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１９８４年夏季の北西太平洋における海況概要

Outline of oceanographic conditions of the Northwest Pacific during the summer of 1984.

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1982年夏季における北西太平洋の海況について例年と同様、水温資料より解析を行った。ここに用いられた水温資料は、主にさけ・ます調査船9隻、さけ・ます母船4隻、および母船所属独航船6隻によって得られたものである。観測点数は、4月62点、5月126点、6月202点、7月262点であった。4月の観測は大部分が40°N～44°Nにおけるものである。その他に表面水温資料としては「北太平洋漁海況速報」（漁業情報サービスセンター発行）と「全国海況旬報」（気象庁発行）を使用した。北西太平洋におけるさけ・ますの分布・回遊は Western Subarctic Water，Alaskan Stream および表層水温の影響をうけることが知られていることから、これらの性状に注目して検討した。

1. Western Subarctic Water

Western Subarctic Water は、冬季の表層冷却に起因する寒冷水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100 *m*層3°C以下の冷水をこの水系として取り扱った。

5月（Fig 1）：4月後半に調査された44°N以南の観測点62点も考慮しつつ描いた100 *m*深水温分布図である。千島列島に並行に描かれている等温線図は、この水域における冷水の起源が、千島列島もしくはその西方のオホーツク海にあることを示唆している。この寒冷水が東に張り出すと同時に北方からの寒冷水も、南方に張り出してくるのがこの水域の特徴である。例年160°E～170°Eにこの南方張り出しが見られ、それはコマンドルスキー冷水舌と呼ばれている。

4°Cラインでこの南方張り出しを見ると、163°Eと167°Eを先端とする2分枝が見られる。

この文書を引用する場合は下記による：

松村皐月．1984．1984年夏季の北西太平洋における海況概要
水産庁　遠洋水産研究所

この数年間、寒冷水の南方張り出しは南偏傾向にあるが、今年は更に南偏し、168°Eにおける3°Cラインは43°Nにまで達している。

Western Subarctic Water の東方張り出しは、3°Cラインをその指標とすれば、49°Nにて180°Eにまで達しており、過去2カ年に較べても寒冷水の勢力はやや強い。

6月（Fig 2）：100 *m*水温で見る限り、Western Subarctic Water は平担な分布をしており、3°C等温線の形状からはコマンドルスキー冷水舌の存在は見られない。5月に見られた冷水舌の張り出しは、4°C線上にややその根跡を残している程度である。逆に5月に47°N 173°Eに見られた暖水の貫入が、6月には更に北上し48°N 172°Eに達しているのが特徴として挙げられる。

この中で強いて3°Cラインをコマンドルスキー冷水舌の南端と位置づけると、167°Eにおいて45.7°Nと近年のうちでは1974年以来の北偏位置にある（Fig 4）。5月の海況では3°Cラインの南偏傾向から寒冷水の勢力増大を推定したが、1カ月後には全く逆の現象を見せるようになっており、海況の大きな変化があったことを示唆している。

3°Cラインの南偏は見られないものの、3°C以下の寒冷水の東方張り出しは近年になく強く、180°以東に及んでいるものと見られる。

7月（Fig 3）：40°N 149°Eから東北東方面に小さな蛇行を含む Subarctic Boundary が見られる。Boundaryは45°N 161°Eから南下し44°N 165°Eにある暖水域を迂回して44°N 176°Eに至っている。この暖水域の広がりにより、コマンドルスキー冷水舌はその形をより顕著に現わすようになった。その先端位置は45°N 168°Eと前月よりもやや西南に張り出すようになった。

前月、東方にまで範囲を広げていた3°C以下の寒冷水の分布は後退し、168°E附近までとなり、あとは178°E附近に孤立冷水域を形成するにとどまっている。

2. Alaskan Stream

Alaskan Stream は、アラスカ湾域よりアリューシャ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。この流れの勢力を把握する一つの方法としてアリューシャン列島南方沿いにみられる100 *m*層の4°C以上の水系について検討した。

5月（Fig 1）：中部アリューシャン列島に沿って相対的高温域が見られ、Alaskan Stream 系水の張り出しを示している。3.5°Cラインの先端は172°Eにまで及び、4°Cラインも177°Eにまで見られる。5月にこの水が認められたのは過去数年間はなかったことである。Subarctic Boundary の4C°ラインとAlaskan Stream 系水の4°Cラインは少なくも177°W以西においては明瞭に区別されている。

6月（Fig 2）：アリューシャン列島周辺に観測点がないために連続性は定かでないが、4°C以上の相対的高温水の東端は170°Eにまでみられる。この位置は昨年と同様、過去20年間の中では西方への貫入が大きい部類に属し、Alaskan Stream の勢力が1979年に次いで強かったことを

示唆している（Fig 5）。

7月（Fig 3）：4°Cラインの西端は明らかではないが169°Eにまで達してはいる。6月に比べ僅かではあるが更に勢力を増し西進して来た。

3. 表面水面

Fig 6、7、8、9に本年4月から7月までの表面平均水温平年偏差を示す。平年値とは過去30年間の各月毎の平均値である。4月は北太平洋全域において負の値となっており、三陸東方海上では－5°Cという異常低温が見られている。この傾向は5月においても続いているがオホーツク海及びその影響を受けている水域においてはこの現象は見られず、むしろプラス傾向を示している。これはオホーツク海の結氷が例年になく少ないという現象と一致している。しかし100 *m*水温で見た寒冷水の東方張り出しが強いという現象とは一見矛盾しているかに見える。この両者を以下のように説明することができる。

