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HOKKAIDO UNIVERSITY

Spacio-temporal change in feeding pattern of Pacific salmon in the North Pacific Ocean ecosystems during 1958-2009

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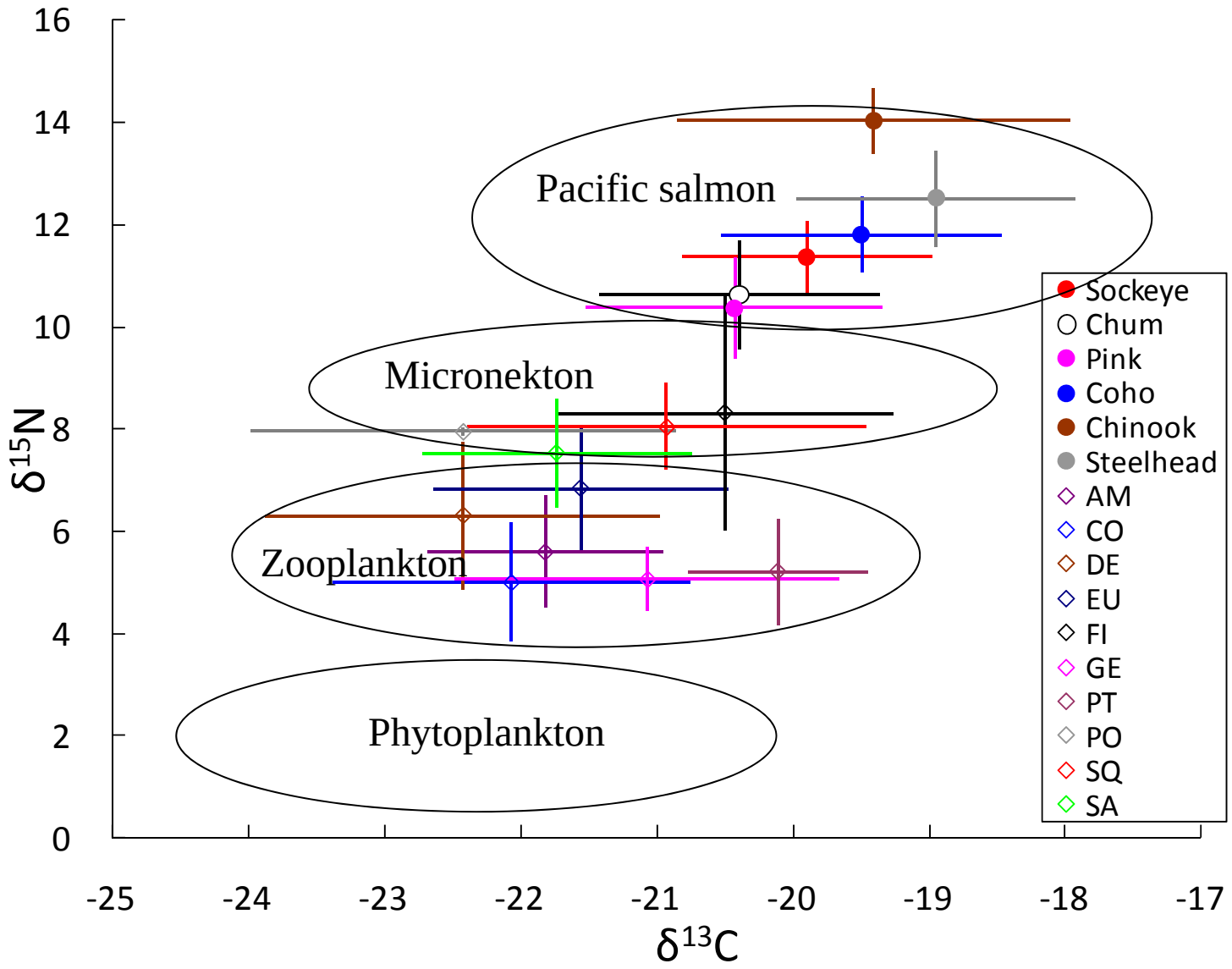
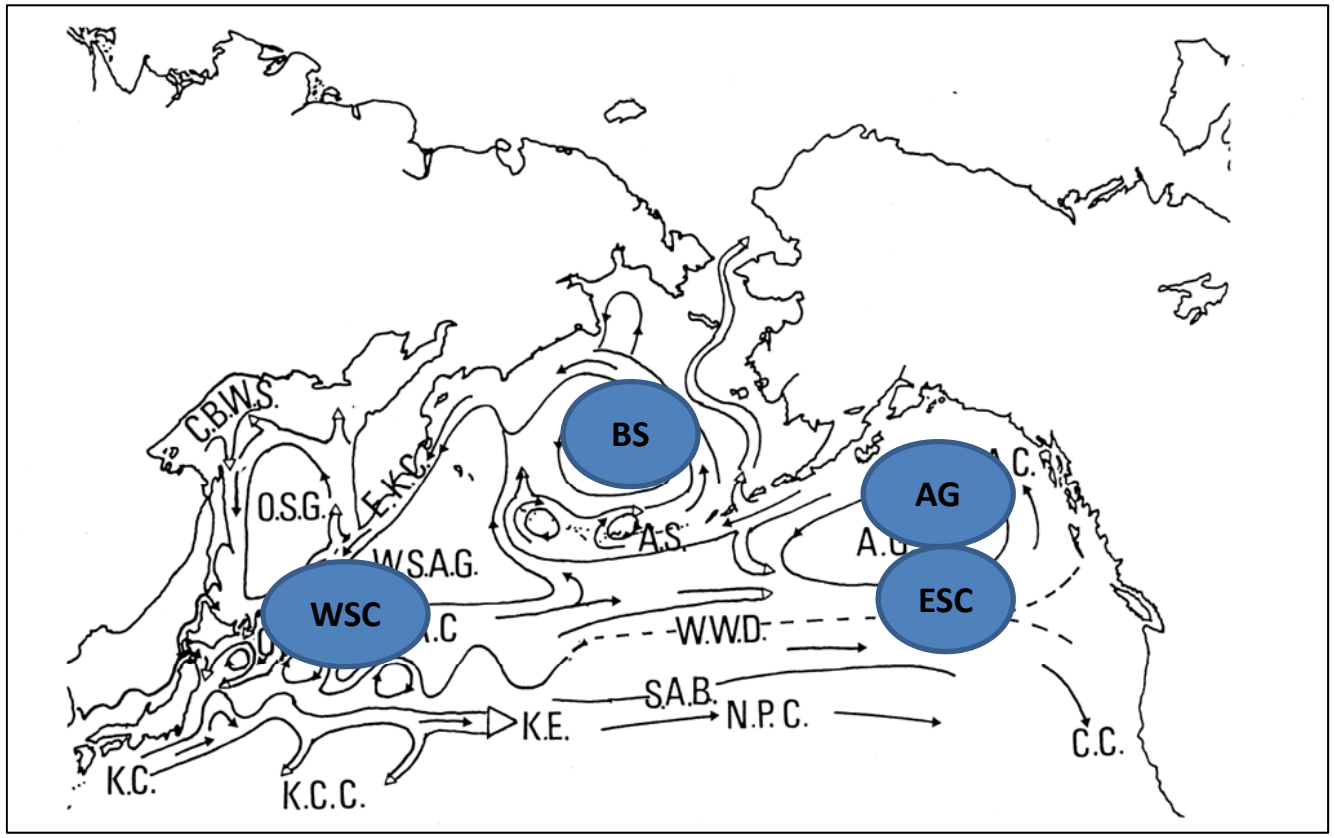


Relationship between carbon and nitrogen stable isotope of animals in the Gulf of Alaska, 1999-2000 (Kaeriyama 2004).

