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Population Structure and Demographic History of Human Arctic Populations Using Quantitative Cranial Traits

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POPULATION STRUCTURE AND DEMOGRAPHIC HISTORY OF HUMAN ARCTIC POPULATIONS USING QUANTITATIVE CRANIAL TRAITS

by

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ABSTRACT

The Arctic of North America provides an excellent laboratory for examining human population movement and differentiation. This research utilizes cranial morphological variation from 27 discrete Arctic populations spread across the North American Arctic to examine the role that culture and migration may have played in defining biological relationships and population structure among modern human Arctic populations. The unique pattern of cranial variation among Arctic populations, spread over a large and difficult environment, is the result of a complicated mixture of isolation, fragmentation, and migration. By examining this pattern using a number of statistics that quantify cranial morphological affinities and hence biological relationships, this work has provided a framework for explaining population structure differences and ancestor-descendent relationships. Most prominently, a pattern of ancestry and descent emerges from two primary sources, the Ipiutak at Point Hope and the Birnirk at Point Barrow. Overlapping in time, these two occupations along the north coast of Alaska appear to be fundamentally important in their contribution to the formation of variation patterns across the Arctic at the time of European contact. However, when the Ipiutak and Birnirk disappeared from the North Arctic coast, where did they go?

This work lends additional support to the hypothesis that the Birnirk at Point Barrow are the formative ancestor to the Thule, from which modern Arctic populations are associated. Emerging out of the Birnirk, the Thule spread into the Central Arctic and Greenland, likely following aquatic food resources. There is support for biological continuity between the Birnirk and Greenland populations rather than the previously held supposition that the cultural continuum is based solely on a diffusion of culture. In contrast, the tight biological relationship between the Dorset-affiliated Sadlermiut and their neighboring Thule-associated groups suggests that cultural differences do not necessarily mean biological differences.

The Ipiutak at Point Hope appear to have stronger affinities with historic west and northwest Arctic populations, including to a lesser extent the north Arctic Tigara population. Previous research suggests that as Point Hope became less hospitable, the Ipiutak went inland

and south. Perhaps as the coastal climate improved, some Ipiutak returned to the coast, interacting to some extent with the Punuk and Birnirk associated populations, perhaps influencing the Thule technological complex and/or being influenced by it. The strong biological relationship of the Ipiutak to the west and northwest Arctic populations suggests that these populations were variably descendent from the Ipiutak.

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CHAPTER 1

INTRODUCTION

Over a century of archaeological exploration has provided researchers with an extensive and well-established archaeological record throughout the Arctic. This includes both substantial collections of human remains and thoroughly analyzed associated material cultures. Throughout the North American Arctic (henceforth Arctic) there is strong archaeological evidence of a sweeping technological replacement event associated with advanced whale-hunting technology, broadly defined as the Thule, which emerged out of the northern coast of Alaska around 1100 years BP (Before Present) (Dumond, 1987; McGhee, 2000). Although this archaeological-cultural framework has been present for some time, and a number of aspects have been used to assess associated human population dynamics (Hayes, 2002; Hollinger et al., 2009; Mason, 2009), a comprehensive consideration of the associated patterns of human biological variation across the Arctic and their relationship through time is not currently available. Previous work (Hayes, 2002; Helgason et al., 2006; Hollinger et al., 2009, Jaskulska, 2002; Laughlin and Jørgensen, 1956; Mason 2006, 2009) has raised a number of issues, but it has not been comprehensive across the Arctic. This work is an attempt to place the Thule transition into an operational framework of human population relationships, associated material culture, and spatial and temporal patterning.

One of the long-standing questions in anthropology is the degree to which biological change and associated material culture are correlated over time. In other words, when presented with evidence for replacement or differentiation of associated technology and cultural attributes, to what extent are these cultural changes correlated with shifts in the human populations? Cranial morphological variation was therefore used to quantify the biological relationships among Arctic archaeological samples, for testing hypotheses of homogeneity in biological variation patterns across the Arctic, and to answer specific questions in regards to ancestor-descendent relationships in the context of associated material-culture change.

The Thule Transition

Between 1600 and 1400 years BP, several regional material cultures begin to emerge across what is now the northern coast of Alaska along the Bering Sea. These are the Punuk in the Bering Sea and western Arctic, the Ipiutak in the western and northern Arctic, and the Birnirk in the northern and central Arctic. During this transition, a rapid and dramatic change in culture occurred, specifically the emergence of whale hunting and more advanced seal-hunting technologies, among some coastal Arctic habitations.

Sometime around 1600 years BP, the first evidence of the Ipiutak culture emerged at Point Hope, Alaska. Characterized by complex burial items, ornate ivory and wood carvings, and the use of iron, the Ipiutak thrived at Point Hope for several centuries (Larsen and Rainey, 1948). While the Ipiutak culture seems to wane at Point Hope and other coastal sites around 1300 years BP, there is continuity inland until roughly 700-800 years BP (Gerlach and Mason, 1992).

The Punuk appear to arise out of the Old Bering Sea Culture (OBS) (Dumond, 1987). While some archaeologists explain the Punuk as a result of new populations moving into the region from coastal Asia to islands around the Bering Strait, others explain it through some diffusion of new maritime technologies between the OBS and the lingering Ipiutak culture (Anderson, 1984; Dumond, 1987; Ford, 1959; Mason, 2009). The Old Bering Sea culture dates as far back as 2200 years BP, stretching contentiously in some areas as late as 1000 years BP (Mason, 2009). Found primarily on St. Lawrence and Okvik Islands in the Bering Strait, the OBS has also been excavated on both Siberian and Alaskan coasts. The material culture associated with the OBS is dominated by polished slate rather than flaked stone tools and includes snow goggles, more advanced ivory harpoon heads, snow shovels, sleds, and inflated harpoon-line floats, and it is apparently the origin of kayaks and other skin boats (Dumond, 1987). The Punuk is largely an extension of the OBS culture, with an increased reliance on whale hunting (Ackerman, 1984). However, the arrival of the Punuk coincides with the Ipiutak disappearing from Point Hope, and some technological similarities between the two cultures suggest intermixing (Mason, 2009).

As the Punuk culture arose in the Bering Strait area, many aspects of this complex spread to mainland Alaska and appear to have been rather influential in the simultaneous formation of Birnirk culture in northern Alaska (Ford, 1959). The Birnirk, found at Point Barrow between 1500-900 years BP (Hollinger et al., 2009; Mason, 2009), features highly developed harpoon heads, decorative clay lamps and cooking pots, and distinct wood- and ivory-carving artistic traditions. With some influence from the Norton (a regional pre-cursor to the Ipiutak and Birnirk cultures), Punuk, and Ipiutak cultural traditions, the Birnirk people continued to innovate, producing a range of highly specialized tools for hunting and other tasks (Dumond, 1987; Mason, 2009). By roughly 1100 years BP the Thule tradition appears to emerge from the Birnirk, primarily defined by its association with advanced whale hunting and dog-pulled sleds, which allowed greater consistency in subsistence, greater mobility, and greater population size. The Thule material culture spread rapidly from the northern coast of Alaska, eastward across northern Canada and into Greenland, as well as southwest along the coast as far as the Aleutians (Dumond, 1987; Gerlach and Mason, 1992; Mason, 1998).

As the Thule material culture spread across the Arctic, the question remains – to what extent is the Thule transition a population replacement versus a diffusion of culture? There is substantial variation over geography, depending largely on available resources and the previous local material culture. Regional differentiation and local affinities with previous occupants have been used as evidence that the Thule spread through the Arctic as a material-culture advancement for more efficient exploitation of resources. It has been suggested that amalgamation with earlier regional traditions indicates diffusion of technology rather than the dislodging or replacing of previous occupants (Dumond, 1987). More recent morphological and genetic analysis provides evidence for population replacement in some regions (Hayes, 2002; Helgason et al., 2006; Hollinger et al., 2009). The reality may be a combination of both, and by placing Arctic cultural change in the context of morphological differentiation across the Arctic, this research examines the variability of the biological context of the cultural change.

Craniometric Approaches

The genetic relationship among archaeological human remains cannot be explicitly quantified for archaeological material without ancient DNA extraction, the methods for which are wrought with issues of contamination and preservation, and are expensive and prohibitively time consuming. Because of this, morphometric methods that utilize quantitative traits are commonly used by physical anthropologists to examine questions of population differentiation. Quantitative traits are continuous, often normally distributed, measurements that define some aspect of morphology in biological organisms. The human cranium is commonly utilized in morphological studies that examine population variability because of availability, wide geographical distribution, and utility to frame population differentiation (Debets, 1999; Frøhlich and Pedersen, 1992; Hollinger et al., 2009; Howells, 1973; Jaskulska, 2002; Konigsberg, 1988; 1990b; Konigsberg and Ousley, 1995; Laughlin and Jørgensen, 1956; Martínez-Abadías et al., 2006; Powell and Neves, 1999; Relethford and Lees, 1982; Relethford, 1994; 2001; 2002; 2004a; Relethford and Blangero, 1990; Steadman, 2001; Stringer and Andrews, 1988). One of the assumptions necessary for using phenotypic variation to explain population relationships is that the measurements have a genetic underpinning that is consistent among traits and populations. The effect of the environment on morphological trait values is generally accounted for by measuring the narrow-sense heritability (h^2) of each trait in a population, which is the ratio of the additive genetic variance to total phenotypic variance (Falconer and Mackay, 1996). Heritabilities are usually measured by comparing the phenotypic values of individuals of known relationship (Falconer and Mackay, 1996). Because this requires data from a substantial pedigreed population for accurate estimation, such estimates are not feasible for archaeological collections. Despite difficulties in reliable heritability estimation, the pattern of correlation among traits within the cranium has proven to be relatively stable (Cheverud, 1988). As a result, the relationship of heritabilities has also remained relatively stable. Consequently, the phenotypic covariance structure of morphological traits can be used as a reliable predictor for comparing the biological relationships among populations (Cheverud, 1988; 1995; 1996; Relethford, 1994; 1997; Relethford and Blangero, 1990; Steadman, 2001; Varela and Cocilovo, 2007).

For this research, the cranium was analyzed as a series of quantitative traits, commonly used for providing a general measure for population structure (Howells, 1973; 1989). The pattern of variance and covariance around the multivariate trait means was used to measure relative differentiation among the samples being studied. This pattern provides the basis for calculating a number of statistics that define population structure and relationships.

Research Hypotheses

Quantitative morphological cranial data were collected from a large number of Arctic samples, and used to define biological distances, Q_{ST}, and a number of other population structure parameters to test the following set of null hypotheses:

- Null Hypothesis 0: Cranial variation among populations is randomly distributed across the Arctic. The prediction of this hypothesis is that there is no geographic pattern to cranial variation across the Arctic
- Null Hypothesis 1: Cranial variation among populations shows geographic variation as predicted by a population-genetic model of isolation by distance with a two-dimensional stepping-stone model of migration (an open grid where each sample has multiple neighbors using direct great-circle distances between pair-wise samples). Pending rejection of null hypothesis 0, this hypothesis predicts that the amount of cranial differentiation between a pair of populations is correlated with the geographic distance between them.
- Null Hypothesis 2: Cranial variation within and among regions is randomly distributed across the Arctic. This null hypothesis tests whether the variance among groups relative to the variance within groups is distributed in a consistent pattern among Arctic regions. Pending rejection of null hypothesis 0, this hypothesis predicts that morphological variation is a function of geographic region rather than geographic distance per se, and provides a baseline for establishing deviations from the expected pattern of regional affiliation.

- Null Hypothesis 3: Cranial variation among populations is random with respect to temporal and cultural association. This null hypothesis tests whether there is a relationship between temporal or cultural affiliation and biological variation. Pending rejection of null hypothesis 0, this hypothesis asks how much of the variation correlates with temporal and cultural variation.

Rejection of null hypothesis 0 combined with a strong correlation between morphometric distance and geographic distance would suggest that Arctic populations fit an empirically defined pattern of isolation by distance regardless of regional, temporal, or cultural affiliation. Null hypotheses 1-3 are designed to test for deviations from expected patterns due to regional, temporal, or cultural affiliation. Where these null hypotheses are rejected, further examination of the pattern of these deviations is warranted through the generation of a number of possible alternative hypotheses that best support the data for each deviation. These alternative hypotheses are:

- Alternative Hypothesis 1: The pattern of cranial variation among populations is influenced by cultural or temporal affiliations rather than by physical geographic distance between them.
- Alternative Hypothesis 2: The pattern of cranial variation among populations is influenced by specific ancestor-descendent affinities rather than physical geographic distance between them.
- Alternative Hypothesis 3: The pattern of cranial variation among populations represents increased migration from more distantly related populations.
- Alternative Hypothesis 4: The pattern of cranial variation among populations represents physical isolation of one or more populations from other populations.

These null and alternative hypotheses were used to help describe ancestor-descendent relationships and migration patterns in recent Arctic pre-history. Statistical methods used to test and explore these null and alternative hypotheses, are described in detail in the respective methods and analysis chapters.

This research places a broad geographic spread of Arctic populations into a comparative biological-distance framework, including the derivation of an empirical model of Arctic population differentiation. Using this framework, the pattern of morphological differentiation through time and space was defined in the American Arctic and used to address specific population-relationship questions. These questions include:

- The relationship of the pre-Thule Ipiutak population to the Thule-affiliated Tigara population, both occupying Point Hope, Alaska during different time periods.
- The relationship of the pre-Thule Birnirk at Point Barrow, Alaska to the origination and spread of the Thule culture across the North American Arctic.
- The relationship of the pre-Thule Sadlermiut population to neighboring Thule-associated Nunavut and other Arctic populations.
- The pattern of Greenland settlement and history, including an examination of the relationship among Greenland samples in the context of pre-Thule or Thule derivation.

This research examines mechanisms of material culture change through the lens of biological differentiation, placing Arctic biology in a framework of historical population movement, temporal association, and material culture change. Hypotheses concerning population differentiation are tested by quantifying the biological differences in cranial morphology between an extensive collection of Arctic population samples to assess whether biological differentiation tracks an expected pattern of differentiation across the Arctic. In addition, the analysis of specific population relationships, ancestor-descendent affinities, and migration patterns in Arctic pre-history is included.

CHAPTER 2

ARCHAEOLOGY AND BIOLOGY OF ARCTIC HUMAN POPULATIONS

Anthropological research in the Arctic has two central themes: (1) niche construction and biological adaptation of Arctic people to a difficult environment and (2) Beringia as an entry through which humans moved into the New World. It was Aleš Hrdlička who first proposed that humans entered the New World through the Bering Sea area around 15k years BP. To test his hypothesis, he organized an expedition to the Arctic between 1926 and 1931 to collect human remains (Hrdlička, 1932). Although ethnologists had been working with Arctic groups since Boas (1888), it was not until the 1920s that archaeologists, such as Diamond Jenness, Henry Collins, Helge Larson, Froelich Rainey, James Giddings, and Therkel Mathiassen, began exploring human pre-history in these areas. The Beringean migration theory cemented the Arctic as a research focus throughout the 20th century, and much work has been done examining population variability, biological adaptation, niche construction, and human history throughout the Arctic region.

Early American Migrations from Beringia

Archaeology: The first modern humans appeared in northern Siberia between 30-40k years BP, securely dated to 30k years BP at the Yana Rhinoceros Horn Site (Pitulko et al., 2004). Paleoenvironmental reconstructions have rendered viable entry conditions for migration into the New World some time around the Last Glacial Maximum (LGM), between 18-24k years BP (Mix et al., 2001). During the LGM, sea levels were up to 120 meters below current levels, making it possible to migrate into Beringia from northern Siberia (Clark and Mix, 2002; Fairbanks, 1989). However, until roughly 12.5k years BP, the Cordilleran and Laurentide glaciers covered much of the North American continent, restricting human migration over land, largely limiting migratory movement to coastal routes (Calkin et al., 2001; Duk-Rodkin and Barendregt, 2004; Erlandson, 2002; Jackson and Duk-Rodkin, 1996; Schurr, 2004). In terms of archaeology, the first securely dated sites are between 13-15k years BP in the Arctic (Bever, 2006). Almost instantaneously, modern humans are spread throughout North and South America just after this 13k years BP horizon (Adovasio and Pedler, 1997; Dillehay, 1999; Elias, 2002; Goebel, 2003; Meltzer et al., 1997; Pitulko et al., 2004). At around 13k years BP, many areas in Beringia appear to become ice free, with periodic connections via an ice-free corridor down through what is currently Canada and northern USA (Schurr, 2004). However, because there is evidence of human occupation as far south as South America near the time of the formation of the corridor, researchers have suggested that migrations occurred along coastal routes prior to the ice-free corridor (Erlandson, 2002).

Mitochondrial DNA (mtDNA) variation: Previous research examining molecular genetic variability in modern and ancient populations has utilized allelic variation based on haplogroup frequency distributions. Haplogroups are a set of haplotypes that share a common ancestral haplotype and were originally defined based on the presence of definitive restriction fragment length polymorphisms (RFLPs). Native Americans show mtDNA haplotype variation belonging exclusively to haplogroups A, B, C, D, and X, some of which are also present in Asia from northern Siberia to Mongolia (Brown et al., 1998; Derbeneva et al., 2002; Forster et al., 1996; Merriwether, 2002; Schurr et al., 1990; 1999; Schurr and Sherry, 2004; 2005; Starikovskaya et al., 1998; Torroni et al., 1992; 1993a; 1993b). These haplogroups have recently been more specifically categorized as A2, B2, C1, C4h, D1, D2a, D3, D4h3, and X2a lineages (Achilli et al., 2008; Bandelt et al., 2003).

The two main questions regarding overall New World genetic variation upon which molecular researchers focus, are the number of migration events and the timing of those events. Initial phylogenetic studies of the time depth for the founding of each of the American haplogroups suggested that haplogroup founding events began between 20-35k years BP (Bonatto and Salzano, 1997; Torroni et al., 1994). This time frame has recently been confirmed using complete mtDNA genomes. Similar age ranges were calculated for the major haplogroups (A2, B2, C1, and D1), ranging between 18 and 24k years BP and centered at 20k years BP (Achilli et al., 2008). It was suggested that an entry of these four major root haplogroups into Beringia occurred around the peak of the Last Glacial Maximum ~21k years BP. Other studies, using different molecular clock estimates and substitution rates, revealed evidence for a more recent, either 13-15k years BP (Kemp et al., 2007) or 15-18k years BP (Tamm et al., 2007), single founding event. For the number of independent migration events, researchers examine the differential distribution and coalescence times of the haplogroups. Evidence of the emergence of these groups as a single migration is supported by relatively similar coalescence times for the first hyper-variable region (HVI) of the mtDNA of A, B, C and D haplogroups. As they have roughly the same degree of genetic variability within North America, it is probable that all four haplogroups could have been brought to the New World in a single migration (Achilli et al., 2008; Bonatto and Salzano, 1997; Forster et al., 1996; Lorenz and Smith, 1997; Merriwether et al., 1995; Stone and Stoneking, 1998).

To contrast the single-migration hypothesis, several researchers point to the possibility of multiple migrations. Haplogroup B, due to its strange distribution and decreased variation, might be part of a more recent and separate migration between 13-17k years BP (Brown et al., 1998; Schurr and Sherry, 2004; Schurr, 2004). Similarly, studies of the coalescence time depth of haplogroup X suggest possible younger coalescent dates for this haplogroup and, therefore, a secondary later migration event (Brown et al., 1998; Reidla et al., 2003; Starikovskaya et al., 1998). In addition, there is credible evidence for a smaller later migration from Siberia of sub-haplogroup D2 found in modern Arctic people (Tamm et al., 2007).

To reconcile discrepancies between the predicted migration times and archaeological dates, some have suggested that a maritime colonization between these periods would better account for archaeological and genetic evidence found in New World populations (Erlandson 2002). Additionally, recent work suggests a long period of isolated occupation in Beringia, which permitted significant inter-haplogroup variation to develop before it spread rapidly through North and South America sometime before 13k years BP (Fagundes et al., 2008; Tamm et al., 2007). The problem is that no evidence of such an occupation has been found, even though it would have been sizeable, spanning a substantial period of time.

Cranial variation: Recent research highlights the relationship between the archaic European populations and early Paleoamericans from South America (Hubbe et al., 2011). This research supports previous findings that cranial morphology of early migrants differs from the current Native American form (Neves et al., 2003), concluding that these affinities between early Paleoindians found in North America prior to 10,000 years BP and Upper Paleolithic Europeans indicate a rapid migration from Asia via a coastal route, and perhaps bypassing the Beringian occupation altogether (Hubbe et al., 2011).

The Arctic People

Mitochondrial DNA variation: More specific to Circum-Arctic populations, mtDNA diversity in Chukchi, Northern Siberian, Native Alaskan, and Greenland populations features mainly A and D haplogroups, with trace amounts of C (Derbeneva et al., 2002; Merriwether et al., 1995; Rubicz et al., 2003; Saillard et al., 2000; Shields et al., 1993; Starikovskaya et al., 1998; Ward et al., 1993). These populations are in contrast to the Koriak and Itelmen of the adjacent Kamchatka peninsula, who share a similar language class but contain only Eurasian haplogroups G, Z, and Y, all of which are completely absent in Native American groups (Starikovskaya et al., 2005). Molecular analysis suggests a recent migration of sub-haplogroup D2a from Siberian populations (Tamm et al., 2007). Haplogroup D2a is a sub-group of haplogroup D2, which is common among Arctic populations and has a broad geographical range, crossing distant linguistic groups such as the Tungusic Turk and Mongol populations. Sub-group D2b is found only among Siberian Arctic peoples and is closely related to haplogroup D2a, found only in North American Arctic populations, specifically the Eskimo, Chukchi, Aleut, and Athapaskans. The lack of this haplogroup among other American groups suggests that it spread through Beringia in a later migration from Siberia (Tamm et al., 2007). There is also evidence for a recent back migration of haplogroup A2 from the American Arctic to Siberia (Tamm et al., 2007). Haplogroup A2, previously thought to be exclusive to North America and found ubiquitously throughout the American Arctic, has more recently been discovered throughout Siberia, even beyond the Arctic into western and southern Siberia. The frequency distribution of this haplogroup suggests the possibility of a back migration from North America onto the Asian continent (Tamm et al., 2007).

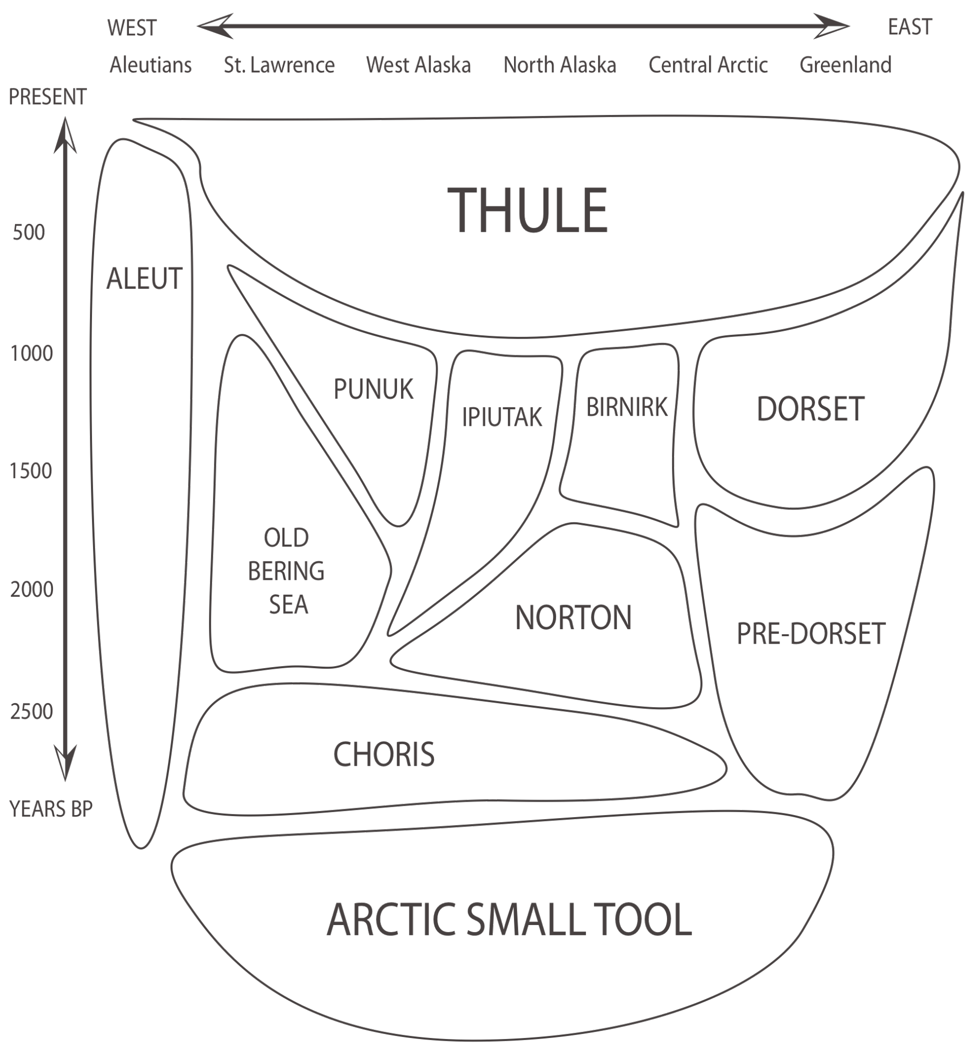
While it is difficult to substantiate continual human occupation in the Arctic from the initial migrations to the present, ancient DNA (aDNA: DNA extracted from archaeological remains) extracted from an archeological sample from the early Holocene shows continuity with current Arctic populations. Haplotype D4h3 was found in ancient skeletal remains from Alaska dating to 10k years BP (Kemp et al., 2007). This haplotype is currently found in Arctic Alaska and has a broad geographical spread, ranging from the Arctic down to Tierra del Fuego (Kemp et al., 2007).

Morphology: There is a long history of defining population structure and changes in skeletal morphology over time when comparing distinct human samples. More recently, much of this work has examined the evolutionary genetics underlying patterns of human variation. Craniometric studies of worldwide morphological diversification, including one or several Arctic populations, suggests that Arctic populations are outliers relative to that expected based on a purely isolation-by-distance model (Gonzalez-Jose et al., 2004; Harvati and Weaver, 2006; Relethford, 2010; Roseman and Weaver, 2004; Roseman, 2004). These studies have compared cranial measures to molecular microsatellite data, as a proxy for neutral genetic loci to look at the broader implications of selection on cranial shape as correlated with latitude, and revealed that drift was a possible explanation for world-wide cranial diversity among regions with the exception of Arctic groups, whose characteristic morphology is more likely due to selective forces. This does not preclude the possibility that these deviations might be due to dietary differences or the extreme environment having a direct impact during development.

What makes these Arctic groups distinct, and what are the evolutionary mechanisms responsible for the observed differences? Air must be moistened and heated as it enters the respiratory system to avoid damage to the lungs. The nasopharynx functions to heat and moisten air upon inhalation, it then recaptures moisture upon exhalation to prevent dehydration (Churchill et al., 2004; Shea, 1977). The hypothesis that the nasopharynx may be under strong selection to adapt to this environmental stress has been examined by several studies, which reveal significant correlation between the nasal index (nasal breadth / nasal height) and latitude of the populations, and more specifically, a strong negative correlation between nasal height and temperature and a strong positive correlation between nasal breadth and absolute humidity (Franciscus and Long, 1991; Franciscus, 2003). A study comparing Tierra del Feuguian populations (another cold-adapted population) to other human populations, examined evidence of selection for climatic adaptations revealing that the Fueguians and the Eskimos had the narrowest and highest nasal apertures, while a range of New and Old World equatorial groups had low and wide nasal apertures (Hernandez et al., 1997). These studies suggest a possible selective shift to narrow and high external nasopharyngeal morphology that is strongly correlated with cold temperatures.

Arctic Archaeology: **Figure 2.1** is provided for a summary of geographic and temporal associations for recent Arctic material cultures.

Figure 2.1: Cultural groups and their general temporal and geographical associations.



The earliest archaeological evidence confirming human occupation in Alaska is at Swan Point, radiocarbon dated to 14.5k years BP (Bever, 2006; Holmes, 2004). A handful of other sites show human presence along the north coast of Alaska before 11k years BP (Bever, 2006). While these sites are evidence of occupation, the Pleistocene archaeological record is hard to decipher in this area in any linear fashion (Bever, 2001).

After the early migration through Beringia, archaeological evidence in the Arctic is sparse and equivocal until around 3000-4000 years BP. During this period, the material culture is generally defined as the Paleo-Arctic tradition, descendent of technologies developed earlier in Eurasia and largely focused on big game hunting. Sometime around 4500 years BP, the sea level stabilized and long-term settlements began to emerge along the coast (Anderson, 1984). The next two thousand years saw the development of the Arctic Small Tool tradition (Denbigh Flint complex), which by 2000 years BP was widely spread throughout the Arctic from Alaska to Greenland (Anderson, 1984; Dumond, 1987; Giddings, 1964). This complex is defined by more regular and delicate tooling and characterized by diminutive blades and scrapers with polished edges. Perhaps more important, this period initiated the spread of the bow and arrow into the Americas for the first time. Because this complex type is from the Aldan River region of Siberia (Anderson, 1968; 1984) well before the Alaskan sites ~5000 years BP, archaeologists have suggested that it began there and spread rapidly through the Arctic sometime around 4000 years BP (Dumond, 1987). Sites from this period are relatively uniform in artifact inventories, regardless of location, and over time assemblage compositions became increasingly more focused on the exploitation of maritime food sources (Anderson, 1984). Around 3500 years BP, the Arctic Small Tool tradition underwent a series of changes, including increased use of pottery and greater between-site variability, suggesting niche exploitation. This set of assemblages, broadly defined as Choris (Giddings, 1957), spread as far east as the MacKenzie Delta. By 2500 years BP, a significant shift in settlement patterns emerges, generally called the Norton culture (Giddings, 1960). Seemingly a derivative of the Choris culture, the Norton complex suggests a greater dependence on maritime resources, especially seal and salmon, ubiquitous use of clay and stone lamps for light and heat, and tools more akin to bone and wood carving (Bockstoce, 1979). Over the Norton period there is continued improvement in efficiency for fishing, sealing, and caribou hunting.

A cold cycle commenced around 2700 years BP, lasting roughly 500 years. This brought groups south along the western coast. There, they appear to have been less reliant on seasonal migration into the interior and maintained a more permanent coastal occupation (Mason and Gerlach, 1995; Mason, 1998). Sometime around 1600 years BP, the first evidence of the Ipiutak culture at Point Hope, Alaska emerges. Characterized by complex burial items, ornate ivory and wood carvings, and the use of iron, the Ipiutak thrived at Point Hope for several centuries (Larsen and Rainey, 1948). While the Ipiutak culture seems to wane at Point Hope and other coastal sites around 1300 years BP, there is continuity inland until roughly 700-800 years BP (Gerlach and Mason, 1992).

Climatic change during this transitional period coincides with the Medieval Warm Period, a period of slight global temperature increase between roughly 1050-750 years BP that seems to have had a varied and local impact throughout the Arctic (Jordan, 2009; Mann et al., 2009). The increased variability during this period produced continual spatial and ecological reorganization of marine and terrestrial dynamics throughout the Arctic, and this impacted resource availability for humans (Jordan, 2009).

During this transition, a rapid and dramatic change in culture occurred, specifically the emergence of large-scale whale and seal hunting among coastal Arctic habitations. This is commonly defined as the Punuk culture (Dumond, 1987). While some archaeologists explain the change as a result of new populations moving into the region from coastal Asia or islands around the Bering Strait (Old Bering Sea culture), others explain it through introduction and diffusion of new maritime technologies to the lingering Ipiutak culture (Anderson, 1984; Dumond, 1987; Ford, 1959; Mason, 2009).

The Old Bering Sea culture (OBS) dates as far back as 2200 years BP, stretching contentiously in some areas as late as 1000 years BP (Mason, 2009). Found primarily on St. Lawrence and Okvik Islands in the Bering Strait, the OBS has also been excavated on both the

Siberian and the Alaskan coasts. The material culture associated with the OBS is dominated by polished slate rather than flaked stone tools and includes snow goggles, more advanced ivory harpoon heads, snow shovels, sleds, and inflated harpoon-line floats, and appears to be the origin of kayaks and other skin boats (Dumond, 1987). Apparently evolving directly out of the OBS around 1400 years BP, the Punuk culture is defined additionally by an increased reliance on whale hunting (Ackerman, 1984). Recently, Mason (2009) suggested that the Punuk was also influenced considerably by the Ipiutak, as the arrival of the Punuk coincides with the Ipiutak disappearing from Point Hope. In addition there are some technological similarities between the two cultures. The Punuk culture also coincided with increased warfare and weaponry technology, apparently a result of increased population size (Ackerman, 1984).

As the Punuk culture arose in the Bering Strait area, many aspects of this complex spread to mainland Alaska and appear to be rather influential in the simultaneous formation of Birnirk culture in North Alaska (Ford, 1959). The Birnirk, first found at Point Barrow between 1500-900 years BP (Hollinger et al., 2009; Mason, 2009), featured highly developed harpoon heads, decorative clay lamps and cooking pots, and specific wood and ivory carving artistic traditions. With some influence from the Norton, Punuk, and other neighboring cultural traditions, the Birnirk people continued to innovate, producing a range of highly specialized tools for hunting and other tasks (Dumond, 1987; Mason, 2009). By roughly 1100 years BP the Thule tradition appears to have emerged from the Birnirk. The Thule is largely defined by its association with established whale hunting and dog-pulled sleds, which allowed greater consistency in subsistence, greater mobility, and greater population size. The Thule appears to have spread rapidly from the northwest coast of Alaska, across northern Canada, into Greenland, and, to a lesser extent, traveling southwest as far as the Aleutians (Dumond, 1987; Gerlach and Mason, 1992; Mason, 1998). Within the broadly defined Thule, there is substantial variation over geography, depending largely on available resources and the previous material culture. As the Thule spread along the Alaskan coast, they amalgamated with earlier regional traditions in what appears to be a diffusion of technology rather than a population movement or replacement (Dumond, 1987). It is important to note that the later Thule groups found at Point Barrow, where the Thule originated, appear to be unrelated to the Birnirk (Hollinger et al., 2009). The Thule, in its regional variants, continued until European contact.

Synthesizing the Archaeology with Human Biology

Map 2.1: Map of Arctic regions described in this section.

Despite the extensive border with neighboring non-Arctic Native North Americans to the south, there appears to have been little contact between these neighboring regions of North America, with no evidence of admixture between Arctic and non-Arctic Native Americans for the past 5500 years BP (Szathmary and Ossenberg, 1978).

Aleutians: While human occupation in the Aleutian Islands stretches from at least 8700 years BP (Laughlin et al., 1979), the last 4000 years show striking continuity in cultural sequence (McCartney, 1984). Despite this, Hrdlička (1945) suggested a more recent repopulation replacement event, based on his collection of two distinct cranial “types” –the Pre-Aleuts, with long and narrow crania, followed later by the Aleuts, with broadly shaped crania. Laughlin and Marsh (Laughlin and Marsh, 1951; Laughlin, 1980) countered this theory by suggesting that the distinct types were a function of adaptive change among island isolates, which maintained some independence due to distance and dialect differences.

In an examination of molecular affinities between the populations, direct radiocarbon dates and aDNA were used to compare the Pre-Aleut and Aleut samples based on direct carbon dates (Hayes, 2002). The two groups were statistically indistinguishable based on haplogroup frequencies and temporal overlap, suggesting a continuous population. This gave support to Laughlin and Marsh's (1951) argument concerning the nature of the cranial shape changes during this period.

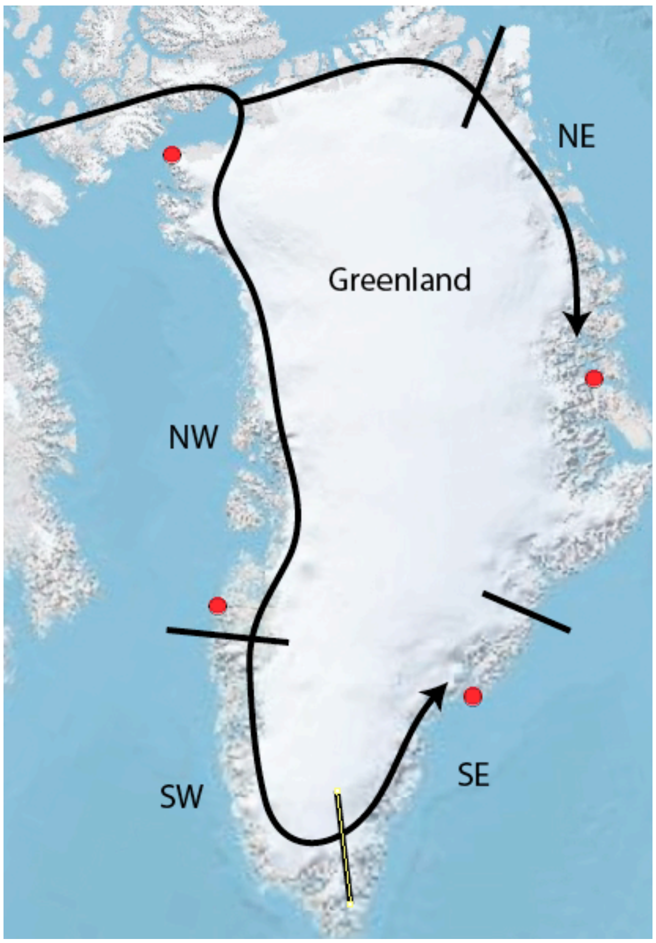
Central Arctic Occupation: By 5000 years BP there is evidence for occupations associated with the Arctic Small Tool tradition in the Central Arctic and Greenland. This regional variant of the Arctic Small Tool becomes known as the Pre-Dorset (Dumond, 1987). The Pre-Dorset was supplanted by the Dorset sometime after 3000 years BP. While it is generally agreed that the Dorset was a direct transition from the Pre-Dorset (McGhee, 1996; Savelle et al., 2009), it has some cultural continuities with the Choris of the Western Arctic. This suggests some continual contact throughout the Arctic during this period. The Dorset, relying on small marine mammals and large terrestrial mammals, does not appear to have developed dog sleds, bow and arrow use, or whale hunting and appears to have been supplanted by the more recent expansion of the Thule some time after 1000 years BP (Dumond, 1987; Mathiassen, 1927; McGhee, 1996). The biological relationship between the Dorset and the Thule populations remains obscured and highly controversial. Dating in the Arctic has proven to be difficult and contentious, and the debate concerning the relationship of the Thule and the Dorset largely hinges upon uncertainty in the date ranges of the material cultures (McGhee, 2000). Based on reanalysis of the dating methods, the Thule expansion may have happened several centuries later than the previously supposed 1000 years BP, between 800-700 year BP (McGhee, 2000; 2009). A more conservative read of the radiocarbon dates suggests that by the time the Thule had arrived, sometime around 700 years BP, the Dorset had already abandoned the Central Arctic for several centuries (Park, 2000).

Evidence that the Dorset may have continued as a tradition in some locations has been suggested based on a potential Dorset site at Native Point on Southampton Island, radiocarbon dated between 500-300 years BP (Collins, 1957). The Sadlermiut, as they were known, had cultural practices that diverged from those of the neighboring Thule-associated populations of Kamarvik and Salumiut (Hayes, 2002), and the skeletal remains associated with all three groups overlap in date ranges, all within 700-300 years BP. Molecular work, using aDNA to examine the population affiliations, found evidence of continuity between established Dorset-affiliated samples and the Sadlermiut and of a more distant relationship between the Sadlermiut and their contemporary neighboring groups (Hayes, 2002).

Other research has offered evidence that these shifts in material culture were not purely population replacement events but rather incorporations of technological diffusion with some degree of biological continuity (Dumond, 1987; Helgason et al., 2006; McGhee, 2000; Ossenberg, 2005; Sutherland, 2000). These studies proposed an overlap between these material culture traditions for several centuries where the Thule incorporated some elements of Dorset technology through diffusion and gene flow. The molecular work also provides a mixed picture. Recent aDNA work comparing haplogroup frequencies between pre-Thule to Thule inhabitants in the Central Arctic revealed different haplogroup frequencies, suggestive of replacement (Hayes, 2002). However, based on more recent genetic work (Helgason et al., 2006), it appears that a much more thorough aDNA study would be necessary to show anything conclusive concerning a replacement event.

Greenland: Archaeological evidence suggests a single port of entry into Greenland via the Cape York area (Laughlin and Jørgensen, 1956), at which point groups began to circumnavigate in both directions; north across Pearyland, down the northeast coast as far as Scoresby Sound, and south along the western coast, turning around the southern tip and proceeding north toward Scoresby Sound. To test the hypothesis that Greenland presents an example of a “ring distribution,” where, due to the enormous and impassible Greenland Icecap, all gene flow is confined to contiguous populations along the periphery, researchers have divided Greenland into 4 quadrants (NW, NE, SE, SW) based on several “impassible” geographic features and linguistic evidence (Frøhlich and Pedersen, 1992; Jaskulska, 2002; Laughlin and Jørgensen, 1956). These studies use the Blosseville Coast, between Angmagssalik and Scoresby Sound to separate the NE and SE groups, and some evidence of distinct dialect of the SE is used to justify separation from the West coast groups (**Map 2.2**).

Map 2.2: Map of Greenland showing ring of entry model with the quadrants as described by Laughlin and Jørgensen (1956).



Initial work using discrete cranial data and several cranial measurements to calculate biological distance claimed support for this ring-of-entry model and the greatest divergence between the NE and SE groups (Laughlin and Jørgensen, 1956). In a more recent study, the quadrant hypothesis was unsupported in this context with the largest distance between the SW and SE quadrants, and the shortest distance between the NE and SW quadrants (Jaskulska, 2002).

Molecular research examining the genetic diversity between two modern Greenland populations using mitochondrial DNA inferred significant admixture from the previous Dorset occupation (Helgason et al., 2006). However, this is difficult to substantiate because the genetic makeup of the Dorset people is not well documented.

Northwest Arctic: In North Alaska, there are several sites that have well provenienced skeletal samples associated with the two time frames important to the Thule transition.

- **Point Barrow:** Although not much research has been done to examine the Birnirk to Thule transition, two skeletal samples, an older Birnirk-associated sample and an historic Thule sample (now repatriated), have allowed some quantitative examination of these population relationships. A recent study using multivariate statistics on cranial shape to examine population continuity concluded that recent populations found at Point Barrow bear little resemblance to the Thule-initiating Birnirk (Hollinger et al., 2009), and in accordance, discrete trait variation among Arctic populations found that the earlier Birnirk group at Point Barrow contained much greater within-group diversity than other Circum-Arctic groups (Hollinger et al., 2009; Ossenberg, 2005).
- **Point Hope:** Substantial research has been conducted on the human occupations at Point Hope, Alaska. The Point Hope settlements of the Ipiutak and Tigara lie along the northern shore of the Point Hope Bar, a long narrow peninsula that reaches into the Arctic Ocean from Cape Thompson near the mouth of the Kukpuk River (Rainey, 1941). What makes this site archaeologically unique is that it presents two large and distinct archaeological settlements associated with different time periods and material cultures. The Tigara village was discovered by Knud Rasmussen in 1924. In 1939, Froelich Rainey, James Giddings, and Helge Larsen further excavated the Tigara site, finding 349 human burials with 295 relatively complete skeletons (Larsen and Rainey, 1948). Shortly after beginning the Tigara excavations, they found the older Ipiutak site to the north, its burials occupying a long, narrow strip of land on the lagoon side of the Point Hope spit. There, they documented approximately 600 house ruins and 140 graves, 47 of which yielded complete skeletons. The house ruins have little superimposition, which Larsen

and Rainey argued indicated that most of the dwellings were occupied contemporaneously, estimating an occupation size as large as three to four thousand individuals, several times larger than any known Arctic settlement from that period (Rainey, 1941). More recent dating and size evaluations suggest a more conservative range between 150-215 individuals during any one generation with a maximum of ~400 individuals (Mason, 1998).

A series of 25 ^{14}C dates from antler and wood has centered the Ipiutak culture at Point Hope securely between 1600-1300 years BP. After 1300 years BP, occupation at Point Hope was evidently diminished. There is evidence of low-level Birnirk and early Thule occupations throughout this period until the subsequent Tigara occupation (Mason, 2009), beginning between 600-500 years BP (Gerlach and Mason, 1992; Mason, 2006). The material culture associated with the older Ipiutak settlement is characterized by distinct burial practices, worked ivory, and stone tool tradition. Although their subsistence strategy was aquatically based, there is also evidence of substantial reliance on caribou (Larsen and Rainey, 1948).

Dental paleopathological analysis comparing the Ipiutak and Tigara populations at Point Hope inferred that the two groups had different diets (Costa, 1980). Sexual differences in tooth wear suggests a differential division of labor between the two populations (Madimenos, 2002). Research comparing craniofacial variation between the Ipiutak and Tigara found some similarity between the groups using mean trait differences, concluding that the two groups were distinct populations, with the Ipiutak more closely related to Siberian Yukagir than to the Tigara. These studies employed comparisons of univariate variation on cranial measurements (Debets, 1999 originally published in 1960 in Russian). Studies comparing the two populations using aDNA (Maley et al., 2006; Maley, 2007) found similarity in haplotypes, although no direct overlap.

Dating and material culture analysis of other regional sites place the Ipiutak material culture contemporaneously with the Birnirk of Northern Alaska, the Norton of the Bering Sea region south of the Bering Strait, and the Old Bering Sea and Okvik cultures (Punuk) of Siberia and St. Lawrence Island (Gerlach and Mason, 1992; Giddings, 1960). As mentioned above, these groups that were contemporaneous with the Ipiutak developed a set of advantageous technologies –seal oil lamps, pottery, ground slate tools, sleds, and types of ice-hunting gear – not found among the Ipiutak. While there is some degree of overlap with neighboring cultures, their technological complex as a whole, as well as their artistic tradition, is maintained as distinct during the duration of their occupation at Point Hope.

Paleoenvironmental reconstructions show no large shifts in temperature or sea level after 2000 years BP. Geological investigation of the beach ridges suggests a slightly lower sea level between 1100-1000 years BP, followed by a small rise from 1000-900 years BP, but in both cases the variation was no more than a meter from present levels (Moore, 1960). At no point would this variation put either site, usually between 2-3 meters above sea level, below sea level. However, there is evidence of increased storm frequency and temperature fluctuation during the intervening period 1200-600 years BP (Hume, 1965). It has been suggested that the coastal groups, including those on Point Hope, Point Barrow, Deering, Cape Krusenstern, and Cape Espenberg, went inland during this period due to some combination of depleted aquatic resources (salmon and seal) and the increasingly devastating coastal weather (Mason and Gerlach, 1995). These coastal sites all have strong association with the Ipiutak complex during the period between 1700-1200 years BP. The Ipiutak material tradition is continued at the inland sites of Onion Portage, Itkillik Lake, South Meade, and Lake Tukuto, in some cases up until 500 years BP (Gerlach and Mason, 1992). Sometime after 1000 years BP (more commonly around 800-500 years BP), the coastal sites are repopulated, this time associated with Thule-like material culture containing technologies for more efficient exploitation of aquatic resources, including whale hunting (Mason and Gerlach, 1995). When the Tigara show up at Point Hope sometime after 600 years BP, their material culture is consistent with these repopulation events.

The Ipiutak material culture is regularly juxtaposed to that found at the later Tigara site, which fits into the more broadly defined Thule tradition. The Tigara consisted of a long continuous occupation representing the increasing complexity of the Arctic whale hunting Thule culture. Associated with pottery, an advanced blade technology, more modern artistic design, clay lamps, whale-bone houses, and a whale and ocean-based subsistence strategy, the material culture of the Tigara occupation clearly diverged from that of the Ipiutak (Larsen and Rainey, 1948).

Cultural evolution: However differences in group dynamics throughout the Arctic during the period 2000-1000 years BP are defined, there is substantial temporal overlap of distinct groups with some form of interaction and the apparent maintenance of geographic boundaries based on access to resources and the cultural need for social boundary maintenance. Theoretical work suggests that the development and maintenance of technological and artistic boundaries might be due to groups looking for ways to define themselves (Gerlach and Mason, 1992). If so, the question is, do these distinct artifact styles mark political, kin, and/or economic boundaries? One possibility is that these groups were part of a larger network comprising an "Interaction Sphere" (Caldwell, 1964) –in this case, a political system based on status differences that maintained a center of power that diffused over geographical space. Under the assumption that some manner of cultural interaction sphere existed, the expectation that there was some level of gene flow between populations working to break down the genetic differences among the populations. When the Ipiutak and Birnirk disappear from the North Arctic coast, where did they go? The Ipiutak cultural tradition moved inland for an extensive period of time (Gerlach and Mason, 1992), but that is not evidence that some of the Ipiutak did not move along the coast and increase interaction, and therefore gene flow, with their Punuk or Birnirk contemporaries. Likewise, the Birnirk at Point Barrow do not appear to be related to the later Thule occupation at Point Barrow. However, there is evidence that the Thule material culture emerged out of this Birnirk population, which spread rapidly throughout the Arctic.

Summary

Relevant to the arguments presented in this research, there are sweeping human population movements throughout the Arctic around 1000 years BP that are associated with the modern whale hunting culture of the Thule. While it is difficult to develop a model through which this culture developed and spread, population growth consistent with a stable whale-based feeding culture might have spread in a myriad of ways: From cultural diffusion with no gene flow, to migration along the coast with some interbreeding with local groups at some locations, to full population replacement of previously existing populations.

CHAPTER 3

QUANTITATIVE METHODS USING HUMAN CRANIA

This chapter describes how morphological variation in human crania is structured, the utility of quantitative traits for examining population relationships, and derivations for the methods used to quantify these relationships.

Cranial Traits and Multivariate Methods

Cranial measurements are quantitative traits often employed by physical anthropologists because of their availability and wide geographical distribution. Because cranial traits maintain a strong genetic signature in addition to accessibility and ease in data acquisition, they are commonly used to measure human population relationships (Debets, 1999; Frøhlich and Pedersen, 1992; Hollinger et al., 2009; Howells, 1973; Jaskulska, 2002; Konigsberg, 1988; 1990b; Konigsberg and Ousley, 1995; Laughlin and Jørgensen, 1956; Martínez-Abadías et al., 2006; Powell and Neves, 1999; Relethford and Lees, 1982; Relethford, 1994; 1997; 2001; 2002; 2004a; Relethford and Blangero, 1990; Steadman, 2001; Stringer and Andrews, 1988; Varela and Cocilovo, 2007).

There are several methodological assumptions necessary for measuring population relationships using cranial morphology from archaeological sampling. The first relates to what constitutes a discrete "population" sample, as opposed to a sample from a "population lineage."

An ideal population in biological studies is a community of interbreeding individuals from a discrete location, where any two individuals have an equal probability of mating to produce offspring (Mayr, 1963). For archaeological "populations" used in anthropological studies and in most cases with extant population studies, this is rarely the case. Moreover, the usual deviation from this normative definition is very difficult if not impossible to quantify. In addition, applying morphological archaeological material to studies of population relationships makes the assumption that the populations being studied provide a sample unit of interbreeding individuals representing a reasonably discrete moment in time. The reality of archaeological sampling is that there is no way to know if this is truly the case, and for the most part, this assumption is probably not met. While this is not a new issue, it is largely ignored due to the inability of researchers to discriminate between a lineage relationship (different generations) within a sample, and sample composition from individuals representing this discrete moment in time (Cadien et al., 1974). As long as the time span of the “population lineages” is small relative to the temporal distributions across samples, it probably makes little difference. For the purposes of this work, therefore, the Arctic is considered a discrete population, with both an unbroken common ancestor-descendent relationship between all samples, and only partial geographic differentiation, with some potential for interbreeding between all samples.

The other assumption related to using archaeological remains is that the phenotypic variation within a population is an expression of biological or genetic information that can be used to quantify population differentiation, relationships, and other population-structure parameters. Variance/covariance (V/Cov) matrices are frequently used in evolutionary studies to calculate population-biological distances and to assess population structure when taking into account multivariate data (Blangero, 1988; Cheverud, 1988; Harpending and Ward, 1982; Konigsberg, 1988; 1990b; Martínez-Abadías et al., 2006; Relethford and Blangero, 1990; Uytterschaut and Wilmink, 1983). The covariance of two random variables is the manner in which they vary together, calculated by the product of the deviation of both from their respective means. Thus, the matrix contains as its off-diagonal elements the covariances between all pairs of variables, with the variance of each trait along the diagonal (Felsenstein, 1988). The V/Cov matrix of morphological traits is defined as the phenotypic V/Cov matrix (**P**), and the manner in which morphological traits co-vary through time and between populations can yield information about evolutionary history (Lande, 1976; 1979; Lande and Arnold, 1983).

The effect of the environment and environmental plasticity on trait values is generally accounted for by measuring the narrow-sense heritability (h^2) of each trait, which is the ratio of the additive genetic variance to total phenotypic variance (Falconer and Mackay, 1996). Heritabilities are usually measured by comparing the phenotypic values of individuals of known relationship (Falconer and Mackay, 1996). However, because this requires data from a substantial pedigreed population for accurate estimates, such estimates are not feasible for archaeological collections. To complicate this matter further, the relationship between the genotype and phenotype is also dependent on the environment, and the degree to which the environment affects trait variability is population-specific. Consequently, there is a range of heritability estimates for human cranial measurements, which are estimated to vary between 0.45 and 0.60 (Devor, 1987).

Despite inherent variability in heritabilities and difficulties in their reliable estimation, the pattern of correlation among traits within the cranium appears to be relatively stable (Cheverud, 1988). As a result, the relationship of heritabilities has also remained relatively stable. For example, although measurements of the face may have different heritabilities than those of the cranial vault, the relationship between the heritabilities of these two regions remains proportional because of their relatively stable covariance structures. Consequently, assessing the covariance structure of cranial traits should be a reliable and informative method for comparing the relationship among populations based on their craniofacial morphology (Cheverud, 1988; 1995; 1996; Relethford, 1994; 1997; Relethford and Blangero, 1990). Given the nature of heritabilities, for the purposes of this work the assumption is made that the environments were similar and that the heritability relationships among the traits were stable across all of these samples.

Partitioning Variation Among Populations

Phenotypic variation can therefore be used to quantify relationships between populations. The most commonly used method for comparing phenotypic variation among populations is to calculate a measure of biological distance that takes into account the amount of variation within a sub-population relative to some “larger” encompassing population. By examining how the covariance structure of traits differs across populations, it is possible to discriminate alternative explanations for population structure differences: isolation and drift versus the interaction between migration and admixture (Konigsberg, 1990a; Konigsberg, 1990b; Martínez-Abadías et al., 2006; Relethford and Blangero, 1990; Steadman, 2001; Varela and Cocilovo, 2002; Williams-Blangero and Blangero, 1989).

The framework for comparing biological variation among samples using morphological trait variation quantifies the proportion of phenotypic variance that exists as differences among sub-populations relative to the total phenotypic variation. Generally referred to as F_{ST} in the literature (Relethford, 1994; 2001; 2004a; 2004b; Relethford and Blangero, 1990; Roseman, 2004), this measure of among-population differentiation is based on the variance of quantitative traits, distinct from the traditional calculation of Wright's F_{ST} (1951), which is calculated using allelic frequencies. Wright's F_{ST} statistic is a measure of allelic diversity among populations relative to total allelic diversity. Large populations that have substantial migration between them will have low values, and small fragmented populations with low rates migration between them will have high values. Traditionally calculated from allele frequencies among populations, F_{ST} provides a measure of how similar the allelic frequencies within populations are to the other populations being sampled (Holsinger and Weir, 2009).

Since 1951, the F_{ST} statistic has been converted to a number of analogous measures that partition genetic diversity into within- and among-population components, including measures that utilize sequence data, microsatellite data, and morphological data. Relethford and Blangero (1990) derived a method for calculating an analogous measure to Wright's F_{ST} using multivariate quantitative traits based on the assumptions that phenotypic variance is proportional to additive genetic variance and that additive genetic variance of a trait is proportional to its observed level of heterozygosity. The manner in which this observed level of heterozygosity deviates from the expected value (population centroid) provides the basis for calculating the quantitative trait derived F_{ST} value. The Relethford-Blangero estimator thus converts multivariate quantitative traits into measures of relative sample variation, including biological distances and F_{ST}, by treating quantitative traits as multi-locus genetic markers based on the Harpending-Ward derived F_{ST} model (Harpending and Ward, 1982). For the purposes of this work, I will follow Spitze (1993), who redefined this analogous measure of among group genetic variability "Q_{ST}" when referring to quantitative traits.

The calculations for Q_{ST} and the other statistics rely on the **R**-matrix, which is the standardized V/Cov matrix of sample relationships based on each sample's deviation from the total sample mean. Its derivation follows (Relethford, 1994; 1997; Relethford and Blangero, 1990):

1. Based on *g* samples and *m* traits, all data are converted into standardized scores by variable.

2. A matrix of deviations (Δ) from the population centroid is constructed, consisting of deviations of group means from the total means pooled over all populations, where $\mathbf{I}$ is the *g* x *g* identity matrix **1** is the vector of *g* ones, and $\mathbf{W}$ is the relative census size vector. X is the *g* x *m* matrix, its elements containing the trait means for each group. The (‘) signifies the transpose of the respective matrix:

$$\Delta = (\mathbf{I} - 1\mathbf{W}')X$$

3. A co-divergence matrix $\mathbf{C}$ is computed using $\mathbf{P}_w^{-1}$, the inverse of the pooled within-subdivision phenotypic V/Cov matrix:

$$\mathbf{C} = \Delta \mathbf{P}_w^{-1} \Delta'$$

The diagonal elements of the $\mathbf{C}$ matrix are:

$$c_{ii} = \frac{\left(\bar{x}_i - \bar{x}\right)^2}{g_w}$$

Where g_w is the pooled within-group phenotypic variance weighted by sample size.

4. The $\mathbf{R}$-matrix is written as a function of $\mathbf{C}$:

$$\mathbf{R} = \mathbf{C}\left(1 - r_0\right) / 2m$$

where:

$$r_0 = \frac{\sum w_i c_{ii}}{2m + \sum w_i c_{ii}}$$

The diagonal elements of the $\mathbf{R}$-matrix are:

$$r_{ii} = \frac{c_{ii}}{2m + \sum w_i c_{ii}}$$

5. Q_{ST} is calculated by summing the weighted diagonal of the $\mathbf{R}$-matrix:

$$\mathrm{Q}_{\mathrm{ST}} = \sum_{i=1}^{g} w_i r_{ii}$$

CHAPTER 4

MATERIALS AND MEASUREMENTS

Population Samples and Provenience

Data Collection: Cranial material was collected from museums samples as noted and placed into discrete Arctic populations based on museum archive records.

- **American Museum of Natural History** (AMNH), New York City, NY.
- **Smithsonian Institution** (SI), Washington DC.
- **Greenland National Museum and Archives, Panum Institute** (Panum), Copenhagen, Denmark.
- **Harvard Peabody Museum** (Peabody), Cambridge, MA.
- **Canadian Museum of Civilization** (CMC), Hull, Quebec.

Data from 27 discrete Arctic populations were collected (**Table 4.1**). A minimum sample size of 25 individuals per group was the goal for this analysis.

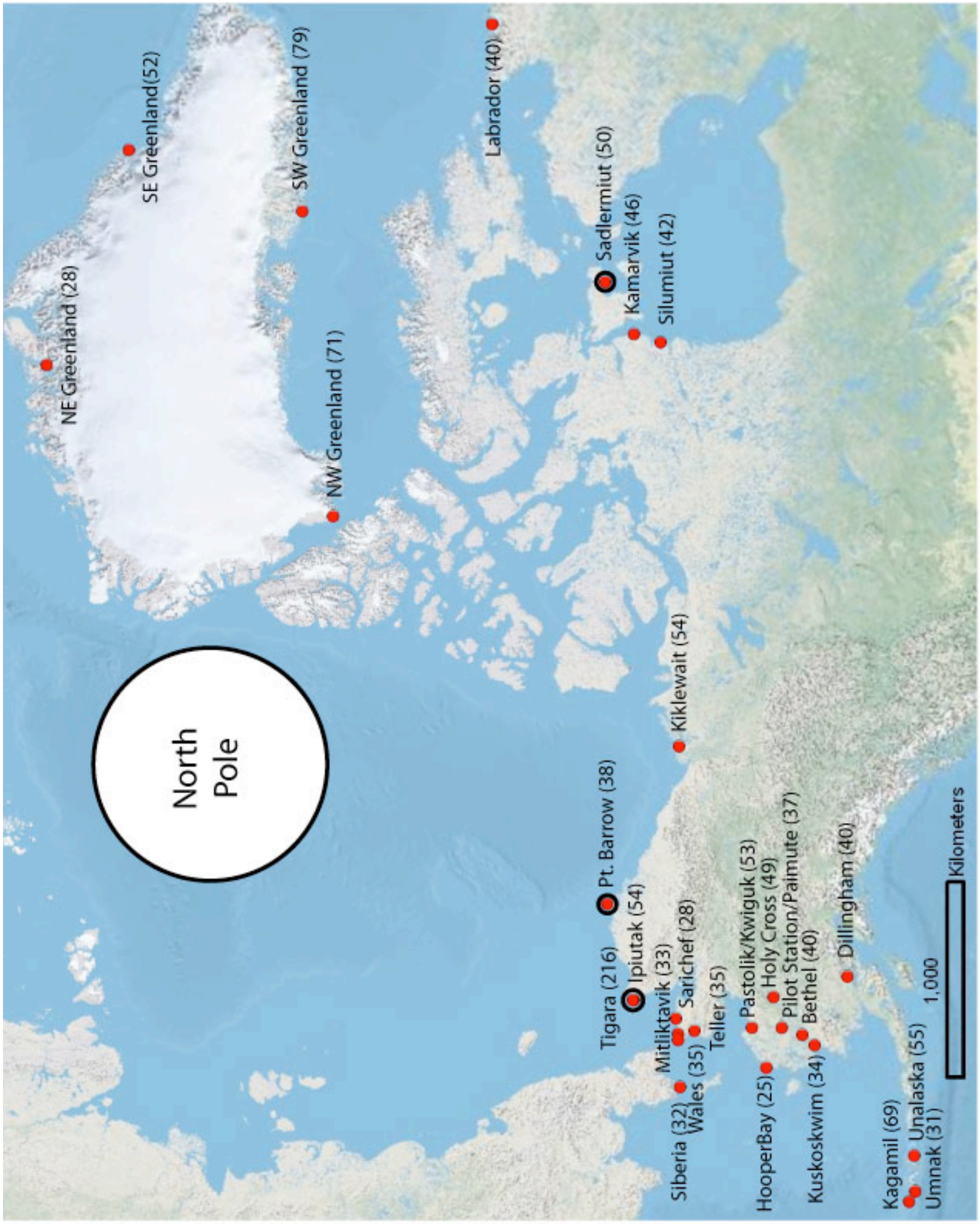
Table 4.1: Population list described by location (see Map 4.1) according to museum acquisition logs with sample sizes. Museum Key: American Museum of Natural History (AMNH), Smithsonian Institution (SI), Greenland, National Museum and Archives, Panum Institute (Panum), Harvard Peabody Museum (Peabody), Canadian Museum of Civilization (CMC).

ID	Sample	n	Museum
1	Bethel	37	SI
2	Dillingham	40	SI
3	Holy Cross	42	SI
4	Hooper Bay	25	SI
5	Ipiutak (Point Hope)	54	AMNH
6	Kagamil Island	68	SI
7	Kamarvik	46	CMC
8	Kiklewait	53	CMC
9	Kuskoskwim	33	SI
10	Labrador	40	Peabody
11	Mitliktavik	33	SI
12	NE Greenland	28	Panum
13	NW Greenland	62	SI, AMNH
14	Pastolik and Kwiguk	53	SI
15	Pilot Station and Paimute	34	SI
16	Point Barrow	38	SI
17	Sadlermiut	50	CMC
18	Sarichef Island	27	SI
19	SE Greenland	43	Panum
20	Siberia (Indian Point)	32	AMNH
21	Silumiut	42	CMC
22	SW Greenland	70	Panum
23	Teller	35	SI
24	Tigara (Point Hope)	216	AMNH
25	Umnak Island	31	SI
26	Unalaska Island	55	SI, AMNH
27	Wales	34	SI

Criteria for sample affiliation (Table 4.2): Because populations of individuals from the same archaeological site and layer did not always meet sample-size requirements, the following criteria were used for pooling individuals into samples for comparative analysis:

If a sample met minimum sample size requirements and provenience dictates that all individuals come from a single "population," the sample was used as a discrete population. When the sample size did not meet this minimum requirement, the sample was lumped with the most geographically proximate group or groups until minimum sample size was achieved. In most cases where this was done, such as in the W Arctic, the distance ranged between 1-100

Map 4.1: Map of Arctic with Sample Locations. Sample size in parentheses. Red dots with black borders indicate the samples with pre-Thule associated material culture (See Table 4.4).



kilometers, generally along a river system. However, in the samples from Greenland, distances along the coast for each quadrant are substantial. The “most geographically proximate” sample is variably interpreted depending on potential geographic barriers–for example, distance over a mountain range is not given equal consideration to distance up and down a river system. This was applicable only to the W Arctic samples that were collected along several different adjoining river systems. The assumption is that a sample from a single locale is of homogenous temporal origin, despite the lack of extensive dating for most of these samples.

Table 4.2: Sub-sampling composition of samples that are pooled from a number of specific local sub-samples. For the n, the number within parentheses is the number of sub-samples being pooled, while for the sub-samples, the value in parentheses is the sample size from that sub-sample.

ID	Sample	n	Sub-samples
1	Labrador	40(2)	Hebron (16), Okak (13), other assorted (11)
5	Kiklewait	53(3)	Kiklewait (5), Kittegazuit (41), and Richards Island (7)
8	Kamarvik	46(3)	Kamarvik (29), the Inuksivik (9), and the Kulaituijavik/Yellow Bluff (8)
9	NE Greenland	28(8)	Scoresbysund (12), Dodemandsbugten (6), Suessland (4), Strindbergs land Nordfjord (1), Baadsted (2), Kap Harry (1), Greysdalen Andree land (1), Adolf Jensens land kap beurmann (1)
10	SE Greenland	43(5)	Akorninap Kangerlua Ruinaesset (8), Ammassalik (18), Saggarmiut Kangertigvatsiaq (7), OstGreenland (5), Sermilik Suukkurti (5)
11	SW Greenland	70(9)	Avanersuup Kommunia Thule Uummannaq (9), Upernavik Inussuk (6), Qeqertap Ilua Iglorsuit (5), Anap Nunaa Illutalik (16), Tunu Hamborgersund, Qeqertarmiut (13), Uummannalik Illutalik (5), Inussuk Tununngassaq (5), Kangaamiut (7), Uunartoq Fjord (5)
12	NW Greenland	62(3)	Port Foulke (45), North Star Bay (11), Ikertok Fiord (6)
13	Bethel	37(4)	Bethel (12), kwishluk (9), Napaskiak (11), Jocelyn's Village (5)
14	Dillingham	40(4)	Kakwek (10), near Hurley (11), 1st Woods Lake (7), and Kaskanak (12)
15	HolyCross	42(5)	HolyCross 9), Bonasila(8), GhostCreek(6), Kozerevsky(6), Shageluk(13)
18	Kuskoskwim	33(3)	Apokak (17), Akulurak (7), Kuskogamute (9)
20	Pastolik-Kwiguk	53(3)	Pastoloik (28), Kwigut pass (8), Old and New Hamilton (17)
21	PilotSt-Paimute	34(3)	Pilot Station (18) Ingrehak (7), Paimiut (9)
24	Teller	35(2)	Port Clarence (15), Kauwerak (Kuzitrin R) (20)
26	Unalaska	55(3)	Unalaska (24), Amaknak (15) and Fortress (16)

Special Case of Greenland: In the case of sampling variation from Greenland, individuals were collected in a continuous pattern along the coast from pockets with small numbers of individuals (**Map 4.2**). In an effort to utilize all the data collected, the specimens were placed into discrete groups based on Greenland Quadrant affiliation. Upon further examination of previously defined quadrant groupings according to Laughlin and Jørgensen (1956), several problems were identified:

- Based on geography, division along the West coast is unwarranted because there is no discernable distance or notable geographic barrier delineating subgroups. In addition, any modern linguistic evidence typically used to support these distinctions (Laughlin and Jørgensen, 1956) does not necessarily apply to archaeological samples of unprovenienced ages.

- Some of the samples used in the SE and NE groups were incorrectly assigned in the museum archive based on their geographic locations. This was based on the Museum catalogue assignment, relative to the barriers identified by Laughlin and Jørgensen (1956). These samples –Sermilik (5) and OstGreenland (5) –were removed from the NE quadrant and placed into the SE quadrant.

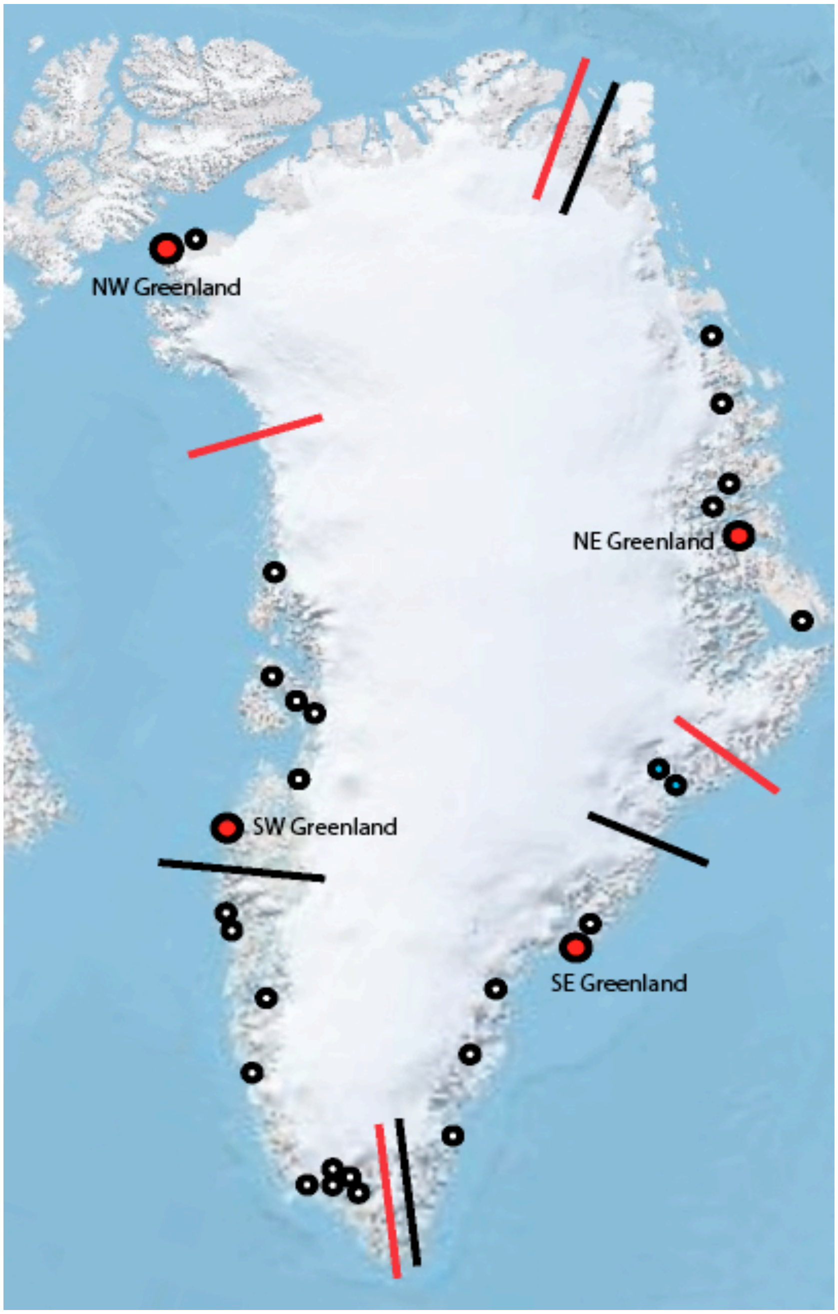
To test these new population delineations, Greenland was divided into four quadrants (**Map 4.2**). The NW and SW samples of Laughlin and Jørgensen (1956), who set the precedent for quadrant division, were redefined into a single SW sample. A new NW sample was formed by combining the Smithsonian and AMNH collections from Smith Sound. These samples have not been utilized in any of the previous studies of Greenland population history and are more clearly separated geographically from the SW samples than are the previously used NW quadrant samples.

Regional Samples: The 27 samples from **Table 4.1** were divided into regional groupings based on geographic distance (**Table 4.3**) to examine regional differentiation. For the regional sample set (**Table 4.3**), the samples were pooled into regional groups based on geographic affiliation to test for within-region versus among-region variability and biological-distance differences (see Chapter 5).

Table 4.3: Regional Samples (see Map 4.3) constructed by pooling the sub-samples defined in Table 4.1.

ID	Population	n	Sub-samples
1	Aleut	154	Kagamil, Umnak, Unalaska
2	W Arctic	264	Bethel, Dillingham, HolyCross, HooperBay, Kuskoskwim, Pastolik, PilotStation
3	NW Arctic	129	Mitlik, Sarichef, Teller, Wales
4	N Arctic	361	Ipiutak, Kiklewait, PointBarrow, Tigara
5	Nunavut	178	Kamarvik, Labrador, Sadlermiut, Silumiut
6	Greenland	203	NEGL, NWGL, SEGL, SWGL
7	Siberia	32	Siberia

Map 4.2: Map of Greenland with New Quadrants. Quadrant centroids, defined by their larger sample sizes and/or central positions along the coast, are shown in red with black border. Black circles indicate the sub-samples. The black lines indicate quadrant demarcation according to Laughlin and Jørgensen (1956). The red lines indicate the quadrant demarcation used in this work.



Regional affiliations were delineated by geographic barriers, geographic distances, and number of samples. In the case of the W, NW, and N Arctic groups, although they are less geographically distant from each other compared with other regional groups, each is based on an occupation of a distinct peninsula separated by far-reaching inland water channels, and sufficient number of samples for comparative analysis. These regional grouping were further justified by their grouping using principal-component analysis (Chapter 6).

GIS Locations: Locations were identified by latitude and longitude in Google Earth based on museum locality descriptions, Google Earth, historic maps, and published archaeological accounts. Pair-wise distances in kilometers were calculated from the latitude and longitude data using CrimeStat (Levine, 2010). For defining geographical distances for pooled samples made from multiple smaller sub-samples, the sub-sample with the largest sample size was used as the sample centroid. In cases where multiple sub-groups are along a river system or coastal perimeter, such as along coastal Greenland, the most centrally located sub-population has been used as the sample centroid. For the macro-region sample analysis, the geometric centroid was calculated using un-weighted mean latitude and longitude for the regional samples.

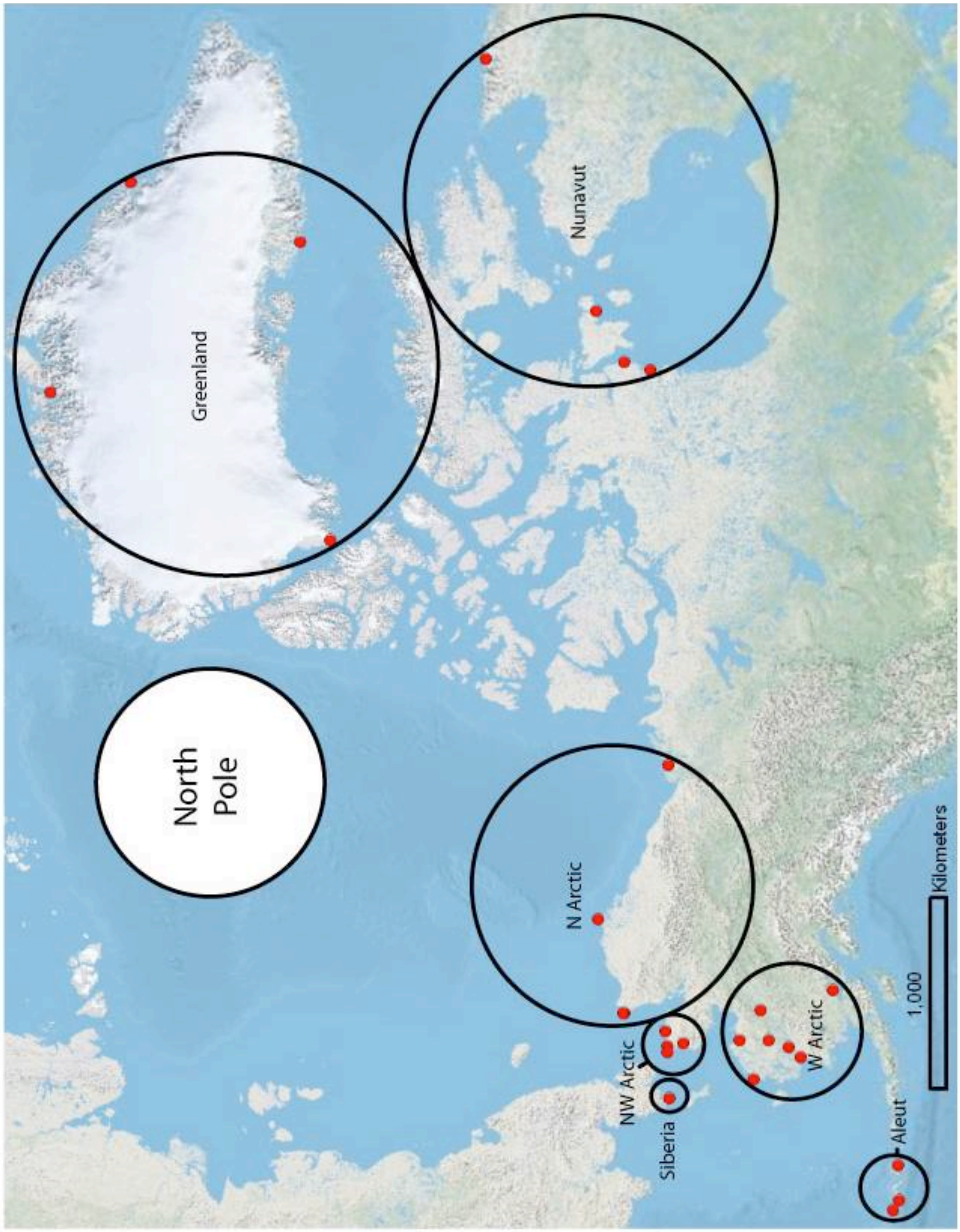
Age: Because age and developmental status can be confounding factors when comparing size and shape, only fully developed adult individuals were used for this research. Individuals were aged as adults based on dentition, requiring full eruption of the upper M3, or, in cases where it was clear no M3 was present or developing, of the M2.

Temporal/Cultural Affiliation: Most of the museum samples have little known archaeological provenience. However, several of the samples have been extensively dated and provenienced with associated material cultures. **Table 4.4** provides these cultural affiliations, broken down into Pre-Thule (Birnirk, Ipiutak, Dorset) cultures, generally existing prior to 1000 years BP, and Historic/Thule cultures, roughly 1000 years BP to present.

Table 4.4: Populations with Pre-Thule and Thule Cultural Affiliations, including the associated date range (period) and associated date means (mean).

Sample	n	culture	period	mean	citation
Ipiutak	54	Ipiutak	1600-1300 BP	1450	(Gerlach and Mason, 1996)
Sadlermiut	50	Dorset	500-300 BP	400	(Hayes, 2002)
Point Barrow	38	Birnirk	1500-1000 BP	1250	(Hollinger, 2009)
Tigara	216	Thule	600-150 BP	375	(Gerlach and Mason, 1996)
Silumiut	42	Thule	700-400 BP	550	(Hayes, 2002)
Kamarvik	46	Thule	700-400 BP	550	(Hayes, 2002)

Map 4.3: Map of Arctic with regional-sample affiliations based on Table 4.3.



Most of the samples have not been officially provenienced and are generally considered to be from more recent historical occupations, existing within the last 500 years. Despite the inconsistencies between the Sadlermiut dates, previous research has suggested that this population was affiliated with the Dorset, a Pre-Thule material culture and should be treated as such (Hayes, 2002).

Morphological Landmarks

Landmark data were generated using a Microscribe G2 3-D digitizer (Immersion Corp, San Jose, CA). Landmarks were separated into midline and paired. When not measuring distance between paired landmark sets, measurements utilized the right landmark. Definitions are from previous research as noted (Bass, 2005; Burns, 1999; Howells, 1973; Martin and Saller, 1956; Moore-Jansen et al., 1994; White and Folkens, 2000).

Midline Landmarks:

- Orale: The single most anterior point on the hard palate where a line drawn lingual to the central incisors intersects the palatal suture (Burns, 1999). Because of variable amounts of damage, frequently missing teeth, and rebsorbed alveolar bone, orale can be variable in the inferior-superior dimension.
- Staphylion: The single point on the posterior hard palate where the palatal suture is crossed by a line drawn tangent to the curves of the posterior margin of the palatal bones (Burns, 1999). Staphylion is variable in the inferior-superior dimension due to variable thickening in the midline of the posterior palate.
- Hormion: The most posterior midline point on the vomer. When vomer is missing, Hormion is taken where the posterior vomer imprint aligns on the sphenoid.
- Basion: The point where the anterior margin of the foramen magnum is intersected by the mid-sagittal plane. Basion is located on the inner border of the anterior margin of the foramen magnum directly opposite the opisthion. In rare cases, the position of basion is

obscured by a thickening of the anterior margin that produces two distinct posteriorly projecting lips. In this case, the inferior lip is used (Martin and Saller, 1956).

- Opisthion: The point where the mid-sagittal plane intersects the posterior margin of the foramen magnum. Opisthion is located on the inner border of the posterior margin of the foramen magnum facing basion (Martin and Saller, 1956).
- Nasospinale: The lowest point on the inferior margin of the nasal aperture as projected in the mid-sagittal plane. In crania with slight to moderate development of the anterior nasal spine, this point is determined by connecting the lowest point on the inferior margin of the nasal aperture right and left of the nasal spine. Nasospinale is located wherever this line intersects the mid-sagittal plane at the base of the nasal spine. If the nasal spine is well developed, the point of Nasospinale is marked on the lateral wall of the projecting nasal spine. However, if the nasal spine is at or below the line connecting the lowest point on the inferior margins of the aperture, the lowest point on the nasospinale occurs on the upper margin of the nasal spine (Martin and Saller, 1956). Due to the inherent variability in the nasal spine, nasospinale is a more effective measure of nasal height when paired with nasion rather than a good measure of nasopharynx length.
- Nasion: The point of intersection of the nasofrontal suture and the mid-sagittal plane. Nasion corresponds to the nasal root (Martin and Saller, 1956). Nasion is a consistent and well-preserved landmark that defines the supero-anterior border of the nasopharynx.
- Lambda: The single point at the intersection of the sagittal and lambdoidal sutures (Burns, 1999). When there are lambdoid ossicles present, lambda is triangulated from the three suture lines.
- Bregma: The point where the sagittal and coronal sutures meet (Martin and Saller, 1956). Bregma is not always along the sagittal plane and suture fusion can obscure its exact location.

Paired Landmarks:

- Ectomolare: The most lateral point on the lateral surface of the alveolar crest. Ectomolare is generally positioned on the middle lateral alveolar margin of the second maxillary molar (White and Folkens, 2000).
- Alare: The most laterally positioned point on the anterior margin of the nasal aperture, marked on both the right and left sides of the nasal aperture (Bass, 2005; Howells, 1973).
- Frontomalare Orbitale: The point taken at the anterior edge of the Frontomalare suture along the lateral orbital rim.
- Dacryon: The point on the medial border of the orbit at which the frontal bone, lacrimal bone, and maxilla intersect. Dacryon lies at the intersection of the lacrimomaxillary suture and the frontal bone. There is often a small foramen at this point (Martin and Saller, 1956). There is some variation in the way the lacrimal, the frontal and the maxilla come together relative to the lacrimal groove. In addition, because these bones sometimes fuse, it can be difficult to decipher its exact position.
- Zygion: The most laterally positioned points on the zygomatic arches. The distance between right and left zygion is defined as the measurement of bi-zygomatic breadth (Martin and Saller, 1956).
- Porion: Paired points at the most lateral part of the superior margin of the external auditory porous (White and Folkens, 2000).
- Asterion: The point where the lambdoidal, parietomastoid, and occipitomastoid sutures meet (White and Folkens, 2000). In cases where there are supranumerary bones, the landmark is taken along the lamdoidal suture at the point of intersection with the supranumerary bone.
- Zygomaxillare: The most inferior point on the zygomaticomaxillary suture (White and Folkens, 2000).
- Zygoorbitale: The point where the orbital rim intersects the zygomaticomaxillary suture (White and Folkens, 2000).

- Sphenoid 3(L) and 8(R): The point where the posterior lateral margin of the lesser wing of the sphenoid begins to curve medially along the superior curve. It is a measure of internal width of the posterior nasopharynx.

These measurements were chosen based on the consistency and accuracy of their landmarks during data collection, as well as their ability to describe a broad spectrum of cranial morphology. A complete list of measurement data for all 27 samples is included in the Appendix (**Appendix A**). The correlation matrix for the 29 measurements is also included in the Appendix (**Appendix B**) providing the distribution of inter-trait correlations. The inter-trait correlations range between -0.15 and 0.79 for the 29 traits, with a median of 0.15 and a mean of 0.17. Only 2 out of 406 trait pairs have correlations greater than 0.7.

Table 4.5: Measurement Definitions. ID number refers to Figures 4.1-3.

ID	Measurement	Measurement description
1	Orale to Staphylion	palatal length
2	Hormion to Basion	spheno-occipital length
3	Basion to Opisthion	foramen magnum length
4	Opisthion to Lambda	midsagittal occipital squama cord length
5	Lambda to Bregma	saggital suture cord length
6	Nasion to Bregma	midsagittal frontal cord length
7	Nasospinale to Nasion	anterior nasal height
8	Orale to Nasospinale	midfacial alveolar height
9	Nasion to Lambda	cranial length
10	Orale to Basion	posterior cranial length
11	Basion to Bregma	cranial height
12	EctomolareL to EctomolareR	maxillary width
13	FrontomOrbL to FrontomOrbR	bi-orbital breadth
14	ZygionL to ZygionR	absolute cranial width
15	AsterionL to AsterionR	cranial width at Asterion
16	ZygomaxillareL to ZygomaxillareR	superior facial width
17	PorionR to ZygomaxillareR	cranial length
18	ZygomaxillareR to ZygoorbitaleR	zygomaticomaxillary suture length
19	FrontomOrbR to AsterionR	midcranial length
20	FrontomOrbR to ZygoorbitaleR	orbital zygomatic cord length
21	Bregma to PorionR	mid-cranial coronal cord length
22	Lambda to AsterionR	lamdoid suture cord length
23	FrontomOrbR to Bregma	coronal suture cord length
24	PorionR to AsterionR	posterior cranial length
25	Staphylion to Hormion	posterior nasopharynx length
26	AlareL to AlareR	anterior nasal width
27	Sphenoid8 to AlareR	mid-lateral nasopharynx length
28	DacryonL to DacryonR	anterior nasopharynx width
29	Hormion to Nasion	mid-facial length

Landmarks and measurements are marked in **Figures 4.1-4.3** from computed tomography (CT) scans of Ipiutak crania 96 and 102 (AMNH catalog, c/o Lynn Copes). The CT scans were processed using OsiriX v3.7 (Rosset et al., 2010).

