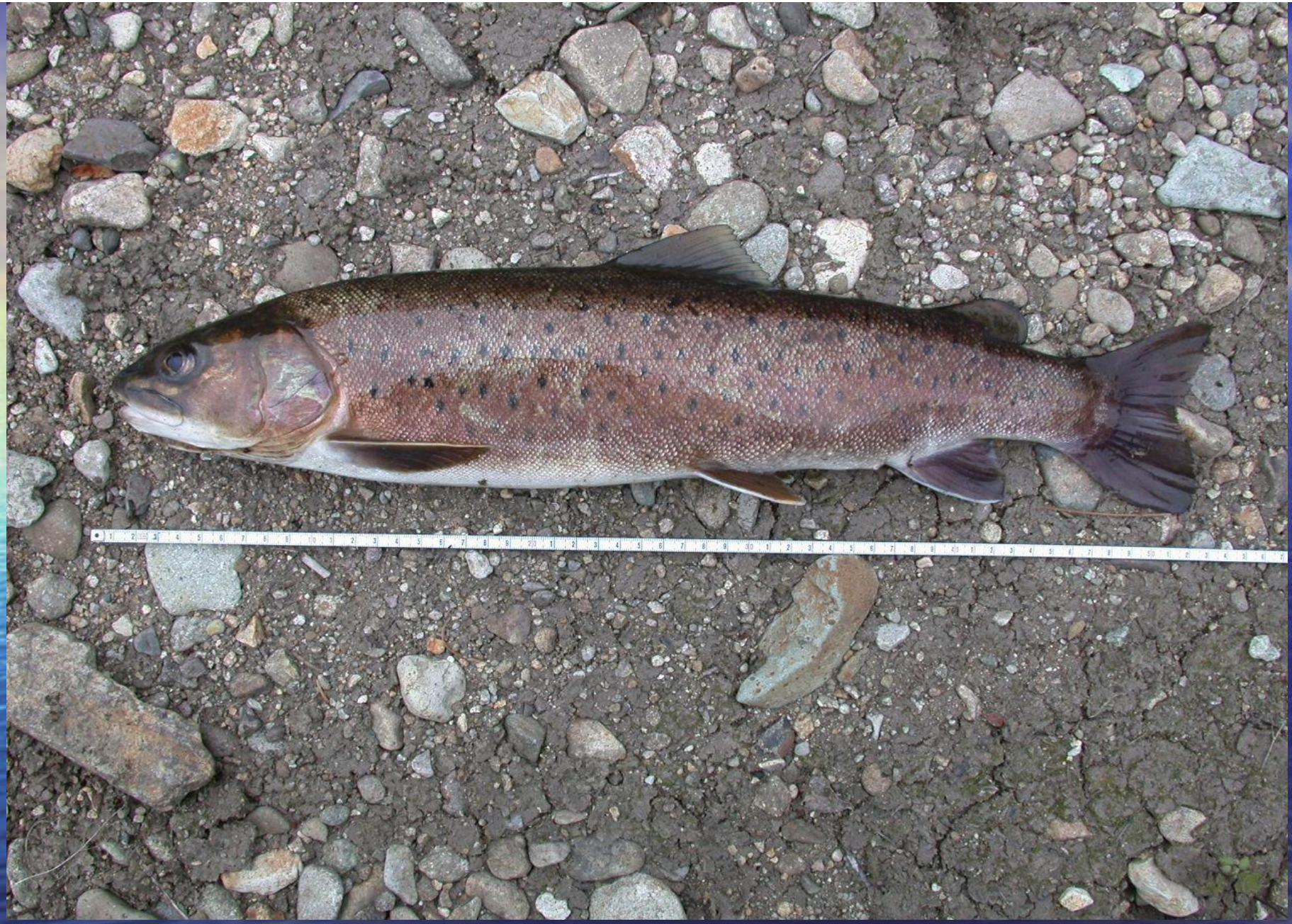
Pacific redfin

Lagowski`s minnow

Bearded stone loach

Lutera`s loach


Nine-spined sticklback

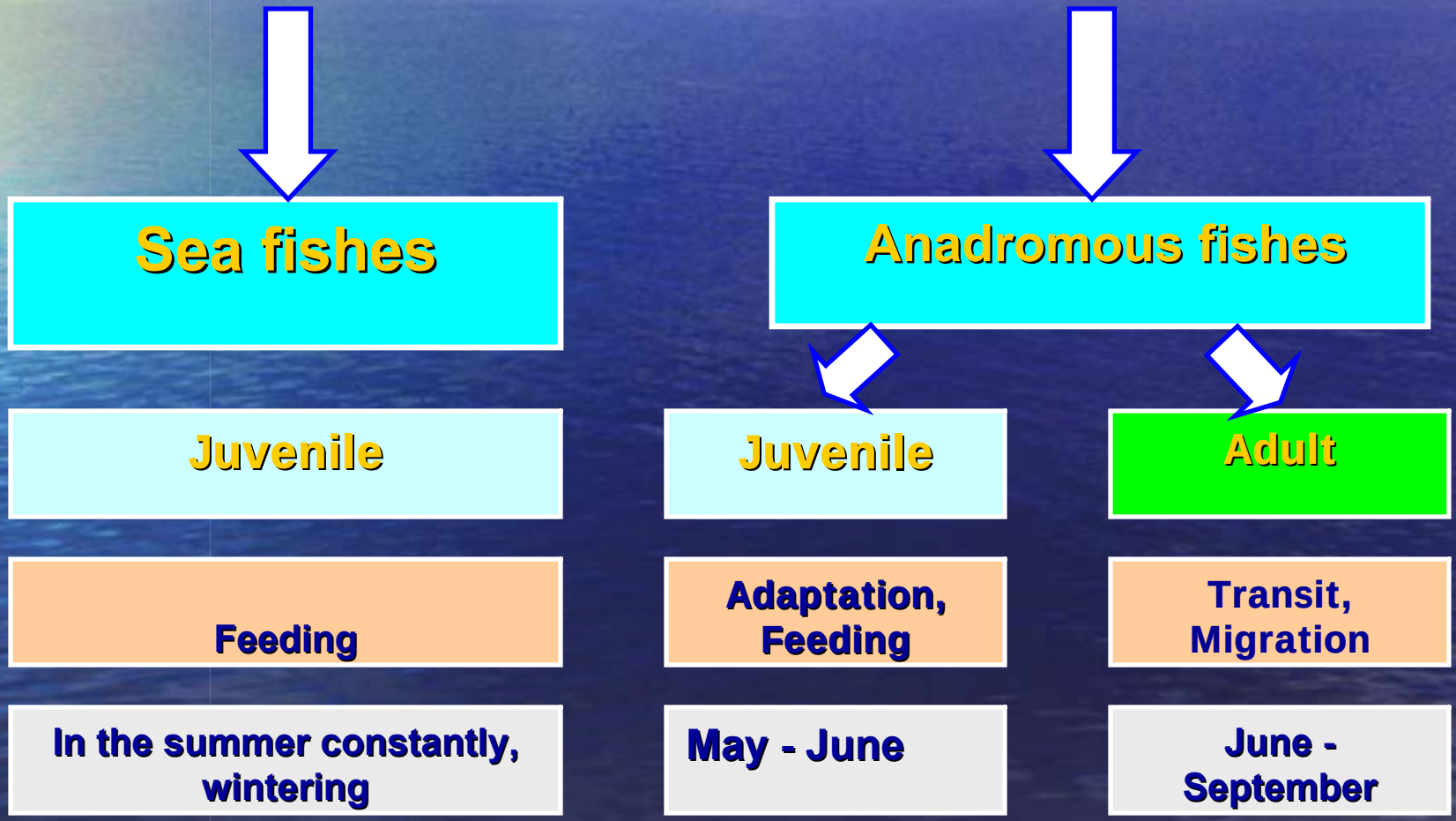


Lenok

Amur greyling

Amur sleeper (rotan goloveshka, rus.)

Biotha of coastal waters: sea littoral, estuary, lagoons



Property: Estuary animals with a wide range of tolerance

Function role: a feed, reproduction

Specific structure: sea fishes (short migration)

Pacific river lamprey	Lagowski`s minnow*
Smelts	Sculpins
Pacific redfin	Ratan goby
Big scaled redfin	Flatfishes
Mulet	Three-spined stickleback
Juvenile taimen	Amur stickleback

* Fresh-water origin

Property: Estuary animals with a wide range of tolerance

Function role: a feed, transit

Specific structure: adult anadromous salmon fishes

