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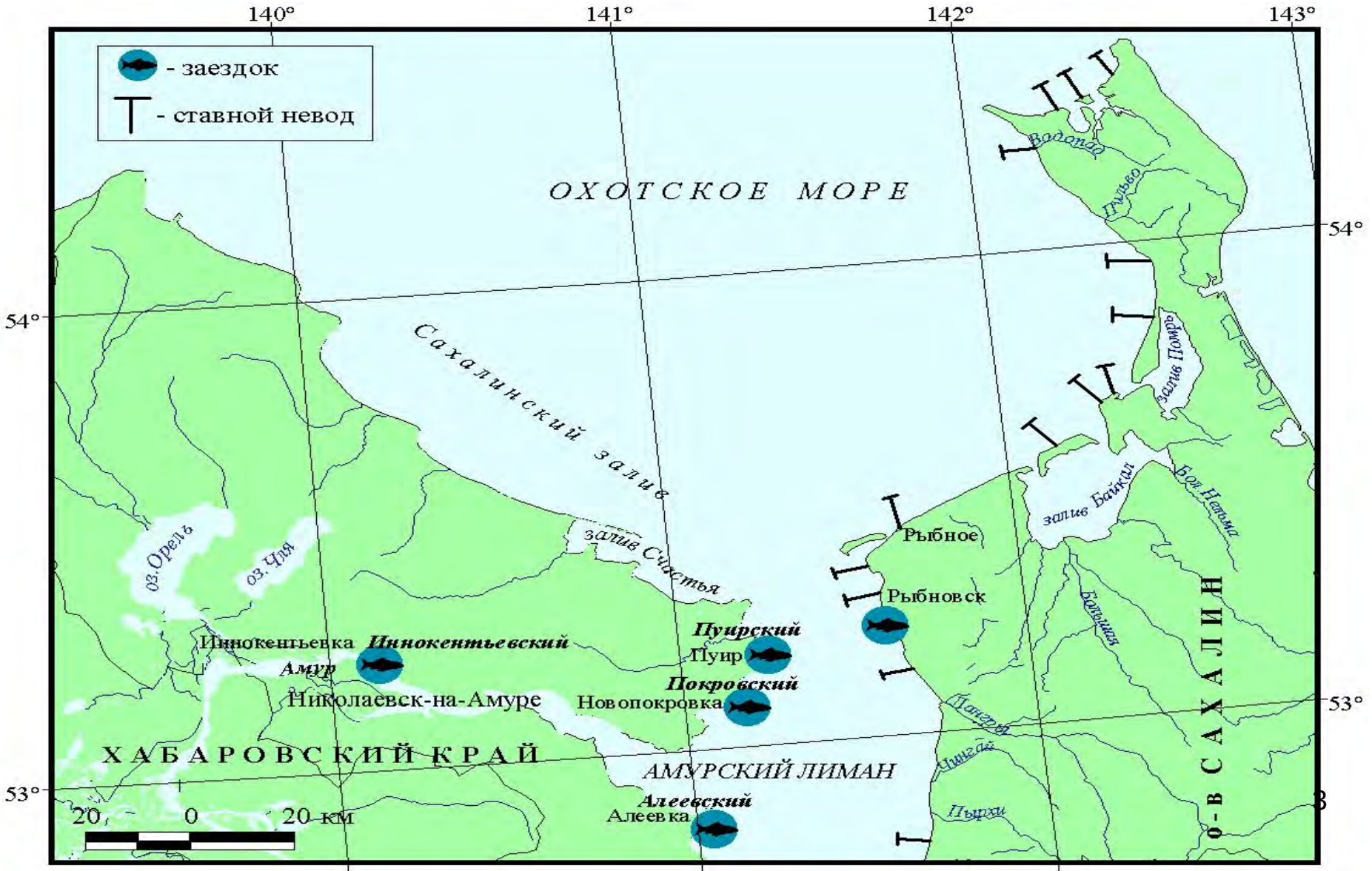
Contribution of Pacific salmon from the Amur River to the total salmon biomass of the North Pacific Ocean

