TRANSLATION

OUTLINE OF OCEANOGRAPHIC CONDITIONS IN THE
NORTHWESTERN PACIFIC DURING THE SUMMER OF 1981

Kozo Kitani
Fisheries Agency of Japan
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Introduction

Oceanographic conditions in the northwestern Pacific Ocean during the summer of 1981 were examined using distributions of water temperature, as in previous years. Data used were obtained from nine salmon research vessels, four salmon motherships, and eight catcher boats attached to the motherships. Observations were made at 123 stations in May, 289 in June, and 339 in July. For surface water temperatures, "The Ten-Day Marine Report" of the Meteorological Agency of Japan and "The prompt report on fisheries in the North Pacific Ocean" by the Fisheries Information Service Center, were used. Much previous work has pointed out that distribution and migration of salmon in the northwestern Pacific Ocean is influenced by Western Subarctic Water and the Alaskan Stream. Therefore, we assessed the distribution and features of these water masses.

1. Western Subarctic Water

Western Subarctic Water is a cold water mass produced from surface cooling in winter and is widely distributed in the northwestern Pacific Ocean, centering off the eastern areas of the Kamchatka Peninsula and Kuril Islands. Here we will deal with the cold water mass with temperature less than 3.0°C at 100 m depth as identifying this water system, as in previous years.

May (Fig. 1)

Since observations in May of 1981 were in waters east of 155°E, conditions in waters south of the southern Kuril Islands were not determined, but the 3°C isotherm was observed to extend in a northeasterly direction and included a small zigzag phenomenon from the eastern area of Hokkaido to 165°E. In waters between 160°E and 175°E, a large zigzag distribution has been observed every year. The southward intrusion of the cold water mass, observed in
waters of 165°E to 172°E, was the pattern which has appeared each year as the Komandorskie Cold Tongue, but in 1981, it extended further north than in 1978 and 1979 but further south than in 1975 and 1980 which is considered a normal pattern.

The eastward extension of Western Subarctic Water reached to 177°E around 47°N and 51°N. On the other hand, water mass of 4°C and over was distributed in waters east of 178°W in the southern Aleutian Area (47° to 51°N) and, in waters between that water mass and the eastern extrusions of Western Subarctic Water, water temperature inclines which were larger than in previous years were observed.

In waters between the Western Subarctic Water and relatively higher temperature water south of the Western Subarctic Water, a sharp water temperature front indicating the boundary area was formed which was most pronounced in the eastern area of the Komandorskie Cold Tongue.

In general, Western Subarctic Water was considered to be somewhat stronger in appearance than in normal years.

June (Figs. 2 and 4)

Locations of the 3°C isotherm were generally the same as in May but the southerly extension of the Komandorskie Cold Tongue was somewhat stronger. The southerly extension of the Komandorskie Cold Tongue in June of 1968 to 1981 has shifted each year in waters between 47°N and 42°N (Fig. 4). After the remarkable southerly extension of the Tongue in 1977, it showed a somewhat northward trend, and in June 1980 and 1981, was located in water around 44°N which was still somewhat south of the normal extension.

The easterly extension of Western Subarctic Water was regarded as similar to that in May, and on the whole, the strength of this water mass appears to be somewhat stronger than in normal years.
July (Fig. 3)

The strength of Western Subarctic Water in July, generally was similar to that in June but the location of the 3°C isotherm in waters from 152° to 175°E showed irregular southerly extension and northerly extensions in comparison with June. These conclusions may result only because there were more observations in the 3°C isotherm in July than in June. Many small and large zigzag phenomena were observed.

The southern tip of the Komandorskie Cold Water Tongue around 168°E was located in waters south of 45°N, which was similar to that in June. However, the northerly extension of a relatively high temperature water mass was observed in the vicinity of 172°E which was not observed in June, and the southerly extension of cold water was observed in the vicinity of 174°E. These caused a large complicated pattern which had quite changeable horizontal temperatures. The eastern extension of Western Subarctic Water in July was considered to be similar to that in June.