Sampling area of Pacific salmon in the North Pacific Ocean



Current system of the North Pacific Subarctic Circulation (Ohtani 1991)

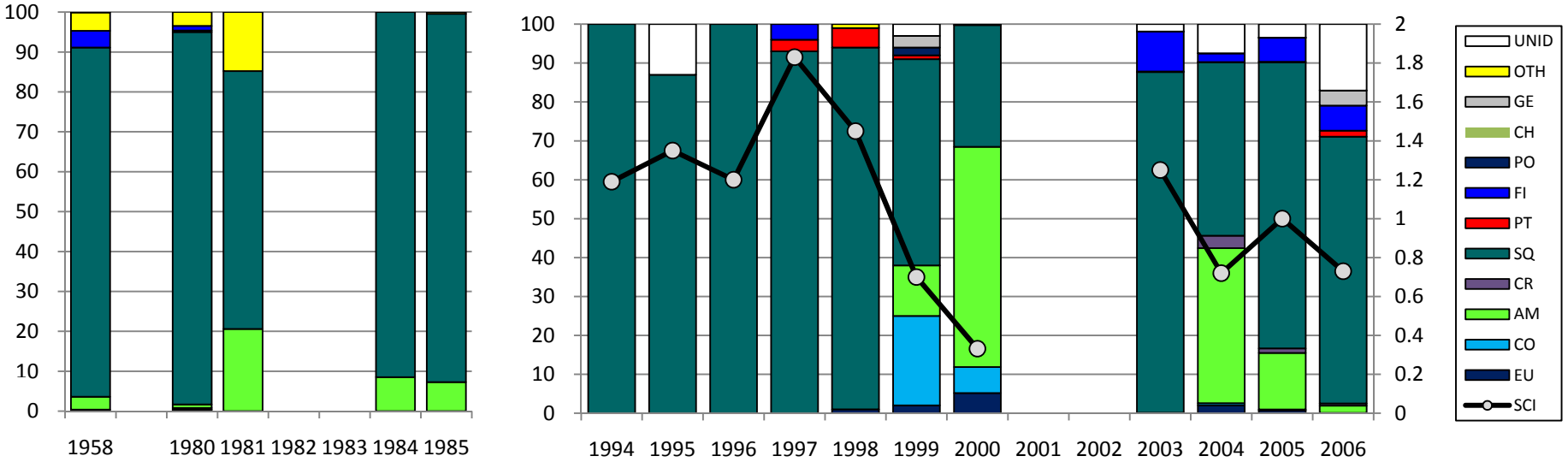
BS: Bering Sea, 2007 & 09, No=1544
WSC: Western Subarctic Current, 2003-2008, No=474
ESC: Eastern Subarctic Current, 1958-2006, No=3697
AG: Alaskan Gyre, 1980-2000, No=6272 (Total 11987)

1958: LeBrasseur (1966)
1980-1985: Pearcy et al. (1988)
1994-2000: Kaeriyama et al. (2004)
2003-2006: Unpublished data

Temporal change
in feeding pattern of Pacific salmon in the Eastern Subarctic Current

Annual change in prey composition of sockeye salmon in the Eastern Subarctic Current of the Gulf of Alaska

ESC
Sockeye salmon
H': 0.584±0.428

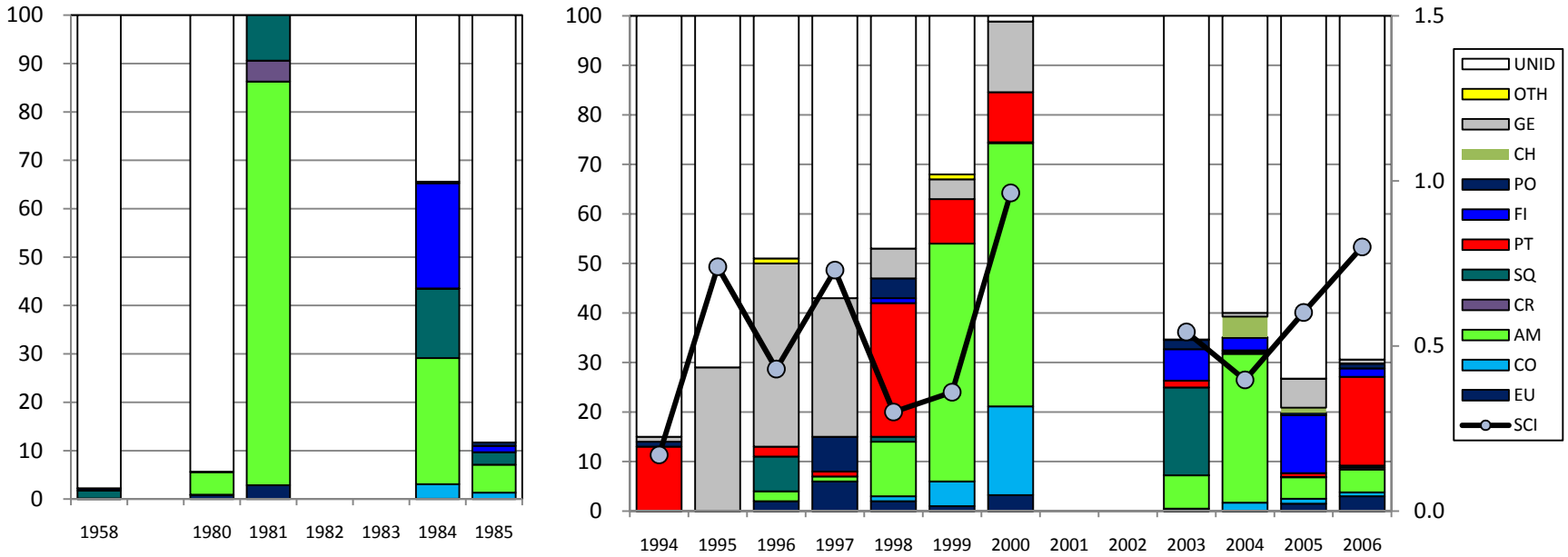


1958: LeBrasseur (1966)
1980-1985: Pearcy et al. (1988)
1994-2000: Kaeriyama et al. (2004)
2003-2006: Unpublished data

Squids: Dominant (a few: 99, 00, 04)
Amphipods: 81, 84, 85, 99, 00, 04, 05
Copepods: 99, 00
Pteropods: 97, 98
Fish: 97, 03, 05

Annual change in prey composition of chum salmon in the Subarctic Current of the Gulf of Alaska

