# The State of the Western North Pacific in the First Half of 2013

*by Shiro Ishizaki*

***Sea surface temperature***

Figure 1 shows monthly mean sea surface temperature (SST) anomalies in the western North Pacific from January to June 2013, computed with respect to JMA's (Japan Meteorological Agency) 1981–2000 climatology. Monthly mean SSTs are calculated from JMA's MGDSST (Merged satellite and *in-situ* data Global Daily SST), which is based on NOAA/AVHRR data, MetOp/AVHRR data, GCOM-W1/AMSR2 data, Coliolis/WINDSAT data and *in-situ* observations for the period since 1985.

Time-series of 10-day mean SST anomalies are presented in Figure 2 for the 9 regions indicated in the panel at the bottom. From January to March, SSTs were above normal in the seas around 30ºN, 180ºE. From April to June, positive anomalies dominated in the seas from the area east of the Philippines to the area around the Mariana Islands. During the entire period, positive anomalies prevailed in the South China Sea. Negative anomalies observed in regions 1 and 3 from January to May turned positive in June. In June, positive anomalies exceeding +1ºC were found in the seas south of Okinawa. From May to June, negative anomalies were seen in the seas along 30ºN south of Japan.

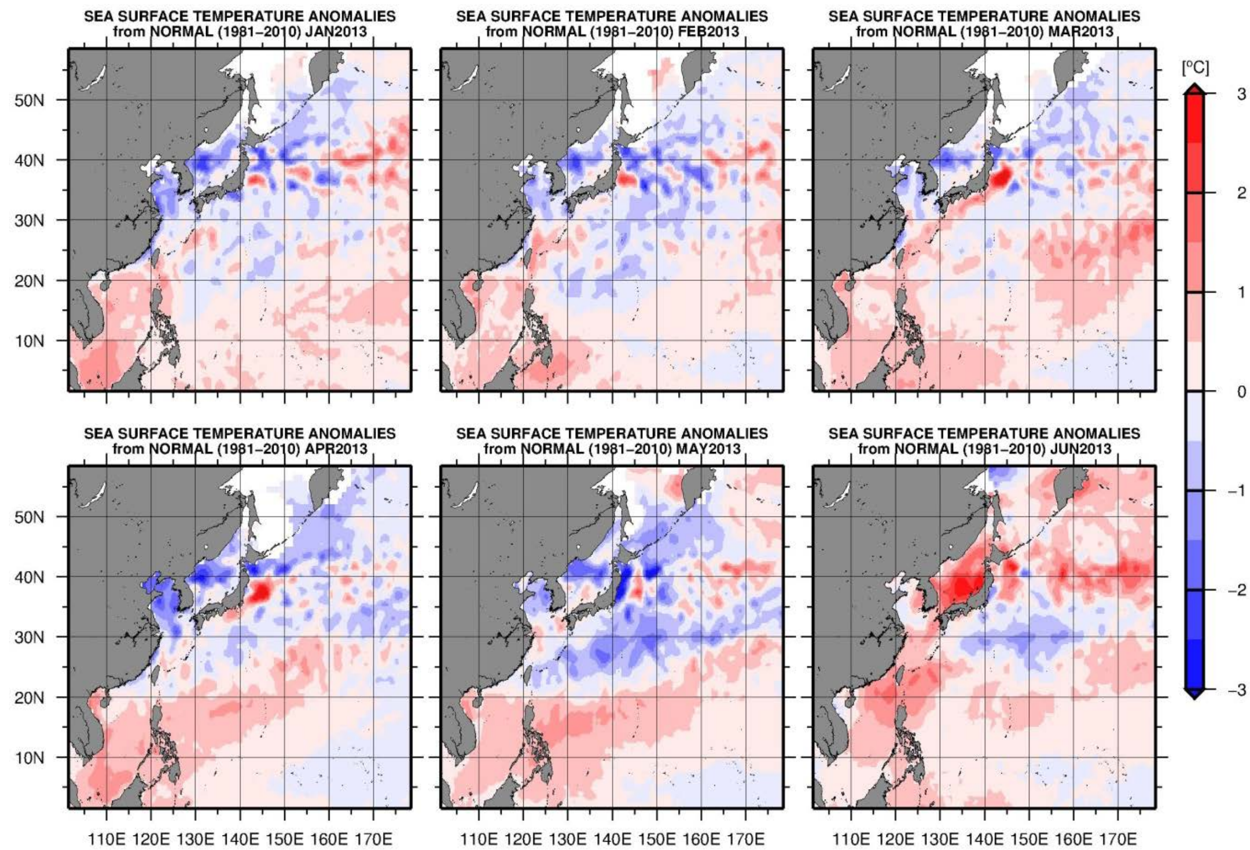


*Fig. 1 Monthly mean sea surface temperature anomalies (ºC) from January to June 2013. Anomalies are deviations from JMA's 1981–2010 climatology.*