Cherry salmon	Active migration to the river. Very short adaptation period (delay) to new inhabitancy. The termination of the feed. The period: 1 - 5 days
Chum salmon	
Pink salmon	
Charrs	Active migration to the river. The short period of adaptation to a river inhabitancy. Do not stop the feed. The period: 1 – 15 days

Property: Estuary animals with a wide range of tolerance

Function role: a feed, smoltification

Specific structure: anadromous juvenile salmon fishes

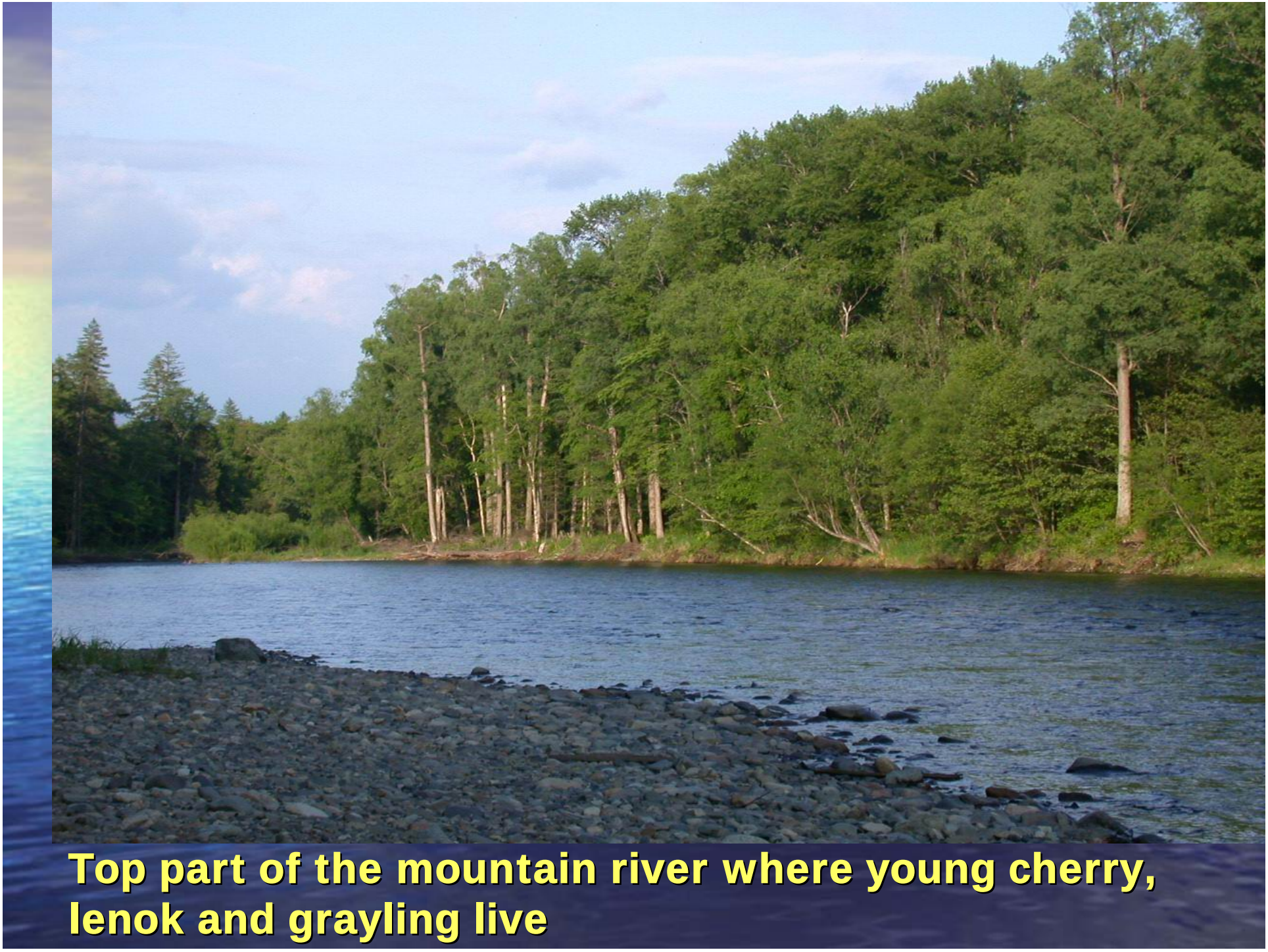
Cherry salmon	**Passive and active migration to the sea. Long adaptation period to new inhabitancy. Food migrations.**
Charrs	**Period: 15 – 45 days**
Chum salmon	**Passive migration to the sea. The short period of stay in estuary for a feed fodder zooplankton.**
Pink salmon	**Period: 5 - 15 days**