ESC
Chum salmon
H': 0.909±0.433

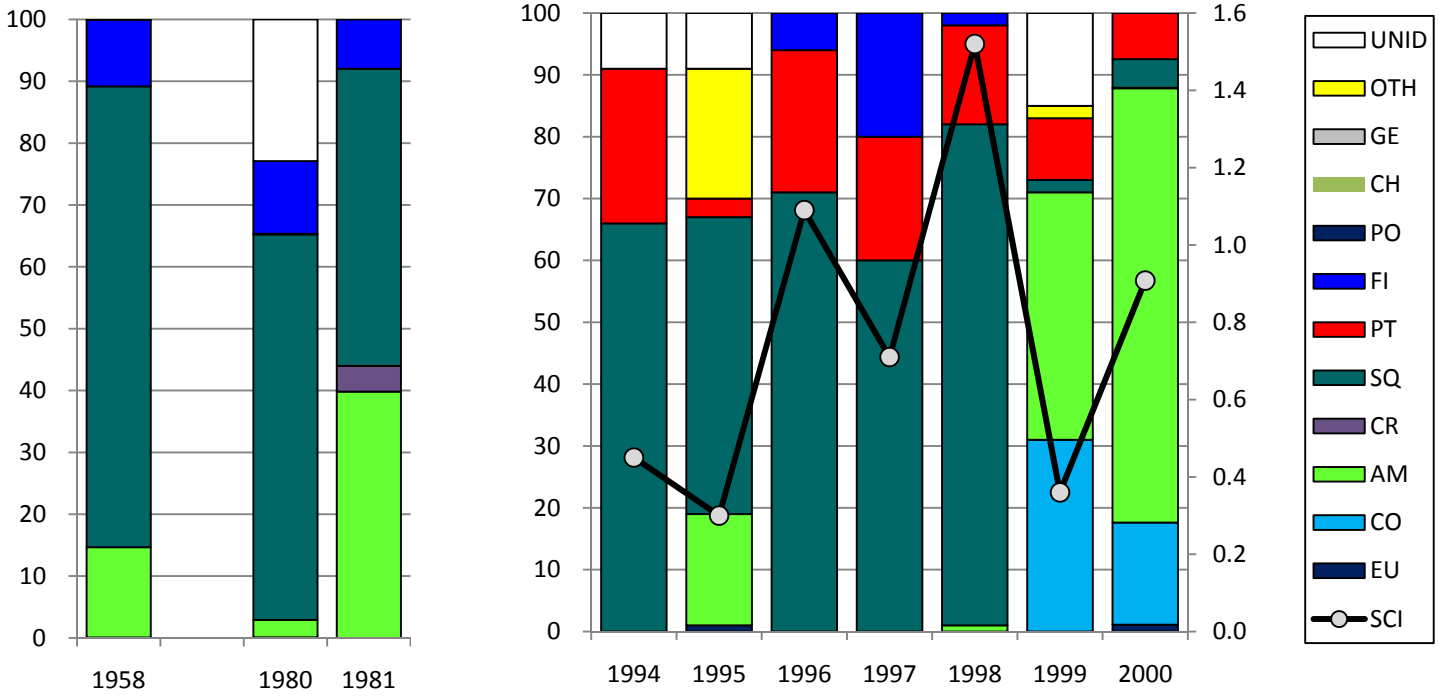


Amphipods: 81, 84, 85, 98, 99, 00, 03, 04, 05, 06
Copepods: 99, 00
Pteropods: 94, 98, 99, 00, 06
Gelatinous zooplankton: 95, 96, 97, 98, 99, 00, 05
Fish: 84, 03, 04, 05, 06

1958: LeBrasseur (1966)
1980-1985: Pearcy et al. (1988)
1994-2000: Kaeriyama et al. (2004)
2003-2006: Unpublished data

Annual change in prey compotion of pink salmon in the Subarctic Current of the Gulf of Alaska

ESC
Pink salmon
H': 0.875±0.380

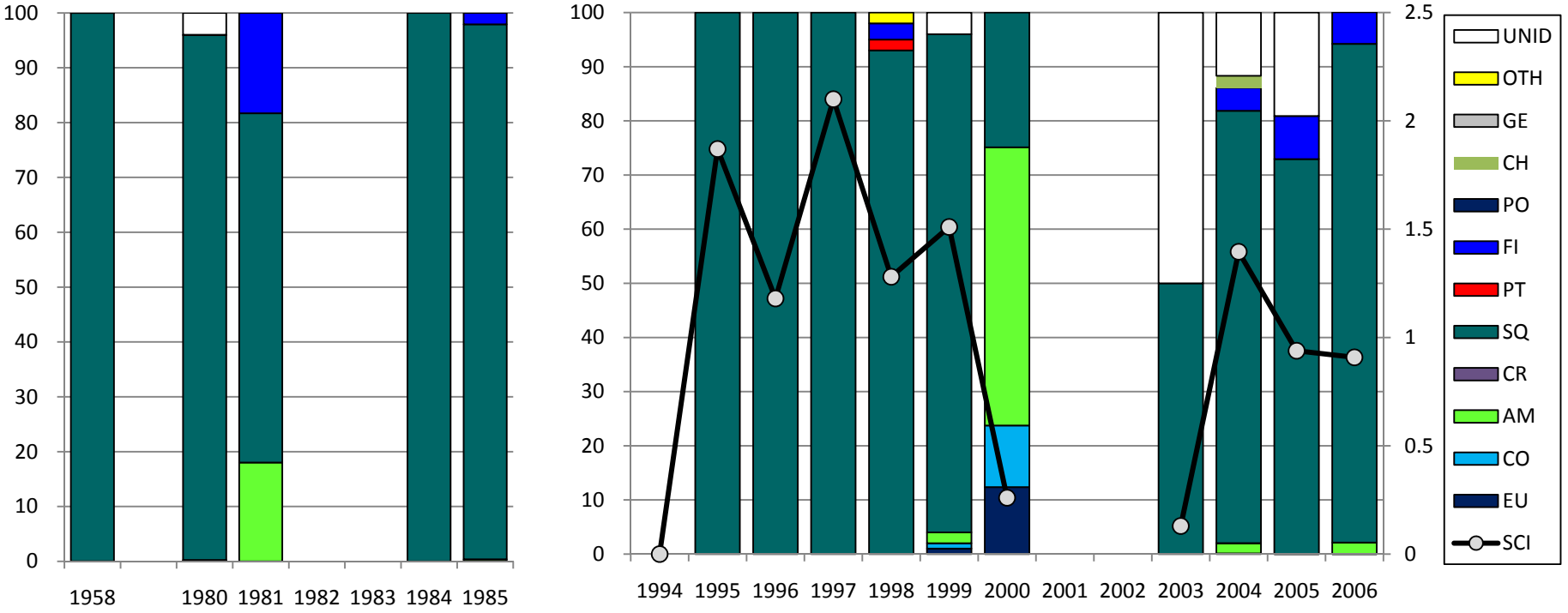


Squids: Dominant (a few: 99, 00)
Amphipods: 58, 81, 95, 99, 00
Copepods: 99, 00
Pteropods: 94, 95, 96, 97, 98, 99, 00, 06
Fish: 58, 80, 81, 96, 97, 98

1958: LeBrasseur (1966)
1980-1985: Pearcy et al. (1988)
1994-2000: Kaeriyama et al. (2004)

Annual change in prey composition of coho salmon in the Subarctic Current of the Gulf of Alaska