2. Alaskan Stream

According to the past reports, the Alaskan Stream, which flows from the Gulf of Alaska, is recognized as a relatively high temperature current which flows toward the west along the south side of the Aleutians. We determined location of water of 4°C and over south of the Aleutian Islands in order to determine the strength of the Alaskan Stream and examine mixing conditions with Western Subarctic Water located at the western tip.

May (Fig. 1)

In the vicinity of 178°W south of the central Aleutian Islands, a relatively warm current of 4°C and over was observed. However, because of inadequate observations, it was not certain whether this
was representative of the Alaskan Stream or the warm water current which is found in the southern area of Western Subarctic Water.

**June** (Figs. 2 and 5)

A narrow belted relatively warm current area was observed in waters between the Aleutian Islands and 51°N. Though data were limited, this water mass was recognized as the Alaskan Stream from the east based on past patterns of occurrence. The western tip of the 4°C isotherm extended to the vicinity of 173°E. In addition, a water mass of 3°C and over, which was considered to be influenced by this water current, extended to the vicinity of 50°N and 170°E and a part of this water mass flowed into Western Subarctic Water further west.

Diversities in locations of the western tip of the 4°C isotherm, observed along the south side of the Aleutian Islands in 1963 to 1981, are shown in Fig. 5 as the index of strength of the western extension of the Alaskan Stream. The strength of the western extension of this water mass in 1981 June was weaker than in 1978, 1979, and 1980, but was considered to be stronger than average.

**July** (Fig. 3)

Continuity of warm water of 4°C and over was evident to the vicinity of 174°E and isolated warm water recognized to 170°E. Currents of 3°C and over in the area south of the Aleutian Islands, which are known to be influenced by the Alaskan Stream water, were found to be extended in comparison with June. This indicates that strength of the Alaskan Stream gradually increased from June to July.
3. **Surface conditions**

The surface water temperature in the northwestern Pacific Ocean in April, in general, was lower than in previous years. Cooling phenomena were observed, particularly in 155°E to 170°E around 40°N and in 170°E to 180° around 42°N (Fig. 6).

In May, this cooling phenomena generally continued, but the temperature became closer to normal than in April. In the vicinity of the central Kuril Islands, around 170°E and 45°N, water temperature somewhat higher than in previous years was observed.

Surface water temperature rose remarkably in this area in June, with rises of 2°C to 5°C observed. However, in comparison with the normal temperature, in general, cooling was notable in waters south of 50°N. In particular, the cooling phenomenon was remarkable in the east-west belt between 35°N and 45°N which included the area offshore of Sanriku and the Subarctic Boundary (Fig. 7). Although this cooling trend weakened slightly in July, in waters south of 47°N, the cooling continued.

Representative patterns of the surface temperature cooling during summer indicate that the location of the Subarctic Boundary was further south than in previous years. In waters north of 50°N, which are considered as the westerly extension of the Alaskan Stream, water temperature in June and July was higher than in the previous years indicating that strength of this water current was greater than in previous years.

Oceanographic conditions in the northwestern Pacific during the summer of 1981 can be summarized as follows:

1. **Strength of Western Subarctic Water during the summer of 1981 was somewhat stronger than in normal years.**
2. The western extension of the Alaskan Stream in 1981 was also slightly stronger than in normal years.

