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Monte Carlo Likelihood Estimation For Conditional Autoregressive Models With Application To Sparse Spatiotemporal Data

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MONTE CARLO LIKELIHOOD ESTIMATION FOR CONDITIONAL AUTOREGRESSIVE MODELS WITH APPLICATION TO SPARSE SPATIOTEMPORAL DATA

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LIST OF ABBREVIATIONS

CalCOFI	California Cooperative Oceanic Fisheries Investigations
CAR	conditional autoregressive
HCAR	homogeneous conditional autoregressive
MCL	Monte Carlo likelihood
$\text{MCSE}_{\text{Mean}}$	Monte Carlo standard error of mean
MCSE_{SD}	Monte Carlo standard error of standard deviation
MRF	Markov random field
OBS	Observations
PMCL	penalized Monte Carlo likelihood
WCAR	weighted conditional autoregressive

ABSTRACT

Spatiotemporal modeling is increasingly used in a diverse array of fields, such as ecology, epidemiology, health care research, transportation, economics, and other areas where data arise from a spatiotemporal process. Spatiotemporal models describe the relationship between observations collected from different spatiotemporal sites. The modeling of spatiotemporal interactions arising from spatiotemporal data is done by incorporating the space-time dependence into the covariance structure. A main goal of spatiotemporal modeling is the estimation and prediction of the underlying process that generates the observations under study and the parameters that govern the process. Furthermore, analysis of the spatiotemporal correlation of variables can be used for estimating values at sites where no measurements exist. In this work, we develop a framework for estimating quantities that are functions of complete spatiotemporal data when the spatiotemporal data is incomplete. We present two classes of conditional autoregressive (CAR) models (the homogeneous CAR (HCAR) model and the weighted CAR (WCAR) model) for the analysis of sparse spatiotemporal data (the log of monthly mean zooplankton biomass) collected on a spatiotemporal lattice by the California Cooperative Oceanic Fisheries Investigations (CalCOFI). These models allow for spatiotemporal dependencies between nearest neighbor sites on the spatiotemporal lattice. Typically, CAR model likelihood inference is quite complicated because of the intractability of the CAR model's normalizing constant. Sparse spatiotemporal data further complicates likelihood inference. We implement Monte Carlo likelihood (MCL) estimation methods for parameter estimation of our HCAR and WCAR models. Monte Carlo likelihood estimation provides an approximation for intractable likelihood functions. We demonstrate our framework by giving estimates for several different quantities that are functions of the complete CalCOFI time series data.

CHAPTER 1

INTRODUCTION

Advances in methods of collecting and retrieving spatial and spatiotemporal data, such as remote sensing and Geographic Information Systems, have brought a new impetus to the field of spatial statistics. The development of high performance computers and easily obtainable statistical software, such as R, has gradually eased the computational difficulty associated with the modeling of spatial data, thus, allowing for wider applications of spatial and spatiotemporal models. Today, methods for spatial and spatiotemporal modeling are increasingly used in a diverse array of fields, such as ecology, epidemiology, health care research, transportation, economics, and other areas where data arise from a spatial process.

Spatiotemporal models measure the relationship between observations collected from different locations at different times. The basic assumption of these models is that data collected close in space and time are correlated and that this correlation decreases as distance and time differentials increase. These models also assume correlation of error terms in space and time. A main goal of spatiotemporal modeling is the estimation and prediction of the underlying process that generates the observations under study and the parameters that govern the process. Furthermore, analysis of the spatiotemporal correlation of variables can be used for estimating values at sites where no measurements exist.

Unfortunately, analyses of spatiotemporal models become quite difficult in the presence of missing data. Maximum likelihood estimation of spatiotemporal model parameters becomes problematic or infeasible when data are incomplete. Even with complete data, statistical analysis based on likelihood methods can still be problematic for very large lattices [1]. Moreover, many spatiotemporal models have intractable likelihoods.

Thus, there is a need for a framework which allows for likelihood based approaches to spatiotemporal modeling when data are incomplete. This paper presents such a framework (based on Geyer and Thompson [2]) for a class of spatiotemporal models called Conditional Autoregressive (CAR) models [3]. The CAR model assumes only pairwise spatiotemporal interaction among the data. Maximum likelihood analysis will be used to estimate model parameters. This choice of model allows for likelihood analysis through MCMC simulations. Here the Monte Carlo Likelihood [2], will be used to compute maximum likelihood estimators. The Monte Carlo Likelihood (MCL) algorithm allows us to obtain an approximation to the maximum likelihood estimator in the presence of missing data and intractable likelihood functions.

We will apply this framework to an analysis of spatiotemporal variation in zooplankton production in the California Current system. The zooplankton measurements were collected as part of the California Cooperative Oceanic Fisheries Investigations (CalCOFI) study. CalCOFI was established in 1949 to determine the cause of the large-scale changes in the California sardine industry. Analysis of the CalCOFI samples has been problematic due to changes made to the sampling plan over time, resulting in incomplete data.

This paper is organized as follows. The remainder of this chapter provides background on the CalCOFI survey, the California Current System and zooplankton. Chapter 2 provides a review of methods of statistical analysis with missing data. Chapter 3 concerns spatiotemporal analysis. Chapter 4 discusses Conditional Autoregressive (CAR) models and simulation of CAR models. Chapter 5 presents the framework for CAR parameter estimation by Monte Carlo maximum likelihood (MCL) estimation. Chapter 6 details the implementation of the MCL estimation procedure. Chapter 7 presents an application of MCL estimation to the CalCOFI time series.

1.1 California Cooperative Oceanic Fisheries Investigations (CalCOFI)

The California Cooperative Oceanic Fisheries Investigations (CalCOFI) was established in 1949 to investigate the cause of the large-scale changes in the Pacific sardine fishery off California and Mexico. The study was initiated by the California state government in response to the collapse of the California sardine fishing industry, with the long-term goal of understanding the spatial and temporal patterns of variation as they relate to physical and biological features of the California Current region. Since its inception, CalCOFI has taken over 50,000 plankton tows (conducted during more than 300 cooperative biological-oceanographic survey cruises) that measure the physical, chemical, and biological characteristics of the California Current region. The CalCOFI time series includes oceanographic and plankton volume data on the 50,000 stations occupied since 1951, as well as larval abundance data on over 250 species of fishes along with larval length frequency data and egg abundance data on key commercial species.

1.1.1 CalCOFI Survey

The CalCOFI study as originally planned consisted of taking measurements at more than 1800 hydrographic stations on a regular rectangular spatial grid parallel to the California Coast (Figure 1.1). The historical CalCOFI sampling grid extends approximately1600 kilometers along the California coast from the southern reaches of Baja California to the California-Oregon border. Hydrographic stations were surveyed at grid points along 36 nominal parallel lines oriented approximately perpendicular to the California coastline and extending several hundred kilometers from shore out to sea with the maximum distance from station to shore varying along the grid. Figure 1.1 illustrates the survey grid as established in 1949. Stations along the sampling grid are designated by a line and station number (e.g. 66.7.120 is station 120 on line 66.7). Station spacing along each line is approximately 70 km for stations west of station 60, while spacing is considerable less for stations inshore of station 60. Station spacing between parallel lines is approximately 65 kilometers.

The initial CalCOFI survey program conducted monthly biological and physical measurements at each of the sampling grid points. This plan lasted with few interruptions from 1950 until 1961. The greatest spatial and temporal coverage occurred during this early time period. In 1961 financial problems resulted in a change from monthly sampling cruise surveys to quarterly surveys from 1961 to 1965. In 1969 the sampling plan changed from every third month to monthly surveys every third year because of difficulty scheduling sampling cruises. This change in sampling plan resulted in intermittent data with measurements made only in 1969, 1972, 1975, 1978, and 1981. A consequence of using three different sampling plans between 1949 and 1981 is temporal discontinuity in the data. In addition to

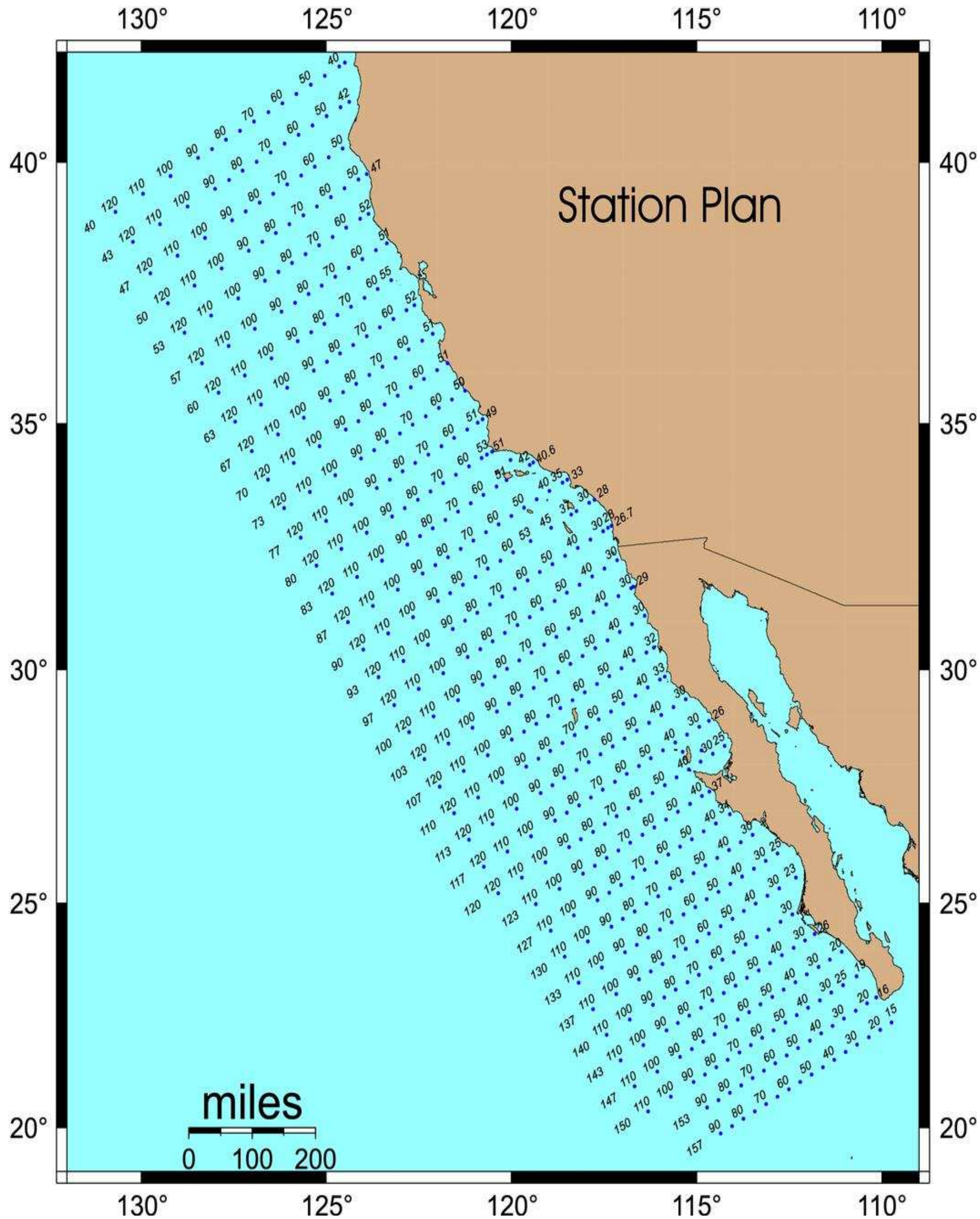


Figure 1.1: Historical CalCOFI Survey.

change in sampling plan, not all hydrographic stations in the CalCOFI grid were occupied during any given sample month, resulting in data loss. During the period from 1949 to 1984, stations on the historical grid were sampled over 23,000 times. Standard station sampling consisted of 12- to 18-Nansen bottle casts made at up to 500-m depth with an occasional cast of up to 2000 m. In 1985, a reduced sampling grid scheme covering waters only off southern California was established (Figure 1.2).

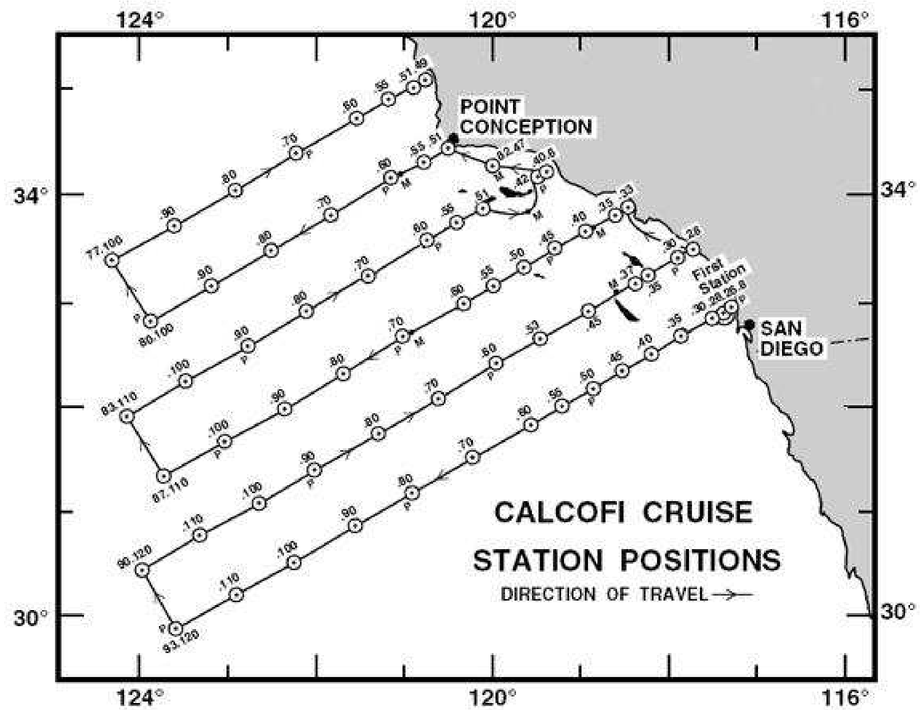


Figure 1.2: CalCOFI reduced sampling grid.

1.2 Plankton

Plankton are the minute animal and plant life of oceans (and other bodies of water), with limited to no swimming ability, that generally drift or float with water currents. Plankton are classified as either phytoplankton (plant plankton), or zooplankton (animal plankton). Phytoplankton are generally limited to the photic zone (also called euphotic zone) of a body of water and provide nutrients for zooplankton and fish by photosynthesizing organic matter from water, carbon dioxide, and light. Zooplankton spend their entire life as holoplankton, such as diatoms and copepods, or they spend a portion of their life as meroplankton, the larval stages of benthic invertebrates, such as starfish and sea urchins. Zooplankton can occur throughout a body of water from surface to bottom. Zooplankton distribution, abundance, and productivity are influenced by many environmental factors, such as light, nutrients, and upwelling. Zooplankton distribution tends to be very patchy [5] and characterized by high seasonal and inter-annual variability [6].

1.2.1 Phytoplankton

Nearly all marine life depends directly or indirectly on primary production (oceanic), which is the production of new organic compounds from aquatic carbon dioxide, principally through photosynthesis. Phytoplankton are responsible for the majority of primary production, as such, they form the base of the aquatic food chain and serve as nutrients for zooplankton. Therefore, phytoplankton productivity (the measure of growth or new plant material per unit time) is an indicator of zooplankton productivity. The spatial distributions of both phytoplankton and zooplankton are extremely patchy. Because of the solar energy needed in photosynthesis, plankton primary production is generally confined to surface waters and to geographical regions and seasons having abundant light. Phytoplankton primary productivity (off the California coast) is highest during the summer months and lowest during the winter months [7]. Phytoplankton productivity levels are highest within approximately 50 km of the California coastline [7] and in upwelling areas [8]. Upwelling is the process of upward movement to the ocean surface of deeper cold usually nutrient-rich waters especially along some shores due to the offshore movement of surface waters. Owen [7] reports phytoplankton biomass to be higher near Point Conception, the point where the Santa Barbara Channel meets the Pacific Ocean, than in other locations.

1.2.2 Zooplankton

Zooplankton are classified as either meroplankton (spending part of their life as plankton), or holoplankton (spending their entire life as plankton). Zooplankton form the second level of the aquatic food web, as such, they are the initial prey for almost all fish larvae.

Fisheries rely on zooplankton density and distribution to be greater than that of new larvae, for larval survival. Zooplankton exist primarily in surface waters where phytoplankton and other types of zooplankton are abundant. Their spatial and temporal distributions are dependent on several factors such as phytoplankton abundance and water temperature [9]. Zooplankton production is highest in early spring and summer and periods coinciding with upwelling periods and increased levels of phytoplankton [10]. In waters off Southern California, macrozooplankton biomass has decreased by 80 percent since 1951 [11].

1.3 CalCOFI Research

Analysis of the CalCOFI time series data from the CalCOFI program has shown that the California Current System (CCS) is sensitive to interannual climate changes; especially El Niño associated climate changes [12], [13]. Within the CCS, El Niño affects salinity, sea surface temperatures (increasing), coastal upwelling (decrease), and sea level (higher) [12], [14], [13]. However, the many poorly sampled regions and time periods of the CalCOFI time series do not adequately describing changes in the physical and biological structure of the CCS [15].

CHAPTER 2

MISSING DATA

Missing data is a common problem for researchers in a wide range of fields such as economics, epidemiology, image analysis, political science, remote sensing, and survey sampling. In survey sampling, missing data can result from nonresponse by the interview subject, from omitted questions by the interviewer, and from poorly designed questionnaires. Longitudinal studies are subject to participants potentially not being available during one or more data collection times or dropping out of the study entirely. Missing data are especially prevalent in databases assembled from several sources, such as hospital administrative and clinical lab data and Medicaid claims data, where an inability to link 100 percent of records will result in missing data for some variables in the combined database.

These types of missingness will inevitably complicate statistical analyses for researchers. Applications of common statistical methods are made more difficult or entirely inappropriate when data are missing [16] since many procedures cannot handle missing data [17]. Omitting records with missing data effectively reduces sample size, resulting in less information which leads to a loss of statistical power [18]. Biased estimates can result from statistical modeling of incomplete data due to differences between missing data and observed data [17]. In survey sampling, if values are missing systematically, then a sample cannot be representative of the population of interest and estimates based on the sample will be substantially biased. Furthermore, maximum likelihood estimation is made more complicated by the presence of missing data [19].

2.1 Types of Missingness

Missing data can occur in patterns with the severity of the incompleteness varying. The effect missing data has on statistical analysis depends on the mechanism that produced the missing data. The *Missing-Data Mechanism* (MDM) explains the reasons for data being missing and whether the missingness is dependent on the values in the data set. Failure to properly understand the MDM or to assume the MDM is ignorable may invalidate inference. Rubin [20] formulated the processes that led to missing data with respect to the information they give about the missing observations. Following Rubin [20], let $Y = (y_{ij})$ be an $n \times p$ set of data without missing observations, X = predictor variables, M = missing data indicator matrix = (m_{ij}), such that $m_{ij} = 1$ if y_{ij} is missing and that $m_{ij} = 0$ if y_{ij} is observed. Let Y_{obs} and Y_{mis} denote the observed and missing values of Y respectively. The missing-indicator-matrix defines the pattern of the missing data.

Data is said to be *Missing at Random* (MAR), if conditional on the observed data, the values of the actual missing data do not influence the MDM, i.e.

$$P(M|Y, X) = P(M|Y_{obs}, X) \; \forall \; Y_{mis}, X \tag{2.1}$$

Under MAR, the missing data mechanism is said to be ignorable, meaning that modeling of the MDM is not needed for valid estimation [21]. Thus, if the MAR assumption holds, likelihood inference ignoring the MDM is valid [20].

There exists a special case of MAR, *Missing Completely at Random* (MCAR), if the missing data mechanism is independent of both the observed data and the values of the missing data, i.e.,

$$P(M|Y, X) = P(M|X) \; \forall \; Y, X \tag{2.2}$$

[20]. Under MCAR, the missing data can be viewed as a random sub-sample of the potentially complete data, though the pattern of the missing data is not necessarily random. If MCAR holds then the MDM is ignorable, furthermore, sampling inferences and likelihood inferences without modeling the MDM are valid [19]. The MCAR conditions rarely occur since missing values must be randomly distributed across all observations rather than randomly distributed within one or more subsamples, as with the MAR assumption.

The most difficult condition is the *Not Missing at Random* (NMAR) or non-ignorable missing data condition. Under NMAR, missing values are not randomly distributed across observations; rather, the MDM depends on the actual values of the missing data. When this condition holds, the missing-data mechanism must be specified and incorporated into the analysis in order for estimators to be unbiased [20].

2.2 Methods for Handling Missing Data

After proper study of the missing-data mechanism, a solution to the problem can be implemented. Missing data requires modification of our analysis since many procedures cannot handle explicitly coded missing data [17]. This is generally done through modification of the incomplete data. Data modification methods generally fall under three categories: deletion of incomplete records (complete-case analysis), imputation of missing data values, or iterative procedures. Deletion methods simply omit some or all of the incomplete data. Imputation strategies provide either a single estimate or multiple estimates for each missing data value. Data modifications based on deletion or imputation modify the datasets while allowing for analyses by standard complete-data statistical methods without modification [16]. The intent of these methods is to fix the data so that analyses designed for complete data can be performed. These techniques are easily employed but very often they produce biased estimates and they have little theoretical justification.

Iterative procedures assume a model for the complete data. Missing values are then replaced through a series of steps as follows: first initial values are imputed for the missing values; next complete data analysis proceeds and model parameters are estimated; then we re-estimate the missing data using the new parameter values and repeat, iterating until parameter estimates converge [16].

2.2.1 Data Deletion Methods

Data deletion methods, such as listwise deletion (Complete-Case analysis) or pairwise deletion (Available-Case analysis), provide the simplest strategy for handling missing data. These methods solve the missing data problem by deleting entire records or pairs of variables with missing data. *Listwise deletion* (LD) removes an entire observation if it is missing one or more variables used in the statistical analysis. It is only appropriate for use if the MCAR condition holds; otherwise, the result will be biased [16]. Listwise deletion results in a loss in statistical power due to the reduction in the sample size.

Pairwise deletion (PD) removes missing variables by pairs. For each variable, PD computes a mean and variance estimate from the univariate complete data. Next, covariance estimates are computed from all cases with complete observations on both variables. This uses more information than LD. However, analysis of the PD covariance matrix is problematic since each entry of the matrix can be based on a different sample size. Consequently, joint statistical analysis is difficult. Furthermore, if MAR does not hold, then the estimates will be biased [16].

2.2.2 Data Imputation Methods

Single imputation (SI) methods provide an improvement over data deletion methods by retaining all observed values in the analysis. *Mean imputation* replaces a missing value with its sample mean based on the observed values of the same variable. Computations of means and covariances then proceed as if the data were complete. Mean imputation may provide good estimates of means and totals; however, estimates of other parameters such as variances and covariance matrices are inconsistent. Variance estimates are generally negatively biased, confidence intervals for estimated parameters are too narrow, and Type I errors are usually too high [16]. Nevertheless, a benefit of mean imputation is that covariance matrices must be positive definite or positive semidefinite. Given this benefit, mean imputation is desirable if its disadvantages can be minimized while retaining the full benefit of its use.

Mean imputation can be improved if each missing value is replaced by its conditional mean given the observed values, called conditional mean imputation. *Conditional mean imputation* retains the benefits of mean imputation while reducing the mean squared error of the estimates; however, it distorts estimates of measures that are not linear in the data, such as variances and correlations. A possible solution to this problem is to replace the missing value by the conditional mean plus a random error term, so that the distribution of the completed data set can be preserved [22].

Another limitation of both mean imputation and conditional mean imputation is that a single imputed value does not reflect the uncertainty in missing value estimates as the error term of the missing value estimation equation is equal to zero. Consequently, analyses that treat imputed values as if they are observed values tend to underestimate uncertainty. This is true even if the missing data mechanism is modeled correctly and randomly drawn imputations are created. This problem can be solved by using multiple imputation (MI) methods.

Multiple imputation (MI) [21] is a modification of single imputation. Rather than creating a single complete data set, a set of M complete data sets is created. The imputed values are drawn from a predictive distribution under an appropriate model for consistency of point estimators. Next each of the M data sets is analyzed by standard complete-data statistical methods, and results are combined. Parameter means and variances can then be computed from the samples. For a given parameter, the variance of the MI estimate is the average of the variances from the M data sets plus $(1 + \frac{1}{M})$ times the sample variance of the estimates from the M data sets. The second term is the estimated contribution to the variance from imputation uncertainty [22], which is ignored by single imputation, thus improving upon single imputation. MI also provides more efficient point estimates than does SI, even for very small M. Rubin [21] showed that the efficiency of an estimate based on M imputations to be approximately $(1 + \frac{\lambda}{M})^{-1}$, where λ is the rate of missing data for the quantity being estimated.

2.2.3 Maximum Likelihood Estimation

Maximum likelihood (ML) estimation provides another method for dealing with missing data. With ML estimation, parameter estimates are derived such that the likelihood of reproducing the data given the parameter estimates is maximized [23]. With missing data, inference is based on the likelihood function of the missing data as follows: Let $Y = (y_{ij})$ be an $n \times p$ set of data without missing observations, $X_{n \times q}$ be a matrix of fully observed covariates, $M =$ missing data indicator matrix $= (m_{ij})$, such that $m_{ij} = 1$ if y_{ij} is missing and $m_{ij} = 0$ if y_{ij} is observed. Let Y_{obs} and Y_{mis} denote the observed and missing values of Y respectively. Treat covariates that are not fully observed as random variables. These random variables are modeled with the set of Y_j's. Following [22], model the MDM and data as

$$f(Y, M|X, \theta) = f(Y|X, \theta) f(M|Y, X, \psi), \tag{2.3}$$

where $f(Y|X,\theta)$ is the model without missing observations and $f(M|Y,X,\psi)$ is the MDM model, and θ and ψ are unknown parameters. The likelihood of θ and ψ given Y_{obs},M, and X is

$$L(\theta,\psi|Y_{obs},X) = \text{constant} \times \int f(Y,M|X,\theta,\psi)\, dY_{mis}. \tag{2.4}$$

The likelihood of θ ignoring the MDM is

$$L(\theta|Y_{obs},X) = \text{constant} \times \int f(Y|X,\theta)\, dY_{mis}. \tag{2.5}$$

If θ and ψ have disjoint parameter spaces and the data are MAR, then likelihood inferences about θ using (2.4) and (2.5) are equivalent, with inference using (2.5) preferable [22]. Furthermore, Little and Rubin [22] show that for large-sample inference under (2.5), $(\hat{\theta} - \theta) \sim N_k(0, I^{-1})$, where $\hat{\theta}$ is the maximizer of (2.5) and I is the Fisher information matrix.

The problem now is maximizing the likelihood function to compute $\hat{\theta}$ and I, which can be accomplished using Newton-Raphson (NR) type algorithms. NR methods provide some advantages when calculating parameter estimates from the likelihood function. One advantage of NR is its rapid convergence. NR also provides information about the derivatives of the likelihood function that can be used to compute standard errors for parameter estimates [24]. However, when the likelihood is a function of n variables, implementation of NR is more complicated, as the first derivative is now a vector and the second derivative is an $n \times n$ matrix. Continuity of the second derivative is required and the initial starting point must be in a neighborhood of the root. Furthermore, NR type optimization procedures cannot be used if derivatives do not exist in closed form.

2.2.4 Iterative Methods

Simulation methods such as the Expectation-Maximization (EM) algorithm allow us to perform maximum likelihood estimation when closed form expressions for the likelihood do not exist. The EM algorithm and Markov Chain Monte Carlo (MCMC) methods such as Gibbs Sampling can be regarded as the Bayesian analog of multiple imputation. The use of these methods is based on the Missing Information Principle: fill in the missing data based on the available data [25]. They assume the missing data are MAR, MCAR, or ignorable.

The Expectation-Maximization (EM) algorithm has become a standard tool in the analysis of missing data. Dempster, Laird, and Rubin [26] presented the EM algorithm for use in computing ML estimators in the presence of missing data. The EM algorithm allows many complex statistical problems to be reformulated as missing data problems such that parameter estimation is much simpler. The algorithm is closely related to the ad hoc approach to estimation with missing data where the parameters are estimated after filling in initial values for the missing data. The algorithm consists of an iterative two-step process for estimating model parameters. For example, with linear models, the EM algorithm attempts to fill in the missing data values in each step by substituting each missing value by the mean given the current parameters [27].

The EM algorithm integrates missing data into the estimation process, thus avoiding the need to impute missing values. The two steps of the EM algorithm are the expectation step (E-step) and the maximization step (M-step). First, the data are separated into the observed data and the missing data. The parameters are then assigned initial values. The E-step consists of calculating the mean of the log-likelihood function conditional on the observed data and the current parameter values. Next (M-step) the mean of the log-likelihood function is maximized with respect to the parameters. The maximizing parameters then become the current parameters and the process is repeated until convergence. Wu [28] showed that under regularity conditions on the likelihood function and assuming the initial parameter values are not far from the maximum, then the EM algorithm has two attractive properties.

Property 1: If θ is a real parameter, then $\theta_n \uparrow \hat{\theta}$ or $(\theta_n \downarrow \hat{\theta})$, i.e. the sequence of EM approximations converges monotonically to the ML estimate.

Property 2: For any EM sequence $\{\theta_k\}$, $L(\theta_{k+1}) \geq L(\theta_k)$, i.e. the EM sequence increases the likelihood at each step. Thus, for a sequence of likelihood functions $\{L(\theta_k)\}$ bounded above, $\{L(\theta_k)\}$ converges monotonically to some value $L(\hat{\theta})$ where $L(\theta_k) = L(\theta_k|Y_{obs}, X)$.

CHAPTER 3

SPATIOTEMPORAL ANALYSIS

The theories of Bartlett [29, 30, 31] and Whittle [32] inspired the early development of spatial statistical theory. Bartlett applied a conditional probability approach to spatial statistical problems, whereas Whittle applied a joint probability approach. Bartlett's approach has greater appeal than Whittle's because expression of a joint probability model in terms of conditional probabilities may provide intuitive understanding of its meaning [3]. However, Brook [33] argues that one cannot arbitrarily construct conditional probabilities since there is neither an obvious method of deducing the joint probabilities associated with the conditional probabilities nor a certainty that the joint probabilities exist. In this chapter we present a spatial model for which there is an exact connection between the joint probabilities and the conditional probabilities. We show how to construct the model and we extend this model to spatiotemporal data.

3.1 Finite Lattice

The CalCOFI time series consist of time series data collected on a rectangular grid (Figure 1.1); i.e., a regularly spaced 3-dimensional lattice [34]. Here a 3-dimensional lattice $S \subset \mathbb{R}^3$ is an index set of disjoint and exhaustive fixed sites at which data are observed, i.e., $S = \bigcup_{i=1}^{n} \{s_i\}$ and $s_i \cap s_j = \emptyset$ for $i \neq j$, where $s_1, \ldots, s_n$ are the fixed sites of S. The CalCOFI sampling grid we used for this study is a 9×24 grid of spatial sites sampled over time $T = 672$ months. However some sites (called non-sampling sites) on our grid were either over land or over water but never part of the CalCOFI sampling plan. Those non-sampling sites over water will be treated as sites with zero observations which are never observed.

Spatiotemporal data can be represented by a 3-dimensional lattice of size $M \times N \times T$, denoted by

$$S = \{s(m, n, t) : 1 \leq m \leq M; 1 \leq n \leq N; 1 \leq t \leq T\}. \tag{3.1}$$

The spatiotemporal sites of a 3-dimensional lattice are denoted by $s(m, n, t)$ where m and n are spatial coordinates and t is the temporal index. For the 3-dimensional spatiotemporal lattice define the one-to-one correspondence $s_i : S \to \{1, 2, \ldots, K\}$ where $K = M \times N \times T$ by

$$s_i = s_{m+(n-1)*M+(t-1)*M*N} = s(m, n, t). \tag{3.2}$$

Thus, by re-labeling the spatiotemporal sites of the 3-dimensional lattice S by a single index i where $i \in \{1, 2, \ldots, K\}$ with $K = M \times N \times T$, the sites of a lattice can be represented as a K-dimensional vector S^* with spatiotemporal sites $s_i \in S^*$ for $i = 1, 2, \ldots, K$. In this dissertation, we will use (3.2) to represent a site s_i of the CalCOFI 3-dimensional regular lattice S of (3.1) where $(M, N, T) = (9, 24, 672)$.

3.2 Neighborhood System

To be able to define conditional dependence structures on a spatiotemporal lattice S, a neighborhood structure must be defined. A *neighborhood* structure is a symmetric relationship that defines which sites are neighbors of any given site s_i and the range of immediate influence from one site to another. A neighborhood structure may be visualized as a graph of connections between sites. Two sites are neighbors if they are connected. Connectivity is often expressed in terms of distances between two sites [35]. For lattice data, weights can be used to express the strength of influence between sites as follow:

$$c_{ij} = \begin{cases} 1 & \text{if } s_i \text{ and } s_j \text{ are connected} \\ 0 & \text{if } s_i \text{ and } s_j \text{ are not connected.} \end{cases} \tag{3.3}$$

We will denote site neighbors (connectivity) by $s_i \sim s_j$ in this paper. The set of all sites connected to a site s_i is the *neighborhood of site* s_i and the set of all such neighborhoods in S is the *neighborhood system* for S. Formally, $N_i = \{j : s_j \in S, s_i \sim s_j, j \neq i\}$ is the neighborhood of site s_i and the neighborhood system is $N \equiv \{N_i : \forall s_i \in S\}$. The complete neighborhood of site s_i is $\tilde{N}_i \equiv N_i \bigcup \{s_i\}$. For any $A \subset S$, the neighborhood of A

is defined as $N_A = \{\bigcup_{s_i \in A} N_i\}\backslash A$ and the complete neighborhood of A is $\tilde{N}_A \equiv N_A \bigcup A\}$. The neighborhood of site s_i and the neighborhood system satisfy the following properties:

a) $s_i \notin N_i$

b) $s_j \in N_i \Longleftrightarrow s_i \in N_j$.

In this dissertation, we will use the nearest (or first order) neighborhood system for the CalCOFI 3-dimensional regular lattice S (3.1). The *nearest neighbor neighborhood system* is the neighborhood system consisting of the nearest adjacent sites. For a particular site $s(m,n,t)$ the neighbors are $\{s(m+1,n,t), s(m-1,n,t), s(m,n+1,t), s(m,n-1,t), s(m,n,t+1), s(m,n,t-1)\}$. For any given site $s_i = s_{\{m+(n-1)*M+(t-1)*M*N\}} = s(m,n,t)$, the nearest neighbors for the CalCOFI lattice S (3.2) are as follows:

1. Spatial neighborhood structure: The North and South neighbors are given by $s_{i-1} = s(m-1,n,t)$ and $s_{i+1} = s(m+1,n,t)$ respectively. The East and West neighbors are given by $s_{i+M} = s(m,n+1,t)$ and $s_{i-M} = s(m,n-1,t)$ respectively.

2. Time neighborhood structure: The future and past neighbors are given by $s_{i+M*N} = s(m,n,t+1)$ and $s_{i-M*N} = s(m,n,t-1)$ respectively.

For CalCOFI sites on the interior of our 3-dimensional regular lattice S, the set of neighbors of a site s_i is $N_i = \{s_{i+1}, s_{i-1}, s_{i+M}, s_{i-M}, s_{i+M*N}, s_{i-M*N}\}$. All sites on the boundary of S have fewer neighbors.

3.3 Spatiotemporal Processes

Stochastic process (3.4) is the fundamental concept underlying the theory of spatiotemporal modeling of spatiotemporal data [36]

$$Y = \{Y_{s_i}(\omega), \omega \in \Omega, s_i \in S\}, i = 1, \ldots, K. \tag{3.4}$$

When the dimension of the index set S of a stochastic process (3.4) is greater than one; the stochastic process is called a random field [35]. A *spatiotemporal process* is a random field with index set $S \subset \mathbb{R}^3$ containing spatiotemporal sites $s_1, \ldots, s_K$ as defined in section 3.1.

Each single realization $y = (y_1, \dots, y_K)$ of the random field Y is called a *configuration* of the random field. The configuration assigns a value $y_i \in \Lambda$ (where typically $\Lambda = \mathbb{R}$) to each random variable Y_{s_i} of the random field Y. The set of all possible configurations of y is the *configuration space* Λ^S. Hence, we can view the random field as a random variable taking its values in the configuration space Λ^S. Thus, a configuration $y \in \Lambda^S$ is of the form $y = \{y_{s_i}, s_i \in S\}, i = 1, \dots, K$, where $y_{s_i} \in \Lambda$ for all $s_i \in S$ [37]. Also for a given configuration y and any subset $A \subset S, Y_A = \{Y_{s_i}(\omega), \omega \in \Omega, s_i \in A\}$ is a *subconfiguration* of the configuration y [38]. If the probability distribution of the random field Y is denoted $p(y)$, then the marginal probability of the subfield Y_A is $p(y_A) = \int p(y)\, dy_{S \setminus A}$ where the integration is over all state variables not contained in Y_A. As was the case with a 1-dimensional stochastic process, expectation and covariance functions can be defined for a random field Y.

3.4 Markov Random Field

Ross [39] defines the Markov property for stochastic processes on a 1-dimensional index set. Using the definition of N_i given in section 3.2, a Markovian property can be given for a random field. Given a neighborhood system $N \equiv \{N_i : \forall s_i \in S\}$, a random field model of the spatiotemporal dependence structure on an index set S can be constructed. In this model, direct dependencies exist only between a site s_i and sites in N_i. Let $Y = \{Y_{s_i}, s_i \in S\}, i = 1, \dots, K$, be a random field on a lattice $S = \{s_1 < s_2 < \cdots < s_K\}$ with neighborhood system N. The random field is a *Markov random field* (MRF) on S if $Y_{s_i} \perp \{Y_{s_j} : s_j \notin N_i \bigcup s_i\} \mid \{Y_{s_j} : s_j \in N_i\}$ for every $s_i \in S$.

This generalization of the Markov property says that random variable Y_{s_i} is conditionally independent of all other sites in S, given its values in N_i. Hence the full conditional probability density function at a particular $s_j \in S$ depends only on the values of the random field at the neighboring sites of index set S. For any random vector $Y = (Y_1, \dots, Y_K)$, the conditional distribution of Y_i given all other $K - 1$ values Y_j for $i \neq j$ is called the full conditional distribution for Y_i. All conditional probabilities of a Markov random field on index set S take the form

$$P(Y_{s_i} = y_{s_i} \mid Y_{s_j} = y_{s_j}, s_j \in S \setminus s_i) = P(Y_{s_i} = y_{s_i} \mid Y_{s_j} = y_{s_j}, s_j \in N_i). \tag{3.5}$$

Conditional probabilities of the form in (3.5) are called the *local characteristic* of an MRF at site s_i and will be denoted by

$$p_{s_i}(y) = P(Y_{s_i} = y_{s_i} \mid Y_{s_j} = y_{s_j}, s_j \in N_i). \tag{3.6}$$

The local specification of the MRF is given by the family $\{p_{s_i}(y)\}_{s_i \in S}$. Besag [3] proved that the joint distribution of y is uniquely determined by local specifications of conditional distributions.

Existence of a joint distribution is necessary if estimation and inference is to be employed. Besag [3] showed that for a Markov random field (MRF), there is an exact connection between the joint probabilities and the conditional probabilities. The Markov property allows the joint probability distribution of the MRF to be determined by local specifications whenever the local specifications lead to a unique joint distribution. The *Hammersley-Clifford Theorem* [3], also referred to as the *MRF-Gibbs Equivalence Theorem*, gives the conditions necessary for the local specifications to determine a valid unique joint distribution and provides a result for finding the form of this joint distribution.

Let Y be a random field on an index set S with respect to neighborhood system N. Now given a joint probability, it is clear that the full conditional probabilities are uniquely determined [23]. The converse is proven by *Brook's Lemma* [36]. Consequently, for Markov random fields, Brook's Lemma allows for the construction of the unique joint probability distributions determined by these full conditional probabilities. The Hammersley-Clifford theorem asserts that Y is an MRF on S with respect to N if and only if Y is a *Gibbs random field* (GRF) on S with respect to N [36]. A random field Y is a GRF on S with respect to N if and only if its configurations obey a Gibbs distribution [40]. Given the result of the Hammersley-Clifford theorem, we can implement simulation of a MRF via a Gibbs sampler.

Our analysis of the CalCOFI time series will make use of a *Gaussian Markov random field* (GMRF). A Markov random field Y on S with respect to N is a GMRF if for any integer $K > 1$ and any subset $\{s_1, \ldots, s_K\} \in S$, $Y = (Y_{s_1}, \ldots, Y_{s_K})$, has a multivariate normal distribution.

CHAPTER 4

CONDITIONAL AUTOREGRESSIVE (CAR) MODELS

Most classical statistical inference assumes observations are independent and identically distributed. However, these assumptions are not tenable for spatiotemporal data. Spatiotemporal data contain dependencies between values of a variable at neighboring sites, since by *Tobler's first law* [41], observations collected over sites near to each other tend to have similar characteristics as compared to distant sites. Therefore, there is a need for models requiring less stringent assumptions than those of classical statistical inference. The modeling of spatiotemporal interactions arising from spatiotemporal data is done by incorporating the space-time dependence into the covariance structure [42].

Spatiotemporal models measure the relationship between observations collected from different spatiotemporal sites. These models assume that data collected from nearby sites are correlated, that this correlation decreases as the distance between sites increases, and that the correlation of error terms occurs in both space and time. A main goal of spatiotemporal modeling is the estimation and prediction of the underlying process that generates the observations under study and the parameters that govern the process. Furthermore, analysis of the spatiotemporal correlation of variables can be used for estimating values at sites where no measurements exist. This chapter presents a modeling strategy for the spatiotemporal lattice data of the CalCOFI time series

4.1 Spatiotemporal Autocorrelation

Autocorrelation is the correlation of a variable with itself. More precisely, if Y_{s_i} is the data observed for a single variable at site s_i of the spatiotemporal lattice S, then the correlation between Y_{s_i} and Y_{s_j} is called the *spatiotemporal autocorrelation*. The concept of spatiotemporal autocorrelation is at odds with classical statistical inference which assumes observations are independent. However, ignoring this autocorrelation has serious implications for the ensuing statistical inference [35]. Accounting for spatiotemporal autocorrelation in our model enables us to determine how the independence assumption is violated and to measure the extent to which it is violated. Consequently, we can measure the degree to which statistical inferences are affected by spatiotemporal autocorrelation.

For a lattice S with K sites, we view the data $Y = \{Y_{s_1}, \ldots, Y_{s_K}\}$ as a single realization of the K-dimensional multivariate distribution rather than a sample of size K. This presents a problem when the estimation of expectation or variance of the random variables is desired since repeated realizations are not available. Analysis of the CalCOFI time series requires models that can incorporate spatiotemporal autocorrelation while allowing for statistical inference based on a sample of size one. The solution exists in the form of the spatiotemporal processes, discussed in chapter 3, which can be used to construct models of spatiotemporal data. Our proposed form for the spatiotemporal process is the Gaussian Markov random field on the spatiotemporal lattice S with respect to neighborhood system N (also known as a Gaussian conditional autoregressive model).

4.2 Conditional Autoregressive Model (CAR)

The spatiotemporal association among sites on a 3-dimensional lattice can be specified by defining a neighborhood system for the lattice. Markov random fields (MRF) are ideally suited for modeling data on a spatiotemporal lattice in which a joint distribution is determined by using a set of locally specified conditional distributions for each site, conditioned on its neighbors. The class of MRF used in this dissertation is the *Gaussian conditional autoregressive model* (CAR) introduced by [3]. CAR models focus on the conditional distribution of a site given the site's neighbors. These models have been widely used in spatial statistics where they are intended to describe interactions between random variables at fixed sites in Euclidean space [43].

CAR models are simply MRFs that are Gaussian processes. Assume that conditional on $\{Y_{s_j} : j \neq i\}$; the variable Y_{s_i} is Gaussian distributed, and that there are *pairwise* spatiotemporal interactions only, meaning non-adjacent pairs of random variables are independent conditional on the remaining random variables. Then the CAR model can be defined by the following K conditional distributions:

$$Y_{s_i} \mid \{Y_{s_j} : j \neq i\} \sim N\left(\mu_{s_i} + \sum_{s_j \in N_i} c_{ij}\,(Y_{s_j} - \mu_{s_j}), \tau_{s_i}^2\right);\ i = 1, \ldots, K, \tag{4.1}$$

where μ_{s_i} is the mean at site s_i, $\tau_{s_i}^2 > 0$ is the conditional variance, and c_{ij} are spatiotemporal-dependence parameters of the model such that $c_{ij} = 0$ if $s_j \notin N_i$ and $c_{ji}\tau_{s_i}^2 = c_{ij}\tau_{s_j}^2$, $i, j = 1, \ldots, K$ [1].

The conditional expectation and the conditional variance of Y_{s_i} given the remaining sites are

$$\mathrm{E}\left[Y_{s_i} \mid \{Y_{s_j} : j \neq i\}\right] = \mu_{s_i} + \sum_{s_j \in N_i} c_{ij}\,(Y_{s_j} - \mu_{s_j});\ i = 1, \ldots, K; \tag{4.2}$$

$$\mathrm{Var}\left[Y_{s_i} \mid \{Y_{s_j} : j \neq i\}\right] = \tau_{s_j}^2. \tag{4.3}$$

From Brooke's Lemma, the joint distribution for the CAR model is

$$Y \sim N\left(\mu, (I - C)^{-1}M\right); \tag{4.4}$$

with joint density function

$$f(Y) = (2\pi)^{-\frac{K}{2}}|M|^{-\frac{1}{2}}|I - C|^{\frac{1}{2}} \exp\{-\frac{(Y-\mu)'M^{-1}(I-C)(Y-\mu)}{2}\}, \tag{4.5}$$

where $Y = (Y_{s_1}, \ldots, Y_{s_K})$, $\mu = (\mu_{s_1}, \ldots, \mu_{s_K})$, $C = (c_{ij})_{K\times K}$; $i, j = 1, \ldots, K$, and $M = \mathrm{diag}(\tau_{s_1}^2, \ldots, \tau_{s_K}^2)_{K\times K}$. If covariates are present a regression formulation can be used. Parameterize μ as $\mu = X\beta$, where X is a $K \times p$ full rank matrix of known covariates and β is a $p \times 1$ vector of regression coefficients where $p < K$.

For the error term,

$$\epsilon = (I - C)(Y - \mu); \tag{4.6}$$

$$\mathrm{E}(\epsilon) = \mathrm{E}\{(I - C)(Y - \mu)\} = (I - C)(\mu - \mu) = 0; \tag{4.7}$$

$$\mathrm{Var}(\epsilon) = \mathrm{Var}\{(I - C)(Y - \mu)\} = M(I - C)'; \tag{4.8}$$

$$\mathrm{Cov}(\epsilon, Y) = \mathrm{Cov}\{(I - C)(Y - \mu), Y\} = M. \tag{4.9}$$

Hence, $\epsilon \sim N(0, M(I - C)')$ and ϵ_i is not correlated with Y_{s_j} for $j \neq i$.

4.3 Spatiotemporal-Dependence Matrix C

The number of spatiotemporal-dependence parameters in the matrix C exceeds the number of observations and makes parameter estimation difficult. Therefore, we must reduce the number of spatiotemporal-dependence parameters if we are to have enough degrees of freedom for parameter estimation. The general structure of C is determined by the shape of the lattice [42] and by the choice of nearest-neighbor structure in the spatiotemporal grid.

A site s_i with lattice coordinates $s(m, n, t)$ has three types of neighbors $s(m \pm 1, n, t)$, $s(m, n \pm 1, t)$, $s(m, n, t \pm 1)$ called *type 1*, *type 2*, *type 3*, respectively. We will specify C as a function of known adjacency matrices W^1, W^2, W^3 and parameters ρ_1, ρ_2, ρ_3, where ρ_l, $l = 1, 2, 3$ are the spatiotemporal-dependence parameters controlling the strength of the spatiotemporal-dependence. We define the $K \times K$ adjacency matrices W^1, W^2, W^3 by

$$w_{ij}^l = I(s_i \sim s_j \text{ of type } l,\ j \neq i); \tag{4.10a}$$

$$(W^l)_{ij} = w_{ij}^l. \tag{4.10b}$$

The elements of C, c_{ij}^l, represent the interaction between type l neighbors s_i and s_j. Here $c_{ij}^l > 0$ implies positive interaction between type l neighbors s_i and s_j, while $c_{ij}^l < 0$ implies negative interaction between type l neighbors s_i and s_j.

4.4 Special Cases of CAR Models

Many different classes of CAR models are possible given our choice of neighborhood system N and spatiotemporal-dependence parameters $\{c_{ij}^l\}$. We consider two classes of CAR models in this dissertation, the homogeneous CAR (HCAR) model [44] and the weighted CAR (WCAR) model. We will use the notation of [44] for CAR models in this section of the dissertation, where

$$M = \Phi\tau^2,$$

for known $\Phi \equiv \text{diag}(\phi_1, \ldots, \phi_K)_{K\times K}$.

4.4.1 Homogeneous CAR (HCAR) Model

The spatiotemporal-dependence matrix C for the HCAR model is specified as a function, $C(\rho)$, of the spatiotemporal-dependence parameters $(\rho_1,\ \rho_2,\ \rho_3)$ and adjacency matrices, $(W^1,\ W^2,\ W^3)$ where

$$C(\rho) = \rho_1 W^1 + \rho_2 W^2 + \rho_3 W^3. \tag{4.11}$$

We assume $\Phi = I_{K\times K}$ and $\tau^2_{s_i} = \tau^2$ for all $i = 1, \ldots, K$ so that $M = \tau^2 I$. Furthermore, we assume covariates in the model and parameterize μ as $\mu = X\beta$, where X is a $K \times p$ full rank matrix of known covariates and β is a $p \times 1$ vector of regression coefficients where $p < K$. Making these substitutions (writing C for $C(\rho)$) into expressions (4.1)-(4.9) for the general CAR model we obtain the HCAR model expressions below.

The HCAR model has the following K conditional distributions:

$$Y_{s_i} \mid \{Y_{s_j} : j \neq i\} \sim N\left(\mu_{s_i} + \sum_{l=1}^{3} \sum_{s_j \in N_i^l} \rho_l w_{ij}^l \,(Y_{s_j} - \mu_{s_j}), \tau^2\right);\ i = 1, \ldots, K, \tag{4.12}$$

where μ_{s_i} is the mean at site s_i, $\tau^2 > 0$ is the conditional variance, and w_{ij}^l for $l = 1, 2, 3$ are the elements of the adjacency matrices, $(W^1,\ W^2,\ W^3)$.

The conditional expectation and the conditional variance of Y_{s_i} given the remaining sites are

$$\mathrm{E}\left[Y_{s_i} \mid \{Y_{s_j} : j \neq i\}\right] = \mu_{s_i} + \sum_{l=1}^{3} \sum_{s_j \in N_i^l} \rho_l w_{ij}^l \,(Y_{s_j} - \mu_{s_j});\ i = 1, \ldots, K; \tag{4.13}$$

$$\mathrm{Var}\left[Y_{s_i} \mid \{Y_{s_j} : j \neq i\}\right] = \tau^2. \tag{4.14}$$

The joint distribution for the HCAR model is

$$Y \sim N\left(X\beta, \tau^2 (I - C)^{-1}\right); \tag{4.15}$$

with joint density function

$$f(Y) = (2\pi\tau^2)^{-\frac{K}{2}} |I - C|^{\frac{1}{2}} \exp\{-\frac{(Y - X\beta)'(I - C)(Y - X\beta)}{2\tau^2}\}. \tag{4.16}$$

For the error term,

$$\epsilon = (I - C)(Y - X\beta); \tag{4.17}$$

$$\mathrm{E}(\epsilon) = \mathrm{E}\{(I - C)(Y - X\beta)\} = (I - C)(X\beta - X\beta) = 0; \tag{4.18}$$

$$\mathrm{Var}(\epsilon) = \mathrm{Var}\{(I - C)(Y - X\beta)\} = \tau^2(I - C); \tag{4.19}$$

$$\mathrm{Cov}(\epsilon, Y) = \mathrm{Cov}\{(I - C)(Y - X\beta), Y\} = \tau^2(I - C)(I - C)^{-1} = \tau^2 I. \tag{4.20}$$

Hence, $\epsilon \sim N(0, \tau^2(I - C))$ and ϵ_i is not correlated with Y_{s_j} for $j \neq i$. For the HCAR model, the spatiotemporal-dependence parameters (ρ_1, ρ_2, ρ_3) have a simple interpretation: ρ_l is the partial or conditional correlation between neighboring Y_{s_i} and Y_{s_j} of type l.

4.4.2 Weighted CAR (WCAR) Model

To specify C and $M = \Phi\tau^2$ for the WCAR model, it is necessary to introduce some notation. From the $K \times K$ adjacency matrices W^1, W^2, W^3 (defined in section 4.3), we define

$$w_{i+}^l = \sum_{j=1}^{K} w_{ij}^l; \quad w_{i+} = \sum_{l=1}^{3} w_{i+}^l, \tag{4.21}$$

where w_{i+}^l is the number of neighbors of type l for site i and w_{i+} is the total number of neighbors of site i. Let $D_w^l = \mathrm{diag}(w_{1+}^l, \ldots, w_{K+}^l)_{K\times K}$, and $D_w = \sum_{l=1}^{3} D_w^l = \mathrm{diag}(w_{1+}, \ldots, w_{K+})_{K\times K}$. Then the spatiotemporal-dependence matrix C for the WCAR model can be specified as a function of the spatiotemporal-dependence parameters (ρ_1, ρ_2, ρ_3) and $C(\rho)$, where

$$C = D_w^{-1}\left(\sum_{l=1}^{3} \rho_l W^l\right) = D_w^{-1} C(\rho). \tag{4.22}$$

We assume $\Phi = \mathrm{diag}(\frac{1}{w_{1+}}, \ldots, \frac{1}{w_{K+}})_{K\times K}$ so that $(M)_{ii} = \frac{\tau^2}{w_{i+}}$ for all $i = 1, \ldots, K$. Futhermore, we assume covariates in the model and parameterize μ as $\mu = X\beta$, where X is a $K \times p$ full rank matrix of known covariates and β is a $p \times 1$ vector of regression coefficients where $p < K$. Making these substitutions into expressions (4.1)-(4.9) for the general CAR model we obtain the WCAR model expressions below.

The WCAR model has the following K conditional distributions

$$Y_{s_i} \mid \{Y_{s_j} : j \neq i\} \sim N\left(\mu_{s_i} + \sum_{l=1}^{3} \sum_{s_j \in N_i^l} \rho_l \frac{w_{ij}^l}{w_{i+}} (Y_{s_j} - \mu_{s_j}), \frac{\tau^2}{w_{i+}}\right); \; i = 1, \ldots, K, \tag{4.23}$$

where w_{i+} is the total number of neighbors for site i. The conditional expectation and the conditional variance of Y_{s_i} given the remaining sites are

$$\mathrm{E}\left[Y_{s_i} \mid \{Y_{s_j} : j \neq i\}\right] = \mu_{s_i} + \sum_{l=1}^{3} \sum_{s_j \in N_i^l} \rho_l \frac{w_{ij}^l}{w_{i+}} (Y_{s_j} - \mu_{s_j});\ i = 1, \ldots, K; \tag{4.24}$$

$$\mathrm{V}ar\left[Y_{s_i} \mid \{Y_{s_j} : j \neq i\}\right] = \frac{\tau^2}{w_{i+}}. \tag{4.25}$$

The joint distribution for the WCAR model is

$$Y \sim N\left(X\beta, \Sigma_y\right); \tag{4.26}$$

with joint density function

$$f(Y) = (2\pi)^{-\frac{K}{2}} \xi^{\frac{K}{2}} |D_w - C(\rho)|^{\frac{1}{2}} \exp\{-\frac{(Y - X\beta)'\Sigma_y^{-1}(Y - X\beta)}{2}\}, \tag{4.27}$$

where $\xi = \frac{1}{\tau^2}$ and

$$\Sigma_y^{-1} = \xi\left\{(D_w^1 - \rho_1 W^1) + (D_w^2 - \rho_2 W^2) + (D_w^3 - \rho_3 W^3)\right\} \tag{4.28a}$$

$$= \xi\left\{D_w - (\rho_1 W^1 + \rho_2 W^2 + \rho_3 W^3)\right\} = \xi(D_w - C(\rho)). \tag{4.28b}$$

For the WCAR model error term,

$$\epsilon = (D_w - C(\rho))(Y - \mu); \tag{4.29}$$

$$\mathrm{E}(\epsilon) = \mathrm{E}\{(D_w - C(\rho))(Y - \mu)\} = (D_w - C(\rho))(\mu - \mu) = 0; \tag{4.30}$$

$$\mathrm{Var}(\epsilon) = \mathrm{Var}\{(D_w - C(\rho))(Y - \mu)\} = \tau^2(D_w - C(\rho)); \tag{4.31}$$

$$\mathrm{Cov}(\epsilon, Y) = \mathrm{Cov}\{(D_w - C(\rho))(Y - \mu), Y\} = \tau^2 I. \tag{4.32}$$

Hence, $\epsilon \sim N(0, \tau^2(D_w - C))$ and ϵ_i is not correlated with Y_{s_j} for $j \neq i$.

4.5 Simulation of CAR model

In general, it is difficult to generate samples directly from the joint distribution for the CAR model (4.4). However, given the results of the Hammersley-Clifford theorem and using Markov Chain Monte Carlo (MCMC) simulations we can easily generate realizations of (4.4). Geman and Geman [40] showed that an MRF (or CAR model) can be simulated via a Gibbs sampler. *Gibbs sampling* is an algorithm to simulate from a joint probability density function, e.g., (4.4) when direct simulation from the full conditionals e.g., (4.1) is possible. Gibbs sampling is used to compute the next configuration of Y by sampling from the full conditional distributions. In this dissertation we use the term *unconditional Gibbs sampler* when simulating is from a joint distribution. We use the term *conditional Gibbs sampler* when simulating is from a conditional distribution (described below).

4.5.1 Unconditional Gibbs Sampler

Let $Y = \{Y_1, \ldots, Y_K\} \in \mathbb{R}^{\mathbb{K}}$ be an MRF with joint density given by $f(y_1, \ldots, y_K)$. Assume the full conditional densities $f_i(y_i|y_{-i})$, $i = 1, \ldots, K$ where $y_{-i} = \{y_1, \ldots, y_{i-1}, y_{i+1}, \ldots, y_K)\}$, are known in closed form and can be sampled directly, then the unconditional Gibbs sampler can be used to sample from $f(y_1, \ldots, y_K)$. The Hammersley-Clifford theorem implies that this complete set of full conditional densities uniquely determines $f(y_1, \ldots, y_K)$.

Starting from a specified initial configuration $y^{(0)} = \{y_1^{(0)}, \ldots, y_K^{(0)}\}$ of Y, the unconditional Gibbs sampler generates a sequence of configurations $y^{(0)}, y^{(1)}, y^{(2)}, \ldots$ which converge in distribution to the desired joint density $f(y_1, \ldots, y_K)$. For all j, configuration $y^{(j+1)}$ is generated from $y^{(j)}$ by generating new values for each of the K components from their full conditionals as follows:

1. Draw $y_1^{(j+1)} \sim f_1\left(y_1 \mid y_2^{(j)}, y_3^{(j)}, \ldots, y_K^{(j)}\right)$;
2. Draw $y_2^{(j+1)} \sim f_2\left(y_2 \mid y_1^{(j+1)}, y_3^{(j)}, \ldots, y_K^{(j)}\right)$;

$\vdots$

K. Draw $y_K^{(j+1)} \sim f_K\left(y_K \mid y_1^{(j+1)}, y_2^{(j+1)}, \ldots, y_{K-1}^{(j+1)}\right)$.

The full conditionals are given in (4.12) for the HCAR model and by (4.23) for the WCAR model. The sample generated by the unconditional Gibbs sampler is called an unconditional sample.

4.5.2 Conditional Gibbs Sampler

Let $\mathcal{Y} = (X, Y)$ denote the complete data consisting of the missing data X and the observed data Y. Section 4.5.1 gives an algorithm for obtaining realizations from a joint distribution. Obtaining realizations from the conditional distribution of X (the missing data) given $Y = y$ is similar. As described in section 4.5.1, to generate from the joint distribution of $\mathcal{Y}$, the Gibbs sampler repeatedly 'visits' each of the K components of $\mathcal{Y}$, updating each component with a new value sampled from its full conditional distribution. To generate from the conditional distribution of X given $Y = y$, the Gibbs sampler visits *only* the components of $\mathcal{Y}$ in X, leaving the components in Y fixed at their observed values y. The sample generated by the conditional Gibbs sampler is called a conditional sample. The unconditional and conditional Gibbs samplers differ only in the components (i.e., the sites) which are visited.

CHAPTER 5

MONTE CARLO LIKELIHOOD (MCL) INFERENCE

Consider data modeled as an observation $y = (y_1, \ldots, y_K)$ from a known distribution with unknown parameters $\theta = (\theta_1, \ldots, \theta_p)'$. In this case, the joint distribution of y (given by $P(y_1, \ldots, y_K \mid \theta) \equiv L(\theta)$) is viewed as a function of θ called the *likelihood function*, with each realization of y producing a different likelihood. A natural estimator of θ can be derived by finding the maximizer of $L(\theta)$. This maximizing value, denoted by $\tilde{\theta}$, is called the *Maximum Likelihood Estimator* (MLE) *of* θ. It is usually computationally more convenient to work with $\log L(\theta) \equiv l(\theta)$, called the *log-likelihood function*. Under mild regularity conditions, the MLE of θ is consistent, asymptotically Gaussian, and asymptotically efficient [34].

5.1 Parameter Estimation for CAR Models

The Hammersley-Clifford Theorem gives the general form of the underlying probability distribution of a Markov random field (MRF) model as

$$f_\theta(y) = \frac{h_\theta(y)}{c(\theta)} = \frac{\exp\{Q_\theta(y)\}}{c(\theta)}, \tag{5.1}$$

where $y = (y_1, \ldots, y_K)$. Here $\theta \in \Theta$ is a vector of unknown model parameters, y is a $K \times 1$ vector of data, $c(\theta)$ is a normalizing constant for the unnormalized density $h_\theta(y)$ and $Q_\theta(y)$ is called an *energy function* and it is a sum of functions defined on cliques. A *clique* is either a singleton or a set of sites that are neighbors with respect to a given neighborhood system [27]. Unfortunately, for MRF models, $c(\theta)$ is generally very difficult to compute even if it does exist in closed form. As a result, the MLE for Markov random field models is usually very difficult to compute. In fact, many classes of MRF models have intractable likelihoods [34].

The Gaussian Markov random field (GMRF) model (or CAR model) is one class for which the normalizing constant is available in closed form; however, its computation is problematic for large lattice sizes [1]. The joint density of the CAR model is given by (4.5). Substituting in (5.1), we have

$$Q_\theta(y) = -\frac{(Y - X\beta)' M^{-1}(I - C(\rho))(Y - X\beta)}{2}. \tag{5.2}$$

The normalizing constant is

$$c(\theta) = (2\pi)^{\frac{K}{2}} |M|^{\frac{1}{2}} |I - C(\rho)|^{-\frac{1}{2}}$$

where

$$\theta = (\rho_1, \rho_2, \rho_3, \xi, \beta)$$

and the matrix $C(\rho)$ is a $K \times K$ function of the spatiotemporal parameters ρ_1, ρ_2, ρ_3 [1]. For large K, evaluation of the determinants in $c(\theta)$ becomes a very difficult task. Thus, likelihood inference is quite complicated because of the intractability of the normalizing constant.

Likewise, it is often difficult to compute $L(\theta)$ explicitly when data are missing because the resulting likelihood function usually contains an intractable integration [45]. Suppose that the complete data consist of (x, y) and follows an MRF model with probability distribution

$$f_\theta(x, y) = \frac{h_\theta(x, y)}{c(\theta)} = \frac{\exp\{Q_\theta(x, y)\}}{c(\theta)}, \tag{5.3}$$

but that the part x is missing. The likelihood for the observed data y is the marginal distribution given by

$$L(\theta) = \int f_\theta(x, y)\, dx = \int \frac{h_\theta(x, y)}{c(\theta)}\, dx = f_\theta(Y). \tag{5.4}$$

Thus as in the case of (5.1), we have an intractable likelihood function [46]. Therefore, alternative likelihood methods are needed when estimating the parameters of CAR models with missing data. The author proposes the Monte Carlo Likelihood (MCL) method of [2] and [47] for parameter estimation for the CAR model with missing data.

5.2 Monte Carlo Likelihood Inference (MCL)

The MCL algorithm allows us to obtain an approximation to (5.4). We give a brief review of the MCL method in this paper. For a more detailed explanation of MCL analysis, see Geyer and Thompson [2], Thompson and Guo [48], and Gelfand and Carlin [49]. Geyer and Thompson [2] introduced the general method for MCL analysis with unknown normalizing constant models. Thompson and Guo [48] originated the general method for MCL analysis with missing data models. Gelfand and Carlin [49] developed the general method for MCL analysis for models with both an unknown normalizing constant and missing data.

MCL provides many advantages over other methods used for parameter estimation with missing data and intractable normalizing constants. We can calculate an asymptotic approximation for the Monte Carlo standard error with MCL. MCL allows us to calculate likelihood ratio tests and likelihood based confidence regions. It also allows for the calculation of Fisher information and hence for asymptotically valid standard errors for the parameter estimates.

5.2.1 Importance Sampling

Following [50], MCL methods directly approximate the log-likelihood and indirectly its derivatives at all parameter values simultaneously using the importance sampling formula (5.6). The normalizing constant of (5.4) is

$$c(\theta) = \iint h_\theta(x, y)\, dx\, dy.$$

Thus the log-likelihood function of (5.4) is

$$l(\theta) = \log\left(\int h_\theta(x, y)\, dx\right) - \log\left(\iint h_\theta(x, y)\, dx\, dy\right). \tag{5.5}$$

Monte Carlo methods can be used to approximate the integrals in (5.5). We do this by using two different importance sampling distributions

$$l(\theta) - l(\psi) = \log\left(E_\psi\left\{\frac{h_\theta(X, Y)}{h_\psi(X, Y)} \,\middle|\, Y = y\right\}\right) - \log\left(E_\psi\left\{\frac{h_\theta(X, Y)}{h_\psi(X, Y)}\right\}\right), \tag{5.6}$$

where $\psi \in \Theta$ is a fixed parameter point and E_ψ denotes that (X, Y) has an MRF distribution (5.3) with parameter vector $\theta = \psi$. In order to approximate (5.6), we use Gibbs sampling to generate samples from the conditional distribution of X given Y and the joint distribution of X and Y, both for the parameter value ψ. The Monte Carlo approximation to (5.6) is

$$l_{m,n}(\theta) = \log\left(\frac{1}{m}\sum_{i=1}^{m}\frac{h_\theta(X_i^*, y)}{h_\psi(X_i^*, y)}\right) - \log\left(\frac{1}{n}\sum_{i=1}^{n}\frac{h_\theta(X_i, Y_i)}{h_\psi(X_i, Y_i)}\right), \tag{5.7}$$

where $X_1^*, \ldots, X_m^*$ are Gibbs samples from the conditional distribution, y denotes the observed value of Y, and $(X_1, Y_1), (X_2, Y_2), \ldots, (X_n, Y_n)$ are Gibbs samples from the joint distribution, both for the parameter value ψ.

Maximizing (5.7) gives the MCL approximation $\tilde{\theta}_{m,n}$, to the MLE $\tilde{\theta}$ of θ. The MCL estimate is more accurate for ψ in a neighborhood of the true MLE $\tilde{\theta}$, with the size of the neighborhood depending on the number of samples m and n. For ψ in a neighborhood of the true MLE, $\tilde{\theta}_{m,n}$ converges to $\tilde{\theta}$ as the sample sizes m and n tend to infinity. However, if ψ is outside this neighborhood, $\tilde{\theta}_{m,n}$ can be very bad or may not even exist (i.e. $l_{m,n}(\theta)$ has no maximum). Hence, in practice MCL is usually performed recursively as in Geyer and Thompson [2] to obtain a Monte Carlo approximation to $\tilde{\theta}$. This recursive algorithm repeats the above procedure as follows:

1. Choose an initial ψ;

2. simulate $X_1^*, \ldots, X_m^*$ from the conditional distribution given the observed value of Y, and $(X_1, Y_1), (X_2, Y_2), \ldots, (X_n, Y_n)$ from the joint distribution, both for the parameter value ψ;

3. perform local maximization of $l_{m,n}(\theta)$ in (5.7), restricting the maximization to a neighborhood of ψ;

4. set ψ equal to the value of θ obtained in 3;

5. repeat steps 2 to 4 until ψ is in the neighborhood of the true MLE.

This recursive procedure was used to obtain the results in chapter 7.

5.2.2 Gradient and Hessian of the CAR Model Log-Likelihood

The MCL method above approximates the derivatives of the log-likelihood (5.5) by those of the Monte Carlo approximant $l_{m,n}(\theta)$ in (5.7). Using the notation in (5.1) and (5.2), the

Monte Carlo approximation to the log-likelihood function for the CAR model given by (4.5) is

$$l_{m,n}(\theta) = \log\left(\frac{1}{m}\sum_{i=1}^{m}\frac{\exp\{Q_\theta(X_i^*, y)\}}{\exp\{Q_\psi(X_i^*, y)\}}\right) - \log\left(\frac{1}{n}\sum_{i=1}^{n}\frac{\exp\{Q_\theta(X_i, Y_i)\}}{\exp\{Q_\psi(X_i, Y_i)\}}\right). \tag{5.8}$$

We need both the gradient and Hessian of (5.8) in order to maximize the log-likelihood. We first define normalized importance weights $w_{m,\theta,\psi}(X^*, y)$ and $w_{n,\theta,\psi}(X, Y)$ for the conditional and unconditional samples in (5.8) as

$$w_{m,\theta,\psi}(X_i^*, y) \equiv \frac{\dfrac{h_\theta(X_i^*, y)}{h_\psi(X_i^*, y)}}{\displaystyle\sum_{i=1}^{m}\frac{h_\theta(X_i^*, y)}{h_\psi(X_i^*, y)}} \text{ and } w_{n,\theta,\psi}(X_i, Y_i) \equiv \frac{\dfrac{h_\theta(X_i, Y_i)}{h_\psi(X_i, Y_i)}}{\displaystyle\sum_{i=1}^{n}\frac{h_\theta(X_i, Y_i)}{h_\psi(X_i, Y_i)}}. \tag{5.9}$$

Define for any integrable g

$$E_{m,\theta,\psi}\{g(X^*, Y) \mid Y = y\} = \sum_{i=1}^{m} g(X_i^*, y)\, w_{m,\theta,\psi}(X_i^*, y); \tag{5.10a}$$

$$E_{n,\theta,\psi}\{g(X, Y)\} = \sum_{i=1}^{n} g(X_i, Y_i)\, w_{n,\theta,\psi}(X_i, Y_i). \tag{5.10b}$$

These are the importance sampling estimates of $E_\theta\{g(X, Y) \mid Y = y\}$ and $E_\theta\{g(X, Y)\}$, respectively. Let $\nabla Q_\theta \equiv \nabla Q_\theta(X, Y)$. Using the notation of Geyer, [50], the gradient of (5.8) can be expressed as

$$\nabla l_{m,n}(\theta) = E_{m,\theta,\psi}\{\nabla Q_\theta \mid Y = y\} - E_{n,\theta,\psi}\{\nabla Q_\theta\}. \tag{5.11}$$

The Hessian of (5.8) can be expressed as

$$\begin{aligned} \nabla^2 l_{m,n}(\theta) &= E_{m,\theta,\psi}\left\{\nabla^2 Q_\theta \mid Y = y\right\} + E_{m,\theta,\psi}\left\{\nabla Q^{\otimes 2} \mid Y = y\right\} \\ &- E_{m,\theta,\psi}\{\nabla Q_\theta \mid Y = y\}\, E_{m,\theta,\psi}\{\nabla Q_\theta \mid Y = y\}^T \\ &- \left[E_{n,\theta,\psi}\left\{\nabla^2 Q_\theta\right\} + E_{n,\theta,\psi}\left\{\nabla Q^{\otimes 2}\right\} - E_{n,\theta,\psi}\{\nabla Q_\theta\}\, E_{n,\theta,\psi}\{\nabla Q_\theta\}^T\right], \end{aligned} \tag{5.12}$$

where for any column vector V we define $V^{\otimes 2} = VV^T$.

Throughout this dissertation derivatives are always with respect to θ so that for any function $f(\theta)$ we denote ∇f to be the vector $(\nabla f)_i = \dfrac{\partial f}{\partial \theta_i}$ and $\nabla^2 f$ to be the matrix $(\nabla^2 f)_{ij} = \dfrac{\partial^2 f}{\partial \theta_i \partial \theta_j}$.

5.2.3 Derivatives of $Q_\theta(Y)$ for the HCAR Model

The joint density of the HCAR model is given by (4.16). Let $\xi = \frac{1}{\tau^2}$. Substituting in (5.1), we have

$$Q_\theta(Y) = -\frac{\xi}{2}(Y - X\beta)'(I - C)(Y - X\beta). \tag{5.13}$$

The first and second derivatives of $Q_\theta(Y)$ are

$$\nabla Q_\theta(Y) = \begin{pmatrix} -\frac{\xi}{2}(Y - X\beta)^T W^1 (Y - X\beta) \\ -\frac{\xi}{2}(Y - X\beta)^T W^2 (Y - X\beta) \\ -\frac{\xi}{2}(Y - X\beta)^T W^3 (Y - X\beta) \\ -\frac{1}{2}(Y - X\beta)^T (I - C)(Y - X\beta) \\ \xi X^T (I - C)(Y - X\beta) \end{pmatrix} \tag{5.14}$$

and

$$\nabla^2 Q_\theta(Y) = \begin{pmatrix} & \rho_1 & \rho_2 & \rho_3 & \xi & \beta \\ \rho_1 & 0 & 0 & 0 & \frac{1}{2}(Y - X\beta)^T W^1 (Y - X\beta) & -\xi X^T W^1 (Y - X\beta) \\ \rho_2 & & 0 & 0 & \frac{1}{2}(Y - X\beta)^T W^2 (Y - X\beta) & -\xi X^T W^2 (Y - X\beta) \\ \rho_3 & & & 0 & \frac{1}{2}(Y - X\beta)^T W^3 (Y - X\beta) & -\xi X^T W^3 (Y - X\beta) \\ \xi & & & & 0 & X^T (I - C)(Y - X\beta) \\ \beta & & & & & -\xi X^T (I - C) X \end{pmatrix}, \tag{5.15}$$

where we have written the symmetric matrix $\nabla^2 Q_\theta(Y)$ using only the upper triangular portion. The negative of the Hessian at the maximum is an estimate of the Fisher information matrix, and its inverse supplies an estimate of the covariance matrix of our parameter estimates. Newton-Raphson or other optimization algorithms can be used to maximize (5.5).

5.2.4 HCAR Model $\nabla Q_\theta(Y)$ and $\nabla^2 Q_\theta(Y)$ in terms of Sufficient Statistics

Expanding (5.13) we have

$$\begin{aligned} Q_\theta(Y) = -\frac{\xi}{2}\Big\{ & Y'Y - 2\beta' X'Y + \beta' X'X\beta \\ & - \sum_{l=1}^{3} \rho_l (Y'W^l Y - 2\beta' X' W^l Y + \beta' X' W^l X\beta)\Big\}, \end{aligned} \tag{5.16}$$

from which we obtain the sufficient statistics for the HCAR model. The sufficient statistics are $Y'Y$, $X'Y$, $Y'W^lY$, and $X'W^lY$ for $l = 1,2,3$. Hence, we can write the gradient (5.14) and Hessian (5.15) in terms of the sufficient statistics.

The gradient in terms of sufficient statistics is

$$\begin{aligned}
\frac{\partial Q_\theta(Y)}{\partial \rho_1} &= \frac{\xi}{2}(Y'W^1Y - 2\beta'X'W^1Y + \beta'X'W^1X\beta); \\
\frac{\partial Q_\theta(Y)}{\partial \rho_2} &= \frac{\xi}{2}(Y'W^2Y - 2\beta'X'W^2Y + \beta'X'W^2X\beta); \\
\frac{\partial Q_\theta(Y)}{\partial \rho_3} &= \frac{\xi}{2}(Y'W^3Y - 2\beta'X'W^3Y + \beta'X'W^3X\beta); \\
\frac{\partial Q_\theta(Y)}{\partial \xi} &= \frac{1}{2}\Big\{Y'Y - 2\beta'X'Y + \beta'X'X\beta \\
&\quad - \sum_{l=1}^{3}\rho_l(Y'W^lY - 2\beta'X'W^lY + \beta'X'W^lX\beta)\Big\}; \\
\frac{\partial Q_\theta(Y)}{\partial \beta} &= \xi\Big\{X'Y - X'X\beta; \\
&\quad - \sum_{l=1}^{3}\rho_l(X'W^lY - X'W^lX\beta)\Big\}.
\end{aligned} \tag{5.17}$$

The Hessian in terms of sufficient statistics is

$$\begin{aligned}
\frac{\partial^2 Q_\theta(Y)}{\partial \rho_l \partial \rho_m} &= 0, \text{ for } l, m = 1, 2, 3; \\
\frac{\partial^2 Q_\theta(Y)}{\partial \xi^2} &= 0; \\
\frac{\partial^2 Q_\theta(Y)}{\partial \rho_l \partial \xi} &= \frac{1}{2}(Y'W^lY - 2\beta'X'W^lY + \beta'X'W^lX\beta), \text{ for } l = 1, 2, 3; \\
\frac{\partial^2 Q_\theta(Y)}{\partial \rho_l \partial \beta} &= -\xi\sum_{l=1}^{3}(X'W^lY - X'W^lX\beta), \text{ for } l = 1, 2, 3; \\
\frac{\partial^2 Q_\theta(Y)}{\partial \xi \partial \beta} &= \Big\{X'Y - X'X\beta - \sum_{l=1}^{3}\rho_l(X'W^lY - X'W^lX\beta)\Big\}; \\
\frac{\partial^2 Q_\theta(Y)}{\partial \beta^2} &= -\xi\Big\{X'X - \sum_{l=1}^{3}\rho_l(X'W^lX)\Big\}.
\end{aligned} \tag{5.18}$$

These formulas are important in our later Monte Carlo work. They allow us to save only the sufficient statistics instead of the entire Gibbs samples $X_1^*, \ldots, X_m^*$ and $(X_1, Y_1), (X_2, Y_2), \ldots, (X_n, Y_n)$ used in (5.7). Thus we are able to carry out the likelihood calculations without the need to store extremely large Monte Carlo samples.

5.2.5 Derivatives of $Q_\theta(Y)$ for the WCAR Model

The joint density of the WCAR model is given by (4.27). Let $\xi = \frac{1}{\tau^2}$. Substituting in (5.1), we have

$$Q_\theta(Y) = (-\frac{\xi}{2})(Y - X\beta)'\Big(D_w - C(\rho)\Big)(Y - X\beta). \tag{5.19}$$

The first and second derivatives of $Q_\theta(Y)$ are

$$\nabla Q_\theta(Y) = \begin{pmatrix} \frac{\xi}{2}(Y - X\beta)'W^1(Y - X\beta) \\ \frac{\xi}{2}(Y - X\beta)'W^2(Y - X\beta) \\ \frac{\xi}{2}(Y - X\beta)'W^3(Y - X\beta) \\ -\frac{1}{2}(Y - X\beta)'(D_w - C(\rho))(Y - X\beta) \\ \xi X'(D_w - C(\rho))(Y - X\beta) \end{pmatrix} \tag{5.20}$$

and

$$\nabla^2 Q_\theta(Y) = \begin{pmatrix} & \rho_1 & \rho_2 & \rho_3 & \xi & \beta \\ \rho_1 & 0 & 0 & 0 & \frac{1}{2}(Y - X\beta)'W^1(Y - X\beta) & -\xi X'W^1(Y - X\beta) \\ \rho_2 & & 0 & 0 & \frac{1}{2}(Y - X\beta)'W^2(Y - X\beta) & -\xi X'W^2(Y - X\beta) \\ \rho_3 & & & 0 & \frac{1}{2}(Y - X\beta)'W^3(Y - X\beta) & -\xi X'W^3(Y - X\beta) \\ \xi & & & & 0 & X'(D_w - C(\rho))(Y - X\beta) \\ \beta & & & & & -\xi X'(D_w - C(\rho))X \end{pmatrix}, \tag{5.21}$$

where we have written the symmetric matrix $\nabla^2 Q_\theta(Y)$ using only the upper triangular portion.

5.2.6 WCAR Model $\nabla Q_\theta(Y)$ and $\nabla^2 Q_\theta(Y)$ in terms of Sufficient Statistics

Expanding (5.19) we have

$$\begin{aligned} Q_\theta(Y) &= (-\frac{\xi}{2})(Y - X\beta)'\Big(D_w - C(\rho)\Big)(Y - X\beta) \\ &= (-\frac{\xi}{2})\Big\{Y'D_wY - 2\beta'X'D_wY + \beta'X'D_wX\beta \\ &\quad - \sum_{l=1}^{3}\rho_l(Y'W^lY - 2\beta'X'W^lY + \beta'X'W^lX\beta)\Big\}, \end{aligned} \tag{5.22}$$

from which we obtain the sufficient statistics for the WCAR model. The sufficient statistics are $Y'D_wY$, $X'D_wY$, $Y'W^lY$, and $X'W^lY$ for $l = 1,2,3$. Hence, we can write the gradient (5.20) and Hessian (5.21) in terms of the sufficient statistics.

The gradient in terms of sufficient statistics is

$$
\begin{aligned}
\frac{\partial Q_\theta(Y)}{\partial \rho_1} &= \frac{\xi}{2}(Y'W^1Y - 2\beta'X'W^1Y + \beta'X'W^1X\beta); \\
\frac{\partial Q_\theta(Y)}{\partial \rho_2} &= \frac{\xi}{2}(Y'W^2Y - 2\beta'X'W^2Y + \beta'X'W^2X\beta); \\
\frac{\partial Q_\theta(Y)}{\partial \rho_3} &= \frac{\xi}{2}(Y'W^3Y - 2\beta'X'W^3Y + \beta'X'W^3X\beta); \\
\frac{\partial Q_\theta(Y)}{\partial \xi} &= \frac{1}{2}\Big\{Y'D_wY - 2\beta'X'D_wY + \beta'X'D_wX\beta \\
&\quad - \sum_{l=1}^{3}\rho_l(Y'W^lY - 2\beta'XW^lY + \beta'X'W^lX\beta)\Big\}; \\
\frac{\partial Q_\theta(Y)}{\partial \beta} &= \xi\Big\{X'D_wY - X'D_wX\beta; \\
&\quad - \sum_{l=1}^{3}\rho_l(X'W^lY - X'W^lX\beta)\Big\}.
\end{aligned}
\tag{5.23}
$$

The Hessian in terms of sufficient statistics is

$$
\begin{aligned}
\frac{\partial^2 Q_\theta(Y)}{\partial \rho_l \partial \rho_m} &= 0, \text{ for } l, m = 1, 2, 3; \\
\frac{\partial^2 Q_\theta(Y)}{\partial \xi^2} &= 0; \\
\frac{\partial^2 Q_\theta(Y)}{\partial \rho_l \partial \xi} &= \frac{1}{2}(Y'W^lY - 2\beta'X'W^lY + \beta'X'W^lX\beta), \text{ for } l = 1, 2, 3; \\
\frac{\partial^2 Q_\theta(Y)}{\partial \rho_l \partial \beta} &= -\xi\sum_{l=1}^{3}(X'W^lY - X'W^lX\beta), \text{ for } l = 1, 2, 3; \\
\frac{\partial^2 Q_\theta(Y)}{\partial \xi \partial \beta} &= \Big\{X'D_wY - X'D_wX\beta - \sum_{l=1}^{3}\rho_l(X'W^lY - X'W^lX\beta)\Big\}; \\
\frac{\partial^2 Q_\theta(Y)}{\partial \beta^2} &= -\xi\Big\{X'D_wX - \sum_{l=1}^{3}\rho_l(X'W^lX)\Big\}.
\end{aligned}
\tag{5.24}
$$

CHAPTER 6

MONTE CARLO LIKELIHOOD IMPLEMENTATION

The HCAR model (4.12) and WCAR model (4.23) were fit using the R statistical software [51] and code written in the C programming language. Parameter estimation for the HCAR and WCAR model with missing data via the Monte Carlo Likelihood method requires the maximization of the Monte Carlo approximation (5.8) to the log-likelihood function given in (5.6). Because the maximization cannot be carried out analytically, we must use numerical optimization methods. In this chapter we present the optimization methods used to maximize the Monte Carlo log-likelihood functions of the HCAR and WCAR models.

6.1 Penalized Monte Carlo Log-Likelihood (PMCL)

As discussed in section 5.2.1, maximizing (5.8) gives the MCL approximation $\tilde{\theta}_{m,n}$, to the MLE $\tilde{\theta}$ of θ, where $\theta = (\rho_1, \rho_2, \rho_3, \xi, \beta)$. The importance sampling approximation (5.8) is only accurate for θ in a neighborhood of ψ, with the size of the neighborhood depending on m and n. If the true MLE $\tilde{\theta}$ lies outside this neighborhood, the approximation $\tilde{\theta}_{m,n}$ can be very bad or may not even exist. For this reason the optimization is usually performed recursively (i.e., in stages) with each stage using a different value of ψ, and with the optimization in each stage restricted to the neighborhood of the current value of ψ.

We impose this restriction by adding a penalty term to $l_{m,n}(\theta)$. In general, the accuracy of an importance sampling approximation degrades as the variability of the importance sampling weights (given in our case by (5.9)) increases. This tends to occur as θ departs further from ψ. Thus, it is natural to penalize variability in the weights. We experimented with two different types of such penalties.

Let $w_1, w_2, \ldots, w_n$ be an arbitrary list of positive real values (weights). In our earlier work (mainly with HCAR models) we used a penalty function based on

$$\log\left(\frac{1}{n}\sum_{i=1}^{n} w_i\right) - \frac{1}{n}\sum_{i=1}^{n}\log(w_i). \tag{6.1}$$

In our later work with the WCAR models, we used a penalty based on

$$\frac{\left(\sum_{i=1}^{n} w_i\right)^2}{\sum_{i=1}^{n} w_i^2}. \tag{6.2}$$

If $\sum w_i$ is held fixed, then (6.1) is minimized when all the weights are equal and increases as the weights become more variable, whereas (6.2) is maximized when all the weights are equal and decreases as the weights become more variable. (The expression (6.2) is the "effective sample size" of Kong, Liu, and Wong [52], but it does not have that interpretation in our setting.) The penalties based on these functions always have two components, one penalizing variability in the "conditional" weights $w_{c,1}, w_{c,2}, \ldots, w_{c,n}$ and the other penalizing variability in the "unconditional" weights $w_{u,1}, w_{u,2}, \ldots, w_{u,n}$ (where $w_{c,i}$ and $w_{u,i}$ are defined below).

6.1.1 Penalized Monte Carlo Log-Likelihood Notation

The Monte Carlo log-likelihood function of the CAR model given in (5.8) can be expressed as

$$l_{m,n}(\theta) = \log\left(\frac{1}{m}\sum_{i=1}^{m} e^{\left\{Q_\theta(X_i^*,y)-Q_\psi(X_i^*,y)\right\}}\right) - \log\left(\frac{1}{n}\sum_{i=1}^{n} e^{\left\{Q_\theta(X_i,Y_i)-Q_\psi(X_i,Y_i)\right\}}\right). \tag{6.3}$$

In equation (6.3) let $m = n$ and define $l_n(\theta) \equiv l_{n,n}(\theta)$. To define the penalized Monte Carlo log-likelihood function of the CAR model, it is necessary to introduce the following notation:

$$Q_{c,i} = Q_\theta(X_i^*, y) - Q_\psi(X_i^*, y) \text{ and } Q_{u,i} = Q_\theta(X_i, Y_i) - Q_\psi(X_i, Y_i); \tag{6.4}$$

$$l_{c,n}(\theta) = l_{c,n,n}(\theta) = \log\left(\frac{1}{n}\sum_{i=1}^{n} e^{Q_{c,i}}\right) \text{ and } l_{u,n}(\theta) = l_{u,n,n}(\theta) = \log\left(\frac{1}{n}\sum_{i=1}^{n} e^{Q_{u,i}}\right); \tag{6.5}$$

$$w_{c,i} = e^{Q_{c,i}} \text{ and } w_{u,i} = e^{Q_{u,i}}; \tag{6.6}$$

$$R_c = \frac{\left(\sum_{i=1}^{n} w_{c,i}\right)^2}{\sum_{i=1}^{n} (w_{c,i})^2} \text{ and } R_u = \frac{\left(\sum_{i=1}^{n} w_{u,i}\right)^2}{\sum_{i=1}^{n} (w_{u,i})^2}. \tag{6.7}$$

We use the superscripts c and u to denote quantities computed from the conditional sample and unconditional sample respectively. Using this notation, the Monte Carlo log-likelihood function of the CAR model (6.3) can now be expressed as

$$l_n(\theta) = l_{c,n}(\theta) - l_{u,n}(\theta). \tag{6.8}$$

We modify the Monte Carlo log-likelihood given in (6.8) by a penalty term to form the PMCL. We define the PMCL as

$$\tilde{l}_n(\theta) = l_n(\theta) - \lambda J_n(\theta), \tag{6.9}$$

where the function $J_n(\theta)$ is a penalty term that penalizes unwanted characteristics of the parameters and λ controls the influence of the penalty term on the estimation [53]. The gradient of the PMCL is given by

$$\nabla\tilde{l}_n(\theta) = \nabla l_n(\theta) - \lambda\nabla J_n(\theta), \tag{6.10}$$

where $\nabla l_n(\theta)$ is computed using (5.14).

6.1.2 HCAR Penalized Monte Carlo Log-Likelihood

The HCAR PMCL is given by (6.9) where the penalty term is

$$J_n(\theta) = l_{c,n}(\theta) - \frac{1}{n}\sum_{i=1}^{n} Q_{c,i} + l_{u,n}(\theta) - \frac{1}{n}\sum_{i=1}^{n} Q_{u,i}. \tag{6.11}$$

Note that (6.11) can be written using the notation in (6.6) as

$$J_n(\theta) = \log\left(\frac{1}{n}\sum_{i=1}^{n} w_{c,i}\right) - \frac{1}{n}\sum_{i=1}^{n}\log(w_{c,i}) + \log\left(\frac{1}{n}\sum_{i=1}^{n} w_{u,i}\right) - \frac{1}{n}\sum_{i=1}^{n}\log(w_{u,i}),$$

which is the sum of the two terms having the form (6.1). The gradient of the penalty term is given by

$$\nabla J_n(\theta) = \nabla l_{c,n}(\theta) - \frac{1}{n}\sum_{i=1}^{n}\nabla Q_{c,i} + \nabla l_{u,n}(\theta) - \frac{1}{n}\sum_{i=1}^{n}\nabla Q_{u,i}, \tag{6.12}$$

which can be computed using (5.11) and (5.14).

6.1.3 WCAR Penalized Monte Carlo Log-Likelihood

The WCAR PMCL is given by (6.9) with the penalty term

$$J_n(\theta) = e^{-R_c} + e^{-R_u}, \tag{6.13}$$

and $\lambda = e^{R^0}$ where R^0 is the minimum desired effective sample size for our samples. The terms R_c and R_u defined in (6.2) are based on the notion of effective sample size [52]. The gradient of the penalty term is given by

$$\nabla J_n(\theta) = -\nabla R_c e^{-R_c} - \nabla R_u e^{-R_u}, \tag{6.14}$$

where

$$\nabla R_c = 2R_c \left\{ \frac{\sum_{i=1}^{n} \nabla Q_{c,i} w_{c,i}}{\sum_{i=1}^{n} w_{c,i}} - \frac{\sum_{i=1}^{n} \nabla Q_{c,i} w_{c,i}^2}{\sum_{i=1}^{n} w_{c,i}^2} \right\} \tag{6.15}$$

and

$$\nabla R_u = 2R_u \left\{ \frac{\sum_{i=1}^{n} \nabla Q_{u,i} w_{u,i}}{\sum_{i=1}^{n} w_{u,i}} - \frac{\sum_{i=1}^{n} \nabla Q_{u,i} w_{u,i}^2}{\sum_{i=1}^{n} w_{u,i}^2} \right\}. \tag{6.16}$$

6.2 Initial Parameter Estimates

Initial parameter estimates for the HCAR model and the WCAR model were obtained by weighted least squares regression. In this regression the response variable was the average log transformed small zooplankton at each spatiotemporal site with observed small zooplankton data and the predictor variables were the covariates in the model. We standardized the response and predictor variables (standardized variables denoted by $Y_{K\times 1}$ and $X_{K\times p}$, respectively). Next, we performed a weighted least squares regression of Y on X for both the HCAR model and the WCAR model. The weights for each model were chosen on the basis of the conditional variances in 4.14 and 4.25 and were defined as follows:

1. HCAR model: The i^{th} weight equals one, for $i = 1,\dots,K$;

2. WCAR model: The i^{th} weight equals the total number of neighbors of Y_i, for $i = 1,\dots,K$.

Hence, for the HCAR model the weighted least squares regression reduces to unweighted least squares regression and for the WCAR model, the i^{th} weight is equal to w_{i+} as defined in section 4.4.2. Finally, the initial parameter values of the HCAR and WCAR models were set as follows:

1. $\rho_i = 0$, for $i = 1, 2, 3$;
2. $\tau = \left(\frac{\text{residual sum of squares}}{K - p}\right)^{\frac{1}{2}}$;
3. $\beta_j =$ the j^{th} regression coefficient, for $j = 0, \ldots, (p-1)$.