ESC
Coho salmon
H': 0.326±0.441

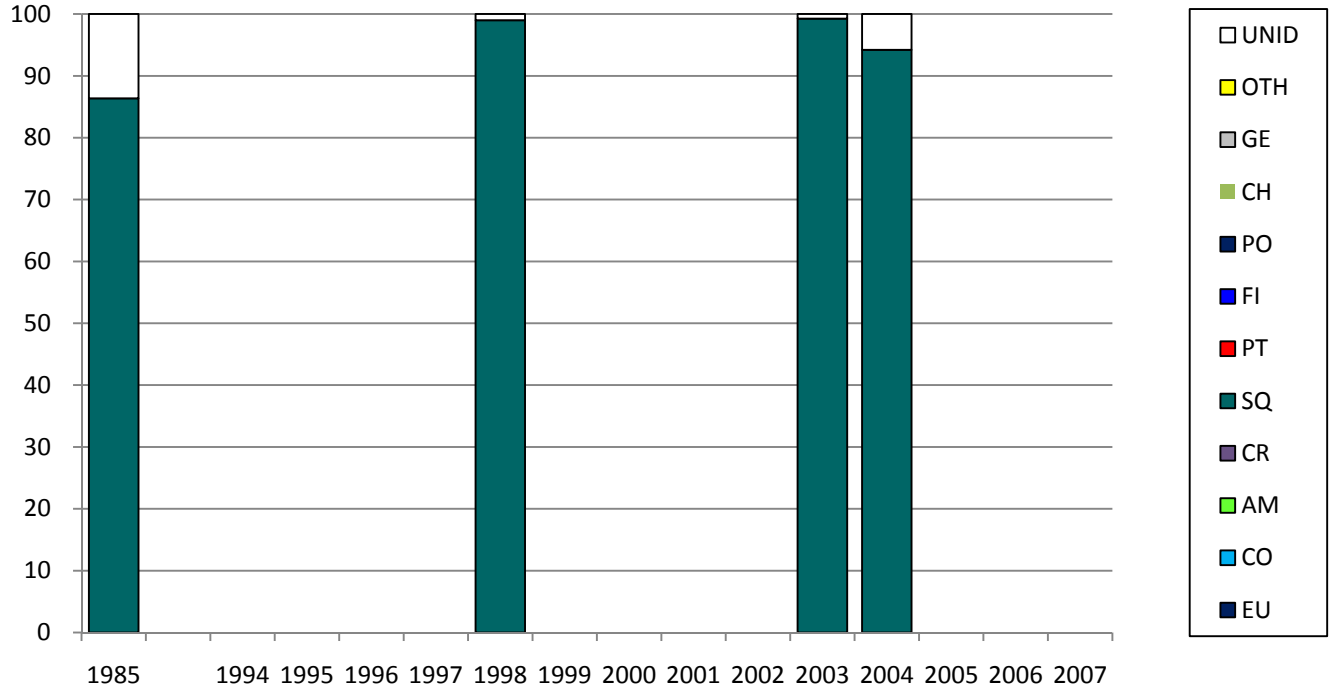


Squids: Dominant (a few: 00)
Amphipods: 81, 00
Copepods: 00
Fish: 81, 85, 98, 04, 05, 06

1958: LeBrasseur (1966)
1980-1985: Pearcy et al. (1988)
1994-2000: Kaeriyama et al. (2004)

Annual change in prey composition of Chinook salmon in the Subarctic Current of the Gulf of Alaska

ESC
Chinook salmon
H': 0.180±0.167

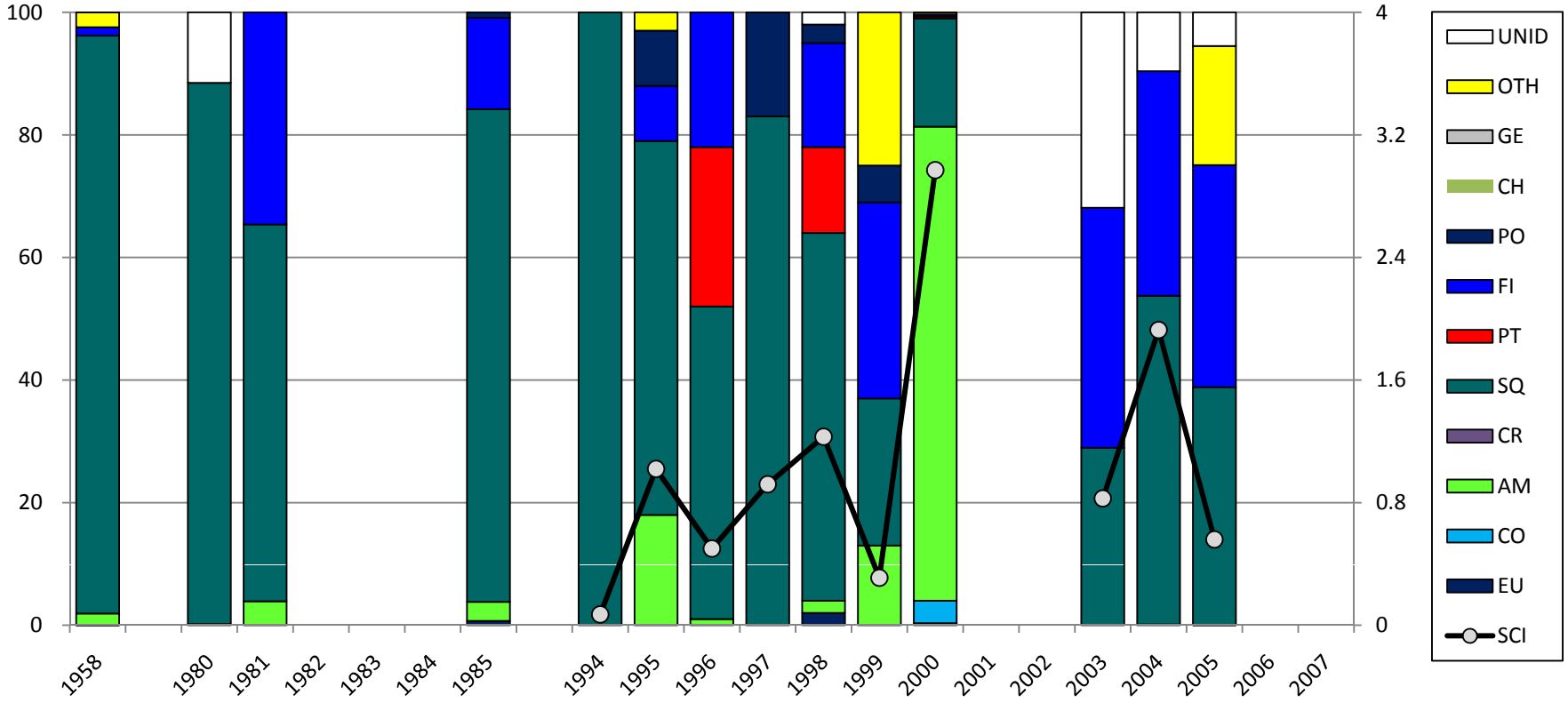


1958: LeBrasseur (1966)
1980-1985: Pearcy et al. (1988)
1994-2000: Kaeriyama et al. (2004)

Squids: Dominant

Annual change in prey composition of steelhead trout in the Subarctic Current of the Gulf of Alaska