*Shiro Ishizaki (s_ishizaki@met.kishou.go.jp) is a Scientific Officer of the Office of Marine Prediction at the Japan Meteorological Agency. He works as a member of a group in charge of oceanic information in the western North Pacific. Using the data assimilation system named "Ocean Comprehensive Analysis System", this group provides an operational surface current prognosis (for the upcoming month) as well as seawater temperature and an analysis of currents with a 0.25 × 0.25 degree resolution for waters adjacent to Japan. Shiro is now involved in developing a new analysis system for temperature, salinity and currents that will be altered with the Ocean Comprehensive Analysis System.*

*We would like to express our deep appreciation to Shiro for consistently providing two articles per year on the state of the NW Pacific since 2006.*

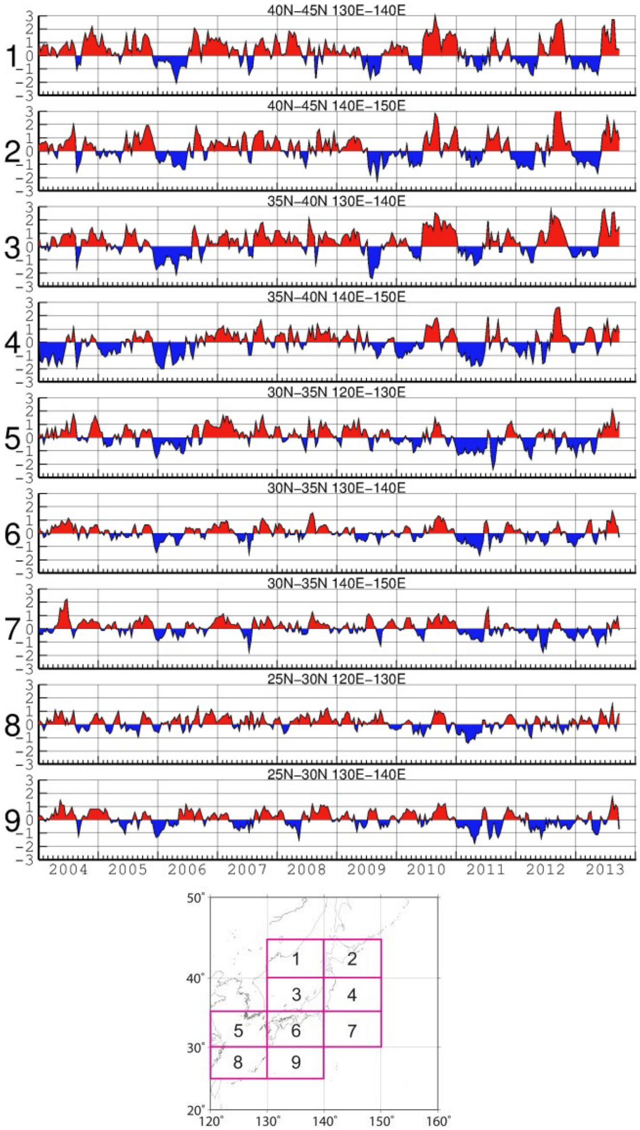


*Fig. 2 Time-series representation of 10-day mean sea surface temperature anomalies (ºC) averaged for the sub-areas shown in the panel at the bottom. Anomalies are deviations from JMA's 1981–2010 climatology.*

### *Kuroshio and Oyashio*

A time-series outlining the location of the Kuroshio path from January to June 2013, at intervals of 10 days, is presented in Figure 3. During the entire period, the current took a non-large-meandering path off the southern coast of Honshu Island, between 135ºE and 140ºE. East of 135ºE, several small perturbations propagated eastward along the Kuroshio. Corresponding to the passage of each perturbation, the latitude of the current's axis over the Izu Ridge (around 140ºE) moved north and south. The latitude of the axis at the Izu Ridge (about 140ºE) was about 34ºN (around Miyake Island) from January to April. From May to June, the Kuroshio flowed south of Hachijo Island (33ºN, 140ºE).

Figure 4 shows monthly mean subsurface temperatures at a depth of 100 m in the waters east of Japan for March 2013 generated using the numerical ocean data assimilation system (MOVE/MRI.COM-WNP). The Oyashio cold water (defined as areas with temperatures lower than 5ºC in Fig. 4) normally extends southward in spring and returns northward from summer until autumn, as indicated by the green line in Figure 5. The coastal branch of the Oyashio cold water extended southward from January to March before retreating northward from March to April. Its position was almost normal during the entire period (Fig. 5).