この水域の寒冷水源であるオホーツク海及びその周辺における’83年夏の表面水温は平年より1°～4°C低かった。加えて今冬の寒さは例年になく厳しいものであった。その影響を受けて海面は冷却を受けたが、上層混合層の厚さが平年以上に厚くなっているため海水の鉛直循環に時間がかかる。それゆえに、海表面水温が結氷点に達せず結氷が少なかった。表面水温も結氷時に比較するとやや高い現象が見られるが、総量としての冷水勢力は強いものであり、それが親潮勢力の増大をもたらし、親潮才1分枝の異常冷水現象を引き起こしたのであろう。

Fig 1、Fig 2に見られる5、6月の100 *m*深寒冷水分布の広さもこれで説明がつく。

6月の表面海況は様相を異にする。冷水部分が後退し、北方から平年偏差プラスの部分が勢力を拡大し、北海道東方には＋3°Cとなる水域が出現する。7月には更に暖水部分が拡大し、冬期から北太平洋を覆っていた平年偏差マイナスの部分は僅かになってしまった。

表層水の急激な昇温に伴い、7月の100 *m*深水温図における3°Cラインも西に後退していったと考えられる。またこれは、Alaskan Stream 勢力の増大とも関連した現象であると云える。

6月の中冷水の強さと表層の高温現象により、当水域の水温鉛直勾配は例年になく大きいものであったと推測される。

以上に述べた1984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. Western Subarctic Water の東方への張り出しは強く、180°以東にも及んでいた模様である。南の方にもやや勢力の強さを示しており、親潮の異常冷水現象にも影響を与えていたものと見られる。
2. Alaskan Stream の西方張り出し勢力は昨年同様強く、Western Subarctic Water との間に顕著な境界を持ち、互いに楔状に食い込み合うような分布をしている。
3. 表面水温は5月迄の低温現象と6月以後の高温現象との間に急激な変化が見られた。1983年夏

の表面水温が低かったことと、1984年冬の厳冬が寒冷水の勢力を増大させたが、7月以後は暖水の勢力が強くなった。

4. 100 m深水温の動きと Alaskan Stream の分布及び表面水温の変動は互いに連動しており、この水域の海況を総合的に判断することができる。今夏の表面水温の高温化は来冬における Western Subarctic Water の形成に影響を与えることが十分予想される。