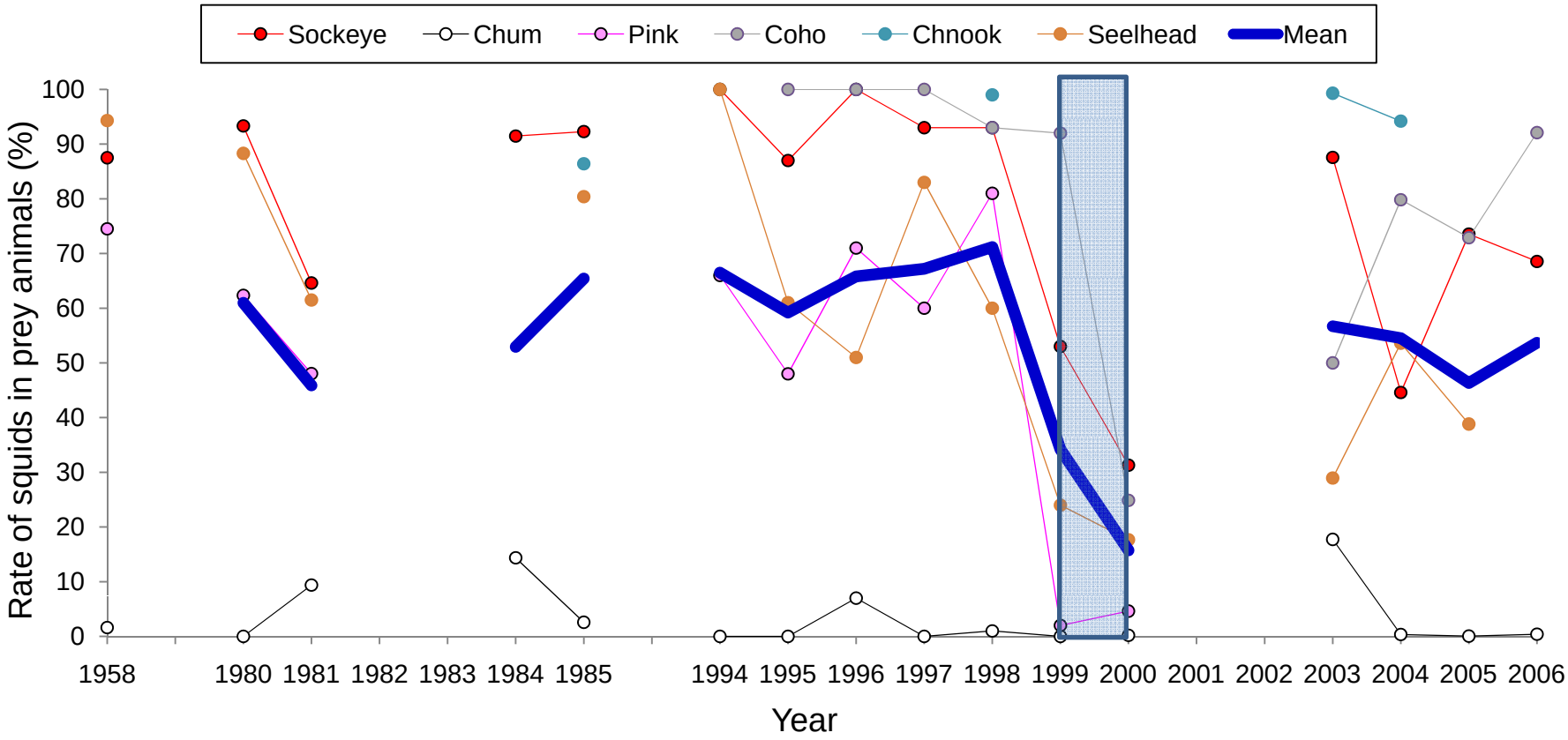
ESC
Steelhead trout
H': 0.761±0.462



Squids: Dominant (a few: 99, 00)
Amphipods: 58, 81, 85, 95, 99, 00
Copepods: 00
Pteropods: 96, 98
Fish: 81, 85, 95, 96, 98, 99, 03, 04, 05

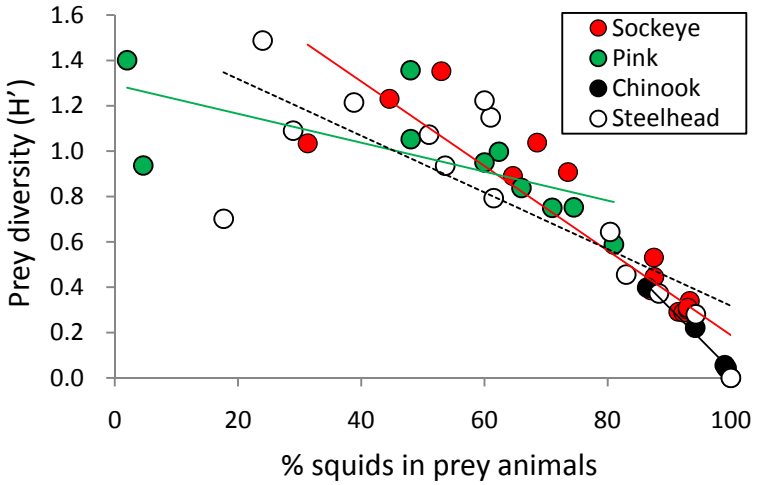
1958 : LeBrasseur (1966)
1980-1985: Pearcy et al. (1988)
1994-2000: Kaeriyama et al. (2004)

Annual change in rate of squids in prey animals of Pacific salmon in the Eastern Subarctic Current



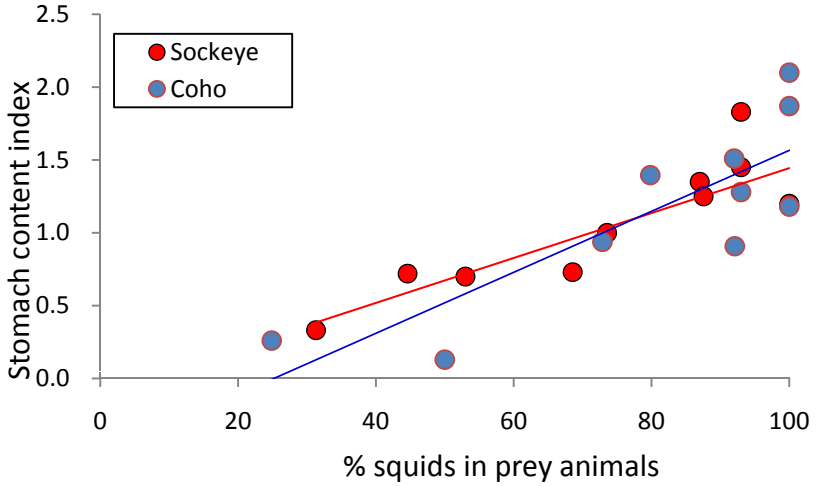
Relationship between rate of squids in the prey animals and prey diversity of Pacific salmon

	N	R^2	F	P
Sockeye	15	0.81	65.09	<0.001
Chum	15	0.05	0.67	0.427
Pink	9	0.46	6.91	0.030
Coho	7	0.33	2.96	0.136
Chinook	4	0.99	166.00	0.006
Steelhead	13	0.61	18.44	0.001

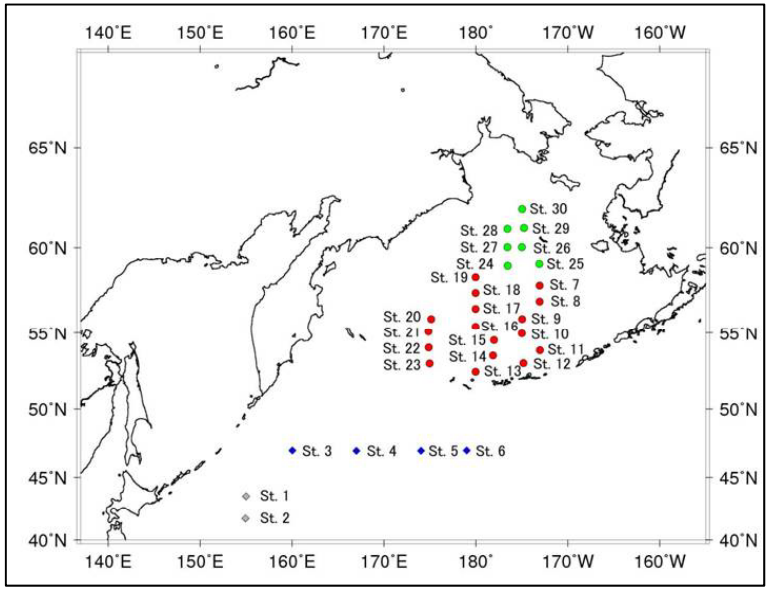


Relationship between rate of squids in the prey animals and stomach content index of Pacific salmon

	N	R^2	F	P
Sockeye	11	0.74	25.55	0.010
Chum	11	0.07	0.60	0.811
Pink	7	0.21	1.29	0.307
Coho	10	0.69	17.93	0.030
Chinook	3	0.98	41.52	0.098
Steelhead	10	0.17	1.60	0.241