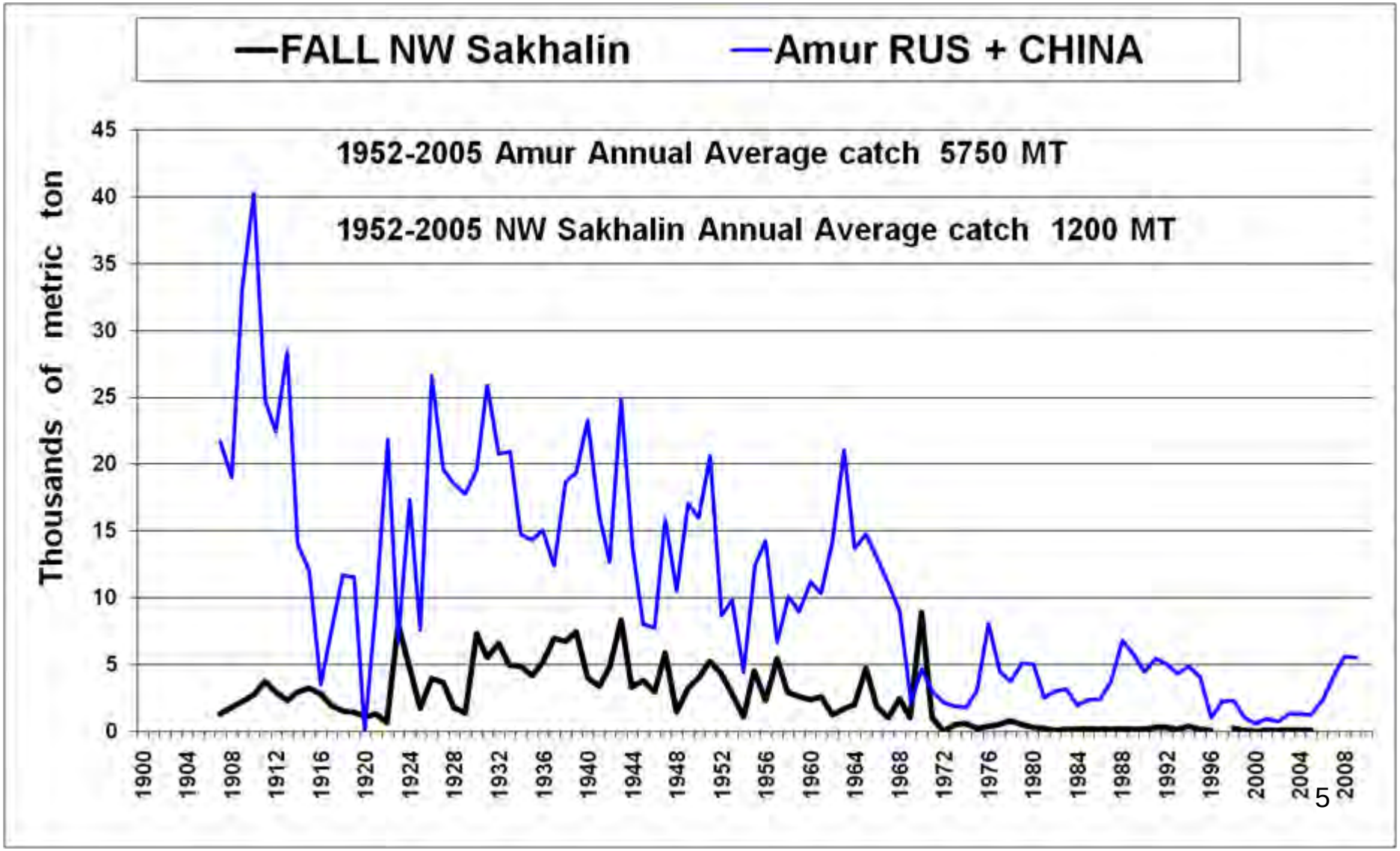

RUSSIA
Chitinskaya Oblast
Aginskii Buryatskii Avtonomnyi Okrug
Hentiy
Dornod
MONGOLIA
Suhbaatar
Neimenggu
Heilongjiang
Jilin
CHINA
Amurskaya Oblast
Khabarovskii Kral
Yevreiskaya Avtonomnaya Oblast
Primorskii Kral
SEA OF OKHOTSK
SEA OF JAPAN
BLAGOVESHCHENSK
KHABAROVSK
VLADIVOSTOK
120°
130°
140°
MONGOLIA
STATUS
National Wildlife Refuge
National Wildlife Refuge
National Nature Reserve
National Park
National Park
National Park
RUSSIA
STATUS
National Nature Reserve
National Nature Reserve
National Nature Reserve
National Nature Reserve
National Nature Reserve
National Nature Reserve
National Nature Reserve
National Nature Reserve
National Nature Reserve
National Nature Reserve
National Nature Reserve
National Nature Reserve
National Nature Reserve
National Wildlife Refuge
National Wildlife Refuge
National Wildlife Refuge
National Wildlife Refuge
National Wildlife Refuge
National Wildlife Refuge
National Park
CHINA
NAME
STATUS
1 Bachadao National Nature Reserve
2 Changbai Shan National Nature Reserve
3 Dalaihu National Nature Reserve
4 Fenglin National Nature Reserve
5 Hanma National Nature Reserve
6 Heifeng National Nature Reserve
7 Horighe National Nature Reserve
8 Honghua Ergi National Nature Reserve
9 Huihe National Nature Reserve
10 Huzhong National Nature Reserve
11 Ke'ergin National Nature Reserve
12 Liangshui National Nature Reserve
13 Longwan National Nature Reserve
14 Momoge National Nature Reserve
15 Mudanfeng National Nature Reserve
16 Nanwenghe National Nature Reserve
17 Naolihe National Nature Reserve
18 Qixinghe National Nature Reserve
19 Sanjiang National Nature Reserve
20 Tumuji National Nature Reserve
21 Wudalianchi National Nature Reserve
22 Xianghai National Nature Reserve
23 Xingkaihu National Nature Reserve
24 Yitonghuoshaniquan National Nature Reserve
25 Zhalong National Nature Reserve
State border
Provincial border
Settlement
City
Rivers
Amur Basin Boundary
PROTECTED AREAS OF RUSSIA AND MONGOLIA
National Nature Reserve
National Park
National Wildlife Refuge
PROTECTED AREAS OF CHINA
National Nature Reserve

