



Russian Federal Institute of Fisheries and Oceanography
Moscow, Russia

INTEGRATED METHOD FOR SOCKEYE SALMON STOCK DIFFERENTIATION IN THE WEST PACIFIC AND THE SEA OF OKHOTSK

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Distribution of sockeye salmon in Asia



Sockeye salmon population structure studies

Population differentiation methods

Biological markers

Tagging

Morphological

Parasitologic

Genetic markers

Immune-genetic

Molecular genetic

Biochemical

Micro-satellites

DNA-fingerprinting

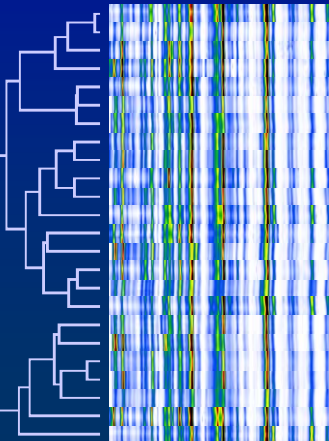
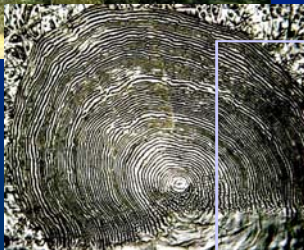
mtDNA