6.3 Gibbs Samplers and Sufficient Statistics

Our Gibbs samplers and sufficient statistics codes were written in the C programming language. We used the initial parameter estimates described above (section 6.2) to initiate our simulation. We ran a conditional Gibbs sampler to generate the conditional sample, $X_1^*, \ldots, X_m^*$ of equation (6.9). We ran an unconditional Gibbs sampler (4.5.2) to generate the unconditional sample, $(X_1, Y_1), (X_2, Y_2), \ldots, (X_n, Y_n)$ of equation (6.9). This was done for both the HCAR and WCAR models.

The sufficient statistics as described in section 5.2.4 (for the HCAR model) and section 5.2.6 (for the WCAR model) were collected for both samples. We computed 20,000 total sufficient statistics for both the conditional sample and the unconditional sample of equation (6.9). These sufficient statistics were collected after every sweep of the conditional Gibbs sampler and after every sweep of the unconditional Gibbs sampler. They were used to calculate (5.14) for the HCAR model and to calculate (5.20) for the WCAR model.

6.4 Optimization

We employed BFGS, a quasi-Newton method, to optimize both the HCAR and WCAR PMCL functions. The BFGS method was developed by Broyden [54], Fletcher [55], Goldfarb [56], and Shanno [57]. Quasi-Newton methods require reasonable starting parameter values, otherwise, parameter estimates may diverge to distant parts of the parameter space from which the routine cannot recover. Really poor starting parameter estimates may also result in a flat likelihood surface or result in missing or infinite values for the objective function

[58]. These methods use both the gradient and a numerically approximated Hessian to iteratively approximate the maximum of the PMCL.

The $K \times K$ covariance matrix, Σ, of a CAR process must be positive definite. Since the covariance matrix of the HCAR and WCAR models is a function of the parameters ρ_1, ρ_2, ρ_3 (section 4.4.1 and section 4.4.2 respectively), this requirement imposes a constraint on these parameters. Unfortunately, it is difficult to check the positive definiteness of a very large matrix. In fact, during the course of simulations we sometimes became aware that a particular matrix Σ was not positive definite only by observing that the corresponding Gibbs sampler produced output that was clearly non-stationary; the output would "blow up" exponentially as the Gibbs iterations progressed, eventually crashing the program. Optimization of the HCAR models that we used never led to values of ρ_1, ρ_2, ρ_3 for which the Gibbs sampler exhibited obviously non-stationary behavior. However, for the WCAR model, this particular problem occurred quite frequently

Therefore, for the WCAR models it was necessary to explicitly impose some type of constraint on ρ_1, ρ_2, ρ_3 to guarantee the positive definiteness of the covariance matrix. The simplest sufficient condition which guarantees the positive definiteness of a symmetric matrix is that of diagonal dominance: if, in each row of the matrix, the diagonal element exceeds the sum of the off-diagonal elements, then the matrix is positive definite. A symmetric matrix is positive definite if and only if its inverse is positive definite. For the WCAR model, the inverse of the covariance matrix given in (4.28b) is proportional to $D_w - C(\rho)$. This satisfies the diagonal dominance condition if

$$w_{i+} > \rho_1 w^1_{i+} + \rho_2 w^2_{i+} + \rho_3 w^3_{i+},$$

for all sites $i = 1, \ldots, K$ and w^l_{i+} and w_{i+} in (4.21). For the neighbor configurations which occur in the CALCOFI data, this results in the twelve inequalities listed below. These were imposed as constraints during the optimization process.

(a) $\rho_1 + 0 + \rho_3 < 2$;

(b) $\rho_1 + \rho_2 + \rho_3 < 3$;

(c) $2\rho_1 + 0 + \rho_3 < 3$;

(d) $\rho_1 + 0 + 2\rho_3 < 3$;

(e) $\rho_1 + 2\rho_2 + \rho_3 < 4$;

(f) $2\rho_1 + \rho_2 + \rho_3 < 4$;

(g) $\rho_1 + \rho_2 + 2\rho_3 < 4$;

(h) $2\rho_1 + 0 + 2\rho_3 < 4$;

(i) $2\rho_1 + 2\rho_2 + \rho_3 < 5$;

(j) $\rho_1 + 2\rho_2 + 2\rho_3 < 5$;

(k) $2\rho_1 + \rho_2 + 2\rho_3 < 5$;

(l) $2\rho_1 + 2\rho_2 + 2\rho_3 < 6$.

6.4.1 HCAR Model Optimization

We used the *optim* function in R to optimize the PMCL (6.9) with penalty term given by (6.11) and $\lambda = .05$. The gradient is given by (6.10), substituting (5.11) for $\nabla l_n(\theta)$ and (6.12) for $\nabla J_n(\theta)$. We set the parameter estimates for the next iteration equal to the parameter values returned from optim. We repeated this process until our estimates appeared to converge.

6.4.2 WCAR Model Optimization

We used the *constrOptim* function in R to perform the local maximization of the PMCL (6.9) with penalty term given by (6.13), $\lambda = e^{R^0}$ and $R^0 = 100$. The gradient is given by (6.10), substituting (5.11) for $\nabla l_n(\theta)$ and (6.14) for $\nabla J_n(\theta)$. We set the parameter estimates for the next iteration equal to the parameter values returned from constrOptim. We repeated this process until our estimates appeared to converge.

6.5 Final Parameter Estimate

For both model types (HCAR and WCAR), we performed a final iteration of the PMCL algorithm after the PMCL estimates converged. We took the average of the all PMCL estimates, after convergence, as the value of ψ for this final iteration. We ran conditional and unconditional Gibbs samplers (with burnin of 100,000 and a spacing of 10) to generate 200,000 vectors of sufficient statistics.

The Newton-Raphson algorithm was used to optimize the HCAR PMCL. The inverse of the Hessian matrix (H^{-1}) was computed to get the covariance matrix and standard errors (square roots of the diagonial elements of H^{-1}) of the parameter estimates. The standard errors of the parameter estimates were used to calculate *t-values* for the parameter estimates. We used the constrOptim function to optimize the WCAR PMCL.

CHAPTER 7

APPLICATION TO CALCOFI TIME SERIES DATA

7.1 Data

7.1.1 CalCOFI Time Series

In this chapter, we apply the previously outlined methodology to analyze zooplankton data contained in the CalCOFI time series (discussed in chapter 1). The CalCOFI time series used in this dissertation was obtained from calcofi.org. The time series consists of all sampling data (including line and station number as described in section 1.1.1) collected at CalCOFI collection sites. We use two time frames in our analysis, January 1951 through December 2006 (672 months) and January 1960 through December 2006 (564 months). The time frames were chosen based on the covariates used in the model (as explained below in section 7.1.4). The line and stations numbers refer roughly to latitudinal and longitudinal positioning, respectively. Line numbering starts at the northern boundary of the CalCOFI grid increasing downward while station numbering starts at the California coast increasing outward.

This analysis covers a subset of the original CalCOFI sampling grid described in section 1.1 and section 1.1.1. Our spatial lattice has dimensions 9×24 (9 lines, 24 stations). We chose those sites that were continuously sampled from 1/1951 through 12/2006. This leads to a spatial sampling grid which consists of 84 sites (henceforth called sampling sites) between lines 66.7 and 93.3 and stations 26.7 and 120 (Figure 7.1). We use the pair "Line-Station" (e.g., 93.3-65, line 93.3 and station 65) to refer to a site. To simplify programming, we embedded our 84 sampling sites in a rectangular lattice consisting of all 216 possible grid locations (9 lines $\times$ 24 stations, Figure 7.2). The 216 grid locations are classified as sampling sites, extended sites, and non-sites (to be described below).

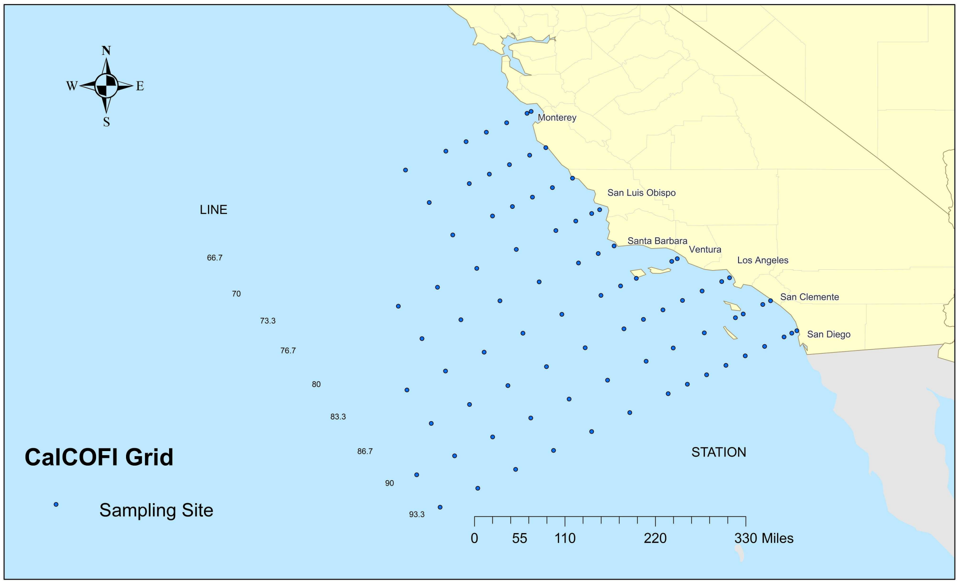


Figure 7.1: CalCOFI Sampling Grid.

A grid location was classified as an extended grid site if it was over water and between two sampling sites on the same line or between a sampling site and land. There are 47 such sites. No actual zooplankton data was collected at these sites. The remaining 85 ($= 216 - 84 - 47$) grid locations, called non-sites, are either over land or outside the region occupied by the 84 sampling sites. The sites in our CAR models will be the spatiotemporal sites corresponding to 131 spatial locations given by the 84 sampling sites and 47 extended grid sites. We include the extended grid sites (even though there is no observed data at these sites) for the following reasons:

1. Their inclusion created a more regular neighborhood structure;
2. They are sites that could possibly contain zooplankton samples;
3. As neighbors to true sampling sites (possibly containing zooplankton samples), they have the potential to influence zooplankton yields at true sampling sites.

Because of these reasons, the extended sites are treated as sampling sites with completely missing data during the Gibbs simulation.

In our Gibbs sampling, the extended grid sites will be treated exactly the same as the sampling sites. We will update the values at the extended grid sites in both the conditional and unconditional samples (by the conditional and unconditional Gibbs samplers respectively). The extended grid sites are described by giving a pair of numbers (a line number and a station number) just as are the sampling sites.

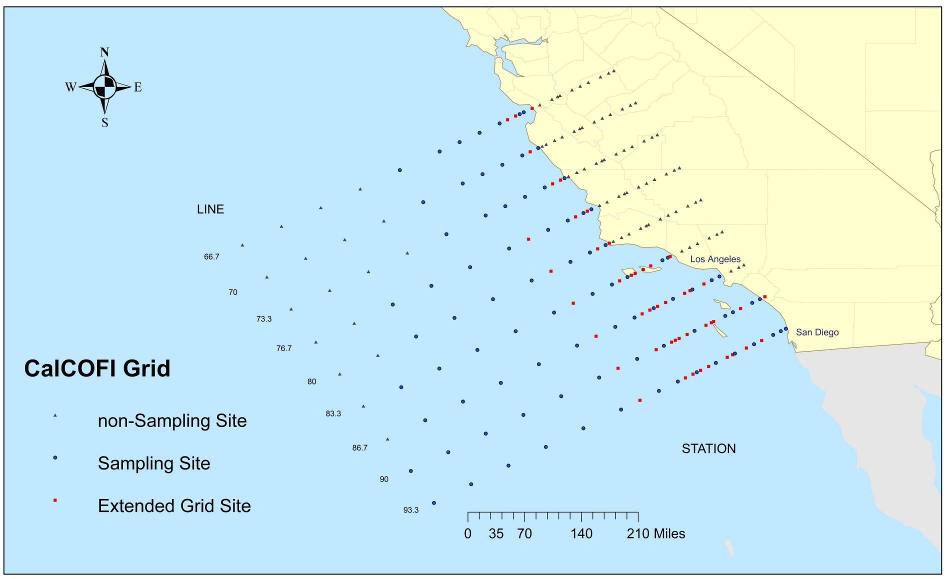


Figure 7.2: CalCOFI Extended Grid.

7.1.2 Sparseness of Zooplankton Data

The initial CalCOFI survey program conducted monthly zooplankton measurements at each of the 84 sampling sites in our grid. Unfortunately, difficulty scheduling sampling cruises, the cost of sampling, and other considerations resulted in several alterations of the original survey program. A consequence of these alterations is temporal discontinuity in the data due to intermittent data collection at all sites on our grid over the 56 years of our analysis. Assuming our data was collected by the original CalCOFI sampling design we would expect our 84 sites to be sampled 672 times each, giving us 56,448 total mean zooplankton observations. Under this assumption, 75 percent of the data in this analysis is considered missing.

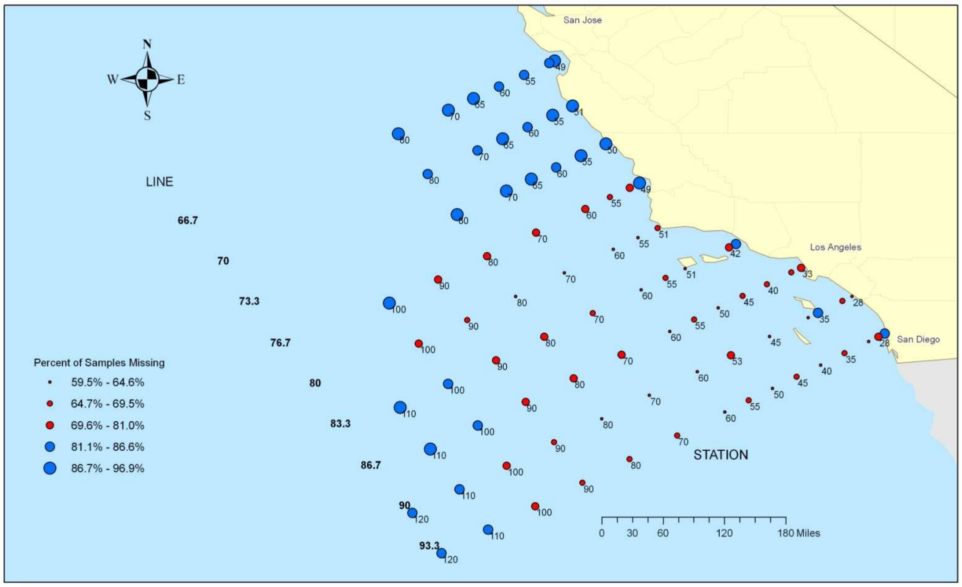


Figure 7.3: Percent of zooplankton data missing by site.

Analyses of summary statistics show the missingness to be pervasive throughout our spatiotemporal lattice. The proportion of missing zooplankton data at each site is given in Appendix A, where the blank areas are the extended grid sites and non-sites. Assuming a zooplankton sample for each of the 672 months at each site then at least 60 percent of each site's samples is missing. Analysis of the data is particularly troublesome north of line 76.6 and west of station 90 (Figure 7.3). The percentage of missing zooplankton data for each of the 672 months in our analysis is given in Appendix A. Assuming a potential zooplankton sample at each of the 84 sites for each month then 319 months have data completely missing.

7.1.3 Observed Zooplankton Data

"Since zooplankton growth rates are usually an exponential function of population density" [12], we used a log transformation in the analysis of the CalCOFI time series. The log transformed observations were more nearly normally distributed allowing for easier statistical analysis. We used average log values for sites with multiple observations during a single time period. All observations were standardized after being log transformed. The seasonal trends for the mean observed zooplankton biomass $ml/1000m^3$ for lines and stations are given in Appendix B, Figure B.1 and Figure B.2 respectively. The large amount of missing data allows outliers to greatly influence the trend lines. Mean observed zooplankton volume by site is given in Appendix B, Figure B.3.

7.1.4 Covariates

The CalCOFI time series include variables known to be influencing factors in zooplankton production such as sea surface temperature and weather. However we did not use them in this analysis since they were only collected when zooplankton samples were collected. Having missing covariates (in addition to the missing response values) would greatly complicate the analysis. Therefore, it was necessary to obtain or construct covariates that would be present at each point in our spatiotemporal lattice.

We chose two sets of covariates to use in our analyses. The first set of covariates (henceforth called set 1 covariates) were constructed from the indices assigned to lines, stations, and months. Since these covariates can be defined for all the data, we were able to use all of the CalCOFI data for the analyses with the set 1 covariates; the set 1 covariates have a time frame from January 1, 1951 through December 31, 2006 (672 months). The set 1 covariates were as follows:

$$\begin{aligned}
X_1 &= \text{ spatial row number (line)} \\
X_2 &= \text{ spatial column number (station)} \\
X_3 &= X_2^2 \\
X_4 &= \text{ time index (month)} \\
X_5 &= X_4^2 \\
X_6 &= X_4^3 \\
X_7 &= \sin\left(\frac{2\pi X_4}{12}\right) \\
X_8 &= \cos\left(\frac{2\pi X_4}{12}\right).
\end{aligned} \tag{7.1}$$

In the second set of covariates (henceforth called set 2 covariates), we introduced the additional covariates of sea surface temperature (SST) and ocean depth, and replaced the spatial row and column indices by the sampling site latitude and longitude. It was hoped that these modifications would result in a better fitting model. Unfortunately, the SST values are only available starting in 1960 so that the analyses with the set 2 covariates have a time frame from January 1, 1960 through December 31, 2006 (564 months).

The set 2 covariates were as follows:

$$
\begin{aligned}
X_1 &= \text{ time index (month)} \\
X_2 &= X_1^2 \\
X_3 &= X_1^3 \\
X_4 &= \sin\left(\frac{2\pi X_1}{12}\right) \\
X_5 &= \cos\left(\frac{2\pi X_1}{12}\right) \\
X_6 &= \text{ monthly mean sea surface temperature} \\
X_7 &= \text{ sampling site ocean depth in meters} \\
X_8 &= X_7^2 \\
X_9 &= \text{ sampling site latitude in decimal degrees} \\
X_{10} &= \text{ sampling site longitude in decimal degrees} \\
X_{11} &= X_{10}^2.
\end{aligned}
\tag{7.2}
$$

The decision to include the sine and cosine terms and various powers of the spatiotemporal indices and of ocean depth and longitude in the set 1 and set 2 covariates was based on informal exploratory analysis of the observed zooplankton data which revealed clear seasonal trends and some potential spatial trends and long-term time trends. After being computed as defined above, all covariates in set 1 and set 2 were standardized using the values for all sampling sites and extended grid sites.

7.1.5 Sea Surface Temperature

The mean monthly sea surface temperatures (SST) data for January 1960 through December 2006 were obtained from the Nation Oceanic and Atmospheric Administration (NOAA). The spatial coverage of the data was a 2.0 degree latitude $\times$ 2.0 degree longitude global grid (90×180) from 89.0 N to -89.0 S and 180.0 E to -180.0 W. We matched SST longitude and latitude to the sampling sites' spatial coordinates (to within a 4 mile radius).

7.1.6 Ocean Depth

The ocean depth was obtained from the CalCOFI data and from data at the NASA Global Change Master Directory (GCMD). We used the depth included with the CalCOFI data set for the 84 sampling sites. The NASA GCMD estimated depth is based on the method of Smith and Sandwell [59] and was used for the extended grid sites. The spatial coverage of the data is from global 1-minute grids from 72.0 N to -72.0 S and 180.0 E to -180.0 E. We matched ocean depth longitude and latitude to the sampling sites' spatial coordinates (to within a 4 mile radius).

7.2 Models for Mean Zooplankton Yields

We used the two special cases of the CAR models HCAR (4.12) and WCAR (4.23), with the two sets of covariates to analyze the CalCOFI time series. The models were formulated as follows:

1. model 1.1 - HCAR model with set 1 covariates;
2. model 1.2 - HCAR model with set 2 covariates;
3. model 2.1 - WCAR model with set 1 covariates;
4. model 2.2 - WCAR model with set 2 covariates.

7.2.1 Parameter Estimates

We carried out the procedure outlined in section 5.2.1 and chapter 6 to fit our models. The evolution of the parameter estimates returned from the MCL recursive algorithm is given in Appendix C for all models. The final parameter estimates for model 1.1 and model 2.1 are given in Table 7.1. The final parameter estimates for model 1.2 and model 2.2 are given in Table 7.2.

Because of the differences between HCAR and WCAR models, their parameter estimates for ρ_1, ρ_1, ρ_1, and ξ are not comparable. The covariate parameters β_i do have the same meaning in both models, and the estimated values $\hat{\beta}_i$ tend to be similar for HCAR and WCAR.

Table 7.1: Models 1.1 and 2.1 Parameter Estimates.

	Model 1.1					Model 2.1
Parameter	$\hat{\theta}$	SE	t-value	95% lower	95% upper	$\hat{\theta}$
ρ_1	0.32444	0.00569	56.97718	0.31328	0.3356	1.0014
ρ_2	0.1044	0.0049	21.29588	0.09479	0.11401	1
ρ_3	0.0871	0.00555	15.69553	0.07622	0.09797	0.9962
ξ	2.93833	0.03915	75.05165	2.8616	3.01507	0.5289
β_0	-0.09093	0.01969	-4.61901	-0.12951	-0.05234	0.0737
line	-0.28963	0.01335	-21.70282	-0.31578	-0.26347	-0.2741
station	0.74735	0.04422	16.90087	0.66068	0.83403	0.8975
station^2	-0.52009	0.04604	-11.29582	-0.61034	-0.42985	-0.7361
time	1.0724	0.15087	7.10806	0.77669	1.3681	1.0519
time^2	-2.76277	0.36134	-7.64586	-3.471	-2.05454	-3.0096
time^3	1.50413	0.22332	6.73517	1.06641	1.94184	1.7456
$\sin(\frac{2\pi\times\text{time}}{12})$	0.01904	0.01213	1.57024	-0.00473	0.04281	0.0024
$\cos(\frac{2\pi\times\text{time}}{12})$	-0.25098	0.01206	-20.80309	-0.27462	-0.22733	-0.2532

Table 7.2: Models 1.2 and 2.2 Parameter Estimates.

	Model 1.2					Model 2.2
Parameter	$\hat{\theta}$	SE	t-value	95% lower	95% upper	$\hat{\theta}$
ρ_1	0.32055	0.00696	46.05942	0.30691	0.33419	1.0076
ρ_2	0.12611	0.00707	17.83349	0.11225	0.13998	1
ρ_3	0.0698	0.00662	10.53771	0.05681	0.08278	0.9838
ξ	2.97184	0.04545	65.38289	2.88276	3.06093	0.5411
β_0	0.0774	0.02056	3.76504	0.03711	0.1177	0.1182
time	1.10984	0.1626	6.82567	0.79115	1.42853	1.1033
time^2	-3.50867	0.39523	-8.87743	-4.28333	-2.73401	-3.6364
time^3	2.18492	0.24483	8.92411	1.70505	2.66479	2.3212
$\sin(\frac{2\pi\times\text{time}}{12})$	-0.1006	0.01916	-5.25097	-0.13815	-0.06305	-0.1226
$\cos(\frac{2\pi\times\text{time}}{12})$	-0.27226	0.01391	-19.57074	-0.29952	-0.24499	-0.2628
sst	-0.16471	0.02024	-8.13786	-0.20438	-0.12504	-0.192
depth	-0.11708	0.03957	-2.95879	-0.19463	-0.03952	-0.087
depth^2	0.15256	0.04362	3.49791	0.06708	0.23805	0.1192
latitude	0.32815	0.01605	20.43949	0.29668	0.35962	0.3223
longitude	7.39703	1.58915	4.6547	4.28229	10.51177	8.9006
longitude^2	-7.56797	1.58773	-4.76654	-10.67992	-4.45603	-9.0749

We were able to calculate standard errors and estimated correlation matrices (Appendix E) to accompany model 1.1 and model 1.2 parameter estimates, however, this was not possible for models 2.1 and 2.2. This is because the maximum of the log-likelihood $l_n(\theta)$ for the HCAR models 1.1 and 1.2 is achieved at a point in the interior of the parameter space so that the inverse of the Hessian matrix supplies an estimate of the covariance matrix of the parameter estimates. However, for the WCAR models 2.1 and 2.2 the maximum is achieved on the boundary of the parameter space (i.e., the boundary imposed by the diagonal dominance condition; see the discussion in section 6.4) and it is no longer clear how to estimate the covariance matrix.

For models 1.1 and 1.2, assuming approximate normality, we use the standard errors of the parameter estimates to compute the t-values and approximate 95% confidence intervals. All parameters in model 1.1, with the exception of the sine term, appear to be significant, based on their t-values. We chose to keep the sine term in the model since the cosine term was highly significant and it did not seem prudent to include a cosine term without a sine term when measuring a trend. Based on the t-values, all coefficients in model 1.2 were deemed significant.

7.2.2 Estimated Conditional Variance

The estimated conditional variances of the HCAR and WCAR models (given by (4.14) and (4.25), respectively) give us one way to compare the fit of our models. These are displayed in Table 7.3. For sampling sites with six neighbors, the WCAR models for both set 1 and set 2 covariates had smaller conditional variances than the set 1 and set 2 HCAR models respectively. For sites with less than six neighbors, the HCAR models for both set 1 and set 2 had smaller conditional variances than the set 1 and set 2 WCAR models respectively. The conditional variances for the models fit with set 2 covariates were slightly smaller than the models fit with set 1 covariates. Overall, the conditional variances for our models were very similar.

A question of interest in our analysis was which set of covariates better explains the zooplankton data. We showed that models fit with set 2 covariates resulted in slightly smaller conditional variances than models fit with set 1 covariates (Table 7.3). However, this result does not adequately answer the question because the models fit with set 2 covariates

Table 7.3: Model Conditional Variance.

Parameter	Neighbors[1]	Frequency[2]	Conditional Variance	Conditional SD
Model 1.1			0.34033	0.58338
Model 1.2			0.33649	0.58008
Model 2.1	6	30150	0.31509	0.56133
Model 2.1	5	18850	0.37811	0.61491
Model 2.1	4	6756	0.47264	0.68749
Model 2.1	3	690	0.63018	0.79384
Model 2.1	2	2	0.94527	0.97225
Model 2.2	6	25335	0.308	0.55497
Model 2.2	5	15809	0.3696	0.60794
Model 2.2	4	5658	0.462	0.6797
Model 2.2	3	573	0.61599	0.78485
Model 2.2	2	1	0.92399	0.96124

[1] Number of Neighbors of a spatiotemporal site.
[2] Total number of spatiotemporal sites with number of neighbors equal to *Neighbors*.

had a different time frame than the models fit with set 1 covariates. Thus the difference in the conditional variances could be due to either the difference in covariates or the difference in time frames.

Table 7.4: Model Conditional Variance Comparison.

Model	Covariates[1]	Neighbors[2]	Conditional Variance	Conditional SD
HCAR	set 1		0.33417	0.57807
HCAR	set 2		0.33649	0.58008
WCAR	set 1	6	0.31299	0.55945
WCAR	set 2	6	0.308	0.55497

[1] Time frame is January 1, 1960 through December 31, 2006.
[2] Number of Neighbors of a spatiotemporal site.

To better answer this question, we fit all our models again using data from just the time frame January 1, 1960 to December 31, 2006 (the same time frame as models 1.2 and 2.2). We fit two HCAR models, one with set 1 covariates and the other with set 2 covariates, and two WCAR models, one with set 1 covariates and the other with set 2 covariates. The estimated conditional variances are displayed in Table 7.4. (For the WCAR model, we report the conditional variance for sites with six neighbors.) For the HCAR models, the estimated conditional variance is slightly smaller for the set 1 covariates, whereas, for the WCAR models, the set 2 covariates produced a slightly smaller estimated conditional variance. Overall, there is not much difference in the fit between the models using the set 1 and set 2 covariates.

7.3 Predicted Mean Zooplankton Methodology

As in section 4.5.2, let $\mathcal{Y} = (X, Y)$ denote the complete data consisting of the missing data X and the observed data Y. Suppose we are interested in estimating some quantities $T(\mathcal{Y})$, such as the mean monthly or the yearly zooplankton yields, which are functions of the complete data. Using the conditional Gibbs sampler (see section 4.5.2) with the parameter vector ψ set equal to the MLE $\tilde{\theta}$ allows us to impute values X^* for the missing data X by simulating from the conditional distribution of X given $Y = y$. Thus we impute the value $T(X^*, y)$ for $T(X, y)$. Generating a sample $X_1^*, X_2^*, \ldots, X_n^*$ with the conditional Gibbs sampler, we use the sample mean

$$\bar{T} = \frac{1}{n} \sum_{i=1}^{n} T(X_i^*, y) \tag{7.3}$$

to estimate $E_{\tilde{\theta}}(T(X, Y)|Y = y)$ which is the optimal estimate of $T(X, Y)$ given $Y = y$. The sample variance

$$S_T^2 = \frac{1}{n-1} \sum_{i=1}^{n} (T(X_i^*, y) - \bar{T})^2 \tag{7.4}$$

gives an estimate of $\text{Var}_{\tilde{\theta}}(T(X, Y)|Y = y)$. There is some sampling variation (Monte Carlo variance) associated with the Monte Carlo estimates $\bar{T}$ and S_T^2 because we used simulated samples in their calculation.

There are many methods available for estimating the Monte Carlo variance. For example, the batch means method, covariance method, and regenerative method [60] [61] are all appropriate for estimating the Monte Carlo variance. We used the batch means method in this chapter to obtain Monte Carlo standard errors for both $\bar{T}$ and S_T^2.

In the batch means method we divide the conditional Gibbs sample $(X_1^*, X_2^*, \ldots, X_n^*)$ of length n into N successive non-overlapping batches of equal size M. Let B_{ij} denote the

j-th observation of the i-th batch for $i = 1, \ldots, N$ and $j = 1, \ldots, M$. The elements of batch i are $T(X^*_{(i-1)M+1}, y), \ldots, T(X^*_{iM}, y)$. Let $\bar{B}_i$ be the sample mean of the i-th batch:

$$\bar{B}_i = \frac{1}{M} \sum_{j=1}^{M} B_{ij},\ i = 1, \ldots, N. \tag{7.5}$$

Now another estimate of $E_{\tilde{\theta}}(T(X, Y)|Y = y)$ is given by

$$\bar{B} = \frac{1}{N} \sum_{i=1}^{N} \bar{B}_i. \tag{7.6}$$

Clearly the overall sample mean (7.3) is equal to the mean of the batch means (7.6). If we choose M large enough, then the batch means will be approximately independent and normally distributed so that confidence intervals can be constructed [60]. With approximately independent batches and N large enough to reliably estimate $\text{Var}(\bar{B}_i)$, then the Monte Carlo variance of $\bar{B}$ is estimated by

$$S^2_{\bar{B}} = \frac{1}{N} \sum_{i=1}^{n} \frac{(\bar{B}_i - \bar{B})^2}{(N-1)}, \tag{7.7}$$

[36] and the Monte Carlo standard error of $\bar{B}$ ($\text{MCSE}_{\text{Mean}}$) is estimated by

$$S_{\bar{B}} = \sqrt{S^2_{\bar{B}}}. \tag{7.8}$$

Let $S^2_{B_i}$ denote the i-th batch sample variance

$$S^2_{B_i} = \sum_{j=1}^{M} \frac{(B_{ij} - \bar{B}_i)^2}{M-1},\ i = 1, \ldots, N, \tag{7.9}$$

and let S_{B_i} denote the i-th batch sample standard deviation

$$S_{B_i} = \sqrt{S^2_{B_i}},\ i = 1, \ldots, N. \tag{7.10}$$

An alternative estimate of the variance $\text{Var}_{\tilde{\theta}}(T(X, Y)|Y = y)$ is given by

$$\hat{S}^2 = \frac{1}{N} \sum_{i=1}^{N} S^2_{B_i}. \tag{7.11}$$

This is approximately equal to (7.4) when M and N are large. Taking the square root of $\hat{S}^2$ gives us an estimate of the standard deviation

$$\hat{S} = \sqrt{\hat{S}^2}. \tag{7.12}$$

The Monte Carlo variance of $\hat{S}$ is estimated by

$$S^2_{\hat{S}} = \frac{1}{N}\sum_{i=1}^{N}\frac{(S_{B_i} - \hat{S})^2}{N-1}. \tag{7.13}$$

and the Monte Carlo standard error of $\hat{S}$ (MCSE_{SD}) is given by

$$S_{\hat{S}} = \sqrt{S^2_{\hat{S}}}. \tag{7.14}$$

In the following sections, this general approach is used to give estimates for several different quantities $T(\mathcal{Y})$. For each quantity, we used the conditional Gibbs sampler with ψ set to the parameter estimates given in Tables 7.1 and 7.2 to generate 100,000 values of the quantity of interest. We used a burn-in of 100,000 and collected the value of $T(X_i^*, y)$ after every 100 sweeps of the Gibbs sampler. We examined the autocorrelation of our 100,000 values to determine the batch size. After creating the batches, we confirmed the appropriateness of the batch size by analyzing the autocorrelation of the batch means. We determined the batches to be roughly independent if the autocorrelation of the batch means was insignificant for all lags. We found that a size of 1,000 was sufficient to assure approximate independence of the batches for all quantities of interest in this chapter. Consequently, all estimates were constructed using 100 batches of size 1,000.

In this chapter our quantities of interest will be functions of the complete data which consists of the values of the zooplankton biomass (displacement volume) in $ml/1000m^3$ volume at each space-time site, which we will refer to as the zooplankton yields. At space-time sites with observed data, there were typically multiple observed values and the "zooplankton yield" we use is the average of these values.

7.4 Results for Predicted Monthly Mean Zooplankton Yields

Our first quantities of interest are monthly mean zooplankton yields, which describe zooplankton seasonal variations for the CalCOFI time series. The autocorrelation plot of the 100,000 monthly mean zooplankton yields (Appendix F) shows the autocorrelation decaying quickly for each month. Dividing the 100,000 values into 100 non-overlapping batches of size 1,000, we found the autocorrelation of the 100 batches (Appendix F) to be insignificant for all lags. Hence we were able to carry out our analysis by treating the batch means as independent.

Figure 7.4 shows the predicted monthly mean zooplankton yields for models with set 1 and set 2 covariates. Assuming our models to be correct, then the mean estimates are fairly accurate (varying very little between batches) according to the MCSE of the mean (see Tables 7.5 through 7.8).

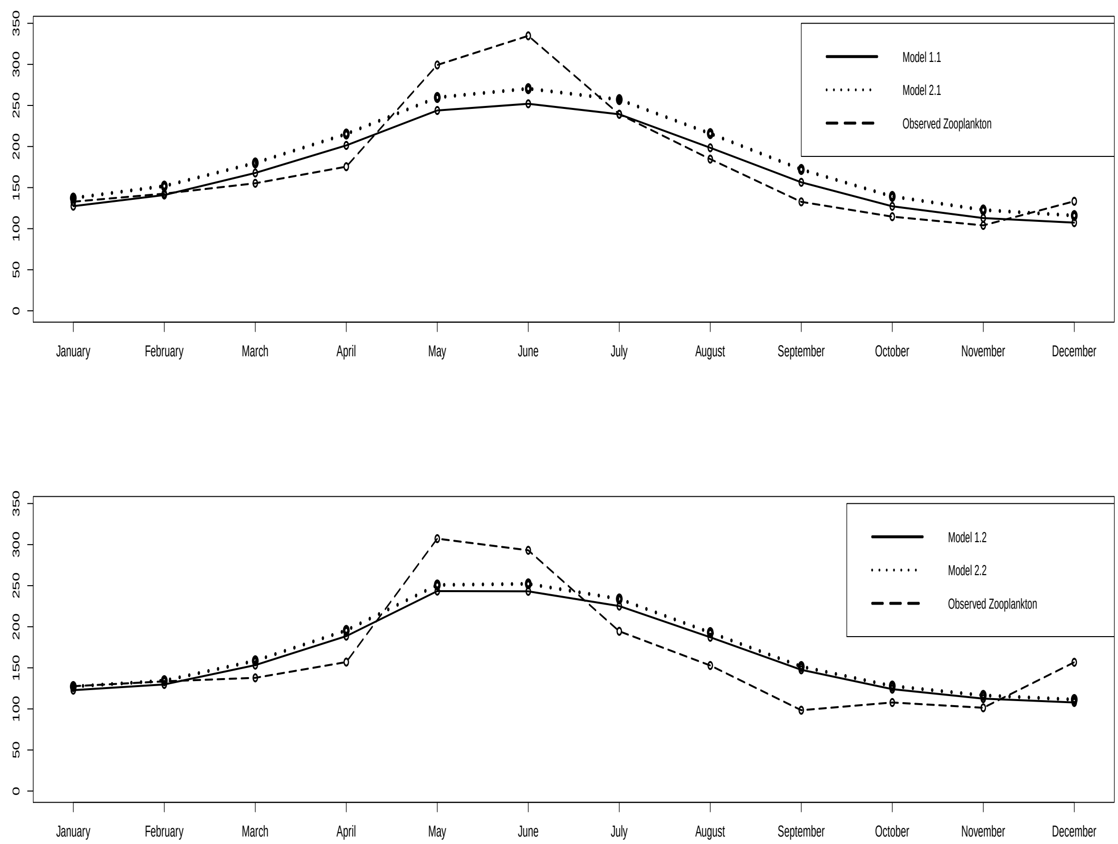


Figure 7.4: Predicted Monthly Mean Zooplankton Yields for HCAR and WCAR Models

The WCAR model produced higher mean monthly zooplankton yields than the HCAR model for both sets of covariates. The standard deviations were small for all models. The MCSEs were small for all models with the WCAR model having smaller MCSEs than the HCAR model for both the set 1 and set 2 covariates.

Table 7.5: Model 1.1 Predicted Monthly Mean Zooplankton Yields.

Month	Mean[1]	$\text{MCSE}_{\text{Mean}^2}$	SD[3]	$\text{MCSE}_{\text{SD}^4}$	OBS Mean[5]	OBS Count[6]
January	131.09	0.0196	3.74	0.0164	132.82	1734
February	146.1	0.0265	4.71	0.0188	142.63	1290
March	174.82	0.0331	6.11	0.026	155.27	938
April	210.47	0.0433	7.35	0.0362	175.48	2120
May	253.96	0.0476	8.83	0.0389	299.29	1138
June	263.49	0.0514	9.71	0.0401	334.76	781
July	250.6	0.0493	9.08	0.0379	239.32	1885
August	209.63	0.0441	8.47	0.0313	184.68	776
September	166.94	0.0368	7.11	0.0254	132.65	527
October	136.9	0.0295	5.6	0.0198	114.63	1420
November	122.08	0.024	4.84	0.0153	103.99	885
December	117.25	0.0215	4.33	0.0151	133.36	413

[1] Mean of the imputed mean monthly zooplankton yields, $\bar{B}$ (7.6). (This is the optimal prediction of the true monthly zooplankton yield.)
[2] Monte Carlo standard error of Mean, $S_{\bar{B}}$ (7.8).
[3] Standard deviation of the imputed mean monthly zooplankton yield, $\hat{S}$ (7.12).
[4] Monte Carlo standard error of SD, $S_{\hat{S}}$ (7.14).
[5] Mean of the observed zooplankton yields.
[6] Total number of observed zooplankton yields.

Table 7.6: Model 2.1 Predicted Monthly Mean Zooplankton Yields.

Month	Mean	$\text{MCSE}_{\text{Mean}}$	SD	MCSE_{SD}	OBS Mean	OBS Count
January	141.56	0.0137	3.88	0.0915	132.82	1734
February	157.81	0.0185	4.66	0.1168	142.63	1290
March	188.18	0.023	5.83	0.1749	155.27	938
April	226.18	0.0287	6.97	0.2626	175.48	2120
May	272.36	0.0359	8.25	0.3223	299.29	1138
June	284.94	0.0345	9.03	0.436	334.76	781
July	271.82	0.0327	8.47	0.4111	239.32	1885
August	229.89	0.0315	7.83	0.3018	184.68	776
September	184.88	0.0252	6.53	0.219	132.65	527
October	150.68	0.0181	5.13	0.1191	114.63	1420
November	133.24	0.0154	4.39	0.099	103.99	885
December	126.88	0.0146	4.04	0.0731	133.36	413

Table 7.7: Model 1.2 Predicted Monthly Mean Zooplankton Yields.

Month	**Mean**[1]	**MCSE$_{\text{Mean}^2}$**	**SD**[3]	**MCSE$_{\text{SD}^4}$**	**OBS Mean**[5]	**OBS Count**[6]
January	126.85	0.0134	3.29	0.0525	127.62	1506
February	134.69	0.0174	3.99	0.0694	133.53	1048
March	160.08	0.0193	5.14	0.133	137.83	702
April	198.14	0.0248	6.19	0.1778	157.02	1707
May	254.12	0.0287	7.97	0.3209	307.25	689
June	255.51	0.0315	8.85	0.4396	293.08	361
July	237.53	0.0323	8.05	0.3236	194.49	1469
August	198.13	0.0337	7.32	0.2563	152.85	641
September	157.33	0.0243	6.06	0.2048	98.40	388
October	132.92	0.0172	4.81	0.1211	107.80	1150
November	121.73	0.0177	4.54	0.1039	101.37	718
December	118.44	0.0146	4.24	0.0845	156.75	236

[1] Mean of the imputed mean monthly zooplankton yields, $\bar{B}$ (7.6). (This is the optimal prediction of the true monthly zooplankton yield.)
[2] Monte Carlo standard error of Mean, $S_{\bar{B}}$ (7.8).
[3] Standard deviation of the imputed mean monthly zooplankton yield, $\hat{S}$ (7.12).
[4] Monte Carlo standard error of SD, $S_{\hat{S}}$ (7.14).
[5] Mean of the observed zooplankton yields.
[6] Total number of observed zooplankton yields.

Table 7.8: Model 2.2 Predicted Monthly Mean Zooplankton Yields.

Month	**Mean**	**MCSE$_{\text{Mean}}$**	**SD**	**MCSE$_{\text{SD}}$**	**OBS Mean**	**OBS Count**
January	131.69	0.0121	3.33	0.0495	127.62	1506
February	139.62	0.0131	3.85	0.0672	133.53	1048
March	165.92	0.0177	4.9	0.1084	137.83	702
April	206.07	0.0235	6.08	0.1834	157.02	1707
May	263.36	0.0296	7.7	0.271	307.25	689
June	266.81	0.0307	8.52	0.3464	293.08	361
July	248.37	0.0303	7.86	0.314	194.49	1469
August	206.06	0.0252	6.95	0.2076	152.85	641
September	163.32	0.0201	5.61	0.1408	98.40	388
October	138.6	0.0153	4.49	0.0925	107.80	1150
November	127.36	0.0158	4.04	0.0871	101.37	718
December	123.42	0.0131	3.74	0.0611	156.75	236

7.5 Results for Predicted Yearly Mean Zooplankton Yields

We next calculated yearly mean zooplankton yields, which describe zooplankton long-term variations for the CalCOFI time series. The autocorrelation for the 100,000 yearly mean zooplankton yields from each model were insignificant at all lags for all years except for years 1970, 1971, 1973, 1974, 1976, 1977, and 1979-1983. Figure 7.5 shows the model 1.1 autocorrelation function estimates for 1970, 1971, 1974, and 1976. (The acf's were similar for all other models and years 1973, 1977, and 1979-1983). These were years with data either completely missing (1970, 1971, 1973, and 1976) or nearly completely missing (1974, 1977, and 1979-1983.) However, even for these years the autocorrelation decayed rapidly to zero, and using 100 batches of size 1000 seems reasonable. The autocorrelation of the 100 batch means (Figure 7.6) was insignificant at all lags.

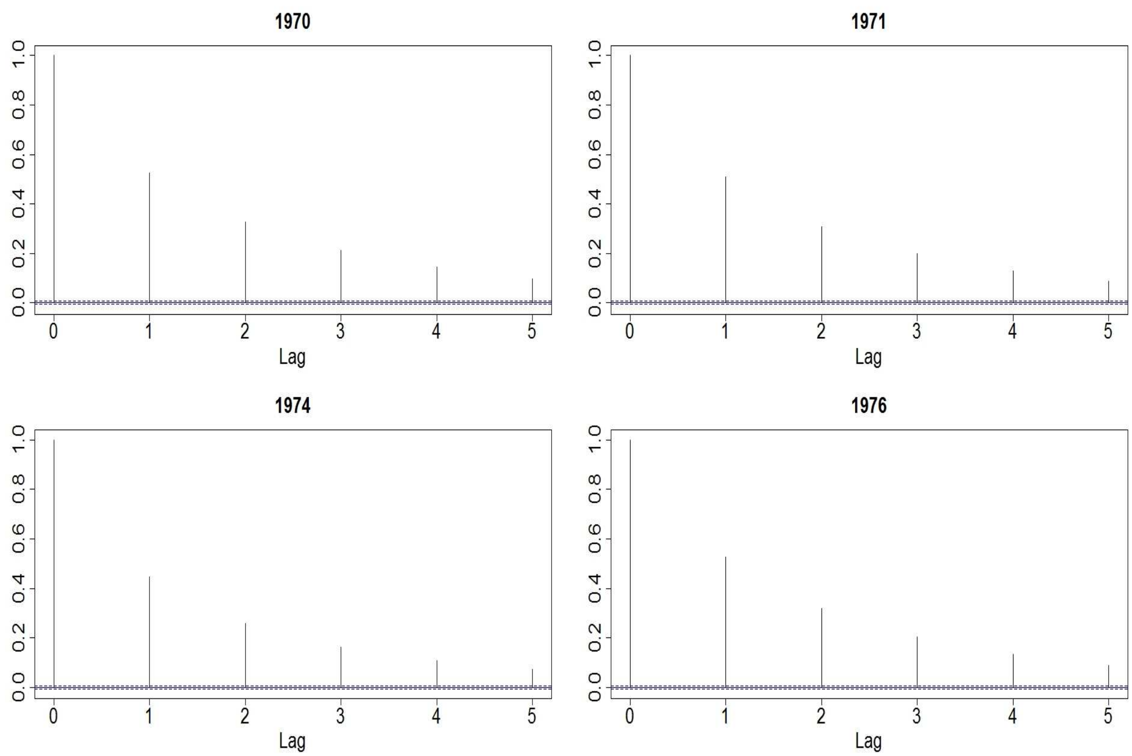


Figure 7.5: Model 1.1: ACF of Predicted Yearly Mean Zooplankton Yields

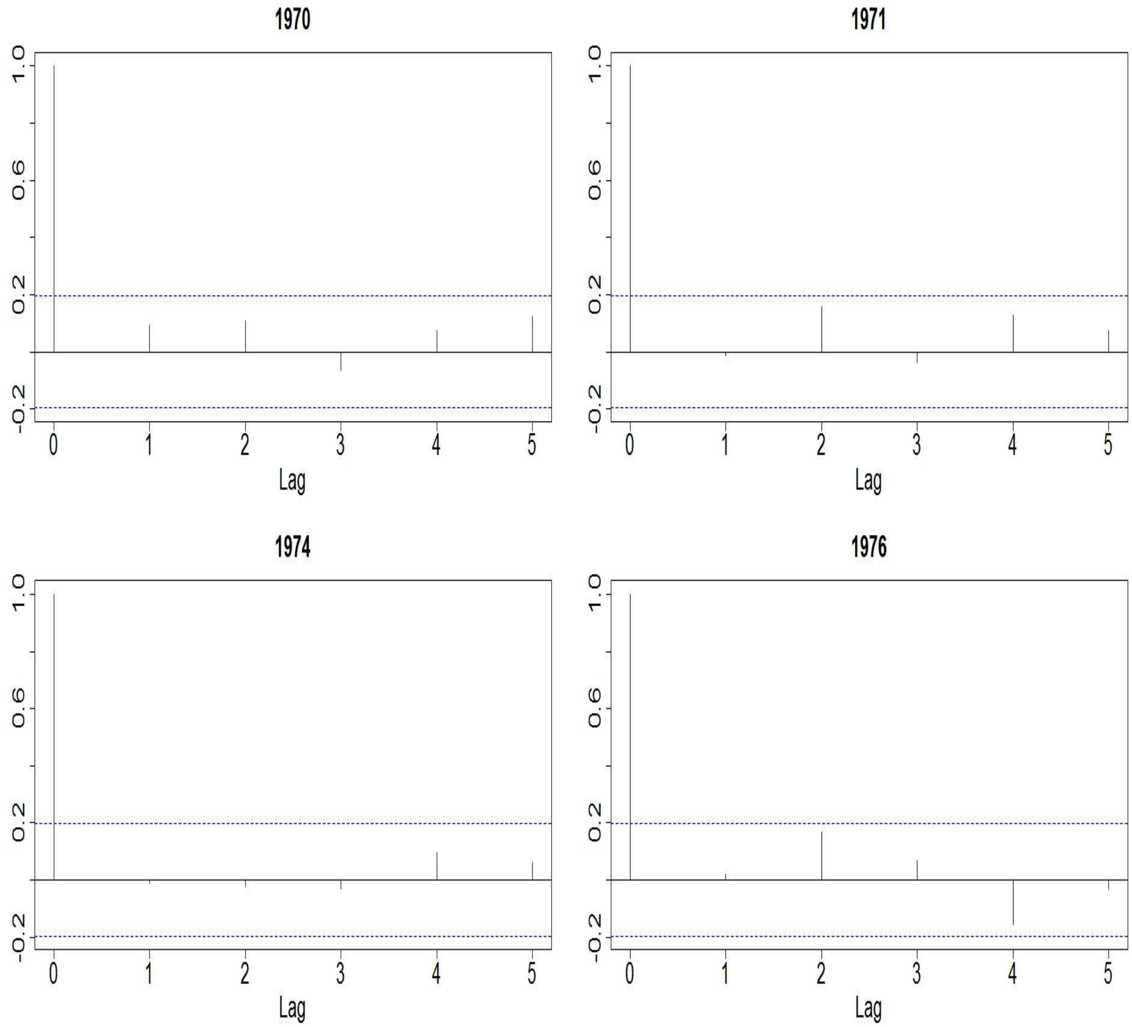


Figure 7.6: Model 1.2: ACF of Predicted Yearly Mean Zooplankton Yield Batch Means

Figures 7.7 and 7.8 show the predicted mean zooplankton yields for models with set 1 and set 2 covariates respectively. The plot of the predicted yearly means shows a decreasing trend in zooplankton yields. No single model produces systematically higher or lower yields as is the case with the predicted monthly zooplankton yields. Assuming our models to be correct, then the yearly mean estimates (see Appendix G) are accurate based on the $\text{MCSE}_{\text{Mean}}$. However, the standard deviations and MCSE_{SD} are much more variable; in particular, the standard deviations and MCSE_{SD} values for the years with completely missing data are quite large for all models.

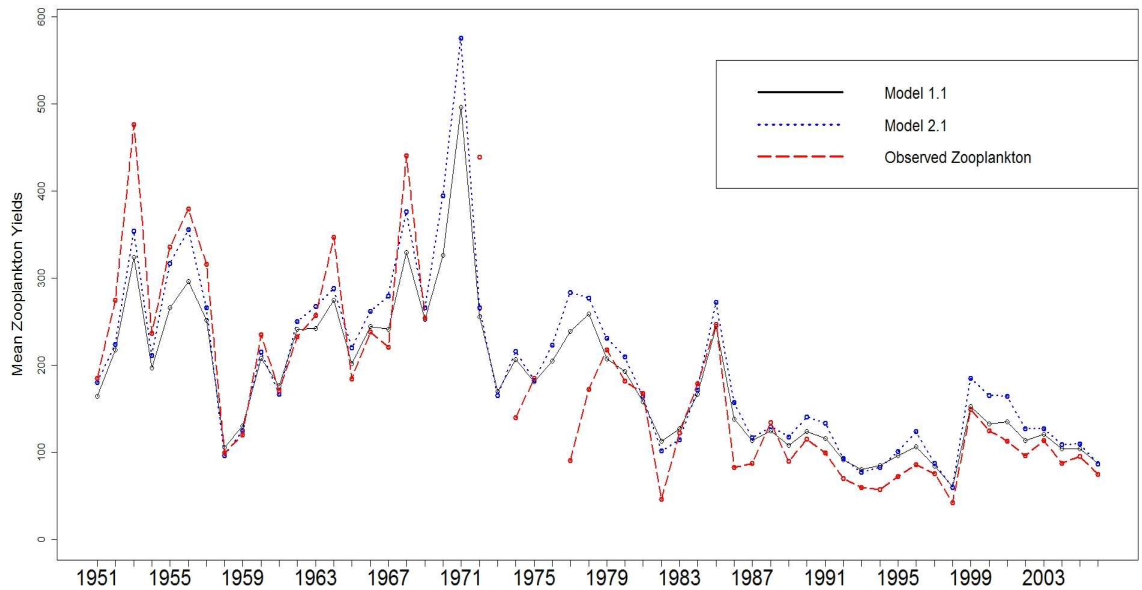


Figure 7.7: Predicted Yearly Mean Zooplankton Yields for HCAR and WCAR Models with set 1 covariates

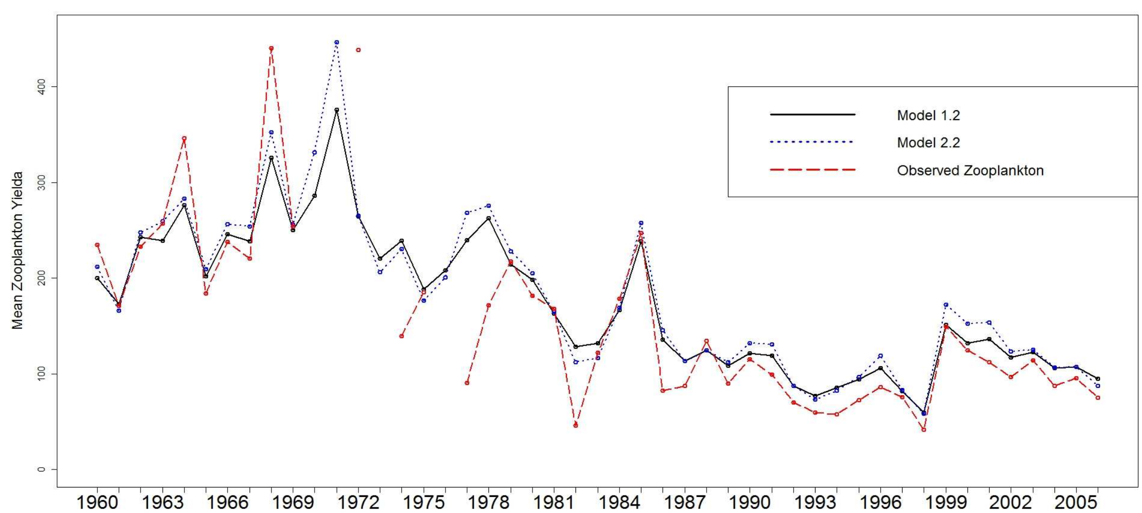


Figure 7.8: Predicted Yearly Mean Zooplankton Yields for HCAR and WCAR Models with set 2 covariates

7.6 Results for Predicted Sampling Site Mean Zooplankton Yields

We calculated mean zooplankton yields for each of the 84 sampling sites, which describe zooplankton spatial variations over all time periods. Figures 7.9 through 7.12 show the predicted mean zooplankton yields for our models. The maps of the predicted site means produced by both sets of covariates show an east to west decreasing trend in zooplankton yields for stations along all lines and a north to south decreasing trend for all stations. The sampling site estimated mean zooplankton yields (see Appendix H) are accurate based on the $\text{MCSE}_{\text{Mean}}$, assuming our models are correct. The standard deviations vary greatly but are accurate based on the MCSE_{SD} (see Appendix H).

A comparison of model estimates shows that the WCAR models (models 2.1 and 2.2) tend to produce higher mean zooplankton yields than the corresponding HCAR models (models 1.1 and 1.2) for sites on the boundary of the sampling grid (see circles in Figures 7.13 and 7.14). Conversely, the HCAR models produce higher mean zooplankton yields for sites in the interior of our sampling grid (see squares in Figures 7.13 and 7.14).

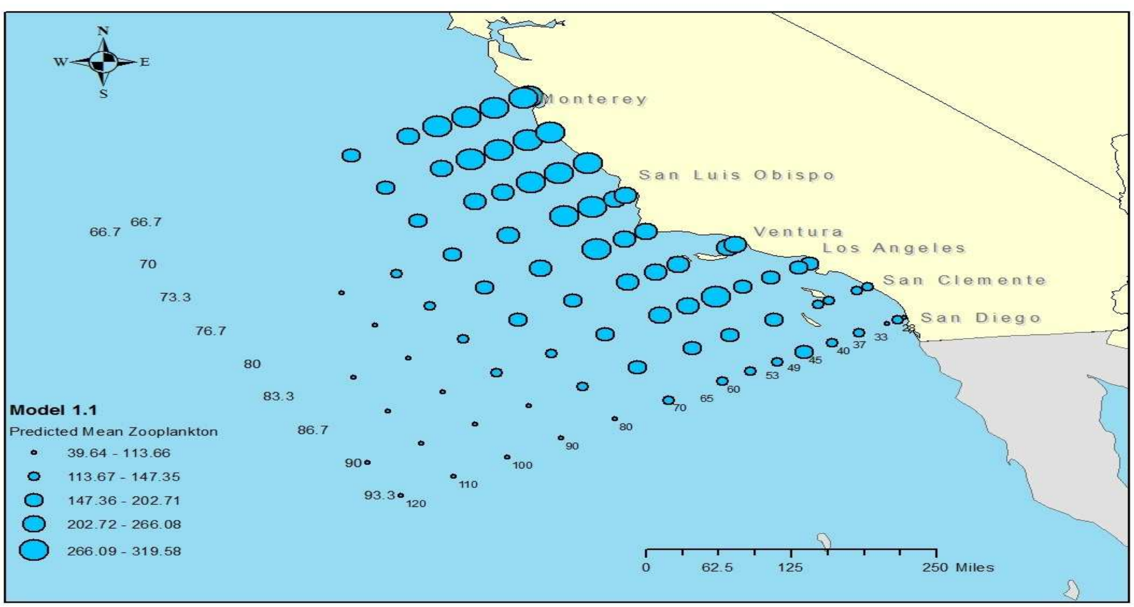


Figure 7.9: Model 1.1 Predicted Sampling Site Mean Zooplankton Yields.

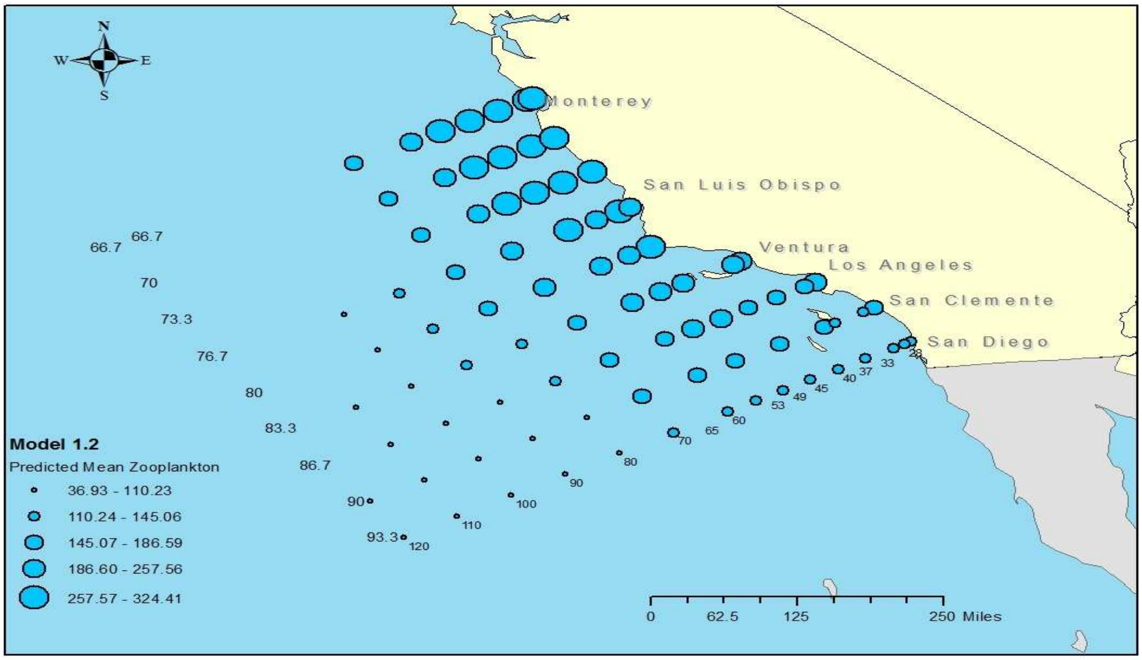


Figure 7.10: Model 1.2 Predicted Sampling Site Mean Zooplankton Yields.

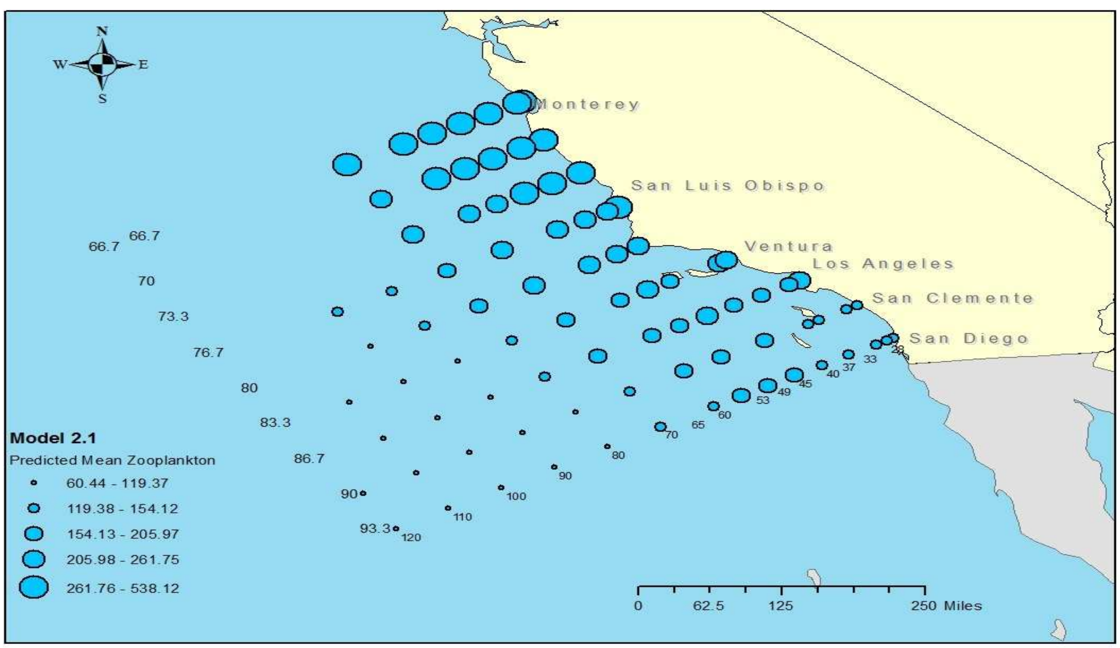


Figure 7.11: Model 2.1 Predicted Sampling Site Mean Zooplankton Yields.

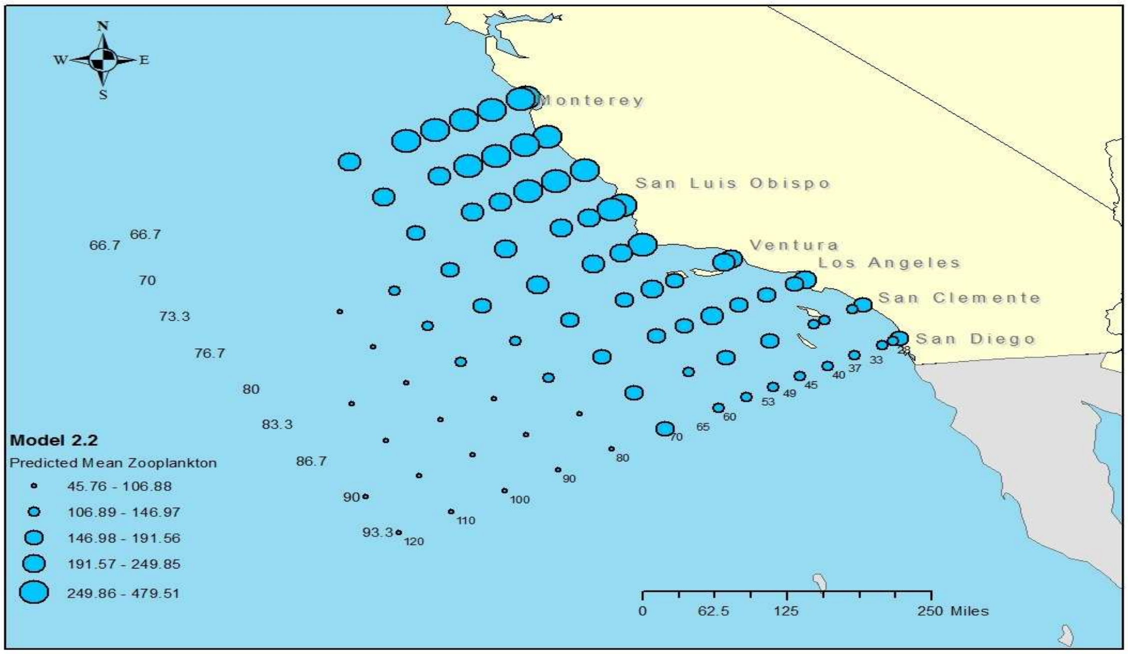


Figure 7.12: Model 2.2 Predicted Sampling Site Mean Zooplankton Yields.

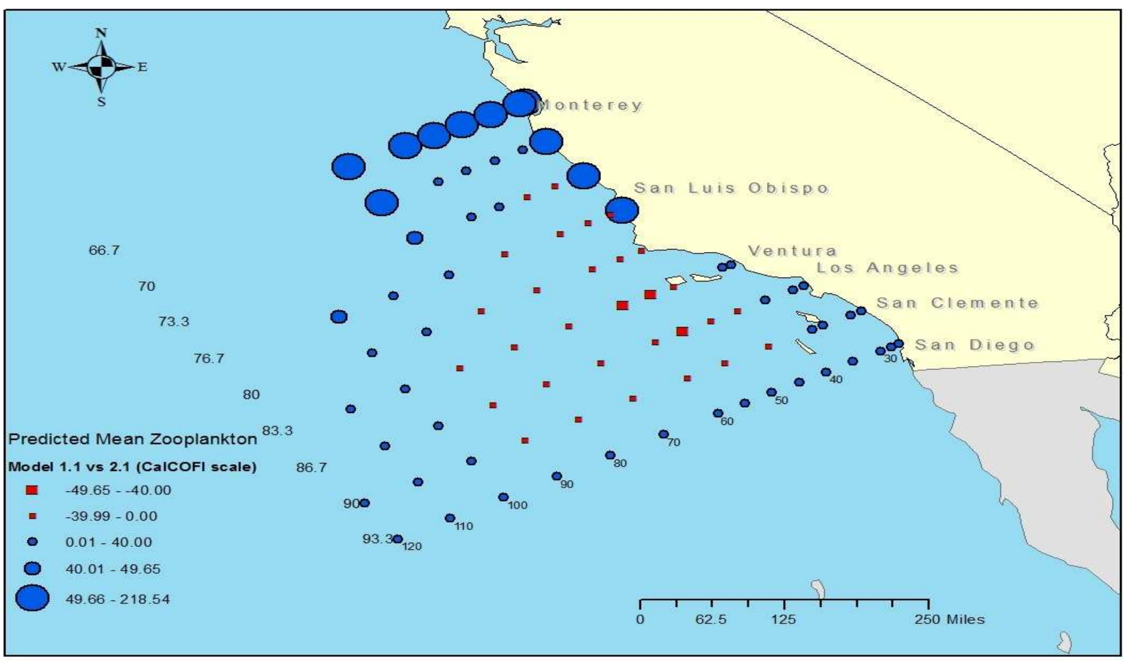


Figure 7.13: Difference of WCAR and HCAR Predicted Sampling Sites Mean Zooplankton Yields (Model 2.1 minus Model 1.1).

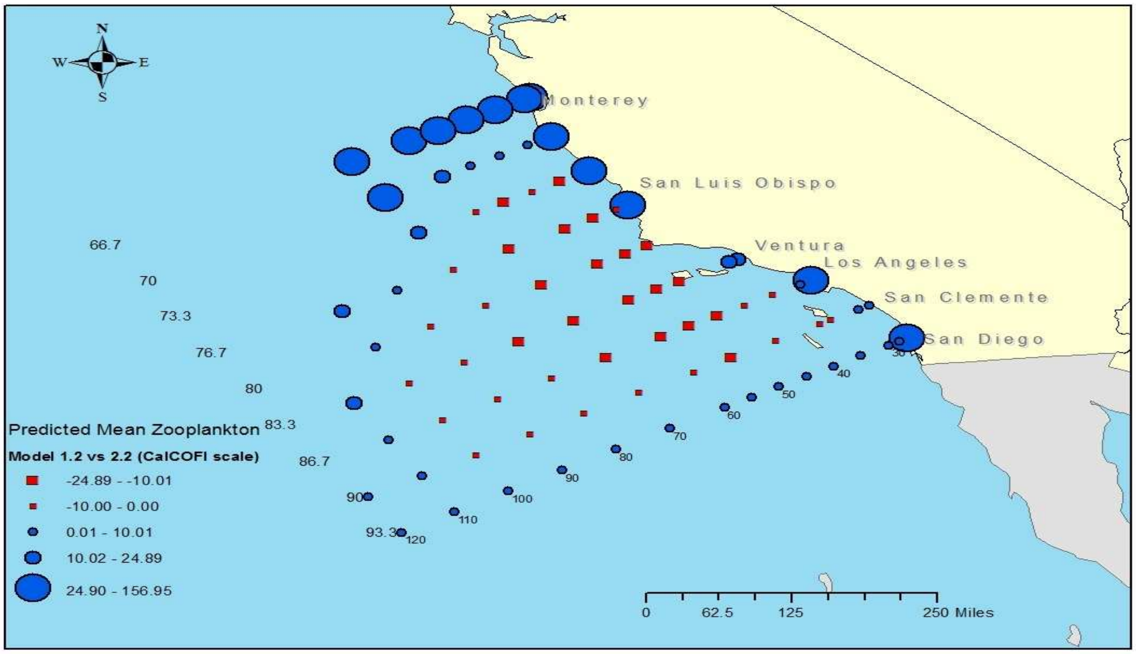


Figure 7.14: Difference of WCAR and HCAR Predicted Sampling Sites Mean Zooplankton Yields (Model 2.2 minus Model 1.2).

7.7 Results for Predicted Sampling Site Monthly Mean Zooplankton Yields

Our last quantities of interest are monthly mean zooplankton yields for each of the 84 sampling sites, which describe monthly zooplankton spatial variations. Figures 7.15 to 7.17 show the predicted monthly mean zooplankton yields at three sites in our grid for models with set 1 and set 2 covariates. Unlike the section 7.4 estimates, neither the HCAR or WCAR models produced produced uniformly higher mean monthly zooplankton yields. (See Appendix I for the plots of monthly mean zooplankton yields for each of the 84 sampling sites.)

The maps of the predicted monthly site means (see Appendix J) produced by both sets of covariates show spatial trends similar to the trends found in section 7.6. For each month, there is an east to west decreasing trend in zooplankton yields for stations along all lines and a north to south decreasing trend for all stations. The estimated mean zooplankton yields (see Appendix K) are accurate based on the $\mathrm{MCSE}_{\mathrm{Mean}}$, assuming our models are correct. The standard deviations vary greatly for both the HCAR and WCAR models but they are accurate based on the MCSE_{SD}. A comparison of model estimates show that the WCAR models produced higher monthly mean zooplankton yields than the corresponding HCAR models for sites on the boundary of the sampling grid and vice versa for sites on the interior of our sampling grid (see Appendix L).

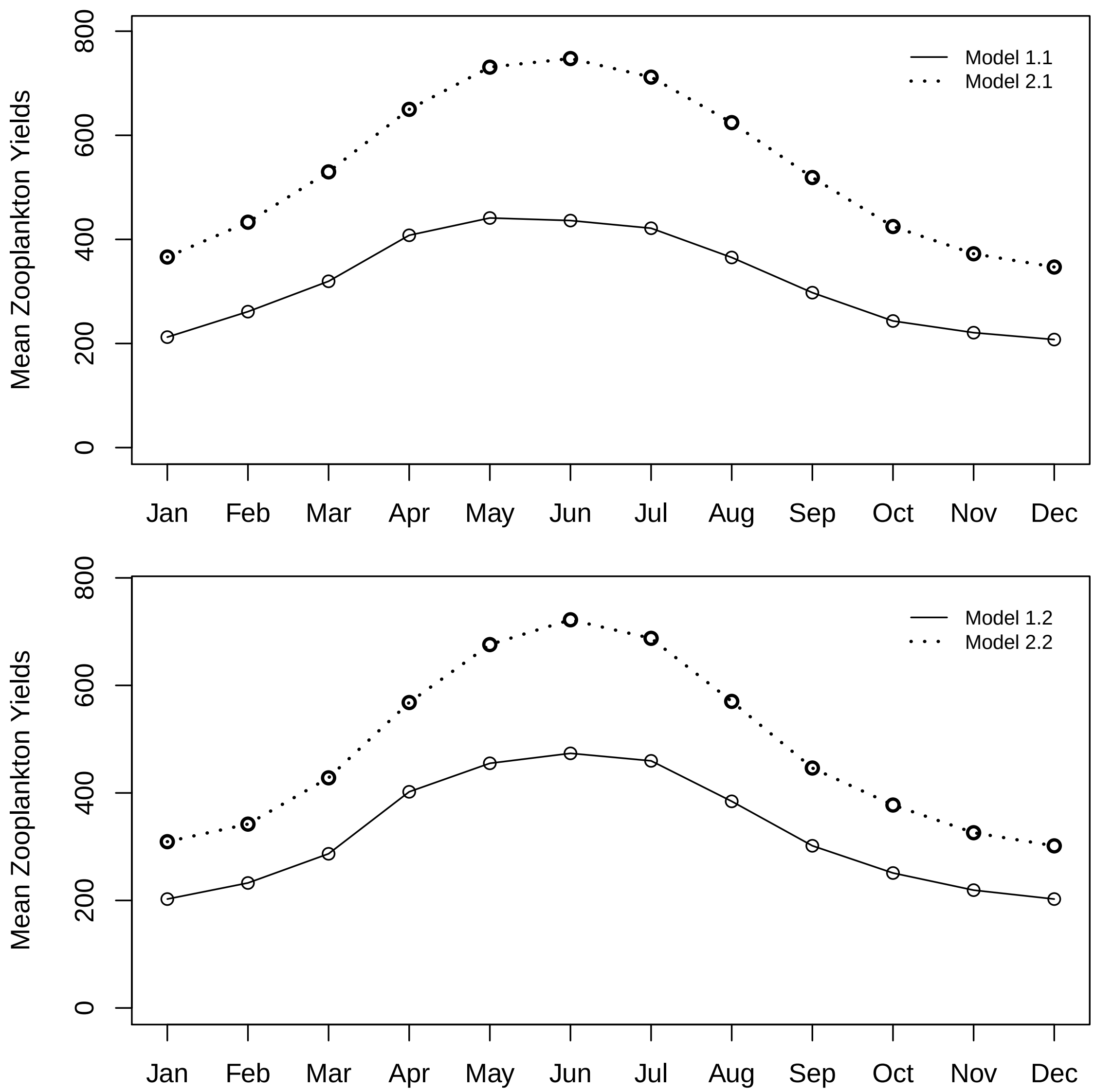


Figure 7.15: Predicted Monthly Mean Zooplankton Yields: Sampling Site 66.7-49.

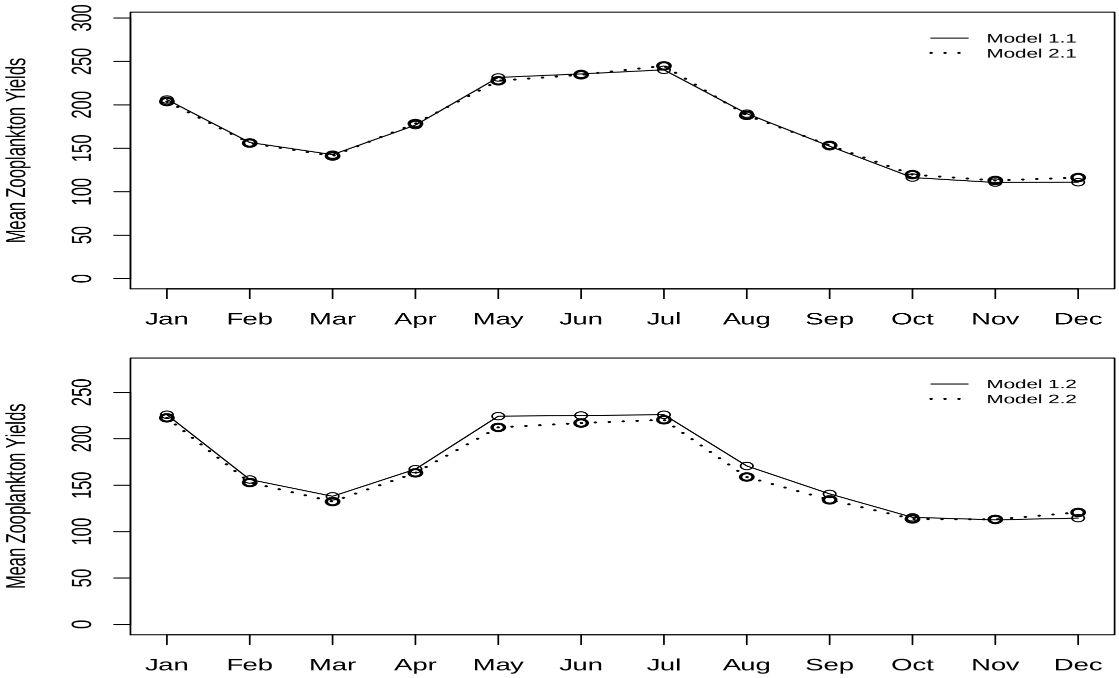


Figure 7.16: Predicted Monthly Mean Zooplankton Yields: Sampling Site 86.7-40.

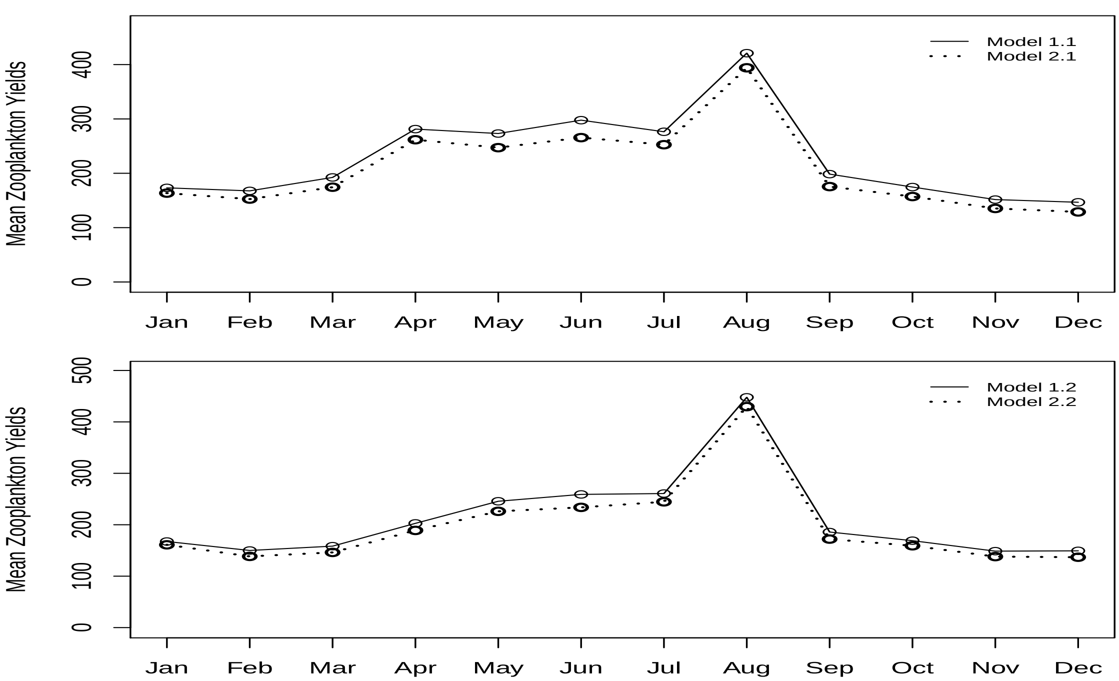


Figure 7.17: Predicted Monthly Mean Zooplankton Yields: Sampling Site 80-70.

7.8 Conclusion

We found the predictions for the HCAR and WCAR models to be generally similar. However, there are some systematic differences between the models. In comparing the predictions of the HCAR and WCAR models, we observe that the WCAR models produce higher predicted monthly mean zooplankton yields than the HCAR models for all months (Figures 7.4). In Figures 7.7 and 7.8 the predicted yearly mean zooplankton yields from WCAR are generally larger than those from HCAR. In Figures 7.13 and 7.14 (as well as Appendix L), for sampling sites on the boundary, WCAR gives larger predicted yields, whereas for sites in the interior, HCAR is larger. These observations are connected; the larger predictions by WCAR on the boundary sites are sufficient (since the magnitude of the dominance of WCAR over HCAR on the boundary exceeds that of HCAR over WCAR in the interior) to cause the larger predictions by WCAR for the monthly and yearly yields. Thus, much of the difference in the predictions from the HCAR and WCAR models is due to their different behavior on the boundary sites.

The predicted yields displayed in our figures and tables are given on the scale of the original zooplankton measurements (the CalCOFI scale), whereas the WCAR and HCAR models apply to the standardized log-zooplankton values (the Gibbs scale). To understand the different behavior of HCAR and WCAR on the boundary, we think first about the Gibbs scale, which is the scale on which the Gibbs sampling occurs.

The HCAR and WCAR models have different expressions for their conditional mean and conditional variance; compare (4.12) and (4.23). Consider first the conditional variance. The conditional variance for the HCAR model (4.14) is the same for all spatiotemporal sites, while for the WCAR model the conditional variance (4.25) for a site is inversely proportional to the number of neighbors of that site, so that boundary sites (having fewer neighbors) have larger conditional variances (see Table 7.3). The result of this (for the particular parameter estimates we obtain) is that the WCAR model gives larger conditional variances than the HCAR model to the boundary sites. This will tend to lead to the boundary sites also having larger marginal variances under the WCAR model than the HCAR model. After transforming back to the CalCOFI scale, this larger variance on the Gibbs scale translates into both a larger mean and a larger variance for the spatiotemporal boundary sites on the CalCOFI scale. To see this, note that if $Y \sim N(\mu, \sigma^2)$, then e^Y has a log-normal distribution for which the mean and variance are well known to be $Ee^Y = e^{\mu+(\sigma^2/2)}$ and $\text{Var}(e^Y) = e^{2\mu}(e^{2\sigma^2} - e^{\sigma^2})$, which are both increasing functions of σ^2 for fixed μ.

Finally, the larger means for the spatiotemporal boundary sites on the CalCOFI scale will produce larger means for quantities (such as the spatial sampling site means displayed in Figures 7.9 through 7.12) obtained by aggregating over spatiotemporal boundary sites. This, we believe, is the primary explanation for the larger mean yields for WCAR on the boundary sampling sites shown in Figures 7.13 and 7.14 and Appendix L and for the larger monthly and yearly yields for WCAR in Figures 7.4, 7.7, and 7.8.

The situation with regard to the conditional means is more complicated than that for the conditional variances. Suppose there is a region in the spatiotemporal lattice where one of our models exhibits a systematic lack of fit, that is, a region where the observed values of Y_{s_j} (the Gibbs scale values) differ systematically from the fitted mean values μ_{s_j} obtained from $\mu = X\hat{\beta}$. For example, suppose that in some region the difference $Y_{s_j} - \mu_{s_j}$ has a mean of $\delta \neq 0$ when we average over the sites s_j with observed data. Then, when the conditional Gibbs sampler is used to impute values Y_{s_i} for the sites s_i in this region with missing data, the average difference $E(Y_{s_i} - \mu_{s_i})$ will be more attenuated (i.e., more shrunk towards zero) for HCAR than for WCAR models.

To see this, consider a hypothetical site s_i for which Y_{s_i} is missing but all of whose neighboring sites have observed values Y_{s_j}, and suppose that for all of these neighboring sites $Y_{s_j} - \mu_{s_j} = \delta$ holds exactly. Then, according to the general expression for the conditional mean of a CAR model given in equation (4.2), the conditional mean of $Y_{s_i} - \mu_{s_i}$ is equal to $\left(\sum_{s_j \in N_i} c_{ij}\right)\delta$. For a neighboring site s_j of type l, the value of c_{ij} is always ρ_l for an HCAR model, regardless of whether site i is a boundary or interior site. Thus, for HCAR models, since boundary sites have fewer neighbors, $\left(\sum_{s_j \in N_i} c_{ij}\right)$ will tend to be smaller for boundary sites than interior sites, leading to greater attenuation of the difference δ at boundary sites. For WCAR models, in contrast, the value of c_{ij} for a neighbor of type l is ρ_l / w_{i+} (since $w_{ij} = 1$), and the denominator w_{i+} compensates for the differing number of neighbors at boundary versus interior sites, so that there is no tendency for $\left(\sum_{s_j \in N_i} c_{ij}\right)$ to be smaller at boundary sites, and hence no attenuation of the difference δ at the boundary. (In comparing the values c_{ij} for HCAR and WCAR models, it should be kept in mind that the estimated values of ρ_l are very different for HCAR and WCAR.)

In a similar fashion one can argue that, for WCAR models, the effect of isolated outlying (i.e., extreme) observed values of $Y_{s_j} - \mu_{s_j}$ on the conditional means of their neighbors with missing values will tend to be larger for neighbors which are boundary sites than for those which are interior sites (because c_{ij} is larger for boundary sites s_i), but that there will be no such tendency for HCAR models. Thus outliers among the observed values which occur close to the boundary will have a greater effect on predictions for WCAR models than for HCAR models.

In summary, the conditional means (on the Gibbs scale) for HCAR and WCAR models behave rather differently from each other at the boundary. It is not clear what effect this has on the aggregated values on the CalCOFI scale which are displayed in Figure 7.4 and Figures 7.7 through 7.14 but it may be contributing to some of the differences we see.

