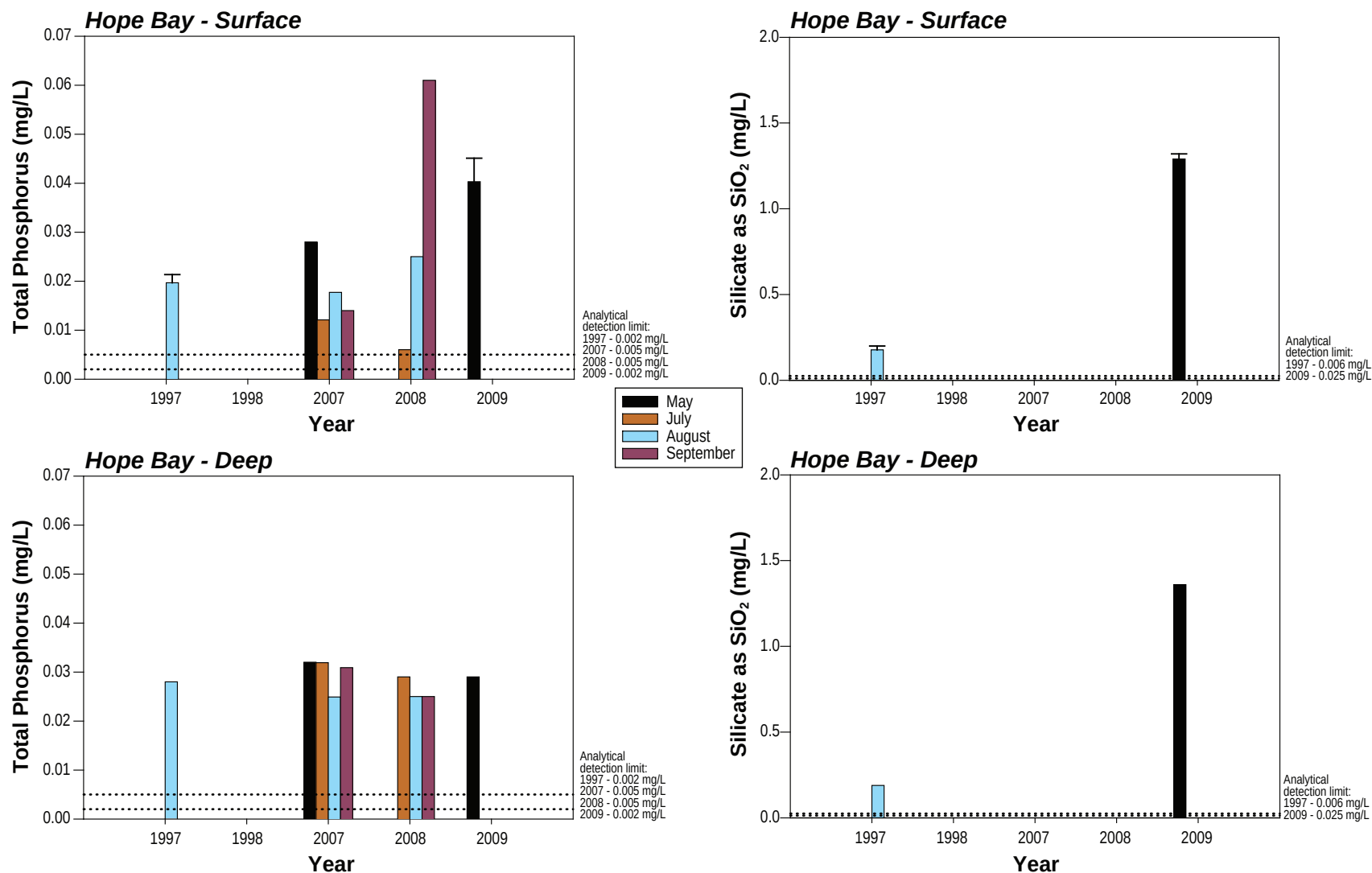


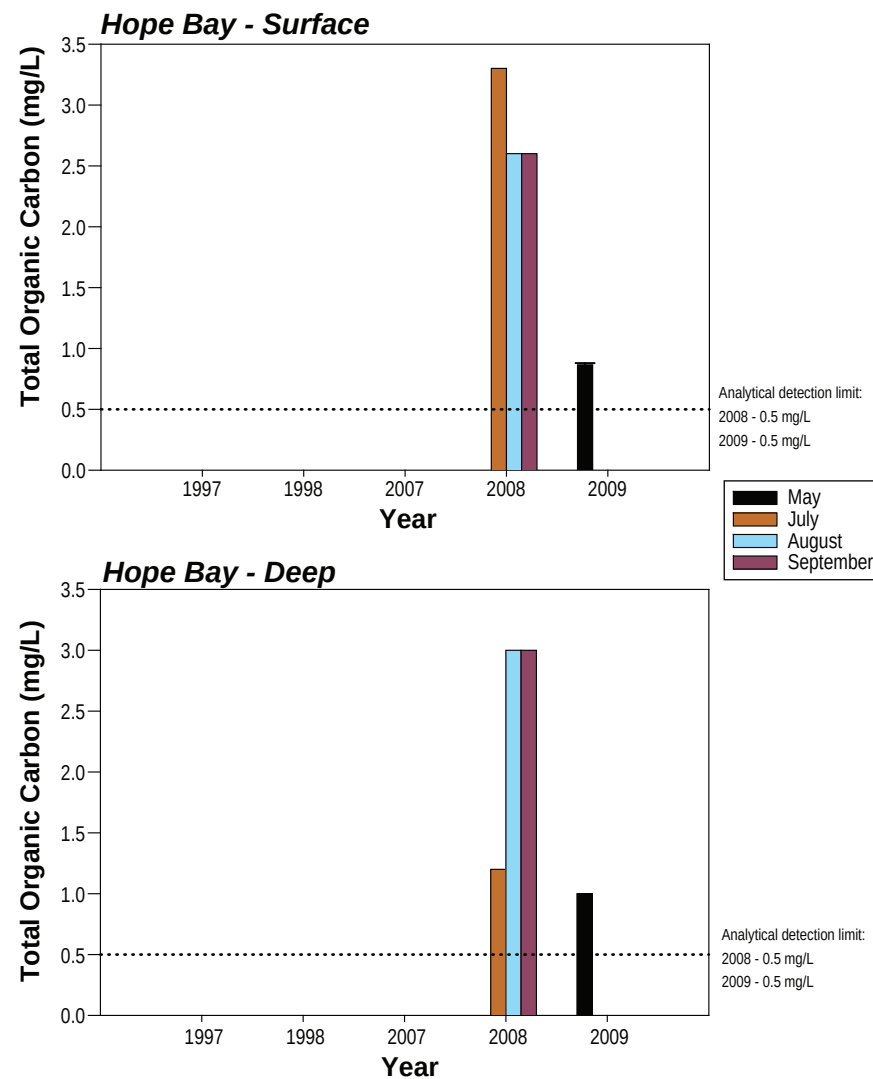


Notes: Error bars are standard error of the mean of multiple sampling sites.