Figure 4.1: Cranial Landmarks and Measurements –Frontal View.

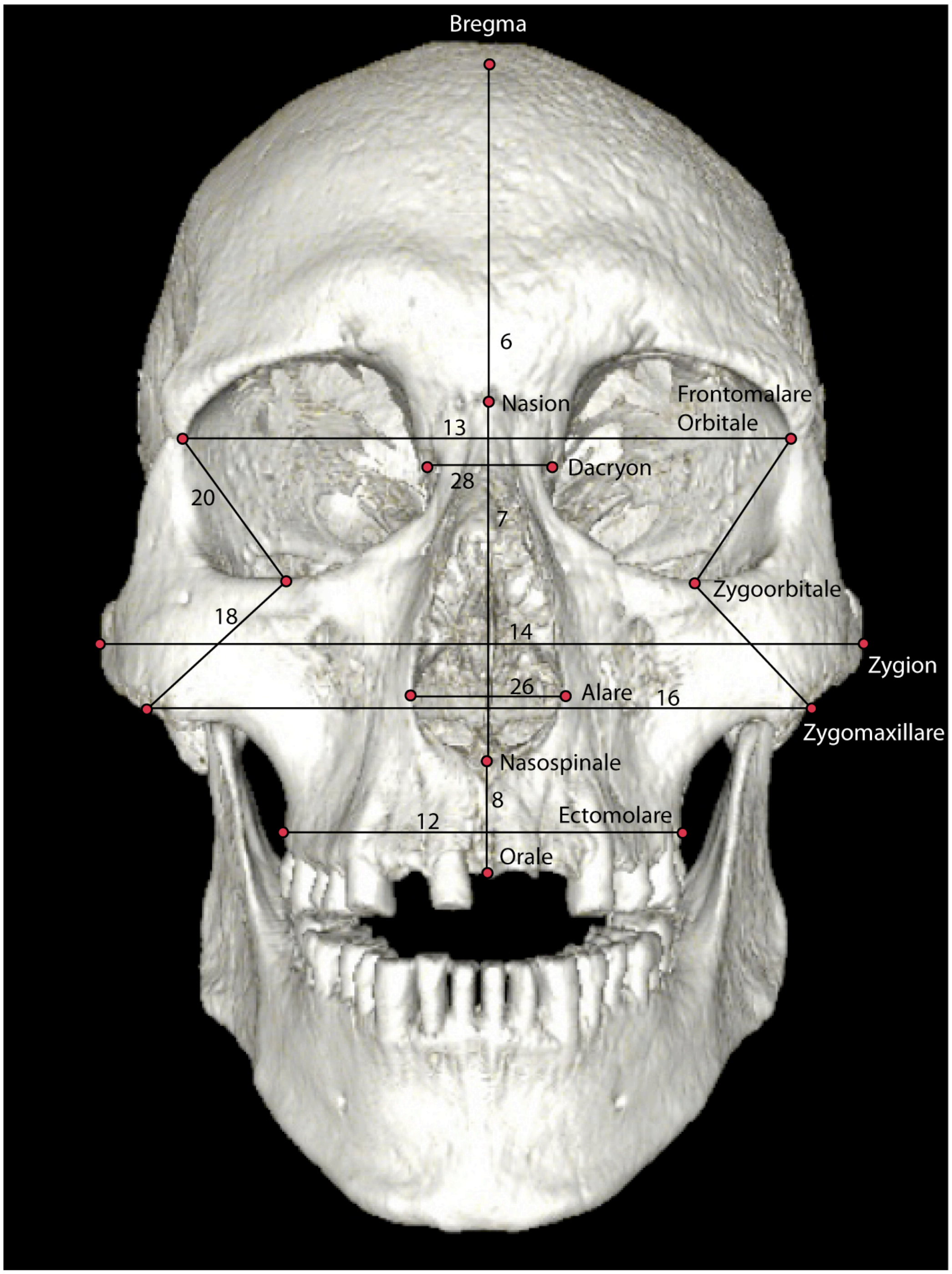


Figure 4.2: Cranial Landmarks and Measurements –Sagittal View.

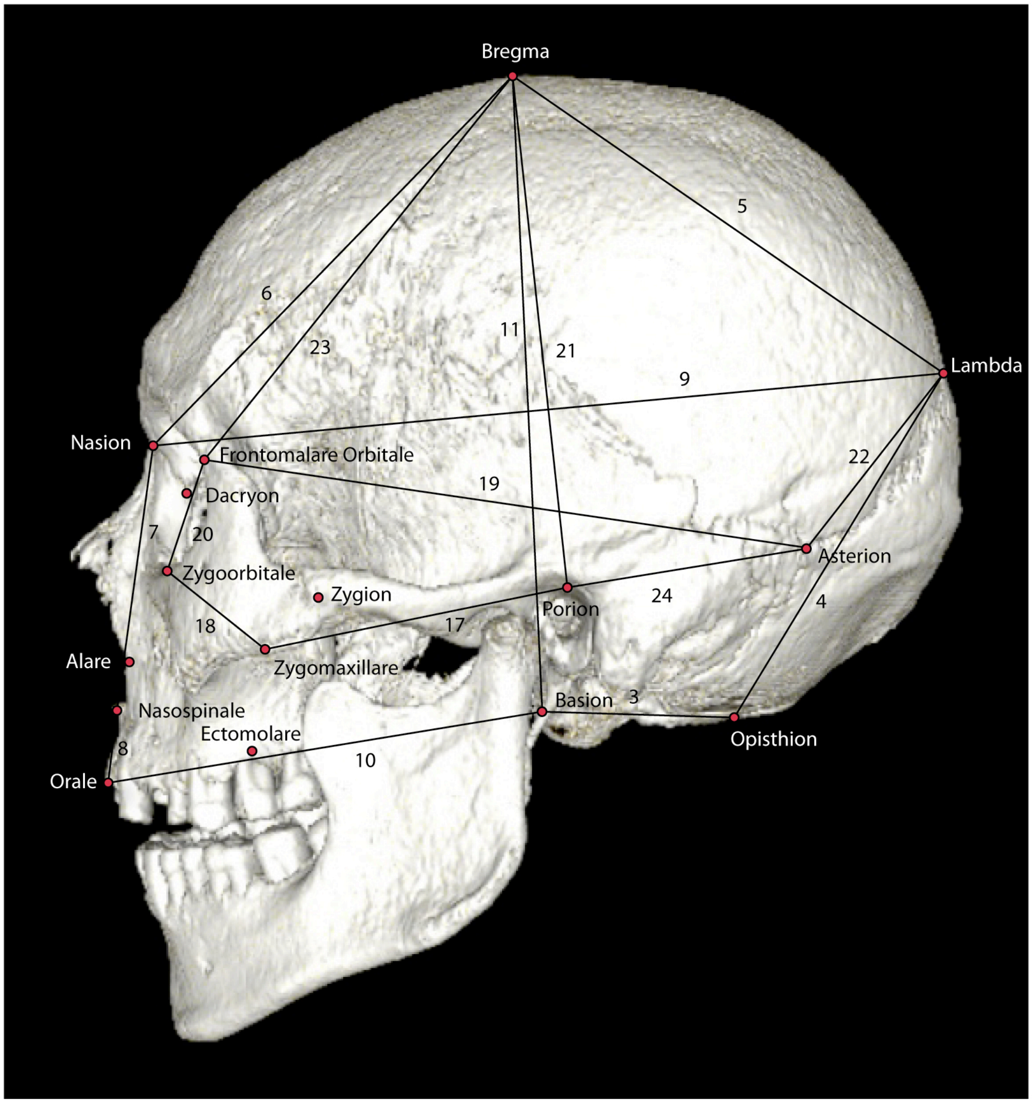
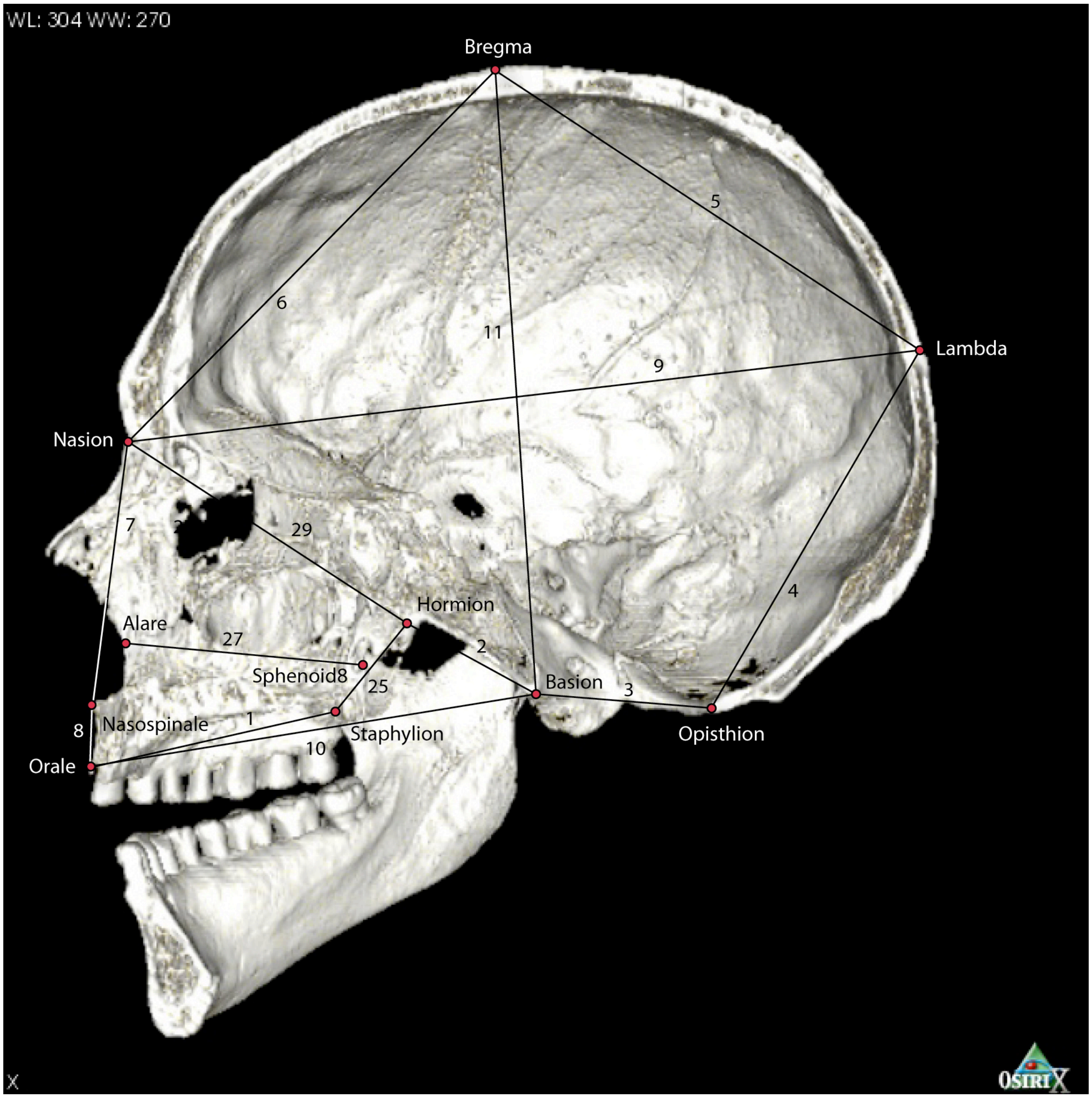


Figure 4.3: Cranial Landmarks and Measurements –Median Sagittal View.



CHAPTER 5

METHODS

This chapter describes the specific methods of analysis and statistics utilized in this research. This includes an introduction to the methodological issues relating to general data handling, and the methods and specific analyses used for examining variability patterns, biological distance, and population history.

General Data Considerations

All data handling and statistical analyses were performed in the R programming language (R Development Core Team, 2008) unless otherwise noted. Specific R package functions not written by the R development team are noted where appropriate. Landmark data were collected using the Microscribe G2 digitizer and imported into Excel using Microscribe Utility Software (Immersion, San Jose, CA). The 3-D landmark data were imported into R and converted into pair-wise measurements for each specimen.

Data exploration: To make sure that there were no gross errors or abnormalities in data collection, box plots for all traits in each sample were constructed and analyzed. Where extreme outliers were found, the raw data were examined to find the cause, and problematic specimens or landmarks were removed.

Repeatability: Repeatability was measured by replicating measurements on 26 individuals from the Ipiutak sample for 28 traits (the sphenoid8 landmark was not collected in the replicate sample). **Table 5.1** provides the average squared difference between the repeated measures for each trait, standardized by the trait mean, as well as the repeatability using a repeated measures ANOVA (Falconer and Mackay, 1996).

These repeatability scores are considered minimum values for this data, as the replicate data set was taken at the beginning of data collection as a test for the landmark collection methods. Thus, it is expected that later measurements have greater repeatability. Several of the measures, Dacryon to Dacryon and Hormion to Basion are low, (0.598) and (0.482) respectively.

This is due to changing the specific landmark definition after the initial test of data-collection methods. If these two repeatability values are removed, the mean repeatability for the 26 measurements is 0.975 with a standard deviation of 0.036.

Table 5.1: Repeatability of measurements. Average squared difference between the repeated measures (*), and repeatability (r).

Measurement	*	r
Orale to Staphylion	0.011	>0.999
Orale to Basion	0.006	0.994
Orale to Nasospinale	0.039	0.928
Staphylion to Hormion	0.010	0.997
Basion to OpisthionR	0.009	>0.999
Basion to Bregma	0.014	>0.999
OpisthionR to Lambda	0.006	0.983
EctomolareL to EctomolareR	0.007	0.924
Nasospinale to Nasion	0.009	0.997
AlareL to AlareR	0.019	0.991
Nasion to Lambda	0.078	0.999
Nasion to Bregma	0.009	0.934
FrontomOrbL to FrontomOrbR	0.003	0.988
DacryonL to DacryonR	0.048	0.598
FrontomOrbR to AsterionR	0.005	0.982
Hormion to Basion	0.117	0.482
Hormion to Nasion	0.017	0.987
FrontomOrbR to Bregma	0.005	0.971
FrontomOrbR to ZygoorbitaleR	0.059	0.987
Lambda to Bregma	0.025	0.998
Lambda to AsterionR	0.009	0.980
Bregma to PorionR	0.010	0.994
ZygionL to ZygionR	0.003	0.997
AsterionL to AsterionR	0.009	0.946
ZygomaxillareL to ZygomaxillareR	0.022	0.958
PorionR to AsterionR	0.021	0.840
PorionR to ZygomaxillareR	0.016	0.998
ZygomaxillareR to ZygoorbitaleR	0.091	0.966

Sex: To control for the potentially confounding impact that sex differences have on measurements of population structure and differentiation, variation attributable to size-related sexual dimorphism has been removed. To test for significant interaction due to sex related variation, the crania in each sample were placed into Male (M) or Female (F) categories based on a suite of dimorphic characteristics utilized for quantifying sexual differences in morphological studies (White and Folkens, 2000). These include general levels of robusticity specific to the nuchal crest, mastoid process, supra-orbital margin, supra-orbital ridge, and mental eminence of the mandible. Multivariate analysis of variance (MANOVA) was used to test if sex was a significant source of variance within samples, with the traits as dependent variables and sex as an independent variable. For each sample, sex was found to have a significant impact on trait means at the 0.05 level. Previous research found that removing variation due to sexual differences provided a better correspondence to the molecular genetic markers when calculating Q_{ST} and biological distances (Relethford, 1994), and it is common practice in population studies that utilize cranial morphology (1994; 2001; 2004a; 2004b; Relethford and Blangero, 1990; Roseman, 2004). Because sex differences can have an impact on measures of population differentiation, differences due to sex were removed from the sample data using mean scaling. After separating the samples by sex (M and F), ½ the difference in means was added to the smaller sample and ½ the difference in means was subtracted from the larger sample before pooling (Cheverud, pers. comm.).

Missing data: To maximize the amount of data available for analysis, it was necessary to fill in missing data. There are multiple methods for estimating missing values; substitution with group means, substitution with grand means, and using predicted values from a range of sources, including regression, linear interpolation, and multiple imputation (Horton and Kleinman, 2007).

Linear interpolation is a process by which a missing value is filled based on linear approximation between the prior and subsequent trait values for the specific variable within the sample. The advantage of interpolation is that it simulates variability and requires no minimum sample size. Individuals were randomly ordered within each sample for this procedure. This method was used to fill missing data in all samples using the “zoo” package in R (Zeileis and Grothendieck, 2005), and was chosen because many of the analyses performed require there to be no missing data, as occurs with pair-wise removal. In addition, the multiple imputation methods require a minimum sample size that precluded the smaller samples. To examine the impact on the data using this method to fill in the missing values, an interpolation-filled data set was compared to the V/Cov matrix calculated through pair-wise removal of missing data, and the V/Cov matrix calculated from a multiple imputation filled data set. Using the Mantel test of matrix correspondence (this chapter), the Mantel r statistic for all three pair-wise comparisons was >0.999, meaning that there was no difference between the differently filled data sets.

Size: Size-related variation has been shown to be important in studies involving cranial variation, because it has its own genetic underpinnings and is relevant to population differentiation (Shirai and Marroig, 2010). Because of this, no size correction was done other than the sex-related size correction. The means and standard deviations for each sample are provided in **Appendix C**.

Calculating Biological Distances and other Variability Statistics

Biological distances, Q_{ST}, and the other population variability statistics (listed below) were calculated using the 29 traits (**Table 4.5**) for all population samples (**Table 4.1)** and regional samples (**Table 4.3**) using RMET v5.0 (Relethford, 1997). RMET uses the methods outlined in Chapter 3 to calculate biological-distance and variability statistics using quantitative-trait variation (Relethford and Blangero, 1990). Following convention, the **P**-matrix for each sample was scaled by an average cranial heritability of $h^2 = 0.55$ to put the Q_{ST} values according to convention to more closely mirror F_{ST} values calculated from allelic markers (Devor, 1987; Relethford, 1994; 2001; 2004a; 2004b; Relethford and Blangero, 1990; Roseman, 2004). This heritability scaling was done for Q_{ST} and other measures of phenotypic variation (**Tables 6.2-6**). No scaling was done in the biological-distance analysis, the principal component analysis, or the discriminant function analysis. In addition, geographical distances have been worked into these models to examine relative gene flow and geographical relationships to expected isolation-by-distance models, both through regression and matrix comparison.

The following statistics have been calculated for comparison of phenotypic variation among the Arctic samples (1997; Relethford, 1994; Relethford and Blangero, 1990):

- $\mathbf{R}$-matrix: The standardized V/Cov matrix of sample relationships based on each sample's deviation from the total sample mean (derivation in Chapter 3).
- r_{ii}: Phenotypic distance to the total population centroid for each sample and region (the diagonal elements of the $\mathbf{R}$-matrix).

- Q_{ST}: The ratio of among sample variation to total variation expected under panmixia. The mean distance of each sample to the total sample centroid, calculated as the weighted mean of the diagonal elements of the $\mathbf{R}$-matrix (r_{ii}). Q_{ST} was calculated among all samples, among all regions, and among all samples within regions, to examine the hierarchical partitioning of variation throughout the Arctic to test hypotheses of differential gene flow.
- D^2: Biological (phenotypic) pair-wise distance between all samples and regions, calculated from the R-matrix elements: $d_{ii}^2 = r_{ii} + r_{jj} - 2r_{ij}$.
- $\bar{v}_{Gi}$: Observed mean phenotypic variance for each sample and region over all traits.
- $E\left(\bar{v}_{Gi}\right)$: Expected mean phenotypic variance for each sample and region, which is the observed value weighted by its deviation from the average distance to the total sample centroid.
- $\bar{v}_{Gi} - E\left(\bar{v}_{Gi}\right)$: Residuals between observed and expected phenotypic variance for each sample and region.
- Principal Components: Eigenvalues and their Eigenvectors have been calculated from $\mathbf{R}$-matrix decomposition.
- Discriminant Functions: Discriminant-function analysis was done using the sample measurement data.
- Mahalanobis distances: $D_{ij}^2 = \left(\bar{x}_i - \bar{x}_j\right)' \mathbf{P}^{-1} \left(\bar{x}_i - \bar{x}_j\right)$ A measure of Euclidean distance based on mean differences between samples that takes into account the covariance structure of the data. Although the biological distance calculated from the $\mathbf{R}$-matrix is essentially a similar measure of Euclidean-based Mahalanobis distance, the Mahalanobis distance matrix was also calculated directly from the data for comparison.

Determining a model of isolation-by-distance: For testing hypotheses of deviation from expected sample relationships, an empirically derived model of population differentiation was constructed based on geographic distance across the Arctic. This was done by plotting pair-wise geographical distance on pair-wise biological distance for all samples. The linear model was used to define the statistical parameters for an empirical model of differentiation across the Arctic. For testing the relevant null hypothesis, it was necessary to develop a model that allowed comparison between observed versus predicted values of biological distances based on observed values of geographical distance. Hence, linear modeling using least-squares regression was justified, because it permits prediction of the dependent variable (biological distance) in the context of a known independent variable (geographic distance) for which error is not a concern. For statistical testing against the empirical model, a linear model for each sample was defined, again using least-squares linear regression to compare the specific pair-wise geographical distances on pair-wise biological distance to all other samples. The slope and r^2 of each sample's linear model has then been compared to the overall empirical "expected" model to find significant sample deviations.

Principal-Component Analysis: Principal-component analysis (PCA) is a tool for transforming data into a reduced number of uncorrelated variables. PCA uses matrix decomposition of a V/Cov matrix to reform the data into two or three principal-component vectors that redefine most of the variation in the dataset. The principal components are defined as the eigenvalues and their loadings (eigenvectors) that can be decomposed from the V/Cov matrix. The eigenvalues are quantities analogous to variance, the first defining the axis that describes the maximum amount of variance in the multidimensional space of the dataset. The second axis describes the maximum variance left after removal of the variance ascribed to the first principal component. This continues until each non-zero eigenvalue has a set of the eigenvectors that define the vector (or axis) for each eigenvalue.

For this research, the principal components were compared to explore the relationship among the different samples and regions. The eigenvalues and vectors were calculated from the **R**-matrix, then plotted between all samples and regions between the first and second principal components, the first and third principal components, and the second and third principal components.

Discriminant-Function Analysis: Discriminant-function analysis is a methodological tool for assigning group membership. Samples are assigned to groups using a linear combination of the variables analyzed. Based on mean differences among samples and the overlap of their distribution among a number of traits, the discriminant function yields a set of functions used to compare the individuals in a sample by classifying each individual according to the sample function of best fit. The number or percentage of individuals that are correctly classified provides information about the differences between the populations or regions that are defined by the discriminant function. The distribution of classification of the individuals in a sample over the range of potential samples provides information concerning the sample's uniqueness and overlap with the other samples included in the analysis. In this sense, the discriminant function allows the categorization of each individual into the most appropriate category.

For this work the step-wise standardized Fisher discriminant function was calculated using Mahalanobis distances to quantify the distance between the populations for each trait. The coefficients were standardized for comparison of the impact of each trait on the discriminant function. Prior probabilities were calculated with all groups being equal, and sample size was not included to prevent larger samples from having inflated attraction.

The measure of precision of the discriminant function to differentiate is cross-validation, a jack-knife procedure that examines the classification of each individual into the category set in the absence of its own discriminant-function coefficients. The correct categorization under this circumstance is a measure of how robust the discriminant function is.

The following set of discriminant-function analyses were run:

- All Arctic samples (27) using all traits (29)
- All Arctic samples based on regions (1:6)
- Greenland samples only (1:4)

For the Greenland analysis the traits were entered together rather than in a step-wise fashion, as was done in the previous analyses. Because of the smaller sample size, this produced a more robust discriminant function.

Matrix Comparison with Other Distance Metrics: Biological distances were compared to geographic distances and cultural affiliation to examine whether controlling for cultural affiliation improved the relationship between biological and geographical distance. In addition, the Mahalanobis distance calculated directly from the data was compared to the biological distance calculated from the $\mathbf{R}$-matrix to check for consistency as well as the impact of not correcting for noise during matrix inversion (See Marroig and Melo correction below). To compare the structure of relationship matrices from different data sources, the Mantel Test of matrix correspondence has been applied (Mantel, 1967; Smouse et al., 1986; Sokal, 1979).

The Mantel test is a sample randomization technique that compares samples expressed in distance or dissimilarity (Sokal and Rohlf, 1995). The Mantel test works by estimating the association between two independent dissimilarity matrices and then testing to determine if this association is stronger than one would expect from chance alone (Sokal and Rohlf, 1995), in other words testing a null hypothesis of no association between the elements of the two matrices. First, a Z statistic is calculated:

$$Z = \sum_{i=1}^{n-1} \sum_{j=i+1}^{n} X_{ij} Y_{ij}$$

Where X_{ij} and Y_{ij} are elements of the two distance matrices **X** and **Y**, and Z is the Hadamard product, the sum of the products of corresponding off-diagonal elements in the two matrices. Significance is evaluated by random permutation of rows and columns of the specific distance matrices. If large distances in one matrix match larger distances in the other, the Z score is larger than expected. If there is a negative association (large values in one match smaller values in the other), the Z score is smaller than the average randomly permutated score. When the matrices carry more than seven entities, the elements of only one matrix are randomly rearranged.

The Mantel test statistics provide a correlation of the matrices based on random permutation of matrix elements and statistical support for matrix structure similarities between them. In this way, I computed the geographical pair-wise distance matrix of all populations and compared this to the biological distance matrix calculated from RMET. Mantel testing was done in R using the Mantel function in the "ecodist" package (Goslee and Urban, 2007). This function allows for multiple corrections using the Smouse et al. (1986) generalization of the Mantel test. This statistical test, also called a partial Mantel test is an extension of the Mantel's test designed to include three or more matrices (Smouse et al., 1986). Through using this model design, distance data from three different sources has been compared to determine the significance of each independent variable matrix while controlling for the other (time or geography).

Marroig and Melo correction: To calculate Mahalanobis distances, it is necessary to invert the **P** matrix. To correct for residual noise from matrix inversion (small eigenvalues that represent little more than measurement error have too great an impact when inverted), a method has been derived for reducing noise by removing the smallest eigenvalues (Marroig and Melo, 2011). By examining where the second derivative between consecutive eigenvalues has dropped to 0 (for my purposes 0.001 or below) on a sliding window that incorporates the second derivative of a small number (3-5) of eigenvalues, they have established a method for identifying which of these small eigenvalues are exerting too large an impact in matrix inversion. Where this variance of the sliding window of the second derivative approximates zero, the last eigenvalue preceding this cutoff value is used for the remaining eigenvalues in the matrix decomposition. For example, if there are 40 traits, and the rate of change of the rate of change for a sliding window of 3-5 eigenvalues (2^{nd} derivative) drops below 0.001 at the sixteenth second derivative, only the first fifteen eigenvalues are used, with the fifteenth eigenvalue filling in for the remaining 25. **P** is then inverted according to the equation:

$$\mathbf{G}^{-1} = \mathbf{V}^{\mathbf{T}}\Lambda^{-1}\mathbf{V}$$

Where **V** is the matrix of normalized eigenvectors for each eigenvalue, $\mathbf{V}^{\mathbf{T}}$ is its transpose. Λ is the square diagonal matrix with the newly defined eigenvalue vector set as the diagonal elements and zeros in the off-diagonal elements. To invert Λ to Λ^{-1}, the reciprocal of each diagonal element is used. This correction was utilized on the pooled data set, cutting the eigenvalues at 22 of the 29 traits.

CHAPTER 6

EXAMINING ARCTIC POPULATION HISTORY USING BIOLOGICAL DISTANCE

Introduction and Methods

This chapter provides analyses of population structure and biological relationships for Arctic populations using phenotypic cranial diversity in the context of geographic, temporal, and cultural variation. The goal of this work is an understanding of the role that migration played in forming the pattern of population diversification found across the Arctic, while answering the archaeological record's attempt to explain relationships through temporal and technological associations.

This chapter is divided into sections specific to each null hypothesis being tested. In each section, the relevant methods, statistics, and analyses are presented, including some discussion of the consequences of rejecting each null hypothesis. In addition, alternative hypotheses were generated to examine deviations of specific Arctic samples.

Variance statistics (including the $\mathbf{R}$-matrix, Q_{ST}, and D^2) were calculated using RMET v5.0 (Relethford and Blangero, 1990). Eigenvalues, eigenvectors and principal-component analysis plots were calculated in R. Discriminant-function analyses were done in SPSS. For these analyses, the following data were analyzed using the 29 traits (**Table 4.5**) according to the methods presented in Chapter 5:

- 27 samples (**Table 4.1**).
- 7 regional samples (**Table 4.3**).
- 6 cultural subgroups (**Table 4.4**).

Null Hypothesis 0

Cranial variation among populations is randomly distributed across the Arctic. To test this hypothesis, the Mantel test of matrix correspondence was used to test for a significant correlation between biological distance and geographic distance across the Arctic. The consequence of testing this null hypothesis:

- Rejection of the H_0 suggests some patterning in the distribution of biological differentiation across the Arctic.
- Failure to reject H_0 suggests cranial variation is randomly distributed across the Arctic.

The geographical pair-wise distance matrix of all samples was compared to the biological distance matrix using the Mantel test. The Mantel test calculates the correlation of the matrices based on random permutation of matrix elements and provides statistical support for matrix structure similarities between any two matrices. The resulting Mantel correlation, $r = 0.452$ (**Table 6.7**), was statistically significant at $p < 0.001$, rejecting the null hypothesis that cranial variation is randomly distributed across the Arctic. Rejection of this null hypothesis allows further inspection of the manner in which biological variation is patterned across the Arctic.

Null Hypothesis 1

Cranial variation among populations shows geographic variation as predicted by a population-genetic model of isolation by distance with a two-dimensional stepping-stone model of migration. Null hypothesis 1 asks to what extent cranial morphological variation is explained as a function of geographic distance between population samples. To test this hypothesis, an empirically derived model of population differentiation was constructed based on geographic distance (See Chapter 5). Linear modeling using least-squares regression was used to determine the statistical parameters of the relationship between biological distance and geographical distance across the Arctic. To test for statistically significant deviations from the empirically defined model, the linear model for each sample was calculated based on regressing the pair-wise biological geographical distances on the pair-wise geographical distances for each sample to all other samples. When a sample's linear model was significant, it was compared for statistically significant difference (at $\alpha = 0.05$) to the empirical overall Arctic model based on the overlap of the standard errors multiplied by 1.96 (to calculate the 95% confidence interval) of both models. Samples having a significantly different model from the empirically defined model of Arctic differentiation, as well as those that did not have a significant linear model were considered a rejection of null hypothesis 1. By quantifying these relationships, the manner that biological relationships correlate with distance throughout the Arctic region was defined. The consequence of testing this null hypothesis:

- Rejection of the H_0 suggests discontinuity in the distribution of geographic differentiation across the Arctic. Where significant deviations from the expected pattern are found, the samples are used to examine specific hypotheses of regional association and ancestor-descendent relationships.
- Failure to reject H_0 suggests a consistent pattern of geographical biological variation across the Arctic according to the empirically defined neutral model of isolation-by-distance.

Biological Distance (D^2): Biological distance was calculated for all pair-wise samples based on their deviation from the total sample centroid (**Appendix D**). To put these distances into a testable framework, the pair-wise values were regressed on the pair-wise geographical distances for each sample to find the linear model that best explains biological variation across the Arctic (**Figure 6.1**). Because analyses in a following section (Alternative Hypotheses) demonstrates that the Aleut samples are biologically distinct, and other research has shown the Aleuts to be highly divergent from other Arctic populations (Hayes, 2002; Hrdlička, 1945; Laughlin and Marsh, 1951; Laughlin et al., 1979; Laughlin, 1980; McCartney, 1984), these samples were removed from this model. To examine the null hypothesis that all samples fit this empirically defined isolation-by-distance model, the linear model for each sample was compared to the total sample model. The outcome of this analysis is provided in **Table 6.1**.

Figure 6.1: Pair-wise biological distances vs. geographic distances for all samples. Equation for the line y = 1.04e-05x + 5.25e-02, SEE = 0.034, r = 0.46, p<0.001.

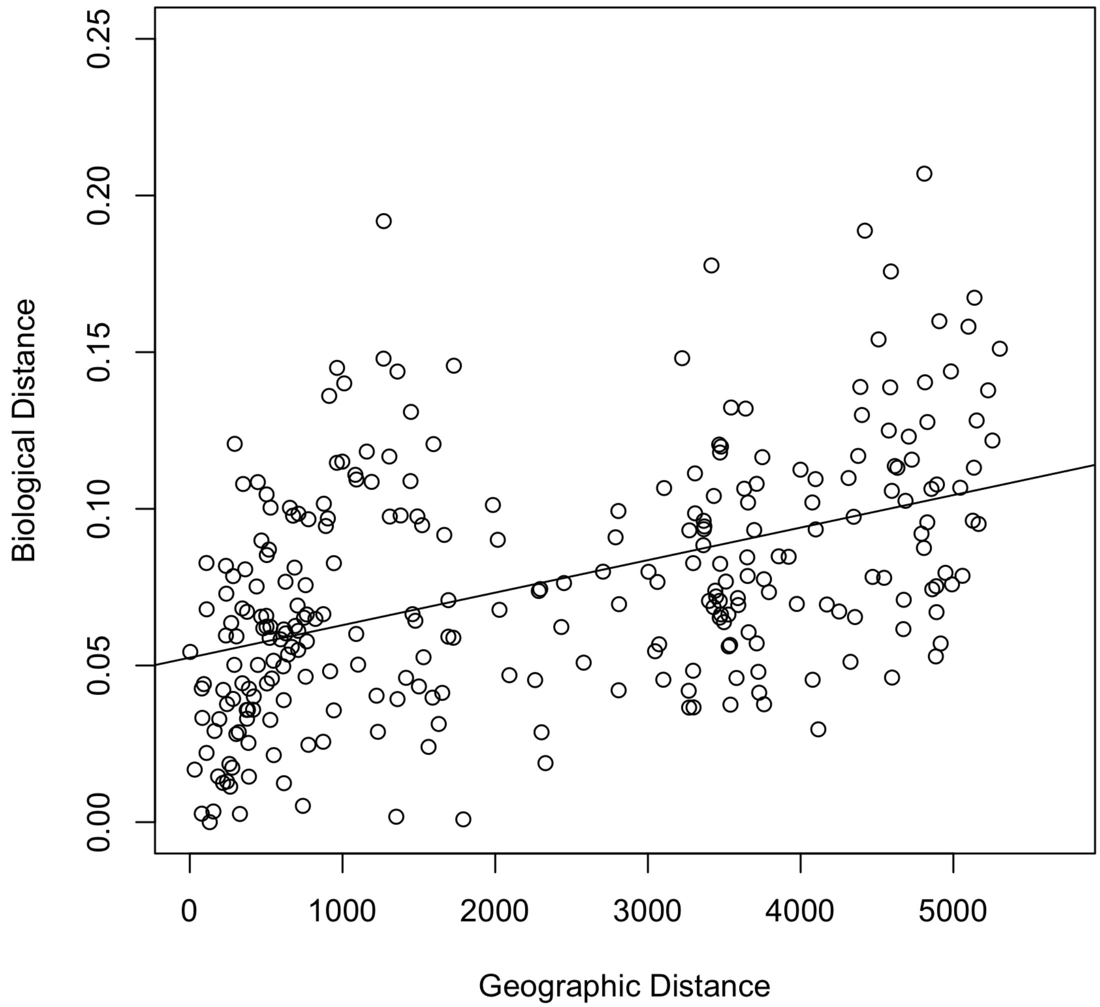
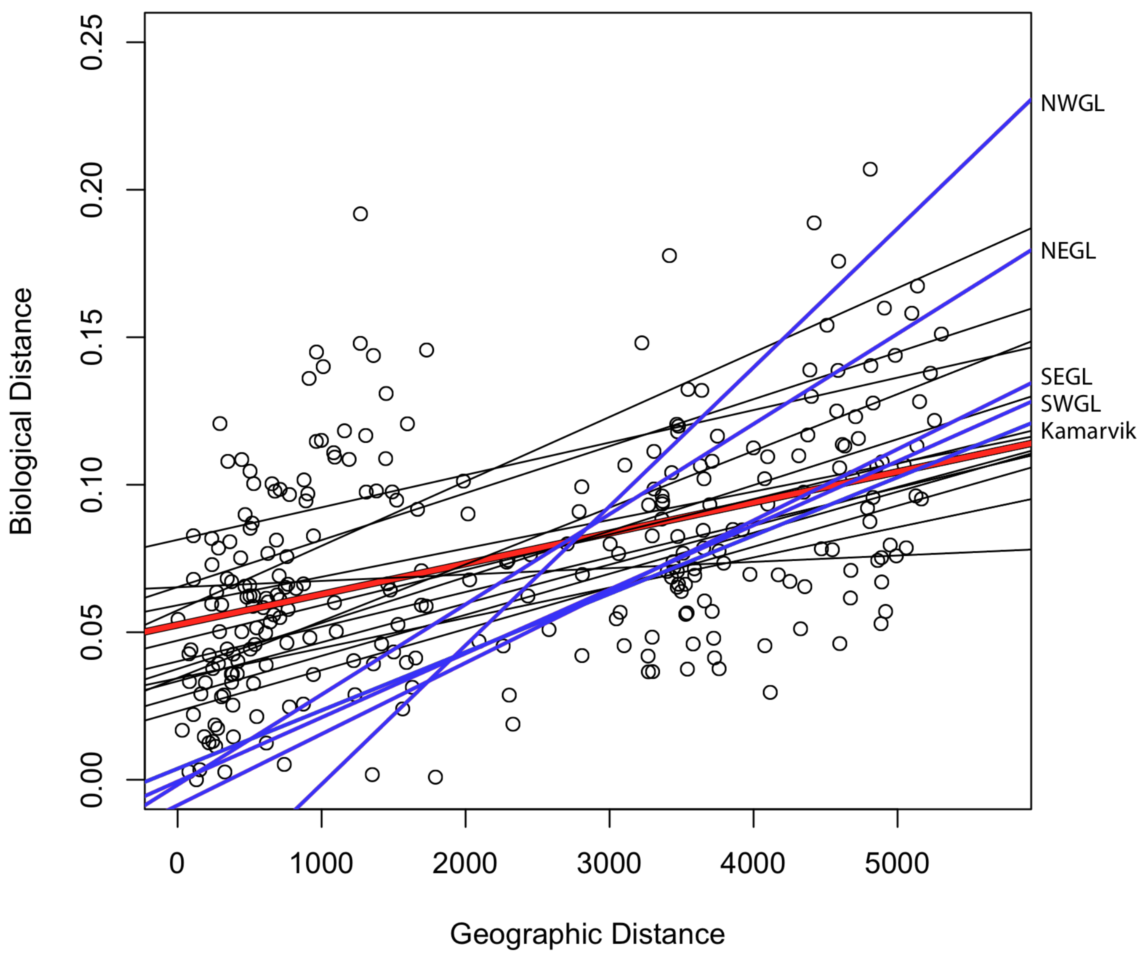


Table 6.1: Slopes, slope standard error (Slope SE), y-intercept (y-Inter), R^2, standard error of the estimate (SEE), and p-value (p) for the least squares regression of geographical distance on biological distances for all samples together (Bold), and each individual sample below. In orange highlight diagonals are the samples whose model is not significant at the 0.05 level. In blue highlight are the samples that are significantly different from the All-Sample empirical model of Arctic differentiation. All other samples are not significantly different from the All Samples model.

	Slope	Slope SE	y-Inter	R^2	SEE	p
All Samples	**1.04E-05**	**1.21E-06**	**0.053**	**0.212**	**0.034**	**p<0.001**
Bethel	1.56E-05	3.16E-06	0.038	0.537	0.028	p<0.001
Dillingham	2.19E-05	5.75E-06	0.057	0.408	0.046	p<0.001
Holy Cross	1.59E-05	3.90E-06	0.065	0.443	0.032	p<0.001
Hooper Bay	1.20E-05	3.53E-06	0.047	0.355	0.032	0.003
Ipiutak	5.54E-06	3.32E-06	0.058	0.117	0.025	0.110
Kamarvik	1.98E-05	3.38E-06	0.004	0.619	0.017	p<0.001
Kiklewait	-3.32E-06	6.50E-06	0.105	0.012	0.024	0.614
Kuskoskwim	1.93E-05	3.71E-06	0.035	0.562	0.033	p<0.001
Labrador	1.03E-05	2.72E-06	0.034	0.405	0.020	p<0.001
Mitliktavik	3.95E-06	2.63E-06	0.053	0.097	0.022	0.149
NEGL	3.06E-05	4.20E-06	-0.002	0.716	0.025	p<0.001
NWGL	4.71E-05	8.74E-06	-0.049	0.581	0.031	p<0.001
Pastolik Kwiguk	1.32E-05	2.79E-06	0.033	0.515	0.024	p<0.001
Pilot Station Paimiut	1.18E-05	2.59E-06	0.040	0.497	0.023	p<0.001
Point Barrow	-1.34E-05	6.88E-06	0.113	0.153	0.040	0.065
Sadlermiut	1.39E-05	4.20E-06	0.023	0.344	0.024	p<0.001
Sarichef Island	4.73E-06	2.50E-06	0.068	0.146	0.020	0.072
SEGL	2.41E-05	4.28E-06	0.000	0.603	0.032	p<0.001
Siberia	1.10E-05	2.85E-06	0.081	0.415	0.025	p<0.001
Silumiut	1.39E-05	4.27E-06	0.028	0.336	0.021	p<0.001
SWGL	2.17E-05	4.00E-06	-0.001	0.584	0.027	p<0.001
Teller	9.64E-06	3.76E-06	0.059	0.239	0.032	0.018
Tigara	-2.31E-06	3.12E-06	0.066	0.025	0.024	0.468
Wales	2.16E-06	3.61E-06	0.065	0.017	0.030	0.555

The samples that do not have a significant linear model are Mitliktavik and Sarichef Island from the NW Arctic, and all four N Arctic samples, the Tigara, Ipiutak, Point Barrow, and Kiklewait. The lack of significance for the Mitliktavik and Sarichef Island samples is unclear and will be further discussed upon additional analysis. The lack of significance for the Point Barrow and Ipiutak samples might be explained by their temporal variation, as each dates from a pre-Thule time period and material culture. The lack of significance for the Kiklewait sample may be responding to its relative isolation lying between the other N Arctic and Nunavut samples with increased geographic distance from both. The Tigara sample has substantial phenotypic overlap with a broad geographic range of other Thule samples (indicated by its low biological distances to a geographically diverse set of samples), and this might be driving its non-significant correlation. For the samples that had significant deviations from the empirically derived model (**Table 6.1**), their regression lines are graphed (in blue) among all sample regression lines in **Figure 6.2**.

Figure 6.2: Pair-wise biological distances vs. geographic distances (km) for all samples with significant linear models for each sample, including All-Samples in red, and the samples which show significant difference from the All-Sample Arctic model in blue (see Table 6.1).



The deviation of the four Greenland samples (NWGL, NEGL, SEGL, and SWGL) can be explained by their large geographical distance from all other Arctic samples, as well as the substantial distances over Greenland between the quadrants. The large geographic distances between these samples are juxtaposed by minimal biological differentiation between them, and this may account for their significant difference from the empirical model. The deviation of Kamarvik, a Nunavut sample, is unclear in light of its close biological and geographic proximity to the other Nunavut samples, which do not have significant deviations from the overall Arctic model.

In summary, the null hypothesis that cranial variation among populations shows geographic variation as predicted by a population-genetic model of isolation-by-distance with a two-dimensional stepping-stone model of migration has been rejected. This is based on both the significant differences in individual linear models derived for some of the samples, and the lack of a significant model for other samples. While 13 of the 24 samples have linear models that do not deviate significantly from the empirically derived model, the lack of significance for 6 of the individual linear models, and the lack of a significant association between biological distance and geographical distance for the N Arctic samples and several NW Arctic samples, suggests a deviation from the empirically derived model of geographical differentiation for specific samples. The consequences of these deviations are addressed in Chapter 7.

Null Hypothesis 2

Cranial variation within and among regions is randomly distributed across the Arctic. To test this hypothesis, a number of statistics that quantify Arctic sample variability were calculated to demonstrate how variation is partitioned throughout the Arctic. Q_{ST}, observed vs. expected phenotypic variance, and biological distance from the regional centroid were calculated for all Arctic samples and regions. To put these values into the context of regional variation, geographic parameters, including mean geographical distance of each sample to its regional centroid and geographical distance between each regional centroid and the total Arctic centroid, were calculated.

Using these metrics, the overall pattern of phenotypic variation throughout the Arctic was described. This includes how variation is partitioned overall, among regions, and among samples within regions. The deviation of observed from expected phenotypic variation was used to test the null hypothesis of similarity among and within Arctic regions. Specific outliers were redefined according to their relevant deviations to explain regional Arctic variation in an historical framework. The consequence of testing this null hypothesis:

- Rejection of the H_0 suggests differential resemblance among sample populations within regions. Deviations from the expected pattern suggest greater or reduced differentiation among samples within regions. The inference is that greater than expected values indicate reduced migration among populations within the region or a high degree of migration from outside the region. Less than the expected values indicate a swamping of differences within the region is due to high levels of migration from neighboring or closely related populations.
- Failure to reject H_0 suggests that the regional groupings of populations do not explain the patterns of biological relatedness.

Hierarchical partitioning of variance: Hierarchical partitioning of variance was used to examine how variation is distributed throughout the Arctic among populations, among regions, and within regions (Barbujani et al., 1997; Jorde et al., 2000; Relethford, 2002). To place Arctic variation into a framework for use in examining deviations from the expected pattern, Q_{ST} was partitioned into the following sub-sets:

- **AR**: Among Region –variation among Arctic geographic regions.
- **WR**: Within Region –variation within Arctic geographic regions.
- **AL**: Among Local –variation among local Arctic samples within regions.
- **WL**: Within Local –variation within local samples.
- **Q_{RT}**: the Q_{ST} value calculated among geographic regions.
- **Q_{LT}**: the Q_{ST} value calculated among all Arctic samples.

Table 6.2: Among region Q_{ST} partitioning. A common heritability = 0.55 was applied to this analysis based on the mean cranial trait heritability according to convention (Devor, 1987). Scaling using a common heritability has little impact on the distribution of these values.

Q_{LT}	0.084
AR = Q_{RT}	0.064
WR = 1-Q_{RT}	0.936
AL = Q_{LT}-Q_{RT}	0.020
WL = 1-Q_{LT}	0.916

For the Arctic hierarchical breakdown, 8.4% of variation in cranial traits was explained by differences among all Arctic samples, 6.4% was explained by differences among Arctic sub-regions, and 2% was explained by differences among local groups within Arctic sub-regions. 1-Q_{ST} represents the similarity among samples and groupings relative to the others being measured, and is provided for reference. When Q_{ST} values are calculated among samples within regions directly from the samples in each region, a statistically significant pattern emerges based on expected mean value. These values are analogous to the **AL** (variation among Arctic samples within regions) presented in **Table 6.2**, without the swamping effect of incorporating all samples.

Table 6.3: Q_{ST} values calculated using all local samples as the unit of analysis (All Samples), using Arctic regions as the unit of analysis (Regional Samples), and running each sub-region separately using the local samples within each region as the unit of analysis. The standard error for the Q_{ST} (SE) is also presented (as derived by Relethford, 1997).

	Q_{ST}	**1-Q_{ST}**	**SE**
All Samples	0.084	0.916	0.002
Regional Samples	0.064	0.936	0.002
Aleut	0.014	0.986	0.003
W Arctic	0.030	0.970	0.003
NW Arctic	0.050	0.950	0.005
N Arctic	0.057	0.943	0.004
Nunavut	0.026	0.974	0.004
Greenland	0.021	0.979	0.004
mean	**0.033**	**0.967**	

The Q_{ST} for all Arctic samples is 0.084, meaning that 8.4% of Arctic variation is due to differences among samples, the rest, 91.5% (1-Q_{ST}) is explained as variation within the samples. By using the sub-regions as the units of analysis, the variability was partitioned into differences among Arctic regions, indicating that 6.4% of variability is explained by regional affiliation. To put this in perspective, previous work examining the partitioning of cranial variance components among 6 global regions provided a Q_{ST} of 0.146 with the average among the samples in each global region equal to 0.067 (Relethford, 2002). This study partitioned regions such that there was a single American region that included South and North America including the North American Arctic. The All Sample Q_{ST} = 0.084 statistic for Arctic samples is higher than the average global within region value. This sheds light into how variable these populations are within the Arctic region, and provides support for the Arctic being utilized as a discrete region in global studies of morphological variation. By calculating the Q_{ST} values for each specific Arctic region separately, the relative variability pattern among samples within each region produced statistically significant deviations from the expected pattern, which is the sample statistic mean (0.033). Two samples show significantly higher Q_{ST} values than expected based on the SE for each Q_{ST} statistic:

- The N Arctic region (encompassing the Ipiutak, Tigara, Point Barrow, and Kiklewait samples) shows the greatest among-sample, within-region variability (0.057), which is not far from the overall among Arctic region Q_{ST} of 0.064. This suggests substantial among-sample variation in this region. This might be expected due to increased temporal variation, specifically incorporation of the pre-Thule Ipiutak and Point Barrow samples.
- The NW Arctic region (consisting of the Wales, Teller, Sarichef, and Mitliktavik samples) also shows a significantly higher than expected Q_{ST} of 0.050 that may reflect a mixture of ancestry among these samples.

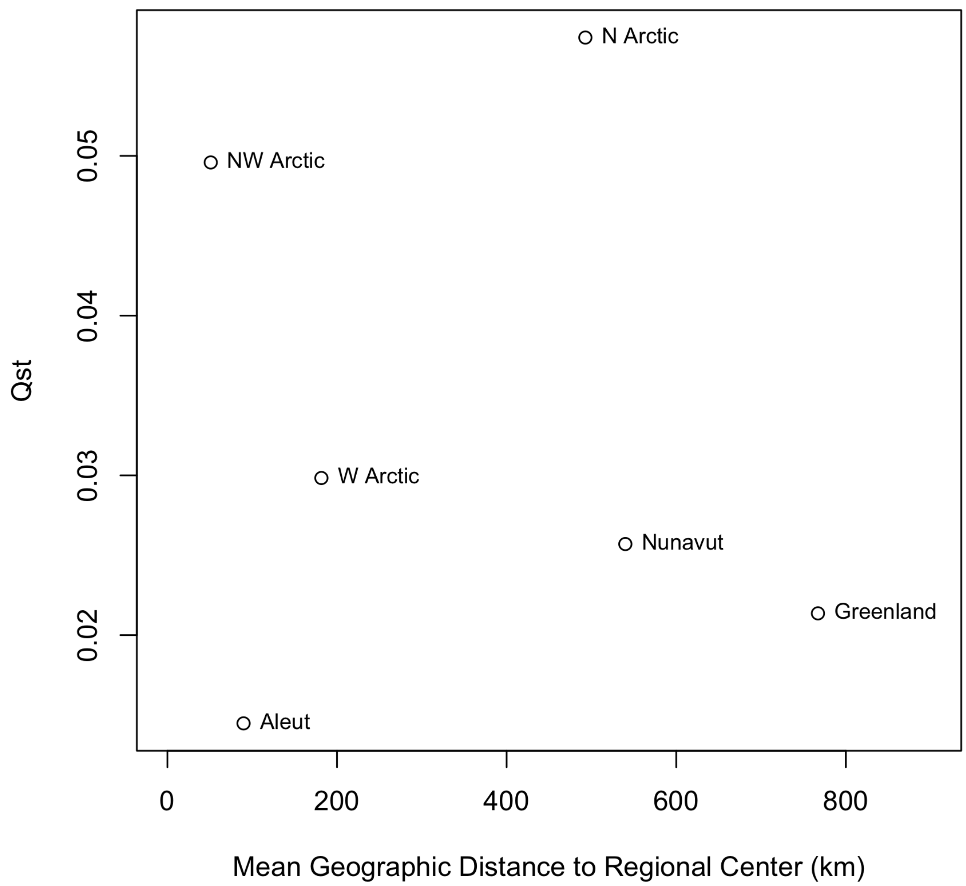
Several of the regions show significantly lower than expected Q_{ST} values among their sub-samples. The low Q_{ST} values for the Aleut (0.014), Greenland (0.021), and Nunavut (0.026) regions suggest that these regions are relatively homogenous, with either substantial migration between the samples within the regions and/or lack of immigration from outside. These lower Q_{ST} values are not entirely surprising for these samples as they are more geographically isolated from the other regions, and in the case of the Aleut and Greenland regions, are island isolates.

Correlation of biological differentiation to geographic distance: To examine the impact that region size and distance away from the total Arctic sample centroid plays in explaining the pattern of biological differentiation, regional Q_{ST} values were plotted against the average geographic distance of the region's samples to their regional centroid (**Figure 6.3**), as well as the distance between each regional centroid and the total Arctic sample centroid (**Figure 6.4**). The data are presented in **Table 6.4**, with distances in km.

Table 6.4: Among samples within region Q_{ST} compared with the mean geographic distance to the regional centroid (Region Size) and region distance to Arctic centroid (Regional Deviation).

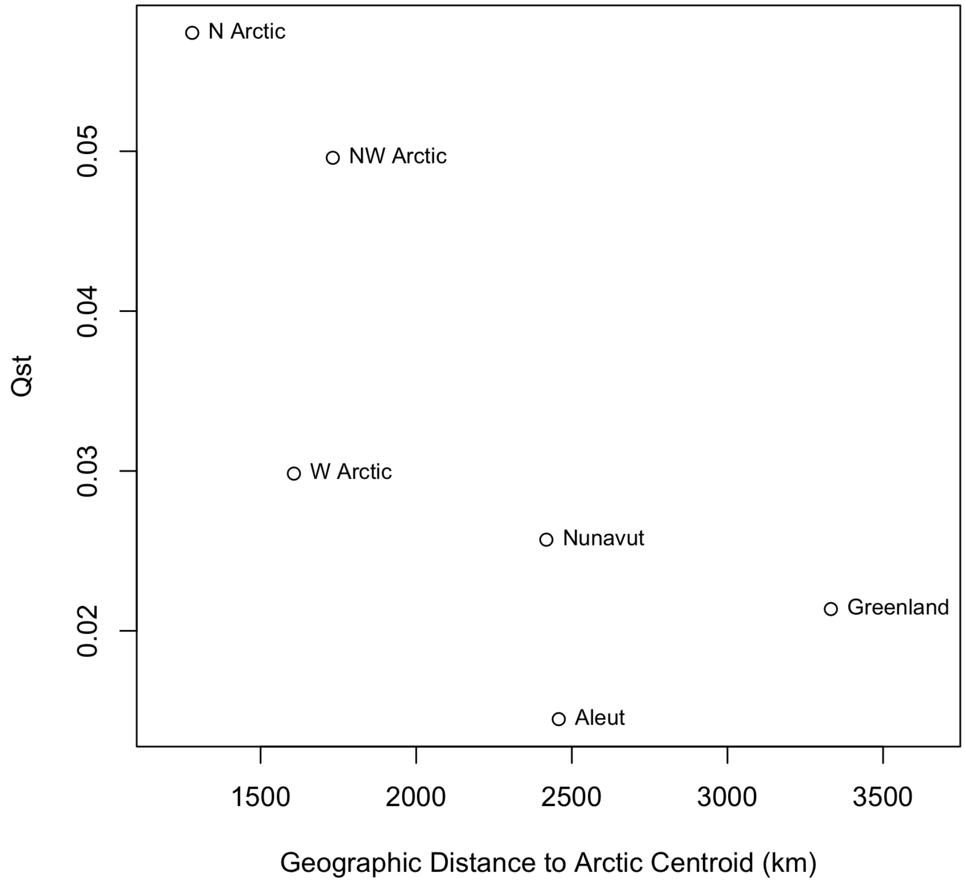
Region	Q_{ST}	Region Size (km)	Regional Deviation (km)
Aleut	0.014	90	2458
W Arctic	0.030	182	1607
NW Arctic	0.050	51	1732
N Arctic	0.057	493	1280
Nunavut	0.026	540	2418
Greenland	0.021	767	3332

Figure 6.3: Plot of Q_{ST} vs. mean geographical distance to the regional center (km).



The least squares regression line of Q_{ST} on mean geographical distance to each regional centroid is not statistically significant ($p = 0.85$). The widespread pattern in **Figure 6.3** demonstrates that region size has little explanatory power for understanding biological patterning among Arctic regions.

Figure 6.4: Plot of Q_{ST} vs. geographical distance of region to the Arctic centroid (km).



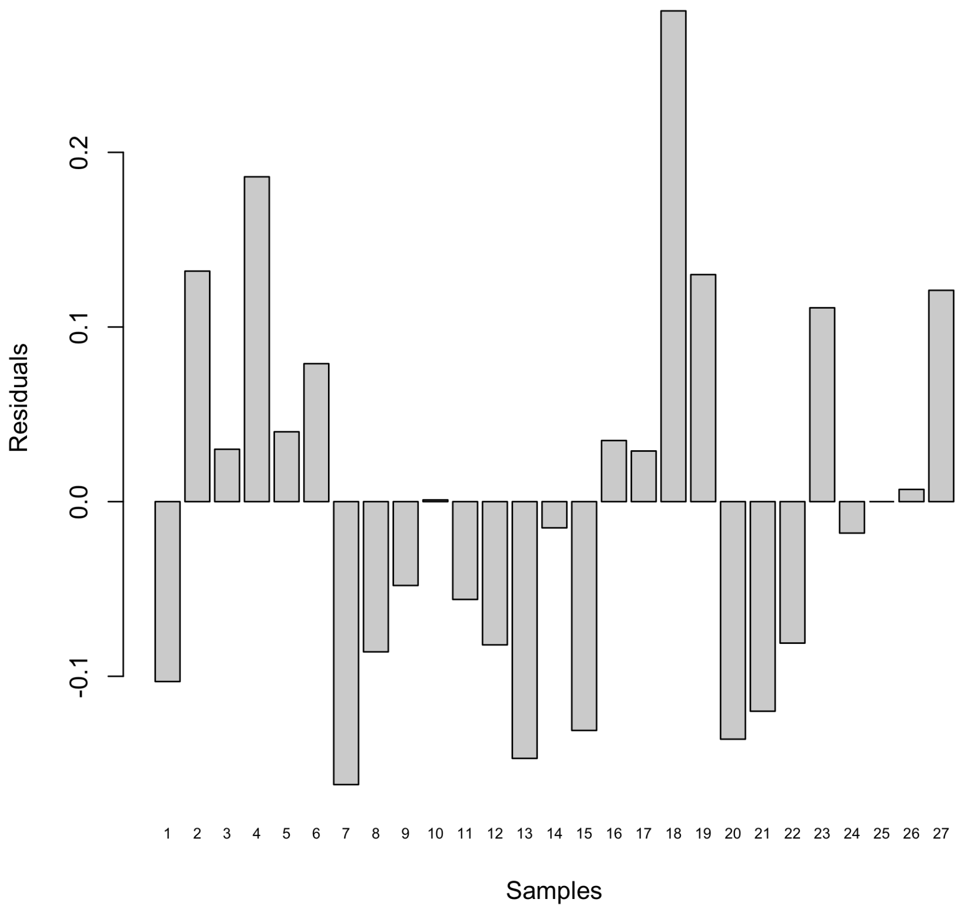
While the correlation between Q_{ST} values and Absolute geographic distance to the Arctic region centroid is not statistically significant at the $p < 0.05$ level ($p = 0.078$) using linear regression, the pattern demonstrated in the plot (**Figure 6.4**) suggests a trend where among-sample variation within regions decreases with increased distance to the total Arctic centroid. In other words, as these samples get farther from the Arctic center, they are less likely to have substantial resemblance to samples from outside their region, and more likely to resemble other samples within their region.

Relethford-Blangero analysis: The Relethford-Blangero analysis provides a tool for examining population structure as a function of deviation from expected variation levels. This method compares observed within-sample phenotypic variance to total variance expected under panmixia. By plotting the regression of observed phenotypic variance on biological distance to the centroid, the significance of deviations from expected variability patterns was examined. The observed phenotypic variance value is calculated using the average phenotypic variance over all 29 traits for each sample. The expected variance for that sample is based on the average deviance among all samples, weighted by each sample's deviation from the Arctic centroid (Relethford and Blangero, 1990). Through an examination of deviation from expected variance relationships, the impact of local vs. distant admixture was predicted (**Table 6.5**). Large positive values indicate greater than expected admixture from afar, while negative values suggest increased localized admixture from neighboring or closely related populations that swamps the among-sample variance differences.

Table 6.5: Relethford-Blangero analysis. Arctic samples with sample size, phenotypic distance to the centroid (r_{ii}), observed mean phenotypic variance ($\bar{v}_{Gi}$), expected mean phenotypic variance ($E(\bar{v}_{Gi})$), and residuals between observed and expected values ($\bar{v}_{Gi} - E(\bar{v}_{Gi})$). A common heritability = .55 was applied to this analysis based on the mean cranial trait heritability according to convention (Devor, 1987). Scaling using a common heritability has little impact on the distribution of these values. In orange highlight diagonals are the samples whose residual value is in the bottom 16% of the distribution. In blue highlight are the samples whose residual value is in the top 16% of the distribution.

ID	Sample	N	r_{ii}	$\bar{v}_{Gi}$	$E(\bar{v}_{Gi})$	$\bar{v}_{Gi} - E(\bar{v}_{Gi})$	*Sub-Group*
1	Bethel	37	0.048	0.767	0.929	-0.162	W Alaska
2	Dillingham	40	0.105	0.914	0.873	0.040	W Alaska
3	HolyCross	42	0.095	0.827	0.883	-0.056	W Alaska
4	HooperBay	25	0.058	0.833	0.919	-0.086	W Alaska
5	Ipiutak	54	0.047	0.965	0.929	0.035	N Alaska
6	Kagamil	68	0.213	0.901	0.768	0.132	Aleut
7	Kamarvik	46	0.049	0.847	0.928	-0.081	Nunavut
8	Kiklewait	53	0.097	1.011	0.881	0.130	N Alaska
9	Kuskoskwim	33	0.050	1.006	0.927	0.079	W Alaska
10	Labrador	40	0.080	1.009	0.897	0.111	Nunavut
11	Mitliktavik	33	0.051	0.911	0.926	-0.015	NW Alaska
12	NEGL	28	0.134	0.966	0.845	0.121	Greenland
13	NWGL	62	0.080	0.879	0.898	-0.018	Greenland
14	Pastolik	53	0.029	0.899	0.947	-0.048	W Alaska
15	Pilot	34	0.047	0.931	0.930	0.001	W Alaska
16	PointBarrow	38	0.103	1.156	0.875	0.281	N Alaska
17	Sadlermiut	50	0.060	0.782	0.918	-0.136	Nunavut
18	Sarichef	27	0.069	0.778	0.908	-0.131	NW Alaska
19	SEGL	43	0.098	0.887	0.880	0.007	Greenland
20	Siberia	32	0.110	0.765	0.868	-0.103	Siberia
21	Silumiut	42	0.063	0.794	0.914	-0.120	Nunavut
22	SWGL	70	0.073	0.904	0.904	0.000	Greenland
23	Teller	35	0.078	0.817	0.899	-0.082	NW Alaska
24	Tigara	216	0.049	0.957	0.927	0.029	N Alaska
25	Umnak	31	0.146	0.864	0.834	0.030	Aleut
26	Unalaska	55	0.181	0.985	0.799	0.186	Aleut
27	Wales	35	0.064	0.767	0.914	-0.147	NW Alaska

Figure 6.5: Bar plot of residuals between mean observed phenotypic variance and expected phenotypic variance ($\overline{v}_{Gi} - E\left(\overline{v}_{Gi}\right)$). The sample numbers refer to the sample list adjacent to plot, rearranged from Table 6.5 to reflect geographic position from western to eastern Arctic. The values outside one standard deviation (0.111 and -0.111) were used as an arbitrary delineation of deviation from the expected value (0).



1	Siberia
2	Kagamil
3	Umnak
4	Unalaska
5	Dillingham
6	Kuskoskwim
7	Bethel
8	Hooper Bay
9	Pastolik
10	Pilot Station
11	Holy Cross
12	Teller
13	Wales
14	Mitliktavik
15	Sarichef
16	Ipiutak
17	Tigara
18	Point Barrow
19	Kiklewait
20	Sadlermiut
21	Silumiut
22	Kamarvik
23	Labrador
24	NWGL
25	SWGL
26	SEGL
27	NEGL

Positive residuals of observed phenotypic variance relative to their expected values demonstrate a higher than expected phenotypic variance for that sample. These high values generally suggest greater than average admixture and from more distantly related populations. Negative residual values indicate a lack of admixture from distantly related populations. For **Figure 6.5** the residuals were rearranged according to region to reflect western-to-eastern geographic position across the Arctic. By doing this, a pattern emerges where higher positive and negative residuals are grouped according to geography. The Aleut samples have positive values. The W and NW Arctic samples have negative values, with the exception of the two southern-most samples, Dillingham (5) and Kuskoskwim (6). This deviation might be explained by their southern-most position among the region, providing increased accessibility for admixture with non-Arctic Native American groups to the south. The N Arctic samples all have positive values. The Nunavut samples have negative values with the exception of Labrador, whose positive value might also be explained by its proximate position to non-Arctic Native Americans to the south. Farthest east, the Greenland samples show an interesting pattern that is further evaluated in Section 3 of this chapter.

Values of 0.111 and -0.111 (the standard deviation of the residual distribution at each side of the mean) were applied to examine biologically meaningful deviations of specific samples. Although an arbitrary delineation, one standard deviation in both directions provides an examination of the upper 16% and lower 16% of the distribution. The most extreme outlier is the Birnirk sample from Point Barrow (18) with 0.281. This high value suggests substantially more phenotypic variation in the population than would be expected.

Figure 6.6 shows the plot of biological distance from total Arctic centroid versus observed phenotypic variance. There is no significant correlation for the regression line ($p = 0.34$), but note the position of Point Barrow as an extreme positive outlier in terms of observed phenotypic variance. This suggests greater phenotypic variance within the sample than would be expected under panmixia. Other samples with values greater than 0.111 are Kagamil (2) Kiklewait (19), Labrador (23), NEGL (27), and Unalaska (4). Because the expected values are weighted by each population's phenotypic distance to the centroid, the Aleut samples of Kagamil and Unalaska have high residual values. Based on the Aleut observed phenotypic variances, this does not appear to indicate gene flow from outside, rather that these samples are different from the other Arctic samples and the residual is being driven by their deviation from the centroid. The Kiklewait population is isolated between N Arctic and Nunavut, and it may have received admixture from populations in both regions. The Labrador population is on the edge of the southeastern Arctic and may have received some admixture from non-Arctic North American Native populations to their south. The NEGL population may have been a mixture of Dorset and Thule populations, which might explain its positive residual value.

Samples with residuals below -0.111 are Bethel (7), Sadlermiut (20), Sarichef (15), Silumiut (21), and Wales (13). In each case, the negative residual values suggest that these populations were generally isolated and shared migrants only with other neighboring closely related populations.

Figure 6.6: Plot of observed mean phenotypic variance ($\overline{v}_{Gi}$) vs. biological distance from the centroid (r_{ii}) for all Arctic samples.

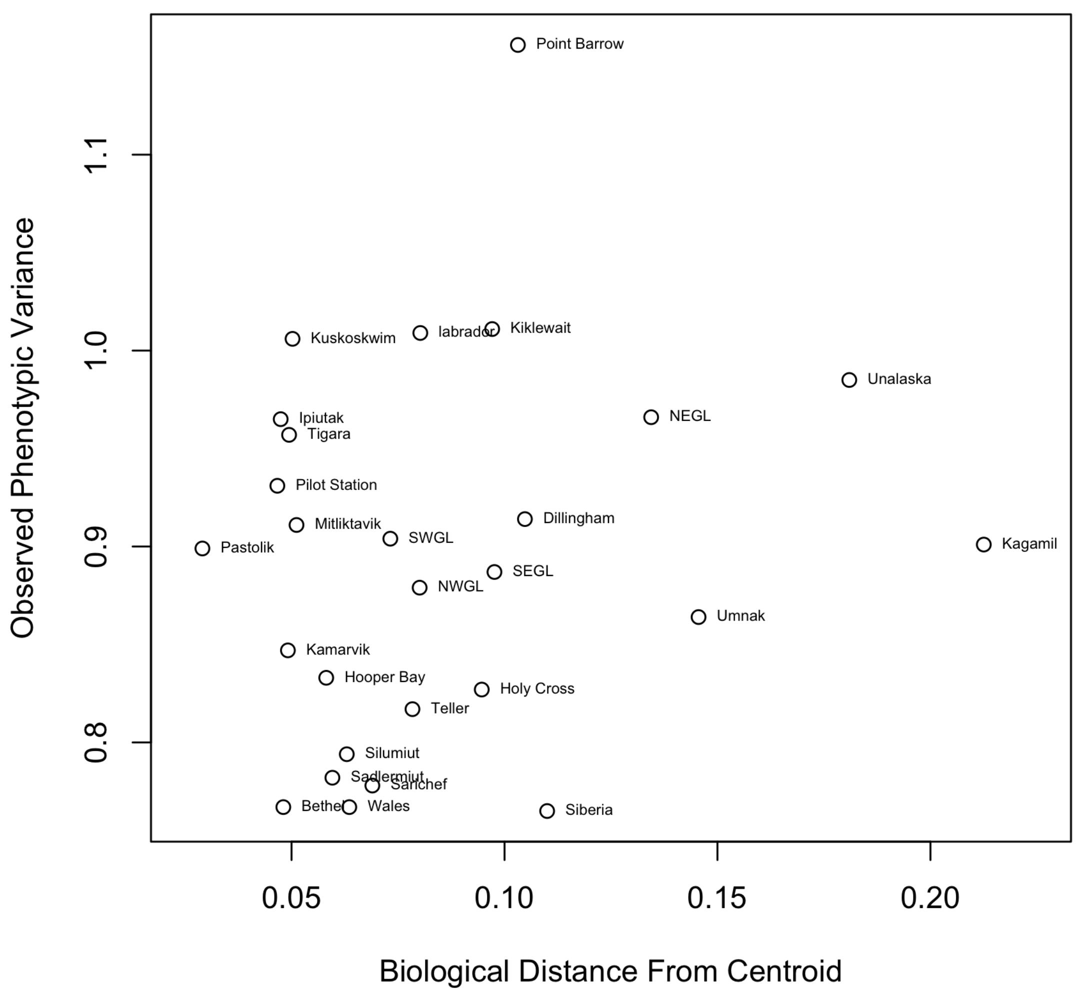


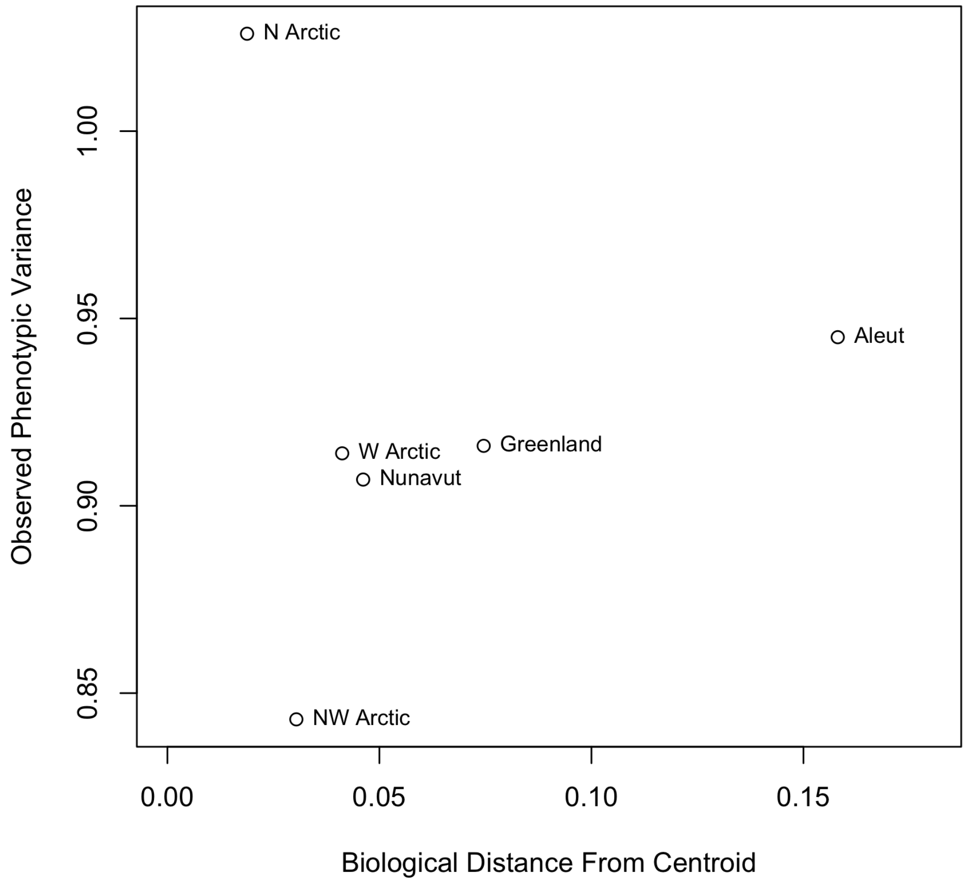
Table 6.6: Relethford-Blangero analysis. Arctic regional groups with sample size, phenotypic distance to the centroid (r_{ii}), observed mean phenotypic variance ($\bar{v}_{Gi}$), expected mean phenotypic variance ($E(\bar{v}_{Gi})$), and residuals between observed and expected values ($\bar{v}_{Gi} - E(\bar{v}_{Gi})$), using heritability = 0.55

Sample	*N*	r_{ii}	$\bar{v}_{Gi}$	$E(\bar{v}_{Gi})$	$\bar{v}_{Gi} - E(\bar{v}_{Gi})$
Aleut	154	0.158	0.945	0.813	0.133
W Arctic	264	0.041	0.914	0.926	-0.011
NW Arctic	130	0.030	0.843	0.936	-0.093
N Arctic	361	0.019	1.026	0.947	0.079
Nunavut	178	0.046	0.907	0.921	-0.014
Greenland	203	0.075	0.916	0.893	0.023
Siberia	32	0.079	0.773	0.889	-0.116
Average		0.064	0.903	0.904	0.000

For the regional Relethford-Blangero analysis (**Table 6.6**), as in the sample-wise comparisons, the Aleut region has a high residual value. This suggests either significant admixture from afar or long-term isolation. While significant admixture from afar conflicts with an interpretation of island isolation for explaining Aleut morphology (Laughlin and Marsh, 1951), this statistic is high because of the Aleut difference from other Arctic samples (expected phenotypic variance). This difference is probably attributable to a period of sustained isolation and small effective population size.

To demonstrate the regional deviations, the observed phenotypic variation was plotted against the biological distance to the centroid (**Figure 6.7**). This plot demonstrates that the N Arctic sample is extremely variable within the region. The other extreme is the neighboring NW Arctic sample, which has low variability within the region. The Aleut region's deviation from the other Arctic samples, while not excessively variable in comparison to the other Arctic regions, is driven by its deviation from the total Arctic centroid.

Figure 6.7: Plot of observed phenotypic variance ($\overline{v}_{Gi}$) vs. biological distance from the centroid (r_{ii}) for regional samples with Aleut. Note the extreme observed phenotypic variance value for the N Arctic sample relative to its biological distance to the Arctic Centroid.



In summary, there is substantial evidence that cranial variation within and among regions is not randomly distributed across the Arctic. This null hypothesis is rejected. Based on the Q_{ST} values calculated among samples within regions, three of the regions showed significantly higher values than expected, and three others showed significantly lower values than expected ($p < 0.05$). To examine whether these deviations could be explained by region size or region distance to the total Arctic sample centroid, linear regression was used to test for significant association between the regional Q_{ST} and geographical distances. No significant association between region size and Q_{ST}, or between Q_{ST} and each region's distance to the Arctic centroid was found. To explain the specific sample deviations that account for regional differences, the observed phenotypic variance for each sample was plotted against biological distance to the total sample centroid. While no significant association was found, the Aleut samples had substantial deviations between observed and expected values, largely explained by their biological distance from the Arctic centroid, and likely due to long-term island isolation. The positive deviation of the NE Greenland sample suggests combined sampling from Dorset and Thule populations, a possibility that explains the high observed phenotypic variance within the sample. Large values for the observed phenotypic variance relative to biological deviation from the sample centroid in the Kiklewait, Labrador, and especially the Birnirk at Point Barrow, suggests these samples are relatively phenotypically heterogeneous compared with other Arctic samples.

Null Hypothesis 3

Cranial variation among populations is random with respect to temporal and cultural association. This null hypothesis examines whether biological distance is a function of cultural or temporal association. Based on the last two sections, there is substantial variability in population structure across the Arctic and among regions. There are a number of samples that do not fit the empirically defined pattern of differentiation across the Arctic. The culturally and temporally affiliated samples (**Table 4.4**) were placed in a comparative framework to see if these factors explain the deviations from the expected pattern. The consequence of testing this null hypothesis:

- Rejection of the H_0 suggests discontinuity over time among samples within regions. This could be due to extensive migration into or from other regions over time between cultural or temporal affiliates. Significant deviations related to temporal differentiation, can be further tested for association with other regions to find historical signatures for population dispersions.
- Failure to reject H_0 suggests no influence of cultural or temporal affiliation on phenotypic affinities of samples.

As described in Chapter 5, the Mantel test calculates the correlation of the matrices based on random permutation of matrix elements and provides statistical support for matrix structure similarities between any two matrices. For samples with cultural associations (**Table**

4.4), biological distances were compared to geographical and temporal distances separately, as well as to geographical distance controlling for temporal distance and to temporal distance controlling for geographic distance. In addition, the biological distances calculated from the R-matrix are compared with Mahalanobis distances calculated directly from the untransformed raw measurement data corrected for noise. Mantel testing was done in R using the Mantel function in the "ecodist" package (Goslee and Urban, 2007). This function also permits multiple independent variables (see Chapter 5) using a generalization of the Mantel test (Smouse et al., 1986). The results of these Mantel tests are provided in **Table 6.7**.

Table 6.7: Mantel test for biological distance vs. Mahalanobis distance for all samples, and biological distance vs. geographic distance for all samples and for the samples with cultural associations (Table 4.4). In addition, samples with cultural association were tested vs. temporal distance (time between sample occupations). Tests were also performed controlling for temporal distance (biodist~geodist | time) and controlling for geographic distance (biodist~time | geodist).

Test	Mantel r	p-value	95% CI	
All groups: biodist~mahalanobisdist	0.917	<0.001	0.909	0.929
All groups: biodist~geodist	0.452	<0.001	0.386	0.513
Cultural groups: biodist~geodist	0.237	0.159	-0.103	0.632
Cultural groups: biodist~time	0.369	0.146	-0.200	0.777
Cultural groups: biodist~geodist | time	0.173	0.221	-0.033	0.680
Cultural groups: biodist~time | geodist	0.335	0.178	-0.135	0.809

Not surprisingly, the Mantel test showed a significant correlation between biological distances calculated using the Relethford-Blangero method and the Mahalanobis distances (Mantel r = 0.917). There was no significant correlation between biological distance and geographic distance for the temporally and culturally affiliated samples. Likely because there were a limited number of culturally associated samples for the temporal analysis (only 6 samples with associated dating), no significant relationship was demonstrated in these tests.

In summary, these analyses do not reject the null hypothesis that cranial variation among populations is random with respect to temporal and cultural association. The Mantel test that utilized the temporal data was inconclusive because of the insufficient number of temporally associated samples. That biological distance is better explained with temporal distance rather than regional affiliation does not have statistical support.

Alternative Hypotheses

Rejection of null hypotheses 1 and 2 provides support for further investigating the specific causes of deviations from expected pattern for specific samples across the Arctic. Despite the lack of sufficient data for rejecting null hypothesis 3, several specific deviations were examined in light of their cultural and temporal deviations. To place the pattern of specific deviations into a useful framework for understanding ancestor-descendent relationships and migration patterns across the Arctic, a set of alternative hypotheses for describing the quality of these deviations for specific samples were generated. These alternative hypotheses are:

- Alternative Hypothesis 1: The pattern of cranial variation among populations is influenced by cultural or temporal affiliations rather than by physical geographic distance between them.
- Alternative Hypothesis 2: The pattern of cranial variation among populations is influenced by specific ancestor-descendent affinities rather than physical geographic distance between them.
- Alternative Hypothesis 3: The pattern of cranial variation among populations represents increased migration from more distantly related populations.
- Alternative Hypothesis 4: The pattern of cranial variation among populations represents physical isolation of one or more populations from other populations.

Principal-component and discriminant-function analyses were added to the previous analyses from this chapter to examine the specific sample deviations in more detail. The alternative hypotheses were then used to examine specific questions regarding ancestor-descendent and migration patterns across the Arctic in Chapter 7.

Principal-Component Analysis: The first two eigenvectors (scaled by dividing by the square root of the corresponding eigenvalues) were extracted from the $\mathbf{R}$-matrix and plotted against each other in R. Plots that show regional group affiliations are also provided to demonstrate specific sample affiliations, plotted using the “car” package in R (Fox, 2008). In each case, the percent of total variance that the first two principal components represent is provided. The eigenvalues, the percent of variation that each explains, and their corresponding loadings (eigenvectors) are presented in **Appendix E** for both the full sample set, and the sample set with the Aleut samples removed.

The plot of principal component 2 versus 1 for all samples (**Figure 6.8**) and for all samples with the Aleuts removed (**Figure 6.9**) show similar results. The Plot including the Aleut samples demonstrates their divergence from other Arctic samples based on the first two principal components. This, taken with the large deviation of the Aleut samples from the regional centroid (**Figure 6.5**), suggests a fit into alternative hypothesis 4, that isolation from the other Arctic populations may explain the Aleut deviation from the expected pattern of geographic and regional differentiation.

The plots demonstrate the variable position of the N Arctic samples in their relationship to the samples of other regions. This distribution provides support that the pre-Thule samples of the Ipiutak and Point Barrow (Birnirk) may have had divergent ancestor-descendent pathways, with the Ipiutak in both cases lying between the NW Arctic and W Arctic historic samples and Point Barrow falling between the Nunavut and Greenland samples. To examine the robustness of these regional associations, principal components 3 versus 1 (**Figure 6.10**) and 3 versus 2 (**Figure 6.11**) were plotted. In both cases a similar pattern to **Figures 6.9** emerges, with tight regional grouping for most regions and dissociation into other regions among the N Arctic samples. Several additional relationships emerge when PC3 is plotted against PC2 (**Figure 6.11**). The Tigara sample moves closer to the Point Barrow sample, and the NW Arctic region samples deviate from their previous position lying between the W and NW samples to a more scattered relationship, dividing between the N and W region samples. The Sarichef Island sample groups closely with the W Arctic and Ipiutak samples, while the Wales and Mitliktavik samples group tightly with Point Barrow and Tigara samples from the N Arctic region.

Figure 6.8: PC2 (16.7%) vs. PC1 (36%) for all Arctic samples. The first two principal components encompass 52.2% of the total variation. The second graph shows regional group affiliations with specific outliers labeled. This graph shows the distinctness of the Aleut samples.

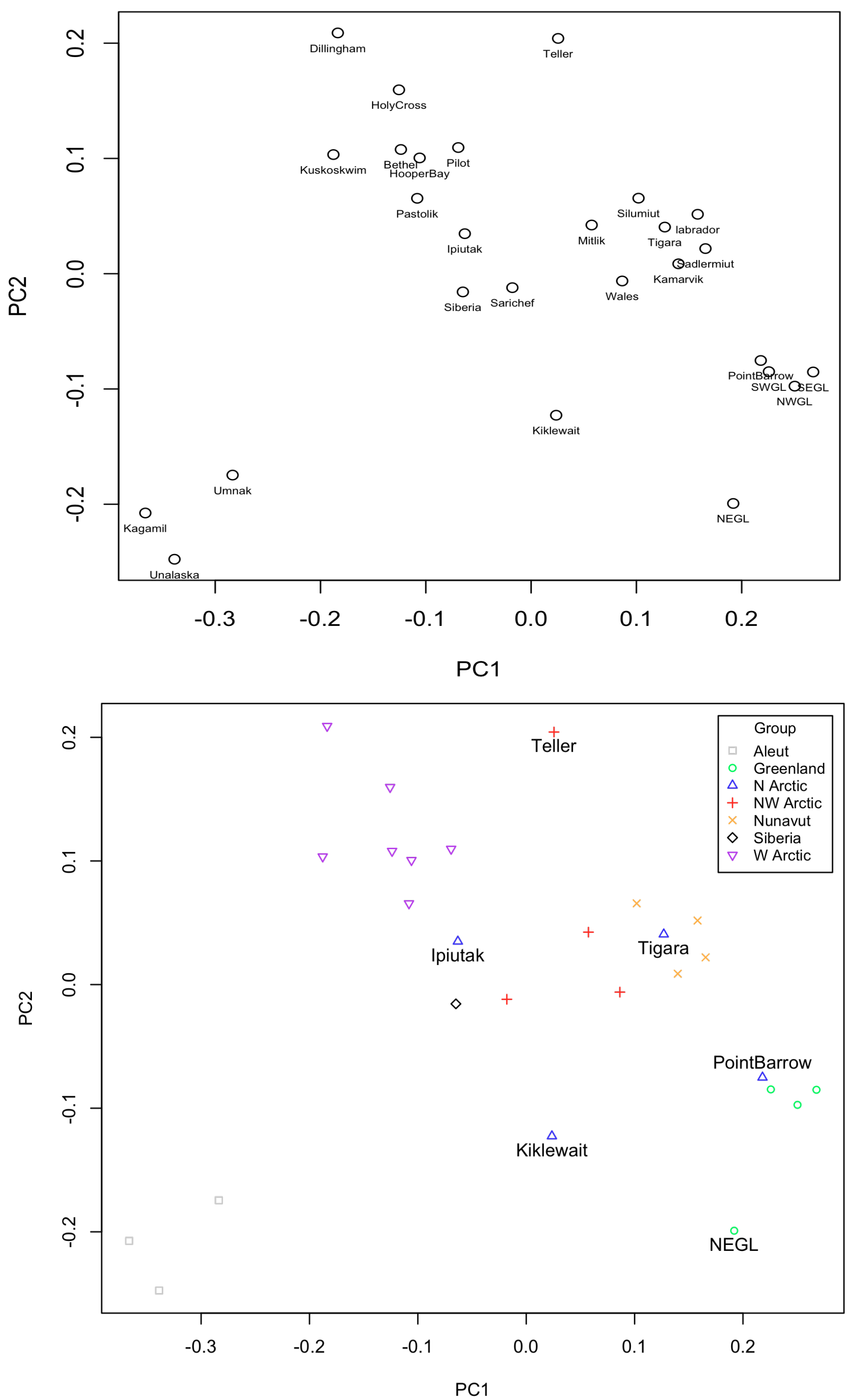


Figure 6.9: PC2 (13.4%) vs. PC1 (38.7%) for Arctic samples with Aleuts removed. The first two principal components encompass 52.7% of the total variation. The second graph shows regional group affiliations with specific outliers labeled. Note the lack of grouping for the N Arctic samples, specifically how the Ipiutak and Point Barrow samples align with the samples from other regions. Also the Dorset Affiliated Sadlermiut groups tightly with the other Nunavut regional samples.