Net set commercial fisheries area near Amur River mouth

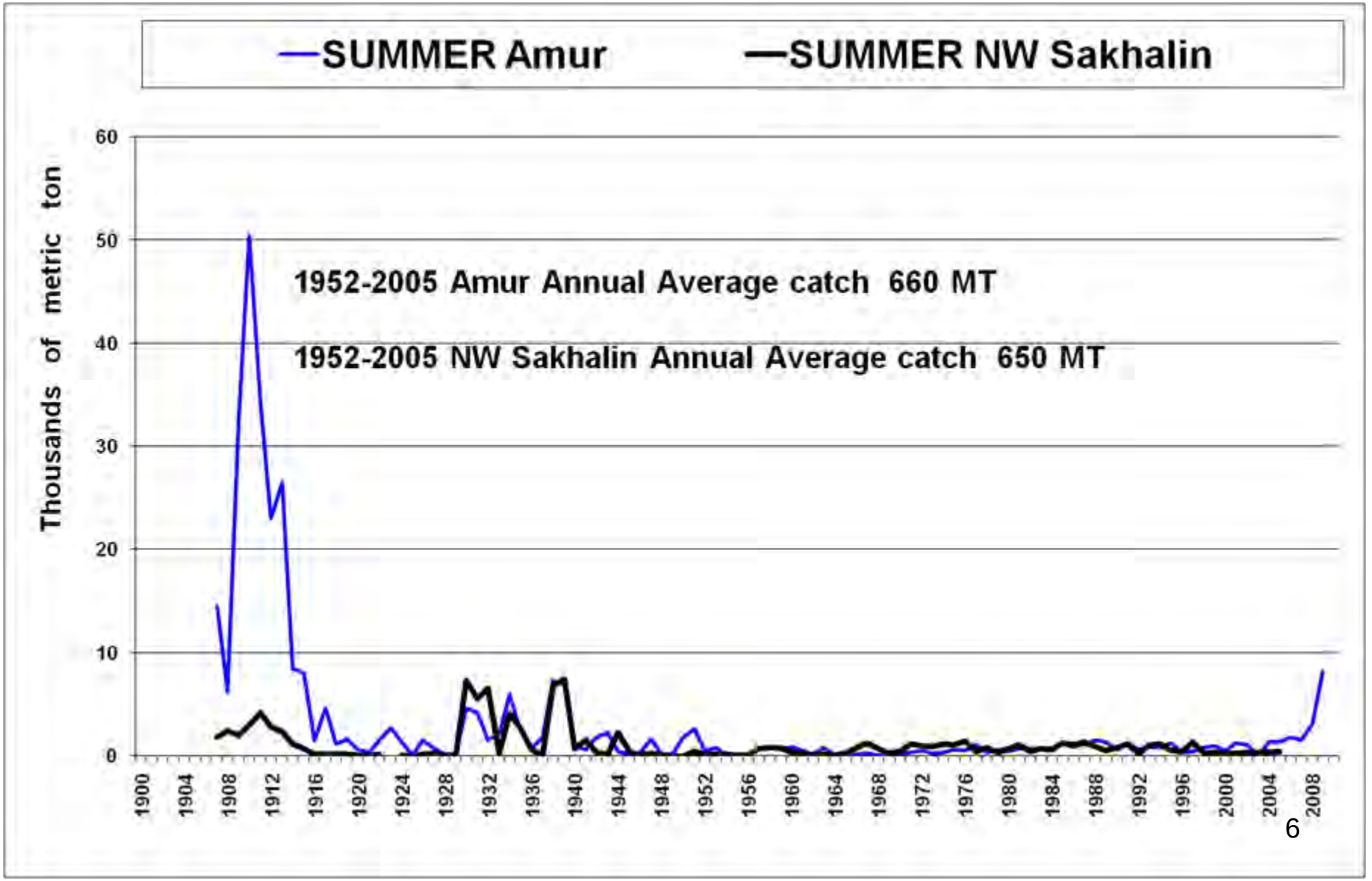


A net set “Zaezdok” near Amur River mouth

Amur River **Fall Chum** Salmon: 1900-2010 Catch, and 1952-2005 Average Catch



Amur River **Summer Chum** Salmon: 1900-2010 Catch, and 1952-2005 Average Catch



Number of spawning tributaries for different species in Amur basin

- Fall chum salmon – 58
- Summer chum salmon – 60
- Pink salmon – 60
- Cherry salmon – about 60

- Total – 118 rivers, 13273 km long

Fall chum salmon spawning area in Amur River basin

Area	Spawning ground square, **millions m^2**	Portion of historical spawning ground **square, %**	Portion of current spawning ground **square, %**
Lower Amur River (from Amur River estuary to Khabarovsk)	8.7775	76.6	95.0
Middle Amur River (from Khabarovsk to Zeya River mouth, including China)	2.562	22.4	5.0
Upper Amur River (from Zeya River mouth to Shilka River mouth), including China	0.115	1.0	0.0
Amur River total	**11.4545**	100	100

Total spawning area for different species in Amur River basin

- **Fall chum salmon – 11,5 million m^2**
- **Summer chum salmon – 6,0 million m^2**
- **Pink salmon – 6,0 million m^2**

Cherry salmon - 6,0 million m^2

W.E. Ricker, 1975

Coefficient of exploitation

$u = R/M_R*100$, where:

u — coefficient of exploitation,

M_R — number of tagged fish,

R — number of recaptured fish

Coefficient of exploitation (%) in Amur River basin by tagging (Pasechnik, Shmigirilov, 2008)