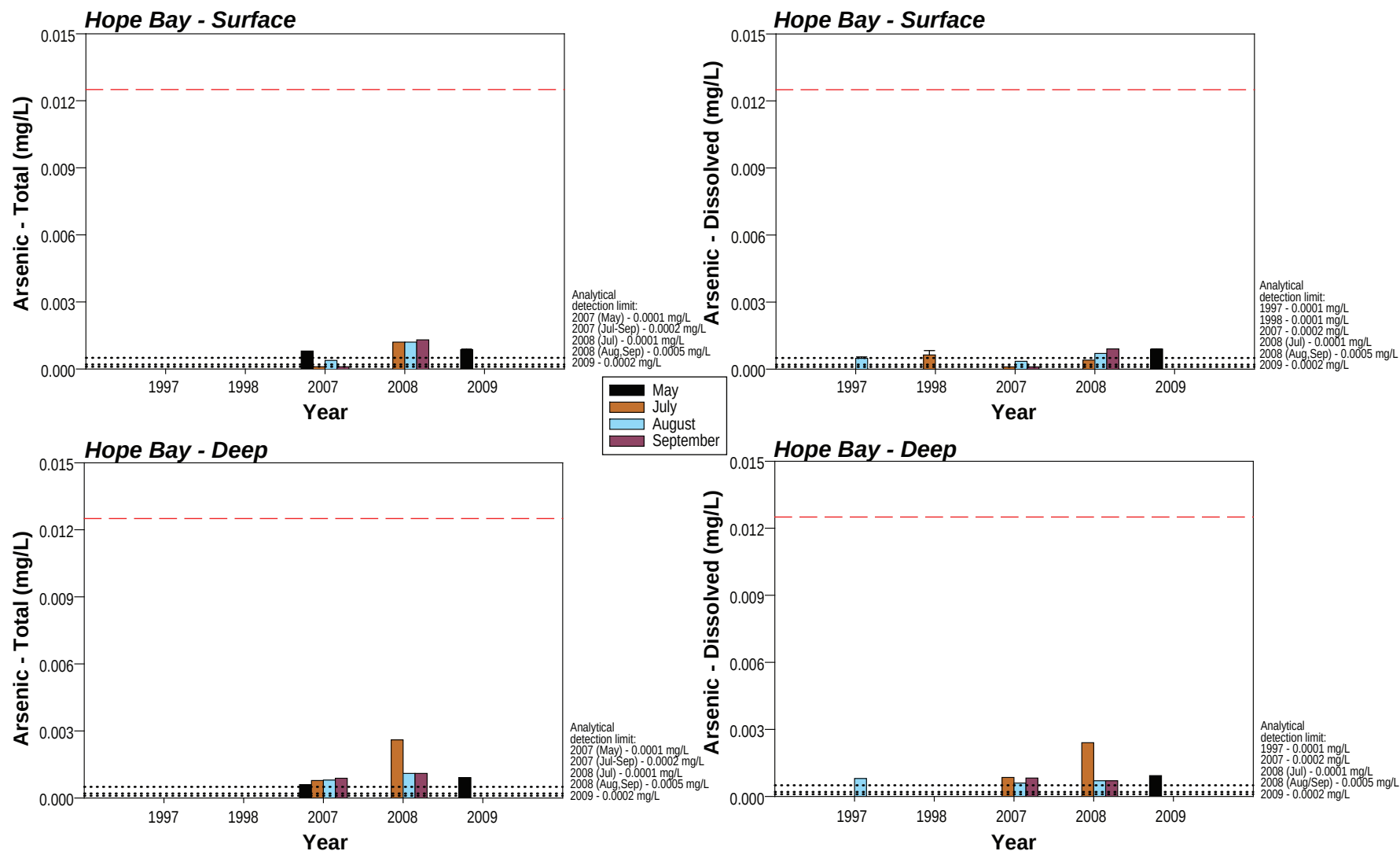
Dotted lines represent analytical detection limits.

Only a subset of sites sampled in 2009 (HB1 and HB2) are plotted here; these sites were selected because they are comparable to historical sampling locations.

There are no CCME water quality guidelines for total phosphorus or silicate.



Notes: Error bars are standard error of the mean of multiple sampling sites.
Dotted lines represent analytical detection limits.
Only a subset of sites sampled in 2009 (HB1 and HB2) are plotted here;
these sites were selected because they are comparable to historical sampling locations.
There is no CCME water quality guideline for total organic carbon.



Notes: Error bars are standard error of the mean of multiple sampling sites.