APPENDIX A

PERCENT OF MISSING DATA

Table A.1: Percent of Missing Data by Site, 1951-2006.

site	L66.7	L70	L73.3	L76.7	L80	L83.3	L86.7	L90	L93.3	Station Avg.
S120								81.8	85.7	83.8
S110						88.8	88.8	83.6	85.7	86.8
S100				87.5	80.4	86.2	86.6	75.3	79.5	82.6
S90				79.5	65	72.3	72.6	65.5	69.5	70.7
S80	91.4	82.4	89.9	77.8	63.1	71	71.4	63.7	67.4	75.3
S70	90.2	81.2	87.9	75.9	62.5	68.9	69.9	61.2	65.8	73.7
S65	91.7	93.3	94.6							93.2
S60	86.6	81.5	82.4	74.9	61.9	63.1	64.6	59.7	64.3	71
S55	82.6	91.2	94.5	68.9	62.5	65.3	66.5		68.9	75.1
S53								70.8		70.8
S51		89		77.8	67.6	63.8				74.6
S50	84.1		87.2				64.6		61	74.2
S49	96.9			87.8						92.3
S46.9										
S45							65.8	59.8	67.4	64.3
S42						81				81
S40.6						81.5				81.5
S40							65.5		60.9	63.2
S37								59.5		59.5
S35							65.3	84.7	67.1	72.4
S33							78			78
S30								68.5	60.9	64.7
S28								61.3	74.3	67.8
S26.7									83.5	83.5
Line Avg.	89.1	86.5	89.4	78.8	66.1	74.2	71.6	68.9	70.8	75.4

Table A.2: Percent of Missing Data by Year and Month, 1951-2006.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yearly Avg.
1951	52.4	66.7	71.4	48.8	57.1	57.1	67.9	64.3	77.4	83.3	71.4	85.7	67
1952	75	75	77.4	46.4	41.7	36.9	52.4	67.9	67.9	71.4	70.2	100	65.2
1953	70.2	69	70.2	38.1	46.4	35.7	52.4	58.3	90.5	86.9	90.5	81	65.8
1954	61.9	69	70.2	44	41.7	47.6	59.5	96.4	58.3	69	100	71.4	65.8
1955	76.2	77.4	72.6	61.9	50	39.3	40.5	100	100	59.5	95.2	78.6	70.9

Table A.2 - continued

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yearly Avg.
1956	75	72.6	63.1	46.4	34.5	70.2	33.3	100	85.7	79.8	79.8	65.5	67.2
1957	100	69	69	59.5	33.3	31	39.3	100	100	64.3	61.9	81	67.4
1958	69	64.3	52.4	29.8	32.1	32.1	29.8	100	83.3	29.8	70.2	67.9	55.1
1959	48.8	48.8	72.6	33.3	28.6	50	29.8	52.4	71.4	34.5	61.9	58.3	49.2
1960	34.5	40.5	50	47.6	61.9	51.2	47.6	70.2	84.5	57.1	100	100	62.1
1961	69	65.5	100	36.9	100	92.9	45.2	100	100	36.9	100	100	78.9
1962	69	67.9	83.3	56	100	100	67.9	83.3	100	50	92.9	100	80.9
1963	70.2	59.5	100	42.9	89.3	100	52.4	100	100	51.2	100	100	80.5
1964	69	56	100	22.6	100	70.2	58.3	100	100	48.8	100	100	77.1
1965	32.1	100	98.8	23.8	100	67.9	64.3	97.6	57.1	100	100	100	78.5
1966	75	44	75	52.4	51.2	25	29.8	52.4	53.6	27.4	100	29.8	51.3
1967	100	100	100	100	100	58.3	86.9	100	100	100	100	100	95.4
1968	28.6	100	100	100	100	36.9	100	100	100	100	100	100	88.8
1969	20.2	25	97.6	46.4	26.2	100	20.2	63.1	64.3	20.2	56	69	50.7
1970	100	100	100	100	100	100	100	100	100	100	100	100	100
1971	100	100	100	100	100	100	100	100	100	100	100	100	100
1972	35.7	23.8	25	75	100	100	29.8	100	88.1	98.8	88.1	100	72
1973	100	100	100	100	100	100	100	100	100	100	100	100	100
1974	100	100	100	100	100	100	100	100	100	100	60.7	59.5	93.4
1975	46.4	77.4	27.4	100	27.4	76.2	50	100	100	65.5	56	73.8	66.7
1976	100	100	100	100	100	100	100	100	100	100	100	100	100
1977	100	100	100	100	100	100	100	100	100	100	100	60.7	96.7
1978	17.9	65.5	40.5	40.5	26.2	71.4	40.5	16.7	100	100	100	100	59.9
1979	48.8	28.6	96.4	35.7	32.1	100	100	100	100	100	100	100	78.5
1980	100	65.5	61.9	100	45.2	100	100	100	100	100	65.5	53.6	82.6
1981	27.4	86.9	85.7	16.7	25	90.5	29.8	100	100	100	100	100	71.8
1982	100	100	44	72.6	100	100	100	100	100	100	100	100	93.1
1983	100	100	26.2	89.3	100	100	100	100	100	100	100	100	93
1984	17.9	31	81	23.8	53.6	64.3	16.7	100	100	22.6	100	100	59.2
1985	100	51.2	90.5	100	40.5	100	100	35.7	100	100	38.1	100	79.7
1986	98.8	40.5	100	100	35.7	100	100	100	41.7	92.9	34.5	100	78.7
1987	100	100	28.6	96.4	27.4	100	100	100	26.2	100	28.6	100	75.6
1988	31	95.2	100	88.1	52.4	100	100	23.8	100	23.8	100	100	76.2
1989	39.3	88.1	100	26.2	100	100	31	94	100	100	22.6	100	75.1
1990	100	100	32.1	42.9	100	100	63.1	60.7	100	100	22.6	100	76.8
1991	28.6	85.7	51.2	100	100	100	58.3	65.5	84.5	42.9	100	100	76.4
1992	81	48.8	100	23.8	100	100	22.6	100	73.8	51.2	100	100	75.1
1993	22.6	100	89.3	33.3	100	100	100	23.8	100	22.6	100	100	74.3
1994	48.8	75	54.8	67.9	100	100	100	22.6	95.2	29.8	100	100	74.5
1995	25	100	100	35.7	100	100	22.6	100	100	22.6	100	100	75.5
1996	88.1	35.7	100	32.1	97.6	100	100	22.6	100	28.6	95.2	100	75
1997	84.5	38.1	100	27.4	100	100	22.6	100	46.4	65.5	100	90.5	72.9
1998	54.8	71.4	86.9	2.4	88.1	76.2	17.9	78.6	22.6	81	82.1	82.1	62
1999	23.8	100	100	28.6	100	100	100	26.2	100	23.8	100	100	75.2
2000	22.6	100	100	22.6	100	89.3	33.3	100	100	25	100	100	74.4
2001	26.2	100	100	23.8	100	100	22.6	100	100	61.9	61.9	100	74.7
2002	61.9	61.9	79.8	44	100	100	22.6	100	100	100	22.6	100	74.4
2003	89.3	16.7	100	8.3	100	100	27.4	100	100	38.1	85.7	100	72.1
2004	7.1	100	58.3	52.4	100	100	22.6	100	100	100	23.8	100	72
2005	11.9	100	100	9.5	100	100	22.6	100	100	100	28.6	100	72.7
2006	100	7.1	100	20.2	100	100	22.6	100	100	42.9	79.8	100	72.7
Monthly Avg.	63.1	72.6	80.1	54.9	75.8	83.4	59.9	83.5	88.8	69.8	81.2	91.2	75.4

APPENDIX B

OBSERVED MEAN ZOOPLANKTON BIOMASS

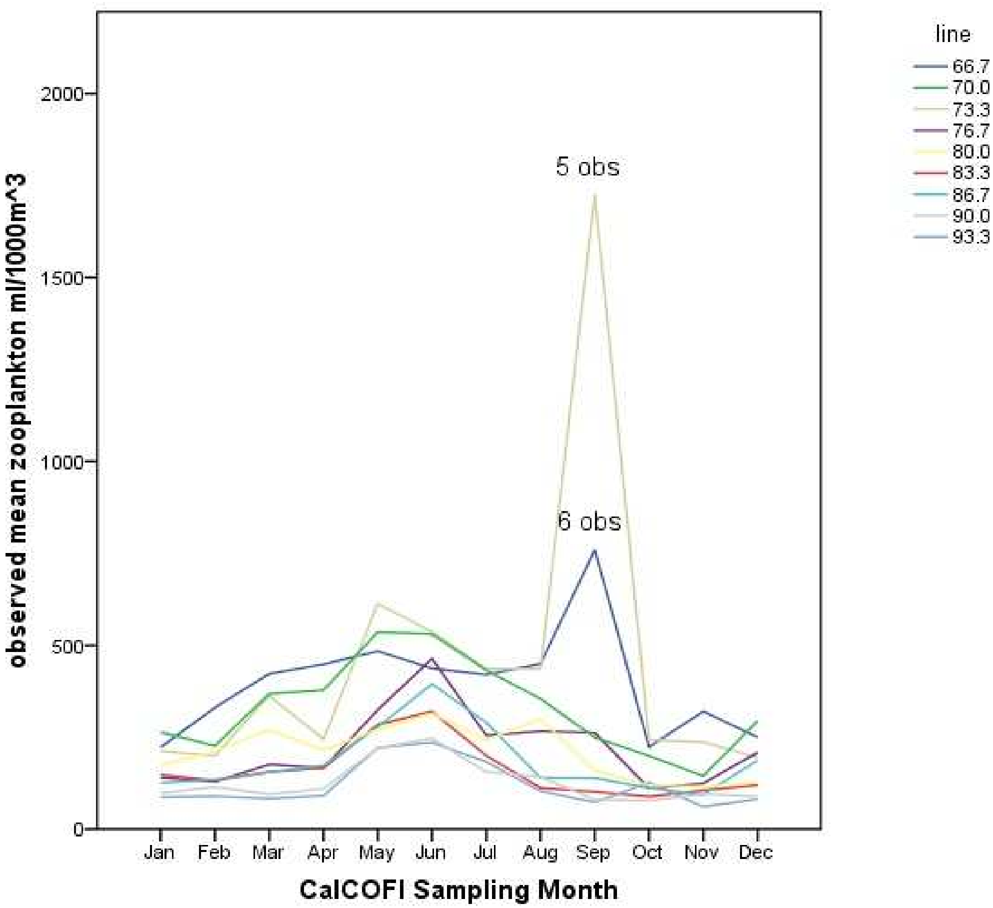


Figure B.1: Observed Mean Zooplankton Biomass by line and month.

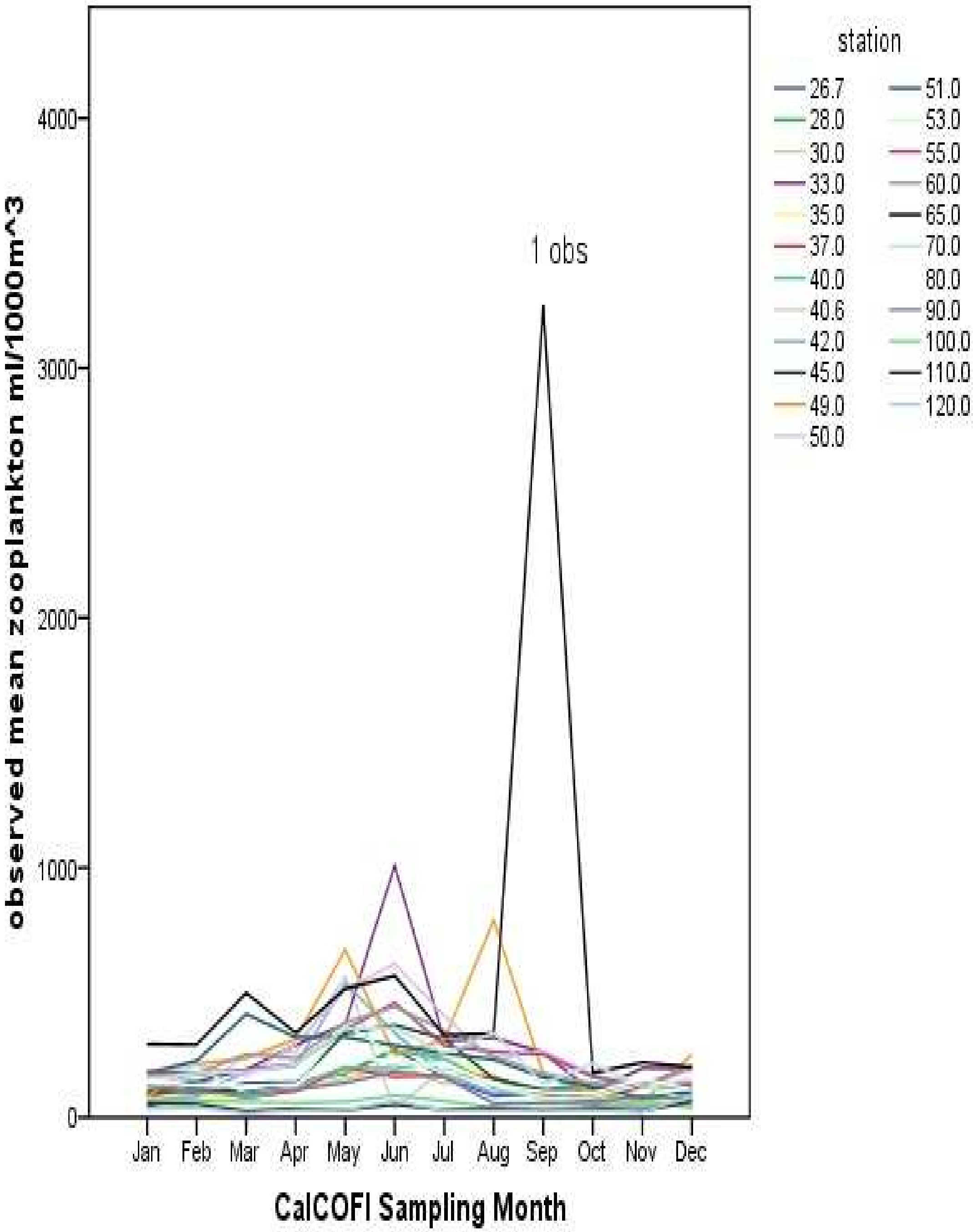


Figure B.2: Observed mean zooplankton biomass by station and month.

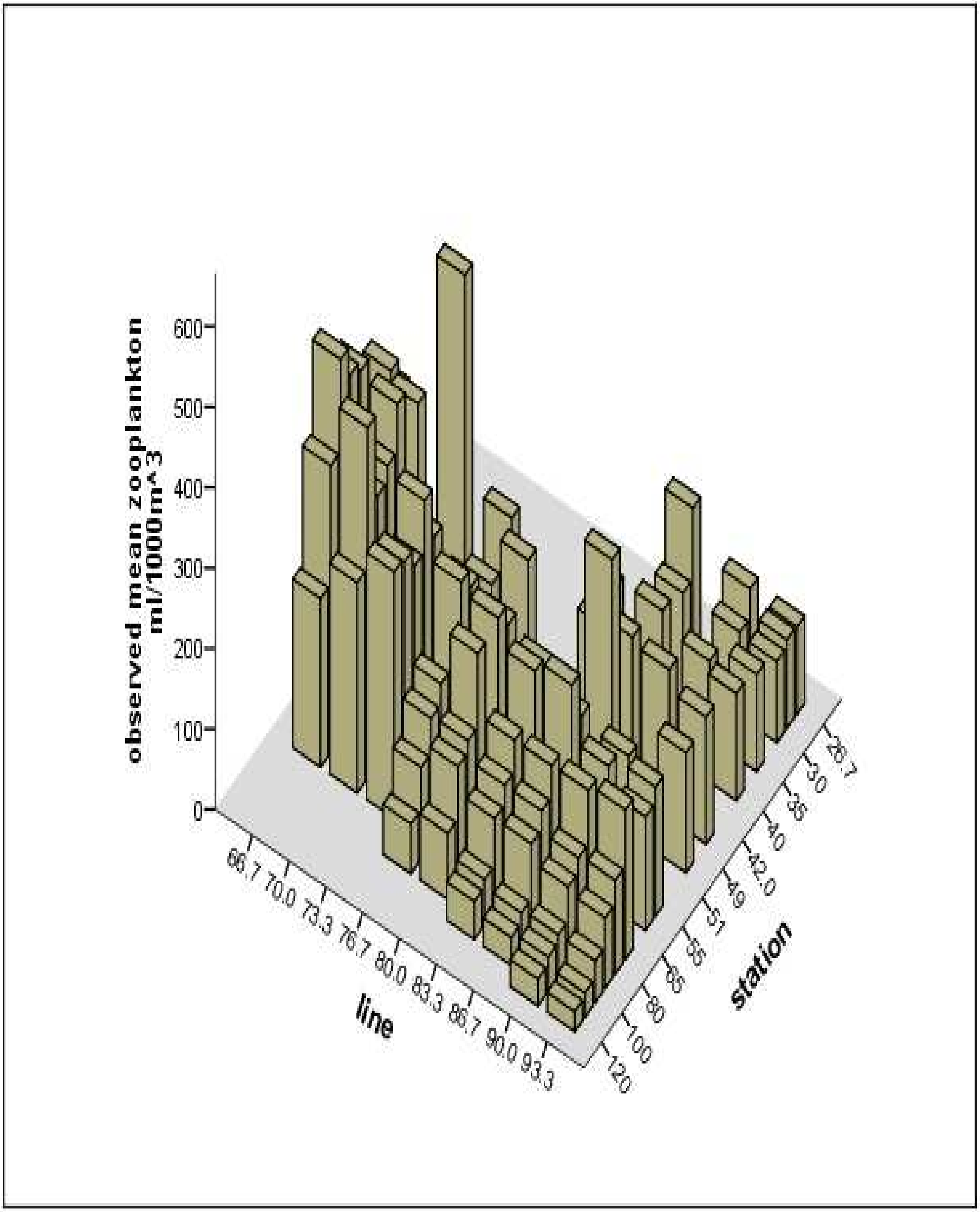


Figure B.3: Observed mean zooplankton biomass by CalCOFI site.

APPENDIX C

MCL PARAMETER ESTIMATES

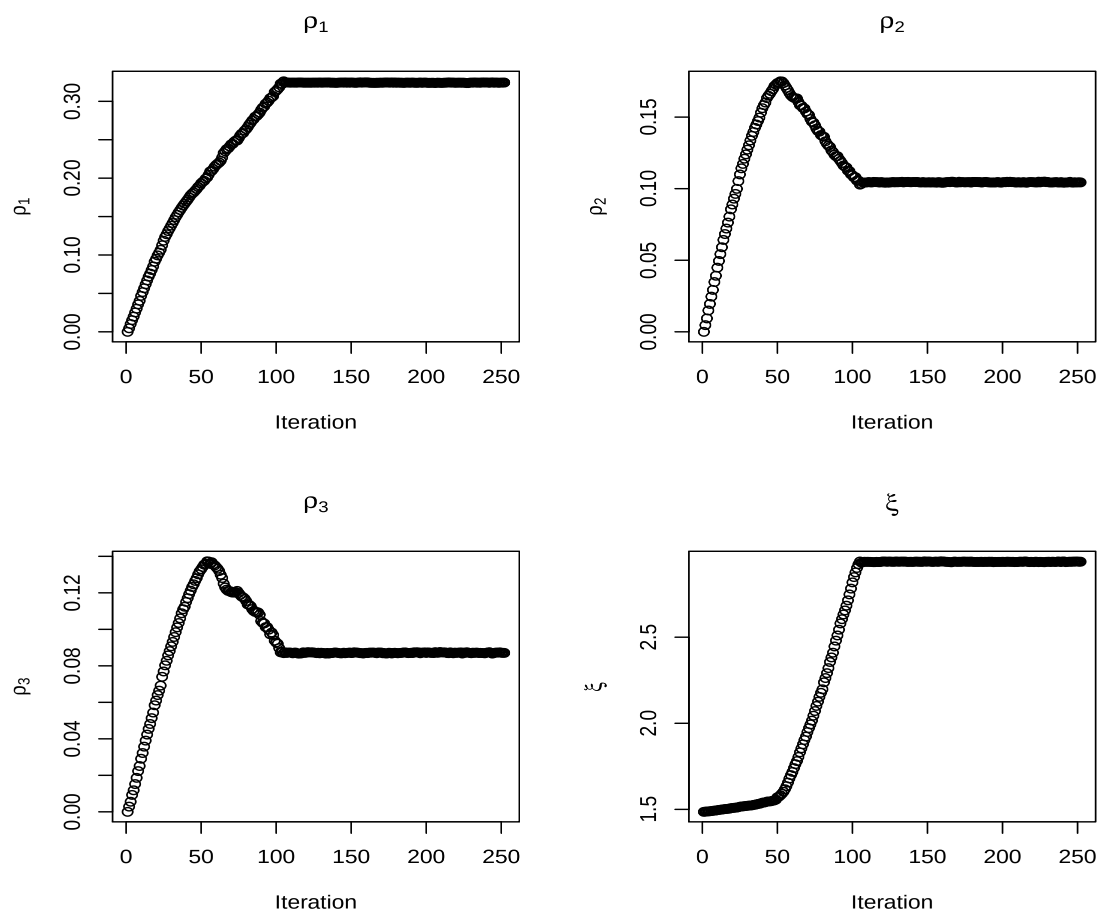


Figure C.1a: MCL Model 1.1 Parameter Estimates $(\rho_1, \rho_2, \rho_3, \xi)$ obtained at each stage of the recursive process. A total of 252 stages were conducted and convergence occurred at about stage 110.

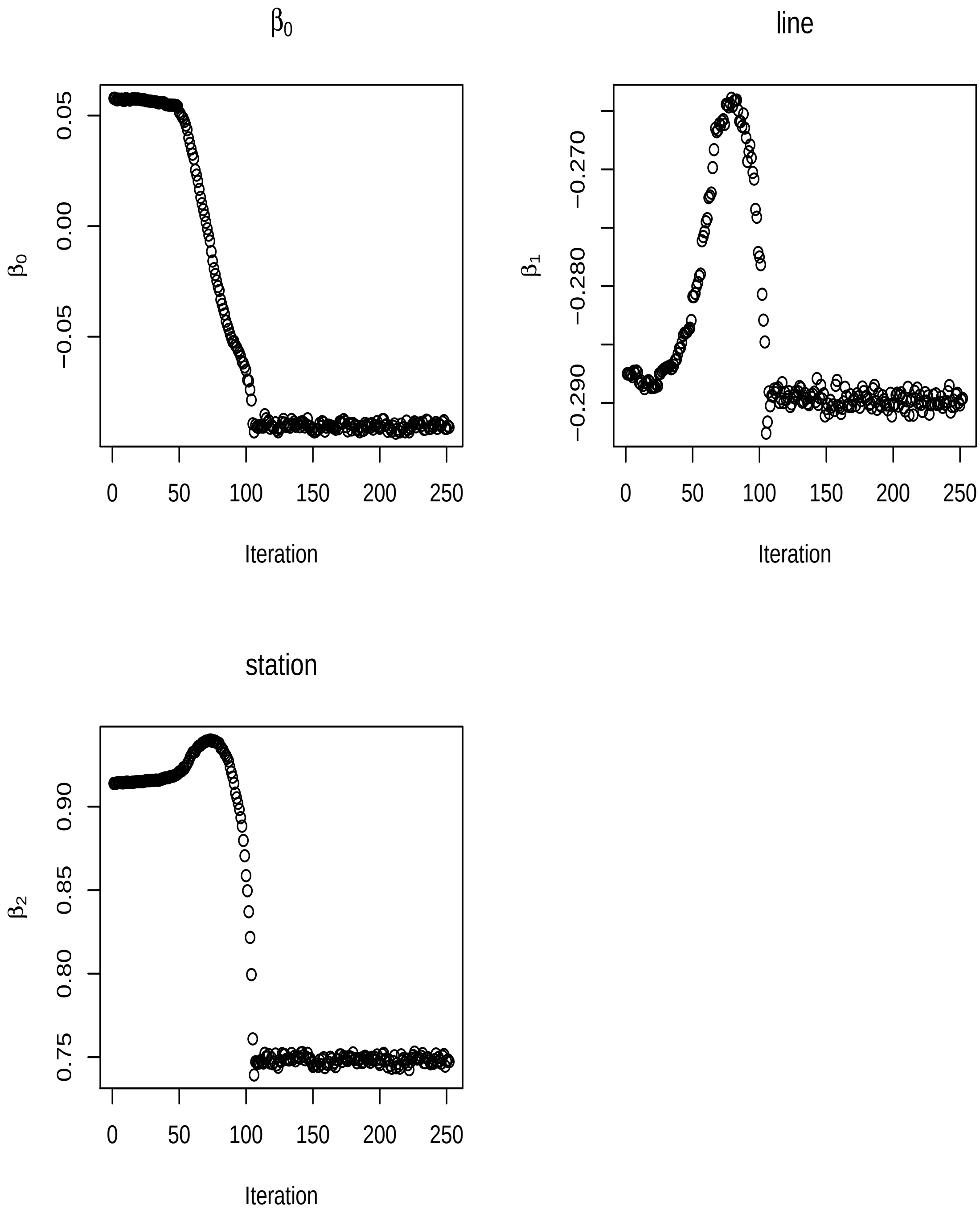


Figure C.1b: MCL Model 1.1 Parameter Estimates ($\beta_0, \beta_1, \beta_2$) obtained at each stage of the recursive process. A total of 252 stages were conducted and convergence occurred at about stage 110.

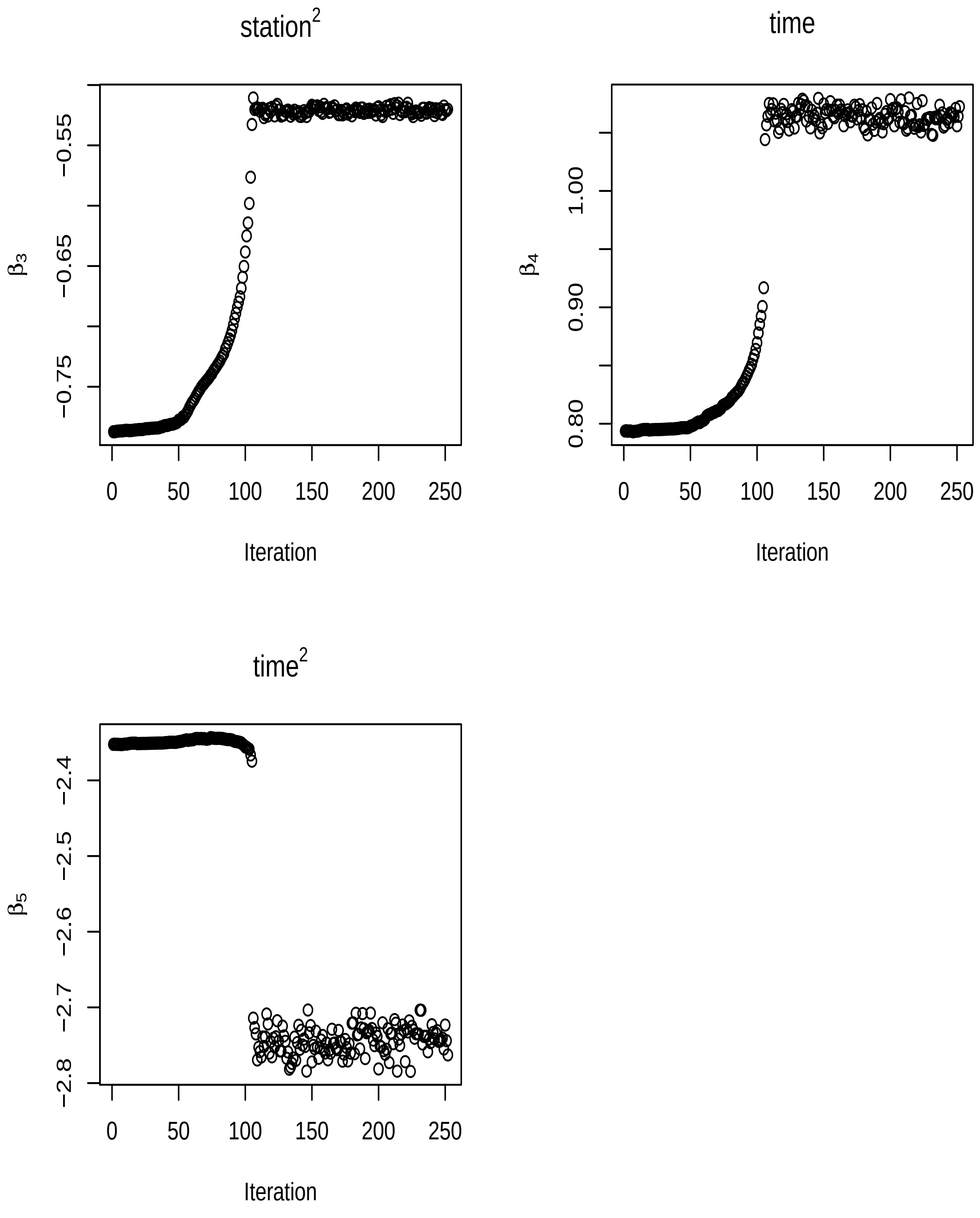


Figure C.1c: MCL Model 1.1 Parameter Estimates ($\beta_3, \beta_4, \beta_5$) obtained at each stage of the recursive process. A total of 252 stages were conducted and convergence occurred at about stage 110.

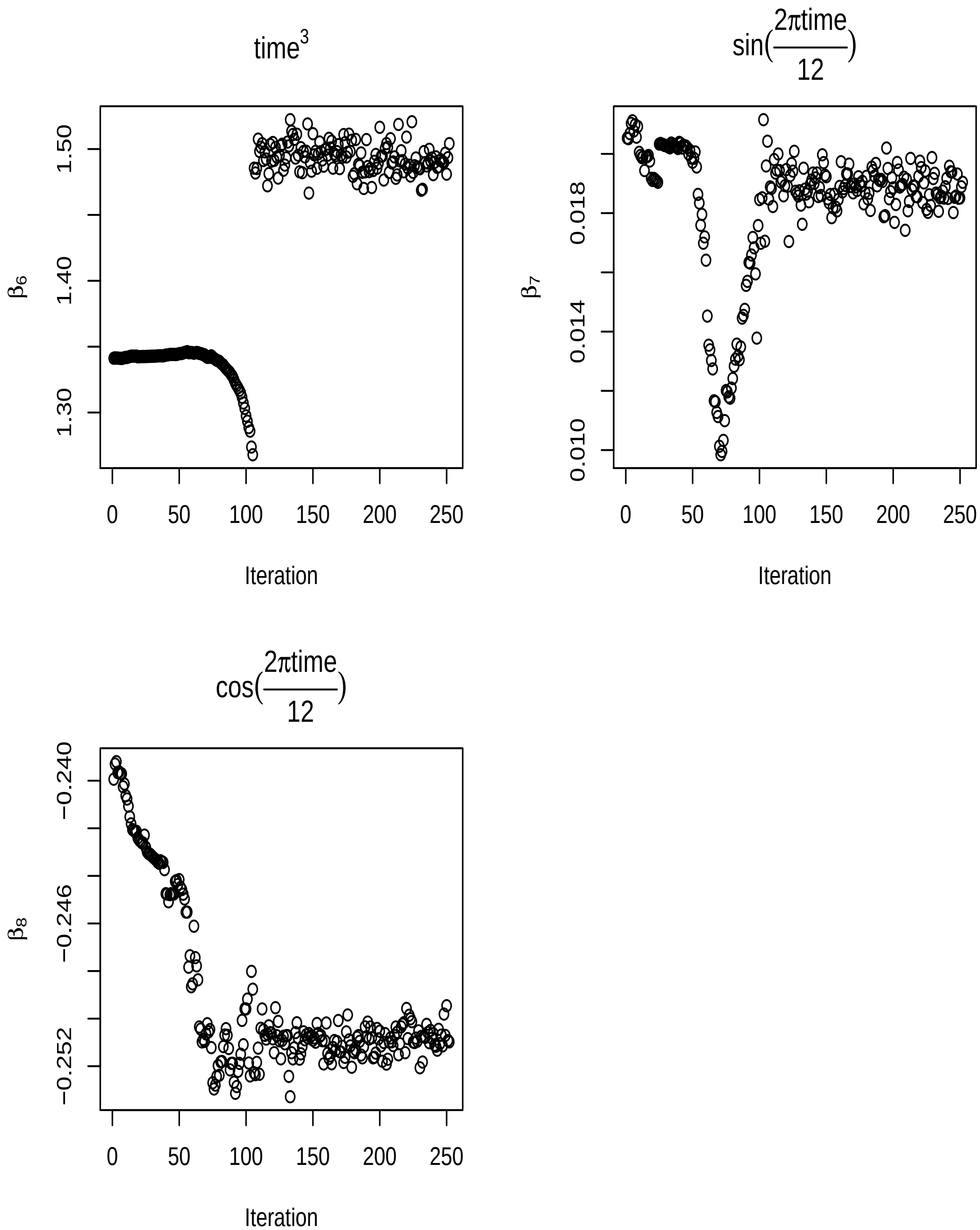


Figure C.1d: MCL Model 1.1 Parameter Estimates ($\beta_6, \beta_7, \beta_8$) obtained at each stage of the recursive process. A total of 252 stages were conducted and convergence occurred at about stage 110.

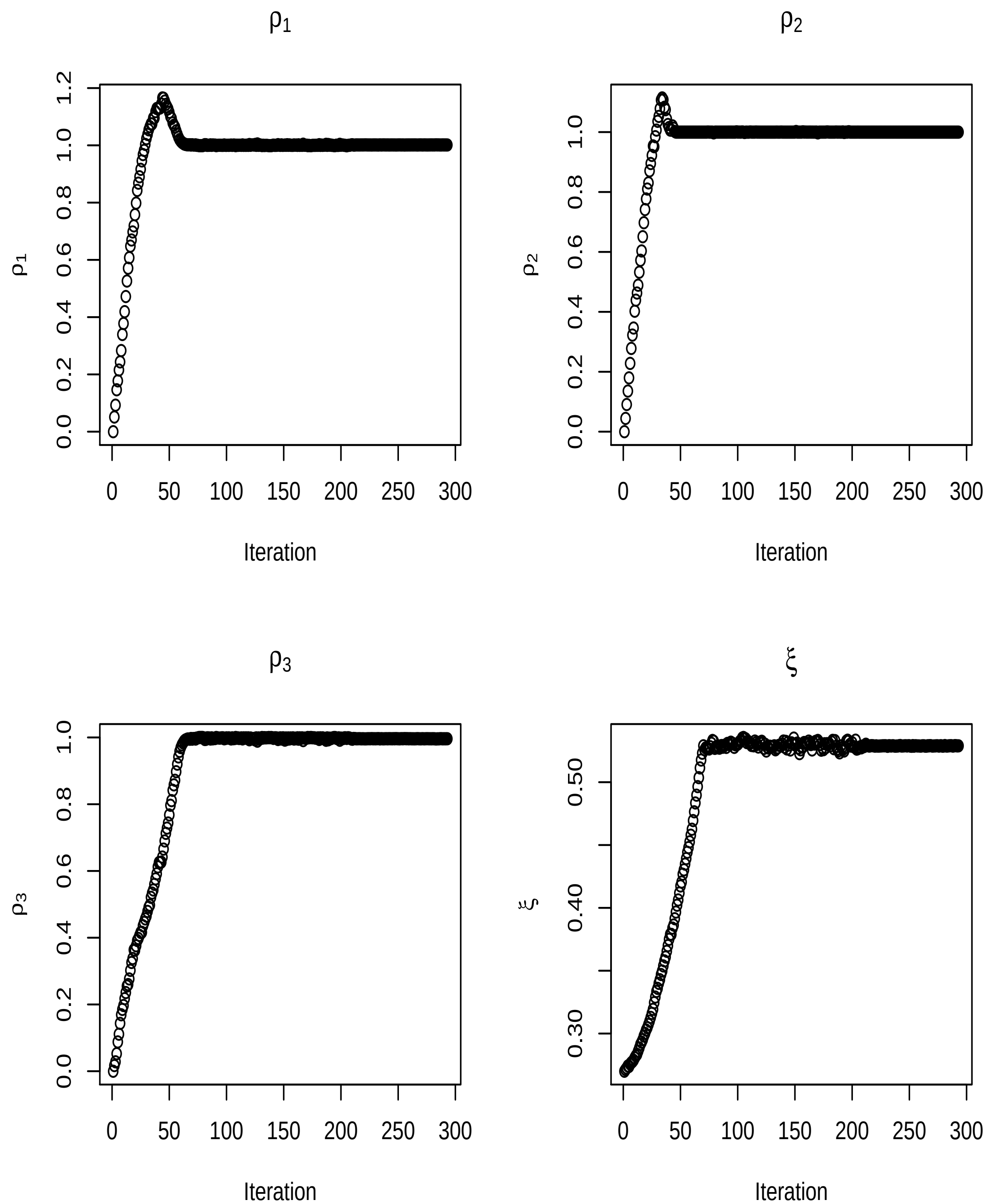


Figure C.2a: MCL Model 2.1 Parameter Estimates $(\rho_1, \rho_2, \rho_3, \xi)$ obtained at each stage of the recursive process. A total of 293 stages were conducted and convergence occurred at about stage 220.

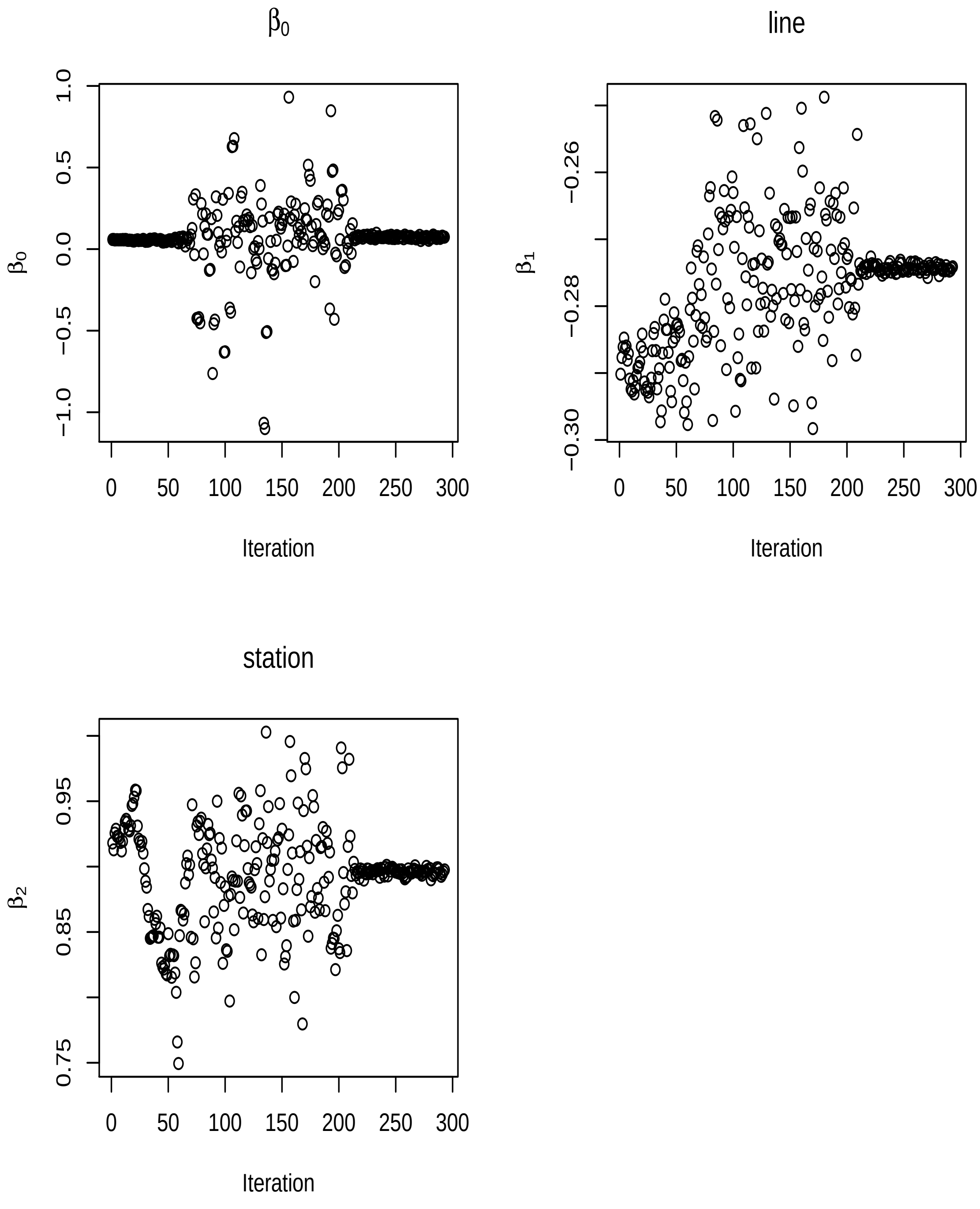


Figure C.2b: MCL Model 2.1 Parameter Estimates ($\beta_0, \beta_1, \beta_2$) obtained at each stage of the recursive process. A total of 293 stages were conducted and convergence occurred at about stage 220.

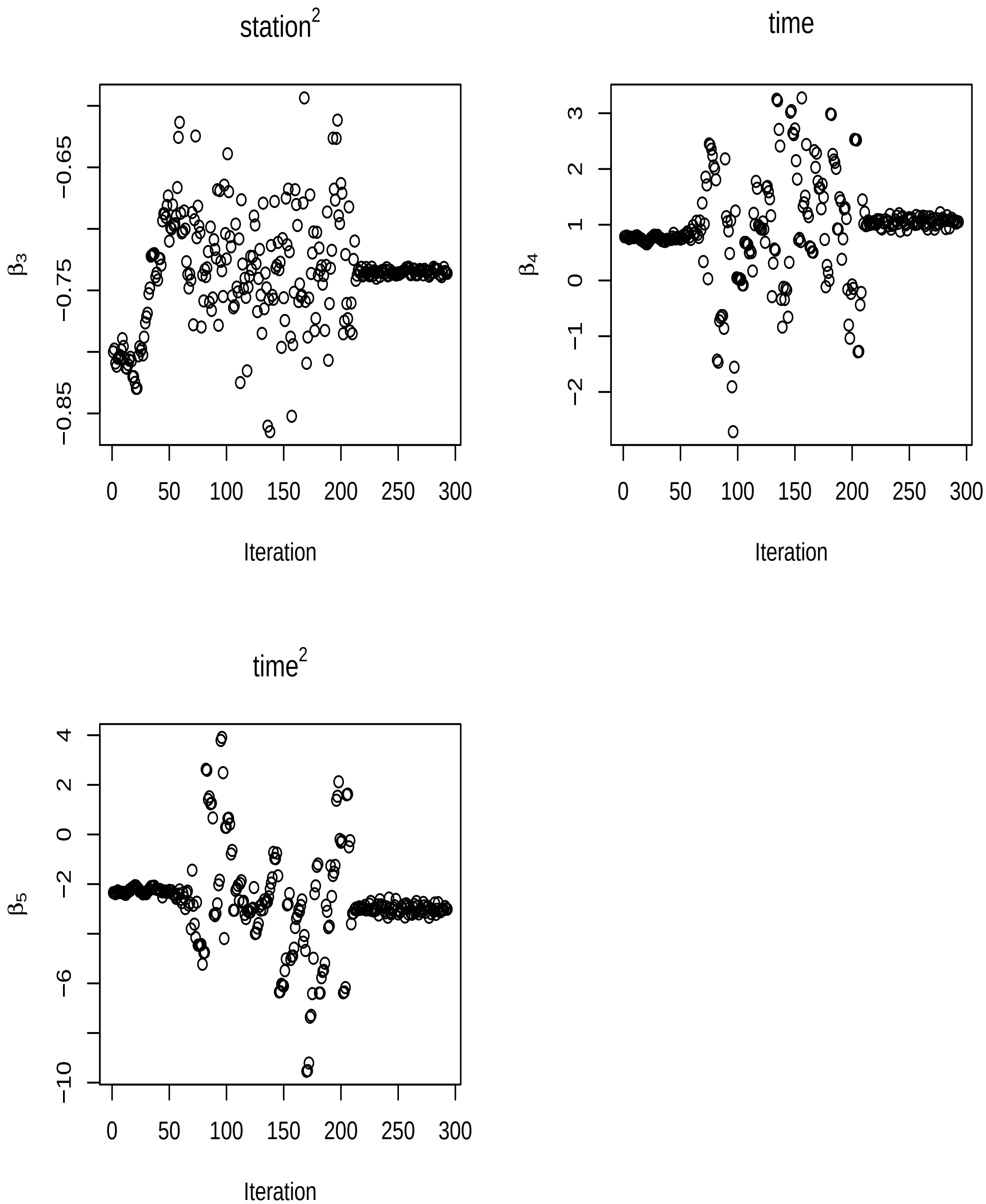


Figure C.2c: MCL Model 2.1 Parameter Estimates ($\beta_3, \beta_4, \beta_5$) obtained at each stage of the recursive process. A total of 293 stages were conducted and convergence occurred at about stage 220.

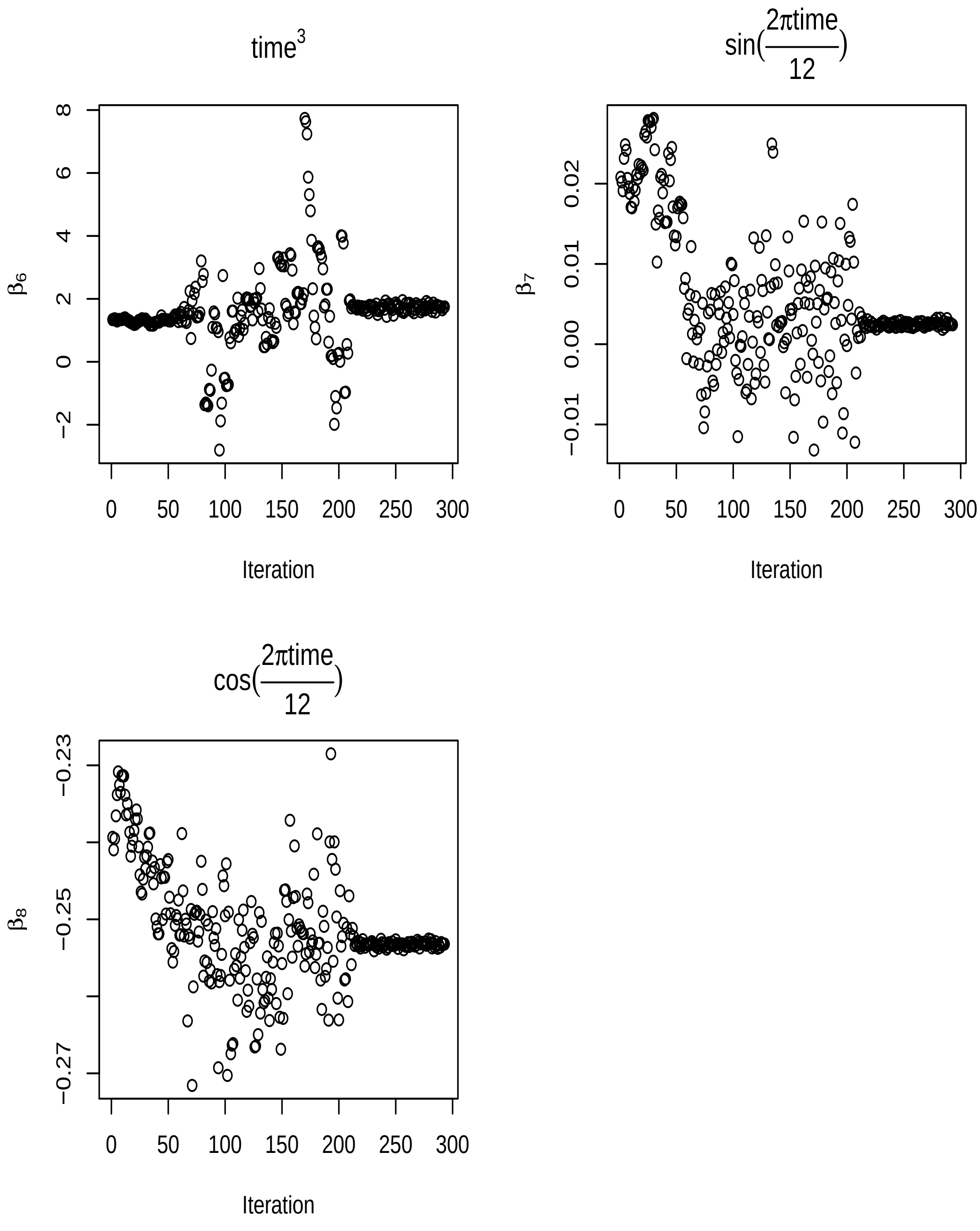


Figure C.2d: MCL Model 2.1 Parameter Estimates ($\beta_6, \beta_7, \beta_8$) obtained at each stage of the recursive process. A total of 293 stages were conducted and convergence occurred at about stage 220.

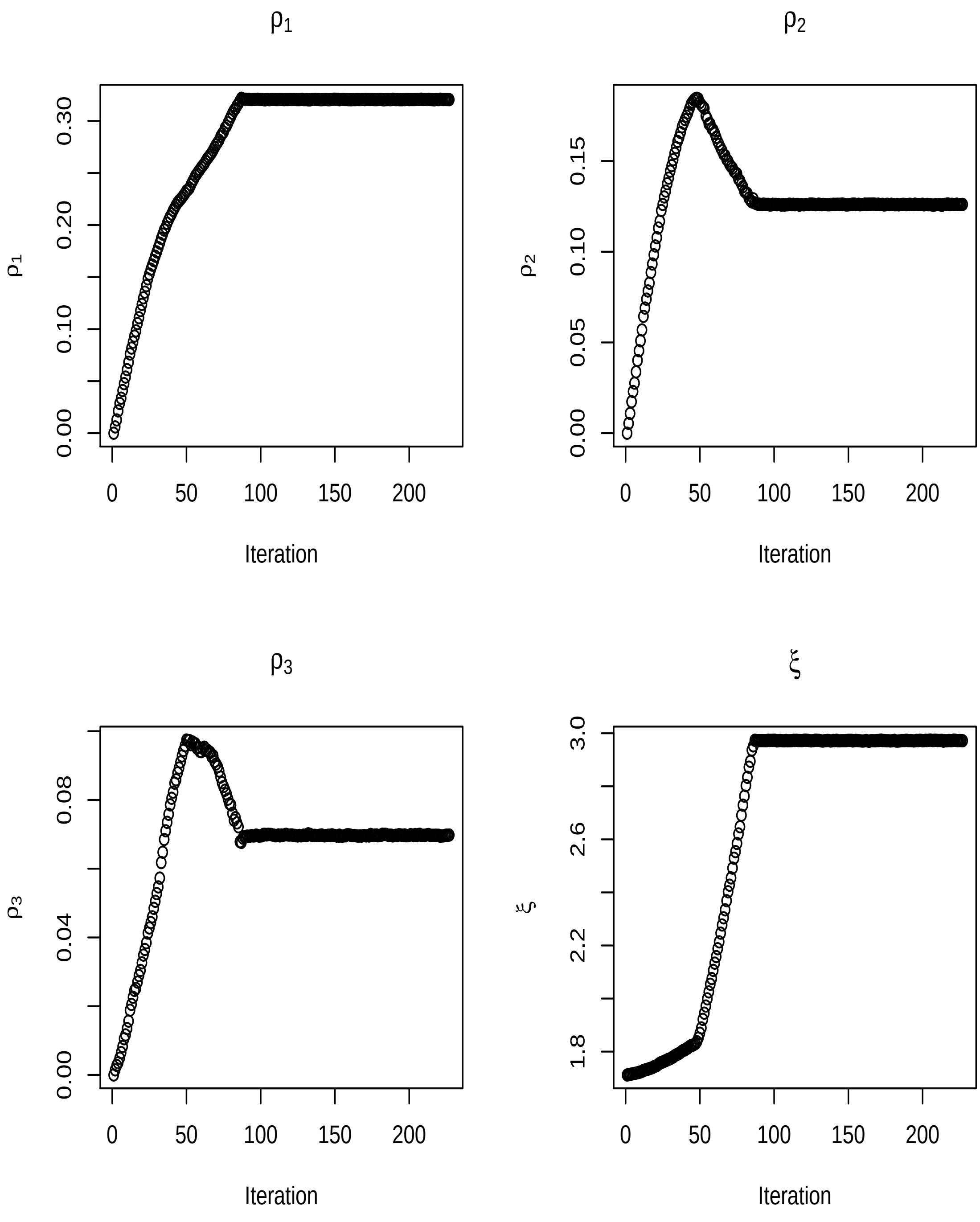


Figure C.3a: MCL Model 1.2 Parameter Estimates $(\rho_1, \rho_2, \rho_3, \xi)$ obtained at each stage of the recursive process. A total of 227 stages were conducted and convergence occurred at about stage 100.

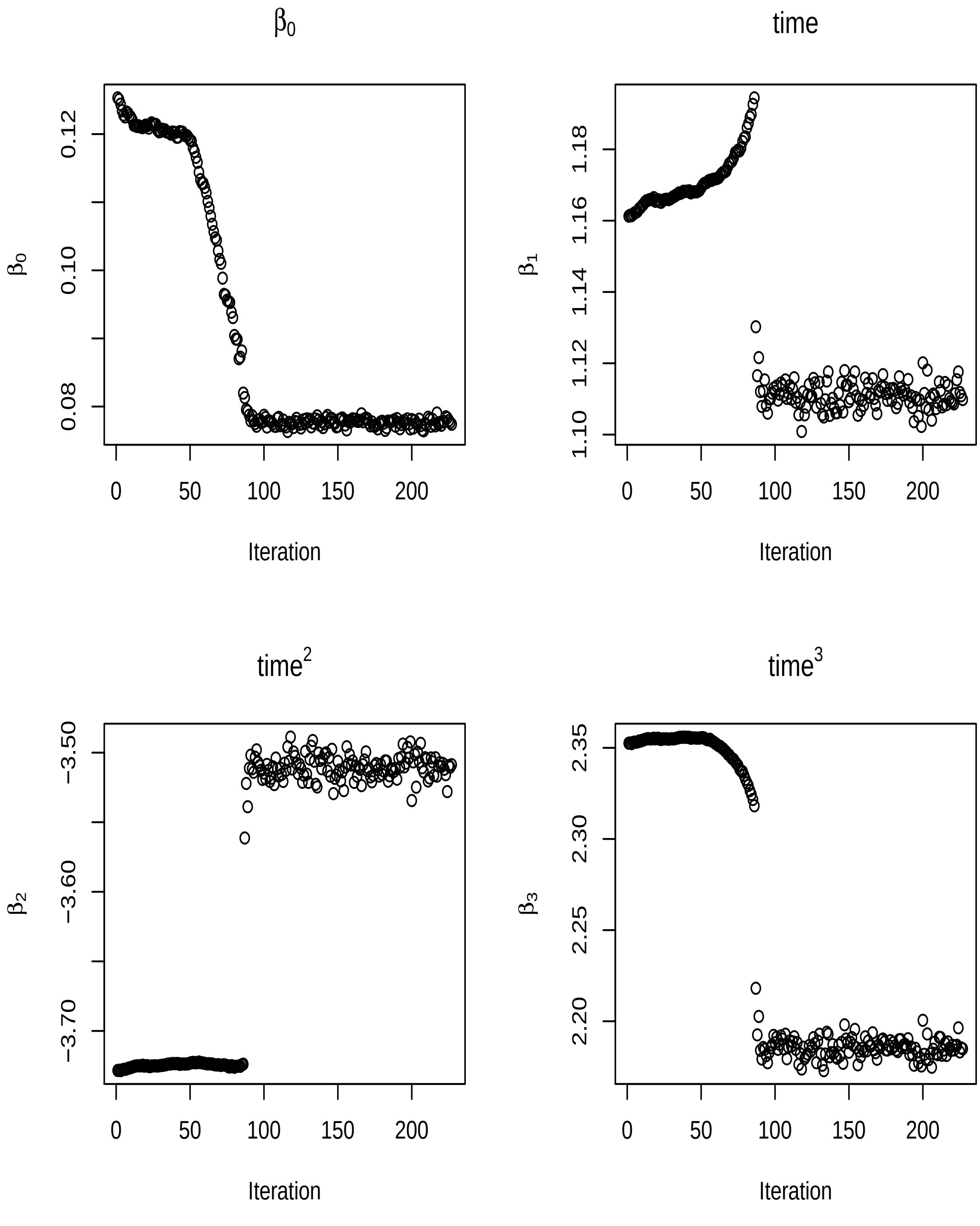


Figure C.3b: MCL Model 1.2 Parameter Estimates ($\beta_0, \beta_1, \beta_2, \beta_3$) obtained at each stage of the recursive process. A total of 227 stages were conducted and convergence occurred at about stage 100.

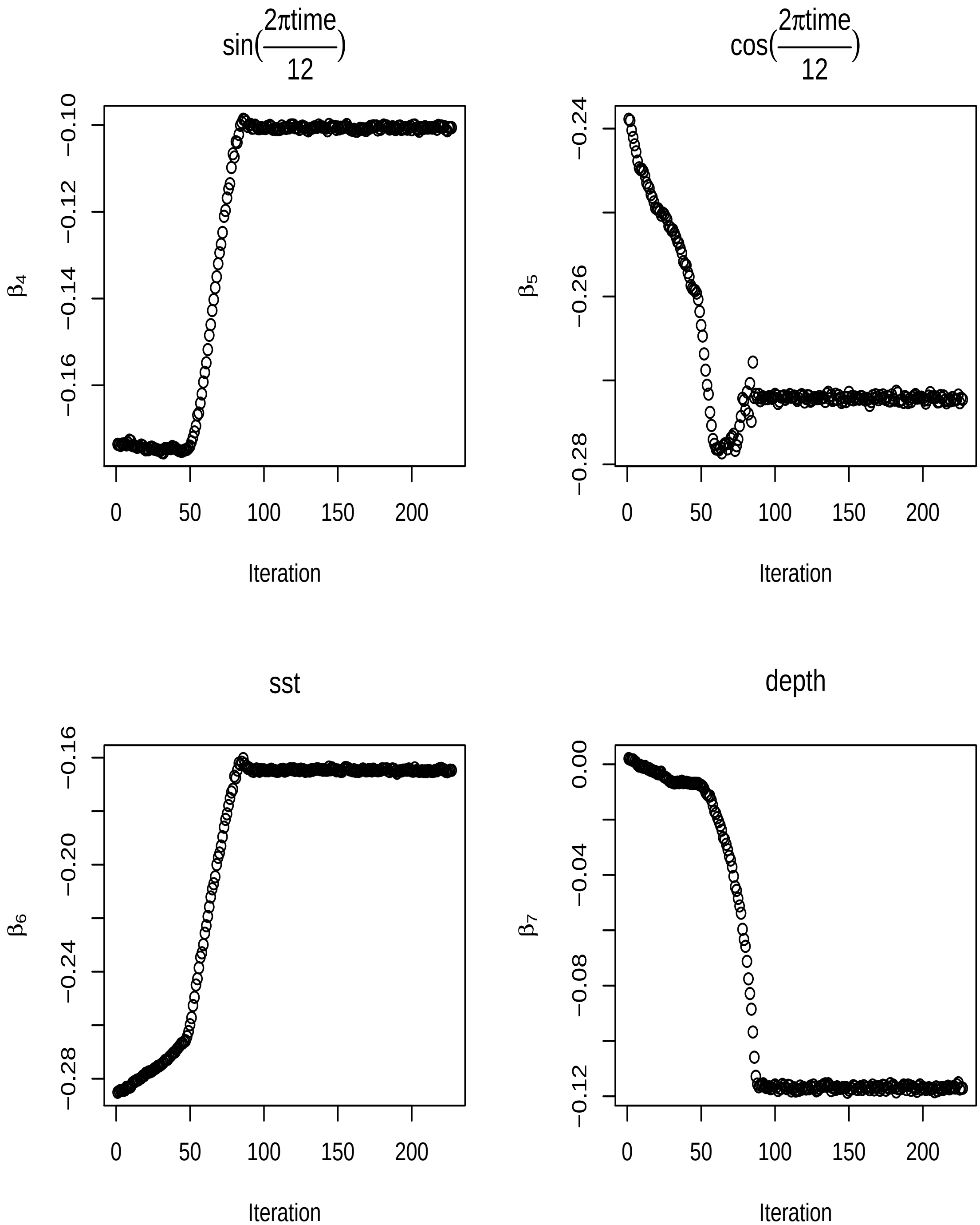


Figure C.3c: MCL Model 1.2 Parameter Estimates ($\beta_4, \beta_5, \beta_6, \beta_7$) obtained at each stage of the recursive process. A total of 227 stages were conducted and convergence occurred at about stage 100.

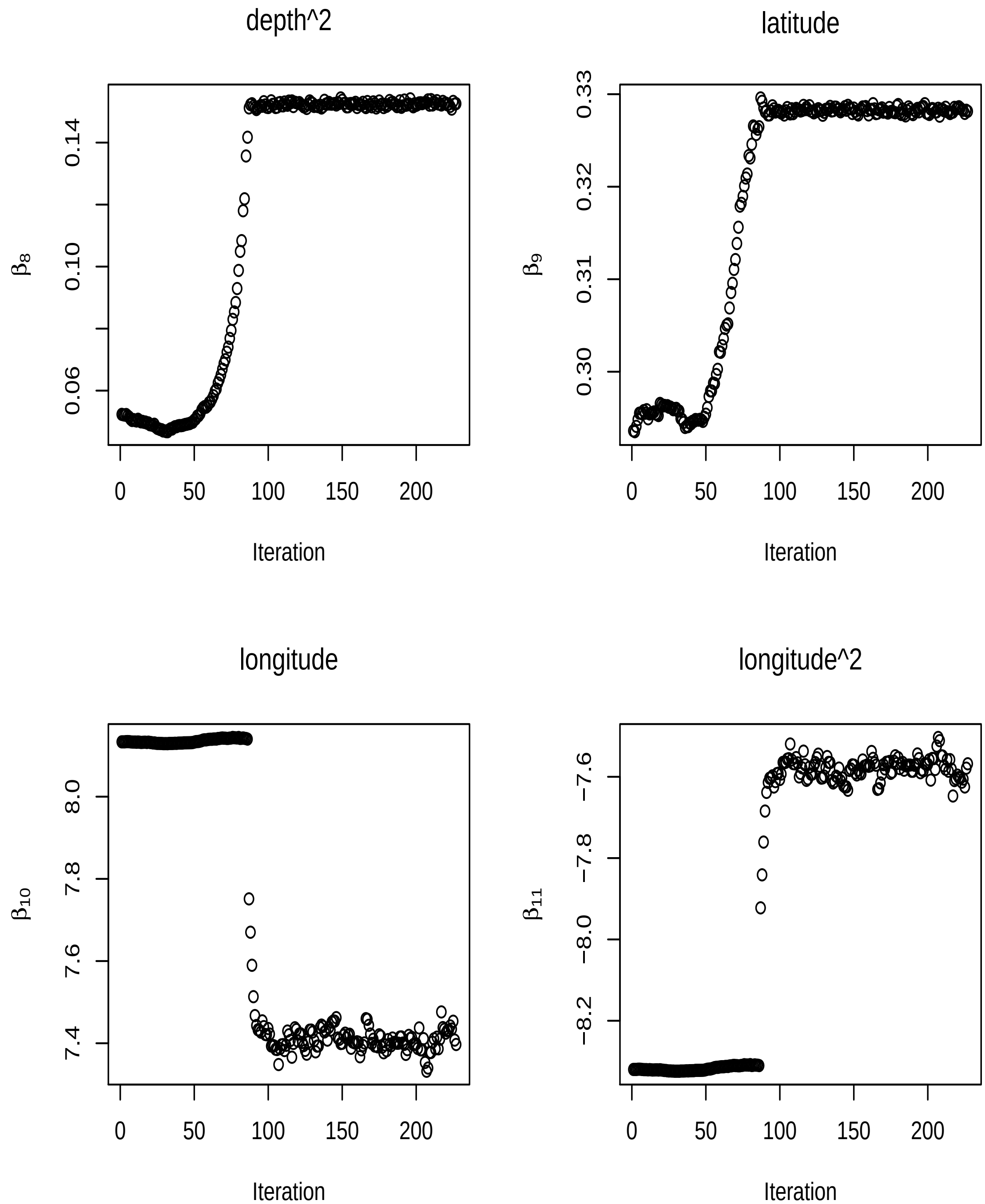


Figure C.3d: MCL Model 1.2 Parameter Estimates ($\beta_8, \beta_9, \beta_{10}, \beta_{11}$) obtained at each stage of the recursive process. A total of 227 stages were conducted and convergence occurred at about stage 100.

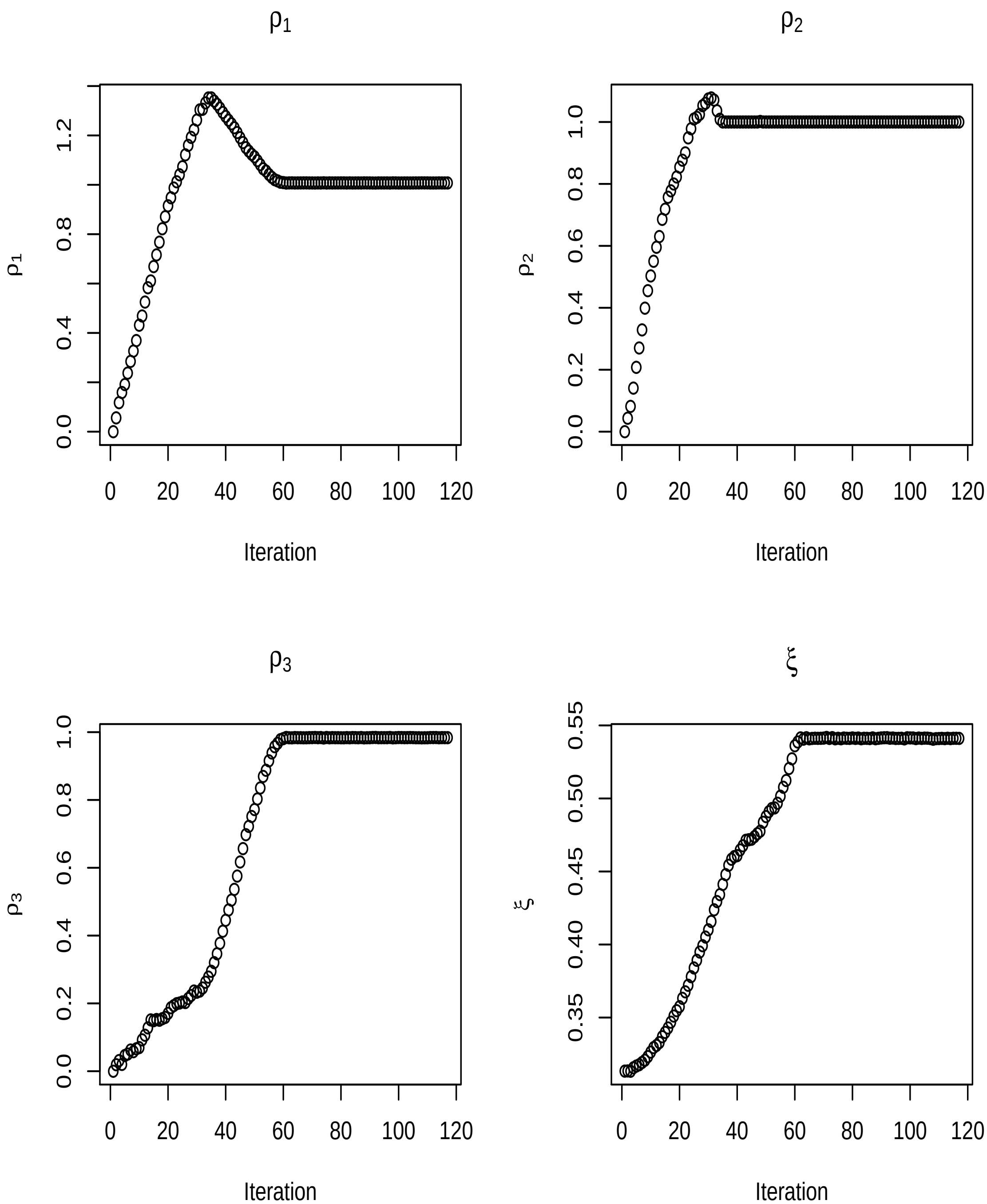


Figure C.4a: MCL Model 2.2 Parameter Estimates ($\rho_1, \rho_2, \rho_3, \xi$) obtained at each stage of the recursive process. A total of 117 stages were conducted and convergence occurred at about stage 70.

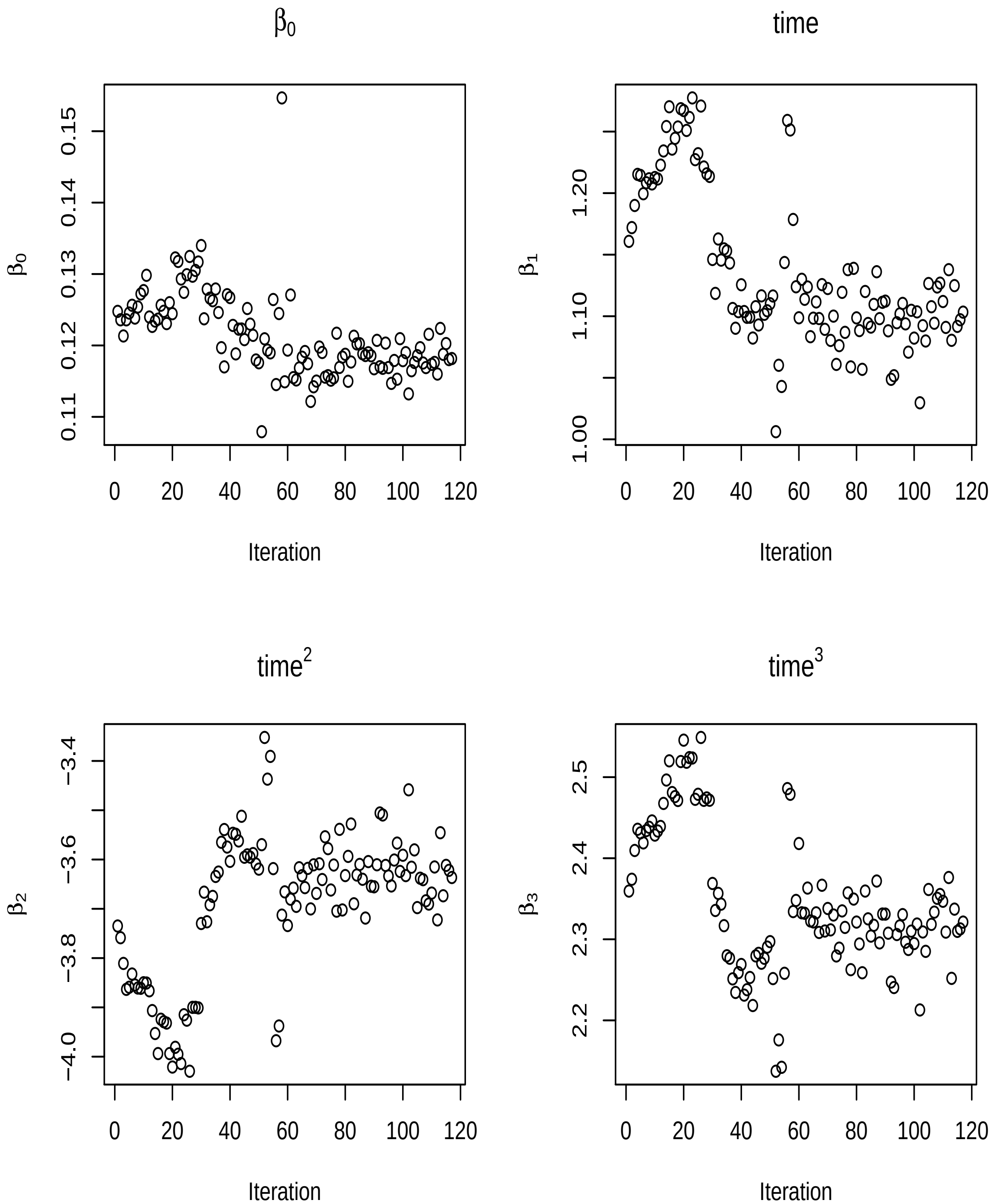


Figure C.4b: MCL Model 2.2 Parameter Estimates $(\beta_0, \beta_1, \beta_2, \beta_3)$ obtained at each stage of the recursive process. A total of 117 stages were conducted and convergence occurred at about stage 70.

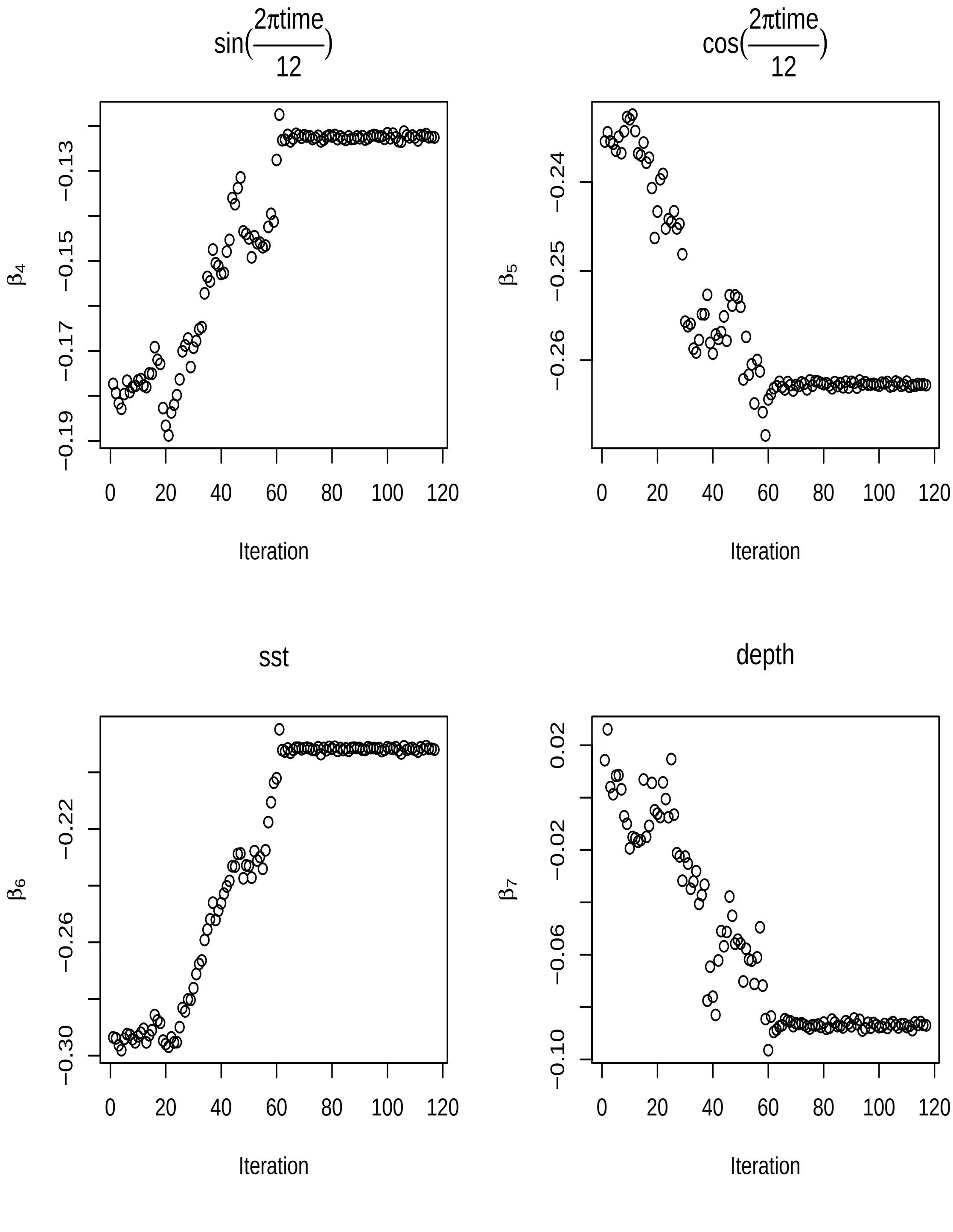


Figure C.4c: MCL Model 2.2 Parameter Estimates $(\beta_4, \beta_5, \beta_6, \beta_7)$ obtained at each stage of the recursive process. A total of 117 stages were conducted and convergence occurred at about stage 70.

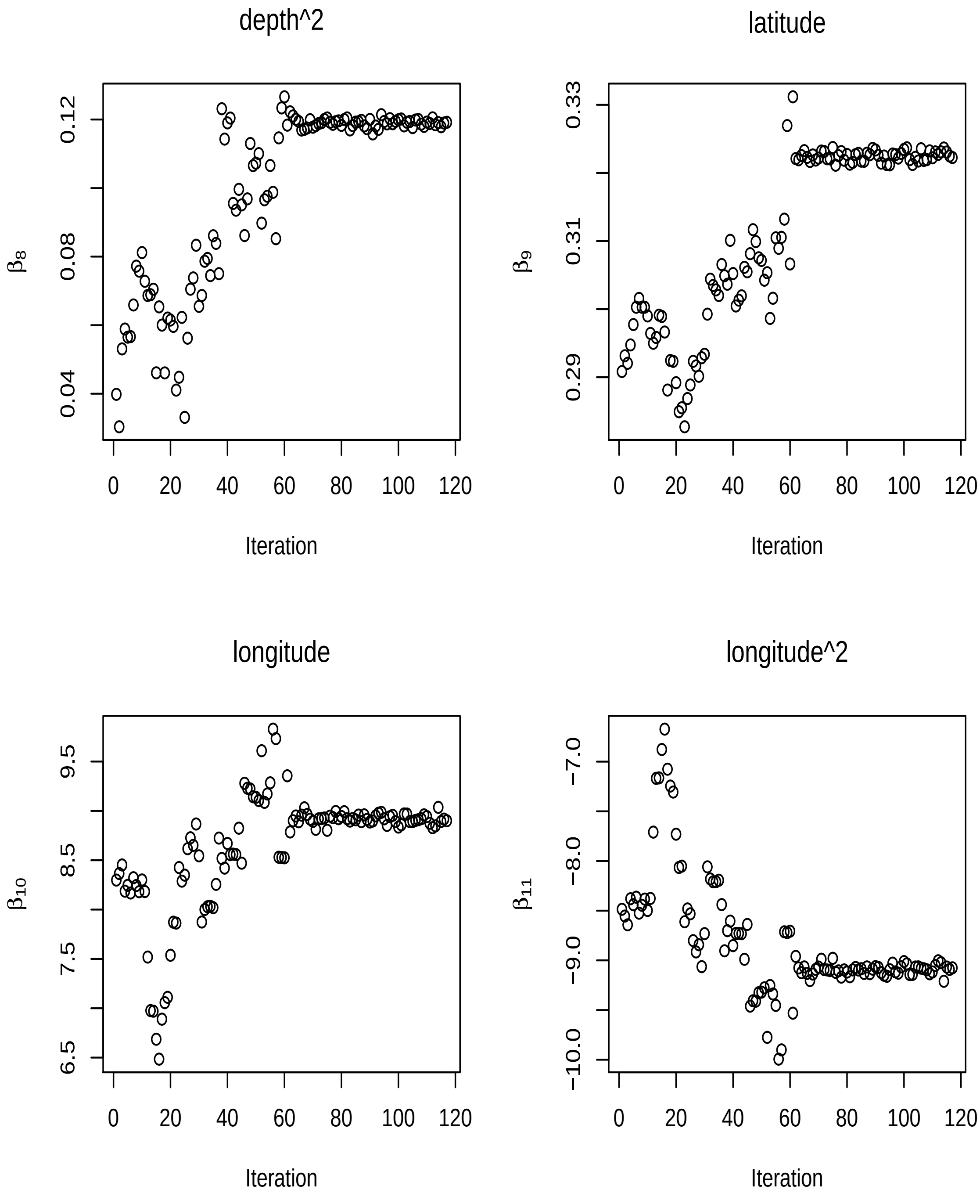


Figure C.4d: MCL Model 2.2 Parameter Estimates ($\beta_8, \beta_9, \beta_{10}, \beta_{11}$) obtained at each stage of the recursive process. A total of 117 stages were conducted and convergence occurred at about stage 70.

APPENDIX D

INITIAL PARAMETER ESTIMATES

Table D.1: Set 1 Covariates Initial Parameter Estimates.

Parameter	Model 1.1 Estimate	Model 2.1 Estimate
ρ_1	0	0
ρ_2	0	0
ρ_3	0	0
ξ	1.485832	0.270019
β_0	0.057822	0.05884
line	-0.287504	-0.290166
station	0.91392	0.918068
station^2	-0.787274	-0.799974
time	0.793752	0.784007
time^2	-2.352356	-2.341841
time^3	1.341243	1.339612
$\sin(\frac{2\pi \times \text{time}}{12})$	0.020534	0.020797
$\cos(\frac{2\pi \times \text{time}}{12})$	-0.239936	-0.239345

Table D.2: Set 2 Covariates Initial Parameter Estimates.

Parameter	Model 1.2 Estimate	Model 2.2 Estimate
ρ_1	0	0
ρ_2	0	0
ρ_3	0	0
ξ	1.712041004	0.31335
β_0	0.125324	0.124775
time	1.161267	1.160839
time^2	-3.728411	-3.734829
time^3	2.352556	2.359497

Table D.2 - continued

Parameter	**Model 1.2 Estimate**	**Model 2.2 Estimate**
$\sin(\frac{2\pi\times\text{time}}{12})$	-0.173591	-0.177323
$\cos(\frac{2\pi\times\text{time}}{12})$	-0.23888	-0.235447
sst	-0.285054	-0.293542
depth	0.002075	0.01431
depth^2	0.052352	0.03983
latitude	0.293616	0.290839
longitude	8.1334	8.299161
longitude^2	-8.319673	-8.485867

APPENDIX E

ESTIMATED CORRELATION MATRICES

	ρ_1	ρ_2	ρ_3	ξ	β_0	line	station
ρ_1	1	−0.412	−0.668	0.455	0.001	−0.084	−0.078
ρ_2		1	−0.403	−0.248	0.003	0.14	0.056
ρ_3			1	−0.253	−0.008	−0.031	0.029
ξ				1	−0.033	−0.034	−0.067
β_0					1	0.205	0.519
line						1	0.329
station							1
station^2							
time							
time^2							
time^3							
$\sin(\frac{2\pi\times\text{time}}{12})$							
$\cos(\frac{2\pi\times\text{time}}{12})$							

	station^2	time	time^2	time^3	$\sin(\frac{2\pi\times\text{time}}{12})$	$\cos(\frac{2\pi\times\text{time}}{12})$
ρ_1	0.081	0.046	−0.029	0.015	0.052	0.033
ρ_2	−0.07	−0.008	0.004	0.004	−0.019	−0.051
ρ_3	−0.021	−0.041	0.027	−0.019	−0.036	0.007
ξ	0.069	0.029	−0.016	0.006	0.044	0.011
β_0	−0.575	0.1	−0.068	0.045	−0.098	0.048
line	−0.399	0.087	−0.098	0.097	0.017	−0.031
station	−0.972	−0.017	0.034	−0.034	−0.034	0.015
station^2	1	0.012	−0.028	0.028	0.034	−0.016
time		1	−0.968	0.914	−0.02	−0.02
time^2			1	−0.985	0.017	0.015
time^3				1	−0.015	−0.014
$\sin(\frac{2\pi\times\text{time}}{12})$					1	−0.001
$\cos(\frac{2\pi\times\text{time}}{12})$						1

Estimated correlation matrix for the parameter estimates of Model 1.1.

	ρ_1	ρ_2	ρ_1	ξ	β_0	time	time^2	time^3	$\sin(\frac{2\pi\times\text{time}}{12})$
ρ_1	1	−0.526	−0.508	0.41	0.024	0.071	−0.065	0.055	0.072
ρ_2		1	−0.464	−0.226	0.073	−0.057	0.04	−0.024	−0.033
ρ_3			1	−0.19	−0.109	−0.018	0.029	−0.034	−0.038
ξ				1	−0.028	0.049	−0.042	0.034	0.016
β_0					1	0.144	−0.122	0.1	−0.09
time						1	−0.971	0.925	−0.003
$texttime^2$							1	−0.988	−0.009
time^3								1	0.013
$\sin(\frac{2\pi\times\text{time}}{12})$									1
$\cos(\frac{2\pi\times\text{time}}{12})$									
sst									
depth									
depth^2									
latitude									
longitude									
longitude^2									

	$\cos(\frac{2\pi\times\text{time}}{12})$	sst	depth	depth^2	latitude	longitude	longitude^2
ρ_1	0.077	0.081	−0.042	0.012	−0.007	0.017	−0.017
ρ_2	−0.056	−0.004	0.058	−0.049	0.024	0.072	−0.072
ρ_3	−0.023	−0.076	−0.017	0.038	−0.015	−0.097	0.096
ξ	0.012	−0.004	−0.06	0.04	−0.059	−0.001	0.001
β_0	0.004	−0.008	0.214	−0.188	0.014	0.47	−0.469
time	0.012	0.014	−0.016	0.005	−0.107	−0.008	0.008
$texttime^2$	−0.02	−0.035	0.033	−0.02	0.118	0.01	−0.01
time^3	0.021	0.04	−0.038	0.024	−0.117	−0.009	0.009
$\sin(\frac{2\pi\times\text{time}}{12})$	0.099	0.712	0.034	−0.062	0.272	0.187	−0.185
$\cos(\frac{2\pi\times\text{time}}{12})$	1	0.161	−0.01	0.0003	0.08	0.05	−0.05
sst		1	0.056	−0.088	0.453	0.266	−0.263
depth			1	−0.91	0.142	−0.054	0.055
depth^2				1	0.028	0.083	−0.087
latitude					1	−0.026	0.024
longitude						1	−0.999
longitude^2							1

Estimated correlation matrix for the parameter estimates of Model 1.2.

APPENDIX F

ACF OF PREDICTED MONTHLY MEAN ZOOPLANKTON YIELD

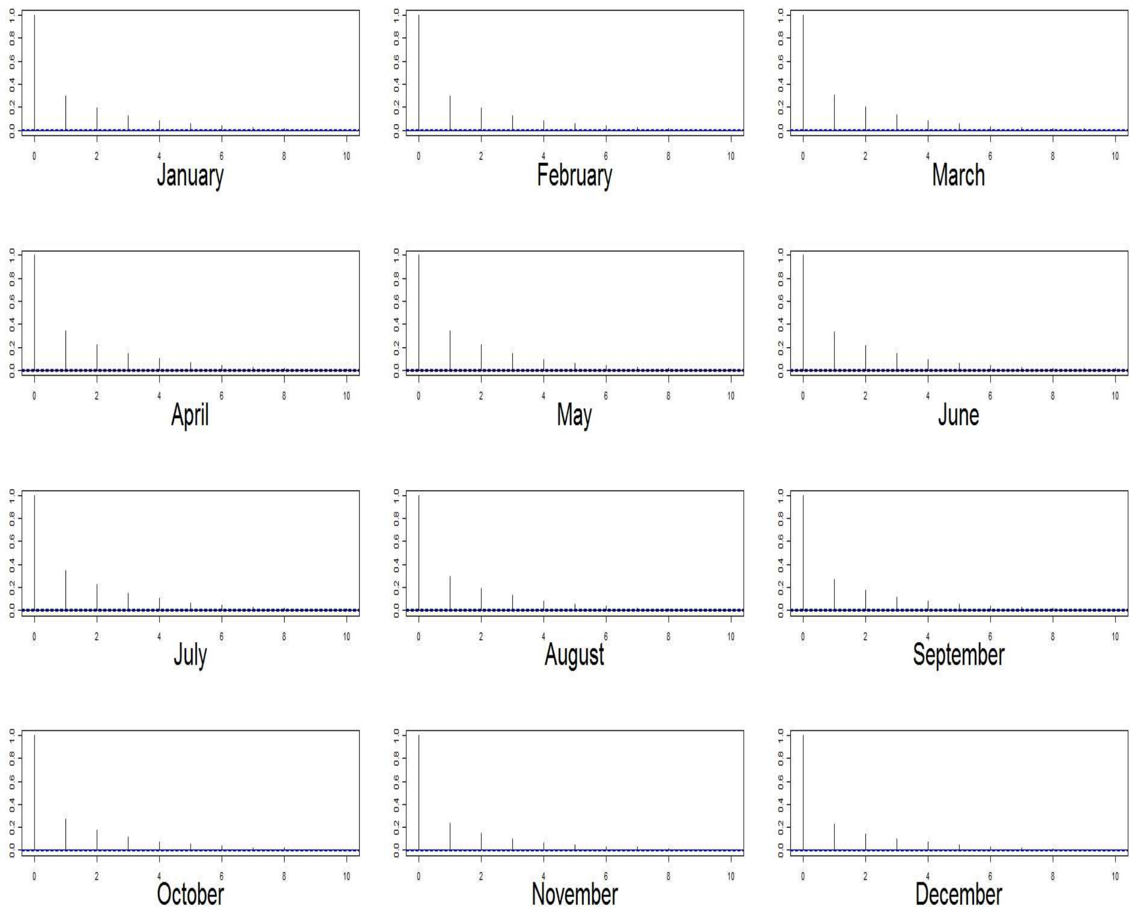


Figure F.1: Model 1.1: ACF of Predicted Monthly Mean Zooplankton Yield Sample.

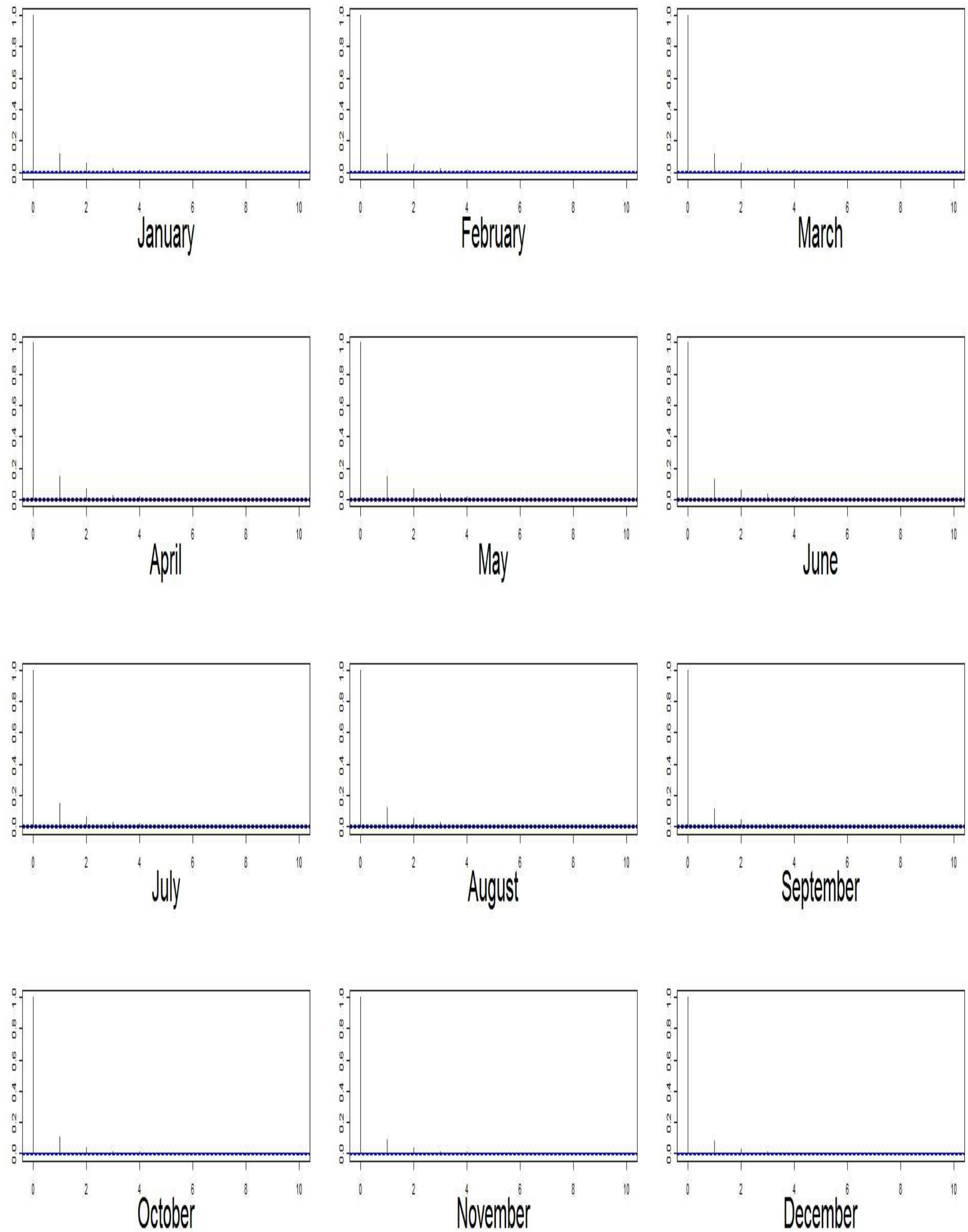


Figure F.2: Model 1.2: ACF of Predicted Monthly Mean Zooplankton Yield Sample.

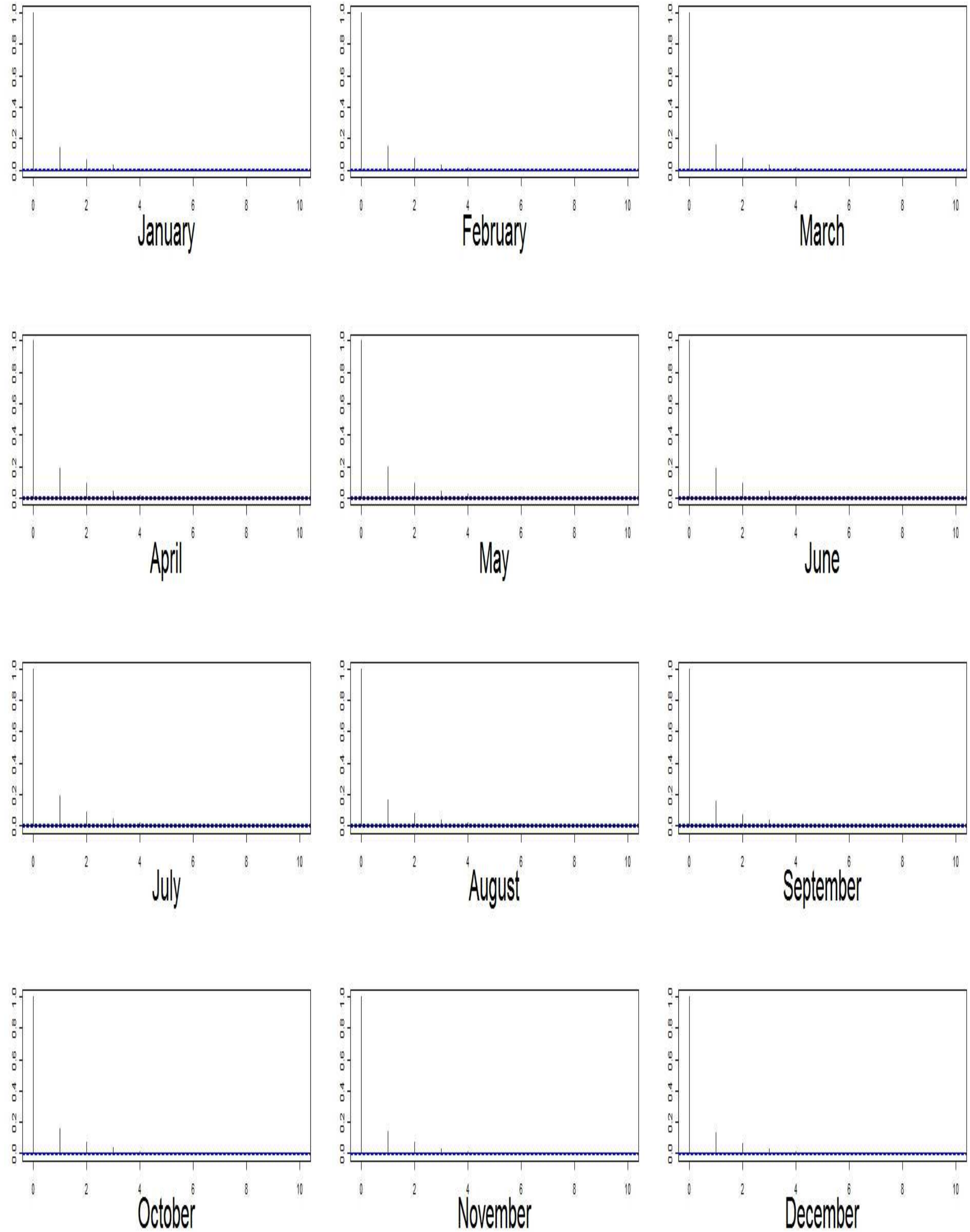


Figure F.3: Model 2.1: ACF of Predicted Monthly Mean Zooplankton Yield Sample.