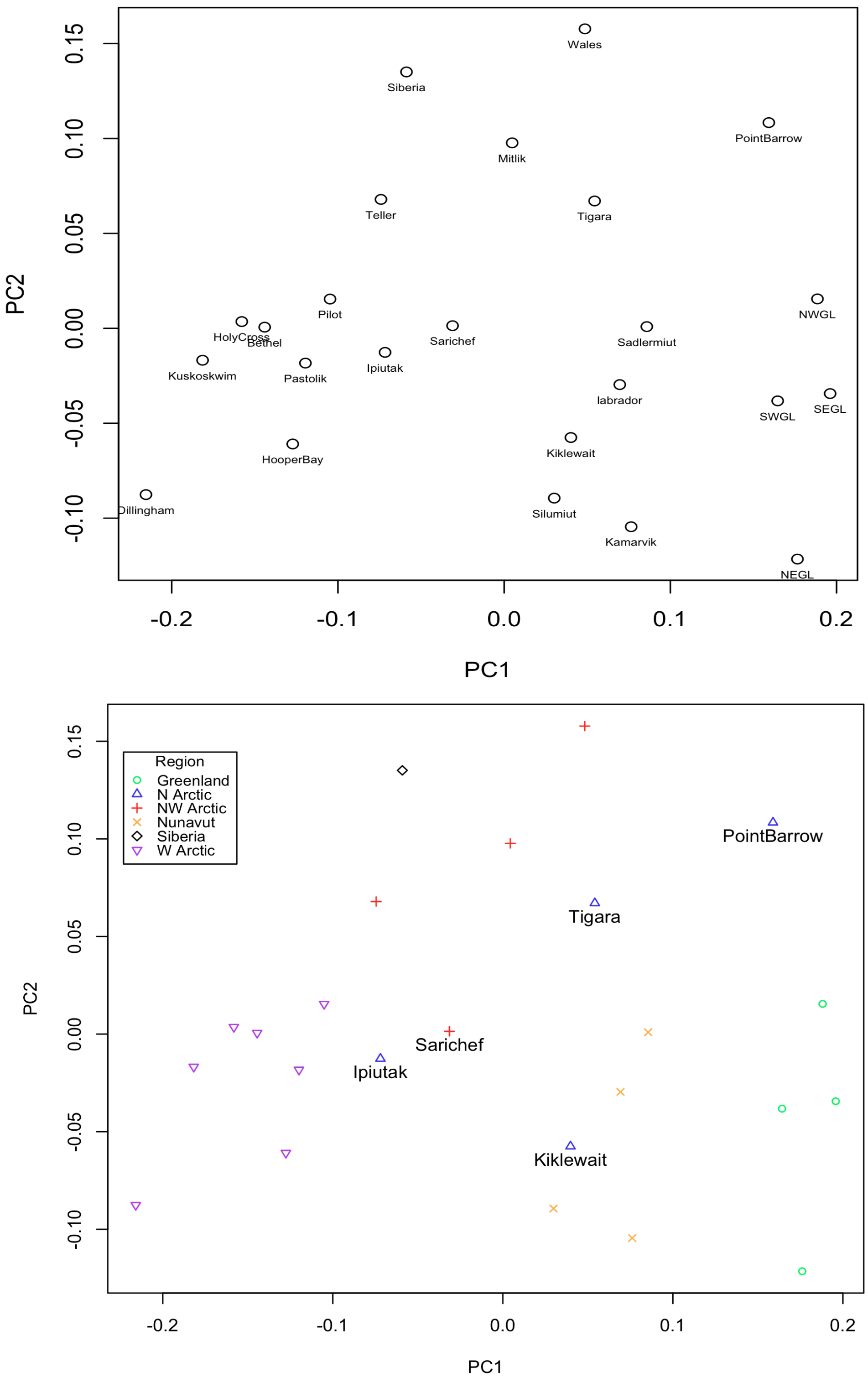


Figure 6.10: PC3 (10.7%) vs. PC1 (38.7%) for Arctic samples with Aleuts removed. The fully labeled plot is provided in Appendix F.

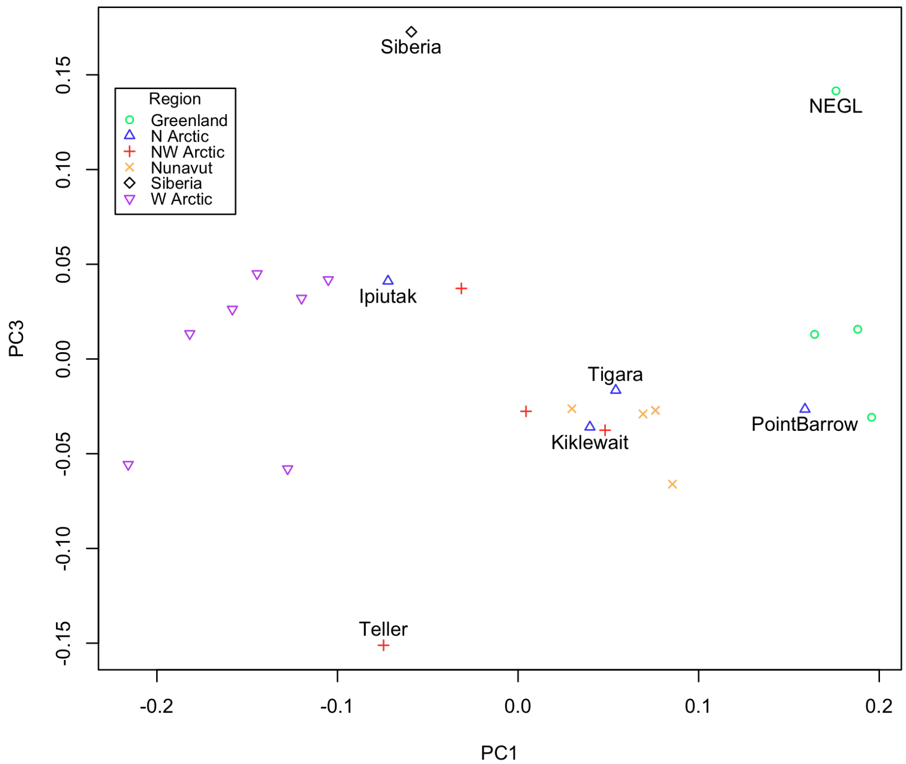


Figure 6.11: PC3 (10.7) vs. PC2 (13.4%) for Arctic samples with Aleuts removed. The fully labeled plot is provided in Appendix F.

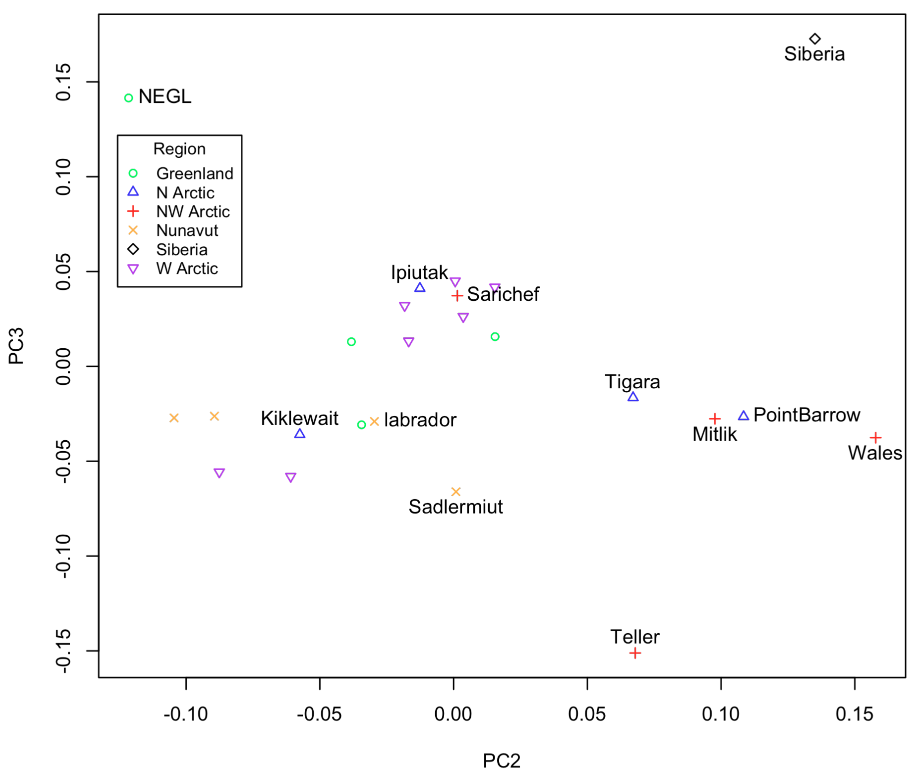
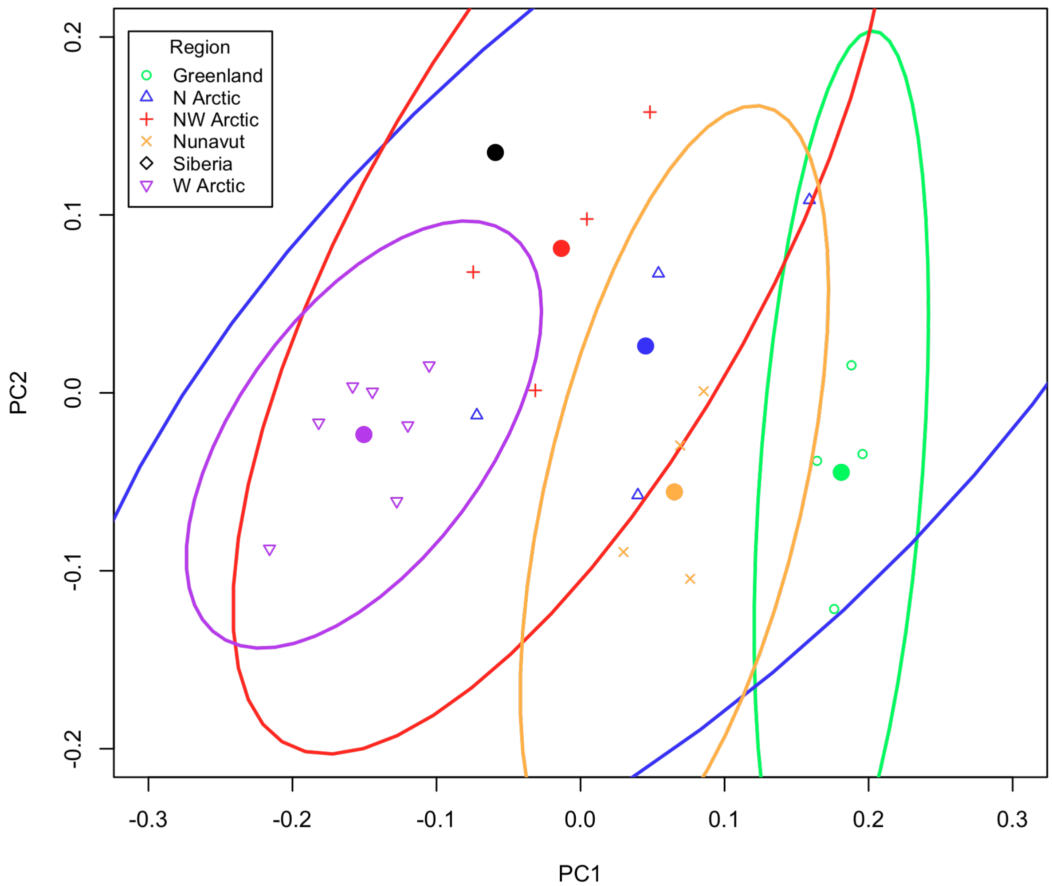


Figure 6.12: PC2 (13.4%) vs. PC1 (38.7%) for Arctic samples with Aleuts removed. The 95% confidence ellipse for each regional group is plotted.



Based on the plot of the first two principal components, the spread of the samples within each region provides a 95% confidence ellipse for that region (**Figure 6.12**). The 95% confidence ellipse represents the area that 95% of the time would be expected to include the samples within the region. When specific samples lie in the 95% confidence ellipse for another region, there are several ways this can be interpreted. First, samples that fit within the 95% confidence ellipse for another region fit within the expected pattern of that other region with 95% confidence and share biological similarity with the other samples in that region. Second, as in the case of N Arctic, whose 95% confidence ellipse incorporates all other Arctic samples, the within-region variance is so large as to suggest that the samples are no more likely to belong in that region than they are to any other region. For the analysis and discussion of principal components, the N Arctic was not used as a region so that specific population affinities of these samples could be examined more closely. The Ipiutak falls into the 95% confidence ellipse of the W Arctic and NW Arctic samples, the Tigara and Kiklewait samples fall into the 95% confidence ellipse of the NW Arctic and Nunavut samples, and the Point Barrow just falls within the border of the NW Arctic, Nunavut, and Greenland samples.

Discriminant-Function Analysis: Discriminant-function analysis was performed on the measurement data for all samples, all regions, and Greenland to examine the classification of the individuals within each sample and region according to their discriminant function. For each analysis, the classification percentages are provided in **Tables 6.8-6.10** according to the discriminant function calculated in SPSS using the step-wise method. The summary of the canonical discriminant functions, the standardized canonical discriminant function coefficients (Fisher's), and the complete classification tables including cross-validation are provided in **Appendix G.**

Table 6.8: Classification table with percentage of individuals classified into each regional sample according to their discriminant function. The rows are the samples, the columns represent the percentage classified into each region using the discriminant-function. 51.4% of individuals were correctly classified, 48.4% were correctly classified when cross-validated (see Appendix G for cross-validation table).

	Aleut	**W Arctic**	**NW Arctic**	**N Arctic**	**Nunavut**	**Greenland**
Aleut	**72.0**	12.4	3.2	8.1	3.8	0.5
W Arctic	11.4	**57.2**	14.4	4.9	8.3	3.8
NW Arctic	5.4	17.1	**48.1**	15.5	8.5	5.4
N Arctic	7.2	11.9	16.3	**33.2**	11.9	19.4
Nunavut	2.8	7.3	10.1	11.8	**48.9**	19.1
Greenland	1.5	3.9	9.9	11.8	11.3	**61.6**

Regional classification provides the percentage of individual cases correctly assigned to their region and the percentage misclassified to other regions. Not surprisingly, the Aleut regional sample has the highest percent correctly assigned (72%), followed by the Greenland region (61.6%). The W Arctic, NW Arctic and Nunavut samples hover around 50% correct classification (57.2%, 48.1%, and 48.9% respectively) while the N Arctic regional sample is correctly classified only 33.2% of the time. The N Arctic region shows substantial overlap with the NW Arctic, Nunavut, and Greenland regions, as the previous analyses suggested. The pattern of misclassification is concurrent with the isolation-by-distance pattern across the Arctic, with neighboring regions in all cases having the highest frequency of misclassification for each region. This discriminant function was extremely robust in predicting membership, the cross-validation classification only 3% lower for correct classification. Regional correct classification values are inversely correlated with the Q_{ST} values (**Table 6.4**). This is not surprising as correct classification is a function of among region differentiation.

The classification for all Arctic samples is provided to examine the overall variation pattern among Arctic populations. In addition, specific outliers from previous analyses are examined in the context of relevant misclassification percentages. As was the case for the regional samples, the population samples have a strong pattern of differentiation according to geographic distance, where most of the misclassification occurs with neighboring and within-region samples. An outlier to this pattern is the Ipiutak, where only 31.5% of individuals were correctly classified, the remaining individuals appear to evenly distribute evenly across all other regions including Siberia and the Aleutians. The Ipiutak has an especially strong affinity with W Arctic samples, where the same percentage that were correctly classified, 31.5%, were misclassified to W Arctic region samples. Point Barrow also has an interesting pattern, with 44.7% individuals correctly classified, and misclassified individuals found primarily in the N Arctic, Nunavut and Greenland, and some overlap with Siberia and the Aleutians. Point Barrow individuals appear to be absent from the W Arctic and NW Arctic regions altogether with the exception of Wales, to which 18% of the Point Barrow individuals were misclassified. Despite the large number of samples in this analysis, the discriminant function was still robust, correctly classifying individuals from each population sample on average 34.8% of the time, with cross-validation still correct 22.3% of the time. Based on the principal-component and discriminant-function analyses, the variance patterns of the Ipiutak and Birnirk samples appear to fit into alternative hypothesis 1, that temporal and cultural association explains their deviation from the expected patterns of Arctic differentiation.

Table 6.9: Classification table with percentage of individuals classified into each sample according to their discriminant function. 34.8% of individuals were correctly classified, 22.3% were correctly classified when cross-validated (see Appendix G for cross-validation table). Numbers along the top represent the population samples according to the first two columns. Correct classification in bold.

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Bethel	**24.3**	0.0	5.4	5.4	8.1	2.7	0.0	0.0	13.5	2.7	5.4	2.7	0.0	2.7
2	Dillingham	2.5	**37.5**	5.0	5.0	5.0	0.0	2.5	0.0	12.5	0.0	5.0	0.0	0.0	2.5
3	Holy Cross	7.1	4.8	**47.6**	0.0	0.0	0.0	2.4	0.0	2.4	2.4	4.8	0.0	0.0	2.4
4	Hooper Bay	16.0	12.0	0.0	**40.0**	4.0	0.0	4.0	0.0	4.0	0.0	0.0	0.0	0.0	4.0
5	Ipiutak	3.7	5.6	3.7	1.9	**31.5**	0.0	0.0	3.7	7.4	0.0	0.0	3.7	1.9	3.7
6	Kagamil	1.5	1.5	0.0	2.9	4.4	**55.9**	0.0	2.9	4.4	0.0	0.0	0.0	0.0	1.5
7	Kamarvik	0.0	2.2	2.2	2.2	2.2	0.0	**17.4**	4.3	0.0	4.3	0.0	8.7	2.2	2.2
8	Kiklewait	0.0	1.9	1.9	1.9	3.8	1.9	1.9	**49.1**	1.9	1.9	3.8	3.8	1.9	1.9
9	Kuskoskwim	9.1	6.1	3.0	12.1	0.0	3.0	0.0	3.0	**30.3**	0.0	6.1	0.0	0.0	3.0
10	Labrador	0.0	2.5	5.0	0.0	2.5	5.0	2.5	5.0	0.0	**40.0**	5.0	2.5	2.5	0.0
11	Mitlik	3.0	3.0	6.1	3.0	0.0	0.0	0.0	9.1	0.0	0.0	**30.3**	9.1	3.0	0.0
12	NEGL	0.0	0.0	0.0	0.0	0.0	3.6	0.0	3.6	0.0	7.1	0.0	**60.7**	3.6	0.0
13	NWGL	0.0	0.0	0.0	0.0	3.2	1.6	6.5	3.2	0.0	8.1	1.6	6.5	**29.0**	0.0
14	Pastolik	1.9	18.9	3.8	1.9	1.9	1.9	0.0	9.4	3.8	1.9	3.8	3.8	1.9	**15.1**
15	Pilot	2.9	2.9	11.8	5.9	0.0	0.0	0.0	2.9	2.9	2.9	5.9	0.0	0.0	5.9
16	Point Barrow	2.6	0.0	0.0	0.0	0.0	0.0	2.6	2.6	0.0	0.0	0.0	0.0	5.3	0.0
17	Sadlermiut	0.0	0.0	0.0	4.0	4.0	0.0	4.0	2.0	0.0	6.0	4.0	2.0	2.0	0.0
18	Sarichef	7.4	3.7	0.0	0.0	3.7	0.0	0.0	0.0	0.0	0.0	3.7	3.7	0.0	0.0
19	SEGL	0.0	0.0	2.3	4.7	4.7	0.0	4.7	0.0	0.0	4.7	2.3	4.7	9.3	2.3
20	Siberia	0.0	3.1	3.1	0.0	6.3	0.0	0.0	0.0	9.4	0.0	3.1	0.0	0.0	0.0
21	Silumiut	2.4	2.4	0.0	2.4	7.1	2.4	9.5	2.4	0.0	0.0	0.0	4.8	0.0	0.0
22	SWGL	0.0	0.0	0.0	2.9	0.0	0.0	2.9	2.9	0.0	5.7	5.7	10.0	12.9	1.4
23	Teller	2.9	5.7	5.7	0.0	2.9	0.0	0.0	0.0	2.9	2.9	5.7	0.0	0.0	0.0
24	Tigara	1.4	1.9	0.5	1.4	4.2	0.0	1.4	1.9	0.5	2.3	5.6	2.8	4.6	3.2
25	Umnak	3.2	0.0	3.2	3.2	3.2	12.9	0.0	0.0	3.2	0.0	0.0	0.0	0.0	3.2
26	Unalaska	0.0	0.0	5.5	0.0	1.8	23.6	0.0	1.8	1.8	0.0	1.8	0.0	0.0	0.0
27	Wales	0.0	0.0	0.0	0.0	5.9	0.0	0.0	0.0	2.9	5.9	2.9	2.9	0.0	0.0

		15	16	17	18	19	20	21	22	23	24	25	26	27
1	Bethel	5.4	2.7	0.0	0.0	0.0	5.4	0.0	0.0	2.7	5.4	2.7	2.7	0.0
2	Dillingham	7.5	0.0	0.0	0.0	0.0	2.5	2.5	0.0	7.5	0.0	2.5	0.0	0.0
3	Holy Cross	2.4	0.0	0.0	7.1	2.4	4.8	2.4	0.0	4.8	0.0	2.4	0.0	0.0
4	Hooper Bay	0.0	0.0	4.0	0.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0	4.0	4.0
5	Ipiutak	0.0	1.9	0.0	3.7	1.9	5.6	9.3	0.0	1.9	1.9	1.9	3.7	1.9
6	Kagamil	0.0	0.0	1.5	1.5	0.0	0.0	1.5	0.0	0.0	0.0	2.9	17.6	0.0
7	Kamarvik	6.5	8.7	6.5	0.0	4.3	0.0	15.2	4.3	4.3	0.0	0.0	2.2	0.0
8	Kiklewait	0.0	1.9	1.9	5.7	5.7	1.9	0.0	1.9	0.0	1.9	0.0	1.9	0.0
9	Kuskoskwim	3.0	3.0	3.0	0.0	0.0	3.0	3.0	3.0	0.0	0.0	3.0	3.0	0.0
10	Labrador	0.0	2.5	0.0	2.5	0.0	0.0	5.0	7.5	2.5	2.5	0.0	2.5	2.5
11	Mitlik	0.0	3.0	3.0	6.1	0.0	3.0	0.0	3.0	6.1	0.0	0.0	3.0	6.1
12	NEGL	3.6	0.0	0.0	0.0	3.6	0.0	3.6	7.1	0.0	0.0	0.0	3.6	0.0
13	NWGL	0.0	3.2	3.2	1.6	16.1	0.0	1.6	6.5	3.2	3.2	0.0	0.0	1.6
14	Pastolik	3.8	1.9	0.0	11.3	0.0	1.9	0.0	1.9	1.9	0.0	3.8	0.0	3.8
15	Pilot	**35.3**	0.0	0.0	2.9	2.9	0.0	8.8	0.0	0.0	2.9	0.0	0.0	2.9
16	Point Barrow	2.6	**44.7**	0.0	0.0	2.6	5.3	2.6	2.6	0.0	2.6	5.3	0.0	18.4
17	Sadlermiut	0.0	2.0	**40.0**	0.0	4.0	0.0	6.0	8.0	4.0	6.0	2.0	0.0	0.0
18	Sarichef	7.4	3.7	0.0	**51.9**	3.7	0.0	0.0	0.0	0.0	3.7	3.7	0.0	3.7
19	SEGL	0.0	7.0	4.7	2.3	**37.2**	0.0	0.0	4.7	0.0	2.3	2.3	0.0	0.0
20	Siberia	6.3	3.1	3.1	0.0	0.0	**53.1**	0.0	0.0	0.0	3.1	0.0	3.1	3.1
21	Silumiut	2.4	2.4	9.5	4.8	2.4	0.0	**33.3**	0.0	4.8	7.1	0.0	0.0	0.0
22	SWGL	2.9	2.9	5.7	2.9	11.4	0.0	1.4	**18.6**	4.3	4.3	0.0	0.0	1.4
23	Teller	2.9	5.7	5.7	0.0	2.9	2.9	0.0	0.0	**42.9**	2.9	0.0	0.0	5.7
24	Tigara	3.7	6.0	4.2	0.5	6.5	2.8	3.7	5.6	5.6	**24.1**	0.5	0.0	5.6
25	Umnak	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2	0.0	**45.2**	19.4	0.0
26	Unalaska	0.0	1.8	0.0	0.0	0.0	3.6	0.0	0.0	0.0	1.8	20.0	**36.4**	0.0
27	Wales	2.9	11.8	2.9	2.9	0.0	5.9	0.0	0.0	5.9	2.9	0.0	2.9	**41.2**

Discriminant-function analysis was run separately for the Greenland samples to examine the specific relationship between the NE Greenland samples and the other three quadrants (**Table 6.10**).

Table 6.10: Classification table with percentage of individuals classified into each Greenland sample according to their discriminant function. 54.7% of individuals were correctly classified, 29.6% were correctly classified when cross-validated (see Appendix G for cross-validation table).

	NEGL	NWGL	SWGL	SEGL
NEGL	**82**.1	3.6	7.1	7.1
NWGL	6.5	**54.8**	19.4	19.4
SWGL	17.1	15.7	**44.3**	22.9
SEGL	7.0	23.3	16.3	**53.5**

82.1% of the NEGL individuals were correctly classified, versus a very different pattern for the other three quadrants. The NWGL, SWGL, and SEGL samples all showed similar patterns, correctly classifying 54.8%, 44.3%, and 53.5% of individuals respectively, with substantial overlap among all three. With the exception of SWGL, where 17.1% of individuals were misclassified to NEGL, there was minimal overlap with the NEGL population sample. These findings suggest the outlier status of the NEGL sample from the other Greenland samples may best be explained by alternative hypothesis 4 of relative isolation.

In summary, the large variance among the N Arctic samples results in a 95% confidence ellipse that contains all Arctic samples (with the exception of the Aleuts). If the N Arctic is not considered a region and the regional associations for each of the N Arctic samples are examined as isolates, a pattern of temporal association emerges. The Ipiutak fits within the W and NW Arctic 95% confidence ellipses, while the Point Barrow sample fits within the Nunavut, Greenland, and NW Arctic 95% confidence ellipses. This suggests some differentiation in ancestry among Arctic regions and is further addressed in Chapter 7. In the case of the Sadlermiut from the Nunavut region, this sample was well within the 95% confidence ellipse for the Nunavut region, and only slightly overlapped the NW Arctic region. These analyses provide evidence that the variation in the N Arctic region, specifically the deviations of the Ipiutak at Point Hope and the Birnirk at Point Barrow can be explained by alternative hypothesis 1: the pattern of cranial variation among populations is influenced by cultural or temporal affiliations rather than by physical geographic distance between them.

Specific affinities of the NW and N Arctic samples that more closely align with the Ipiutak or Birnirk samples, rather than their own regional affiliates, suggests deviations in accordance with alternative hypothesis 2: the pattern of cranial variation among populations is influenced by specific ancestor-descendent affinities rather than physical geographic distance between them.

From analyses done for testing null hypothesis 2, the Labrador sample from Nunavut, and the Kuskoskwim and Dillingham samples from W Arctic showed positive residuals (**Figure 6.5**) of observed vs. expected phenotypic variance in contrast to the negative residuals for all other closely related samples within their region. This deviation appears to fit alternative hypothesis 3: the pattern of cranial variation among populations represents increased migration from more distantly related populations. In the case for these samples, likely interbreeding between non-Arctic samples to their south.

Several samples show deviation from neighboring samples or regions, specifically the NW Greenland sample and the Aleut samples, whose deviations can be explained by alternative hypothesis 3: the pattern of cranial variation among populations represents physical isolation of one or more populations from other populations. These deviations are further examined in Chapter 7.

CHAPTER 7

DISCUSSION

The null hypothesis that cranial variation is randomly distributed across the Arctic is rejected, warranting examination of the pattern of variation in light of geographic distance, regional affiliation, and/or temporal and cultural affiliation. The null hypothesis that cranial variation among populations shows geographic variation as predicted by a population-genetic model of isolation-by-distance with a two-dimensional stepping-stone model of migration has also been rejected due to the lack of significant models for some samples and significant deviation of other samples from the empirically derived linear model of Arctic differentiation. The null hypothesis that cranial variation within and among regions is randomly distributed across the Arctic is rejected based on statistically significant differences in variability patterns and Q_{ST} values among samples within regions. Because of the small number of temporally associated samples, it was not possible to reject the null hypothesis that cranial variation among populations is random with respect to temporal and cultural association. However, there is strong support based on biological distances, principal components and discriminant functions, that the temporally and culturally pre-Thule affiliated groups have specific affinities with other Arctic regions, and this helps to explain historic population movements and cultural relationships throughout the Arctic. In this chapter the biological importance of deviations of specific regions and samples within regions are discussed in the context of Arctic prehistory, including indications of specific migrations and ancestor-descendent relationships. Each region is discussed separately, followed by applying the analyses from Chapter 6 to answering the previously posed questions regarding Arctic prehistory.

Aleutian Islands: The Aleut samples are outliers in having relatively low variance among samples within the region but large geographical distances to samples from other regions. The Aleut Q_{ST} value is the lowest of the Arctic regions, suggesting that only 1.4% of their total variance occurs among samples within the region. While this might be expected due to the close geographic proximity of the three Aleut samples, the biological distance between the three Aleut samples and all other Arctic populations is much greater than would be expected by their geographic separation based on the isolation-by-distance model. This is likely attributable to long separation times and fragmentation/bottleneck events that are a function of island-habitat dynamics concurrent with previous studies which suggest lack of substantial intermixing of the Aleuts and other Arctic populations over the past 4000 years or more (Hayes, 2002; Laughlin, 1980; Laughlin and Marsh, 1951; McCartney, 1984). These analyses provide no support for recent mixing between the Aleut samples and other Arctic populations utilized in this study.

West Arctic: All W Arctic samples group nicely in the principal-components analysis; there are no samples that show significant deviations from the empirically derived model of Arctic differentiation, and all have significant linear regressions of biological distance with geographic distance. The only interesting deviation comes from the analysis of the residuals from the expected pattern of phenotypic variance (**Table 6.5**), which showed the two most southern samples, Dillingham and Kuskoskwim, to have positive residuals from the expected pattern, whereas the other W Arctic samples all show negative deviations. This suggests that these southern-most populations may have experienced higher levels of admixture from non-Arctic Native American populations to the south.

Northwest Arctic: The NW Arctic region has a significant positive deviation in Q_{ST} relative to the expected value. This variance component is notable because of a relatively small average biological-distance to the regional centroid and assumed lack of temporal variation. This positive significant deviation is likely due to decreased observed phenotypic regional variance, amplifying the importance of the between sample differences. Based on the empirically derived pattern of Arctic differentiation (**Figures 6.1-6.2**), two of the four NW Arctic samples, Mitliktavik and Sarichef Island, do not have a significant linear regression between biological and geographic distances to the empirically derived model, and the Sarichef Island sample had a substantial negative deviation from the expected phenotypic variance pattern (**Table 6.5**). While it is difficult to explain the deviation of the Mitliktavik sample in light of all the other evidence, the distinctiveness of the Sarichef Island sample can be explained by reduced admixture due to island population dynamics. The 95% confidence ellipse for this region contains all the W Arctic and N Arctic samples (**Figure 6.12**); this suggests substantial admixture between these regions or a shared recent common ancestral population, possibly descendent from the Ipiutak and Birnirk populations. While these samples grouped nicely between the N and W Arctic regional samples when plotting PC2 on PC1 (**Figure 6.9**), in the plot of PC3 on PC2 (**Figure 6.11**), a distinct pattern emerges where these samples divide between the N and W region samples. The Sarichef Island sample groups closely with the W Arctic and Ipiutak samples, while the Wales and Mitliktavik samples group tightly with Point Barrow and Tigara samples from the N Arctic region. This pattern may be evidence of differential ancestry among the NW Arctic samples, with Sarichef Island descendent from the Ipiutak, and the Wales and Mitliktavik samples descendent from the Birnirk at Point Barrow. The position of the Teller sample is still unclear, although in the discriminant-function analysis it is primarily misclassified into the other NW samples, then to a lesser extent to both W Arctic and N Arctic samples, suggesting the likelihood of a mixture from both ancestral populations.

North Arctic: The N Arctic region shows a significantly higher among-sample variance relative to other Arctic regions, with 5.7% among-region variation relative to the region mean of 3.3% (**Table 6.3**). The PCA for the N Arctic region (**Figure 6.12**) shows a distinct pattern relative to other regions, its 95% confidence ellipse encompassing all other Arctic samples (with the exception of the Aleuts). The regional discriminant function analysis correctly classified only 33.2% of the N Arctic individuals, with substantial overlap into all other regions (**Table 6.9**). These deviations are not surprising because of the region's large geographical range that encompasses the two pre-Thule affiliated populations, which are potential ancestors for historic Arctic populations that traveled primarily east to Nunavut and Greenland (Point Barrow), and west to NW and W Arctic regions (Ipiutak).

Nunavut: Several of the Nunavut samples deviate substantially from their expected phenotypic variance (**Table 6.5**). The Sadlermiut and Silumiut samples have a negative deviation, suggesting decreased admixture from outside the region. The Labrador sample has a positive deviation suggesting increased admixture from outside the region. An explanation for this may be the location of the Labrador sample, which lies along the eastern Canadian coast just north of non-Arctic northeastern Canadian Native groups. Admixture of these non-Arctic people with the

Labrador population can explain this increased phenotypic variation. The only sample that has a significantly different linear model from the empirically derived model of Arctic differentiation is the Kamarvik, which does not overlap the 95% confidence ellipse for any other region (**Figure 6.12**). The Nunavut 95% confidence ellipse contains only the Nunavut samples and three of the N Arctic samples, the Kiklewait, Tigara, and Point Barrow. This suggests that the Nunavut samples are all closely related to each other and to the neighboring Kiklewait, and possibly descendent from the Birnirk at Point Barrow.

Greenland: Only the NEGL sample deviates (as a positive outlier) from the expected phenotypic variance (**Figure 6.5**). The NEGL differences might be explained by its more variable composition, possibly attributable to a combination of Dorset- and Thule-derived populations. The Greenland samples all deviate in their linear models for geographic distance on biological distance (**Figure 6.2**). This may be due to the relative isolation and substantial size of Greenland, which yields significant and strongly negative correlations between biological and geographic distances for these samples. The Greenland region's 95% confidence ellipse only accommodates the Point Barrow sample in addition to the Greenland samples (**Figure 6.12**). This suggested the possibility of an ancestor-descendent relationship between the Birnirk at Point Barrow and the Greenland samples.

Specific Sample Affiliations

The following discussion concerns specific population relationships. Analyses from Chapter 6 were applied to discern these relationships and to provide a general historic framework to explain cultural and temporal associations across the Arctic.

What is the relationship of the pre-Thule Ipiutak population to the Thule-affiliated Tigara population, both occupying Point Hope, Alaska during different time periods: The Ipiutak are associated with a distinct technology and occupied Point Hope between 1600-1300 years BP. As the population dwindled, there is evidence of increased coastal weather fluctuations and the possible movement inland into Northwest Alaska (Mason, 2009). Sometime after 1000 years BP (most dates are between 800-500 years BP), the coastal sites were repopulated with people associated with “Thule” like material culture, which contains technologies for efficient exploitation of aquatic resources including whale hunting (Mason and Gerlach, 1995). The main Tigara occupation at Point Hope began around 600 years BP. The question is: where did the Ipiutak go and to what extent are they ancestral to the Tigara and other Thule associated populations?

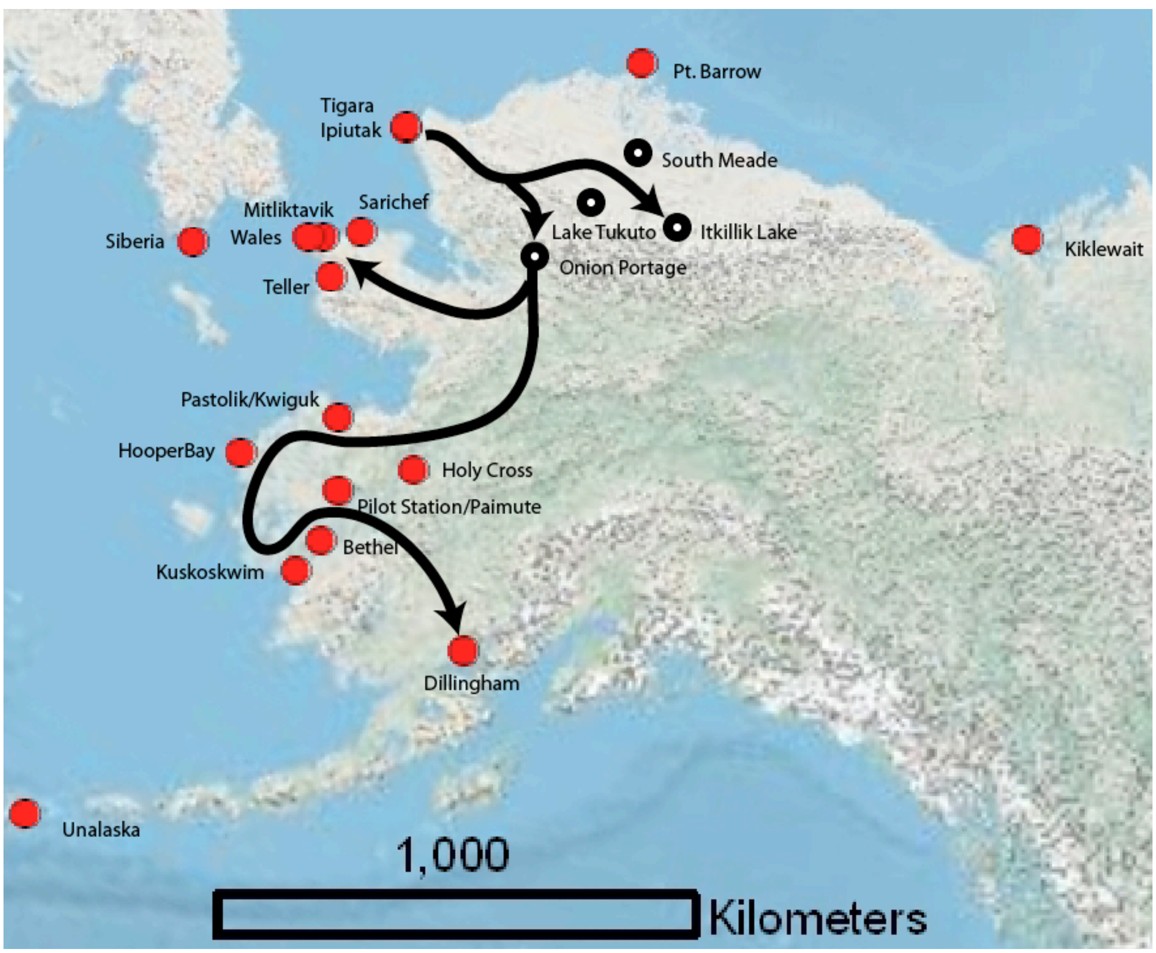
According to biological distances the Ipiutak has the strongest associations with the W Arctic samples (Bethel, Hooper Bay, Kuskoskwim, and Pastolik), and the Silumiut from Nunavut. The PCA analysis shows a similar affinity with the W Arctic in addition to the NW Arctic samples (**Figures 6.8-12**), with the Ipiutak nestled directly between the W and NW Arctic samples and well inside both regions’ 95% confidence ellipses. The discriminant-function analysis calculated equivalent percentages of individuals from the Ipiutak sample to be correctly classified (31.5%) as were misclassified into the W Arctic region samples (**Table 6.9**). To a lesser extent, the Ipiutak individuals had a wide distribution of classification into all regions, suggesting some component of ancestry and/or admixture throughout the Arctic.

The samples that represent the N Arctic region are widely spread in the principal-component analysis. This may have more to do with their temporal variation rather than geographic variation. The biological distances relating to the Tigara have biological similarity to a much broader range of samples, including the Point Barrow sample, the NW Arctic samples (Mitliktavik, Teller, and Wales), all the Nunavut samples (except Labrador), and the Greenland samples (except NEGL). The principal-component analysis is in general agreement with the biological distances; the plot of PC2 on PC1 places the Tigara tightly between the Nunavut and NW Arctic samples, but outside the 95% confidence ellipse of the Greenland region. However, when examining the other plots, PC3 on PC2 shows a tighter affinity of the Tigara with the Birnirk at Point Barrow and the Mitliktavik and Wales samples from the NW Arctic, while PC3 on PC1 provides additional association of the Tigara to the Nunavut samples.

Although this analysis does not provide conclusive evidence that there is no ancestral role for the Ipiutak to the Tigara, it does demonstrate greater similarity between the Tigara and the Birnirk at Point Barrow, whose biological distance is smaller, falling just inside the bottom quartile of all sample pair-wise differences. However, it is difficult to make a conclusion one way or the other, and in all likelihood the Tigara is a product to some extent of both populations.

To summarize the most parsimonious scenario according to the results of these analyses (**Map 7.1**), some time around 1300 years BP the Ipiutak left Point Hope and went inland during the period of intensified coastal weather. The Ipiutak archaeological complex has been excavated at inland sites of South Meade, Itkilik Lake, Lake Tukuto, and Onion Portage, dating up to 500 years BP (see Chapter 2). As the weather improved along the coast, large populations began to re-occupy the coast. The close biological relationship between the Ipiutak and many of these NW and W Arctic samples suggests that the descendents of the Ipiutak at Point Hope migrated back along the coast, deriving the W Arctic populations and to a lesser extent perhaps intermixing with the Thule to form the NW Arctic and N Arctic historic populations.

Map 7.1: Possible migration routes and the pattern of descent from the Ipiutak at Point Hope among NW Arctic and W Arctic populations.



What is the relationship of the pre-Thule Birnirk at Point Barrow, Alaska to the origination and spread of the Thule culture across the North American Arctic: Previous work has suggested that the Birnirk (who occupied Point Barrow shortly after the Ipiutak began to occupy Point Hope) were the originators of the Thule culture, which rapidly spread throughout the Arctic (Hollinger et al., 2009). The Birnirk has been described as culminating out of the Old Bering Sea, Punuk, Ipiutak, and Norton traditions that span across the Arctic. Perhaps Point Barrow was a melting pot of other Arctic regions 1100 years BP –the regions coming together for cultural events or sharing technology. This might explain the origination of the Thule at this place and time and the initiation of large-scale technologically advanced whale hunting.

The examination of the observed phenotypic variance to biological distance to the population centroid (**Figure 6.4**), demonstrates that the Point Barrow sample is an outlier among other Arctic sample variability patterns. This confirms previous work using discrete trait variation that identified the Birnirk at Point Barrow as having much greater than expected within-sample variability compared with other Arctic samples (Ossenberg, 2005). In terms of biological distances, the Birnirk have a strong similarity to the Greenland samples (with the exception of the NEGL), the Wales sample of northwestern Alaska, and the Tigara at Point Hope. The discriminant-function analysis showed misclassification of Point Barrow individuals into Greenland, Nunavut, and other N Arctic samples, but there was virtually no overlap with the W and NW Arctic with the exception of Wales, which misclassified at 18.4%.

The overall pattern of variation suggests that the early Thule arising out of Point Barrow migrated east following aquatic resources, carrying their technology into Nunavut and Greenland where they interbred with previous Dorset occupants. The PCA shows the Point Barrow sample just within the 95% confidence ellipse for the NW Arctic, Nunavut, and Greenland regions; this suggests the Birnirk at Point Barrow might have played an ancestral role for all three. The relationship according to the discriminant-function analysis misclassified individuals primarily among samples in the N Arctic, Nunavut and Greenland regions, and some overlap with Siberia and the Aleutians. Point Barrow individuals appear to be absent from the W Arctic and NW Arctic

Map 7.2: Possible migration routes and pattern of descent from the Birnirk at Point Barrow to the NW Arctic, N Arctic, Nunavut, and Greenland populations (Black). The Dorset migration (Red) following Helgason et al. (2006).

regions all together with the exception of Wales, in which 18% of the Point Barrow individuals misclassified.

A possible scenario for the Birnirk (**Map 7.2**) provides one scenario for the Thule migration that puts the biological relationships into the context of historic population movement. The earlier migration routes for the Dorset (Helgason et al., 2006) in red, are superimposed with a possible migration route of the Thule in black. There is evidence that the Birnirk and their Thule descendents had a substantial ancestral role throughout the Arctic. The early Thule traveled east to Kiklewait, then on to Nunavut, some continuing on to the Nunavut occupations of Kamarvik, Sadlermiut, Silumiut, and Labrador, others moving across into Greenland. Over time, with back migration, isolation, and differential admixture between previous Dorset and the Thule immigrants, the current pattern of differentiation throughout this region was established.

What is the relationship of the pre-Thule Sadlermiut population to neighboring Thule-affiliated Nunavut and other Arctic populations: The Dorset were the cultural affiliate of the Central Arctic who appear to have been replaced by the Thule sometime around 1000 years BP. The argument concerns the relationship between the Dorset and Thule; was there an actual population replacement event or can the material-culture transition be explained in terms of technological sharing and some amount of admixture? Previous research has described the Sadlermiut population as associated with a Dorset technological complex, despite the Sadlermiut occupation dating simultaneously with neighboring Thule-affiliated populations of Kamarvik and Silumiut (Hayes, 2002). Genetic research using aDNA (Hayes, 2002) suggests that the Sadlermiut were a distinct residual Dorset population, while more recent genetic analysis (Helgason et al., 2006) claims more work needs to be done to establish this relationship conclusively.

The cranial biological distances indicate that the Sadlermiut sample is most similar to the other Nunavut samples (Kamarvik, Silumiut, and Labrador), the Tigara sample, the Greenland (except NEGL) samples, and the Mitliktavik and Wales samples from the NW Arctic region. All of these samples are considered Thule-associated samples. The PCA indicates that the Sadlermiut groups with the other Nunavut samples and the neighboring Kiklewait sample, with some overlap with the NW Arctic regional samples. Similarly, the discriminant-function analysis suggests greatest misclassification with other Nunavut and Greenland samples, with lesser overlap with N Arctic samples. Combined, there is strong evidence that the Sadlermiut sample is biologically similar to the other Nunavut samples, as well as other Thule-associated samples from Greenland and the N Arctic. There is little evidence to support the Sadlermiut being part of a Dorset remnant population that is distinct from the other regional Nunavut samples. This indicates that despite their affiliation with the Dorset material culture, the Sadlermiut are closely related to the neighboring Thule groups. This neither confirms nor rejects the continuity between the Thule and Dorset in the central and eastern Arctic, which is tenuous until the Dorset are more clearly defined. The strong similarity between the Tigara sample and NW Arctic samples suggests that all of the Nunavut samples are, in part, descendent from the larger Thule migration throughout the Arctic.

What is the pattern of Greenland settlement and history, including an examination of the relationship among Greenland samples in the context of pre-Thule or Thule derivation: Previous research has suggested a ring occupation for coastal Greenland, with a geographic barrier to population movement along the eastern coast. This barrier presumably prevented population movement between the NEGL and SEGL quadrants and caused biological distances to be greatest between the NEGL and SEGL samples (Frøhlich and Pedersen, 1992; Jaskulska, 2002; Laughlin and Jørgensen, 1956).

The PCA showed a discrete grouping of the Greenland samples with very little overlap with samples from other regions (**Figure 6.12**); however, the NEGL sample still appears to be an outlier relative to the other sample quadrants. The biological-distance analysis found the NEGL sample equally distant from all the other Greenland samples. In addition, the discriminant-function analysis among the Greenland quadrants (**Table 6.10**) showed a distinct pattern of misclassification overlap when compared with the other quadrant samples. None of these analyses support the ring model of increasing biological distance from NE>NW>SW>SE. There is almost no difference among the other three quadrants. This lack of differentiation along the west and southeast coasts can be explained by continual migration between the populations among these quadrants. Based on the PCA, the Greenland samples show a strong affinity with the Nunavut samples, and the Point Barrow sample falls within the 95% confidence ellipse for the region. This may indicate that the Thule, who originated from the Birnirk at Point Barrow, may have migrated east following aquatic resources into the Central Arctic and Greenland. There are several explanations for the divergence of the NEGL sample from the others. First, the deviation is consistent with smaller more fragmented populations strung along a harsh coastline with more restricted migration. The environment seems to be somewhat more difficult along the northern coast, and these populations were gone by European contact. One scenario is that the sub-samples that form the NEGL sample represent a mixture of Dorset- and Thule-derived populations, which would increase the observed phenotypic variance and the biological distance between the NEGL and the other Greenland quadrants, which are relatively homogenous. Second, the later Thule migration might have headed south along the coastline and skipped the northeastern coast altogether. There, intermixing occurred with the current Dorset occupants while they traversed south and eventually into the SWGL quadrant (**Map 7.2**). This could explain the divergence of the other Greenland samples from the NEGL sample, while increasing their similarity to the other Thule samples from the N Arctic and Nunavut.

Conclusions

One of the primary questions this research seeks to answer is the relationship of cultural and biological change. By examining the population affiliations among the broad range of Arctic samples with distinct material cultures, several conclusions can be made. First, the Ipiutak and Point Barrow samples from North Alaska, who possess distinct cultural and temporal associations, have specific affinities throughout the Arctic region that help explain historic migration patterns and ancestral relationships. Second, the Sadlermiut, associated with a distinct Dorset technology, are biologically similar to their contemporaneous Thule association neighbors, suggesting that differences in technology do not equate to differences in ancestry.

The Ipiutak appear to have a stronger affinity with W and NW Arctic samples than with other N Arctic or eastern Arctic populations, including the Tigara, found later at Point Hope. This supports the notion that the Ipiutak went inland and south, and played a substantive ancestral role in the W and NW Arctic populations.

The Birnirk at Point Barrow, apparent predecessor to the Thule, are convincingly ancestral to the Nunavut and Greenland Arctic populations and may have an ancestral role in the N Arctic Tigara and Kikewait populations and the NW Arctic Wales and Mitliktavik populations. There exists substantially higher observed phenotypic variance within the Point Barrow sample than predicted from the expected pattern. While this is difficult to explain, it shows close similarity to the Greenland and Nunavut samples and perhaps a subset of the Point Barrow population migrated into the Central Arctic (Nunavut) and Greenland, likely following aquatic food resources. This supports biological continuity between the Birnirk, Nunavut, and Greenland populations rather than solely diffusion of culture. This also supports the notion that these early Thule groups had an ancestral impact on the later Thule groups in the Northwest, North, and Northeast Arctic. The N Arctic Thule associated Tigara sample shows overlap with the Nunavut, NW Arctic, and Point Barrow samples, suggesting some degree of migration among them or recent common ancestral origins.

For the Greenland occupation, this research refutes earlier notions that Greenland was occupied in a strict ring pattern, with restricted gene flow along the eastern coast between the NEGL and SEGL populations (Laughlin and Jørgensen, 1956). Rather, there appears to be restricted admixture between the NEGL sample and all the other quadrants. This divergence of the NEGL sample from the other quadrant samples is likely due to a harsher environment, which limited contact and kept population sizes small, and perhaps restricted admixture from the incoming Thule. In addition, the similarity between the other three quadrants to each other suggests no justification for using them as discrete groups. There was likely consistent movement between these populations, and this swamped any differences among them. In addition, their similarity to the Tigara and other Thule groups suggests that they are a product of admixture from the later Thule spread.

However differences in group dynamics throughout the Arctic during the last 2000 years are defined, there is substantial temporal overlap of distinct groups with some form of interaction and the apparent maintenance of geographic boundaries based on access to resources and the cultural need for social boundary maintenance. In all likelihood, the Arctic possessed its own unique interaction sphere that worked to maintain some cultural boundaries, while breaking down others for sharing technology and allowing some amount of migration.

In conclusion, the utility of examining anthropological questions using a framework of morphological variation across time and space shows excellent potential for greater understanding of the modern human condition. History must be examined very carefully. Evidence for material culture change is not an indicator of population replacement, and this work suggests there is no evidence that major material culture transitions cannot be fully accounted for via a combination of migration and interaction. It is my hope that this work, and the methods employed, will improve the resolution for understanding human history as dating and cultural assessment becomes better established.

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APPENDICES

Appendix A: Measurement data from all samples used in research component 1. Samples (rows) are numbered 1-27 according to sample affiliation from Table 4.1 (repeated below), with traits (columns) 1-29 from Table 4.5 (repeated below).

From Table 4.1	
ID	**Sample**
1	Bethel
2	Dillingham
3	Holy Cross
4	Hooper Bay
5	Ipiutak (Point Hope)
6	Kagamil Island
7	Kamarvik
8	Kiklewait
9	Kuskoskwim
10	Labrador
11	Mitliktavik
12	NE Greenland
13	NW Greenland
14	Pastolik and Kwiguk
15	Pilot Station and Paimute
16	Point Barrow
17	Sadlermiut
18	Sarichef Island
19	SE Greenland
20	Siberia (Indian Point)
21	Silumiut
22	SW Greenland
23	Teller
24	Tigara (Point Hope)
25	Umnak Island
26	Unalaska Island
27	Wales

From Table 4.5	
ID	**Measurement**
1	Orale to Staphylion
2	Hormion to Basion
3	Basion to Opisthion
4	Opisthion to Lambda
5	Lambda to Bregma
6	Nasion to Bregma
7	Nasospinale to Nasion
8	Orale to Nasospinale
9	Nasion to Lambda
10	Orale to Basion
11	Basion to Bregma
12	EctomolareL to EctomolareR
13	FrontomOrbL to FrontomOrbR
14	ZygionL to ZygionR
15	AsterionL to AsterionR
16	ZygomaxillareL to ZygomaxillareR
17	PorionR to ZygomaxillareR
18	ZygomaxillareR to ZygoorbitaleR
19	FrontomOrbR to AsterionR
20	FrontomOrbR to ZygoorbitaleR
21	Bregma to PorionR
22	Lambda to AsterionR
23	FrontomOrbR to Bregma
24	PorionR to AsterionR
25	Staphylion to Hormion
26	AlareL to AlareR
27	Sphenoid8 to AlareR
28	DacryonL to DacryonR
29	Hormion to Nasion

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
1	49.9	33.2	35.4	90.9	104.4	106.0	50.2	16.6	162.8	98.3	129.7	63.7	104.9	132.9	106.8
1	44.9	33.8	36.5	92.1	102.4	112.9	53.4	20.7	169.3	89.2	129.5	63.8	95.2	131.4	120.4
1	51.0	32.8	37.9	96.0	111.9	106.7	50.6	21.0	171.0	98.7	125.8	63.2	102.0	134.3	110.7
1	37.8	32.6	36.9	91.7	113.3	101.9	52.5	8.5	166.4	88.4	135.2	63.0	102.5	134.4	107.4
1	48.6	29.7	36.8	100.5	105.5	108.4	55.4	19.5	166.8	91.8	129.0	62.8	102.9	130.1	111.3
1	55.9	27.6	38.5	96.3	107.7	109.4	51.8	23.4	168.8	95.3	132.2	58.5	96.2	132.6	105.1
1	46.2	34.8	40.9	89.6	107.3	106.9	51.1	20.3	169.1	94.0	128.7	58.8	93.3	129.3	102.9
1	45.5	32.4	36.6	95.8	112.6	107.2	52.3	11.9	167.6	96.5	134.5	50.6	96.7	130.4	111.1
1	51.3	32.4	38.2	104.0	95.2	108.9	54.6	11.1	166.7	96.5	132.5	60.4	100.0	131.6	108.0
1	54.9	35.3	34.8	96.3	107.7	111.8	58.5	22.5	170.4	105.1	138.2	69.0	104.5	136.1	105.6
1	51.9	32.6	39.6	89.9	109.8	101.4	54.1	17.4	170.7	100.1	123.5	59.1	100.9	134.5	106.1
1	55.3	35.1	36.8	98.8	104.7	109.0	51.6	20.1	170.2	107.9	131.9	67.0	100.2	132.3	110.9
1	52.2	33.6	41.6	83.0	105.5	113.3	52.4	21.4	164.0	101.1	131.0	62.3	99.6	133.7	102.4
1	48.5	30.6	36.5	104.7	112.2	105.4	52.9	14.3	170.3	90.1	135.6	58.0	100.1	129.3	111.0
1	45.7	30.5	37.7	98.5	105.8	112.4	53.4	23.0	169.0	92.8	130.1	64.7	98.0	133.9	112.1
1	49.1	28.5	43.8	98.1	103.6	115.5	55.5	21.0	170.3	93.1	126.5	62.8	97.4	131.1	108.7
1	45.5	29.3	33.5	88.6	110.2	107.7	53.7	11.9	168.4	89.8	132.3	59.7	93.0	133.3	104.2
1	50.2	30.6	35.8	90.7	105.4	112.7	58.7	13.5	173.0	96.8	128.5	67.6	105.7	142.8	109.9
1	45.7	29.6	35.4	92.4	103.7	106.9	52.7	16.6	166.8	88.8	135.1	66.9	93.5	139.3	108.8
1	42.3	28.9	38.7	87.4	118.7	110.7	49.0	19.3	174.3	89.7	134.7	63.0	96.1	138.3	111.6
1	48.1	30.2	32.3	93.7	97.8	108.2	53.3	20.0	168.4	100.7	126.1	64.1	98.7	143.6	104.6
1	38.5	28.6	32.6	86.4	106.6	115.0	53.8	8.2	165.0	84.1	134.8	53.9	96.3	138.8	106.9
1	45.0	28.3	36.4	93.6	112.1	110.4	51.7	14.3	174.4	91.4	128.1	58.4	96.4	137.1	116.9
1	49.0	29.1	33.0	90.9	103.7	111.6	47.8	21.1	174.1	96.0	126.5	57.8	102.4	134.6	107.6
1	44.0	29.9	36.6	89.5	102.4	106.8	59.5	13.6	170.0	92.6	132.3	65.4	99.0	142.5	112.0
1	47.5	30.6	38.9	93.9	108.2	113.4	55.8	19.6	174.9	96.2	137.1	59.4	94.5	130.5	107.2

Appendix A (continued)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	45.7	27.1	35.3	94.6	111.8	111.8	59.3	20.8	175.2	93.9	131.7	62.8	101.1	142.4	109.6
1	47.2	28.4	33.1	99.8	107.9	109.3	48.8	16.6	169.4	94.7	129.4	58.9	93.1	126.3	107.5
1	46.4	31.6	39.3	89.5	97.5	110.2	53.0	14.6	165.1	97.1	134.6	64.1	99.5	143.0	106.6
1	47.7	30.7	39.5	101.2	101.7	111.1	58.3	19.9	177.8	103.7	137.3	65.7	97.7	136.0	111.9
1	47.3	29.1	34.7	94.7	117.4	112.7	50.7	19.9	174.3	92.5	134.6	58.8	97.8	129.1	105.8
1	48.7	30.4	36.0	107.3	104.8	114.1	55.9	16.8	179.2	96.5	131.2	65.2	95.8	134.8	109.8
1	51.2	27.6	38.5	94.8	119.6	111.8	51.0	23.2	176.7	102.7	140.0	63.0	99.1	138.7	110.0
1	44.4	31.5	39.6	101.5	103.9	110.5	53.8	20.1	175.3	99.2	134.9	60.3	96.3	137.8	99.8
1	44.6	30.9	40.6	84.9	104.8	106.0	53.6	9.0	169.3	97.2	132.6	52.4	99.2	133.5	102.9
1	48.7	29.2	36.3	97.1	108.2	112.9	53.6	22.6	171.3	94.9	138.3	60.8	96.2	134.8	105.6
1	45.8	31.4	36.3	102.7	104.4	111.6	56.0	15.1	176.2	97.3	135.6	65.5	101.3	146.7	117.1
2	45.2	35.6	37.6	104.0	101.2	105.8	51.3	20.6	163.6	93.5	131.3	62.1	93.9	123.1	99.9
2	47.9	32.1	40.4	92.9	99.2	109.1	55.3	19.8	166.8	95.4	126.2	65.9	93.7	127.1	109.1
2	48.5	27.0	37.9	87.8	108.0	100.2	53.5	25.7	160.6	91.9	127.6	61.9	98.9	135.4	105.6
2	43.3	32.2	38.8	98.0	106.9	108.8	52.1	14.8	173.6	94.4	133.4	54.6	103.1	131.4	110.6
2	49.0	31.7	34.4	98.8	111.9	113.9	55.4	20.6	172.3	93.9	133.7	65.1	93.4	139.5	110.1
2	49.9	31.2	40.2	92.7	112.6	107.4	50.5	22.2	167.2	98.6	132.6	57.1	96.1	128.2	107.7
2	54.6	32.3	35.2	107.4	92.3	104.7	49.5	21.0	159.3	99.1	128.4	60.8	92.5	131.1	109.6
2	45.1	30.9	37.0	97.0	108.5	106.8	53.4	18.6	163.7	91.6	135.6	64.4	96.2	133.8	118.6
2	49.8	27.8	40.3	92.8	111.7	110.9	52.4	22.6	174.9	94.1	127.4	62.6	97.3	129.3	113.2
2	46.0	32.9	39.9	89.3	95.6	108.7	47.7	17.9	158.8	94.7	124.7	48.5	97.4	125.1	105.1
2	43.9	25.0	37.6	95.9	100.7	107.5	51.4	16.9	165.2	89.8	128.8	60.0	93.6	126.1	117.6
2	54.5	34.4	36.8	96.7	95.1	108.4	53.9	19.5	161.9	102.8	129.8	62.8	96.7	126.3	99.9
2	49.8	32.2	37.0	97.1	108.9	107.7	55.5	23.3	171.8	95.0	126.4	59.1	95.4	132.0	108.3
2	50.3	28.8	32.7	89.6	103.8	106.0	51.7	20.1	157.6	90.1	126.3	56.1	92.3	118.9	103.2
2	48.3	35.6	34.5	89.7	106.3	113.7	53.4	22.0	168.1	98.9	132.9	63.2	98.4	130.0	100.5
2	55.2	34.5	37.4	96.4	109.1	114.1	58.9	16.6	174.8	100.9	135.2	64.2	100.0	133.9	108.7
2	52.3	32.3	37.8	95.9	105.1	111.4	57.5	23.3	166.6	96.6	135.9	65.2	95.2	137.1	107.1
2	43.7	32.2	36.4	92.5	109.5	104.5	55.8	14.4	163.5	88.5	132.0	57.4	91.2	126.3	115.1
2	52.4	34.8	39.5	90.5	108.2	106.7	49.5	24.7	165.6	99.3	135.4	63.6	98.9	132.0	109.9
2	44.0	34.0	34.2	96.8	117.9	106.8	53.0	16.7	169.6	87.4	131.1	61.3	94.1	126.0	108.9
2	52.9	32.1	39.6	96.8	107.9	106.9	55.3	18.3	171.0	93.2	128.5	61.0	95.0	126.9	112.6
2	47.9	34.5	40.7	90.5	99.7	110.1	54.2	21.9	160.9	97.4	130.4	63.5	96.0	129.1	105.7
2	48.8	31.0	37.1	92.9	106.5	112.6	51.0	18.6	163.0	92.6	138.9	60.9	98.1	131.3	107.3
2	53.6	31.8	34.2	96.7	114.2	114.8	58.7	25.6	179.0	99.1	144.9	62.5	107.5	141.1	113.6
2	46.1	26.7	31.4	100.5	93.5	111.0	54.8	19.8	171.3	95.0	125.9	59.2	96.2	133.4	111.3
2	53.4	32.4	35.6	89.1	99.4	113.0	56.0	20.5	166.3	97.3	133.4	64.0	97.4	133.5	103.8
2	46.1	27.6	31.9	88.4	102.7	103.0	48.7	21.7	167.0	90.9	125.5	61.4	98.2	136.5	106.4
2	48.0	29.4	31.0	98.9	100.9	113.1	51.4	13.8	169.8	89.4	131.7	60.5	89.3	131.1	106.5
2	47.6	27.7	34.1	91.6	109.0	102.9	51.0	14.1	167.7	93.8	132.6	63.7	98.9	131.2	106.0
2	47.4	29.7	34.2	89.3	102.0	103.0	50.8	17.3	159.2	89.9	131.9	57.1	93.9	128.4	104.9
2	45.8	27.5	34.0	86.1	105.6	106.3	53.2	12.7	165.8	91.8	129.8	52.4	99.0	133.7	97.4
2	50.3	28.6	33.9	94.8	107.6	111.2	54.3	24.0	169.9	97.1	137.3	65.0	101.5	142.3	114.3
2	49.1	25.6	34.7	104.7	112.9	107.3	56.4	15.3	174.6	95.7	135.2	65.8	100.2	142.7	112.3
2	45.8	31.2	34.2	99.1	114.1	115.2	53.7	12.4	180.3	98.5	143.2	61.4	103.0	140.2	109.7
2	49.3	32.9	33.0	95.2	105.0	110.7	53.3	24.1	167.7	99.0	136.7	59.9	101.6	136.9	113.0
2	50.5	31.3	31.8	94.6	93.9	115.0	60.3	14.5	171.1	101.9	130.3	65.0	99.8	142.7	107.5
2	39.3	31.9	33.7	93.1	106.4	111.4	50.8	18.2	170.5	93.1	129.9	62.0	97.5	139.1	109.2
2	42.6	28.7	37.0	91.7	102.3	112.4	54.3	15.9	172.0	88.0	125.6	62.0	100.1	129.2	105.8
2	50.0	29.6	32.2	85.4	107.5	93.7	57.7	11.8	161.4	103.4	128.7	69.0	96.6	137.2	109.9
2	41.1	24.9	32.5	88.9	96.3	112.6	57.8	18.2	165.5	85.1	124.5	61.0	92.4	132.3	110.6
3	55.3	30.5	40.7	96.8	103.5	111.4	56.8	26.2	170.8	105.5	138.5	68.1	100.0	138.3	109.0
3	48.9	29.1	37.9	93.2	104.3	109.0	48.5	21.3	162.2	94.7	127.5	58.5	95.5	129.5	106.7
3	51.6	33.5	38.3	112.9	101.2	106.9	51.3	24.3	171.2	99.3	134.3	62.4	96.8	128.0	106.6
3	48.6	30.0	41.3	87.3	112.0	100.9	52.4	18.3	164.0	95.9	133.4	59.7	94.3	125.1	106.1
3	50.7	32.1	34.6	107.7	110.6	112.1	49.2	23.2	171.8	97.3	132.8	62.8	91.9	119.7	108.1
3	53.9	29.0	32.4	89.9	106.6	102.3	48.9	21.2	158.6	94.6	128.5	56.4	92.5	116.1	105.1
3	51.7	32.9	38.7	97.7	109.1	113.6	56.8	20.3	172.6	98.4	137.1	60.5	96.6	129.9	109.7
3	47.5	35.0	33.2	93.8	114.1	110.0	51.0	17.5	171.4	100.0	137.0	65.9	98.5	128.7	105.7
3	53.6	37.6	37.0	102.9	120.5	115.7	49.1	19.6	177.4	103.5	143.6	62.6	99.3	132.8	108.6
3	50.6	29.2	39.3	91.0	104.0	110.7	52.7	24.7	162.1	92.1	124.1	58.9	93.1	127.1	102.7
3	52.3	36.5	37.9	82.3	102.0	111.3	50.7	24.1	166.0	100.3	125.7	63.9	100.4	124.1	103.8
3	52.7	31.7	36.5	92.4	112.0	115.6	55.5	24.5	170.3	100.9	132.7	63.3	98.3	129.1	106.4
3	50.8	30.0	37.9	89.6	113.1	112.3	52.4	21.5	170.1	94.0	138.5	63.7	100.0	136.5	100.6
3	54.2	33.6	36.4	101.5	113.2	118.3	50.9	21.7	176.1	95.4	138.0	65.9	101.3	134.8	113.9
3	51.0	29.9	37.2	94.9	114.1	115.0	56.3	27.4	172.8	90.6	133.9	67.7	97.5	129.8	106.1
3	53.9	36.5	40.2	104.5	104.6	111.8	55.7	23.2	176.1	98.4	136.5	66.6	105.5	130.7	107.4
3	54.9	32.3	40.3	95.1	107.0	105.8	57.7	28.4	169.8	98.2	129.2	62.2	100.7	132.6	104.3
3	53.4	29.7	34.0	97.9	97.9	103.1	56.6	27.8	165.3	90.8	126.9	66.5	97.1	129.8	107.4
3	51.3	37.3	39.4	108.4	108.9	119.0	52.6	18.3	178.2	96.5	144.3	65.0	102.6	129.6	109.5
3	43.3	29.4	39.1	86.6	112.9	114.8	52.9	18.6	169.8	90.0	133.1	64.2	97.4	131.3	102.9
3	53.5	34.0	39.0	86.7	113.7	107.7	51.2	21.3	166.4	101.1	138.9	73.9	98.3	132.7	105.2
3	47.4	28.8	37.3	91.8	95.3	106.2	52.7	17.2	161.6	95.8	121.6	62.2	90.9	124.0	108.2

Appendix A (continued)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
3	54.7	32.4	34.6	97.4	116.0	116.6	52.9	20.3	179.0	101.7	136.4	67.1	99.2	129.9	112.6
3	53.9	29.7	37.6	97.9	105.2	112.4	54.6	24.1	169.5	95.6	129.8	65.1	98.9	131.4	105.1
3	53.4	27.4	37.4	93.5	108.4	110.0	57.3	20.1	171.5	99.7	131.9	62.9	94.2	139.6	110.5
3	45.2	29.4	32.2	93.9	112.2	107.6	50.1	14.1	174.0	89.3	133.0	65.1	96.5	138.9	105.5
3	49.9	28.7	36.6	103.8	111.0	110.2	55.2	17.9	175.4	98.2	138.1	62.1	95.2	131.1	108.5
3	49.2	33.9	32.6	96.9	107.2	110.6	54.6	16.9	171.7	97.4	138.6	70.0	95.2	128.5	107.8
3	46.2	23.5	36.2	95.6	104.8	109.3	52.8	19.3	165.6	91.0	129.9	59.8	95.0	134.9	108.7
3	47.4	32.6	37.8	89.2	111.9	110.7	49.8	17.9	171.2	90.6	130.7	70.0	95.9	139.2	115.1
3	50.7	32.7	31.5	101.5	113.3	112.2	56.9	17.7	172.7	98.8	141.4	70.1	100.7	143.6	119.9
3	53.2	30.7	32.5	104.0	114.7	119.8	55.4	19.8	186.6	99.1	135.9	62.5	102.8	133.9	107.4
3	47.8	30.6	34.8	91.8	108.6	116.6	53.8	17.2	174.0	97.8	131.8	63.0	97.0	130.7	107.3
3	46.0	33.9	37.5	96.1	114.0	122.9	54.5	18.0	179.1	94.7	145.5	63.5	99.3	134.9	108.9
3	48.8	31.0	37.3	93.3	106.4	107.7	59.5	17.2	172.0	99.7	135.3	61.2	94.1	131.6	111.3
3	49.1	31.4	32.6	107.2	103.2	110.9	53.1	19.8	172.6	98.9	134.0	61.9	102.2	130.8	107.0
3	50.5	32.5	35.2	91.8	107.1	107.6	55.7	16.7	169.0	102.1	133.2	67.1	94.3	136.4	111.5
3	46.5	31.8	35.6	100.4	113.4	115.9	54.5	25.8	177.4	100.8	142.0	65.9	98.2	139.4	113.8
3	42.1	30.4	36.4	87.4	101.5	106.9	50.4	14.9	163.4	95.9	118.4	58.0	95.1	130.8	104.1
3	44.6	31.2	35.4	93.6	108.0	115.6	55.1	17.4	174.2	94.1	136.6	61.1	101.2	139.5	106.5
3	43.6	27.4	33.5	93.5	100.0	112.3	49.8	18.2	162.0	93.5	131.9	57.7	96.7	126.3	102.8
3	48.6	29.9	36.3	99.6	113.7	109.7	54.4	24.3	176.3	92.4	139.7	62.9	100.9	139.5	108.8
4	46.1	34.0	38.4	95.9	111.5	110.2	50.1	7.6	173.5	95.0	137.2	56.8	102.3	131.7	106.7
4	40.4	35.7	41.4	92.6	107.4	105.8	54.9	20.8	166.2	86.9	136.4	64.9	93.0	131.9	109.3
4	55.5	36.2	40.6	97.4	110.7	113.1	51.8	22.7	174.5	108.5	135.1	64.4	98.3	132.1	109.0
4	44.6	37.1	35.6	90.4	111.3	108.1	53.4	17.0	167.8	92.3	130.4	58.6	97.6	136.4	115.1
4	51.8	29.7	40.6	113.4	110.3	110.1	52.9	25.0	178.8	94.5	131.8	66.9	102.0	134.4	115.7
4	50.9	32.0	40.0	94.3	103.4	106.4	53.3	15.6	170.5	93.6	125.9	53.6	103.3	140.2	114.3
4	49.7	35.0	45.3	85.4	107.7	107.1	49.2	19.0	165.6	97.8	127.7	62.7	98.3	130.7	103.8
4	50.8	34.6	32.7	89.2	108.1	113.0	53.9	20.3	172.7	96.8	127.4	66.1	95.2	133.9	108.1
4	48.2	27.3	38.1	93.2	100.8	115.9	55.8	16.4	170.7	94.2	133.9	62.7	101.1	138.3	108.9
4	48.4	32.1	36.9	100.1	107.2	120.8	55.7	16.5	176.3	97.5	142.8	60.6	101.0	136.2	119.5
4	43.0	32.4	38.8	98.9	106.4	122.2	54.4	15.2	179.3	93.2	139.6	62.1	103.6	142.5	116.5
4	47.8	28.0	38.1	97.0	101.2	105.3	53.6	18.9	172.5	96.4	128.2	57.6	96.3	139.6	117.2
4	47.8	28.6	33.6	92.9	108.1	111.3	56.5	21.6	172.3	97.0	135.3	61.9	95.2	138.1	106.3
4	47.9	29.0	35.3	97.4	104.7	110.2	50.0	19.4	168.5	95.5	138.6	61.5	92.9	136.6	106.4
4	47.9	32.2	37.6	92.0	103.4	114.5	55.8	20.8	172.8	97.8	138.6	68.3	98.1	139.6	110.1
4	40.6	29.7	34.0	100.9	116.1	105.0	54.7	10.3	180.6	90.1	136.4	56.4	93.0	137.3	110.8
4	50.1	29.9	33.9	95.1	113.7	114.3	56.7	18.9	179.5	99.0	134.4	64.4	98.3	141.5	111.5
4	45.6	31.3	33.9	98.4	105.4	110.0	54.7	18.1	169.0	94.9	135.4	61.4	95.8	140.0	117.6
4	50.5	30.9	33.2	93.9	100.9	105.6	59.7	19.1	170.2	97.6	133.8	65.4	97.4	141.1	104.8
4	49.9	28.9	36.2	96.3	104.3	104.7	53.5	16.3	171.0	101.8	128.9	61.5	100.9	143.6	112.5
4	44.6	29.9	32.1	85.2	102.9	106.6	52.5	16.3	163.0	87.9	129.4	66.4	92.8	143.5	107.7
4	49.2	32.4	32.8	88.5	113.2	105.4	55.4	18.3	165.2	102.6	138.3	61.4	95.6	135.2	106.6
4	48.5	30.1	36.3	100.0	100.4	111.5	57.1	15.0	167.0	95.8	134.7	66.4	96.7	140.1	110.7
4	44.5	27.1	36.6	91.6	111.2	107.3	61.9	18.4	169.3	96.0	134.9	64.7	97.1	147.9	112.5
4	49.0	29.3	34.7	94.4	117.2	110.6	58.4	19.8	178.4	96.1	134.5	61.9	97.6	131.7	111.5
5	49.5	35.7	38.4	108.0	101.3	114.1	53.7	18.1	172.7	94.7	136.3	65.7	99.8	138.7	119.3
5	52.4	29.4	44.1	114.7	107.7	107.5	56.8	20.1	171.1	100.6	136.8	67.0	96.3	135.9	115.8
5	49.6	31.0	33.9	98.1	101.4	109.0	48.0	11.8	166.5	88.1	128.2	59.6	94.7	129.6	99.1
5	46.8	28.3	37.8	93.8	112.4	110.1	52.4	17.6	170.8	89.7	127.7	67.1	95.7	128.5	109.3
5	48.5	30.1	38.3	100.3	119.9	115.3	53.7	21.4	180.2	91.7	137.9	65.5	93.9	125.4	107.3
5	44.5	37.6	45.3	94.4	106.9	109.7	53.4	20.8	172.1	90.6	134.5	60.2	97.5	130.9	116.8
5	52.8	37.0	41.3	95.1	119.7	111.9	59.6	26.1	179.9	98.1	138.1	70.8	96.9	138.6	114.5
5	46.2	32.8	34.5	83.4	108.2	101.6	49.5	20.6	159.8	89.9	122.8	62.6	89.0	125.7	101.5
5	49.5	33.5	37.3	89.4	116.5	108.6	56.7	24.8	176.4	95.0	130.6	65.6	100.1	137.9	111.8
5	56.1	34.9	40.0	95.3	112.4	109.2	54.6	26.1	173.3	102.4	132.3	71.2	103.6	136.0	110.0
5	50.2	33.0	39.0	94.9	115.8	106.7	58.2	25.3	171.9	97.0	132.5	66.5	99.5	130.0	112.9
5	51.0	33.4	36.8	93.8	111.5	113.1	53.5	22.8	174.6	99.0	136.0	66.9	98.6	140.0	110.7
5	52.6	33.9	41.5	97.1	107.9	109.0	53.4	22.5	172.8	97.1	128.7	60.3	106.2	140.5	116.7
5	60.4	35.2	40.7	108.7	114.8	121.6	60.2	33.4	179.3	105.2	145.1	72.8	103.8	140.9	117.2
5	45.7	28.6	31.4	95.6	105.4	102.6	50.1	15.6	166.5	87.5	121.7	59.0	96.6	124.5	100.9
5	49.8	34.5	36.8	99.5	109.7	109.0	54.9	23.0	172.2	95.6	133.4	67.1	101.2	129.7	112.5
5	51.0	35.3	36.6	90.8	106.9	110.7	58.2	21.3	166.2	99.4	136.0	68.7	97.8	136.1	107.1
5	43.7	34.6	38.7	94.6	110.2	110.6	52.2	17.1	170.7	90.2	133.8	65.3	94.0	135.4	113.7
5	45.5	30.0	36.3	96.7	106.7	107.9	54.2	21.8	164.4	85.2	127.9	66.4	92.2	131.9	112.9
5	43.6	35.2	37.6	96.6	118.8	110.9	49.7	15.8	178.6	91.1	130.6	60.6	94.2	125.8	108.7
5	47.1	28.9	38.7	104.4	99.0	101.9	51.5	15.7	166.4	93.2	118.8	65.2	92.7	122.3	105.9
5	40.9	28.0	36.3	96.9	103.5	107.4	47.8	13.6	163.2	81.2	129.7	57.2	90.1	125.1	106.0
5	44.7	33.3	36.2	92.4	103.6	108.2	50.7	11.6	164.4	93.0	127.9	59.7	93.3	123.1	105.0
5	46.1	33.0	36.1	97.8	105.5	113.5	55.4	12.3	171.0	88.9	133.7	65.4	98.5	135.3	109.8
5	49.9	27.9	39.1	99.6	97.0	111.8	55.3	21.7	169.5	92.6	127.7	63.9	96.1	134.6	111.1
5	52.0	32.0	35.4	91.5	103.7	111.6	55.1	15.9	170.7	96.2	127.1	61.5	100.0	139.1	105.5
5	52.6	33.4	34.6	100.0	110.9	114.6	57.0	22.3	177.2	99.2	130.9	64.7	103.0	133.3	113.3
5	44.5	29.6	34.7	93.9	97.9	113.2	53.5	21.4	168.6	81.7	125.6	53.3	94.3	125.9	103.3

Appendix A (continued)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
5	48.1	34.9	39.6	101.2	106.6	110.9	54.3	25.1	170.0	95.1	133.2	68.6	94.0	122.4	105.8
5	51.0	34.5	37.2	102.0	101.1	109.5	55.9	17.2	172.0	97.8	137.4	52.8	96.6	143.0	107.1
5	46.6	31.8	33.6	89.4	106.3	110.8	57.7	19.2	172.3	94.9	132.7	64.7	96.5	131.6	104.7
5	53.0	30.7	33.4	96.8	116.1	110.3	54.7	24.3	177.7	98.0	132.7	66.7	97.7	138.6	109.4
5	53.9	31.4	33.7	94.4	118.5	113.5	53.1	22.7	181.6	99.2	128.2	65.0	104.1	144.0	114.2
5	49.0	32.1	34.1	92.0	103.2	99.8	52.5	19.5	167.7	100.5	123.8	66.0	101.2	135.1	99.4
5	49.4	30.3	34.5	89.6	105.8	111.3	55.1	19.3	173.0	96.3	133.4	57.5	96.1	137.0	108.6
5	47.5	28.4	34.9	95.4	107.8	111.4	58.4	19.8	176.9	93.0	129.3	68.4	98.4	133.0	107.8
5	48.4	28.0	35.5	93.6	113.9	111.2	54.5	19.6	173.7	93.8	134.3	67.1	95.7	129.4	107.2
5	44.7	30.5	36.1	91.8	105.7	116.0	52.1	15.9	175.4	91.0	131.3	55.2	90.9	134.5	108.5
5	51.1	30.9	36.8	90.0	105.7	116.7	58.4	20.3	174.0	103.2	139.4	76.1	103.2	143.7	109.6
5	46.1	30.6	38.1	97.4	105.7	110.9	47.1	21.7	170.3	95.3	128.5	53.9	95.4	129.4	112.6
5	49.0	27.6	36.9	90.5	106.9	113.1	55.9	15.6	170.5	94.0	135.0	64.4	100.3	131.4	98.7
5	43.1	26.5	36.6	95.1	114.0	112.8	46.5	16.9	171.5	88.4	137.6	61.9	99.9	139.1	108.1
5	47.3	28.8	30.9	94.7	120.4	111.6	50.6	24.3	184.8	96.6	130.3	60.1	94.8	132.5	108.2
5	46.9	28.7	34.3	102.9	97.0	106.5	52.5	17.7	168.1	88.9	130.1	64.6	96.6	135.9	110.1
5	42.3	33.2	32.8	99.3	108.3	106.0	54.8	15.8	168.1	90.8	135.0	60.2	103.2	139.5	102.5
5	52.1	32.2	31.3	95.6	109.0	110.8	58.8	19.0	172.6	101.9	135.3	63.6	102.7	138.6	106.7
5	44.2	29.1	35.8	91.6	112.4	109.4	52.9	19.0	171.4	87.6	135.2	59.4	101.1	139.7	107.3
5	46.4	28.7	29.1	86.6	119.8	108.8	56.2	17.9	172.1	90.3	129.1	65.6	99.4	134.6	102.1
5	48.5	27.4	39.7	99.1	106.1	108.2	59.5	16.9	172.8	92.9	128.3	66.0	97.7	139.0	111.0
5	47.7	30.5	34.9	92.2	101.8	111.2	48.7	20.1	170.0	94.0	125.6	64.2	95.8	133.7	102.2
5	50.5	33.1	33.4	90.0	107.2	112.7	53.0	15.4	174.4	100.0	132.2	65.0	101.6	137.5	108.9
5	44.7	23.5	40.5	97.2	108.5	117.9	55.9	17.7	175.2	89.2	132.2	66.6	104.8	151.7	110.7
5	56.7	33.5	32.6	95.9	114.4	113.9	48.8	21.4	176.3	105.4	136.0	63.1	98.3	140.7	103.1
5	47.8	29.8	35.7	109.4	103.0	117.1	55.4	18.3	180.6	92.1	139.0	61.6	100.7	142.9	106.5
6	51.9	33.8	37.1	105.5	95.2	113.6	52.2	27.8	175.0	100.2	124.8	61.9	95.3	142.0	120.6
6	55.9	27.5	32.0	110.7	92.9	106.1	50.0	22.4	166.6	104.6	124.0	70.4	103.8	137.3	110.0
6	54.0	33.0	37.6	108.7	100.2	110.1	50.5	21.5	171.3	107.3	125.6	69.5	104.0	142.5	125.4
6	51.5	35.0	33.9	103.4	103.6	118.6	54.0	22.2	177.8	102.6	133.6	66.1	104.3	134.5	112.1
6	50.5	35.4	39.0	100.8	114.6	112.6	50.9	18.9	179.7	107.8	132.9	66.6	101.1	140.0	118.8
6	50.8	36.3	40.0	92.9	115.7	110.3	48.5	19.1	177.4	101.9	126.8	65.3	100.9	140.6	113.7
6	49.2	29.7	37.6	104.2	97.7	111.7	50.2	21.4	168.4	92.7	127.8	60.9	93.5	123.1	119.9
6	51.2	37.5	39.8	92.6	104.7	106.0	55.4	26.0	170.3	99.4	125.5	64.9	95.5	131.7	109.3
6	53.1	30.9	40.0	91.9	102.6	111.0	54.2	22.2	169.0	97.2	125.9	64.0	96.8	130.2	109.9
6	44.0	31.2	34.8	91.8	110.8	107.2	55.3	14.7	166.6	84.7	122.3	59.7	97.9	127.6	107.1
6	52.1	30.9	31.2	94.0	107.0	111.0	55.5	22.7	170.9	97.0	125.6	63.0	97.1	137.4	114.5
6	55.9	31.1	40.3	96.1	103.3	110.6	51.8	26.1	169.1	105.0	119.7	68.2	103.8	143.1	108.2
6	45.4	35.9	37.9	93.7	100.7	104.1	55.1	20.5	165.4	86.6	128.5	59.1	98.6	125.4	108.3
6	54.9	36.2	37.5	93.5	106.1	107.5	47.8	19.7	167.8	104.3	125.5	66.3	95.8	132.6	112.3
6	49.4	33.5	36.9	96.5	113.1	106.1	53.1	22.4	174.5	97.0	129.6	62.8	100.0	137.1	111.6
6	55.6	34.3	37.7	94.9	100.8	108.3	51.3	24.6	167.2	105.3	120.2	65.8	99.0	134.4	113.1
6	48.6	30.6	36.3	100.6	103.3	110.7	53.8	23.1	175.3	88.5	126.7	67.1	99.7	138.6	111.1
6	52.2	35.0	35.6	93.5	99.7	105.0	54.0	21.9	161.8	105.1	119.4	66.1	96.7	132.9	115.4
6	50.2	30.8	37.6	89.0	114.3	104.5	49.1	23.0	168.2	91.3	126.9	56.6	96.3	135.3	112.6
6	50.5	28.7	42.8	100.0	111.1	113.5	49.7	20.5	173.6	96.5	128.0	57.2	95.2	131.3	111.5
6	56.9	33.0	38.1	96.9	99.6	114.2	49.5	24.0	172.5	106.5	124.2	64.9	94.2	137.3	116.0
6	51.6	32.0	33.7	94.6	116.0	110.1	50.9	24.2	179.9	99.2	122.1	59.6	99.3	142.0	116.2
6	51.7	29.8	37.4	106.8	97.8	113.5	53.7	22.6	170.2	94.4	126.3	62.8	95.9	135.7	111.7
6	50.9	35.2	34.0	91.8	105.9	114.1	51.6	21.5	168.6	98.6	128.3	66.6	95.5	135.8	118.1
6	48.1	31.6	38.5	107.7	100.6	115.7	53.1	17.7	176.7	99.1	130.1	62.8	97.5	138.3	118.8
6	52.3	31.0	34.8	107.7	91.5	103.8	52.8	23.1	165.9	100.8	121.7	62.7	101.3	144.4	120.3
6	48.7	27.2	39.9	87.1	112.1	107.3	53.9	20.8	171.3	87.3	126.6	60.1	93.8	130.2	105.5
6	51.3	31.6	35.1	88.5	103.1	106.2	49.3	23.5	164.9	99.2	123.2	60.2	96.1	130.9	110.2
6	48.5	30.6	39.5	93.9	99.4	113.1	53.0	21.0	163.5	95.8	128.1	61.7	102.8	144.0	118.2
6	49.0	26.4	33.4	99.4	95.7	102.0	53.0	17.4	162.2	95.3	119.9	59.7	98.3	137.7	112.0
6	49.2	29.5	33.1	94.7	96.4	109.0	56.3	14.1	162.8	99.4	133.8	63.8	103.6	148.1	107.5
6	50.9	25.9	34.4	92.6	102.2	115.2	55.8	23.7	170.2	91.6	129.0	58.4	99.5	139.9	114.3
6	50.0	29.9	34.6	97.1	101.0	106.4	48.8	24.1	176.9	98.7	121.4	62.8	97.6	144.4	117.5
6	56.8	29.7	38.4	107.9	94.0	113.8	54.4	22.1	176.5	111.3	131.6	61.0	100.6	147.2	109.2
6	55.2	23.9	34.9	84.3	102.6	109.0	53.7	21.9	169.3	106.7	120.2	62.0	99.6	150.3	113.1
6	50.0	30.3	29.0	91.9	105.0	112.9	52.0	17.3	172.6	104.4	123.7	67.4	102.4	148.4	115.8
6	48.7	27.5	38.1	95.6	99.2	112.8	57.1	20.1	172.3	100.3	127.8	69.4	98.0	146.0	124.6
6	52.8	32.0	37.1	105.9	89.1	108.2	50.5	20.0	169.9	103.3	125.3	65.1	94.8	141.8	118.4
6	50.6	34.7	34.6	97.8	100.8	111.5	54.0	14.8	168.2	105.0	134.9	54.9	104.1	140.2	107.4
6	48.9	31.8	34.4	97.1	109.9	119.7	53.9	22.2	182.0	99.9	130.8	70.1	95.1	137.2	114.8
6	45.7	30.5	34.9	81.3	104.1	112.0	54.5	16.8	171.4	102.9	119.0	63.9	101.1	144.0	113.9
6	52.1	27.2	35.8	97.4	106.0	114.2	57.8	17.0	171.0	101.6	135.8	65.4	103.5	145.8	119.0
6	51.8	29.4	33.4	101.3	104.2	109.8	50.4	21.7	174.3	102.1	127.6	60.2	94.4	139.9	114.7
6	53.1	25.7	37.9	96.3	106.4	113.1	49.4	22.2	176.3	105.8	131.3	66.3	99.0	147.1	117.1
6	50.5	31.2	34.3	93.5	98.8	117.4	50.5	23.0	175.9	99.4	123.2	60.5	99.1	133.2	118.1
6	45.3	33.9	31.9	92.6	97.0	110.4	53.5	16.7	170.5	97.0	128.0	62.6	99.8	139.1	113.3
6	47.4	26.5	31.7	94.2	103.1	110.8	52.5	19.9	167.2	89.9	126.2	60.9	95.1	141.1	107.4