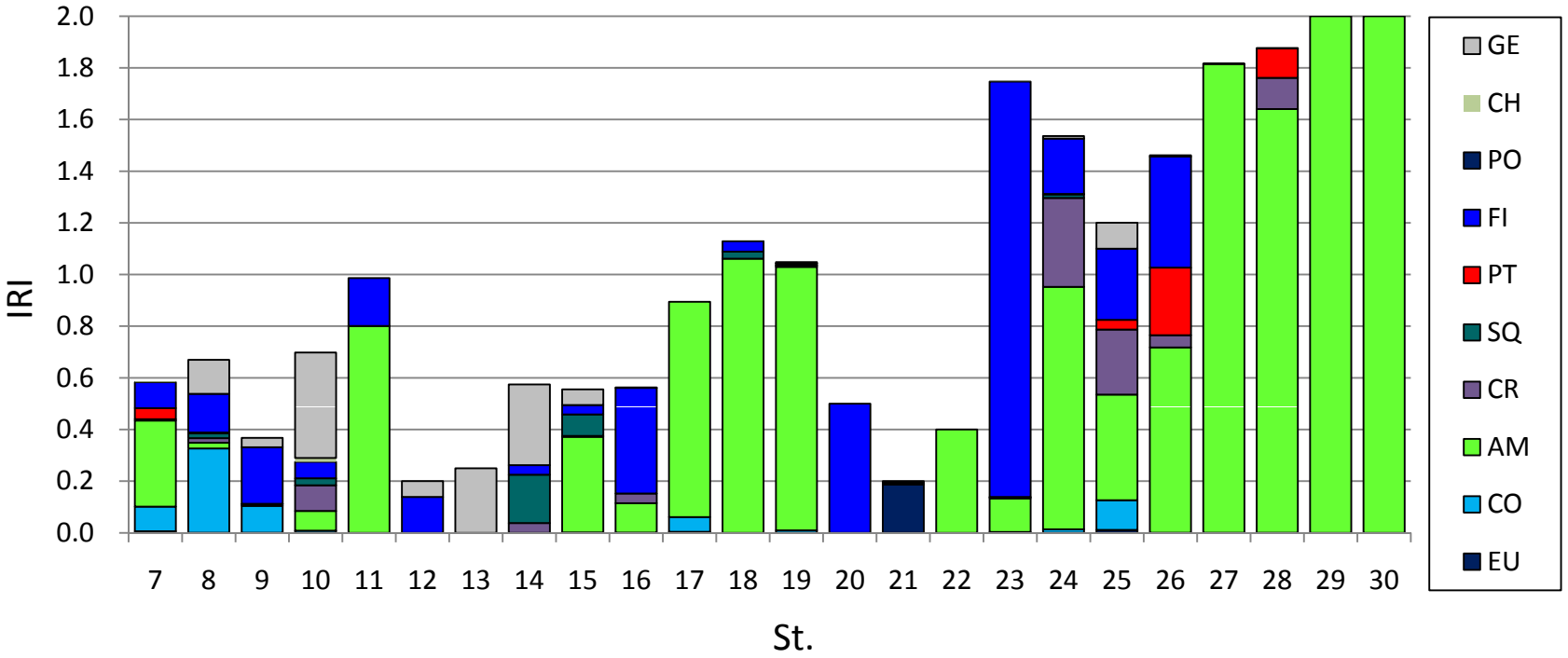


Spacial variation
in feeding pattern of Pacific salmon in the North Pacific Ocean and the Bering Sea



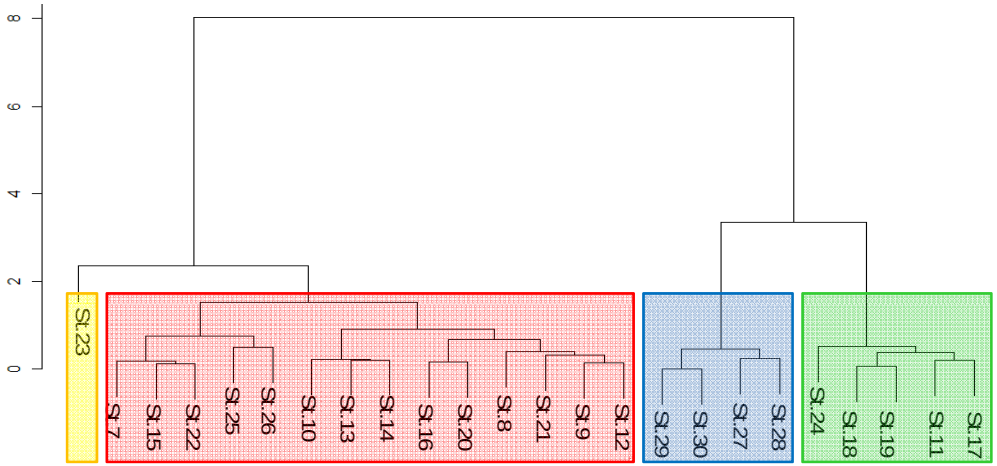
BS
Chum salmon
H': 1.522

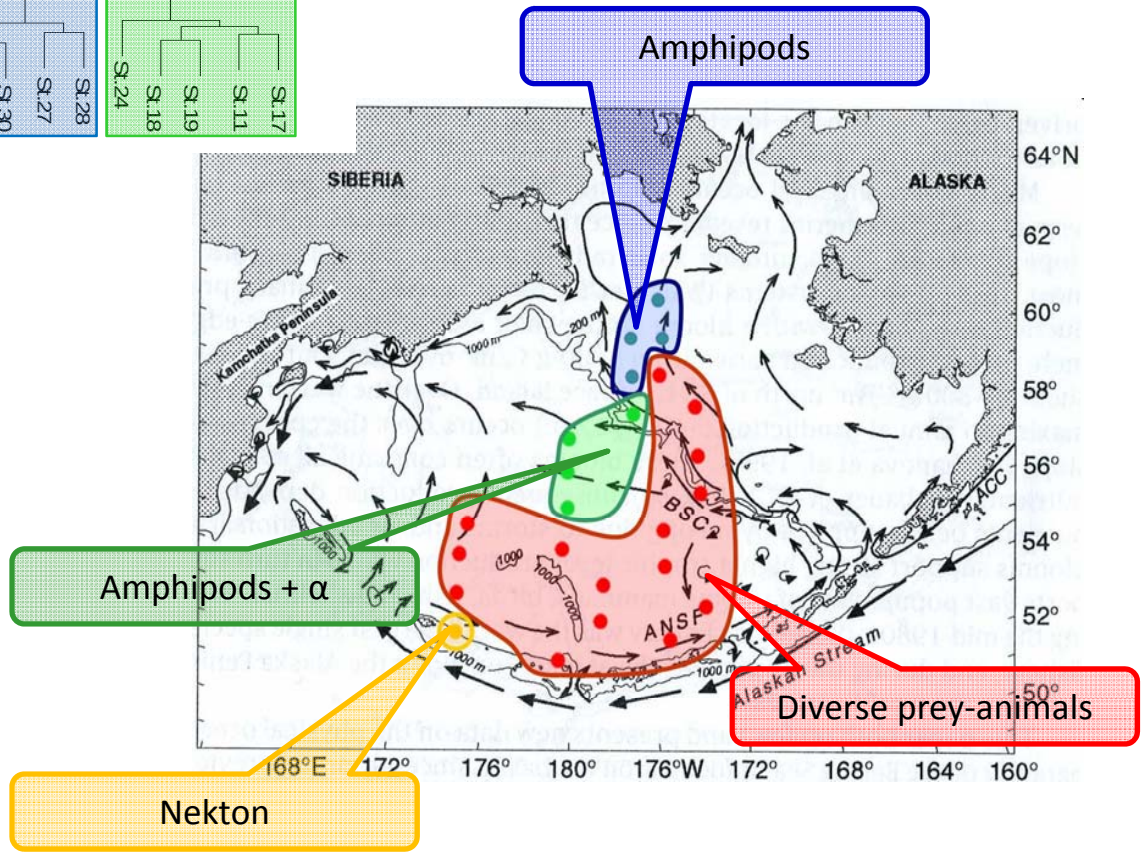
Prey composition of chum salmon in the Bering Sea, 2009