SNP

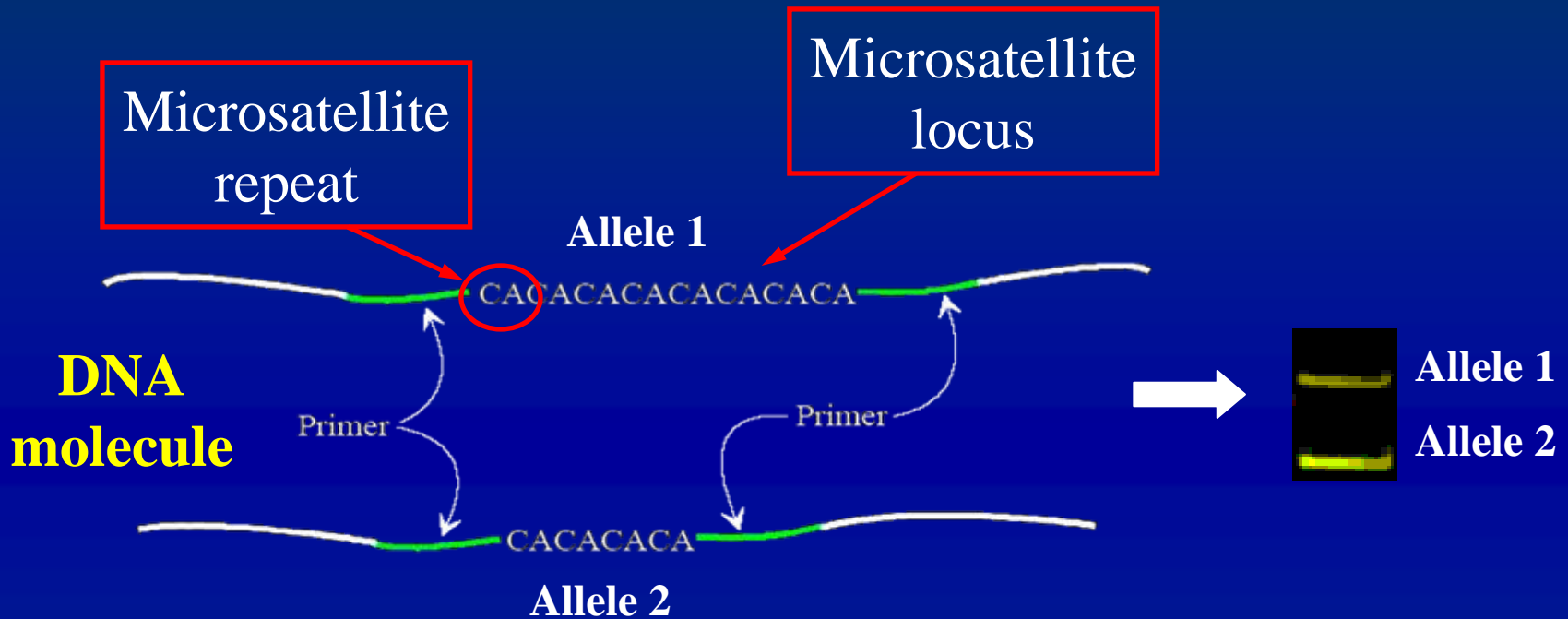
RFLP

AFLP

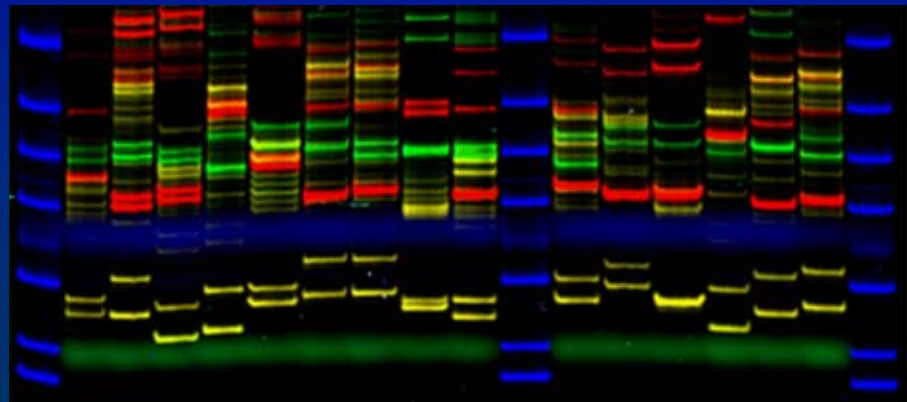
RAPD



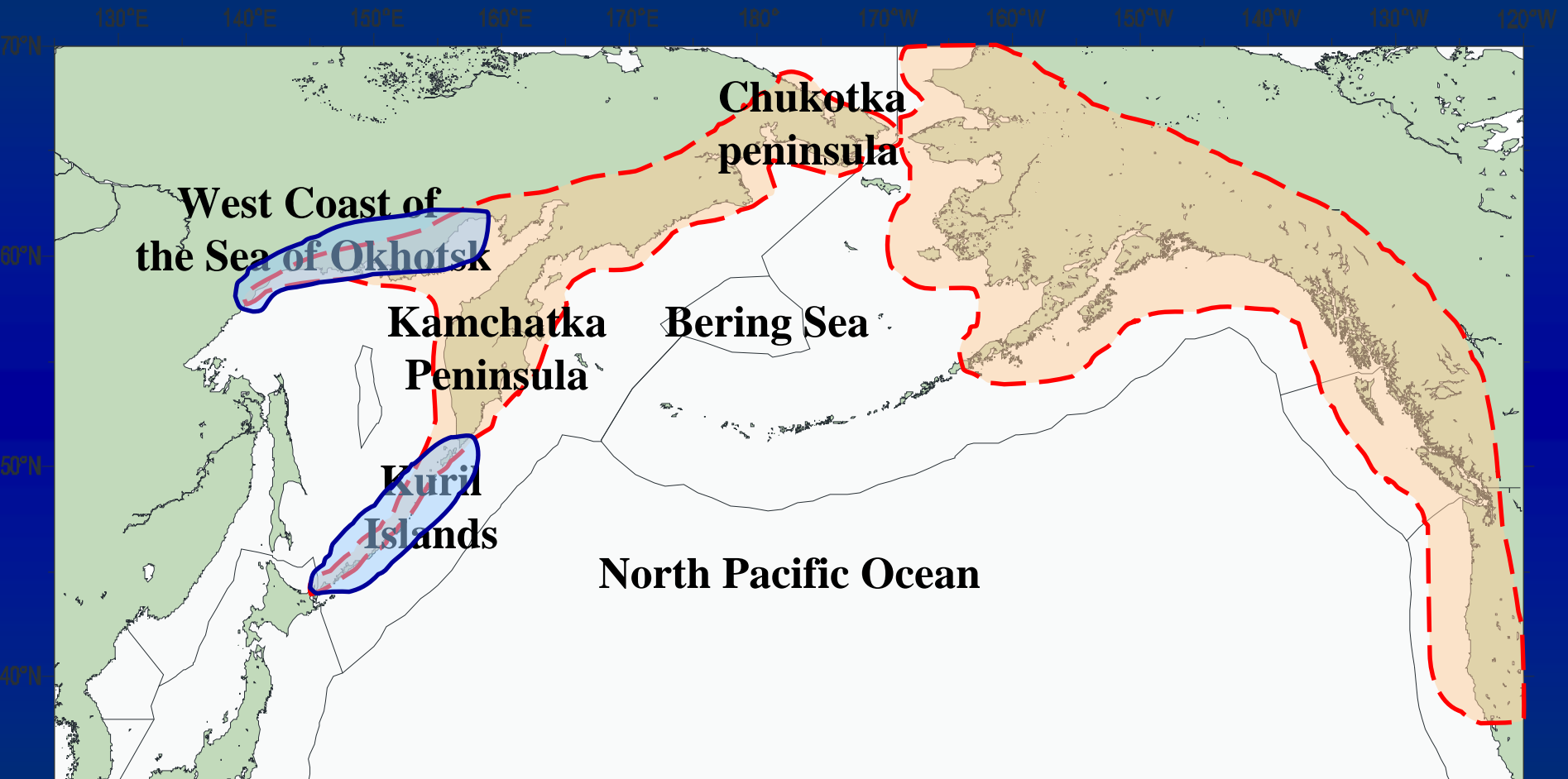
Microsatellite markers



Microsatellite DNA polymorphism



Distribution of sockeye salmon

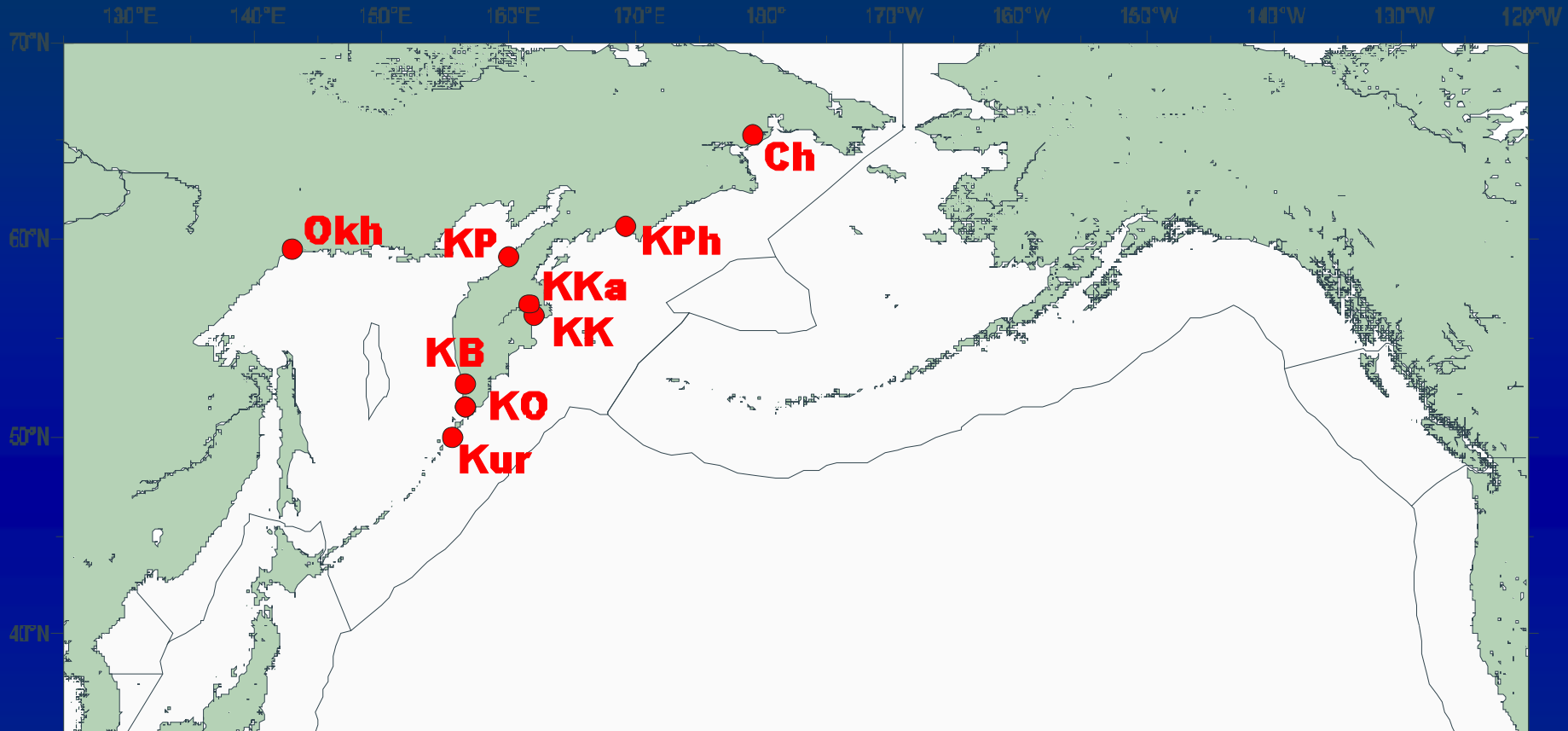


- Sockeye salmon area



- Unexplored area

Populations studied



Ch – Chukotka peninsula

Kur – North Kuril Islands

Okh – Okhota R.

