Abstract: Visual assessment of discontinuities in the morphological features of diatom cells has been widely used in the discovery and delimitation of diatom species. However, a multidisciplinary approach to species-level taxonomy has revealed hidden diversity within the traditional diatom morphospecies. Consequently, this work examined both the natural and clonal populations of diatoms by diverse traditional and modern approaches, in order to assess the diversity, ecology, and distribution of diatom species. Although a detailed investigation of natural diatom samples was confounded by uncertain morphological boundaries between the traditional diatom species, it recognized that the diversity was relatively high; even one new diatom species was described using the morphological species concept. The multivariate statistical analyses showed that the variation of natural communities of traditional diatom morphospecies reflected differences in the local environmental conditions, as well as microhabitat heterogenity within a region. Since each diatom morphospecies is most likely a complex of sibling species, the two model traditional morphospecies were investigated, in order to assess morphological variation, genetic diversity, and/or the reproductive compatibility of monoclonal cultures. Even though isolated strains were cultivated under controlled conditions, the morphological variability of the cells was relatively high within the strains, as well as within the phylogenetic lineages. The morphometric study indicated that shape changes associated with the size diminution of diatoms during their life cycle might obscure characteristic morphological features that are important for species identification. Furthemore, the morphological variation of genetically differentiated strains was relatively high, and in many cases the morphology between particular phylogenetic lineages overlapped. Nonetheless, there is good reason to believe that genetic differentiation within model diatom morphospecies represented meaningful information about diatom biology, as the phylogeny was congruent with cytological, reproductive, and/or ecological differentiation.