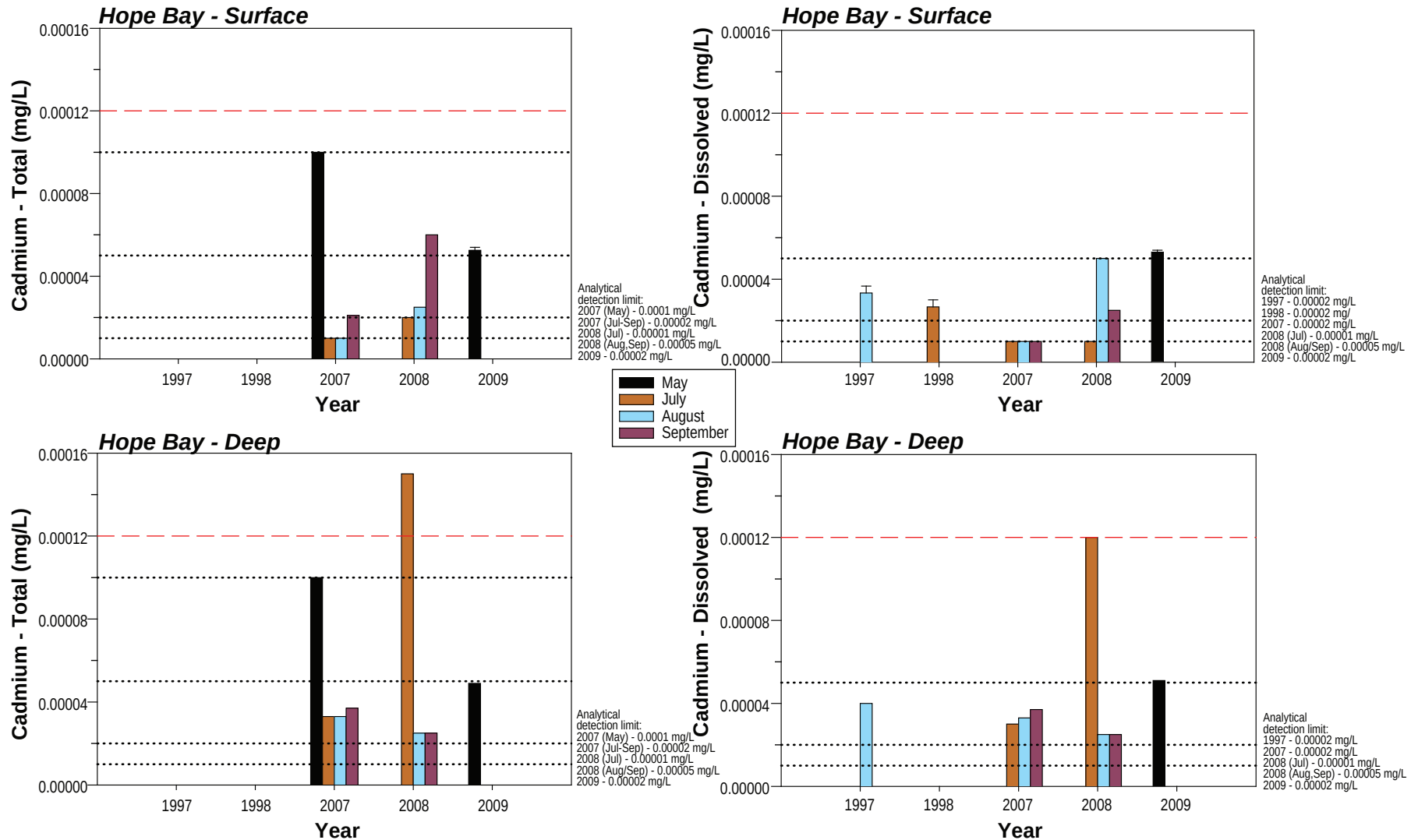
Dotted lines represent analytical detection limits.

Red dashed line represents CCME water quality guideline for arsenic (0.0125 mg/L).

Only a subset of sites sampled in 2009 (HB1 and HB2) are plotted here; these sites were selected because they are comparable to historical sampling locations.

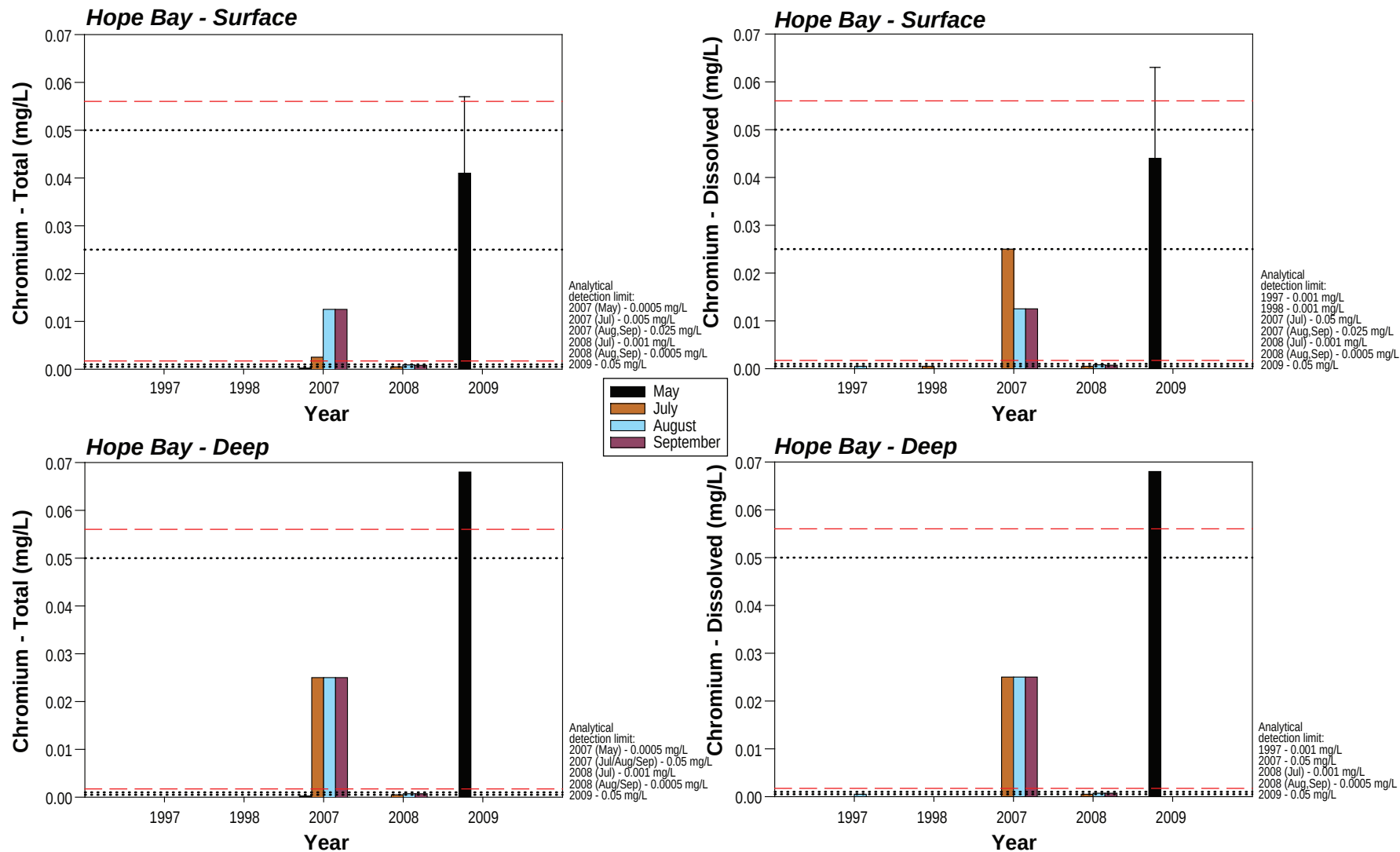
Arsenic Concentrations in Hope Bay, Hope Bay Belt Project, 1997–2009