Kamchatka peninsula:

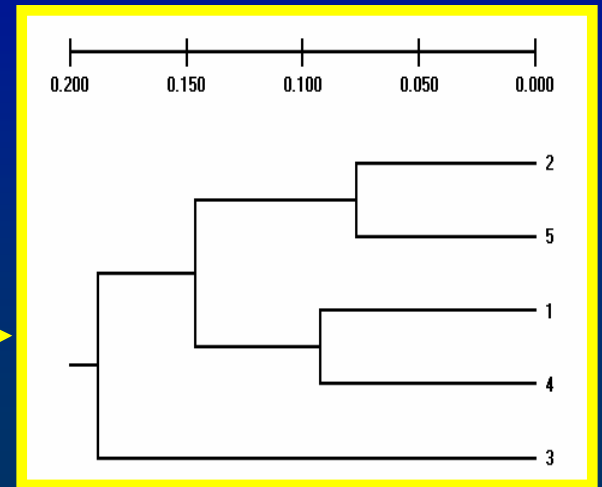
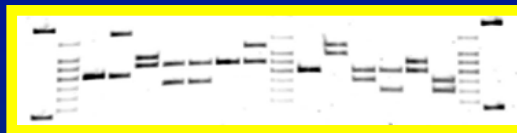
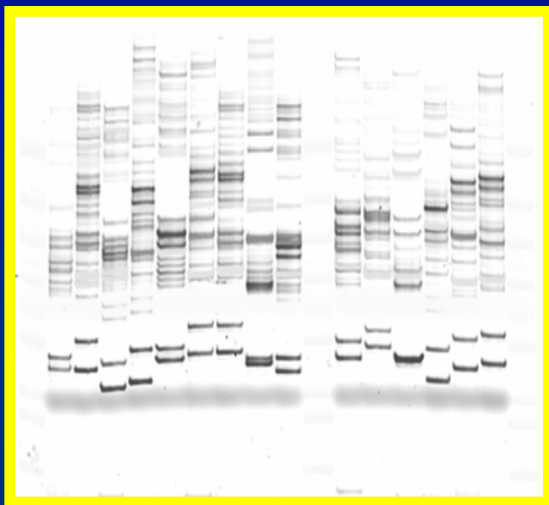
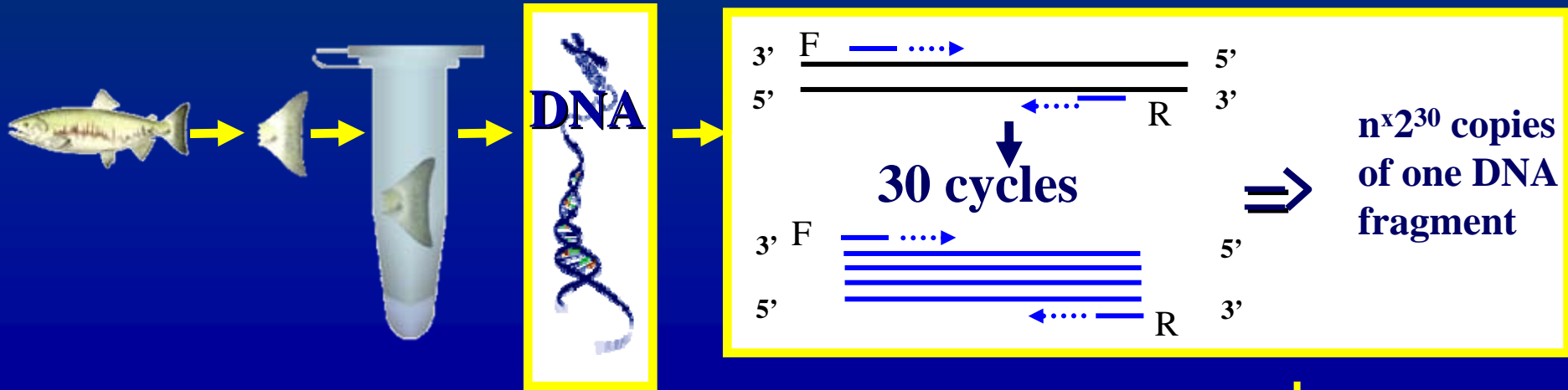
KPh - Pakhacha R.; **KK** - Kamchatka R., late run; **KKa** - Kamchatka R., early run;

KB - Bol'shaya R.; **KO** - Ozernaya R.; **KP** - Palana R.

Sampling locations, sampling dates, and number of fish studied

Population	Group	Date of sampling	Number of fish studied			
			Bio-analysis	Age determination	DNA extraction	Electrophoresis
Chukotka peninsula, Vaamochka Lake	Ch	28 July 2004	50	50	50	50
East Kamchatka, Pakhacha River	KPh	17-27 June 2005	67	67	60	55
East Kamchatka, Kamchatka River, late run	KK	29 June - 9 July 2004	200	200	100	55
East Kamchatka, Kamchatka River, Azabache Lake, early run	KKa	3-13 July 2004	150	-	80	60
West Kamchatka, Ozernaya River	KO	4-7 August 2003	200	200	100	100
West Kamchatka, Bolshaya River	KB-03	23-30 July 2003	200	200	100	100
	KB-04	11-20 August 2004	100	-	80	80
West Kamchatka, Palana River	KP	10-21 July 2003	200	200	100	100
West coast of the Sea of Okhotsk, Okhota River	Okh	22 July 2004	100	100	80	70
North Kuril Islands, Shumshu Island, Bettobu Lake	Kur	30 July - 5 August 2004	60	60	60	50

DNA extraction, DNA amplification, gel electrophoresis, and band analysis



Age structure in sockeye salmon populations studied

Freshwater period duration

1 year

Bol'shaya R.

Okhota R.

North Kuril Islands

1 – 2 years

Chukotka peninsula

Pakhacha R.