Cluster analysis on feeding habit of chum salmon in the Bering Sea in 2009

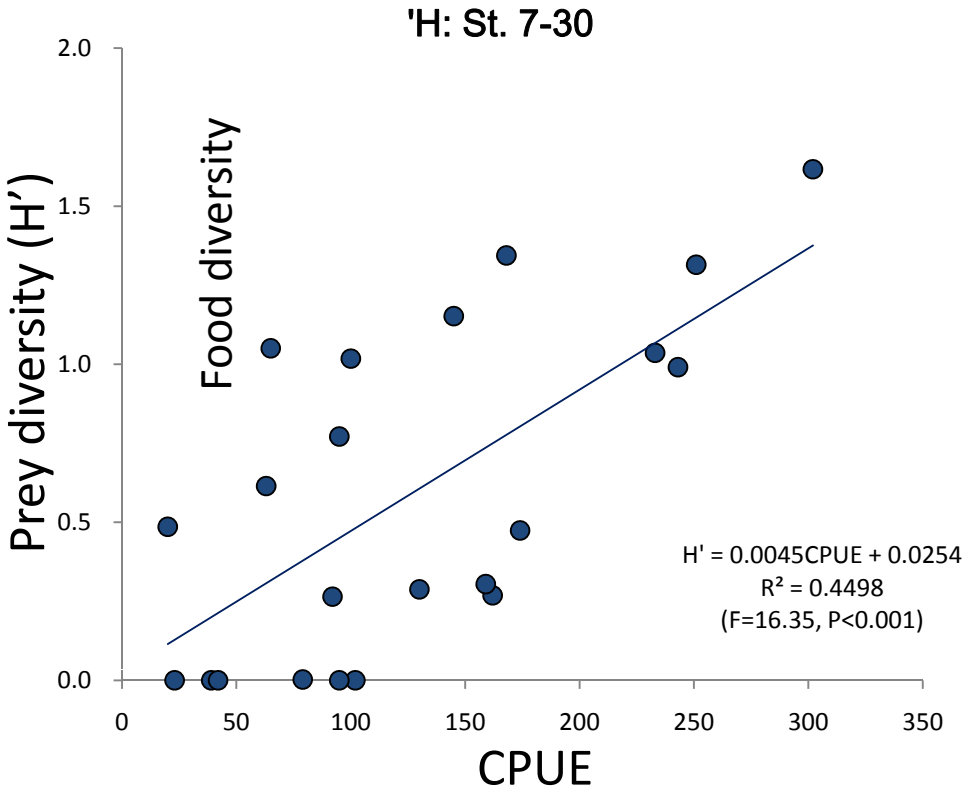
BS
Chum salmon
H': 1.522



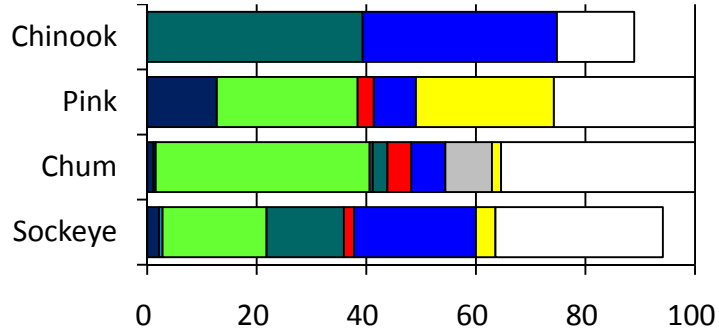


Relationship between CPUE and food diversity (H') of chum salmon collected in the Bering Sea in 2009.