3. The southerly extension of Subarctic Boundary was remarkable.

FIGS. 1 TO 5 ARE IN ENGLISH IN THE JAPANESE DOCUMENT
Fig. 1 Temperature distribution at 100m layer in May, 1981

Fig. 2 Temperature distribution at 100m layer in June, 1981
**Fig. 3** Temperature distribution at 100m layer in July, 1981

**Fig. 4** Annual fluctuation of southward extension of Komandorskie tongue-shaped cold water in June indicated 3°C isotherm at 100m depth.
Fig. 6 Deviation of the sea-surface temperature in April, 1981 from the monthly mean for 30 years, 1951-1980. (From The Ten-Day Marine Report, No.1245)
Fig. 7 Deviation of the sea-surface temperature in June, 1981 from the monthly mean for 30 years, 1951-1980. (From The Ten-Day Marine Report, No.1251)
Outline of oceanographic conditions of the
Northwest Pacific during the summer of 1981
1981年夏季の北西太平洋における海況概要

遠洋水産研究所 海洋部 木谷浩三

まえがき

1981年夏季における北西太平洋の海況について例年と同様、水温分布より検討を行なった。ここに使用された資料は、さけ・ます調査船9隻、さけ・ます母船4隻、および母船団所属独航船8隻によって得られたものである。観測点数は5月128点、6月289点、7月339点であった。

表面水温については、「気象庁全国海況旬報」、漁業情報サービスセンター「北太平洋漁海況速報」をも参考とした。

北西太平洋におけるさけ・ます分布、回遊は、Western Subarctic WaterおよびAlaskan Streamの影響をうけることが知られていることから、これら水塊の挙動に注目して記述した。

1. Western Subarctic Water

Western Subarctic Waterは、冬季の表層冷却に起因する冷水塊でカムチャッカ半島、千島列島の東方域を中心にして北西太平洋に広く分布している。ここでは例年と同様に100m層3℃以下の冷水をこの水系として取扱った。

5月（Fig.1）：本年5月の調査域は、155°E以東であったため南千島列島南方域については不明確であるが、8℃等温線は北海道東方域より165°Eまで小さな蛇行を含みながら、ほぼ北東方向に分布していたと見られる。160°Eから175°Eの間では、例年等温線の大きな蛇行分布が示される。165°E～172°Eにみられる冷水の南方張り出し分布は、コマンドルスキー冷水舌として例年出現するパターンであるが、本年のそれは、1978年、1979年より偏北、平年並みと考えられる1975年、1980年よりやや南側していた。

Western Subarctic Waterの東方への拡がりは47°N付近と51°N付近で177°Eにまで達し、1980年より東方に張り出していた。一方アリューシャン南方域（47°～51°N）の178°W以東には4℃以上の相対的高温水が分布し、Western Subarctic Waterの東方張り出しとの間に例年より大きい水温傾度を示した。

この文書を引用する場合は下記による：
木谷浩三、1981、1981年夏季の北西太平洋における海況概要、遠洋水産研究所、水産庁

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Western Subarctic Water とその南端域の相対的高温水の間には境界域を示す水温前線が生じるが、概してコマンドルスキー冷水帯の東側域に顕著な傾向がみられた。

Western Subarctic Water は全体として平年並みよりやや勢力が強いため推察された。

6月（Fig. 2, Fig. 4）：3°C等温線の分布位置は、概して5月のそれと同じであるが、コマンドルスキー冷水帯の南側域は、5月のそれよりやや強くなっていた。Fig. 4 に示すように1988年から1981年までの6月におけるコマンドルスキー冷水帯の南側域は、47°Nから42°Nの間で各年毎に変化をしている。近年では、このコマンドルスキー冷水帯は、1977年に著しく南側を示した後、やや北上する傾向を示し、本年6月には、平均的な南側域はよりやや南側として44°N付近に位置していた。

Western Subarctic Water の東側域は、5月とほぼ同様の勢力とみなされ、全体としてこの水の強さは平年よりもやや強いものと推察される。

7月（Fig. 3）：Western Subarctic Water の分布は、全体として6月と大差ないが、152°Eから175°Eまでの8°C等温線の位置は、6月のそれと比較すると南側域水や水帯と北側域水帯が不規則に現れていた。観測点が6月にくらべて多いことも起因するかもしれないが、7月の3°C等温線は、大水の流向がよく示されていた。