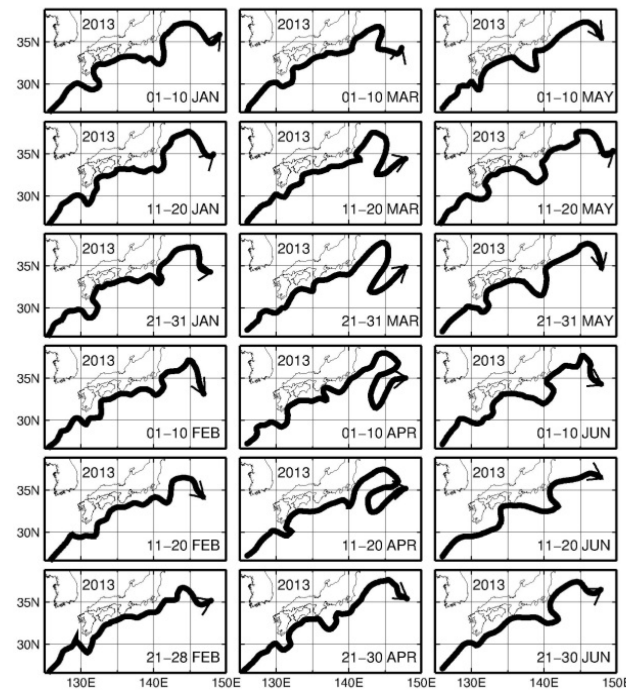


*Fig. 3 Location of the Kuroshio path from January to June 2013.*

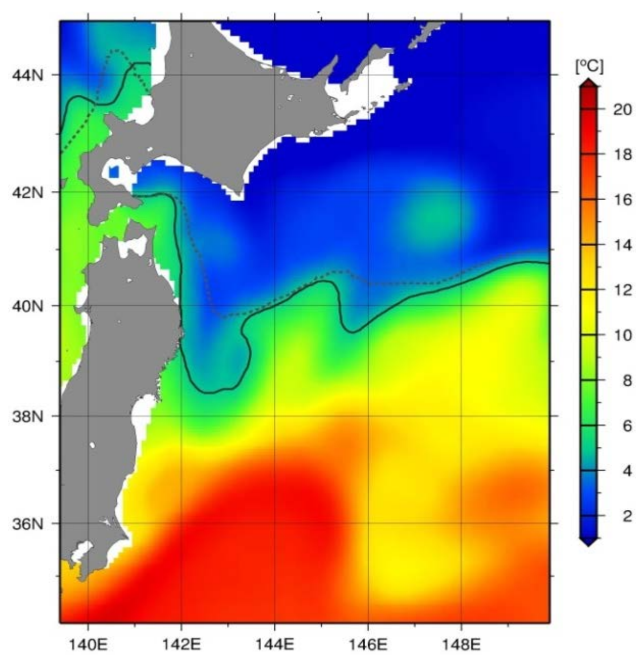


*Fig. 4 Subsurface temperatures (ºC) at a depth of 100 m east of Japan for March 2013. The solid line shows the 5ºC isotherm, while the dotted line denotes that of the monthly climatology (26-year average values from 1985 to 2010).*

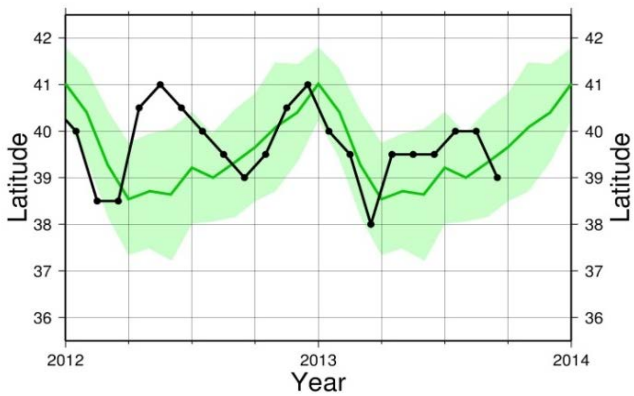


*Fig. 5* *The monthly southernmost position of the coastal branch of the Oyashio cold water from January 2012 to July 2013 (black line), and 26-year average values (green line) with a range of one standard deviation (green shading) from 1985 to 2010.*