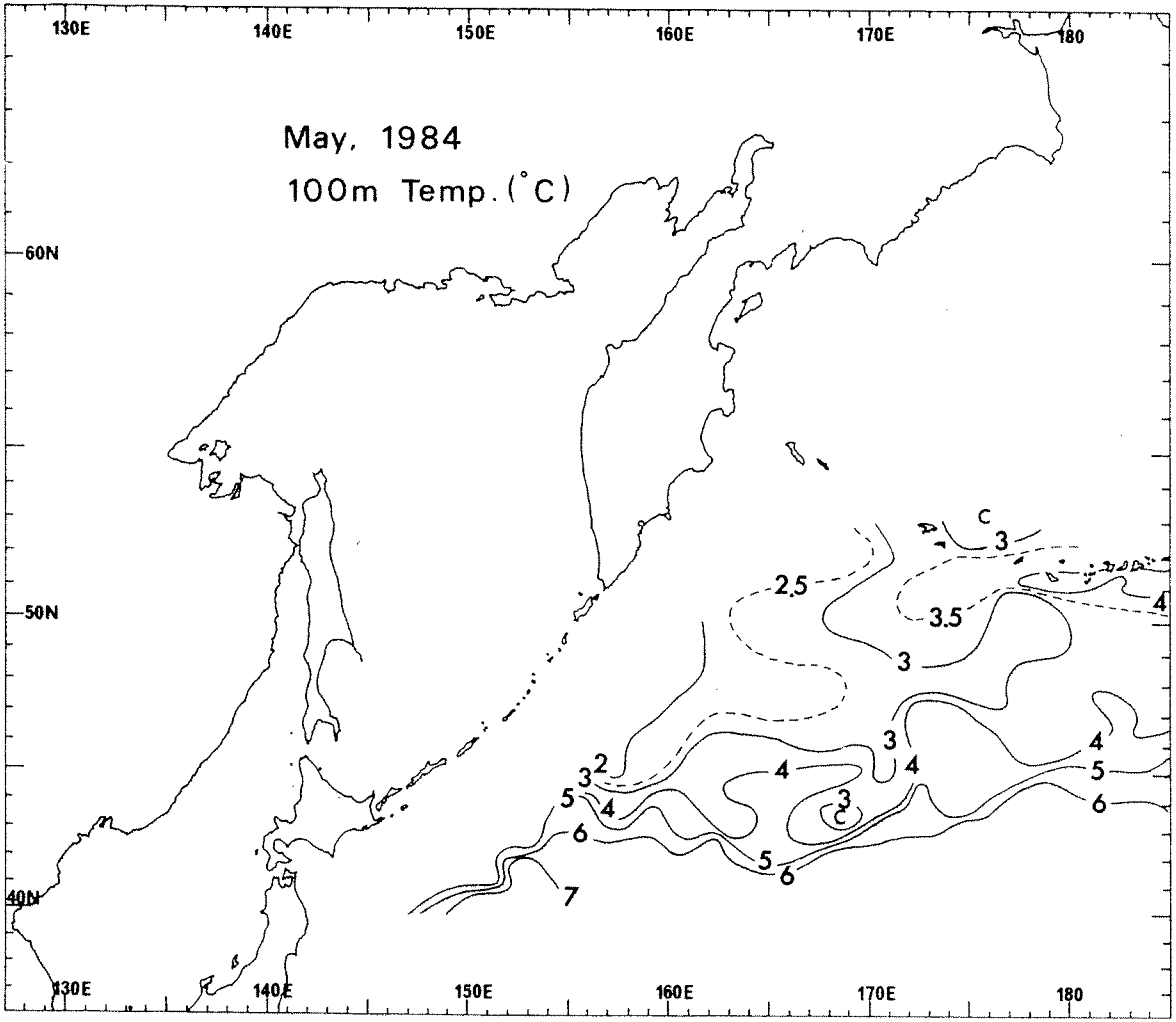


Fig. 1 Temperature distribution at 100m layer in May, 1984

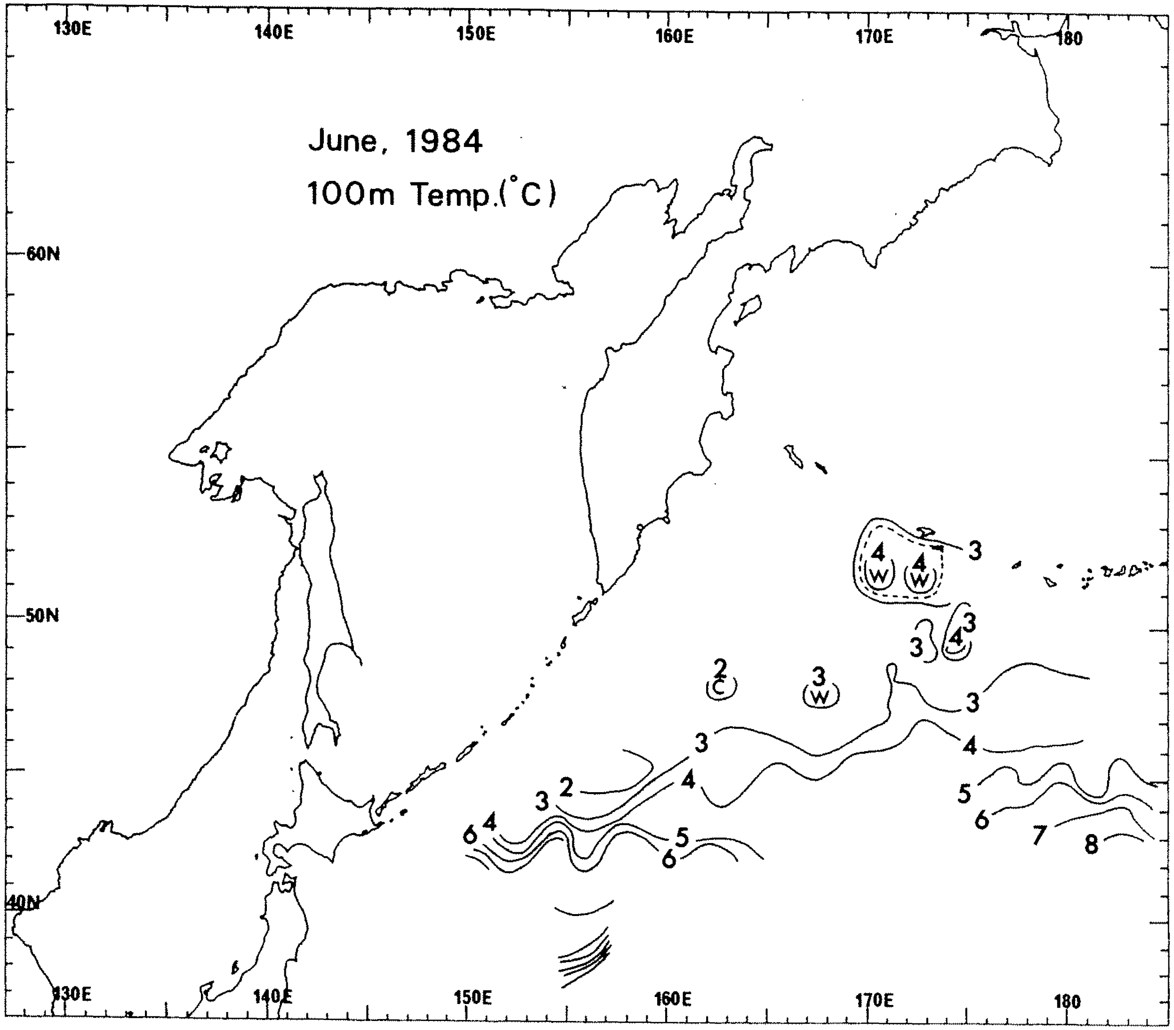


Fig. 2 Temperature distribution at 100m layer in June, 1984