Appendix A (continued)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
6	46.4	33.8	35.4	97.3	117.6	117.6	52.5	16.5	186.9	90.2	135.8	58.7	96.0	142.0	112.8
6	49.5	29.3	34.5	92.0	104.8	108.2	52.1	21.7	171.1	95.7	126.2	59.9	95.9	130.8	111.3
6	49.4	28.8	36.0	88.8	100.3	110.6	53.0	21.4	168.4	95.1	123.1	68.2	100.2	138.9	112.0
6	48.1	26.4	35.2	89.6	96.8	109.8	50.1	18.2	166.1	99.3	125.8	61.8	102.7	144.1	109.2
6	54.5	35.3	35.3	95.5	90.0	111.6	54.8	21.5	169.8	103.0	118.3	69.9	98.6	140.2	117.2
6	48.7	31.0	32.9	95.7	96.7	110.1	49.6	20.0	166.3	93.9	131.5	63.7	93.1	137.3	109.5
6	52.5	32.0	32.1	95.2	103.2	103.4	52.2	20.0	165.2	100.0	124.7	55.3	95.3	132.6	114.1
6	47.9	31.9	29.1	98.8	108.7	114.5	50.7	17.2	171.2	91.3	138.9	61.6	94.6	138.3	113.9
6	60.6	28.9	35.8	95.9	113.7	104.1	56.5	25.0	171.3	114.2	130.0	67.3	103.2	144.1	113.1
6	52.5	31.2	33.1	93.1	109.8	110.4	52.8	21.4	173.4	105.3	132.8	63.2	105.0	143.5	112.4
6	52.3	27.2	38.5	93.2	104.4	113.9	58.0	20.6	169.0	97.9	137.2	57.0	96.0	143.5	114.8
6	54.8	30.1	38.3	99.5	110.1	103.1	53.3	23.7	167.3	105.3	130.6	64.9	93.4	139.4	118.0
6	51.7	34.1	35.9	96.2	103.7	113.8	53.6	21.0	167.7	102.2	141.9	63.2	100.1	148.9	120.5
6	48.5	27.0	38.9	98.1	109.7	103.6	54.0	18.2	176.5	99.2	124.2	61.5	100.3	141.3	118.2
6	59.4	29.9	36.1	94.0	101.6	103.2	56.1	22.7	170.3	109.0	116.9	65.9	100.5	144.7	112.9
6	54.2	26.4	39.2	97.4	93.6	109.7	50.8	20.7	166.7	100.9	125.6	59.9	93.1	140.2	100.9
6	45.1	25.8	33.2	86.9	104.1	109.9	44.4	17.5	163.5	89.3	126.5	64.3	92.6	128.6	107.7
6	51.6	30.6	37.8	94.9	103.0	107.9	56.9	20.7	176.7	102.4	126.9	62.0	95.4	129.9	107.4
6	43.8	28.2	36.2	93.3	106.8	114.4	58.7	15.5	173.1	92.4	130.5	67.9	98.0	146.1	109.4
6	50.4	33.7	36.9	91.8	102.6	115.2	58.2	20.5	175.1	110.7	133.6	67.2	96.7	142.5	115.4
6	54.8	34.6	31.6	96.2	100.3	111.7	53.8	17.0	170.6	108.9	127.0	59.0	97.0	137.7	119.4
7	45.2	32.5	44.2	94.6	112.5	107.1	54.4	18.7	168.4	91.3	133.1	55.1	96.8	129.7	112.1
7	47.8	30.4	36.7	96.9	110.3	107.1	55.2	20.0	179.3	100.1	125.2	63.5	97.9	145.9	109.4
7	47.3	31.3	41.5	93.4	105.5	109.1	56.5	16.1	164.6	92.6	133.1	58.9	97.2	142.4	103.5
7	47.2	32.1	35.1	96.7	97.4	117.8	51.6	24.2	168.0	91.8	132.1	54.6	91.9	138.9	106.1
7	48.6	32.7	39.7	102.5	112.2	111.0	56.3	20.1	172.8	93.4	135.6	65.9	100.7	135.3	112.1
7	46.5	33.4	40.6	96.4	125.0	102.0	55.2	15.3	178.6	89.2	131.8	64.4	95.1	127.4	106.8
7	44.9	33.9	36.9	98.4	110.3	107.2	50.6	18.2	166.9	87.7	134.2	62.1	97.1	131.6	109.8
7	45.4	31.9	37.3	93.7	94.9	103.1	43.1	19.7	156.7	89.6	122.9	52.5	89.3	120.3	96.1
7	61.4	32.6	38.2	97.4	113.9	113.1	59.2	22.7	169.1	103.6	139.7	63.9	97.9	143.0	108.9
7	46.4	33.7	39.1	93.9	115.4	100.5	52.6	16.8	168.8	86.6	131.0	68.3	98.2	136.1	115.0
7	49.7	29.0	40.0	101.8	104.5	109.2	51.7	19.0	171.4	91.1	128.9	64.6	90.5	130.7	107.4
7	49.7	35.4	32.7	91.5	115.3	104.0	50.5	20.5	169.4	93.7	129.4	62.7	98.2	131.5	106.5
7	50.4	36.7	35.4	104.3	116.9	108.4	52.4	22.4	175.0	95.8	140.9	63.0	99.2	129.2	108.7
7	52.2	29.0	40.5	103.2	116.7	108.9	54.9	20.7	175.1	95.2	129.0	61.9	100.3	129.7	106.1
7	47.6	35.6	36.3	90.1	117.0	110.9	53.8	15.1	176.4	92.6	135.0	50.8	101.3	130.2	112.9
7	50.3	29.4	40.2	91.3	108.4	103.1	51.4	19.9	167.3	89.4	127.7	62.9	97.3	121.8	97.1
7	45.0	36.3	38.0	96.9	103.1	108.2	54.9	17.5	169.7	93.2	128.6	64.9	95.3	137.5	107.8
7	49.2	34.9	44.3	94.5	104.2	104.6	52.1	21.5	169.3	89.3	127.8	60.0	104.6	127.9	108.6
7	52.8	37.6	36.3	95.0	104.7	110.9	54.0	21.8	164.1	98.8	133.5	64.4	99.0	135.2	109.6
7	51.0	34.1	37.9	86.7	108.9	111.0	52.7	17.5	170.8	97.9	132.9	67.4	103.5	134.4	111.7
7	50.0	32.6	38.6	97.5	114.5	115.2	55.5	17.9	177.6	91.5	131.0	62.7	92.8	134.8	110.8
7	44.9	32.0	35.2	93.5	110.0	119.2	46.9	16.2	177.3	89.5	135.5	58.8	92.8	130.1	104.5
7	47.8	33.0	35.4	92.0	113.8	100.3	57.2	15.3	174.9	96.8	134.9	62.6	96.5	142.2	111.4
7	47.4	33.2	35.1	98.7	96.5	101.6	54.7	19.2	161.8	96.6	130.1	60.6	100.1	145.9	100.8
7	48.9	33.4	40.6	93.3	112.7	105.0	53.0	21.3	174.5	99.2	136.8	60.0	94.7	132.9	95.6
7	51.4	30.0	36.9	105.3	101.9	111.0	49.6	16.3	170.4	99.3	137.7	60.7	97.2	133.2	111.2
7	43.2	34.4	41.3	91.4	112.1	105.6	53.1	19.0	177.5	97.9	131.9	64.2	93.5	130.1	112.6
7	47.0	33.8	38.1	92.0	104.5	103.7	48.5	24.0	165.6	91.2	131.3	58.0	91.7	133.1	102.1
7	46.4	31.3	34.1	95.5	104.3	110.2	48.4	15.1	173.4	93.3	131.0	65.7	94.2	129.9	105.9
7	45.9	28.4	33.4	89.5	118.1	104.7	47.2	17.8	171.3	90.3	132.2	57.6	94.2	136.7	103.5
7	45.1	31.6	38.7	93.2	110.8	109.0	58.4	14.3	174.4	91.0	133.9	67.2	97.8	135.5	107.9
7	45.3	34.8	36.8	95.0	110.6	102.5	51.5	12.5	169.0	98.7	131.7	63.2	91.5	135.3	101.0
7	44.7	34.0	38.5	93.3	111.0	115.8	55.8	16.4	174.1	93.3	141.6	61.8	99.4	136.2	107.0
7	42.1	31.0	39.3	91.1	113.7	117.7	54.5	12.5	178.1	95.3	140.6	58.2	90.1	126.4	106.9
7	44.5	28.1	34.8	92.6	105.4	114.5	52.6	20.7	172.2	90.5	138.0	55.4	94.1	136.7	102.6
7	55.1	28.0	40.5	91.9	114.4	113.3	57.4	20.2	177.6	97.3	139.2	60.6	102.0	145.5	110.2
7	46.0	32.4	40.7	99.3	108.7	105.6	50.0	15.4	174.2	94.1	133.0	60.7	97.9	141.5	108.8
7	46.3	33.2	32.5	92.7	120.9	110.3	52.0	14.2	175.5	91.4	135.7	62.2	93.3	130.8	107.7
7	50.3	29.1	36.8	94.4	113.5	106.9	50.7	15.6	175.0	94.6	133.0	67.3	97.5	138.3	108.7
7	47.7	31.9	37.4	93.2	117.6	115.2	58.9	23.7	179.5	97.6	142.5	54.5	91.2	136.6	101.9
7	54.4	31.0	36.1	96.7	115.5	110.1	55.5	16.4	177.2	103.8	136.7	66.2	97.1	135.8	105.9
7	44.7	31.3	36.9	92.7	104.6	109.8	52.3	15.7	171.7	93.3	133.9	62.1	99.8	141.7	103.8
7	48.7	30.5	36.7	98.2	106.9	111.8	50.9	13.8	172.0	94.6	135.4	60.7	103.0	147.6	109.1
7	49.6	28.0	33.4	89.2	116.5	109.1	51.7	15.9	174.5	96.8	135.9	67.1	91.5	134.0	101.0
7	52.3	31.3	38.7	100.0	118.2	115.1	52.7	20.4	181.0	97.3	139.5	72.7	97.0	139.7	118.6
7	54.1	29.2	34.4	89.1	109.6	108.5	50.4	20.4	172.2	101.4	131.0	62.0	90.9	136.7	102.7
8	55.7	37.1	35.2	101.4	103.4	112.9	56.9	26.0	186.7	105.9	132.9	60.6	101.9	130.3	109.6
8	55.9	40.7	39.7	93.6	110.3	110.8	56.2	24.4	176.4	111.5	129.8	56.7	102.7	139.4	115.3
8	47.7	32.6	37.5	96.0	107.4	110.7	56.5	20.3	175.8	98.2	139.0	66.1	97.5	137.6	108.2
8	52.9	35.2	40.1	99.6	112.0	118.1	57.5	24.5	179.3	99.6	133.8	68.3	95.6	130.3	105.5
8	50.0	34.5	35.0	91.1	105.9	116.2	52.2	24.4	175.7	100.8	135.6	63.6	95.3	135.3	116.3
8	46.9	35.6	39.3	106.2	109.7	113.6	57.0	27.0	186.7	97.4	132.8	69.2	92.5	130.6	108.0

Appendix A (continued)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
8	47.9	38.8	38.2	102.5	109.7	111.2	53.4	19.0	179.0	103.8	141.1	64.4	98.5	136.4	107.1
8	44.7	35.3	39.9	101.6	122.6	111.2	54.5	16.2	186.3	92.6	134.4	53.9	100.5	132.3	113.6
8	52.7	34.5	37.3	94.9	108.7	118.5	53.2	21.9	179.9	98.3	130.8	64.8	99.1	128.1	109.5
8	55.6	39.8	38.0	101.3	107.7	110.5	59.2	25.0	179.2	106.5	138.6	67.4	101.1	139.4	116.5
8	44.9	32.7	37.3	99.2	103.5	108.7	51.1	18.0	171.8	89.1	126.1	47.9	96.2	133.9	113.8
8	55.0	34.1	36.1	102.7	104.4	106.4	57.2	21.8	171.2	100.5	131.4	66.8	100.2	129.7	116.1
8	53.3	36.4	43.5	97.5	104.8	106.2	56.2	20.1	173.3	102.3	129.3	60.9	98.4	138.2	117.1
8	51.6	38.7	41.3	101.4	116.2	110.4	60.7	22.6	179.2	92.7	141.4	63.4	94.0	135.4	113.5
8	47.9	35.7	47.4	91.5	110.2	109.7	55.9	23.2	173.0	92.2	131.1	66.2	105.4	147.6	118.2
8	47.2	36.5	39.7	113.3	109.3	111.2	53.1	10.9	176.4	90.0	138.1	62.9	101.7	134.3	112.1
8	48.5	33.3	39.3	94.1	113.1	105.2	54.6	16.2	169.6	90.7	127.9	59.2	96.3	128.0	111.1
8	50.9	33.1	40.1	97.1	106.0	109.8	57.0	17.7	170.0	96.0	124.4	60.1	98.3	125.5	107.7
8	46.2	27.6	38.3	91.9	110.0	101.4	51.2	20.0	163.8	89.2	118.2	55.4	95.9	127.6	102.8
8	50.4	41.0	42.4	99.7	112.8	113.6	56.3	17.4	179.3	103.8	133.2	67.4	102.5	139.6	112.0
8	57.6	43.2	40.0	98.5	115.0	116.2	55.7	21.2	182.1	103.9	137.3	62.3	96.3	135.0	106.5
8	47.6	32.0	41.0	100.7	119.4	105.0	54.0	23.8	175.2	96.7	129.3	59.8	93.9	126.8	107.0
8	57.8	37.3	39.1	95.0	100.3	110.7	57.1	26.3	166.8	103.1	131.3	63.9	96.0	132.3	112.3
8	56.1	37.1	36.4	105.9	113.1	115.4	58.1	26.8	179.0	105.6	137.3	69.2	106.0	134.5	110.6
8	48.3	37.8	39.8	101.3	109.0	116.2	60.7	25.2	179.0	99.0	134.9	63.8	102.4	130.7	109.8
8	45.2	33.8	37.4	92.1	115.1	114.4	56.1	20.2	178.8	95.0	124.5	58.0	93.3	128.7	109.0
8	50.7	32.3	40.2	100.7	111.1	113.7	51.6	16.3	176.4	97.9	137.3	54.5	101.3	137.0	100.7
8	51.7	31.6	36.6	94.4	111.9	108.1	54.6	17.4	177.1	100.5	136.3	67.6	98.0	136.3	109.6
8	57.3	37.5	38.1	98.0	112.0	115.2	56.0	23.4	186.1	108.3	134.0	59.6	97.9	134.7	110.5
8	51.2	33.3	40.6	92.5	106.5	111.3	50.1	14.6	176.9	102.2	134.9	63.1	104.7	143.1	111.7
8	55.4	32.1	32.0	108.3	95.9	110.0	52.0	18.8	175.0	103.2	140.6	56.4	100.6	138.8	116.3
8	50.9	36.6	40.1	102.2	128.9	103.3	51.8	15.2	180.4	101.3	146.0	66.7	104.1	139.2	111.6
8	48.8	30.4	36.9	90.1	115.5	100.5	57.0	15.0	173.0	99.4	131.6	57.8	102.9	152.2	105.2
8	47.5	34.3	35.7	91.7	110.3	110.9	55.6	15.2	178.3	99.9	133.5	63.2	97.9	144.1	108.6
8	48.5	27.7	43.6	87.1	105.5	114.7	53.9	14.8	172.2	91.9	132.5	59.6	95.9	131.4	108.5
8	47.5	32.5	38.7	89.8	112.0	105.7	52.1	23.5	170.9	95.5	133.0	62.5	101.5	139.2	110.7
8	50.3	31.6	37.5	98.3	106.8	110.7	53.0	18.8	179.0	104.0	133.7	66.7	101.4	142.3	111.4
8	44.8	34.5	36.4	93.9	120.0	108.7	60.3	12.4	178.6	94.0	129.4	62.9	97.2	134.5	106.0
8	49.4	33.5	34.0	99.4	112.7	114.2	50.2	18.4	179.2	99.3	137.2	64.8	108.2	146.4	112.4
8	55.4	31.2	37.1	94.3	103.6	110.2	51.7	18.6	170.9	109.4	129.3	63.4	91.1	134.8	106.3
8	52.3	32.2	35.3	97.3	106.2	115.0	61.4	21.0	178.8	103.2	137.9	62.1	102.6	147.0	110.3
8	45.6	31.2	38.1	93.1	108.5	113.6	56.9	16.4	185.1	97.7	129.6	65.6	98.1	140.4	114.3
8	48.6	28.6	36.1	92.8	99.2	108.5	50.7	20.7	165.8	100.0	131.9	60.6	88.8	136.0	103.1
8	48.9	28.2	36.1	95.5	111.6	114.6	57.4	22.4	182.5	97.9	134.2	66.8	103.9	143.2	109.8
8	51.8	32.1	37.9	100.9	113.8	114.7	60.7	26.4	185.5	104.2	143.4	58.7	103.1	146.9	123.9
8	47.5	30.1	35.7	89.8	114.8	119.3	53.8	19.8	183.0	96.7	131.6	62.2	93.9	130.5	109.1
8	54.6	35.3	34.5	95.4	103.3	120.3	61.8	22.4	178.7	109.3	142.6	67.1	105.0	141.9	108.4
8	48.6	32.6	37.0	96.5	109.9	108.8	59.9	18.4	182.8	102.7	139.1	69.3	99.6	142.9	109.5
8	54.1	31.9	35.1	100.7	113.7	110.7	58.0	19.3	183.8	105.3	137.0	69.2	97.9	139.7	107.1
8	48.4	34.8	40.7	93.7	95.4	112.5	57.1	17.2	177.7	106.1	133.2	65.5	96.6	142.0	107.1
8	48.7	31.5	34.1	101.5	103.2	114.8	54.0	19.0	177.4	101.7	134.1	61.9	99.0	133.1	120.0
8	49.4	31.1	36.4	94.3	107.5	107.2	57.0	20.3	174.7	97.7	134.6	61.5	92.8	139.0	111.7
8	53.8	29.1	39.6	90.9	103.4	110.9	54.6	21.2	178.0	99.7	134.1	72.7	95.2	136.5	114.1
9	53.0	37.0	36.8	93.0	112.3	107.5	53.1	17.7	175.4	104.3	127.6	68.3	97.4	141.8	102.7
9	48.0	35.8	39.6	93.7	102.9	112.9	52.3	18.3	168.3	101.7	128.1	58.6	96.0	133.1	109.9
9	52.4	29.3	41.7	91.8	109.0	108.6	60.7	24.3	173.9	101.6	128.9	63.6	94.6	133.1	109.6
9	51.5	34.4	38.1	89.7	112.2	101.6	52.9	19.4	168.4	97.1	123.7	62.8	98.8	130.9	112.6
9	53.6	32.2	35.6	97.4	104.6	111.7	54.6	21.4	170.4	102.5	132.5	60.8	97.0	128.6	114.9
9	60.3	37.8	40.8	94.2	110.7	107.8	53.5	24.2	166.2	114.4	135.2	68.4	102.8	127.6	110.6
9	45.5	32.6	34.4	84.7	105.3	103.9	51.5	13.2	162.0	92.2	121.0	56.0	103.5	126.6	104.9
9	50.0	33.2	36.3	90.8	113.9	108.4	55.5	21.3	168.9	101.0	134.5	61.4	104.1	130.8	111.6
9	56.2	28.8	44.4	91.5	107.7	113.3	61.9	24.6	170.9	99.9	132.7	64.1	99.4	133.3	110.3
9	48.4	34.2	34.0	95.6	101.0	115.6	51.7	21.3	167.8	96.7	130.8	63.5	98.8	131.0	115.0
9	46.1	29.5	41.2	101.7	94.5	111.9	51.4	19.3	163.3	92.5	132.3	57.5	96.4	129.1	107.4
9	52.3	29.5	39.9	92.2	104.2	102.9	53.3	23.8	164.5	92.4	125.1	57.4	99.9	130.6	103.6
9	46.5	30.3	33.5	93.3	110.2	115.7	48.7	26.3	169.6	91.4	131.1	61.0	100.0	125.0	106.4
9	46.7	32.4	38.0	92.7	114.3	111.0	52.1	12.6	172.1	90.7	130.5	58.2	103.1	136.6	107.6
9	58.2	37.5	37.7	94.2	114.7	113.4	56.1	23.1	179.5	108.9	135.8	66.9	102.2	139.3	114.6
9	54.2	29.6	41.3	101.9	112.1	117.1	56.3	25.5	176.5	100.2	134.1	67.6	97.7	131.4	108.8
9	46.4	32.1	34.2	87.9	102.4	103.7	49.4	17.3	158.4	89.3	126.6	60.7	96.8	129.8	106.2
9	54.6	27.7	36.0	100.7	112.3	111.9	53.9	29.4	180.9	100.3	134.1	65.8	95.2	137.7	114.5
9	46.1	30.8	32.1	89.3	103.9	109.7	53.6	19.2	160.5	94.4	134.4	66.7	103.2	141.8	106.9
9	49.8	26.4	34.8	84.7	104.4	109.7	50.2	19.8	159.7	93.8	134.2	64.3	91.6	142.7	105.6
9	45.3	30.7	34.1	89.0	103.5	113.8	53.7	19.7	164.8	90.8	131.6	60.1	98.6	143.5	103.4
9	52.5	30.5	36.3	96.4	107.4	110.9	51.2	19.2	177.0	102.9	137.3	66.1	102.4	144.4	115.3
9	49.6	32.0	35.3	101.2	113.1	122.7	55.7	22.8	179.7	94.3	142.5	71.2	99.2	141.7	107.9
9	46.3	24.0	33.6	84.8	116.3	100.3	56.1	18.7	167.3	93.7	128.5	63.6	101.1	139.2	104.2
9	52.2	30.3	34.7	97.8	99.8	110.8	53.9	20.5	174.0	99.6	130.4	65.2	97.3	136.6	111.5
9	50.7	33.1	31.0	101.1	105.3	114.0	50.9	17.9	169.1	99.7	136.4	60.0	97.3	131.4	111.2

Appendix A (continued)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
9	54.3	33.4	36.6	94.0	103.2	107.6	55.7	17.9	170.9	102.4	131.9	63.3	102.9	142.2	108.3
9	41.0	30.1	30.5	94.5	108.1	116.5	53.2	11.3	171.8	90.9	138.7	63.2	99.0	139.4	109.2
9	47.4	31.3	33.6	100.1	110.2	106.5	52.9	21.0	174.0	91.7	133.4	54.7	101.4	136.3	108.2
9	44.7	28.1	33.1	94.6	106.3	107.0	56.9	15.0	174.2	89.2	131.6	64.6	97.8	140.1	114.4
9	29.8	31.7	38.6	95.5	113.3	115.6	55.9	12.0	183.9	88.1	134.5	61.9	94.1	130.8	113.1
9	51.1	32.0	37.1	99.8	97.3	115.3	54.7	18.3	171.1	94.8	136.8	68.6	100.4	153.8	117.2
9	44.2	32.0	36.5	84.6	107.6	102.1	56.6	14.5	165.4	97.5	133.1	65.8	101.0	140.1	110.1
10	50.7	32.4	34.4	95.8	100.7	109.0	53.4	19.1	167.5	96.7	128.8	61.9	91.4	126.5	98.7
10	49.0	31.2	39.7	96.9	111.7	109.9	53.9	18.0	172.9	92.9	135.3	64.3	96.3	129.0	106.5
10	53.5	34.2	37.4	101.9	114.4	117.7	57.1	22.6	186.8	104.4	131.8	66.1	103.2	137.3	117.8
10	46.6	31.7	36.6	100.1	110.7	110.1	50.4	16.7	171.4	92.1	135.4	57.0	95.4	129.0	98.8
10	50.0	28.9	39.4	92.0	108.6	110.3	51.1	21.8	169.3	97.7	134.6	68.0	93.3	132.0	102.6
10	44.2	33.0	39.1	91.3	111.1	111.2	55.6	13.3	175.8	93.2	132.6	55.4	101.2	132.7	102.2
10	52.5	32.4	38.1	99.8	115.4	122.3	49.6	20.0	178.4	99.2	141.2	60.4	97.0	124.4	107.2
10	51.4	30.2	36.1	99.9	108.9	107.8	50.7	21.1	173.3	100.6	127.8	66.1	98.9	136.9	100.9
10	52.8	33.1	34.6	97.5	106.4	108.1	51.2	20.6	175.1	102.3	130.3	61.2	96.9	130.8	106.4
10	52.9	32.2	37.8	100.8	119.3	117.1	57.5	23.6	178.4	92.5	138.0	60.4	101.5	141.1	111.2
10	45.3	27.6	32.9	91.8	111.4	119.1	49.9	16.8	172.0	87.2	125.9	54.1	88.2	120.9	100.9
10	54.4	29.7	36.8	97.6	117.7	111.4	50.6	20.3	166.6	101.2	130.9	64.9	94.4	121.9	103.6
10	46.1	33.9	35.8	95.5	97.8	103.7	51.4	15.9	161.2	90.2	123.0	61.3	84.1	119.6	93.3
10	48.2	26.9	41.1	90.7	107.4	107.2	46.1	20.6	168.0	93.9	129.3	56.9	93.6	123.8	103.2
10	54.7	32.3	35.7	96.1	104.6	108.6	51.7	23.0	166.1	94.0	129.6	65.1	99.6	127.9	102.3
10	53.7	32.6	39.6	110.6	113.1	116.0	55.2	26.1	179.8	97.3	139.7	67.4	97.8	133.1	105.3
10	50.4	34.1	37.1	96.6	125.4	116.2	52.6	23.8	183.7	98.5	138.5	60.7	99.7	129.4	105.5
10	48.8	33.5	37.5	93.0	105.0	109.9	55.0	18.5	165.6	93.4	129.4	63.6	91.0	123.0	99.0
10	46.3	32.8	35.9	99.0	103.4	108.4	48.9	18.4	166.1	87.1	123.1	64.9	88.7	121.0	101.1
10	53.2	32.1	37.8	92.6	110.8	112.8	54.0	23.3	172.9	101.5	134.5	66.2	94.8	130.1	108.2
10	51.1	30.9	36.3	94.2	101.3	106.8	51.5	19.3	169.5	96.3	125.8	63.5	97.4	134.4	100.5
10	48.0	29.6	37.8	90.2	116.6	114.0	47.2	24.1	173.1	86.2	125.0	56.9	91.3	121.6	102.4
10	44.7	30.6	33.1	96.0	105.5	112.3	49.2	13.1	172.1	88.2	124.8	60.4	98.4	132.2	106.3
10	53.0	32.5	36.4	96.1	113.8	112.8	58.4	18.0	183.3	103.3	136.3	61.7	104.7	140.9	105.9
10	44.1	28.9	33.0	91.8	101.5	107.7	51.3	14.8	165.8	94.2	129.4	55.5	94.5	131.7	102.2
10	49.4	33.0	38.9	100.4	117.8	115.0	52.9	17.9	180.9	99.6	135.5	59.6	95.1	140.3	110.6
10	49.5	30.3	35.6	94.7	112.7	109.1	50.8	18.1	172.6	96.5	132.3	61.1	96.9	137.8	102.1
10	48.2	29.5	35.1	93.9	122.1	111.4	50.9	17.6	176.4	100.6	126.3	65.6	93.1	126.4	105.1
10	47.6	22.0	36.7	106.0	109.3	112.9	48.0	16.5	177.6	89.7	130.1	60.4	90.6	131.6	111.1
10	55.0	32.8	35.8	96.6	115.8	117.3	53.7	22.0	184.2	104.6	140.5	65.7	100.8	93.9	114.5
10	54.4	31.2	35.1	100.7	105.7	111.1	49.7	20.0	176.0	98.2	132.5	62.8	97.8	56.1	107.2
10	43.1	31.3	42.2	99.2	106.0	111.0	51.9	20.1	174.7	92.5	136.4	64.9	98.9	140.4	107.1
10	46.6	31.7	32.1	102.8	105.5	114.3	52.4	15.9	174.9	96.0	133.5	61.5	94.9	125.5	106.1
10	49.0	33.5	35.3	92.8	111.7	108.5	52.5	18.5	173.8	93.7	135.4	63.5	92.5	126.6	108.9
10	50.6	31.2	34.8	96.9	103.3	108.3	49.0	20.0	176.4	96.2	121.9	62.0	95.2	125.3	109.3
10	49.3	29.7	33.4	100.4	114.3	109.8	51.1	19.5	175.3	98.9	139.2	61.8	98.7	134.6	105.8
10	47.1	26.3	32.0	90.2	113.2	110.1	49.2	17.5	173.4	88.6	124.3	55.6	94.1	127.4	97.4
10	46.8	32.1	39.5	101.9	105.0	108.5	56.7	20.7	172.0	95.8	136.3	63.3	88.8	133.7	107.6
10	45.4	28.9	37.9	91.7	105.4	112.7	49.6	15.3	170.9	92.0	127.5	55.0	95.7	130.4	109.5
10	51.7	28.3	36.0	94.6	113.9	107.6	54.1	21.7	177.7	99.5	131.5	67.9	101.0	139.3	107.7
11	52.4	34.9	39.5	101.6	105.8	100.6	59.3	18.1	169.1	101.9	124.8	71.2	95.5	129.2	105.0
11	49.7	37.6	36.0	93.9	109.2	114.0	53.5	22.9	174.0	100.4	131.4	59.7	98.7	129.0	107.2
11	54.2	33.0	36.3	102.4	110.5	109.0	53.5	26.3	173.1	110.3	138.3	71.3	100.6	131.3	106.1
11	50.3	34.2	38.1	101.5	101.3	107.8	53.2	20.6	165.7	92.5	127.2	65.8	91.7	127.9	112.4
11	41.7	34.4	39.4	95.3	112.0	106.2	53.9	17.2	175.6	96.7	131.4	62.7	104.5	138.1	107.7
11	52.5	31.0	43.2	97.7	106.5	109.0	59.0	23.9	168.4	96.7	130.7	66.8	98.2	129.4	108.7
11	43.6	35.0	41.9	90.2	109.0	110.7	58.2	20.7	174.2	93.8	127.3	53.0	92.0	120.8	111.0
11	52.6	33.7	41.6	97.3	123.5	117.6	58.0	24.4	180.5	107.2	144.5	69.0	104.4	131.3	112.7
11	53.8	32.4	44.6	89.6	112.9	111.5	53.6	23.9	169.4	98.5	137.0	61.3	97.2	125.2	113.0
11	56.6	35.5	39.1	93.3	111.6	111.8	52.8	21.7	173.5	106.9	140.8	70.6	105.1	137.4	119.4
11	59.9	35.5	39.9	103.7	120.2	112.7	53.6	26.2	182.7	106.7	135.6	70.6	103.1	137.7	108.4
11	57.8	32.8	37.0	102.8	96.7	111.9	55.7	24.0	167.0	100.7	130.9	58.1	87.6	123.2	108.9
11	57.3	32.5	39.5	93.7	110.5	120.3	52.7	27.5	172.9	100.5	137.9	65.9	103.8	135.4	111.9
11	56.8	32.2	40.8	98.1	109.3	115.1	51.7	26.3	176.5	99.0	134.0	63.3	100.9	131.0	106.6
11	51.2	29.8	32.6	95.6	110.3	110.9	50.5	22.4	171.2	98.1	135.4	54.6	97.0	123.6	106.1
11	56.9	32.9	37.4	92.8	112.1	112.9	50.1	25.8	179.0	102.1	123.0	59.3	99.2	130.4	108.8
11	53.5	33.8	40.9	97.6	110.9	109.6	52.2	24.0	168.8	98.2	136.3	62.9	97.3	131.7	108.4
11	50.7	38.0	37.0	110.3	115.9	115.2	58.6	16.5	187.9	99.6	141.6	67.9	102.1	143.5	113.4
11	53.7	30.3	38.9	95.3	110.7	110.3	48.8	18.4	170.8	100.0	135.0	63.7	96.5	130.6	107.7
11	51.5	34.5	35.9	97.7	105.1	112.8	56.0	19.6	171.4	103.0	139.6	71.5	96.0	141.6	105.9
11	51.1	31.3	37.0	97.8	102.9	111.7	53.6	17.5	166.7	103.4	136.7	64.1	96.7	138.5	112.5
11	47.2	30.3	38.7	87.8	109.4	108.9	48.9	20.5	171.4	98.0	139.2	66.5	95.5	139.5	108.1
11	51.5	30.3	34.7	107.2	105.9	108.5	58.5	22.2	175.6	102.5	136.5	64.9	100.1	142.3	108.2
11	54.5	29.8	37.1	94.5	116.4	109.1	52.1	20.1	177.5	105.7	138.5	63.2	102.5	134.9	103.4
11	55.2	28.5	35.9	110.1	97.3	113.5	55.0	22.1	177.2	99.5	136.7	73.7	98.9	140.2	105.9
11	51.0	35.8	38.4	96.1	106.4	111.2	53.2	20.9	172.4	104.9	135.7	63.1	100.5	139.1	109.7

Appendix A (continued)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
11	49.3	33.6	35.1	101.9	104.0	110.9	52.1	23.7	170.8	96.9	142.5	61.5	99.5	132.5	107.1
11	47.5	30.8	32.3	101.1	109.7	118.7	57.6	16.4	179.0	101.9	142.8	63.2	98.8	133.8	107.3
11	48.3	33.0	35.8	92.8	106.7	116.9	53.5	17.1	172.6	95.8	139.8	60.4	102.7	133.1	103.9
11	47.9	29.0	32.4	91.5	107.3	106.4	50.2	19.9	174.8	101.8	130.7	67.7	105.9	134.4	105.5
11	44.1	28.2	35.1	102.1	107.6	110.7	50.3	18.5	180.0	99.3	131.4	61.0	94.5	127.5	107.5
11	54.5	39.6	36.2	94.2	107.6	108.8	59.7	16.5	177.0	107.8	135.6	61.7	94.7	132.3	110.5
11	47.8	29.9	36.4	93.2	104.2	112.8	56.0	18.7	172.0	99.8	140.6	66.8	97.2	138.4	115.0
12	48.2	33.4	39.6	98.9	118.9	106.5	56.6	17.9	179.1	92.9	133.2	58.3	96.8	130.5	113.0
12	44.4	29.8	36.6	102.7	109.9	109.3	54.8	18.9	175.1	89.2	131.7	63.3	91.7	125.4	104.0
12	55.3	41.6	37.9	95.9	112.7	117.4	54.9	21.0	177.0	102.6	131.6	63.2	96.6	124.2	106.0
12	54.1	33.7	37.7	98.0	112.9	111.4	51.8	20.7	171.9	96.0	138.5	61.7	95.6	127.3	108.8
12	50.3	40.6	36.0	102.6	109.8	122.6	59.9	18.1	178.5	103.2	143.2	64.2	99.5	138.3	113.5
12	53.7	33.6	41.8	87.7	108.2	103.8	50.2	18.6	167.0	93.0	125.3	58.5	93.1	127.5	104.6
12	50.8	36.0	42.6	94.6	127.8	113.4	60.9	21.4	190.9	98.5	136.4	60.4	93.6	133.6	107.0
12	44.8	32.8	38.2	95.3	111.9	109.1	54.9	15.3	168.9	88.3	129.9	59.9	96.2	134.2	115.3
12	48.7	31.3	42.9	100.4	111.2	107.7	52.1	11.8	173.7	89.2	128.2	53.4	95.3	131.3	107.9
12	49.2	31.3	39.5	103.2	116.4	107.9	59.8	19.6	175.3	91.3	131.4	60.4	95.4	128.4	110.9
12	50.8	31.2	43.8	104.1	100.0	109.0	54.4	22.4	168.3	91.5	128.4	61.9	94.6	130.9	104.3
12	50.1	32.6	41.4	94.5	114.4	112.3	53.9	14.8	176.7	95.7	135.0	62.8	93.2	132.8	110.1
12	49.2	31.6	35.6	94.9	115.2	110.2	54.3	14.1	170.6	89.2	128.6	61.1	91.4	128.9	110.2
12	54.9	33.7	38.8	101.3	118.6	114.8	56.6	21.9	181.4	101.0	135.6	63.2	89.1	125.0	104.8
12	50.4	33.9	39.8	93.8	113.1	114.1	50.6	24.8	175.0	99.0	132.7	64.3	95.8	131.5	106.0
12	52.7	33.4	41.0	96.1	117.3	108.7	55.1	21.0	173.2	98.2	132.8	62.2	92.7	128.6	101.9
12	45.9	30.0	39.7	107.0	117.3	113.9	55.7	13.2	179.5	93.9	144.9	52.2	100.9	143.4	110.8
12	49.4	27.5	37.1	97.1	123.2	106.1	47.8	19.2	179.4	98.0	129.4	62.6	98.4	125.7	113.3
12	55.3	25.8	39.5	109.9	103.4	119.6	53.7	21.5	181.2	105.0	131.6	59.4	99.8	128.0	108.0
12	49.3	31.8	38.7	103.8	119.2	111.5	56.5	19.0	180.4	99.9	142.3	66.6	102.7	141.7	118.5
12	50.7	31.9	42.7	101.3	110.3	110.5	51.2	17.1	172.8	98.0	131.2	60.3	97.5	132.8	108.8
12	55.1	33.5	34.9	103.5	108.7	120.2	57.8	18.6	181.7	106.0	131.1	67.7	99.7	146.5	113.0
12	43.8	30.9	39.1	91.6	110.2	115.5	57.4	13.8	179.6	92.7	136.0	60.6	92.3	142.7	114.1
12	48.3	31.9	37.1	95.7	108.0	114.5	53.4	12.9	175.7	93.6	131.3	58.0	93.9	130.8	109.2
12	45.0	27.9	33.1	100.7	104.0	113.8	57.7	14.0	174.4	95.1	133.9	62.2	97.5	136.1	105.6
12	49.6	29.4	45.3	92.4	102.9	109.0	54.9	13.6	171.1	98.8	124.9	65.2	103.3	145.5	111.1
12	41.2	30.6	36.8	99.4	106.8	107.2	58.8	10.0	168.4	87.5	135.8	57.4	93.6	136.2	114.3
12	44.1	32.0	35.2	85.7	103.1	95.5	50.2	9.7	162.6	88.2	118.2	55.5	94.3	130.3	105.2
13	46.8	32.6	38.7	97.6	111.3	105.5	53.8	16.5	169.2	98.6	133.1	65.4	91.6	127.3	103.2
13	54.4	32.8	38.0	93.8	104.4	109.6	55.9	19.4	169.0	102.3	126.9	59.7	96.5	133.7	105.5
13	50.9	36.4	38.8	86.9	118.6	99.7	52.8	19.9	167.7	100.7	134.7	60.9	94.4	136.9	103.9
13	49.9	33.7	35.8	92.5	115.0	109.5	55.0	20.6	172.5	99.6	126.8	63.7	99.2	132.5	107.8
13	41.0	37.6	39.4	102.0	112.4	115.4	54.7	22.3	177.5	87.5	139.9	57.3	96.2	130.2	109.8
13	55.6	36.5	41.9	106.7	116.4	114.3	56.0	23.1	183.2	101.4	140.6	62.5	94.9	132.2	112.5
13	48.4	31.0	37.8	90.8	110.9	109.0	52.8	19.4	172.3	95.5	130.4	63.4	94.7	132.1	103.0
13	52.6	37.4	36.2	96.2	112.7	111.5	54.4	28.6	180.7	104.4	135.1	59.1	99.8	129.3	104.0
13	49.3	35.4	40.8	97.1	111.8	103.6	53.5	21.8	168.5	90.4	131.4	60.9	90.6	128.7	108.6
13	55.8	29.0	34.8	103.9	101.7	111.8	56.3	23.7	179.2	102.8	130.3	61.9	94.7	131.3	103.3
13	58.8	34.5	35.6	97.7	111.3	110.0	54.9	23.4	173.7	103.6	130.6	62.4	96.0	127.5	112.6
13	51.7	33.5	40.6	98.2	113.4	112.3	57.3	18.3	182.0	100.3	130.8	61.6	101.3	133.5	111.6
13	51.6	34.6	37.3	92.2	107.5	113.8	52.1	21.3	173.4	99.4	128.2	68.4	97.9	123.2	106.5
13	59.8	32.8	34.5	90.5	109.0	107.1	58.0	20.6	170.7	105.6	127.2	66.9	98.7	131.4	99.2
13	54.8	31.1	37.5	91.2	108.3	111.1	55.2	19.4	166.6	101.6	130.8	67.0	101.1	131.0	106.8
13	54.2	38.7	36.0	93.3	108.3	112.3	52.1	19.4	171.5	101.5	133.9	61.6	92.0	124.7	98.5
13	55.3	32.9	39.1	99.9	114.6	116.2	55.1	21.2	180.5	101.4	138.7	67.5	101.7	141.6	116.3
13	55.3	36.5	41.3	90.4	114.1	114.2	54.6	23.6	175.5	103.1	133.3	67.2	94.9	133.7	111.9
13	46.2	33.3	37.7	107.2	119.8	114.2	54.5	15.4	181.3	98.7	144.6	62.1	104.6	134.7	100.3
13	53.7	36.6	40.1	87.2	115.3	108.6	55.4	19.8	175.5	103.0	131.4	62.3	95.6	133.0	102.0
13	49.0	29.8	35.8	95.0	108.2	109.1	50.9	15.8	170.9	90.2	127.8	61.3	95.3	131.4	107.4
13	46.9	32.6	38.3	106.4	106.0	109.7	55.5	13.2	173.1	95.9	134.2	62.6	90.0	122.2	112.7
13	59.1	35.4	36.8	96.8	116.7	107.8	53.8	21.6	179.0	107.5	126.5	65.1	93.5	125.2	109.6
13	48.7	37.6	41.2	98.1	118.4	109.8	55.5	16.2	182.1	106.5	136.6	63.0	96.0	132.6	106.8
13	45.6	26.5	40.0	102.2	111.3	114.1	55.5	18.4	173.4	96.5	133.4	64.8	92.5	128.3	107.7
13	49.5	31.6	37.9	103.3	117.9	114.4	54.2	15.3	181.6	95.6	138.3	63.6	95.8	131.2	112.6
13	52.2	29.3	39.8	102.8	120.1	109.4	52.0	22.8	180.8	100.1	133.6	66.1	94.8	128.6	109.2
13	53.8	33.2	37.8	102.2	124.8	113.0	54.2	24.1	180.6	101.1	138.1	65.7	91.1	135.6	108.4
13	55.5	32.1	40.4	100.9	113.5	110.1	55.2	22.2	185.5	110.1	134.5	64.5	91.5	130.3	106.9
13	43.9	31.0	43.1	99.7	110.1	106.8	51.5	14.1	170.9	95.5	123.7	62.6	95.5	129.2	105.3
13	48.6	37.8	40.1	95.0	111.2	106.3	50.5	19.9	168.0	97.3	140.2	62.9	102.8	127.6	107.9
13	50.1	30.7	42.8	89.1	121.3	118.9	50.6	19.5	182.8	94.9	138.3	65.5	100.4	127.3	102.6
13	54.1	32.4	41.5	108.8	130.3	119.1	55.1	20.9	187.8	98.0	143.8	66.0	95.5	142.7	113.1
13	50.5	32.8	43.2	96.8	116.6	115.7	57.4	24.2	179.5	92.8	140.2	67.3	98.6	138.9	110.0
13	50.1	32.4	38.2	102.1	116.5	111.0	53.4	16.1	176.3	94.6	140.9	64.6	94.0	136.8	112.6
13	49.8	38.1	43.4	91.3	107.5	122.5	61.0	21.5	178.0	102.2	143.0	61.8	98.8	143.4	115.1
13	48.8	33.3	33.2	90.7	114.6	106.6	48.8	15.9	171.7	97.7	134.3	53.3	94.5	125.7	103.1
13	47.0	34.1	37.5	94.0	111.7	114.0	52.0	16.6	178.0	96.9	133.5	59.7	89.4	131.7	108.8

Appendix A (continued)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
13	52.4	33.2	37.5	99.0	118.1	119.5	56.1	19.6	183.7	101.1	140.9	62.4	98.4	133.7	98.9
13	55.3	30.3	40.9	102.8	113.0	108.6	54.7	25.5	178.3	107.4	139.1	68.5	95.6	135.8	103.7
13	47.0	31.6	35.1	92.1	122.9	107.8	50.2	17.1	175.9	94.4	142.9	64.7	99.8	134.7	108.8
13	48.8	32.7	35.1	99.2	108.1	110.3	54.6	15.4	171.9	96.3	139.5	65.1	98.2	149.1	109.8
13	43.9	32.1	39.0	92.3	112.8	103.1	45.2	16.8	168.6	91.1	137.6	57.0	95.8	127.0	102.1
13	52.7	32.1	38.9	92.4	115.3	112.9	57.4	17.4	178.9	104.4	139.9	64.4	92.0	136.3	104.6
13	49.0	28.0	32.2	102.5	113.8	114.4	53.5	20.8	177.5	101.8	139.4	73.1	96.9	135.4	106.8
13	49.6	30.8	37.3	105.2	110.7	117.1	58.1	15.1	182.8	104.0	142.4	58.8	91.9	134.6	106.9
13	50.7	30.9	32.3	91.5	116.8	109.6	49.1	16.8	173.8	104.0	137.4	70.2	99.8	144.1	106.8
13	50.8	34.6	36.3	100.7	113.7	112.9	55.5	22.4	179.7	103.0	144.7	61.0	95.9	129.6	100.5
13	49.0	29.3	42.2	94.6	103.0	113.3	52.7	20.6	175.1	95.5	141.8	65.0	96.3	145.8	109.1
13	57.2	34.4	31.9	105.8	112.8	113.3	54.7	16.8	184.1	110.4	142.6	60.8	95.3	129.5	103.5
13	46.5	29.5	38.4	95.1	116.6	113.7	53.3	17.1	174.9	92.4	143.6	63.1	95.1	140.0	110.7
13	42.3	32.4	39.4	89.0	109.0	112.8	59.4	8.4	178.8	89.8	132.6	62.7	95.9	139.9	115.3
13	54.8	27.9	35.2	98.9	116.3	108.5	51.4	23.5	175.7	102.0	134.2	64.6	101.2	139.7	108.4
13	51.8	31.3	35.7	91.8	124.9	114.3	48.8	15.5	184.7	100.2	134.9	60.1	98.3	140.2	107.0
13	48.3	31.9	37.1	99.1	118.2	109.5	47.3	14.0	178.4	93.4	127.4	52.6	98.3	130.8	116.9
13	48.0	35.0	40.2	95.4	116.8	114.5	51.1	17.4	176.6	97.3	143.3	61.4	94.7	133.8	103.5
13	50.6	38.6	32.9	98.4	120.3	111.9	54.7	20.2	184.2	98.3	141.7	63.9	98.3	142.4	105.7
13	46.1	28.6	37.3	90.1	116.2	116.9	47.2	16.5	175.4	93.0	132.2	60.1	95.5	122.2	105.8
13	53.5	32.1	35.9	111.5	116.5	117.1	56.7	17.9	184.3	100.3	145.9	63.7	104.5	145.3	102.9
13	56.1	37.9	40.3	90.7	123.8	113.8	52.3	24.2	181.8	109.5	145.2	63.5	104.5	146.7	114.8
13	51.1	30.5	37.1	92.5	118.6	112.7	53.3	17.7	175.4	98.0	137.4	64.5	95.3	135.8	102.4
13	55.6	31.6	37.7	96.8	114.3	107.1	55.9	20.6	173.7	102.9	135.5	65.7	95.2	138.2	104.0
14	54.9	33.3	40.9	96.9	112.3	121.3	54.1	26.2	182.6	102.4	139.7	68.1	98.9	138.2	112.3
14	48.8	31.6	36.9	96.5	90.7	104.0	50.9	17.4	157.1	98.3	125.4	63.5	93.7	129.5	107.4
14	45.9	33.5	39.6	103.4	97.1	111.6	49.4	17.2	169.8	95.9	135.2	64.4	98.6	132.6	111.4
14	47.1	33.5	39.4	96.6	108.9	111.4	55.2	19.6	173.7	95.5	137.0	64.3	95.0	130.3	108.9
14	56.2	36.0	40.4	90.0	109.1	110.8	56.9	27.8	172.5	106.6	133.0	63.7	103.2	128.1	104.9
14	53.9	32.4	43.8	99.4	108.5	113.6	57.5	20.3	177.1	96.9	131.7	56.3	97.4	131.6	112.0
14	52.3	28.8	38.2	97.0	108.1	111.1	52.2	25.7	169.5	99.8	126.9	61.2	97.1	135.1	115.9
14	51.9	36.9	43.6	96.0	112.6	107.8	56.1	25.4	179.2	104.7	132.3	67.3	101.1	131.3	119.8
14	50.8	33.9	39.9	94.5	100.6	111.0	55.9	21.7	170.3	98.1	127.9	60.9	93.5	132.7	112.9
14	55.1	38.6	39.8	102.4	108.2	110.6	55.4	21.6	176.6	108.0	138.4	65.7	100.3	129.0	110.6
14	44.1	38.9	37.2	97.2	109.1	107.4	52.3	13.6	172.3	92.2	136.5	49.6	101.5	139.8	114.1
14	53.9	29.7	37.2	104.1	101.2	113.6	56.0	23.5	176.3	102.3	132.5	61.6	90.8	131.8	114.9
14	44.0	32.1	39.4	100.8	101.2	108.4	56.1	13.4	165.7	89.9	134.5	51.1	99.4	133.3	111.5
14	55.3	33.4	37.3	95.8	112.8	111.6	55.1	25.4	173.2	95.3	129.8	60.3	94.4	134.7	111.8
14	52.8	35.1	37.3	99.2	102.0	117.5	54.6	27.8	173.7	100.0	134.1	69.3	97.8	136.4	110.2
14	54.9	33.8	41.3	91.0	111.9	118.9	57.5	24.6	177.8	102.5	139.2	69.5	94.0	127.8	112.9
14	50.1	32.4	36.9	101.7	116.0	112.4	58.0	27.3	178.6	97.6	134.2	64.5	98.3	128.2	111.5
14	42.9	32.4	36.9	96.4	112.1	108.6	53.2	14.6	171.4	86.0	132.8	55.6	94.1	128.7	110.3
14	42.9	33.1	37.4	87.7	101.7	102.0	54.3	7.5	160.6	95.1	120.4	56.8	97.7	137.3	112.3
14	52.6	32.6	37.6	88.1	108.9	107.0	53.7	21.2	166.8	99.1	125.6	61.5	97.6	131.4	107.5
14	52.6	31.0	38.5	101.3	102.7	117.5	54.6	21.6	170.4	96.0	133.1	63.3	97.8	131.3	109.7
14	47.9	30.4	35.8	96.0	107.8	112.6	51.7	23.5	165.7	93.8	134.0	61.4	91.7	118.5	105.7
14	48.5	36.2	34.0	100.1	101.6	111.8	55.0	17.3	164.1	98.8	136.8	67.5	93.5	137.1	115.1
14	53.9	29.6	34.1	100.8	106.4	110.3	53.2	23.8	171.3	100.7	128.3	62.9	95.4	125.4	103.1
14	48.2	36.9	37.4	90.8	111.8	108.1	56.9	14.1	164.7	94.7	138.4	66.3	96.9	132.1	109.0
14	43.3	30.8	36.0	97.3	97.3	106.1	47.4	16.3	157.9	86.9	126.8	61.9	98.3	121.3	98.4
14	50.0	31.3	37.3	91.3	106.4	111.5	56.9	12.7	168.9	98.7	129.1	66.8	103.5	135.1	105.1
14	51.1	32.9	35.3	97.5	108.4	114.3	57.5	22.5	173.1	104.5	137.5	73.5	97.4	128.5	110.9
14	56.6	34.3	36.8	100.3	104.2	113.2	55.8	22.4	168.4	103.7	137.9	69.2	104.7	136.7	114.1
14	53.9	31.3	35.5	98.0	101.3	113.5	53.0	18.2	170.0	99.5	129.5	68.3	103.8	134.9	106.6
14	56.1	37.0	35.6	96.9	106.4	105.1	54.4	18.5	167.3	113.4	135.6	66.7	100.1	138.3	105.8
14	51.9	39.1	40.7	94.2	105.8	113.0	55.3	21.2	170.9	104.3	135.2	64.3	91.8	126.8	113.4
14	54.5	30.1	39.7	96.4	113.3	108.2	57.2	19.2	178.1	105.0	133.3	65.9	102.9	130.8	107.4
14	50.7	25.4	34.3	93.5	110.0	105.8	55.8	19.5	171.2	97.4	131.4	67.7	95.9	137.1	109.3
14	48.2	29.3	33.2	92.7	98.4	112.7	49.0	18.3	160.6	94.8	136.4	58.5	92.2	143.4	105.9
14	50.6	30.0	30.6	103.2	96.2	108.5	62.1	18.0	168.2	93.9	132.0	63.7	97.9	139.5	110.3
14	47.4	27.1	39.0	97.6	109.6	113.7	56.0	12.6	172.9	92.9	131.5	61.4	96.9	138.9	109.3
14	48.9	38.5	33.4	100.0	100.5	109.9	50.8	21.7	175.1	102.7	138.9	61.3	102.5	138.2	112.2
14	52.2	38.7	36.5	104.4	98.9	114.4	55.2	19.6	175.2	107.4	134.1	68.4	94.6	139.0	112.5
14	48.6	32.9	32.7	100.3	116.4	116.0	51.3	20.0	180.0	97.7	141.7	64.3	92.3	132.3	107.8
14	49.2	30.0	34.7	101.6	103.8	114.4	61.6	16.2	173.4	95.6	134.6	73.2	91.1	141.2	114.8
14	49.2	28.8	39.2	94.2	107.2	113.5	55.4	16.9	171.7	96.4	135.1	62.7	101.3	145.7	118.1
14	52.1	28.1	37.2	92.0	97.0	108.1	51.4	18.2	164.4	100.7	128.1	66.4	100.4	136.6	100.8
14	48.1	32.8	41.5	94.4	107.7	114.3	53.9	20.5	173.7	96.9	140.9	64.7	100.8	142.4	109.7
14	49.8	25.9	31.8	87.6	99.9	106.5	52.3	16.8	164.2	92.0	124.7	62.0	96.5	133.3	112.5
14	51.8	29.8	32.5	88.1	104.0	108.5	56.3	16.9	166.5	100.1	130.5	64.9	100.0	136.2	114.4
14	51.2	33.0	37.0	90.4	115.1	114.7	54.1	24.9	176.9	106.3	142.8	66.9	101.4	139.1	112.7
14	44.2	33.2	36.1	91.7	119.2	120.0	55.3	16.2	178.4	94.3	142.6	65.0	99.7	131.9	107.2
14	55.0	35.3	37.8	92.8	107.6	107.3	60.7	20.1	173.8	110.2	137.3	68.2	106.1	137.5	109.3

Appendix A (continued)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
14	55.4	33.2	36.6	86.3	109.7	107.5	58.1	21.4	176.8	101.6	125.6	65.6	100.3	139.9	105.6
14	45.1	26.3	34.5	103.1	108.7	115.0	58.9	18.0	175.4	88.2	141.6	58.6	101.4	140.8	111.2
14	54.2	35.3	36.4	98.5	100.0	112.2	54.8	19.3	174.6	110.2	128.6	69.1	101.2	134.5	112.9
14	48.4	29.4	38.0	88.9	111.3	111.5	54.1	19.6	166.2	92.8	139.8	58.9	96.4	132.4	111.3
15	52.2	39.9	44.2	104.5	108.5	105.3	53.3	26.7	173.0	99.4	133.7	65.2	102.4	130.0	111.8
15	45.5	33.1	34.4	93.0	107.1	106.5	53.7	19.4	165.7	90.7	132.5	55.6	103.6	135.6	104.9
15	53.2	32.1	38.0	96.4	113.6	114.7	60.2	22.3	175.7	100.4	135.6	62.9	104.8	141.1	111.7
15	54.0	37.8	38.8	98.2	112.8	108.6	53.3	24.7	169.5	100.4	140.4	67.1	98.3	131.5	112.3
15	52.8	32.2	36.8	99.4	107.5	110.0	50.0	29.6	172.8	101.1	133.6	68.8	94.5	134.1	113.9
15	56.1	31.2	38.5	99.5	110.4	116.7	54.9	26.9	171.0	100.2	133.5	66.2	97.5	127.6	107.1
15	45.5	34.2	36.5	99.8	102.6	109.0	55.2	15.3	167.5	90.8	136.5	61.9	96.3	134.9	109.3
15	55.4	33.5	42.2	96.8	92.8	109.3	54.8	23.9	160.9	103.7	128.8	65.9	100.7	132.0	104.8
15	51.6	29.0	34.7	100.7	107.5	107.1	51.7	23.4	168.5	95.4	130.2	63.9	94.9	129.4	105.8
15	47.4	30.0	33.3	96.1	113.0	104.6	52.2	20.8	168.3	92.6	129.0	61.6	97.0	134.4	116.7
15	41.8	36.3	33.7	99.3	109.6	110.6	52.1	10.2	172.1	88.4	135.3	59.2	98.2	127.2	98.9
15	52.5	33.9	36.9	89.6	101.1	103.8	49.2	21.7	168.6	104.0	122.7	63.3	94.5	117.9	95.1
15	49.7	36.7	31.4	96.8	108.4	111.5	52.1	22.3	174.8	99.9	123.7	63.4	94.6	130.7	103.1
15	52.9	31.9	35.0	100.8	107.6	111.2	52.4	16.8	174.8	99.4	131.8	53.3	93.1	133.5	103.8
15	50.9	32.6	37.5	95.4	108.4	117.3	52.0	18.2	165.8	97.7	142.4	66.4	99.9	135.9	107.1
15	52.1	36.0	37.8	90.3	105.2	107.9	55.4	23.4	168.3	99.5	131.7	65.8	100.6	132.5	114.5
15	52.0	32.6	34.2	99.5	103.4	120.0	56.8	21.3	173.1	96.9	138.1	65.8	103.2	133.8	101.5
15	58.6	34.0	42.1	90.9	108.2	111.2	56.7	23.2	168.3	106.2	135.8	61.5	100.3	126.7	101.1
15	50.4	32.0	33.6	87.5	103.8	107.7	54.2	19.8	167.9	103.4	123.7	60.7	98.2	128.8	107.1
15	49.0	35.8	37.2	94.8	102.7	118.9	51.2	13.8	165.5	101.2	138.0	59.8	96.1	134.9	111.5
15	48.2	36.6	36.7	90.7	101.6	114.5	47.5	14.9	163.2	93.2	137.0	56.9	97.1	135.4	101.2
15	49.9	37.9	31.8	86.7	109.8	113.0	49.8	20.0	164.9	97.0	133.0	61.2	96.1	126.2	103.4
15	50.8	31.8	34.8	88.2	100.7	108.4	47.5	19.1	160.0	97.5	131.5	58.6	90.8	129.9	106.2
15	51.4	32.9	39.1	95.9	99.5	111.8	56.6	15.6	170.6	100.6	135.6	63.9	102.3	141.0	110.1
15	51.7	30.5	37.0	101.3	105.8	111.4	58.8	16.1	169.2	103.6	140.5	65.3	97.1	132.7	107.2
15	48.4	27.1	35.3	94.3	107.6	112.5	52.7	24.7	174.6	91.6	136.4	70.6	97.1	142.8	122.4
15	39.9	33.4	39.5	97.8	109.8	114.0	48.4	14.8	170.7	93.3	137.6	62.0	97.3	143.3	118.7
15	45.5	30.8	36.0	95.5	111.9	106.5	49.3	21.5	166.6	93.5	132.1	62.2	98.3	131.0	109.1
15	53.1	32.5	40.0	98.0	103.3	116.4	53.0	16.8	176.6	106.7	134.2	70.2	103.0	147.4	119.6
15	49.1	36.1	39.3	97.2	100.5	117.5	55.0	15.3	173.2	100.1	139.6	62.0	99.1	139.5	115.7
15	43.3	29.0	36.6	99.5	101.0	101.3	52.5	15.3	164.4	93.5	130.9	63.8	101.3	138.6	104.2
15	49.2	28.2	37.9	97.0	107.4	116.4	49.7	15.0	172.0	96.4	135.1	63.7	96.6	134.6	113.3
15	46.9	30.6	35.4	90.0	118.3	109.6	56.1	18.7	175.3	100.9	137.7	60.3	95.1	135.8	109.4
15	38.3	29.6	34.5	96.8	112.0	109.8	56.0	3.2	165.8	83.7	140.5	62.3	93.5	136.9	108.1
16	47.0	38.2	44.1	92.6	102.0	116.2	55.1	24.3	167.4	93.8	141.3	60.9	104.4	135.5	104.8
16	49.8	36.3	38.1	96.9	126.5	121.4	57.7	15.4	181.6	104.3	142.7	65.2	101.3	135.2	116.5
16	54.5	35.2	37.6	106.8	117.6	113.6	56.3	23.1	184.6	109.6	137.5	64.7	98.1	136.2	115.2
16	46.9	35.5	34.9	96.4	108.2	112.0	44.3	17.5	169.9	97.4	135.7	59.2	91.4	123.7	107.4
16	52.5	32.6	40.5	93.8	117.3	112.4	52.9	19.9	174.7	97.2	140.0	63.2	90.8	126.2	100.8
16	51.5	31.6	37.8	101.6	108.6	109.3	51.5	17.3	170.0	94.9	132.4	61.5	93.0	121.8	107.0
16	55.4	36.9	40.9	98.2	117.1	116.6	51.4	23.5	181.6	100.4	135.9	68.0	97.1	140.6	116.5
16	32.4	34.0	38.7	95.1	111.8	109.9	51.7	11.1	172.8	95.4	135.4	67.3	100.1	137.1	101.6
16	49.6	31.1	36.5	86.8	111.7	101.5	47.5	21.0	164.2	90.4	134.9	66.5	97.4	133.6	97.6
16	50.2	33.2	40.3	100.2	114.7	112.0	46.3	20.0	180.9	100.4	135.8	61.0	95.8	128.3	110.8
16	55.5	36.3	37.2	92.6	112.7	113.0	62.2	21.1	177.1	107.2	136.5	64.4	95.3	129.5	107.4
16	49.9	37.2	39.1	93.8	114.0	119.6	51.0	21.8	176.2	97.2	136.9	61.2	95.1	127.5	103.6
16	49.1	30.6	43.0	86.1	105.6	104.8	49.8	11.6	169.1	96.6	122.2	58.2	88.8	117.7	99.6
16	58.9	33.6	37.5	96.9	118.4	115.6	55.4	18.9	182.2	104.8	135.1	66.1	97.4	131.2	113.4
16	49.8	39.0	43.5	101.4	121.3	118.6	56.9	21.4	183.1	100.7	148.5	69.4	98.3	134.9	106.8
16	54.4	36.7	35.7	99.7	111.9	117.6	49.7	20.1	177.9	105.1	144.3	66.9	95.1	136.3	102.4
16	42.8	33.6	35.2	94.7	115.5	116.0	54.3	16.8	183.5	100.7	139.6	54.2	94.0	132.2	121.7
16	51.9	30.5	34.7	89.8	109.0	116.3	55.3	11.0	172.9	96.3	134.8	61.4	92.3	139.9	102.2
16	42.0	31.9	34.4	106.7	103.7	115.9	54.7	8.6	179.0	90.6	135.0	57.0	100.7	137.6	107.0
16	58.4	32.4	39.8	93.6	124.3	114.2	57.9	19.3	190.6	106.8	142.2	64.4	102.2	134.7	102.0
16	44.3	33.5	35.1	94.9	112.4	109.2	52.0	13.0	172.9	94.1	139.1	62.9	98.9	141.4	103.4
16	49.1	35.7	40.2	112.6	112.9	110.0	59.5	17.7	186.1	102.1	144.6	64.9	105.8	145.8	107.7
16	53.8	35.5	38.2	98.8	115.2	117.4	52.8	18.1	184.0	104.4	144.5	63.7	97.1	142.1	101.4
16	42.3	33.3	35.0	103.7	108.9	113.9	55.2	18.3	181.0	93.3	136.3	59.5	94.4	130.4	108.0
16	50.1	30.2	31.0	99.4	115.1	109.1	53.7	23.0	179.8	94.1	137.0	65.4	92.4	127.6	104.6
16	53.0	34.4	37.3	105.3	118.5	111.0	54.8	21.9	189.6	105.6	138.4	66.0	103.7	149.1	106.3
16	53.3	29.2	35.8	92.4	114.9	108.6	53.8	19.2	173.8	96.4	137.2	66.3	96.7	145.8	106.9
16	47.4	30.4	37.1	106.9	107.6	109.8	58.1	19.2	177.5	98.5	138.4	63.9	101.5	136.5	109.3
16	44.2	32.9	37.3	95.2	108.9	114.5	51.5	17.2	180.5	99.9	132.2	59.6	93.7	134.9	105.1
16	49.3	27.8	38.8	97.9	110.5	110.1	58.7	21.0	176.0	96.9	139.7	59.3	97.2	140.2	103.6
16	48.0	34.1	32.7	98.5	106.5	113.2	55.3	17.1	175.9	102.7	131.7	64.5	93.7	136.2	97.7
16	47.4	33.6	35.7	94.2	117.0	109.8	54.6	16.8	178.4	96.2	143.3	64.9	97.9	144.0	106.7
16	48.2	31.9	41.6	92.1	114.5	109.1	51.3	19.6	181.0	93.9	131.2	59.7	95.4	137.0	107.3
16	43.9	31.9	38.1	96.3	114.4	111.7	49.8	21.5	174.8	95.7	137.8	56.1	94.4	134.2	102.3
16	51.6	30.0	33.3	94.8	114.9	116.4	50.9	16.4	181.8	106.2	136.9	66.8	93.3	131.4	103.1

Appendix A (continued)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
16	54.8	30.4	34.8	104.5	125.6	121.2	56.0	20.1	196.4	106.6	135.2	72.2	99.6	143.1	110.5
16	48.6	26.5	39.2	97.6	116.9	120.9	54.6	13.9	188.3	99.3	140.4	60.3	97.2	139.6	113.9
16	50.3	26.0	34.0	92.1	111.8	109.2	46.1	18.9	170.5	99.2	130.0	62.3	90.3	132.3	103.4
17	44.0	30.7	37.0	97.4	106.3	113.2	54.8	18.4	170.3	88.2	129.3	64.7	94.6	129.8	105.9
17	54.1	33.0	35.5	96.5	112.1	115.6	55.9	21.9	176.1	99.0	139.8	64.9	100.2	137.3	103.1
17	53.8	34.4	35.0	98.2	114.7	120.1	56.4	19.2	183.8	102.2	135.9	62.2	97.7	135.6	104.1
17	47.2	34.8	37.8	98.0	110.6	112.9	54.1	20.9	172.7	86.2	137.9	65.3	93.1	132.9	107.7
17	44.7	35.3	34.7	97.6	103.7	111.4	47.7	15.6	167.9	87.0	132.8	60.8	94.4	130.1	99.7
17	46.5	31.0	37.9	86.3	104.9	111.6	55.5	24.9	170.0	85.7	127.5	67.6	95.7	127.4	104.0
17	53.5	34.2	37.6	89.9	115.8	109.3	52.7	24.8	176.5	100.2	133.9	64.3	98.9	124.1	108.3
17	48.9	36.9	37.4	93.4	110.4	113.3	53.6	20.1	173.0	94.3	140.4	65.6	96.4	131.9	105.5
17	51.9	31.0	40.2	101.3	113.2	109.1	52.5	23.1	181.0	95.7	131.9	67.2	93.8	123.2	104.6
17	51.9	34.5	39.3	99.1	95.4	126.2	50.8	19.0	176.0	100.7	143.4	64.3	99.1	139.8	114.0
17	47.5	37.9	38.5	97.0	108.9	118.8	53.3	19.6	181.7	102.1	139.2	64.9	101.0	133.6	108.7
17	47.9	36.5	38.3	99.3	120.3	105.5	51.8	12.9	176.3	97.5	140.4	61.6	101.2	129.6	109.9
17	49.4	32.3	39.0	91.7	109.9	111.6	53.7	22.1	172.5	96.3	131.8	63.4	98.5	134.6	105.4
17	56.3	34.1	38.1	91.9	110.3	111.7	54.2	20.9	173.2	101.2	139.9	64.8	96.0	133.9	103.4
17	54.7	38.0	40.4	110.3	112.6	119.3	58.2	28.4	185.0	98.8	148.9	76.6	101.7	139.3	112.6
17	51.2	36.0	39.8	98.7	102.8	110.1	53.7	18.7	172.1	97.7	138.0	60.4	93.7	134.4	102.5
17	49.4	34.1	39.2	93.1	111.9	107.8	52.3	13.2	173.2	96.6	127.1	64.1	102.0	132.1	106.4
17	48.1	34.4	35.7	98.9	110.6	110.2	48.8	13.4	168.9	96.4	136.4	62.8	95.8	135.0	107.8
17	46.2	32.9	35.0	103.5	101.2	113.1	51.0	17.4	169.7	86.4	133.0	65.9	99.0	134.4	112.1
17	48.4	29.1	38.2	98.7	119.5	112.5	54.1	18.2	175.6	98.5	138.5	63.7	97.1	132.8	102.9
17	51.3	28.7	36.6	101.3	109.0	116.9	52.8	17.7	175.8	95.5	135.2	62.9	105.8	140.7	107.7
17	54.6	34.8	40.7	98.6	121.8	110.4	56.6	22.8	177.8	99.6	140.6	64.2	101.2	137.9	111.9
17	48.6	34.8	38.5	103.0	121.3	113.1	55.0	20.4	183.6	96.4	135.4	68.7	96.8	133.3	111.8
17	48.1	29.1	36.2	100.3	115.7	111.4	52.3	22.0	175.1	89.5	130.6	62.2	93.7	138.2	102.2
17	45.4	29.5	39.7	99.4	115.4	119.0	52.6	17.1	175.9	89.6	140.6	62.4	94.2	122.7	111.5
17	47.2	32.9	37.6	96.9	112.9	110.5	54.2	22.5	172.7	93.8	136.6	66.9	101.9	136.7	98.9
17	53.3	32.5	39.8	95.9	113.4	112.0	57.0	20.9	177.2	96.5	138.4	62.0	102.6	141.8	108.5
17	54.9	30.6	38.1	103.7	113.6	114.9	57.5	23.6	182.3	99.4	139.5	72.7	100.4	147.6	111.2
17	50.9	33.9	36.4	97.0	105.8	110.8	58.0	18.8	174.4	99.4	133.7	70.6	101.0	144.2	109.1
17	50.4	34.5	37.8	95.1	115.4	114.2	57.3	21.7	178.7	94.8	136.2	65.9	97.9	144.1	110.0
17	42.9	35.1	39.2	93.2	104.3	111.2	57.8	13.0	173.9	90.1	138.7	63.7	96.6	139.5	106.9
17	53.4	31.6	34.2	102.8	107.5	106.8	48.5	25.1	171.0	97.1	131.9	66.4	101.7	134.8	110.6
17	48.0	32.7	33.5	95.6	110.3	120.5	59.6	17.9	183.1	97.1	136.1	68.8	101.5	154.8	111.0
17	49.5	30.5	37.0	97.2	110.4	100.6	52.1	19.0	175.3	92.3	126.2	63.7	99.5	135.4	102.3
17	40.6	36.4	38.7	94.8	112.3	100.6	55.1	13.7	168.0	92.1	139.3	58.0	95.3	139.9	111.5
17	50.1	30.5	40.6	102.0	105.4	110.0	51.5	23.3	175.9	96.5	139.0	66.1	99.2	144.4	110.3
17	45.4	37.1	37.0	94.6	105.2	107.2	54.3	16.0	167.2	96.4	138.2	61.4	96.3	139.3	109.4
17	50.8	29.9	32.4	96.5	116.1	107.5	59.2	20.5	175.9	99.6	134.3	68.5	95.3	136.9	107.5
17	50.9	32.6	33.9	92.4	112.2	117.0	52.1	20.8	174.7	95.7	135.7	62.8	97.6	131.8	108.7
17	44.3	34.1	36.3	101.9	112.0	106.1	51.3	17.5	173.1	92.0	136.8	65.2	93.9	120.9	103.8
17	49.9	25.3	38.1	99.6	117.5	114.2	47.8	18.7	179.4	96.9	137.0	63.8	96.8	138.4	106.7
17	47.9	33.9	40.0	96.6	112.9	109.8	53.5	18.0	174.7	98.3	138.3	59.9	96.6	137.3	103.3
17	46.8	30.8	37.9	92.1	115.5	114.2	51.5	15.1	177.2	92.2	138.4	70.4	96.0	141.3	107.8
17	44.9	30.1	36.9	99.4	123.2	116.3	56.5	17.1	182.2	91.5	141.6	61.9	101.0	145.2	113.5
17	50.9	29.2	35.3	95.6	122.7	107.5	55.8	19.2	182.5	104.1	131.6	68.1	100.1	134.2	108.1
17	52.6	31.8	36.5	95.6	107.4	114.9	54.5	20.3	173.3	98.0	136.6	68.9	94.1	135.0	102.6
17	50.7	32.5	34.3	98.6	109.7	110.2	59.1	22.4	175.8	98.0	136.7	71.2	101.6	140.5	109.3
17	49.3	33.2	41.4	104.5	119.9	114.0	53.1	13.7	181.7	97.5	141.3	67.5	101.5	138.9	115.9
17	55.4	33.0	41.5	90.7	123.9	109.6	58.2	16.5	183.4	104.4	134.4	60.9	102.2	142.2	105.2
17	43.4	30.9	34.1	100.3	113.4	109.1	47.9	15.3	173.1	89.5	132.5	60.4	99.2	128.1	108.8
18	47.9	32.5	40.6	95.0	103.9	111.1	51.7	18.0	169.5	92.6	131.0	63.7	94.0	121.8	109.4
18	51.5	35.3	40.5	94.5	114.1	115.4	54.6	24.0	178.3	102.2	139.4	68.1	99.4	126.4	108.4
18	44.2	31.0	36.9	89.6	113.6	109.7	51.1	15.6	170.1	91.1	132.4	69.1	95.2	127.3	107.1
18	53.8	30.1	37.3	87.0	106.5	105.9	54.0	23.6	164.9	98.7	129.6	66.3	95.5	135.3	117.7
18	54.3	39.2	35.4	87.9	102.4	105.4	50.3	18.4	164.6	103.4	130.6	61.9	94.2	134.2	108.9
18	47.7	35.7	34.9	98.5	105.1	109.4	54.6	20.5	171.8	96.3	132.9	61.9	97.4	126.9	113.2
18	56.6	38.8	35.6	100.4	105.6	108.9	52.8	22.4	168.9	105.4	133.1	73.7	97.4	127.7	109.6
18	52.8	35.8	35.1	97.9	114.8	115.6	54.9	26.6	176.2	104.2	131.8	64.9	95.2	129.8	104.5
18	57.0	32.8	34.5	92.4	109.7	108.0	51.7	28.0	166.8	103.0	130.5	63.6	100.9	131.9	112.8
18	56.4	35.3	36.8	98.7	108.8	115.2	57.8	16.7	178.3	107.9	138.6	71.5	94.4	135.7	113.2
18	54.3	30.2	33.0	108.8	101.3	114.4	57.4	18.1	174.0	103.5	143.5	65.1	93.6	143.8	110.2
18	45.5	31.1	34.5	88.9	111.8	115.0	56.1	13.3	175.0	94.4	131.9	63.5	94.9	140.1	109.7
18	51.1	29.8	38.8	82.1	111.2	104.0	53.2	12.8	169.9	102.4	129.6	68.0	95.3	135.0	105.5
18	49.2	31.8	38.1	87.4	107.0	115.5	54.7	20.2	175.4	99.7	130.5	64.8	98.0	135.2	108.7
18	51.6	30.8	38.5	93.2	111.3	101.0	54.3	15.7	171.9	99.1	131.1	66.7	90.1	141.2	114.3
18	56.2	31.2	31.9	95.3	106.5	107.9	53.6	21.9	174.4	106.6	131.0	69.0	97.4	134.9	113.2
18	50.3	35.9	36.4	96.5	109.3	114.3	55.2	15.0	181.2	99.7	131.8	62.2	101.9	138.3	107.5
18	49.6	30.7	34.8	97.4	106.7	107.0	57.3	15.3	170.9	101.7	138.4	60.5	102.4	136.6	107.4
18	51.5	30.9	30.8	95.8	111.1	107.5	51.5	20.5	170.1	102.6	133.5	73.4	96.9	129.0	107.3
18	51.9	31.6	34.6	91.1	111.6	102.4	51.7	16.8	167.5	105.8	133.9	66.0	100.5	145.6	111.3

Appendix A (continued)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
18	45.2	29.4	32.0	107.6	111.0	112.9	58.2	16.9	178.2	92.1	137.1	60.8	97.5	137.8	110.3
18	55.0	33.4	36.2	97.6	96.1	104.1	51.9	20.4	163.4	107.9	130.3	67.0	92.7	131.0	103.7
18	46.1	29.5	39.8	84.0	110.2	103.6	54.7	16.5	172.6	103.7	123.8	64.4	98.3	138.6	114.5
18	47.2	33.5	34.7	94.9	113.5	109.9	55.8	18.8	172.8	96.7	132.5	67.8	102.1	139.8	113.5
18	49.9	28.0	36.1	91.3	99.7	102.3	54.8	17.3	163.5	102.3	130.0	61.6	95.0	137.9	116.3
18	50.8	32.4	37.2	88.5	107.7	110.7	54.3	19.1	175.2	106.6	126.7	70.2	100.4	138.4	112.0
18	46.7	28.9	39.4	95.1	105.2	105.4	53.4	11.5	168.4	96.0	134.7	58.5	99.2	142.2	104.8
19	53.1	33.5	36.6	94.0	113.9	108.7	54.4	16.8	176.1	101.9	131.7	64.4	101.6	136.0	108.9
19	49.7	31.1	39.6	94.1	121.1	96.5	50.3	15.9	169.5	96.1	128.3	63.1	92.9	124.0	107.6
19	47.1	29.7	35.3	110.1	100.5	109.9	48.5	22.1	173.3	94.1	131.0	60.3	93.7	131.1	112.0
19	57.2	32.5	44.2	109.1	115.9	107.7	52.6	19.9	182.0	104.6	139.9	62.5	99.5	134.4	108.5
19	55.8	33.9	40.2	95.3	119.6	110.8	51.4	27.7	177.5	106.2	137.9	60.0	97.4	137.2	108.2
19	46.0	32.7	44.3	98.0	127.3	113.5	56.6	22.6	183.2	86.8	141.6	59.5	98.5	128.2	108.9
19	57.7	34.6	38.2	103.4	112.4	115.3	56.1	23.8	176.8	103.7	139.2	67.8	100.0	129.7	107.4
19	54.2	34.6	40.7	102.7	121.1	112.6	53.8	21.3	180.5	101.0	139.7	68.5	100.7	131.2	102.0
19	55.8	27.0	41.0	92.4	118.5	112.3	53.3	17.2	178.0	104.9	136.9	59.8	95.5	129.2	111.1
19	47.7	29.2	42.4	90.0	107.3	107.8	51.2	17.9	165.3	93.5	128.9	60.6	91.9	127.9	107.2
19	51.1	35.2	36.6	100.8	111.3	115.1	52.0	20.4	178.1	97.4	137.9	61.0	91.6	124.2	109.8
19	51.0	31.5	37.6	98.6	115.9	110.9	49.5	16.7	171.9	99.1	131.4	56.9	90.8	120.6	101.4
19	55.6	35.3	37.9	91.0	117.2	111.9	55.1	20.0	178.3	103.9	138.1	59.3	94.9	130.7	106.9
19	55.6	31.3	37.3	93.7	117.5	117.7	55.2	17.4	175.2	100.7	135.6	65.9	88.9	127.3	105.0
19	54.8	34.7	34.4	85.7	109.5	108.1	49.2	19.0	161.3	99.1	129.4	60.3	88.6	129.1	99.7
19	49.8	35.7	40.1	88.9	113.6	111.9	58.6	18.3	171.0	97.2	138.3	62.7	94.5	131.0	101.0
19	55.5	36.8	39.0	99.6	118.1	110.3	51.8	18.2	174.6	106.4	136.3	63.1	96.2	132.9	102.9
19	52.9	30.6	44.3	98.2	117.6	107.2	51.3	19.9	176.0	94.4	129.3	58.4	98.3	132.1	114.5
19	50.3	35.1	41.0	99.4	120.7	116.1	57.0	22.8	179.3	96.5	145.5	63.1	89.7	129.5	108.8
19	56.2	38.0	39.6	93.2	124.4	114.2	57.8	23.9	181.3	106.3	141.3	65.6	101.6	136.4	104.2
19	50.2	33.1	39.4	98.7	114.1	105.0	54.3	18.0	172.3	93.0	132.6	63.6	98.2	127.2	104.5
19	55.0	32.9	38.1	91.9	117.5	111.9	51.8	23.4	175.4	102.3	128.9	67.1	97.2	132.3	106.0
19	53.6	35.7	45.8	107.6	105.4	112.6	61.8	19.9	178.5	101.6	140.7	63.9	100.0	134.1	116.2
19	50.7	32.5	31.9	93.7	112.2	103.6	53.3	20.8	168.2	97.9	136.6	65.9	96.7	140.0	108.0
19	54.1	34.0	39.6	100.6	113.1	112.8	51.6	17.1	182.6	103.6	134.8	67.6	104.1	147.6	112.3
19	49.8	28.4	34.0	88.1	113.2	111.0	48.9	15.8	170.5	93.9	136.2	58.4	93.7	130.3	103.8
19	51.0	31.5	34.4	91.4	112.2	109.4	54.8	19.8	170.9	98.6	136.9	61.8	96.4	139.7	105.2
19	49.9	36.1	36.1	98.3	106.9	118.1	55.1	16.9	173.9	95.3	144.1	57.8	94.0	134.5	109.4
19	49.2	35.7	36.8	99.8	116.3	105.9	55.6	18.8	178.3	99.6	140.0	61.8	93.5	142.1	113.8
19	55.6	33.4	32.8	103.1	120.1	116.9	49.7	25.5	182.5	103.1	148.7	64.0	99.4	144.4	110.8
19	52.2	33.7	36.4	101.2	126.4	110.2	54.9	25.9	183.8	94.9	140.6	62.6	95.3	142.5	103.1
19	47.2	25.7	39.3	92.1	115.7	113.4	60.8	20.6	179.4	96.0	129.7	67.0	94.9	140.5	103.4
19	45.7	32.7	37.0	91.4	118.0	112.6	51.1	17.4	180.5	86.6	138.5	61.7	103.7	144.0	112.6
19	46.8	28.9	36.3	96.6	112.1	106.7	56.3	15.6	171.8	92.6	133.3	63.4	92.3	141.8	109.4
19	49.3	33.6	33.9	83.6	121.4	113.4	55.5	17.4	180.8	97.7	130.7	64.3	100.0	131.8	104.3
19	54.1	32.6	34.1	102.7	99.0	119.1	52.9	20.5	180.7	101.5	132.7	66.4	98.8	133.9	107.3
19	44.9	33.0	40.3	90.4	119.4	113.7	49.8	16.7	179.8	101.5	133.9	57.2	94.3	125.7	106.3
19	46.7	32.2	37.5	114.0	102.2	109.3	50.3	23.1	176.4	97.2	136.4	61.9	97.6	128.3	106.7
19	48.5	37.2	38.8	101.0	116.1	117.4	57.4	17.8	185.0	100.2	143.7	64.6	90.5	141.8	104.8
19	48.5	34.3	35.2	96.6	118.1	116.0	50.3	17.4	179.2	96.7	135.1	62.8	99.6	133.9	99.8
19	52.4	27.9	34.2	99.4	114.1	111.3	53.5	13.3	176.9	100.4	136.5	60.7	99.1	132.9	112.7
19	44.0	30.9	41.4	88.3	125.8	118.2	55.7	11.9	187.0	93.0	132.5	61.1	99.4	129.2	103.0
19	56.6	30.0	34.3	107.0	120.9	110.2	57.7	22.9	186.3	109.0	136.5	67.4	95.8	136.1	108.7
20	40.0	33.5	37.8	108.0	109.2	115.9	52.7	16.7	175.2	88.3	139.1	65.0	96.7	130.1	105.3
20	45.7	34.8	37.3	95.5	106.2	110.3	50.8	16.9	169.7	91.4	128.7	62.6	95.3	130.4	105.4
20	53.0	37.1	34.7	98.7	116.2	107.9	51.1	22.2	174.8	108.2	136.7	68.5	101.3	138.1	109.8
20	49.4	35.8	41.2	99.8	104.0	110.4	59.5	30.0	174.2	99.5	130.4	69.9	99.3	136.3	105.4
20	45.2	30.7	38.9	102.1	103.9	112.2	55.7	22.3	168.6	91.6	131.8	57.5	96.1	129.6	97.4
20	47.2	33.7	39.4	91.7	117.4	120.2	56.8	25.0	175.9	105.2	141.0	67.1	98.5	133.3	103.5
20	51.0	29.8	38.1	97.3	112.5	119.6	57.2	23.5	178.3	94.9	135.7	64.8	100.8	136.8	106.2
20	56.0	29.7	38.0	102.4	113.0	117.6	52.5	25.0	177.8	104.3	134.6	64.1	100.2	131.0	112.4
20	48.3	32.0	42.2	91.6	106.2	111.5	53.8	18.5	170.3	99.6	132.7	63.4	97.6	131.4	112.4
20	52.5	28.1	36.4	101.9	116.4	112.5	51.1	25.1	174.7	96.1	133.6	64.8	96.7	130.5	107.9
20	49.2	31.7	37.5	97.8	108.2	113.8	52.7	22.0	169.4	95.8	136.2	67.0	95.0	132.7	107.1
20	49.6	33.9	40.0	89.2	99.2	113.4	57.1	21.7	167.5	98.5	126.4	65.6	99.4	139.1	108.2
20	52.3	32.7	37.0	95.9	105.0	115.5	58.9	24.6	172.9	99.5	134.9	69.4	107.8	138.8	113.3
20	53.0	34.5	38.3	103.6	106.6	110.3	58.7	21.5	167.7	94.1	140.8	63.1	98.6	133.1	106.5
20	51.1	32.9	35.6	102.4	109.2	114.4	50.7	16.9	174.2	105.6	132.0	61.9	98.1	128.6	104.0
20	52.8	32.2	42.6	91.3	110.8	112.8	54.0	22.9	171.5	98.9	129.2	60.3	101.0	139.1	108.7
20	52.4	32.1	36.8	99.0	109.2	111.7	55.9	21.4	169.4	99.3	136.1	64.9	98.9	130.8	110.4
20	43.4	25.9	37.5	92.2	114.8	116.8	55.5	19.1	179.8	92.9	134.5	61.7	106.0	142.7	100.8
20	42.9	33.3	35.8	89.0	110.8	117.3	59.8	21.8	180.6	100.2	130.3	66.1	103.2	140.6	111.3
20	46.9	29.5	38.7	83.6	102.2	106.2	53.4	21.6	159.2	96.6	131.0	56.4	95.9	126.1	101.6
20	53.2	32.2	37.3	91.8	109.9	107.2	57.2	22.2	172.6	98.4	132.3	68.7	99.7	140.5	115.9
20	48.5	35.9	37.2	94.7	108.0	111.8	56.5	19.0	170.7	101.2	138.2	66.9	102.1	146.6	109.0
20	53.0	32.1	34.7	98.1	113.0	107.5	56.0	22.4	171.3	102.9	135.6	68.4	101.9	141.7	108.6