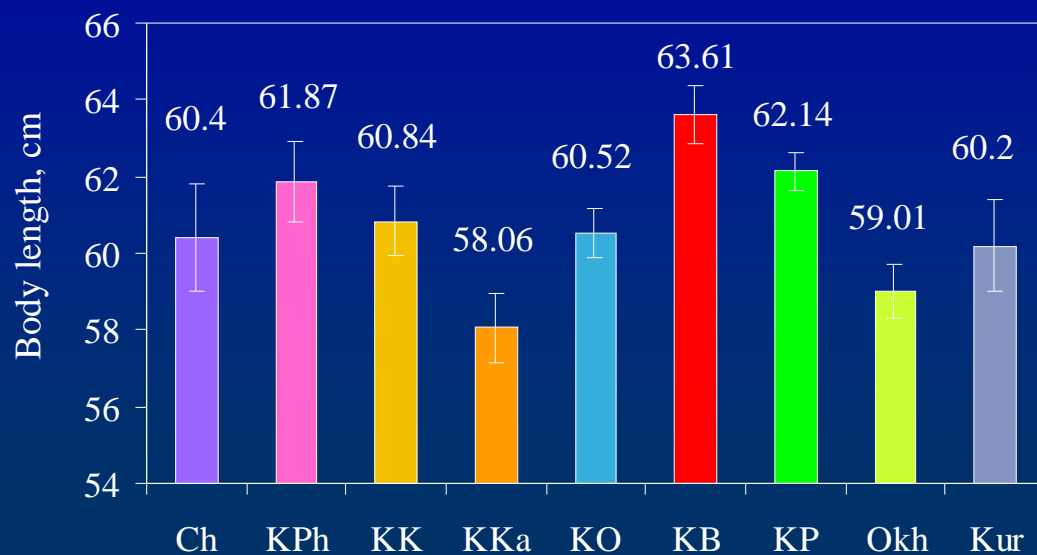
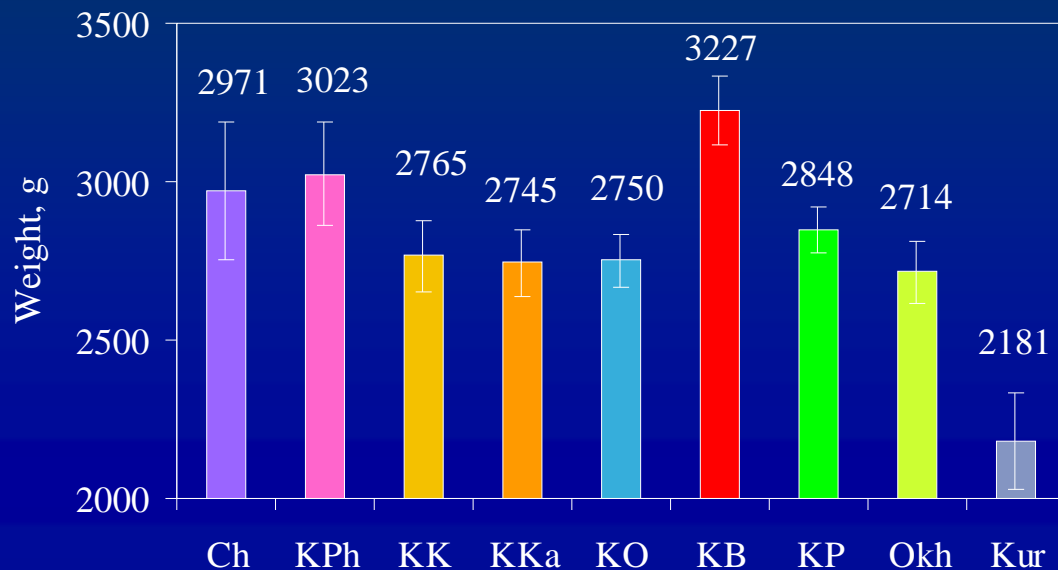
Kamchatka R.

2 years

Ozernaya R.

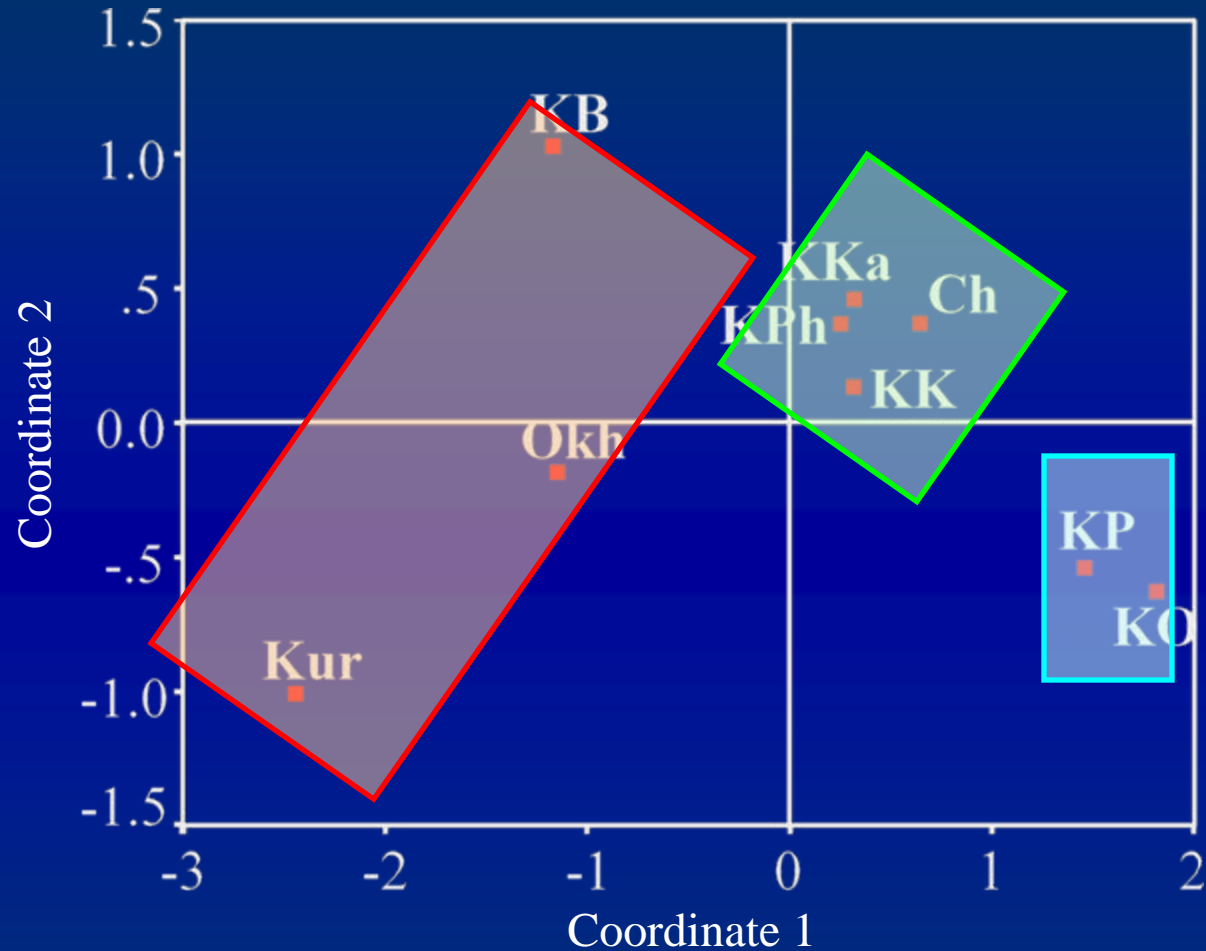
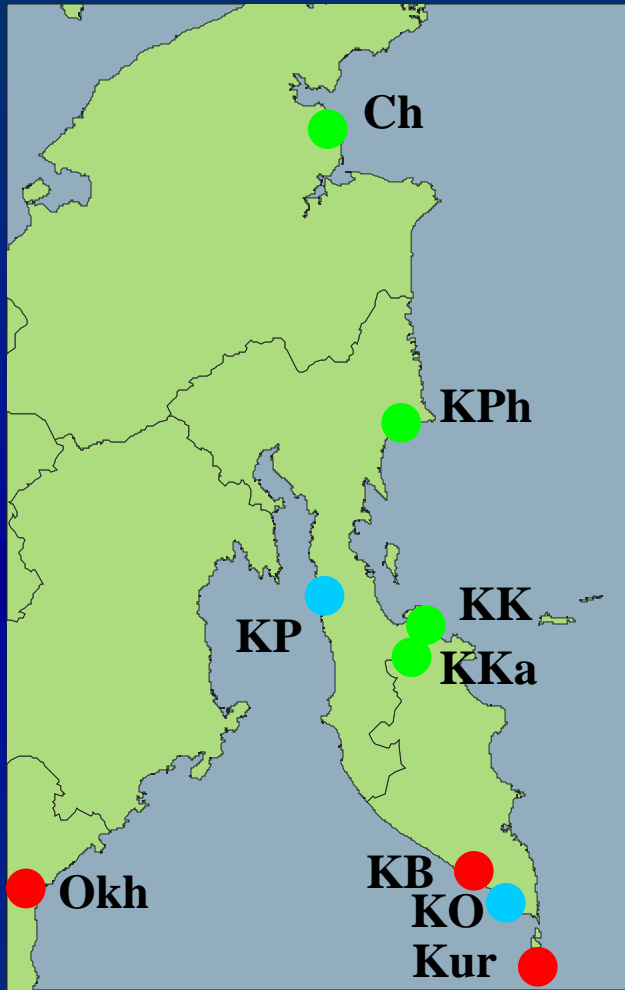
Palana R.