Running waters. Rhitron

Typical source of the mountain river (Crenal)

Inflow of the spawning river

Top part of the mountain river



Top part of the mountain river where young cherry, lenok and grayling live

River woody jams (sunk wood)

River reaches and stony taluses

Debris slide

River channels. Formation of meanders

Down stream part of the river is characterized by alluvial adjournment

Lagoons

River lagoon of the Samarga River

Design of the river lagoon and sandy bar

Mouth and lagoon of the Velikaya Kema River

Lagoon of the Samarga River

The river Estuaries of Primorsky Krai

Estuary of the Peya River

Lagoon and estuary of the Botchi River

Complex system of the river channel, old channel and lagoon

The small river with the mouth blocked by sandy bar many years ago

Position of the Samarga R. basin on a map of Primorsky Krai

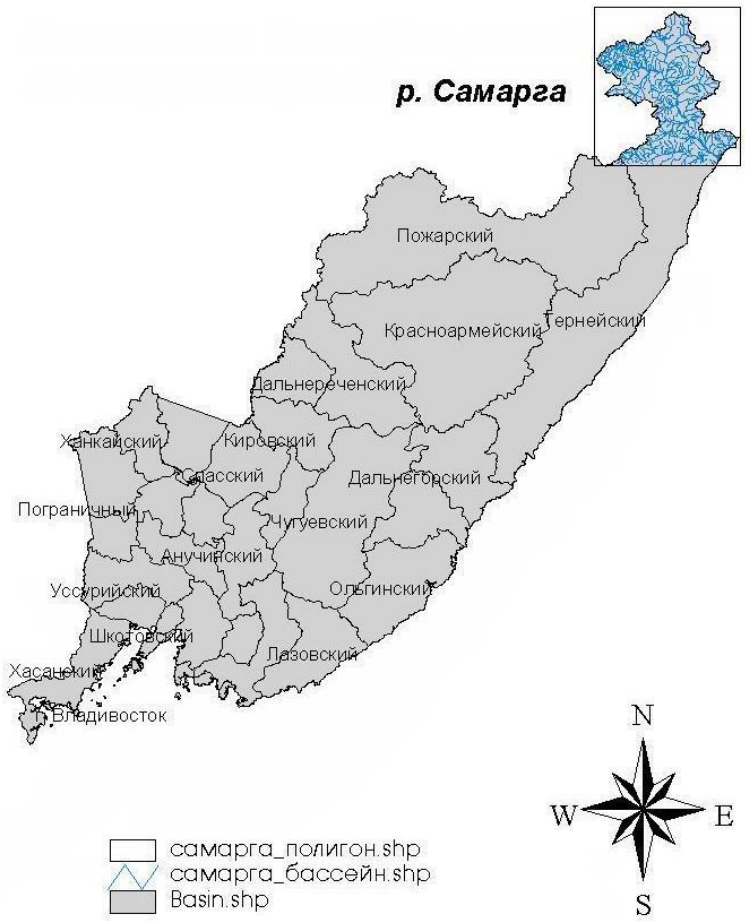
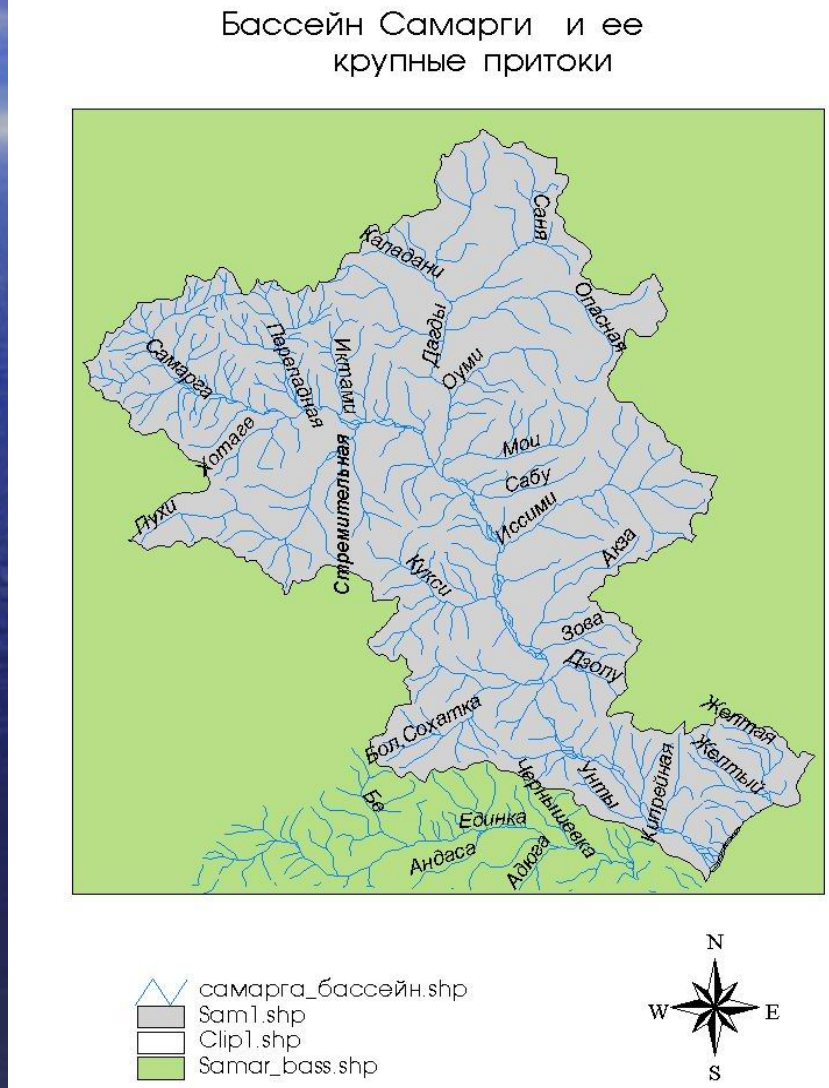
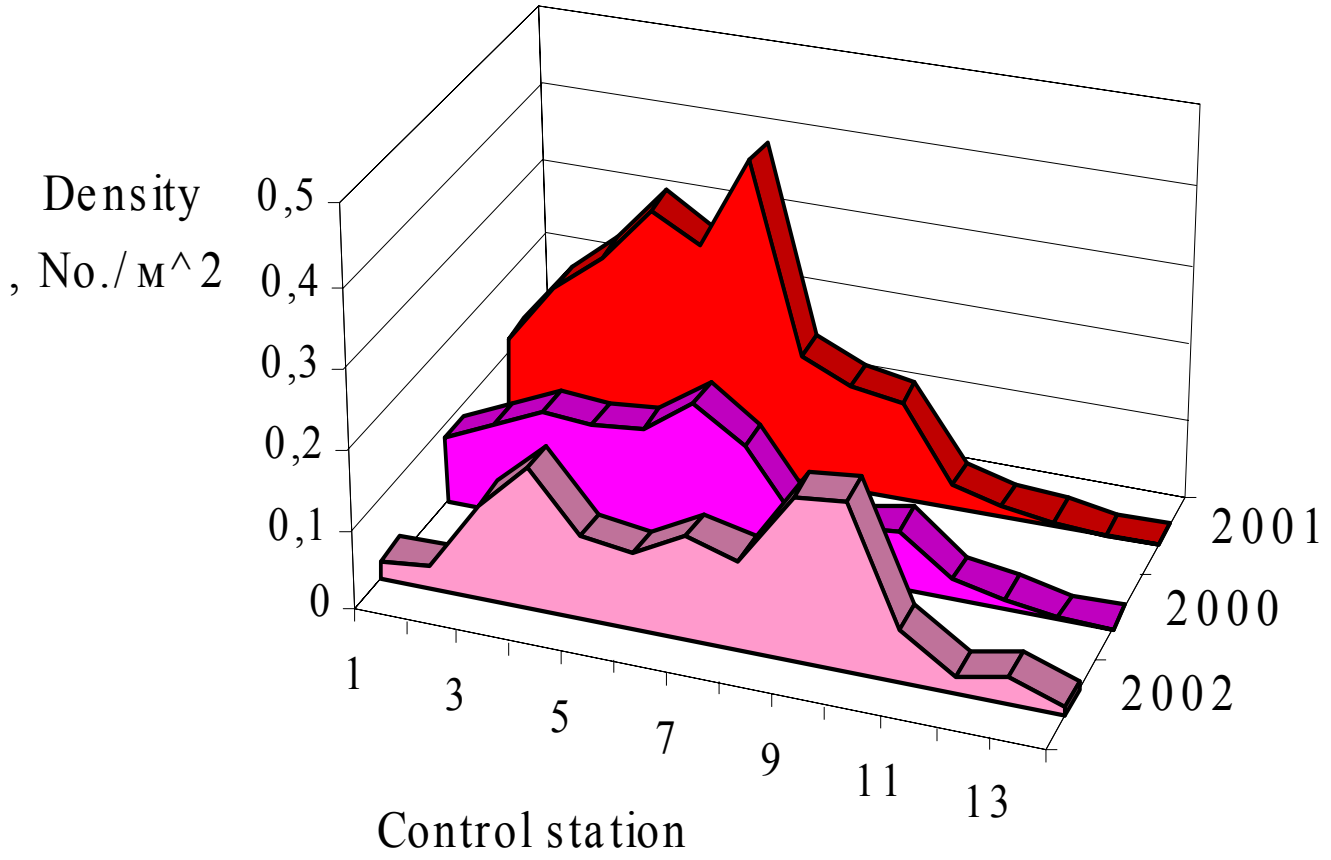