Appendix A (continued)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
20	47.5	34.9	40.0	98.1	108.5	113.7	59.1	17.1	178.3	99.8	141.2	69.0	108.0	155.6	110.8
20	50.1	32.3	38.0	108.9	97.2	113.2	55.1	19.0	178.1	100.3	133.4	63.0	94.7	133.6	103.6
20	46.3	32.8	36.6	100.6	115.3	113.3	54.9	22.6	173.4	99.4	137.7	61.2	98.4	136.9	107.3
20	45.9	32.9	35.8	100.4	112.5	117.3	52.0	22.9	171.9	98.5	139.6	61.0	96.2	136.6	107.5
20	47.1	32.0	37.6	106.3	104.0	115.0	49.9	19.5	175.0	99.9	136.1	61.7	98.3	133.9	108.1
20	54.7	31.1	39.4	89.8	108.0	110.6	57.9	20.0	175.0	101.3	132.7	61.4	104.1	147.1	107.2
20	42.6	34.2	35.7	104.1	110.0	118.1	54.5	13.8	174.2	92.5	146.1	56.6	99.7	140.6	111.3
20	46.0	30.2	34.8	96.5	107.6	117.7	58.4	17.3	178.2	101.0	136.7	58.4	102.1	143.2	108.6
20	49.3	30.3	33.0	94.7	107.2	107.4	54.5	18.9	172.0	96.1	126.7	57.9	98.1	141.2	109.8
21	45.8	33.6	37.5	94.0	109.8	104.3	54.9	17.1	165.2	93.0	132.1	63.8	90.9	132.4	100.0
21	51.4	33.9	39.3	95.6	113.5	105.7	53.0	23.5	172.6	94.8	129.7	66.2	97.8	130.1	102.6
21	41.0	33.3	33.6	90.1	111.1	109.0	52.2	13.5	164.9	88.4	133.7	65.3	93.5	133.5	106.6
21	48.8	31.6	39.9	88.7	109.1	120.8	52.0	19.3	173.6	93.5	132.9	62.9	93.1	132.1	109.0
21	49.7	31.7	37.8	98.6	107.9	107.6	54.0	24.3	169.7	92.2	130.5	62.1	96.7	127.0	106.4
21	51.6	35.3	39.3	93.9	110.9	106.9	53.2	19.7	167.6	101.5	131.4	66.7	98.3	130.7	109.7
21	48.5	32.2	35.1	94.2	110.4	105.3	51.0	18.0	163.9	88.6	127.4	57.2	88.8	121.8	102.6
21	49.9	31.9	40.8	104.4	98.1	102.8	53.0	12.3	160.8	92.8	131.7	56.9	98.6	126.9	107.1
21	51.3	31.6	41.1	91.1	115.0	109.5	53.2	18.2	167.4	93.4	136.1	64.3	96.8	129.3	107.5
21	49.8	31.1	36.3	94.9	104.8	101.1	47.2	15.2	161.7	93.5	127.7	56.7	94.0	123.1	106.2
21	47.3	32.2	42.7	92.9	111.9	115.3	49.2	23.9	167.9	93.1	134.2	58.9	97.9	133.0	103.1
21	53.8	33.7	35.4	97.1	110.6	108.7	55.8	18.4	172.0	96.7	130.3	56.4	93.4	131.9	108.5
21	48.1	30.2	36.3	94.4	107.7	107.2	47.5	19.1	168.7	89.1	131.1	55.2	100.8	130.3	107.8
21	48.2	29.9	36.9	97.2	104.9	107.6	55.7	18.8	169.5	85.5	130.3	60.6	96.2	132.8	106.3
21	51.6	37.3	36.2	98.6	110.6	115.6	52.6	24.8	174.3	93.3	142.0	54.2	101.7	134.4	102.6
21	55.2	37.2	38.2	92.5	111.5	113.2	46.0	25.5	169.4	103.1	136.5	62.9	102.6	136.0	114.7
21	50.1	28.4	38.2	87.2	106.3	103.6	54.9	18.9	161.2	89.7	128.6	55.5	94.1	124.7	100.6
21	52.6	31.8	35.5	97.5	108.4	109.9	45.3	20.2	173.5	95.0	136.6	64.1	95.5	140.9	105.8
21	45.8	33.5	36.4	90.5	111.1	104.8	49.7	12.9	166.9	86.3	136.3	50.8	100.2	146.0	103.3
21	48.1	33.8	30.5	95.6	109.1	108.2	51.6	19.3	175.8	99.9	128.9	50.8	99.1	136.7	114.1
21	49.6	28.9	36.3	92.6	112.1	112.9	51.4	19.6	176.5	96.1	131.1	64.4	94.1	141.0	105.5
21	50.2	32.1	38.7	89.7	109.1	99.5	54.6	18.6	176.2	98.9	129.5	64.4	98.3	141.0	104.9
21	41.7	32.4	34.1	91.1	112.9	107.3	51.0	9.6	171.7	89.2	136.2	55.4	96.6	141.0	104.2
21	39.4	31.5	37.4	90.4	105.6	103.3	51.5	12.1	163.3	87.6	133.4	51.2	92.7	133.3	96.5
21	43.8	28.8	39.4	102.2	107.3	104.4	47.2	15.7	175.4	90.9	133.8	61.5	94.2	133.3	107.5
21	47.0	32.0	34.9	91.3	102.0	107.8	47.7	20.1	165.3	97.4	130.4	55.7	96.6	131.9	102.3
21	45.6	29.0	38.9	96.7	106.9	107.6	51.4	13.0	170.3	92.4	136.6	62.6	102.2	133.7	107.0
21	47.4	30.8	36.3	93.4	114.7	112.2	51.4	16.8	176.2	90.5	136.7	61.1	100.8	139.2	106.4
21	41.4	32.5	33.7	93.3	109.6	113.6	49.5	13.6	170.4	88.6	136.7	60.9	95.6	139.0	101.5
21	49.8	30.5	37.6	97.2	112.7	108.0	49.5	12.5	172.1	98.5	139.4	64.4	101.3	137.8	107.0
21	36.2	29.3	39.0	95.7	102.4	106.4	47.7	13.8	169.7	84.0	130.8	59.7	97.5	136.6	107.0
21	49.3	31.7	38.9	98.2	109.4	113.8	56.3	15.6	179.8	97.2	136.9	53.0	101.0	136.4	109.9
21	45.8	31.0	37.1	98.2	100.5	104.4	53.5	16.5	165.5	93.6	131.6	67.3	101.2	136.1	105.5
21	46.3	28.7	38.3	102.4	108.3	114.7	53.5	20.3	172.4	90.8	136.6	64.3	98.6	136.2	103.1
21	52.6	26.7	34.0	104.9	101.6	109.9	48.3	15.9	168.2	97.9	138.2	59.4	92.8	132.7	105.7
21	49.0	30.0	33.2	96.8	116.0	118.8	50.7	20.2	175.7	92.9	141.2	61.7	94.8	126.0	108.0
21	47.9	26.0	39.7	103.3	116.8	110.2	55.1	16.0	183.7	92.4	129.3	64.9	97.3	133.2	104.2
21	49.6	30.8	32.3	86.1	103.5	104.9	53.7	17.7	166.1	95.0	125.0	61.2	97.4	134.6	102.4
21	50.0	29.8	35.0	93.1	114.0	108.0	55.3	23.0	173.3	99.8	133.8	65.9	98.8	140.1	111.2
21	48.7	30.2	36.3	84.9	107.2	101.1	50.9	18.2	166.6	91.2	127.9	64.3	97.1	137.9	102.7
21	46.9	32.3	38.3	100.1	98.1	100.9	50.9	17.6	163.7	91.2	125.6	58.7	98.2	137.2	108.5
21	47.4	26.3	33.9	94.8	99.5	105.6	51.3	20.9	166.5	92.1	123.4	57.8	93.6	135.0	102.6
22	57.6	33.2	40.2	90.3	109.8	110.4	45.2	31.5	167.0	107.5	133.6	64.7	99.2	126.8	110.3
22	49.5	32.9	37.7	89.7	108.5	107.6	55.3	19.7	167.4	94.9	129.3	59.7	91.6	123.3	105.0
22	50.8	36.8	36.8	91.1	105.4	113.8	54.6	21.4	172.6	103.6	134.2	65.9	93.7	129.6	110.0
22	56.7	35.4	35.9	92.5	111.0	109.1	55.8	19.3	175.5	107.8	131.3	64.8	95.7	135.8	99.5
22	47.7	36.5	41.0	96.6	105.1	108.2	54.8	20.9	171.4	92.3	133.0	62.4	95.8	139.0	108.1
22	45.3	37.0	35.7	99.2	116.6	109.5	53.4	17.5	170.5	94.1	140.7	64.8	98.7	131.4	105.9
22	50.8	31.6	37.8	101.1	117.5	109.3	66.4	19.7	178.9	94.8	133.7	57.3	96.8	136.6	110.7
22	49.1	32.2	37.6	96.4	113.5	114.7	56.8	19.7	178.7	101.1	128.9	63.3	98.2	125.2	104.4
22	53.5	34.0	39.5	101.2	106.0	115.2	53.1	20.7	175.3	100.7	134.8	64.7	98.1	136.8	106.4
22	48.5	32.8	37.9	88.6	117.4	110.8	51.5	15.6	174.1	89.6	129.8	63.9	101.4	130.6	108.1
22	56.1	35.4	40.8	94.8	122.7	115.7	55.1	19.3	183.2	102.0	144.1	64.5	95.1	128.8	108.7
22	46.8	32.8	36.4	88.6	104.3	103.6	53.5	16.7	163.2	93.9	131.0	59.5	93.3	132.1	100.5
22	50.7	36.5	43.2	88.1	111.0	114.2	54.2	18.3	171.6	99.9	134.4	63.3	94.7	132.4	106.9
22	55.4	32.9	36.5	92.1	119.6	112.0	52.3	18.6	176.7	99.4	135.8	63.5	97.7	131.5	110.8
22	51.6	33.8	36.9	97.5	122.6	124.5	52.2	18.6	184.4	99.0	140.5	64.4	103.3	136.4	109.3
22	52.6	33.6	40.6	105.1	105.0	114.0	54.8	20.8	171.9	101.1	134.0	63.6	95.1	125.0	114.2
22	53.0	36.3	43.2	97.0	108.9	119.8	57.5	16.1	179.4	105.0	134.1	71.3	100.7	137.3	111.2
22	48.6	31.9	38.4	98.9	109.8	109.5	52.6	17.2	168.4	98.0	131.5	59.6	91.9	130.8	113.3
22	53.1	31.2	39.3	102.8	107.7	109.4	53.6	21.5	172.6	100.3	132.4	61.0	96.2	133.1	106.5
22	54.7	30.4	40.3	106.8	101.4	115.2	52.5	26.3	172.3	99.7	135.3	62.0	97.9	134.6	106.9
22	50.6	32.1	41.8	96.9	113.0	110.4	53.3	19.8	175.7	98.2	134.4	62.7	92.3	127.4	112.0
22	54.8	31.7	41.7	88.9	113.8	117.5	55.0	24.6	169.5	101.8	138.8	63.8	95.9	131.8	101.2

Appendix A (continued)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
22	43.1	31.8	39.9	92.6	118.0	108.0	54.4	13.8	174.3	92.8	132.1	60.3	97.6	136.3	111.6
22	51.9	34.9	42.9	95.9	117.2	115.1	59.7	19.7	179.4	102.4	136.6	70.0	98.8	138.0	112.1
22	50.3	32.9	40.2	93.8	111.7	106.9	50.7	22.8	169.9	96.5	126.1	63.8	99.2	131.6	107.2
22	49.1	29.7	42.9	102.6	94.2	109.0	53.1	20.1	166.3	96.1	127.5	64.6	89.2	124.8	99.8
22	53.9	33.0	43.5	100.5	111.1	114.6	55.3	24.5	175.4	98.0	136.6	69.1	93.4	131.4	112.2
22	50.6	35.5	40.2	100.4	107.7	111.5	48.9	23.0	171.8	94.9	133.6	58.5	93.1	125.3	105.5
22	53.1	34.6	41.1	102.8	117.5	111.9	52.6	21.1	181.2	100.5	135.5	58.7	97.7	126.9	106.8
22	51.9	33.7	42.5	90.0	110.8	111.3	56.7	23.3	170.9	97.0	135.4	65.5	104.4	136.8	111.6
22	53.6	37.3	38.5	93.3	102.5	110.6	57.0	18.6	169.9	106.0	134.3	63.7	95.6	132.2	100.4
22	52.6	34.7	40.3	103.0	110.0	119.4	56.8	20.7	180.5	103.6	134.6	66.9	90.7	133.0	111.4
22	54.3	35.4	43.2	101.4	115.0	106.4	57.9	20.6	175.3	104.7	133.4	64.2	101.4	131.0	103.5
22	52.4	32.2	39.6	99.5	115.5	110.0	54.6	19.0	172.8	99.0	135.9	66.7	95.3	132.5	110.5
22	44.1	26.9	40.5	96.2	111.4	108.6	49.8	17.7	172.0	87.8	125.8	60.9	92.2	128.3	107.3
22	56.1	31.8	36.4	94.6	119.4	113.7	57.1	19.6	180.5	109.4	141.6	62.0	99.1	140.3	103.8
22	48.2	30.4	36.9	91.5	109.3	110.9	50.8	12.4	171.8	101.2	131.9	63.0	93.2	129.4	101.4
22	50.9	31.8	37.7	95.6	116.1	114.6	53.6	22.4	180.9	103.5	138.1	62.7	96.6	133.9	114.6
22	47.9	29.3	37.8	100.0	120.2	114.8	53.3	21.7	183.1	88.9	140.7	65.6	96.8	142.5	109.4
22	46.7	34.8	37.7	97.0	112.8	113.7	55.4	17.2	179.7	100.2	139.1	63.9	95.5	138.5	108.9
22	50.2	34.7	36.3	100.3	115.3	105.3	53.8	6.6	175.7	102.8	137.7	59.6	99.1	143.5	112.5
22	49.2	33.8	34.4	96.5	111.3	105.7	50.8	13.3	175.9	103.3	128.6	59.7	94.8	135.6	104.4
22	50.6	32.9	37.9	101.4	113.4	104.1	49.6	19.6	175.5	99.2	138.8	57.6	97.5	138.0	101.8
22	50.2	32.4	34.9	102.3	91.0	111.2	50.1	18.6	166.5	99.9	132.1	60.4	97.9	138.5	104.5
22	44.8	30.1	38.4	95.6	107.4	107.1	54.3	11.9	171.5	95.8	136.8	61.7	97.9	139.0	101.5
22	44.2	29.2	35.6	88.3	112.0	111.7	54.6	13.5	174.3	94.3	127.9	60.9	99.7	134.6	113.9
22	54.8	31.7	32.6	90.7	119.7	109.1	48.8	20.0	178.5	105.6	132.4	60.3	97.7	125.0	98.8
22	52.5	28.8	39.3	89.8	118.3	109.0	57.5	19.8	177.0	92.0	136.2	65.8	91.6	142.1	108.4
22	44.0	35.1	36.5	88.1	102.1	109.2	51.3	16.4	165.6	93.9	133.3	66.2	100.0	132.2	101.6
22	50.9	35.2	38.2	89.8	116.9	105.1	52.3	18.8	173.9	96.6	134.1	64.8	98.1	135.0	105.5
22	48.6	35.2	38.3	87.5	117.4	111.0	61.4	13.2	182.2	104.6	140.0	65.9	92.3	137.0	110.0
22	48.3	32.0	37.3	102.9	110.9	105.4	55.9	16.2	175.0	95.2	133.4	65.3	96.1	133.2	106.6
22	41.1	37.3	44.6	98.8	115.0	111.1	54.0	10.5	182.2	93.5	145.2	59.0	100.7	135.9	111.5
22	43.6	30.1	37.5	107.6	106.3	112.3	53.8	14.1	174.7	91.6	134.9	61.6	99.3	136.8	105.1
22	51.0	31.5	40.0	93.4	119.3	108.2	48.3	17.5	176.9	95.8	128.4	65.4	91.0	130.1	112.5
22	44.5	37.9	39.1	96.1	115.6	114.0	55.2	17.7	176.0	93.2	147.1	62.6	103.5	145.4	107.9
22	50.9	30.9	33.9	96.8	104.8	105.4	50.9	21.1	172.2	99.4	129.9	61.8	97.0	134.3	102.6
22	51.5	34.9	39.4	102.6	116.4	114.1	54.1	20.1	178.5	104.5	145.5	61.1	99.3	139.1	113.2
22	52.8	33.8	37.7	91.8	115.8	113.6	55.1	23.5	177.1	104.7	142.3	67.2	98.8	135.6	109.8
22	52.8	33.9	39.5	100.7	118.8	108.8	60.9	18.8	182.7	101.7	138.9	61.1	98.7	132.1	107.0
22	52.5	31.7	37.1	100.4	97.3	107.0	55.0	14.8	166.9	99.2	135.1	64.4	93.5	143.9	105.7
22	51.5	33.3	39.5	96.0	113.4	117.1	50.2	21.2	178.9	98.6	136.3	51.2	95.0	132.4	104.3
22	55.2	34.9	33.2	93.8	114.9	118.2	54.7	18.6	183.0	104.5	136.8	66.3	102.5	138.8	106.0
22	50.2	31.7	37.0	85.4	109.7	105.1	55.0	19.0	165.8	101.2	127.3	67.8	97.4	145.6	110.9
22	42.7	33.4	37.8	94.0	120.2	108.4	54.0	12.1	169.5	85.6	141.5	57.1	92.6	134.2	109.6
22	54.7	37.2	31.5	100.1	116.4	107.8	50.5	16.3	182.0	109.4	131.4	62.3	98.2	136.8	105.5
22	50.2	35.3	36.4	103.8	113.4	114.4	55.2	11.4	184.5	100.5	139.0	60.8	94.8	133.8	115.0
22	53.2	31.4	38.8	104.6	128.1	122.1	56.1	20.3	192.6	104.8	147.2	67.9	94.6	141.1	116.9
22	52.1	34.3	39.4	106.0	107.2	104.4	58.2	16.2	176.8	108.8	138.0	61.3	103.1	145.0	109.0
22	51.8	32.1	34.4	99.9	111.8	120.1	50.8	10.2	183.3	103.9	136.4	59.1	97.2	129.7	113.1
23	46.5	36.0	40.2	96.0	111.8	116.4	51.1	22.2	172.3	94.0	140.8	61.3	96.0	130.5	102.8
23	49.1	26.1	38.9	92.9	106.0	108.5	53.1	13.2	166.0	95.4	126.3	59.7	95.7	137.2	108.8
23	53.9	34.7	39.8	89.5	106.7	112.2	53.8	15.4	170.1	106.6	140.6	63.3	95.2	130.2	109.5
23	43.8	30.4	36.7	93.1	114.6	108.0	50.0	17.6	172.6	92.3	128.8	61.9	98.3	134.2	115.6
23	51.2	35.0	40.4	98.1	112.3	121.7	55.5	14.9	180.0	102.9	138.6	66.9	103.2	145.9	112.6
23	47.5	35.9	35.2	99.0	105.7	109.4	54.2	18.7	170.0	97.6	136.4	71.1	99.9	138.1	108.5
23	53.8	32.1	37.5	92.5	109.5	112.3	49.4	20.9	167.5	103.3	132.5	63.6	99.0	130.7	108.2
23	49.3	34.1	33.4	100.3	113.1	113.4	49.3	20.8	171.4	100.6	138.9	63.7	97.7	129.2	109.6
23	46.8	31.3	30.1	97.2	109.7	112.4	52.0	16.9	170.7	94.9	131.5	65.2	96.2	127.6	101.8
23	47.4	36.8	33.9	100.0	112.0	120.2	57.6	16.5	171.3	95.3	145.2	59.8	98.5	130.2	109.0
23	50.7	31.1	36.5	94.6	106.6	109.8	56.7	14.0	172.6	97.5	129.1	57.5	102.6	141.6	102.0
23	51.9	37.0	39.4	92.0	109.2	116.9	54.5	21.6	167.2	97.9	141.8	64.7	100.9	141.3	108.4
23	49.4	34.7	37.3	105.8	102.1	116.8	57.9	20.0	174.7	98.4	141.6	67.3	101.5	139.0	111.1
23	55.8	33.1	40.5	102.8	107.2	112.8	54.4	25.4	172.5	97.1	135.9	63.4	100.5	126.6	110.5
23	50.6	32.2	39.7	98.1	106.8	107.5	59.8	20.1	167.3	94.7	135.0	63.7	98.9	131.9	104.4
23	49.2	38.4	37.1	101.0	105.9	116.5	49.0	12.8	177.7	96.0	137.0	53.9	101.2	135.9	103.9
23	52.9	30.5	37.2	89.5	108.3	108.6	51.1	22.1	168.9	103.1	130.3	62.1	96.2	130.3	110.3
23	54.1	37.0	34.0	98.7	104.7	112.5	50.4	22.8	173.3	99.2	132.9	66.0	97.4	129.4	109.5
23	52.6	33.2	39.1	94.3	109.8	106.0	55.0	22.0	171.5	94.8	128.9	64.6	103.0	130.2	106.4
23	48.8	36.1	41.1	103.3	109.1	114.8	54.6	20.4	181.4	99.1	132.2	74.5	104.6	134.1	104.0
23	55.7	40.8	39.4	89.0	109.4	114.1	51.9	21.3	171.4	105.7	133.7	66.6	107.6	152.6	106.5
23	52.4	34.3	39.2	97.5	112.4	105.9	56.3	23.7	175.5	98.0	138.6	63.6	96.3	138.7	110.1
23	57.7	34.0	36.4	89.5	109.6	111.2	55.5	22.0	172.4	104.6	129.5	60.4	98.1	132.5	102.2
23	48.3	30.8	36.9	94.8	105.3	104.7	49.7	19.8	163.2	92.2	127.7	59.3	94.3	131.2	108.8
23	50.1	32.6	36.6	95.0	107.5	107.2	54.5	21.9	174.4	99.4	134.5	65.9	100.4	147.0	108.9

Appendix A (continued)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
23	46.1	33.8	38.1	86.0	110.1	117.1	53.8	12.3	176.4	97.9	137.9	59.2	98.0	140.6	102.3
23	51.9	27.8	35.0	91.9	114.9	109.0	52.0	22.9	174.6	96.1	135.4	59.6	96.0	135.0	108.5
23	50.0	34.3	32.8	98.8	104.5	116.0	51.7	20.0	168.2	97.8	140.5	65.3	93.7	137.4	100.1
23	41.4	27.8	39.6	83.8	109.5	112.9	49.8	14.0	171.0	96.4	136.2	61.7	100.5	137.6	104.4
23	45.9	36.0	39.9	101.0	117.9	116.0	46.1	18.7	182.4	95.4	142.2	59.8	100.8	141.0	115.4
23	52.3	27.2	35.2	94.9	107.8	117.2	56.1	21.9	175.3	98.2	140.1	73.7	99.6	138.3	108.0
23	52.7	29.5	34.9	92.6	112.6	104.8	53.3	19.9	170.4	101.3	136.1	69.3	102.8	141.2	112.3
23	47.1	30.1	38.0	95.3	116.7	115.8	55.4	18.1	177.8	90.1	141.8	61.4	99.3	133.8	105.0
23	55.7	32.3	37.3	90.5	117.4	108.4	56.4	23.4	176.8	107.5	142.0	71.1	104.9	144.1	111.5
23	47.1	30.0	36.4	91.9	102.2	115.5	52.4	16.4	169.0	91.1	132.5	61.1	99.4	140.0	111.1
24	53.2	34.7	36.1	96.0	113.8	110.4	52.4	22.2	177.0	97.5	130.6	68.3	96.9	129.2	112.3
24	47.0	39.2	35.7	103.0	116.9	119.0	59.5	15.5	180.2	97.3	143.6	62.1	96.8	138.8	111.2
24	50.2	36.0	39.4	98.9	119.6	107.3	55.2	15.6	171.7	98.4	139.3	53.6	95.8	138.2	103.4
24	50.2	34.4	35.0	102.5	115.6	114.0	54.1	23.4	175.5	95.3	134.6	56.4	99.5	130.7	111.8
24	51.3	33.5	39.8	96.3	110.5	108.6	57.5	19.0	175.3	98.1	135.9	63.0	102.0	134.8	103.4
24	52.8	37.4	43.8	106.7	114.7	113.8	62.5	21.1	179.9	98.7	147.7	64.9	106.0	152.1	111.5
24	53.2	38.1	39.8	101.7	119.1	113.8	57.4	21.5	182.0	100.4	140.6	66.2	99.9	140.9	103.1
24	54.4	32.0	34.0	96.5	122.2	114.1	53.8	22.5	177.4	103.7	137.1	65.7	95.2	131.7	106.7
24	52.2	30.5	43.4	97.1	107.8	114.2	53.2	22.7	172.6	94.9	130.4	59.3	88.4	126.2	103.9
24	53.7	32.5	36.8	100.1	116.8	109.2	58.3	20.6	177.4	99.0	139.4	61.8	92.1	133.7	106.0
24	59.6	36.5	40.5	100.7	123.0	119.0	53.9	22.1	181.7	107.7	140.6	66.3	99.7	133.7	111.8
24	48.7	33.7	39.5	96.6	111.7	114.4	51.0	22.4	171.5	95.6	135.0	63.2	100.4	132.1	106.0
24	49.3	33.2	39.5	98.8	106.7	108.6	51.0	19.4	169.0	92.3	133.6	63.0	96.9	125.8	108.9
24	55.3	34.4	38.4	97.5	121.2	109.7	51.2	22.0	175.3	96.1	136.6	58.9	94.7	120.9	101.9
24	50.4	31.1	41.4	90.5	109.9	104.3	53.0	21.1	163.0	94.9	126.2	56.8	95.3	125.3	99.7
24	51.4	35.2	41.1	95.9	110.6	113.3	52.5	22.7	171.5	95.5	134.7	62.6	94.0	132.0	107.0
24	52.0	33.2	37.4	90.8	110.1	114.2	55.3	21.8	164.4	99.1	138.3	63.8	100.9	133.5	108.6
24	47.8	37.0	41.4	91.8	111.1	105.5	50.6	19.4	171.5	94.5	130.7	58.4	91.0	128.6	101.0
24	54.6	33.0	45.3	92.7	113.0	117.2	60.2	24.3	174.3	100.4	141.3	70.8	98.5	136.9	106.6
24	48.1	37.8	39.4	92.4	120.0	110.7	47.6	22.7	176.8	98.6	135.6	65.6	98.7	131.6	110.8
24	48.0	28.7	48.1	96.2	117.9	119.4	60.2	18.1	178.2	93.4	134.1	66.9	92.7	129.3	113.6
24	45.9	26.5	35.8	104.4	105.7	112.2	56.9	31.5	171.0	95.1	125.7	60.6	95.6	122.6	98.0
24	48.8	39.6	41.0	99.2	113.4	112.3	54.5	16.0	174.7	96.2	140.1	65.1	91.6	128.7	110.0
24	47.5	35.9	42.2	92.5	124.7	107.2	52.1	21.7	176.8	97.7	133.7	64.1	97.5	126.0	106.7
24	53.8	32.5	37.3	101.7	111.9	116.4	58.9	20.3	177.1	102.4	134.9	67.2	98.3	132.8	113.4
24	50.2	33.8	39.5	99.7	117.8	114.2	51.0	17.1	178.0	101.9	134.0	56.7	95.5	128.2	108.7
24	49.0	36.5	38.6	100.3	116.3	120.1	52.9	17.6	181.0	101.3	141.0	67.4	97.0	131.8	105.6
24	55.0	31.9	41.0	104.2	120.3	119.2	54.4	21.6	181.2	97.1	138.7	64.4	100.8	132.1	104.5
24	50.4	34.6	38.4	96.7	110.0	113.7	59.0	15.5	172.0	97.0	135.7	67.1	94.1	137.4	112.4
24	53.3	34.7	35.7	94.3	111.5	114.2	51.8	23.4	176.5	100.3	130.5	62.5	95.0	129.5	105.9
24	52.2	36.8	35.5	98.6	116.5	108.1	55.6	20.5	177.5	103.8	133.2	64.1	100.7	138.4	112.4
24	47.3	33.5	39.5	90.5	103.8	115.0	53.6	19.4	170.5	90.3	133.6	60.9	95.0	136.9	104.1
24	48.6	33.4	34.8	96.9	113.9	113.7	49.9	18.4	171.6	92.8	135.6	59.0	93.1	129.5	102.6
24	48.9	32.4	38.8	106.4	100.4	108.2	53.5	16.7	168.3	94.6	135.4	67.8	95.7	134.4	112.0
24	48.8	31.2	34.2	89.3	113.9	108.9	50.4	15.1	167.7	89.6	130.8	50.3	94.0	128.8	106.3
24	45.8	33.7	39.9	97.3	111.5	110.3	50.4	8.9	171.7	84.9	135.3	50.4	98.7	133.3	107.4
24	46.9	31.4	37.5	90.6	112.8	112.0	51.0	13.7	168.9	92.9	133.9	59.5	104.0	139.3	104.0
24	52.9	37.3	42.6	96.2	107.4	119.1	55.4	23.3	173.0	98.7	141.4	58.2	106.6	147.5	109.9
24	53.4	33.7	37.7	99.5	103.7	112.1	56.3	22.0	173.0	95.1	137.0	65.6	98.3	132.0	111.2
24	52.2	35.4	38.0	98.5	113.5	113.0	57.1	19.1	171.6	101.7	138.7	66.9	102.6	136.4	105.5
24	54.8	34.1	40.2	103.0	111.3	113.9	51.0	22.8	173.4	103.3	141.6	64.0	104.1	142.7	108.9
24	48.3	33.1	39.3	94.9	103.1	109.1	49.4	16.4	165.5	90.3	134.4	58.3	97.4	135.7	104.4
24	59.8	32.1	41.1	103.0	118.8	113.1	53.7	27.1	176.2	105.2	135.5	66.6	103.6	135.8	108.2
24	52.6	34.1	39.8	97.5	114.4	115.0	55.0	22.2	177.1	98.7	139.3	66.4	107.8	135.2	109.1
24	52.1	33.0	38.9	106.3	107.0	114.0	54.3	23.7	173.8	96.2	136.5	64.0	100.1	135.2	107.8
24	49.1	36.3	42.0	103.1	97.0	113.3	54.2	17.2	165.9	101.0	137.5	66.3	104.9	138.8	118.2
24	49.1	26.2	40.5	102.7	102.8	111.4	54.4	21.0	167.7	90.4	135.3	60.7	96.4	123.9	105.3
24	51.4	34.0	41.5	94.8	102.5	109.3	52.4	18.3	163.4	98.3	135.2	58.0	96.8	137.4	109.1
24	56.7	33.9	36.0	95.5	105.5	113.6	53.6	19.7	169.8	105.8	140.5	63.9	106.0	138.1	113.1
24	43.2	31.3	41.2	101.8	109.7	111.8	48.0	17.2	168.1	82.2	133.5	57.9	94.1	123.4	102.4
24	44.1	34.1	36.3	107.2	100.0	105.6	54.8	17.8	161.7	92.4	133.5	64.0	98.0	130.8	104.7
24	49.4	32.9	36.7	97.5	105.2	106.7	51.2	15.7	165.2	91.6	127.5	63.7	100.4	127.9	102.1
24	48.0	30.9	40.3	90.3	114.0	105.2	57.9	23.0	164.3	93.2	129.1	65.7	95.8	134.4	110.6
24	52.2	32.5	40.6	90.9	117.0	111.1	50.8	25.7	170.7	94.1	138.4	60.8	98.1	129.1	102.0
24	45.1	33.8	40.0	95.1	111.0	112.3	54.0	22.5	164.9	88.8	134.9	61.7	92.6	127.1	105.7
24	51.0	34.9	36.7	96.3	110.4	112.6	51.6	20.7	169.5	95.4	134.1	72.0	96.4	131.3	106.2
24	52.1	31.2	39.6	100.1	110.3	107.2	57.7	22.0	169.6	96.5	129.3	55.9	98.4	132.2	109.2
24	42.8	36.1	39.0	103.1	108.9	110.9	53.6	16.4	169.9	89.8	140.7	62.7	98.3	139.7	105.8
24	45.7	29.5	37.4	93.0	114.2	116.9	47.2	16.6	173.5	87.0	132.3	54.6	96.0	125.5	105.2
24	51.9	37.4	36.6	97.5	116.5	113.6	53.3	22.4	174.6	99.3	138.9	64.7	98.5	129.5	104.8
24	47.2	34.1	38.1	96.8	102.0	106.8	50.8	20.9	163.3	94.2	132.9	68.3	97.9	136.6	108.3
24	48.7	34.1	36.0	98.6	113.1	105.3	50.4	18.4	169.4	90.6	129.9	58.6	96.9	131.6	102.7
24	45.7	38.5	35.1	97.5	118.0	111.1	57.0	19.8	173.9	92.4	142.7	67.6	98.2	132.7	110.8

Appendix A (continued)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
24	52.6	29.5	39.1	98.1	107.0	110.3	51.9	25.1	170.7	96.8	129.4	61.5	93.9	131.9	102.5
24	55.1	36.9	38.9	104.3	109.3	117.1	55.6	22.5	176.2	99.8	145.4	72.0	103.4	134.4	114.9
24	55.1	32.7	38.3	100.8	110.8	115.1	56.4	21.2	174.7	102.9	143.9	67.7	100.5	142.7	105.8
24	51.0	37.6	40.7	93.6	100.2	112.1	52.7	22.5	166.9	101.1	132.4	60.4	94.7	127.1	106.9
24	42.8	32.2	39.9	103.9	105.5	112.7	53.8	7.1	176.8	87.4	134.6	54.1	102.8	137.7	111.1
24	54.5	37.0	37.3	97.6	119.4	112.1	52.3	23.0	177.3	101.0	138.5	65.4	105.3	137.1	95.6
24	46.8	31.6	38.3	93.5	110.2	116.3	52.1	17.8	172.0	92.0	134.2	59.0	103.7	138.4	96.7
24	52.6	30.8	40.2	101.0	112.9	107.2	52.5	21.3	174.3	95.4	133.6	60.9	98.3	135.6	109.6
24	63.8	34.9	41.1	100.8	108.4	115.8	53.5	22.5	178.1	113.0	135.7	70.6	104.4	140.9	107.0
24	50.4	28.8	42.5	91.3	109.5	107.7	56.2	26.4	170.6	97.4	132.9	63.9	106.1	135.4	105.1
24	56.0	32.2	38.3	104.8	104.4	111.1	51.7	20.6	168.1	100.6	132.3	63.7	102.1	137.9	110.9
24	50.3	33.8	43.8	93.5	115.9	107.2	53.4	23.6	170.3	96.3	134.2	61.9	96.6	123.8	105.6
24	58.6	35.9	40.4	95.3	102.0	107.4	54.8	19.0	169.5	108.9	132.2	65.8	101.2	138.6	106.3
24	53.3	32.1	41.9	97.6	117.9	115.8	53.8	22.6	176.5	99.0	139.1	64.5	96.1	124.9	108.4
24	52.8	28.1	36.1	97.6	122.0	109.2	55.4	22.4	176.5	97.3	139.0	61.1	98.5	135.0	108.7
24	51.4	35.7	42.7	95.7	108.4	109.9	54.4	19.7	172.1	102.4	136.8	66.2	100.2	135.4	108.8
24	48.8	32.9	38.8	93.0	105.1	114.7	50.3	22.3	165.4	99.5	134.1	60.8	95.8	126.5	105.1
24	51.8	34.2	40.3	92.6	106.8	106.6	51.3	18.9	168.0	97.2	130.8	65.8	101.8	134.8	105.9
24	57.8	38.3	36.5	103.3	123.4	117.3	61.7	24.1	183.6	107.4	143.7	73.2	102.0	136.1	111.2
24	47.2	30.1	36.9	97.9	112.2	110.2	55.9	19.0	171.1	95.5	136.5	63.5	95.9	137.4	111.2
24	47.8	31.1	37.8	108.7	111.7	110.3	58.7	21.4	172.0	93.1	133.4	56.5	96.1	120.2	101.6
24	47.0	32.2	38.6	95.6	110.9	106.7	52.7	19.5	168.3	90.8	130.2	64.6	92.0	130.8	106.1
24	53.2	39.1	41.8	94.2	122.5	113.8	61.4	21.0	177.8	99.9	142.1	68.8	95.2	134.6	110.1
24	50.2	34.3	38.2	98.5	107.2	111.7	63.6	16.1	171.7	99.5	137.9	64.3	97.0	139.9	117.1
24	49.5	35.0	34.3	89.4	114.6	108.8	50.6	20.7	171.9	96.4	133.6	63.2	105.2	137.5	107.5
24	50.0	38.0	36.1	94.2	115.0	104.7	53.9	20.0	171.3	98.3	133.4	62.5	103.7	139.5	107.7
24	45.2	35.0	42.3	96.0	110.4	114.0	57.8	19.8	172.2	93.6	144.0	67.3	99.1	146.4	105.4
24	47.7	36.7	40.2	91.9	108.2	106.2	52.1	17.9	165.8	93.1	132.7	62.9	97.3	132.7	104.6
24	52.3	36.9	37.5	96.4	107.4	115.7	57.4	18.0	173.8	98.6	139.9	64.8	98.5	139.9	107.8
24	53.1	34.6	41.5	100.1	107.9	114.9	51.8	23.1	173.2	100.5	140.8	61.7	95.9	135.7	113.9
24	59.0	35.7	36.4	96.6	110.9	115.5	58.9	24.6	175.4	107.5	140.8	69.8	95.7	143.6	108.2
24	48.9	33.6	40.0	95.3	106.5	115.9	51.1	22.6	172.6	97.0	136.2	57.6	98.5	135.2	106.9
24	48.0	33.5	36.5	99.2	105.8	116.2	49.6	20.6	173.1	89.3	131.8	61.1	93.0	127.8	105.5
24	50.7	36.2	36.6	98.4	107.4	112.5	51.6	21.9	172.0	93.5	137.4	61.8	99.1	134.7	102.0
24	56.5	38.2	40.2	90.8	108.4	106.7	54.2	22.9	164.6	101.9	133.6	59.5	100.1	134.5	104.1
24	50.4	33.8	39.7	95.2	105.0	115.0	52.4	20.7	171.1	98.6	128.5	63.9	96.8	134.8	105.2
24	53.9	28.6	37.8	91.7	111.2	113.0	52.3	24.9	168.2	95.3	132.8	62.9	89.6	118.7	100.5
24	53.3	30.6	37.7	103.1	101.2	117.4	50.1	19.1	168.3	92.3	135.6	55.4	96.6	129.4	110.0
24	45.7	35.5	35.0	101.4	100.4	112.4	50.5	15.3	166.5	94.5	134.7	53.8	101.9	130.6	113.7
24	50.6	29.2	35.6	97.8	113.1	109.8	47.6	26.4	166.6	88.1	133.4	58.9	95.0	135.3	106.4
24	47.0	34.2	36.4	99.5	100.8	117.9	48.4	19.6	165.6	95.5	136.7	63.7	101.4	128.2	112.7
24	52.7	33.4	36.9	96.9	104.6	110.7	52.2	20.1	169.9	101.2	133.1	64.5	94.3	133.8	102.9
24	53.0	31.6	40.1	104.7	95.0	109.0	53.8	24.2	161.1	96.0	133.6	60.9	98.5	136.7	106.6
24	48.7	32.6	41.7	91.7	113.7	109.9	54.0	22.6	171.4	96.7	137.0	66.1	99.8	146.0	116.7
24	50.9	28.6	41.4	103.0	113.8	115.1	55.2	21.7	175.0	90.3	136.1	61.3	90.1	126.9	109.0
24	50.7	34.8	39.7	99.6	108.2	107.7	49.4	24.7	171.5	101.0	130.0	63.5	103.1	134.1	106.7
24	55.4	30.5	39.1	98.7	104.2	114.8	53.5	22.5	171.0	96.5	130.4	64.0	99.0	135.9	102.4
24	53.0	35.0	39.3	98.1	109.2	109.1	54.6	25.0	169.2	101.2	135.2	62.0	95.1	128.5	103.6
24	49.1	31.6	33.6	108.0	112.1	113.3	55.6	20.6	176.4	92.3	139.8	61.8	101.8	133.2	109.3
24	54.0	36.6	37.2	105.3	114.0	108.1	62.3	24.4	173.4	96.3	137.0	64.3	98.7	131.4	103.7
24	47.6	31.2	35.6	100.0	123.6	116.8	54.1	18.3	176.6	93.9	141.9	66.8	89.5	127.7	112.8
24	50.6	34.5	43.5	90.7	112.1	111.5	58.7	18.1	170.7	99.1	133.7	59.8	95.4	136.1	104.6
24	52.9	32.1	37.1	95.8	105.1	109.8	57.8	18.7	165.8	96.2	132.9	63.5	96.7	133.9	104.7
24	53.9	37.7	36.8	99.3	106.9	113.4	56.7	24.5	170.0	101.3	142.0	66.3	101.1	140.2	117.5
24	53.8	41.6	45.2	97.9	113.2	113.2	54.3	16.5	178.0	105.2	144.1	66.1	99.4	138.8	101.8
24	53.7	32.1	39.7	97.5	105.6	115.2	54.7	20.9	174.5	102.8	136.1	63.6	100.3	143.8	98.8
24	49.6	34.4	34.7	97.8	99.3	113.7	52.8	22.6	168.4	96.7	126.6	68.5	97.7	132.7	110.2
24	49.6	38.9	36.3	96.2	107.5	109.1	56.6	19.1	175.6	94.9	130.7	68.3	95.9	136.0	105.0
24	50.0	34.5	36.7	89.4	103.5	99.2	48.3	19.9	161.6	93.7	124.2	60.2	89.6	123.8	111.3
24	42.4	38.0	35.7	101.2	108.7	112.1	51.9	15.1	174.0	90.4	131.0	62.6	99.7	133.8	104.1
24	48.9	30.1	39.5	91.9	125.3	100.1	52.7	20.7	177.5	100.8	129.7	61.5	102.1	138.2	103.8
24	51.3	33.3	40.1	97.2	109.5	114.9	52.8	23.4	167.8	96.6	142.2	62.7	99.5	137.1	112.0
24	51.0	27.9	37.4	99.2	106.0	110.3	51.8	20.3	168.4	84.8	136.8	55.3	94.5	124.4	108.4
24	46.9	35.2	40.9	96.0	108.5	113.0	54.2	12.6	166.6	87.2	136.3	61.6	94.0	123.3	103.5
24	48.9	35.9	39.2	107.8	98.8	120.0	50.3	17.1	172.9	98.4	140.6	51.7	101.3	133.8	110.2
24	48.9	33.4	33.6	97.6	111.4	109.5	45.5	25.4	169.3	96.9	135.2	63.3	92.6	129.2	107.5
24	53.4	34.7	37.5	105.1	111.6	118.1	53.8	19.5	184.9	108.6	139.1	64.9	94.0	134.9	107.5
24	53.2	32.2	40.6	91.8	115.6	102.5	53.3	16.1	169.3	102.8	134.4	59.1	95.1	134.0	99.3
24	51.6	30.9	35.2	110.9	111.1	116.9	60.2	17.0	179.3	102.2	139.5	71.4	94.8	138.6	112.3
24	51.1	31.2	34.1	100.2	114.1	127.9	53.9	19.2	183.9	93.5	150.9	63.8	104.4	144.5	102.0
24	51.4	31.8	42.5	104.3	106.6	115.7	61.7	21.2	178.1	100.3	147.6	64.6	105.7	149.0	108.9
24	50.9	27.9	32.3	103.0	115.4	113.7	53.1	18.7	182.0	95.1	140.4	67.4	95.9	139.9	106.2
24	48.8	32.3	36.2	85.1	106.4	109.7	51.5	19.1	173.6	98.0	132.7	61.0	99.8	134.4	94.2

Appendix A (continued)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
24	51.8	30.9	27.7	102.4	115.9	103.5	54.4	20.0	174.6	104.9	138.3	58.4	94.7	130.6	96.0
24	53.6	31.3	34.1	93.8	107.4	115.7	51.5	21.0	177.6	102.4	136.8	62.7	99.9	139.7	96.7
24	47.1	28.2	37.6	91.9	111.7	113.9	61.1	16.6	179.9	97.3	138.5	65.4	98.4	138.4	101.6
24	51.4	26.8	38.9	102.3	115.3	116.8	51.6	20.1	180.4	101.6	137.4	62.8	96.5	139.5	107.4
24	53.0	25.4	40.3	92.0	106.5	116.4	54.2	19.5	173.4	105.9	136.4	57.5	99.3	145.6	108.2
24	40.8	31.0	32.8	101.0	122.6	114.3	45.9	13.4	181.7	90.0	135.6	53.5	101.5	131.1	109.4
24	48.8	29.3	33.3	109.1	94.8	107.5	48.7	19.2	163.4	99.4	136.2	64.1	93.0	131.2	102.2
24	45.8	31.3	36.6	94.9	114.1	108.9	49.0	13.2	173.6	98.0	134.0	58.8	88.7	128.5	108.0
24	53.9	28.0	35.4	94.1	112.7	112.3	51.4	18.5	180.3	103.2	135.3	67.3	98.8	140.4	106.6
24	49.8	30.7	37.1	94.9	109.5	101.1	54.4	13.6	167.4	103.0	136.1	52.7	102.8	143.5	108.5
24	46.2	34.8	39.0	102.0	106.9	106.8	52.2	19.5	169.3	100.8	141.5	66.8	92.6	134.2	112.3
24	47.2	35.9	41.3	95.3	106.7	108.4	56.8	18.9	171.2	97.1	138.3	71.3	105.3	144.0	110.7
24	46.7	33.1	36.5	98.1	113.4	112.6	59.7	18.6	176.2	92.5	142.4	60.4	100.5	138.5	103.6
24	47.4	26.9	35.2	97.0	103.8	119.5	54.2	16.6	170.1	93.6	141.4	68.2	101.5	144.9	106.1
24	49.1	29.0	38.7	106.5	113.2	109.6	56.5	18.0	179.0	98.7	136.3	63.6	103.9	148.6	106.8
24	46.8	33.9	35.4	100.9	105.6	112.8	52.0	17.8	172.3	90.6	134.4	64.9	98.3	136.1	105.8
24	46.7	33.5	34.1	98.8	108.6	110.7	55.8	15.2	172.8	95.1	139.5	57.5	98.4	134.6	97.2
24	52.6	31.0	36.6	92.8	123.8	118.1	56.6	16.1	180.5	97.0	142.5	67.5	99.5	140.7	102.6
24	44.5	35.6	31.2	95.3	112.6	121.3	53.2	15.3	178.9	96.1	141.0	58.6	98.5	135.7	101.8
24	54.9	31.6	36.8	102.0	123.9	117.5	60.0	16.9	183.0	105.5	147.9	65.7	92.4	143.9	108.5
24	52.3	34.2	40.1	98.4	115.9	118.0	59.6	18.7	186.6	105.2	136.8	60.6	109.4	145.8	103.4
24	53.4	32.2	38.1	96.9	116.5	111.0	58.7	20.6	179.7	100.5	138.0	69.0	108.7	150.5	112.0
24	49.7	31.8	37.3	96.5	114.9	110.2	54.8	11.7	175.9	97.2	136.1	60.6	105.7	146.4	113.4
24	46.2	28.3	35.0	97.0	103.3	115.4	55.1	12.0	165.2	88.5	142.4	61.6	101.7	142.3	101.7
24	50.6	32.7	35.3	106.8	105.3	102.9	51.6	11.1	171.9	100.3	129.6	60.8	101.3	144.1	107.4
24	53.1	30.3	36.0	93.2	104.8	114.0	55.4	15.0	171.4	96.3	142.5	67.7	102.6	142.4	103.8
24	50.8	30.6	36.1	100.1	111.7	108.1	55.9	18.5	171.8	99.6	138.6	67.6	94.2	141.7	108.7
24	45.6	34.7	33.5	102.6	98.3	106.7	49.2	4.9	167.3	93.8	136.4	58.2	97.5	140.5	106.7
24	51.1	30.3	37.4	96.3	107.1	107.4	53.1	10.7	166.3	96.0	138.6	54.5	102.6	144.6	107.5
24	48.2	31.7	36.9	98.1	96.7	106.1	61.4	14.4	168.4	100.1	136.8	64.0	100.0	145.4	105.3
24	51.2	30.9	43.1	92.1	106.3	115.8	52.9	15.9	176.2	101.2	143.8	61.5	98.7	140.9	104.6
24	42.8	29.3	34.3	99.5	107.1	102.7	59.3	6.6	168.8	95.4	136.9	57.6	94.9	147.7	111.3
24	49.7	29.3	28.9	92.1	111.0	106.2	49.4	17.0	170.7	101.5	136.9	58.2	93.5	129.1	102.4
24	46.5	30.1	36.5	108.5	94.4	107.9	53.3	17.5	167.9	95.8	136.3	62.5	107.5	149.9	105.5
24	46.9	32.8	37.4	91.0	108.8	110.4	54.9	11.8	174.6	97.1	138.9	55.8	106.2	144.5	104.7
24	49.8	30.8	32.3	98.3	105.4	116.3	50.3	20.9	171.4	98.9	140.5	63.1	97.5	147.4	101.2
24	50.3	31.3	33.6	96.4	109.5	110.9	55.1	16.9	170.5	100.3	141.8	65.1	102.8	136.9	110.0
24	50.5	32.0	36.1	93.7	111.9	106.4	50.6	25.0	175.5	101.7	135.3	70.9	100.7	147.1	101.9
24	54.0	29.5	39.9	98.6	111.0	115.3	54.3	23.1	179.4	105.4	146.0	71.6	105.4	145.6	105.1
24	45.6	31.3	34.5	93.7	92.7	110.4	51.8	19.2	167.4	94.2	123.8	60.6	97.0	128.5	104.3
24	54.7	30.9	36.4	94.2	117.6	122.2	55.7	23.1	181.9	101.8	145.1	70.4	104.0	145.7	105.9
24	46.3	28.3	32.8	103.8	111.4	121.3	55.2	20.8	177.6	96.5	141.7	65.0	103.0	141.7	115.5
24	46.1	32.8	38.7	98.5	114.8	107.0	57.3	16.8	178.1	101.0	140.2	71.0	108.1	148.5	109.2
24	53.5	36.5	38.3	101.6	108.3	111.0	57.5	14.8	177.5	107.0	140.3	69.9	100.5	145.8	110.8
24	48.4	32.9	40.7	89.6	111.5	108.1	52.1	19.2	170.7	97.1	137.5	59.3	99.1	138.6	106.3
24	52.8	28.3	36.6	107.2	102.0	111.5	56.4	22.0	169.9	101.4	140.6	68.8	100.4	138.4	103.1
24	48.0	30.4	41.5	99.4	108.4	108.1	55.7	20.0	175.0	95.0	133.5	62.2	97.6	139.7	102.7
24	45.7	31.8	29.7	96.9	107.5	114.8	52.9	18.8	164.4	91.8	142.1	62.8	98.7	147.6	104.2
24	51.3	30.0	38.1	101.7	114.2	116.7	53.8	21.4	179.2	101.2	142.9	63.6	101.1	143.3	102.8
24	45.6	30.7	35.5	94.2	107.8	114.4	50.3	16.8	174.7	92.9	133.9	60.8	94.3	133.5	98.5
24	45.1	30.4	43.1	103.9	106.2	115.1	53.6	17.0	173.8	91.2	139.9	62.3	99.5	145.1	108.9
24	47.6	32.8	32.9	91.9	103.0	112.7	52.9	12.6	168.2	92.9	132.9	52.1	91.4	137.2	107.1
24	53.2	29.4	35.4	95.0	118.1	116.6	53.8	16.7	175.6	95.5	140.8	57.5	100.8	140.0	107.1
24	47.2	29.9	33.9	97.1	125.0	110.4	52.5	18.5	180.6	93.6	135.0	71.0	98.1	142.9	109.2
24	46.9	30.1	36.7	100.5	109.7	109.3	46.6	12.7	178.0	92.7	132.9	57.7	94.7	132.6	103.7
24	46.8	32.1	40.4	85.2	109.3	115.8	53.7	17.2	168.2	96.4	139.1	60.9	95.0	138.1	100.1
24	50.8	36.2	34.9	93.4	120.6	111.2	55.0	16.9	186.3	102.0	142.3	62.7	96.7	146.1	106.4
24	47.0	32.9	37.6	88.5	109.9	108.7	50.7	11.9	171.8	94.2	135.1	61.1	96.5	139.2	102.0
24	48.1	35.7	40.2	99.6	113.9	110.1	60.4	15.9	187.3	108.7	139.1	71.2	102.2	147.4	112.5
24	53.3	29.7	34.5	95.5	90.3	115.4	54.0	19.8	168.5	102.3	136.5	63.3	98.9	143.7	109.2
24	46.7	30.5	32.3	85.2	105.6	102.2	47.9	18.5	159.7	93.4	130.7	65.0	96.4	141.0	103.9
24	49.0	34.0	32.2	95.8	102.7	111.3	50.1	17.9	170.5	102.9	139.6	60.8	99.8	147.0	110.2
24	54.1	28.5	40.9	104.1	111.7	116.1	60.1	18.8	185.1	108.9	140.3	69.4	101.6	147.5	110.0
24	47.8	26.9	37.0	92.3	116.3	114.1	58.8	16.9	181.2	91.8	138.2	62.6	100.2	140.5	109.8
24	43.0	31.9	35.0	96.1	106.8	110.9	53.2	10.4	169.4	91.4	139.3	52.4	95.7	140.9	104.2
24	49.4	32.6	35.9	95.4	106.2	103.5	49.9	16.9	166.8	102.5	133.0	64.5	100.6	138.1	109.4
24	52.8	29.2	36.9	90.0	105.8	115.0	55.7	17.5	174.6	107.0	135.0	65.1	94.7	141.6	104.1
24	50.6	31.0	38.6	95.9	103.6	112.0	51.5	19.4	174.3	102.6	138.1	66.8	98.3	141.7	103.8
24	49.6	35.4	34.9	92.2	100.0	115.0	58.7	20.9	168.5	102.0	141.8	61.3	102.1	146.9	105.8
24	49.0	31.4	35.5	93.1	110.0	122.0	55.6	18.6	176.1	96.4	144.4	62.7	99.1	141.1	106.0
24	46.3	28.7	32.0	96.6	104.7	109.5	49.2	17.0	168.4	95.4	127.0	63.5	97.1	132.8	102.1
24	52.8	30.4	34.9	109.9	106.9	111.5	53.4	17.0	175.9	100.5	136.1	55.5	95.8	139.4	107.0
24	51.3	34.9	36.0	99.7	95.2	128.2	61.2	20.3	177.1	101.4	141.4	66.2	98.5	138.0	110.3

Appendix A (continued)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
24	50.6	36.4	39.2	89.9	119.5	103.0	49.4	20.0	173.2	99.2	139.0	58.7	98.3	136.6	107.3
24	52.9	30.6	45.2	95.3	105.8	115.1	60.5	21.9	180.3	97.2	135.7	64.0	104.4	144.9	111.8
24	54.6	32.6	40.4	94.0	112.6	113.7	52.4	20.5	177.3	100.2	141.4	68.6	100.4	145.9	111.7
24	50.5	29.9	36.6	96.7	115.9	117.8	56.8	16.8	177.6	102.6	140.1	59.1	95.0	135.7	108.3
24	48.8	32.1	38.7	99.1	109.2	110.5	56.6	14.0	172.1	98.7	140.2	57.5	95.5	135.2	109.5
24	49.2	29.7	37.2	103.1	104.8	111.5	56.5	19.7	172.6	97.0	139.3	65.2	96.8	135.7	102.5
24	50.0	27.8	38.3	91.3	113.6	113.6	58.7	14.4	171.0	95.2	138.4	63.1	97.9	142.2	105.1
25	51.6	34.3	37.3	99.8	96.2	105.9	54.9	16.7	164.5	106.6	119.8	61.0	94.7	136.2	120.1
25	52.8	33.1	33.3	97.6	117.0	108.6	56.1	19.7	174.1	102.6	126.5	59.6	97.5	138.1	116.9
25	45.1	30.1	36.3	98.6	107.9	112.3	56.4	15.7	175.4	89.8	124.9	64.8	93.0	136.6	107.2
25	51.5	35.9	33.3	106.6	110.1	119.7	55.8	21.9	181.5	105.4	138.7	69.6	99.5	135.1	107.7
25	50.4	33.8	33.6	96.7	111.5	105.4	58.5	20.5	170.8	98.2	134.0	71.6	98.6	138.2	111.4
25	51.9	34.4	34.2	101.0	121.3	114.1	53.3	20.5	180.2	102.6	133.3	70.9	93.5	135.9	110.1
25	51.0	35.0	37.4	104.8	99.8	110.0	56.2	25.0	171.4	102.5	127.5	64.8	98.1	141.1	116.7
25	49.6	34.8	35.0	98.0	114.6	106.7	54.9	22.5	176.4	98.5	127.8	61.0	97.6	141.4	112.5
25	50.1	34.7	32.5	96.8	109.3	110.6	56.3	14.7	171.3	94.5	128.2	64.4	98.4	128.0	106.2
25	52.4	36.8	41.2	103.7	114.8	109.9	55.4	21.9	182.5	104.4	134.4	69.7	102.5	144.0	111.0
25	53.5	31.6	36.4	96.6	110.4	105.6	54.8	21.9	168.4	100.0	131.9	61.2	102.0	138.3	105.6
25	46.9	33.1	36.0	97.4	114.0	115.0	59.2	27.0	174.9	93.4	130.4	70.1	99.3	134.1	117.7
25	52.1	34.7	34.7	103.4	106.5	118.0	58.3	20.0	180.1	99.5	135.8	64.0	96.6	134.6	109.5
25	51.9	31.5	36.0	96.7	99.3	110.2	54.4	21.1	171.3	95.0	122.9	67.3	102.5	144.2	115.9
25	52.2	26.2	33.9	97.8	106.4	110.0	55.5	16.9	172.9	101.2	137.9	63.6	105.2	139.8	111.3
25	51.9	32.4	37.1	97.5	103.8	108.7	50.6	20.0	174.5	105.2	128.7	62.2	103.6	144.1	116.9
25	46.4	28.8	35.5	95.0	100.8	115.4	53.4	12.1	174.3	92.2	129.3	62.3	98.9	141.2	105.8
25	50.2	29.9	34.1	90.2	110.0	114.6	54.3	20.4	175.9	99.1	132.2	64.5	100.9	147.4	114.0
25	48.2	27.3	30.4	102.2	112.2	112.8	54.8	19.8	181.8	92.8	133.6	64.4	95.5	134.7	114.6
25	46.3	25.3	36.2	95.4	101.6	120.7	52.0	12.1	176.9	90.6	131.6	53.9	98.6	131.7	111.6
25	56.8	30.8	37.8	108.8	106.4	112.7	56.3	18.5	178.8	104.6	133.8	66.0	106.3	143.3	112.7
25	57.8	31.5	32.1	96.9	111.2	114.6	58.3	27.5	187.6	108.5	126.3	69.2	100.1	148.2	123.6
25	45.5	32.1	32.2	100.4	108.5	111.8	47.6	12.4	174.0	94.2	133.5	63.2	91.9	130.3	108.3
25	45.1	28.0	32.0	93.7	115.4	106.6	58.4	10.4	179.0	93.9	126.9	60.4	97.6	135.6	115.8
25	50.4	29.5	33.9	98.6	114.0	114.2	57.0	16.5	176.7	95.2	142.9	68.0	94.7	141.0	115.7
25	46.8	31.0	33.4	94.2	110.3	97.4	47.0	14.6	169.6	95.5	127.9	61.0	93.5	139.6	106.5
25	53.2	29.5	37.3	103.5	113.8	116.9	62.2	23.0	186.9	101.9	138.4	67.3	105.2	156.0	116.0
25	44.9	30.9	35.0	102.2	96.2	111.0	53.8	15.6	175.6	97.1	126.2	57.8	96.6	140.3	114.2
25	46.0	32.7	35.8	112.8	99.6	112.3	55.8	10.7	173.2	92.9	138.6	67.7	95.9	144.1	111.0
25	54.7	33.3	35.0	95.2	105.1	108.7	53.5	17.6	173.9	104.7	134.6	58.5	97.6	145.1	107.1
25	48.3	35.6	33.9	93.1	110.6	105.0	51.2	16.9	174.6	104.4	130.6	69.4	99.4	146.1	113.7
26	55.5	32.9	33.4	95.1	106.9	114.3	55.4	23.3	176.4	105.6	134.8	60.8	100.0	136.9	113.2
26	48.1	30.1	36.8	109.5	105.6	110.5	56.1	17.0	175.1	94.8	129.1	60.8	97.1	131.1	107.2
26	54.4	30.2	36.4	105.2	124.2	116.1	48.1	30.1	186.2	106.3	139.5	62.9	98.4	135.9	113.1
26	48.8	30.3	35.9	101.8	102.0	114.4	56.4	13.9	175.0	99.7	131.0	65.3	99.6	137.9	107.4
26	45.9	34.8	39.4	101.9	114.3	107.2	65.5	18.6	176.6	92.4	141.2	72.3	101.0	132.9	111.6
26	56.6	35.6	34.8	99.4	119.9	100.4	60.8	27.4	180.7	105.8	133.8	66.7	96.7	132.5	109.7
26	50.7	33.0	35.5	104.1	108.1	114.1	55.5	17.3	176.0	103.8	139.8	68.4	101.9	135.0	107.6
26	48.1	32.1	35.3	101.7	108.0	115.2	56.4	17.5	177.9	98.9	133.1	64.3	96.7	133.7	112.6
26	52.7	28.3	32.9	98.9	107.9	106.5	53.2	19.4	172.7	93.9	130.2	60.6	102.3	132.2	104.8
26	53.8	30.7	38.1	97.5	105.3	112.6	55.8	21.1	174.2	100.7	132.5	63.4	99.6	133.1	111.4
26	47.9	34.7	41.5	87.6	108.1	107.2	49.4	15.7	171.4	99.0	125.2	60.8	96.1	133.4	115.7
26	51.2	38.3	36.7	106.8	105.4	103.3	53.5	20.5	175.8	108.3	121.2	68.9	106.2	148.7	119.8
26	47.4	28.6	32.6	94.4	99.7	108.4	52.9	19.2	166.3	90.8	123.1	59.4	97.9	137.5	110.8
26	56.9	32.7	32.8	87.6	97.7	105.9	52.9	18.2	163.8	99.2	124.1	59.4	94.9	137.7	102.5
26	55.2	29.3	38.5	93.3	108.6	108.5	55.1	22.0	174.4	100.7	127.1	65.4	100.3	144.0	110.0
26	55.2	30.0	36.9	91.1	104.7	109.7	53.8	26.0	166.7	102.8	123.6	67.5	96.9	135.4	120.3
26	52.0	28.5	39.9	99.2	119.1	110.1	54.4	23.8	182.7	97.9	131.2	62.8	96.0	139.1	110.0
26	50.2	32.4	39.3	99.4	105.7	105.0	54.6	18.3	165.9	105.8	117.6	64.8	99.3	138.2	124.2
26	51.2	32.1	38.7	99.6	109.4	108.0	54.3	17.7	176.2	95.5	125.7	62.9	94.3	137.4	110.5
26	44.7	34.7	38.2	96.1	112.3	103.9	51.1	20.2	173.9	93.5	126.1	67.0	97.1	137.6	117.3
26	54.5	34.0	37.2	95.9	110.2	111.2	57.2	22.3	172.6	100.4	129.8	64.4	102.9	137.6	116.9
26	48.3	29.9	36.1	95.6	108.1	101.1	52.7	16.5	171.3	97.2	117.7	56.2	94.6	128.6	116.6
26	52.4	29.2	37.2	92.9	110.2	112.9	54.9	19.4	171.0	93.9	128.0	66.3	98.0	135.0	110.4
26	46.8	33.9	36.4	98.3	111.0	110.0	58.3	23.5	176.9	95.0	124.0	72.0	95.4	134.5	108.0
26	51.7	40.0	35.7	94.9	109.6	111.6	60.1	23.3	178.0	99.0	127.7	66.4	94.2	143.0	112.4
26	50.0	34.1	36.7	96.8	106.8	111.8	55.4	17.4	177.7	103.0	120.8	59.1	98.7	134.2	119.2
26	47.3	31.7	39.0	111.9	99.4	106.5	53.2	17.2	169.1	97.0	124.9	57.4	92.2	135.3	111.2
26	56.5	26.6	36.6	101.5	102.2	107.5	50.8	22.4	166.0	103.3	128.6	59.5	100.5	136.3	109.6
26	52.9	32.0	31.3	105.4	108.4	109.9	51.7	18.6	175.5	101.7	124.4	67.7	90.2	146.1	116.4
26	50.4	30.4	36.7	111.7	116.6	109.9	57.9	16.3	185.1	93.6	135.7	61.5	100.1	139.2	117.3
26	47.7	35.9	31.0	100.4	109.6	116.1	52.1	21.0	179.7	95.3	133.1	60.7	95.2	142.1	112.1
26	54.2	32.6	34.3	105.6	105.4	110.0	54.5	19.1	176.2	99.6	133.9	64.0	97.3	137.4	107.0
26	47.7	35.4	34.2	97.8	105.8	112.2	51.3	12.9	173.6	98.8	130.4	54.2	93.0	139.3	112.5
26	50.7	31.2	39.8	102.8	106.2	115.2	52.0	20.6	172.0	101.0	137.4	66.7	99.1	147.5	115.4
26	50.9	28.4	34.4	106.4	90.0	110.3	53.3	21.4	171.4	100.6	118.0	68.1	102.7	139.9	118.9

Appendix A (continued)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
26	54.9	33.5	35.4	92.8	103.2	110.5	56.2	21.6	167.9	108.4	131.5	64.2	107.2	152.3	114.9
26	46.5	27.2	35.6	93.3	99.5	115.6	53.2	18.0	172.7	106.1	125.2	67.7	103.5	150.5	120.1
26	52.6	28.7	33.9	93.1	112.3	106.8	55.8	18.6	181.1	104.9	125.9	66.5	103.8	146.0	117.6
26	53.1	30.7	33.7	89.4	103.3	114.0	49.2	24.2	171.2	102.0	128.6	62.3	94.3	131.5	113.3
26	47.3	24.5	37.4	100.3	94.7	104.2	49.7	16.7	166.3	95.4	122.7	59.6	89.9	126.1	110.6
26	48.6	29.9	35.0	98.6	108.3	116.6	57.9	20.9	179.1	107.0	133.9	67.3	96.8	147.9	115.8
26	44.2	23.0	35.4	87.8	104.3	111.8	52.1	17.5	175.3	93.0	127.2	57.2	97.7	136.9	113.6
26	54.1	31.2	29.5	91.9	101.3	120.5	50.4	20.7	179.8	110.1	126.5	66.3	104.4	151.5	122.3
26	59.1	26.9	38.0	91.4	110.5	118.8	55.0	19.9	184.9	112.1	119.2	64.0	108.7	142.5	129.0
26	44.4	28.7	32.5	93.2	99.5	115.8	54.9	13.8	181.3	94.6	126.4	66.5	105.0	142.8	113.1
26	46.7	26.5	39.4	98.7	99.4	112.8	54.9	15.3	177.7	96.3	127.1	63.1	101.4	143.1	123.0
26	54.9	25.8	37.7	105.4	100.8	108.4	51.7	19.7	176.6	104.5	132.2	66.9	100.8	148.0	114.9
26	45.6	33.0	34.7	96.5	106.6	107.8	57.2	14.1	178.9	95.5	122.4	75.4	96.8	149.5	121.3
26	46.6	26.3	35.7	93.1	105.2	106.1	52.5	16.6	164.0	90.7	125.9	70.0	95.1	139.6	115.2
26	44.5	30.3	31.8	92.4	103.6	115.3	49.1	15.0	173.4	93.0	127.1	70.0	103.8	149.7	113.5
26	46.3	28.4	37.6	93.8	106.0	107.9	52.7	13.9	175.5	98.7	120.2	61.1	96.1	147.8	115.0
26	53.4	32.1	31.4	102.3	96.2	117.3	58.0	19.2	179.4	101.1	126.4	54.3	105.2	145.9	117.9
26	57.6	31.8	35.0	92.3	108.3	110.1	58.6	22.6	182.4	107.1	127.1	63.2	93.4	146.5	118.4
26	48.1	32.6	39.5	106.1	88.0	108.2	52.7	19.6	168.1	100.3	129.3	56.2	91.9	137.1	117.3
26	54.4	28.1	39.1	95.6	104.4	108.5	50.8	16.2	173.1	104.2	125.1	61.4	95.9	137.9	115.0
27	45.3	34.1	37.2	97.0	116.4	110.1	51.8	20.3	176.9	90.8	134.1	63.4	93.0	129.2	106.0
27	52.1	33.0	35.4	102.7	121.3	120.6	52.9	17.2	183.6	101.8	141.1	66.0	105.5	136.3	106.9
27	51.5	33.8	38.7	103.1	110.5	116.0	51.2	22.0	178.9	101.9	132.6	64.5	95.9	131.3	103.2
27	46.7	33.4	38.5	109.1	100.2	114.5	52.5	24.0	170.8	98.2	137.4	61.8	100.3	134.4	110.0
27	56.7	32.4	39.5	96.0	119.8	109.2	53.9	26.5	176.0	103.6	134.1	66.6	100.6	134.9	108.7
27	53.6	33.4	33.4	93.2	106.2	111.9	51.4	26.4	169.6	101.3	130.4	63.8	96.2	131.9	105.5
27	47.2	31.9	42.4	89.5	120.0	114.7	52.2	17.0	177.6	88.6	134.1	59.0	96.9	135.2	109.9
27	51.5	32.1	38.6	91.5	115.6	111.1	54.5	24.2	177.4	98.0	136.4	64.0	100.8	130.4	97.6
27	55.1	33.4	41.6	106.1	101.0	108.0	57.6	22.5	170.4	100.4	133.6	63.0	97.0	136.2	107.8
27	54.2	30.9	38.2	93.5	112.8	115.3	61.5	22.7	178.7	100.4	137.6	65.9	101.3	143.7	109.9
27	56.0	35.9	35.1	95.8	113.4	112.1	56.1	21.1	174.5	104.1	138.3	64.1	95.4	131.2	106.2
27	56.6	33.6	36.0	98.7	118.2	117.6	49.0	24.6	186.5	106.3	132.6	68.7	98.7	134.8	106.5
27	53.1	34.9	36.8	100.3	117.8	128.3	51.4	22.1	181.2	99.9	140.2	66.7	93.1	124.2	107.0
27	56.2	31.6	40.2	108.6	92.6	104.4	55.1	18.3	166.7	100.4	125.4	67.1	94.6	131.1	109.9
27	50.2	30.5	31.1	103.0	104.2	103.9	54.1	18.6	166.6	89.5	131.0	67.1	93.0	131.8	102.5
27	55.5	36.0	38.5	108.5	103.5	112.0	53.4	20.6	173.8	100.9	135.5	65.3	107.4	141.2	104.4
27	51.5	33.2	37.6	104.7	100.1	113.1	55.0	22.1	170.3	98.2	138.5	65.6	98.0	137.5	116.5
27	58.2	34.4	38.0	98.7	115.1	110.1	56.0	24.6	176.9	108.3	131.7	66.6	102.2	136.5	109.8
27	53.7	34.3	33.0	91.2	116.7	116.5	53.2	24.3	178.0	101.3	143.3	65.3	100.9	140.4	112.3
27	55.6	35.1	32.7	102.8	117.3	113.0	53.4	25.1	179.9	100.7	143.1	62.1	102.2	136.8	111.6
27	52.2	35.9	34.7	100.1	105.4	111.5	58.2	26.1	173.0	99.2	142.6	69.6	100.1	141.7	108.9
27	55.2	31.7	34.7	104.0	103.0	111.0	49.8	19.3	178.1	102.7	127.9	66.7	97.0	129.5	107.8
27	51.6	33.1	31.4	91.4	107.8	112.0	52.1	20.8	170.5	103.5	135.8	61.5	99.0	141.0	103.1
27	51.8	29.6	36.3	91.8	112.0	115.1	54.3	16.7	177.0	94.8	131.8	62.2	102.2	136.1	110.6
27	50.9	32.7	32.6	93.8	101.1	115.3	55.9	22.7	178.4	104.9	130.5	63.7	98.5	137.3	99.4
27	55.4	32.1	36.5	93.1	110.4	116.3	55.0	19.2	178.4	101.5	142.2	69.2	97.4	144.6	103.9
27	55.1	34.3	34.8	97.1	113.2	121.8	54.0	23.5	184.3	106.1	140.5	67.0	95.7	138.2	111.7
27	46.9	30.4	35.0	98.6	113.4	113.9	54.3	15.9	173.4	93.0	138.9	66.5	95.4	138.7	106.6
27	53.0	35.3	32.8	101.1	104.9	105.7	52.7	20.5	173.1	108.6	129.9	69.8	99.3	135.7	106.5
27	53.7	31.7	38.3	92.0	117.4	109.9	55.3	20.5	176.7	105.5	145.7	65.8	100.9	141.4	103.6
27	50.9	32.5	34.8	91.4	110.1	112.9	55.3	19.0	182.9	99.4	133.8	65.8	95.5	138.3	104.8
27	52.6	33.1	37.0	102.2	105.3	115.2	53.4	24.5	175.5	104.9	140.0	65.9	94.9	134.9	110.6
27	51.8	34.4	35.7	91.3	114.5	113.2	56.1	17.0	177.9	105.7	134.8	66.4	102.6	143.4	106.2
27	48.3	30.7	35.5	94.1	114.3	104.6	53.8	19.9	173.2	98.9	127.4	65.5	101.1	138.2	113.4

	16	17	18	19	20	21	22	23	24	25	26	27	28	29
1	99.5	78.2	32.0	119.0	36.3	123.5	87.0	114.0	46.9	25.1	26.1	57.4	22.4	71.2
1	103.7	73.4	31.4	119.9	34.9	122.5	83.4	120.1	47.6	31.0	26.5	51.9	21.3	65.8
1	104.0	77.2	30.8	120.4	34.0	121.8	82.2	111.7	50.3	28.4	23.5	56.3	21.8	69.4
1	102.4	77.4	28.2	120.4	34.1	125.9	79.8	114.5	47.4	34.4	30.6	60.1	21.3	71.6
1	98.2	73.0	25.8	120.4	34.1	125.5	88.5	117.3	49.0	27.7	27.3	52.3	19.7	71.3
1	100.0	72.8	32.1	120.4	35.1	124.6	83.0	110.6	45.3	27.2	26.8	57.2	20.0	69.7
1	96.8	72.1	32.8	120.2	35.3	120.3	81.0	114.4	50.8	33.3	22.7	51.7	18.1	61.7
1	98.1	73.7	33.2	120.5	36.6	125.2	79.5	114.5	51.1	29.4	22.7	58.0	20.1	71.7
1	99.4	75.3	33.7	120.8	37.8	121.9	87.6	114.5	50.6	28.7	29.0	60.3	21.4	67.5
1	104.9	82.4	35.0	117.9	38.9	129.5	81.4	120.3	46.8	21.9	25.1	56.4	25.7	74.2
1	103.1	74.0	37.0	127.0	36.6	120.8	78.9	109.4	53.9	31.2	26.1	55.1	21.7	70.7
1	105.5	82.9	34.2	121.4	33.4	120.7	85.4	112.4	47.5	29.1	28.2	60.8	20.5	69.3
1	100.7	78.5	34.2	118.7	36.6	129.3	74.2	117.7	47.4	25.1	25.5	58.8	19.2	66.9
1	91.8	75.6	28.7	118.9	36.5	123.8	91.9	112.8	48.9	29.7	26.1	53.0	20.8	67.2
1	104.2	73.7	28.2	118.9	33.1	129.6	83.5	116.7	51.7	25.6	29.7	54.3	21.9	65.3

Appendix A (continued)

	16	17	18	19	20	21	22	23	24	25	26	27	28	29
1	96.7	73.0	36.1	121.0	33.8	126.9	89.2	119.2	50.1	30.5	23.8	52.1	19.7	68.5
1	97.9	70.7	27.4	124.9	32.4	121.6	76.6	118.0	51.4	29.0	23.0	50.9	21.2	61.1
1	114.7	78.8	39.9	129.5	36.2	124.8	79.8	118.4	49.9	26.7	23.4	61.1	16.4	73.3
1	105.7	71.7	38.8	123.7	30.7	123.9	77.5	119.0	50.0	23.2	20.8	51.3	15.5	66.9
1	105.9	75.4	35.6	124.1	31.8	128.8	82.5	117.4	51.3	25.6	21.6	44.9	20.0	70.6
1	106.1	79.2	32.5	124.5	32.8	119.7	82.7	115.8	48.0	29.6	23.5	54.3	21.1	72.4
1	104.7	72.0	31.8	123.6	34.3	129.0	74.3	117.2	51.2	29.8	22.3	56.2	19.5	62.1
1	101.7	73.5	35.3	118.9	33.0	124.5	89.2	113.7	50.6	23.7	22.3	52.8	18.1	65.5
1	106.2	72.4	30.2	114.9	30.7	120.3	81.9	113.3	45.8	21.4	21.9	56.0	25.1	68.8
1	105.4	79.0	30.8	124.6	34.4	124.5	83.8	110.9	50.0	29.0	23.6	54.5	16.6	76.6
1	92.9	74.7	30.5	123.9	31.9	122.9	83.2	118.4	50.1	28.3	21.5	52.1	18.4	68.1
1	102.2	75.6	36.1	123.1	35.8	122.3	82.0	116.0	50.2	30.9	20.5	55.1	18.6	70.0
1	94.7	70.6	32.3	123.1	31.7	128.5	84.8	115.4	49.2	26.7	20.3	54.2	17.5	67.7
1	101.4	79.8	39.8	120.0	33.4	126.5	77.4	113.8	49.3	27.2	22.2	57.0	19.3	71.6
1	102.7	79.9	39.8	131.7	33.9	127.9	93.8	118.5	53.6	30.0	23.5	55.8	18.7	76.2
1	94.5	75.7	36.0	122.1	36.7	127.9	84.2	119.5	46.7	26.1	20.5	54.3	19.6	63.7
1	99.9	75.8	41.8	127.1	32.7	120.4	87.9	118.9	50.3	25.5	17.9	56.2	18.3	67.4
1	99.1	79.3	41.5	119.0	33.8	134.2	85.6	121.4	46.1	31.3	22.4	54.0	18.5	68.5
1	100.1	79.2	36.1	125.8	35.7	127.4	79.7	112.5	51.1	29.3	22.4	59.6	16.1	71.1
1	102.1	75.8	30.7	124.8	34.6	120.1	77.6	111.1	47.0	28.3	23.1	55.2	18.6	72.5
1	99.1	79.0	38.6	121.9	34.5	126.8	83.3	116.4	48.0	28.9	20.2	55.6	18.8	72.0
1	105.2	72.4	37.4	121.5	31.0	128.6	95.9	116.5	44.9	27.6	28.4	55.9	18.7	71.5
2	102.7	75.3	32.7	115.8	30.5	117.1	83.9	112.1	51.6	26.1	27.1	51.7	22.3	62.7
2	96.9	75.9	29.8	120.5	34.3	116.0	86.7	111.9	51.1	22.8	25.2	54.7	26.1	68.2
2	103.6	73.5	35.8	119.5	33.5	122.0	72.3	109.0	49.1	26.5	26.2	51.1	23.1	72.1
2	104.1	78.6	26.3	121.5	33.0	127.2	84.0	115.4	52.9	28.2	25.9	56.6	24.2	77.6
2	101.6	70.8	31.9	125.3	34.4	128.6	83.2	119.5	52.2	28.0	25.7	55.4	20.6	69.4
2	96.9	73.8	38.6	123.9	37.3	119.2	74.7	113.3	53.6	31.0	25.0	55.1	22.0	71.5
2	96.5	74.8	33.4	117.3	35.5	121.1	91.7	108.0	50.3	22.4	22.9	56.5	22.4	68.0
2	96.7	70.9	33.7	116.4	39.8	127.1	85.9	109.8	45.1	28.0	23.9	50.1	17.5	72.6
2	101.6	67.4	34.1	118.3	36.9	115.9	84.0	111.5	53.1	31.0	23.5	52.6	20.3	70.3
2	96.4	68.2	30.9	112.9	35.4	122.9	78.5	115.3	50.5	23.9	25.4	48.2	22.9	67.1
2	89.8	71.3	29.5	116.8	40.0	124.2	90.8	108.7	46.7	33.1	23.4	49.5	20.7	72.0
2	100.7	74.4	40.8	119.6	43.7	115.2	79.8	108.0	50.3	26.6	24.0	55.7	17.7	72.3
2	106.0	72.3	37.6	123.1	36.6	125.1	84.2	111.4	51.0	29.8	22.2	51.7	20.1	67.3
2	92.6	65.9	26.7	107.5	37.0	116.6	75.8	104.5	48.8	27.4	27.4	45.6	19.6	63.8
2	100.7	79.4	36.5	123.5	35.1	125.0	73.9	116.1	54.6	31.9	25.1	52.5	25.3	70.1
2	107.3	78.8	33.7	120.6	35.4	128.4	85.4	118.2	50.5	25.8	29.2	58.9	21.0	73.2
2	112.0	77.7	34.9	119.8	36.9	131.8	84.2	115.0	49.9	26.0	29.2	55.3	23.1	71.0
2	98.0	70.5	32.8	116.1	33.4	126.7	82.4	107.3	48.6	27.5	27.9	52.8	17.7	70.1
2	103.9	79.8	30.4	120.3	32.3	124.6	83.1	107.5	45.1	26.0	29.6	53.1	20.2	71.1
2	91.8	67.6	28.0	114.8	31.1	121.8	89.3	109.5	48.3	28.0	28.0	49.4	20.3	63.8
2	93.1	72.3	30.2	121.3	37.3	118.7	84.4	110.6	54.5	22.7	26.6	53.2	21.5	67.3
2	99.8	75.6	34.7	115.7	37.4	125.2	76.3	113.4	53.1	30.2	22.9	55.4	21.0	68.6
2	97.2	76.3	26.8	117.4	30.1	130.7	77.9	118.4	52.5	28.7	23.9	52.4	20.7	70.1
2	103.7	79.7	37.3	126.6	38.8	138.9	84.1	119.1	52.1	29.1	21.8	56.3	20.8	72.1
2	92.8	65.2	28.2	121.1	29.6	122.5	90.8	115.3	50.2	27.4	21.0	49.6	21.3	68.9
2	103.8	71.7	37.2	120.6	32.4	125.8	76.0	117.3	50.0	26.1	23.0	56.6	19.1	69.2
2	99.4	68.0	33.4	122.2	31.3	117.1	77.7	107.1	49.2	24.5	20.9	51.7	18.2	69.2
2	93.8	73.3	29.5	114.5	30.1	121.4	80.7	112.3	44.6	21.8	21.4	51.5	16.8	66.9
2	98.9	71.9	34.4	119.8	33.6	125.6	75.8	113.0	51.5	25.6	23.7	50.1	20.0	69.2
2	94.7	65.9	28.9	112.9	31.4	118.4	75.9	108.6	45.4	22.2	23.1	44.9	20.5	63.5
2	98.5	73.2	31.3	118.9	33.7	121.1	75.5	113.1	45.6	28.9	24.2	48.8	20.1	69.5
2	106.8	75.1	36.3	125.4	34.7	136.6	84.1	116.0	50.0	25.1	28.8	52.9	23.4	68.6
2	108.6	71.2	35.1	119.7	30.3	131.8	90.2	114.8	47.1	28.1	19.1	55.5	19.4	72.1
2	105.7	83.2	29.8	131.4	32.7	138.5	87.3	125.2	52.4	27.2	23.3	54.2	22.7	70.8
2	106.5	76.4	36.6	120.2	35.4	128.8	76.8	115.1	50.2	24.2	24.8	52.8	21.1	64.4
2	105.6	74.0	33.3	123.6	31.3	125.1	82.2	121.2	48.7	29.4	25.9	55.3	18.5	74.0
2	97.2	75.9	29.3	128.9	33.3	128.2	78.6	118.4	52.5	29.0	25.1	49.5	17.2	68.5
2	97.9	71.1	31.5	124.3	32.4	120.8	80.4	118.2	49.7	26.1	22.7	50.6	18.1	69.7
2	101.7	75.9	31.0	120.3	33.2	122.9	77.2	104.3	48.6	29.6	22.6	49.6	16.4	72.5
2	99.6	72.0	33.4	117.7	31.4	117.8	80.7	112.9	47.9	29.5	21.9	48.3	14.7	68.4
3	99.3	76.4	32.5	121.8	37.5	129.8	78.7	117.4	51.6	27.6	22.9	63.6	23.1	78.8
3	98.2	73.5	32.4	116.8	39.1	122.2	83.1	110.4	47.7	27.3	23.6	54.7	20.6	69.2
3	90.7	73.1	28.8	121.7	33.8	125.4	95.8	114.3	52.2	21.0	25.6	57.5	23.5	67.7
3	91.9	75.2	35.9	110.4	36.6	120.4	80.0	109.9	47.5	26.9	27.3	54.9	27.3	71.8
3	93.1	71.8	33.8	113.0	33.3	128.9	91.1	117.5	51.6	24.2	24.3	53.0	26.2	66.0
3	87.5	62.6	25.8	102.2	32.4	118.7	80.6	106.9	45.1	23.5	24.2	49.2	22.6	62.2
3	103.3	77.1	35.6	122.6	32.5	129.7	85.3	120.6	52.8	27.1	25.5	58.1	24.4	71.0
3	96.0	73.9	30.4	118.6	35.1	124.8	81.8	115.3	50.0	30.0	23.6	57.6	22.8	69.5
3	95.6	78.9	30.0	125.8	32.8	133.2	85.5	119.3	52.0	29.8	25.9	60.2	25.9	71.9