Mean size and weight of an individual in sockeye salmon populations



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Multidimensional scaling plot based on biological data



Ch – Chukotka peninsula

Kur – North Kuril Islands

Okh – Okhota R.

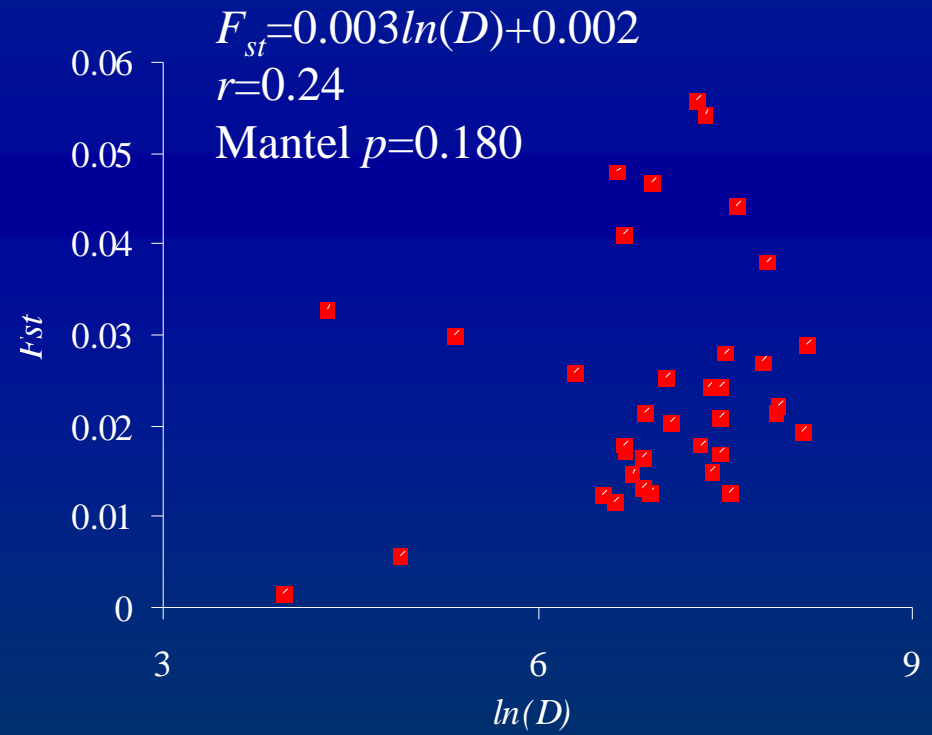
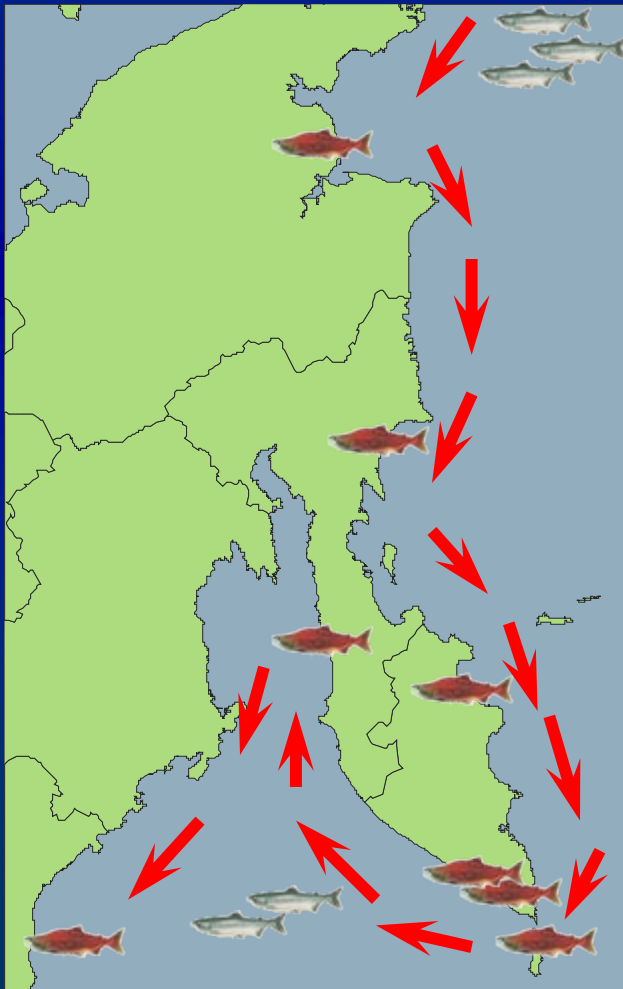
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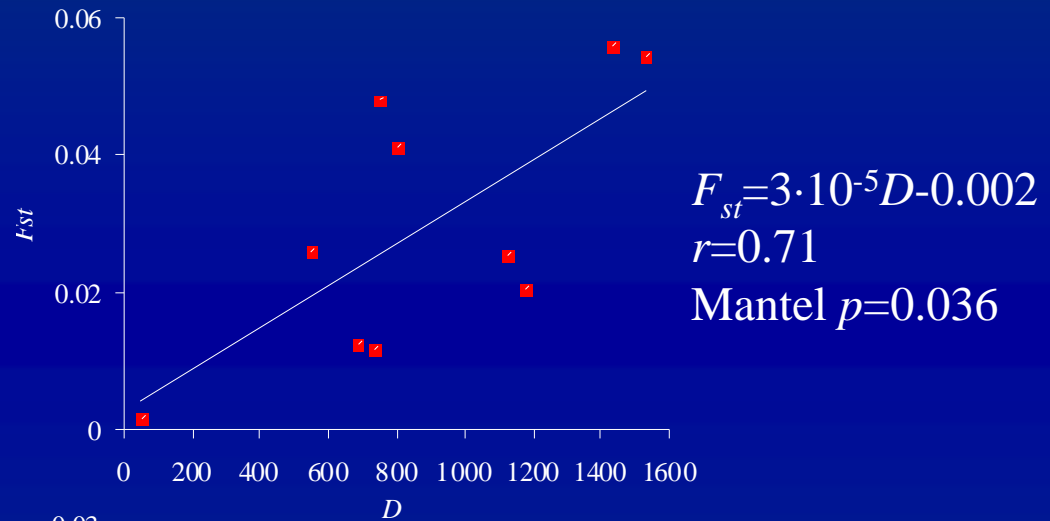
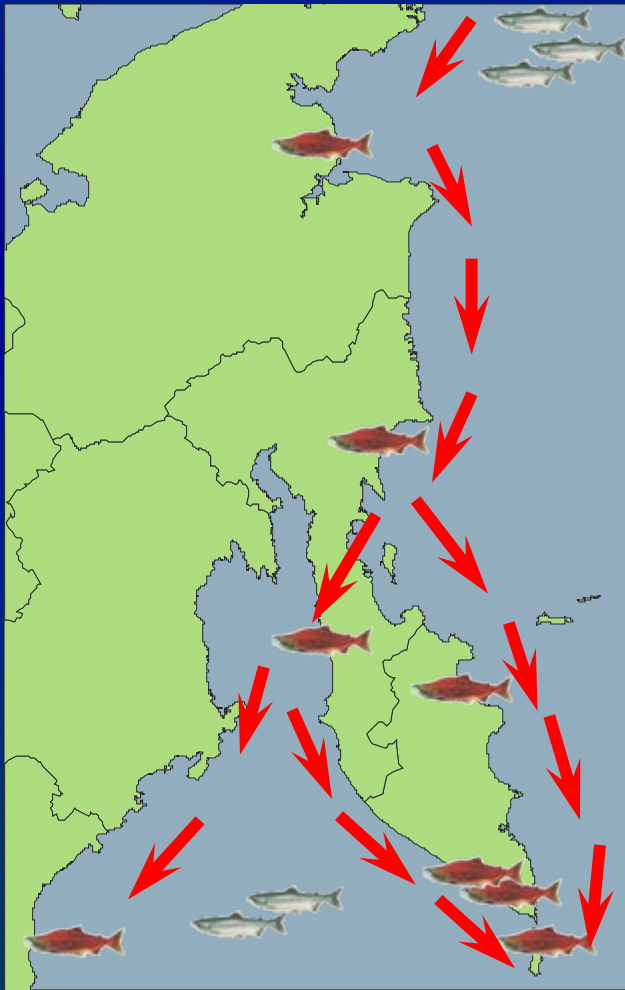
Correlation between genetic and geographic distances among sockeye salmon populations