Figure 3.5-44



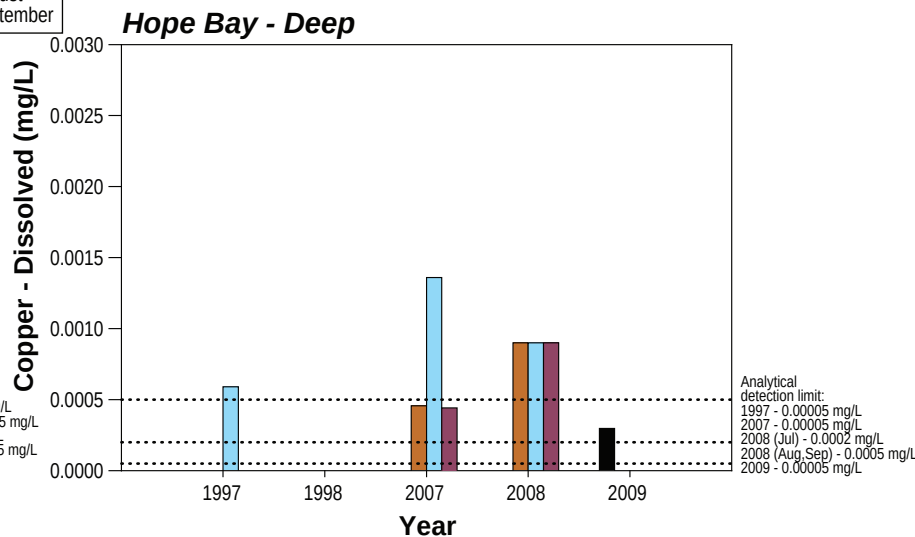
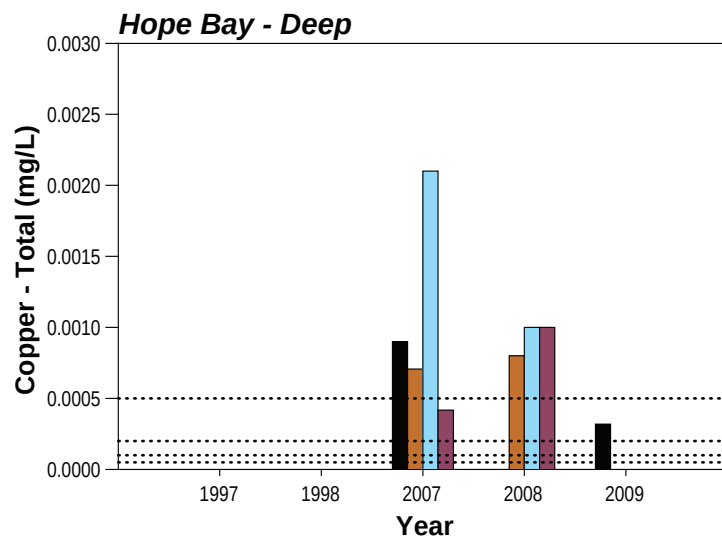
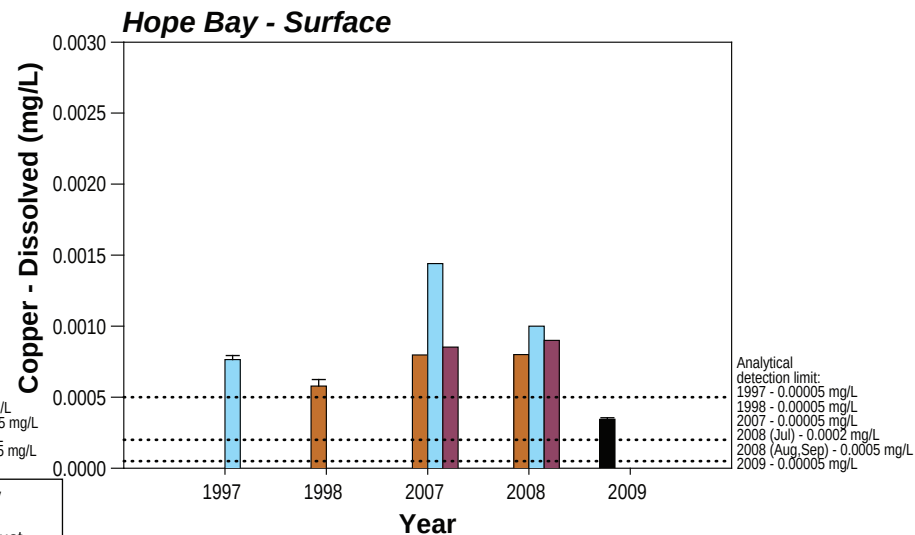
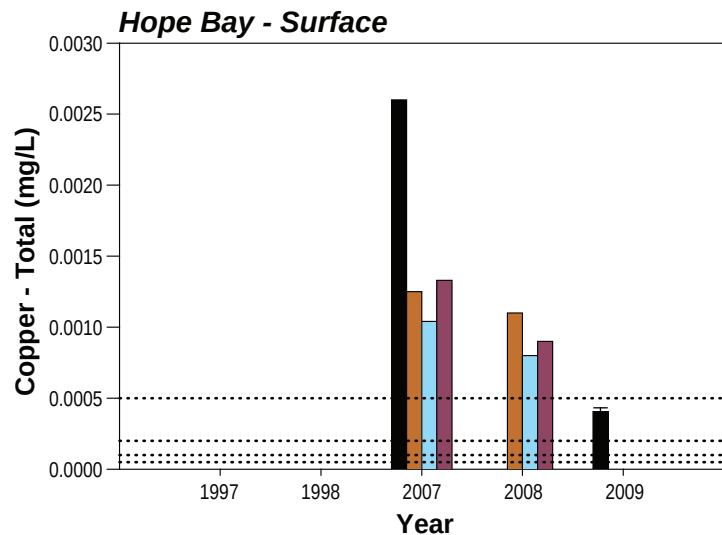
**Cadmium Concentrations in Hope Bay,
Hope Bay Belt Project, 1997–2009**

Figure 3.5-45



**Chromium Concentrations in Hope Bay,
Hope Bay Belt Project, 1997–2009**

Figure 3.5-46



Notes: Error bars are standard error of the mean of multiple sampling sites.