Appendix A (continued)

	16	17	18	19	20	21	22	23	24	25	26	27	28	29
3	95.7	74.1	33.4	112.6	34.7	118.1	80.0	111.3	48.6	29.7	22.4	57.0	18.3	64.4
3	87.5	76.0	27.8	112.7	35.1	117.0	76.8	114.2	49.3	25.8	25.8	55.0	22.2	67.4
3	99.9	80.4	41.6	119.9	41.5	124.1	84.8	115.2	49.7	28.9	26.1	55.6	23.2	69.4
3	103.4	71.9	32.8	116.1	33.6	127.1	82.7	117.7	53.7	30.1	27.0	56.0	23.3	70.8
3	100.7	74.4	30.6	125.5	33.2	129.8	88.9	120.9	53.2	28.3	26.4	57.9	25.9	73.2
3	97.4	71.7	36.6	120.6	39.0	124.8	80.4	115.1	51.8	27.9	26.5	55.1	23.7	65.1
3	99.0	77.6	34.6	119.1	37.4	125.9	89.3	116.2	49.6	25.4	25.6	56.9	20.4	70.9
3	102.0	74.4	31.5	119.6	33.7	120.8	78.0	113.0	51.2	27.4	23.1	55.5	22.3	68.2
3	97.8	70.0	32.1	114.8	36.8	118.4	86.2	110.9	50.0	27.2	26.1	53.8	20.3	67.9
3	99.2	72.6	30.3	118.4	36.4	132.4	88.2	122.8	49.9	29.2	26.6	59.5	22.9	73.1
3	97.1	66.7	32.8	119.7	35.9	125.7	74.6	115.8	52.9	32.0	27.1	55.0	19.1	67.7
3	99.1	75.0	29.0	120.5	34.9	123.9	75.7	109.5	49.0	28.6	25.2	60.8	19.7	70.6
3	93.1	76.3	34.4	121.0	37.2	123.6	82.3	110.5	50.0	26.0	24.8	53.9	18.8	69.6
3	98.7	74.4	34.6	119.2	38.4	130.5	86.0	120.8	49.9	29.8	28.5	59.1	21.4	70.0
3	99.7	71.8	29.3	114.8	37.2	124.3	86.1	115.5	48.8	26.8	28.4	53.9	24.2	68.7
3	107.9	76.2	33.6	123.6	30.5	128.6	85.5	117.2	48.9	32.3	26.3	56.4	17.2	65.6
3	99.1	77.1	30.6	122.8	32.4	119.3	78.3	112.6	51.8	28.0	23.7	51.2	16.7	69.6
3	93.7	74.1	31.3	124.4	33.0	129.3	87.6	120.2	52.3	28.7	23.2	53.4	19.9	66.5
3	98.2	72.0	27.9	119.1	31.1	123.0	75.8	113.2	54.4	28.8	19.2	57.0	20.0	67.3
3	97.2	66.7	35.1	119.5	37.1	125.4	79.2	111.1	49.4	28.3	24.8	51.2	17.9	67.5
3	102.6	67.3	35.6	121.5	33.9	122.1	78.4	112.9	51.7	24.9	23.5	52.2	21.0	61.7
3	104.9	76.2	30.8	125.9	33.6	124.0	80.8	118.1	51.0	27.6	28.2	56.5	18.9	68.5
3	94.8	77.5	31.6	129.8	35.9	132.7	85.4	128.3	52.0	27.9	22.1	58.0	23.9	71.4
3	98.0	74.5	30.3	115.6	31.1	122.3	78.0	120.5	50.8	28.1	24.3	56.8	18.3	66.1
3	100.3	78.7	34.5	117.3	32.5	131.8	84.2	128.1	45.8	27.0	27.1	51.4	20.5	68.1
3	98.1	74.1	31.9	118.6	34.7	120.0	77.5	114.1	51.0	27.2	23.8	55.7	16.9	71.8
3	99.4	75.0	33.3	120.4	32.6	127.2	91.0	118.4	51.0	25.7	23.1	53.5	23.0	69.4
3	108.0	70.5	43.1	118.2	34.2	123.2	78.4	113.5	43.4	27.5	25.4	57.1	17.3	71.6
3	105.9	72.7	39.9	123.8	34.6	131.7	82.7	119.3	52.0	28.4	25.3	55.0	21.7	71.2
3	97.1	73.9	35.5	121.8	30.4	116.5	70.1	110.8	49.6	28.8	24.4	48.7	20.2	64.8
3	99.4	71.3	36.7	124.3	37.4	126.9	79.2	118.5	51.1	27.5	25.7	55.1	17.5	69.2
3	100.3	73.4	27.4	118.0	28.3	121.8	79.4	115.5	46.1	24.7	25.0	55.3	20.4	70.6
3	93.8	76.3	30.5	120.5	35.6	128.7	80.0	119.4	49.4	26.0	22.1	56.3	19.3	70.7
4	95.9	76.0	30.1	122.3	37.3	126.7	81.0	113.7	50.9	30.9	25.1	53.4	25.6	71.1
4	98.1	75.6	29.7	118.1	33.1	126.9	82.9	112.4	50.4	21.9	25.0	50.5	19.5	71.3
4	99.9	81.0	35.6	120.0	35.9	124.0	81.7	112.9	49.7	31.2	25.4	56.4	21.1	73.2
4	103.3	72.1	36.7	120.0	33.7	123.2	76.7	114.3	58.1	21.0	24.6	56.6	21.9	66.5
4	110.6	76.5	40.5	123.0	38.0	124.1	100.0	114.1	50.6	30.5	21.9	53.5	19.8	67.2
4	105.4	79.4	35.5	122.9	37.9	124.0	91.2	111.3	51.5	27.2	24.6	59.3	25.1	72.3
4	100.5	75.2	33.4	124.1	38.6	120.3	75.7	107.6	54.1	26.1	26.5	52.9	20.1	63.1
4	104.1	76.0	31.1	117.9	34.6	125.7	82.2	115.2	46.0	25.4	24.3	53.8	22.7	68.9
4	105.4	72.9	36.1	123.4	35.6	126.0	85.3	120.0	50.5	26.8	22.3	53.0	16.4	70.8
4	110.5	73.4	42.7	125.1	31.1	133.3	90.6	127.5	52.5	25.3	19.7	46.3	18.5	63.8
4	102.9	77.0	33.6	120.4	32.9	129.5	87.7	126.6	47.8	30.8	22.0	54.7	19.2	69.6
4	100.7	75.9	38.0	125.8	33.2	118.9	84.7	113.4	48.2	26.3	18.7	54.0	19.2	69.8
4	101.8	67.3	37.2	123.1	32.9	127.9	77.6	117.6	47.6	25.7	21.2	49.7	16.9	75.6
4	107.6	75.1	32.4	122.9	28.8	128.3	80.9	117.0	48.4	24.5	22.5	51.4	18.0	66.5
4	110.8	77.6	37.3	120.8	34.3	126.9	78.0	115.9	44.7	26.8	24.8	55.8	16.6	72.9
4	104.1	74.5	27.8	133.8	33.0	129.5	89.2	112.4	51.9	30.4	22.8	50.4	20.3	74.0
4	108.0	79.0	37.7	128.3	35.3	130.5	83.5	120.5	44.4	24.3	25.7	52.8	20.8	71.5
4	110.7	73.4	32.7	122.8	26.8	130.8	87.2	115.5	48.6	24.8	20.8	49.7	18.5	69.9
4	106.3	73.5	43.5	121.5	35.6	124.6	84.2	114.7	48.2	27.4	21.6	54.6	16.7	69.7
4	102.0	75.1	34.4	128.5	31.7	119.8	83.2	110.6	52.8	24.5	22.8	56.3	17.2	70.2
4	101.7	67.5	31.0	116.1	36.1	125.4	75.1	111.4	48.4	20.9	25.0	49.9	19.4	65.3
4	102.4	76.1	37.0	122.3	34.7	126.6	76.1	109.8	49.9	26.2	23.3	51.6	17.2	69.1
4	105.5	78.8	33.4	125.6	29.5	127.0	91.6	121.3	47.1	26.2	24.6	52.1	16.8	69.3
4	110.6	75.9	40.8	131.0	36.4	126.2	78.9	116.5	51.4	29.9	20.0	49.6	14.5	75.0
4	102.8	80.5	36.5	125.4	33.0	126.2	81.1	114.4	52.9	24.8	18.6	53.0	18.8	67.5
5	103.8	73.1	36.8	126.8	40.0	132.0	98.0	120.0	53.0	22.6	27.5	53.8	20.7	68.0
5	97.7	73.8	33.6	128.9	33.6	132.9	104.0	121.5	51.1	29.5	25.4	54.8	16.8	73.1
5	98.8	73.6	30.9	115.1	32.2	120.1	83.6	115.1	44.3	28.2	23.2	46.3	15.8	60.6
5	100.0	73.5	28.3	118.3	30.9	124.4	85.0	117.2	47.8	26.8	24.7	53.4	20.4	63.7
5	92.8	76.3	33.2	120.6	38.9	126.3	83.6	117.9	49.5	27.3	24.6	54.9	18.8	69.9
5	101.9	70.4	36.4	128.4	33.0	127.0	86.4	118.3	57.5	29.3	25.1	55.9	18.3	69.0
5	102.2	77.8	37.2	125.7	36.5	130.9	87.6	118.9	50.3	25.2	26.0	58.3	19.9	69.3
5	98.1	71.4	37.4	119.0	34.3	118.5	75.8	108.2	46.3	25.1	23.1	52.8	18.7	61.3
5	110.1	76.6	40.4	127.0	37.8	126.0	85.9	115.7	52.8	26.9	24.0	58.4	20.1	72.6
5	103.6	78.0	38.7	122.9	38.2	124.8	85.2	117.3	50.3	29.0	27.5	60.1	23.3	68.8
5	102.6	75.6	30.8	122.7	37.1	127.1	85.4	113.6	50.6	31.8	27.6	59.6	20.5	72.0
5	99.1	79.2	36.5	130.4	36.3	126.9	82.0	118.7	50.3	25.9	25.2	57.0	18.8	73.2
5	106.5	81.7	37.1	122.6	36.7	124.3	88.3	116.4	50.3	26.0	29.1	55.1	23.6	72.5

Appendix A (continued)

	16	17	18	19	20	21	22	23	24	25	26	27	28	29
5	113.9	84.1	37.7	130.3	37.1	136.8	95.1	128.5	52.7	31.9	30.9	62.0	23.1	72.9
5	92.7	68.4	26.5	111.1	34.2	114.2	81.2	106.3	43.7	22.3	22.2	54.5	22.1	65.6
5	100.1	75.6	33.2	119.5	33.6	121.5	82.8	113.9	51.5	27.1	24.5	54.0	22.1	70.3
5	98.6	81.1	32.6	130.1	34.6	128.8	81.9	119.0	50.6	28.4	26.2	55.1	22.7	73.2
5	98.9	75.8	32.9	122.8	32.6	130.2	85.4	116.7	48.9	25.8	26.2	52.7	23.2	68.3
5	95.4	70.7	30.6	117.3	36.7	125.0	85.0	110.2	47.8	24.7	25.6	50.8	19.7	66.7
5	95.8	74.4	32.1	131.5	35.3	130.9	80.2	115.3	57.5	25.0	24.6	51.4	21.9	65.5
5	95.9	72.7	34.8	124.2	33.6	116.1	88.1	106.4	54.6	28.8	25.8	55.6	21.3	68.1
5	89.6	68.7	28.4	116.8	33.6	124.9	81.7	110.9	44.8	23.5	22.8	47.2	14.3	63.7
5	94.7	73.2	36.5	116.1	36.5	117.2	82.3	111.5	48.6	28.4	27.0	53.1	19.4	67.4
5	104.1	75.9	34.1	115.2	31.6	122.5	89.0	115.9	43.6	27.0	26.0	53.9	21.8	66.9
5	101.5	76.1	29.9	124.3	34.1	120.0	84.6	113.7	51.5	28.1	26.8	51.5	20.5	70.6
5	102.0	72.4	37.7	118.4	35.8	120.6	80.7	113.9	45.9	23.3	23.1	56.8	23.7	70.2
5	104.9	74.6	33.1	117.4	35.1	127.6	87.9	117.5	48.8	27.6	29.4	56.3	22.7	73.2
5	93.7	70.2	21.8	117.1	31.7	120.4	85.7	115.3	42.5	22.5	26.5	43.6	19.0	66.1
5	95.3	74.5	37.7	120.7	35.7	121.7	83.6	113.5	47.1	29.0	28.5	54.1	21.2	67.3
5	101.0	78.5	30.3	127.7	34.8	128.4	83.7	113.3	50.8	21.6	22.4	55.3	15.2	71.6
5	96.5	75.4	33.5	128.2	31.4	121.4	75.5	118.4	55.8	28.4	23.4	51.2	13.8	69.6
5	97.9	78.2	36.0	120.8	29.7	127.1	85.1	121.5	46.1	23.8	23.3	54.6	16.9	67.6
5	106.1	81.4	34.1	120.3	36.7	127.9	88.3	124.6	46.6	26.0	25.7	55.9	20.5	70.4
5	101.9	78.6	29.8	125.9	30.9	123.1	77.8	112.7	50.1	26.6	23.9	55.7	18.2	67.4
5	101.3	72.4	36.5	127.5	31.9	124.1	76.2	113.7	53.5	26.0	23.1	55.4	14.9	69.2
5	106.4	68.5	41.2	125.8	32.6	119.1	84.0	116.8	50.0	25.3	21.4	53.1	17.7	70.9
5	95.1	75.7	37.2	119.9	31.1	127.5	82.5	118.6	44.7	29.6	24.5	54.3	18.0	69.9
5	99.6	74.6	34.9	125.6	33.3	124.1	87.3	118.8	47.1	21.2	21.8	56.2	17.4	66.8
5	97.7	80.6	31.8	126.2	35.7	127.8	82.9	120.0	48.9	27.1	25.3	59.4	19.3	70.5
5	90.8	73.1	31.7	120.6	36.4	124.9	82.5	115.0	44.6	21.6	22.9	50.9	15.6	67.7
5	97.3	72.5	35.7	121.0	31.9	122.7	74.0	115.9	50.9	27.3	22.1	58.3	19.6	73.5
5	99.5	72.8	39.1	123.0	32.3	130.5	84.0	122.7	47.5	24.0	24.9	54.8	23.6	68.3
5	97.1	75.0	33.8	132.8	35.9	124.7	72.0	113.4	58.5	21.0	22.5	58.9	18.6	72.1
5	100.4	73.1	39.6	119.1	37.4	124.5	85.1	106.8	48.6	22.1	25.4	52.4	15.5	64.3
5	99.9	72.7	40.4	125.5	36.2	123.1	72.6	113.7	50.6	25.5	23.5	54.6	18.4	71.9
5	114.7	76.3	38.0	123.5	33.8	125.6	84.8	113.7	48.4	26.2	24.1	59.5	24.2	70.7
5	100.8	72.5	43.2	124.2	36.1	126.1	77.7	113.5	47.1	24.6	21.7	50.2	19.6	67.6
5	102.4	72.7	23.7	127.6	35.8	127.7	81.5	113.8	40.6	24.7	21.3	53.7	17.4	69.4
5	99.3	79.8	31.0	131.1	35.6	122.2	77.0	114.1	53.5	27.5	20.9	57.2	15.3	71.3
5	104.6	72.4	33.5	130.5	30.8	123.6	77.5	114.6	53.3	23.7	25.3	51.9	20.1	68.1
5	104.6	76.7	35.6	124.2	34.1	120.9	80.7	114.0	44.0	22.9	23.5	53.2	18.5	71.0
5	107.2	75.3	37.8	126.6	32.8	127.9	88.7	127.0	48.2	25.8	22.1	54.4	21.8	70.5
5	105.2	82.1	27.9	127.7	30.7	131.3	75.9	118.0	48.4	24.3	22.9	59.0	19.1	71.7
5	107.9	76.4	39.7	124.8	33.5	129.5	86.8	121.5	52.4	26.4	23.6	51.3	17.0	70.2
6	99.6	79.5	34.3	130.1	35.7	123.7	95.9	115.5	52.5	24.8	22.4	53.9	17.2	64.9
6	109.5	74.0	35.5	114.1	34.6	121.0	98.4	108.7	49.7	29.7	26.9	55.2	22.4	68.6
6	99.5	82.6	29.3	125.4	34.0	128.9	96.5	114.7	52.5	29.0	27.1	59.4	21.4	65.1
6	102.6	77.8	35.6	124.0	39.0	129.4	89.7	116.9	53.5	24.8	27.5	57.5	24.4	67.5
6	100.9	77.8	36.0	135.1	35.2	130.9	84.2	118.2	59.3	28.5	29.4	58.1	21.1	71.1
6	99.6	77.1	35.4	122.4	39.1	125.9	83.5	114.7	55.5	26.7	25.4	54.9	20.8	65.3
6	86.0	74.9	30.2	119.3	32.7	126.6	91.4	117.5	51.1	22.2	21.0	53.9	19.7	66.1
6	99.6	76.3	35.6	121.1	38.0	115.5	82.0	107.8	47.9	22.0	24.4	57.0	20.9	66.7
6	101.9	75.7	30.3	128.8	31.2	122.7	78.6	113.1	51.9	26.6	26.9	57.2	23.2	68.9
6	97.5	69.3	37.0	118.1	40.0	118.6	74.0	112.1	51.3	24.2	27.8	51.9	20.0	64.0
6	103.0	72.3	38.2	121.2	35.2	125.8	85.3	112.5	47.7	30.0	27.4	55.0	22.7	69.6
6	107.8	78.5	41.1	130.8	38.1	120.3	76.2	111.6	60.6	27.4	29.3	55.4	24.0	67.3
6	91.4	69.8	29.9	112.4	36.6	116.8	83.1	110.3	46.7	25.1	22.7	50.9	21.2	65.5
6	98.0	79.6	34.7	122.5	34.1	123.4	84.9	111.9	48.8	25.6	26.1	58.4	19.9	65.8
6	93.7	79.0	28.5	123.9	35.5	129.9	84.5	112.8	53.7	30.7	26.2	57.4	19.2	71.2
6	92.7	76.7	33.8	120.3	37.2	122.7	79.3	112.7	54.9	28.5	26.8	56.8	22.8	68.5
6	102.7	73.6	36.7	124.4	39.2	118.9	89.2	115.5	57.1	26.4	25.6	54.6	23.7	65.9
6	100.4	77.3	30.7	121.6	36.3	121.7	86.7	110.3	51.1	28.3	31.5	55.6	23.8	61.8
6	96.8	75.0	35.6	116.6	38.0	126.2	86.4	111.4	48.3	29.4	23.0	53.3	19.0	62.3
6	87.7	77.8	24.9	121.9	39.1	126.7	83.5	113.8	55.6	27.4	26.9	54.9	20.1	68.2
6	97.7	80.1	32.6	126.6	35.8	126.0	88.0	123.3	49.2	27.4	26.6	55.6	21.4	64.9
6	101.9	81.9	35.3	128.4	38.7	124.3	84.6	113.8	55.8	30.8	27.4	57.6	21.0	67.2
6	100.3	76.2	37.3	125.7	34.9	128.2	92.7	119.3	55.1	25.1	26.1	51.3	20.8	64.5
6	102.8	79.1	35.5	131.0	39.2	127.9	83.8	117.4	54.1	29.3	26.6	55.7	19.3	67.5
6	101.5	75.8	33.6	123.6	35.3	129.9	102.7	116.5	50.8	27.3	29.6	55.9	23.3	69.9
6	107.4	79.5	43.5	122.4	41.0	124.0	96.2	110.9	48.2	29.2	26.8	58.1	23.9	68.1
6	96.7	70.9	38.2	117.9	36.6	117.7	80.7	110.4	50.9	24.9	25.0	49.4	19.0	62.6
6	97.3	71.0	33.2	120.0	34.4	120.7	76.3	110.4	50.4	29.7	23.9	54.5	19.6	65.9
6	99.5	84.1	37.6	130.7	36.0	125.5	83.4	113.4	57.2	27.2	26.8	55.8	22.4	65.5
6	102.0	72.8	31.3	116.2	34.3	118.4	90.5	105.9	47.9	26.6	25.3	54.1	20.0	66.2

Appendix A (continued)

	16	17	18	19	20	21	22	23	24	25	26	27	28	29
6	104.6	80.0	37.9	126.4	38.4	126.7	79.7	114.2	50.3	23.0	22.3	55.2	17.9	69.9
6	93.0	74.6	27.5	124.1	38.1	127.3	79.9	122.0	51.9	28.8	22.9	57.0	14.1	66.4
6	97.8	76.5	30.7	125.3	32.3	117.7	90.2	111.2	53.2	25.3	23.5	54.5	16.9	67.9
6	100.0	82.9	37.6	128.0	35.0	130.4	87.8	118.1	54.9	32.1	24.6	64.3	20.4	77.6
6	104.7	82.0	31.2	127.4	34.9	122.8	81.0	114.8	50.1	29.1	24.6	56.0	19.9	70.3
6	107.0	80.4	34.7	123.7	36.9	127.9	83.6	117.7	48.7	25.8	24.4	53.7	19.4	70.4
6	98.2	77.9	37.1	127.5	38.6	131.1	89.8	121.0	48.7	31.1	23.7	59.0	16.9	68.3
6	98.5	79.7	27.9	126.0	34.6	119.8	89.5	113.4	52.2	24.8	22.7	56.5	14.5	68.2
6	99.3	82.8	30.2	124.9	34.8	131.7	90.0	120.9	46.2	26.6	24.7	53.9	24.7	66.9
6	101.0	75.5	33.7	125.7	34.6	128.4	90.4	124.6	46.3	21.5	23.9	52.9	14.1	64.7
6	110.1	75.1	32.7	126.1	35.8	122.4	80.8	116.1	51.3	31.5	25.5	55.1	20.3	69.8
6	104.4	75.9	37.3	122.1	32.7	135.8	92.2	118.9	43.9	30.1	24.7	51.8	22.1	69.3
6	95.1	75.2	31.3	124.0	30.5	125.6	89.1	116.6	52.1	28.7	23.1	52.5	21.9	73.7
6	102.4	81.2	33.0	129.8	31.8	127.4	84.8	116.2	55.4	26.4	23.0	55.4	18.5	70.7
6	101.6	75.2	29.3	122.7	33.6	125.4	84.3	114.3	49.5	25.5	25.9	52.0	25.0	67.2
6	99.6	77.4	32.2	129.1	34.0	123.5	83.2	113.1	50.6	25.3	22.6	56.4	19.0	68.7
6	97.1	71.1	30.5	120.0	30.7	122.5	81.2	116.5	48.6	27.3	21.2	52.6	19.2	61.9
6	108.2	74.3	35.1	123.7	30.4	129.9	87.7	122.9	51.4	24.5	21.4	53.1	20.0	62.9
6	97.8	80.5	30.5	119.3	33.7	121.1	83.1	112.3	46.2	27.7	20.9	52.4	18.8	60.9
6	97.7	81.9	28.3	122.8	36.7	125.8	80.8	113.7	45.4	27.9	24.1	56.3	19.3	65.3
6	99.7	79.9	28.3	121.1	33.2	120.5	74.5	111.6	50.7	31.7	22.7	55.1	19.5	72.6
6	109.3	80.4	30.2	124.9	32.0	120.8	89.9	112.9	53.4	27.1	28.6	58.0	23.7	60.4
6	101.4	76.4	31.9	121.6	33.6	123.9	81.2	117.3	50.0	23.9	19.8	52.6	18.7	59.6
6	89.1	71.8	32.7	113.6	31.9	122.1	85.2	111.1	46.1	25.0	20.0	58.6	17.9	62.4
6	89.2	79.4	28.3	128.7	36.0	129.7	77.8	121.0	52.6	24.9	21.7	54.1	14.2	63.6
6	99.8	86.3	35.1	131.7	34.4	130.4	80.4	111.6	57.1	27.4	23.7	62.5	17.9	72.2
6	103.7	81.3	34.9	123.8	37.1	130.2	81.8	122.6	49.4	27.6	25.1	55.9	22.4	71.7
6	96.7	74.4	33.5	126.1	34.7	133.0	80.2	118.1	51.5	27.0	19.7	57.6	16.3	70.0
6	97.3	79.3	30.9	127.4	33.1	128.7	87.1	113.6	52.4	27.4	24.3	59.0	15.2	66.6
6	109.4	73.0	36.2	126.1	32.5	133.5	86.6	119.6	53.1	27.8	23.0	57.8	18.0	67.5
6	103.8	74.4	34.3	127.7	34.0	115.4	87.9	101.9	51.7	28.2	21.7	56.8	18.8	73.5
6	109.2	79.6	27.8	127.2	28.8	122.6	84.6	113.0	52.4	23.5	23.6	57.9	14.7	65.0
6	103.8	79.7	39.7	129.3	32.5	120.4	81.6	114.6	51.2	26.8	26.6	55.1	19.1	70.9
6	92.4	70.1	29.8	118.4	32.5	124.1	81.6	113.3	49.6	23.9	20.2	51.0	17.4	59.0
6	105.2	80.0	32.7	126.9	37.2	115.4	78.7	110.7	52.7	27.0	25.8	57.6	17.8	71.9
6	107.8	75.3	39.1	128.7	37.4	125.2	80.4	117.9	50.7	27.7	22.5	51.0	18.9	67.9
6	110.0	76.6	38.6	127.8	35.0	123.9	78.5	118.7	55.5	30.6	26.2	56.9	17.8	74.7
6	105.7	83.4	31.3	129.6	30.9	126.3	95.2	121.6	49.5	26.0	22.1	55.1	21.1	65.1
7	89.1	71.1	24.4	115.5	35.0	122.1	77.9	108.1	49.6	30.7	26.0	50.2	20.0	71.9
7	104.0	81.2	37.1	131.0	37.1	121.2	88.2	110.7	56.0	37.7	25.4	50.4	19.8	76.1
7	98.6	75.9	36.6	124.7	36.2	122.0	80.3	113.0	51.8	30.0	24.9	50.5	17.8	71.0
7	98.4	78.8	27.6	116.6	35.3	121.1	79.5	115.5	48.6	22.4	22.0	50.6	17.9	65.8
7	98.1	75.5	32.6	122.9	36.6	128.5	87.3	115.8	50.4	24.1	23.7	54.3	21.5	68.2
7	95.6	75.2	25.4	126.7	29.0	120.8	79.5	106.9	53.0	25.9	26.7	52.7	19.0	70.6
7	97.9	72.1	32.4	117.9	37.3	127.1	79.9	111.9	50.5	25.0	25.5	48.9	20.9	60.7
7	82.3	68.7	32.1	114.4	33.8	116.1	80.6	108.1	47.9	28.1	22.5	49.8	18.4	63.4
7	97.9	77.5	38.0	126.6	37.3	132.5	78.0	118.5	54.8	26.5	23.1	56.7	18.8	69.1
7	101.1	73.6	36.4	121.3	35.5	126.6	83.6	107.8	49.7	23.8	27.0	52.9	19.5	69.4
7	96.1	74.4	31.2	120.3	33.0	115.6	77.0	113.8	52.8	28.0	25.7	55.2	20.6	69.1
7	91.2	72.9	27.9	120.6	35.5	123.3	77.2	113.0	51.2	24.0	25.8	49.6	19.2	62.5
7	106.3	74.1	37.3	121.9	36.1	130.5	84.4	113.1	51.9	28.2	26.7	58.2	24.4	72.3
7	92.9	72.4	30.3	123.2	36.8	122.6	81.8	113.2	47.1	26.6	24.1	55.1	19.1	69.2
7	95.6	76.8	30.3	124.4	37.4	127.2	84.0	113.3	52.2	20.0	25.3	55.7	16.7	70.3
7	95.5	69.7	33.3	116.4	39.0	115.6	79.3	108.5	50.2	27.1	24.9	53.6	18.8	66.2
7	101.0	77.5	37.2	123.3	40.7	123.5	82.6	110.0	50.7	28.8	22.7	53.5	17.9	67.5
7	97.8	74.2	33.6	124.6	40.3	117.3	82.5	111.3	48.2	28.6	25.7	51.0	20.9	70.5
7	102.3	80.9	35.9	119.7	38.8	127.9	79.7	116.4	50.3	29.3	23.1	57.0	20.3	66.9
7	96.8	73.1	27.9	120.4	35.9	123.6	77.9	112.5	51.8	26.5	25.2	51.7	21.1	69.7
7	90.6	75.6	32.4	121.5	39.4	124.7	88.9	115.4	50.0	23.8	22.6	51.4	17.4	68.4
7	101.1	73.8	30.3	119.8	33.1	129.0	74.5	118.9	56.7	20.2	17.6	53.2	12.8	65.1
7	98.4	79.1	37.0	126.8	37.8	122.1	85.2	110.3	51.5	21.6	18.7	51.0	14.6	72.4
7	101.1	76.9	32.5	125.3	32.8	120.1	74.4	107.7	54.1	26.9	18.4	51.8	14.8	70.1
7	98.0	73.9	36.4	123.1	36.5	121.5	75.2	111.4	51.5	23.5	23.8	53.6	18.3	69.8
7	103.2	79.3	32.1	129.6	31.5	127.0	84.6	119.0	53.6	27.1	19.7	54.7	18.1	67.6
7	92.3	75.8	32.1	129.8	33.5	120.2	74.7	112.1	52.2	25.4	21.5	50.2	13.0	71.0
7	93.9	67.6	39.0	112.8	33.2	119.4	74.3	108.8	48.1	23.8	17.1	48.4	16.9	59.9
7	105.9	69.5	34.4	117.8	28.8	119.6	82.9	112.0	46.5	24.7	23.9	51.8	18.5	66.8
7	100.9	72.4	34.1	119.5	34.2	122.6	78.1	111.6	47.2	18.5	20.0	51.1	15.3	67.8
7	97.9	73.7	26.3	122.5	30.6	127.0	82.3	115.0	46.1	21.5	20.5	52.5	13.0	68.5
7	98.9	76.6	30.9	128.1	35.3	124.5	72.5	106.0	51.4	24.4	23.2	53.8	16.5	69.1
7	105.1	76.7	35.3	128.4	32.8	130.8	83.5	119.6	51.7	28.2	21.2	52.6	20.6	69.4

Appendix A (continued)

	16	17	18	19	20	21	22	23	24	25	26	27	28	29
7	85.9	78.4	30.7	134.3	34.1	129.1	75.3	122.4	53.8	26.3	19.8	54.3	15.6	71.7
7	88.1	71.2	32.4	122.8	36.6	125.7	80.9	116.2	47.2	24.3	20.8	55.9	13.5	74.0
7	97.6	73.8	35.9	125.1	37.2	128.4	79.3	118.3	48.9	21.6	21.8	53.3	17.6	70.4
7	88.4	79.8	28.0	126.4	34.1	123.1	84.1	110.6	46.5	21.8	20.3	54.3	16.1	69.3
7	96.8	71.2	31.1	123.8	32.1	127.0	82.4	111.7	47.6	23.8	22.8	48.8	18.4	66.6
7	101.3	72.9	37.2	129.6	32.7	124.1	80.0	112.0	53.4	23.5	19.8	57.4	18.1	70.3
7	109.7	74.2	42.1	128.1	37.1	132.2	85.4	116.1	45.6	26.8	19.7	56.9	17.8	73.7
7	99.5	70.3	36.2	121.9	33.2	128.5	81.3	114.2	48.7	25.1	22.6	57.5	21.7	72.2
7	102.0	71.9	34.5	127.8	36.2	128.3	82.3	114.1	50.8	26.4	20.5	53.7	16.6	73.4
7	98.4	73.5	30.2	125.5	35.8	128.2	85.5	114.4	52.9	24.5	18.5	52.7	16.8	72.7
7	102.4	78.2	39.6	126.3	30.8	125.0	75.8	112.2	49.9	20.5	20.9	53.9	16.8	70.4
7	101.8	75.3	28.7	127.9	29.0	132.0	90.1	119.4	50.8	24.5	21.7	53.4	17.6	72.2
7	94.6	74.7	35.9	120.1	32.1	125.2	78.7	113.7	49.5	22.6	20.3	56.2	16.3	69.1
8	98.2	79.2	34.6	127.7	41.3	124.9	85.3	116.1	57.4	27.3	25.8	60.5	20.0	72.6
8	103.9	78.9	32.1	120.6	37.1	123.1	88.1	114.7	54.9	26.6	26.4	58.4	23.3	70.3
8	100.5	78.2	39.1	124.4	40.3	128.1	85.4	116.7	53.9	30.5	27.9	58.5	21.7	74.4
8	97.7	73.7	38.5	121.9	37.7	122.3	76.5	118.4	56.6	31.3	24.4	57.7	17.8	63.3
8	96.5	78.5	34.1	131.5	34.9	126.0	77.4	118.7	59.2	30.2	24.5	56.5	19.5	69.5
8	95.9	77.3	43.2	128.6	35.9	120.3	80.7	110.7	61.1	34.5	27.7	55.7	21.0	69.8
8	96.2	82.2	29.9	129.1	39.9	122.7	85.9	115.6	55.5	31.6	25.7	57.8	19.7	76.5
8	104.5	72.1	31.5	121.9	38.0	123.8	85.5	109.5	54.1	25.1	26.1	55.6	20.1	72.4
8	94.6	81.0	36.2	126.5	41.2	125.6	86.0	123.0	55.1	30.1	23.5	54.5	19.4	70.8
8	107.9	82.9	31.3	129.9	36.3	124.7	86.1	114.6	53.3	23.7	24.8	59.6	23.6	74.6
8	91.6	76.5	34.6	119.3	34.5	123.1	87.9	111.7	51.2	27.9	24.6	51.9	18.3	71.9
8	101.7	73.6	37.3	119.9	38.3	126.1	94.9	111.8	48.9	24.4	25.1	56.4	24.1	75.2
8	100.4	78.6	27.5	126.8	33.2	122.5	87.9	111.1	54.9	25.9	25.4	54.2	19.8	71.9
8	99.3	72.5	39.8	124.9	36.4	136.0	90.5	118.4	53.9	27.4	22.5	52.0	19.2	68.6
8	110.0	78.0	41.1	127.2	38.6	127.3	81.1	121.1	54.3	22.6	27.2	59.0	27.9	72.1
8	91.9	75.0	31.7	121.8	36.7	129.9	88.0	116.5	54.3	25.9	24.3	50.8	18.2	69.3
8	103.4	74.3	34.2	117.1	39.2	120.5	77.8	101.5	51.3	24.3	24.1	51.2	22.8	70.7
8	101.2	76.0	35.8	128.3	40.4	113.7	72.5	107.0	58.8	27.5	23.3	53.3	18.9	66.1
8	92.5	71.8	35.7	115.8	38.1	113.5	78.0	102.4	48.5	29.3	24.9	45.6	21.8	68.5
8	110.4	84.8	35.1	130.1	38.1	125.7	82.0	116.0	54.8	25.7	25.4	58.0	24.7	71.5
8	102.4	79.1	40.6	134.0	39.0	126.2	85.6	117.2	54.4	23.7	27.9	58.5	17.2	69.5
8	99.6	80.2	35.1	121.7	39.8	122.3	82.3	102.5	53.9	30.1	23.9	57.9	18.9	69.5
8	103.0	76.8	36.4	121.9	39.8	126.8	78.0	112.6	53.3	22.8	23.6	61.2	21.1	71.4
8	104.8	85.2	41.9	126.8	42.2	127.8	88.8	117.5	51.9	29.9	23.6	60.9	19.3	70.1
8	105.3	74.9	34.2	122.3	40.5	129.2	86.8	122.6	50.9	29.8	24.1	50.5	23.5	69.6
8	97.3	71.5	37.1	120.0	38.4	120.2	85.0	115.2	50.8	26.7	24.8	46.2	20.1	64.7
8	96.6	78.8	29.9	121.7	39.2	127.4	87.5	119.5	51.9	28.1	23.8	54.2	16.4	72.4
8	101.1	73.7	39.4	122.4	34.1	130.1	83.8	116.5	49.5	19.1	22.8	54.4	17.2	72.9
8	102.8	76.1	34.0	132.2	37.3	127.6	83.1	118.6	56.4	24.1	16.3	55.5	17.6	67.6
8	96.8	78.7	29.8	125.3	37.7	123.8	74.7	116.0	48.2	22.1	21.8	55.0	17.6	72.0
8	98.9	80.8	27.8	127.3	36.8	126.8	90.4	115.8	49.1	22.4	18.1	56.8	17.7	78.1
8	102.1	78.6	38.9	125.4	40.0	131.0	78.4	113.1	53.7	24.0	21.0	54.4	17.7	70.7
8	103.9	78.5	41.6	132.9	36.1	126.7	68.6	107.0	64.8	23.3	22.3	57.0	17.9	72.7
8	110.7	76.5	33.0	129.2	35.6	133.4	84.2	119.7	55.5	26.1	20.7	54.8	16.4	69.6
8	96.0	70.9	35.7	122.9	32.1	125.2	80.3	115.6	53.0	22.0	21.0	53.6	10.7	71.6
8	103.6	71.4	31.0	120.5	33.2	126.9	82.5	111.2	47.3	25.1	18.6	49.1	18.2	66.1
8	106.3	85.3	39.1	126.8	32.8	126.3	83.1	116.2	55.5	27.9	23.9	54.9	18.2	73.1
8	99.5	69.3	32.5	126.5	32.2	122.3	76.6	112.2	51.2	23.0	19.8	51.9	17.0	64.8
8	110.6	78.5	38.1	125.7	37.0	131.3	81.7	121.1	54.7	22.9	20.6	54.4	17.2	69.5
8	103.5	72.4	36.9	119.8	29.4	123.7	80.0	114.4	52.3	25.2	21.7	59.8	13.5	67.6
8	109.5	86.4	42.4	135.9	36.8	127.6	82.9	119.8	52.0	22.7	22.9	58.0	18.5	78.9
8	101.6	76.8	38.8	126.6	32.5	123.5	79.8	113.7	55.6	24.1	18.8	53.9	12.2	73.2
8	97.5	79.7	32.0	130.6	33.3	121.7	79.5	114.2	54.8	28.3	24.6	54.9	15.8	70.0
8	104.8	77.4	37.1	129.1	33.0	129.2	83.3	119.6	53.4	27.0	21.6	59.8	18.0	76.8
8	112.3	80.4	45.6	135.9	36.3	131.3	91.0	121.9	54.4	29.7	19.3	57.3	17.5	77.0
8	98.5	65.9	40.1	120.6	34.3	128.6	77.5	117.3	54.3	22.9	21.8	55.1	19.7	68.6
8	109.8	81.3	34.3	134.9	33.8	133.9	75.0	126.1	55.8	24.9	24.8	61.6	21.5	76.8
8	111.0	86.3	43.2	138.1	36.5	125.3	77.2	111.1	52.5	28.9	24.6	59.7	21.2	77.4
8	105.0	76.2	36.7	132.3	32.1	128.6	80.0	112.1	56.8	26.7	22.0	58.9	18.8	74.7
8	107.0	78.8	37.6	130.2	33.7	127.1	87.3	116.1	52.3	25.4	19.7	56.2	20.7	77.8
8	99.8	78.7	40.5	125.0	36.1	127.0	89.3	119.3	48.9	24.6	20.0	55.0	18.6	69.1
8	101.8	73.7	38.9	124.1	35.2	122.9	84.3	112.5	45.2	24.5	19.5	55.5	21.5	75.7
8	108.6	77.3	44.7	129.2	34.5	124.1	76.4	114.9	52.7	25.6	20.4	57.5	18.3	70.6
9	98.1	81.1	29.0	124.6	33.4	120.1	75.2	113.7	51.6	25.9	24.5	57.9	24.5	71.1
9	98.6	79.1	31.4	123.8	33.4	128.5	84.0	114.2	53.6	30.7	26.3	61.5	21.7	74.2
9	99.1	77.1	33.8	122.9	33.4	124.8	84.6	114.7	49.9	32.9	25.2	57.8	23.0	75.0
9	96.7	76.9	32.2	111.3	36.2	116.6	86.3	105.5	45.1	25.7	27.0	58.9	20.7	68.5
9	97.4	79.5	33.1	125.6	36.4	122.1	83.6	113.1	54.2	30.8	26.0	59.7	23.8	73.6

Appendix A (continued)

	16	17	18	19	20	21	22	23	24	25	26	27	28	29
9	100.0	76.2	26.8	119.5	34.8	127.0	86.5	110.6	47.7	25.7	27.0	62.0	21.9	72.9
9	98.6	76.6	30.7	118.3	36.3	113.2	78.8	113.0	50.4	30.1	24.7	54.6	17.6	68.2
9	97.1	77.0	34.6	117.1	37.9	126.5	80.9	115.5	47.1	24.8	27.5	58.9	22.7	71.0
9	107.3	78.0	35.7	128.6	34.9	128.2	83.2	122.0	54.5	32.8	22.6	62.7	21.5	74.7
9	101.5	76.2	39.3	117.8	42.7	123.3	87.2	120.0	52.5	28.0	25.9	49.2	23.9	63.7
9	96.9	77.2	28.5	117.3	36.6	120.1	86.5	112.7	46.6	28.1	22.7	52.9	20.3	68.3
9	100.7	77.5	32.2	117.7	37.0	116.6	78.8	110.0	49.0	34.3	22.8	54.5	20.4	70.1
9	102.9	71.7	37.9	115.8	32.1	124.6	77.6	117.1	49.4	28.3	23.8	49.1	23.1	62.1
9	100.3	73.1	34.2	122.4	39.0	125.7	85.0	114.8	50.0	29.2	28.1	55.2	27.0	67.6
9	109.8	78.2	35.6	125.4	41.7	125.9	87.1	117.6	53.3	29.2	25.3	59.2	19.9	65.5
9	99.6	80.0	38.8	121.6	35.4	127.5	82.4	121.9	50.1	31.2	28.9	56.4	23.4	68.4
9	97.9	69.7	33.7	114.9	35.6	120.5	79.1	112.7	47.3	27.6	27.4	49.6	19.2	64.8
9	105.9	73.0	37.3	132.1	32.5	129.4	81.7	116.4	58.1	29.6	22.7	54.3	19.9	73.3
9	99.8	78.6	27.4	123.3	30.7	127.9	66.0	115.5	55.7	28.7	22.8	53.0	22.0	66.4
9	100.3	72.0	27.1	124.3	31.6	124.4	73.6	110.3	49.6	25.8	23.9	50.8	19.4	63.7
9	100.8	75.9	35.3	122.0	32.6	122.5	79.8	115.4	45.2	20.2	20.7	47.1	22.2	67.7
9	108.6	79.4	31.3	131.9	32.1	128.7	82.6	118.4	58.1	25.7	23.9	56.1	21.0	70.2
9	105.3	77.0	38.2	131.3	33.9	135.9	78.9	125.3	57.5	26.8	22.7	53.7	22.4	66.9
9	103.9	71.6	26.9	121.6	28.9	123.6	68.1	106.1	51.0	26.6	25.4	55.4	21.4	75.1
9	102.5	75.8	29.3	123.6	30.4	122.3	90.2	115.2	51.2	28.3	25.2	55.4	14.5	64.9
9	106.5	75.2	35.7	123.0	30.3	128.8	85.3	118.8	48.3	20.7	21.6	49.2	18.7	67.9
9	105.5	78.4	35.5	121.9	35.5	122.8	80.7	114.0	53.5	28.2	22.6	58.9	19.1	65.9
9	106.0	78.2	40.5	122.9	36.2	123.0	82.6	118.5	52.2	27.6	20.3	52.3	19.1	69.4
9	102.5	74.8	31.2	128.1	35.8	122.3	81.8	113.4	54.5	21.7	22.3	55.3	17.7	69.2
9	96.4	72.5	33.6	128.2	32.7	121.0	82.3	115.2	51.9	27.3	22.9	50.2	19.7	73.2
9	103.7	74.7	37.9	131.0	33.9	128.6	85.0	118.4	53.0	28.5	22.7	54.3	14.0	74.4
9	110.9	82.3	43.3	125.7	32.5	126.0	89.9	119.0	48.9	26.7	21.2	53.3	16.5	68.9
9	101.7	75.5	35.2	121.5	38.6	122.9	71.6	111.2	49.4	28.4	23.5	56.6	19.1	69.3
10	95.7	74.3	38.1	119.6	34.2	116.6	78.8	113.3	48.9	22.0	19.1	52.5	22.7	69.4
10	88.2	76.6	24.1	126.4	35.5	129.7	84.1	115.7	53.1	21.3	23.1	56.6	20.2	71.9
10	106.1	83.2	37.9	132.7	38.8	130.9	93.5	124.2	53.0	30.8	23.5	60.7	24.6	73.6
10	93.9	75.2	33.1	124.1	33.6	125.8	85.1	115.4	51.6	27.7	19.2	51.4	21.7	71.9
10	102.9	76.2	37.7	122.9	34.4	128.2	81.0	113.7	50.0	32.7	21.8	56.9	19.1	71.3
10	89.4	80.9	28.0	121.4	37.1	120.0	81.5	119.3	44.8	27.5	21.5	53.3	19.9	72.6
10	95.4	77.3	27.0	125.0	31.3	133.1	86.0	125.2	49.9	24.2	23.7	52.6	18.9	68.9
10	99.6	80.6	39.7	127.9	38.4	122.4	78.4	111.1	53.3	28.6	23.1	58.1	20.5	71.6
10	95.4	76.6	38.0	119.1	38.1	119.8	80.7	111.2	50.2	29.3	23.0	56.8	21.9	75.9
10	107.0	72.7	34.4	121.6	37.5	132.8	86.3	120.3	49.2	25.7	23.6	51.6	21.5	72.7
10	88.2	66.6	34.5	125.2	35.0	128.0	79.1	121.5	55.6	26.0	19.5	48.4	18.3	63.0
10	99.3	77.8	29.9	123.7	32.4	124.6	76.8	115.8	53.0	27.9	22.7	55.8	16.8	62.4
10	93.7	67.9	31.7	115.8	37.1	116.4	80.1	99.6	48.5	21.8	20.2	53.2	16.8	61.9
10	88.9	75.9	29.3	120.2	35.4	121.5	79.9	106.9	50.1	32.4	25.4	54.9	17.4	72.1
10	101.7	70.1	30.0	113.3	36.7	117.6	81.3	109.3	49.2	26.5	24.8	53.9	18.7	64.3
10	103.5	83.4	30.8	127.2	35.0	128.2	87.1	118.5	54.4	28.4	24.9	55.8	17.2	71.9
10	105.1	73.7	35.7	123.5	38.5	129.7	85.9	119.2	49.3	27.1	23.3	54.6	20.2	70.0
10	97.6	75.9	34.0	121.4	33.7	118.7	75.0	112.3	50.6	27.0	24.3	52.6	18.8	71.1
10	99.9	69.1	29.2	115.8	30.8	121.8	83.3	110.8	50.3	26.9	21.7	50.2	19.2	72.2
10	102.3	79.8	35.9	124.8	36.6	124.7	82.4	113.1	49.5	26.8	25.9	59.6	20.5	73.4
10	102.3	72.5	31.7	118.9	33.7	117.6	77.8	110.9	51.6	26.1	25.5	56.7	22.0	67.6
10	93.2	74.4	31.2	123.0	32.1	123.2	77.7	116.6	50.4	25.5	22.8	53.8	18.1	61.8
10	98.1	76.3	33.9	121.4	35.0	121.8	83.2	111.9	50.3	24.5	22.5	55.9	19.1	68.6
10	102.9	78.2	36.6	133.3	37.9	130.6	87.3	118.4	53.8	26.7	22.2	58.0	21.0	77.7
10	96.4	73.7	30.4	117.1	32.3	119.8	79.1	112.4	44.1	28.7	19.9	47.7	16.3	68.6
10	104.1	74.1	33.1	126.6	31.4	130.9	86.9	117.2	52.6	27.0	22.4	49.1	15.5	66.1
10	96.9	69.0	33.8	123.1	34.3	125.1	77.4	116.6	53.3	23.3	23.5	51.3	15.8	67.2
10	96.2	77.2	26.6	121.1	28.1	127.4	79.6	116.4	48.1	27.2	24.2	49.8	16.3	61.1
10	96.5	77.1	30.1	125.6	32.8	126.1	88.7	118.7	53.3	28.7	20.7	52.2	16.4	62.4
10	107.1	90.5	31.3	128.3	30.0	132.3	84.5	124.3	45.2	24.0	24.5	59.8	20.0	75.8
10	94.1	76.9	32.7	122.5	34.5	123.4	79.1	115.2	49.5	21.0	21.2	49.8	19.7	70.4
10	106.5	77.1	39.5	128.0	34.6	128.9	84.3	117.3	52.3	27.7	22.6	52.3	16.8	72.1
10	101.8	74.7	30.3	121.9	34.2	125.6	91.5	118.4	45.2	23.5	20.2	57.0	16.1	67.7
10	96.1	74.4	33.9	120.3	31.2	125.4	81.9	115.9	45.7	22.0	21.7	56.8	17.1	67.0
10	89.3	71.8	27.6	117.7	31.9	117.2	92.8	111.0	45.7	23.3	21.1	55.0	19.5	63.4
10	96.4	81.7	32.2	123.7	34.6	126.0	77.6	112.7	49.4	24.3	23.4	52.4	17.3	77.5
10	95.8	70.4	29.0	122.4	32.4	120.6	74.7	114.1	53.9	23.8	21.8	50.1	17.7	65.7
10	94.0	77.5	34.2	128.3	33.3	126.8	89.7	113.6	51.1	24.8	16.8	52.6	15.3	74.0
10	97.6	74.7	25.5	121.7	33.2	124.0	76.4	114.0	51.7	24.1	21.7	50.7	17.6	66.6
10	102.4	76.4	38.3	128.8	32.6	122.3	80.1	116.2	53.9	28.2	21.7	56.0	16.2	73.0
11	97.2	76.9	36.3	127.1	36.7	122.8	88.1	108.7	54.1	26.4	20.8	55.8	17.1	68.5
11	97.7	81.4	29.0	119.7	37.4	123.0	85.6	115.5	48.6	27.1	27.1	55.5	21.1	72.7
11	100.6	81.8	25.3	119.5	33.5	128.6	88.6	113.6	49.7	32.4	27.8	62.6	20.8	71.4

Appendix A (continued)

	16	17	18	19	20	21	22	23	24	25	26	27	28	29
11	88.3	72.6	31.3	117.0	35.6	122.4	92.4	109.3	49.4	28.1	23.7	55.8	18.6	69.8
11	101.0	84.3	30.2	125.7	39.6	123.7	82.9	111.3	53.3	35.5	25.2	59.0	25.5	76.7
11	94.9	78.6	31.1	122.0	39.4	124.3	86.4	111.7	47.2	26.4	23.4	56.0	18.7	74.4
11	86.6	76.1	32.5	121.8	40.4	122.9	87.1	117.3	51.9	33.2	21.1	57.6	16.8	70.4
11	99.9	74.7	38.0	128.0	42.4	132.9	76.9	117.8	59.1	28.1	25.7	59.1	19.5	74.1
11	101.0	76.0	31.1	119.3	37.8	127.8	83.7	115.5	49.4	28.2	22.0	60.6	21.6	73.5
11	108.3	83.3	40.2	124.8	39.8	129.9	87.0	120.8	52.0	31.4	26.6	63.1	20.2	73.2
11	111.5	82.4	32.2	126.2	31.9	127.8	84.5	114.5	51.6	27.2	25.7	58.3	20.8	72.5
11	93.5	77.1	38.2	123.3	40.1	127.2	91.4	115.1	48.4	29.0	21.8	57.4	18.6	72.6
11	105.8	77.6	36.5	121.1	40.3	127.7	83.2	118.9	50.1	29.7	27.0	56.7	20.0	71.3
11	94.4	78.3	30.7	125.1	40.0	122.1	87.1	119.3	49.6	30.3	25.7	56.0	20.4	70.1
11	97.3	70.0	34.2	116.3	36.9	127.0	81.5	115.8	47.4	28.1	21.2	57.6	20.8	70.8
11	107.7	79.9	41.6	124.8	37.4	117.8	83.9	112.4	48.5	28.4	26.0	59.9	22.2	69.2
11	98.6	73.3	35.2	128.1	37.4	126.4	83.8	117.1	53.8	28.1	21.9	54.9	20.0	70.2
11	109.5	82.3	43.2	132.3	40.1	138.9	96.6	122.0	52.4	23.5	24.4	54.4	19.0	65.8
11	104.9	78.3	33.5	126.1	30.7	125.7	81.1	113.9	48.5	23.5	21.7	56.9	19.6	68.9
11	106.2	81.9	35.4	128.1	37.0	129.5	84.9	115.7	50.8	26.4	23.0	52.7	15.5	65.3
11	106.3	81.9	28.9	124.7	30.5	128.2	83.3	117.5	48.0	24.9	23.1	53.4	17.5	71.6
11	103.4	78.8	27.4	126.0	31.7	131.5	78.3	115.3	51.7	22.7	23.5	56.6	19.7	72.7
11	107.2	79.9	41.2	129.9	38.9	130.9	85.2	114.4	53.8	24.7	18.2	54.2	16.8	72.8
11	109.5	80.1	33.9	132.9	32.6	132.9	77.5	114.1	56.3	22.4	22.9	59.0	19.4	75.6
11	113.8	77.7	40.0	131.8	32.2	129.9	91.5	118.6	56.3	25.3	24.3	57.6	21.7	70.4
11	99.4	77.0	33.9	123.1	33.5	125.7	86.2	113.8	50.1	19.6	23.4	55.1	18.7	69.8
11	98.2	76.1	30.5	123.9	34.6	130.6	91.2	116.0	47.4	22.3	22.0	58.3	15.4	71.1
11	106.5	73.6	36.5	123.3	36.9	132.5	82.5	122.2	53.5	27.1	22.6	51.4	19.3	75.2
11	101.3	77.7	33.8	119.7	37.3	128.8	85.3	119.0	47.9	23.4	24.7	56.1	17.4	71.7
11	108.3	79.8	33.2	116.7	34.1	116.7	85.8	109.4	45.6	34.8	22.3	56.0	18.7	72.2
11	94.1	79.2	32.3	116.9	34.4	123.0	96.3	113.2	40.6	30.2	22.8	55.9	12.8	71.6
11	105.1	77.8	36.2	124.8	33.5	123.2	85.4	111.4	50.7	24.2	19.1	62.3	14.7	73.0
11	100.2	77.2	36.2	119.4	32.9	131.6	86.6	117.5	45.8	23.2	22.1	57.0	19.0	73.8
12	95.2	76.6	36.2	121.6	38.8	118.6	88.7	107.1	49.6	20.8	20.8	53.7	19.9	73.4
12	91.9	74.3	32.4	121.1	33.4	125.5	87.6	116.6	50.7	27.5	22.7	51.0	17.6	68.7
12	95.8	80.3	40.6	122.2	38.5	128.8	80.1	123.4	51.4	20.7	24.0	57.9	18.7	66.6
12	89.1	74.7	32.2	114.8	35.9	127.4	84.5	112.9	50.1	23.4	23.3	58.9	18.0	65.7
12	95.0	75.7	31.4	125.8	33.7	133.6	88.9	124.9	51.3	28.1	22.0	59.3	16.8	70.2
12	100.8	76.7	30.6	111.8	31.5	115.6	80.3	108.7	41.8	24.0	24.8	57.7	20.6	67.6
12	94.5	83.7	38.2	133.0	39.4	126.8	86.4	118.2	54.7	32.7	22.0	57.3	18.5	72.5
12	91.6	70.7	28.2	118.6	38.0	125.0	82.6	111.8	49.7	25.3	21.6	53.0	16.8	65.8
12	91.7	70.8	34.6	124.5	37.2	126.9	82.0	114.9	51.7	28.2	21.3	55.9	20.8	67.1
12	99.7	72.9	34.6	120.1	37.4	124.7	85.2	118.4	49.1	27.0	23.8	55.5	20.6	68.3
12	95.8	75.2	36.0	125.1	36.3	122.6	81.9	114.2	51.4	25.9	18.2	55.4	18.4	66.5
12	97.5	77.7	38.2	124.4	35.5	130.9	84.1	118.9	50.7	28.1	24.3	53.8	21.7	67.8
12	90.3	68.8	29.9	124.3	35.0	130.3	83.4	114.7	54.8	23.8	25.3	52.2	17.6	67.4
12	95.3	82.8	31.4	127.2	31.9	128.2	83.2	117.0	48.6	27.4	21.6	56.1	20.0	70.3
12	97.0	75.1	33.8	125.3	37.1	130.6	78.2	121.1	53.7	25.7	24.4	52.8	19.2	63.7
12	94.0	82.4	36.7	130.1	36.9	126.3	78.5	110.2	52.2	32.5	24.6	52.8	23.5	71.3
12	94.6	74.8	34.8	127.1	37.7	131.8	82.5	122.5	55.4	28.2	18.4	53.0	14.7	72.9
12	95.1	79.3	33.9	132.0	32.2	126.4	83.9	115.6	54.0	22.2	20.4	51.3	14.0	65.6
12	96.8	77.3	33.5	130.4	36.0	127.0	91.3	120.1	50.8	29.3	21.4	58.8	18.5	73.8
12	102.6	77.8	41.4	130.3	37.2	131.1	86.3	120.4	52.0	24.6	17.5	56.8	17.9	66.6
12	103.0	80.1	28.4	128.5	31.9	129.0	86.8	121.0	52.1	21.3	19.7	52.6	17.4	64.3
12	111.6	76.8	38.3	121.9	37.9	129.6	91.7	122.4	51.5	22.3	22.5	56.4	15.7	64.3
12	98.0	78.9	44.5	129.6	36.4	125.6	83.7	117.1	47.0	23.4	17.4	53.5	15.8	72.2
12	96.3	78.9	32.9	122.0	32.0	121.5	81.1	119.2	45.0	23.7	24.1	55.0	13.5	70.8
12	95.1	78.5	33.7	131.3	34.2	130.7	84.6	120.0	52.0	25.7	19.4	56.2	12.4	74.1
12	93.9	80.8	30.1	126.2	35.0	125.1	87.4	114.7	49.4	25.9	26.8	55.8	18.4	69.7
12	87.2	74.5	26.8	118.1	35.0	128.5	85.3	109.0	46.8	20.6	17.7	47.9	13.5	66.0
12	86.4	75.3	22.7	124.9	36.0	117.2	75.9	105.5	52.7	19.7	18.2	52.7	15.4	62.3
13	95.6	82.4	31.5	126.7	34.7	128.3	76.2	112.0	52.5	30.5	26.2	55.3	19.4	73.2
13	100.1	78.2	35.3	128.4	37.2	118.7	72.7	114.4	52.8	26.9	26.1	59.7	20.3	64.6
13	99.4	77.4	33.1	122.7	35.7	124.0	74.0	104.8	49.4	26.4	21.1	57.7	19.8	68.6
13	100.0	77.2	38.0	125.9	34.2	127.9	79.4	114.9	47.8	27.3	25.8	54.9	22.3	69.8
13	91.6	72.0	25.6	127.6	36.5	133.3	90.7	121.1	52.3	26.3	25.5	51.0	15.9	67.3
13	94.5	81.7	29.0	136.1	35.7	135.4	86.4	117.5	58.6	27.7	26.2	56.5	18.5	75.4
13	96.3	80.3	32.4	126.9	35.0	126.1	73.8	110.3	52.2	28.4	23.4	56.3	18.8	72.2
13	100.7	80.7	36.3	131.1	37.6	127.0	82.7	113.4	51.4	26.8	26.1	54.7	20.3	73.1
13	88.5	77.6	24.8	119.2	32.9	119.3	81.5	106.1	48.2	25.0	24.1	53.8	15.8	67.1
13	94.1	84.1	25.6	126.6	36.0	118.2	82.3	108.4	49.9	33.9	23.4	57.7	20.5	81.8
13	96.1	80.4	33.5	127.2	36.6	125.8	88.1	118.7	50.2	26.2	22.1	56.2	16.7	72.5
13	97.3	83.4	27.5	128.1	37.1	121.6	84.4	117.9	53.2	28.2	26.4	57.0	17.0	72.0
13	95.2	78.9	37.3	116.3	39.2	119.9	84.0	110.8	46.0	28.8	22.1	56.4	18.7	66.2

Appendix A (continued)

	16	17	18	19	20	21	22	23	24	25	26	27	28	29
13	93.0	81.9	26.8	127.6	31.9	126.6	80.4	110.4	49.6	28.5	27.2	58.3	20.3	77.1
13	101.8	74.3	36.4	122.0	36.9	123.1	85.7	114.0	50.8	25.4	27.3	57.9	21.4	74.1
13	95.9	81.9	35.2	128.7	32.4	123.9	74.9	114.7	53.4	26.7	24.1	52.8	21.3	71.0
13	110.6	81.6	35.0	127.1	34.5	129.1	93.5	122.9	54.3	26.2	24.8	57.0	20.1	72.4
13	98.3	79.7	32.7	121.7	32.3	127.2	87.4	113.6	45.4	22.9	22.7	58.0	17.7	72.3
13	98.6	85.9	33.7	128.1	39.2	134.5	84.1	121.2	56.6	31.5	19.5	55.9	19.0	76.7
13	96.8	79.1	33.5	124.0	33.3	121.9	83.1	115.1	50.6	24.3	25.8	56.2	20.4	70.6
13	97.6	77.3	36.7	123.2	34.2	122.1	88.1	113.3	51.4	24.9	22.5	55.5	20.8	70.9
13	100.3	77.4	27.2	122.4	31.1	127.9	93.1	117.5	52.3	25.2	24.1	57.8	18.5	69.3
13	103.1	83.9	36.4	125.4	32.4	118.8	82.1	111.2	47.1	25.3	25.4	60.1	18.6	72.9
13	99.2	79.4	28.4	130.4	34.9	129.0	81.7	114.0	54.3	28.7	20.4	58.8	23.5	72.2
13	95.7	82.1	29.8	126.2	36.0	125.1	84.0	116.1	52.5	33.7	23.8	52.5	16.5	75.8
13	96.4	80.1	30.6	125.8	36.3	126.9	85.0	115.3	51.4	24.5	24.9	56.6	22.7	73.5
13	100.3	74.3	29.0	127.8	35.1	131.9	84.3	112.1	53.9	27.4	26.3	55.1	18.3	71.4
13	104.1	79.7	30.1	123.1	35.9	131.6	82.8	113.0	50.0	22.9	26.1	55.5	19.2	72.6
13	98.5	76.3	29.5	126.8	33.5	124.9	82.7	114.0	54.2	32.6	24.4	62.0	18.9	77.0
13	98.1	78.5	30.8	128.4	38.7	127.1	83.4	113.2	51.7	31.9	24.4	53.8	17.2	68.6
13	97.8	74.8	32.2	120.4	38.9	127.3	79.4	113.5	51.2	22.3	24.9	61.0	23.2	68.0
13	98.3	78.9	31.0	128.8	38.3	129.3	80.4	121.1	50.5	28.3	26.0	56.5	18.6	70.7
13	103.3	78.2	37.2	134.9	35.4	140.0	89.5	125.8	52.0	27.4	24.1	60.8	20.3	71.6
13	103.3	74.1	36.9	120.5	35.8	130.8	88.1	120.2	49.9	29.7	28.4	54.3	17.6	70.3
13	98.3	71.1	34.5	125.4	30.1	128.8	78.5	116.2	52.3	23.2	20.7	52.8	15.3	71.3
13	101.4	81.6	29.8	130.2	33.8	129.4	79.2	126.0	53.3	25.8	18.6	58.6	16.8	72.8
13	93.8	76.7	28.3	117.3	32.0	121.8	71.7	106.6	48.9	25.7	21.8	51.5	15.6	68.7
13	95.2	74.9	27.4	130.7	31.1	124.4	79.6	110.4	51.1	22.2	19.5	52.1	13.4	69.4
13	100.5	82.0	29.0	129.8	31.9	127.0	79.7	125.1	47.9	23.8	23.3	54.9	15.9	67.7
13	99.5	81.6	28.4	132.9	31.6	128.9	75.1	114.5	54.1	25.4	25.2	55.6	18.2	75.6
13	101.0	69.9	38.1	118.3	35.8	126.5	79.9	109.3	49.0	22.4	16.3	51.8	18.8	67.6
13	101.3	75.2	37.1	129.5	36.8	131.1	80.2	116.3	50.7	23.7	21.4	52.8	14.5	70.5
13	92.9	74.2	31.7	121.6	32.7	122.7	76.1	106.9	51.2	21.3	18.3	50.6	16.2	66.6
13	102.8	79.3	34.9	129.3	31.1	129.7	74.2	120.3	50.1	26.1	18.0	54.6	16.0	69.4
13	100.3	81.6	33.9	134.7	32.8	134.7	80.1	119.2	54.4	27.1	24.5	54.7	17.6	74.4
13	97.8	80.4	31.5	131.9	36.4	127.1	85.0	118.5	54.9	29.0	19.8	57.3	13.9	73.9
13	104.9	80.2	31.6	129.5	30.5	131.9	77.8	117.0	50.3	26.3	24.5	55.7	18.2	69.5
13	98.1	86.1	36.2	133.2	35.2	126.6	78.8	117.3	51.1	23.4	19.9	53.8	14.0	72.3
13	103.7	83.8	37.7	131.6	37.0	127.5	76.3	116.5	50.4	25.5	21.0	56.0	14.9	75.0
13	91.8	83.3	32.2	129.1	36.6	125.7	83.7	113.9	53.6	20.5	20.2	55.9	15.8	72.2
13	97.0	75.9	36.2	124.7	36.2	130.3	82.8	119.2	45.9	27.5	19.7	50.4	14.0	70.2
13	103.5	78.9	32.0	128.3	36.1	126.5	82.2	119.2	52.6	23.1	22.3	53.0	18.4	67.7
13	110.0	79.9	40.2	129.0	32.4	132.4	82.4	121.0	54.7	25.8	21.9	54.3	17.9	70.3
13	95.3	82.8	34.2	134.5	35.3	132.4	79.3	120.3	53.3	23.6	22.0	53.0	18.5	71.9
13	96.5	71.8	31.5	122.0	37.7	125.2	88.2	113.6	47.5	21.4	22.8	52.1	14.7	65.6
13	97.8	75.4	37.5	123.8	36.4	131.8	80.4	121.0	48.6	23.0	23.3	49.9	16.1	64.9
13	100.2	81.5	34.7	128.3	33.1	131.1	80.1	119.5	49.9	25.9	20.6	57.8	18.0	71.5
13	103.5	82.6	34.2	120.6	33.9	127.6	79.5	119.8	47.8	26.0	21.8	60.7	19.1	64.5
13	106.8	83.8	33.7	134.6	32.1	137.6	83.1	128.8	56.1	25.4	23.8	63.5	20.3	75.4
13	105.0	89.4	34.2	128.6	38.0	136.7	83.6	122.6	43.7	26.5	20.5	62.2	19.7	76.1
13	97.0	79.4	35.8	131.1	37.2	134.1	75.3	116.4	49.2	26.4	22.7	57.5	17.2	72.7
13	102.9	77.1	30.2	124.3	31.1	131.0	80.3	114.7	49.3	27.5	22.6	56.5	14.7	68.2
14	103.6	81.5	41.7	132.3	37.9	131.2	81.8	125.6	56.3	28.7	26.5	59.9	18.5	74.5
14	99.2	71.7	33.6	119.0	33.0	117.2	78.9	108.9	51.0	31.1	25.0	56.8	20.6	69.3
14	96.0	74.1	28.5	116.5	37.3	124.5	91.5	110.1	49.1	26.9	26.6	51.4	21.6	71.5
14	101.5	75.1	38.1	124.5	33.9	125.2	81.3	114.2	51.8	28.3	25.0	55.3	19.2	71.2
14	102.0	83.7	35.5	125.2	40.0	123.9	82.9	117.9	50.2	31.9	25.3	59.9	21.3	70.2
14	94.6	79.1	32.4	120.8	35.3	125.0	80.8	117.0	52.9	26.4	25.9	57.9	21.2	67.9
14	100.5	73.2	33.2	118.6	33.2	125.5	85.8	116.2	50.7	29.6	23.7	55.0	22.1	68.3
14	104.2	81.5	40.8	124.7	37.2	124.2	89.5	114.1	51.4	30.8	28.1	56.3	19.7	69.7
14	101.1	69.7	36.7	125.3	35.6	125.5	82.8	113.9	56.2	26.5	23.7	51.2	19.9	67.9
14	106.1	86.5	34.4	122.5	32.7	126.4	93.4	117.7	48.4	31.6	26.1	58.4	21.4	76.1
14	89.3	74.6	28.6	118.8	36.9	126.4	83.6	116.0	53.9	22.1	22.2	52.6	20.1	68.6
14	102.4	75.3	35.2	122.2	35.2	125.1	91.2	115.0	51.3	32.8	24.9	57.1	20.0	74.0
14	100.3	82.0	35.1	118.9	37.8	132.5	89.4	123.0	49.6	29.5	26.3	53.5	20.6	70.2
14	98.3	73.9	30.9	124.9	32.7	126.9	86.0	117.6	53.5	26.8	24.5	53.8	20.0	66.4
14	106.8	75.8	36.3	123.6	37.3	125.2	84.0	119.9	51.8	24.0	24.7	52.0	19.2	70.5
14	101.6	78.3	33.1	128.2	37.1	124.1	79.7	119.2	52.4	26.4	23.0	54.6	16.9	72.0
14	96.9	78.2	33.1	125.3	36.0	129.1	91.3	120.9	51.5	28.3	22.6	57.7	19.8	72.8
14	93.7	69.7	29.8	110.4	37.4	123.3	81.9	111.2	51.5	25.9	25.0	49.7	21.2	69.5
14	106.6	74.7	30.9	120.7	33.7	116.9	79.7	105.5	52.9	34.3	29.1	54.4	24.9	72.8
14	93.6	74.5	26.1	115.3	37.8	122.4	77.9	109.5	47.5	26.3	25.9	53.2	22.3	68.6
14	104.4	77.4	34.1	121.2	32.9	130.5	85.8	120.4	49.0	27.2	25.1	52.3	19.6	67.4
14	88.5	70.0	32.7	118.7	37.8	127.3	84.5	117.3	50.3	26.1	23.2	50.5	21.9	69.4

Appendix A (continued)

	16	17	18	19	20	21	22	23	24	25	26	27	28	29
14	99.3	76.2	28.3	121.5	35.7	126.1	84.2	115.6	48.6	27.5	27.5	56.2	22.1	73.9
14	95.8	80.4	34.3	124.4	33.5	121.3	82.8	113.8	50.5	28.8	23.1	57.5	22.0	67.9
14	93.8	78.8	28.3	125.8	36.6	132.2	74.9	113.9	53.0	24.8	25.4	55.6	15.7	72.7
14	94.2	66.7	30.7	113.8	41.1	121.2	77.7	103.1	49.7	26.5	26.6	52.9	21.6	62.5
14	98.0	80.6	33.9	118.2	39.9	120.0	75.7	113.6	45.7	30.9	29.1	59.2	23.0	74.3
14	100.5	77.5	34.8	122.5	35.8	124.7	82.8	116.5	49.6	28.6	23.5	58.5	16.6	75.8
14	107.7	78.8	32.7	125.6	34.4	129.9	87.1	121.0	49.7	28.9	27.7	59.9	23.6	67.6
14	101.2	80.1	32.3	120.7	38.7	122.4	81.7	112.6	53.6	27.9	27.7	56.8	26.5	69.2
14	100.1	86.3	28.7	130.0	36.3	122.4	79.3	111.0	49.1	29.7	24.1	60.9	23.3	75.7
14	96.0	79.9	32.3	122.5	36.5	124.3	86.7	115.6	48.6	25.7	25.7	54.8	18.9	67.2
14	102.6	84.5	37.5	126.3	35.8	123.9	81.7	114.7	50.1	32.0	26.8	61.2	20.5	77.6
14	100.0	77.0	36.9	120.4	31.0	124.0	78.2	116.8	50.3	27.1	25.3	53.9	18.1	71.4
14	100.5	76.3	29.8	116.4	33.3	129.4	71.1	116.8	50.4	24.4	21.6	50.8	16.8	66.5
14	104.5	77.4	36.2	118.2	36.9	128.1	88.3	116.3	44.9	22.1	21.8	56.5	18.2	70.1
14	93.5	77.3	38.3	123.3	34.1	130.7	83.1	119.7	48.3	29.9	20.6	57.9	18.2	69.3
14	106.9	77.4	30.5	125.5	35.9	127.2	83.3	115.9	50.6	28.2	23.8	56.9	18.2	67.7
14	102.4	78.2	36.4	123.7	33.0	124.2	91.3	120.2	51.4	28.9	23.7	57.1	17.5	65.3
14	99.4	80.8	34.9	124.0	31.4	128.5	81.6	118.6	48.1	23.9	18.9	54.9	16.3	66.9
14	105.6	84.0	41.0	133.0	32.9	129.6	88.2	118.1	51.4	27.4	26.3	58.4	21.2	74.5
14	104.0	78.1	36.3	129.8	36.9	127.3	74.7	115.9	57.9	28.3	23.4	49.7	16.8	69.4
14	105.2	72.9	37.0	121.8	33.6	123.4	79.4	114.8	52.6	28.4	22.2	52.6	19.8	68.3
14	105.4	72.4	29.2	121.2	28.1	125.4	85.4	120.9	46.5	26.6	22.3	54.0	16.5	72.2
14	101.4	69.2	40.6	117.6	35.3	119.7	81.8	112.6	47.7	25.5	21.4	53.0	18.9	69.4
14	99.9	73.7	37.8	118.1	33.5	122.6	77.3	111.2	45.5	26.4	23.2	56.7	23.1	71.4
14	98.3	78.2	35.0	129.0	34.5	133.3	81.6	120.8	52.3	27.6	22.4	57.2	23.3	71.5
14	108.7	73.1	40.0	126.9	33.2	128.5	78.2	125.6	47.3	28.7	24.7	55.6	19.6	70.5
14	112.2	83.8	38.6	132.7	30.7	127.4	83.5	118.2	52.5	29.5	21.9	57.9	19.8	74.1
14	108.9	75.5	34.9	128.9	32.9	121.0	82.7	115.4	47.7	25.1	20.5	56.1	17.4	71.0
14	102.4	73.8	33.6	121.1	34.5	128.9	86.9	116.1	44.0	24.3	23.8	50.8	21.5	71.9
14	105.0	82.3	34.1	126.2	32.6	127.3	89.1	117.8	50.2	23.9	22.2	57.5	20.8	71.7
14	97.2	66.1	29.9	119.6	30.0	125.1	78.6	116.9	46.8	22.9	20.2	50.1	15.9	67.5
15	105.9	73.0	32.4	118.9	37.0	127.6	87.5	111.2	55.1	24.3	27.1	55.5	27.8	62.4
15	85.3	77.5	27.1	117.8	39.2	124.7	78.0	113.5	52.3	24.9	24.1	51.2	19.8	66.4
15	106.0	79.9	35.0	122.6	42.3	129.3	79.7	127.7	51.3	31.5	24.7	54.4	24.6	70.4
15	99.2	81.1	33.9	123.8	38.4	133.0	83.5	115.2	49.3	23.7	23.4	56.2	20.8	66.8
15	101.6	73.8	34.5	118.7	36.3	130.8	88.3	114.7	50.9	30.0	24.8	56.0	24.9	71.4
15	98.1	75.5	32.4	119.9	38.1	127.7	85.4	113.7	52.5	28.5	26.8	54.5	19.2	67.7
15	100.6	81.6	32.0	117.7	36.1	127.2	80.3	114.4	49.9	26.9	27.1	53.0	20.2	72.7
15	108.0	80.4	31.6	119.7	34.1	124.4	82.4	112.9	48.6	28.5	25.3	59.2	22.7	70.9
15	94.9	72.7	35.6	112.7	37.0	131.3	88.4	116.3	48.9	29.3	20.2	49.5	19.9	67.1
15	100.3	77.9	31.6	117.8	37.9	125.4	84.3	106.0	52.3	32.8	27.2	54.3	19.8	69.8
15	95.6	78.0	31.0	119.0	39.0	120.6	79.3	111.6	49.0	28.3	21.2	47.8	19.2	70.0
15	97.0	75.1	29.2	115.2	33.3	114.6	76.8	105.6	53.1	30.0	26.4	60.1	18.6	67.3
15	99.3	80.8	27.4	123.7	33.2	123.4	80.1	115.4	50.2	27.5	25.6	55.6	21.2	69.6
15	97.3	77.7	36.6	125.2	33.7	126.4	85.6	117.1	50.0	26.8	24.3	55.0	19.8	74.6
15	103.3	75.5	36.7	123.2	34.6	135.5	82.7	121.0	49.6	29.9	28.1	57.0	20.9	69.1
15	97.6	73.6	27.3	114.6	32.4	121.4	86.3	113.9	49.3	30.0	30.2	53.1	20.8	69.4
15	99.1	77.7	34.9	119.8	37.8	125.3	84.9	116.7	47.9	31.4	24.8	56.7	23.6	68.3
15	100.3	79.2	36.9	122.7	34.6	125.0	79.5	116.4	54.4	30.1	28.6	56.8	21.8	69.6
15	100.5	79.6	34.0	120.8	35.2	119.3	80.1	116.5	45.0	27.8	25.9	59.4	23.9	68.7
15	100.6	79.9	31.1	118.9	35.9	129.6	80.3	116.5	51.7	26.9	26.9	60.8	20.6	69.1
15	97.0	70.5	28.3	120.9	38.8	127.2	70.3	113.2	58.6	26.5	24.5	54.9	20.3	67.4
15	91.2	73.0	29.4	119.5	37.4	121.5	73.9	114.3	51.2	25.1	23.6	57.2	20.6	65.4
15	92.9	74.4	33.6	118.4	32.6	124.1	75.9	111.2	50.0	24.7	19.2	50.6	15.4	66.7
15	101.5	81.4	38.5	117.9	35.6	122.9	79.3	119.4	48.4	21.7	23.0	59.7	20.9	68.4
15	99.3	83.0	33.8	125.4	35.7	130.9	75.0	120.5	46.9	34.5	19.6	65.1	19.1	71.6
15	105.9	76.3	35.9	127.0	33.3	127.1	87.8	116.5	49.6	27.0	18.7	54.1	16.3	70.7
15	102.1	76.1	36.6	121.9	35.4	127.8	92.0	120.9	47.8	27.4	20.8	53.0	21.4	67.5
15	99.1	74.3	32.3	118.9	32.8	125.1	82.2	109.4	48.8	21.7	19.0	53.7	19.8	63.9
15	111.8	84.9	36.4	127.7	33.2	126.5	86.1	123.6	47.2	25.8	25.3	61.2	18.7	73.8
15	98.5	82.1	35.1	122.9	35.5	129.4	89.1	118.5	47.3	25.6	23.1	55.8	17.1	72.7
15	101.0	71.4	33.0	116.4	34.1	116.3	77.4	109.2	51.0	25.6	19.2	51.4	13.3	68.8
15	98.1	75.6	32.0	117.7	31.8	128.8	85.1	123.1	49.5	29.3	22.6	54.2	14.7	67.9
15	91.4	74.6	26.6	118.5	32.8	128.9	83.0	120.7	51.2	26.8	20.0	56.2	20.1	72.1
15	97.1	70.7	29.1	119.2	33.8	137.0	83.7	118.3	47.9	25.8	23.3	50.3	17.3	66.7
16	99.0	82.3	32.4	124.8	36.9	136.5	74.1	122.8	52.0	28.4	24.5	58.0	21.9	69.9
16	100.9	79.2	31.9	133.5	39.1	138.1	82.2	121.5	57.4	33.3	27.2	58.9	23.7	73.0
16	99.3	79.6	41.3	127.6	39.4	135.1	89.8	121.6	56.0	28.3	27.6	58.8	19.0	76.1
16	98.6	76.6	33.4	125.8	39.2	127.0	77.4	106.3	55.6	28.9	26.4	53.4	20.3	66.9
16	97.8	79.2	25.5	126.6	39.0	130.7	78.6	115.1	49.6	23.9	25.7	58.1	25.3	70.8
16	104.0	78.2	36.0	120.3	36.5	127.1	80.7	112.5	50.0	26.4	25.5	58.9	22.3	66.0

Appendix A (continued)

	16	17	18	19	20	21	22	23	24	25	26	27	28	29
16	110.3	82.5	35.5	130.8	36.4	133.5	86.4	118.7	52.1	27.7	27.2	58.8	20.5	71.4
16	98.0	73.1	25.0	126.0	32.6	126.0	83.2	113.4	53.1	32.0	25.4	55.8	20.2	68.7
16	102.7	71.6	35.8	119.1	36.1	125.9	72.5	108.3	50.4	26.2	26.7	52.8	19.9	68.9
16	93.4	74.8	36.5	127.7	37.6	122.6	85.4	112.8	54.7	27.1	26.9	55.2	22.0	69.8
16	108.7	84.4	37.1	128.4	39.1	127.0	82.6	117.8	50.0	28.5	26.8	61.1	20.6	73.8
16	96.2	77.5	34.2	119.6	33.3	130.5	78.6	122.5	50.7	21.6	22.4	57.8	19.9	66.5
16	88.6	74.9	33.6	121.3	30.8	118.7	73.4	105.7	48.6	25.4	21.5	57.0	19.8	69.6
16	104.0	83.7	29.4	128.9	40.9	128.6	87.6	118.6	52.6	25.2	26.1	59.9	22.8	72.1
16	103.1	80.5	37.7	126.2	35.9	136.1	82.0	120.5	52.3	30.4	27.8	58.6	25.1	73.2
16	96.4	86.9	30.3	124.7	32.2	134.7	80.4	118.2	47.6	21.1	22.7	60.3	18.1	70.1
16	103.7	80.7	29.3	104.4	32.2	130.3	105.2	121.9	25.9	31.7	25.6	57.9	12.2	65.5
16	98.1	79.6	27.9	132.4	32.6	128.0	73.2	117.5	53.5	23.1	24.6	55.5	15.7	71.8
16	100.9	78.6	35.4	131.7	35.6	123.4	82.6	116.9	53.1	22.6	22.6	53.7	20.0	69.8
16	109.4	83.1	28.2	135.3	33.6	132.9	84.9	118.6	55.3	27.7	25.9	60.2	17.0	80.1
16	107.3	74.4	41.2	123.2	35.1	131.1	81.6	111.7	52.8	20.2	21.4	56.6	17.8	70.4
16	108.2	79.5	38.4	134.8	33.2	135.2	96.1	120.3	48.5	25.7	23.2	62.8	18.0	76.3
16	110.0	81.6	38.9	124.7	34.8	135.4	83.5	123.7	48.9	19.9	22.4	63.3	18.0	69.3
16	98.0	74.9	36.4	124.4	32.4	124.7	86.4	112.6	43.4	24.5	16.5	55.8	14.5	72.1
16	98.3	74.7	36.5	130.0	33.3	126.3	78.2	113.6	52.9	24.1	21.8	58.5	15.1	67.7
16	110.4	78.5	31.7	130.5	32.4	129.8	93.7	116.5	53.3	25.5	23.9	55.3	16.9	73.9
16	113.8	79.6	38.8	131.5	29.0	128.2	78.3	112.0	48.2	22.2	21.7	59.3	18.8	70.2
16	96.8	79.5	28.3	128.9	33.7	126.0	86.7	119.8	51.5	23.2	23.4	55.4	16.0	74.9
16	96.0	75.2	32.6	126.7	31.4	124.0	78.5	120.3	48.2	26.3	19.1	54.5	18.3	72.7
16	101.2	76.1	32.7	123.8	32.9	135.4	81.9	123.2	47.2	23.5	22.6	55.9	16.1	74.2
16	103.1	74.9	42.1	131.2	34.0	128.5	78.7	115.9	49.0	24.5	19.5	57.6	17.8	68.1
16	106.5	78.4	40.9	123.9	32.6	132.3	78.0	120.5	47.9	20.9	23.7	56.0	16.5	70.5
16	105.3	80.4	37.0	124.9	38.0	115.9	81.2	112.5	45.6	24.3	21.0	47.8	15.9	71.5
16	104.1	82.5	33.2	126.8	34.1	127.5	71.7	114.0	54.9	28.0	16.6	53.8	20.4	68.5
16	102.9	84.6	29.3	128.7	30.2	124.8	80.2	115.6	46.6	27.3	19.7	58.1	21.1	73.3
16	113.1	84.7	41.5	137.9	32.4	130.7	85.6	121.9	53.3	29.6	23.4	61.7	17.2	76.8
16	103.2	79.5	32.5	133.6	34.8	132.5	82.8	123.2	56.3	23.2	23.1	55.5	18.4	75.5
16	100.2	74.3	28.7	121.2	30.0	124.6	79.2	114.7	46.2	27.0	21.4	58.3	16.4	67.8
17	103.2	77.4	30.4	125.4	27.5	122.8	81.4	116.4	49.1	26.3	22.1	58.7	19.1	68.4
17	101.6	80.3	35.4	125.0	36.5	126.0	76.6	116.3	52.1	25.6	27.3	56.3	19.6	74.5
17	109.7	83.3	43.3	134.2	35.9	127.2	80.7	123.6	54.5	26.1	25.6	58.6	22.3	70.2
17	90.9	76.7	29.9	120.0	34.0	129.6	84.9	120.3	46.9	26.5	22.5	57.1	19.6	69.4
17	94.8	71.8	33.1	113.2	33.8	118.1	81.7	108.3	46.8	21.0	22.7	54.5	21.0	62.4
17	106.8	71.8	39.1	116.9	37.0	117.5	77.3	113.3	46.4	25.7	22.0	56.0	20.3	65.9
17	93.0	79.7	32.9	122.5	35.7	124.8	88.3	112.7	49.9	26.9	25.7	53.5	20.2	67.1
17	100.5	77.8	31.3	125.4	34.5	125.7	81.3	117.0	47.7	24.8	22.3	57.4	24.1	68.3
17	100.7	79.7	35.0	123.5	37.6	121.9	85.6	113.5	49.0	27.5	19.8	55.3	18.7	67.9
17	105.8	71.1	32.4	127.7	38.4	135.7	100.3	126.3	50.8	27.6	26.8	54.7	24.7	70.4
17	104.3	78.7	34.0	123.9	37.1	130.3	84.5	121.9	54.4	28.0	25.5	53.9	22.0	72.2
17	99.8	75.3	33.4	124.5	38.9	127.3	90.6	108.2	49.9	24.4	24.9	56.0	18.3	71.6
17	95.1	76.0	31.9	123.3	37.9	127.6	85.6	120.7	48.2	25.5	20.4	57.1	20.8	69.4
17	100.8	76.7	37.5	127.5	39.3	125.4	75.3	112.7	52.8	25.3	20.5	58.1	16.5	74.2
17	108.8	81.9	43.2	134.6	41.3	131.2	89.3	124.2	55.1	26.5	21.0	59.3	20.8	74.0
17	94.0	76.9	33.9	130.7	35.9	132.2	78.8	116.7	57.5	22.5	19.9	48.7	19.8	69.9
17	99.8	79.1	35.6	121.8	37.6	121.7	82.3	109.8	47.5	26.6	23.4	55.8	17.7	70.2
17	101.1	77.1	36.0	126.0	34.5	128.9	78.2	116.2	53.7	27.5	23.9	58.6	19.3	70.2
17	96.8	70.1	31.2	122.0	33.4	126.7	97.0	115.7	51.1	25.2	22.2	52.4	19.8	66.8
17	100.8	76.8	35.5	130.7	39.6	127.9	76.8	114.3	58.9	27.6	23.4	55.1	17.1	75.1
17	106.6	79.3	36.8	124.4	36.1	133.5	88.2	125.3	52.5	29.4	24.8	55.4	21.7	73.4
17	101.9	77.2	36.0	126.1	39.5	125.6	85.6	118.6	53.2	27.6	25.6	57.2	16.7	71.1
17	107.1	71.9	36.4	127.9	36.7	127.8	83.5	115.2	59.1	29.3	21.1	51.3	19.1	68.3
17	96.2	73.3	31.5	126.3	37.0	124.0	78.7	111.8	55.8	26.0	21.7	51.1	15.6	68.5
17	95.0	71.2	36.0	120.0	36.7	132.4	85.1	123.9	54.2	26.3	21.1	53.2	18.7	69.5
17	109.9	76.6	35.2	127.6	36.3	125.8	81.1	113.1	53.1	29.1	24.7	54.0	21.2	70.4
17	100.2	78.2	37.6	133.0	35.4	126.7	74.3	118.7	57.8	25.7	20.7	55.4	20.7	72.2
17	108.2	74.1	36.1	126.3	33.0	130.4	84.1	122.8	51.0	27.5	22.2	53.5	20.3	73.3
17	108.5	81.5	40.9	126.2	36.3	125.6	83.3	116.6	49.2	25.7	23.3	55.0	18.0	70.0
17	104.7	74.5	38.4	130.3	36.3	133.8	85.9	118.1	51.9	26.7	23.2	51.5	16.6	70.9
17	101.0	76.9	31.3	128.0	34.6	123.0	79.1	115.2	51.7	23.6	21.1	56.2	15.7	68.1
17	101.9	75.1	32.1	123.6	36.7	125.2	82.7	109.4	53.4	26.3	23.9	51.4	19.6	65.9
17	112.6	75.5	39.1	129.1	36.8	130.4	83.1	122.9	51.0	26.4	23.1	54.0	15.5	71.5
17	103.6	70.9	34.5	124.3	33.6	122.0	82.6	104.9	52.1	24.7	20.9	55.4	20.1	69.1
17	100.5	72.4	31.9	122.1	31.7	124.8	86.1	108.1	47.5	22.4	18.8	54.3	17.8	63.6
17	108.9	77.0	37.5	132.7	34.7	130.9	79.2	117.1	57.7	24.5	20.9	55.4	16.0	69.6
17	99.7	74.0	30.7	126.1	32.0	130.8	81.2	117.1	52.7	25.4	19.4	53.8	15.6	68.8
17	104.6	75.3	37.3	128.0	35.0	124.4	82.1	114.8	52.4	28.5	21.6	53.2	16.3	68.8
17	97.6	77.0	35.4	123.0	35.1	129.4	78.7	118.0	44.2	23.6	21.5	55.7	20.0	66.4