Hypothetic colonization way

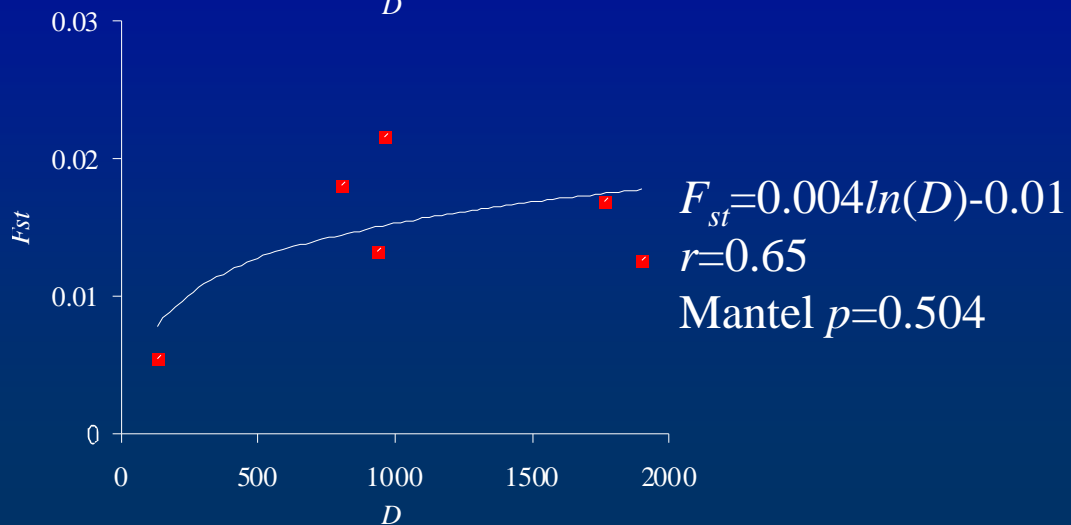


Correlation between genetic and geographic distances among Pacific coast populations (1) and Sea of Okhotsk coast populations (2)