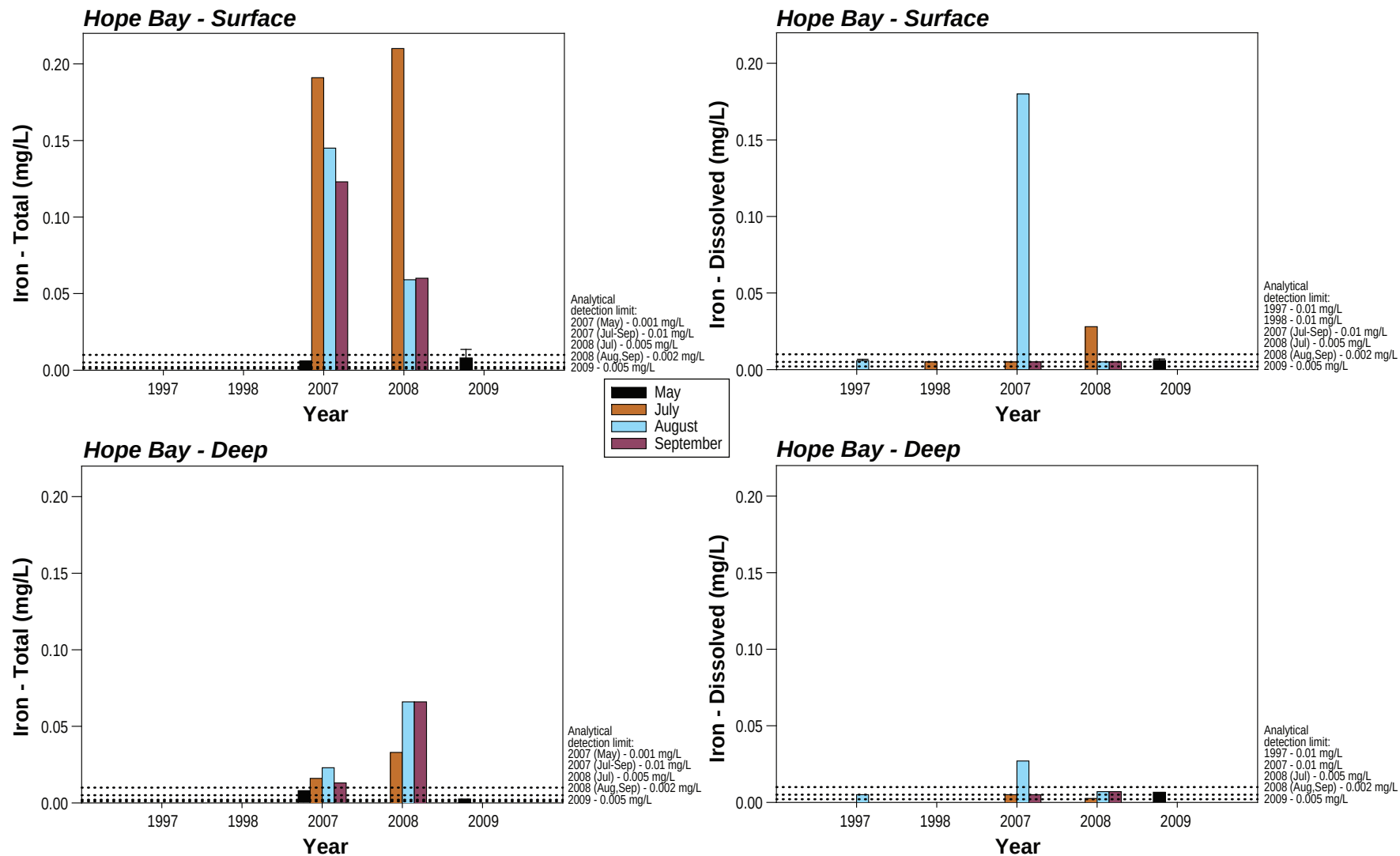
Dotted lines represent analytical detection limits.

Only a subset of sites sampled in 2009 (HB1 and HB2) are plotted here; these sites were selected because they are comparable to historical sampling locations.

There is no CCME water quality guideline for copper.

Copper Concentrations in Hope Bay, Hope Bay Belt Project, 1997–2009

Figure 3.5-47



Notes: Error bars are standard error of the mean of multiple sampling sites.