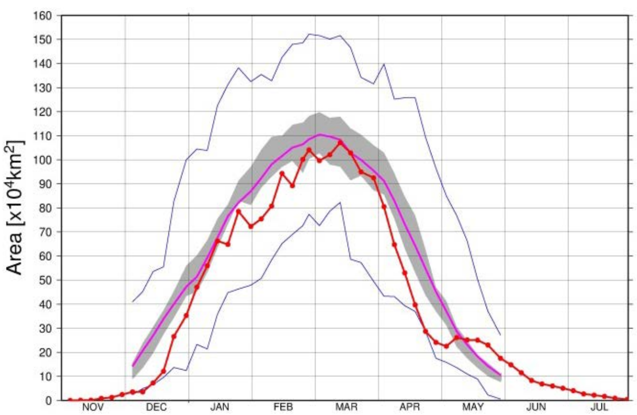


*Fig. 6* *Time-series of the sea ice extent in the Sea of Okhotsk from November 2012 to July 2013 (red line: 2012–2013 analysis; pink line: JMA's 1981–2010 climatology; blue lines: maximum /minimum sea ice extent since 1971; gray area: normal range).*

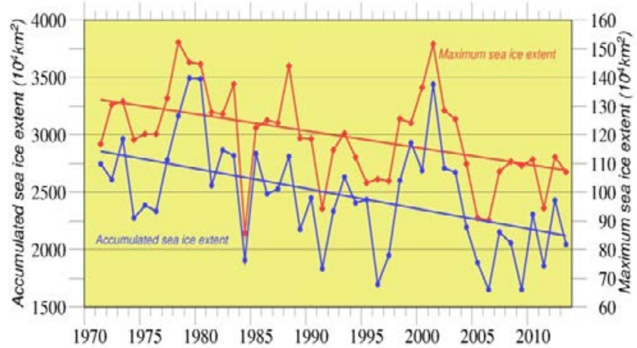


*Fig. 7* *Interannual variations in the maximum sea ice extent (red line) and the accumulated sea ice extent (blue line) in the Sea of Okhotsk from 1971 to 2013. The term accumulated sea ice extent refers to the sum of all 5-day sea ice extent values from December to May.*

### *Sea ice in the Sea of Okhotsk*

The sea ice extent in the Sea of Okhotsk was near or less than normal from December 2012 to April 2013, and became greater than normal due to slow melting of ice in May (Fig. 6). It reached its seasonal maximum of $107.13 \times 10^4$ km$^2$ (less than the normal of $116.92 \times 10^4$ km$^2$) on March 15, 2013.

Figure 7 presents interannual variations in the maximum sea ice extent and accumulated sea ice extent in the Sea of Okhotsk for the period from 1971 to 2013. Although both parameters show large variations, there are long-term decreasing trends of 175 [71–279] $\times 10^4$ km$^2$ per decade (the numbers in square brackets indicate the two-sided 95% confidence interval) in the accumulated sea ice extent, and of 5.8 [2.2–9.5] $\times 10^4$ km$^2$ (equivalent to 3.7% of the Sea of Okhotsk's total area) per decade in the maximum extent.

*(Continued from page 14)*

process models is warranted. However, such efforts must recognize that important ecological responses to anthropogenic climate change (*e.g*., species invasions and replacements) may not be represented accurately in simplified process models. Either explicit acknowledgment of these ecological issues as caveats of the approach or attempts to include such issues in future process models of long-term ecosystem changes should be considered in future discussions.

Further recommendations from the workshop include future workshops that might narrow the focus of discussion while maintaining the exchange of information between physical and biological oceanographers. The advertised scope of the workshop attracted participants from diverse groups within the PICES and ICES communities and brought together experts in physical and biological oceanography and fisheries management. However, the wide-ranging subjects of the presentations and limited time available constrained the further distillation of available hypotheses into a key subset of mechanisms describing climate impacts of marine ecosystems. The entrainment of increasingly diverse and numerous participants acted to broaden, rather than focus, our discussions. The workshop provided a forum for the presentation of mechanisms relating climate and higher trophic levels at a wide range of scales, but we are still faced with the challenge of applying a more systematic approach to represent these underlying relationships using models of reduced complexity. One proposed strategy for future workshops may be to divide participants into smaller groups for more focused discussions emphasizing climate–ecosystem variability at a specific scale (*e.g.*, mesoscale, regional, or global scale; interannual to centennial scale) or via general mechanistic categories (*e.g.*, trophic interactions, ecophysiology, genotypic and phenotypic responses, or species distributions). However, collaboration among physical and biological ocean scientists and recognition of interacting spatial and temporal scales must be maintained.