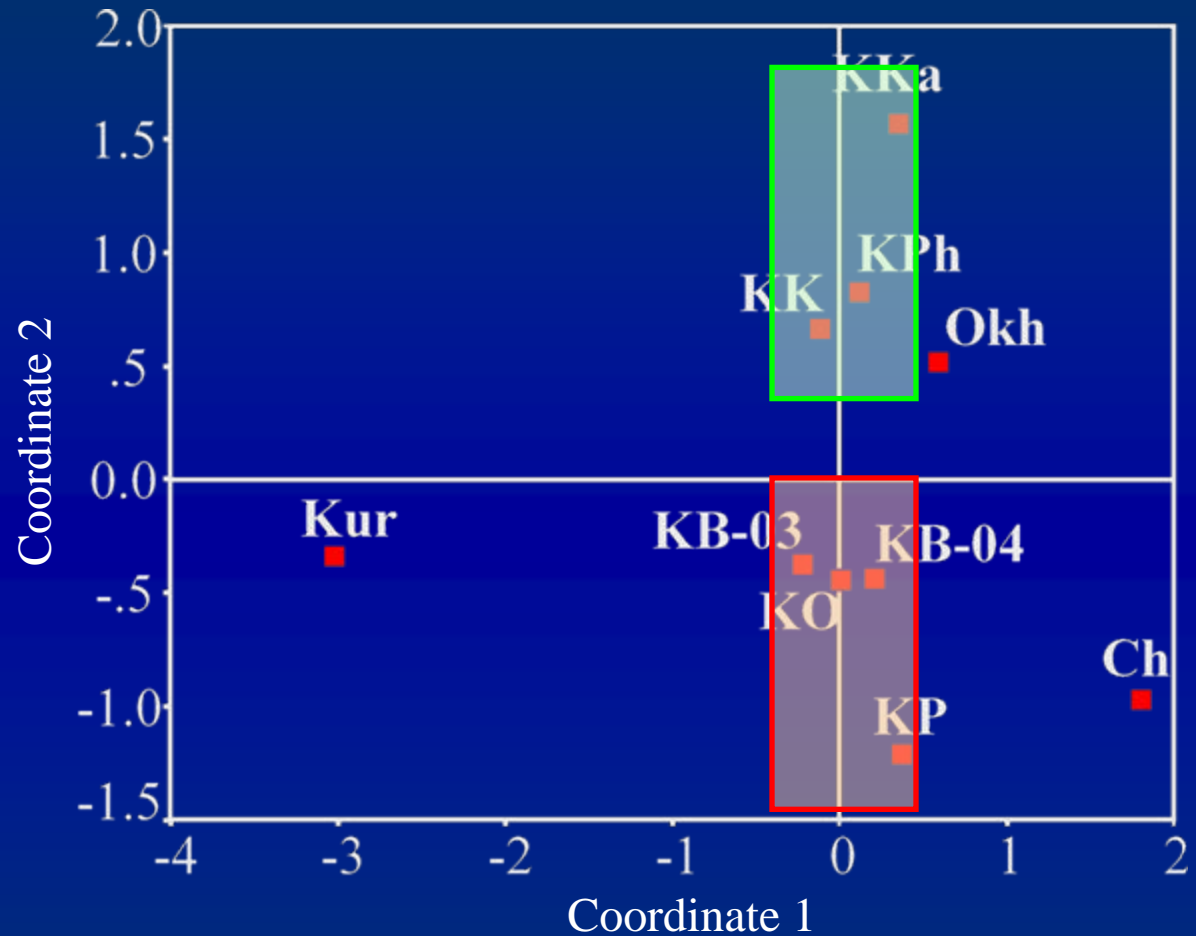
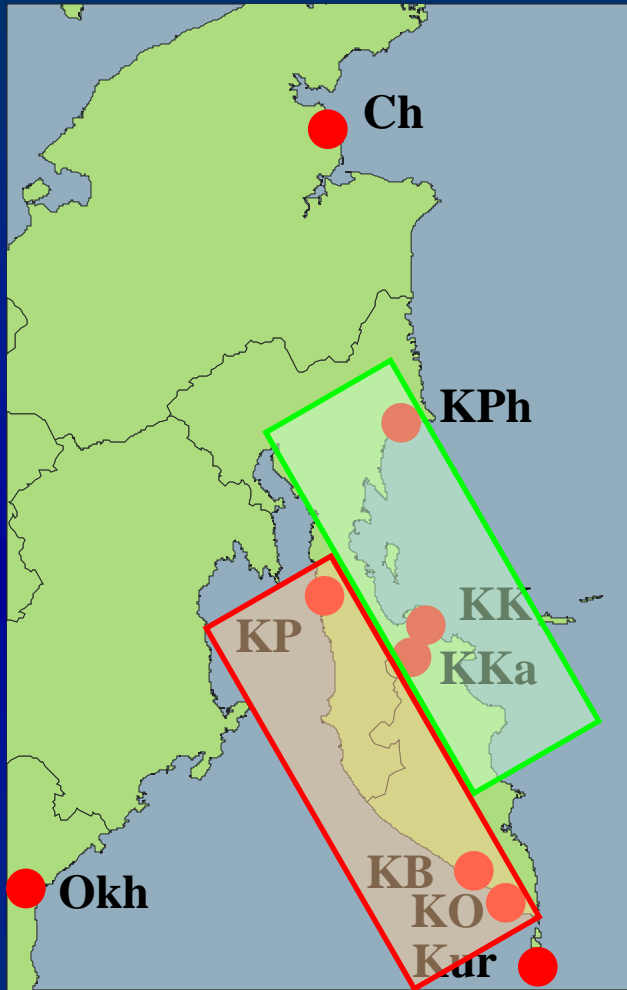
Hypothetic colonization way (1)



(2)



