1 Introduction

Micronekton are structurally defined as relatively small but actively swimming organisms falling into a size class 2–20 cm, *e.g.*, between the plankton which are entirely adrift with the currents and the larger nekton which have the ability to migrate without much effect from currents (Pearcy, 1981; Brodeur *et al.*, 2005). Operationally, micronekton can be defined as taxa that avoid being caught with conventional plankton nets and are too small to be retained by most large trawls. As a consequence, different countries have developed and presently use a variety of sampling gears to catch micronekton quantitatively. Functionally, micronekton are composed of diverse taxonomic groups (Brodeur and Yamamura, 2005). Of particular interest are the cephalopods (mainly gonatid and enoploteuthid forms, as well as juvenile stages of oceanic species), crustaceans (including large euphausiids, pelagic decapods, and pelagic mysids), and fishes (mainly mesopelagic species such as myctophids, gonostomatids and bathylagids). Most of these animals undergo extensive vertical migrations and compose the sound scattering layer . Vertical migrations are conducted either on a daily or seasonal basis, with migrators occupying productive surface waters at night and descending to midwater during the daytime to reduce predation, or undertaking diapause on seasonal scales. These migrations appear to contribute significantly to the rapid vertical transport of organic material from epipelagic to mesopelagic zones (Kishi *et al.*, 2001). The mesopelagic layer, which is arguably among the largest and one of the least variable ecosystems in the world, plays a critical role in controlling marine productivity on global change time scales. This layer is also responsible for the sequestering of atmospheric carbon to the ocean floor, thus impacting climate and acting as a negative feedback to global warming. Thus it is becoming increasingly clear that the mesopelagic realm represents one of the most important ecosystem components controlling biogeochemical cycling on our planet (Tsubota *et al.*, 1999). Micronekton also include small epipelagic 'forage fishes', *e.g.*, juvenile forms of pelagic and demersal resources, which are commonly found in diets of higher level predators (Brodeur and Yamanura, 2005). Generally not fished commercially because of their relatively small size and high lipid content, micronekton therefore represent a poorly understood but critical intermediate trophic level linking the zooplankton and highest trophic levels (including squid, fishes, seabirds, sea turtles, and marine mammals) as well as surface and midwater layers of the ocean (Seki and Polovina, 2001; Brodeur and Yamamura, 2005).

The highly mobile nature (net avoidance) and uneven (patchy) distribution of micronekton in the pelagic environment and their extrusion through the mesh of large trawls make these organisms extremely difficult to sample without bias (Pearcy, 1981). In 1998, the Biological Oceanography Committee (BIO) of the North Pacific Marine Science Organization (PICES) established a Working Group on *Effective Sampling of Micronekton to Estimate Ecosystem Carrying Capacity* (WG 14) to address the concern that there was insufficient information on the distribution, biomass and ecology of micronektonic organisms in the North Pacific. Included in the operational 'Terms of Reference' was a request to "*examine the efficacy of available micronekton sampling gears and propose new sampling devices if the available ones were not adequate for the task*". One of the recommendations included in the WG 14 final report on *Micronekton of the North Pacific* (Brodeur and Yamamura, 2005) is that, although a variety of gears are presently being used to sample micronekton in the North Pacific and other parts of the world ocean (Wiebe and Benfield, 2003), there has been little effort expended in comparing the relative sampling efficiency and selectivity of these gears.

It has been more than 20 years since the Scientific Committee on Oceanic Research (SCOR) symposium on methods of sampling micronekton was convened (Pearcy, 1981). A substantial effort through the International Council for the Exploration of the Sea (ICES)/Global Ocean Ecosystem Dynamics (GLOBEC) Sea-going Workshop was undertaken in 1993 to compare a large variety of plankton nets in the North Atlantic (Wiebe *et al.*, 2002). Although three nets suitable for catching micronekton were used during the experiment, *e.g.*, Isaacs-Kidd Midwater Trawl (IKMT), Multiple Opening/Closing Net and Environmental Sensing System (MOCNESS) and young fish trawl (YF), most of the sampling devices used for comparison were designed to sample mesozooplankton, *e.g.*, organisms < 2 cm (Wiebe *et al.*, 2002). Overall, the absence of inter-calibration coefficients between available gear types has hampered previous efforts to make inter-decadal or regional comparisons of micronekton composition and biomass.

In 2002, PICES formed an Advisory Panel on *Micronekton Sampling Gear Inter-calibration Experiment* (MIE-AP) as a result of recommendations from WG 14. The role of the Advisory Panel (renamed as *Micronekton Sampling Inter-calibration Experiment* in 2004) was to oversee the planning and implementation of a field program to evaluate the efficacy of sampling gears and procedures employed by different agencies to sample micronekton in the North Pacific, and to disseminate the results to the scientific community (see Appendix 1). Between 2004 and 2007, three micronekton sampling gear experiments were completed:

- MIE-1: October 6–13, 2004, off Oahu Island, Hawaii, U.S.A.; acoustics and three gears [Cobb trawl, Isaacs-Kidd Midwater Trawl (IKMT), and Hokkaido University Frame Trawl (HUFT)] were compared;
- MIE-2: September 25–October 3, 2005, southeast of Hokkaido Island, Japan; acoustics and five gears [Midwater otter trawl (OT), Multiple Opening/Closing Net and Environmental Sensing System (MOCNESS-10, MOCNESS-1), FMT (also referred to as HUFT), Matsuda-Oozeki-Hu Trawl (MOHT)] were compared;
- MIE-3: September 21–22, 2007, eastern Bering Sea; acoustics and two gears (IKMT and MOHT) were compared.

A list of fish species collected during the MIE-1 cruise off Ohahu Island is given in Appendix 2. For more details on the working history of the Advisory Panel, the reader is referred to MIE-AP Annual Reports in Appendix 3. Appendix 4 contains featured articles of the three experiments taken from the 2005 and 2008 issues of the PICES Press.

1.1 References

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