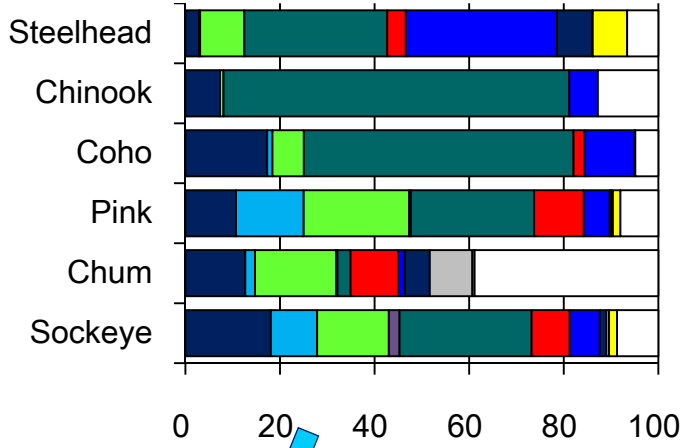
BS
Chum salmon
H': 1.522



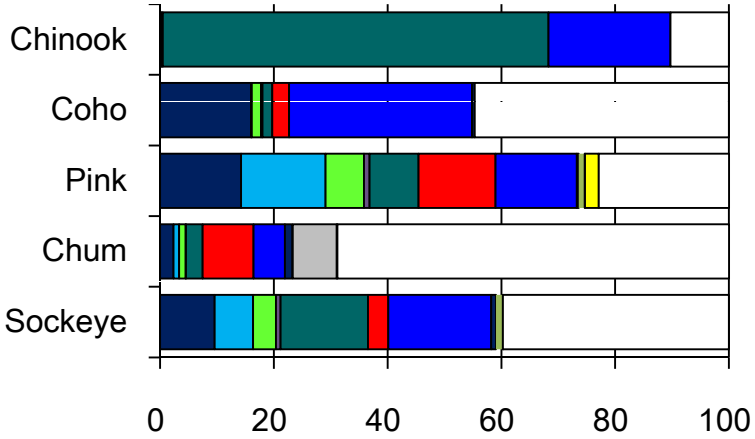
BS: Bering Sea



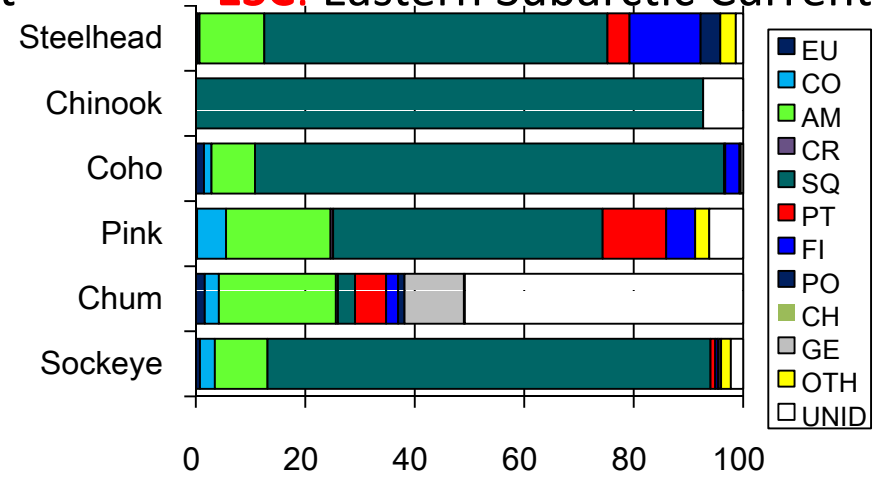
AG: Alaskan Gyre in GA



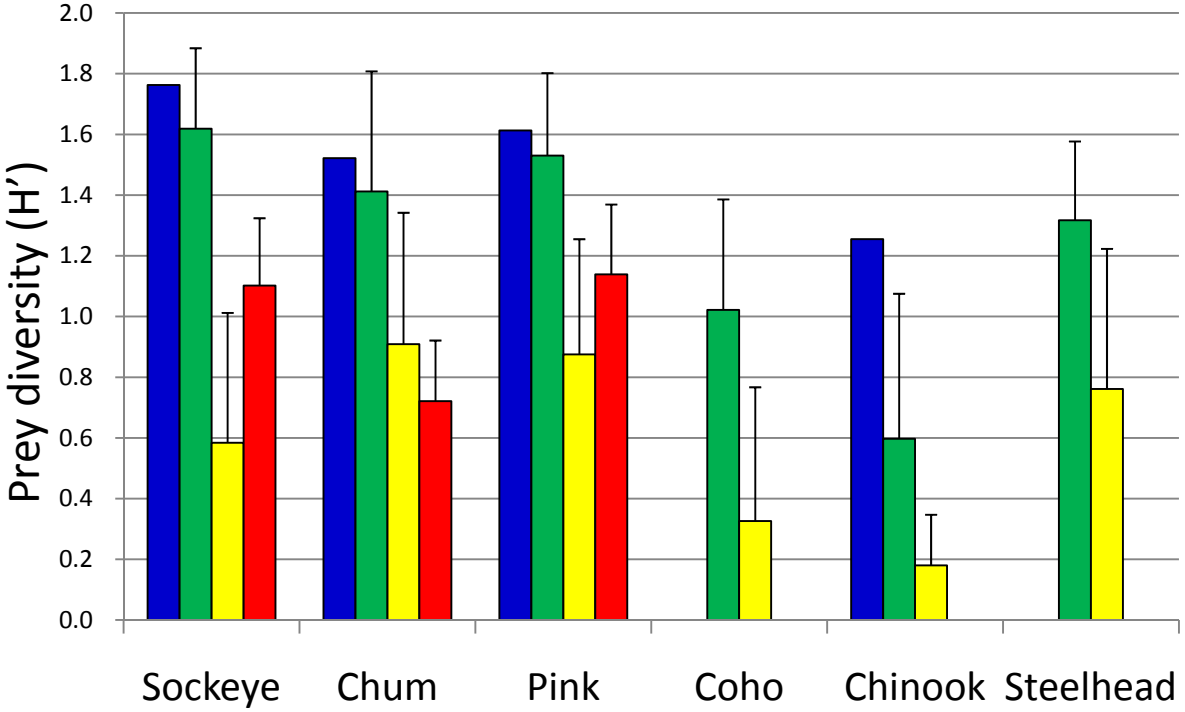
WSC: Western Subarctic Current



ESC: Eastern Subarctic Current



Prey diversity of Pacific salmon in the North Pacific Ocean and the Bering Sea

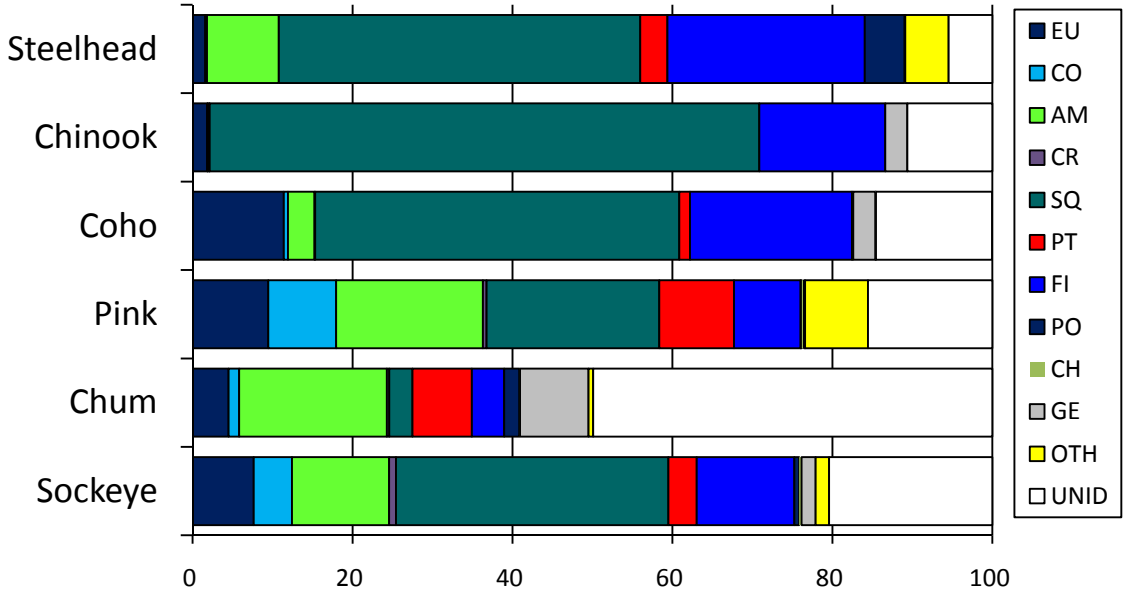


BS: Bering Sea
AG: Alaskan Gyre
ESC: Eastern Subarctic Current
WSC: Western Subarctic Current

H'

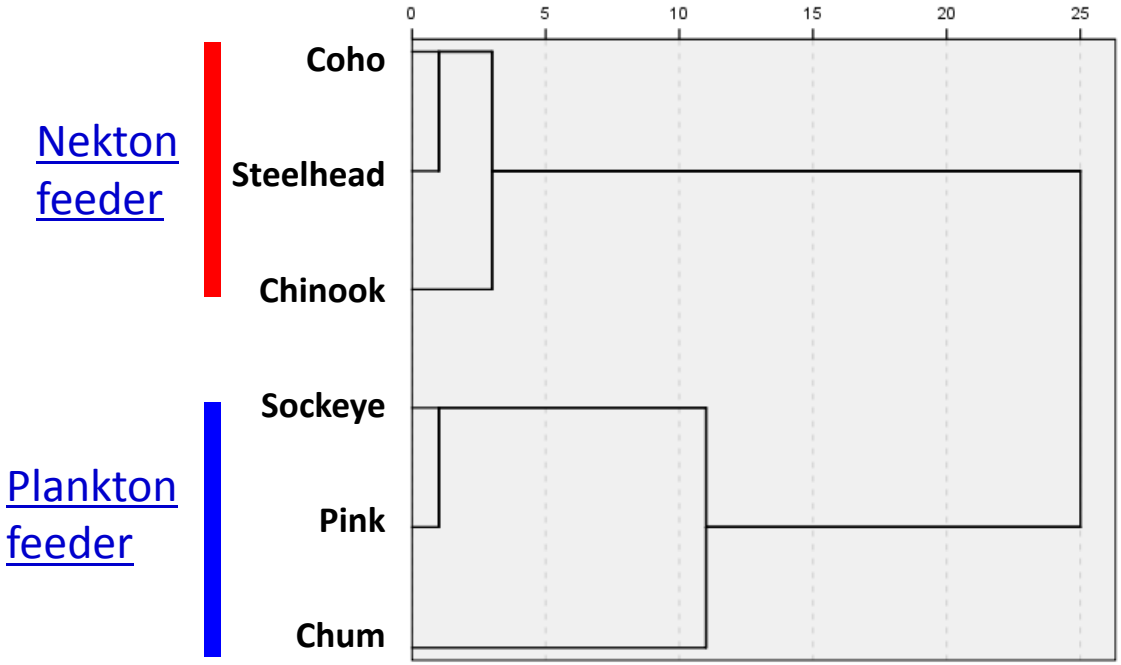
Mean	BS	AG	ESC	WSC
Sockeye	1.763	1.619	0.584	1.102
Chum	1.522	1.412	0.909	0.721
Pink	1.613	1.53	0.875	1.139
Coho		1.022	0.326	
Chinook	1.255	0.597	0.18	
Steelhead		1.317	0.761	

SD	BS	AG	ESC	WSC
Sockeye		0.265	0.428	0.222
Chum		0.396	0.433	0.2
Pink		0.272	0.38	0.23
Coho		0.364	0.441	
Chinook		0.478	0.167	
Steelhead		0.26	0.462	



Summary

Prey composition of Pacific salmon in the North Pacific and the Bering Sea



In Conclusion

- Pacific salmon feed on diverse diets according to the spatio-temporal change. They show a high plasticity in their feeding strategies.
- Chum salmon shift their diets from dominant to more diverse prey-animals in response to changes in population density.
- Pacific salmon are omnivorous and opportunistic feeders, feeding on available and abundant prey species according to intra- and inter-specific competition, food composition, and oceanic environment.
- In general, however, Pacific salmon are categorized as plankton (sockeye, chum, and pink salmon) and nekton (coho, Chinook salmon, and steelhead trout) feeders based on their feeding habit.
- In zooplankton feeders, chum salmon have a different feeding habit because they feed on gelatinous zooplankton, not forage squids.