Multidimensional scaling plot based on genetic distances



Ch – Chukotka peninsula

Kur – North Kuril Islands

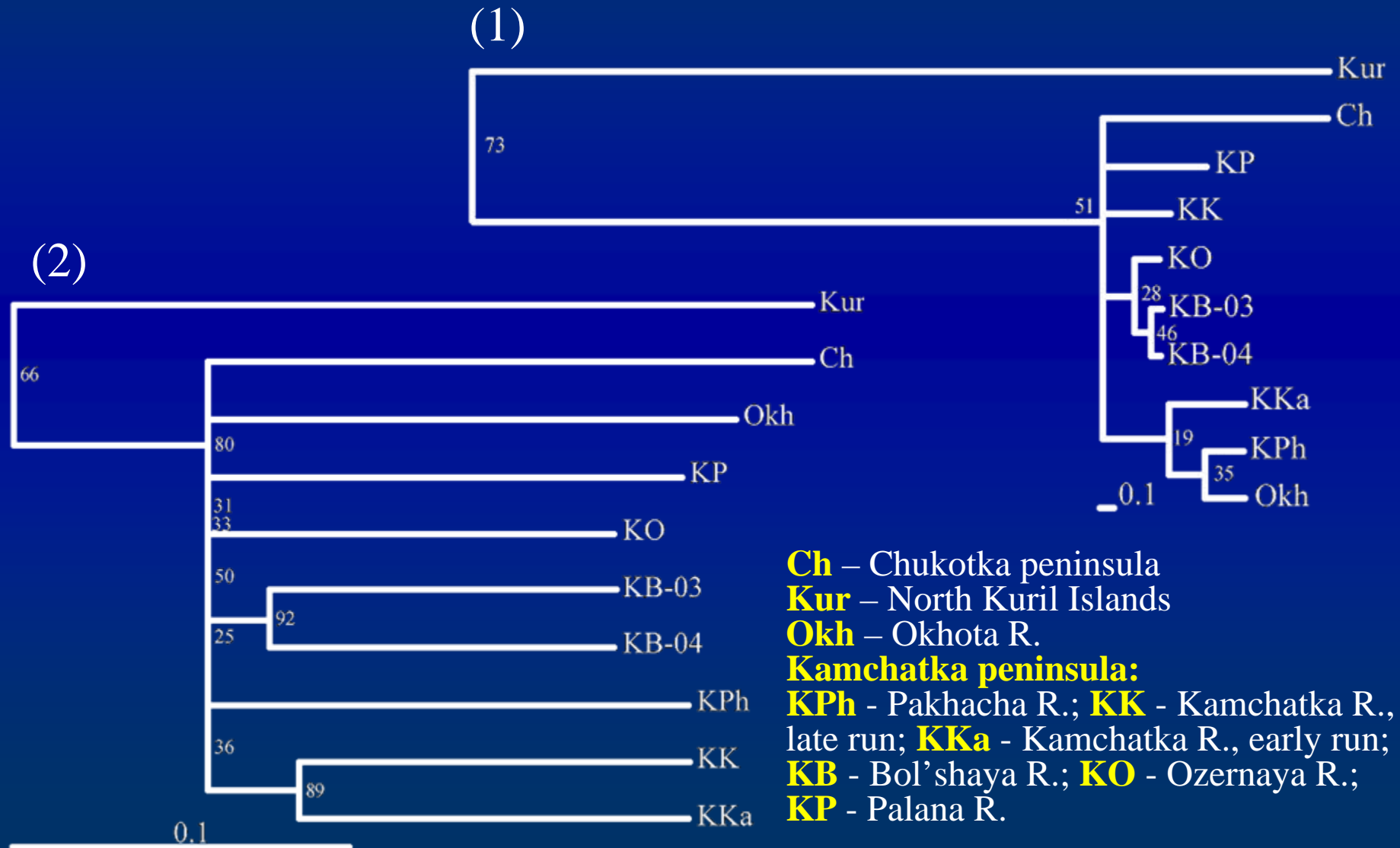
Okh – Okhota R.

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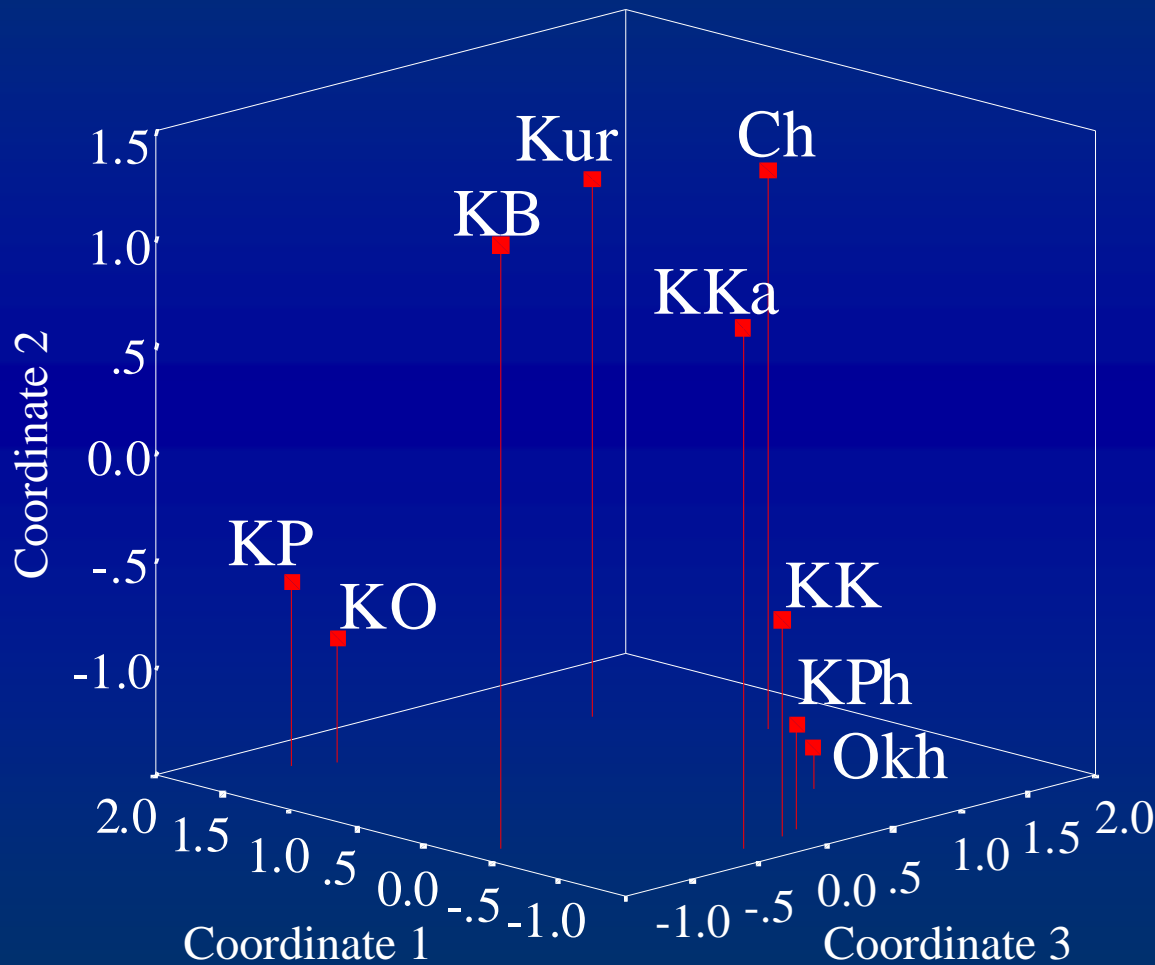
UPGMA-dendrogram of $\delta\mu^2$ (1) and chord distances (2) for 10 samples of Asian sockeye salmon



Mean estimated percentage stock compositions of single-population mixtures (correct = 100%) for 9 populations of Asian sockeye salmon

Population	Estimate
Chukotka (Ch)	79.2%
Kamchatka, Pakhacha R. (KPh)	80.8%
Kamchatka, Kamchatka R., late-run (KK)	74.5%
Kamchatka, Kamchatka R., Asabache L., early-run (KKa)	72.4%
Kamchatka, Ozernaya R. (KO)	60.0%
Kamchatka, Bolshaya R. (KB)	60.8%
Kamchatka, Palana R. (KP)	73.7%
Okhota R. (Okh)	61.7%
North Kuril Islands (Kur)	93.6%

3-D multidimensional scaling plot based on biological and genetic data



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Thank you for your attention!