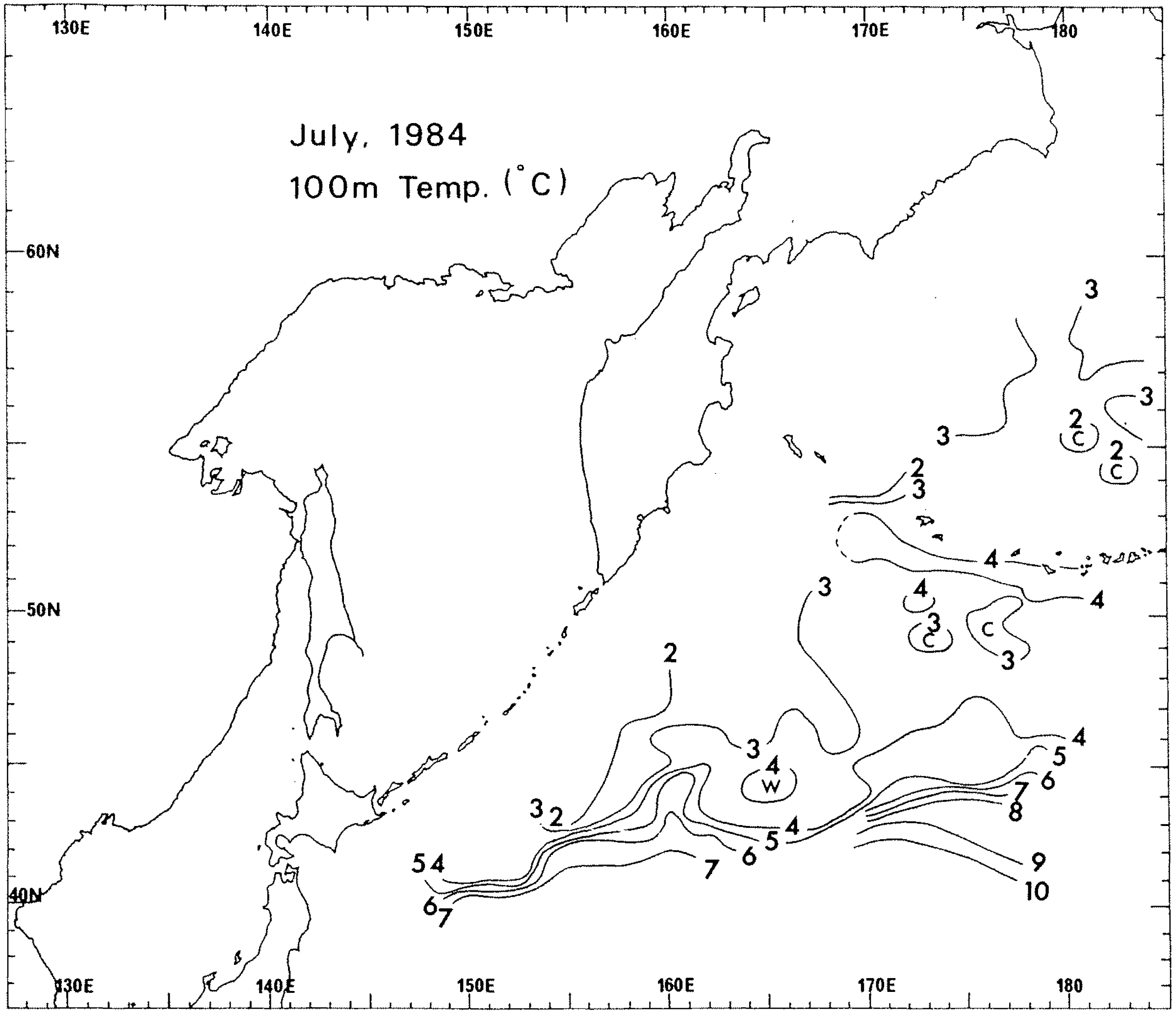


Fig. 3 Temperature distribution at 100m layer in July, 1984

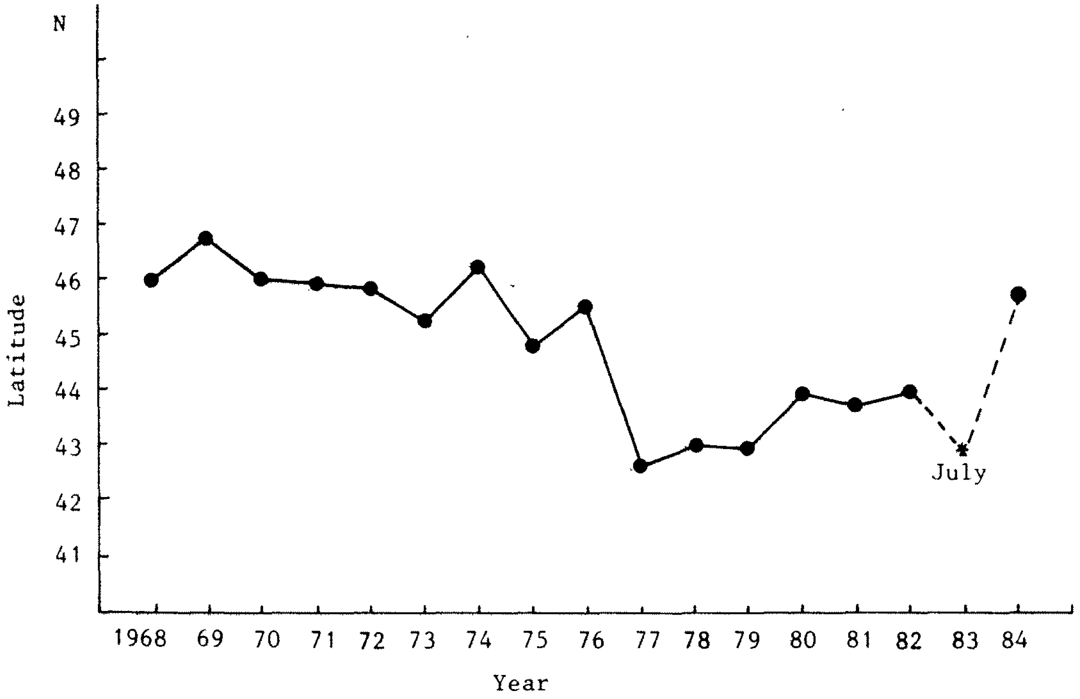


Fig. 4 Annual fluctation of