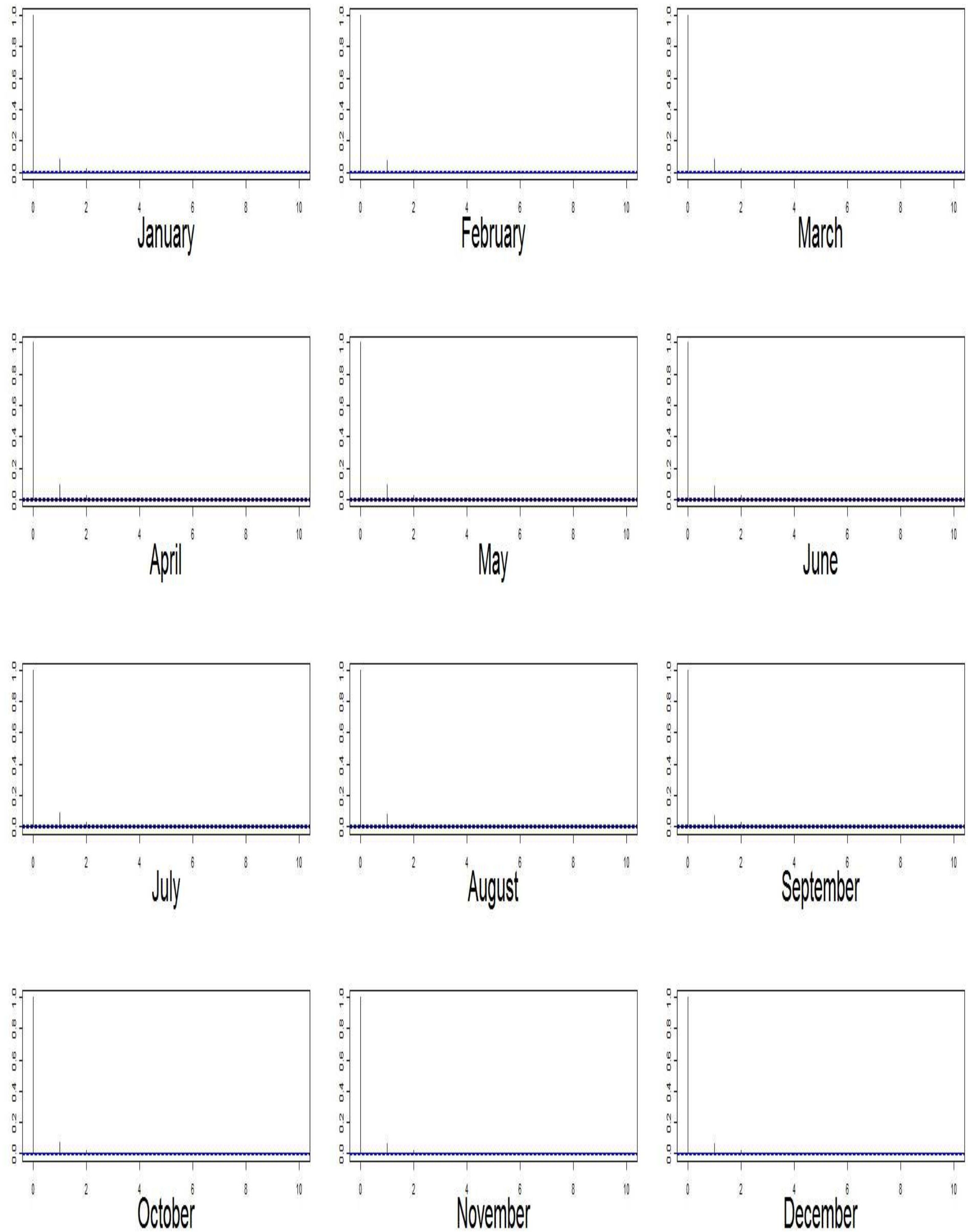


Figure F.4: Model 2.2: ACF of Predicted Monthly Mean Zooplankton Yield Sample.

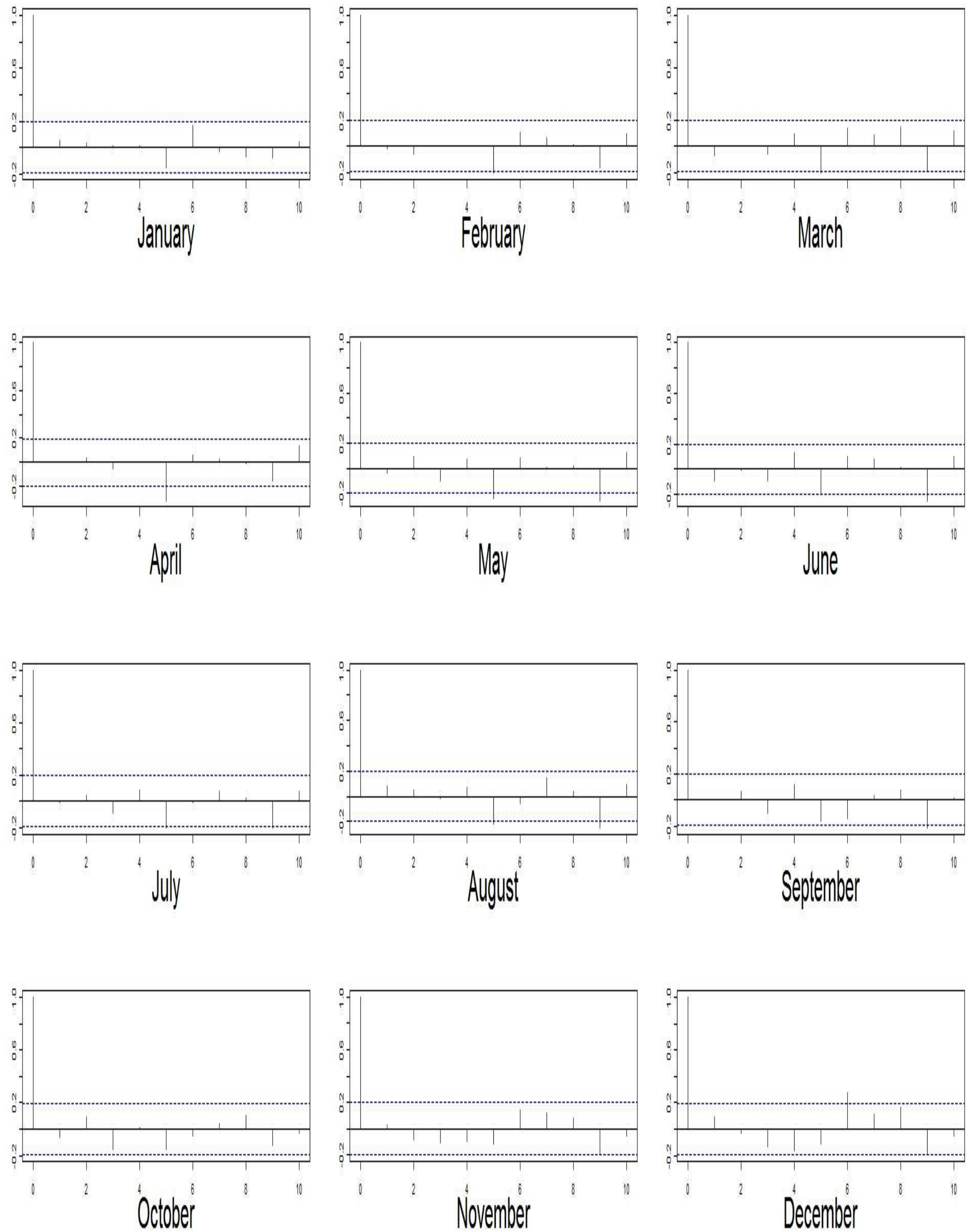


Figure F.5: Model 1.1: ACF of Predicted Monthly Mean Zooplankton Yield Batch Mean.

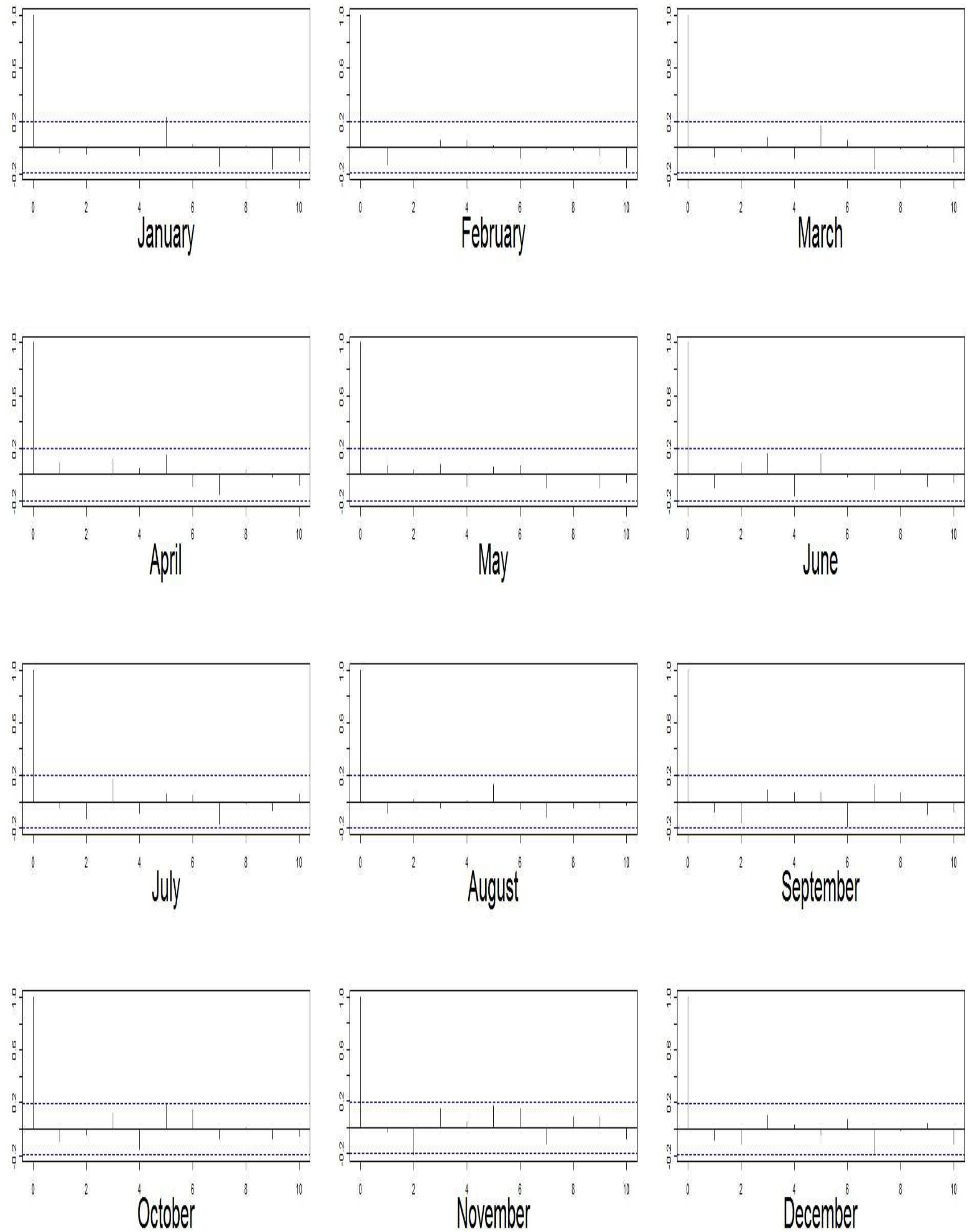


Figure F.6: Model 1.2: ACF of Predicted Monthly Mean Zooplankton Yield Batch Mean.

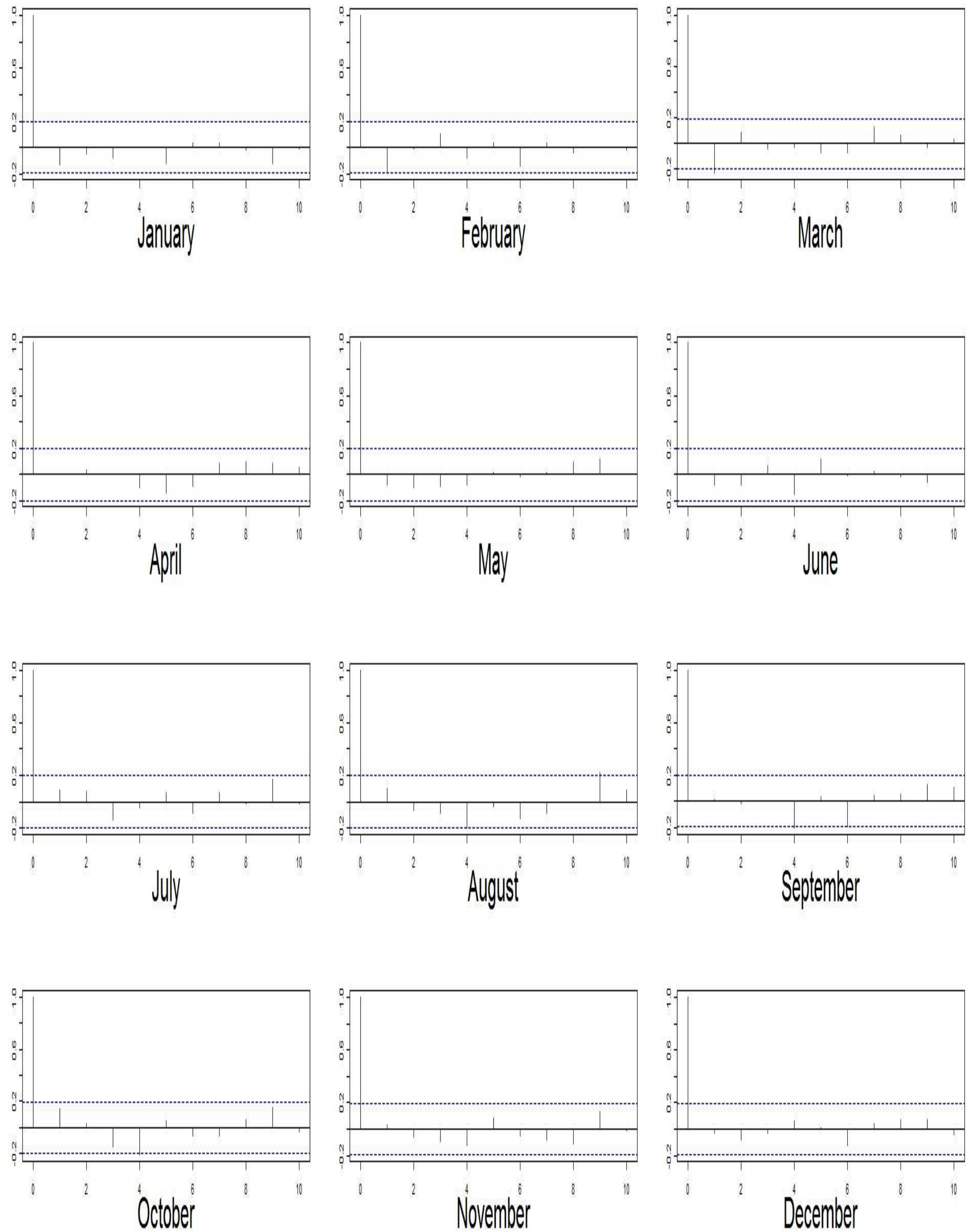


Figure F.7: Model 2.1: ACF of Predicted Monthly Mean Zooplankton Yield Batch Mean.

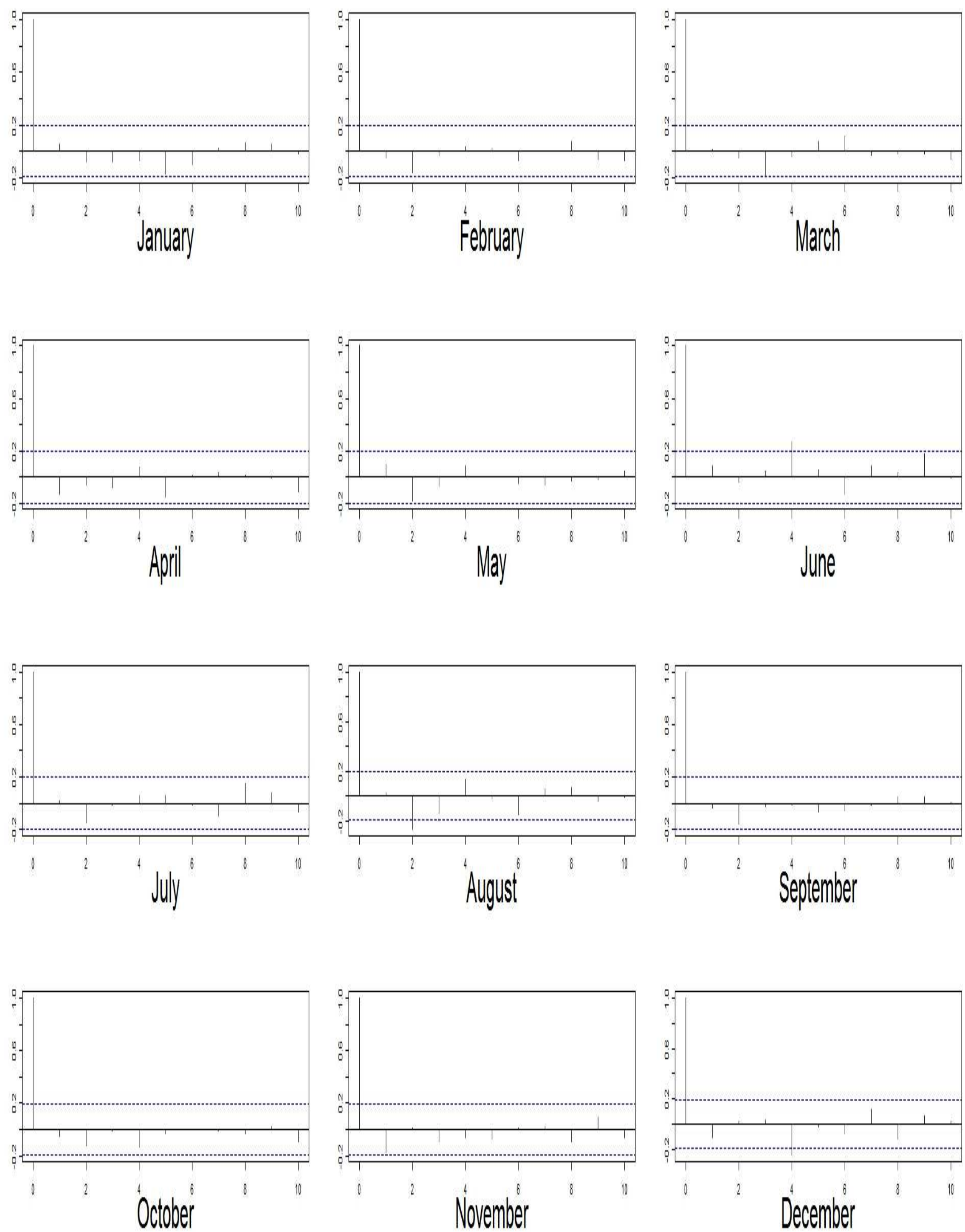


Figure F.8: Model 2.2: ACF of Predicted Monthly Mean Zooplankton Yield Batch Mean.

APPENDIX G

PREDICTED YEARLY MEAN ZOOPLANKTON YIELD

Table G.1: Model 1.1 Predicted Yearly Mean Zooplankton Yield.

Year	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
1951	164.02	0.0198	6.44	0.0151	184.98	333
1952	217.08	0.0274	8.17	0.02	274.69	351
1953	323.75	0.0412	12.54	0.0282	476.18	345
1954	197.02	0.0237	7.79	0.0192	236.7	345
1955	266.13	0.0419	12.68	0.0266	335.63	293
1956	296.14	0.043	12.48	0.0339	379.26	331
1957	251.83	0.0336	11.32	0.0278	315.77	329
1958	105.94	0.0123	3.93	0.0089	99.23	453
1959	130.06	0.0157	5.14	0.0117	120.17	512
1960	207.71	0.029	9.03	0.0222	234.96	382
1961	176.6	0.03	9.62	0.0224	170.93	213
1962	241.59	0.054	16.99	0.0412	232.86	193
1963	241.82	0.0572	16.58	0.0416	257.25	197
1964	274.78	0.0511	14.61	0.0349	346.52	231
1965	201.5	0.0458	12.52	0.0327	184.17	217
1966	244.53	0.0292	9.22	0.0238	238.03	491
1967	241.43	0.0904	26.8	0.062	220.46	46
1968	329.14	0.0985	32.1	0.0771	440.42	113
1969	252.63	0.0315	9.1	0.0215	254.1	497
1970	326.24	0.7401	101.32	0.6838	0	0
1971	496.2	1.1141	169.22	1.1221	0	0
1972	255.76	0.0324	10.95	0.0266	438.72	282
1973	170.22	0.2956	42.87	0.2382	0	0
1974	206.37	0.251	45.45	0.2126	139.63	67
1975	181.2	0.0264	8.1	0.0189	185.2	336
1976	204.65	0.3729	54.99	0.3288	0	0
1977	239.2	0.4085	63.37	0.3956	90.25	33
1978	258.65	0.034	9.82	0.0249	171.87	404
1979	207.4	0.0682	21.31	0.0638	217.72	217
1980	192.52	0.0592	18.14	0.0451	181.4	175

Table G.1 - continued

Year	**Mean**	$\mathbf{MCSE_{Mean}}$	**SD**	$\mathbf{MCSE_{SD}}$	**OBS Mean**	**OBS Count**
1981	158.31	0.0332	10.01	0.0233	167.82	284
1982	112.93	0.0546	14.22	0.037	45.92	70
1983	126.7	0.0515	14.63	0.0427	122.35	71
1984	166.55	0.0219	6.63	0.0165	178.48	411
1985	244.73	0.0388	14.07	0.0262	247.07	205
1986	138.04	0.0373	10.66	0.0246	82.47	215
1987	113.17	0.0223	8.32	0.0206	87.58	246
1988	124.32	0.0246	8.24	0.0184	134.27	240
1989	108.35	0.0224	7.38	0.0201	89.76	251
1990	124.1	0.0275	8.88	0.0215	115.49	234
1991	116.11	0.036	9.59	0.0255	99.04	238
1992	91.48	0.0202	6.22	0.0143	69.96	251
1993	80.53	0.0202	5.84	0.0153	59.61	259
1994	85.3	0.0196	6.19	0.016	57.59	257
1995	96.39	0.0195	6.73	0.0149	72.29	247
1996	106.53	0.0242	7.7	0.0192	85.96	252
1997	84.48	0.0167	5.69	0.0153	75.59	273
1998	60.58	0.0105	3.61	0.0092	41.83	383
1999	152.45	0.0336	10.62	0.0261	149.16	250
2000	132.63	0.0244	8.65	0.022	124.32	258
2001	134.73	0.0329	9.91	0.0226	112.36	255
2002	113.39	0.0233	7.56	0.0174	96.4	258
2003	120.64	0.0231	7.36	0.0212	113.77	281
2004	103.67	0.0249	6.65	0.0151	87.49	282
2005	104.38	0.0197	6.6	0.0176	95.23	275
2006	87.54	0.0168	5.3	0.013	74.81	275

Table G.2: Model 2.1 Predicted Yearly Mean Zooplankton Yield.

Year	**Mean**	$\mathbf{MCSE_{Mean}}$	**SD**	$\mathbf{MCSE_{SD}}$	**OBS Mean**	**OBS Count**
1951	179.84	0.0331	11.28	0.0503	184.98	333
1952	223.98	0.0301	9.72	0.0225	274.69	351
1953	353.85	0.0526	16.51	0.0391	476.18	345
1954	210.99	0.0341	11.59	0.0346	236.7	345
1955	316.68	0.0686	20.48	0.0531	335.63	293
1956	355.18	0.0593	20.6	0.0501	379.26	331
1957	265.56	0.0418	15.07	0.0316	315.77	329
1958	96.23	0.0122	4.09	0.0103	99.23	453
1959	124.32	0.016	5.22	0.0127	120.17	512
1960	215.26	0.0331	12.3	0.0325	234.96	382
1961	166.61	0.0313	9.56	0.0248	170.93	213
1962	249.8	0.0679	20.02	0.0492	232.86	193
1963	267.42	0.0734	23.33	0.0638	257.25	197

Table G.2 - continued

Year	**Mean**	$\mathbf{MCSE_{Mean}}$	**SD**	$\mathbf{MCSE_{SD}}$	**OBS Mean**	**OBS Count**
1964	288.43	0.0499	15.58	0.0352	346.52	231
1965	219.87	0.0551	16.1	0.0452	184.17	217
1966	261.76	0.0375	12.43	0.0319	238.03	491
1967	279.34	0.1293	37.3	0.1182	220.46	46
1968	375.8	0.113	34.97	0.1006	440.42	113
1969	265.96	0.0338	12.29	0.0419	254.1	497
1970	394.12	0.452	92.9	0.2695	0	0
1971	575.06	0.5882	126.64	0.3607	0	0
1972	265.87	0.0389	14.44	0.0658	438.72	282
1973	165.46	0.17	41.68	0.1231	0	0
1974	216.06	0.1778	44.45	0.123	139.63	67
1975	182.3	0.0304	9.08	0.0252	185.2	336
1976	222.86	0.2709	52.39	0.1746	0	0
1977	283.24	0.3065	61.78	0.1826	90.25	33
1978	276.97	0.0393	12.65	0.0372	171.87	404
1979	231.18	0.0872	24.23	0.0648	217.72	217
1980	209.16	0.0559	20.1	0.0502	181.4	175
1981	163.93	0.0311	11.22	0.0325	167.82	284
1982	101.66	0.0401	13.68	0.0382	45.92	70
1983	114.2	0.0426	13	0.0291	122.35	71
1984	171.65	0.0247	6.96	0.0193	178.48	411
1985	272.11	0.0711	21.24	0.0757	247.07	205
1986	156.81	0.0655	18.58	0.0625	82.47	215
1987	116.92	0.0375	12.88	0.0479	87.58	246
1988	129.18	0.041	13.28	0.0507	134.27	240
1989	117.26	0.0404	13.14	0.0474	89.76	251
1990	140.63	0.0483	16.32	0.0606	115.49	234
1991	133	0.0534	17.12	0.0487	99.04	238
1992	92.58	0.034	10.07	0.0331	69.96	251
1993	77.05	0.0251	8.64	0.0335	59.61	259
1994	82.19	0.026	8.65	0.0291	57.59	257
1995	101.11	0.0336	11.07	0.0379	72.29	247
1996	124.23	0.0493	14.81	0.0478	85.96	252
1997	87.25	0.0303	9.28	0.0341	75.59	273
1998	59.46	0.0154	5.27	0.0174	41.83	383
1999	185.31	0.0558	19.86	0.0556	149.16	250
2000	164.8	0.0579	18.56	0.0696	124.32	258
2001	164.04	0.0575	19.24	0.0615	112.36	255
2002	127.24	0.041	13.13	0.0413	96.4	258
2003	126.7	0.0297	9.23	0.0275	113.77	281
2004	108.41	0.0256	8.73	0.0366	87.49	282
2005	109.72	0.0254	8.49	0.0257	95.23	275
2006	86.58	0.022	7.51	0.0307	74.81	275

Table G.3: Model 1.2 Predicted Yearly Mean Zooplankton Yield.

Year	Mean	$\text{MCSE}_{\text{Mean}}$	SD	MCSE_{SD}	OBS Mean	OBS Count
1960	200.47	0.0256	8.09	0.019	234.96	382
1961	172.95	0.0325	9.48	0.0216	170.93	213
1962	242.9	0.0597	17.35	0.0451	232.86	193
1963	239.5	0.0532	16.78	0.0373	257.25	197
1964	276.18	0.045	15.22	0.0319	346.52	231
1965	202.28	0.0443	12.46	0.0314	184.17	217
1966	245.8	0.0275	9.3	0.0246	238.03	491
1967	238.83	0.0804	25.67	0.0616	220.46	46
1968	325.77	0.0971	31.53	0.0743	440.42	113
1969	250.61	0.0323	8.89	0.0208	254.1	497
1970	286.5	0.2795	60.64	0.2045	0	0
1971	376.15	0.3526	82.21	0.2642	0	0
1972	264.48	0.0348	11.24	0.0268	438.72	282
1973	220.88	0.2305	43.7	0.1758	0	0
1974	239.09	0.2011	43.41	0.1477	139.63	67
1975	188.36	0.0314	8.51	0.0192	185.2	336
1976	207.95	0.2058	40.61	0.1405	0	0
1977	239.91	0.2311	47.6	0.1565	90.25	33
1978	262.6	0.0261	10.4	0.0221	171.87	404
1979	214.38	0.0822	22.23	0.0627	217.72	217
1980	198.13	0.0644	18.97	0.0403	181.4	175
1981	163.19	0.0393	10.88	0.0254	167.82	284
1982	128.51	0.0616	16.43	0.0465	45.92	70
1983	132.2	0.0587	15.45	0.0446	122.35	71
1984	166.59	0.019	6.91	0.018	178.48	411
1985	238.64	0.0366	13.56	0.0337	247.07	205
1986	135.94	0.0343	10.57	0.0272	82.47	215
1987	113.38	0.024	8.39	0.0229	87.58	246
1988	124.41	0.0255	8.16	0.0181	134.27	240
1989	108.33	0.0222	7.23	0.017	89.76	251
1990	121.68	0.0285	8.72	0.0225	115.49	234
1991	119.1	0.0316	10.05	0.0252	99.04	238
1992	87.58	0.0184	5.75	0.0133	69.96	251
1993	76.96	0.018	5.39	0.0138	59.61	259
1994	85.78	0.0179	6.28	0.0176	57.59	257
1995	94.47	0.0206	6.58	0.0132	72.29	247
1996	105.91	0.0248	7.77	0.0181	85.96	252
1997	81.71	0.0164	5.37	0.0139	75.59	273
1998	59.64	0.0117	3.5	0.0088	41.83	383
1999	151.5	0.0306	10.82	0.0277	149.16	250
2000	131.84	0.0283	8.66	0.0187	124.32	258
2001	136.28	0.0307	10.28	0.026	112.36	255
2002	117.17	0.0299	7.98	0.0184	96.4	258
2003	122.99	0.0241	7.64	0.0185	113.77	281
2004	105.95	0.0219	6.96	0.0167	87.49	282
2005	107.54	0.024	7.03	0.0153	95.23	275

Table G.3 - continued

Year	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
2006	95.11	0.0186	5.87	0.0139	74.81	275

Table G.4: Model 2.2 Predicted Yearly Mean Zooplankton Yield.

Year	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
1960	212.23	0.0388	11.35	0.0359	234.96	382
1961	165.85	0.0303	9.01	0.0234	170.93	213
1962	247.92	0.0623	18.9	0.0546	232.86	193
1963	259.96	0.0701	21.29	0.058	257.25	197
1964	283.22	0.0479	14.33	0.0344	346.52	231
1965	209.49	0.0442	13.91	0.0329	184.17	217
1966	256.36	0.0302	11.15	0.0312	238.03	491
1967	254.35	0.0981	30.78	0.083	220.46	46
1968	352.31	0.1014	30.22	0.0756	440.42	113
1969	256.09	0.03	10.33	0.0309	254.1	497
1970	331.24	0.2695	62.52	0.1909	0	0
1971	446.86	0.3103	77.13	0.2251	0	0
1972	265.22	0.0419	13.45	0.0372	438.72	282
1973	206.09	0.1594	40.64	0.1122	0	0
1974	230.73	0.1421	39.4	0.1144	139.63	67
1975	176.86	0.0302	8.11	0.0222	185.2	336
1976	200.53	0.1324	37.42	0.1017	0	0
1977	268.1	0.1886	47.29	0.1317	90.25	33
1978	275.47	0.037	12.01	0.036	171.87	404
1979	228.31	0.0749	22.12	0.0633	217.72	217
1980	205.18	0.0651	18.38	0.054	181.4	175
1981	164.77	0.0328	10.62	0.0264	167.82	284
1982	112.4	0.045	13.92	0.0359	45.92	70
1983	116.39	0.0397	12.19	0.0339	122.35	71
1984	169.35	0.0222	6.52	0.0184	178.48	411
1985	257.6	0.0573	17.64	0.0505	247.07	205
1986	145.44	0.0429	14.99	0.0455	82.47	215
1987	113.16	0.034	10.79	0.0266	87.58	246
1988	124.7	0.0371	11.32	0.0325	134.27	240
1989	112.25	0.0349	10.8	0.0367	89.76	251
1990	132.12	0.0423	13.04	0.0377	115.49	234
1991	130.84	0.0482	14.89	0.0437	99.04	238
1992	87.6	0.0274	8.1	0.0257	69.96	251
1993	73.24	0.0258	7.23	0.0243	59.61	259
1994	82.17	0.0231	7.76	0.025	57.59	257
1995	96.66	0.034	9.3	0.0307	72.29	247
1996	118.95	0.0382	12.37	0.0469	85.96	252
1997	82.95	0.0229	7.79	0.0225	75.59	273

Table G.4 - continued

Year	**Mean**	**$MCSE_{Mean}$**	**SD**	**$MCSE_{SD}$**	**OBS Mean**	**OBS Count**
1998	58.15	0.0126	4.64	0.0121	41.83	383
1999	172.48	0.0428	15.65	0.0429	149.16	250
2000	152.73	0.0473	14.26	0.0449	124.32	258
2001	153.66	0.0599	15.49	0.0497	112.36	255
2002	123.54	0.0338	11.3	0.0292	96.4	258
2003	125.48	0.0261	8.35	0.0206	113.77	281
2004	106.87	0.0229	7.95	0.0218	87.49	282
2005	107.24	0.0265	7.79	0.0209	95.23	275
2006	87.35	0.0216	6.93	0.0257	74.81	275

APPENDIX H

PREDICTED SAMPLING SITE MEAN ZOOPLANKTON YIELDS

Table H.1: Model 1.1 Predicted Sampling Site Mean Zooplankton Yields.

Site	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
66.7-80	185.87	0.0223	6.37	0.0147	209.41	58
66.7-70	238.53	0.0326	9	0.0201	356.81	66
66.7-65	274.1	0.0358	10.83	0.0276	470.38	56
66.7-60	297.04	0.0357	11.37	0.0257	433.27	90
66.7-55	310.31	0.0378	11.62	0.0301	420.21	117
66.7-50	314.81	0.0363	11.08	0.023	366.54	107
66.7-49	319.58	0.0386	12.33	0.0301	326.63	21
70-80	181.52	0.0192	5.73	0.0128	261.15	118
70-70	250.4	0.0336	8.84	0.0189	436.09	126
70-65	267.66	0.0423	12.44	0.0307	332.87	45
70-60	285.34	0.0518	12.9	0.0328	352.75	124
70-55	307.01	0.0461	14.49	0.0363	411.03	59
70-51	285.79	0.0282	9.98	0.0242	375.72	74
73.3-80	173.57	0.023	6	0.0131	306.6	68
73.3-70	220.82	0.0374	10.11	0.0228	300.79	81
73.3-65	257.11	0.0565	13.98	0.0316	277.79	36
73.3-60	282.74	0.0616	15.1	0.0323	341.36	118
73.3-55	299.28	0.0658	16.89	0.0382	278.32	37
73.3-50	283.58	0.0292	8.56	0.0167	550.19	86
76.7-100	100.42	0.0142	3.63	0.0084	61.8	84
76.7-90	132.03	0.0189	5.48	0.0123	113.66	138
76.7-80	172.63	0.0377	8.37	0.0205	156.8	149
76.7-70	214.89	0.0608	12.41	0.039	181.88	162
76.7-60	287.54	0.0977	19.36	0.079	272.23	169
76.7-55	280.63	0.0929	18.95	0.0666	248.71	209
76.7-51	265.5	0.0567	13.48	0.0303	215.45	149
76.7-49	233.55	0.0242	7.7	0.0173	262.27	82
80-100	96.47	0.0135	3.54	0.008	82.18	132
80-90	135.6	0.0266	5.78	0.0169	146.97	235
80-80	166.88	0.0498	9.72	0.0313	160.99	248

Table H.1 - continued

Site	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
80-70	229.73	0.0798	15.42	0.0658	251.52	252
80-60	274.04	0.1362	25.13	0.1398	259.81	256
80-55	266.08	0.1363	24.58	0.1337	233.7	252
80-51	263.75	0.0626	13.56	0.0421	277.8	218
83.3-110	70.75	0.0081	2.62	0.0062	47.29	75
83.3-100	94.64	0.0157	4.5	0.0113	56.45	93
83.3-90	124.88	0.0322	6.83	0.0196	114.8	186
83.3-80	158.27	0.0593	11.34	0.0446	137.97	195
83.3-70	198.18	0.0982	17.54	0.0874	175.51	209
83.3-60	251.93	0.1586	28.99	0.1855	226.15	248
83.3-55	256.17	0.1745	29.53	0.1942	214.23	233
83.3-51	221.42	0.1017	19.27	0.0884	158.82	243
83.3-42	205.93	0.0292	8.65	0.0177	153.84	128
83.3-40.6	203.7	0.022	7.75	0.0182	186.11	124
86.7-110	63.51	0.0072	2.47	0.0049	34.63	75
86.7-100	85.91	0.016	4.28	0.0105	47.22	90
86.7-90	116.31	0.0283	6.33	0.0191	115.33	184
86.7-80	147.35	0.0499	9.93	0.035	138.17	192
86.7-70	183.69	0.0787	14.68	0.0688	176.27	202
86.7-60	233.47	0.1289	23.3	0.1576	240.74	238
86.7-55	228.79	0.1377	24.73	0.1556	184.66	225
86.7-50	271.05	0.0819	16.41	0.0708	324.65	238
86.7-45	202.71	0.0384	9.95	0.029	192.49	230
86.7-40	172.5	0.0217	6.72	0.0164	171.36	232
86.7-35	162.93	0.0173	5.52	0.0123	157.59	233
86.7-33	179.92	0.0144	5.01	0.0121	245.23	148
90-120	45.27	0.0051	1.58	0.0037	33.11	122
90-110	59.64	0.0083	2.56	0.0057	42.46	110
90-100	74.19	0.013	3.53	0.0094	52.22	166
90-90	95.59	0.0192	4.48	0.0102	93.76	232
90-80	118.88	0.0313	6.38	0.0185	111.99	244
90-70	159.3	0.0422	8.22	0.0307	177.72	261
90-60	176.35	0.0646	12.18	0.0558	171.8	271
90-53	195.45	0.0729	13.84	0.0564	148.62	196
90-45	188.71	0.034	8.57	0.0224	184.52	270
90-37	146.66	0.0189	5.96	0.0131	123.46	272
90-35	142.32	0.0237	6.52	0.016	79.74	103
90-30	132.61	0.0162	5	0.0112	105.57	212
90-28	138.56	0.0145	4.17	0.0094	141.39	260
93.3-120	39.64	0.0046	1.41	0.0029	24.76	96
93.3-110	49.77	0.0063	2.06	0.0052	30.13	96
93.3-100	62.23	0.0079	2.56	0.0056	51.82	138
93.3-90	78.68	0.0102	2.79	0.0074	87.27	205
93.3-80	97.85	0.0142	3.44	0.0087	116.02	219
93.3-70	131.9	0.0162	4.05	0.0091	185.51	230
93.3-60	128.39	0.0214	4.98	0.0135	141.34	240
93.3-55	140.48	0.0232	5.58	0.0148	160.04	209

Table H.1 - continued

Site	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
93.3-50	144.33	0.0215	5.54	0.011	148.92	262
93.3-45	148.81	0.0162	5.43	0.0128	157.8	219
93.3-40	134.42	0.0141	4.71	0.0106	132.88	263
93.3-35	126.24	0.0141	4.46	0.0102	120.83	221
93.3-30	113.66	0.0123	3.9	0.0083	101.07	263
93.3-28	116.2	0.0121	4.05	0.0095	110.04	173
93.3-26.7	112.49	0.0108	3.61	0.0081	108.16	111

Table H.2: Model 2.1 Predicted Sampling Site Mean Zooplankton Yields.

Site	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
66.7-80	293.18	0.0829	22.59	0.0507	209.41	58
66.7-70	323.87	0.0747	20.11	0.0476	356.81	66
66.7-65	351.81	0.0727	20.67	0.0481	470.38	56
66.7-60	370.88	0.0816	20.83	0.0589	433.27	90
66.7-55	382.76	0.0854	21.64	0.0524	420.21	117
66.7-50	457.02	0.1358	42.95	0.1262	366.54	107
66.7-49	538.12	0.2048	65.29	0.214	326.63	21
70-80	241.22	0.0474	14.46	0.0342	261.15	118
70-70	288.21	0.0461	13.43	0.0325	436.09	126
70-65	291.5	0.0581	15.21	0.0417	332.87	45
70-60	306.05	0.058	14.84	0.0366	352.75	124
70-55	325.74	0.0642	16.71	0.0388	411.03	59
70-51	360.14	0.0759	21.74	0.0492	375.72	74
73.3-80	222.03	0.0469	12.28	0.0288	306.6	68
73.3-70	239.58	0.0399	11.67	0.0278	300.79	81
73.3-65	257.57	0.0464	12.97	0.0295	277.79	36
73.3-60	277.47	0.0469	12.47	0.0295	341.36	118
73.3-55	287.85	0.0573	14.4	0.0286	278.32	37
73.3-50	376.24	0.0794	23.93	0.0647	550.19	86
76.7-100	142.41	0.0369	11.51	0.0324	61.8	84
76.7-90	153.67	0.0332	9.36	0.0281	113.66	138
76.7-80	176.81	0.0335	8.54	0.0212	156.8	149
76.7-70	207.03	0.0359	9.39	0.0235	181.88	162
76.7-60	261.75	0.0386	10.94	0.0299	272.23	169
76.7-55	254.1	0.0387	10.73	0.0264	248.71	209
76.7-51	260.83	0.0485	12.82	0.0314	215.45	149
76.7-49	400.02	0.1303	40.83	0.1355	262.27	82
80-100	119.37	0.0269	7.88	0.0193	82.18	132
80-90	137.77	0.0256	6.43	0.0177	146.97	235
80-80	157.22	0.0246	6.67	0.0147	160.99	248
80-70	209.11	0.0308	7.36	0.0185	251.52	252
80-60	235.68	0.0344	8.63	0.0233	259.81	256

Table H.2 - continued

Site	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
80-55	226.71	0.0354	9.02	0.0272	233.7	252
80-51	254.08	0.0385	10.26	0.0258	277.8	218
83.3-110	99.96	0.0273	8.32	0.0215	47.29	75
83.3-100	101.13	0.0225	6.15	0.014	56.45	93
83.3-90	119.03	0.0217	5.68	0.0167	114.8	186
83.3-80	140.55	0.0243	6.3	0.0151	137.97	195
83.3-70	169.07	0.0273	6.92	0.0166	175.51	209
83.3-60	205.97	0.0283	7.73	0.0206	226.15	248
83.3-55	206.52	0.0309	8.29	0.0208	214.23	233
83.3-51	190.09	0.0362	8.95	0.0234	158.82	243
83.3-42	228.38	0.0588	14.76	0.0391	153.84	128
83.3-40.6	226.94	0.0612	14.65	0.0409	186.11	124
86.7-110	80.97	0.0203	5.98	0.0164	34.63	75
86.7-100	88.76	0.0202	5.36	0.0139	47.22	90
86.7-90	109.92	0.0176	5.15	0.0151	115.33	184
86.7-80	132.49	0.0243	5.76	0.0136	138.17	192
86.7-70	159.99	0.026	6.48	0.0146	176.27	202
86.7-60	196.41	0.0248	7.02	0.0163	240.74	238
86.7-55	185.26	0.0276	7.63	0.0185	184.66	225
86.7-50	246.7	0.0307	8.7	0.0244	324.65	238
86.7-45	195.04	0.0391	9.55	0.0272	192.49	230
86.7-40	173.15	0.0361	9.71	0.0278	171.36	232
86.7-35	175.94	0.0396	11.19	0.0311	157.59	233
86.7-33	216.57	0.054	14.35	0.0476	245.23	148
90-120	66.4	0.0217	6.54	0.0174	33.11	122
90-110	68.97	0.0156	4.86	0.0118	42.46	110
90-100	77.77	0.0169	4.69	0.0116	52.22	166
90-90	94.4	0.0178	4.49	0.0123	93.76	232
90-80	114.73	0.0185	5.08	0.0141	111.99	244
90-70	154.12	0.0194	5.55	0.0142	177.72	261
90-60	162.9	0.0265	6.41	0.0157	171.8	271
90-53	174.07	0.0295	7.99	0.0205	148.62	196
90-45	183.39	0.0341	8.4	0.0242	184.52	270
90-37	147.47	0.0342	8.45	0.0265	123.46	272
90-35	142.75	0.0344	9.12	0.0281	79.74	103
90-30	142.41	0.0345	10.02	0.0325	105.57	212
90-28	153.38	0.0371	10.29	0.041	141.39	260
93.3-120	60.44	0.0197	6.08	0.017	24.76	96
93.3-110	64.53	0.0165	5.18	0.0132	30.13	96
93.3-100	75.27	0.017	5.08	0.0139	51.82	138
93.3-90	90.91	0.0182	4.97	0.0123	87.27	205
93.3-80	112.76	0.0215	5.64	0.0152	116.02	219
93.3-70	152.25	0.0251	6.54	0.0161	185.51	230
93.3-60	146.95	0.024	7.26	0.019	141.34	240
93.3-55	159.91	0.0294	7.9	0.0202	160.04	209
93.3-50	157.38	0.0319	8.21	0.0223	148.92	262
93.3-45	163.31	0.0334	8.97	0.0221	157.8	219

Table H.2 - continued

Site	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
93.3-40	145.18	0.0355	8.67	0.0294	132.88	263
93.3-35	135.88	0.0312	8.5	0.0277	120.83	221
93.3-30	122.66	0.0323	8.56	0.0288	101.07	263
93.3-28	130.66	0.0324	9.56	0.0342	110.04	173
93.3-26.7	142.37	0.0397	12.43	0.0515	108.16	111

Table H.3: Model 1.2 Predicted Sampling Site Mean Zooplankton Yields.

Site	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
66.7-80	166.65	0.0198	6	0.014	222.1	45
66.7-70	242.02	0.0289	9.57	0.0244	397.8	53
66.7-65	260.92	0.0433	11.56	0.028	371.98	27
66.7-60	303.38	0.0429	12.58	0.0313	431.76	71
66.7-55	324.41	0.0495	13.46	0.0284	421.67	72
66.7-50	324.38	0.0382	12.25	0.0292	373.36	72
66.7-49	322.56	0.0439	13.04	0.0312	326.63	21
70-80	169.61	0.0206	6.17	0.0143	228.66	73
70-70	237.9	0.0331	9.9	0.0218	369.57	78
70-65	259.35	0.0412	13.13	0.0312	325.29	35
70-60	274.85	0.0539	13.74	0.0358	315.01	77
70-55	313.11	0.0636	16.52	0.0384	196.57	21
70-51	307.09	0.0408	11.56	0.0269	404.28	63
73.3-80	163.77	0.02	6.34	0.0157	248.37	53
73.3-70	221.73	0.0389	11.07	0.029	270.9	62
73.3-65	258.02	0.0443	14.76	0.0351	299.92	30
73.3-60	272.15	0.0492	15.27	0.0367	305.71	79
73.3-55	295.45	0.064	17.34	0.0443	225.29	14
73.3-50	305.03	0.0334	10.39	0.0224	558.37	60
76.7-100	89.35	0.0099	3.38	0.0075	61.8	84
76.7-90	119.34	0.0178	5.1	0.011	100.3	121
76.7-80	167.14	0.0302	8.45	0.0187	129.12	131
76.7-70	208.96	0.0472	11.93	0.0285	155.84	140
76.7-60	261.44	0.0616	15.57	0.0468	259.87	141
76.7-55	257.56	0.0613	16.37	0.0433	193.06	153
76.7-51	262.48	0.047	13.25	0.0315	215.45	149
76.7-49	253.13	0.026	8.92	0.0212	262.27	82
80-100	86.62	0.0105	3.36	0.0079	73.35	103
80-90	124.02	0.0213	5.52	0.0132	127.88	162
80-80	157.39	0.0303	8.39	0.0211	149.24	167
80-70	211.95	0.0476	11.8	0.0356	232.71	168
80-60	237.59	0.0655	16.3	0.0565	208.81	171
80-55	245.95	0.071	17	0.0539	196.21	168
80-51	273.01	0.0483	13.1	0.0338	273.25	151

Table H.3 - continued

Site	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
83.3-110	60.03	0.0074	2.27	0.006	47.29	75
83.3-100	84.69	0.0143	4.02	0.0097	56.45	93
83.3-90	114.56	0.0217	5.91	0.0145	102.21	151
83.3-80	143.85	0.0319	8.61	0.0236	127.94	158
83.3-70	181.38	0.044	12.18	0.0353	154.53	169
83.3-60	212.16	0.0615	15.34	0.052	200.9	175
83.3-55	216.66	0.0621	16.04	0.0532	184.37	174
83.3-51	212.5	0.0479	13.57	0.0359	158.15	176
83.3-42	214.34	0.0329	9.12	0.0195	153.84	128
83.3-40.6	218.95	0.0304	8.64	0.0186	186.11	124
86.7-110	56.35	0.0072	2.29	0.0056	34.63	75
86.7-100	76.49	0.0138	3.82	0.0084	47.22	90
86.7-90	100.58	0.0192	5.29	0.0142	89.4	150
86.7-80	136.19	0.0301	7.77	0.0206	127.5	155
86.7-70	164.59	0.0377	10.36	0.0287	150.23	161
86.7-60	186.59	0.0515	12.46	0.0381	180.8	168
86.7-55	196.85	0.0588	13.83	0.045	161.49	169
86.7-50	217.81	0.0413	11.11	0.0273	239.85	167
86.7-45	178.45	0.028	8.44	0.0186	159.01	173
86.7-40	168.04	0.0219	6.78	0.0166	175.91	158
86.7-35	159.6	0.0173	6.05	0.0146	138.1	173
86.7-33	195.76	0.017	5.65	0.0116	245.23	148
90-120	40.86	0.0048	1.51	0.0033	29.9	112
90-110	53.53	0.008	2.38	0.0051	35.69	97
90-100	69.67	0.0119	3.4	0.0078	47.34	146
90-90	87.06	0.0154	4.37	0.0105	70.58	173
90-80	110.23	0.0234	5.67	0.0138	96.86	176
90-70	152.72	0.0305	7.66	0.0197	152.73	177
90-60	154.67	0.0311	8.69	0.0246	141.79	179
90-53	170.06	0.0375	9.27	0.0265	146.32	169
90-45	165.1	0.0237	7.34	0.0183	162.78	178
90-37	145.82	0.0172	6.23	0.0149	122.01	182
90-35	145.06	0.0212	6.93	0.0159	73.58	101
90-30	140.31	0.0173	5.96	0.0144	81.97	130
90-28	154.19	0.0149	5.49	0.0131	139.4	178
93.3-120	36.93	0.0047	1.37	0.0027	24.73	95
93.3-110	49.09	0.0069	2.1	0.0048	30.12	95
93.3-100	62.99	0.0089	2.62	0.0059	51.35	135
93.3-90	76.67	0.0103	3.15	0.0066	64.93	165
93.3-80	95.22	0.0141	3.96	0.0093	89.4	168
93.3-70	139.02	0.0177	4.74	0.0116	187.21	171
93.3-60	117.66	0.0171	4.88	0.0112	115.86	173
93.3-55	133.22	0.0195	5.41	0.0133	138.79	169
93.3-50	126.84	0.0164	5.08	0.0117	121.94	173
93.3-45	133.15	0.0143	5	0.0126	134.19	174
93.3-40	126.26	0.0158	4.84	0.0128	122.86	174
93.3-35	125.09	0.0139	4.76	0.0099	114.69	172

Table H.3 - continued

Site	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
93.3-30	118.57	0.0146	4.66	0.0104	92.22	173
93.3-28	126.97	0.0154	4.66	0.0096	115.05	162
93.3-26.7	134.06	0.0139	4.61	0.011	108.16	111

Table H.4: Model 2.2 Predicted Sampling Site Mean Zooplankton Yields.

Site	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
66.7-80	215.15	0.0524	16.39	0.0385	222.1	45
66.7-70	285.7	0.0552	17.78	0.0389	397.8	53
66.7-65	299.74	0.0535	18.73	0.0442	371.98	27
66.7-60	343.68	0.0513	19.82	0.0467	431.76	71
66.7-55	366	0.079	21.42	0.0459	421.67	72
66.7-50	423.19	0.136	38.84	0.1207	373.36	72
66.7-49	479.51	0.1786	56.61	0.1688	326.63	21
70-80	196.15	0.0378	12.15	0.033	228.66	73
70-70	249.85	0.0353	12.5	0.0272	369.57	78
70-65	261.93	0.0456	14.23	0.0316	325.29	35
70-60	275.69	0.0457	14.01	0.0297	315.01	77
70-55	314.06	0.0554	17.41	0.0441	196.57	21
70-51	351.32	0.0627	20.96	0.0489	404.28	63
73.3-80	182.2	0.0357	10.32	0.0277	248.37	53
73.3-70	221.67	0.0382	11.27	0.0271	270.9	62
73.3-65	247.18	0.0409	12.89	0.03	299.92	30
73.3-60	263.7	0.0372	12.68	0.0312	305.71	79
73.3-55	280.47	0.0493	14.82	0.0338	225.29	14
73.3-50	371.8	0.0842	24.42	0.0629	558.37	60
76.7-100	106.88	0.0265	8.24	0.0201	61.8	84
76.7-90	126.95	0.0247	7.53	0.0172	100.3	121
76.7-80	163.36	0.0267	8.18	0.0194	129.12	131
76.7-70	197.81	0.0329	9.39	0.0213	155.84	140
76.7-60	245.14	0.0357	10.4	0.0247	259.87	141
76.7-55	236.39	0.0369	10.88	0.0278	193.06	153
76.7-51	254.11	0.0423	12.28	0.0288	215.45	149
76.7-49	375.73	0.1191	38.49	0.1088	262.27	82
80-100	94.47	0.019	5.88	0.0138	73.35	103
80-90	122.06	0.0166	5.66	0.0139	127.88	162
80-80	148.41	0.0226	6.45	0.0158	149.24	167
80-70	197.88	0.0243	7.57	0.0194	232.71	168
80-60	217.72	0.0282	9.03	0.0215	208.81	171
80-55	221.06	0.0312	9.68	0.0208	196.21	168
80-51	262.34	0.0392	10.94	0.0268	273.25	151
83.3-110	71.07	0.019	5.37	0.0137	47.29	75
83.3-100	83.6	0.0152	4.76	0.0107	56.45	93

Table H.4 - continued

Site	Mean	$\text{MCSE}_{\text{Mean}}$	SD	MCSE_{SD}	OBS Mean	OBS Count
83.3-90	108.47	0.0154	5.07	0.0113	102.21	151
83.3-80	131.82	0.0189	5.89	0.0135	127.94	158
83.3-70	163.96	0.0223	7.07	0.0173	154.53	169
83.3-60	191.56	0.0268	7.78	0.0216	200.9	175
83.3-55	192.09	0.0309	8.28	0.02	184.37	174
83.3-51	191.56	0.0317	8.91	0.0209	158.15	176
83.3-42	227.82	0.047	14.1	0.032	153.84	128
83.3-40.6	234.6	0.0522	14.43	0.0337	186.11	124
86.7-110	61.99	0.0134	4.2	0.0096	34.63	75
86.7-100	73.62	0.0131	4.18	0.0102	47.22	90
86.7-90	94.04	0.0138	4.46	0.0095	89.4	150
86.7-80	126.5	0.0172	5.57	0.0141	127.5	155
86.7-70	150.39	0.0209	6.43	0.016	150.23	161
86.7-60	169.4	0.0229	6.84	0.0149	180.8	168
86.7-55	176.81	0.0255	7.66	0.0181	161.49	169
86.7-50	204.1	0.0247	7.98	0.0176	239.85	167
86.7-45	173.22	0.0267	8.2	0.0213	159.01	173
86.7-40	163.37	0.0274	8.11	0.0199	175.91	158
86.7-35	166.38	0.0369	10.09	0.0251	138.1	173
86.7-33	226.04	0.0453	13.74	0.0381	245.23	148
90-120	49.32	0.0129	4.2	0.0116	29.9	112
90-110	54.41	0.0104	3.44	0.0075	35.69	97
90-100	67.63	0.0118	3.82	0.0089	47.34	146
90-90	83.65	0.0136	4.24	0.0105	70.58	173
90-80	105.96	0.0166	4.92	0.0117	96.86	176
90-70	147.07	0.0202	6.05	0.015	152.73	177
90-60	146.97	0.0222	6.34	0.0163	141.79	179
90-53	159.35	0.022	6.94	0.0176	146.32	169
90-45	160.17	0.0221	7.04	0.0158	162.78	178
90-37	141.97	0.0242	7.27	0.0201	122.01	182
90-35	138.84	0.0303	8.28	0.0182	73.58	101
90-30	144.17	0.0354	10.02	0.0256	81.97	130
90-28	163.41	0.0395	11.12	0.0315	139.4	178
93.3-120	45.76	0.012	4.06	0.0109	24.73	95
93.3-110	54.17	0.0123	3.95	0.0104	30.12	95
93.3-100	66.63	0.0135	4.15	0.0098	51.35	135
93.3-90	80.37	0.0142	4.6	0.0105	64.93	165
93.3-80	101.38	0.0189	5.52	0.0128	89.4	168
93.3-70	148.86	0.0197	6.56	0.0171	187.21	171
93.3-60	127.1	0.0185	6.44	0.0162	115.86	173
93.3-55	142.86	0.0219	7.14	0.0193	138.79	169
93.3-50	134.77	0.0211	7.02	0.0162	121.94	173
93.3-45	141.63	0.0265	7.37	0.018	134.19	174
93.3-40	131.7	0.0244	7.33	0.0161	122.86	174
93.3-35	128.33	0.0258	7.37	0.0207	114.69	172
93.3-30	121.68	0.0255	8.23	0.0216	92.22	173
93.3-28	133.95	0.0331	9.54	0.0265	115.05	162

Table H.4 - continued

Site	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
93.3-26.7	159.13	0.0461	13.85	0.0413	108.16	111

APPENDIX I

PLOT OF PREDICTED SAMPLING SITE MONTHLY MEAN ZOOPLANKTON YIELDS

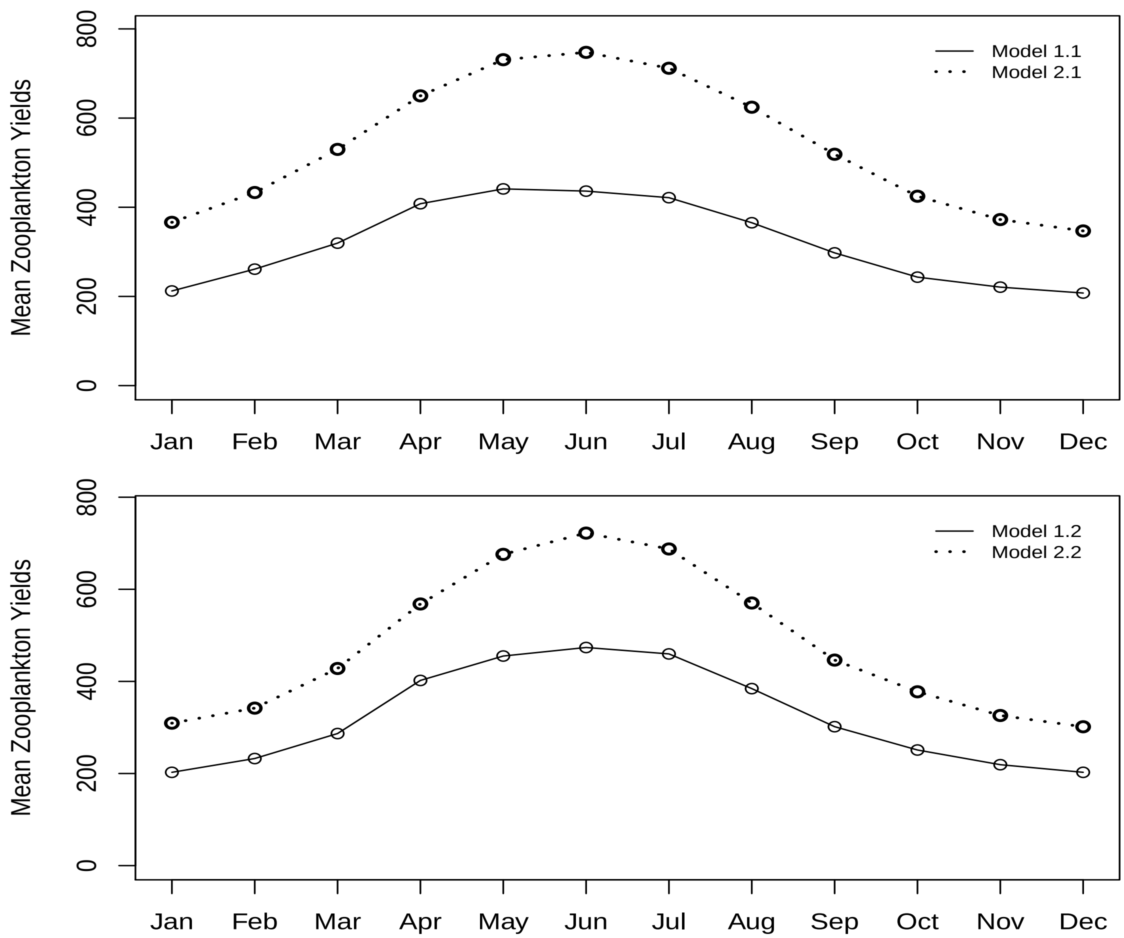


Figure I.1: Predicted Monthly Mean Zooplankton Yields: Sampling Site 66.7-49.

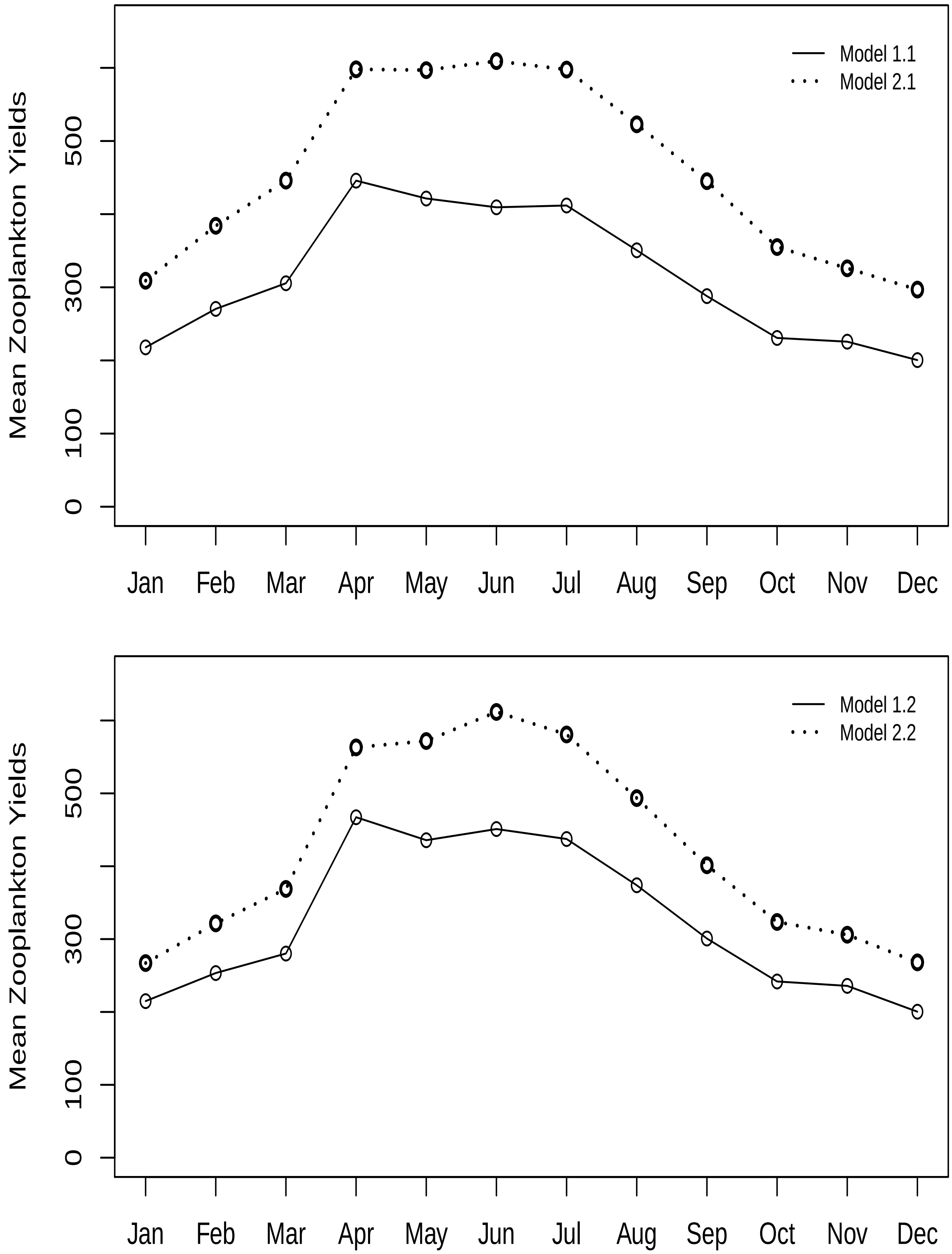
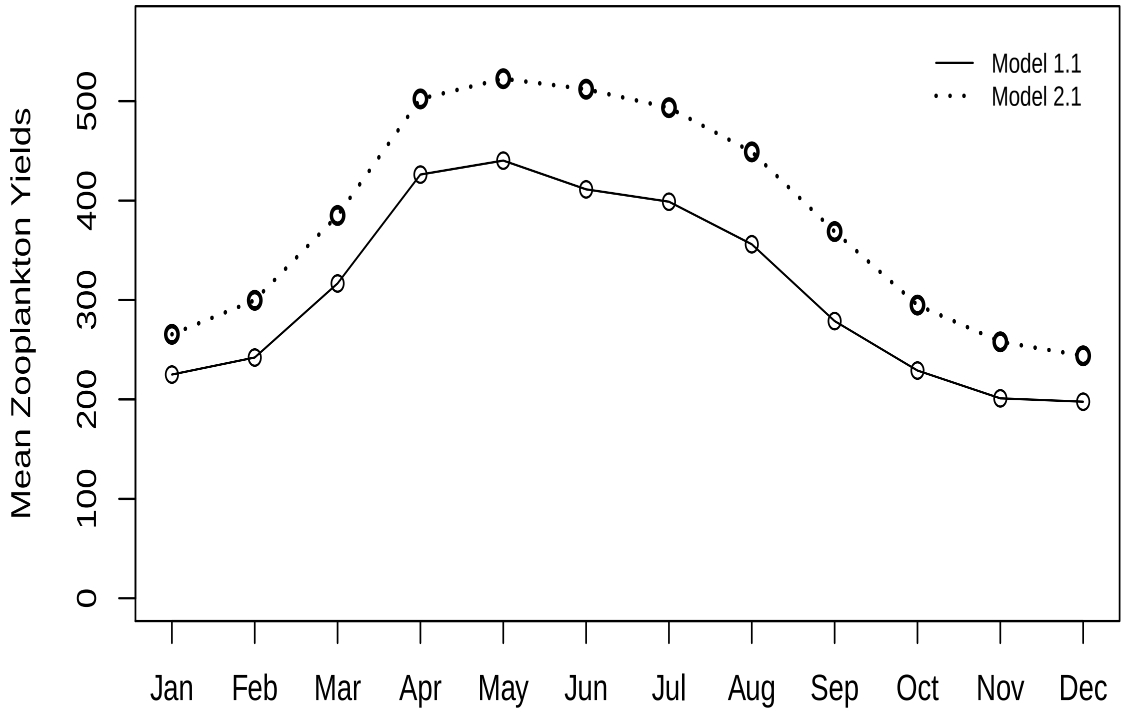


Figure I.2: Predicted Monthly Mean Zooplankton Yields: Sampling Site 66.7-50.



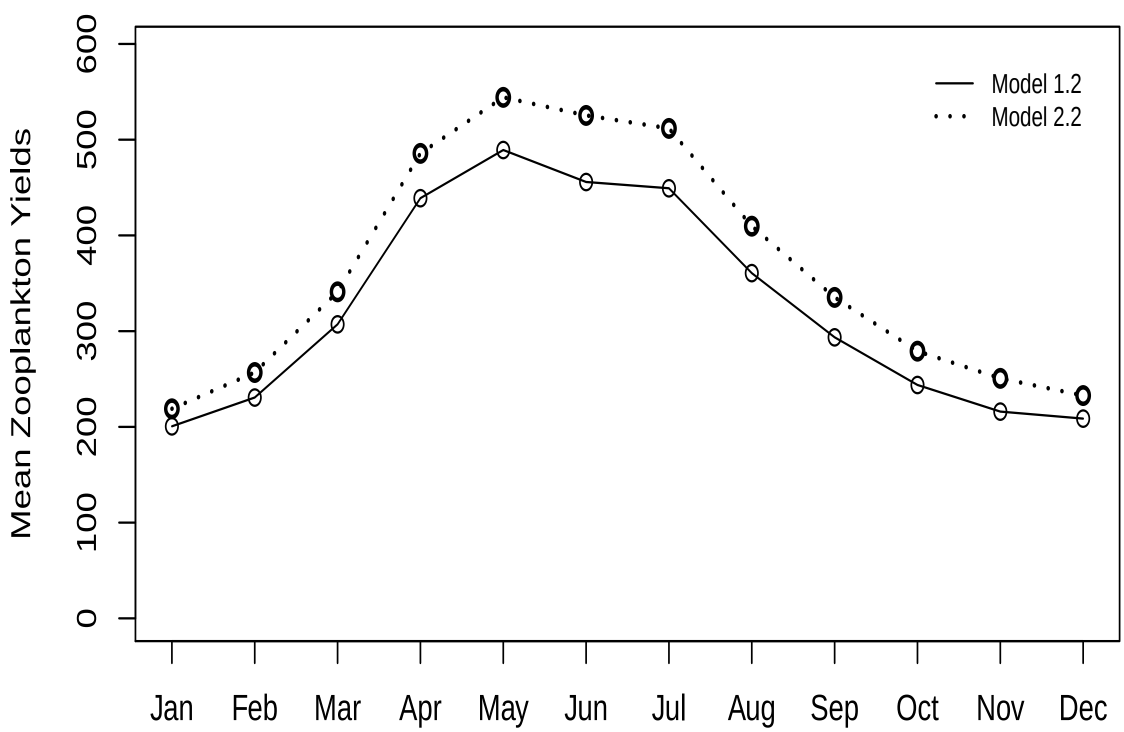


Figure I.3: Predicted Monthly Mean Zooplankton Yields: Sampling Site 66.7-55.

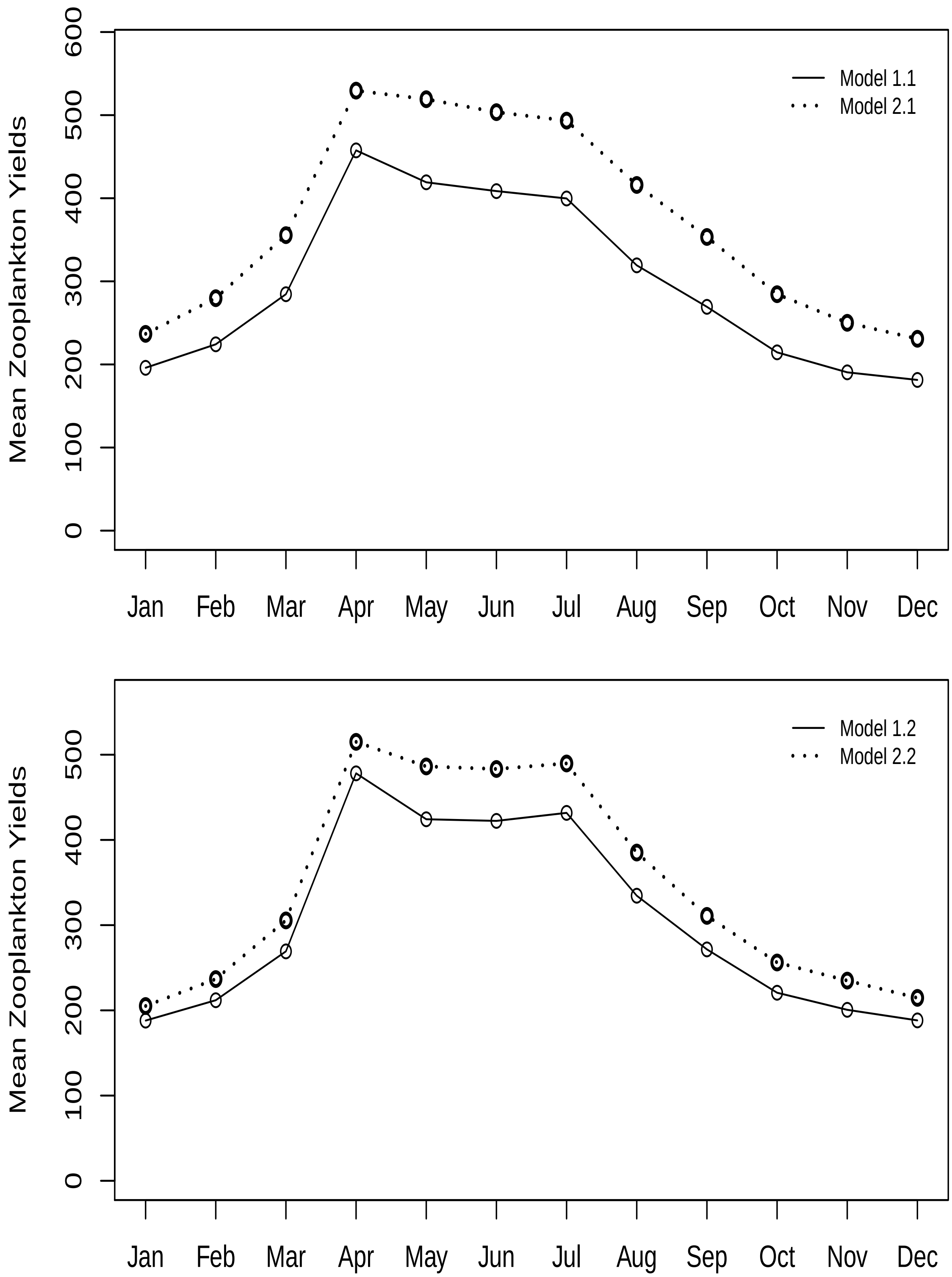


Figure I.4: Predicted Monthly Mean Zooplankton Yields: Sampling Site 66.7-60.

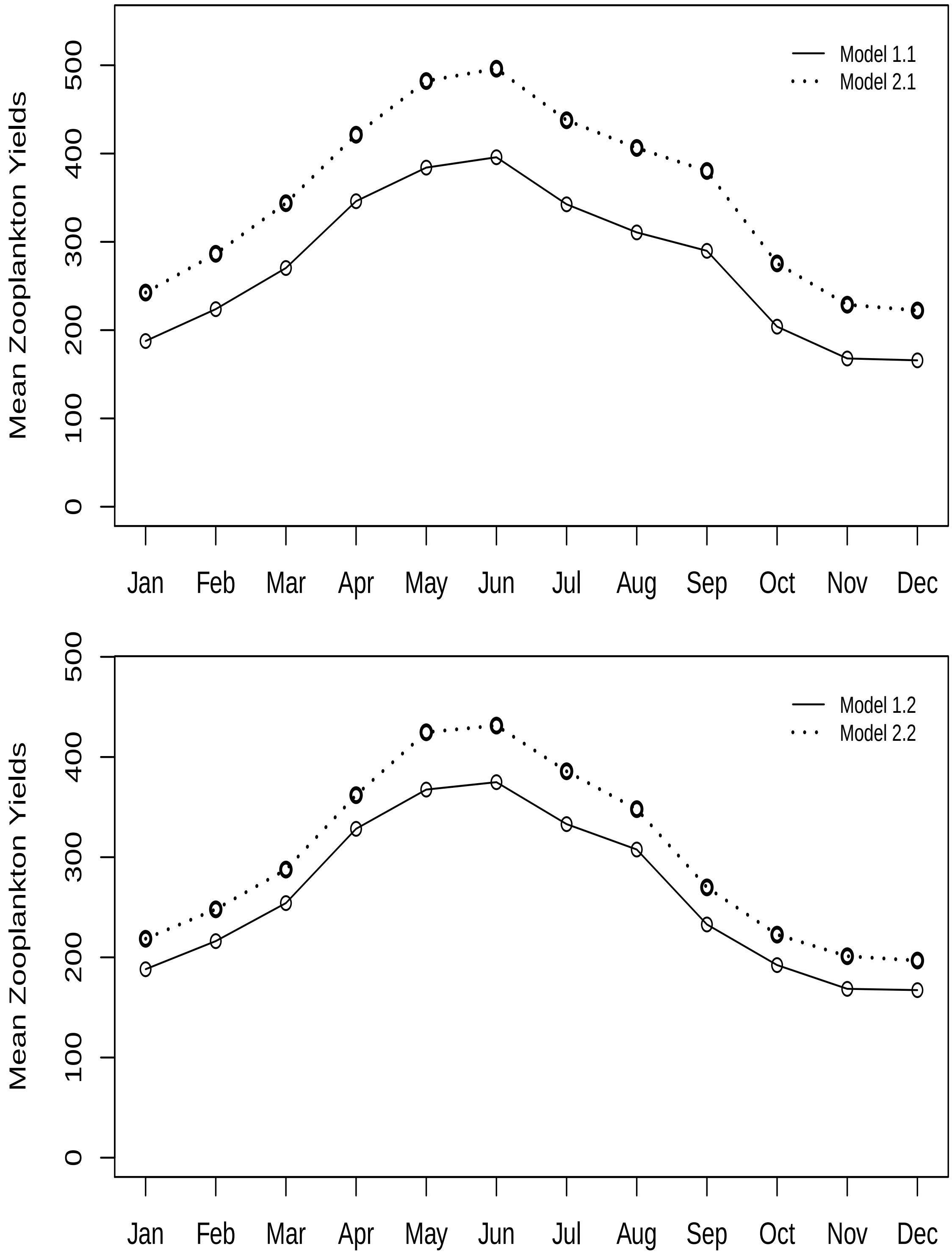


Figure I.5: Predicted Monthly Mean Zooplankton Yields: Sampling Site 66.7-65.

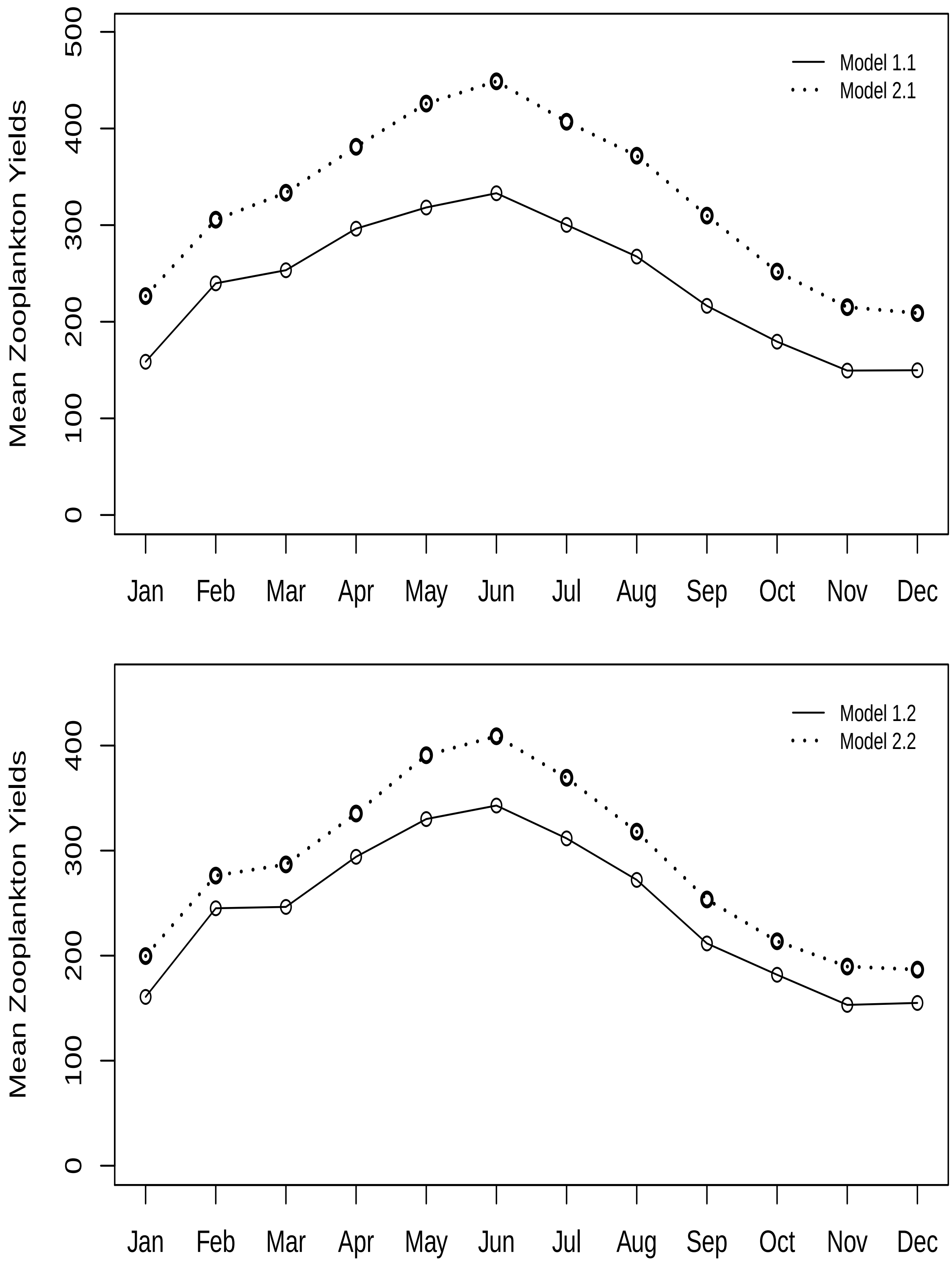


Figure I.6: Predicted Monthly Mean Zooplankton Yields: Sampling Site 66.7-70.

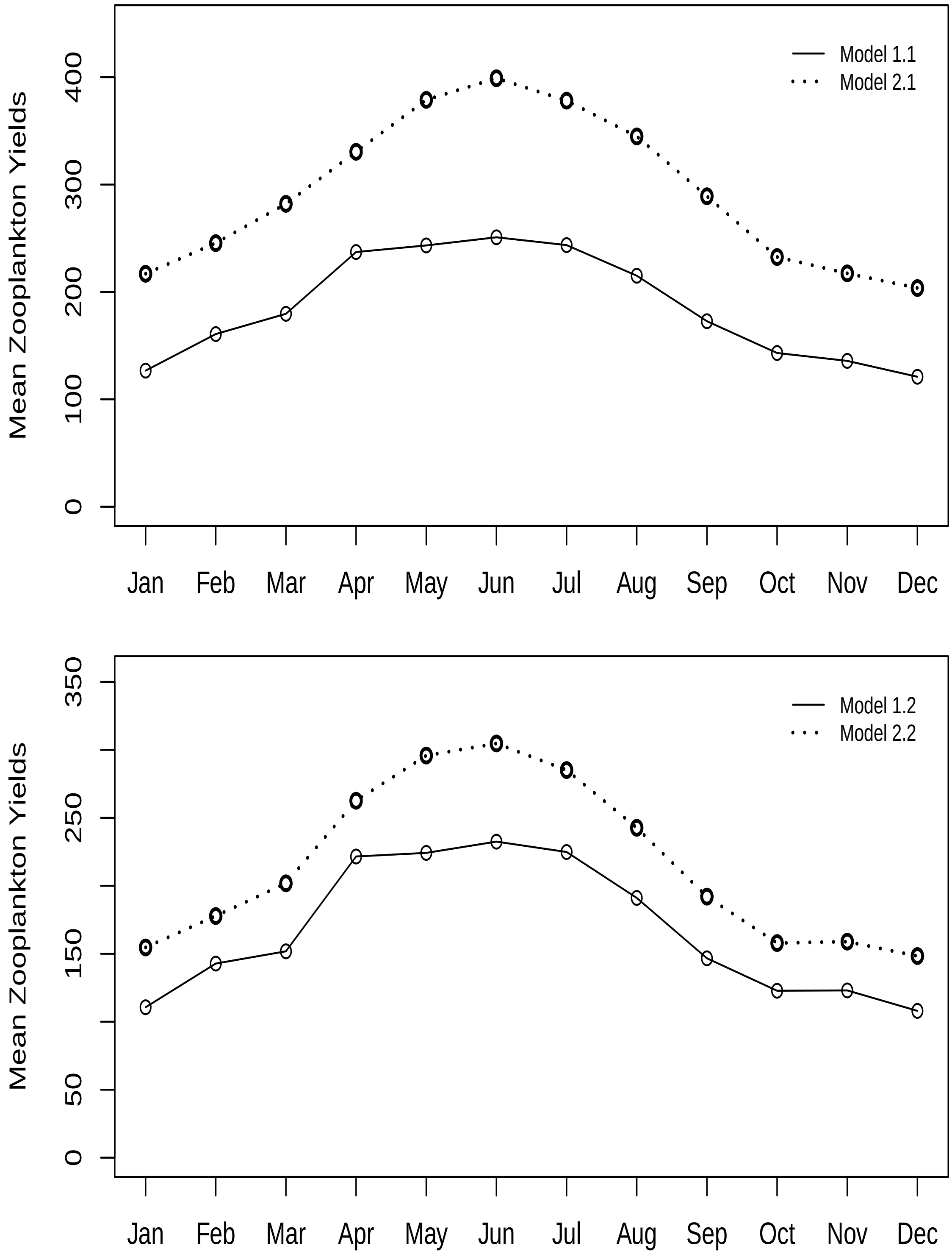


Figure I.7: Predicted Monthly Mean Zooplankton Yields: Sampling Site 66.7-80.

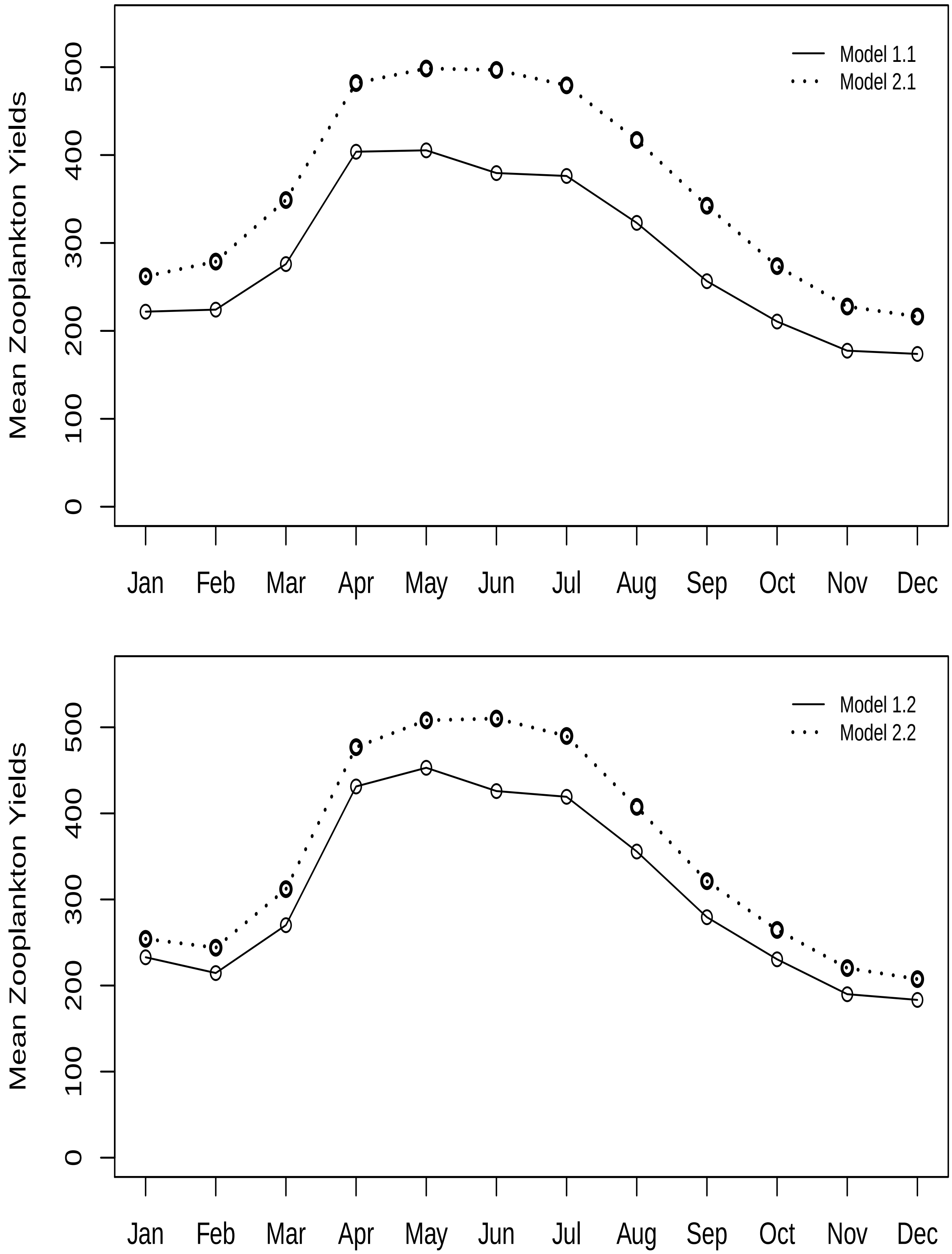


Figure I.8: Predicted Monthly Mean Zooplankton Yields: Sampling Site 70-51.

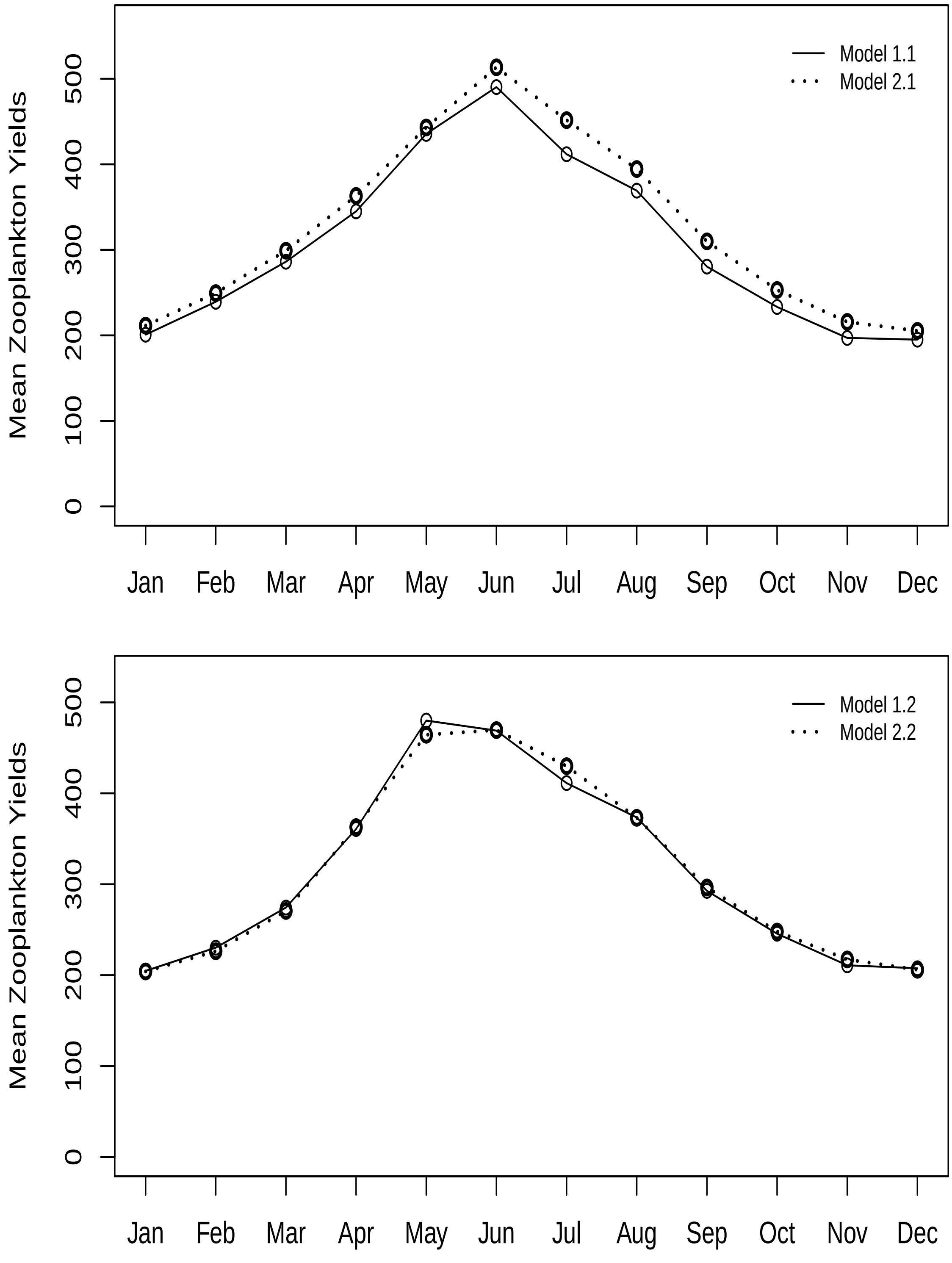


Figure I.9: Predicted Monthly Mean Zooplankton Yields: Sampling Site 70-55.