Fall Chum 2006 - 14.8

Summer Chum 2006 - 17.7

Fall Chum 2007 - 12.3

Summer Chum 2007 - 9.5

Average 13.5%

Amur River Chum salmon coefficient of exploitation

$P_{total} = (C_{summer}+C_{fall})/K_{expl}$, where

P_{total} — total number of fish,

C_{summer} — catch of summer chum salmon

C_{fall} - catch of fall chum salmon

K_{expl} — coefficient of chum salmon exploitation

(13.5*2=27.0)

Stock = Catch + Escapement

Average weight of the both Summer and Fall Amur River Chum Salmon = 3.3 kg

Total catch of Amur R. chum, 2006-2010

Year	NW Sakhalin, MT/**fish**	Amur River, Russia MT/**fish**	Amur River, China MT/**fish**	Total, MT/**fish,million**
2006	173.9/**52697**	3962.0/**1200606**	222.0/**67272**	4357.9/**1.32**
2007	893.4/**270727**	5129.1/**1554272**	600.0/**181818**	6622.5/**2.00**
2008	668.0/**202424**	8165.2/**2474303**	1200.0/**363636**	10033.2/**3.04**
2009	2748.2/**832788**	13135.9/**3980576**	600.0/**181818**	16484.1/**4.99**
2010	2935.0/**889394**	16376.2/**4962485**	1200.0/**363636**	20511.2/**6.21**

Wild chum salmon originated from Amur River basin

Year	Catch, millions of fish	Coefficient of exploitation	Stock, millions of fish
2006	1.32	0.27	4.89
2007	2.00	0.27	7.41
2008	3.04	0.27	11.25
2009	4.99	0.27	18.48
2010	6.21	0.27	23.0

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Magnitude and Trends in Abundance of Hatchery and Wild Pink Salmon, Chum Salmon, and Sockeye Salmon in the North Pacific Ocean