southward extension of Komandrskie tongue-shaped cold water in June indicated 3°C isothermal at 100m depth.

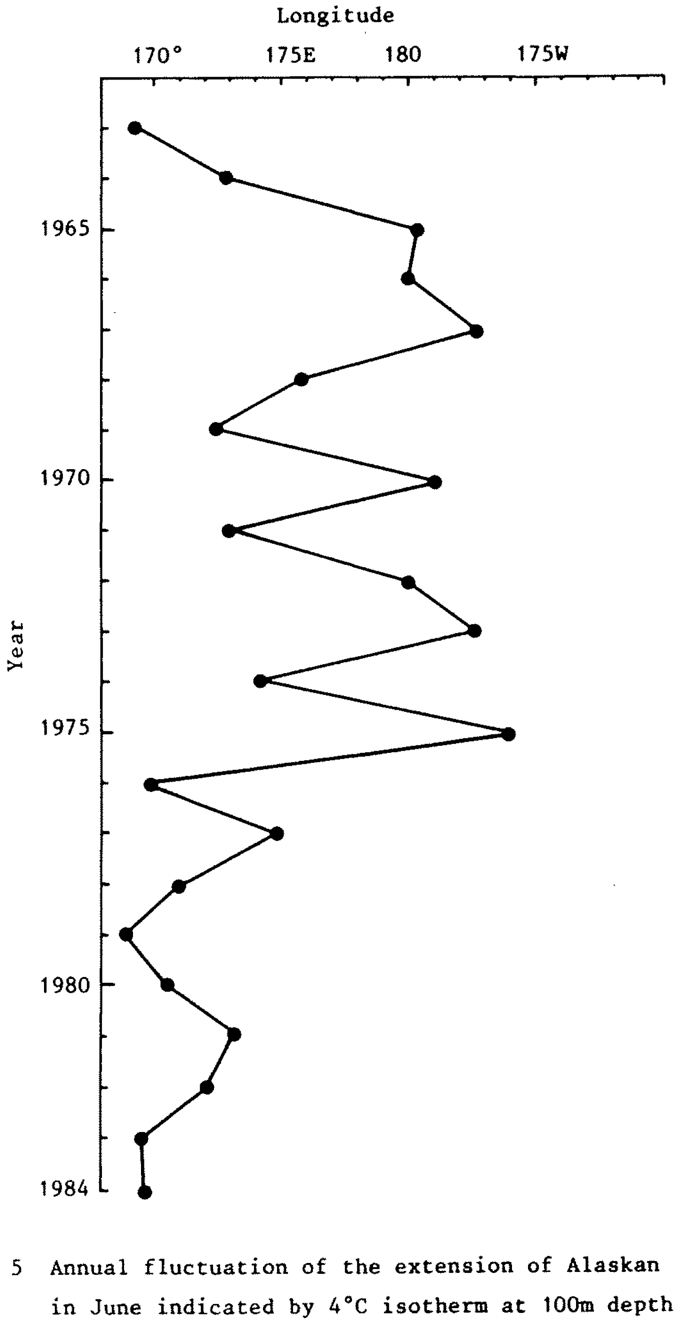
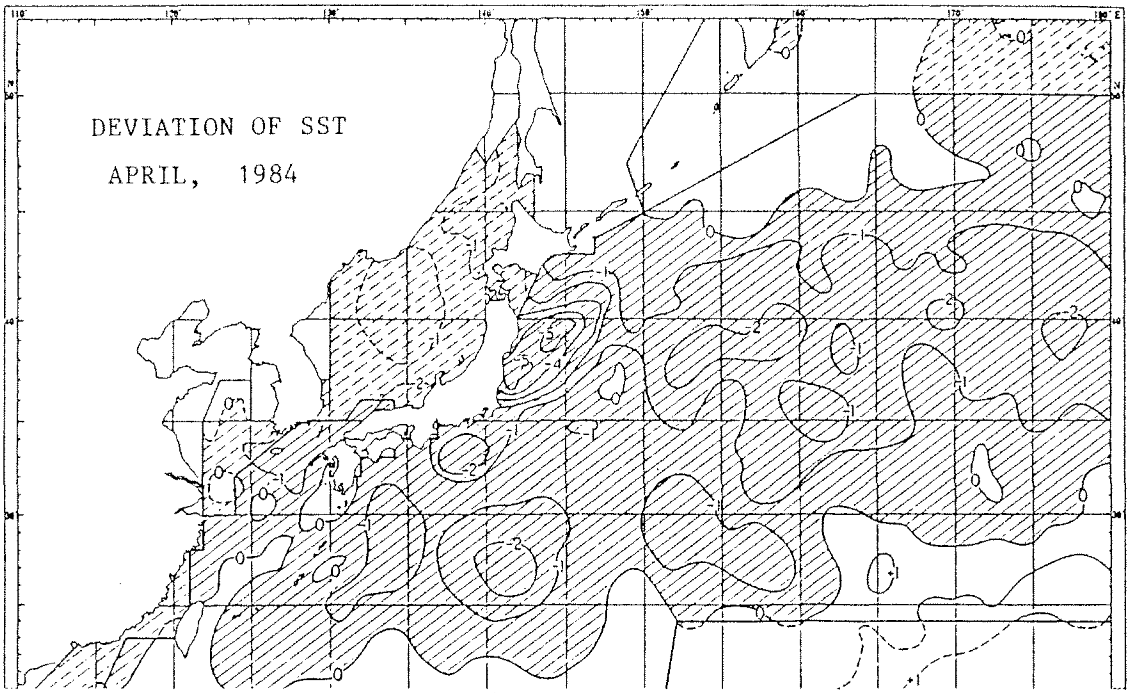