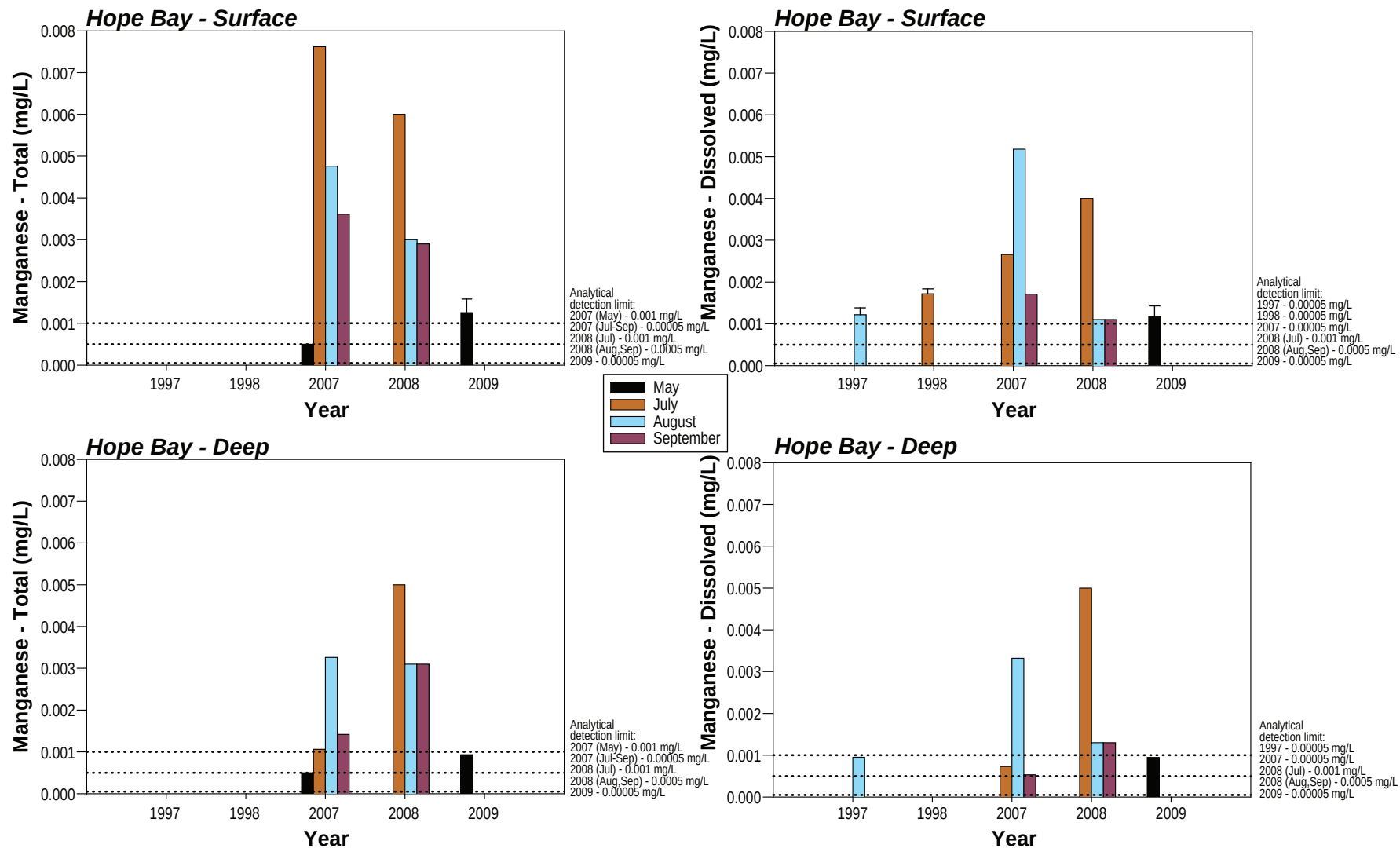
Dotted lines represent analytical detection limits.

Only a subset of sites sampled in 2009 (HB1 and HB2) are plotted here; these sites were selected because they are comparable to historical sampling locations.

There is no CCME water quality guideline for iron.

Iron Concentrations in Hope Bay, Hope Bay Belt Project, 1997–2009

Figure 3.5-48



Notes: Error bars are standard error of the mean of multiple sampling sites.

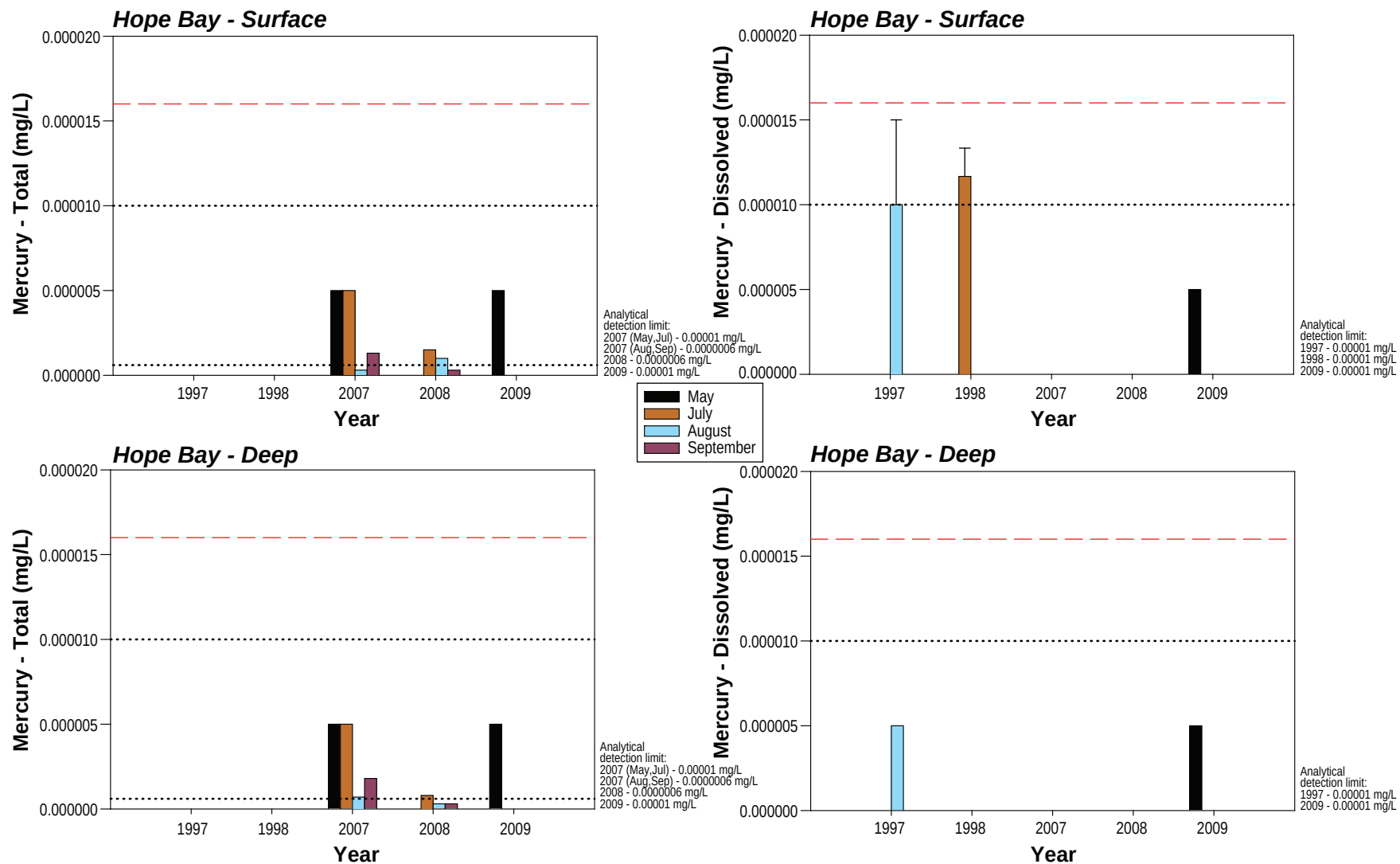
Dotted lines represent analytical detection limits.