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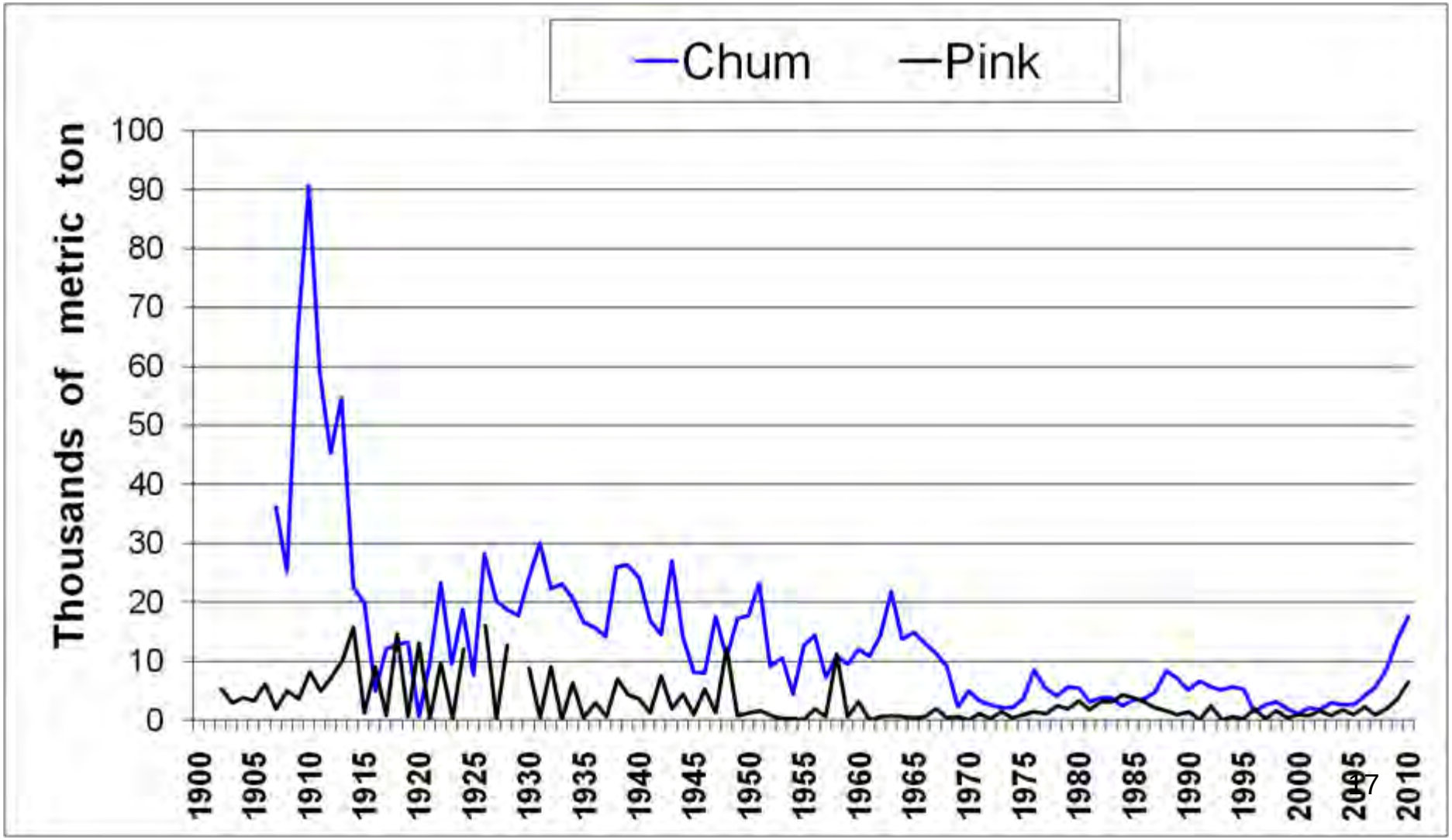
Abstract.—Abundance estimates of wild and hatchery Pacific salmon *Oncorhynchus* spp. are important for evaluation of stock status and density-dependent interactions at sea. We assembled available salmon catch and spawning abundance data for both Asia and North America and reconstructed total abundances of pink salmon *O. gorbuscha*, chum salmon *O. keta*, and sockeye salmon *O. nerka* during 1952–2005. Abundance trends were evaluated with respect to species, regional stock groups, and climatic regimes. Wild adult pink salmon were the most numerous salmon species (average = 268×10^6 fish/year, or 70% of the total abundance of the three species), followed by sockeye salmon (63×10^6 fish/year, or 17%) and chum salmon (48×10^6 fish/year, or 13%). After the 1976–1977 ocean regime shift, abundances of wild pink salmon and sockeye salmon increased by more than 65% on average, whereas abundance of wild chum salmon was lower in recent decades. Although wild salmon abundances in most regions of North America increased in the late 1970s, abundances in Asia typically did not increase until the 1990s. Annual releases of juvenile salmon from hatcheries increased rapidly during the 1970s and 1980s and reached approximately 4.5×10^9 juveniles/year during the 1990s and early 2000s. During 1990–2005, annual production of hatchery-origin adult salmon averaged 78×10^6 chum salmon, 54×10^6 pink salmon, and 3.2×10^6 sockeye salmon, or approximately 62, 13, and 4%, respectively, of the combined total wild and hatchery salmon abundance. The combined abundance of adult wild and hatchery salmon during 1990–2005 averaged 634×10^6 salmon/year (498×10^6 wild salmon/year), or approximately twice as many as during 1952–1975. The large and increasing abundances of hatchery salmon have important management implications in terms of density-dependent processes and conservation of wild salmon populations; management agencies should improve estimates of hatchery salmon abundance in harvests and on the spawning grounds.

1952-2005
Total – 379
millions fish

Wild chum
salmon =
48 millions
of adult fish
per year

Total Catch of Pacific Salmon within Amur River basin:

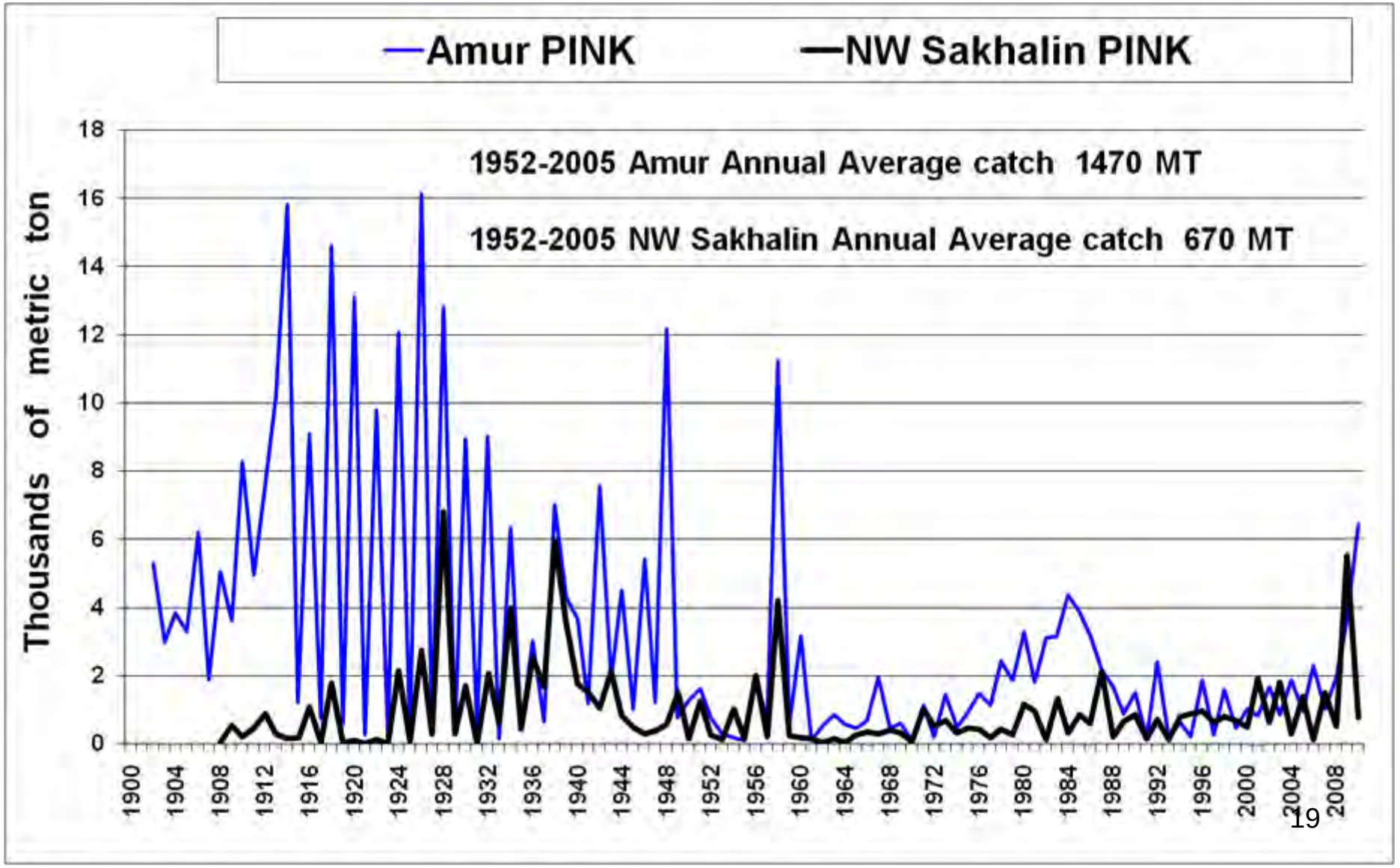
Chum Salmon (Russian Fall + Chinese Fall + Russian Summer) and Pink Salmon



Largest Catch in Amur River basin

	Catch in Amur River basin, thousands MT	**Number of fish, millions**
Summer and Fall Chum salmon **Maxima of 1910**	**90,67**	**30,235**
Pink Salmon **Maxima of 1926**	**16,13**	**13,44**

Amur River **Pink** Salmon: 1900-2010 Catch, and 1952-2005 Average Catch



During 2005-2011 Amur River chum salmon stocks has increased.

The current portion of the Amur River Pacific salmon

is about 9.0%

from the world total among wild fish.