Fig. 5 Annual fluctuation of the extension of Alaskan stream in June indicated by 4°C isotherm at 100m depth.



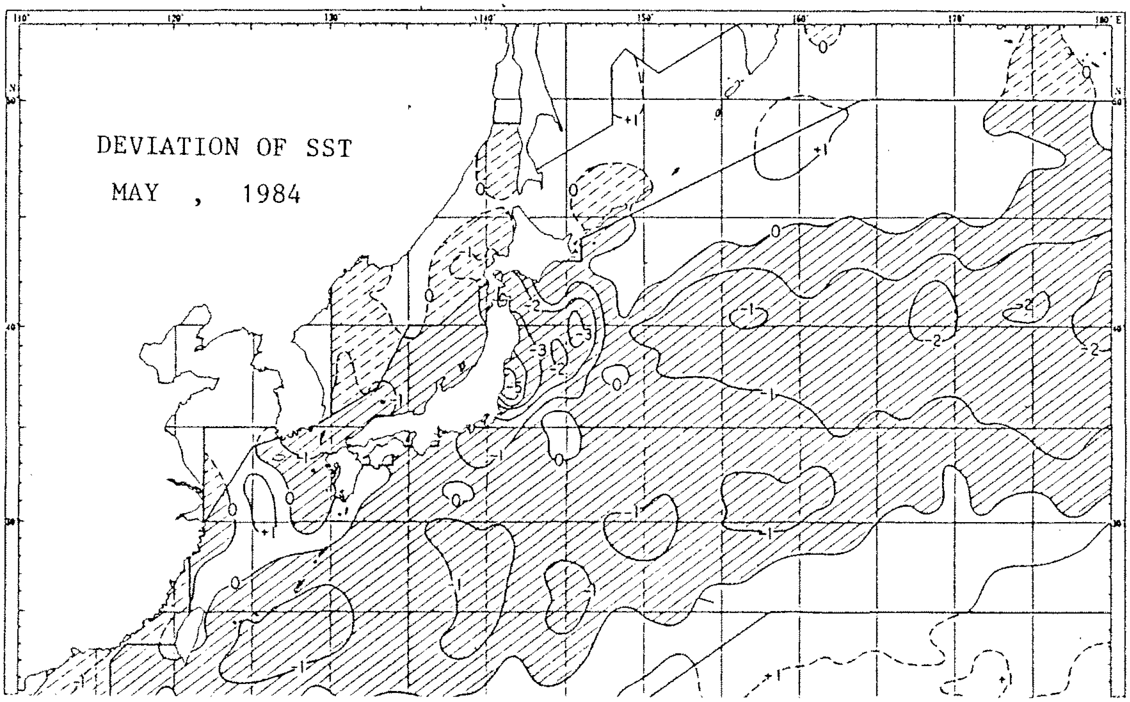


Fig.6 Deviation of the sea-surface temperature in April, May,1984 from the monthly mean for 30 years,1951-'80 (From The Ten-Day Marine Report,No.1353)