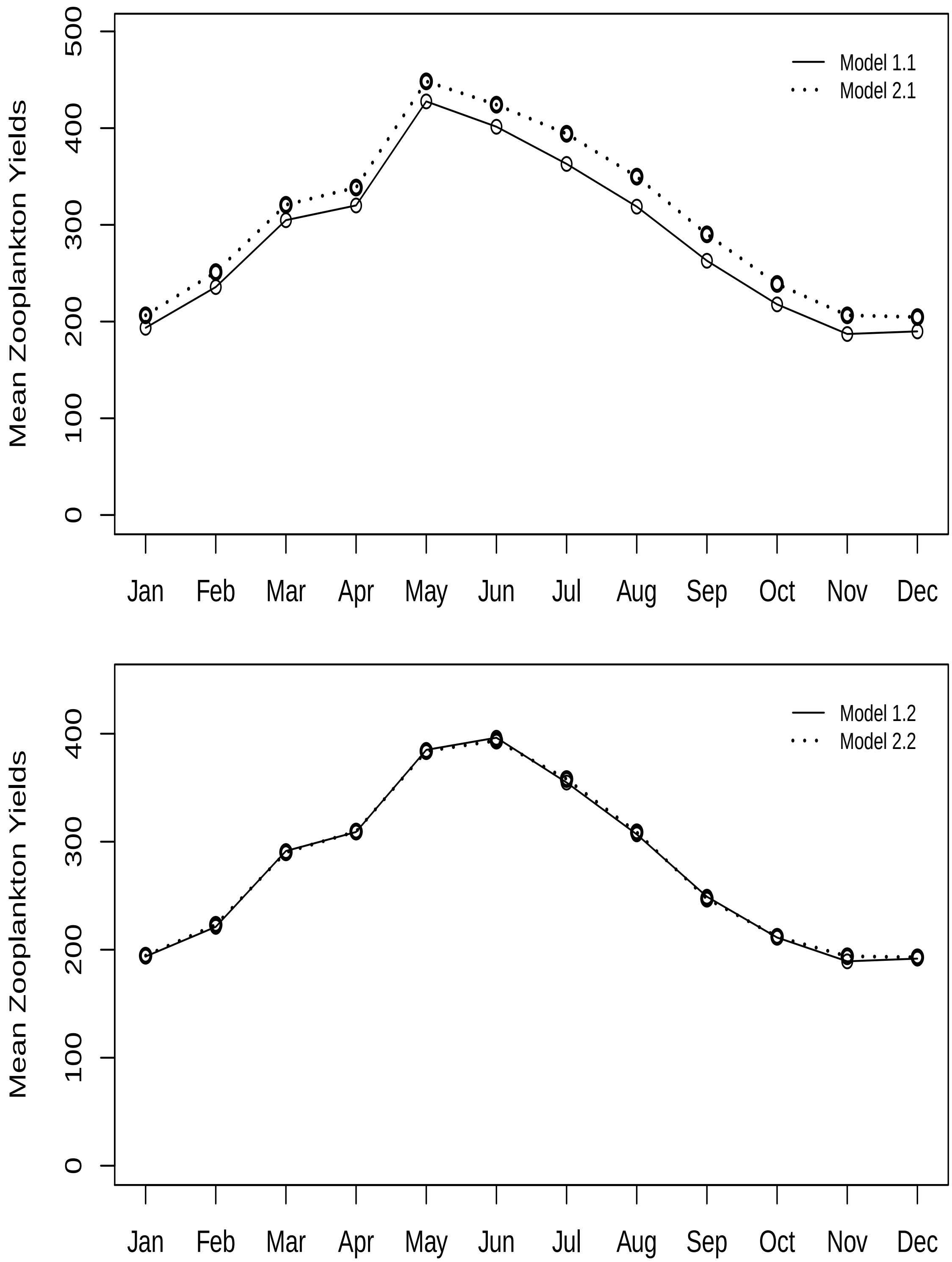


Figure I.10: Predicted Monthly Mean Zooplankton Yields: Sampling Site 70-60.

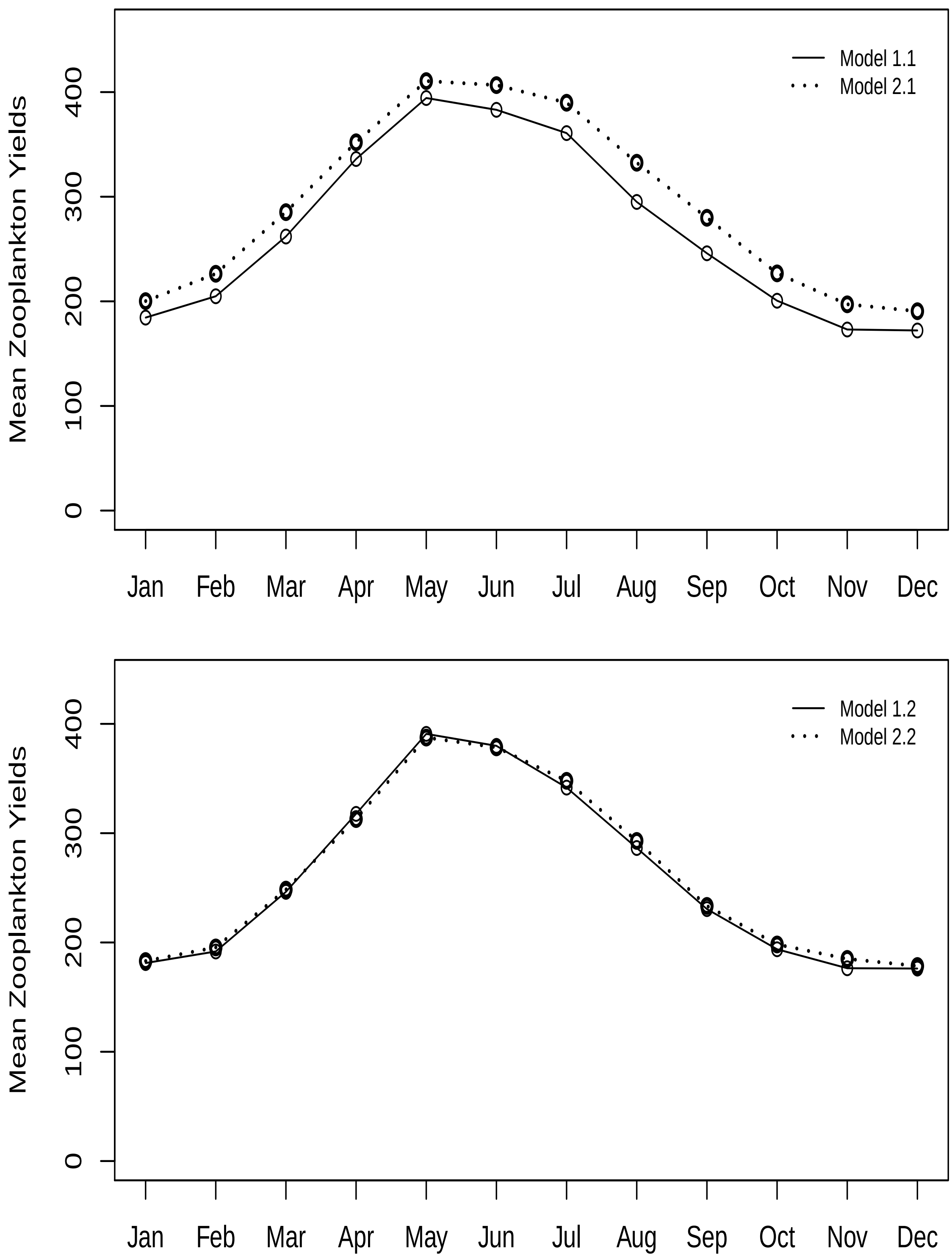


Figure I.11: Predicted Monthly Mean Zooplankton Yields: Sampling Site 70-65.

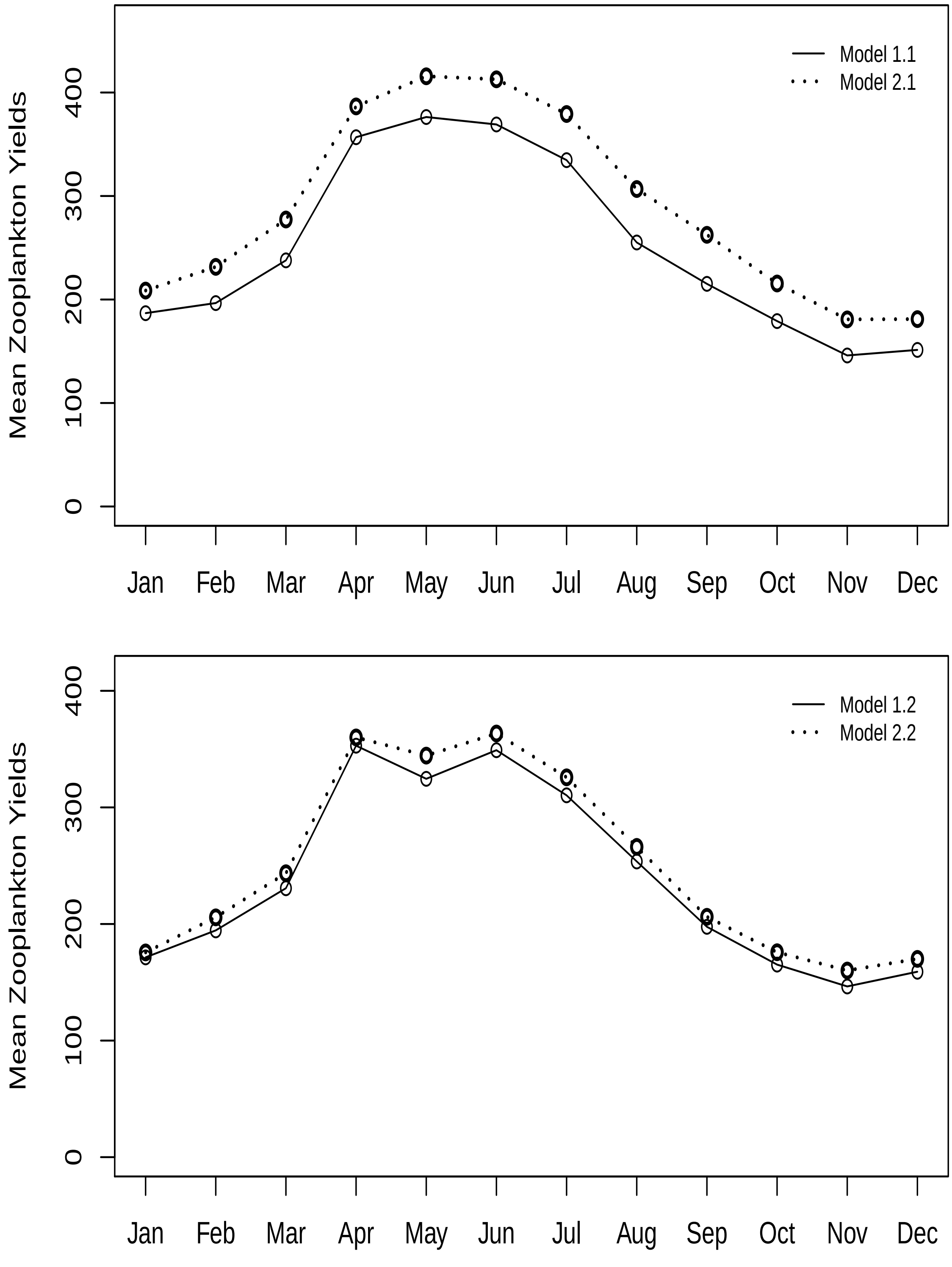


Figure I.12: Predicted Monthly Mean Zooplankton Yields: Sampling Site 70-70.

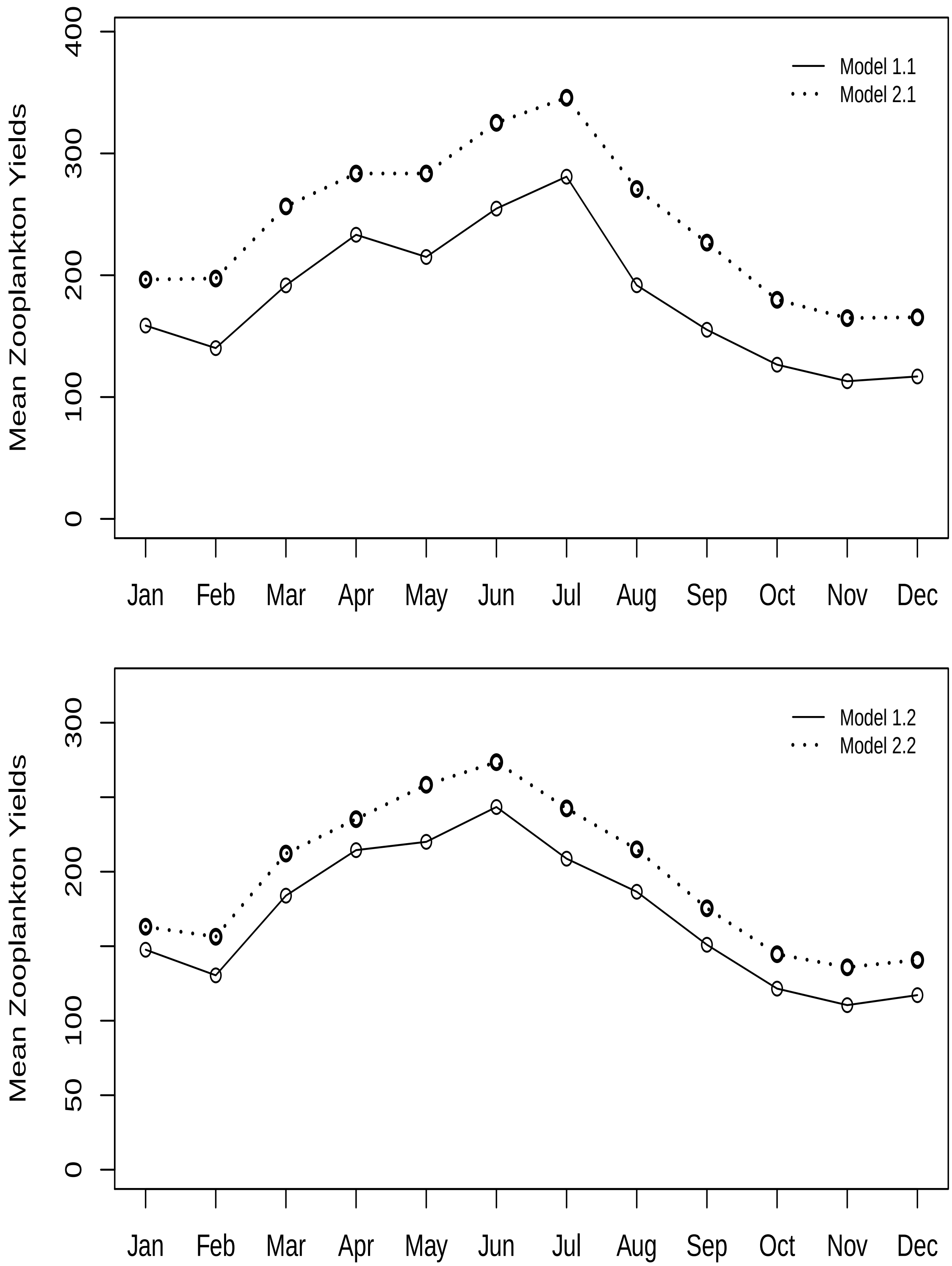


Figure I.13: Predicted Monthly Mean Zooplankton Yields: Sampling Site 70-80.

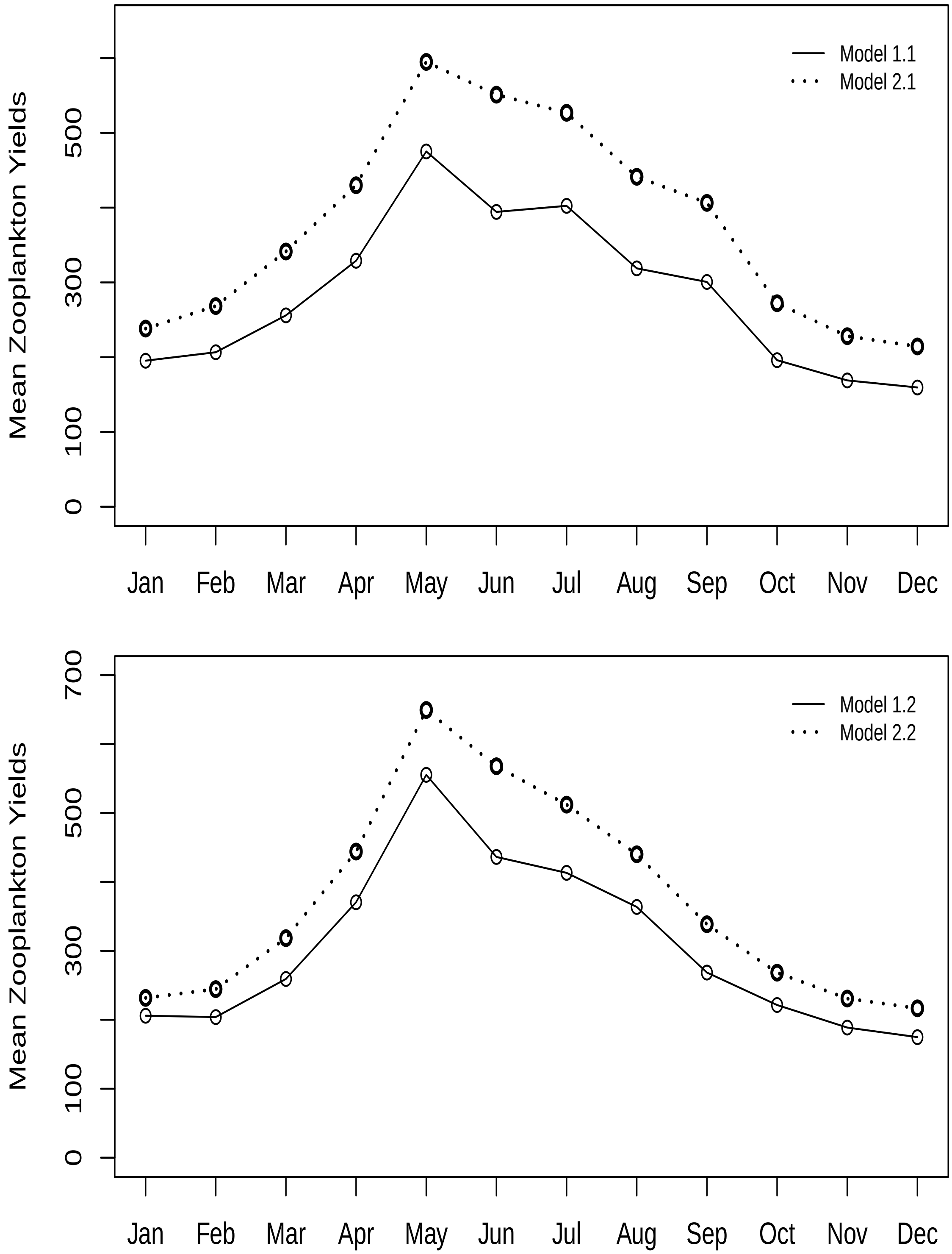


Figure I.14: Predicted Monthly Mean Zooplankton Yields: Sampling Site 73.3-50.

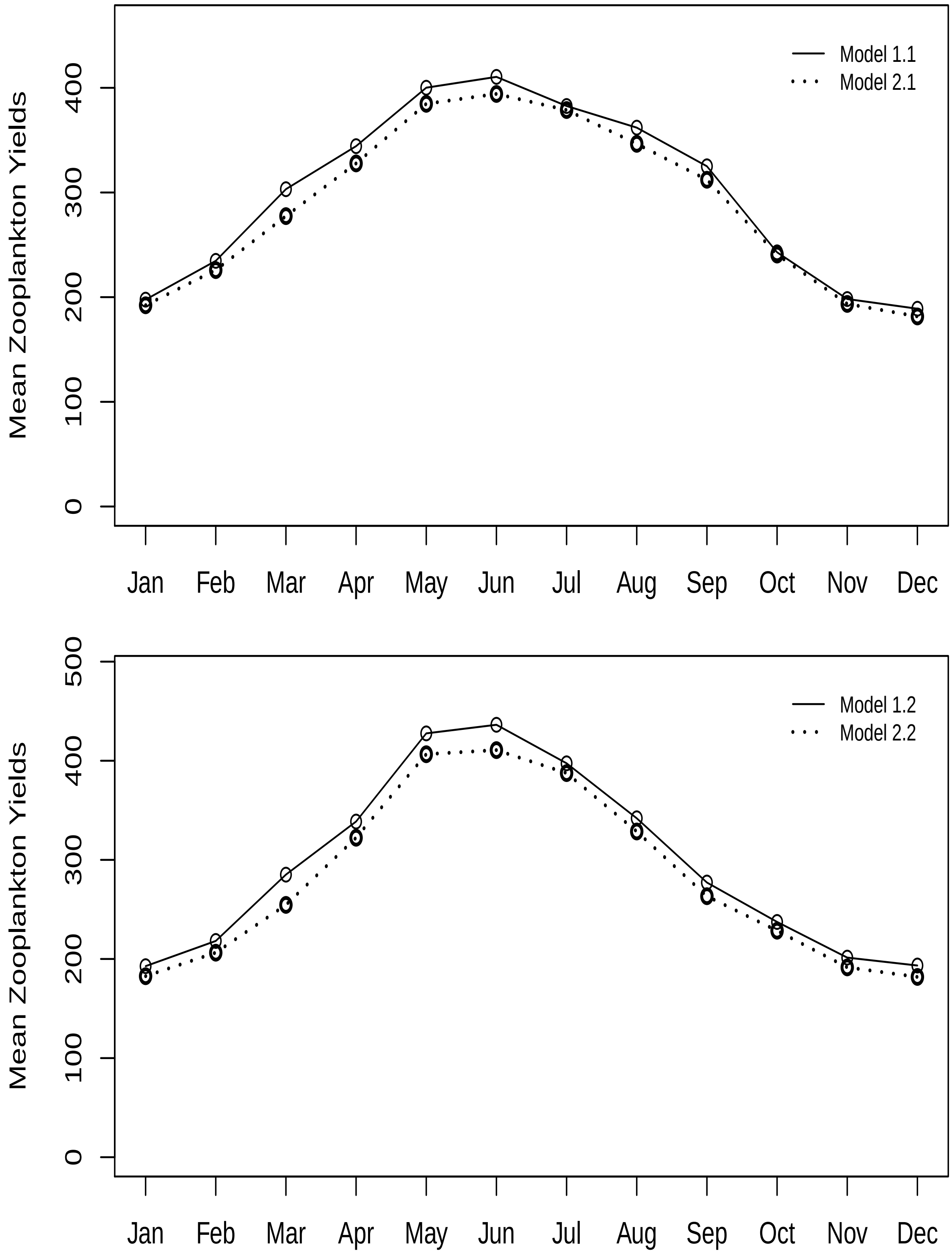


Figure I.15: Predicted Monthly Mean Zooplankton Yields: Sampling Site 73.3-55.

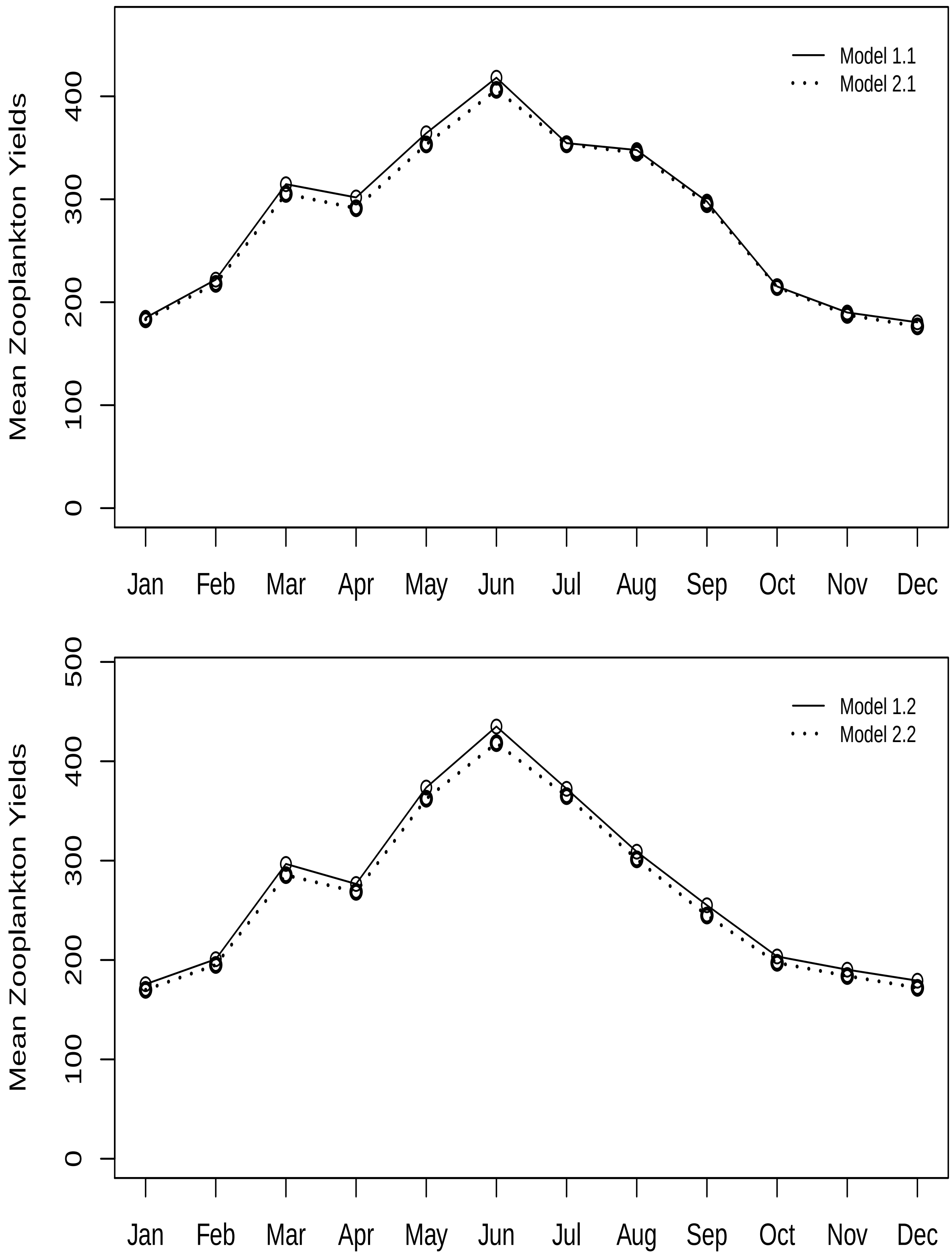


Figure I.16: Predicted Monthly Mean Zooplankton Yields: Sampling Site 73.3-60.

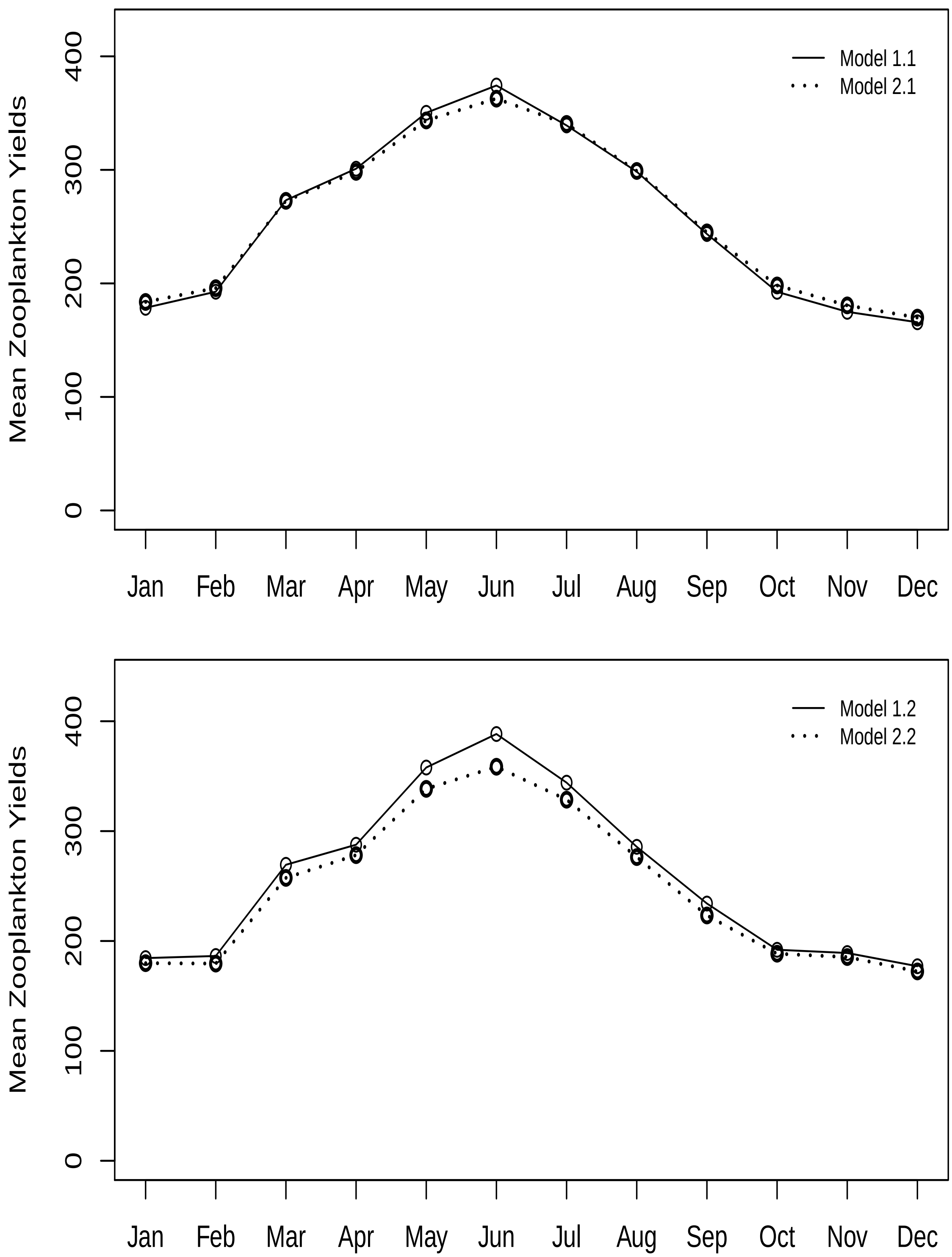


Figure I.17: Predicted Monthly Mean Zooplankton Yields: Sampling Site 73.3-65.

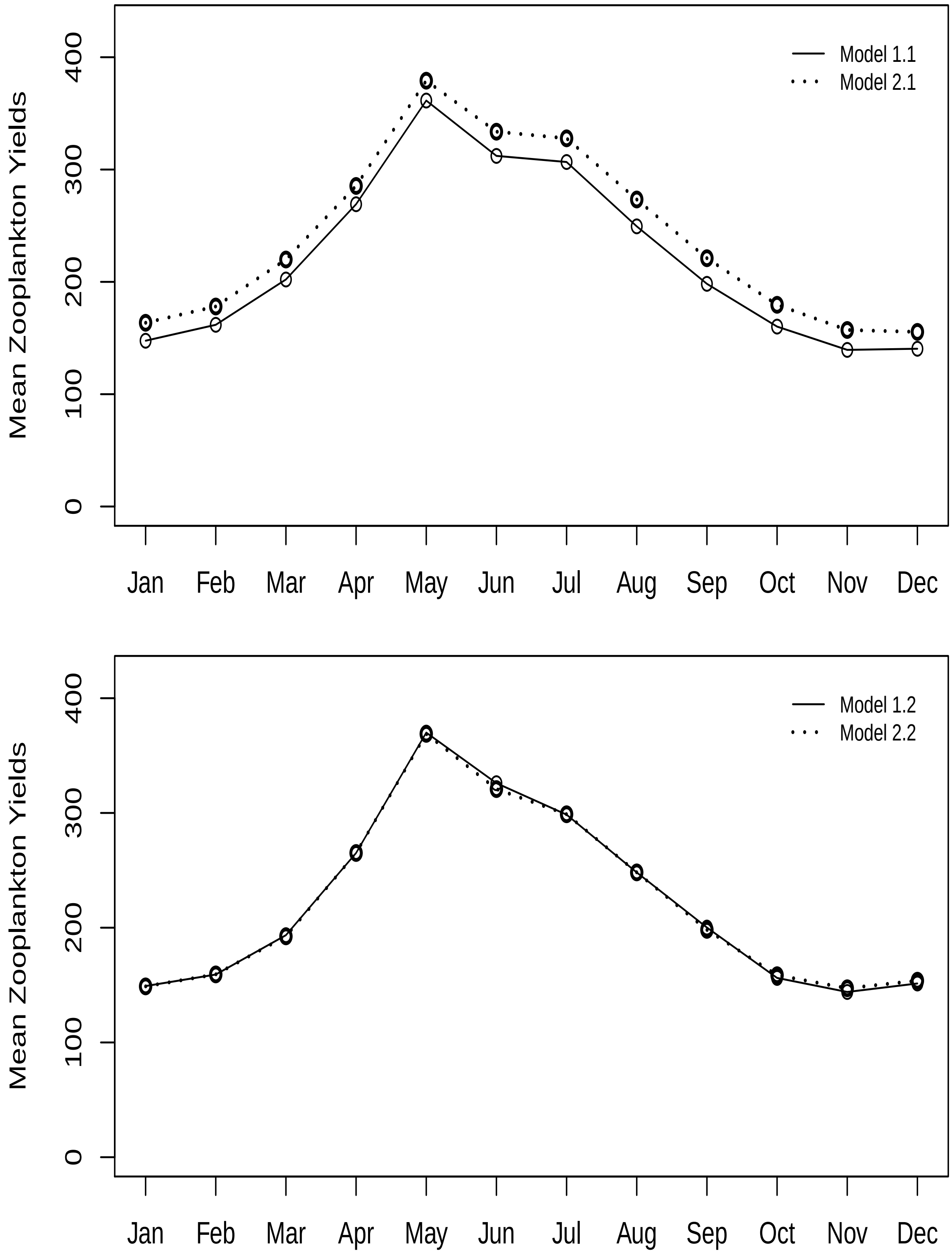


Figure I.18: Predicted Monthly Mean Zooplankton Yields: Sampling Site 73.3-70.

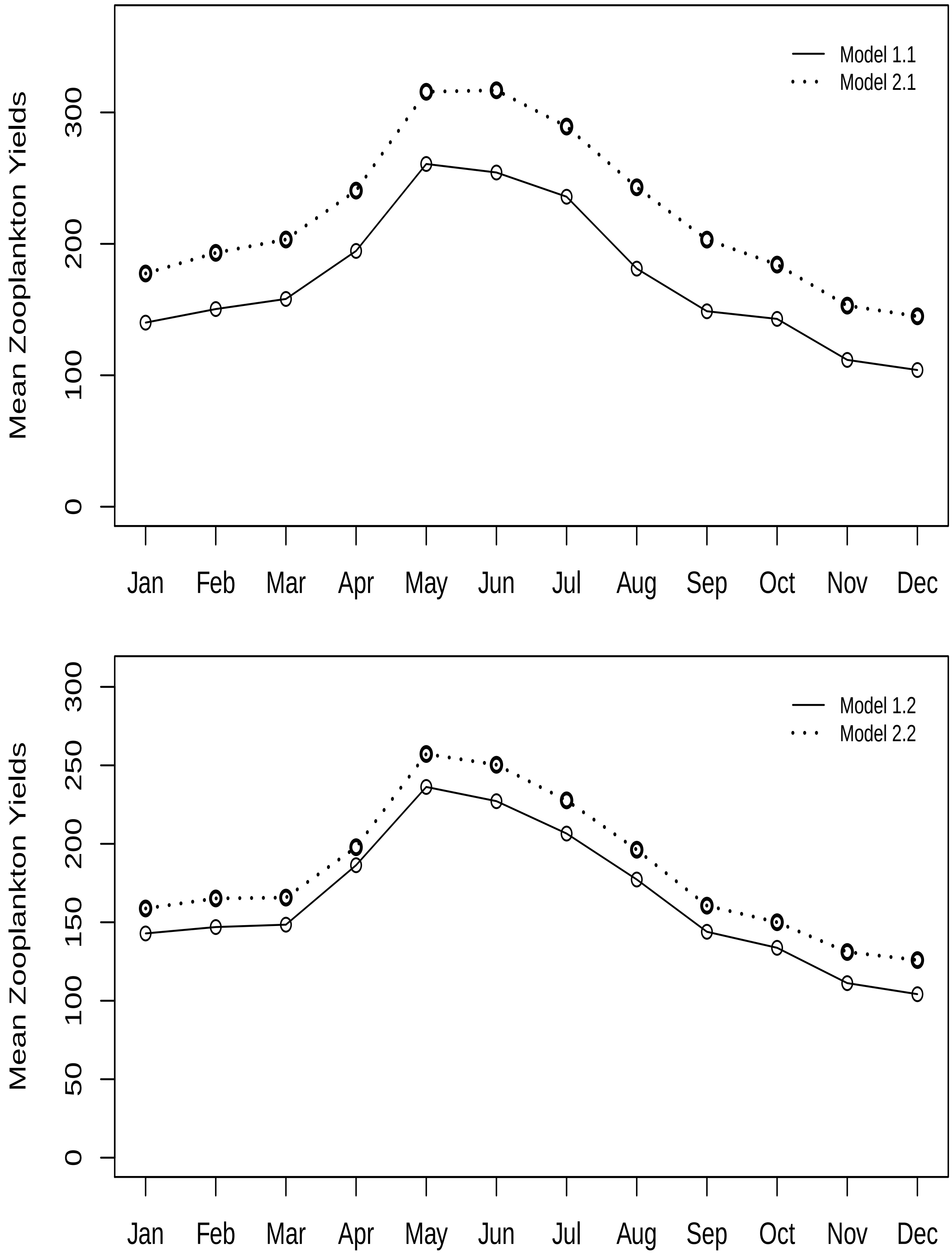
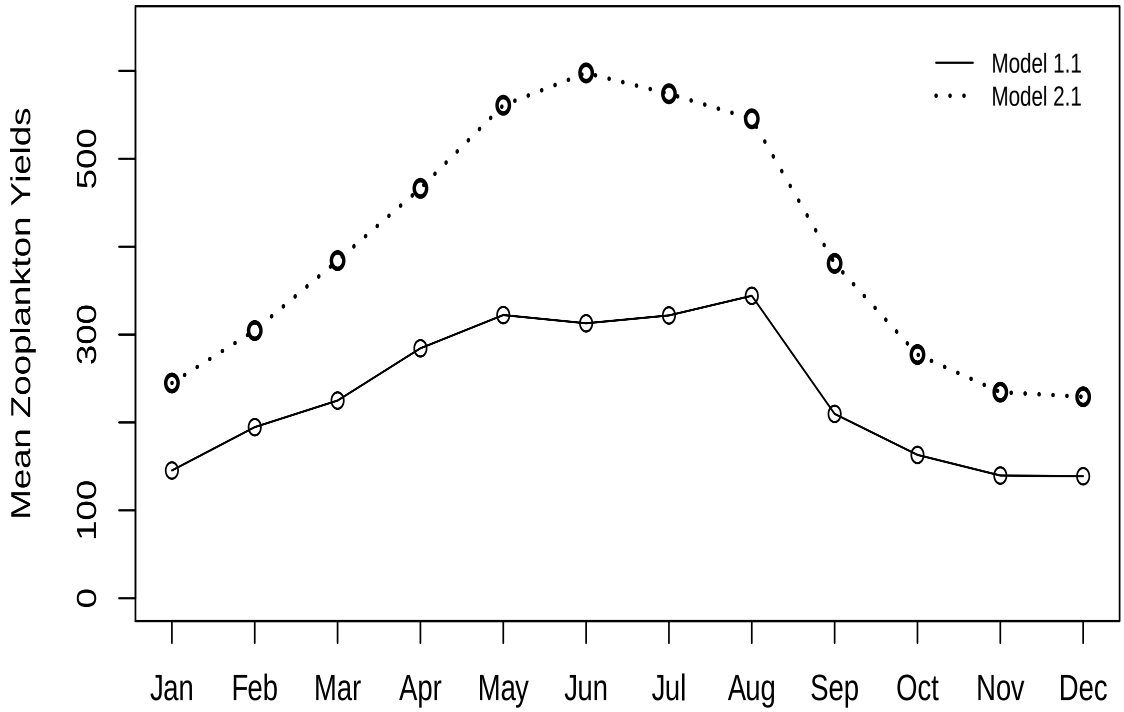


Figure I.19: Predicted Monthly Mean Zooplankton Yields: Sampling Site 73.3-80.



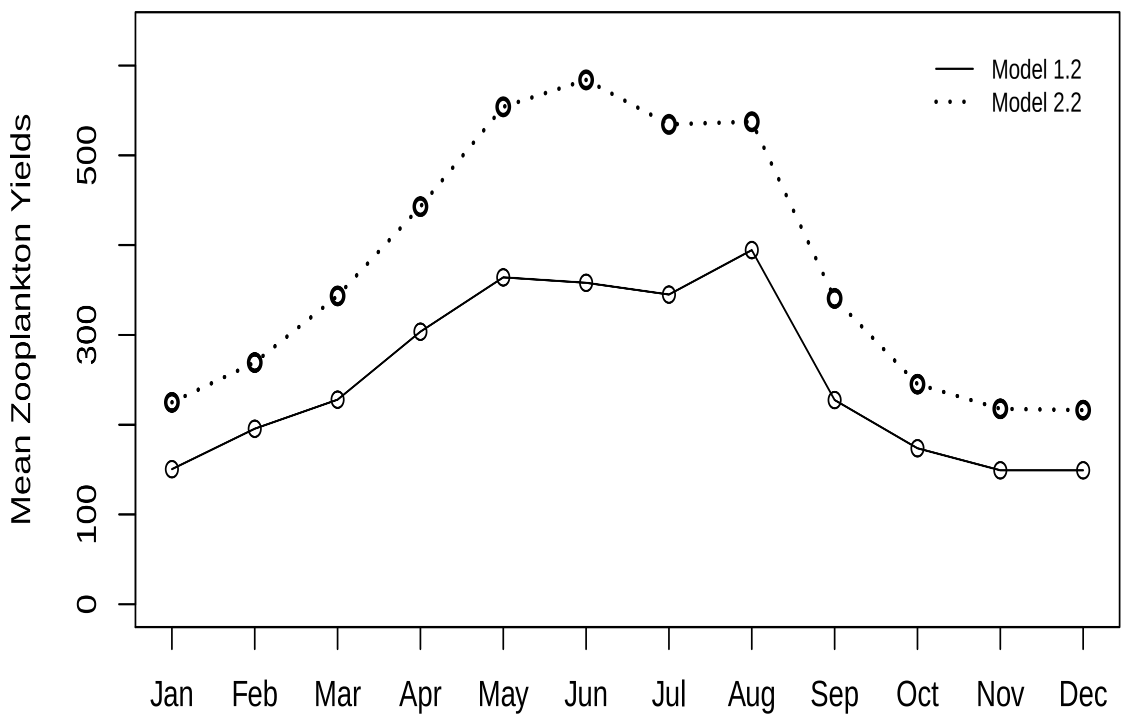


Figure I.20: Predicted Monthly Mean Zooplankton Yields: Sampling Site 76.7-49.

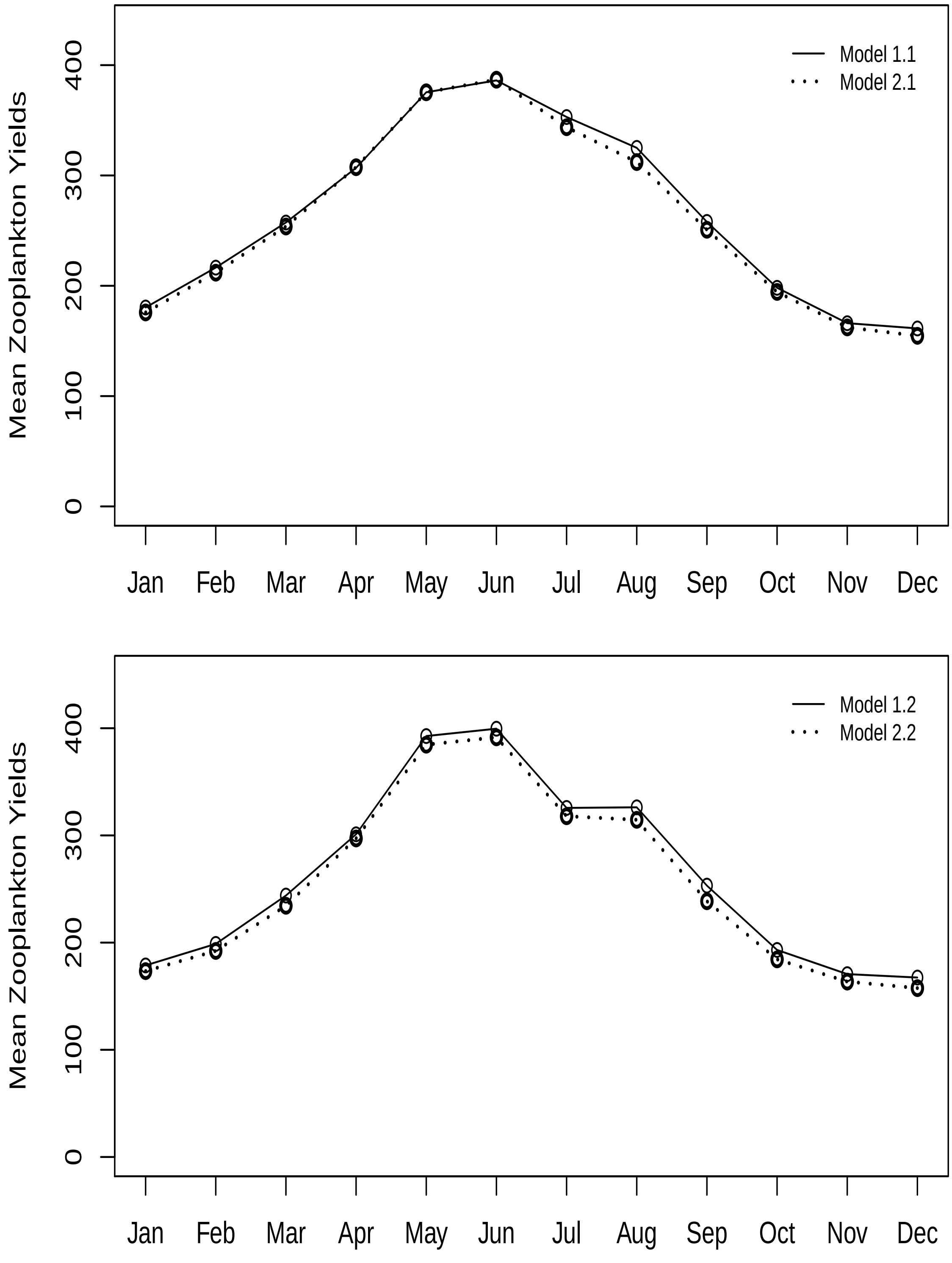


Figure I.21: Predicted Monthly Mean Zooplankton Yields: Sampling Site 76.7-51.

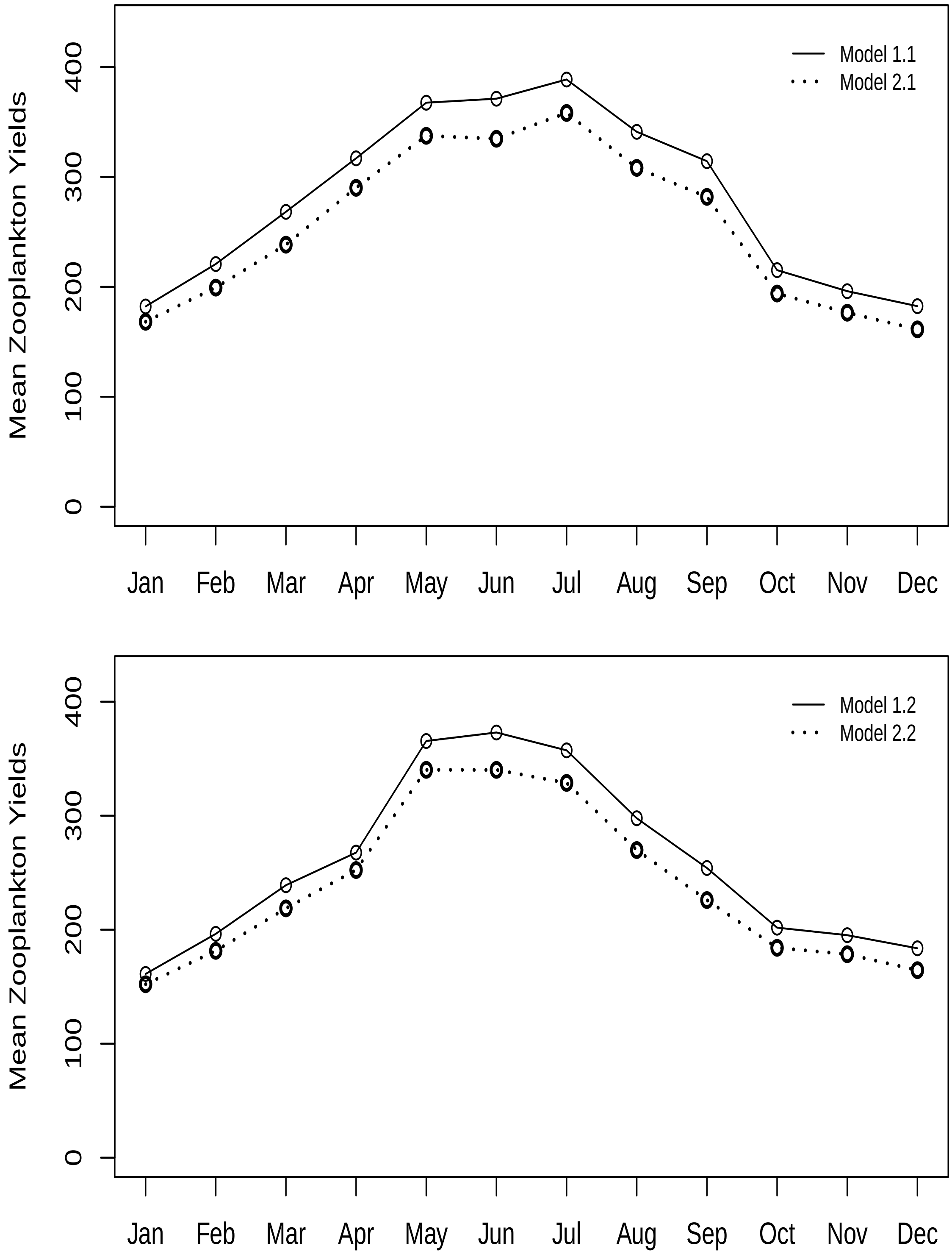


Figure I.22: Predicted Monthly Mean Zooplankton Yields: Sampling Site 76.7-55.

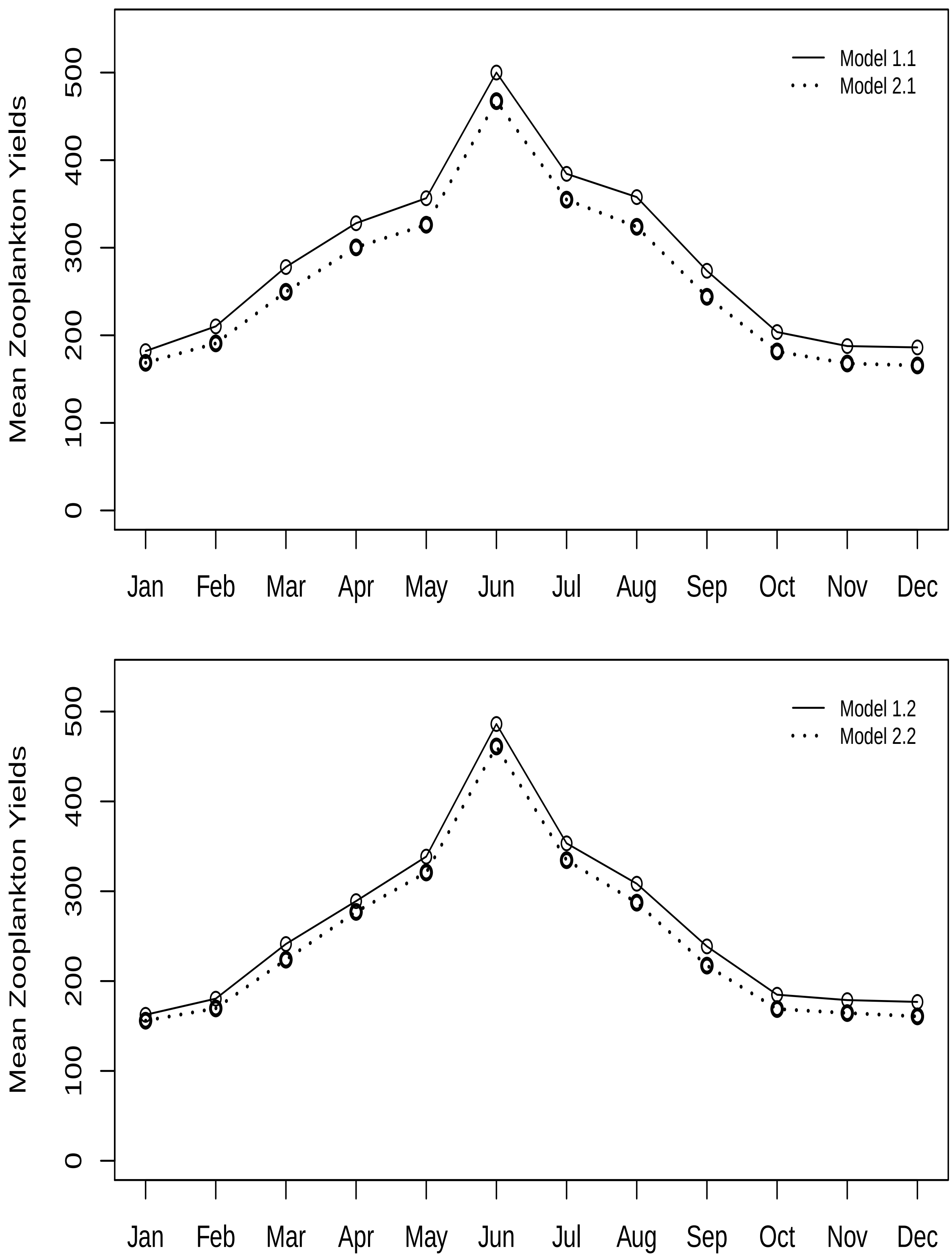


Figure I.23: Predicted Monthly Mean Zooplankton Yields: Sampling Site 76.7-60.

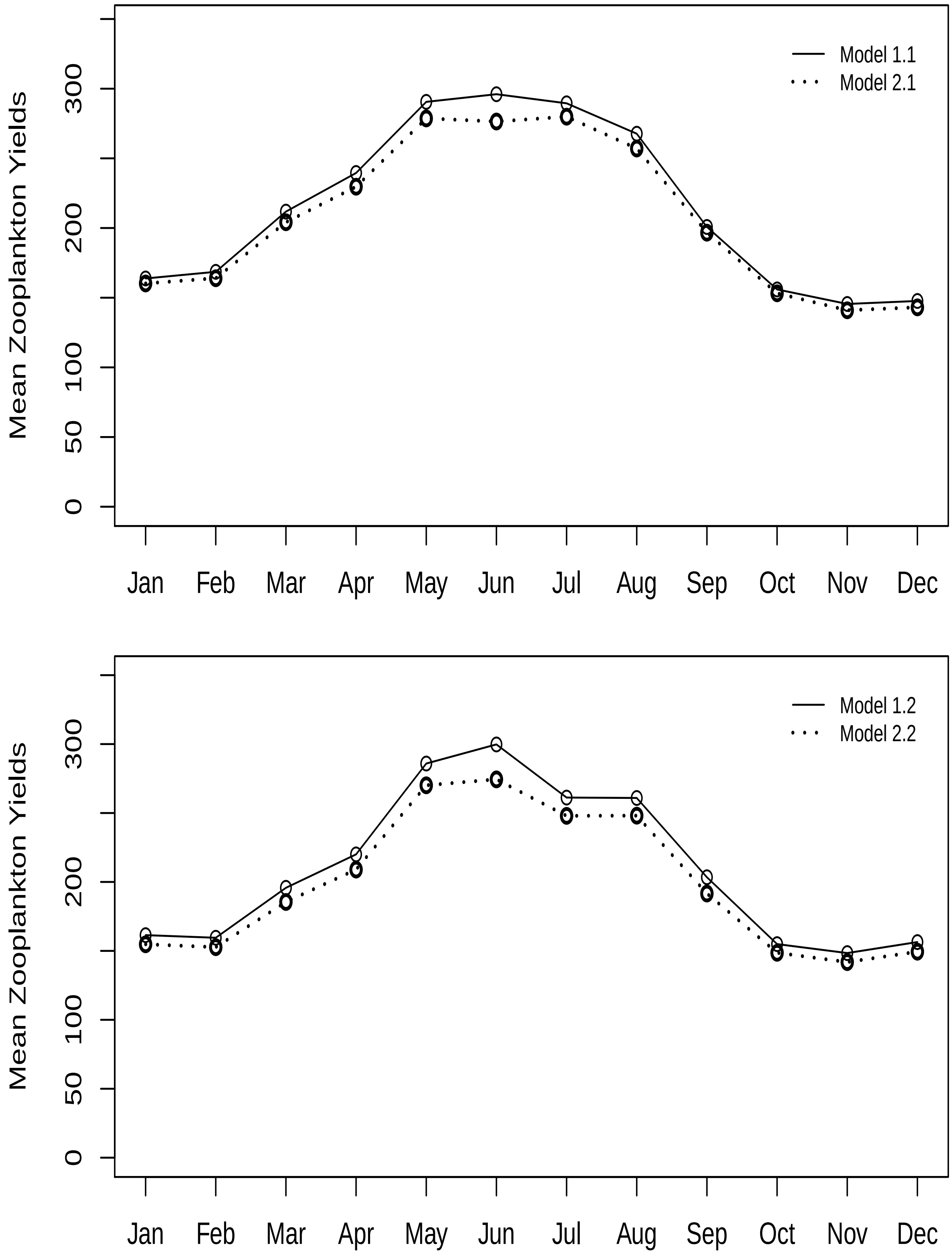


Figure I.24: Predicted Monthly Mean Zooplankton Yields: Sampling Site 76.7-70.

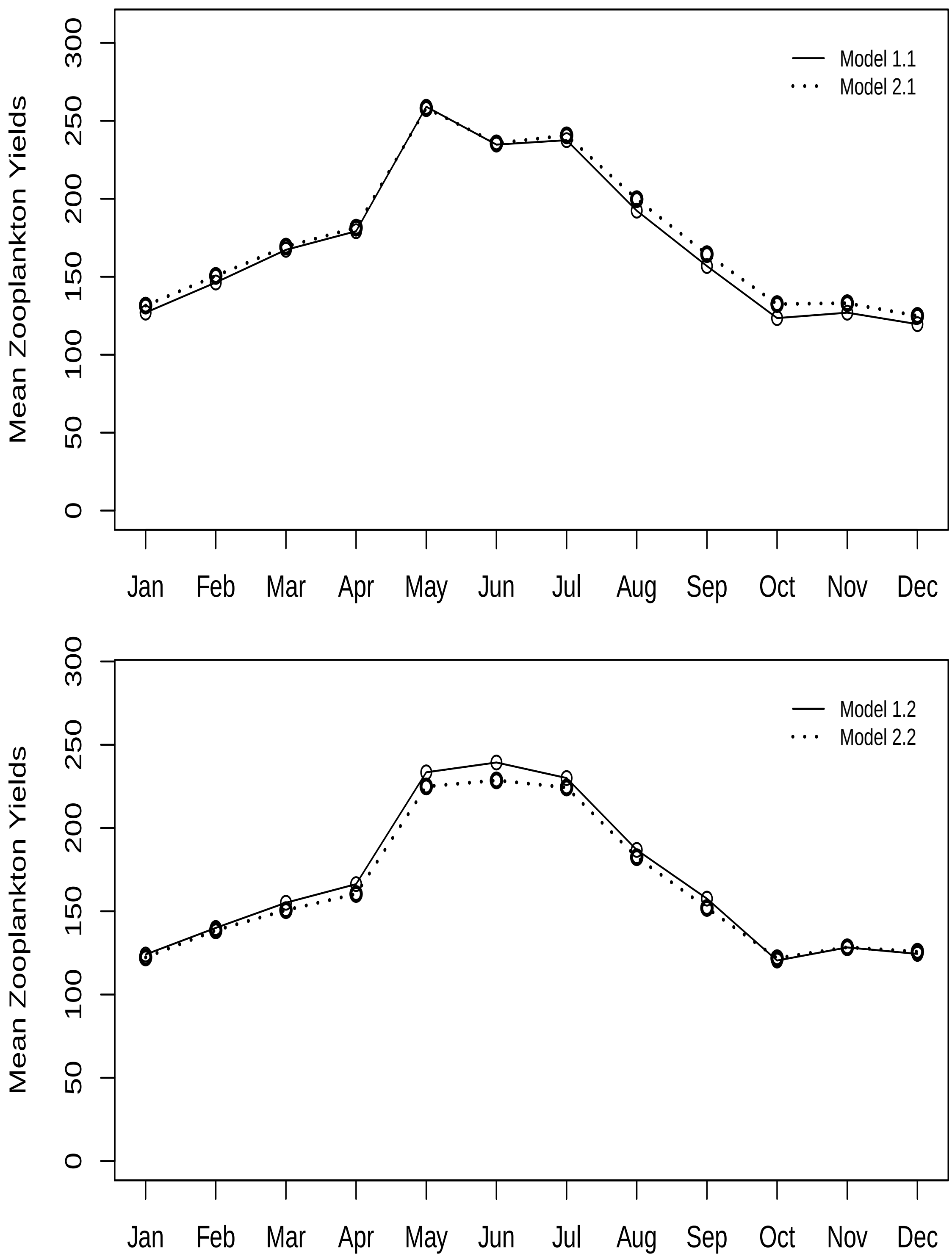
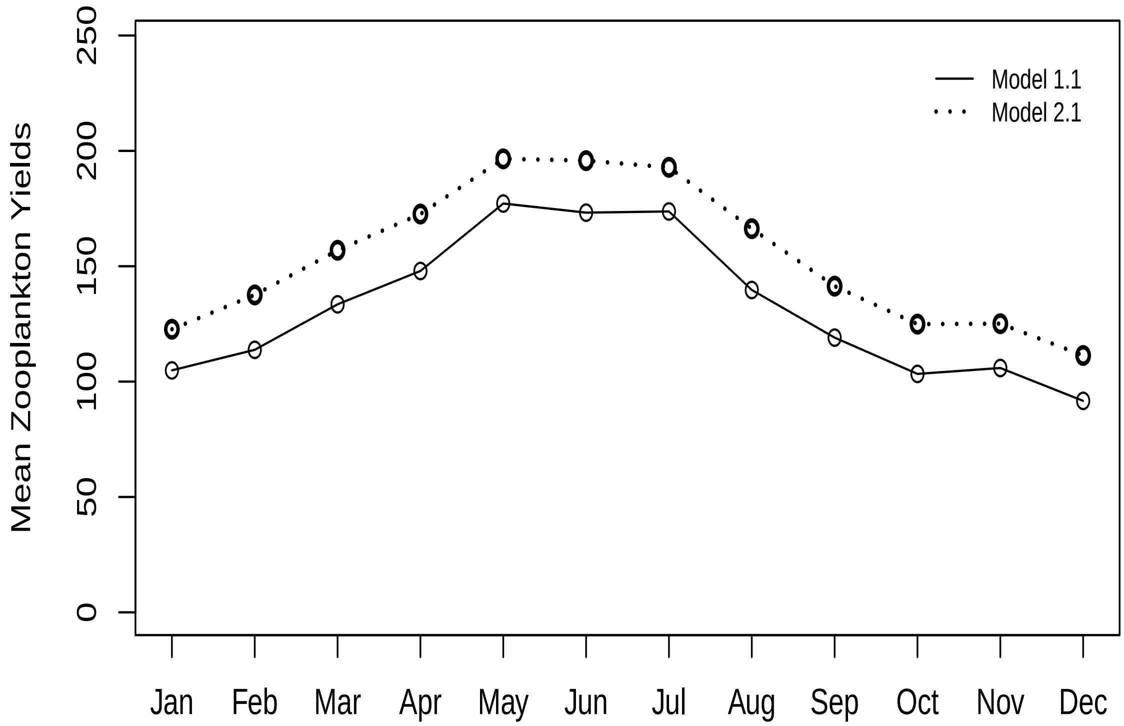


Figure I.25: Predicted Monthly Mean Zooplankton Yields: Sampling Site 76.7-80.



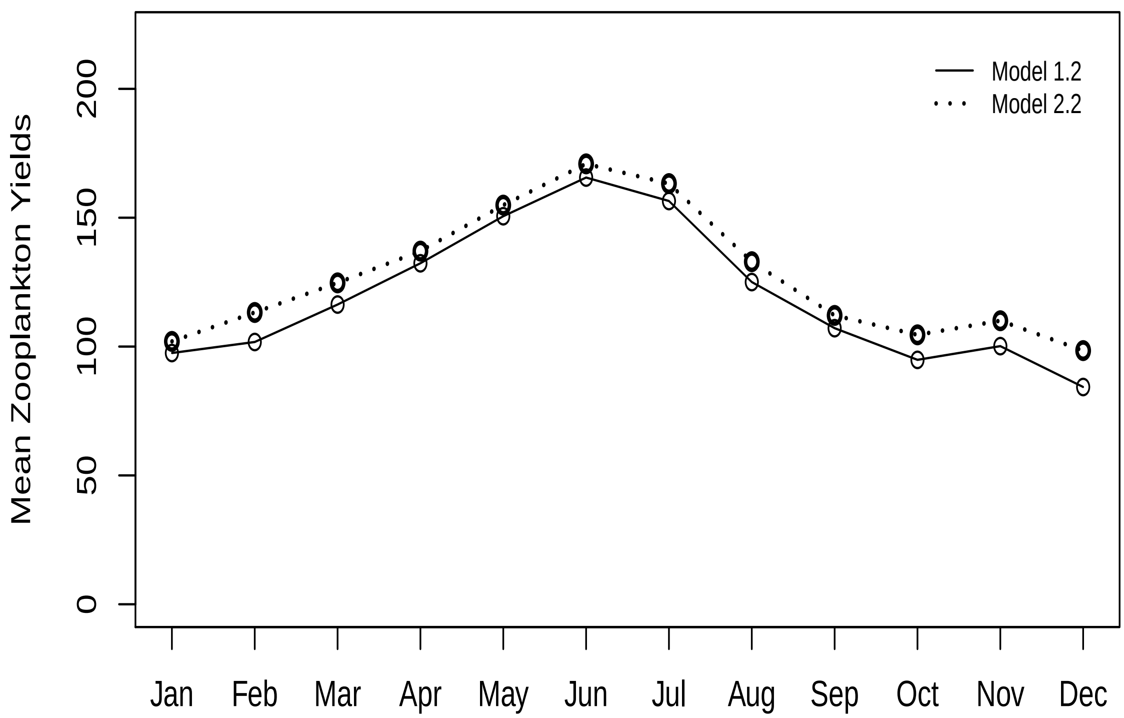


Figure I.26: Predicted Monthly Mean Zooplankton Yields: Sampling Site 76.7-90.

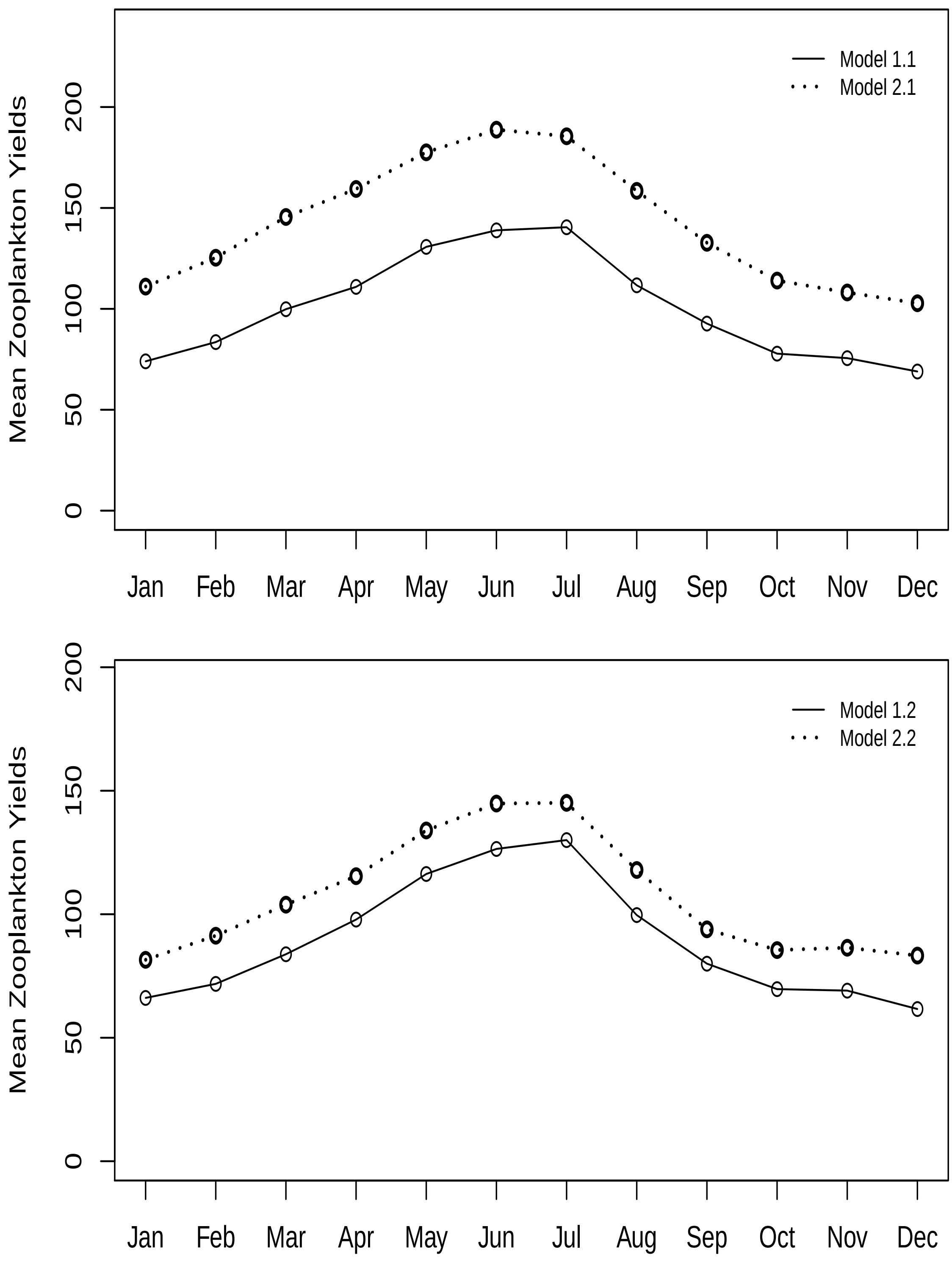


Figure I.27: Predicted Monthly Mean Zooplankton Yields: Sampling Site 76.7-100.

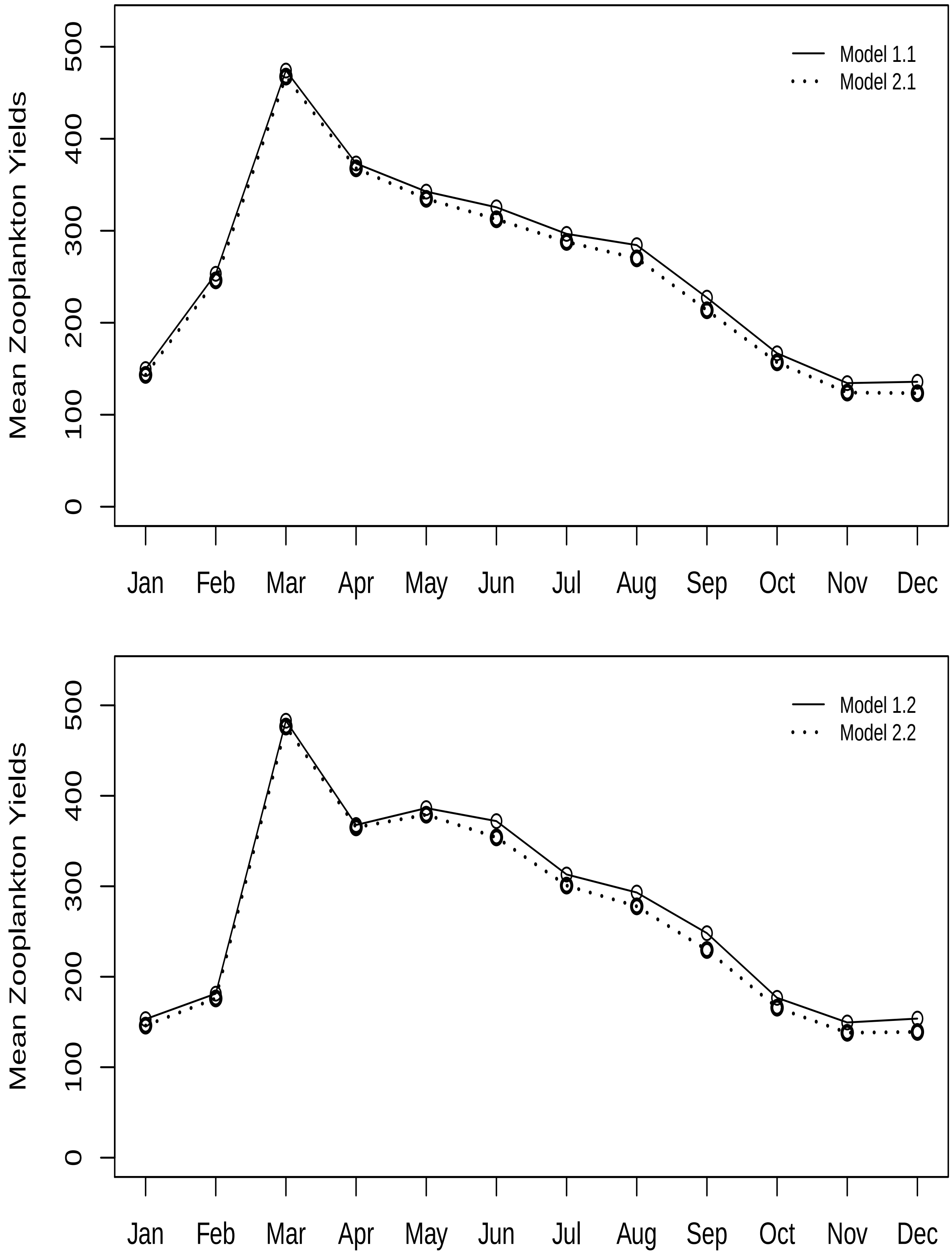


Figure I.28: Predicted Monthly Mean Zooplankton Yields: Sampling Site 80-51.

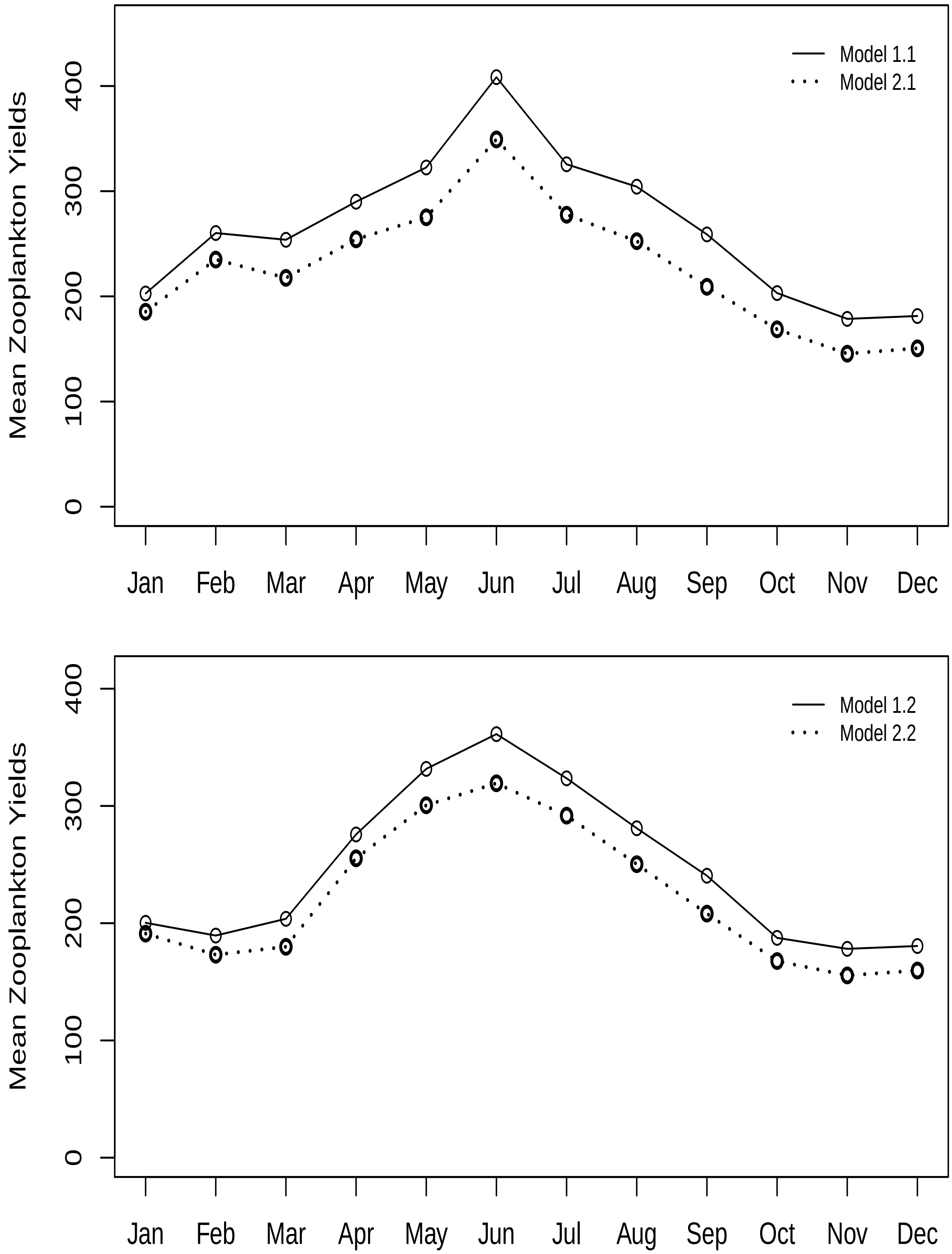


Figure I.29: Predicted Monthly Mean Zooplankton Yields: Sampling Site 80-55.

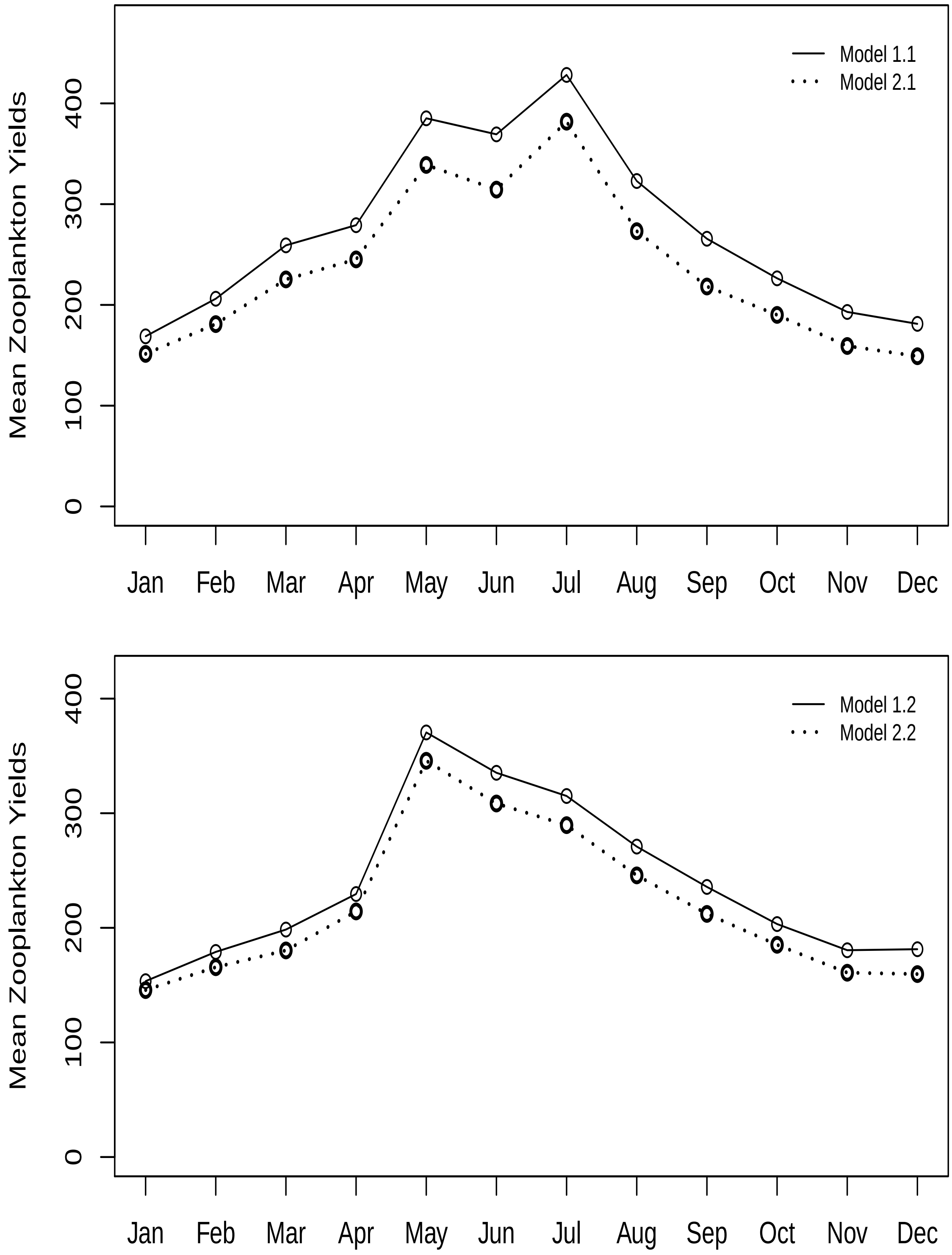


Figure I.30: Predicted Monthly Mean Zooplankton Yields: Sampling Site 80-60.

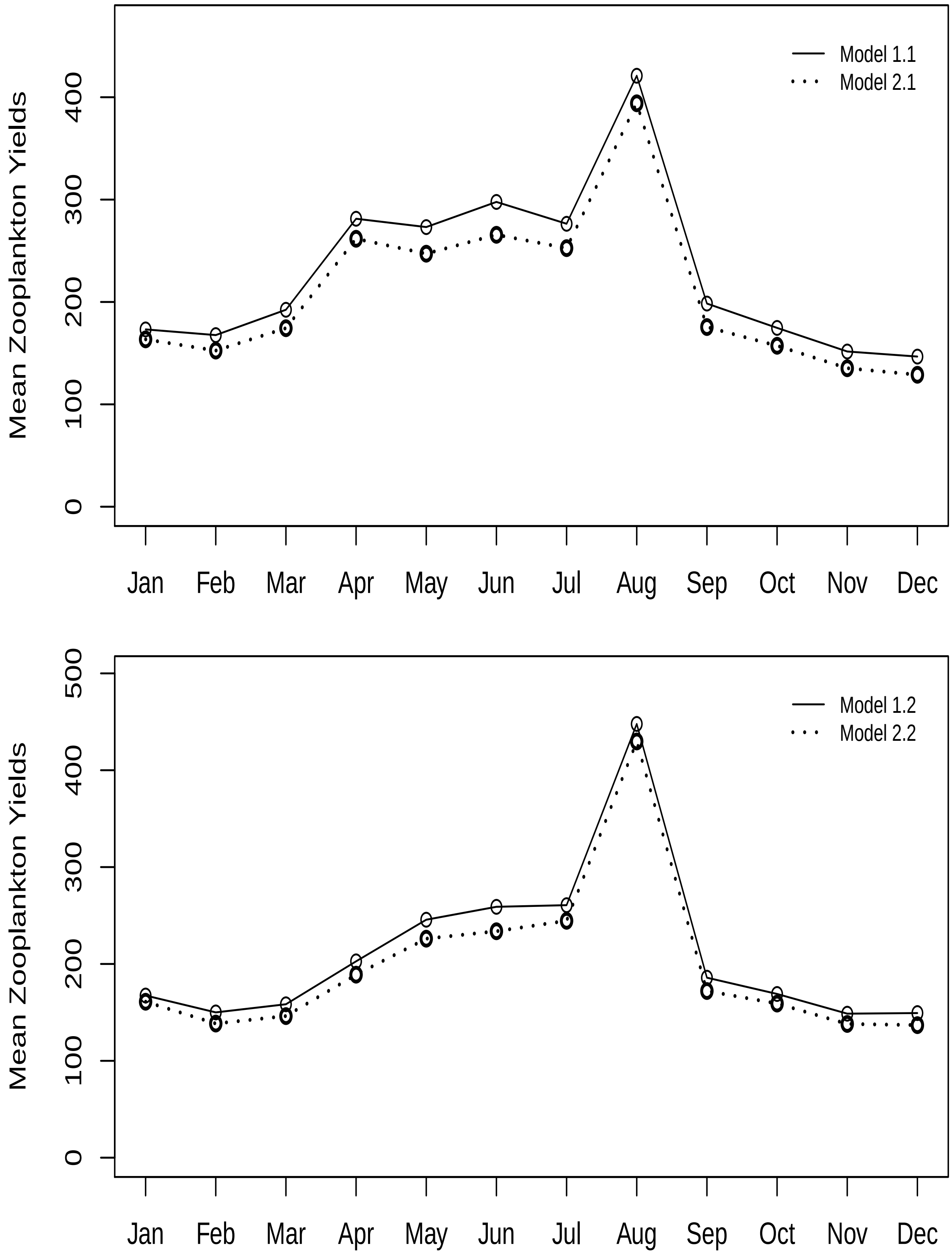


Figure I.31: Predicted Monthly Mean Zooplankton Yields: Sampling Site 80-70.

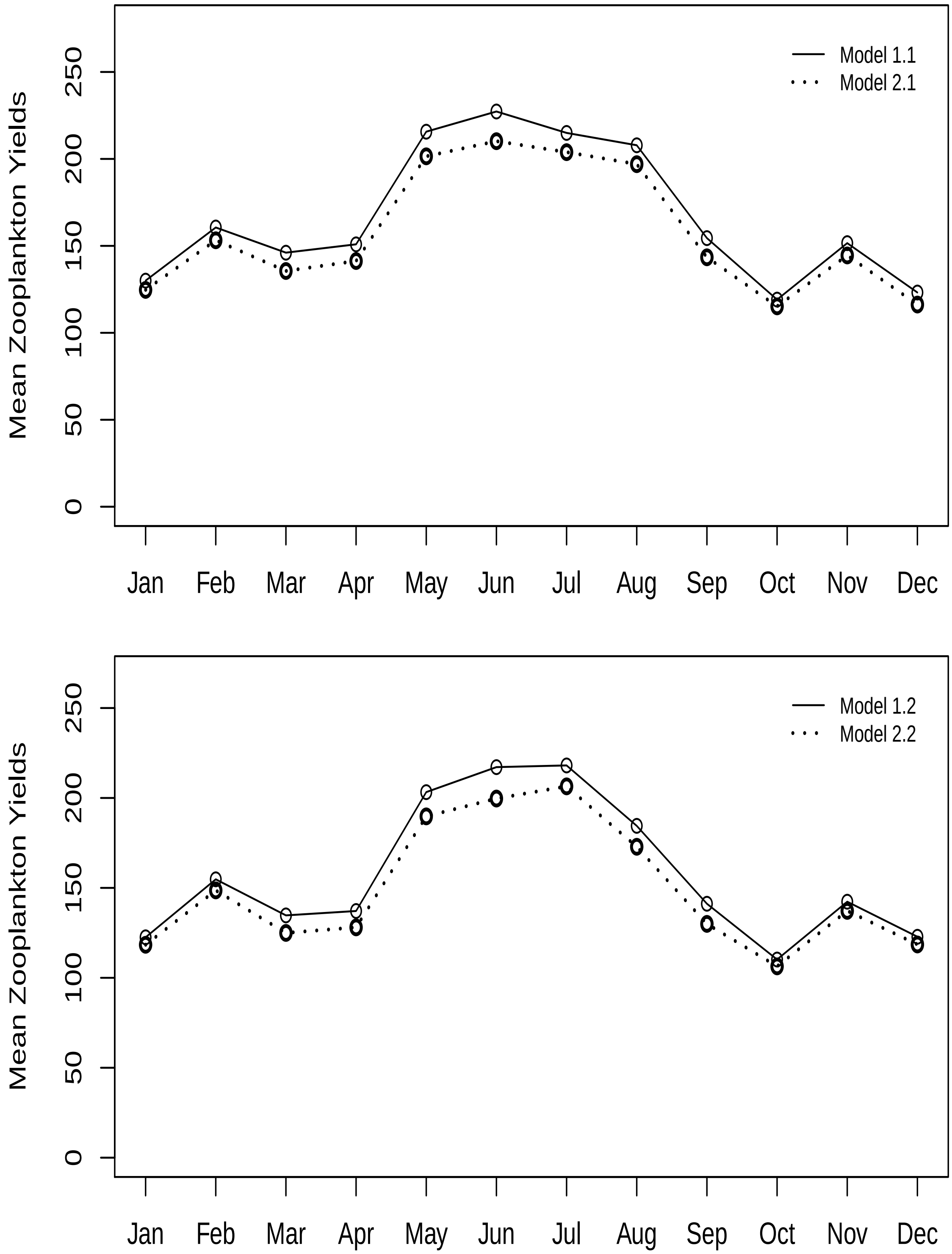


Figure I.32: Predicted Monthly Mean Zooplankton Yields: Sampling Site 80-80.