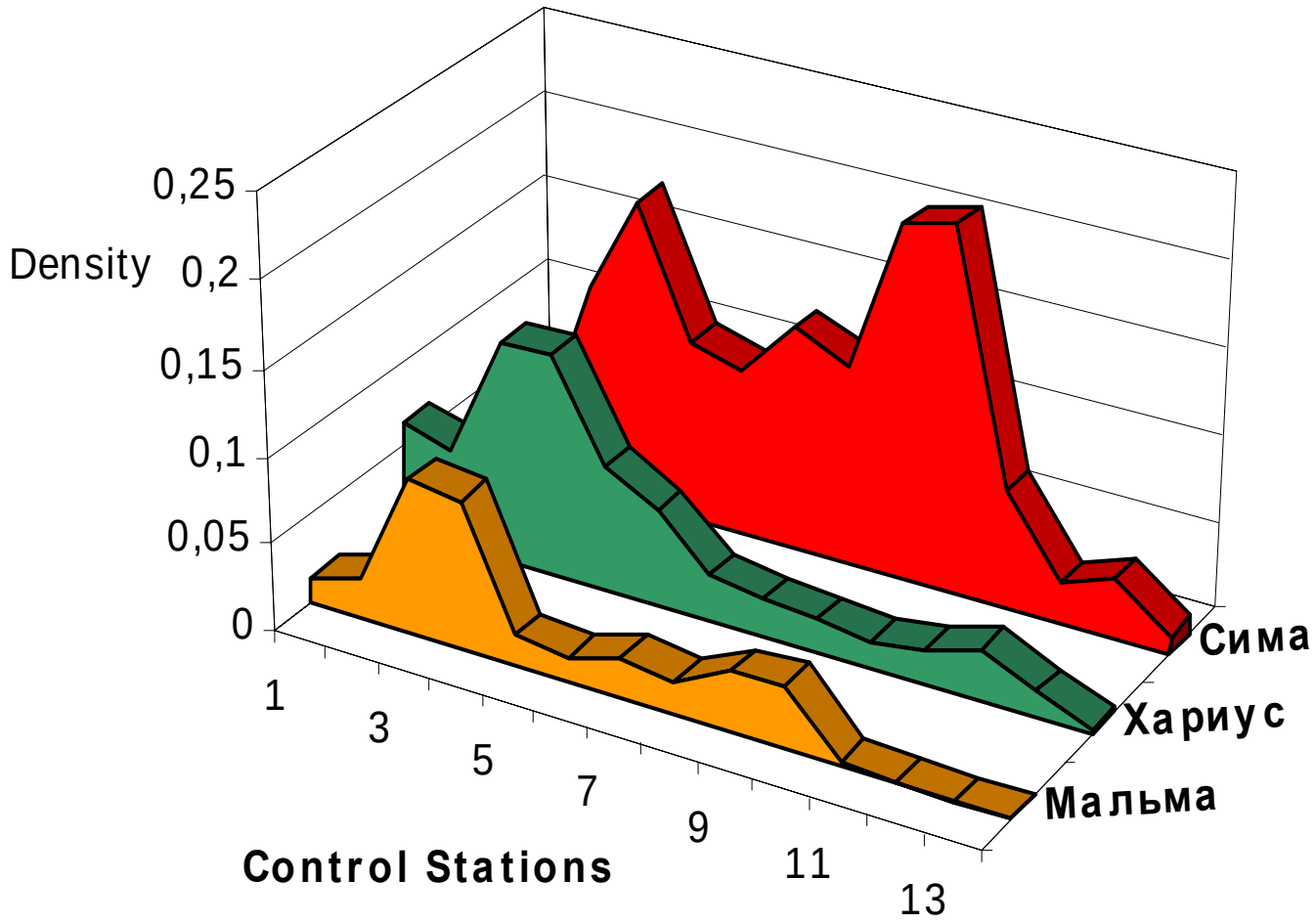
Рис. 1. Положение реки Самарга на территории Приморского края



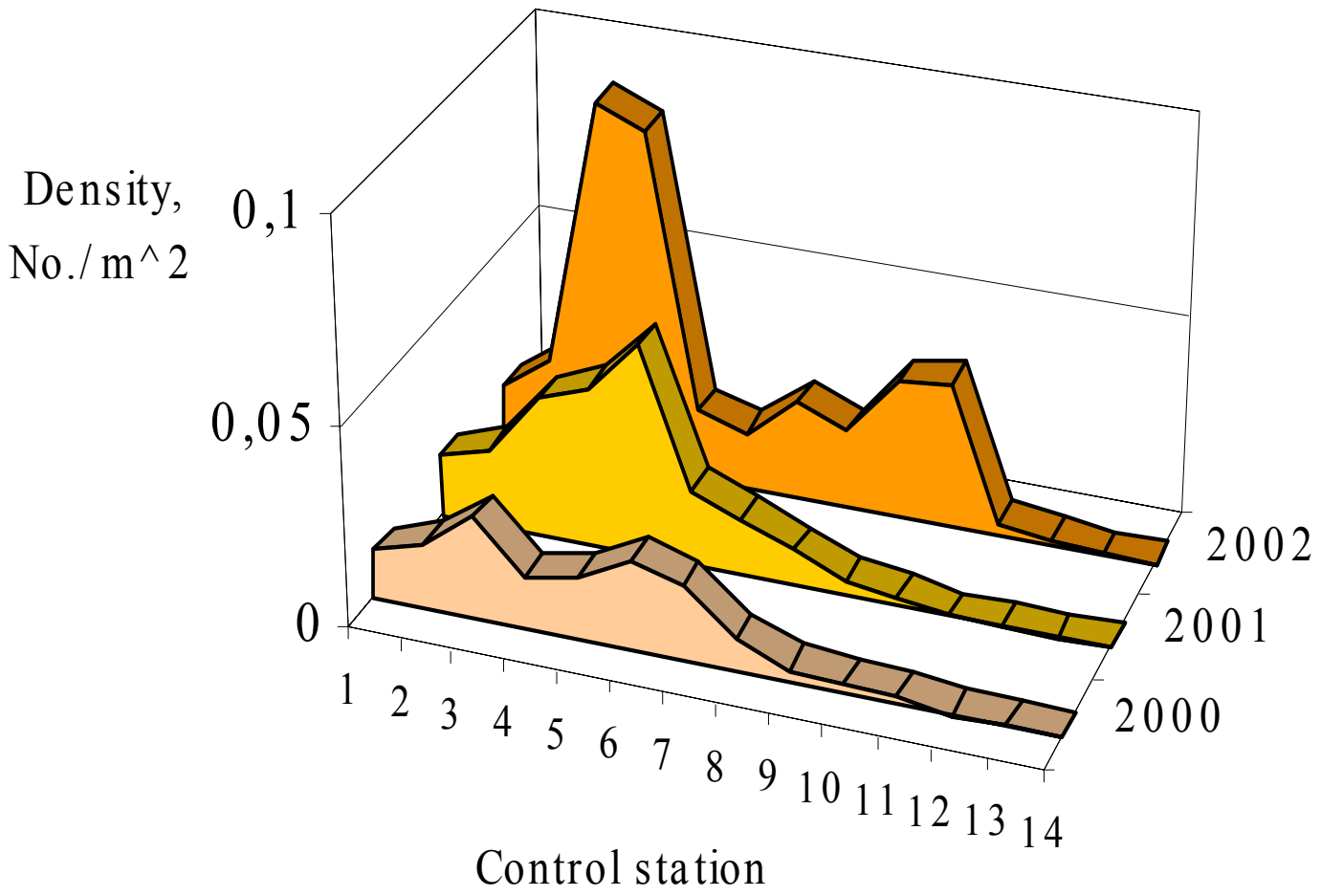
Distribution and density of the juvenile Cherry of Samarga River