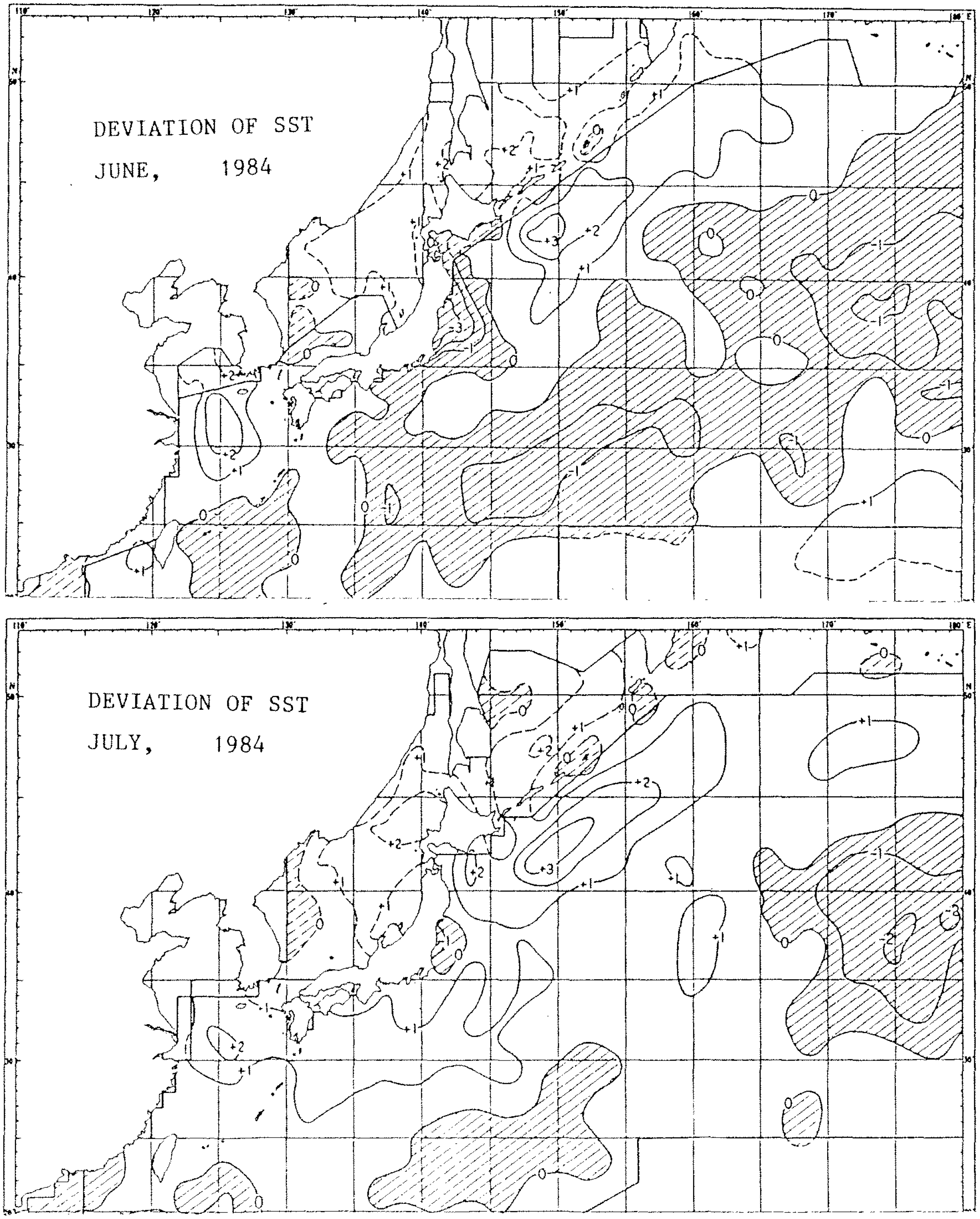


Fig.7 Deviation of the sea-surface temperature in June, July,1984 from the monthly mean for 30 years,1951-'80. (From The Ten-Day Marine Report,No.1359)

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TRANSLATION

OUTLINE OF OCEANOGRAPHIC CONDITIONS OF THE NORTHWEST PACIFIC DURING THE SUMMER OF 1984

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Introduction

Oceanographic conditions in the northwestern Pacific Ocean during the summer of 1984 were examined using data on water temperature as in previous years. Data used were obtained from nine salmon research vessels, four salmon motherships, and six catcher boats attached to the motherships. Observations were made at 62 stations in April, at 126 stations in May, 202 stations in June, and 262 stations in July. Most observations in April were made in areas between 40°N and 44°N. For surface water temperatures, reports used were the "Prompt Report on Fisheries in the North Pacific Ocean" by the Fisheries Information Service Center and "The Ten-day Marine Report" of the Meteorological Agency of Japan. Much previous work has pointed out that distribution and migration of salmon in the northwestern Pacific Ocean are influenced by Western Subarctic Water, the Alaskan Stream, and surface water temperture. Therefore, we assessed the distribution and features of these water masses.

1. Western Subarctic Water

Western Subarctic Water is a cold water mass produced by surface cooling in winter that is widely distributed in the northwestern Pacific Ocean, centering off the eastern areas of the Kamchatka Peninsula and the Kuril Islands. Here we will deal with the cold water mass with temperature 3°C or less at 100 m depth as identifying this water mass as in previous years.

May (Fig. 1): Figure 1 shows water temperature distribution at 100 m depth in May. The results of observations in late April (at 62 stations in areas south of 44°N) were also used for the figure. Isotherms that parallel the Kuril Islands suggest that the origin of this cold water mass is in areas near the Islands or in the Okhotsk Sea west of the Islands. It is characteristic of these waters that when this cold water extends eastward, another cold water mass in the north also extends towards the south. This southward extension is observed almost every year in areas between 160°E and 170°E and is called "the Komandorskie Cold Tongue". Examining this southward extension using the 4°C isotherm, two branches are observed with tips at 163°E and 167°E.

The southward extension of cold water has a tendency to shift towards the south and the trend was more notable in 1984. The 3°C isotherm at 168°E reached as far south as 43°N. Further, using the 3°C isotherm as an index, the eastward extension of the Western Subarctic Water is determined to have reached 180° on 49°N. Therefore we can conclude that the extensions of the cold water masses in May 1984 were strong compared to even the last two years.

June (Fig. 2): As determined by water temperature at 100 m depth, the distribution of the Western Subarctic Water shows a simple pattern and the Komandorskie Cold Tongue cannot be determined by using the 3°C isotherm. The extensions observed in May have left slight traces on the distribution of the 4°C isotherm. In contrast, the northward extension of warm water which was observed at 47°N, 173°E in May shifted farther north to 48°N, 172°E.