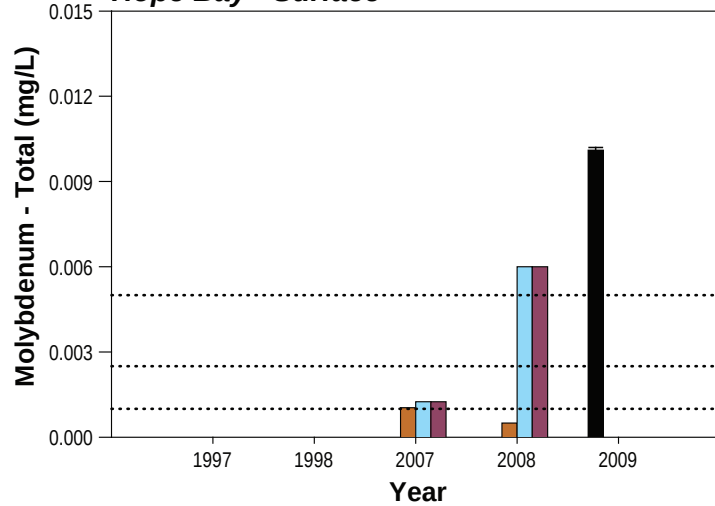
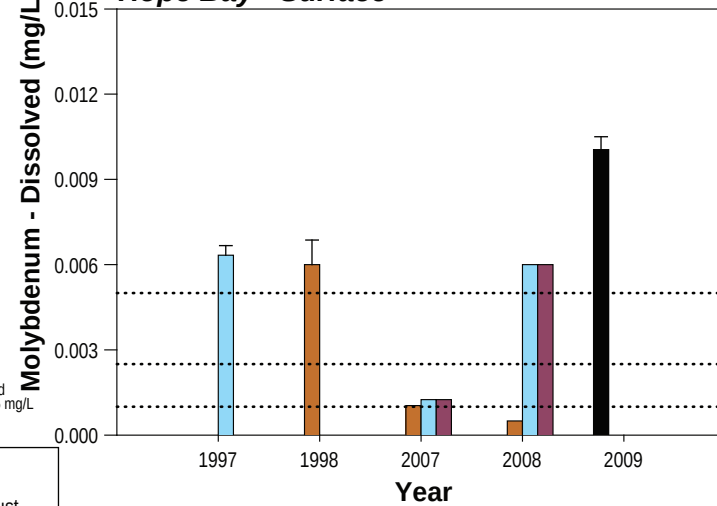
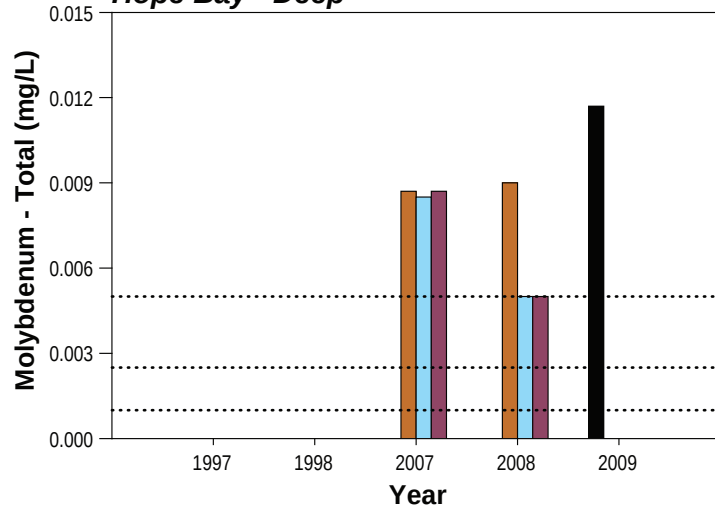
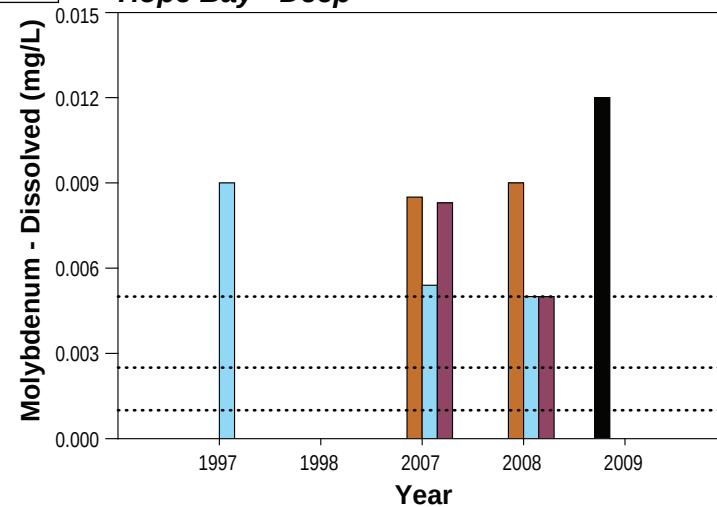
Only a subset of sites sampled in 2009 (HB1 and HB2) are plotted here; these sites were selected because they are comparable to historical sampling locations.

There is no CCME water quality guideline for manganese.

Manganese Concentrations in Hope Bay, Hope Bay Belt Project, 1997–2009

Figure 3.5-49



Hope Bay - Surface**Hope Bay - Surface****Hope Bay - Deep****Hope Bay - Deep**

Notes: Error bars are standard error of the mean of multiple sampling sites.