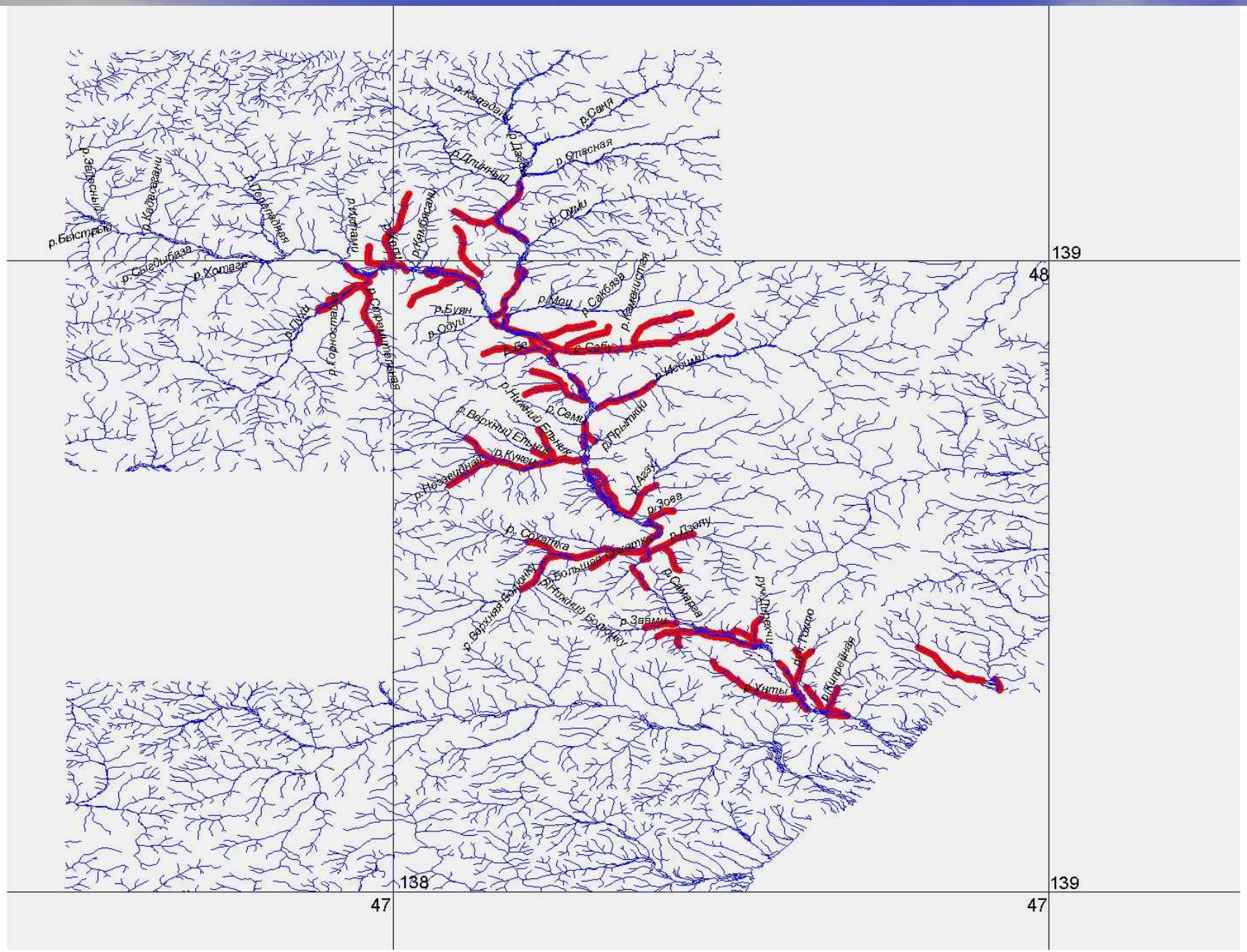
Distribution and density of the juvenile salmon at the medium and down streams of the Samarga River (July, 2002)