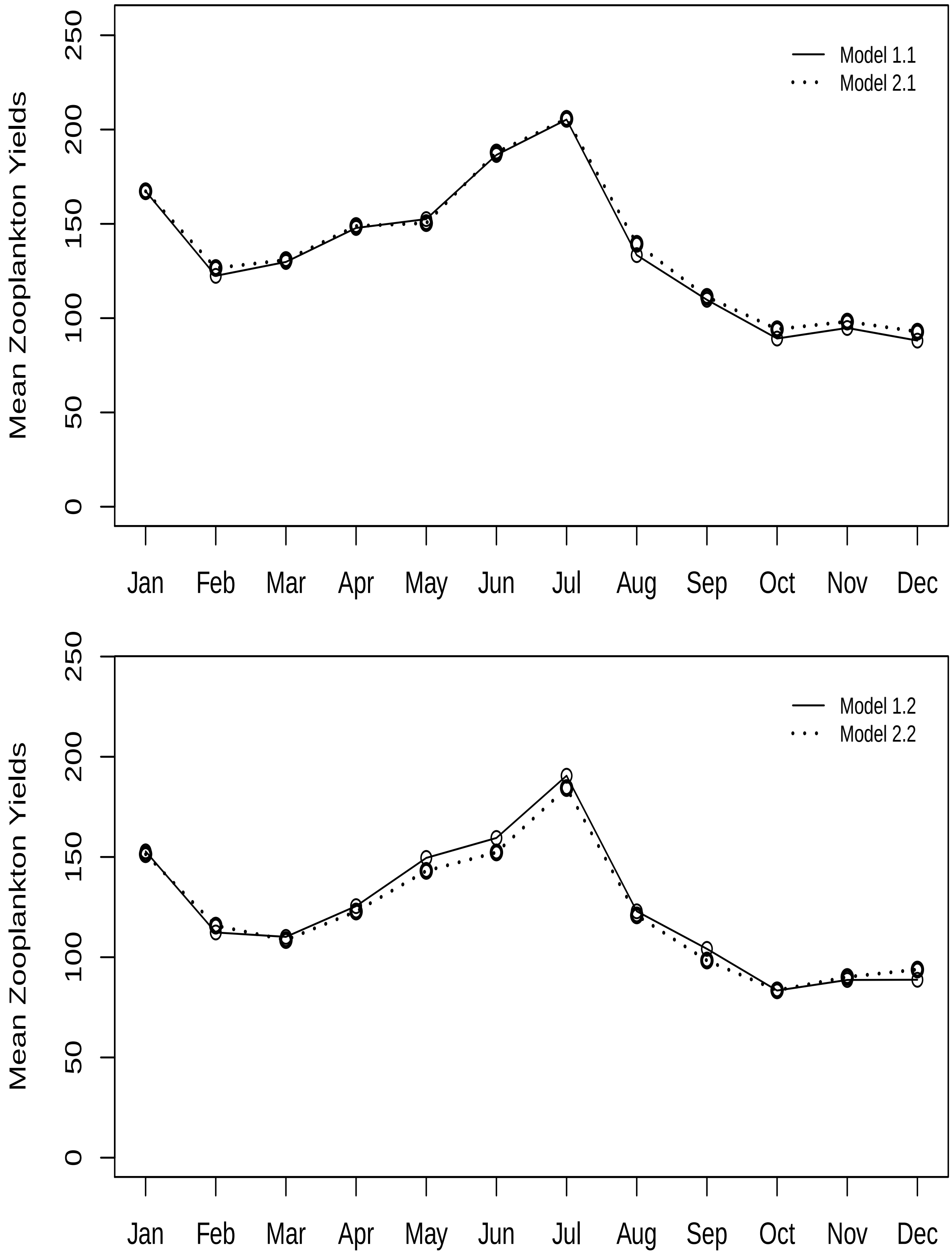


Figure I.33: Predicted Monthly Mean Zooplankton Yields: Sampling Site 80-90.

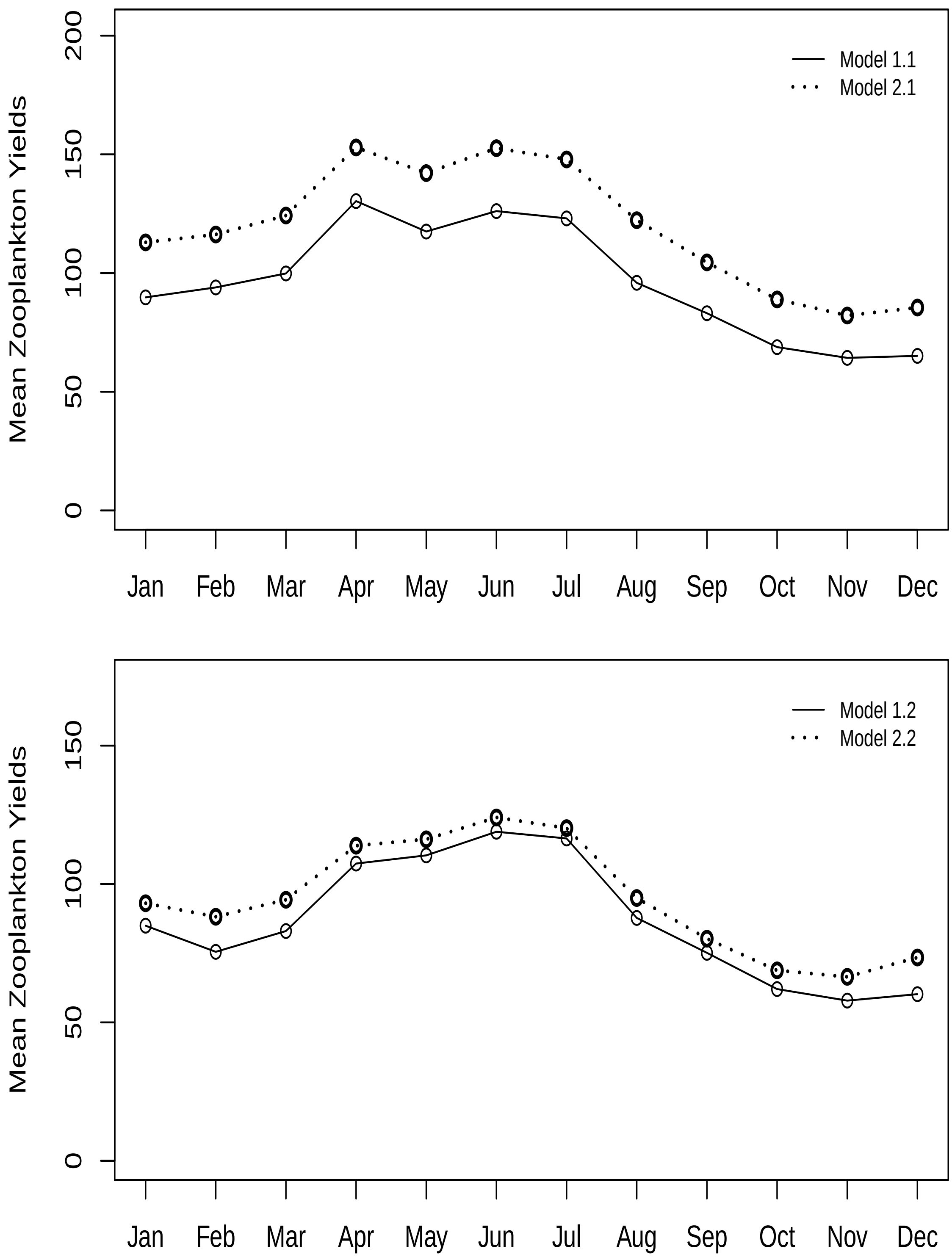


Figure I.34: Predicted Monthly Mean Zooplankton Yields: Sampling Site 80-100.

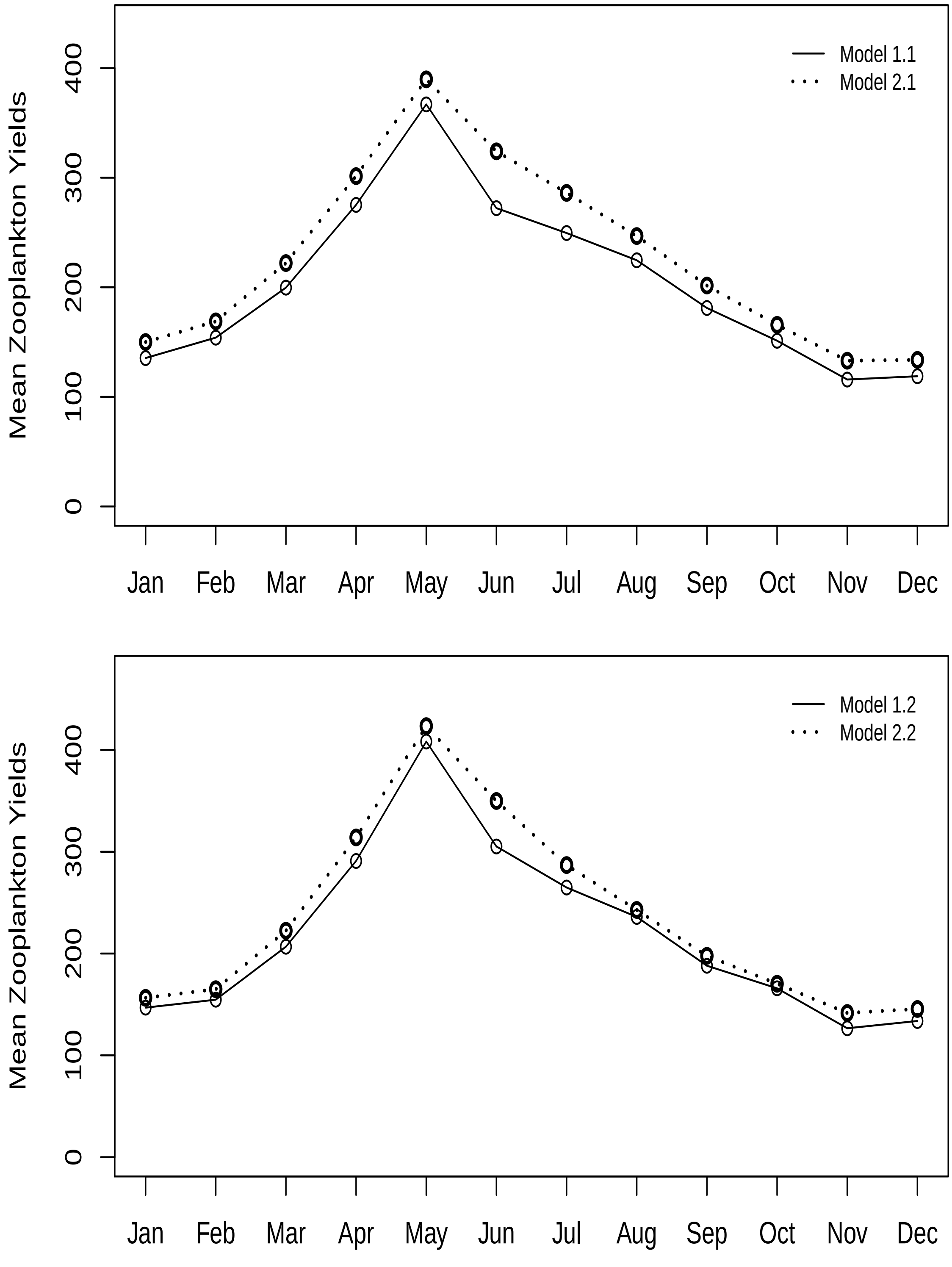


Figure I.35: Predicted Monthly Mean Zooplankton Yields: Sampling Site 83.3-40.6.

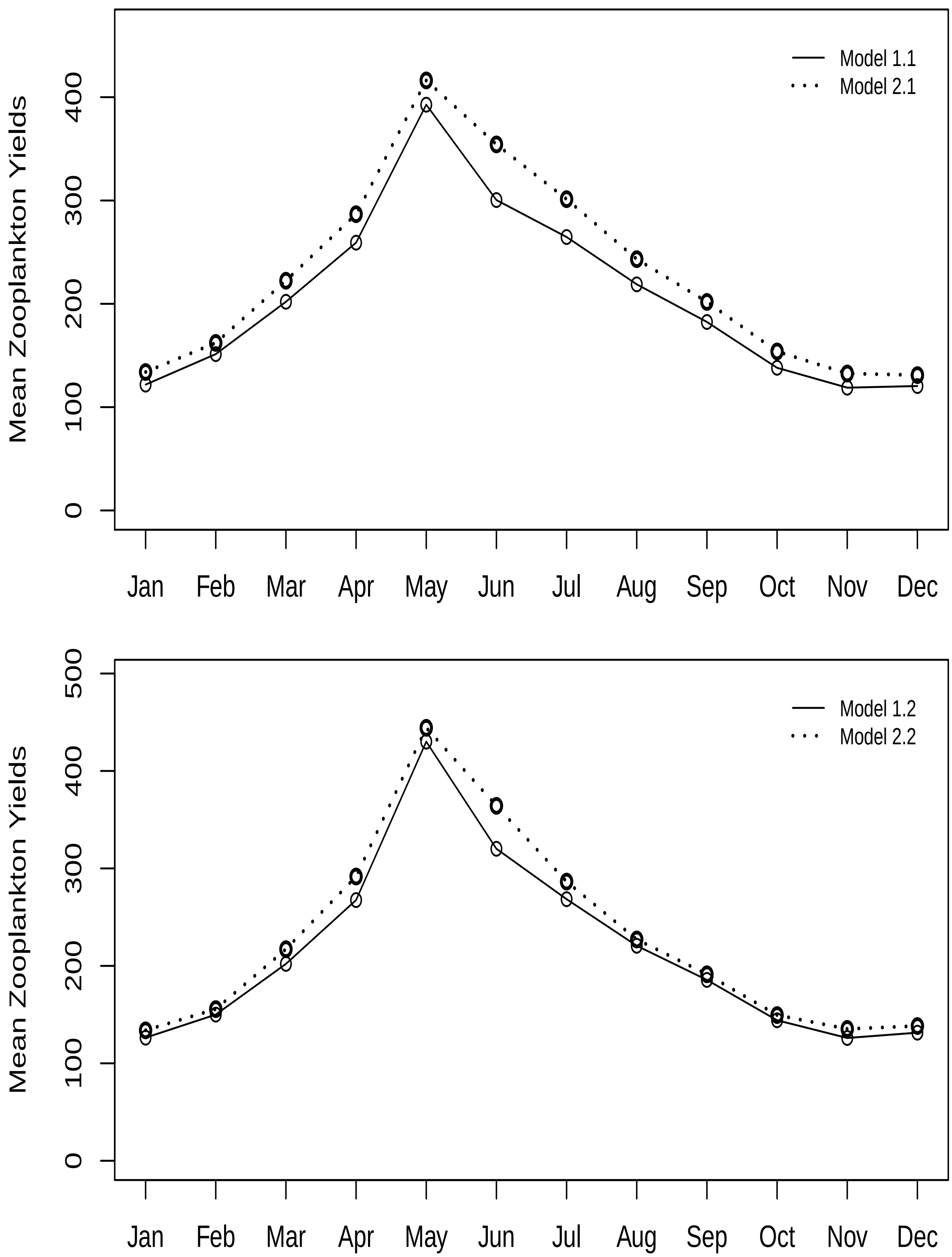


Figure I.36: Predicted Monthly Mean Zooplankton Yields: Sampling Site 83.3-42.

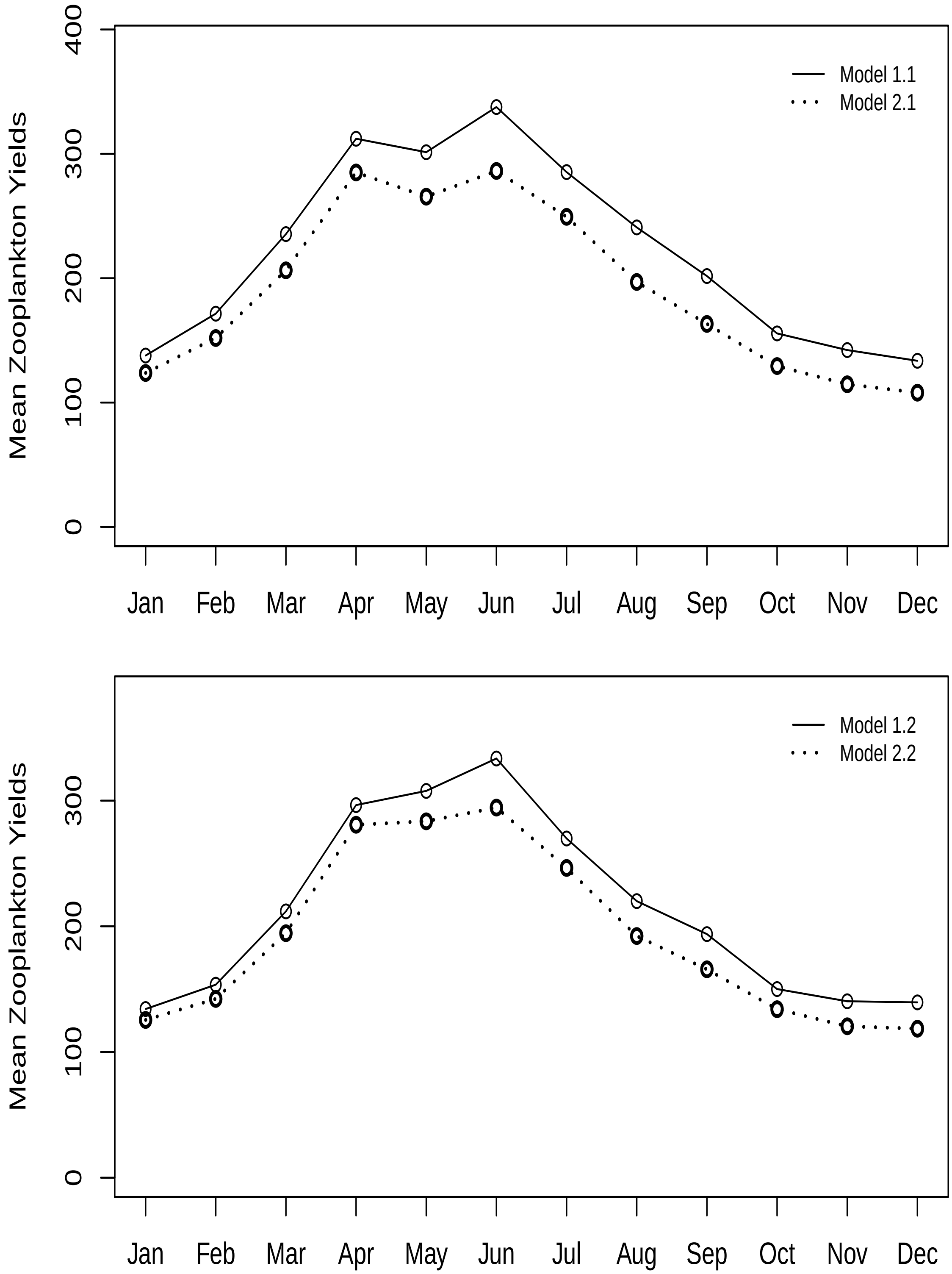


Figure I.37: Predicted Monthly Mean Zooplankton Yields: Sampling Site 83.3-51.

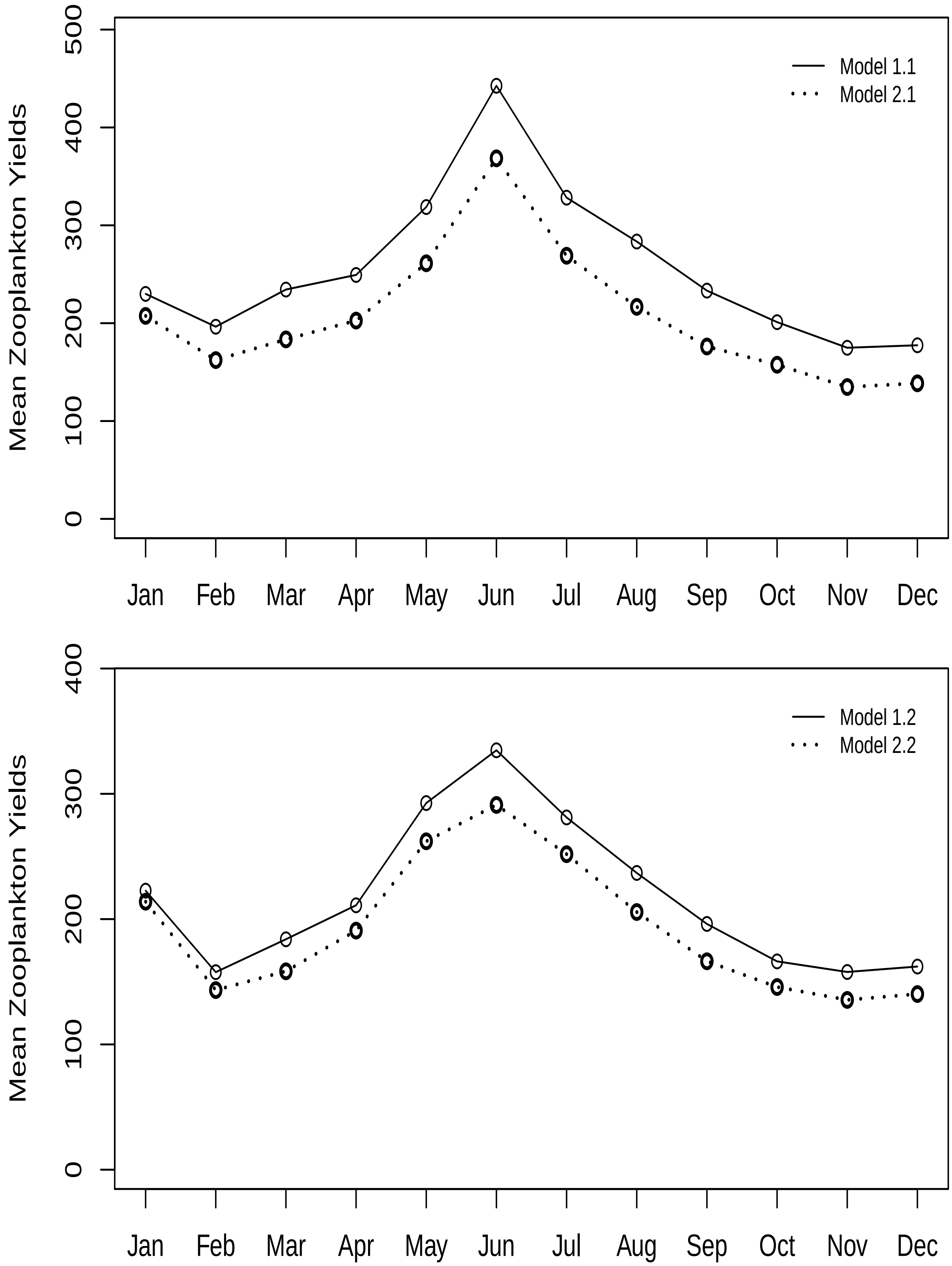
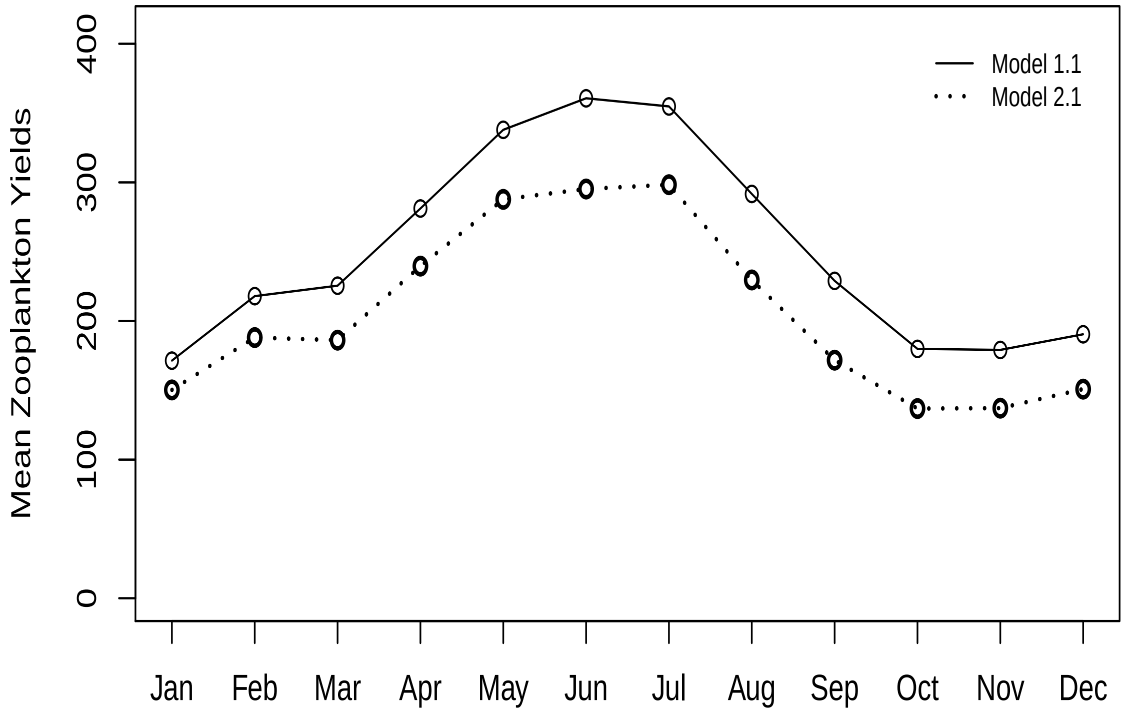


Figure I.38: Predicted Monthly Mean Zooplankton Yields: Sampling Site 83.3-55.



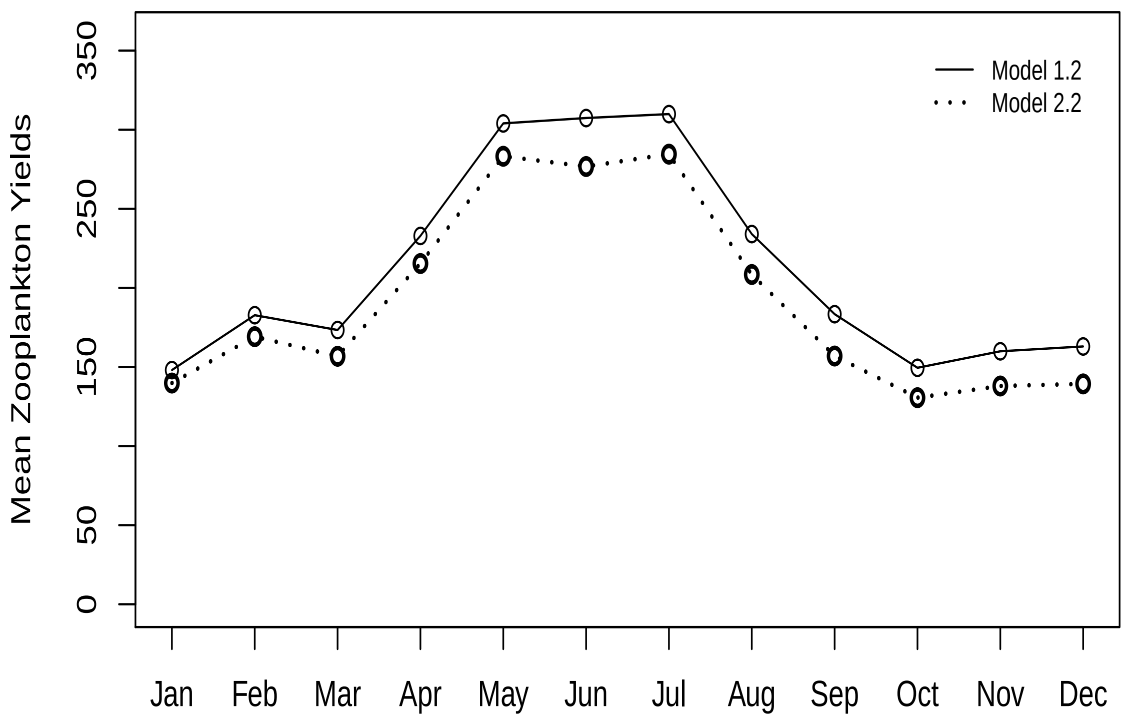


Figure I.39: Predicted Monthly Mean Zooplankton Yields: Sampling Site 83.3-60.

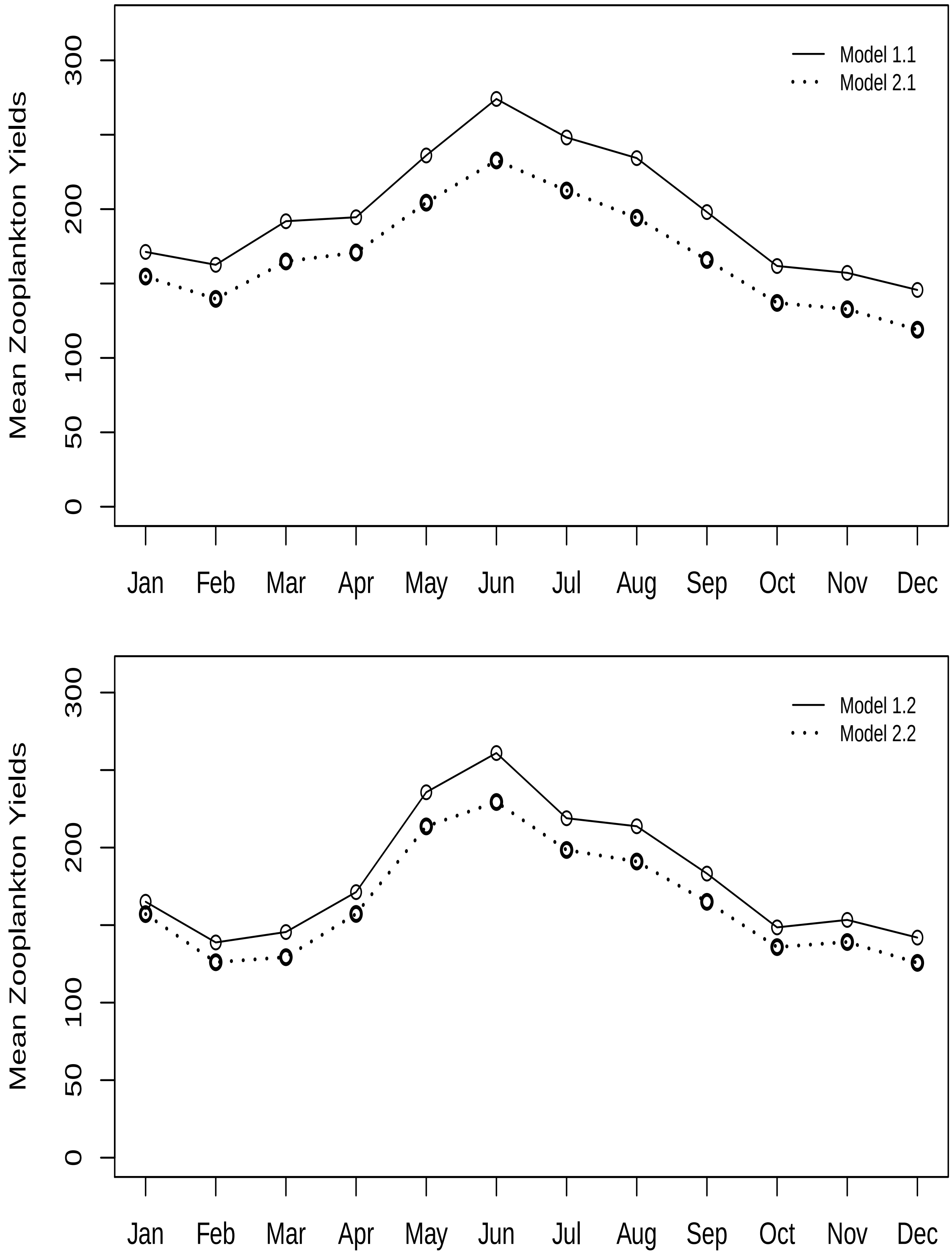


Figure I.40: Predicted Monthly Mean Zooplankton Yields: Sampling Site 83.3-70.

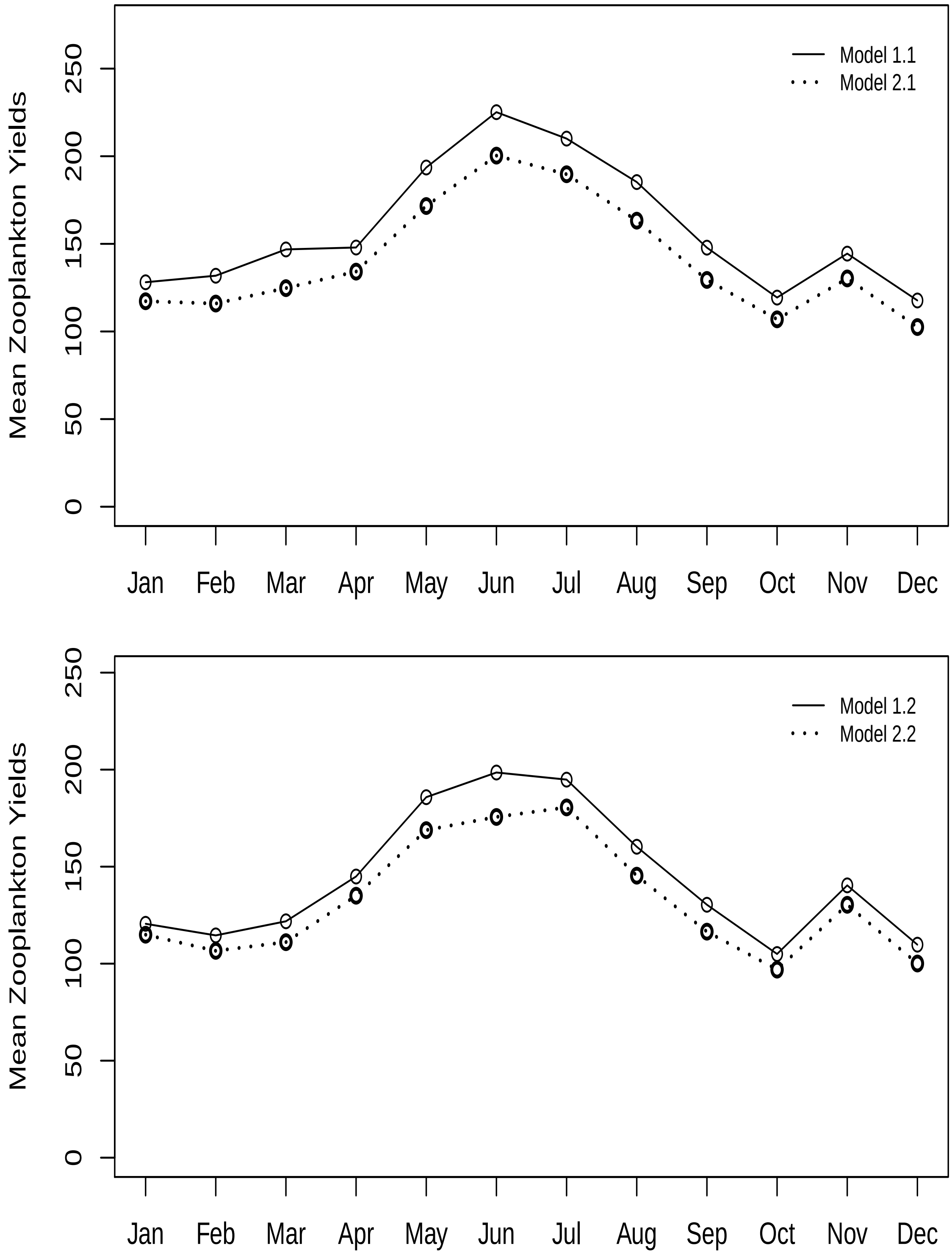


Figure I.41: Predicted Monthly Mean Zooplankton Yields: Sampling Site 83.3-80.

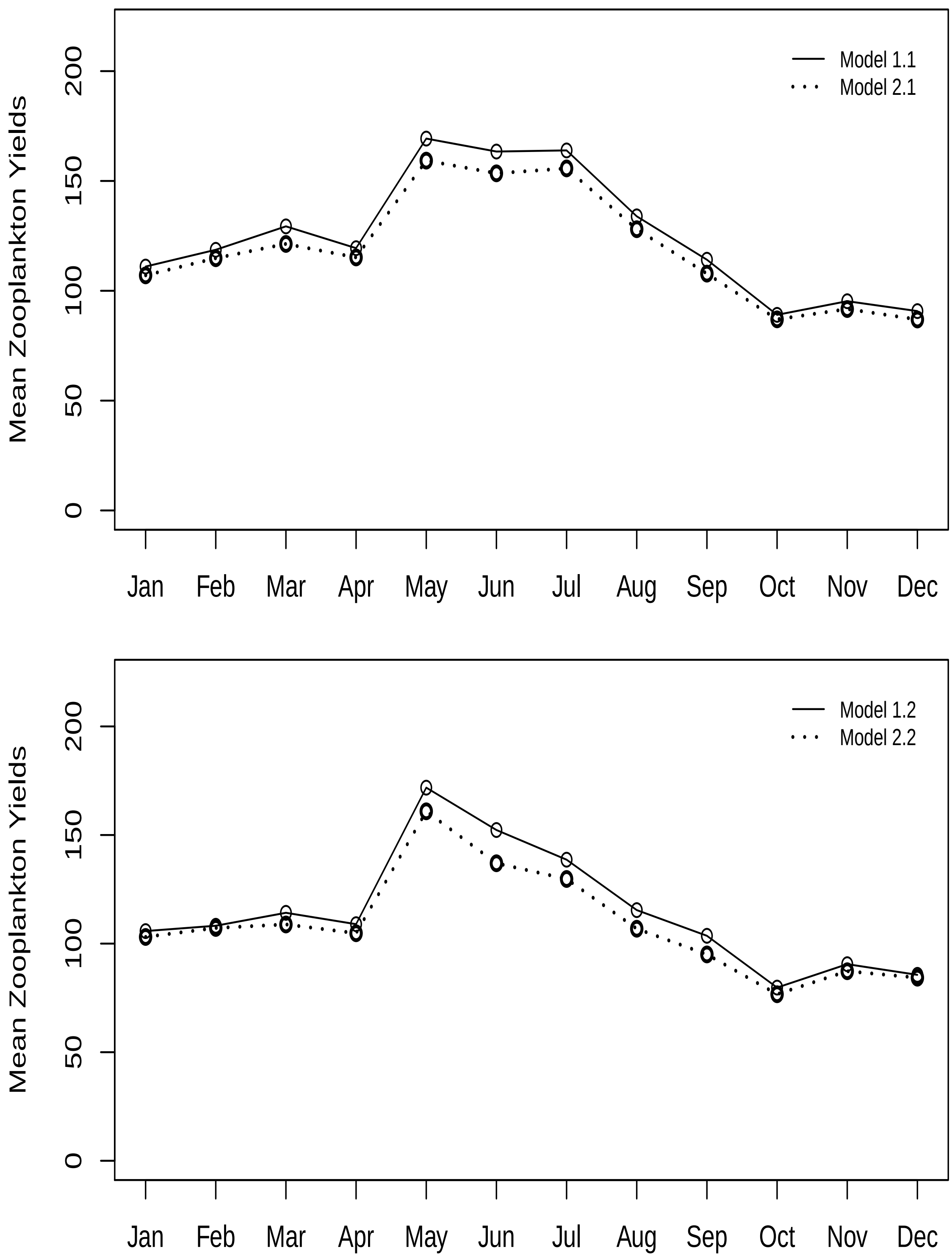


Figure I.42: Predicted Monthly Mean Zooplankton Yields: Sampling Site 83.3-90.

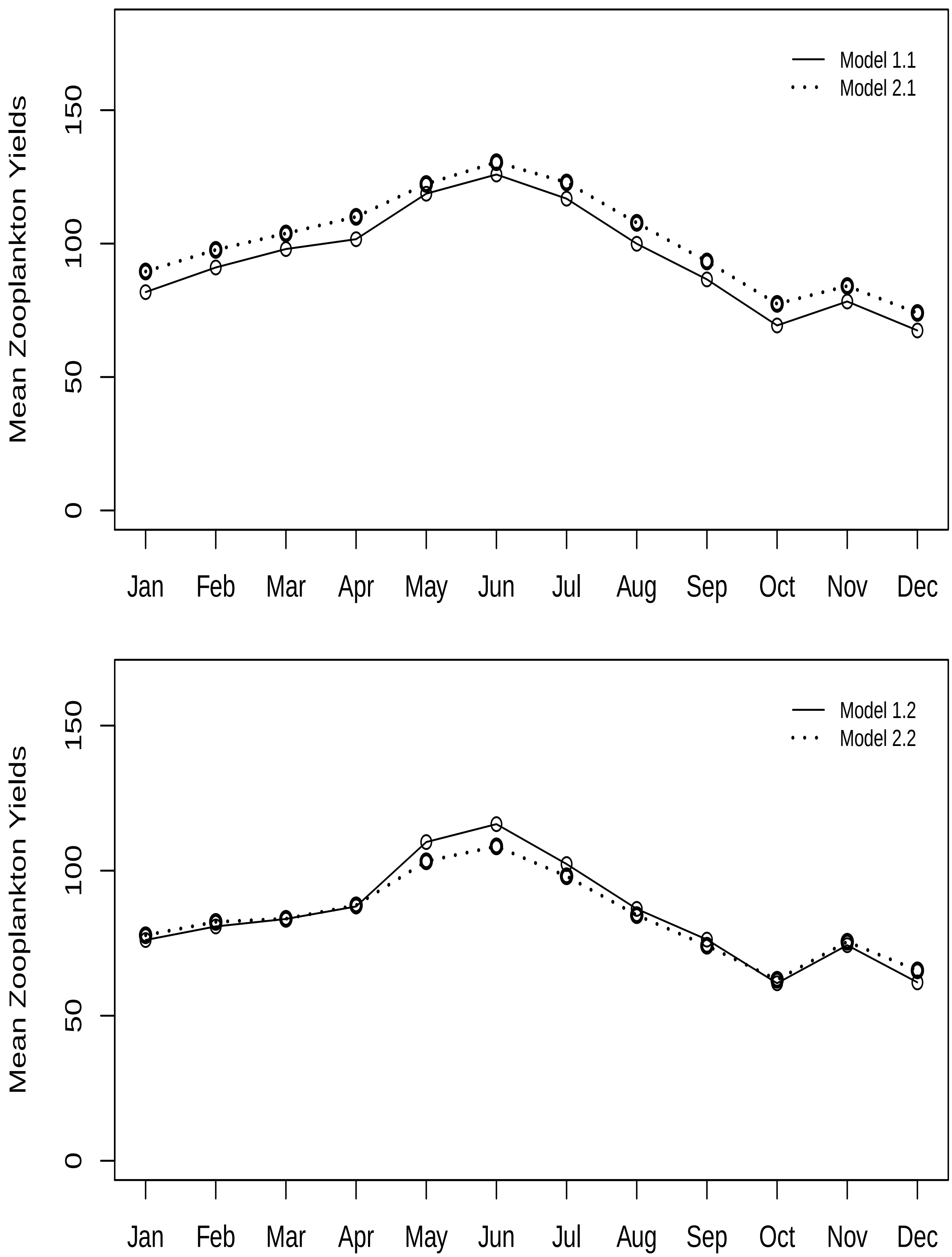


Figure I.43: Predicted Monthly Mean Zooplankton Yields: Sampling Site 83.3-100.

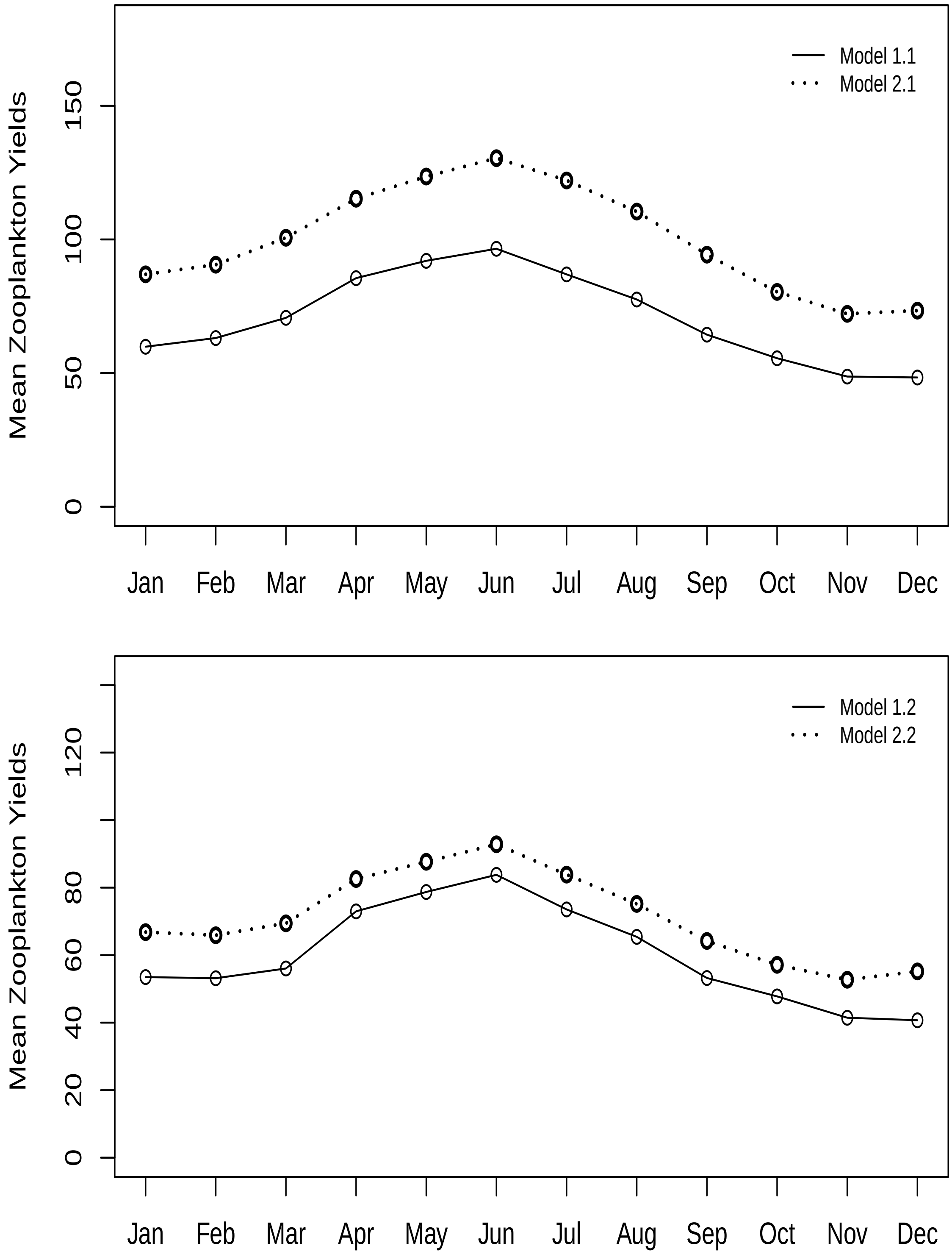


Figure I.44: Predicted Monthly Mean Zooplankton Yields: Sampling Site 83.3-110.

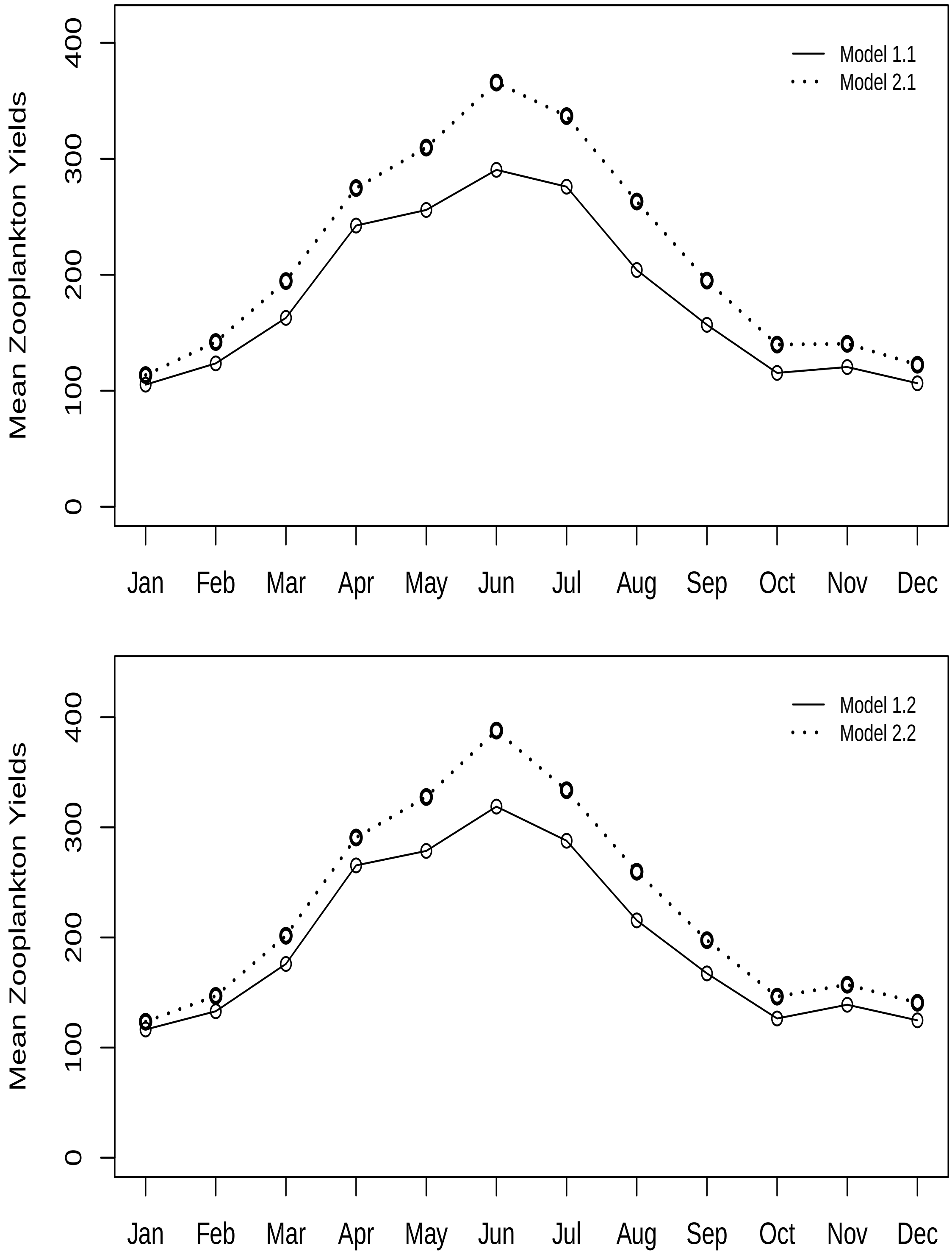


Figure I.45: Predicted Monthly Mean Zooplankton Yields: Sampling Site 86.7-33.

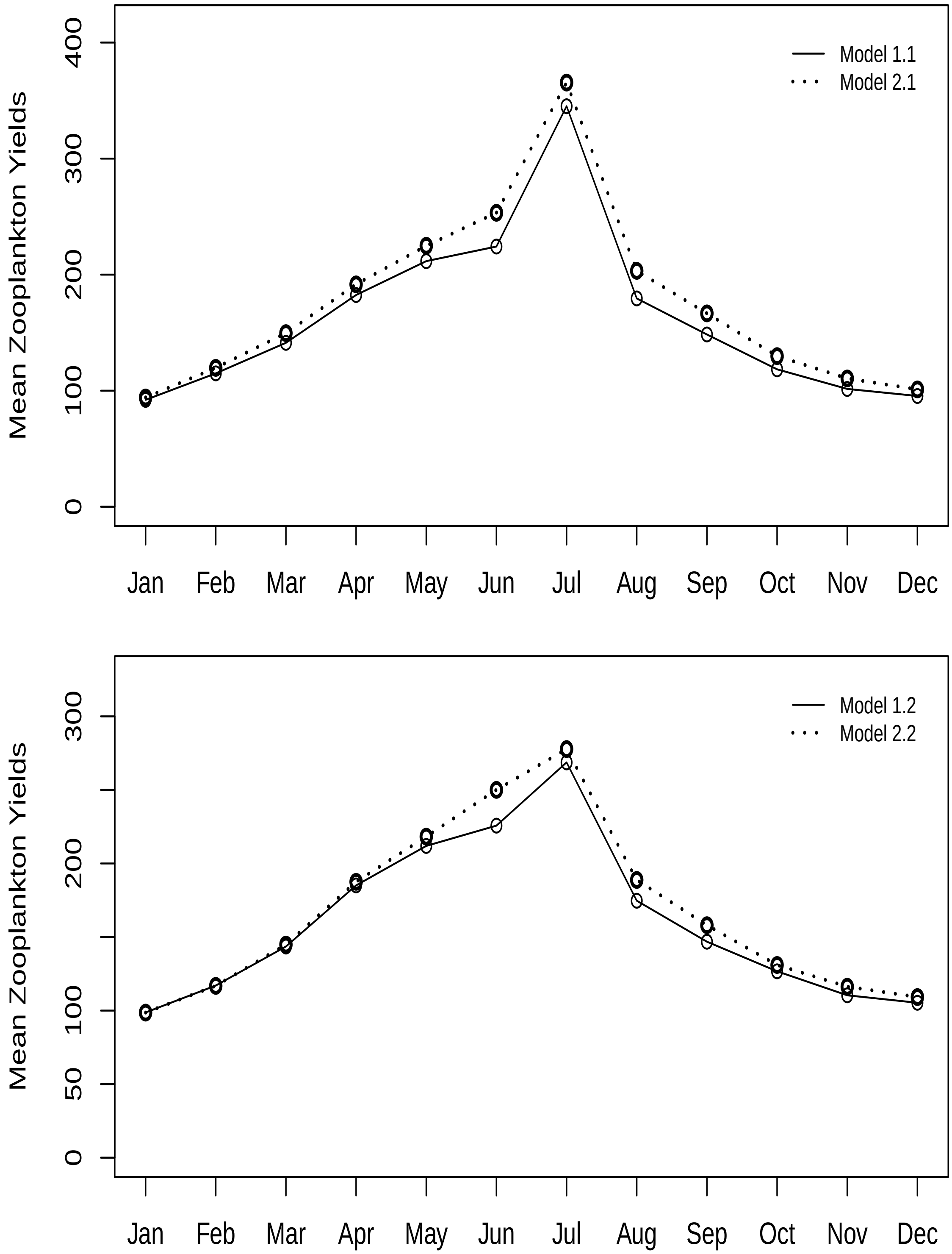


Figure I.46: Predicted Monthly Mean Zooplankton Yields: Sampling Site 86.7-35.

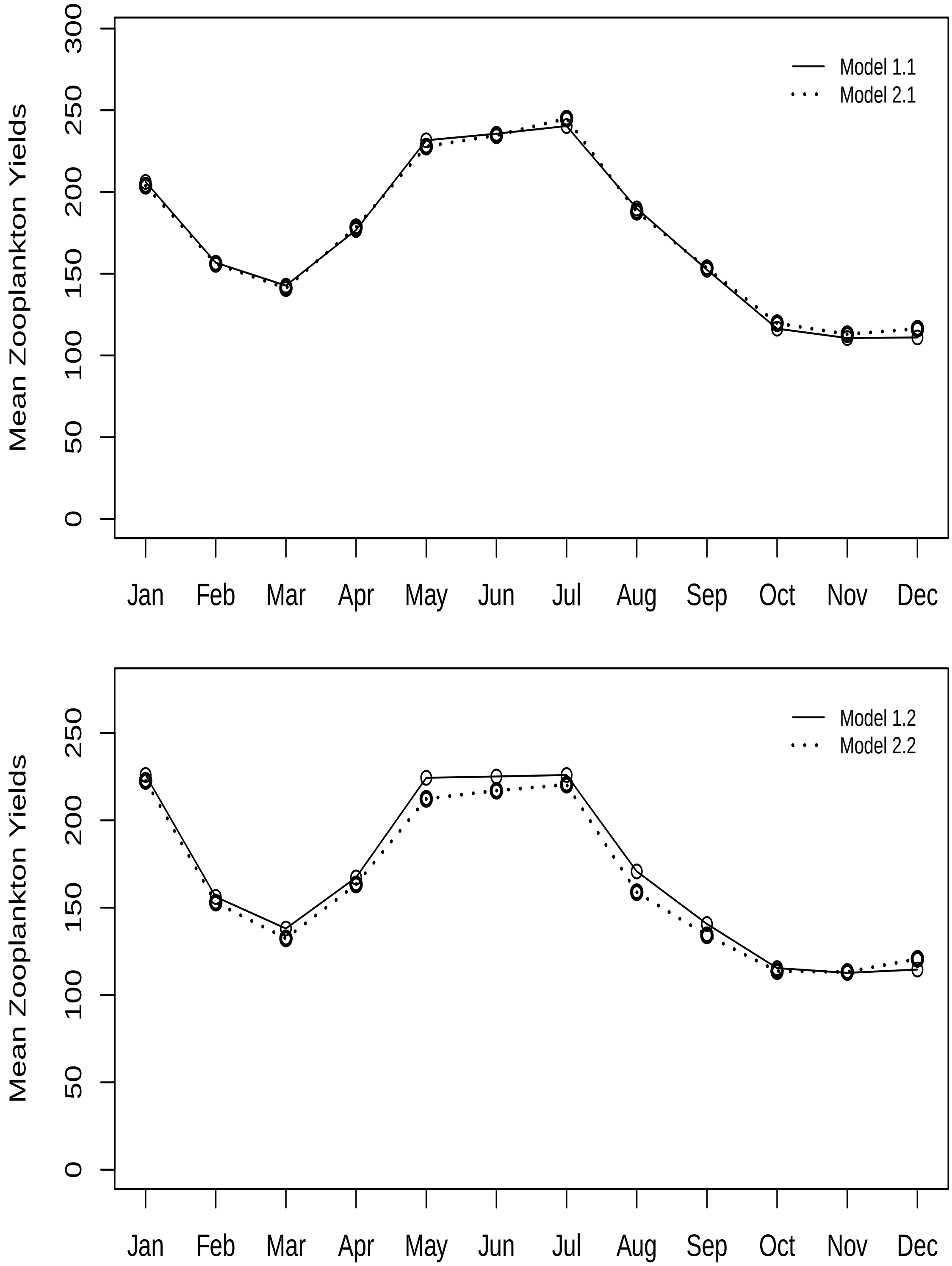


Figure I.47: Predicted Monthly Mean Zooplankton Yields: Sampling Site 86.7-40.

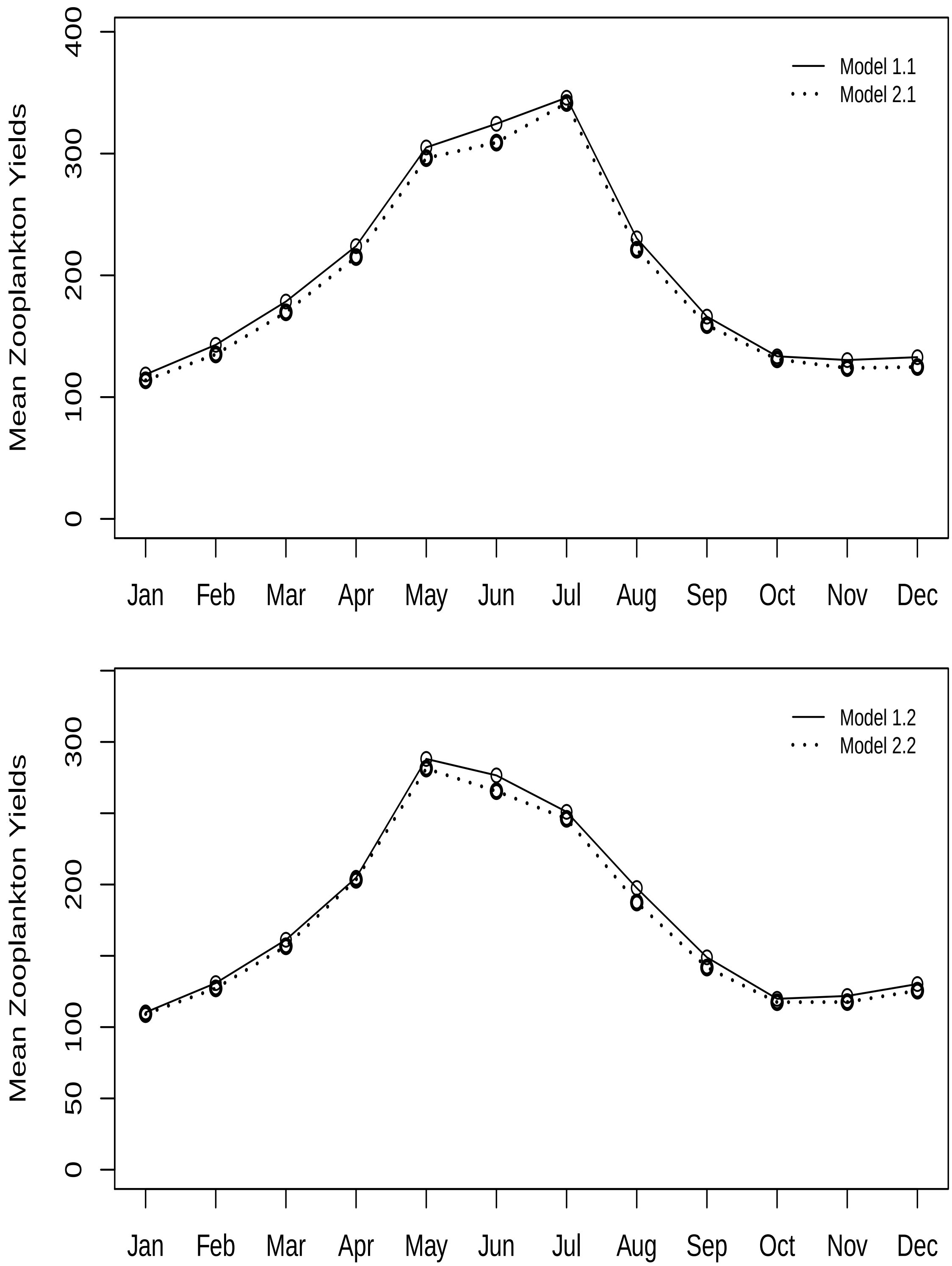


Figure I.48: Predicted Monthly Mean Zooplankton Yields: Sampling Site 86.7-45.

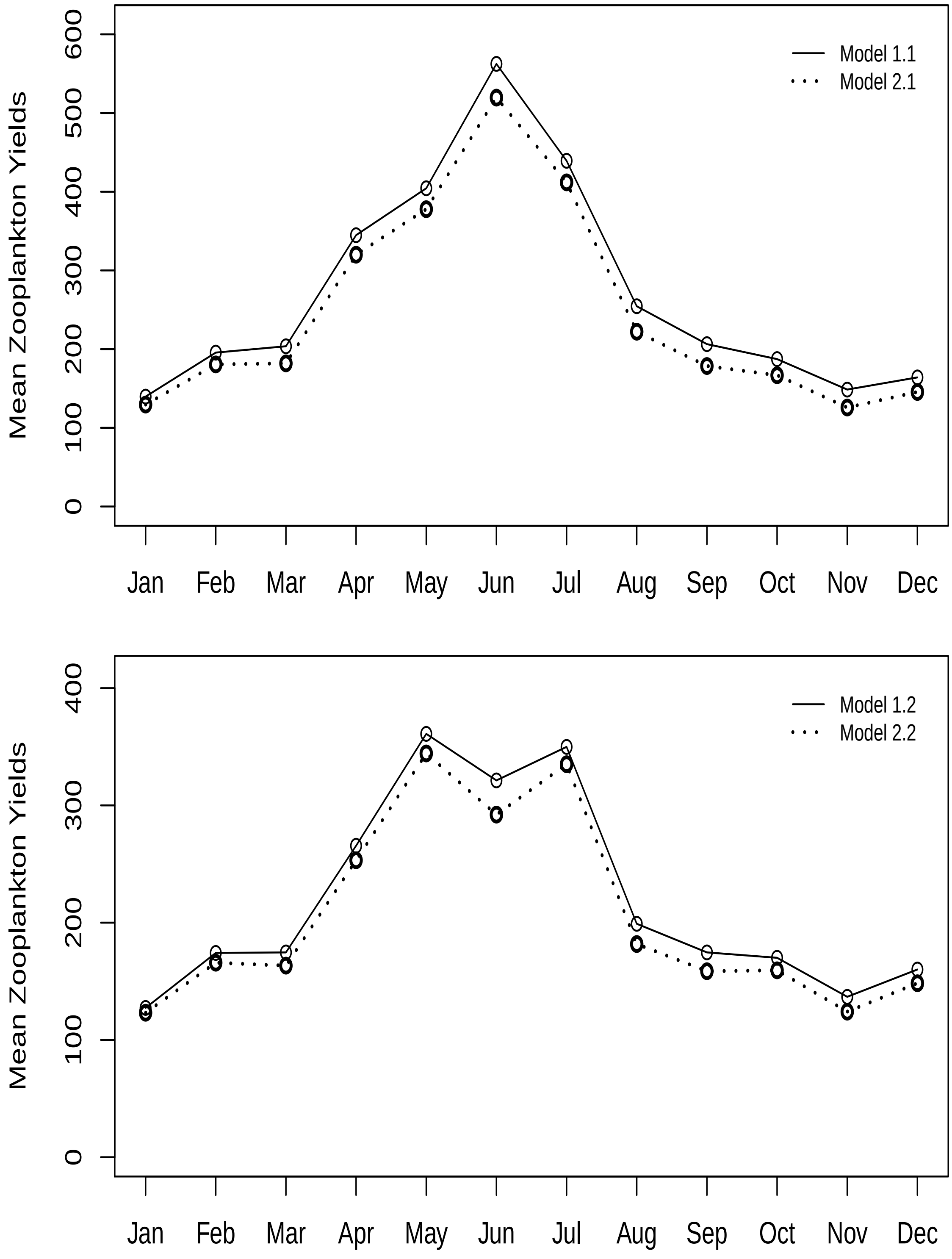


Figure I.49: Predicted Monthly Mean Zooplankton Yields: Sampling Site 86.7-50.

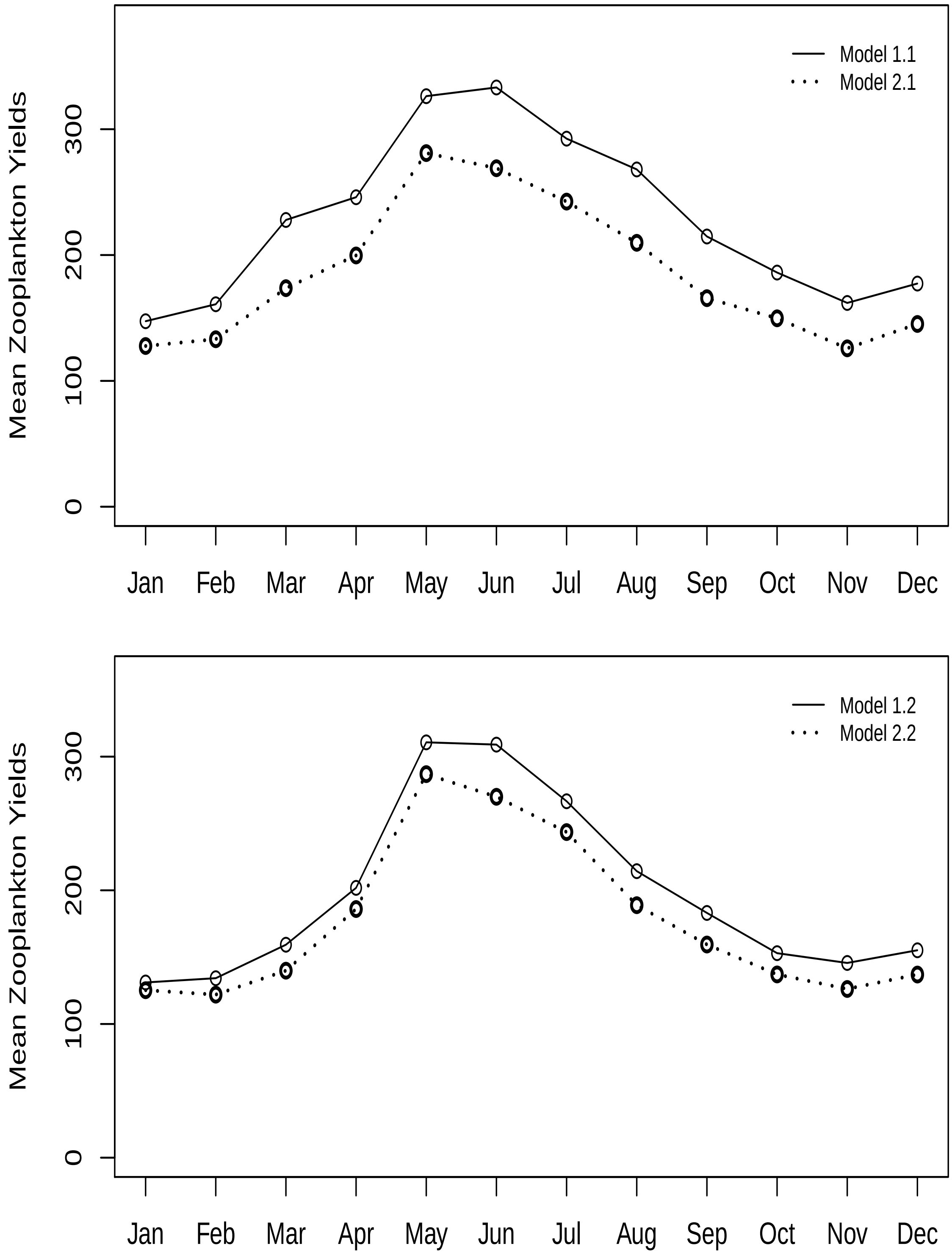


Figure I.50: Predicted Monthly Mean Zooplankton Yields: Sampling Site 86.7-55.

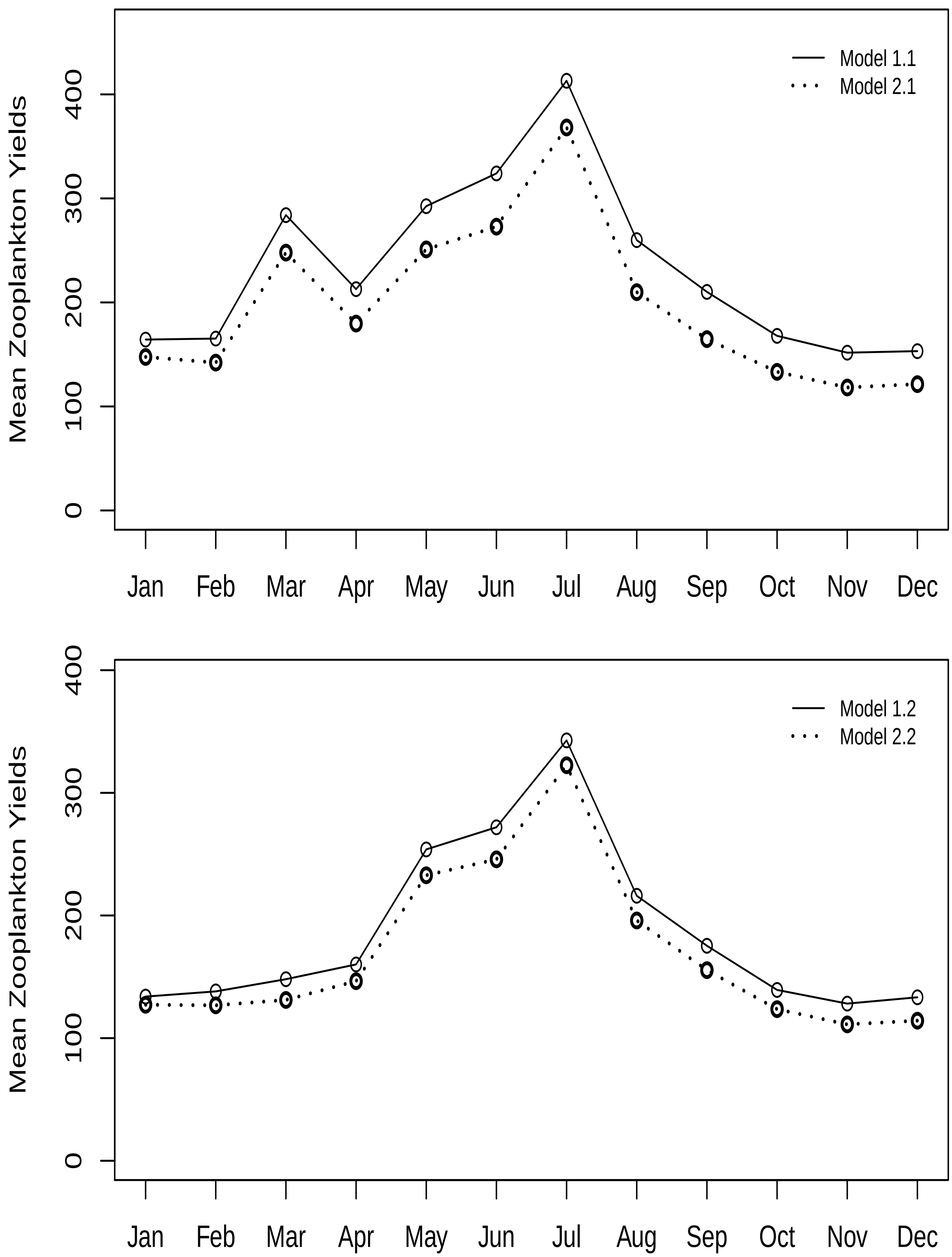
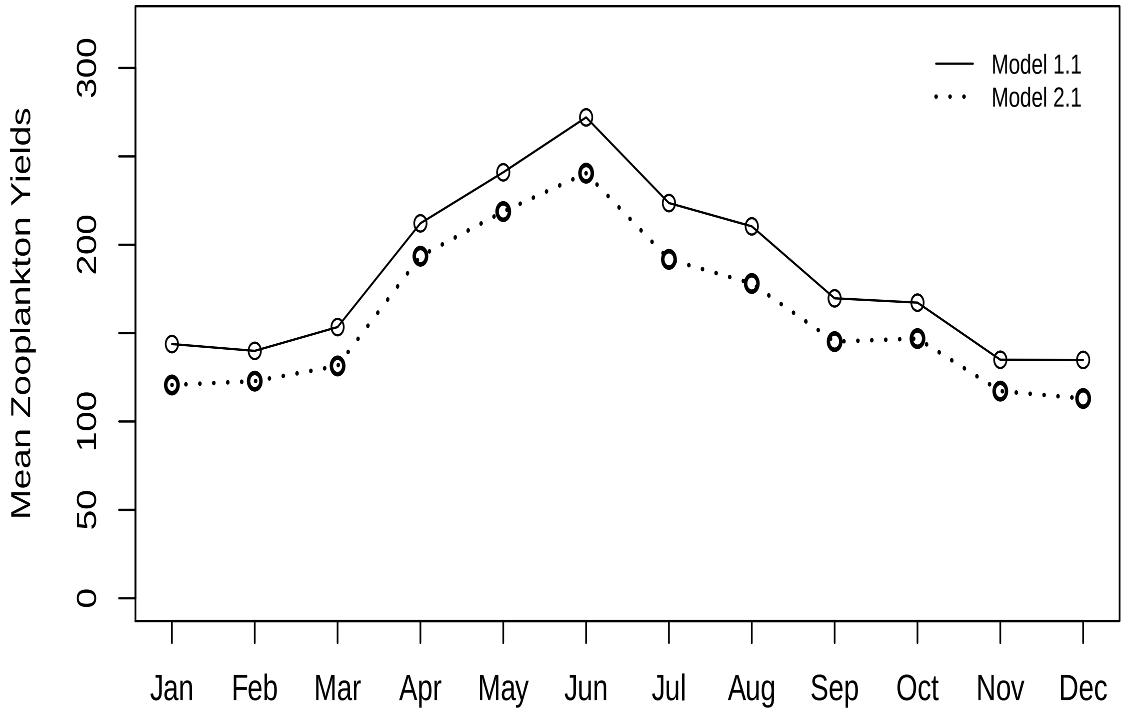


Figure I.51: Predicted Monthly Mean Zooplankton Yields: Sampling Site 86.7-60.



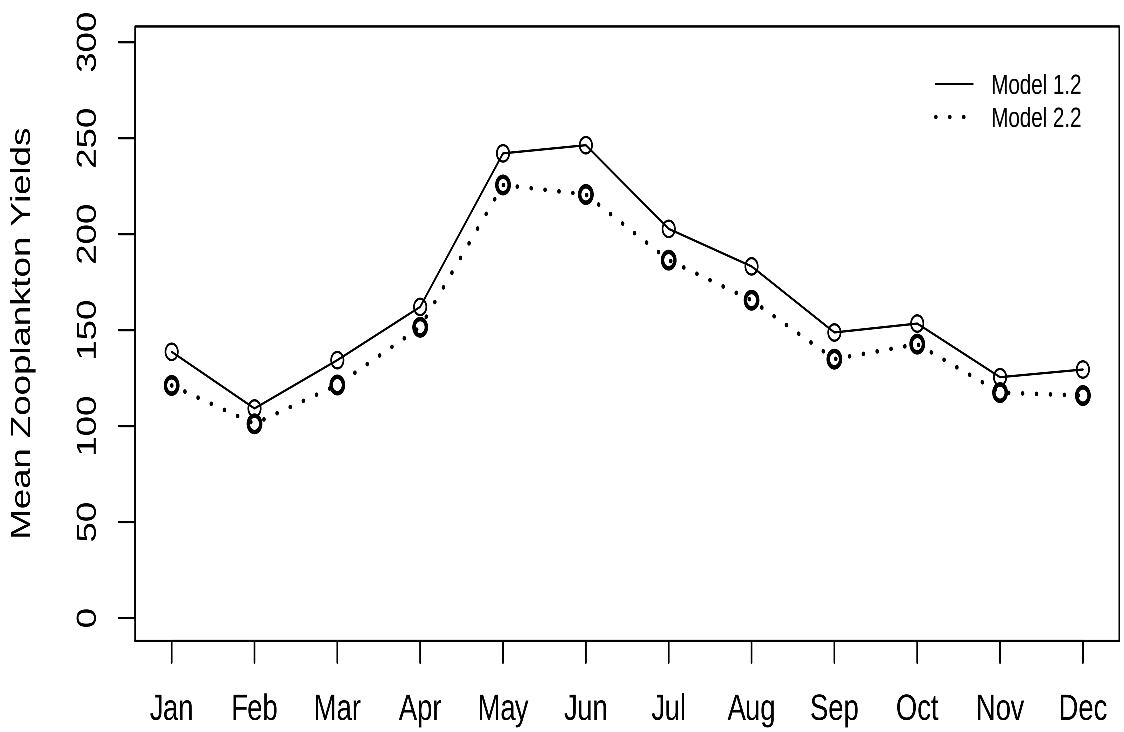


Figure I.52: Predicted Monthly Mean Zooplankton Yields: Sampling Site 86.7-70.

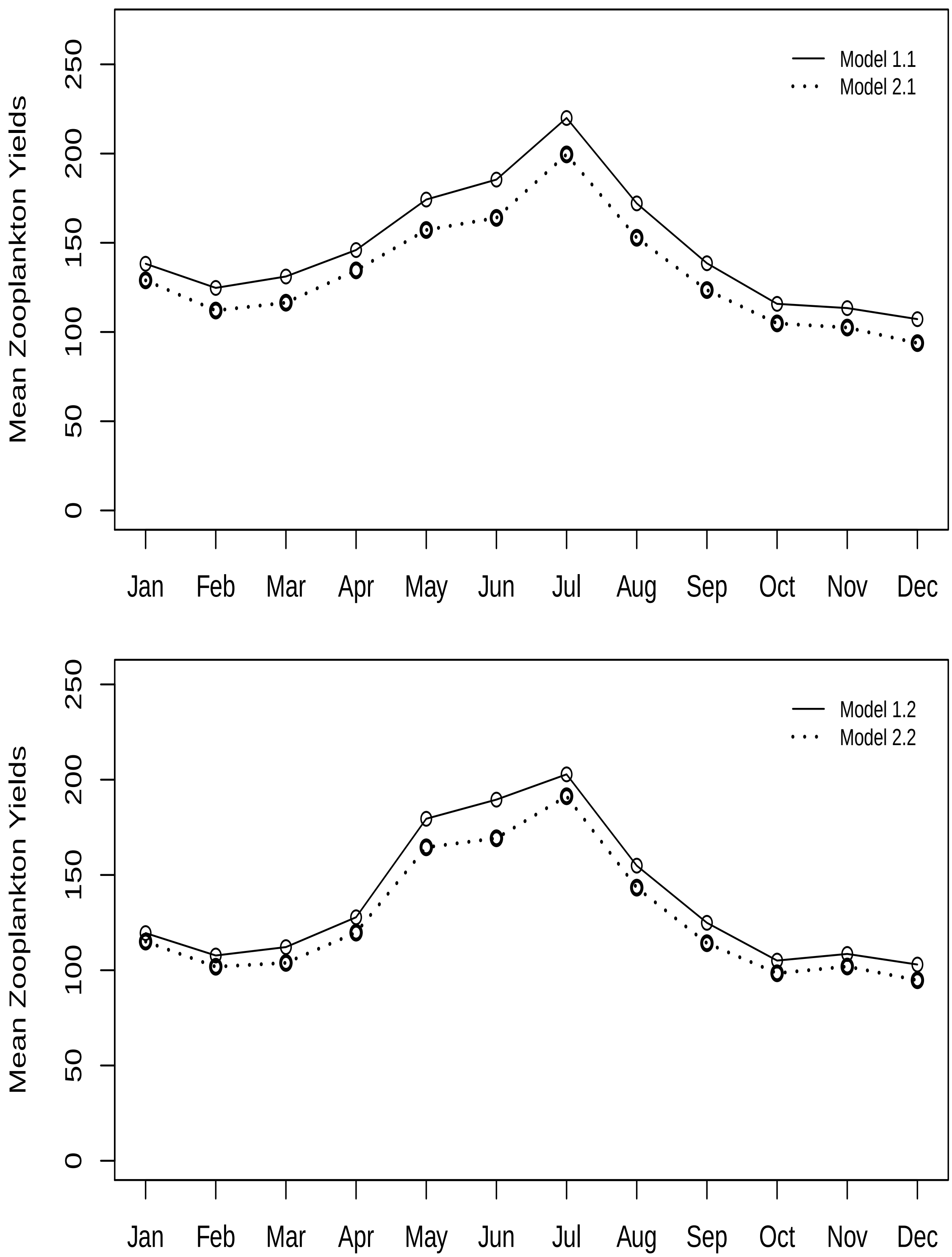


Figure I.53: Predicted Monthly Mean Zooplankton Yields: Sampling Site 86.7-80.

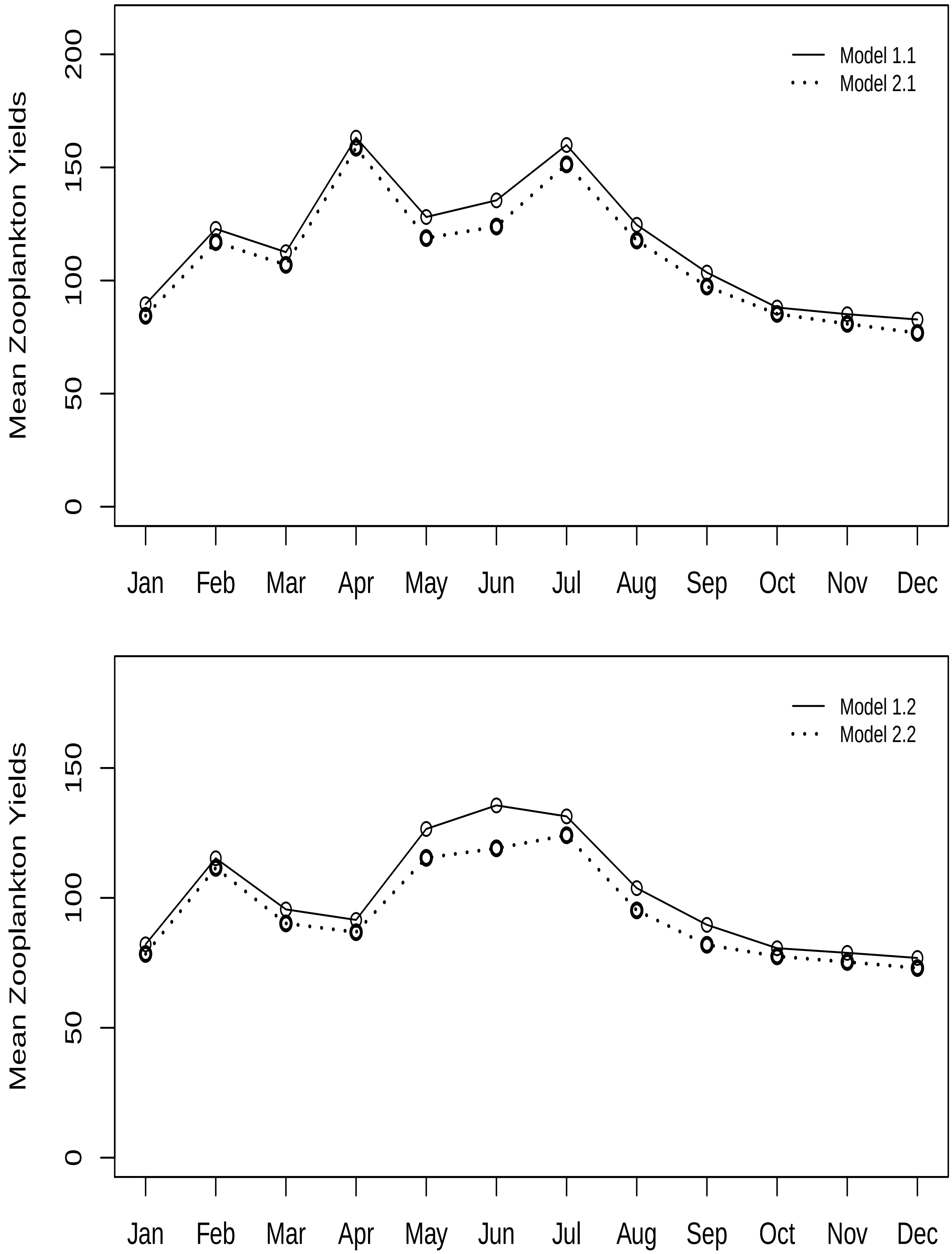


Figure I.54: Predicted Monthly Mean Zooplankton Yields: Sampling Site 86.7-90.

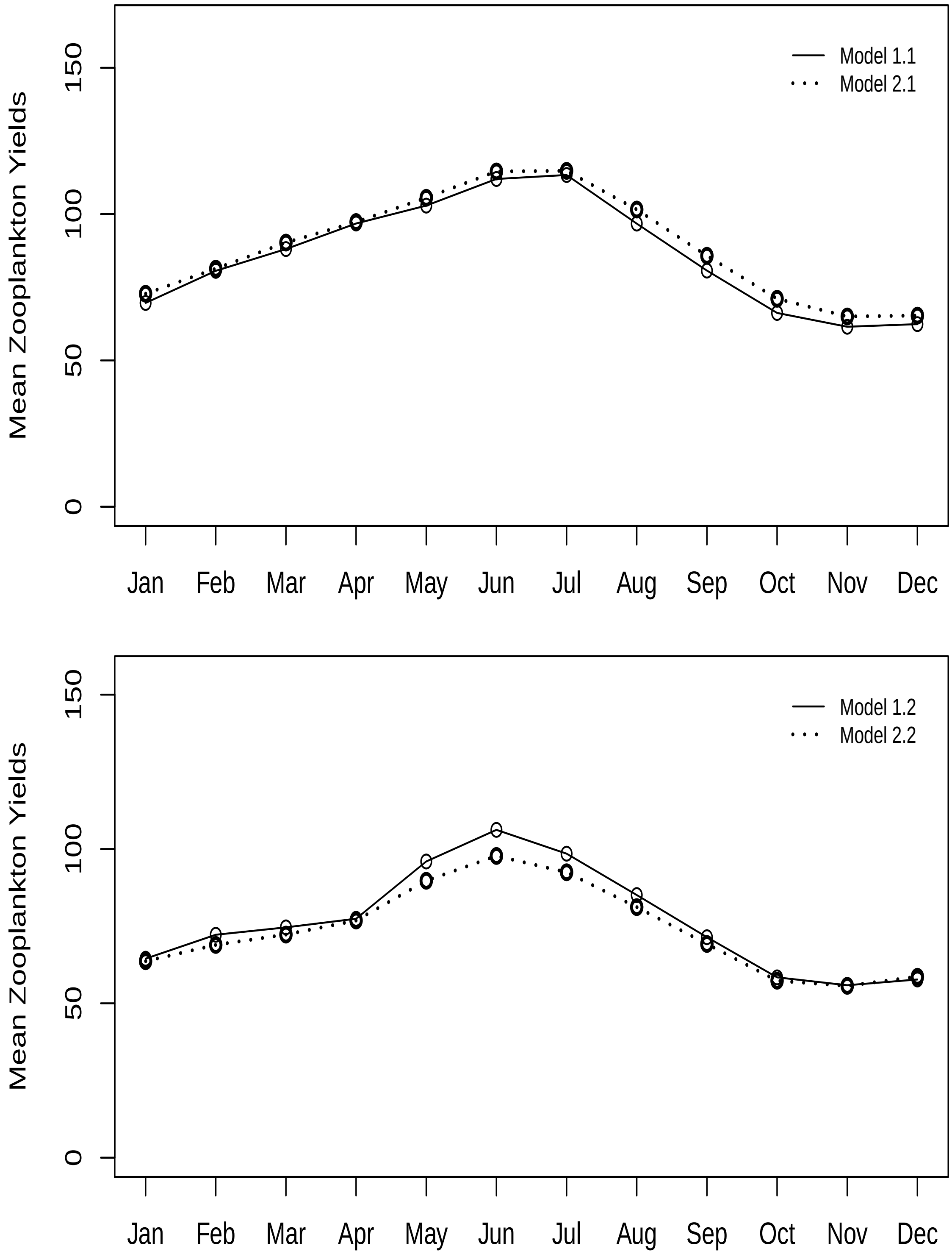


Figure I.55: Predicted Monthly Mean Zooplankton Yields: Sampling Site 86.7-100.

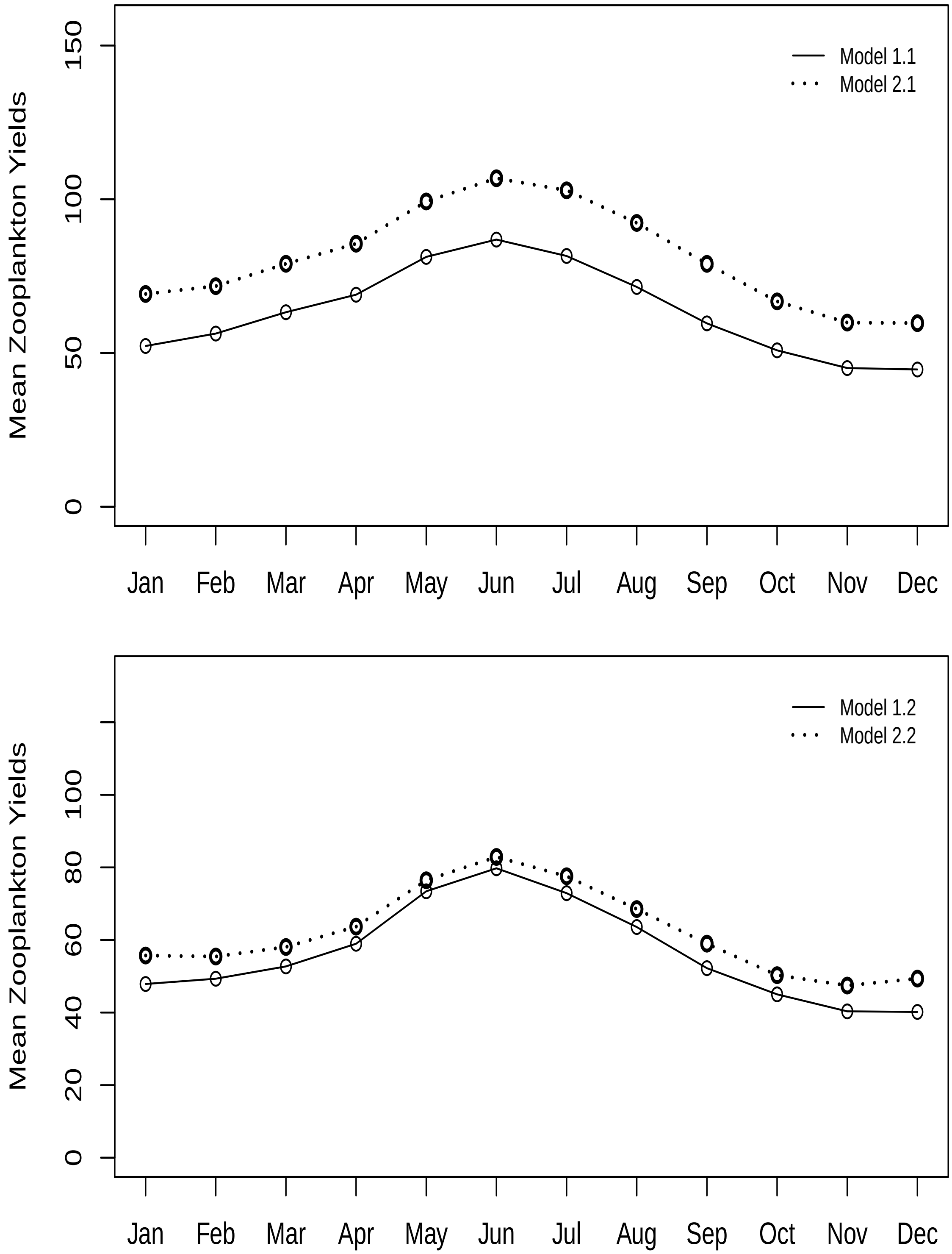


Figure I.56: Predicted Monthly Mean Zooplankton Yields: Sampling Site 86.7-110.