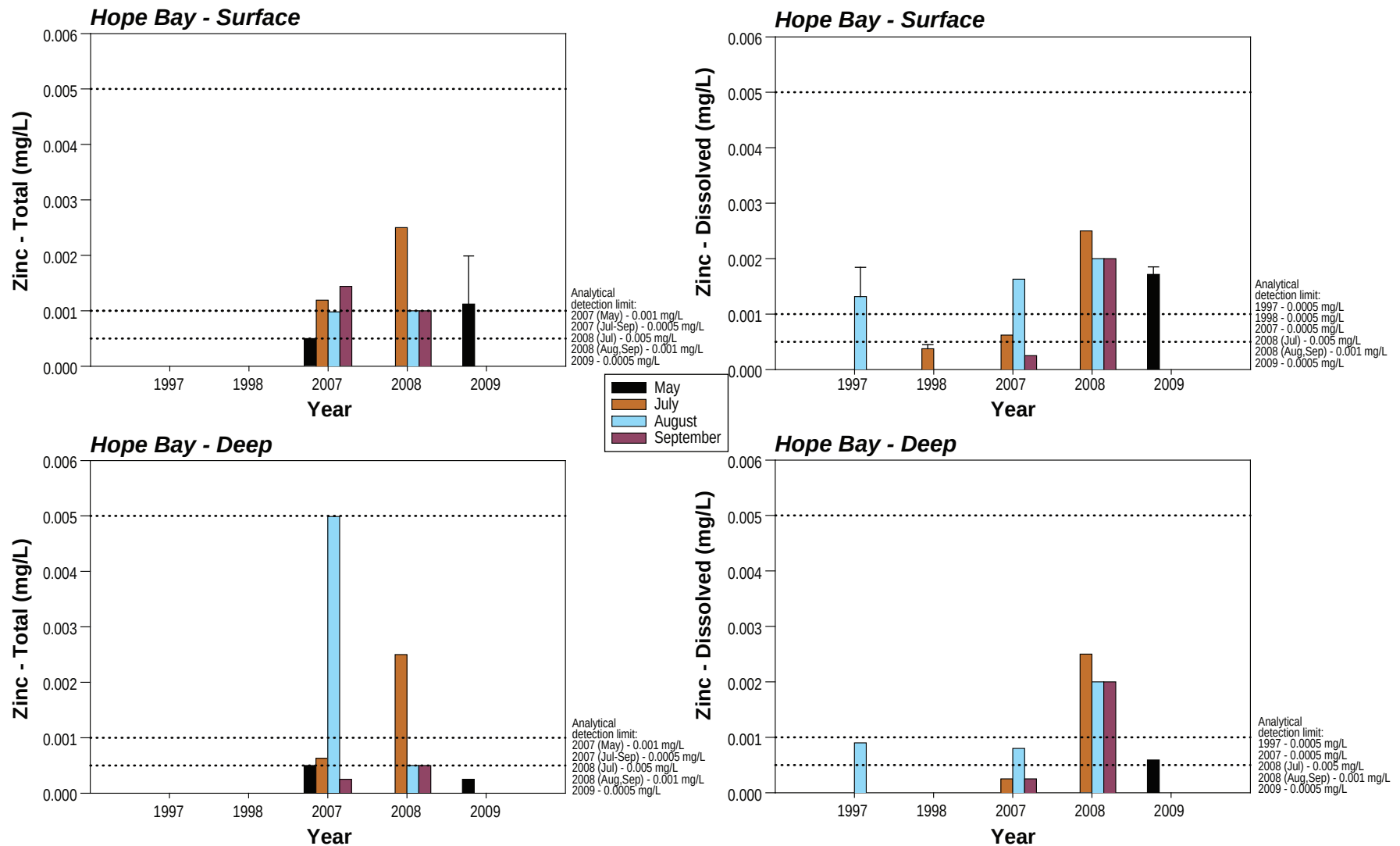
Dotted lines represent analytical detection limits.

Only a subset of sites sampled in 2009 (HB1 and HB2) are plotted here; these sites were selected because they are comparable to historical sampling locations.

There is no CCME water quality guideline for molybdenum.

Molybdenum Concentrations in Hope Bay, Hope Bay Belt Project, 1997–2009

Figure 3.5-51



3.6 SEDIMENT QUALITY

Sediment quality samples were collected from 11 sites in Roberts Bay and 3 sites in Reference Bay on August 16 and 17, 2009. Sediments were analyzed for grain size and various physico-chemical parameters. The 2009 sediment quality program focused on characterizing the natural variation in marine sediments and characterizing sediments in potential infrastructure footprint areas that may require fish habitat compensation. Complete results of sediment quality analyses are provided in Appendix 3.6-1, and select parameters are shown graphically in Figures 3.6-1 to 3.6-10.

Project area sediments were composed mainly of sand-silt-clay mixtures, with little gravel (Figure 3.6-1). Some sediment samples consisted almost entirely of sand (e.g. ST7, ST11, RTF1, TF1, DW3, RP1), while others were mostly composed of fine clays and silts (e.g. ST10 and RP3).

Concentrations of several parameters co-varied with the fine particle composition of the sediment. Sites with finer sediments consisting mostly of clays and silts (e.g., ST8, ST2, ST10, DW1, RP2, RP3) tended to contain the highest concentrations of TOC (Figure 3.6-2), aluminum (Figure 3.6-4), chromium (Figure 3.6-5), copper (Figure 3.6-6), iron (Figure 3.6-7), lead (Figure 3.6-7), manganese (Figure 3.6-8), mercury (Figure 3.6-8), molybdenum (Figure 3.6-9), nickel (Figure 3.6-9), and zinc (Figure 3.6-10). Conversely, sites with coarser sediments (e.g., ST7, ST11, RTF1, TF1, DW3, RP1) tended to contain the lowest concentrations of these parameters.

Project area sediments were analyzed for various polycyclic aromatic and extractable hydrocarbons. Concentrations of these organic compounds were below analytical detection limits in all sediment samples collected from Roberts and Reference bays (Appendix 3.6-1).

3.6.1 Comparison with CCME Sediment Quality Guidelines

All sediment samples collected were compared to CCME guidelines for the protection of marine aquatic life. These include the interim marine sediment quality guidelines (ISQGs) and the probable effects levels (PELs; CCME 2002). The more conservative ISQGs are levels below which adverse biological effects are rarely observed. The higher PELs correspond to concentrations above which negative effects frequently occur.

Concentrations of copper in some sediment samples from sites ST8, ST2, ST9, and ST10 in Roberts Bay and RP3 in Reference Bay were higher than the ISQG of 18.7 mg/kg. Copper levels were particularly high in samples from Roberts Bay sites ST9 and ST10. Concentrations of chromium in all sediment samples collected from ST10 were higher than the ISQG for chromium of 52.3 mg/kg. Notably, the sediments collected at this site consisted almost entirely of fine clays and silts. PEL sediment quality guidelines were never exceeded. Table 3.6-1 shows the percentage of sediment samples in which metal concentrations were higher than sediment quality guidelines, and Table 3.6-2 shows the factor by which concentrations were higher than guidelines. Concentrations of polycyclic aromatic hydrocarbons in Roberts and Reference bays never exceeded CCME guidelines (Appendix 3.6-1).