If we choose to define the 3°C isotherm as the southern edge of the Komandorskie Cold Tongue, the edge was located at 45.7°N at 167°E longitude which is the northernmost since 1974 (Fig. 4). Although a strengthened cold water mass was assumed in May, the reverse results were obtained in June suggesting a big change had occurred during the period.

No southward extension of the 3°C isotherm was observed as explained above but the eastward extension of water with temperature 3°C or less was considered to have reached east of 180°.

July (Fig. 3): The slightly zigzag Subarctic boundary is observed from 40°N, 149°E to east northeast. The boundary extends to the south from 45°N, 161°E making a detour around the warm water mass centered at 44°N and 165°E and reached 44°N, 176°E. Because of the extension of the warm water mass, the shape of the Komandorskie Cold Tongue became clear with the tip at 45°N, 168°E. The tongue extended slightly more southwestward than in June.

The cold water with temperature 3°C or less, which had extended eastward in June, moved back and the eastern edge was located near 168°E leaving some isolated cold water areas around 178°E longitude.

2. Alaskan Stream

The Alaskan Stream is recognized as a relatively high temperature current which flows towards the west along the south side of the Aleutian Islands. We examined the location of water with relatively high temperature of 4°C and over south of the Aleutian Islands at 100 m depth in order to determine the strength of the stream.

May (Fig. 1): High water temperature areas were observed along the mid-Aleutian Islands which shows the extension of water originating from the Alaskan Stream. The tip of the 3.5°C isotherm reached as far south as 172°E and the 4.0°C isotherm also extended to 177°E. This water mass has not been observed in May for several years. The isotherms of 4°C denoting the Subarctic boundary and Alaskan Stream are clearly distinguishable in areas west of 177°W.

June (Fig. 2): Although the continuity of isotherm from east was not clear because no observations were made near the Aleutian Islands, the western edge of the water with relatively high temperature (4°C and greater) is observed as far as 170°E. Distribution to the east was not determined because no observations were made near the Aleutian Islands. This location shows that the westward intrusion of the warm water mass in 1984 was one of the most extensive in the last 20 years, as was the case last year, suggesting that the strength of the Alaskan Stream was strongest in 1984 next to that of 1979 (Fig. 5).

July (Fig. 3): The western edge of the 4°C isotherm is not clear but reached at least 169°E. The warm water flow became slightly stronger and extended further west in July than in June.

3. Surface water temperature

Figures 6, 7, 8, and 9 show deviations of the sea-surface temperature from April to July 1984 from the monthly mean for the past 30 years. In April, the values are negative over a large part of the North Pacific and off Sanriku, in particular, an unusually low value (-5°C) was noted. This trend continued in May. However, in the Sea of Okhotsk and influenced areas, such trend was not observed and the values were positive. This phenomenon agrees well with the fact that the ice formation in the Sea of Okhotsk was slight compared to previous years. Such facts may seem to be contradictory with the strong eastward extension of cold water observed at 100 m depth but these can be explained as follows--

The surface water temperature in the summer of 1983 in the Sea of Okhotsk, where the cold water described above originates, was 1°C to 4°C lower than in a normal year and this winter was much colder than recent years. As a result, the sea surface was greatly cooled and water temperature decreased. However, because the upper convection layer had become much deeper, the vertical circulation of the water took longer than usual. Therefore, the surface water in these areas hardly reached the freezing point and less ice was produced. Although the surface water temperature was slightly higher than when ice was present, the total strength of the cold water mass produced in these areas was great and this phenomenon is considered to have increased the strength of the Oyashio and caused unusually cold water temperature in the first branch of the Oyashio. The large area of distribution of cold water at 100 m depth in May and June shown in Figs. 1 and 2 is also explainable with the above understanding.

The surface water temperature distribution in June has a different feature, the cold temperature area was reduced, and the area with plus values of deviation expanded from the north and an area with a value of +3 was observed east of Hokkaido. In July warm water further expanded and the area with minus deviation values which had covered the north Pacific since winter became very small.

With the rapid increase in surface water temperature, the 3°C isotherm at 100 m depth in July is considered to have withdrawn towards the west. This should also be related to the increased strength of the Alaskan Stream.

Because cold water was widely distributed in the mid-layer and surface water temperature was high in June, the vertical temperature gradient in these areas is believed to have been very steep.

Oceanographic conditions in the northwest Pacific during the summer of 1984 are summarized as follows--

1. The eastward extension of the Western Subarctic Water was strong and seemed to have extended beyond 180° longitude and the southward extension was also relatively strong which is considered to have an influence over the unusual cold water phenomenon in the Oyashio.

2. The westward extension of the Alaskan Stream was as strong as in 1983 and was clearly separated from Western Subarctic Water with a wedge shaped pattern of distribution.

3. There was a rapid change in surface water temperature between the lower temperature period up until May and the higher period from June. The low surface temperature in the summer of 1983 and unusually cold 1984 winter resulted in strong cold water masses but warm water was predominant in these areas from July onward.

4. Trends in water temperature distribution, the Alaskan Stream, and surface water temperature are influenced by each other and by examining these trends oceanographic conditions can be analyzed comprehensively. It is expected that increases in surface water temperature this summer will influence the formation of the Western Subarctic Water in the coming winter.

FIGS. 1 TO 7 ARE IN ENGLISH IN THE JAPANESE DOCUMENT