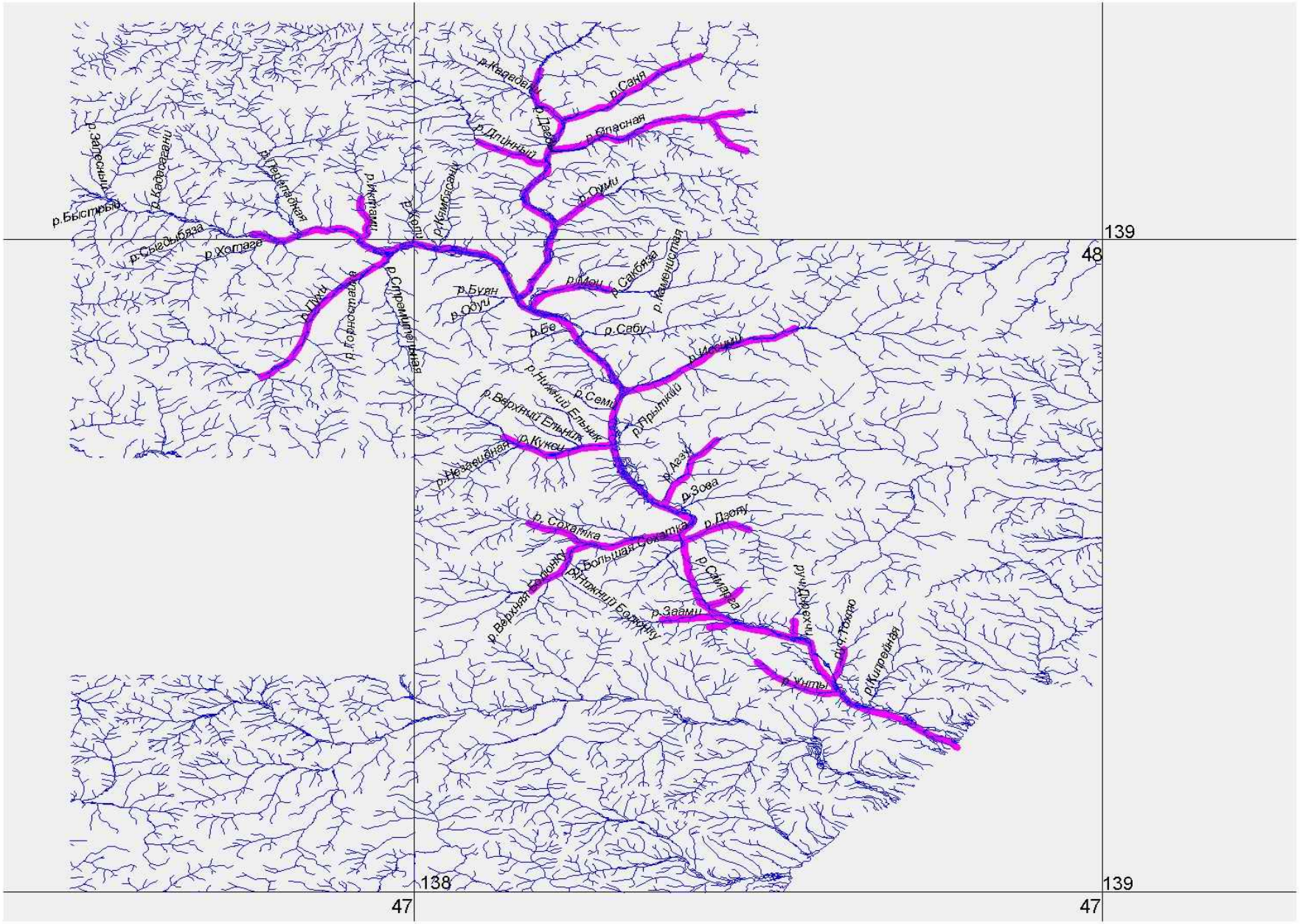
Distribution and density of the juvenile chars at the up stream and down streams of the Samarga River (July, 2000 - 2002)



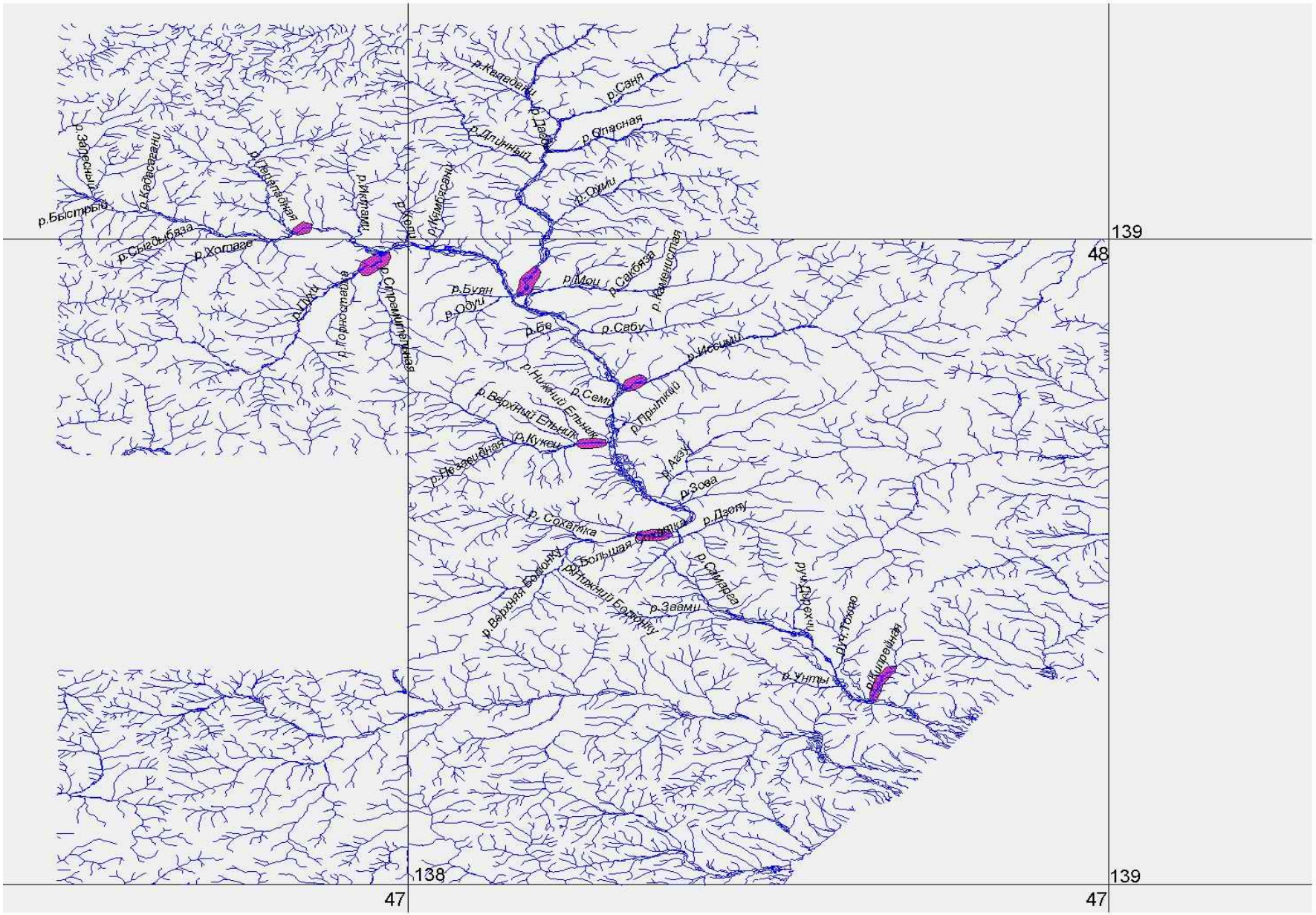
Cherry salmon. Distribution of spawning places in the Samarga River