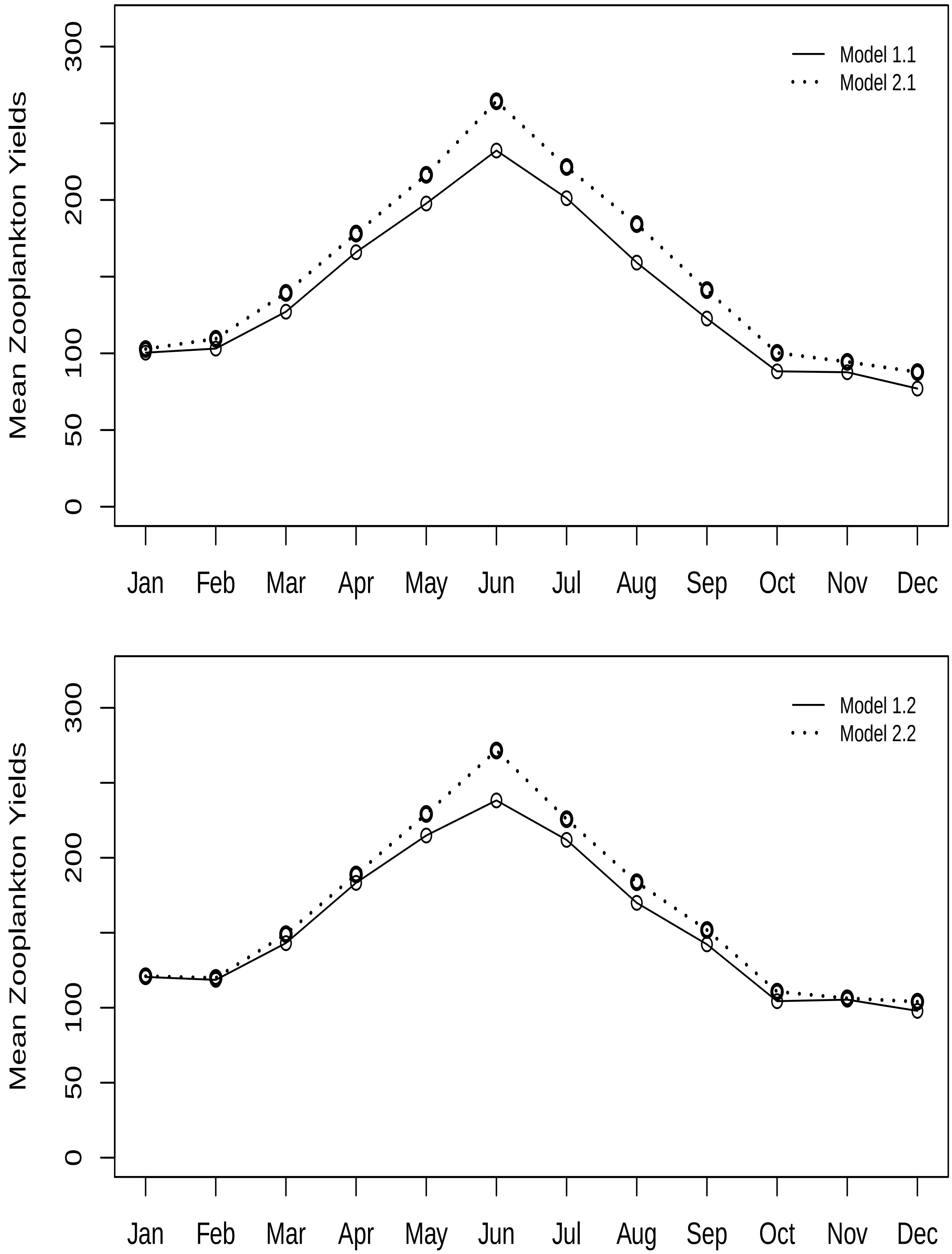


Figure I.57: Predicted Monthly Mean Zooplankton Yields: Sampling Site 90-28.

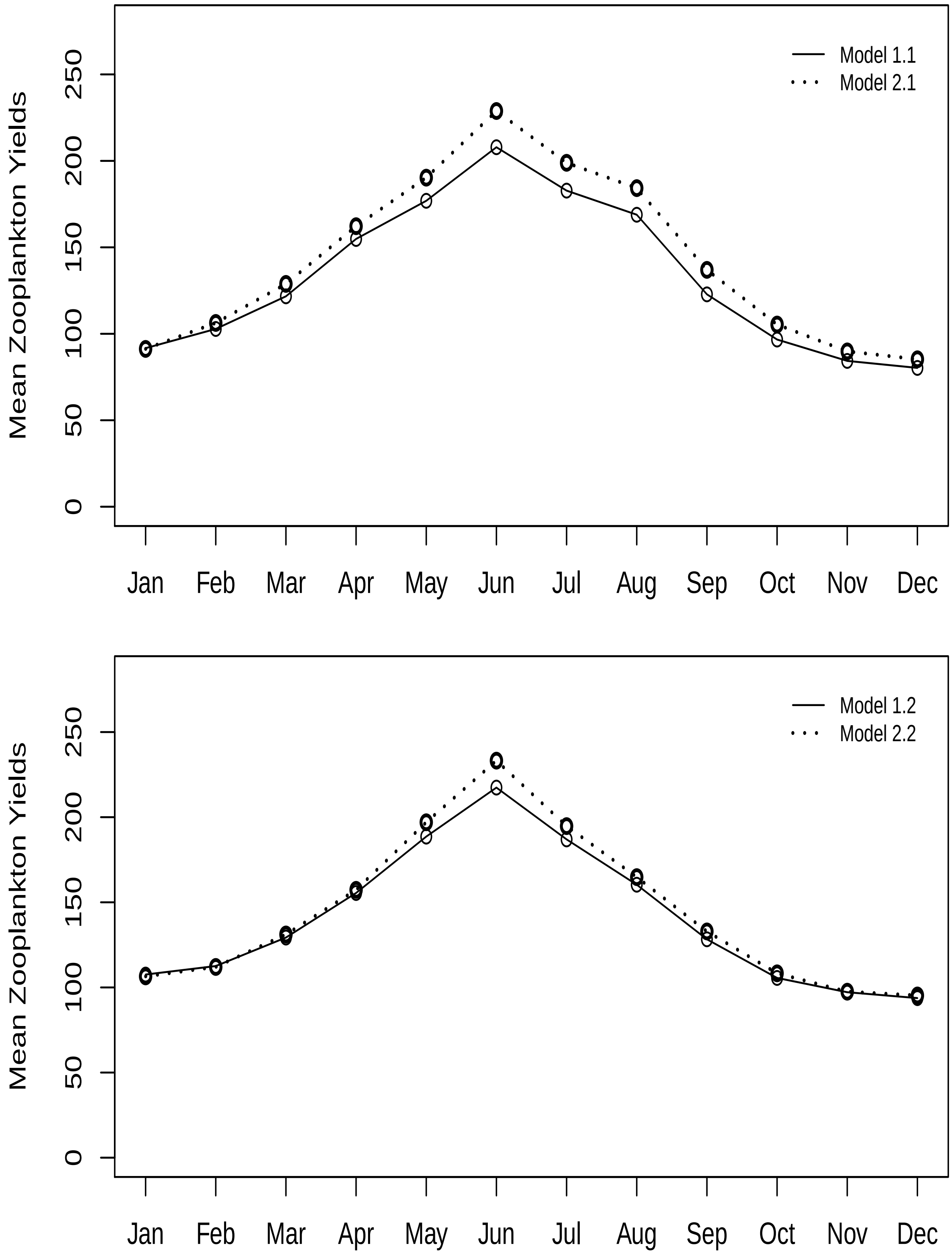


Figure I.58: Predicted Monthly Mean Zooplankton Yields: Sampling Site 90-30.

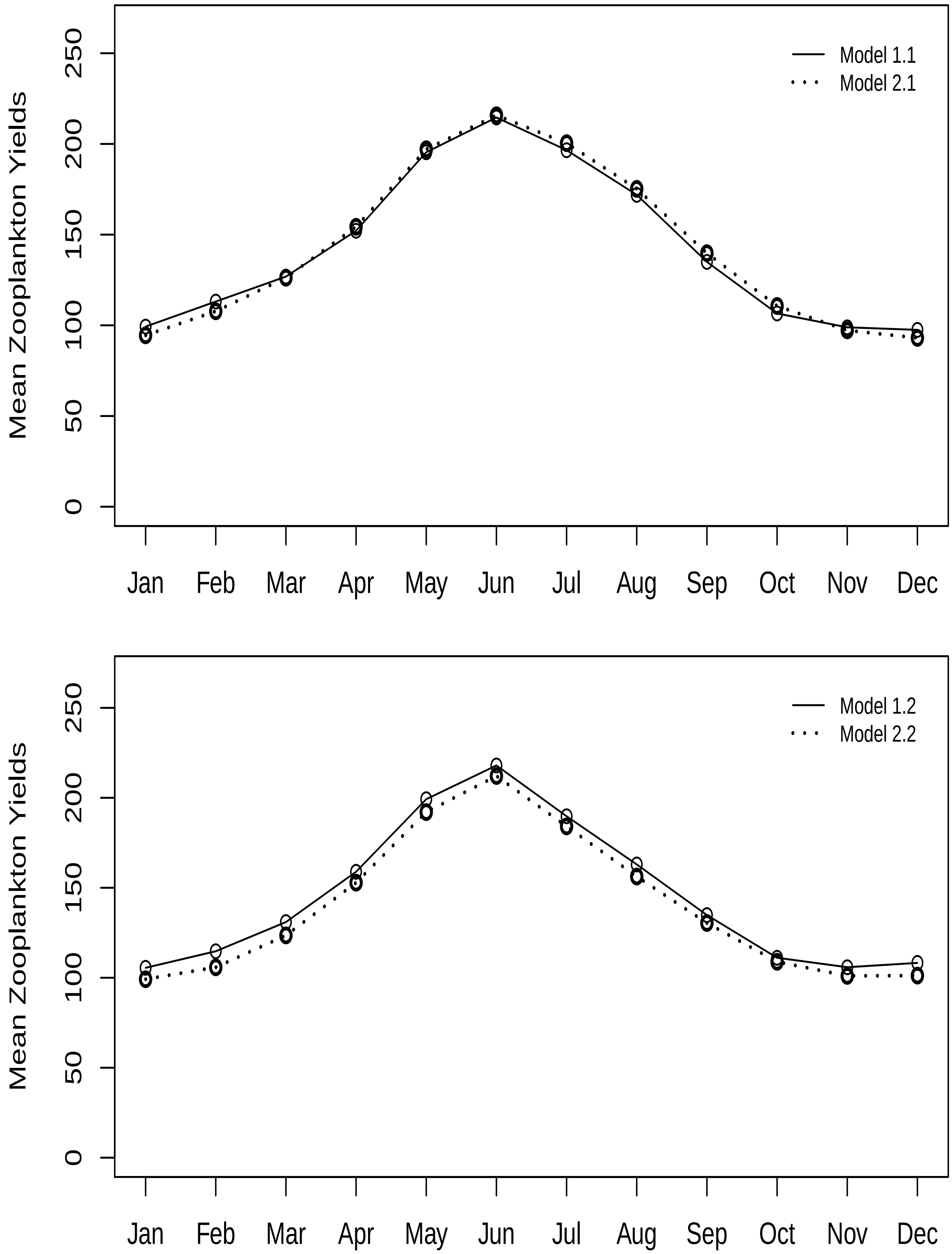
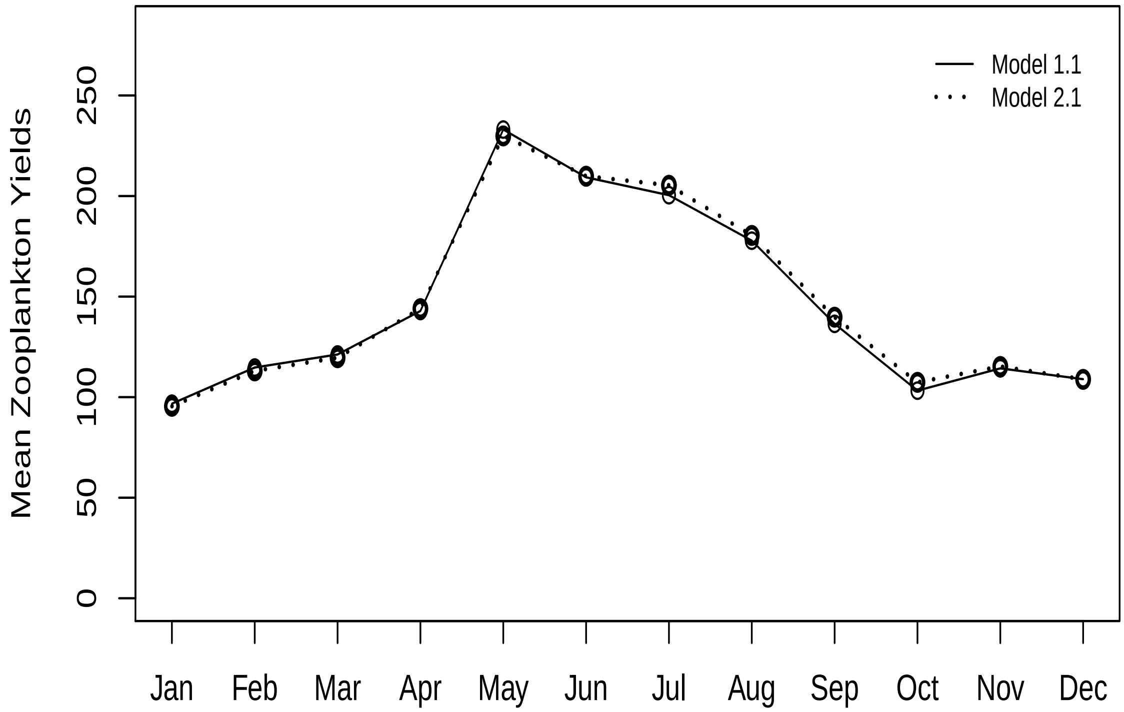


Figure I.59: Predicted Monthly Mean Zooplankton Yields: Sampling Site 90-35.



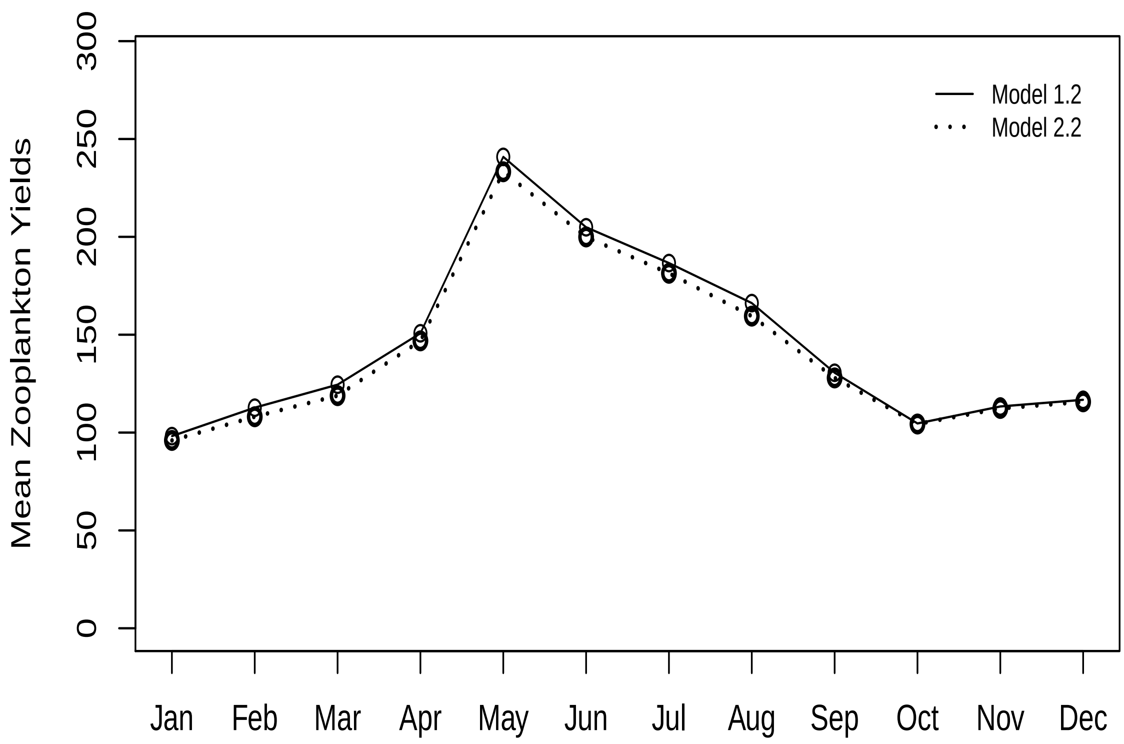


Figure I.60: Predicted Monthly Mean Zooplankton Yields: Sampling Site 90-37.

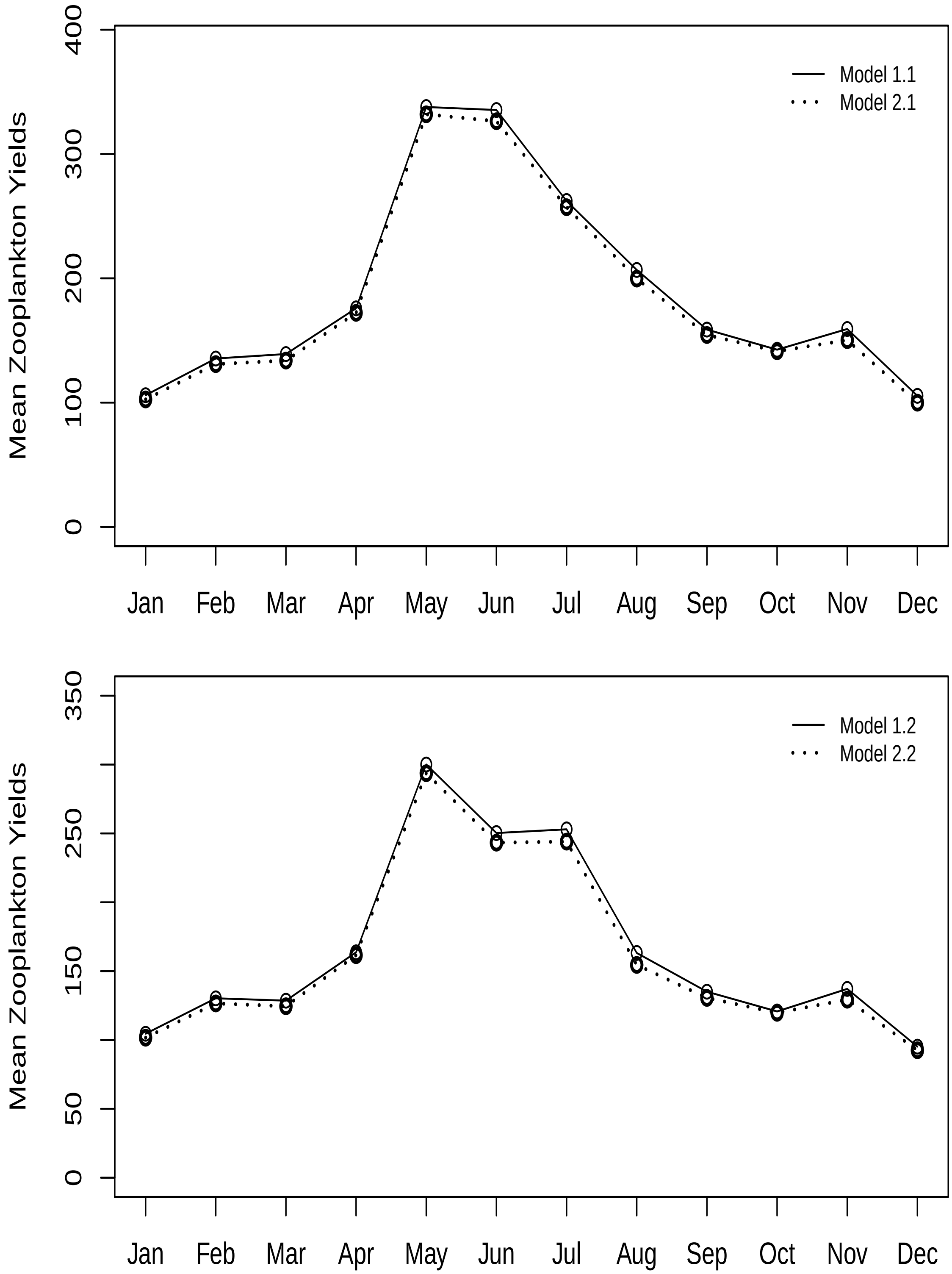


Figure I.61: Predicted Monthly Mean Zooplankton Yields: Sampling Site 90-45.

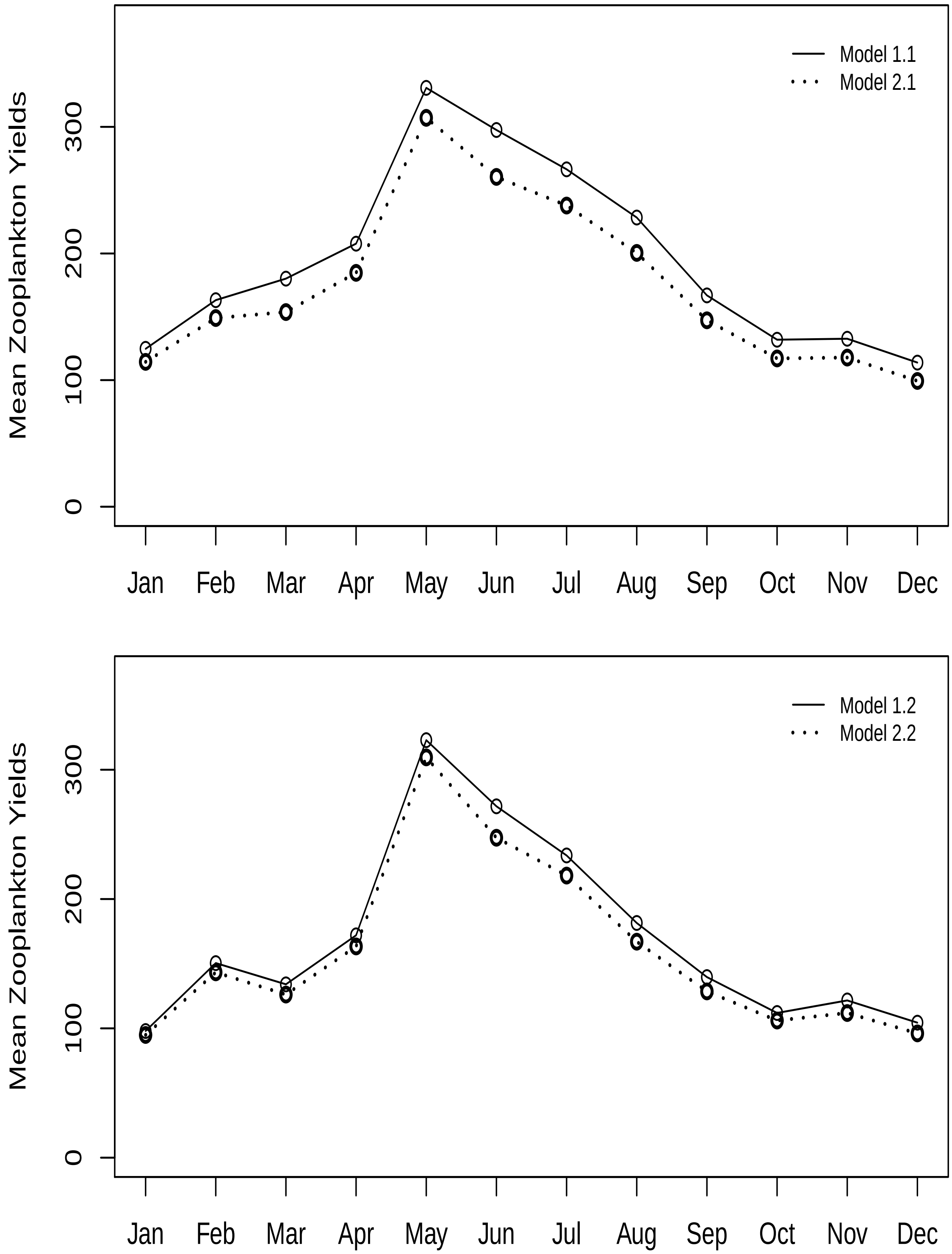


Figure I.62: Predicted Monthly Mean Zooplankton Yields: Sampling Site 90-53.

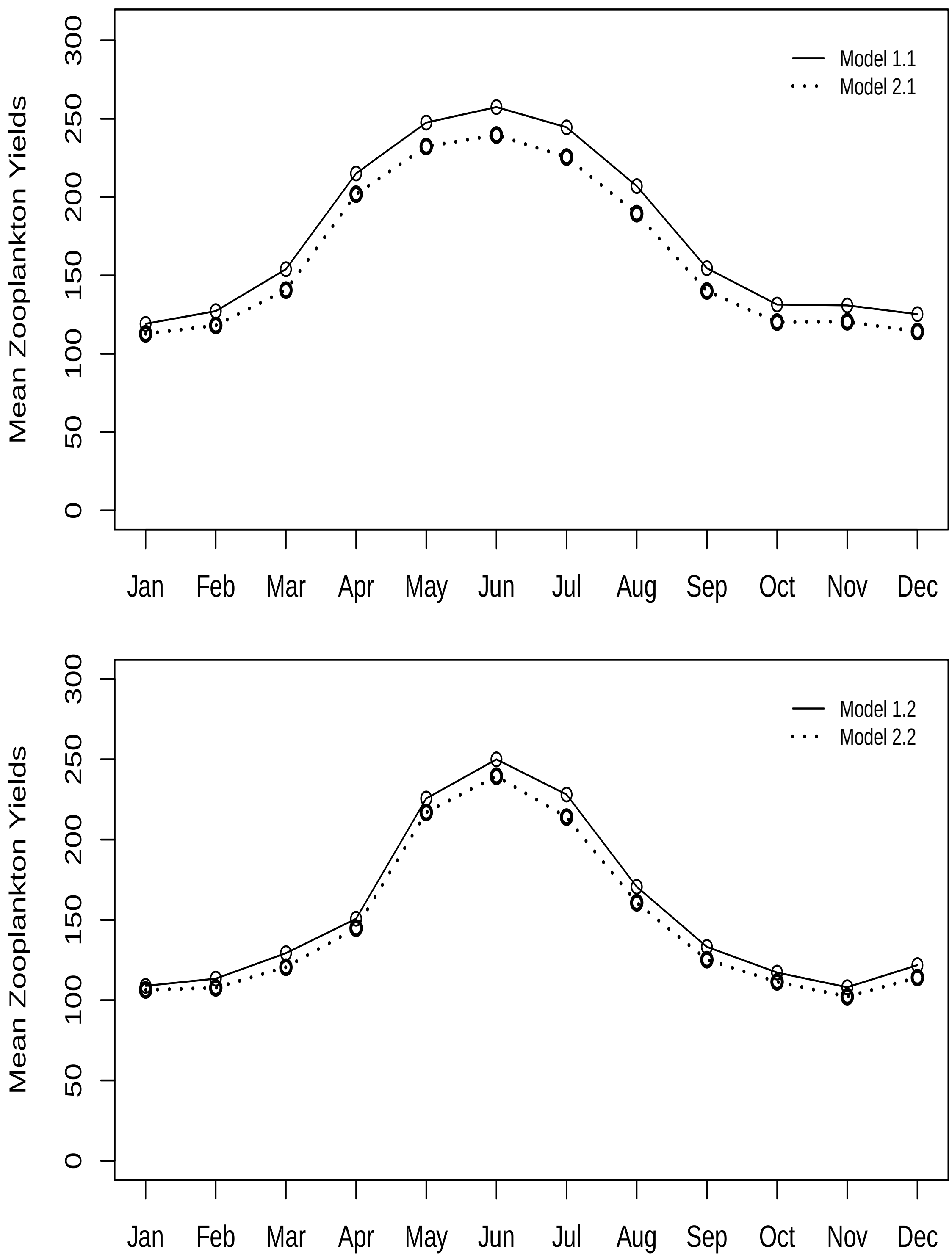


Figure I.63: Predicted Monthly Mean Zooplankton Yields: Sampling Site 90-60.

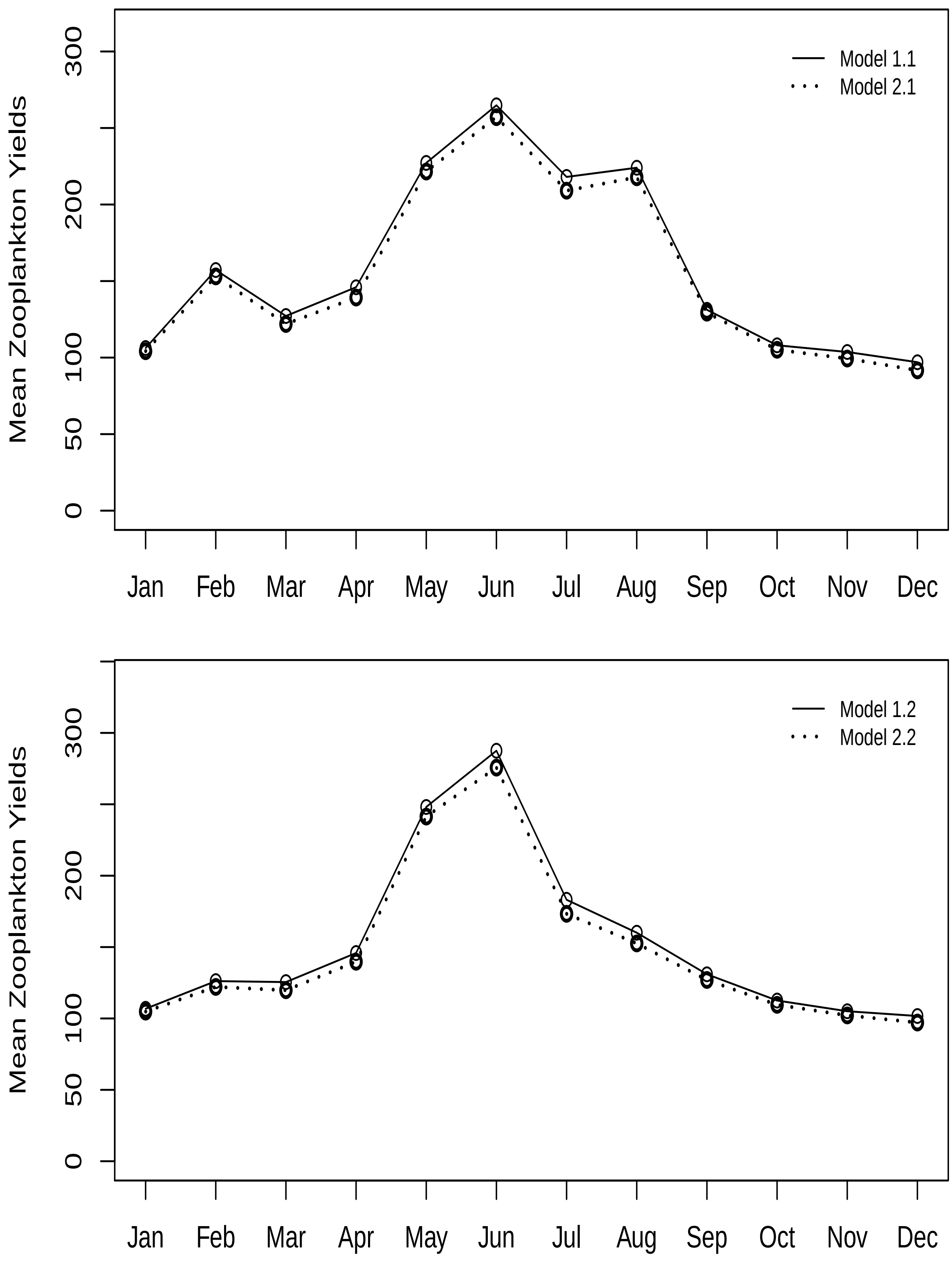


Figure I.64: Predicted Monthly Mean Zooplankton Yields: Sampling Site 90-70.

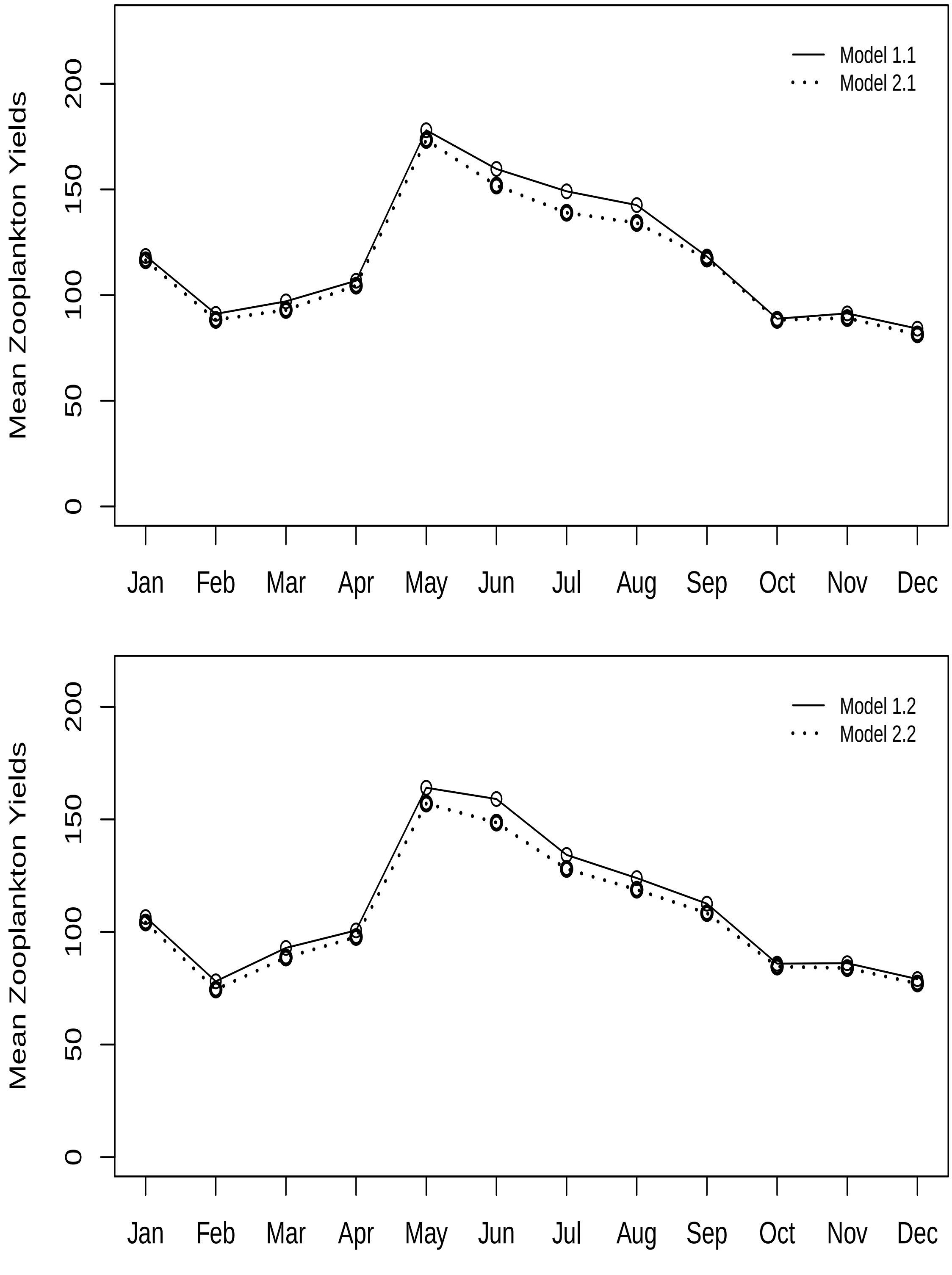


Figure I.65: Predicted Monthly Mean Zooplankton Yields: Sampling Site 90-80.

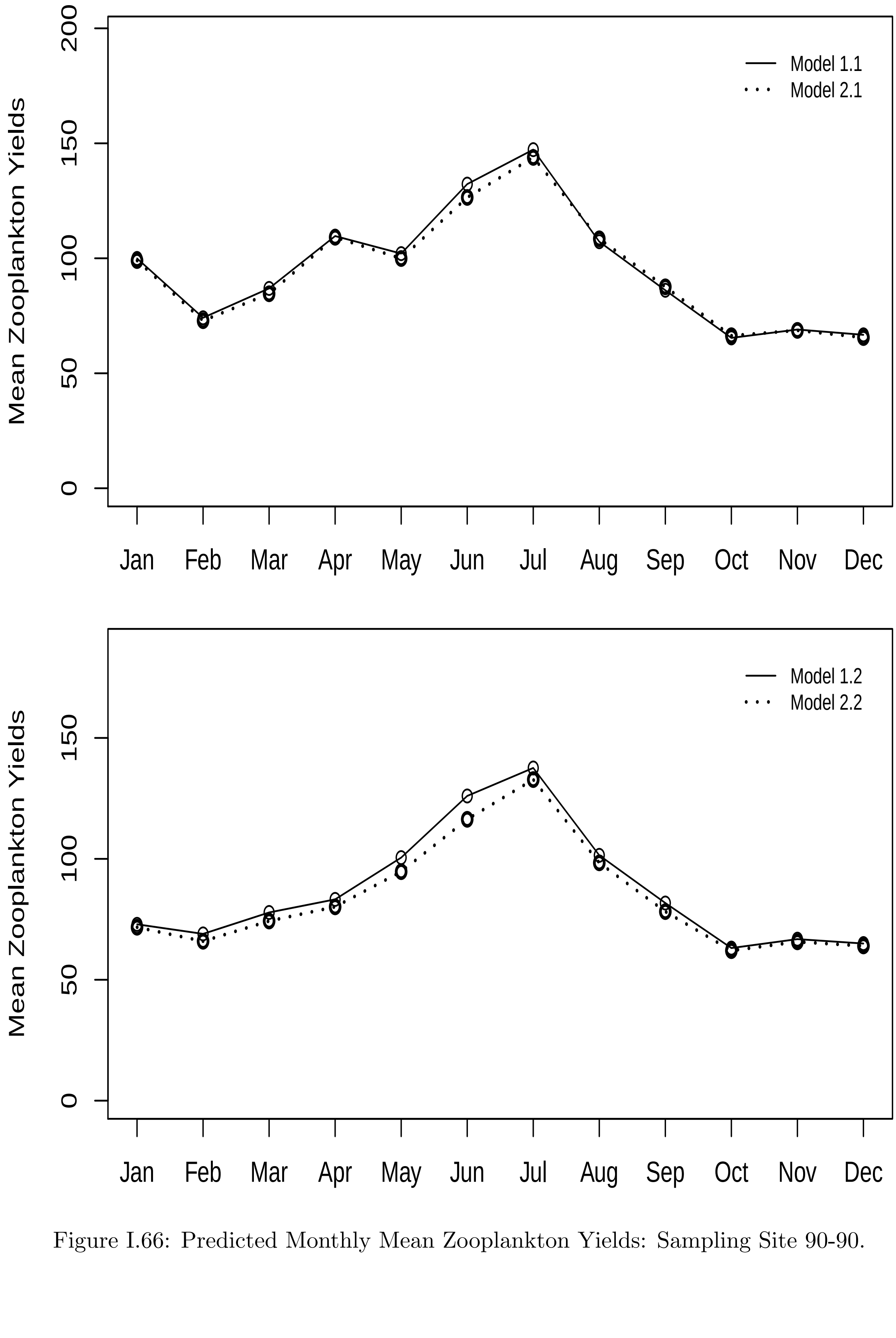


Figure I.66: Predicted Monthly Mean Zooplankton Yields: Sampling Site 90-90.

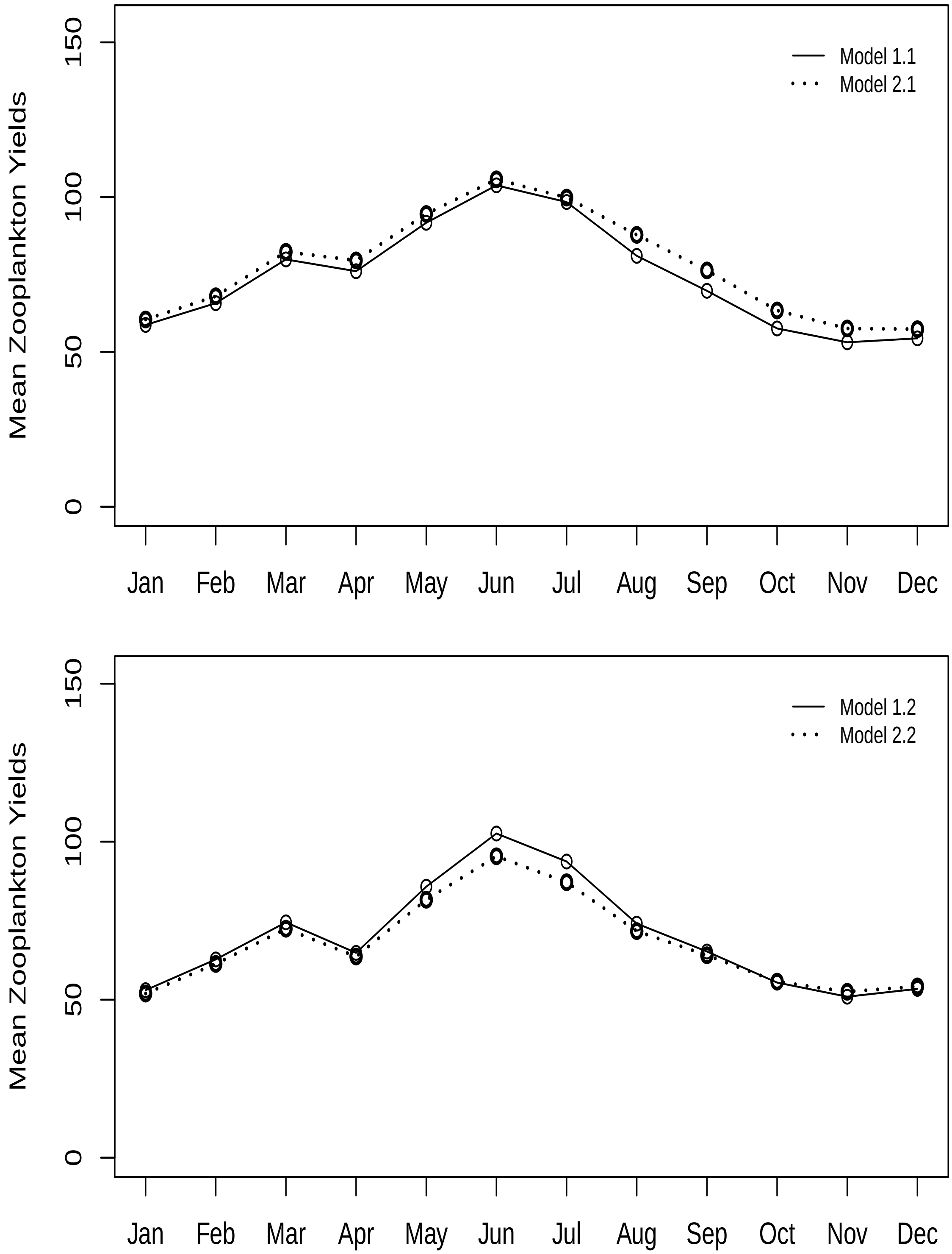


Figure I.67: Predicted Monthly Mean Zooplankton Yields: Sampling Site 90-100.

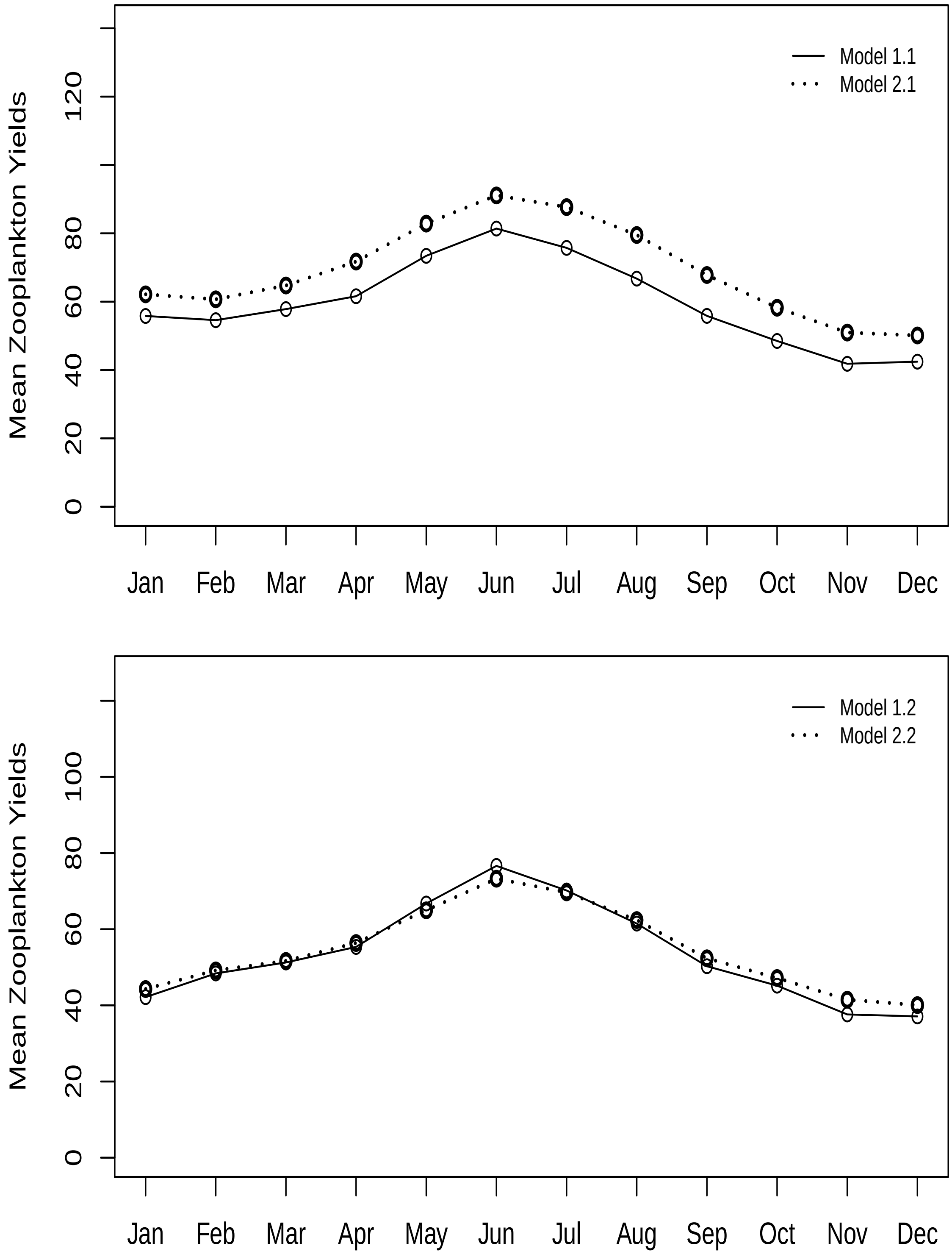


Figure I.68: Predicted Monthly Mean Zooplankton Yields: Sampling Site 90-110.

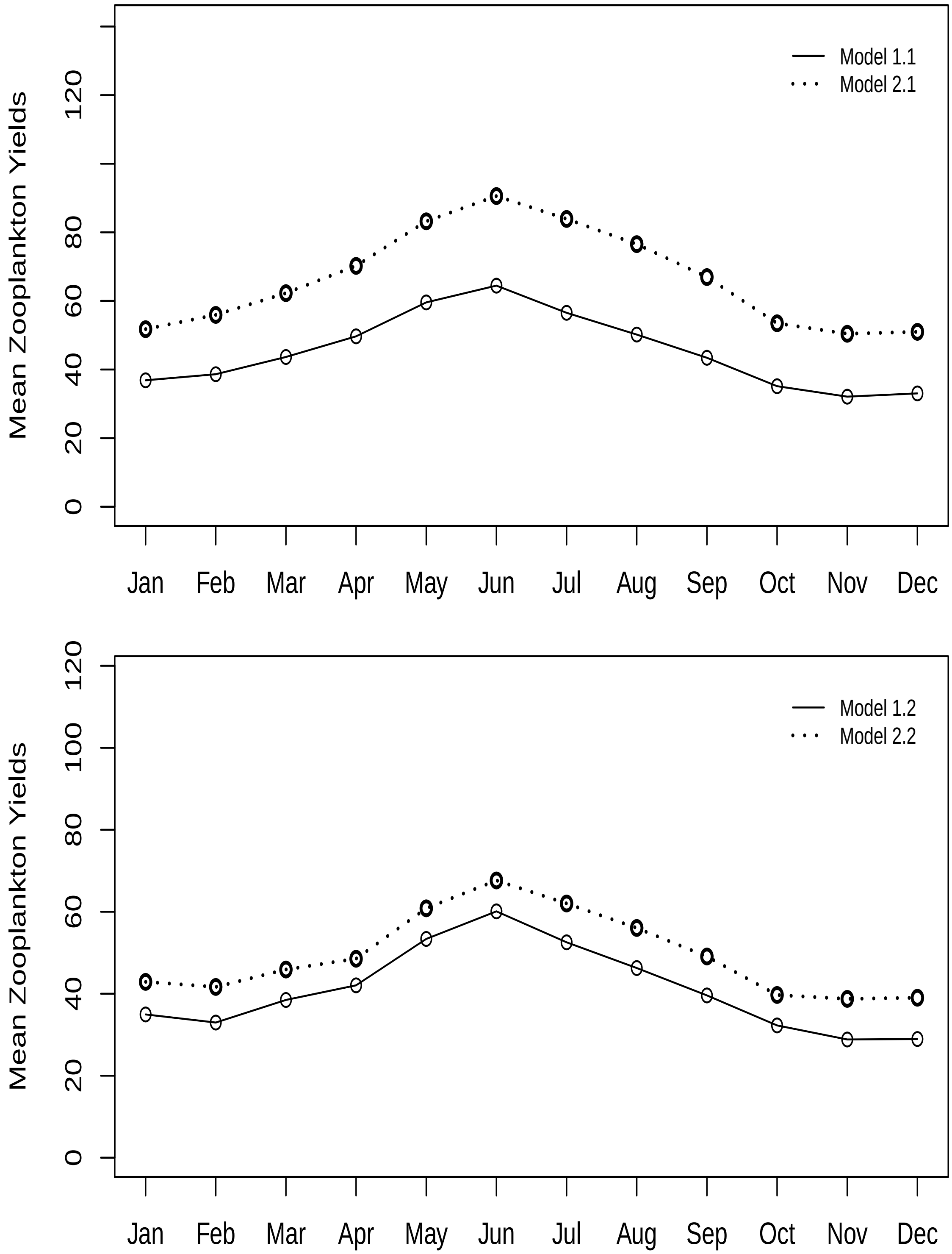


Figure I.69: Predicted Monthly Mean Zooplankton Yields: Sampling Site 90-120.

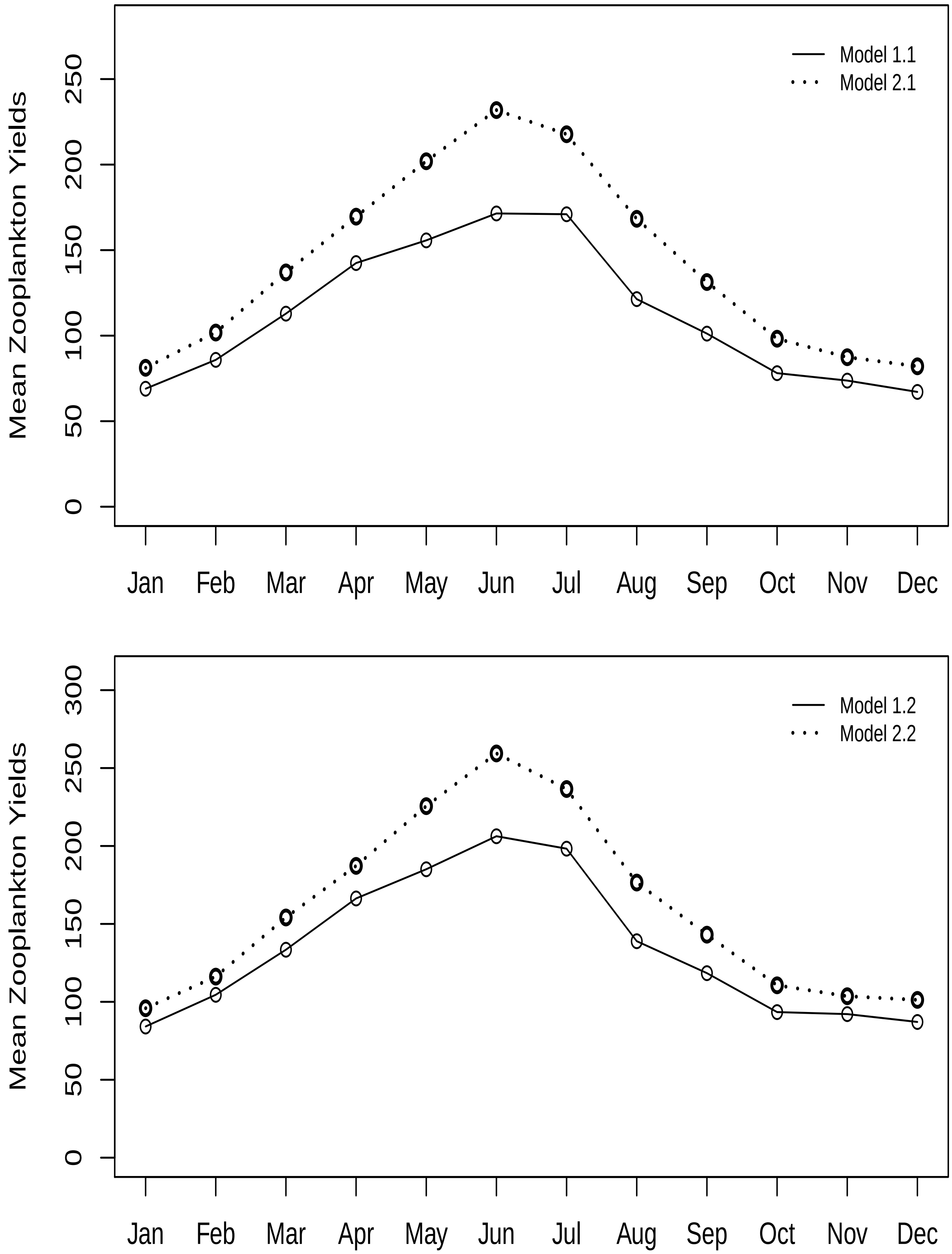


Figure I.70: Predicted Monthly Mean Zooplankton Yields: Sampling Site 93.3-26.7.

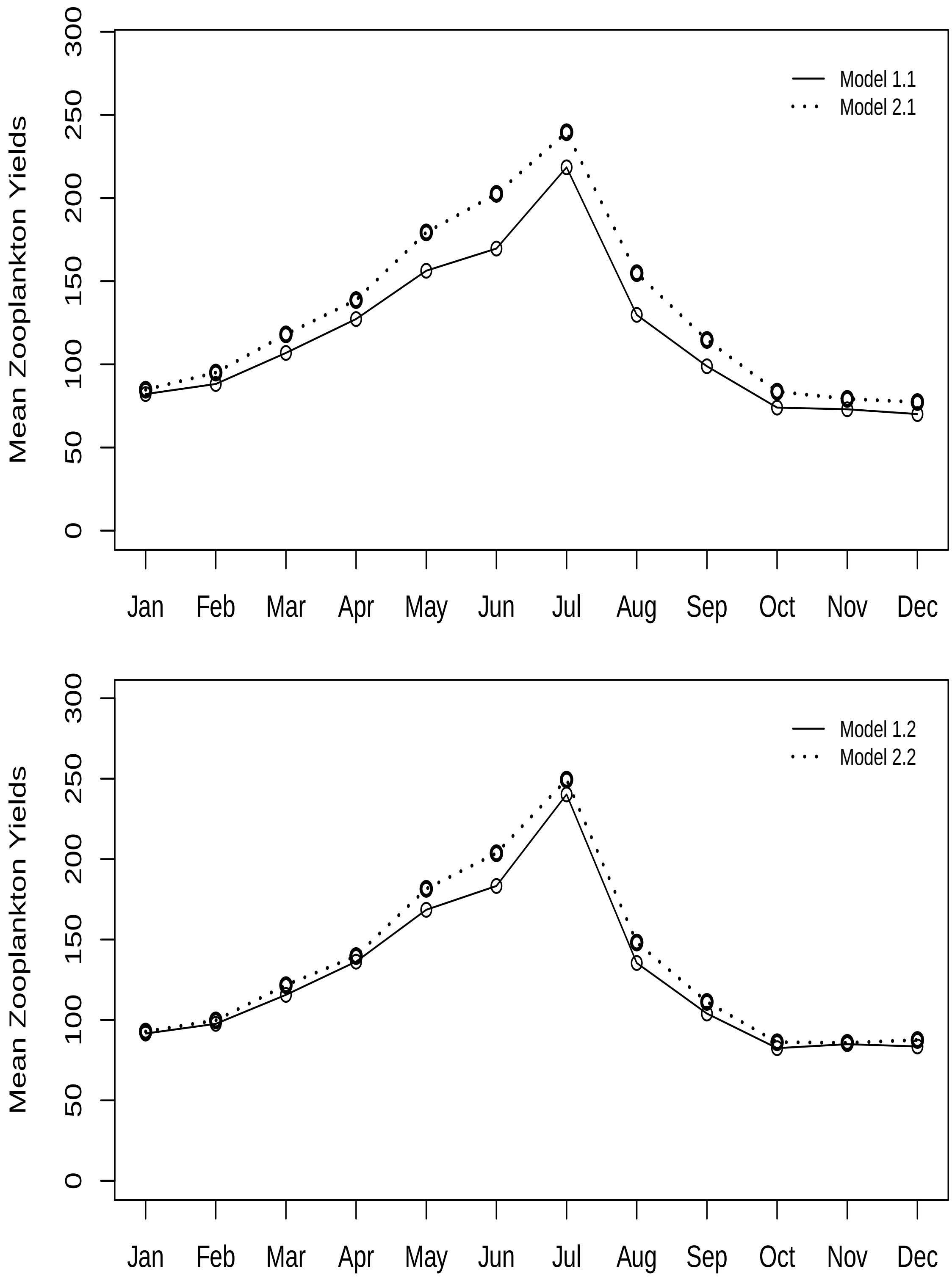


Figure I.71: Predicted Monthly Mean Zooplankton Yields: Sampling Site 93.3-28.

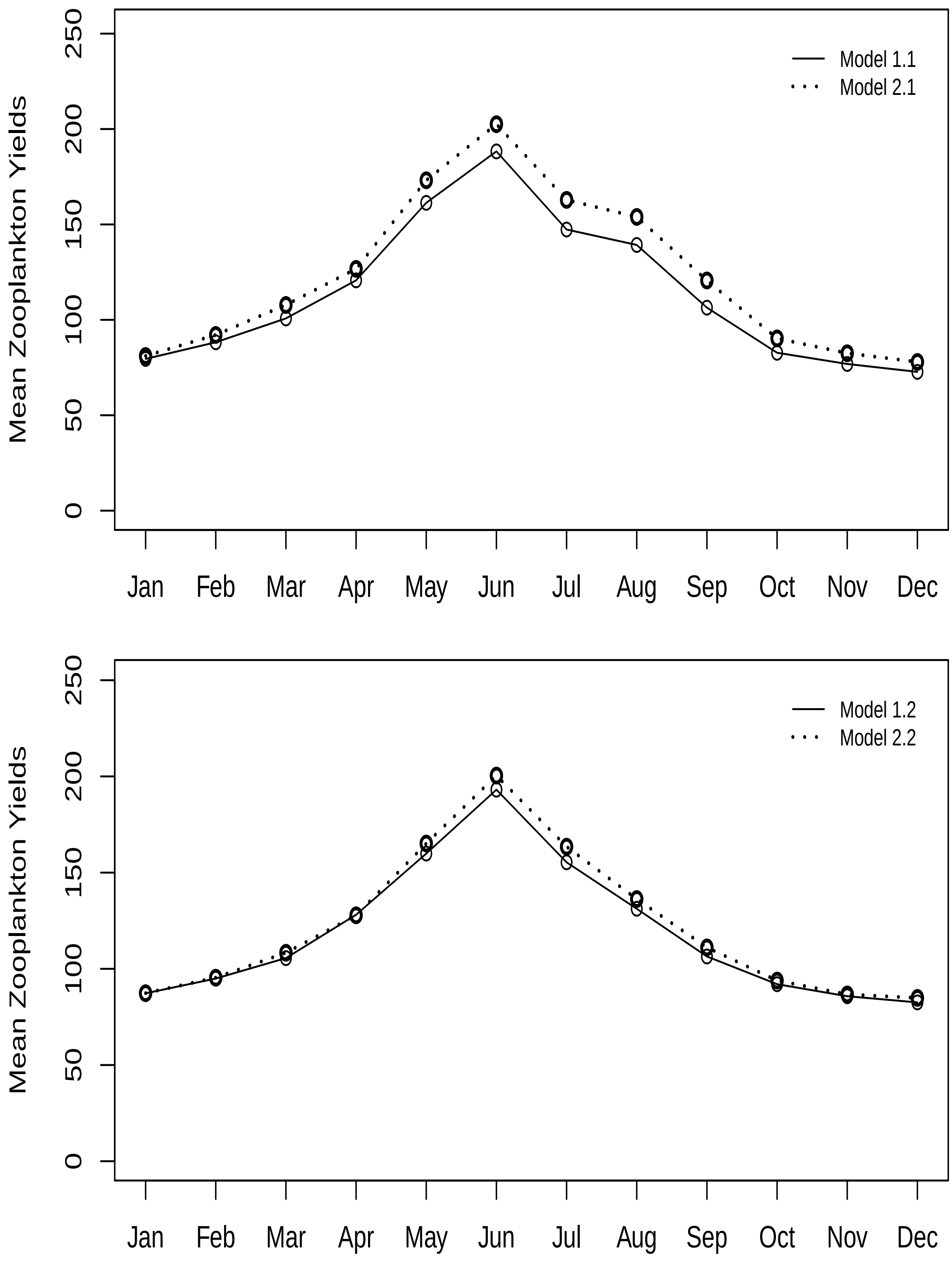


Figure I.72: Predicted Monthly Mean Zooplankton Yields: Sampling Site 93.3-30.

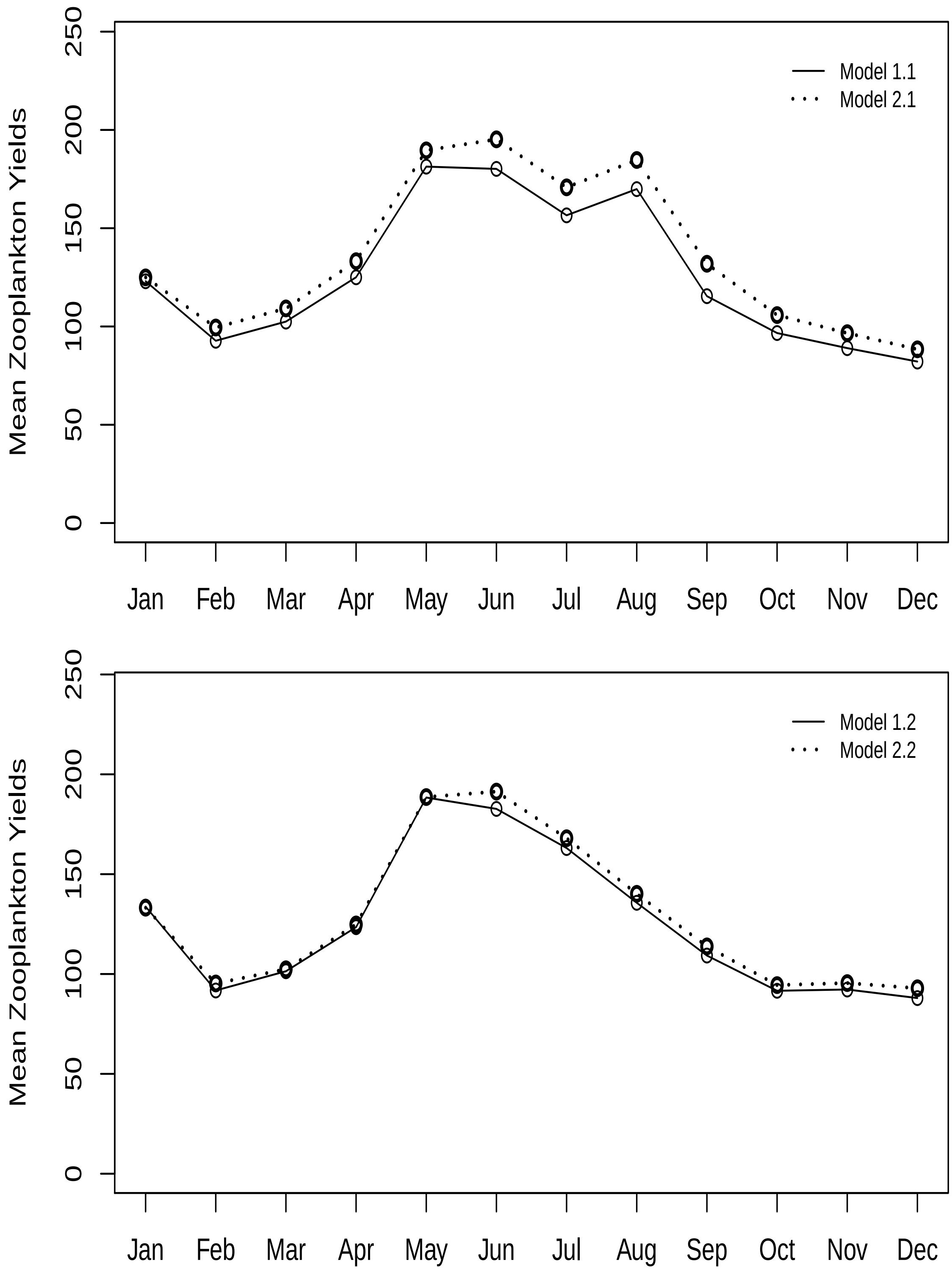


Figure I.73: Predicted Monthly Mean Zooplankton Yields: Sampling Site 93.3-35.

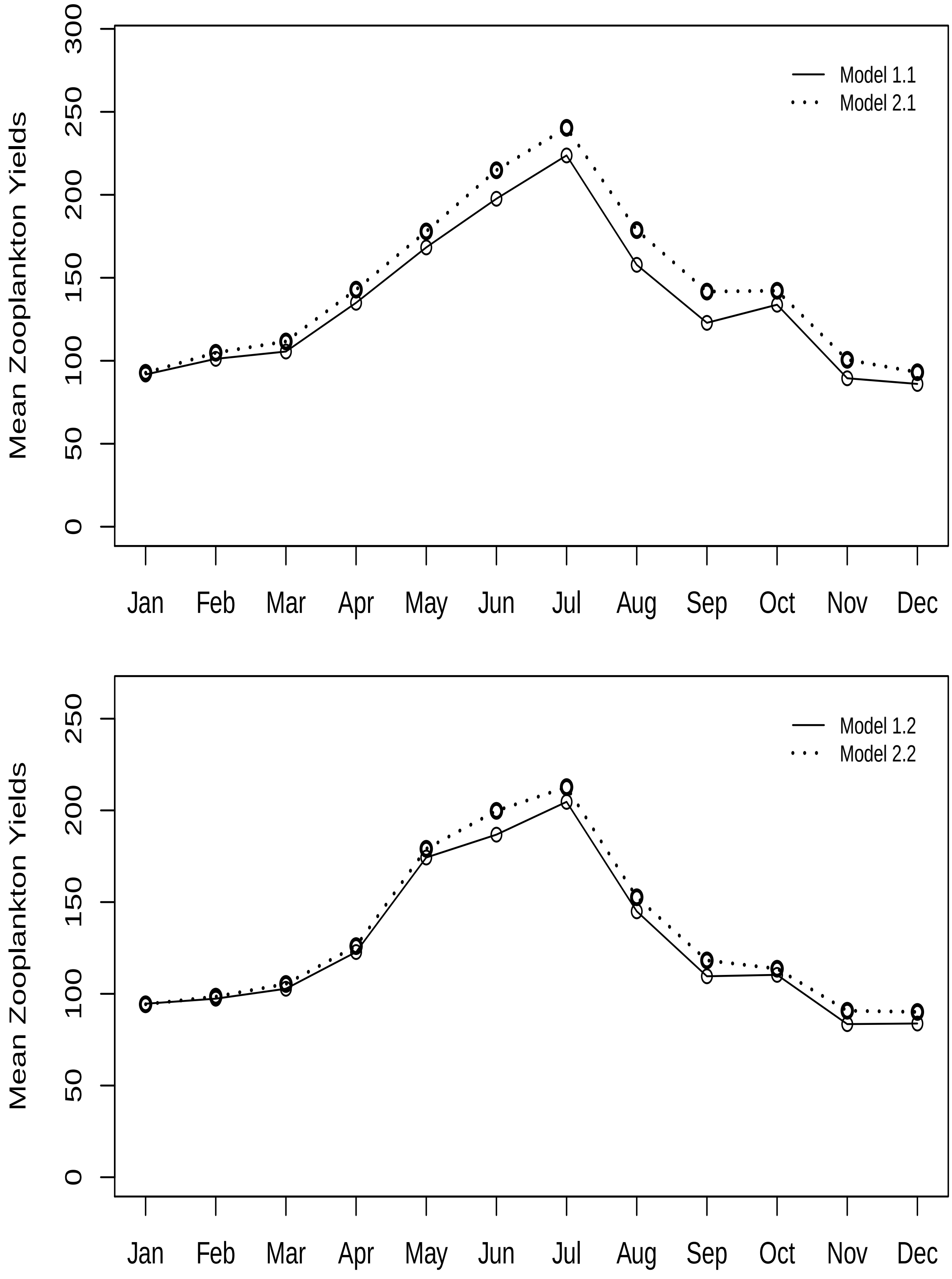


Figure I.74: Predicted Monthly Mean Zooplankton Yields: Sampling Site 93.3-40.

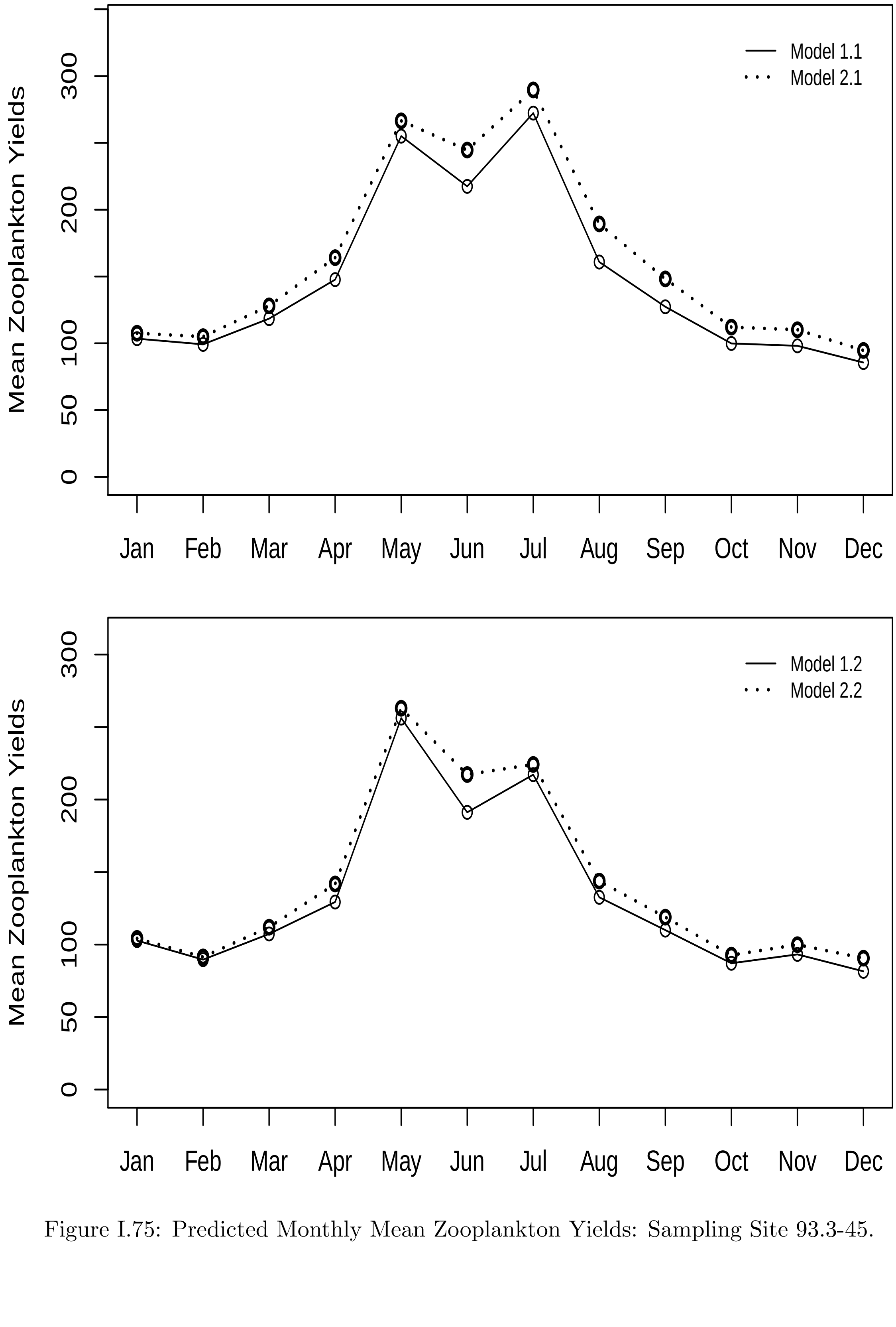


Figure I.75: Predicted Monthly Mean Zooplankton Yields: Sampling Site 93.3-45.

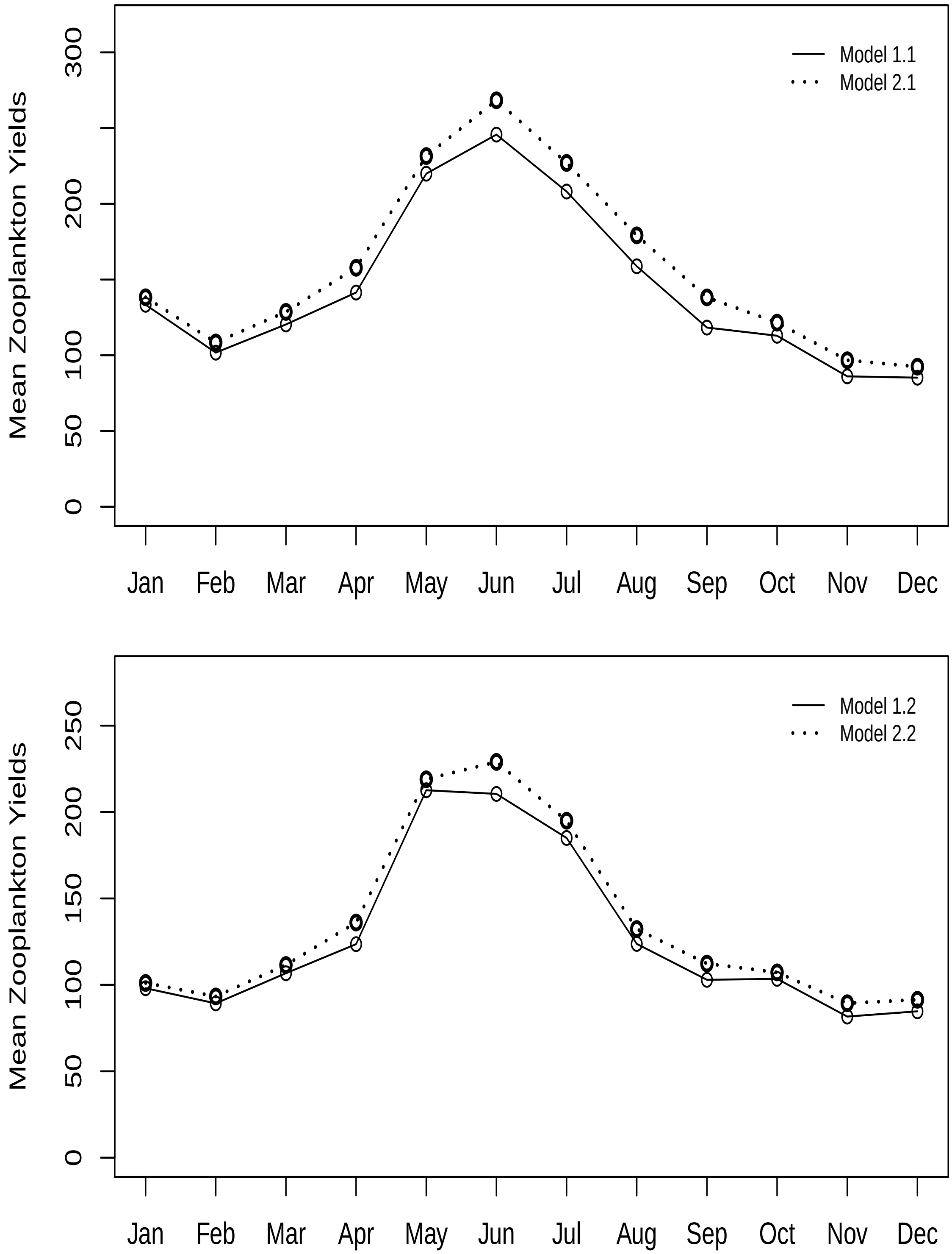


Figure I.76: Predicted Monthly Mean Zooplankton Yields: Sampling Site 93.3-50.

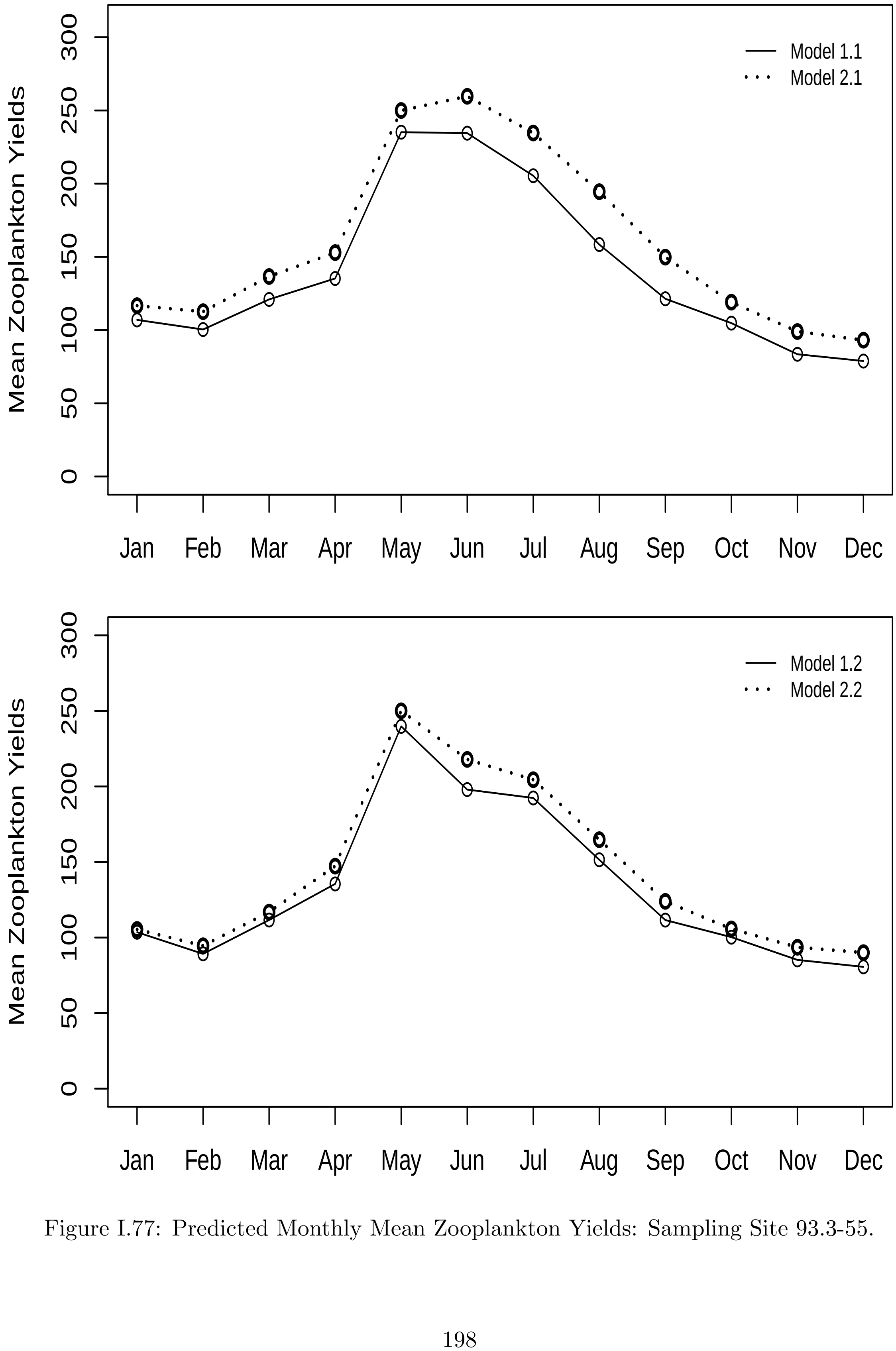


Figure I.77: Predicted Monthly Mean Zooplankton Yields: Sampling Site 93.3-55.

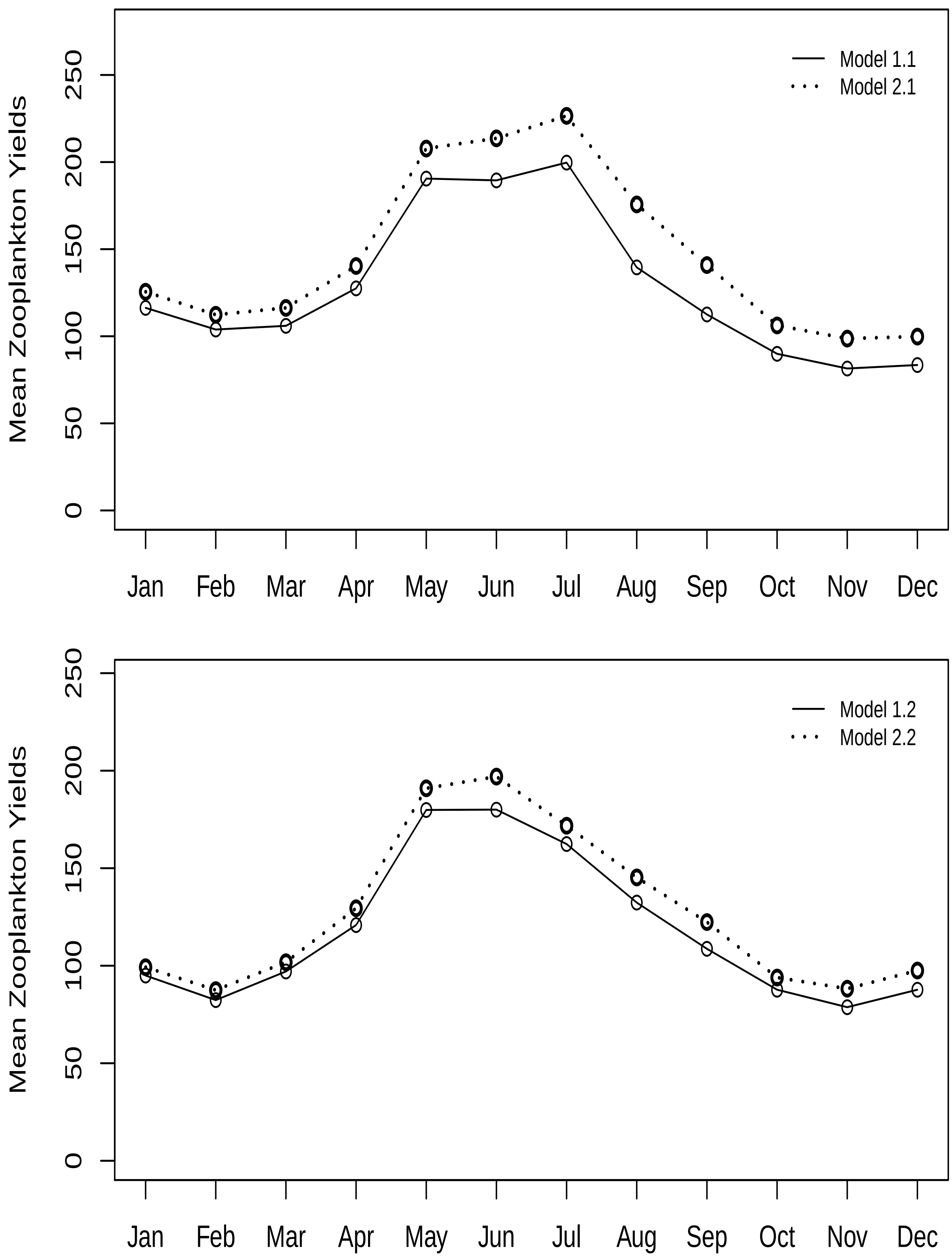


Figure I.78: Predicted Monthly Mean Zooplankton Yields: Sampling Site 93.3-60.

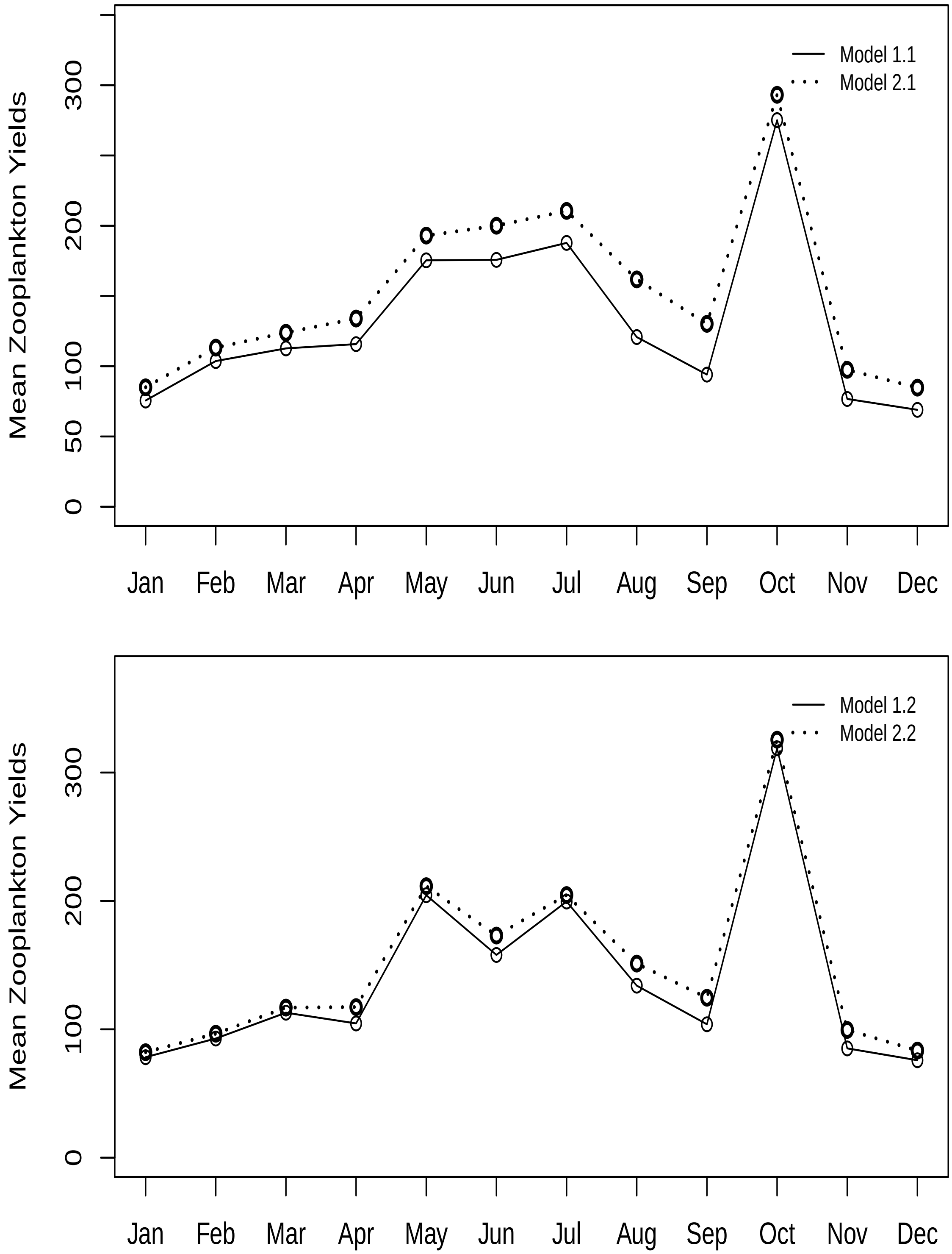


Figure I.79: Predicted Monthly Mean Zooplankton Yields: Sampling Site 93.3-70.

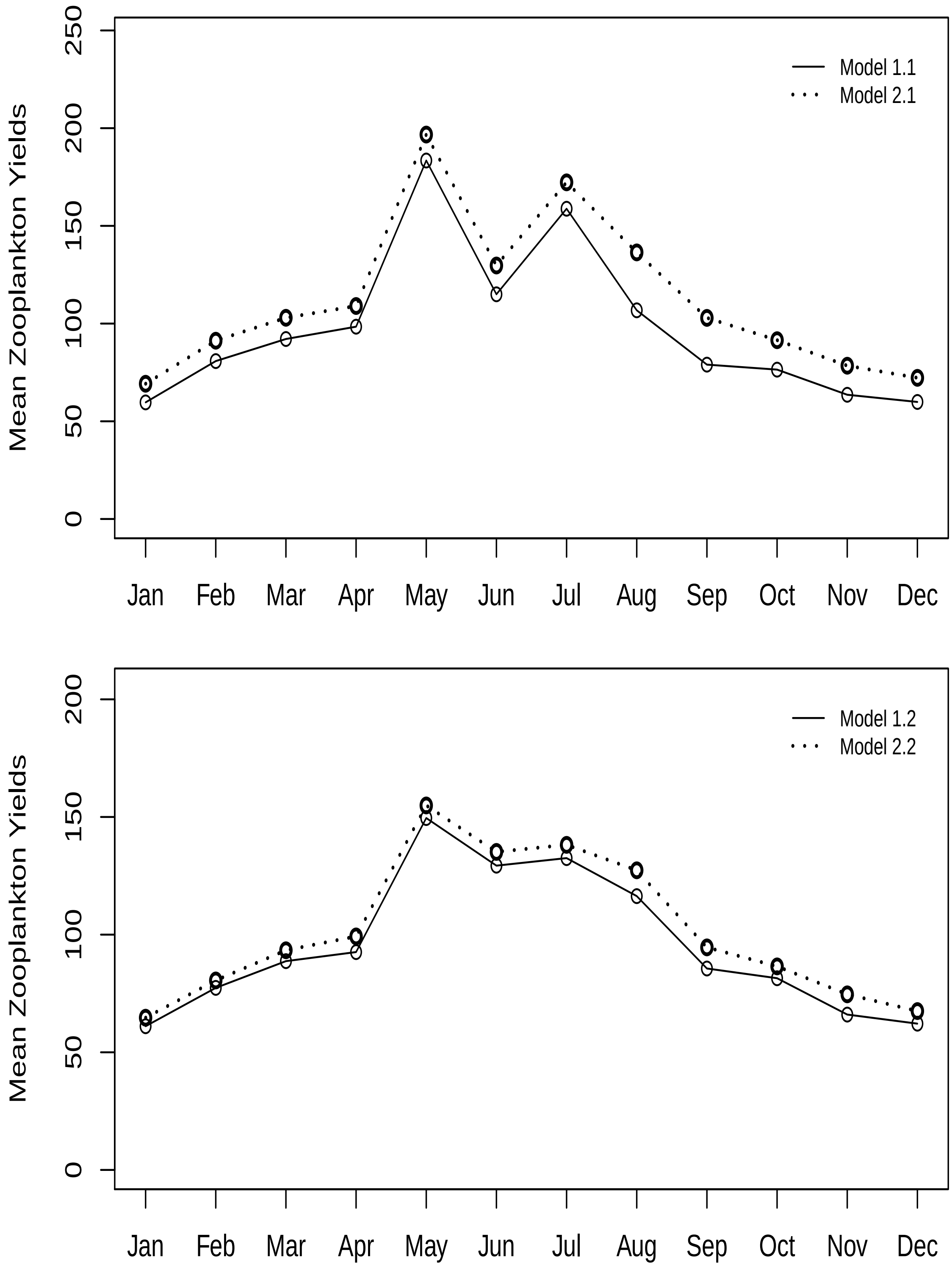
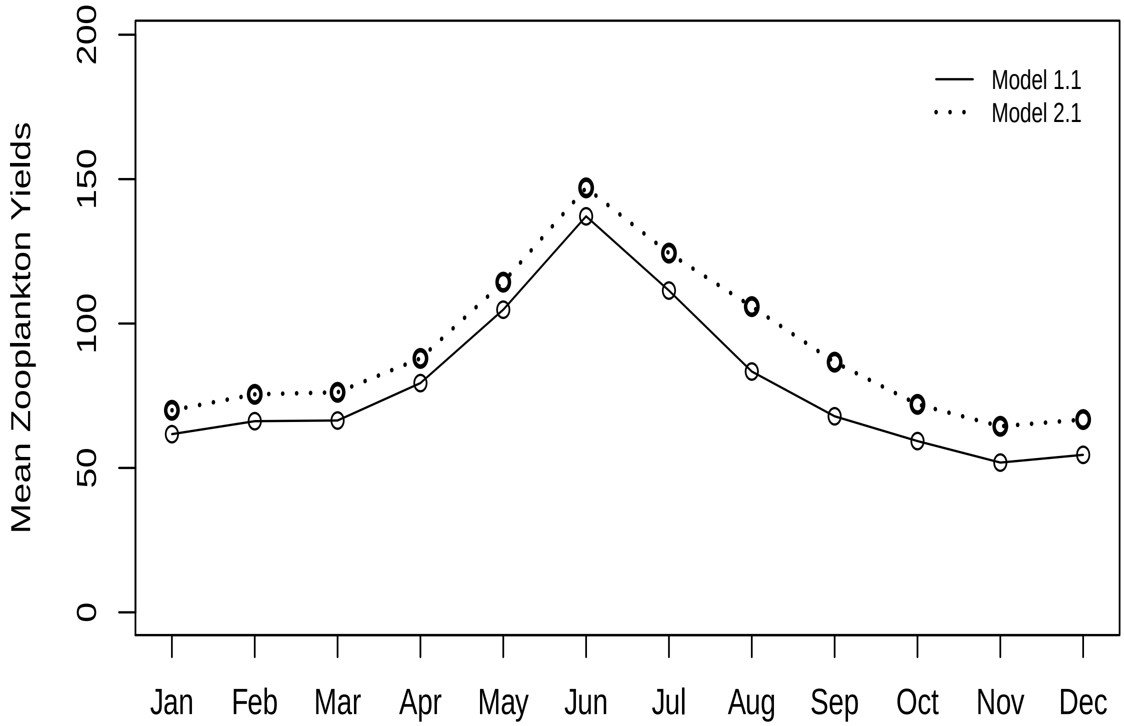


Figure I.80: Predicted Monthly Mean Zooplankton Yields: Sampling Site 93.3-80.



