

## 1.0 Introduction

Over the past 200 years, human activities have led to a secular increase in atmospheric CO<sub>2</sub> from about 280 to greater than 365 ppmv (Keeling and Whorf, 2000; Carbon Dioxide Information Analysis Center, 2001). The impact of the CO<sub>2</sub> increase and that of other “greenhouse” gases on the global climate is at the center of a major international policy debate. Studies of the ocean’s role in the uptake and storage of anthropogenic CO<sub>2</sub> and modulation of future atmospheric CO<sub>2</sub> levels are critical for understanding the global carbon cycle and for the prediction of future climate change. The North Pacific is an important sink region for atmospheric carbon dioxide in the oceans and, consequently, plays a significant role in controlling the long-term fate of CO<sub>2</sub> on Earth. Some biogeochemical processes relating to the oceanic CO<sub>2</sub> system are peculiar to the North Pacific. This occurs because (i) the North Pacific is the final destination of circulation of the deep water that contains a high level of preformed nutrients and dissolved inorganic carbon (DIC), and (ii) the North Pacific Intermediate Water stores dissolved CO<sub>2</sub> for more than a few tens of years.

Much of our understanding of the distribution and fate of anthropogenic CO<sub>2</sub> in the North

Pacific stems from the high-quality carbon data that were acquired as part of the World Ocean Circulation Experiment (WOCE)/Joint Global Ocean Flux Study (JGOFS) Global CO<sub>2</sub> survey and subsequent cruises. In addition, underway measurements were made for *p*CO<sub>2</sub> in the northern North Pacific from 1995 to 1999, as part of the Japan-Canada cooperative vessel of opportunity program. This research was supported, in part, by the member nations of the North Pacific Marine Science Organization (PICES), through the activities of its Working Group 13. The group played a major role in fostering international cooperation in exchanges of samples from cruises, supporting CO<sub>2</sub> inter-comparison studies, and developing strategies for exchanging data at the international level. This report summarizes the research and technical activities that have been conducted by member nations of PICES to synthesize CO<sub>2</sub> data in the North Pacific, and provide a comprehensive picture of the distribution of anthropogenic CO<sub>2</sub> in this region. Then, the implications of the results with respect to climate change processes in the future are discussed. Finally, recommendations are made for future directions by PICES for international cooperation on carbon cycle research in the North Pacific.