Previous studies have documented the abrupt decrease of tropical cyclone (TC) genesis frequency over the western North Pacific (WNP) since 1998. It is found in this study that this abrupt decrease is primarily related to the decrease in a cluster of TCs (C1) that mostly formed over the southeastern WNP and possessed long tracks. Results from statistical analyses show that both geneses and tracks of C1 TCs were significantly modulated by the Interdecadal Pacific Oscillation (IPO), whose recent negative phase corresponded to a La Niña-like sea surface temperature anomaly pattern, which strengthened the Walker circulation and weakened the WNP monsoon trough, suppressing C1 TC geneses and also consequently leading to a significant decrease in TC geneses over the entire WNP basin. These results are further confirmed by analyses with longer datasets and results from a 500-year pre-industrial general circulation model experiment.