Appendix A (continued)

	16	17	18	19	20	21	22	23	24	25	26	27	28	29
17	98.6	71.2	33.0	121.8	34.4	118.2	79.6	109.5	50.4	20.6	18.8	53.8	17.8	63.3
17	107.2	76.1	34.3	131.0	33.1	131.5	84.3	119.7	54.8	26.9	23.6	53.5	17.9	70.5
17	89.8	75.2	29.4	125.6	37.2	127.5	84.2	117.4	52.8	21.3	19.8	54.6	17.5	71.0
17	99.5	74.6	32.5	117.8	33.3	131.6	86.7	121.1	45.9	24.1	21.1	52.2	14.0	68.3
17	98.3	76.4	32.5	125.6	33.5	132.3	88.7	120.0	50.6	22.0	21.3	56.5	18.7	71.2
17	102.4	83.1	31.5	126.7	32.7	128.4	85.8	113.3	50.5	26.0	21.5	53.0	17.9	70.3
17	104.6	79.0	33.6	130.7	33.7	127.2	77.4	118.8	53.5	20.1	18.1	54.4	17.4	71.6
17	106.5	79.9	32.9	130.5	32.7	127.9	82.2	116.8	55.4	25.5	20.2	54.9	19.9	74.3
17	100.5	77.1	33.8	132.1	29.8	135.7	93.6	121.9	58.2	25.3	20.6	56.5	21.2	69.0
17	107.2	81.6	31.0	133.4	34.3	127.1	79.5	115.0	52.3	24.1	22.6	56.6	22.5	72.6
17	95.8	71.8	33.0	118.1	34.6	123.7	85.8	108.9	48.4	23.9	21.8	46.0	17.8	63.1
18	98.5	74.5	35.3	122.4	35.3	122.0	89.6	114.2	49.1	35.3	22.4	54.2	18.6	69.0
18	96.7	75.3	34.4	122.2	37.5	127.7	87.4	118.9	49.0	28.8	25.4	58.6	19.5	75.3
18	100.4	72.9	32.7	122.6	34.5	132.1	81.2	112.3	51.9	29.9	22.5	53.4	27.7	73.5
18	91.1	74.9	34.8	118.4	35.7	127.1	85.7	113.3	45.7	29.3	22.3	58.8	19.8	71.4
18	99.4	79.8	36.8	116.3	33.0	124.5	75.8	111.7	48.5	26.6	23.2	63.4	22.6	74.4
18	95.8	73.7	37.3	125.4	35.9	123.5	89.6	112.8	49.1	28.9	25.3	64.0	22.1	71.4
18	103.9	76.5	30.6	116.6	31.5	124.0	83.8	111.3	51.7	26.7	24.7	64.6	24.0	68.0
18	96.2	78.6	34.9	128.8	35.3	134.6	81.2	118.4	51.3	26.5	27.3	58.8	23.1	69.8
18	100.0	73.1	32.7	117.1	38.2	123.0	75.2	113.5	51.8	26.2	22.0	58.0	21.1	71.6
18	107.5	75.8	35.5	132.2	35.7	135.4	81.3	123.1	55.6	20.5	23.2	58.2	22.0	71.5
18	106.2	82.2	32.9	128.0	34.3	132.2	88.0	119.6	50.9	27.4	21.7	59.4	15.9	75.9
18	102.7	76.7	36.2	126.4	36.4	129.1	81.3	120.5	46.7	25.7	21.4	55.1	17.5	64.1
18	95.5	79.7	36.1	118.1	34.2	125.4	80.8	112.5	43.1	27.1	19.9	59.2	20.9	71.8
18	94.5	77.3	36.0	126.4	37.8	121.9	76.8	118.0	49.5	26.3	20.4	54.9	17.0	69.3
18	97.6	76.1	41.1	125.6	37.0	123.3	84.6	109.0	42.7	23.0	22.5	54.7	20.1	71.5
18	96.4	78.0	34.3	123.3	34.0	118.6	86.9	116.3	47.7	25.1	19.9	57.4	18.0	70.3
18	106.8	80.4	34.9	129.3	34.8	125.3	81.5	120.0	47.2	24.0	23.4	55.2	19.8	68.4
18	102.3	78.1	34.8	123.2	36.9	122.7	84.7	112.4	45.6	30.0	22.1	57.2	18.4	74.5
18	99.1	74.9	27.7	117.1	33.3	126.7	87.9	113.8	43.9	26.8	23.5	54.2	16.4	71.0
18	98.2	75.0	30.9	119.0	34.1	125.5	78.4	113.5	44.4	28.1	23.3	55.9	17.3	69.9
18	102.8	74.2	41.3	122.0	36.9	126.7	86.8	121.4	51.0	23.8	24.5	51.8	16.1	70.7
18	97.6	76.9	33.2	122.2	30.7	121.2	76.0	112.9	49.5	23.8	24.5	56.0	15.9	71.6
18	104.4	79.6	35.6	126.4	35.2	123.5	79.2	112.2	50.6	25.0	20.6	55.1	16.8	74.1
18	97.1	80.8	36.0	132.7	33.7	126.7	80.5	116.7	52.4	23.3	24.1	52.5	21.4	69.3
18	101.5	78.4	29.9	125.9	32.6	124.7	80.5	112.3	47.3	26.3	21.7	56.3	13.0	75.4
18	105.5	85.1	34.9	129.9	32.3	124.3	78.8	115.0	48.2	24.2	22.1	57.3	17.8	74.2
18	108.4	75.2	36.7	131.3	32.5	123.7	80.9	112.9	55.9	26.5	24.9	55.5	15.6	71.9
19	99.7	85.0	29.5	131.4	33.8	122.2	81.9	114.4	48.9	23.0	27.7	61.9	25.4	73.4
19	88.3	72.6	33.6	120.2	35.4	119.5	80.1	100.0	51.4	22.4	20.8	54.7	21.3	65.5
19	93.2	74.4	34.1	125.3	31.9	128.2	91.5	118.5	52.1	25.4	23.4	55.1	18.7	72.5
19	100.8	81.0	33.1	126.1	35.2	130.9	92.4	114.6	51.4	27.8	26.1	59.0	20.9	73.6
19	97.9	82.4	31.8	128.8	34.1	130.3	77.5	116.1	51.0	28.2	27.3	61.1	20.3	75.4
19	93.2	75.1	34.4	130.2	37.2	130.9	84.1	116.8	50.7	30.3	23.7	50.5	16.8	69.4
19	102.6	78.3	39.2	125.2	35.8	128.7	81.2	119.1	55.4	27.0	23.3	56.3	22.9	71.0
19	96.2	77.9	35.1	127.5	35.8	130.7	82.6	117.6	49.7	26.6	20.4	54.4	16.5	74.5
19	95.8	80.5	32.3	123.8	33.2	129.6	81.8	120.9	50.9	31.9	24.5	57.8	23.4	76.7
19	93.8	73.6	33.1	121.1	37.6	119.5	78.9	112.2	50.6	28.0	22.8	51.5	16.4	71.0
19	96.5	76.4	29.0	124.3	36.3	126.9	83.5	116.5	51.7	28.4	24.1	57.9	19.9	69.3
19	94.8	71.4	25.6	121.2	35.9	123.5	81.0	111.9	53.8	28.0	26.8	51.4	15.3	68.9
19	99.9	80.6	35.4	124.2	35.5	129.1	80.7	111.9	50.5	31.8	23.3	56.8	17.5	73.8
19	101.1	73.4	35.4	120.9	37.3	131.3	81.1	115.3	55.3	27.4	26.0	50.2	17.8	68.3
19	91.2	74.2	33.7	121.6	34.6	121.6	69.9	107.4	49.0	24.0	23.4	56.5	19.9	69.1
19	94.4	79.0	33.3	128.9	38.7	125.1	73.0	112.6	53.3	24.7	23.1	57.4	19.4	73.9
19	97.9	77.1	30.1	126.3	37.9	128.8	80.7	110.7	54.5	24.3	25.6	60.4	17.3	69.5
19	97.9	74.8	30.1	121.4	36.1	132.5	84.6	115.0	53.9	24.9	24.0	50.7	19.6	66.2
19	96.1	75.2	33.0	126.1	37.5	135.4	81.5	117.5	52.3	27.7	27.6	54.0	19.5	71.3
19	107.3	83.8	38.4	130.2	37.0	135.7	77.1	120.0	53.9	28.3	23.4	63.4	17.9	75.2
19	93.9	70.7	30.7	113.3	36.4	121.8	85.8	107.4	44.9	24.7	24.9	50.2	20.0	68.8
19	105.7	79.1	34.5	122.7	34.9	122.9	76.3	111.9	50.0	30.0	26.4	57.1	21.6	73.1
19	98.9	85.1	35.7	130.0	36.3	131.2	95.3	117.3	52.0	26.7	25.3	60.2	19.9	75.8
19	103.9	79.3	32.5	117.9	33.9	128.8	82.0	111.3	47.3	22.1	22.0	48.0	19.7	65.5
19	103.7	79.8	33.6	128.0	37.0	128.7	82.0	115.1	52.3	21.4	23.3	61.1	19.2	71.4
19	93.0	78.1	28.2	121.5	30.1	128.7	77.5	118.3	47.3	20.1	22.4	55.2	16.3	71.4
19	95.5	74.6	32.1	119.9	30.7	130.4	80.2	114.4	48.2	23.0	23.3	52.8	17.4	69.4
19	98.5	75.7	31.8	124.9	34.4	133.8	83.9	123.0	48.6	19.1	20.7	53.8	15.4	65.9
19	96.8	78.3	33.9	129.4	33.7	130.1	88.2	115.6	47.9	21.7	18.5	55.6	16.8	72.6
19	104.5	72.9	35.4	123.2	31.9	136.3	80.9	120.1	55.9	23.7	20.6	55.2	22.3	71.1
19	99.7	75.8	38.1	128.2	37.0	132.0	85.0	114.6	48.6	23.7	20.4	50.9	16.9	71.8
19	97.5	75.3	43.6	125.9	35.3	131.4	75.6	116.2	51.1	29.6	18.1	54.2	19.7	74.6
19	103.6	77.8	32.4	127.0	35.2	128.6	80.1	118.0	47.0	23.4	23.2	54.0	20.7	70.8

Appendix A (continued)

	16	17	18	19	20	21	22	23	24	25	26	27	28	29
19	107.6	70.8	43.7	121.2	29.8	129.7	81.8	111.9	47.7	21.9	19.5	54.0	17.5	72.1
19	97.3	79.3	30.5	133.0	34.2	127.0	75.8	118.4	54.6	23.3	19.4	57.8	21.7	73.7
19	97.2	78.0	34.1	129.7	32.3	123.6	89.6	120.9	46.8	22.2	22.2	57.2	21.7	70.8
19	94.0	80.5	28.5	127.5	35.0	131.0	82.5	114.4	47.9	26.1	19.7	54.8	17.9	68.0
19	97.8	78.3	31.9	130.3	35.6	129.0	94.3	114.6	52.2	25.9	21.8	54.1	17.4	68.6
19	100.1	79.6	32.7	136.7	32.4	135.0	84.7	119.1	50.9	25.7	16.9	53.3	18.7	73.2
19	105.0	73.1	32.7	127.3	35.6	132.1	77.4	113.7	53.9	22.8	22.6	49.4	18.4	67.7
19	91.7	74.9	33.1	123.3	34.9	130.7	82.9	112.4	46.3	23.3	22.5	50.4	18.0	73.4
19	100.4	76.8	37.8	133.1	32.9	132.8	80.3	121.4	52.7	24.7	22.8	53.0	20.9	69.8
19	102.2	80.0	33.2	136.4	30.3	128.8	84.3	117.4	51.1	27.2	25.3	61.1	16.6	75.7
20	96.1	74.2	27.6	127.2	35.9	128.5	84.3	120.0	55.2	26.8	28.1	50.6	18.0	70.2
20	88.6	78.3	32.3	129.5	35.3	123.7	85.2	117.1	56.6	26.1	21.4	56.7	18.3	68.3
20	104.1	92.2	32.2	127.2	35.3	127.3	83.5	113.6	48.3	28.8	26.7	61.4	22.8	74.6
20	105.4	75.8	34.5	127.7	35.5	126.1	91.9	116.2	53.6	27.7	25.8	57.8	19.6	74.3
20	94.5	78.5	32.1	124.1	39.4	117.3	81.1	113.1	55.2	29.8	23.0	51.7	16.3	66.6
20	99.3	82.2	32.9	123.3	37.5	131.0	82.0	122.6	48.2	35.0	25.3	57.0	17.9	71.0
20	97.8	82.5	35.9	127.6	39.8	130.6	88.3	122.5	49.0	29.5	26.7	60.7	21.9	73.1
20	97.7	82.6	40.3	124.3	35.8	129.4	87.1	120.9	47.1	27.5	24.8	63.7	21.3	73.8
20	94.3	74.1	30.0	119.6	38.0	123.1	80.5	111.7	53.9	34.2	24.3	59.5	19.7	75.0
20	97.8	73.3	36.7	121.6	37.4	130.0	87.3	122.4	50.8	27.7	23.4	55.6	16.9	64.4
20	95.2	78.9	38.8	120.8	41.0	127.3	82.3	117.6	45.3	28.0	28.0	55.0	17.6	69.6
20	98.0	83.5	38.0	121.9	39.9	120.2	83.3	118.2	44.6	33.7	25.2	60.3	19.6	67.8
20	110.0	79.1	35.5	122.9	34.9	128.4	86.9	121.2	48.8	29.7	26.2	60.5	19.6	72.4
20	92.0	77.2	35.8	117.2	39.2	131.1	87.5	118.0	45.2	27.8	22.8	53.5	21.5	66.2
20	101.4	82.2	30.9	125.2	36.6	128.5	84.0	114.3	49.2	30.3	30.0	55.8	20.3	70.0
20	100.9	76.2	33.0	121.1	34.9	121.2	80.1	115.8	50.1	26.8	27.7	51.9	21.5	66.5
20	98.3	81.7	38.3	118.7	38.8	128.9	83.3	118.0	47.8	31.4	26.9	56.8	18.9	69.0
20	103.4	80.8	31.5	125.8	37.1	129.5	82.7	125.3	45.6	25.5	26.9	53.7	17.1	71.0
20	104.0	82.0	33.9	127.8	38.7	128.6	85.3	122.8	51.9	31.0	22.8	51.4	17.8	67.2
20	104.6	82.6	36.3	117.1	36.8	123.4	76.3	108.0	46.4	23.8	25.8	47.6	19.2	63.6
20	105.2	83.2	38.8	121.1	36.6	115.7	79.6	115.4	46.6	24.5	22.7	52.9	17.5	66.3
20	104.7	77.2	36.1	119.4	36.5	124.2	84.4	116.7	47.3	24.2	22.7	54.6	18.2	65.4
20	108.5	78.1	38.8	121.5	34.6	127.8	82.0	116.3	48.4	27.8	24.5	58.2	24.0	65.9
20	110.6	80.8	32.1	129.0	38.7	130.9	85.1	119.6	51.1	27.1	26.4	58.0	19.2	73.9
20	97.8	77.7	31.0	127.1	33.4	122.1	85.5	114.6	51.1	28.4	26.1	58.1	14.9	74.1
20	97.0	75.8	34.3	124.6	38.4	127.6	82.2	119.3	49.2	29.4	22.9	56.0	17.7	67.0
20	99.2	76.4	33.9	123.1	36.0	129.1	83.5	122.9	47.3	30.4	24.6	55.4	15.9	68.4
20	101.4	79.0	34.7	129.0	35.6	129.6	85.0	117.5	52.3	27.0	24.5	55.2	18.7	71.1
20	103.6	81.6	35.4	133.7	34.9	126.7	80.2	117.6	49.8	23.5	27.7	55.0	18.8	73.8
20	100.7	80.1	34.2	129.4	36.6	132.8	86.6	127.3	50.2	26.8	24.4	58.1	18.9	67.7
20	101.8	85.0	36.5	127.2	33.9	130.7	85.1	122.6	44.2	29.4	25.4	61.1	16.6	76.2
20	109.1	79.0	44.4	125.1	35.7	123.3	81.6	114.8	50.9	24.7	19.0	58.0	14.2	67.3
21	97.6	72.1	27.3	124.3	32.8	125.0	77.5	107.9	51.9	24.2	22.6	51.0	19.2	69.3
21	99.6	75.3	34.2	125.2	39.1	119.8	79.4	106.2	55.6	26.0	21.8	57.0	17.4	71.2
21	93.4	81.8	29.1	126.2	36.2	130.0	76.9	116.9	49.0	29.1	22.8	53.1	20.2	67.0
21	103.6	71.0	38.7	118.8	34.5	123.4	80.4	120.7	51.6	30.1	24.8	55.5	18.8	70.5
21	93.1	72.3	40.4	121.5	41.2	117.7	89.5	110.7	55.8	28.0	21.4	53.3	18.2	68.5
21	103.5	77.1	31.2	121.4	36.0	121.6	83.0	109.1	47.1	22.3	24.7	58.8	18.5	71.7
21	89.3	68.9	34.0	113.6	33.7	118.0	80.7	107.9	48.9	24.3	24.0	54.5	16.4	65.4
21	90.1	74.7	29.0	118.9	35.9	122.2	88.6	112.4	52.1	24.6	22.0	54.2	17.0	67.6
21	93.6	70.3	31.2	119.8	38.5	128.2	73.9	112.8	55.9	25.0	21.9	53.8	21.8	69.7
21	89.0	70.3	33.2	115.3	40.9	117.5	81.3	103.1	47.8	26.3	25.0	52.9	16.1	69.8
21	99.9	77.0	30.9	122.8	33.8	125.8	72.4	116.4	53.4	24.9	26.3	52.4	22.3	68.3
21	90.1	73.4	32.8	121.3	37.3	123.9	84.6	113.8	51.0	26.2	23.6	58.4	18.3	70.8
21	89.1	76.3	31.7	118.8	38.6	119.8	79.8	108.8	46.0	25.8	23.0	51.2	19.3	69.7
21	92.2	73.6	36.3	116.7	35.6	122.4	82.9	113.4	48.2	27.5	24.4	50.1	19.2	69.7
21	99.7	75.9	36.5	122.7	40.2	126.5	81.7	119.6	48.7	22.2	24.4	53.2	18.9	67.2
21	105.5	75.6	29.7	118.8	36.6	126.0	82.0	112.4	50.3	25.2	26.8	56.3	22.9	67.5
21	94.7	68.8	37.3	114.8	36.7	122.3	75.2	114.0	47.5	28.7	23.7	49.1	20.1	70.1
21	96.7	79.6	34.7	125.4	34.8	130.4	80.0	116.3	51.9	20.4	21.7	51.4	18.2	69.0
21	99.2	71.2	32.0	119.4	32.8	122.2	77.9	110.6	49.8	20.0	19.2	45.8	16.3	62.9
21	98.2	77.7	32.0	127.1	28.1	125.2	79.7	117.1	52.3	24.8	19.3	50.8	19.1	72.7
21	112.4	78.7	42.4	124.9	34.9	127.0	78.9	118.9	48.8	25.3	22.7	53.7	16.8	68.5
21	100.9	75.9	31.0	123.1	31.8	124.2	75.5	107.0	48.3	25.4	22.8	54.7	15.1	73.5
21	96.9	73.0	25.8	121.2	31.9	121.5	72.0	110.1	47.8	23.1	23.4	49.4	12.8	69.4
21	88.6	73.6	28.5	123.9	29.9	117.5	75.1	110.9	51.3	25.7	19.8	45.6	13.4	66.5
21	97.3	75.0	38.4	125.6	34.7	125.8	83.6	106.4	53.8	23.4	19.0	52.1	15.8	69.9
21	98.4	73.5	34.4	117.7	33.8	120.0	78.5	114.4	46.3	24.3	24.6	51.6	20.3	64.3
21	98.0	71.8	33.1	118.8	36.2	121.8	77.6	113.0	50.1	25.5	21.6	52.9	12.0	65.0
21	103.4	76.4	42.0	133.2	37.9	127.8	79.2	116.4	53.0	27.3	22.3	52.6	15.8	65.0
21	102.3	75.0	37.2	126.0	33.0	123.6	76.4	117.4	52.2	29.0	22.2	49.0	18.5	64.9

Appendix A (continued)

	16	17	18	19	20	21	22	23	24	25	26	27	28	29
21	106.9	74.2	33.0	125.0	33.9	129.9	81.3	112.9	51.2	22.6	23.4	52.3	21.0	67.3
21	93.3	76.6	27.5	122.4	31.7	121.3	81.7	113.6	45.6	23.3	23.8	50.0	16.5	68.3
21	101.8	78.8	34.4	128.6	33.1	126.2	85.5	116.1	48.6	23.9	23.1	52.9	17.8	70.8
21	101.1	79.1	37.9	124.3	33.1	119.6	79.9	111.2	47.9	29.2	25.3	57.9	20.6	74.2
21	102.4	72.2	38.7	130.7	36.7	128.8	85.0	115.9	53.1	22.9	22.3	49.1	20.5	68.1
21	94.5	79.3	29.0	123.0	30.6	124.6	80.8	112.5	47.1	20.5	21.9	56.2	18.2	70.9
21	86.0	76.3	25.8	126.2	33.9	134.5	85.9	122.4	44.9	22.1	18.9	54.0	16.0	67.0
21	107.8	70.8	39.1	126.0	34.6	125.2	86.5	112.3	54.0	27.5	21.4	52.9	17.3	68.0
21	97.9	78.5	34.5	122.8	33.4	121.7	79.4	112.5	45.5	22.6	21.2	53.8	15.4	67.8
21	105.3	73.1	36.3	132.1	33.1	122.3	81.6	111.4	51.0	26.1	21.9	56.2	21.9	75.5
21	104.5	77.3	36.4	120.5	32.9	117.5	73.0	108.4	49.6	19.0	19.5	55.8	17.0	66.4
21	89.9	71.6	27.3	120.7	33.9	117.4	82.0	107.5	48.2	24.3	19.7	52.9	15.2	64.9
21	98.6	72.8	29.5	122.1	34.3	120.1	78.2	110.5	50.2	26.3	21.9	53.4	16.9	66.8
22	96.4	75.5	37.3	114.3	35.5	129.5	86.7	115.0	45.8	27.4	22.2	53.6	23.8	68.9
22	93.3	74.8	38.8	124.7	38.3	121.2	77.7	110.9	49.7	22.0	23.5	53.7	19.9	65.1
22	96.2	77.0	37.3	125.7	35.5	132.5	86.5	122.0	50.8	25.3	19.9	61.9	20.4	71.1
22	101.1	83.9	36.6	132.3	34.8	127.7	85.8	111.4	51.5	25.0	25.7	61.2	19.0	74.7
22	96.7	83.9	27.8	127.6	34.1	122.3	81.6	113.0	50.9	30.5	21.3	58.9	17.9	70.5
22	101.6	81.6	23.8	118.4	33.9	131.4	82.1	120.1	45.8	23.8	27.7	52.6	18.3	69.9
22	107.9	79.4	41.0	127.4	39.8	127.7	81.3	112.3	54.6	26.4	28.0	54.5	21.3	72.9
22	100.7	82.6	27.4	127.0	30.5	127.2	82.1	117.8	50.2	32.7	25.0	54.7	18.1	70.8
22	100.9	78.0	30.8	125.3	37.5	130.6	91.5	116.8	53.0	23.6	26.7	53.2	16.6	67.5
22	100.3	72.1	30.5	121.0	34.7	127.6	77.9	111.4	47.7	25.6	24.8	54.7	20.7	68.9
22	94.8	80.4	21.2	127.6	34.6	132.4	83.1	119.8	52.4	26.1	26.9	54.9	17.6	77.2
22	96.4	74.4	34.7	114.2	35.6	123.9	79.1	104.2	45.3	27.6	25.0	56.7	20.4	70.3
22	97.0	77.0	27.8	124.6	35.8	128.2	80.6	115.2	48.7	25.0	23.6	54.5	16.9	69.8
22	95.8	77.9	34.4	118.0	35.6	127.0	81.3	113.9	46.9	24.2	28.2	52.3	20.6	66.9
22	102.1	78.8	27.2	126.7	33.6	138.6	80.1	123.6	51.1	28.0	21.7	58.3	19.5	74.9
22	98.4	72.0	28.8	125.2	36.0	129.6	90.5	114.7	58.1	30.4	27.1	55.5	21.6	69.1
22	104.6	80.1	34.9	130.2	38.3	127.1	81.6	121.0	51.4	29.0	25.3	56.1	21.8	74.7
22	93.8	74.9	37.0	121.6	38.4	126.1	84.2	113.9	51.0	26.2	20.6	56.6	18.6	71.3
22	95.7	78.8	33.7	126.1	36.1	126.6	88.4	114.4	48.6	27.3	22.3	55.7	20.2	74.1
22	96.3	79.2	37.5	120.8	40.3	126.0	85.1	115.1	53.0	26.8	24.4	55.3	17.8	71.3
22	94.0	78.0	30.9	121.0	38.5	124.4	79.6	109.7	53.1	26.7	22.5	52.3	21.9	70.9
22	103.2	78.5	33.7	134.3	35.6	129.5	72.5	122.6	56.5	25.9	23.5	55.2	17.7	71.9
22	72.1	82.9	23.6	123.4	44.0	124.4	80.7	115.1	51.3	29.9	22.4	54.7	18.2	72.0
22	99.6	82.3	33.2	129.3	35.5	135.6	90.2	123.7	49.0	28.8	25.5	55.5	19.5	70.7
22	91.0	73.1	34.5	119.8	34.7	123.0	79.4	114.4	51.0	24.1	22.6	50.6	19.6	68.3
22	92.4	70.1	31.7	123.4	35.3	119.6	84.1	104.4	56.2	22.3	22.0	53.1	20.9	68.2
22	97.0	77.1	31.8	125.4	32.5	127.5	84.2	120.6	51.2	22.5	23.3	56.4	19.8	65.0
22	91.1	72.2	28.4	123.0	31.0	124.8	82.7	111.7	55.9	23.5	25.3	51.7	18.4	63.5
22	85.5	79.7	29.1	124.9	36.0	131.5	88.9	119.4	53.8	25.0	23.8	56.4	19.1	68.8
22	102.9	75.7	27.3	128.7	35.0	131.0	80.4	127.4	55.0	26.5	25.2	61.1	23.7	74.0
22	96.9	79.5	25.6	123.1	34.1	126.0	73.3	112.3	55.9	27.5	21.9	56.0	22.3	66.7
22	96.1	80.0	32.8	133.1	36.6	133.9	87.4	125.8	52.0	27.9	21.1	57.9	13.0	71.5
22	93.4	78.3	30.4	120.9	36.6	126.6	90.6	111.6	51.4	26.2	24.6	54.0	18.4	67.9
22	93.0	80.2	24.6	125.0	33.6	130.8	82.9	114.2	51.4	28.6	25.5	55.2	16.2	71.0
22	93.4	73.7	29.3	122.3	37.1	121.8	83.9	108.8	52.1	28.1	22.8	54.0	18.8	70.0
22	99.6	79.5	34.4	137.2	35.7	133.0	77.8	123.3	52.3	27.1	23.3	56.3	15.6	75.0
22	98.6	75.3	31.9	125.7	32.0	126.1	74.1	111.5	56.8	28.9	20.1	54.0	14.1	74.1
22	101.5	80.7	32.4	132.7	35.4	128.1	82.3	117.8	53.7	28.9	24.5	58.1	19.2	75.2
22	104.9	75.8	33.1	125.8	33.4	135.4	82.5	116.1	49.9	23.7	19.0	51.8	18.7	68.9
22	104.3	75.9	39.0	133.0	35.8	131.1	80.6	117.9	55.4	22.1	19.8	57.2	20.8	72.5
22	101.1	81.3	32.0	124.8	33.6	128.1	81.0	110.5	51.8	22.3	17.8	54.4	19.1	72.8
22	92.0	80.2	31.9	130.4	33.6	124.4	77.9	109.1	53.9	23.0	19.1	53.8	17.4	71.9
22	95.9	78.9	31.8	125.3	35.6	127.6	77.0	109.5	50.3	23.8	22.8	53.2	20.1	70.9
22	102.4	77.4	35.5	120.8	29.8	120.5	78.6	110.0	46.0	24.5	19.3	57.0	16.8	72.8
22	108.9	75.9	39.2	122.9	34.5	123.5	81.8	115.4	50.8	25.4	21.2	56.4	17.6	71.5
22	99.9	73.7	38.7	124.0	31.4	127.7	82.6	117.9	51.1	23.6	17.7	51.5	18.6	66.0
22	94.3	74.3	34.6	125.3	31.7	122.5	77.4	116.3	47.6	24.3	20.8	52.5	17.6	73.9
22	97.8	78.7	31.9	129.7	30.0	128.5	77.5	118.1	51.4	23.2	19.7	53.5	13.1	70.9
22	105.8	73.0	34.9	123.3	32.6	124.2	73.0	114.8	49.7	20.2	20.9	58.6	17.6	72.4
22	96.6	77.2	32.5	125.6	35.4	122.9	76.9	109.9	54.0	23.2	19.7	56.2	16.5	64.6
22	98.6	82.1	27.0	137.9	30.2	131.3	78.9	117.1	49.3	26.3	22.2	54.7	15.2	79.9
22	93.4	81.4	31.2	125.3	34.3	124.8	83.3	115.6	50.1	20.8	21.8	56.0	15.3	67.6
22	97.4	76.9	30.1	130.5	33.6	134.8	88.8	118.7	52.0	23.5	22.1	55.9	19.5	72.5
22	99.6	79.1	29.5	127.4	34.6	124.9	89.5	114.4	51.6	25.5	19.8	54.4	19.0	70.2
22	104.2	66.0	36.9	121.2	29.5	125.0	88.6	113.0	50.1	21.5	21.8	52.3	18.6	60.9
22	107.5	75.1	35.5	123.5	34.6	136.1	83.7	121.7	47.9	23.9	19.7	54.4	18.1	69.0
22	107.5	77.1	30.8	119.9	30.6	124.1	85.3	110.3	48.5	28.1	22.7	55.1	17.9	69.9
22	92.8	83.8	20.4	130.2	32.4	134.1	87.2	119.1	47.2	24.9	24.2	46.7	14.3	74.6

Appendix A (continued)

	16	17	18	19	20	21	22	23	24	25	26	27	28	29
22	96.5	79.5	35.3	126.0	39.5	132.7	82.3	117.3	50.5	25.2	19.5	59.1	17.0	72.6
22	105.9	77.7	35.9	125.7	31.9	129.8	85.9	115.0	52.6	25.3	20.6	55.1	17.8	72.2
22	98.1	81.3	33.7	127.5	35.0	126.9	86.2	114.5	49.3	25.5	23.8	58.0	16.2	73.5
22	92.7	81.8	28.1	128.7	37.2	129.1	83.9	115.1	51.5	23.8	24.8	57.3	14.6	72.2
22	100.0	81.9	30.6	134.4	35.3	130.5	79.2	120.7	52.7	22.0	21.3	56.5	15.5	70.9
22	105.2	75.3	39.1	115.1	34.5	122.0	79.9	110.8	42.9	26.2	21.8	48.5	18.8	67.1
22	85.6	70.0	23.7	121.6	32.5	123.9	76.6	118.3	50.6	22.5	19.3	49.0	12.7	58.2
22	95.2	80.6	24.1	129.7	31.3	123.5	81.9	109.2	55.3	29.0	23.7	57.4	18.3	71.8
22	95.3	78.3	30.6	127.8	34.4	131.2	94.1	120.5	50.3	20.4	23.3	52.4	18.0	72.6
22	105.8	80.5	33.3	140.6	34.7	138.4	81.6	130.0	57.5	27.5	19.8	56.0	14.1	75.9
22	97.8	82.6	27.0	130.0	39.4	124.1	92.5	111.4	46.6	28.1	19.6	55.8	20.1	74.5
22	97.3	78.4	31.5	129.0	32.8	127.8	82.7	122.6	51.0	25.0	21.3	58.7	15.3	72.0
23	101.5	70.4	34.6	118.8	34.6	124.8	78.3	115.9	48.2	22.2	25.5	54.6	21.9	67.2
23	102.4	78.4	25.9	126.0	35.5	120.2	84.7	109.7	49.2	27.9	23.4	54.8	20.2	77.4
23	101.6	78.7	36.0	119.7	35.8	129.5	87.4	116.4	46.5	25.6	27.2	60.2	21.3	73.1
23	104.8	70.0	28.1	116.6	35.0	119.9	86.9	108.6	49.3	27.6	27.5	59.5	25.8	70.4
23	116.3	82.8	41.2	127.9	33.1	133.1	87.8	124.8	56.8	29.7	27.7	58.8	22.8	73.7
23	109.2	79.0	33.7	120.7	35.7	119.3	80.3	114.6	52.4	28.4	22.1	58.2	23.5	71.0
23	94.5	82.4	32.5	116.8	33.4	129.0	80.7	113.7	51.8	27.7	24.6	57.7	21.3	72.9
23	99.0	77.8	32.3	127.7	35.3	128.0	83.2	118.9	56.4	26.4	24.4	55.3	25.4	68.4
23	104.8	79.2	31.4	119.8	32.5	122.1	76.8	117.5	48.3	31.1	24.6	56.4	20.6	73.4
23	101.0	74.6	32.8	119.4	36.8	125.0	83.0	123.1	53.5	29.1	25.0	54.6	17.4	70.9
23	102.1	82.6	28.8	126.0	36.3	123.1	78.1	114.1	52.4	28.9	25.0	54.1	21.8	78.6
23	109.9	76.7	38.2	120.3	34.3	130.7	81.1	122.0	50.5	24.5	25.3	52.8	21.8	69.2
23	102.8	73.5	31.2	124.0	31.9	127.4	88.5	122.7	57.4	31.6	24.7	51.8	25.1	74.6
23	99.2	79.5	39.7	123.1	36.1	129.4	91.0	117.4	46.7	24.3	25.1	55.4	21.2	75.3
23	110.7	77.0	31.2	126.1	34.1	122.5	84.0	115.8	54.1	29.8	26.6	53.1	19.0	70.0
23	95.6	77.5	27.9	125.3	33.5	126.4	93.1	117.1	48.3	26.7	23.7	53.3	18.4	71.0
23	103.3	74.5	35.3	123.3	34.6	120.6	81.4	111.2	48.9	31.2	25.5	58.1	20.5	75.2
23	100.5	73.1	31.5	117.9	35.7	124.9	84.7	112.7	47.3	26.5	25.6	52.6	22.1	70.6
23	103.3	69.8	38.0	124.2	36.2	123.1	79.4	110.7	51.8	24.8	24.5	54.8	21.1	71.2
23	101.9	81.2	35.5	125.7	36.3	131.1	93.4	121.3	53.2	31.2	31.1	56.5	21.5	71.3
23	107.0	77.5	39.8	125.0	39.6	128.2	77.5	118.2	50.2	23.8	26.3	59.7	19.9	68.7
23	107.3	75.8	35.3	120.6	37.0	129.4	87.1	111.1	50.2	26.0	23.3	56.0	20.0	72.2
23	101.6	77.7	34.1	122.8	34.6	124.7	80.2	116.5	49.3	27.2	27.4	58.3	19.3	71.1
23	96.6	68.8	29.0	116.9	38.3	123.5	84.7	109.8	45.9	25.3	27.5	53.5	23.7	65.9
23	108.4	76.8	39.1	125.6	34.2	126.2	85.2	110.8	47.8	25.5	21.8	56.6	17.8	71.9
23	105.6	81.0	34.9	128.6	36.3	127.8	73.9	116.9	51.4	22.7	20.4	58.5	16.7	74.5
23	99.9	66.8	35.2	116.9	31.7	132.2	86.0	118.5	47.3	22.1	19.7	55.8	16.6	68.1
23	112.6	76.9	36.2	128.8	30.6	124.5	77.3	114.2	49.7	26.5	19.2	51.0	13.0	67.3
23	102.4	77.3	33.7	124.6	33.1	125.9	77.5	118.5	52.8	32.4	19.8	56.3	17.4	72.3
23	111.3	75.6	34.6	122.3	31.4	135.1	90.5	120.5	51.3	23.0	22.1	52.2	20.3	65.6
23	107.8	64.4	31.5	127.1	32.9	130.9	83.6	119.6	55.6	27.2	23.0	54.0	17.0	75.7
23	110.5	76.0	31.7	121.9	33.5	129.1	84.6	112.5	46.7	26.8	24.7	57.9	17.0	72.2
23	109.2	76.4	37.4	127.7	34.5	133.4	86.9	120.6	51.2	21.9	20.9	51.5	14.7	71.1
23	111.2	74.0	36.9	120.6	33.7	127.1	84.1	114.1	51.9	25.5	22.6	56.6	19.5	76.7
23	108.8	72.5	36.4	121.2	34.8	128.1	83.6	118.5	49.0	22.5	23.0	54.2	18.6	70.9
24	104.0	80.3	29.0	128.3	34.5	124.7	86.1	111.2	52.3	24.1	29.4	55.4	22.4	66.7
24	99.1	77.3	29.8	130.9	37.6	134.1	81.9	120.0	56.5	26.9	28.6	54.2	19.7	74.5
24	97.5	77.0	31.9	126.5	35.5	123.9	84.4	103.3	50.7	23.8	27.0	54.6	17.3	67.7
24	96.5	76.9	29.1	128.5	37.1	132.5	87.8	120.0	53.9	25.6	29.6	52.1	21.5	71.9
24	105.1	78.0	34.1	120.5	34.6	125.4	81.2	113.3	47.3	26.7	28.4	56.5	24.8	72.5
24	105.5	77.4	37.0	131.8	38.3	140.1	79.4	125.3	56.3	26.5	29.0	52.7	23.7	76.5
24	112.1	76.3	34.8	130.7	33.8	128.9	81.0	117.4	54.7	28.8	29.6	57.5	19.1	73.1
24	101.6	79.2	32.9	129.3	35.2	136.6	85.1	118.1	52.1	27.8	25.7	55.1	18.5	67.9
24	98.8	71.6	35.5	121.8	34.8	125.8	82.4	115.4	46.5	30.9	25.4	53.7	17.9	69.6
24	103.4	81.2	31.8	126.9	34.6	124.9	80.0	113.2	46.7	26.0	25.4	55.7	19.0	73.5
24	97.7	78.0	30.9	132.6	38.3	137.5	83.0	123.5	54.3	28.5	29.3	58.5	23.1	71.8
24	92.1	74.8	30.1	119.1	37.8	125.6	80.5	112.2	46.7	25.8	22.9	54.4	19.9	69.0
24	98.6	72.6	29.8	117.7	35.7	127.3	85.7	115.2	44.8	26.8	26.6	53.0	15.8	66.4
24	91.6	71.5	26.0	122.4	33.1	124.7	77.8	111.8	52.5	24.7	23.5	56.3	20.3	67.0
24	92.6	75.6	32.6	117.8	36.9	120.9	77.5	109.3	45.1	29.5	20.5	57.4	16.8	62.1
24	99.4	75.8	36.5	122.4	36.8	128.4	83.1	116.7	45.6	30.3	22.2	54.1	18.3	68.9
24	105.3	77.2	35.6	120.1	36.2	128.4	75.5	116.2	47.9	25.9	26.4	57.7	22.6	70.4
24	92.4	83.0	32.1	121.6	39.7	118.9	81.2	107.3	46.2	27.7	24.6	56.8	19.5	68.3
24	106.4	71.4	33.6	126.1	35.2	130.6	83.5	118.5	50.1	27.3	25.6	56.9	21.7	75.9
24	98.0	87.5	34.3	127.6	37.3	125.2	80.7	116.2	49.7	24.8	24.7	56.4	21.6	64.6
24	103.2	71.9	33.1	126.4	37.3	129.9	92.6	118.0	51.0	31.6	21.7	64.7	17.4	76.1
24	89.6	77.2	30.6	124.2	36.8	121.6	87.3	113.3	48.9	29.3	20.9	56.2	20.0	69.4
24	97.0	77.5	27.2	124.0	36.7	127.5	91.3	113.0	51.3	29.7	24.9	57.4	16.5	68.4
24	91.1	79.0	27.1	121.8	33.2	126.9	80.5	111.3	50.2	23.6	24.7	58.2	19.6	71.0

Appendix A (continued)

	16	17	18	19	20	21	22	23	24	25	26	27	28	29
24	104.3	82.4	31.5	123.3	35.5	130.0	89.7	120.1	50.3	26.9	27.7	57.3	20.3	69.2
24	97.5	74.5	29.6	127.0	35.1	131.1	90.7	118.1	52.2	27.9	28.6	61.5	18.1	75.9
24	94.7	78.9	28.3	130.7	34.6	131.7	87.3	120.6	54.7	27.3	25.5	57.1	20.3	72.1
24	96.2	79.5	29.1	128.9	38.7	130.2	84.2	121.5	56.9	25.7	30.6	59.4	22.2	74.7
24	102.5	77.5	33.8	128.7	36.8	127.5	80.0	114.2	54.7	24.1	24.7	57.2	20.0	71.8
24	98.2	80.3	26.9	125.4	30.4	133.2	87.9	119.1	50.2	23.0	27.2	56.8	19.6	69.4
24	101.2	75.9	30.6	122.1	34.7	126.5	88.0	113.7	49.0	29.2	26.9	59.1	22.0	76.2
24	103.5	77.8	35.1	126.3	36.1	123.7	79.8	116.4	48.2	22.9	24.0	54.2	15.6	69.7
24	99.9	81.4	32.0	132.8	37.7	124.1	70.4	113.2	56.2	25.0	27.8	54.7	20.0	73.5
24	104.5	78.3	35.7	128.5	37.9	123.6	91.7	108.5	51.0	28.1	26.3	56.0	19.2	69.1
24	96.1	74.3	32.7	121.9	33.5	127.7	78.7	116.1	49.4	25.0	25.4	52.5	22.3	65.9
24	94.0	72.5	24.0	116.9	35.0	122.9	80.8	110.2	47.0	24.5	25.9	53.4	17.2	67.3
24	105.9	73.3	32.5	124.8	39.0	128.3	76.8	113.3	52.2	27.0	26.3	54.0	20.3	68.3
24	105.3	76.6	29.5	128.0	39.5	133.8	81.1	121.0	53.6	28.5	26.7	55.1	25.6	70.0
24	102.2	71.2	42.7	123.9	37.6	124.1	82.7	116.7	49.1	23.4	25.2	53.8	19.6	71.6
24	106.4	80.0	39.9	128.6	36.2	134.2	76.5	122.9	51.6	30.7	27.0	59.8	26.4	73.0
24	102.2	80.7	36.1	124.9	36.0	130.4	80.7	115.3	50.3	26.4	26.2	57.5	23.6	73.9
24	94.0	73.5	36.1	117.4	39.5	123.8	83.9	111.0	43.3	25.6	28.0	55.3	21.2	68.0
24	102.3	74.7	34.0	130.1	38.2	130.1	78.6	117.8	59.9	27.6	26.1	62.6	20.7	70.5
24	102.2	78.6	28.0	121.2	37.9	127.2	87.8	113.3	47.6	25.4	26.2	57.9	24.1	72.3
24	100.6	76.8	28.6	127.4	33.4	129.7	84.1	119.2	52.2	31.0	25.8	53.4	21.3	74.2
24	101.9	76.0	31.3	119.5	36.7	130.6	91.6	117.0	47.7	28.1	25.8	59.8	18.7	72.5
24	89.2	74.8	36.5	122.4	42.5	126.1	86.3	115.7	49.0	31.4	24.6	58.1	19.0	75.2
24	95.1	74.1	33.1	120.0	37.7	123.8	82.8	111.1	50.8	25.8	27.5	55.8	20.0	72.3
24	100.2	77.9	30.6	123.0	38.1	130.3	84.8	117.3	53.8	25.8	26.8	61.8	20.7	76.3
24	90.4	71.4	25.6	120.1	34.9	127.0	81.5	113.4	53.6	24.8	22.2	56.2	20.2	66.7
24	99.4	72.2	37.6	116.9	36.0	121.1	86.7	108.2	51.5	24.2	21.5	53.6	21.0	67.0
24	99.9	71.5	37.3	114.6	39.3	120.2	85.8	111.0	50.0	26.6	25.1	57.8	21.9	67.3
24	103.2	74.4	37.9	119.7	35.0	121.1	79.4	110.9	53.1	25.8	23.6	54.6	17.3	66.7
24	95.1	74.4	31.9	121.9	39.4	129.9	81.7	114.1	50.2	22.3	26.6	50.4	18.6	66.8
24	95.6	74.5	33.2	117.7	34.7	125.7	84.4	116.9	46.0	24.4	23.4	53.9	16.7	69.1
24	103.5	73.3	34.6	120.5	36.8	128.7	79.0	116.5	53.6	23.9	26.0	54.8	19.6	63.1
24	97.5	77.5	33.8	126.3	37.5	126.3	85.7	114.9	55.7	24.4	27.7	55.0	18.9	74.0
24	99.2	79.0	32.1	121.9	36.6	130.2	85.2	115.8	49.0	25.2	27.4	50.3	22.4	68.9
24	89.9	78.9	26.9	129.5	34.9	128.5	81.3	120.7	53.2	24.1	23.2	55.9	18.4	67.3
24	96.4	80.3	33.9	127.8	35.4	131.2	78.0	117.1	52.5	26.0	20.6	54.7	19.3	73.8
24	103.1	73.3	29.1	118.3	35.3	124.1	82.0	111.8	51.7	28.2	27.9	51.3	17.2	66.1
24	97.4	72.0	29.5	117.0	35.2	123.3	82.4	112.6	47.9	24.2	29.3	52.6	20.2	67.5
24	100.2	72.1	24.8	123.7	30.8	131.0	81.8	114.8	52.9	24.3	26.4	53.1	22.2	64.6
24	102.4	74.4	36.5	122.7	35.4	127.6	84.1	115.4	50.8	28.2	23.6	57.7	18.8	69.4
24	103.2	77.6	35.4	123.4	37.2	127.2	82.7	119.4	48.9	26.0	24.5	59.5	21.7	73.9
24	110.3	77.4	37.0	128.2	36.5	135.9	81.9	122.0	51.9	28.7	26.4	61.5	20.8	73.7
24	93.1	77.4	34.7	116.8	36.3	123.7	83.2	114.3	50.8	28.9	22.4	58.7	21.3	68.1
24	99.7	77.1	35.5	127.3	36.9	129.4	87.8	119.7	51.1	25.2	23.3	54.3	19.4	71.7
24	104.9	78.0	43.4	129.0	43.7	129.7	77.4	120.0	52.0	28.4	25.6	57.4	22.1	71.9
24	101.0	73.4	35.7	129.4	35.0	125.6	69.3	117.3	60.9	27.7	28.6	55.8	20.7	69.3
24	103.6	74.2	37.5	126.9	38.4	124.6	84.8	109.2	51.8	29.0	27.0	57.1	19.3	70.6
24	106.9	78.2	37.0	127.0	40.1	130.8	85.7	117.6	54.3	27.7	27.1	62.3	23.8	73.4
24	100.5	74.6	33.7	119.9	40.1	125.7	77.8	113.4	51.4	31.5	23.7	55.0	19.4	75.4
24	104.4	74.8	37.3	121.4	37.5	126.7	87.1	118.7	51.6	32.5	24.3	59.7	25.1	68.4
24	102.4	77.2	38.5	121.0	37.0	120.9	76.9	107.5	46.3	27.0	24.2	57.4	16.2	70.3
24	101.4	83.0	39.9	121.0	40.7	123.5	85.1	114.5	48.5	27.1	25.0	64.7	27.2	74.0
24	99.1	78.9	37.2	126.6	36.4	130.1	82.2	118.2	53.8	28.1	25.6	59.4	21.5	72.1
24	96.1	82.4	35.7	128.3	40.0	128.1	81.6	115.5	55.4	28.9	24.9	56.5	15.5	74.4
24	100.6	82.6	31.8	121.1	37.5	129.3	86.4	114.2	50.4	29.0	26.6	66.0	21.4	76.1
24	94.1	78.3	30.2	121.8	36.5	128.7	80.3	120.6	46.2	25.3	21.2	58.2	17.3	68.4
24	104.5	77.7	32.2	121.7	39.0	120.1	84.1	108.0	49.2	28.2	25.7	59.3	17.6	72.7
24	103.0	85.6	34.8	132.2	35.7	131.8	86.2	124.2	54.1	28.0	24.5	64.0	21.0	73.3
24	101.9	79.9	38.5	128.9	38.9	129.8	84.2	113.6	55.9	32.1	24.3	59.8	17.0	72.1
24	94.7	76.3	34.6	122.5	37.0	129.3	92.7	117.4	51.1	29.3	26.2	56.4	18.6	71.3
24	97.8	76.6	31.8	123.4	37.7	126.8	78.2	111.7	52.4	22.8	23.4	53.2	17.4	68.4
24	101.0	81.9	44.4	133.0	42.5	131.5	79.5	117.4	63.2	24.4	25.8	60.6	19.6	74.4
24	105.4	82.6	37.4	125.9	37.2	128.1	84.2	119.4	48.0	29.2	25.7	55.8	17.6	73.7
24	105.5	77.4	37.2	124.3	35.7	126.5	80.4	114.7	53.1	24.9	27.0	58.5	19.3	69.0
24	105.6	75.8	36.8	121.5	37.4	127.0	80.6	111.4	52.3	25.6	26.8	56.1	18.6	71.8
24	100.2	77.9	37.3	132.0	37.6	133.0	81.8	118.4	52.9	28.3	24.0	56.0	17.9	74.4
24	99.0	73.3	33.1	124.6	37.7	123.5	80.7	111.5	51.8	24.1	28.5	52.0	18.6	71.6
24	108.2	79.8	37.8	131.6	34.4	130.0	74.5	117.7	56.1	23.0	22.3	56.3	22.1	68.9
24	107.8	78.4	32.5	122.8	33.0	137.9	88.1	121.5	49.2	27.9	24.9	55.6	24.8	71.0
24	111.2	77.2	39.4	128.2	36.3	129.1	81.5	117.5	54.1	27.4	24.3	60.4	20.4	75.3
24	105.2	80.0	35.6	127.9	36.0	129.9	82.4	120.5	50.1	27.6	25.5	53.9	23.9	67.7

Appendix A (continued)

	16	17	18	19	20	21	22	23	24	25	26	27	28	29
24	95.4	71.8	35.3	121.7	35.9	125.9	83.5	116.1	50.9	26.1	25.5	52.4	21.8	65.0
24	100.6	76.4	37.0	126.6	36.4	123.0	77.1	117.4	47.9	23.6	23.2	54.4	18.8	66.1
24	99.0	76.9	35.4	124.0	40.6	124.9	72.7	113.8	50.6	27.9	25.3	56.3	21.8	69.1
24	107.1	74.7	32.8	121.7	33.6	119.9	75.8	111.6	50.4	28.6	26.2	54.9	20.2	67.2
24	99.9	72.7	42.0	119.5	37.0	129.6	76.3	116.7	48.9	29.0	26.7	58.3	18.0	66.6
24	98.8	71.6	32.2	121.0	35.0	127.8	89.2	118.4	51.9	25.5	24.7	54.9	21.3	64.6
24	102.9	75.9	32.9	121.6	37.3	128.5	84.3	116.5	53.0	24.6	22.3	51.0	19.0	65.4
24	95.3	73.0	35.2	119.5	37.8	123.5	80.6	111.1	46.7	29.4	24.2	50.4	19.1	68.2
24	102.2	75.2	34.3	121.2	39.5	128.6	86.0	118.6	50.0	26.1	26.6	58.7	17.5	70.9
24	103.4	80.1	36.4	121.6	38.5	128.6	84.8	117.3	48.7	29.1	23.1	59.0	19.2	70.4
24	102.5	70.9	36.1	117.2	34.4	122.9	88.0	112.7	48.3	24.5	25.9	56.3	20.8	69.4
24	109.6	77.9	36.7	132.8	36.7	127.9	83.3	117.9	52.5	28.5	24.8	57.5	17.9	72.0
24	94.7	70.9	31.8	123.9	35.6	130.9	86.2	113.7	56.5	28.3	23.9	60.3	16.3	75.6
24	102.0	76.5	32.0	123.6	35.1	121.2	85.3	110.7	51.1	22.5	23.3	54.8	18.6	70.4
24	103.3	79.6	38.3	125.9	40.6	120.9	84.5	118.3	53.2	27.4	25.4	59.4	17.2	70.8
24	92.8	80.1	26.3	122.7	37.0	123.5	78.6	110.9	54.7	25.6	25.7	54.8	19.4	71.1
24	101.6	84.3	33.3	126.6	40.1	129.7	90.5	115.5	52.6	24.7	25.1	57.7	18.7	72.3
24	103.2	74.4	35.0	123.5	38.1	127.4	82.3	115.1	53.6	22.7	23.9	57.9	17.6	73.5
24	98.9	74.4	33.0	122.4	36.3	136.7	90.8	117.7	47.5	25.4	24.2	55.4	14.6	73.2
24	96.6	83.1	26.9	128.7	34.5	130.9	76.7	114.1	57.7	29.1	26.5	61.4	21.9	75.6
24	103.2	75.1	38.8	122.1	37.5	124.0	77.4	113.7	47.5	25.5	26.4	54.5	17.5	72.7
24	104.2	79.8	37.2	131.3	37.1	132.8	85.6	119.0	55.1	24.7	25.3	60.1	21.4	73.5
24	98.2	78.7	33.4	131.3	35.6	137.1	79.4	118.7	61.7	26.2	26.3	60.8	24.3	77.1
24	107.2	82.6	34.7	126.7	36.4	130.4	76.9	118.4	52.3	27.7	29.4	59.0	20.3	73.0
24	101.3	75.1	37.1	121.8	36.3	128.8	88.7	120.4	52.2	26.6	29.1	57.3	23.2	69.9
24	111.9	74.0	35.1	123.2	31.7	125.6	82.8	111.8	53.0	26.2	24.9	53.4	22.2	60.1
24	95.8	67.7	34.8	117.3	33.0	118.3	81.7	107.6	48.8	25.3	24.9	53.2	21.2	66.9
24	100.5	76.1	29.6	125.9	30.7	122.4	86.3	112.8	50.2	28.5	25.7	54.2	21.4	64.6
24	98.1	80.2	29.2	129.0	33.9	130.2	79.1	108.5	53.5	32.3	26.9	54.4	22.8	72.5
24	99.9	80.8	39.7	122.9	38.5	134.1	82.8	120.7	49.9	29.1	26.8	54.6	23.9	70.4
24	96.0	71.8	34.3	121.5	37.9	123.8	84.1	115.3	48.2	22.4	20.1	52.2	17.0	68.5
24	97.6	70.5	39.9	122.2	36.3	133.1	81.3	119.8	48.5	27.8	24.8	54.7	22.8	64.3
24	99.1	78.9	30.6	116.9	37.8	129.5	91.1	117.2	49.1	27.4	26.2	57.2	23.3	69.2
24	104.1	70.0	32.4	116.3	33.5	124.9	84.5	108.2	47.4	25.3	24.1	51.6	17.1	65.0
24	99.0	84.3	21.8	129.8	27.8	134.2	84.9	119.0	52.3	25.9	24.7	59.3	17.2	76.4
24	93.6	78.1	27.8	121.1	35.0	124.9	77.8	107.4	48.4	24.0	24.3	54.4	16.0	70.5
24	108.7	83.2	37.7	136.3	31.7	138.2	95.5	123.2	50.7	26.7	23.7	58.0	19.1	75.2
24	108.1	73.9	42.4	128.4	37.6	137.4	79.2	131.1	54.6	23.7	24.8	58.8	16.2	76.7
24	111.7	82.5	41.5	135.5	38.8	139.2	99.9	125.6	49.6	24.5	25.6	63.8	17.8	84.7
24	105.6	76.2	33.9	130.1	32.1	135.3	87.0	120.7	51.5	26.6	23.2	56.0	19.7	73.7
24	97.8	78.7	32.6	127.2	36.2	124.2	69.3	116.6	51.0	23.3	19.3	54.1	15.9	74.5
24	103.0	88.0	26.9	127.5	33.4	127.4	79.6	111.3	47.6	27.3	25.2	58.6	13.7	71.7
24	107.9	79.1	39.5	130.1	31.8	128.0	79.2	119.8	51.6	24.4	20.8	53.3	18.7	67.7
24	109.3	78.3	39.8	127.4	33.3	128.2	77.8	117.8	49.6	25.0	21.0	58.4	17.5	75.3
24	106.0	79.1	33.1	124.6	33.0	136.9	87.0	122.0	47.9	24.0	25.3	53.8	17.9	66.5
24	104.7	85.4	27.3	130.4	32.0	135.5	79.2	122.1	48.4	31.0	22.4	54.9	12.9	72.4
24	99.4	74.5	28.9	122.7	34.0	130.2	82.1	118.6	47.7	18.9	20.5	53.0	18.4	63.7
24	100.5	79.2	27.8	122.0	30.3	123.0	87.9	110.1	48.1	22.6	20.7	55.9	17.8	62.6
24	98.6	75.1	24.3	123.6	26.1	125.8	84.2	112.3	45.7	22.8	21.5	50.3	7.0	64.9
24	100.2	79.5	33.7	128.7	34.8	127.1	76.7	111.8	48.3	24.9	21.0	53.1	19.2	73.6
24	98.3	79.5	32.9	121.1	36.0	127.1	83.2	108.7	46.9	24.1	15.5	56.6	16.2	67.2
24	100.2	70.8	34.7	122.8	32.6	127.1	80.5	111.1	49.6	21.2	22.5	52.3	16.3	66.5
24	108.3	70.5	34.1	125.2	32.4	126.9	85.7	113.1	45.8	26.4	22.4	48.9	21.1	65.9
24	99.5	77.9	32.0	129.8	34.4	127.0	80.5	112.1	53.8	21.7	19.0	54.3	14.9	73.9
24	104.8	68.3	31.7	119.2	31.6	129.7	78.2	119.6	46.5	24.8	21.8	48.2	17.5	70.3
24	110.0	76.4	36.5	133.1	34.7	126.8	81.8	114.1	55.7	24.9	19.1	57.5	15.0	74.3
24	104.3	70.9	29.6	120.7	27.5	123.9	79.0	111.9	49.1	22.1	20.3	54.7	20.9	61.6
24	94.0	79.6	33.4	129.8	33.0	126.5	71.6	116.0	54.6	23.5	18.9	53.7	17.2	72.5
24	96.2	71.1	30.1	126.6	32.2	132.6	80.0	121.2	52.5	22.0	23.6	54.3	19.2	69.9
24	102.3	73.2	30.7	125.1	31.6	130.2	77.9	122.9	49.8	24.5	20.6	52.8	18.7	72.6
24	102.5	80.9	39.1	135.4	33.6	137.9	84.9	122.5	53.0	24.4	21.7	57.2	19.8	75.1
24	113.1	82.7	36.4	136.0	33.2	131.6	82.0	123.8	52.4	27.1	27.4	66.3	20.5	76.3
24	107.5	78.5	39.6	131.3	40.8	128.4	82.7	117.9	54.9	27.0	24.6	59.5	19.0	75.7
24	106.3	75.0	30.9	125.6	34.0	128.8	86.2	119.9	47.8	26.9	25.9	60.8	16.3	73.9
24	105.5	75.4	32.1	126.1	35.7	129.3	72.6	120.8	50.2	23.2	25.7	53.1	15.7	74.1
24	98.4	80.5	27.5	127.9	31.4	125.8	86.6	113.8	51.5	23.6	22.1	59.0	19.7	73.9
24	109.0	79.4	34.1	125.9	31.5	129.5	78.2	120.4	49.6	25.0	23.8	58.5	20.1	75.6
24	101.2	78.8	32.6	127.2	34.9	130.2	85.3	116.1	49.8	26.7	21.0	56.4	15.0	70.5
24	102.4	73.2	29.8	124.9	36.0	124.2	84.7	109.0	48.9	23.7	25.7	53.8	18.6	69.6
24	102.6	74.4	33.1	120.7	38.2	126.7	82.7	112.3	47.7	24.6	22.2	55.8	15.6	68.5
24	103.5	82.8	36.6	134.4	37.6	126.2	74.7	116.5	54.6	26.5	26.0	55.0	17.6	79.4

Appendix A (continued)

	16	17	18	19	20	21	22	23	24	25	26	27	28	29
24	104.0	82.7	35.2	131.9	33.8	129.8	84.3	121.8	49.8	25.2	22.9	58.0	18.2	71.2
24	105.7	82.0	38.9	135.2	34.3	132.0	84.9	110.7	53.7	25.7	24.0	56.5	15.2	75.7
24	96.4	81.2	31.0	124.6	35.7	129.6	73.5	108.8	47.8	27.4	23.4	54.8	14.9	72.5
24	108.7	76.3	40.5	130.6	40.5	125.4	88.3	112.1	50.5	27.6	20.4	55.8	20.7	69.6
24	97.2	81.9	33.9	126.8	36.9	130.9	73.1	119.4	50.8	21.1	18.1	55.5	18.6	74.7
24	100.3	81.2	36.6	128.7	33.9	134.2	75.4	120.7	53.8	22.0	19.3	57.5	12.6	66.8
24	107.0	79.0	31.0	121.4	33.5	128.8	84.0	118.6	47.8	24.7	21.8	57.3	11.7	68.4
24	114.1	75.8	43.7	125.4	36.8	126.6	78.5	111.4	49.0	23.0	21.5	53.0	19.0	68.7
24	103.4	85.0	38.5	125.9	40.5	132.6	84.9	123.8	46.0	26.6	18.2	57.1	15.3	73.1
24	98.8	72.1	31.2	122.5	30.1	122.2	75.9	115.7	46.0	21.5	22.6	52.9	16.4	65.3
24	105.5	78.3	40.9	127.6	34.0	135.0	80.4	127.8	47.9	26.9	22.8	55.0	17.0	66.9
24	99.2	76.6	29.5	128.3	31.4	136.3	87.3	120.7	51.6	24.7	25.3	54.2	16.6	75.1
24	113.7	79.7	43.8	130.3	37.4	128.7	76.7	117.8	51.4	24.4	22.6	51.2	18.8	72.8
24	105.8	77.2	32.1	129.3	35.2	126.0	82.1	114.6	54.2	23.0	22.6	56.4	16.4	71.1
24	104.2	71.1	33.2	125.4	27.2	129.5	73.8	117.4	54.5	22.2	21.7	55.2	19.5	66.4
24	97.9	75.3	35.2	123.7	33.8	129.5	88.0	115.3	48.0	28.6	20.5	58.6	18.3	75.3
24	103.3	79.3	35.8	131.3	32.9	127.3	83.0	112.9	54.0	24.0	20.8	55.5	16.8	71.8
24	106.3	67.3	38.4	123.7	33.3	135.5	73.8	121.1	54.7	27.1	21.5	50.3	16.8	69.0
24	91.9	76.2	32.1	129.1	31.8	132.3	86.0	120.0	52.7	24.1	22.9	58.3	19.6	76.3
24	102.2	72.8	38.8	124.0	33.5	126.4	73.8	116.4	49.6	25.8	20.2	55.3	16.7	69.5
24	106.9	76.3	35.4	126.1	34.6	132.3	86.7	122.1	53.3	29.4	23.9	51.3	18.6	66.3
24	98.8	71.8	28.7	125.7	32.2	124.9	73.6	116.0	52.5	24.9	20.9	50.9	14.7	66.7
24	105.1	76.3	34.2	124.9	36.1	134.4	78.7	119.7	50.2	25.1	24.2	55.7	18.7	73.4
24	106.3	78.1	35.3	122.7	31.4	127.4	85.9	118.8	47.2	30.4	23.2	52.8	17.0	71.5
24	99.2	73.2	30.4	129.2	32.5	127.3	84.5	117.1	54.8	25.3	21.8	56.3	17.0	69.7
24	100.9	75.8	35.6	123.2	35.4	129.4	74.1	122.0	49.0	24.5	22.1	55.5	15.8	70.4
24	107.2	83.1	36.4	135.7	36.3	131.6	84.4	117.8	47.3	25.3	26.4	59.6	16.8	77.6
24	94.6	78.1	39.1	125.0	35.4	128.4	76.6	114.0	48.0	20.8	19.6	56.2	16.4	67.1
24	112.3	83.9	48.3	136.8	42.5	132.1	85.6	115.3	57.8	26.4	25.0	59.8	16.1	78.4
24	103.9	80.6	36.7	125.6	36.3	129.9	87.5	120.6	47.3	22.5	21.6	57.7	20.4	75.1
24	102.5	74.4	31.4	118.1	35.9	124.6	76.7	106.6	46.3	19.8	22.2	51.5	15.3	62.2
24	102.1	81.0	36.5	129.1	37.6	129.5	78.0	118.3	51.5	26.2	23.1	53.7	15.0	70.8
24	113.1	83.4	42.0	141.9	38.6	133.2	86.3	120.4	57.9	27.6	26.9	63.5	15.2	77.3
24	108.8	69.4	41.5	125.1	34.2	132.7	75.1	115.4	51.5	20.6	23.1	53.8	19.1	76.6
24	95.0	77.0	29.9	126.1	33.8	129.8	77.1	116.4	49.9	23.3	17.8	51.0	14.6	64.9
24	105.6	79.3	34.3	126.6	34.4	124.6	80.9	110.9	49.3	20.8	22.2	52.8	13.7	68.2
24	111.6	78.6	38.7	124.1	35.0	132.2	75.9	116.7	49.8	25.0	21.5	53.2	17.3	71.2
24	106.7	78.7	39.3	129.5	36.0	126.5	79.8	117.5	51.3	24.2	18.1	58.0	14.3	68.5
24	101.0	77.6	30.5	133.9	34.8	130.8	74.1	123.2	53.8	20.4	21.1	54.9	15.3	71.3
24	105.5	77.6	35.3	127.6	32.7	129.6	76.6	122.2	50.5	25.8	19.3	51.9	15.1	68.2
24	100.4	77.0	33.6	118.3	33.2	123.3	81.3	107.1	46.7	20.8	21.7	50.3	16.0	67.7
24	102.0	74.1	33.7	123.9	35.5	129.8	88.9	118.7	45.6	20.2	21.8	54.5	16.9	68.2
24	100.7	79.0	34.5	132.5	33.4	125.8	76.0	129.3	53.4	23.1	21.2	59.2	18.3	72.9
24	99.6	73.7	33.6	118.3	26.1	128.9	83.1	112.6	46.7	21.3	22.9	53.3	18.2	65.1
24	105.8	72.8	43.3	125.2	36.5	130.0	86.6	120.3	53.3	25.0	20.2	53.8	15.2	73.9
24	104.7	77.6	35.9	121.6	35.4	130.6	87.9	116.0	46.0	22.3	24.6	55.2	16.9	73.1
24	101.4	73.4	31.3	124.1	34.3	126.1	78.4	120.5	48.8	28.8	20.4	55.7	14.4	75.7
24	96.7	75.7	30.5	126.7	30.8	130.5	79.7	117.1	53.2	21.2	19.6	55.7	19.3	73.2
24	103.5	72.9	34.6	125.0	31.7	131.4	88.0	118.7	48.0	29.0	21.3	59.6	17.0	74.7
24	98.4	76.4	32.3	123.4	36.6	131.3	76.8	120.1	50.7	28.2	23.5	57.3	15.8	73.7
25	93.4	80.0	30.0	122.1	35.6	123.3	92.7	113.0	47.5	29.6	24.4	59.1	17.0	69.8
25	101.5	79.7	29.2	125.9	33.8	124.2	86.8	112.0	50.9	31.7	25.7	59.3	19.5	69.6
25	102.1	78.2	33.2	128.9	37.3	119.4	85.6	111.9	53.2	25.1	28.6	56.9	20.0	69.8
25	102.6	76.7	37.1	128.8	36.7	130.4	80.7	120.5	54.0	29.4	26.4	54.5	21.6	73.5
25	100.9	73.3	33.1	120.6	34.2	124.4	83.9	110.6	52.0	27.4	30.4	58.7	23.3	73.2
25	108.5	75.8	33.0	120.5	32.9	124.1	88.3	114.7	51.8	28.2	24.9	56.5	18.4	70.9
25	105.6	76.5	38.3	125.4	35.8	121.7	90.1	113.0	53.7	29.0	27.9	58.8	20.0	68.7
25	100.5	83.4	30.9	131.8	38.8	123.1	85.2	110.7	55.1	28.6	27.9	56.4	23.7	72.7
25	105.2	74.6	35.8	123.2	40.6	118.9	81.9	111.8	50.8	26.9	33.1	52.2	22.7	63.6
25	108.5	79.2	36.9	123.4	33.5	124.0	91.9	113.5	51.1	28.1	26.9	60.1	22.5	71.8
25	103.9	76.2	34.3	113.8	38.3	119.2	80.9	114.1	50.4	28.5	25.4	56.7	22.5	68.0
25	99.1	74.5	40.3	118.0	38.3	124.4	98.2	116.5	42.8	27.0	26.9	51.0	23.3	68.8
25	100.2	80.2	32.8	122.3	38.3	126.8	85.7	118.9	51.0	25.4	26.4	56.8	23.1	69.7
25	96.7	74.4	34.5	116.4	39.0	122.5	88.3	116.4	53.3	24.3	28.1	50.3	25.1	67.1
25	107.6	80.0	39.3	130.8	39.1	124.8	83.5	116.8	53.5	32.0	26.3	60.9	20.1	74.4
25	110.4	81.8	41.1	128.8	33.0	122.9	83.8	116.9	52.3	28.3	21.7	57.9	25.1	65.3
25	109.1	71.3	38.4	121.5	34.8	121.6	87.4	115.5	50.2	25.5	25.1	51.2	18.6	68.6
25	106.1	77.5	38.2	127.6	37.5	127.1	83.3	116.2	48.8	24.8	22.0	55.1	20.3	67.5
25	95.8	74.4	33.1	132.2	33.3	129.5	85.8	117.5	50.8	28.3	26.0	59.7	17.0	73.3
25	98.0	79.3	34.0	128.1	34.5	128.0	82.7	125.2	49.7	27.3	24.2	54.1	19.6	67.9
25	108.6	77.0	37.6	128.5	35.8	129.6	88.0	119.0	53.0	28.8	26.5	57.6	19.9	71.1

Appendix A (continued)

	16	17	18	19	20	21	22	23	24	25	26	27	28	29
25	115.5	77.7	42.5	133.7	35.7	126.0	89.6	119.5	55.7	29.1	24.6	59.2	19.4	73.1
25	102.6	70.1	33.0	124.6	30.1	125.8	86.4	114.9	50.2	24.2	26.7	51.8	17.8	63.6
25	111.5	79.0	37.7	130.4	31.0	123.8	83.8	110.7	49.7	28.3	26.0	57.1	22.3	74.5
25	94.9	74.5	42.9	129.2	35.9	129.3	85.4	121.4	54.0	24.6	23.8	54.2	15.8	70.6
25	95.1	76.3	31.4	121.0	30.5	121.4	84.3	104.4	48.3	21.0	22.9	49.7	21.6	66.6
25	104.6	79.8	37.8	131.2	38.2	133.6	86.7	123.9	53.8	28.8	25.7	58.8	19.1	77.8
25	99.1	79.1	36.1	129.4	34.5	119.4	84.1	116.2	56.2	24.8	23.2	56.1	17.9	72.9
25	99.7	78.3	33.0	127.4	34.3	130.4	95.9	117.7	49.9	26.4	25.4	53.1	17.6	66.8
25	97.8	78.6	37.2	126.7	33.8	125.0	84.2	112.6	54.3	22.0	24.1	55.0	20.5	67.7
25	107.2	81.4	41.3	126.0	33.4	119.7	85.1	107.4	47.3	24.3	26.3	54.4	23.5	68.6
26	104.4	78.9	37.3	125.1	37.7	128.9	84.0	119.1	49.6	29.1	29.6	62.2	19.8	73.3
26	104.1	81.2	33.6	118.4	39.1	123.2	90.1	114.4	53.7	24.5	29.8	52.8	21.5	67.3
26	92.9	80.7	32.8	123.6	44.2	131.0	91.6	116.9	50.6	28.3	22.0	58.5	15.6	71.8
26	106.3	79.4	33.2	133.9	36.6	124.8	77.8	115.6	61.4	32.2	24.9	58.5	22.0	76.3
26	100.9	69.5	32.5	129.6	35.7	129.7	85.8	116.2	57.8	27.0	33.7	59.5	21.6	72.4
26	99.7	76.5	31.6	121.6	38.7	117.8	89.5	95.3	49.6	28.5	29.8	60.4	17.3	72.6
26	101.4	79.7	36.1	123.9	38.8	131.1	92.1	122.0	52.0	31.3	29.9	57.3	20.8	71.7
26	106.1	77.5	33.6	128.3	36.5	126.7	84.4	119.0	49.8	30.6	27.3	62.4	20.5	71.6
26	96.8	77.7	30.7	116.4	35.3	121.4	87.6	115.9	45.1	28.2	24.4	59.7	21.8	70.3
26	102.6	74.7	27.9	120.5	34.1	124.5	87.4	116.1	49.2	28.2	31.1	58.2	24.8	66.0
26	91.1	74.1	28.9	121.6	30.8	126.4	84.9	112.6	55.2	27.9	24.1	55.5	22.8	67.9
26	108.4	83.1	37.8	133.1	41.8	128.7	91.4	108.0	60.7	27.7	27.0	60.5	24.0	73.3
26	102.2	76.7	36.1	122.7	36.3	116.7	79.3	112.7	48.7	29.4	25.5	54.0	18.5	69.4
26	98.2	79.3	40.8	121.5	33.8	114.6	76.4	107.7	48.5	24.6	29.2	54.1	22.8	70.0
26	105.6	80.6	38.2	126.3	38.4	123.6	75.7	114.5	52.5	28.7	26.7	58.7	21.6	75.9
26	100.9	74.3	41.8	124.9	36.5	124.4	84.8	115.4	54.4	31.2	24.6	60.1	18.9	72.7
26	105.5	79.5	38.1	126.7	35.9	126.0	85.7	111.8	52.4	32.1	27.8	57.3	25.2	77.0
26	102.4	79.7	38.1	119.3	33.5	117.9	87.8	111.0	47.6	31.3	26.8	53.7	22.7	66.9
26	103.0	76.8	39.7	125.4	35.3	120.5	88.3	108.7	50.2	25.0	24.7	55.5	22.9	67.9
26	100.5	74.6	35.8	121.2	36.7	121.5	89.4	104.7	49.9	26.1	26.9	52.5	19.9	69.3
26	99.5	84.0	38.7	121.6	38.9	116.6	88.0	115.9	49.5	27.3	28.1	52.0	23.6	72.6
26	97.6	71.9	31.2	122.0	37.0	114.8	86.5	104.7	49.1	28.4	24.4	50.8	18.6	69.6
26	104.7	73.4	39.2	121.3	40.1	119.6	84.7	116.5	48.3	30.2	26.4	53.6	20.7	72.7
26	99.9	78.9	35.1	127.7	41.4	120.7	84.9	110.8	51.3	28.6	26.0	53.8	19.0	67.3
26	104.3	77.6	38.7	124.5	36.3	128.7	86.6	114.6	48.2	25.8	24.8	55.1	18.9	70.1
26	105.1	79.7	35.5	124.3	37.0	124.6	88.4	111.9	53.1	26.7	24.7	57.0	22.7	69.5
26	94.9	79.4	34.9	124.4	36.6	127.8	93.5	110.5	54.4	27.7	26.3	56.7	19.8	64.4
26	105.4	78.1	28.8	128.3	31.5	125.0	85.9	113.7	51.8	25.9	26.5	60.4	19.7	70.8
26	98.5	74.0	29.0	122.2	28.9	128.5	97.4	112.3	49.4	25.0	23.4	58.9	18.2	67.2
26	103.7	75.8	34.2	120.6	35.3	125.7	99.3	113.4	49.0	24.8	23.8	54.5	23.0	72.3
26	107.7	76.1	34.2	119.2	29.2	124.0	95.0	118.4	48.1	22.8	24.8	55.7	17.8	66.8
26	99.1	77.4	32.3	117.9	33.5	118.8	90.7	111.9	47.2	27.0	24.5	59.3	20.7	65.0
26	103.5	80.1	34.2	126.8	33.4	123.6	81.7	113.5	47.1	21.4	22.8	55.9	17.2	66.4
26	103.9	82.3	39.2	132.3	35.9	137.2	88.6	116.5	53.5	24.2	22.7	55.1	19.3	70.1
26	99.2	76.7	41.6	124.6	34.8	126.8	99.9	114.1	46.5	25.4	23.4	54.8	19.8	67.7
26	105.5	78.1	39.1	133.1	35.3	130.6	86.2	116.7	49.9	21.1	27.3	57.0	17.8	69.2
26	113.9	80.8	32.1	125.2	34.7	130.3	82.0	119.9	51.6	30.1	21.6	56.0	22.3	70.7
26	99.7	76.7	30.2	124.9	34.5	126.6	86.2	114.1	49.5	25.8	22.4	54.7	21.9	75.1
26	97.2	71.7	37.4	119.2	30.6	122.7	83.2	115.6	47.7	24.3	21.7	55.1	14.0	65.8
26	93.2	73.5	31.8	119.0	32.4	124.3	90.1	109.7	46.7	26.5	20.6	46.9	12.6	62.0
26	108.0	81.2	39.5	133.4	33.9	125.3	84.1	117.4	53.2	29.3	23.9	57.9	17.0	69.0
26	94.5	78.3	33.8	124.0	34.7	121.3	78.6	114.4	44.7	28.3	23.4	55.3	18.2	71.5
26	114.1	86.3	43.8	136.2	37.8	128.7	88.5	122.4	52.9	27.3	25.8	59.2	21.0	68.2
26	111.3	77.5	40.7	125.2	37.4	127.0	96.8	121.2	50.0	29.9	22.9	58.0	22.9	68.8
26	99.3	73.3	39.3	125.0	35.9	120.8	87.0	122.3	53.2	28.6	22.5	55.1	20.4	70.2
26	102.2	78.1	38.0	124.9	34.5	129.8	89.3	123.4	53.3	27.9	22.0	52.2	17.9	71.5
26	111.2	79.5	39.0	127.2	36.3	127.3	91.1	115.5	52.3	32.2	24.0	52.7	17.7	74.2
26	99.8	74.2	45.3	126.9	39.7	117.8	87.1	113.0	54.6	30.0	24.8	55.4	14.6	63.8
26	103.7	73.4	35.5	119.0	34.4	124.2	82.6	114.2	50.4	24.8	23.5	54.0	18.8	61.1
26	103.3	74.6	28.7	124.8	33.7	125.0	90.6	122.7	49.9	24.9	23.8	54.2	24.9	64.7
26	102.1	78.5	35.4	122.8	32.5	118.7	88.9	115.9	49.4	30.1	25.1	53.6	21.5	68.6
26	105.4	76.3	43.7	129.1	35.2	126.8	91.1	125.1	54.7	28.4	27.6	58.2	21.1	70.9
26	109.6	82.7	37.0	133.6	31.0	123.2	87.2	121.8	51.3	28.9	25.2	62.5	18.4	69.7
26	100.7	76.6	28.5	125.0	33.0	126.0	89.4	114.4	51.6	28.5	24.5	56.7	18.1	70.5
26	98.5	81.0	35.0	126.6	34.4	130.1	88.7	116.3	56.0	28.5	25.4	58.6	18.7	68.4
27	101.7	72.6	32.8	127.5	33.5	126.7	76.9	113.8	57.0	25.1	26.0	56.0	19.8	69.0
27	106.1	87.3	35.6	127.0	36.7	133.8	84.8	123.0	49.8	26.7	30.0	57.6	20.8	73.4
27	102.6	81.1	34.9	127.0	35.4	126.8	83.4	117.8	51.3	28.4	22.4	57.6	18.4	75.3
27	99.7	80.3	29.6	121.5	35.7	131.8	95.9	118.8	44.8	26.9	28.7	56.0	18.4	70.0
27	108.6	78.1	39.1	123.5	34.3	123.6	86.0	114.2	51.7	32.0	24.4	60.1	20.3	73.6
27	106.6	75.5	30.7	121.7	36.4	124.6	74.7	112.4	50.5	24.4	24.1	58.2	18.7	67.9

Appendix A (continued)

	16	17	18	19	20	21	22	23	24	25	26	27	28	29
27	102.1	76.1	33.7	125.0	36.0	128.6	79.7	118.5	53.1	23.1	23.9	54.4	19.9	66.1
27	99.8	81.3	37.3	129.7	36.6	121.7	74.5	110.3	56.8	28.4	23.3	61.6	18.6	74.0
27	102.6	75.9	32.4	126.8	34.6	125.2	94.6	111.5	52.0	26.5	22.9	62.2	19.4	70.9
27	107.8	79.1	39.9	130.8	35.9	129.5	77.6	123.3	55.1	32.6	21.8	62.3	20.4	77.7
27	105.4	77.6	36.0	122.7	37.8	126.9	84.0	113.5	49.6	27.3	23.3	61.2	17.0	70.2
27	106.1	82.8	34.7	130.1	38.7	127.3	83.9	116.3	52.2	28.2	25.3	65.6	18.4	73.5
27	95.5	78.9	34.4	120.8	34.5	132.6	90.8	124.8	47.8	27.1	22.2	55.9	19.6	63.0
27	98.5	78.3	31.4	123.3	34.7	119.8	91.8	107.5	49.7	27.0	26.0	58.4	18.8	69.8
27	99.4	74.8	31.0	120.4	35.3	119.6	81.3	109.5	49.5	25.6	24.9	60.2	19.0	64.9
27	104.0	84.8	31.0	125.2	39.3	127.5	92.1	116.7	51.9	25.1	24.7	56.9	20.7	69.2
27	105.5	74.7	33.1	119.6	36.1	133.2	91.0	119.5	47.7	30.5	23.1	58.3	23.5	67.6
27	99.2	85.7	33.5	125.1	39.9	125.9	88.9	115.4	47.5	29.8	24.2	60.6	23.4	69.9
27	107.0	76.5	38.1	123.0	34.4	130.7	80.7	120.8	46.5	23.2	22.9	58.5	20.5	71.4
27	106.9	74.6	31.1	123.3	33.6	132.0	85.0	121.8	48.7	23.9	21.0	58.3	18.6	72.3
27	104.7	75.7	39.8	126.7	34.1	130.6	83.1	118.9	48.8	24.5	23.3	55.6	16.2	73.2
27	107.7	80.4	37.0	123.9	32.3	125.7	94.2	115.7	46.5	24.3	22.4	55.7	22.0	63.0
27	110.8	80.8	33.0	123.4	30.1	126.9	73.8	116.2	47.3	26.0	21.8	57.3	17.3	70.7
27	103.0	74.0	32.9	128.5	32.7	129.3	83.1	118.3	50.3	21.8	23.5	55.1	20.3	66.4
27	103.3	79.6	33.6	127.3	31.6	127.7	76.6	120.7	47.7	27.3	25.7	54.1	20.8	73.7
27	112.9	77.4	36.0	130.9	33.8	131.1	78.0	120.2	56.4	25.6	23.1	57.5	18.6	75.0
27	103.9	80.0	29.3	124.4	34.3	129.8	89.6	121.5	42.4	25.3	25.2	55.4	18.4	70.9
27	111.4	74.3	30.7	124.2	30.2	129.3	84.1	115.0	46.7	21.0	20.2	55.6	16.8	71.9
27	106.7	83.3	27.0	134.2	33.8	125.1	79.0	113.0	56.5	23.9	21.8	59.5	17.2	71.6
27	114.7	79.7	44.8	127.1	36.2	134.2	78.1	118.2	50.6	25.4	23.2	61.6	19.4	75.4
27	100.6	80.6	32.5	128.3	33.6	123.3	81.3	116.9	50.6	26.3	24.2	56.8	17.7	73.2
27	106.4	80.0	27.4	124.5	31.8	132.0	83.7	119.9	53.2	21.7	25.7	56.2	17.0	71.7
27	114.4	84.6	33.9	131.1	32.3	129.9	79.2	120.1	51.0	29.4	26.5	59.7	18.8	74.0
27	99.3	76.9	33.9	120.3	36.3	131.0	86.9	113.4	46.5	23.8	23.9	54.9	18.0	71.1

Appendix B: Inter-trait Correlation Matrix for all measurements using all samples. The rows and columns are numbered with traits 1-29 taken from Table 4.5 (also appendix A).