168°E付近のコマンドルスキー冷水帯の南端は、45°N以南にあり6月のそれと大差ない。しかし6月には顕著でなかった172°E付近の相対的高温水の北側域は、174°E付近の冷水帯の南側域は、北側域水帯による水平的に水温変化の大きな複雑な分布パターンを生じていた。Western Subarctic Water の東側域は、5月とほぼ同様とみなされた。

2. Alaskan Stream

既往の報告によりアラスカ湾域より連続するAlaskan Stream は、阿リュージョン列島南方沿いを西行する相対的高温水としてとらえることができる。Alaskan Stream の勢力を把握する1方法としてアリュージョン列島南方沿いにみられる4°C以上の水系を明らかにし、その西端部位置、Western Subarctic Water との混合状態について検討した。

5月（Fig. 1）：中部阿リュージョン南方、178°W付近に4°C以上の相対的高温水がみられた。しかしデータが少ないためこの水がAlaskan Stream を示唆する水か、Western Subarctic Water の南側域にみられる暖水系か定かでなかった。

6月（Fig. 2, Fig. 5）：阿リュージョン列島と51°Nの間に幅狭い帯状の相対的高温域がみられた。データが十分ではないが、出現パターンなどからこの水が東方域から連続する Alaskan Stream 水系とみなされた。4°C線の西側部は178°E付近に達していた。さらにこ
の水の影響をうけたと考えられる 8°C 以上の水系が 50°N、170°E 付近まで張り出し、1 部はさらに西方のWestern Subarctic Water の中に分離していた。

アリューシャン列島南方沿いにみられる 4°C等温線の西端部の位置をAlaskan Stream の西方張り出し勢力の指標として 1968 年から 1981 年までの変化を示すと Fig. 5 のようになる。本年 6 月は 1978、1979、1980 より、この水の西方張り出しの勢力は弱いものの、平均的な勢力は強いとみなされた。

7月（Fig. 8）: 連続した 4°C以上の暖水域は、174°E付近にあり、さらに分離暖水としては、170°E付近まで認められた。また Alaskan Stream箱水の混合影響をうけたとみられるアリューシャン列島南方域の 3°C以上の水系は 6 月に比較して分布域に広がりがみられた。これらのことは 6 月から 7 月にかけて Alaskan Stream の勢力がいくつ分弱くなったことを示唆していた。

3. 表面海況

4月の北西太平洋の表面水温は、全域的に平均より低温、特に 155°E ～ 170°E では、40°N を中心にして、170°E ～ 180°E では 42°N 付近を中心として低温化現象を示した（Fig. 6）。

5月においても全域的な低温傾向は持続したが、4 月にくらべると平均に近づいた。45°N を中心とする中部千島列島付近から 170°E では、平均よりやや高温を示した。

6 月にはいると当地域での表面水温上昇は著しく、上旬から下旬の間で 2°C ～ 5°C の昇温がみられた。しかし、平均水温との比較では、50°N 以南で全域的に低温化が著しく、特に三陸沖合域、Subarctic Boundary を含む 35°N ～ 45°N を中心とした東西帯状水温域での低温化が目立った（Fig. 7）。

この低温傾向は 7 月には、やや弱まったものの 47°N 以南では、いぜん持続した。

夏季を通じての表面水温低温化の出現パターンは Subarctic Boundary が平均より南に位置したこと示唆している。

Alaskan Stream 箱水の西方張り出し考えられる 50°N 以北の水温では、6 月、7 月において平均より高温を示し、この水系の勢力が平均より強いことを示唆した。

以上に述べた 1981 年夏季の北西太平洋の海況概要は、次のように要約される。
1. 本年夏季を通じてのWestern Subarctic Water の勢力は平年よりやや強かった。
2. Alaskan Stream の西方張り出しも平年よりやや強かった。
3. Subarctic Boundary の南側が顕著であった。
Fig. 1 Temperature distribution at 100m layer in May, 1981