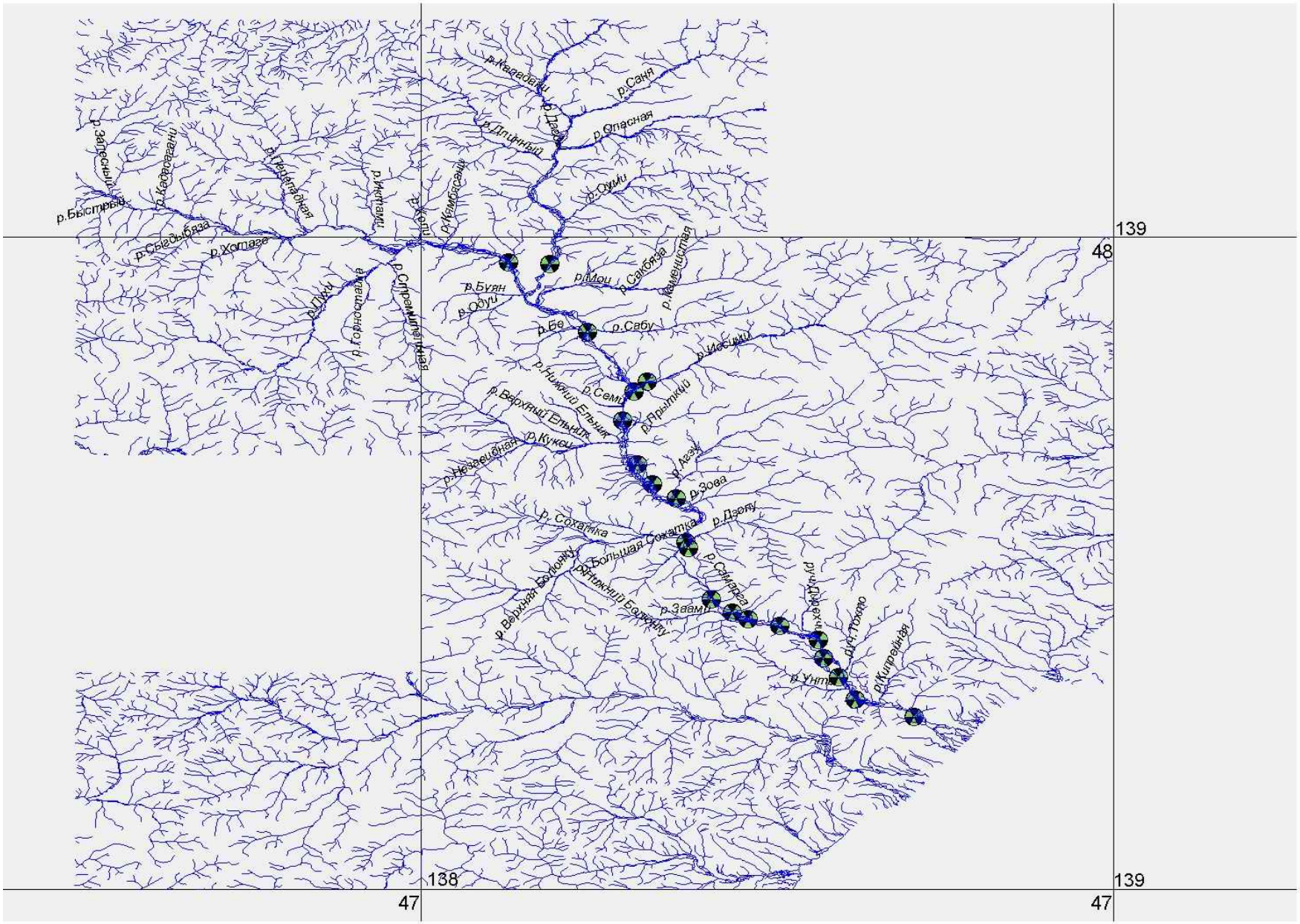
Pink salmon. Distribution of spawning places in the Samarga River



Chum salmon. Distribution of spawning places in the Samarga River



Sakhalin Taimen. Distribution of spawning places in the Samarga River



Thus, half-closed coastal reservoir in the river downstream is the interface or ecoton between sea and fresh-water ecosystems. This small space serves as a zone of the accumulation of river alluvium and organic substance coming from the upper reaches of the river.

Here formed system is specific and very dynamic to change of water conditions. Both estuaries and lagoons are very important and unique water space for the salmon.

So, answering question designated in the title of the report it is possible to say:

Yes, **for anadromous salmon** – chum, pink and cherry and for taimen it is **a transit way** wherefrom the river migration starts up to spawning places.

Yes, **for juvenile salmon** it is **a zone of the adaptation** where very important for its physiological osmoregular processes pass. Here last phase of life cycle connected with river ecosystem is finished. Juvenile chum and pink stay on a short time in the estuaries before the output into the sea. Juvenile cherry salmon remains in estuary space to the end of summer and then moves into open sea.

Estuary zone is original ecological gout for salmon which provides smooth transition to qualitatively new water environment.

Thank you for attention