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	1														
2	0.19	1													
3	0.11	0.21	1												
4	0.14	0.09	0.04	1											
5	0.09	0.15	0.15	-0.06	1										
6	0.13	0.11	0.04	0.21	0.15	1									
7	0.18	0.12	0.15	0.14	0.10	0.18	1								
8	0.55	0.13	0.15	0.10	0.07	0.14	0.09	1							
9	0.20	0.15	0.09	0.33	0.59	0.52	0.31	0.10	1						
10	0.71	0.29	0.03	0.11	0.07	0.16	0.23	0.33	0.34	1					
11	0.08	0.27	0.13	0.28	0.42	0.48	0.25	0.01	0.41	0.15	1				
12	0.33	0.13	0.03	0.12	0.09	0.16	0.30	0.31	0.23	0.37	0.16	1			
13	0.19	0.12	0.05	0.08	0.05	0.15	0.22	0.09	0.21	0.27	0.19	0.21	1		
14	0.05	-0.05	-0.08	0.04	-0.03	0.12	0.30	-0.09	0.23	0.23	0.21	0.24	0.46	1	
15	0.09	0.02	0.04	0.19	-0.05	0.11	0.18	0.08	0.19	0.19	-0.06	0.19	0.20	0.30	1
16	0.21	0.04	-0.08	0.06	0.01	0.21	0.30	0.10	0.26	0.33	0.19	0.41	0.43	0.52	0.20
17	0.35	0.23	0.09	0.16	0.12	0.21	0.24	0.11	0.37	0.57	0.21	0.21	0.28	0.26	0.10
18	0.15	-0.03	0.02	0.02	0.00	0.13	0.27	0.17	0.18	0.14	0.08	0.26	0.18	0.29	0.13
19	0.16	0.09	0.09	0.21	0.26	0.32	0.36	-0.01	0.59	0.37	0.33	0.23	0.18	0.41	0.10
20	0.15	0.21	0.25	0.08	0.06	0.06	0.17	0.20	0.02	0.04	0.03	0.02	0.25	-0.03	0.06
21	0.15	0.13	0.11	0.28	0.40	0.55	0.23	0.06	0.46	0.24	0.70	0.20	0.21	0.30	0.17
22	0.13	0.05	0.09	0.60	-0.10	0.15	0.13	0.12	0.27	0.13	0.01	0.14	0.12	0.07	0.52
23	0.13	0.05	0.03	0.20	0.17	0.79	0.29	0.09	0.48	0.19	0.52	0.18	0.29	0.27	0.20
24	0.12	0.15	0.20	0.20	0.13	0.14	0.16	0.08	0.26	0.15	0.10	0.11	0.10	0.12	0.05
25	0.07	-0.07	0.16	0.05	-0.03	0.07	0.18	0.19	0.01	0.17	-0.12	0.13	0.10	-0.04	0.11
26	0.22	0.22	0.14	0.08	-0.01	0.05	0.08	0.20	-0.06	0.13	-0.11	0.16	0.19	-0.07	0.13
27	0.50	0.24	0.15	0.14	0.08	0.18	0.27	0.23	0.27	0.56	0.17	0.31	0.26	0.13	0.11
28	0.21	0.22	0.11	0.03	-0.04	0.03	0.01	0.22	-0.07	0.11	-0.13	0.13	0.28	-0.09	0.12
29	0.25	0.02	0.16	0.13	0.17	0.17	0.44	0.06	0.38	0.40	0.35	0.19	0.27	0.24	0.05

	16	17	18	19	20	21	22	23	24	25	26	27	28
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													
16	1												
17	0.23	1											
18	0.46	0.08	1										
19	0.32	0.51	0.21	1									
20	-0.07	0.14	0.27	0.01	1								
21	0.24	0.26	0.10	0.43	0.00	1							
22	0.09	0.10	0.05	0.01	0.08	0.19	1						
23	0.26	0.27	0.18	0.39	-0.03	0.66	0.20	1					
24	0.11	0.10	0.10	0.52	0.16	0.18	-0.13	0.12	1				
25	0.07	0.16	0.07	0.01	0.22	-0.04	0.13	0.07	0.12	1			
26	0.12	0.11	-0.05	-0.09	0.26	-0.01	0.17	-0.01	0.09	0.33	1		
27	0.26	0.47	0.15	0.30	0.17	0.21	0.13	0.20	0.15	0.23	0.21	1	
28	0.11	0.05	0.06	-0.15	0.20	-0.02	0.12	0.00	0.10	0.24	0.47	0.20	1
29	0.23	0.41	0.13	0.45	0.12	0.30	0.04	0.20	0.18	0.23	0.08	0.44	0.04

Appendix C: Trait means and SD for all samples. Traits (column 1) listed from Table 4.5, Samples along top row numbered according to list in Table 4.1.

	M1	SD1	M2	SD2	M3	SD3	M4	SD4	M5	SD5	M6	SD6	M7	SD7	M8	SD8	M9	SD9
1	47.6	3.9	48.2	3.8	50.1	3.5	47.7	3.5	48.6	3.8	51.1	3.4	48.3	3.6	50.6	3.6	49.4	5.6
2	30.8	2.2	30.8	2.9	31.4	2.8	31.3	2.8	31.4	2.9	30.9	3.1	32.2	2.4	34.0	3.4	31.5	3.0
3	37.1	2.6	35.8	2.8	36.5	2.6	36.7	3.3	36.5	3.2	35.9	2.8	37.6	2.8	38.2	2.7	36.4	3.3
4	94.6	5.7	94.2	5.0	96.0	6.7	95.0	5.7	96.1	5.7	96.1	5.8	95.0	4.2	97.2	5.2	93.8	5.2
5	107.0	5.4	105.0	6.3	108.6	5.4	107.5	4.8	108.5	6.1	103.2	6.4	110.5	6.4	109.5	6.2	107.4	5.3
6	109.8	3.4	108.7	4.5	111.4	4.7	110.2	4.7	110.6	4.0	110.3	4.1	108.9	4.8	111.4	4.3	110.4	5.1
7	53.5	2.9	53.6	2.9	53.4	2.8	54.6	2.9	53.9	3.4	52.8	2.8	52.9	3.3	55.6	3.1	53.9	2.9
8	17.5	4.4	19.0	3.8	20.7	3.6	17.9	3.6	19.6	4.0	20.8	2.9	18.2	3.0	20.1	3.8	19.7	4.3
9	170.6	4.0	167.5	5.5	171.0	5.7	171.8	4.9	172.3	4.9	171.0	4.9	172.3	5.0	177.4	5.3	170.3	6.2
10	95.5	5.0	94.7	4.4	96.8	3.9	95.9	4.4	94.2	5.4	99.7	6.3	94.3	4.1	99.9	5.4	97.0	6.1
11	132.2	4.0	131.5	4.8	134.0	5.9	134.0	4.3	131.8	4.9	127.2	5.1	133.6	4.3	133.9	5.1	132.1	4.4
12	61.6	4.1	61.3	3.9	63.8	3.7	62.3	3.6	63.9	4.7	63.2	3.7	61.8	4.4	62.9	4.7	63.1	4.0
13	98.6	3.4	97.0	3.6	97.6	3.2	97.7	3.3	97.9	3.9	98.3	3.3	96.4	3.8	98.9	4.1	99.1	3.1
14	135.2	4.8	132.3	5.7	131.7	5.6	137.8	4.4	134.4	6.3	138.9	6.0	134.9	6.1	136.6	6.0	135.8	6.4
15	108.6	4.2	108.4	4.7	107.8	3.7	110.9	4.3	108.5	4.8	113.7	4.6	106.9	4.8	110.7	4.4	109.6	3.9
16	101.4	4.5	100.1	5.1	98.2	4.6	104.5	4.1	100.5	5.2	100.4	5.5	97.7	5.5	102.1	5.3	101.9	4.0
17	75.8	3.2	73.4	4.2	73.7	3.5	75.4	3.3	75.1	3.6	77.3	3.8	74.6	3.2	77.4	4.3	76.4	2.9
18	34.0	4.1	32.7	3.5	32.8	3.6	35.4	4.0	34.3	4.3	33.5	3.7	33.1	4.0	36.4	4.3	33.7	4.2
19	122.1	3.4	119.9	4.5	119.3	4.8	123.4	4.0	123.5	4.9	124.4	4.6	123.4	4.7	126.2	5.1	122.9	5.1
20	34.3	2.0	34.3	3.1	34.7	2.7	34.0	2.9	34.4	2.4	35.1	2.7	34.9	2.9	36.5	2.9	34.7	3.1
21	124.9	3.5	124.3	6.0	125.1	4.6	126.1	3.4	125.1	4.4	124.8	4.7	124.6	4.4	125.8	4.2	124.3	4.4
22	83.2	5.0	81.7	5.2	82.2	5.1	83.4	6.0	83.5	5.8	85.2	5.8	80.7	4.2	82.7	5.2	81.4	5.6
23	115.7	3.1	113.2	4.7	116.0	4.7	115.5	4.8	116.0	4.5	114.9	4.3	113.1	3.7	115.1	5.1	115.1	4.3
24	49.2	2.2	50.0	2.6	50.2	2.3	49.9	3.0	49.3	3.9	51.4	3.3	50.5	2.6	53.6	3.4	51.2	3.4
25	28.0	2.9	27.1	2.7	27.6	2.1	26.4	3.0	25.9	2.6	27.1	2.4	25.3	3.4	26.1	3.1	27.8	3.1
26	23.9	3.0	24.6	2.5	25.0	1.9	22.9	2.2	24.6	2.2	24.6	2.6	22.5	2.7	23.1	2.7	24.3	2.2
27	55.2	3.3	52.4	3.2	55.6	3.0	52.9	2.9	54.5	3.4	55.5	2.7	53.1	2.5	55.7	3.5	55.0	4.0
28	19.7	2.2	20.5	2.4	21.3	2.7	19.2	2.6	19.5	2.7	19.9	2.7	17.9	2.5	19.2	3.0	20.7	2.8
29	69.2	3.7	69.4	3.1	69.0	3.1	69.8	3.2	69.1	3.0	67.2	3.7	69.2	3.3	71.5	3.6	69.3	3.6

	M10	SD10	M11	SD11	M12	SD12	M13	SD13	M14	SD14	M15	SD15	M16	SD16	M17	SD17
1	49.5	3.3	51.7	4.2	49.5	3.8	51.0	4.1	50.5	3.8	49.7	4.5	49.5	5.1	49.4	3.6
2	31.0	2.5	32.9	2.8	32.3	3.3	33.0	2.9	32.6	3.4	33.0	3.0	33.0	3.1	32.9	2.7
3	36.5	2.4	37.7	2.9	39.0	2.9	38.0	2.8	37.2	2.8	36.8	2.9	37.5	3.0	37.5	2.2
4	96.8	4.5	97.6	5.5	98.3	5.6	97.1	5.7	96.2	4.8	95.8	4.4	97.4	5.7	97.5	4.3
5	110.1	6.1	108.8	5.5	112.0	6.5	114.3	5.4	106.2	6.0	106.6	5.1	113.6	5.5	112.0	6.0
6	111.5	3.9	111.5	3.8	111.3	5.5	111.7	4.2	111.3	4.0	111.0	4.5	113.2	4.5	112.1	4.8
7	51.9	2.8	54.1	3.1	54.9	3.2	53.8	3.0	54.9	2.9	53.1	3.1	53.4	3.9	54.0	3.0
8	19.4	3.0	21.3	3.3	17.3	4.0	19.2	3.5	19.8	4.3	19.3	5.2	18.3	3.7	19.3	3.5
9	173.8	5.7	173.9	4.9	175.3	5.8	176.9	5.2	171.2	5.7	169.4	4.3	178.6	6.8	175.8	4.6
10	95.7	4.9	100.9	4.1	95.6	5.3	99.4	5.1	98.8	5.9	97.7	5.2	99.3	5.0	95.7	4.6
11	131.6	5.2	135.4	5.2	132.6	5.6	136.1	5.6	133.6	5.1	134.1	4.8	137.4	4.8	136.3	4.3
12	61.9	3.8	64.5	4.8	61.0	3.6	63.2	3.5	63.9	4.7	63.0	3.8	63.1	3.8	65.0	3.6
13	95.7	4.4	98.8	4.2	95.9	3.5	96.4	3.5	97.9	3.8	98.0	3.4	96.6	4.0	98.2	3.1
14	127.5	14.3	133.2	5.7	132.8	6.4	133.7	6.3	134.0	5.4	133.8	5.8	135.0	6.8	136.0	6.5
15	105.0	4.8	108.9	3.4	109.3	4.1	107.2	4.5	110.3	4.0	108.6	6.2	106.5	5.4	107.5	3.8
16	98.0	5.3	101.8	6.5	95.6	5.1	99.0	4.2	100.8	5.0	99.3	5.0	102.4	5.6	101.7	5.2
17	75.8	4.6	78.3	3.3	76.8	3.6	79.3	3.8	76.9	4.7	77.0	3.7	79.0	3.7	76.3	3.3
18	32.5	4.0	34.2	4.2	33.8	4.7	32.7	3.6	34.1	3.7	32.7	3.2	34.1	4.6	34.5	3.2
19	123.1	4.3	123.9	4.5	124.7	5.2	127.0	4.5	122.8	4.8	120.2	3.4	126.9	5.9	125.9	4.6
20	34.3	2.5	36.3	3.3	35.6	2.3	34.8	2.4	35.0	2.6	35.6	2.4	34.6	3.0	35.4	2.5
21	124.6	4.8	127.1	4.6	126.6	4.4	127.8	4.8	125.6	3.6	126.4	4.8	129.1	5.0	127.3	4.2
22	82.4	4.8	85.8	4.6	84.1	3.8	81.7	4.8	83.1	4.8	82.2	4.8	82.2	6.6	83.4	5.1
23	115.2	4.8	115.4	3.5	116.4	5.1	116.0	5.0	116.1	4.3	115.7	4.8	116.9	4.7	116.4	5.0
24	50.4	2.9	50.4	3.6	50.7	3.0	51.1	2.8	50.3	2.8	50.2	2.6	50.4	5.3	51.9	3.6
25	26.1	2.8	27.1	3.7	25.3	3.4	26.2	2.9	27.6	2.7	27.5	2.9	25.8	3.3	25.5	2.2
26	22.4	2.0	23.4	2.3	21.7	2.7	23.1	2.6	24.3	2.3	24.0	3.1	23.5	2.9	22.2	2.1
27	53.9	3.3	57.1	2.7	54.8	2.7	55.9	3.0	55.4	3.0	55.4	3.7	57.3	3.0	54.7	2.5
28	18.7	2.2	19.0	2.4	17.7	2.7	18.1	2.4	20.1	2.4	20.2	2.9	18.9	2.9	19.0	2.3
29	69.4	4.5	71.6	2.5	68.4	3.3	71.3	3.4	70.4	3.0	69.0	2.7	71.3	3.3	69.7	3.0

	M18	SD18	M19	SD19	M20	SD20	M21	SD21	M22	SD22	M23	SD23	M24	SD24	M25	SD25
1	50.9	3.8	51.5	3.7	48.9	3.9	48.0	3.8	50.6	3.7	50.3	3.6	50.3	3.5	50.2	3.4
2	32.4	2.9	32.8	2.8	32.3	2.4	31.3	2.5	33.3	2.3	33.1	3.3	32.8	3.0	31.9	2.9
3	36.1	2.6	38.1	3.3	37.6	2.2	36.9	2.6	38.5	2.7	37.3	2.5	37.9	3.1	34.9	2.2
4	94.0	6.2	97.1	6.7	97.4	6.0	94.9	4.7	96.6	5.4	95.2	5.0	97.6	4.9	99.2	4.8
5	108.0	4.6	115.4	6.4	108.8	4.8	108.4	4.8	112.2	6.6	109.4	4.0	110.1	6.5	108.3	6.3
6	109.0	4.6	111.6	4.4	113.2	3.8	108.1	4.8	111.3	4.5	112.4	4.4	112.1	4.6	111.1	4.9
7	54.1	2.1	53.7	3.2	55.1	2.9	51.5	2.8	54.1	3.3	53.3	3.0	54.0	3.5	55.0	3.2
8	18.7	4.0	19.5	3.3	21.0	3.2	17.9	3.8	18.5	4.0	19.3	3.5	19.2	3.8	18.5	4.5
9	171.6	4.8	177.0	5.5	173.2	4.4	169.9	5.2	175.3	5.6	172.5	4.3	173.0	5.3	175.8	5.1
10	100.9	4.8	98.8	5.0	98.5	4.4	93.1	4.3	99.3	5.3	98.1	4.3	97.5	5.0	98.9	5.2
11	132.6	4.1	136.2	4.9	134.8	4.5	132.7	4.3	135.2	4.9	135.8	4.9	136.7	4.5	131.3	5.2
12	65.7	3.9	62.7	3.0	63.7	3.9	60.3	4.6	63.0	3.3	63.8	4.5	62.8	4.5	64.5	4.3
13	97.0	3.1	96.3	3.9	99.7	3.4	96.9	3.2	96.8	3.3	99.4	3.2	98.5	4.1	98.6	3.7
14	134.9	5.9	133.4	6.1	136.8	6.4	134.0	5.2	134.2	5.3	136.1	6.0	136.4	6.7	139.8	5.8
15	110.2	3.6	107.2	4.0	107.7	3.8	105.7	3.6	107.8	4.3	107.8	3.9	106.7	4.2	112.5	4.5
16	100.2	4.4	98.3	4.5	100.7	5.2	97.8	6.1	97.9	5.9	104.7	5.2	101.6	5.0	103.0	5.5
17	77.2	2.9	77.2	3.6	79.7	3.8	74.7	3.2	77.9	3.6	75.9	4.4	77.0	3.8	77.4	3.0
18	34.7	3.0	33.5	3.5	34.9	3.4	33.4	4.3	31.8	4.6	34.0	3.7	34.0	4.2	35.9	3.7
19	124.0	5.0	125.9	4.8	124.4	4.0	122.7	4.3	125.9	5.2	122.8	3.7	125.4	4.7	125.7	4.9
20	34.8	2.0	34.8	2.2	36.8	1.9	34.8	2.8	34.8	2.7	34.7	1.9	35.6	2.9	35.4	2.7
21	125.8	4.0	128.9	4.2	126.7	4.2	123.5	4.1	127.9	4.3	126.7	4.1	128.4	4.2	124.7	3.8
22	82.4	4.3	82.1	5.2	83.9	3.1	80.1	4.1	82.6	4.7	83.6	4.7	82.1	4.9	86.5	4.0
23	115.1	3.6	115.3	4.3	118.2	4.1	112.7	4.2	115.7	5.1	116.2	4.2	116.3	4.5	115.3	4.5
24	48.9	3.4	50.8	2.7	49.4	3.2	50.1	2.9	51.2	3.1	50.7	3.0	50.9	3.3	51.5	2.8
25	26.5	2.9	25.4	3.1	28.3	2.9	24.9	2.6	25.5	2.6	26.7	2.9	25.9	2.6	27.0	2.5
26	22.9	1.8	23.0	2.6	25.1	2.3	22.5	1.9	22.6	2.5	24.3	2.6	24.2	2.7	25.9	2.3
27	57.0	3.2	55.2	3.8	56.3	3.6	52.9	3.0	55.1	2.8	55.6	2.5	56.1	3.2	55.9	3.1
28	19.2	3.2	19.1	2.3	18.8	2.2	17.9	2.5	18.2	2.4	20.1	2.9	18.8	2.8	20.6	2.5
29	71.5	2.7	71.2	2.9	69.7	3.5	68.6	2.7	70.7	3.6	71.7	3.1	70.8	3.8	69.9	3.3

	M26	SD26	M27	SD27	M	SD
1	50.8	3.9	52.6	3.1	50.0	3.9
2	31.0	3.3	33.1	1.7	32.3	3.0
3	36.0	2.6	36.2	2.8	37.2	2.9
4	98.1	6.0	98.1	5.8	96.6	5.5
5	106.0	6.5	110.4	7.1	109.3	6.6
6	110.4	4.4	113.0	5.0	111.1	4.6
7	54.2	3.2	54.0	2.4	53.8	3.2
8	19.3	3.5	21.5	3.0	19.3	3.8
9	174.8	5.4	176.1	4.8	173.3	5.8
10	100.0	5.2	100.7	4.9	97.7	5.4
11	127.9	5.5	135.7	5.0	133.9	5.5
12	63.9	4.5	65.4	2.4	63.1	4.2
13	98.5	4.3	98.6	3.5	97.8	3.8
14	139.6	6.3	136.1	4.7	135.2	6.8
15	114.3	5.1	107.3	3.9	108.5	4.9
16	102.4	4.9	104.8	4.6	100.6	5.5
17	77.7	3.3	78.9	3.6	76.8	4.0
18	35.7	4.2	33.9	3.7	33.9	4.1
19	124.8	4.5	125.6	3.6	124.3	5.0
20	35.6	3.0	34.8	2.3	35.1	2.7
21	124.5	4.7	128.0	3.8	126.4	4.6
22	87.5	5.1	83.8	6.1	83.0	5.2
23	114.8	5.2	117.0	4.2	115.6	4.6
24	51.1	3.4	50.2	3.5	50.7	3.3
25	27.6	2.6	26.1	2.8	26.4	2.9
26	25.4	2.6	24.0	2.0	23.8	2.7
27	56.3	3.1	58.1	2.7	55.4	3.3
28	20.1	2.7	19.2	1.7	19.2	2.7
29	69.6	3.4	70.9	3.5	70.1	3.6

Appendix D: Pair-wise biological distances (D^2) for Arctic samples. The pair-wise biological distances, calculated from the R-matrix, is a standardized Mahalanobis distance that explains phenotypic distances between samples based on cranial morphology. Below is the table of Mahalanobis distances calculated directly from the raw measurement data.

	Bethel	Dilling	HolyCr	Hoope	Ipiuta	Kaga	Kamar	Kiklew	Kusko	labrad	Mitlik	NEGL	NWGL
Bethel	0												
Dillingham	0.034	0											
HolyCross	0.036	0.042	0										
HooperBay	0.013	0.012	0.079	0									
Ipiutak	0.023	0.060	0.054	0.045	0								
Kagamil	0.119	0.143	0.160	0.135	0.131	0							
Kamarvik	0.067	0.090	0.096	0.053	0.046	0.199	0						
Kiklewait	0.116	0.128	0.139	0.068	0.113	0.168	0.063	0					
Kuskoskwim	0.003	0.014	0.025	0.011	0.034	0.080	0.073	0.088	0				
labrador	0.077	0.106	0.096	0.094	0.060	0.227	0.044	0.114	0.093	0			
Mitlik	0.058	0.096	0.086	0.061	0.077	0.172	0.066	0.064	0.061	0.052	0		
NEGL	0.124	0.204	0.172	0.137	0.106	0.220	0.049	0.099	0.155	0.073	0.116	0	
NWGL	0.115	0.173	0.145	0.114	0.095	0.243	0.031	0.085	0.125	0.044	0.055	0.044	0
Pastolik	0.019	0.022	0.031	0.013	0.038	0.106	0.060	0.062	0.002	0.077	0.035	0.111	0.088
Pilot	0.021	0.039	0.027	0.041	0.064	0.123	0.064	0.092	0.013	0.076	0.033	0.116	0.091
PointBarrow	0.103	0.189	0.142	0.114	0.100	0.264	0.070	0.096	0.141	0.070	0.063	0.099	0.019
Sadlermiut	0.080	0.130	0.107	0.066	0.055	0.225	0.018	0.068	0.079	0.040	0.039	0.072	0.039
Sarichef	0.052	0.094	0.081	0.059	0.058	0.147	0.067	0.096	0.061	0.084	0.041	0.108	0.075
SEGL	0.132	0.163	0.140	0.116	0.101	0.264	0.029	0.088	0.144	0.051	0.073	0.046	0.001
Siberia	0.053	0.140	0.099	0.107	0.061	0.150	0.115	0.144	0.068	0.126	0.065	0.137	0.108
Silumiut	0.053	0.081	0.099	0.057	0.040	0.196	0.000	0.095	0.065	0.041	0.073	0.078	0.058
SWGL	0.109	0.151	0.136	0.099	0.098	0.221	0.023	0.073	0.117	0.049	0.051	0.028	0.001
Teller	0.049	0.064	0.075	0.035	0.066	0.228	0.069	0.105	0.047	0.075	0.031	0.183	0.102
Tigara	0.063	0.108	0.098	0.071	0.052	0.208	0.035	0.092	0.078	0.071	0.039	0.091	0.041
Umnak	0.089	0.117	0.110	0.084	0.074	0.067	0.147	0.111	0.063	0.188	0.143	0.192	0.181
Unalaska	0.103	0.143	0.152	0.110	0.109	0.023	0.184	0.126	0.087	0.211	0.152	0.197	0.216
Wales	0.074	0.135	0.099	0.088	0.057	0.180	0.077	0.095	0.078	0.057	0.017	0.128	0.045

	Pastoli	Pilot	PointB	Sadler	Sarich	SEGL	Siberi	Silumi	SWGL	Teller	Tigara	Umna	Unalas
Bethel													
Dillingham													
HolyCross													
HooperBay													
Ipiutak													
Kagamil													
Kamarvik													
Kiklewait													
Kuskoskwim													
labrador													
Mitlik													
NEGL													
NWGL													
Pastolik	0												
Pilot	0.003	0											
PointBarrow	0.109	0.107	0										
Sadlermiut	0.073	0.071	0.054	0									
Sarichef	0.025	0.046	0.090	0.080	0								
SEGL	0.101	0.110	0.029	0.045	0.086	0							
Siberia	0.066	0.058	0.111	0.111	0.109	0.155	0						
Silumiut	0.070	0.064	0.091	0.036	0.085	0.062	0.107	0					
SWGL	0.075	0.078	0.045	0.037	0.065	0.005	0.123	0.058	0				
Teller	0.047	0.047	0.094	0.047	0.079	0.105	0.118	0.067	0.093	0			
Tigara	0.059	0.056	0.043	0.036	0.078	0.045	0.066	0.036	0.044	0.041	0		
Umnak	0.077	0.121	0.168	0.153	0.111	0.191	0.120	0.156	0.187	0.148	0.148	0	
Unalaska	0.096	0.135	0.211	0.203	0.122	0.229	0.141	0.192	0.208	0.192	0.190	0.004	0
Wales	0.065	0.061	0.024	0.036	0.065	0.066	0.072	0.082	0.065	0.042	0.027	0.126	0.157

Mahalanobis Distances calculated from measurement data.

	Bethel	Dilling	HolyCr	Hoope	Ipiuta	Kaga	Kamar	Kiklew	Kusko	labrad	Mitlik	NEGL	NWGL
Bethel	0												
Dillingham	3.25	0											
HolyCross	3.45	3.54	0										
HooperBay	2.52	2.38	6.03	0									
Ipiutak	2.45	3.87	3.78	3.74	0								
Kagamil	5.79	6.93	7.51	6.79	5.49	0							
Kamarvik	3.78	4.34	4.83	3.61	2.80	6.85	0						
Kiklewait	6.45	6.74	7.34	4.70	6.09	7.16	3.86	0					
Kuskoskwim	1.58	2.29	2.75	2.48	2.68	4.14	3.55	4.85	0				
labrador	4.41	5.21	5.17	5.87	3.52	8.40	3.67	6.36	4.76	0			
Mitlik	4.05	5.44	5.25	4.69	4.75	7.00	4.45	4.28	3.94	3.92	0		
NEGL	6.30	9.86	8.44	7.68	5.63	8.24	4.00	6.00	7.56	5.30	7.18	0	
NWGL	4.90	6.97	6.10	5.47	4.23	7.68	2.38	4.45	4.72	3.08	3.37	3.73	0
Pastolik	2.25	2.21	2.60	2.38	2.82	4.84	3.39	3.76	1.37	4.27	2.62	5.80	3.52
Pilot	2.63	3.39	2.54	4.21	4.46	5.57	4.05	5.72	2.10	5.00	3.19	6.57	4.34
PointBarrow	4.92	8.44	6.80	5.93	5.04	9.61	4.52	5.43	6.19	4.52	4.31	6.49	1.94
Sadlermiut	4.28	6.21	5.33	4.08	2.85	7.72	1.97	3.98	3.71	3.40	3.24	4.95	2.76
Sarichef	4.22	5.85	5.29	5.15	4.28	6.68	4.67	6.28	4.35	5.80	3.78	6.98	4.30
SEGL	5.93	6.51	5.84	5.71	4.55	8.60	2.43	4.69	5.83	3.61	4.30	3.98	1.08
Siberia	3.94	7.94	6.20	6.86	4.28	7.01	6.09	7.68	4.50	6.93	4.54	7.25	5.02
Silumiut	3.43	4.31	5.47	4.10	2.83	7.09	0.78	5.41	3.54	3.40	4.92	5.21	3.50
SWGL	4.82	6.12	5.87	5.01	4.42	6.85	1.94	4.00	4.73	3.45	3.26	2.91	0.86
Teller	3.29	3.86	4.51	3.13	4.13	8.78	4.29	5.67	2.99	4.95	2.87	9.92	5.06
Tigara	3.18	4.70	4.58	4.01	2.72	6.79	2.32	4.64	3.38	4.26	2.72	5.26	2.24
Umnak	5.40	6.69	6.27	5.42	4.04	4.54	6.02	5.61	4.41	8.16	7.17	8.34	6.51
Unalaska	5.04	7.08	7.30	5.67	4.72	2.05	6.56	5.40	4.68	7.98	6.36	7.44	6.90
Wales	4.83	7.19	5.62	5.90	3.75	6.99	5.22	5.88	4.46	4.31	2.52	8.04	3.14

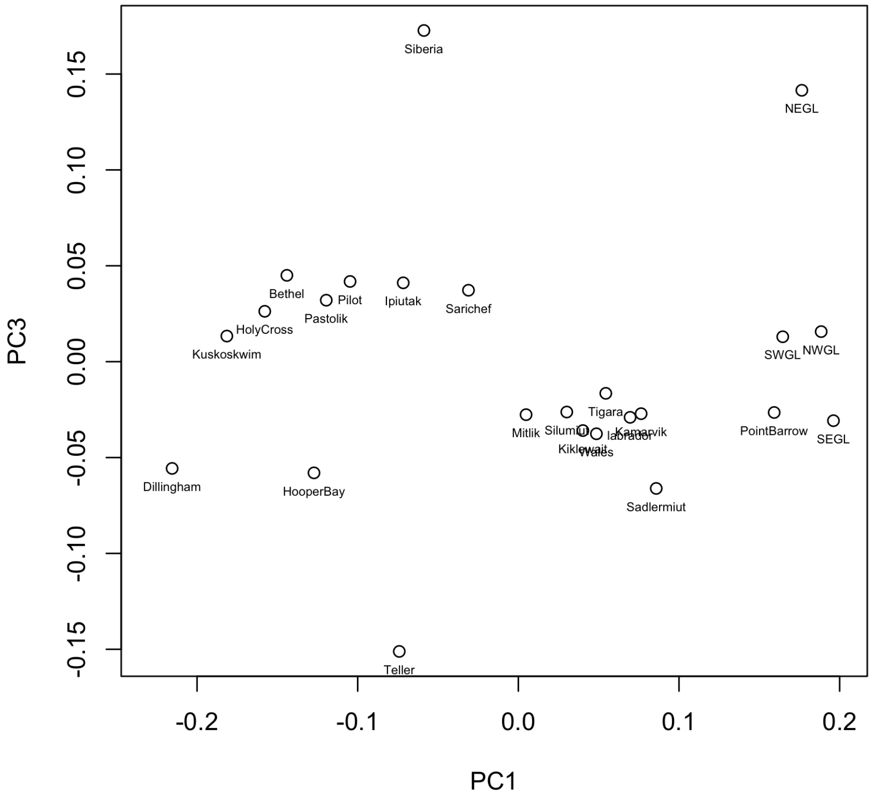
	Pastoli	Pilot	PointB	Sadler	Sarich	SEGL	Siberi	Silumi	SWGL	Teller	Tigara	Umna	Unalas
Bethel													
Dillingham													
HolyCross													
HooperBay													
Ipiutak													
Kagamil													
Kamarvik													
Kiklewait													
Kuskoskwim													
labrador													
Mitlik													
NEGL													
NWGL													
Pastolik	0												
Pilot	1.40	0											
PointBarrow	5.19	5.52	0										
Sadlermiut	3.87	4.41	3.71	0									
Sarichef	2.64	4.06	5.50	5.34	0								
SEGL	4.35	5.37	2.59	3.21	4.81	0							
Siberia	4.16	3.99	6.03	5.70	7.14	7.44	0						
Silumiut	4.10	4.31	5.38	2.89	5.65	3.83	6.13	0					
SWGL	3.15	3.87	3.21	2.64	3.91	1.24	5.90	3.50	0				
Teller	3.11	3.61	4.77	3.32	5.43	5.28	6.73	4.48	4.75	0			
Tigara	2.74	3.01	2.71	2.26	4.69	2.56	3.76	2.44	2.33	2.53	0		
Umnak	4.53	6.62	6.63	5.91	6.23	6.88	6.81	6.83	7.05	6.66	5.72	0	
Unalaska	4.57	6.40	7.41	7.10	5.76	7.35	6.86	7.30	6.80	7.42	6.42	1.45	0
Wales	4.04	4.37	2.49	3.15	5.01	4.26	4.95	5.53	4.20	3.27	2.26	5.96	6.32

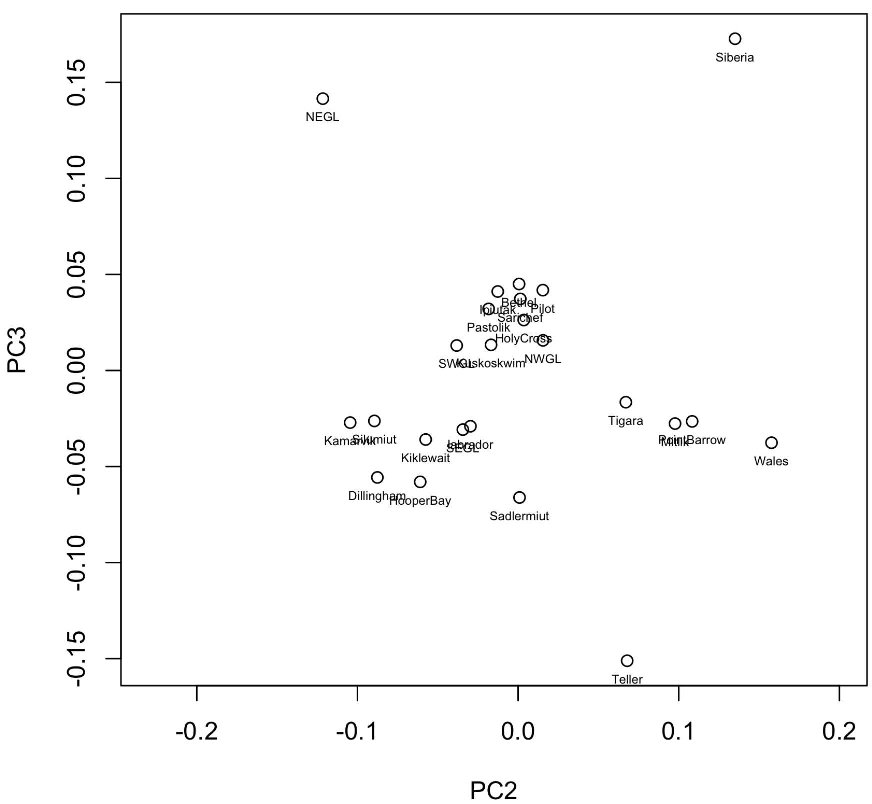
Appendix E: Eigenvalues (top row) and the corresponding eigenvectors for each sample. The percent of variation each eigenvalue explains is provided below the eigenvalues. For the full sample set (All Samples), there were 16 non-zero eigenvalues. For the sample set with Aleut samples removed (Without Aleuts), there were 14 non-zero eigenvalues.

All Samples	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Eigenvalues	**0.482**	**0.220**	**0.127**	**0.098**	**0.077**	**0.059**	**0.046**	**0.039**	**0.033**	**0.027**	**0.017**	**0.016**	**0.011**	**0.009**	**0.002**	**0.001**
% var explained	0.381	0.174	0.101	0.077	0.061	0.046	0.036	0.031	0.026	0.021	0.013	0.013	0.009	0.007	0.002	0.000
Bethel	-0.093	-0.093	-0.049	-0.036	-0.019	-0.097	0.033	0.005	-0.037	0.028	0.008	0.026	0.029	-0.011	-0.004	0.006
Dillingham	0.120	0.157	0.091	0.050	0.016	-0.081	0.003	-0.039	0.030	0.013	0.009	-0.040	-0.017	0.010	0.008	-0.003
Holy Cross	0.004	-0.125	0.001	-0.053	-0.008	-0.013	-0.066	-0.027	-0.009	-0.016	0.034	-0.039	0.005	-0.004	0.002	0.008
Hooper Bay	-0.129	0.044	-0.062	0.077	-0.066	-0.030	-0.005	0.096	-0.002	-0.022	0.020	-0.038	-0.004	0.005	-0.005	0.002
Ipiutak	-0.040	0.015	0.049	-0.031	-0.102	0.034	-0.037	0.019	0.004	-0.001	0.034	0.018	0.008	0.026	0.017	-0.003
Kagamil	0.007	-0.039	-0.130	0.045	-0.043	0.022	0.024	0.069	0.015	-0.048	0.020	0.011	-0.008	0.001	0.006	-0.005
Kamarvik	0.065	0.017	0.100	0.033	-0.009	-0.110	0.002	0.035	-0.002	-0.074	-0.035	0.013	0.006	0.016	0.002	0.006
Kiklewait	0.153	-0.007	-0.180	0.097	0.027	-0.009	0.006	-0.068	-0.017	-0.042	-0.001	0.001	0.003	0.005	-0.005	0.001
Kuskoskwim	-0.107	0.114	0.008	-0.022	-0.055	0.091	0.024	-0.044	0.005	-0.042	-0.019	-0.036	0.018	-0.005	0.005	0.002
labrador	-0.198	-0.121	0.092	-0.097	0.047	0.007	0.049	-0.002	0.000	-0.061	0.002	-0.008	-0.010	0.003	0.003	-0.009
Mitliktavik	-0.202	0.120	-0.030	-0.049	0.063	-0.031	0.020	0.054	-0.027	0.034	0.028	-0.038	0.012	0.012	-0.010	-0.003
NEGL	0.136	-0.084	0.035	-0.011	-0.047	0.033	0.053	0.038	0.019	-0.014	-0.014	-0.035	0.006	-0.016	0.006	0.011
NWGL	0.138	-0.029	0.052	-0.060	-0.049	-0.028	0.002	0.020	-0.057	0.011	0.025	0.028	-0.038	-0.018	0.005	0.001
Pastolik	-0.005	-0.055	-0.008	-0.024	-0.114	-0.055	0.033	-0.055	0.010	0.011	0.021	-0.019	0.026	-0.014	0.003	-0.004
Pilot Station	-0.138	-0.014	-0.095	-0.025	-0.038	-0.043	-0.028	-0.004	0.014	0.030	-0.042	0.018	0.023	0.028	0.020	-0.002
Point Barrow	0.153	-0.137	0.017	-0.064	0.055	0.016	-0.010	0.054	0.054	0.014	-0.037	-0.005	0.024	0.008	-0.009	-0.002
Sadlermiut	-0.168	0.051	-0.022	0.003	0.069	-0.004	0.045	0.000	-0.075	-0.006	-0.028	-0.003	-0.026	-0.002	0.017	0.005
Sarichef	-0.011	-0.058	-0.011	0.013	0.040	-0.016	0.018	-0.007	-0.002	-0.053	0.009	0.021	0.011	0.001	0.004	-0.005
SEGL	0.130	0.044	0.066	0.011	0.003	-0.030	0.051	-0.021	-0.019	-0.028	0.039	0.010	0.030	0.024	-0.009	-0.001
Siberia	-0.020	0.015	-0.022	-0.010	-0.053	-0.032	-0.044	0.000	0.040	-0.017	-0.003	0.013	-0.040	-0.029	-0.009	-0.004
Silumiut	-0.114	-0.143	0.034	0.044	-0.061	0.048	0.016	-0.031	-0.025	0.015	0.000	0.005	-0.031	0.057	-0.015	0.004
SWGL	-0.137	0.009	0.048	0.065	-0.079	0.015	0.089	-0.005	-0.013	0.021	-0.028	0.013	0.010	-0.030	-0.010	-0.003
Teller	-0.108	0.007	0.038	0.027	0.047	0.053	-0.071	-0.001	-0.046	-0.027	0.029	0.021	0.033	-0.023	-0.001	0.002
Tigara	0.208	-0.011	-0.100	-0.093	0.036	0.021	0.091	0.001	0.010	0.011	0.032	-0.002	-0.011	0.006	0.008	0.001
Umnak	0.329	0.070	0.024	0.000	-0.044	0.043	-0.017	0.040	-0.092	0.010	-0.027	-0.007	0.016	0.007	-0.001	-0.007
Unalaska	0.022	-0.226	0.057	0.169	0.049	-0.003	0.005	0.010	-0.013	0.035	0.013	-0.028	0.002	-0.009	0.014	-0.005
Wales	-0.015	0.100	0.061	0.078	0.033	0.041	0.041	0.023	0.062	0.021	0.031	0.047	0.008	0.002	0.006	0.006

Without Aleuts	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Eigenvalues	**0.365**	**0.127**	**0.100**	**0.094**	**0.064**	**0.042**	**0.038**	**0.037**	**0.027**	**0.019**	**0.015**	**0.009**	**0.005**	**0.001**
% var explained	0.387	0.134	0.107	0.100	0.067	0.044	0.040	0.039	0.029	0.020	0.016	0.010	0.005	0.001
Bethel	-0.144	-0.127	-0.083	-0.065	-0.030	0.026	0.013	-0.058	0.019	0.001	0.036	0.030	-0.014	-0.006
Dillingham	0.001	-0.088	0.003	-0.053	-0.009	-0.060	-0.031	-0.009	-0.014	0.037	-0.042	0.004	-0.004	0.001
Holy Cross	0.086	-0.063	0.026	-0.056	0.033	-0.017	-0.022	0.008	-0.015	-0.012	0.055	0.005	0.007	0.004
Hooper Bay	0.075	0.012	0.047	-0.044	0.079	0.032	-0.117	-0.010	0.045	-0.030	-0.005	-0.002	-0.017	-0.004
Ipiutak	0.026	-0.040	-0.125	0.067	0.040	0.031	0.075	0.014	-0.048	-0.008	0.003	-0.011	-0.007	-0.006
Kamarvik	-0.132	0.018	0.116	-0.089	-0.090	0.011	0.039	0.008	0.013	0.020	0.003	-0.001	0.000	0.011
Kiklewait	0.025	0.072	-0.009	0.038	-0.056	0.022	-0.044	-0.008	-0.084	-0.026	-0.017	0.015	0.005	0.004
Kuskoskwim	0.006	0.026	0.143	-0.007	0.057	-0.010	0.067	0.011	-0.010	-0.048	-0.009	0.002	-0.001	-0.007
labrador	0.169	0.078	-0.104	0.090	-0.067	-0.050	-0.014	0.005	0.068	0.005	0.014	0.009	-0.003	0.001
Mitliktavik	0.207	-0.121	0.051	0.052	-0.057	-0.007	-0.035	0.013	-0.043	-0.027	0.037	-0.014	-0.008	0.007
NEGL	0.091	-0.057	0.013	-0.031	-0.082	0.058	0.019	0.011	0.000	0.004	-0.039	0.012	-0.012	0.006
NWGL	-0.112	0.004	-0.023	0.041	0.012	0.018	-0.041	0.067	-0.019	-0.020	-0.034	0.041	0.005	-0.003
Pastolik	0.076	-0.015	0.073	0.023	0.000	0.019	0.005	-0.057	0.001	0.043	-0.010	-0.012	-0.011	-0.013
Pilot Station	-0.119	0.119	-0.008	0.072	-0.012	0.016	-0.038	-0.061	-0.019	0.034	-0.004	-0.024	-0.002	0.005
Point Barrow	0.159	-0.011	0.021	-0.008	-0.039	-0.018	-0.014	0.074	-0.037	0.052	0.010	-0.002	-0.022	-0.010
Sadlermiut	-0.030	0.029	-0.015	-0.011	0.054	0.035	-0.002	-0.031	-0.039	-0.001	0.006	-0.032	-0.020	0.006
Sarichef	0.134	0.055	0.027	-0.024	0.007	-0.002	0.017	0.036	0.020	0.011	-0.022	-0.009	-0.008	-0.006
SEGL	-0.080	0.015	-0.064	-0.030	-0.006	-0.054	0.022	0.049	0.027	-0.041	-0.016	-0.030	-0.033	0.008
Siberia	-0.087	-0.090	-0.002	0.012	-0.059	-0.013	-0.025	0.026	0.014	-0.015	-0.008	-0.050	0.038	-0.009
Silumiut	0.161	-0.010	-0.041	-0.060	0.106	-0.068	0.016	-0.005	-0.021	0.037	-0.012	0.008	0.019	0.010
SWGL	0.238	-0.019	-0.059	-0.050	0.013	0.124	0.014	0.013	0.033	0.003	-0.016	-0.012	0.015	0.006
Teller	0.240	0.064	0.033	0.011	-0.051	-0.036	0.038	-0.081	0.005	-0.041	-0.009	0.012	0.004	-0.002
Tigara	-0.017	-0.165	0.072	0.188	0.046	-0.001	0.012	-0.014	0.034	0.009	-0.024	0.006	-0.006	0.009
Wales	-0.030	0.092	0.066	0.075	0.022	0.037	0.019	0.060	0.022	0.029	0.046	0.011	0.004	0.004

Appendix F: Fully labeled plots from Figures 6.11 and 6.12: PC3 (10.7%), PC2 (13.4%), and PC1 (38.7%) for Arctic samples with Aleuts removed.





Appendix G.1-3: Continued from Tables 6.7-9, complete classification tables including count numbers and percentage of individuals classified into each sample according to their discriminant function. For each set, the summary of the canonical discriminant functions and the standardized canonical discriminant function coefficients (Fisher's) follow the classification tables. G.1 is the regional set, G.2 is the set of all populations, and G.3 is the Greenland only results.

G.1: Regional samples with region numbers referring to Table 4.3 and traits from Table 4.5 (and Appendix A).

Classification table:

		Regions	Predicted Group Membership					
			1	**2**	**3**	**4**	**5**	**6**
Original	Count	**1**	134	23	6	15	7	1
		2	30	151	38	13	22	10
		3	7	22	62	20	11	7
		4	26	43	59	120	43	70
		5	5	13	18	21	87	34
		6	3	8	20	24	23	125
	%	**1**	72.0	12.4	3.2	8.1	3.8	.5
		2	11.4	57.2	14.4	4.9	8.3	3.8
		3	5.4	17.1	48.1	15.5	8.5	5.4
		4	7.2	11.9	16.3	33.2	11.9	19.4
		5	2.8	7.3	10.1	11.8	48.9	19.1
		6	1.5	3.9	9.9	11.8	11.3	61.6
Cross-validated	Count	**1**	130	25	6	17	7	1
		2	30	148	39	14	23	10
		3	8	25	51	23	13	9
		4	27	44	61	115	44	70
		5	6	15	20	24	79	34
		6	3	8	22	25	28	117
	%	**1**	69.9	13.4	3.2	9.1	3.8	.5
		2	11.4	56.1	14.8	5.3	8.7	3.8
		3	6.2	19.4	39.5	17.8	10.1	7.0
		4	7.5	12.2	16.9	31.9	12.2	19.4
		5	3.4	8.4	11.2	13.5	44.4	19.1
		6	1.5	3.9	10.8	12.3	13.8	57.6

Summary of the canonical discriminant functions:

Function	**Eigenvalue**	**% of Variance**	**Cumulative %**	**Canonical Correlation**
1	.935	57.5	57.5	.695
2	.344	21.1	78.6	.506
3	.167	10.3	88.9	.379
4	.101	6.2	95.1	.303
5	.080	4.9	100.0	.272
Test of Function(s)	**Wilks' Lambda**	**Chi-square**	**Df**	**Sig.**
1 through 5	.277	1673.188	135	<.001
2 through 5	.536	812.749	104	<.001
3 through 5	.720	427.778	75	<.001
4 through 5	.841	226.058	48	<.001
5	.926	100.478	23	<.001

Standardized canonical discriminant function coefficients (Fisher's):

	1	2	3	4	5
1	-.468	.031	-.250	.012	-.279
2	-.416	.012	.165	.004	-.126
3	-.392	.127	-.030	.098	.317
4	-.170	.388	.050	-.135	.481
5	-.342	.369	-.233	.049	-.086
6	-.001	.409	.083	.037	.040
7	.190	-.010	-.150	.324	.522
8	.222	-.025	.221	-.202	-.048
10	.462	.168	-.038	.672	.156
11	.007	-.788	.047	-.039	.098
12	-.124	-.052	-.098	-.005	-.450
14	.314	.458	.049	-.302	.143
15	.386	.060	-.235	.235	.145
16	-.056	-.491	.568	-.114	-.320
17	.077	.181	-.261	.183	-.089
18	.076	.121	.047	-.164	.211
19	-.226	.539	.115	-.376	.014
20	.003	.103	.229	-.189	-.211
21	-.212	.207	.272	.446	.371
22	.132	-.019	.025	-.083	-.811
23	.087	-.358	-.149	-.083	-.091
24	.179	-.196	-.203	-.113	-.151
25	.178	-.257	-.253	.144	-.025
26	.472	.201	.368	-.102	.538
27	.154	.111	.560	.041	-.024
28	.200	-.287	-.241	.094	.152
29	-.455	-.295	.215	.079	-.318

G.2: All Samples with region numbers referring to Table 4.1 (and Appendix A) and traits from Table 4.5 (and Appendix A).

Classification table with original counts (#) and % followed by cross-validated:

	Predicted Group Membership														
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
#	**1**	9	0	2	2	3	1	0	0	5	1	2	1	0	1
	2	1	15	2	2	2	0	1	0	5	0	2	0	0	1
	3	3	2	20	0	0	0	1	0	1	1	2	0	0	1
	4	4	3	0	10	1	0	1	0	1	0	0	0	0	1
	5	2	3	2	1	17	0	0	2	4	0	0	2	1	2
	6	1	1	0	2	3	38	0	2	3	0	0	0	0	1
	7	0	1	1	1	1	0	8	2	0	2	0	4	1	1
	8	0	1	1	1	2	1	1	26	1	1	2	2	1	1
	9	3	2	1	4	0	1	0	1	10	0	2	0	0	1
	10	0	1	2	0	1	2	1	2	0	16	2	1	1	0
	11	1	1	2	1	0	0	0	3	0	0	10	3	1	0
	12	0	0	0	0	0	1	0	1	0	2	0	17	1	0
	13	0	0	0	0	2	1	4	2	0	5	1	4	18	0
	14	1	10	2	1	1	1	0	5	2	1	2	2	1	8
	15	1	1	4	2	0	0	0	1	1	1	2	0	0	2
	16	1	0	0	0	0	0	1	1	0	0	0	0	2	0
	17	0	0	0	2	2	0	2	1	0	3	2	1	1	0
	18	2	1	0	0	1	0	0	0	0	0	1	1	0	0
	19	0	0	1	2	2	0	2	0	0	2	1	2	4	1
	20	0	1	1	0	2	0	0	0	3	0	1	0	0	0
	21	1	1	0	1	3	1	4	1	0	0	0	2	0	0
	22	0	0	0	2	0	0	2	2	0	4	4	7	9	1
	23	1	2	2	0	1	0	0	0	1	1	2	0	0	0
	24	3	4	1	3	9	0	3	4	1	5	12	6	10	7
	25	1	0	1	1	1	4	0	0	1	0	0	0	0	1
	26	0	0	3	0	1	13	0	1	1	0	1	0	0	0
	27	0	0	0	0	2	0	0	0	1	2	1	1	0	0
%	**1**	24.3	0.0	5.4	5.4	8.1	2.7	0.0	0.0	13.5	2.7	5.4	2.7	0.0	2.7
	2	2.5	37.5	5.0	5.0	5.0	0.0	2.5	0.0	12.5	0.0	5.0	0.0	0.0	2.5
	3	7.1	4.8	47.6	0.0	0.0	0.0	2.4	0.0	2.4	2.4	4.8	0.0	0.0	2.4
	4	16.0	12.0	0.0	40.0	4.0	0.0	4.0	0.0	4.0	0.0	0.0	0.0	0.0	4.0
	5	3.7	5.6	3.7	1.9	31.5	0.0	0.0	3.7	7.4	0.0	0.0	3.7	1.9	3.7
	6	1.5	1.5	0.0	2.9	4.4	55.9	0.0	2.9	4.4	0.0	0.0	0.0	0.0	1.5
	7	0.0	2.2	2.2	2.2	2.2	0.0	17.4	4.3	0.0	4.3	0.0	8.7	2.2	2.2
	8	0.0	1.9	1.9	1.9	3.8	1.9	1.9	49.1	1.9	1.9	3.8	3.8	1.9	1.9
	9	9.1	6.1	3.0	12.1	0.0	3.0	0.0	3.0	30.3	0.0	6.1	0.0	0.0	3.0
	10	0.0	2.5	5.0	0.0	2.5	5.0	2.5	5.0	0.0	40.0	5.0	2.5	2.5	0.0
	11	3.0	3.0	6.1	3.0	0.0	0.0	0.0	9.1	0.0	0.0	30.3	9.1	3.0	0.0
	12	0.0	0.0	0.0	0.0	0.0	3.6	0.0	3.6	0.0	7.1	0.0	60.7	3.6	0.0
	13	0.0	0.0	0.0	0.0	3.2	1.6	6.5	3.2	0.0	8.1	1.6	6.5	29.0	0.0
	14	1.9	18.9	3.8	1.9	1.9	1.9	0.0	9.4	3.8	1.9	3.8	3.8	1.9	15.1
	15	2.9	2.9	11.8	5.9	0.0	0.0	0.0	2.9	2.9	2.9	5.9	0.0	0.0	5.9
	16	2.6	0.0	0.0	0.0	0.0	0.0	2.6	2.6	0.0	0.0	0.0	0.0	5.3	0.0
	17	0.0	0.0	0.0	4.0	4.0	0.0	4.0	2.0	0.0	6.0	4.0	2.0	2.0	0.0
	18	7.4	3.7	0.0	0.0	3.7	0.0	0.0	0.0	0.0	0.0	3.7	3.7	0.0	0.0
	19	0.0	0.0	2.3	4.7	4.7	0.0	4.7	0.0	0.0	4.7	2.3	4.7	9.3	2.3
	20	0.0	3.1	3.1	0.0	6.3	0.0	0.0	0.0	9.4	0.0	3.1	0.0	0.0	0.0
	21	2.4	2.4	0.0	2.4	7.1	2.4	9.5	2.4	0.0	0.0	0.0	4.8	0.0	0.0
	22	0.0	0.0	0.0	2.9	0.0	0.0	2.9	2.9	0.0	5.7	5.7	10.0	12.9	1.4
	23	2.9	5.7	5.7	0.0	2.9	0.0	0.0	0.0	2.9	2.9	5.7	0.0	0.0	0.0
	24	1.4	1.9	0.5	1.4	4.2	0.0	1.4	1.9	0.5	2.3	5.6	2.8	4.6	3.2
	25	3.2	0.0	3.2	3.2	3.2	12.9	0.0	0.0	3.2	0.0	0.0	0.0	0.0	3.2
	26	0.0	0.0	5.5	0.0	1.8	23.6	0.0	1.8	1.8	0.0	1.8	0.0	0.0	0.0
	27	0.0	0.0	0.0	0.0	5.9	0.0	0.0	0.0	2.9	5.9	2.9	2.9	0.0	0.0
#	**1**	6	0	2	2	3	1	0	0	6	1	2	2	0	1
	2	1	10	2	2	2	1	1	0	5	0	2	0	0	2
	3	3	3	15	0	0	0	1	0	1	1	2	0	0	2
	4	4	3	0	5	2	0	1	1	1	0	0	0	0	3
	5	4	3	2	0	10	0	0	4	3	0	0	2	1	2

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
	6	1	1	0	3	4	35	0	2	3	0	0	0	0	1
	7	0	1	1	1	2	0	0	4	0	2	0	5	1	1
	8	0	1	2	1	2	1	1	21	1	1	2	2	1	2
	9	5	4	1	4	0	1	0	1	2	0	2	0	0	2
	10	0	1	2	0	2	2	2	2	0	10	3	1	2	0
	11	2	1	2	1	0	0	0	3	0	0	3	3	1	0
	12	0	0	0	0	0	1	0	1	0	4	0	12	2	0
	13	0	0	0	0	2	1	4	2	0	6	1	4	9	0
	14	1	11	2	1	1	1	0	5	3	1	3	2	1	3
	15	2	1	5	2	0	0	0	1	0	2	2	0	0	4
	16	1	0	0	0	0	0	1	1	0	0	1	0	3	0
	17	0	0	0	2	3	0	3	2	0	3	2	2	2	0
	18	1	1	0	0	2	0	0	1	0	1	2	1	0	0
	19	0	0	2	2	2	0	3	0	0	3	1	5	4	1
	20	0	1	1	0	2	0	0	0	3	0	1	0	0	0
	21	1	1	0	1	4	1	7	1	0	0	0	2	1	0
	22	0	0	0	2	0	0	3	2	0	4	4	7	11	1
	23	1	3	2	2	1	0	0	0	1	1	2	0	0	1
	24	3	4	1	3	9	0	3	4	1	5	13	7	10	8
	25	1	0	2	1	3	4	0	0	1	0	0	0	0	1
	26	0	0	3	0	1	15	0	1	1	0	1	0	0	0
	27	0	0	0	0	3	0	0	0	1	3	2	1	0	0
%	**1**	16.2	0.0	5.4	5.4	8.1	2.7	0.0	0.0	16.2	2.7	5.4	5.4	0.0	2.7
	2	2.5	25.0	5.0	5.0	5.0	2.5	2.5	0.0	12.5	0.0	5.0	0.0	0.0	5.0
	3	7.1	7.1	35.7	0.0	0.0	0.0	2.4	0.0	2.4	2.4	4.8	0.0	0.0	4.8
	4	16.0	12.0	0.0	20.0	8.0	0.0	4.0	4.0	4.0	0.0	0.0	0.0	0.0	12.0
	5	7.4	5.6	3.7	0.0	18.5	0.0	0.0	7.4	5.6	0.0	0.0	3.7	1.9	3.7
	6	1.5	1.5	0.0	4.4	5.9	51.5	0.0	2.9	4.4	0.0	0.0	0.0	0.0	1.5
	7	0.0	2.2	2.2	2.2	4.3	0.0	0.0	8.7	0.0	4.3	0.0	10.9	2.2	2.2
	8	0.0	1.9	3.8	1.9	3.8	1.9	1.9	39.6	1.9	1.9	3.8	3.8	1.9	3.8
	9	15.2	12.1	3.0	12.1	0.0	3.0	0.0	3.0	6.1	0.0	6.1	0.0	0.0	6.1
	10	0.0	2.5	5.0	0.0	5.0	5.0	5.0	5.0	0.0	25.0	7.5	2.5	5.0	0.0
	11	6.1	3.0	6.1	3.0	0.0	0.0	0.0	9.1	0.0	0.0	9.1	9.1	3.0	0.0
	12	0.0	0.0	0.0	0.0	0.0	3.6	0.0	3.6	0.0	14.3	0.0	42.9	7.1	0.0
	13	0.0	0.0	0.0	0.0	3.2	1.6	6.5	3.2	0.0	9.7	1.6	6.5	14.5	0.0
	14	1.9	20.8	3.8	1.9	1.9	1.9	0.0	9.4	5.7	1.9	5.7	3.8	1.9	5.7
	15	5.9	2.9	14.7	5.9	0.0	0.0	0.0	2.9	0.0	5.9	5.9	0.0	0.0	11.8
	16	2.6	0.0	0.0	0.0	0.0	0.0	2.6	2.6	0.0	0.0	2.6	0.0	7.9	0.0
	17	0.0	0.0	0.0	4.0	6.0	0.0	6.0	4.0	0.0	6.0	4.0	4.0	4.0	0.0
	18	3.7	3.7	0.0	0.0	7.4	0.0	0.0	3.7	0.0	3.7	7.4	3.7	0.0	0.0
	19	0.0	0.0	4.7	4.7	4.7	0.0	7.0	0.0	0.0	7.0	2.3	11.6	9.3	2.3
	20	0.0	3.1	3.1	0.0	6.3	0.0	0.0	0.0	9.4	0.0	3.1	0.0	0.0	0.0
	21	2.4	2.4	0.0	2.4	9.5	2.4	16.7	2.4	0.0	0.0	0.0	4.8	2.4	0.0
	22	0.0	0.0	0.0	2.9	0.0	0.0	4.3	2.9	0.0	5.7	5.7	10.0	15.7	1.4
	23	2.9	8.6	5.7	5.7	2.9	0.0	0.0	0.0	2.9	2.9	5.7	0.0	0.0	2.9
	24	1.4	1.9	0.5	1.4	4.2	0.0	1.4	1.9	0.5	2.3	6.0	3.2	4.6	3.7
	25	3.2	0.0	6.5	3.2	9.7	12.9	0.0	0.0	3.2	0.0	0.0	0.0	0.0	3.2
	26	0.0	0.0	5.5	0.0	1.8	27.3	0.0	1.8	1.8	0.0	1.8	0.0	0.0	0.0
	27	0.0	0.0	0.0	0.0	8.8	0.0	0.0	0.0	2.9	8.8	5.9	2.9	0.0	0.0

		15	16	17	18	19	20	21	22	23	24	25	26	27	sum
#	**1**	2	1	0	0	0	2	0	0	1	2	1	1	0	37
	2	3	0	0	0	0	1	1	0	3	0	1	0	0	40
	3	1	0	0	3	1	2	1	0	2	0	1	0	0	42
	4	0	0	1	0	0	0	0	0	1	0	0	1	1	25
	5	0	1	0	2	1	3	5	0	1	1	1	2	1	54
	6	0	0	1	1	0	0	1	0	0	0	2	12	0	68
	7	3	4	3	0	2	0	7	2	2	0	0	1	0	46
	8	0	1	1	3	3	1	0	1	0	1	0	1	0	53
	9	1	1	1	0	0	1	1	1	0	0	1	1	0	33
	10	0	1	0	1	0	0	2	3	1	1	0	1	1	40
	11	0	1	1	2	0	1	0	1	2	0	0	1	2	33

		15	16	17	18	19	20	21	22	23	24	25	26	27	sum
	12	1	0	0	0	1	0	1	2	0	0	0	1	0	28
	13	0	2	2	1	10	0	1	4	2	2	0	0	1	62
	14	2	1	0	6	0	1	0	1	1	0	2	0	2	53
	15	12	0	0	1	1	0	3	0	0	1	0	0	1	34
	16	1	17	0	0	1	2	1	1	0	1	2	0	7	38
	17	0	1	20	0	2	0	3	4	2	3	1	0	0	50
	18	2	1	0	14	1	0	0	0	0	1	1	0	1	27
	19	0	3	2	1	16	0	0	2	0	1	1	0	0	43
	20	2	1	1	0	0	17	0	0	0	1	0	1	1	32
	21	1	1	4	2	1	0	14	0	2	3	0	0	0	42
	22	2	2	4	2	8	0	1	13	3	3	0	0	1	70
	23	1	2	2	0	1	1	0	0	15	1	0	0	2	35
	24	8	13	9	1	14	6	8	12	12	52	1	0	12	216
	25	0	0	0	0	0	0	0	0	1	0	14	6	0	31
	26	0	1	0	0	0	2	0	0	0	1	11	20	0	55
	27	1	4	1	1	0	2	0	0	2	1	0	1	14	34
%	**1**	5.4	2.7	0.0	0.0	0.0	5.4	0.0	0.0	2.7	5.4	2.7	2.7	0.0	100
	2	7.5	0.0	0.0	0.0	0.0	2.5	2.5	0.0	7.5	0.0	2.5	0.0	0.0	100
	3	2.4	0.0	0.0	7.1	2.4	4.8	2.4	0.0	4.8	0.0	2.4	0.0	0.0	100
	4	0.0	0.0	4.0	0.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0	4.0	4.0	100
	5	0.0	1.9	0.0	3.7	1.9	5.6	9.3	0.0	1.9	1.9	1.9	3.7	1.9	100
	6	0.0	0.0	1.5	1.5	0.0	0.0	1.5	0.0	0.0	0.0	2.9	17.6	0.0	100
	7	6.5	8.7	6.5	0.0	4.3	0.0	15.2	4.3	4.3	0.0	0.0	2.2	0.0	100
	8	0.0	1.9	1.9	5.7	5.7	1.9	0.0	1.9	0.0	1.9	0.0	1.9	0.0	100
	9	3.0	3.0	3.0	0.0	0.0	3.0	3.0	3.0	0.0	0.0	3.0	3.0	0.0	100
	10	0.0	2.5	0.0	2.5	0.0	0.0	5.0	7.5	2.5	2.5	0.0	2.5	2.5	100
	11	0.0	3.0	3.0	6.1	0.0	3.0	0.0	3.0	6.1	0.0	0.0	3.0	6.1	100
	12	3.6	0.0	0.0	0.0	3.6	0.0	3.6	7.1	0.0	0.0	0.0	3.6	0.0	100
	13	0.0	3.2	3.2	1.6	16.1	0.0	1.6	6.5	3.2	3.2	0.0	0.0	1.6	100
	14	3.8	1.9	0.0	11.3	0.0	1.9	0.0	1.9	1.9	0.0	3.8	0.0	3.8	100
	15	35.3	0.0	0.0	2.9	2.9	0.0	8.8	0.0	0.0	2.9	0.0	0.0	2.9	100
	16	2.6	44.7	0.0	0.0	2.6	5.3	2.6	2.6	0.0	2.6	5.3	0.0	18.4	100
	17	0.0	2.0	40.0	0.0	4.0	0.0	6.0	8.0	4.0	6.0	2.0	0.0	0.0	100
	18	7.4	3.7	0.0	51.9	3.7	0.0	0.0	0.0	0.0	3.7	3.7	0.0	3.7	100
	19	0.0	7.0	4.7	2.3	37.2	0.0	0.0	4.7	0.0	2.3	2.3	0.0	0.0	100
	20	6.3	3.1	3.1	0.0	0.0	53.1	0.0	0.0	0.0	3.1	0.0	3.1	3.1	100
	21	2.4	2.4	9.5	4.8	2.4	0.0	33.3	0.0	4.8	7.1	0.0	0.0	0.0	100
	22	2.9	2.9	5.7	2.9	11.4	0.0	1.4	18.6	4.3	4.3	0.0	0.0	1.4	100
	23	2.9	5.7	5.7	0.0	2.9	2.9	0.0	0.0	42.9	2.9	0.0	0.0	5.7	100
	24	3.7	6.0	4.2	0.5	6.5	2.8	3.7	5.6	5.6	24.1	0.5	0.0	5.6	100
	25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2	0.0	45.2	19.4	0.0	100
	26	0.0	1.8	0.0	0.0	0.0	3.6	0.0	0.0	0.0	1.8	20.0	36.4	0.0	100
	27	2.9	11.8	2.9	2.9	0.0	5.9	0.0	0.0	5.9	2.9	0.0	2.9	41.2	100
#	**1**	2	1	0	0	0	2	0	0	1	2	2	1	0	37
	2	3	0	0	2	0	1	1	0	4	0	1	0	0	40
	3	2	0	0	3	1	3	1	0	3	0	1	0	0	42
	4	0	0	1	0	0	0	0	0	1	0	0	2	1	25
	5	0	1	1	2	1	4	5	0	1	1	1	4	2	54
	6	0	0	1	1	0	0	1	0	0	0	2	13	0	68
	7	3	4	4	0	3	0	9	2	2	0	0	1	0	46
	8	0	2	2	3	3	1	0	1	0	1	0	2	0	53
	9	3	1	1	1	0	1	1	1	0	0	1	1	0	33
	10	0	1	0	1	0	0	3	3	1	1	0	1	2	40
	11	1	1	2	3	0	2	0	2	3	0	0	1	2	33
	12	1	0	0	0	2	0	1	3	0	0	0	1	0	28
	13	0	4	2	1	12	0	2	7	2	2	0	0	1	62
	14	3	1	0	6	0	1	0	1	1	0	2	1	2	53
	15	3	0	0	2	1	2	3	0	1	1	0	1	1	34
	16	1	13	0	0	1	2	1	1	0	3	2	0	7	38
	17	0	1	12	0	2	1	3	4	3	4	1	0	0	50
	18	3	1	0	9	1	0	0	1	0	1	1	0	1	27
	19	0	3	2	1	5	0	0	5	0	1	1	0	2	43
	20	2	2	1	1	0	14	0	0	0	2	0	1	1	32

		15	16	17	18	19	20	21	22	23	24	25	26	27	sum
	21	1	1	5	2	2	0	7	0	2	3	0	0	0	42
	22	2	2	5	2	6	1	1	10	3	2	0	0	2	70
	23	3	3	2	1	1	1	1	0	5	1	0	0	3	35
	24	8	14	10	1	14	6	11	12	12	44	1	0	12	216
	25	0	0	0	0	0	0	1	0	1	0	9	6	1	31
	26	0	1	0	0	0	2	0	0	0	1	15	14	0	55
	27	1	5	2	1	0	2	0	0	3	1	0	1	8	34
%	**1**	5.4	2.7	0.0	0.0	0.0	5.4	0.0	0.0	2.7	5.4	5.4	2.7	0.0	100
	2	7.5	0.0	0.0	5.0	0.0	2.5	2.5	0.0	10.0	0.0	2.5	0.0	0.0	100
	3	4.8	0.0	0.0	7.1	2.4	7.1	2.4	0.0	7.1	0.0	2.4	0.0	0.0	100
	4	0.0	0.0	4.0	0.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0	8.0	4.0	100
	5	0.0	1.9	1.9	3.7	1.9	7.4	9.3	0.0	1.9	1.9	1.9	7.4	3.7	100
	6	0.0	0.0	1.5	1.5	0.0	0.0	1.5	0.0	0.0	0.0	2.9	19.1	0.0	100
	7	6.5	8.7	8.7	0.0	6.5	0.0	19.6	4.3	4.3	0.0	0.0	2.2	0.0	100
	8	0.0	3.8	3.8	5.7	5.7	1.9	0.0	1.9	0.0	1.9	0.0	3.8	0.0	100
	9	9.1	3.0	3.0	3.0	0.0	3.0	3.0	3.0	0.0	0.0	3.0	3.0	0.0	100
	10	0.0	2.5	0.0	2.5	0.0	0.0	7.5	7.5	2.5	2.5	0.0	2.5	5.0	100
	11	3.0	3.0	6.1	9.1	0.0	6.1	0.0	6.1	9.1	0.0	0.0	3.0	6.1	100
	12	3.6	0.0	0.0	0.0	7.1	0.0	3.6	10.7	0.0	0.0	0.0	3.6	0.0	100
	13	0.0	6.5	3.2	1.6	19.4	0.0	3.2	11.3	3.2	3.2	0.0	0.0	1.6	100
	14	5.7	1.9	0.0	11.3	0.0	1.9	0.0	1.9	1.9	0.0	3.8	1.9	3.8	100
	15	8.8	0.0	0.0	5.9	2.9	5.9	8.8	0.0	2.9	2.9	0.0	2.9	2.9	100
	16	2.6	34.2	0.0	0.0	2.6	5.3	2.6	2.6	0.0	7.9	5.3	0.0	18.4	100
	17	0.0	2.0	24.0	0.0	4.0	2.0	6.0	8.0	6.0	8.0	2.0	0.0	0.0	100
	18	11.1	3.7	0.0	33.3	3.7	0.0	0.0	3.7	0.0	3.7	3.7	0.0	3.7	100
	19	0.0	7.0	4.7	2.3	11.6	0.0	0.0	11.6	0.0	2.3	2.3	0.0	4.7	100
	20	6.3	6.3	3.1	3.1	0.0	43.8	0.0	0.0	0.0	6.3	0.0	3.1	3.1	100
	21	2.4	2.4	11.9	4.8	4.8	0.0	16.7	0.0	4.8	7.1	0.0	0.0	0.0	100
	22	2.9	2.9	7.1	2.9	8.6	1.4	1.4	14.3	4.3	2.9	0.0	0.0	2.9	100
	23	8.6	8.6	5.7	2.9	2.9	2.9	2.9	0.0	14.3	2.9	0.0	0.0	8.6	100
	24	3.7	6.5	4.6	0.5	6.5	2.8	5.1	5.6	5.6	20.4	0.5	0.0	5.6	100
	25	0.0	0.0	0.0	0.0	0.0	0.0	3.2	0.0	3.2	0.0	29.0	19.4	3.2	100
	26	0.0	1.8	0.0	0.0	0.0	3.6	0.0	0.0	0.0	1.8	27.3	25.5	0.0	100
	27	2.9	14.7	5.9	2.9	0.0	5.9	0.0	0.0	8.8	2.9	0.0	2.9	23.5	100

Summary of the canonical discriminant functions:

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	1.197a	37.2	37.2	.738
2	.484a	15.0	52.2	.571
3	.287a	8.9	61.1	.472
4	.214a	6.6	67.7	.420
5	.185a	5.7	73.5	.395
6	.153a	4.8	78.2	.365
7	.117a	3.6	81.9	.323
8	.112a	3.5	85.4	.318
9	.086a	2.7	88.0	.281
10	.070a	2.2	90.2	.256
11	.058a	1.8	92.0	.235
12	.050a	1.5	93.5	.218
13	.046a	1.4	95.0	.209
14	.038a	1.2	96.1	.191
15	.028a	.9	97.0	.165
16	.024a	.8	97.8	.154
17	.019a	.6	98.4	.138
18	.016a	.5	98.8	.124
19	.011a	.3	99.2	.105
20	.008a	.2	99.4	.089
21	.008a	.2	99.7	.088
22	.005a	.2	99.8	.070
23	.003a	.1	99.9	.058
24	.001a	.0	100.0	.035
25	.001a	.0	100.0	.029
26	.000a	.0	100.0	.010
Test of Function(s)	**Wilks' Lambda**	**Chi-square**	**df**	**Sig.**
1 through 26	.073	3382.739	728	.<.001
2 through 26	.160	2365.415	675	.<.001
3 through 26	.238	1855.366	624	.<.001
4 through 26	.306	1529.689	575	.<.001
5 through 26	.372	1279.042	528	.<.001
6 through 26	.441	1059.470	483	.<.001
7 through 26	.508	875.202	440	.<.001
8 through 26	.567	732.345	399	.<.001
9 through 26	.631	594.889	360	.<.001
10 through 26	.685	488.442	323	.<.001
11 through 26	.733	400.864	288	.<.001
12 through 26	.776	327.725	255	.001
13 through 26	.815	264.980	224	.031
14 through 26	.852	207.266	195	.260
15 through 26	.884	159.201	168	.674
16 through 26	.909	123.694	143	.876
17 through 26	.931	92.733	120	.969
18 through 26	.949	68.049	99	.993
19 through 26	.963	48.132	80	.998
20 through 26	.974	33.789	63	.999
21 through 26	.982	23.577	48	.999
22 through 26	.990	13.601	35	>.999
23 through 26	.994	7.175	24	>.999
24 through 26	.998	2.831	15	>.999
25 through 26	.999	1.224	8	.996
26	1.000	.127	3	.988

Standardized canonical discriminant function coefficients (Fisher's):

	1	2	3	4	5	6	7	8	9	10	11	12	13
1	-0.31	0.19	-0.36	-0.16	0.21	0.03	-0.37	-0.51	0.23	0.36	-0.07	0.30	0.12
2	-0.37	0.10	-0.11	0.15	0.25	0.16	-0.08	0.05	-0.14	0.37	-0.10	-0.06	0.02
3	-0.40	0.15	-0.02	-0.12	-0.03	0.31	0.13	0.12	-0.17	-0.08	0.09	0.25	-0.02
4	-0.21	0.19	0.27	-0.38	-0.09	0.02	0.41	0.05	0.09	-0.02	-0.33	0.20	-0.04
5	-0.36	-0.05	0.07	-0.42	-0.13	-0.27	0.16	0.06	-0.29	0.33	0.24	-0.05	0.04
7	0.20	0.00	-0.13	0.03	-0.12	0.21	0.49	0.26	-0.10	0.05	-0.26	0.25	0.56
8	0.18	-0.15	0.22	0.01	0.01	0.09	-0.28	0.24	0.35	-0.26	-0.33	-0.47	0.29
9	0.07	0.70	-0.19	0.56	0.18	-0.46	0.23	0.17	0.60	-0.59	0.05	0.05	-0.09
10	0.35	0.10	0.07	0.45	-0.56	0.26	0.49	-0.11	-0.19	-0.24	-0.01	-0.22	-0.27
11	-0.15	-0.62	0.01	0.36	0.14	0.09	0.28	0.10	0.31	-0.03	0.53	-0.46	0.01
12	-0.09	-0.01	-0.07	0.00	-0.24	-0.29	-0.20	0.05	0.08	0.73	0.07	-0.26	0.12
13	0.04	-0.23	0.00	-0.19	0.11	0.24	-0.21	0.32	0.07	0.07	-0.26	0.00	-0.04
14	0.29	0.27	0.32	-0.29	0.32	0.22	0.26	-0.15	0.28	0.25	0.64	-0.18	-0.16
15	0.51	0.24	-0.33	0.14	0.02	0.20	0.19	-0.16	-0.15	0.13	-0.02	-0.09	0.08
16	-0.17	-0.40	0.24	0.53	0.38	-0.17	-0.54	-0.03	-0.38	-0.38	0.09	0.34	0.21
17	0.02	0.21	0.06	0.10	-0.30	0.13	-0.22	0.37	-0.21	-0.39	0.27	-0.25	0.25
18	0.11	0.08	-0.03	-0.09	0.24	-0.10	0.44	0.20	-0.17	0.05	-0.25	-0.02	-0.34
19	-0.15	0.25	0.29	-0.65	0.30	-0.13	-0.25	-0.34	-0.39	0.22	-0.17	-0.38	0.38
20	-0.06	0.17	0.20	0.16	0.03	0.20	-0.18	0.18	0.07	0.08	-0.08	0.00	-0.20
21	-0.23	0.29	0.17	0.09	-0.17	0.46	-0.17	-0.66	0.03	-0.34	-0.32	0.61	0.24
22	0.12	-0.20	0.03	0.14	0.16	-0.28	-0.60	0.17	-0.27	0.27	0.21	0.18	-0.02
23	0.04	-0.30	0.10	-0.29	-0.43	-0.21	0.00	0.47	-0.20	0.38	-0.03	0.20	0.06
24	0.23	-0.06	-0.38	0.46	0.19	0.19	-0.24	0.26	0.51	-0.11	0.24	0.18	0.01
25	0.15	-0.18	-0.11	0.06	-0.19	0.08	-0.03	0.08	-0.11	-0.13	0.30	-0.06	0.01
26	0.39	-0.08	0.56	-0.25	0.17	-0.10	0.53	-0.24	0.14	-0.27	-0.27	-0.28	0.07
27	0.06	0.05	0.66	-0.01	-0.22	-0.15	0.02	0.08	0.24	0.21	0.13	0.32	-0.53
28	0.22	-0.16	-0.24	0.15	-0.09	-0.30	0.26	-0.22	0.18	0.01	0.36	0.17	0.24
29	-0.42	-0.27	-0.29	0.31	0.25	-0.18	-0.02	-0.30	-0.35	0.20	-0.51	-0.21	-0.26

	14	15	16	17	18	19	20	21	22	23	24	25	26
1	0.21	0.76	0.23	0.42	0.60	-0.15	0.30	0.04	0.19	-0.48	0.32	0.21	-0.48
2	-0.18	0.38	0.25	-0.49	0.21	0.27	0.12	-0.24	-0.04	-0.27	0.47	-0.42	0.24
3	-0.06	-0.38	0.32	-0.08	0.12	-0.14	0.27	0.29	0.15	-0.02	-0.19	0.41	0.40
4	-0.03	0.62	-0.11	-0.05	-0.01	-0.01	-0.26	0.27	0.40	-0.13	-0.52	-0.22	0.80
5	0.59	0.16	0.29	0.28	0.19	0.42	-0.75	0.10	0.00	0.57	-0.06	-0.21	0.54
7	-0.06	-0.06	-0.14	0.16	0.02	-0.34	-0.42	-0.49	-0.08	-0.01	-0.02	0.13	-0.09
8	-0.21	-0.49	-0.06	-0.02	0.36	0.07	-0.19	0.07	-0.08	0.19	0.03	-0.06	0.12
9	-0.47	-0.32	-0.17	-0.41	0.24	-0.30	0.54	-0.29	0.18	-0.48	0.00	0.11	-0.52
10	0.29	-0.67	-0.08	-0.14	-0.68	-0.11	-0.82	0.49	-0.14	-0.06	-0.16	-0.18	0.55
11	0.14	-0.16	-0.37	0.57	-0.06	-0.67	0.39	0.34	-0.44	-0.02	0.16	0.00	-0.31
12	-0.04	-0.02	-0.20	-0.26	-0.24	0.06	0.33	-0.03	0.32	0.03	-0.36	0.15	0.08
13	0.01	-0.23	0.33	0.36	0.00	0.17	0.14	-0.39	-0.25	-0.42	-0.52	-0.48	-0.02
14	0.23	-0.04	0.05	-0.40	0.32	0.06	-0.34	0.05	0.27	-0.19	0.05	0.29	-0.12
15	-0.37	0.20	0.01	0.23	0.25	-0.08	0.31	0.24	-0.05	0.43	-0.12	-0.27	0.07
16	-0.11	0.25	-0.01	-0.09	0.07	-0.21	-0.30	0.09	0.26	0.36	0.11	0.16	0.38
17	0.15	0.59	-0.15	-0.01	0.27	0.22	0.27	-0.14	-0.40	0.16	-0.40	0.38	-0.20
18	-0.11	0.05	-0.13	0.28	0.15	0.52	0.20	0.33	-0.21	-0.26	-0.09	-0.17	-0.08
19	-0.23	-0.31	0.08	0.70	-0.60	-0.13	0.18	0.10	-0.07	-0.28	0.59	-0.14	0.25
20	0.16	0.00	-0.47	-0.13	-0.33	0.06	-0.25	0.04	0.26	0.34	0.39	0.39	-0.01
21	-0.36	-0.26	-0.52	-0.25	0.13	0.64	0.32	-0.56	0.25	-0.12	-0.18	-0.27	-0.25
22	1.01	-0.50	-0.07	0.08	-0.09	-0.10	0.02	-0.11	-0.55	0.06	0.38	0.03	-0.27
23	0.14	0.34	0.67	-0.44	-0.26	0.18	-0.53	0.81	0.06	0.22	0.17	0.08	-0.11
24	0.42	0.18	0.22	0.00	-0.29	0.09	-0.03	-0.03	-0.11	0.47	-0.21	-0.03	-0.29
25	0.07	0.14	0.01	0.28	0.19	0.08	0.35	-0.20	0.68	-0.43	0.38	-0.37	-0.04
26	0.20	-0.04	0.21	-0.23	-0.06	-0.13	0.29	0.09	-0.14	0.17	0.03	-0.06	-0.10
27	-0.48	-0.09	0.15	0.28	0.03	-0.22	0.01	-0.33	-0.09	0.36	0.06	-0.06	-0.02
28	-0.13	-0.11	-0.18	0.21	-0.23	0.29	-0.05	0.01	-0.29	-0.25	0.11	0.54	0.25
29	0.26	0.15	0.34	-0.33	0.05	0.36	0.03	0.04	0.19	0.20	-0.21	0.13	-0.20

G.3 Greenland samples 1 = NE, 2 = NW, 3 = SW, 4 = SE quadrants, traits from Table 4.5.

Classification table:

		V3	Predicted Group Membership				Total
			1	2	3	4	
Original	Count	1	23	1	2	2	28
		2	4	34	12	12	62
		3	12	11	31	16	70
		4	3	10	7	23	43
	%	1	82.1	3.6	7.1	7.1	100.0
		2	6.5	54.8	19.4	19.4	100.0
		3	17.1	15.7	44.3	22.9	100.0
		4	7.0	23.3	16.3	53.5	100.0
Cross-validated	Count	1	10	4	7	7	28
		2	8	20	15	19	62
		3	15	17	19	19	70
		4	7	12	13	11	43
	%	1	35.7	14.3	25.0	25.0	100.0
		2	12.9	32.3	24.2	30.6	100.0
		3	21.4	24.3	27.1	27.1	100.0
		4	16.3	27.9	30.2	25.6	100.0

Summary of the canonical discriminant functions:

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	.479	57.8	57.8	.569
2	.185	22.3	80.1	.395
3	.164	19.9	100.0	.376
Test of Function(s)	**Wilks' Lambda**	**Chi-square**	**df**	**Sig.**
1 through 3	.490	132.250	87	.001
2 through 3	.725	59.676	56	.344
3	.859	28.245	27	.398

Standardized canonical discriminant function coefficients (Fisher's):

	1	2	3
1	-.400	-.465	.123
2	-.039	.205	-.103
3	-.133	.018	-.298
4	-.395	-.177	.406
5	-.072	-.181	.307
6	-.098	-.245	-.088
7	-.455	-.168	-.165
8	.199	-.036	.003
9	.095	-.142	.190
10	.314	.290	-.639
11	.779	.104	.262
12	.295	.289	.002
13	-.099	.039	-.164
14	-.096	.043	-.257
15	-.082	.172	.151
16	.439	.259	.122
17	-.046	.507	.505
18	-.259	-.223	.483
19	.188	-.180	.250
20	.015	.062	.059
21	-.089	-.679	-.380
22	.032	.091	-.326
23	-.441	.526	-.024
24	.058	.382	-.248
25	-.057	.305	.342
26	.396	.030	.308
27	-.084	-.044	.392
28	.074	-.537	-.253
29	.396	-.196	-.414