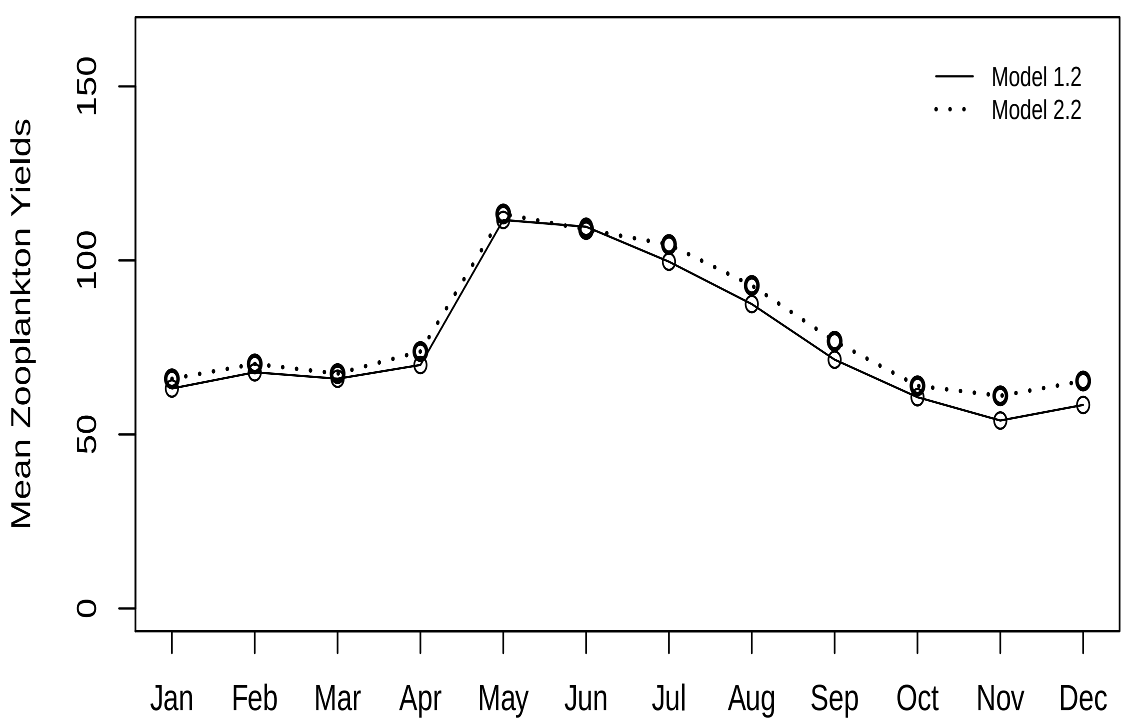


Figure I.81: Predicted Monthly Mean Zooplankton Yields: Sampling Site 93.3-90.

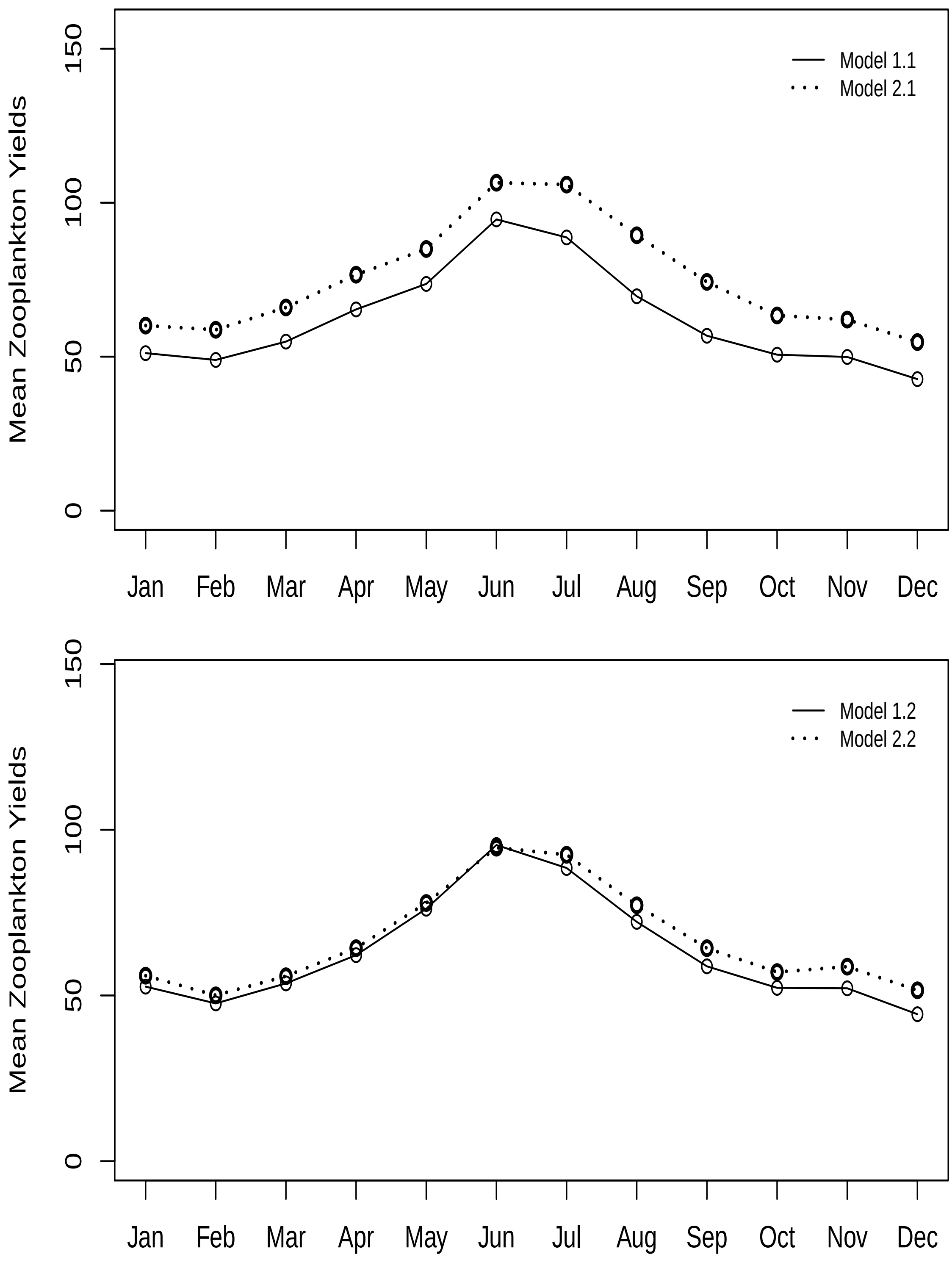


Figure I.82: Predicted Monthly Mean Zooplankton Yields: Sampling Site 93.3-100.

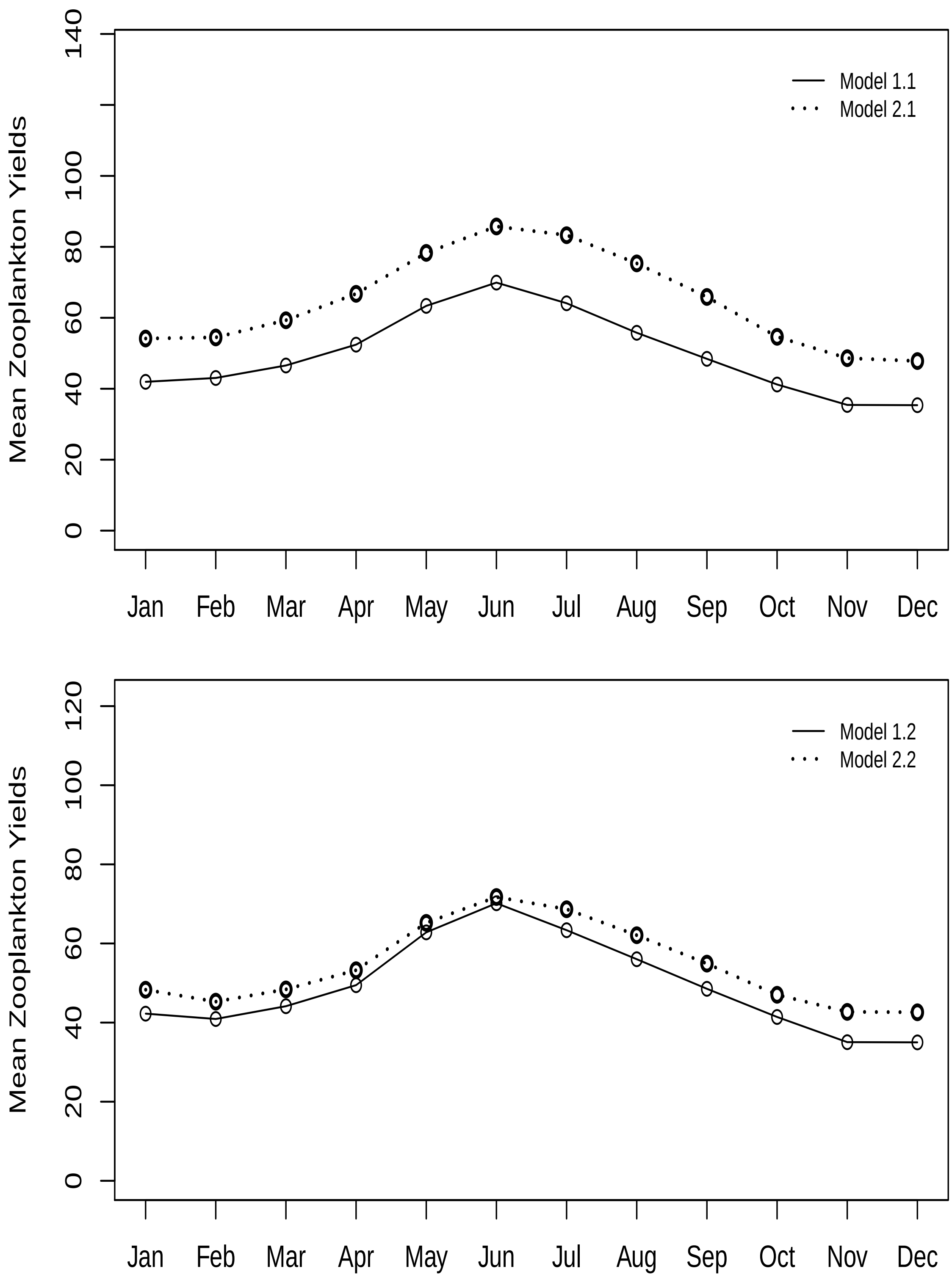


Figure I.83: Predicted Monthly Mean Zooplankton Yields: Sampling Site 93.3-110.

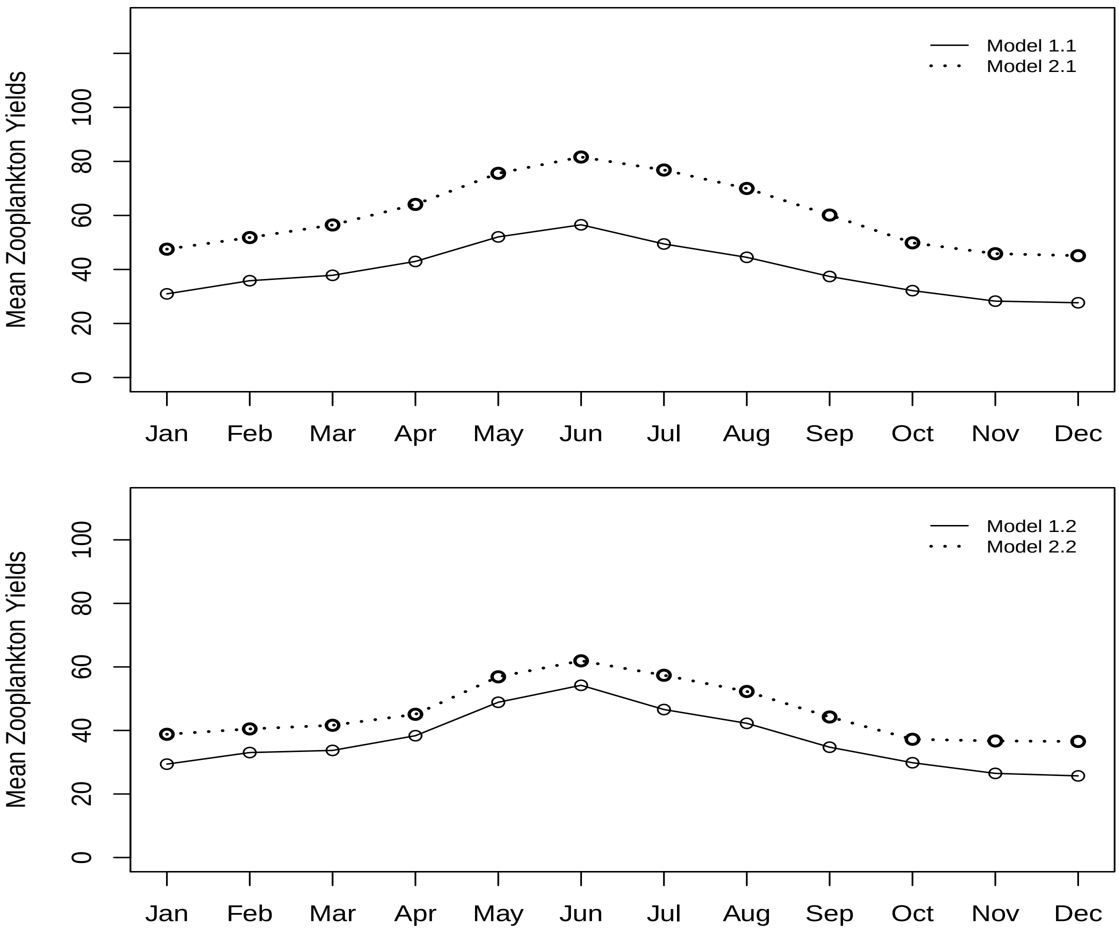


Figure I.84: Predicted Monthly Mean Zooplankton Yields: Sampling Site 93.3-120.

APPENDIX J

MAPS OF PREDICTED SAMPLING SITE MONTHLY MEAN ZOOPLANKTON YIELDS

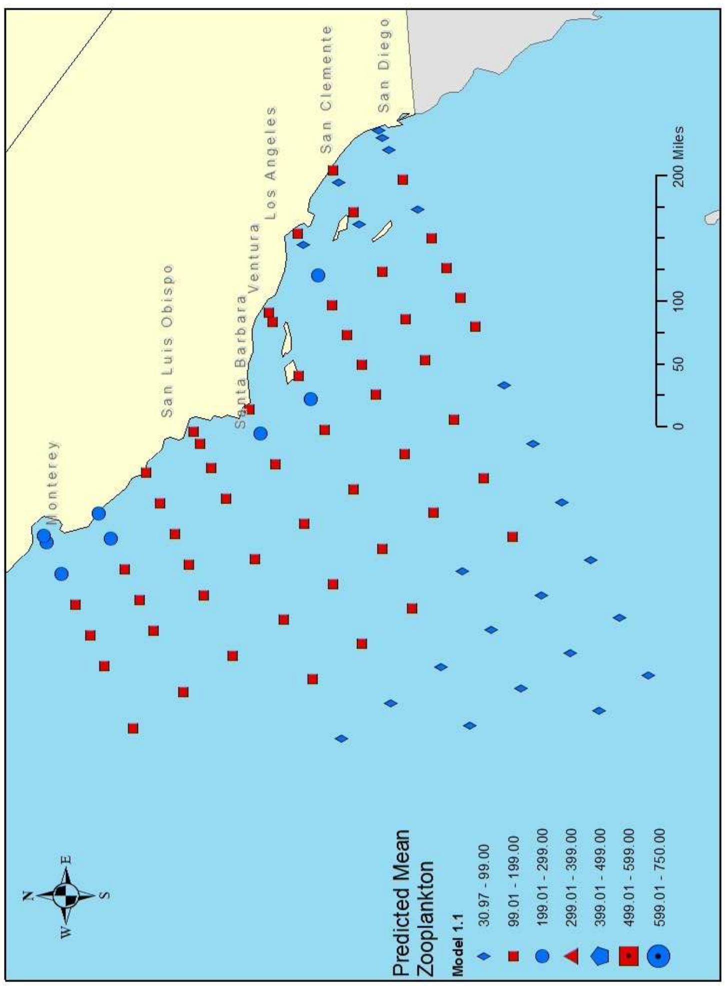


Figure J.1a: Model 1.1 Predicted Sampling Site Mean Zooplankton Yields: January.

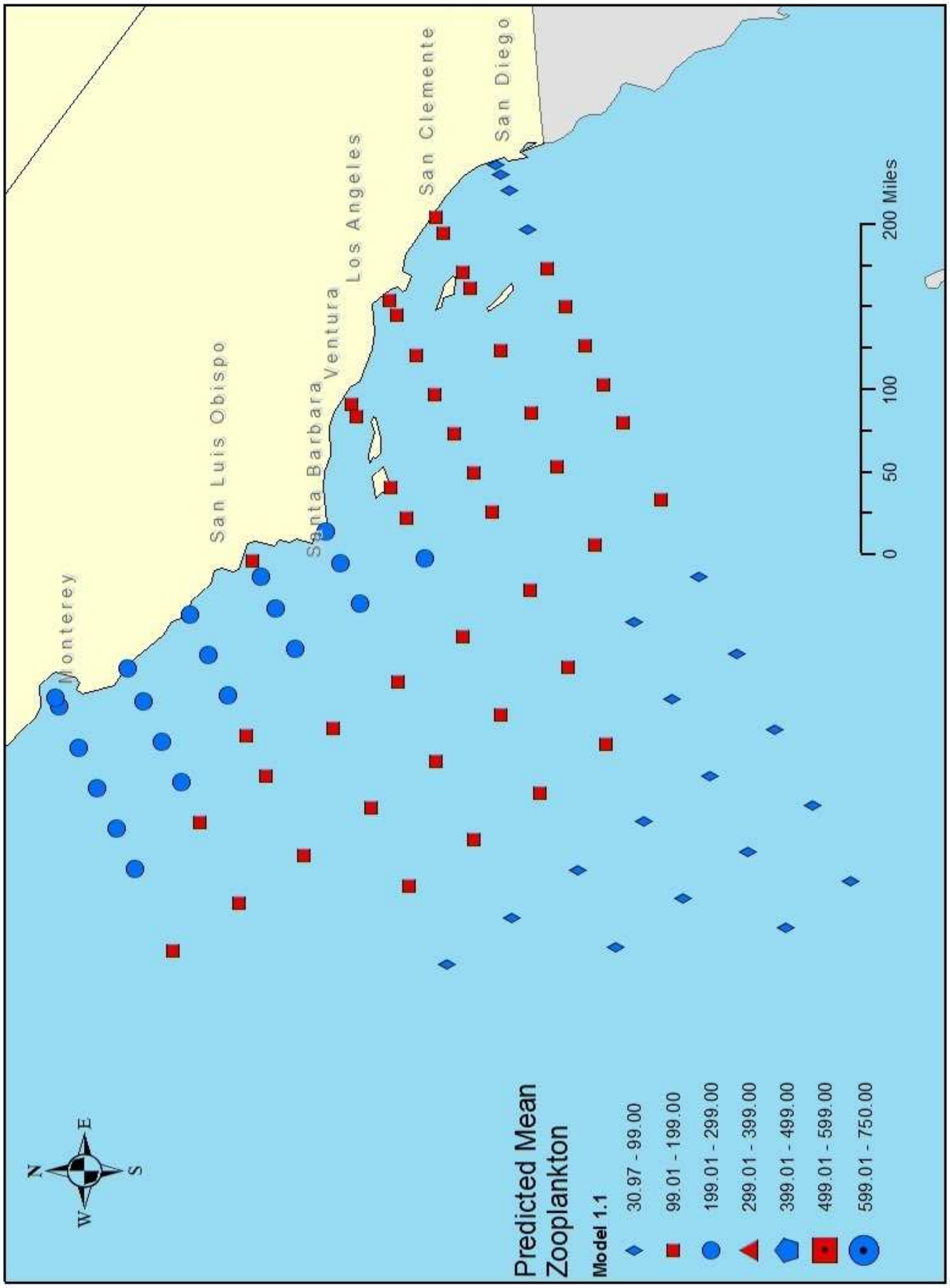


Figure J.1b: Model 1.1 Predicted Sampling Site Mean Zooplankton Yields: February.

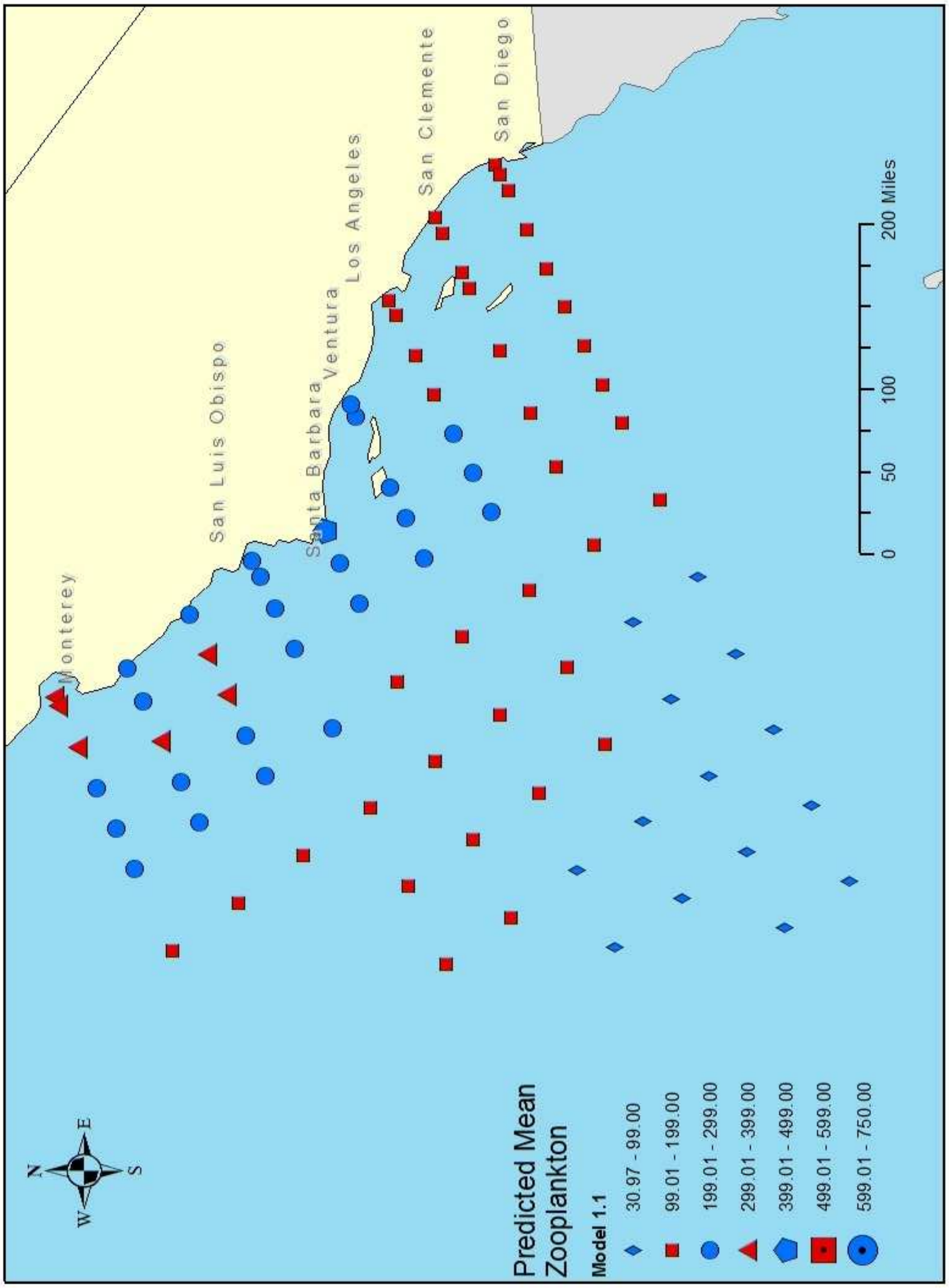


Figure J.1c: Model 1.1 Predicted Sampling Site Mean Zooplankton Yields: March.

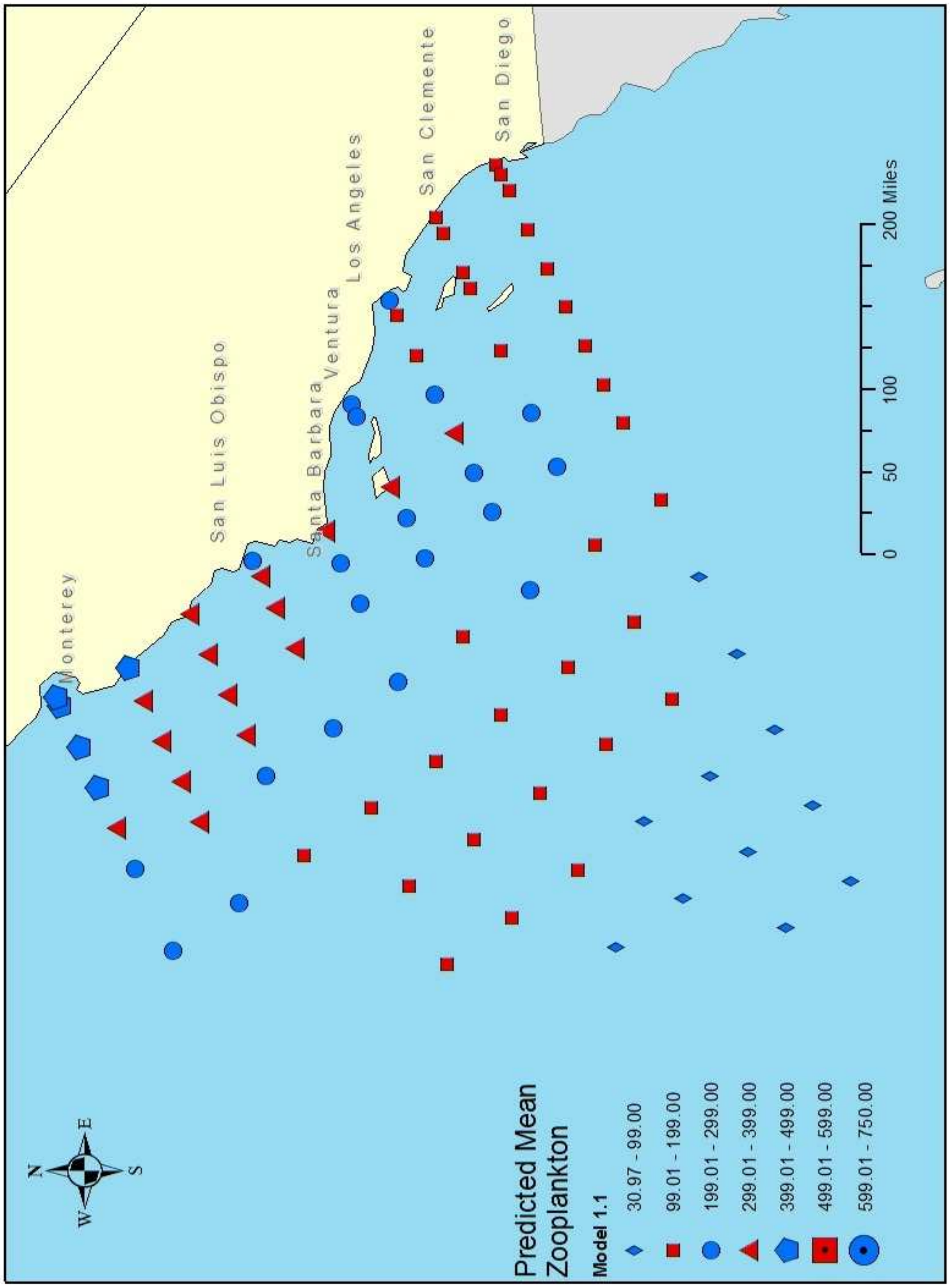


Figure J.1d: Model 1.1 Predicted Sampling Site Mean Zooplankton Yields: April.

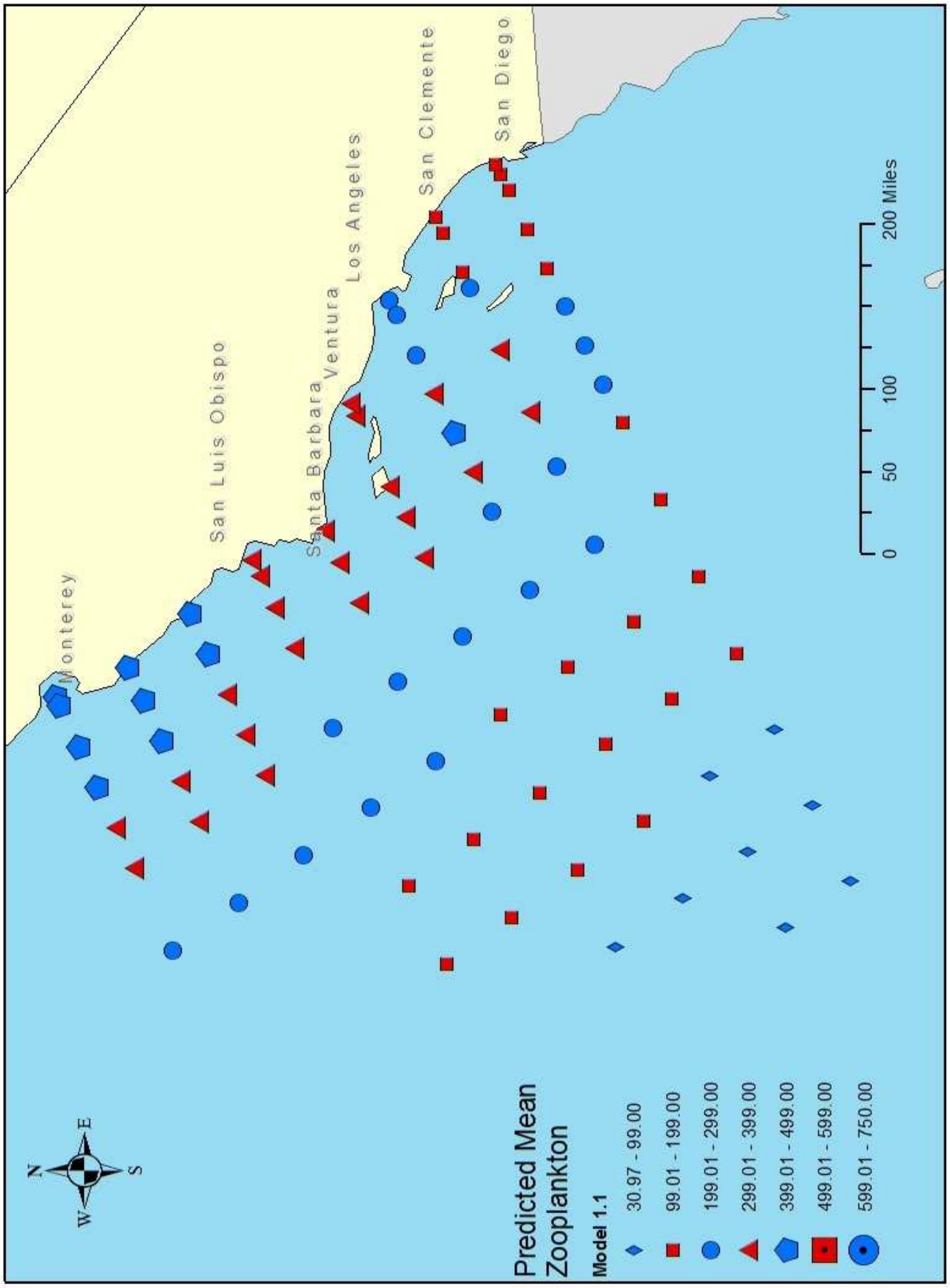


Figure J.1e: Model 1.1 Predicted Sampling Site Mean Zooplankton Yields: May.

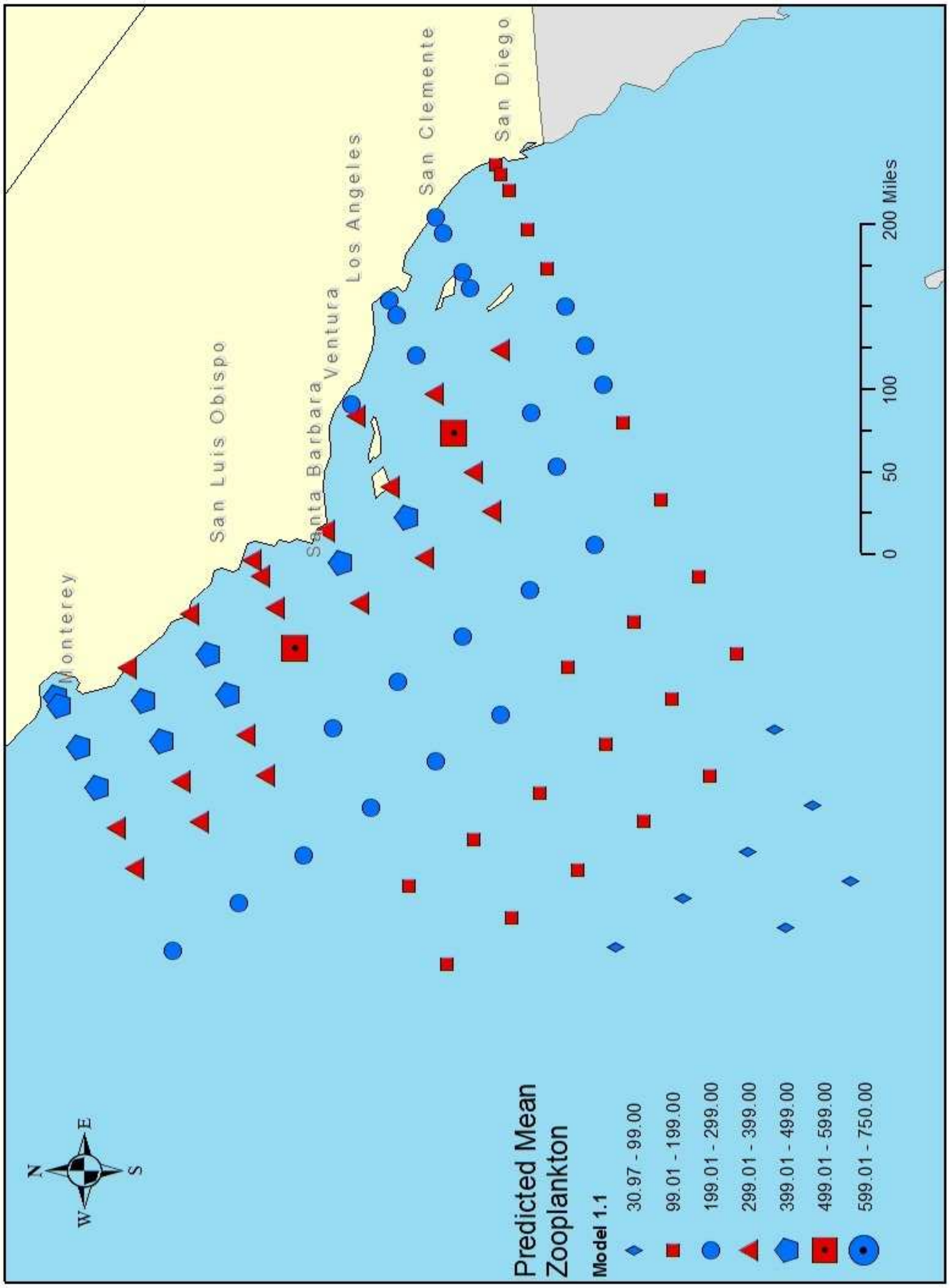


Figure J.1f: Model 1.1 Predicted Sampling Site Mean Zooplankton Yields: June.

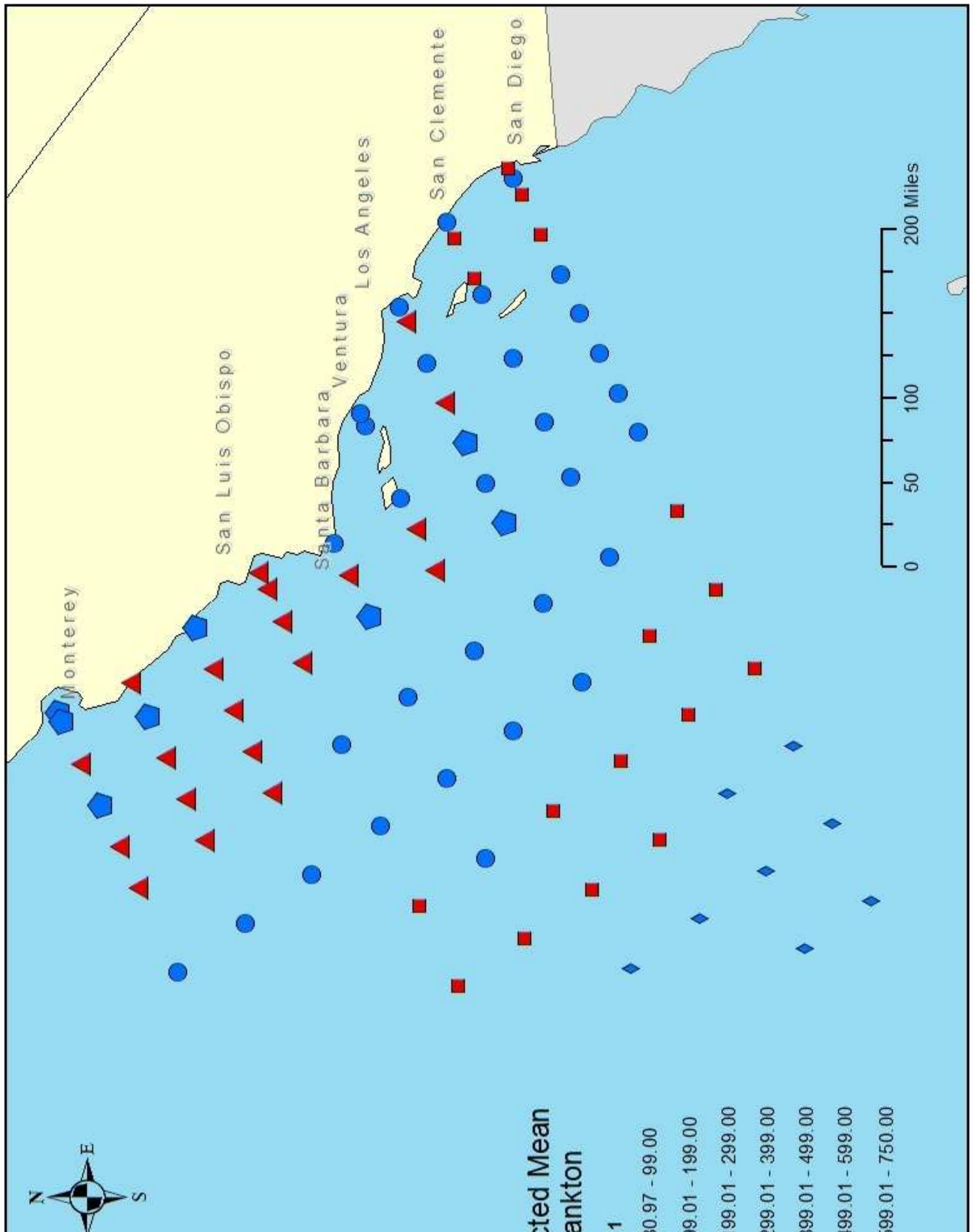


Figure J.1g: Model 1.1 Predicted Sampling Site Mean Zooplankton Yields: July.

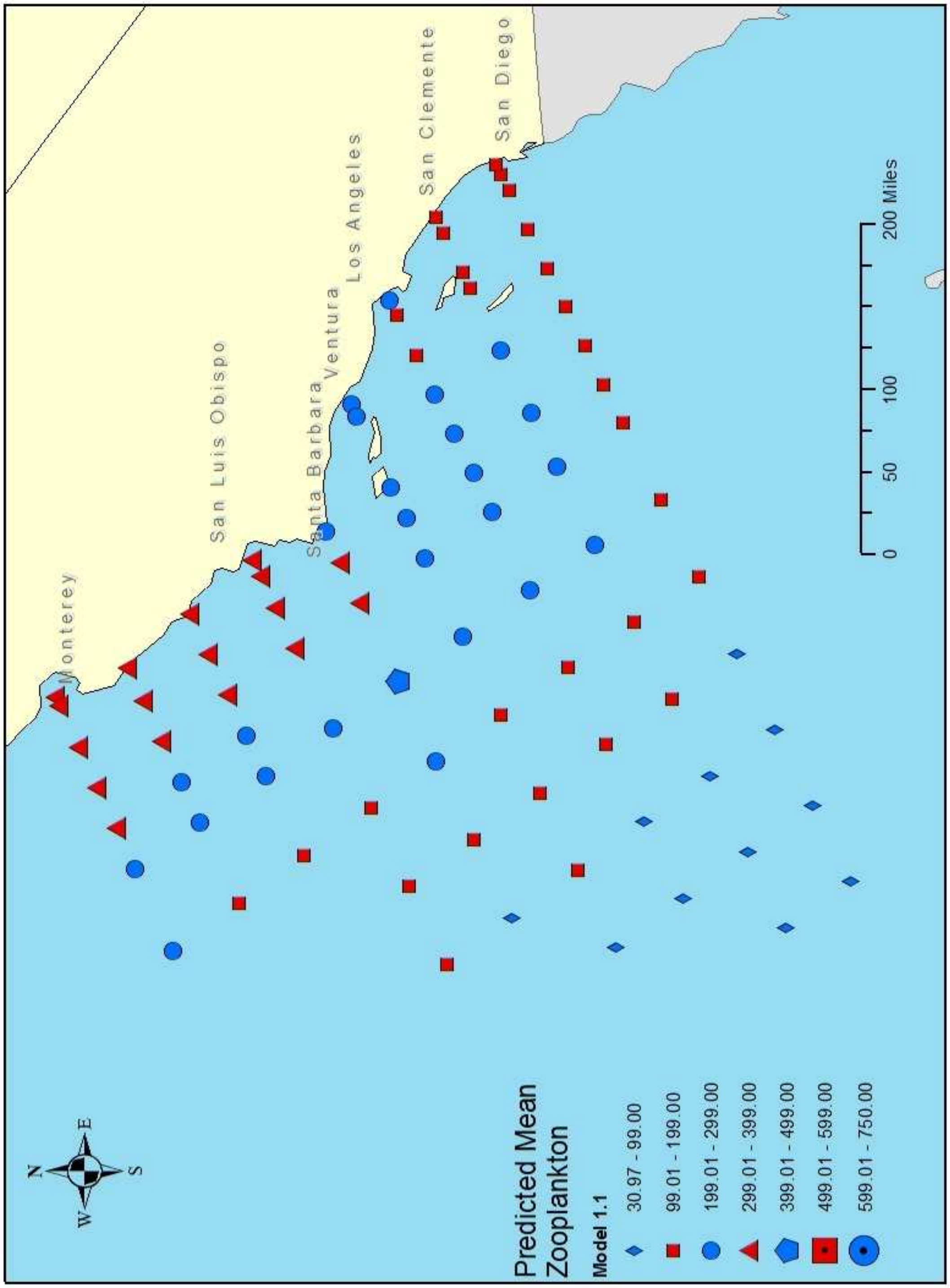


Figure J.1h: Model 1.1 Predicted Sampling Site Mean Zooplankton Yields: August.

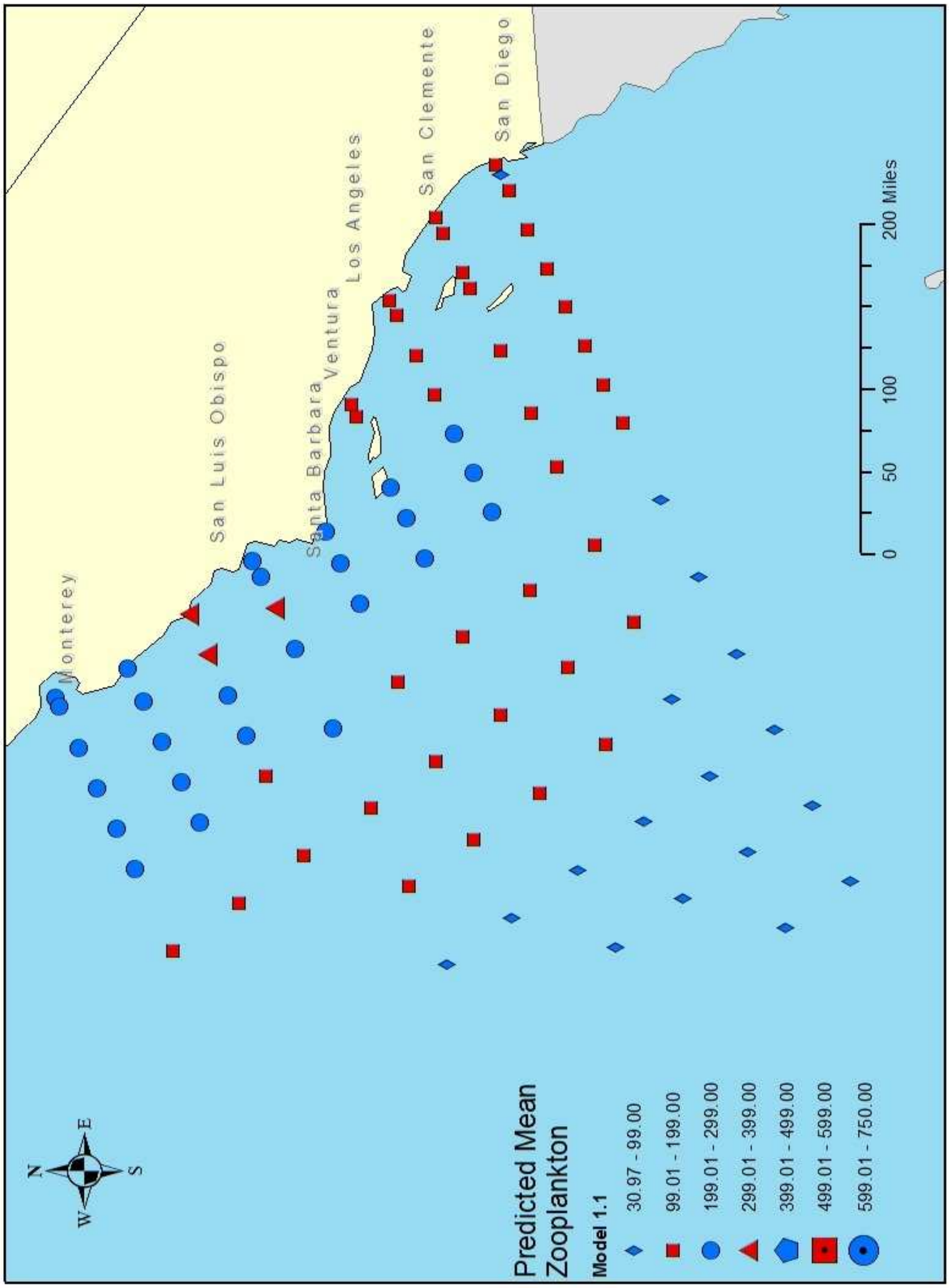


Figure J.1i: Model 1.1 Predicted Sampling Site Mean Zooplankton Yields: September.

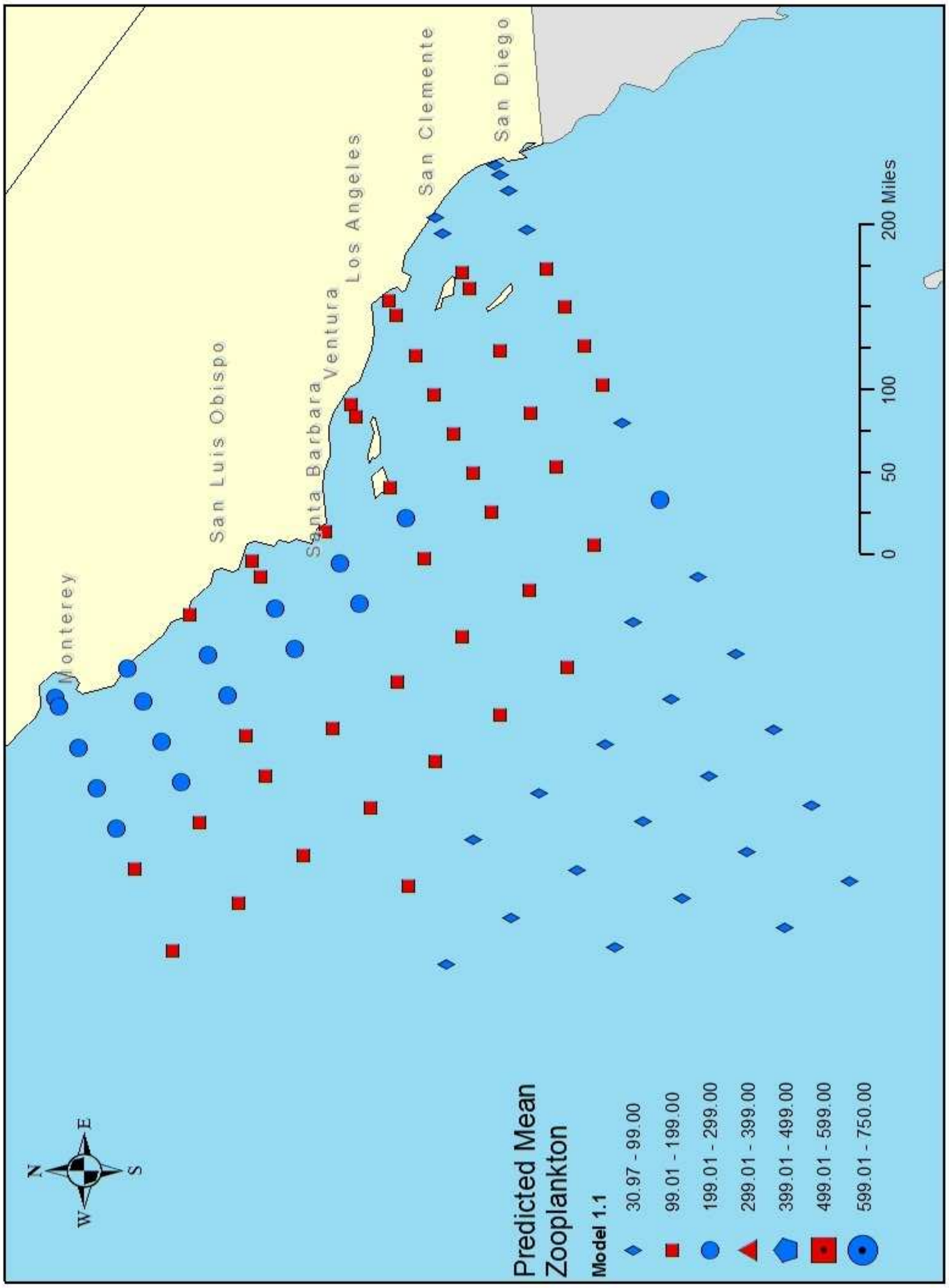


Figure J.1j: Model 1.1 Predicted Sampling Site Mean Zooplankton Yields: October.

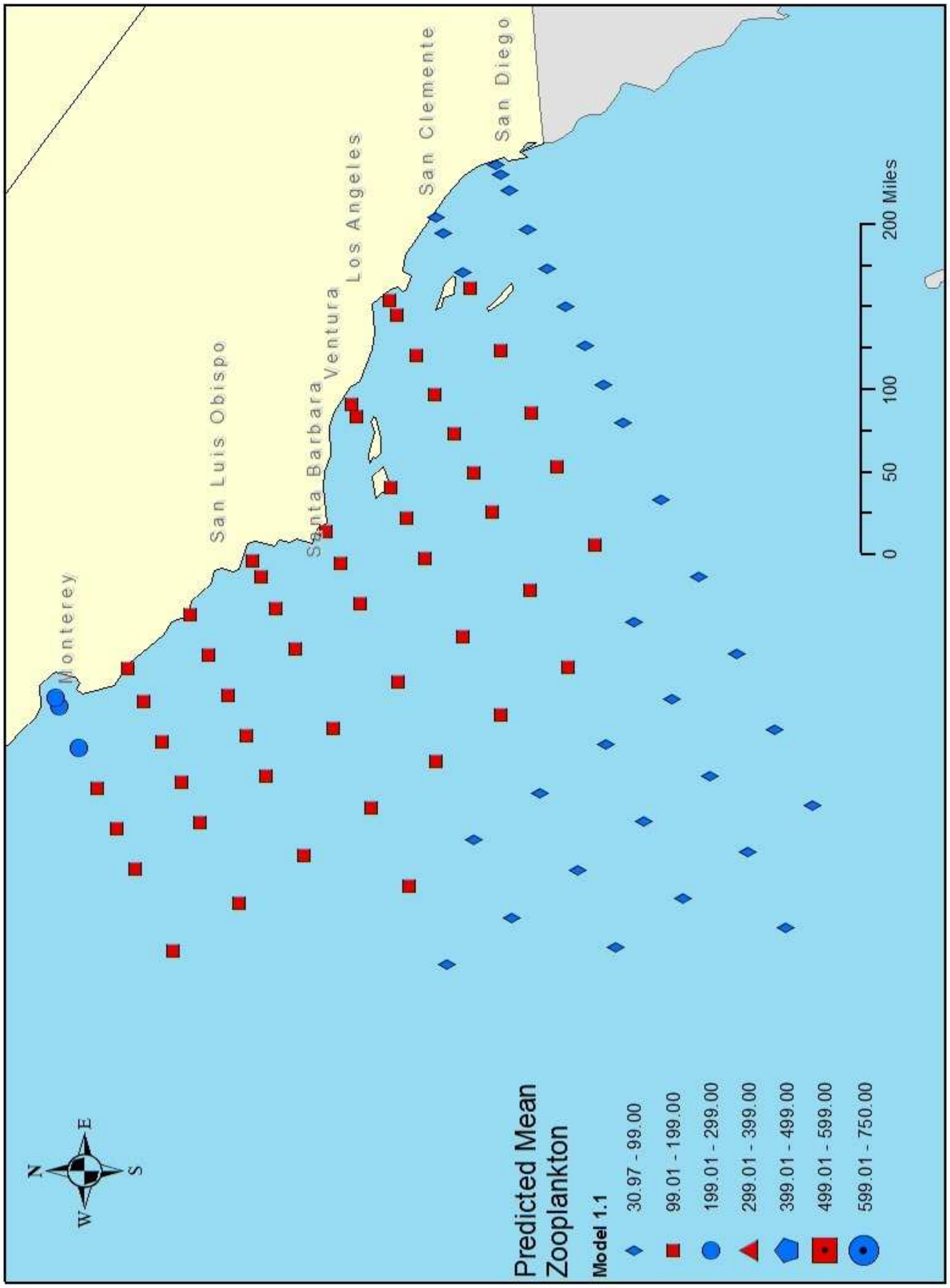


Figure J.1k: Model 1.1 Predicted Sampling Site Mean Zooplankton Yields: November.

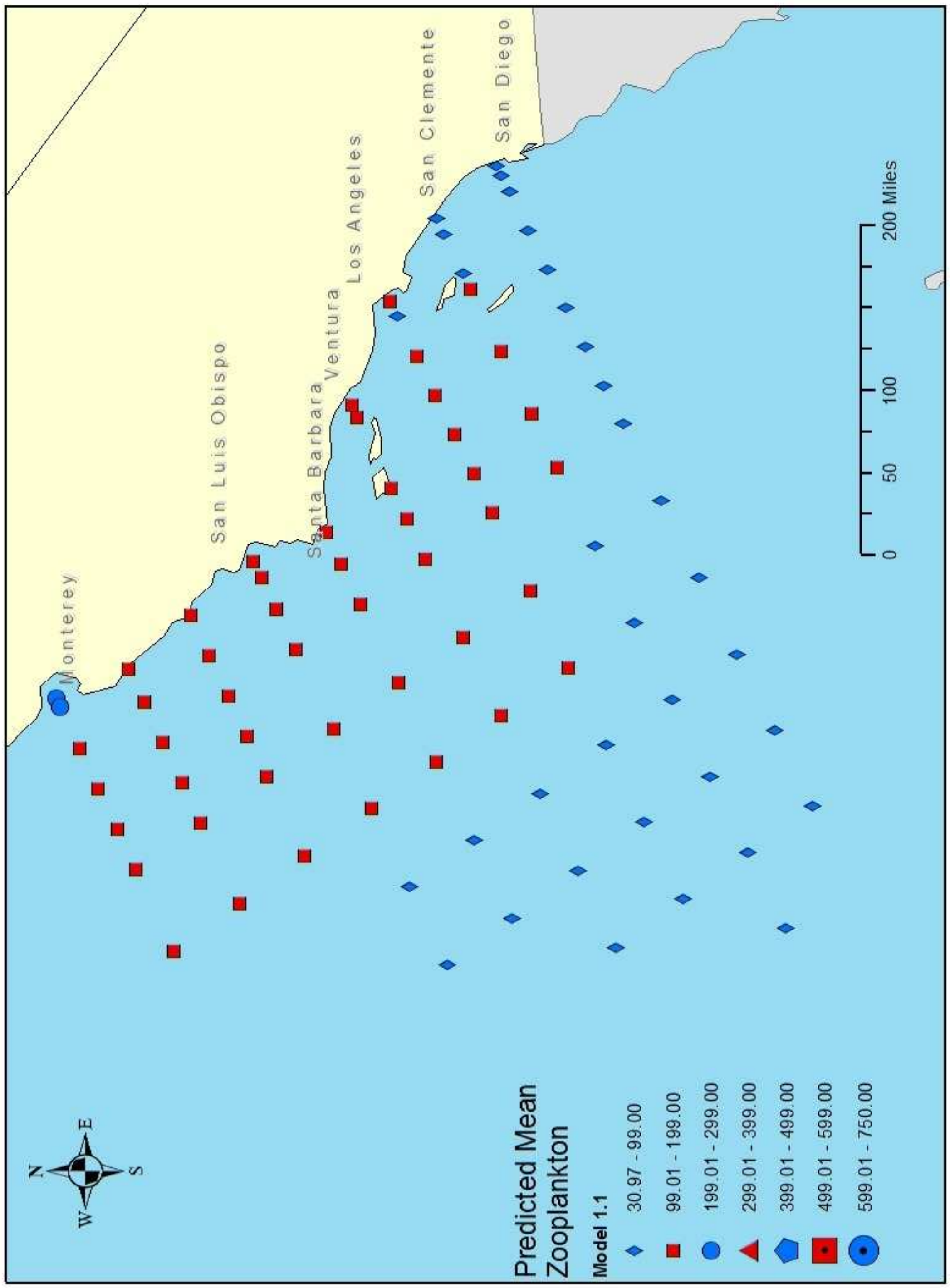


Figure J.1l: Model 1.1 Predicted Sampling Site Mean Zooplankton Yields: December.

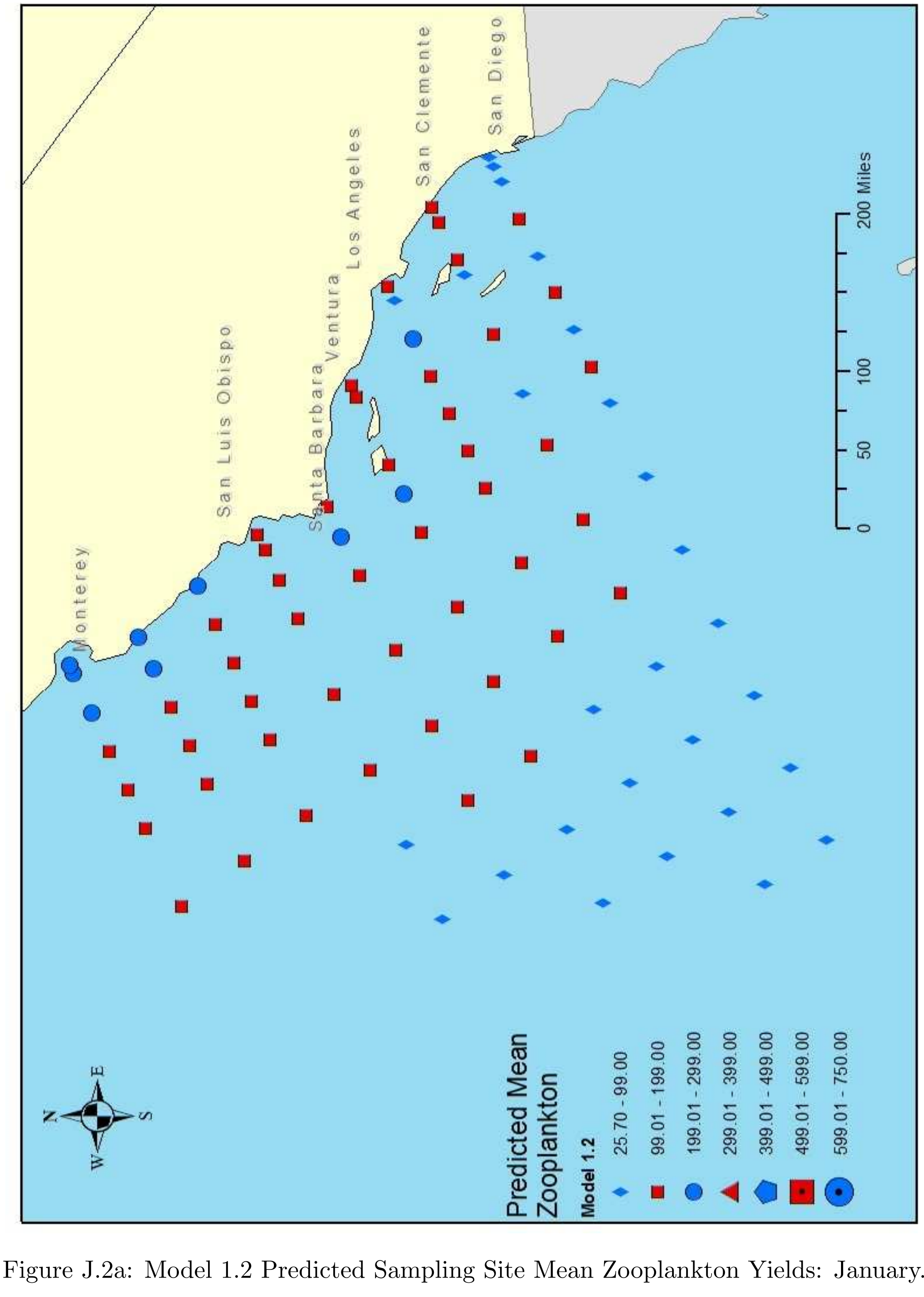


Figure J.2a: Model 1.2 Predicted Sampling Site Mean Zooplankton Yields: January.

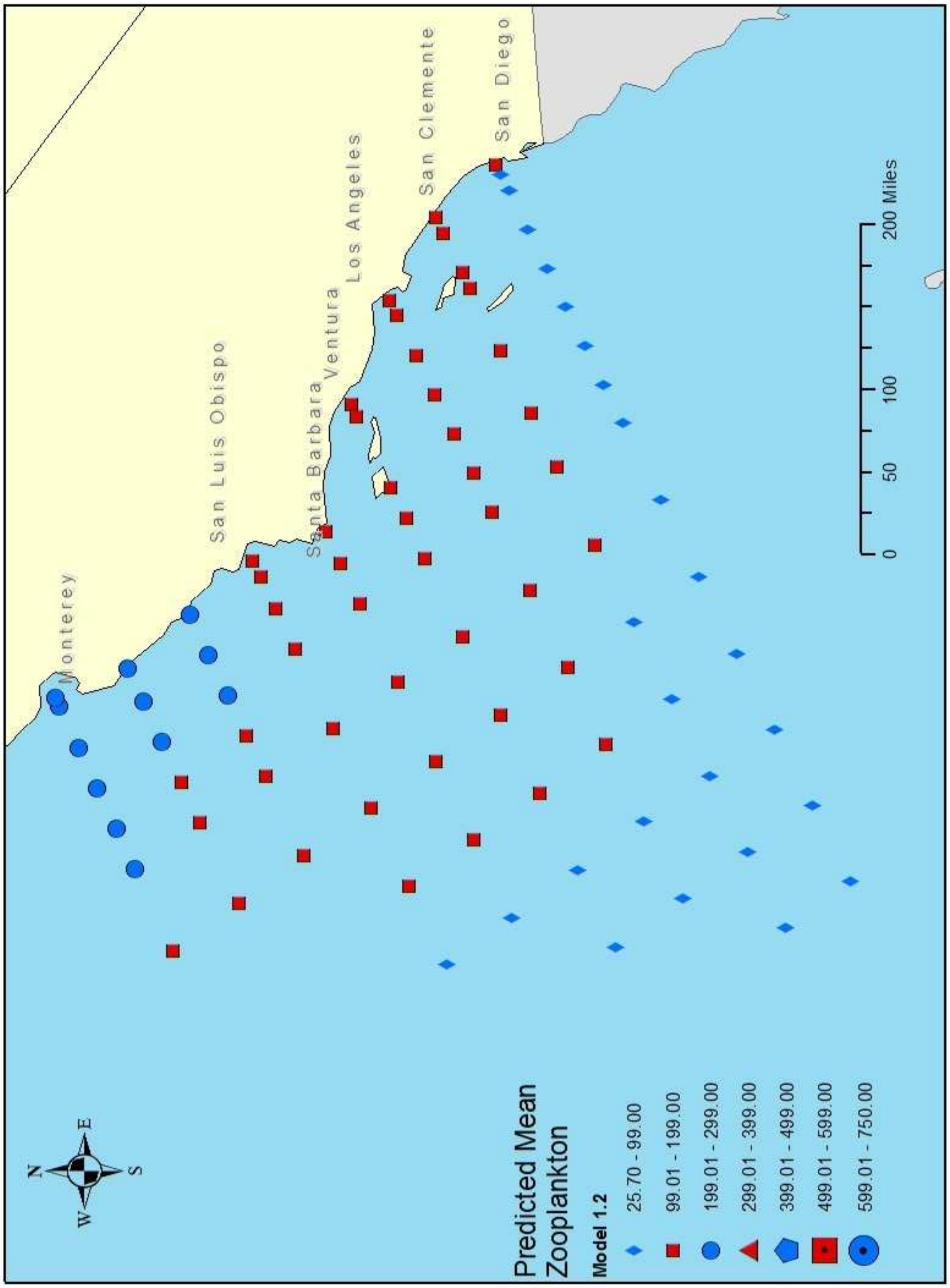


Figure J.2b: Model 1.2 Predicted Sampling Site Mean Zooplankton Yields: February.

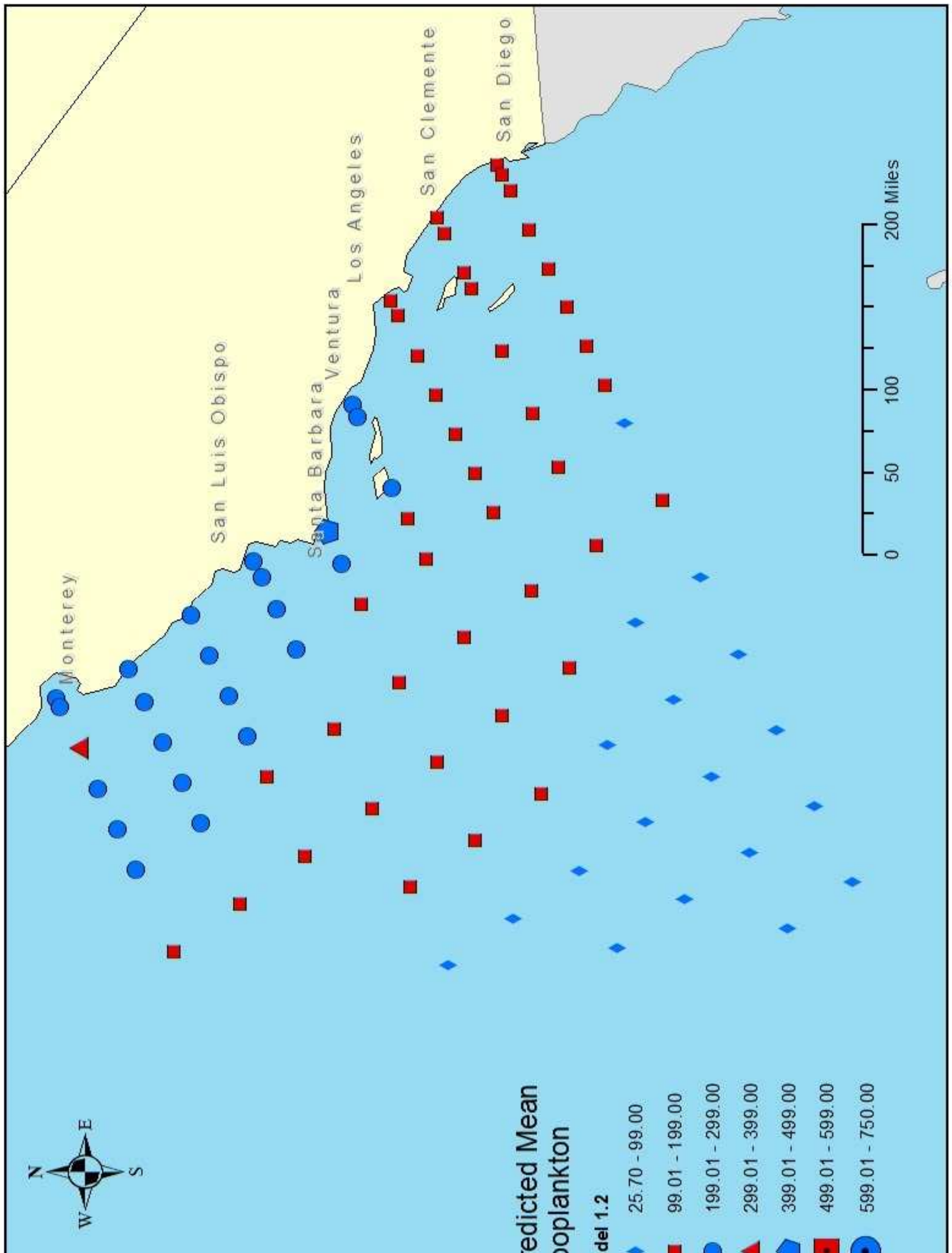


Figure J.2c: Model 1.2 Predicted Sampling Site Mean Zooplankton Yields: March.

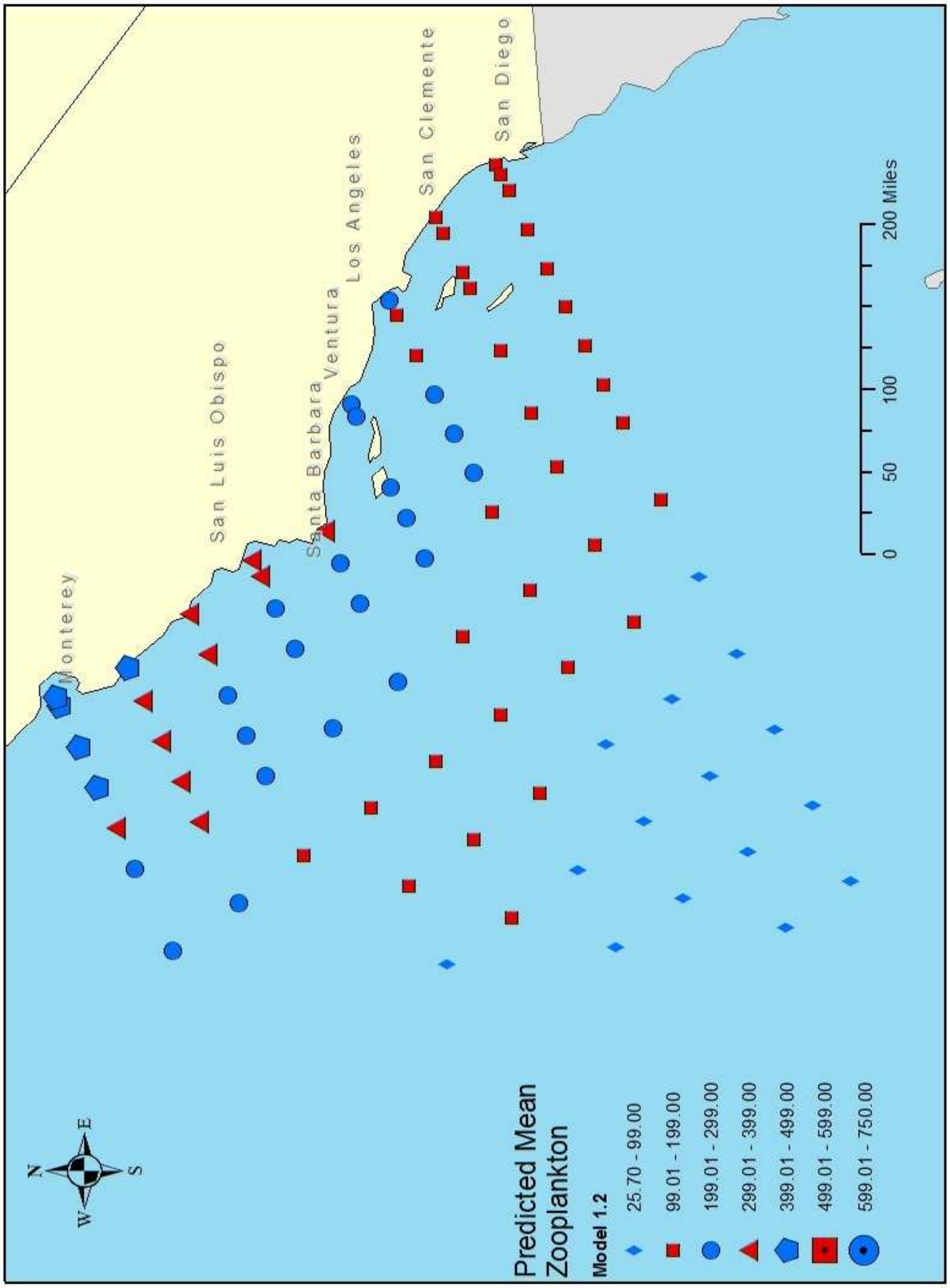


Figure J.2d: Model 1.2 Predicted Sampling Site Mean Zooplankton Yields: April.

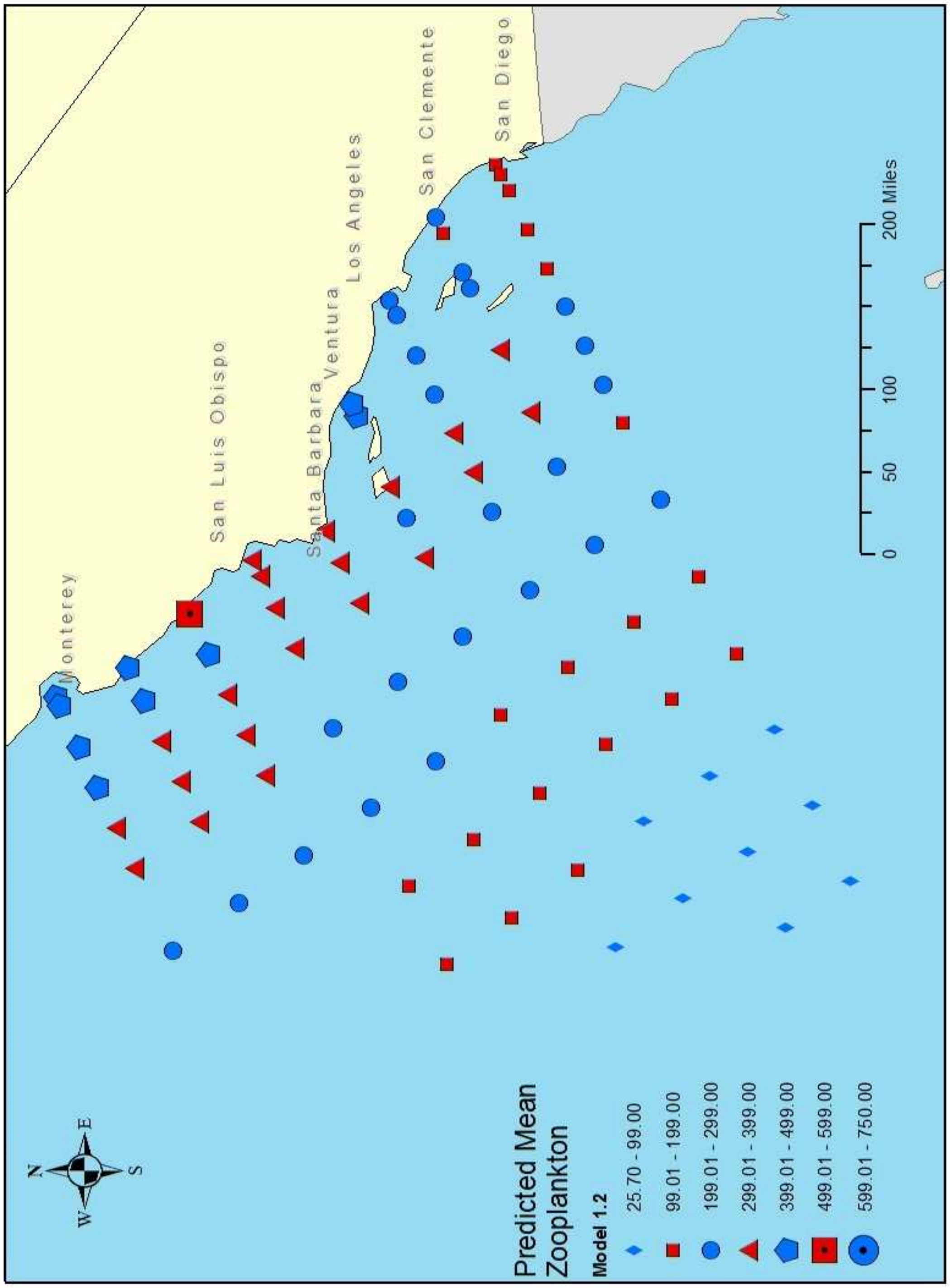


Figure J.2e: Model 1.2 Predicted Sampling Site Mean Zooplankton Yields: May.

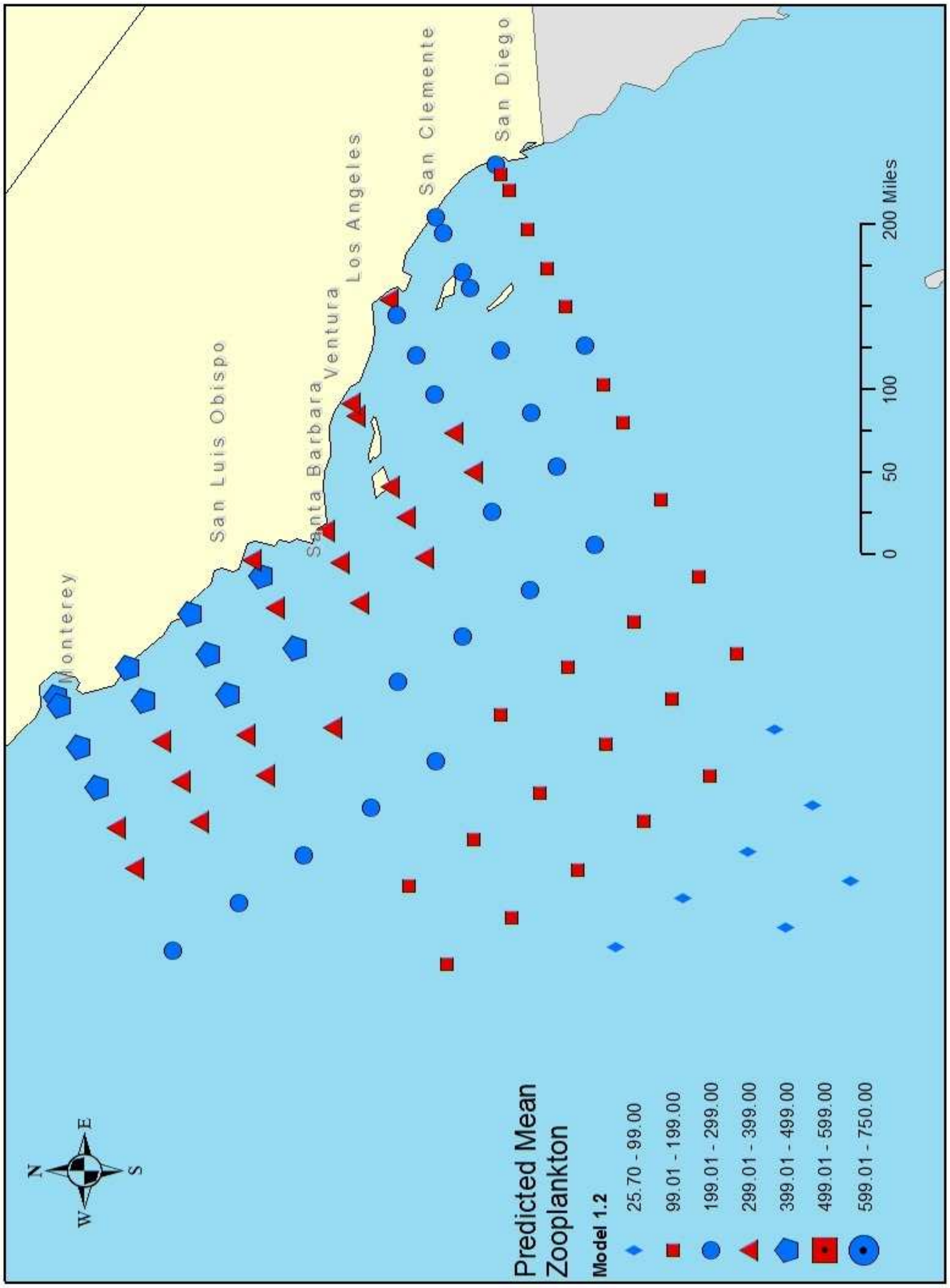


Figure J.2f: Model 1.2 Predicted Sampling Site Mean Zooplankton Yields: June.

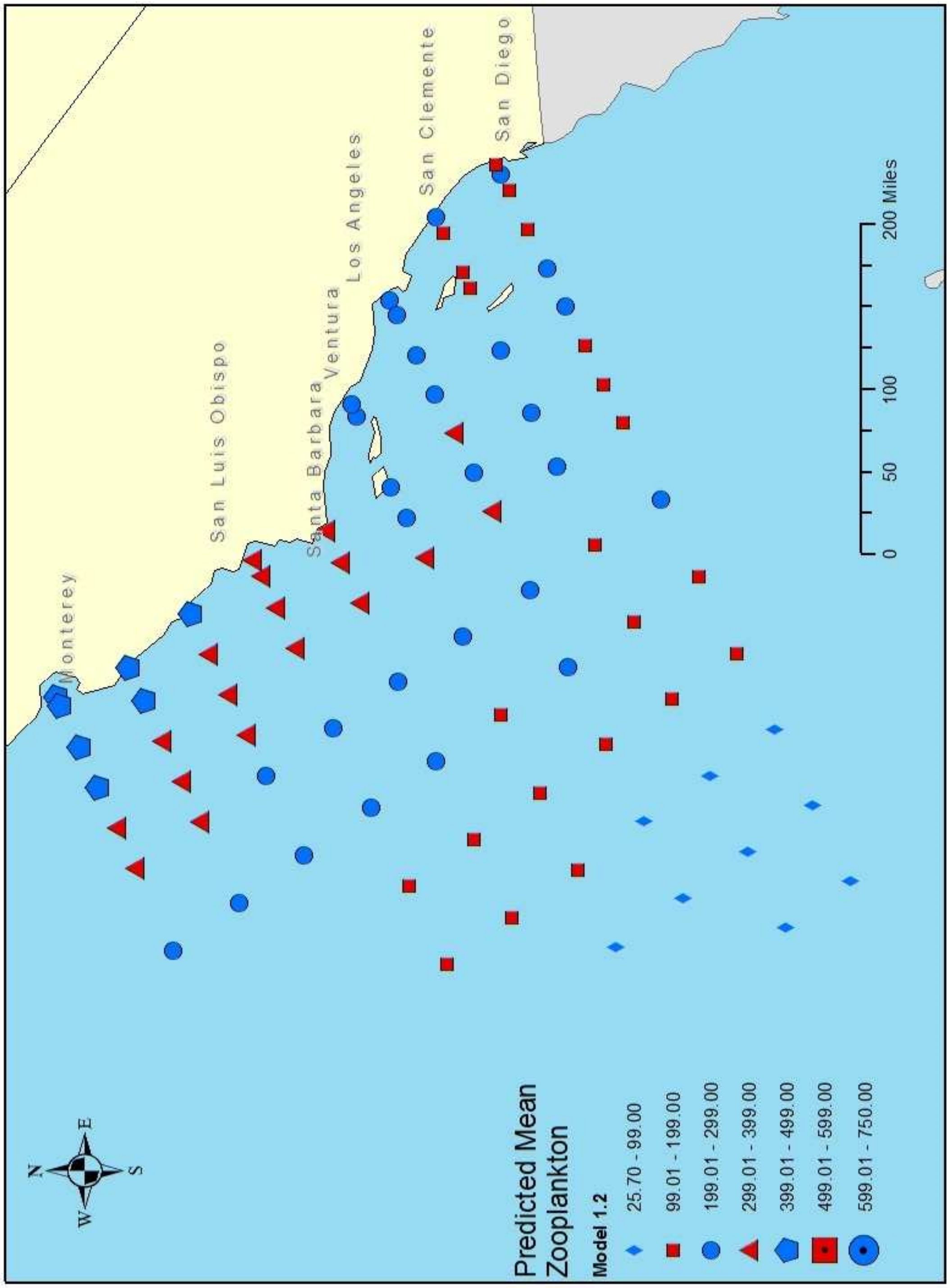


Figure J.2g: Model 1.2 Predicted Sampling Site Mean Zooplankton Yields: July.

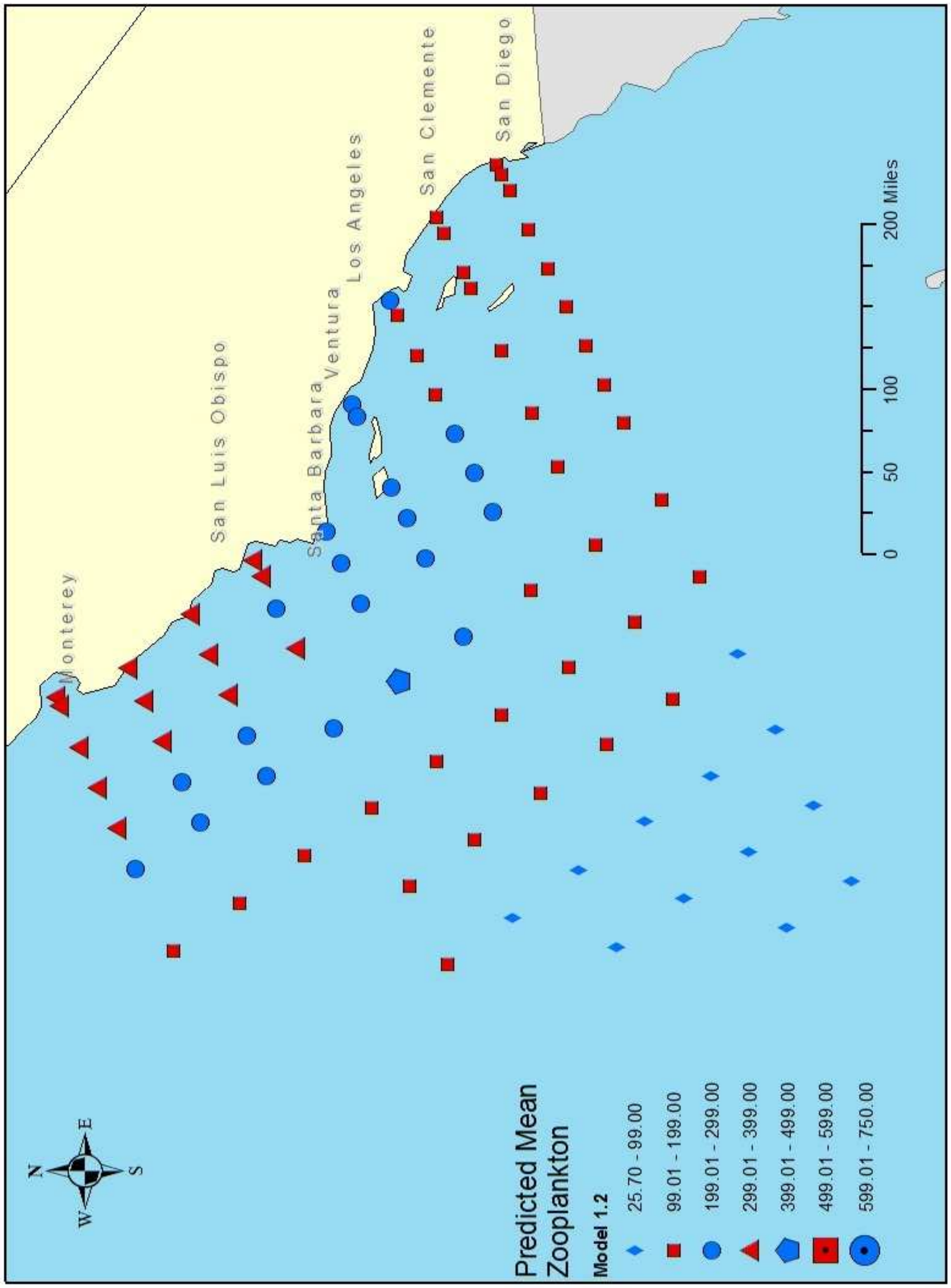


Figure J.2h: Model 1.2 Predicted Sampling Site Mean Zooplankton Yields: August.

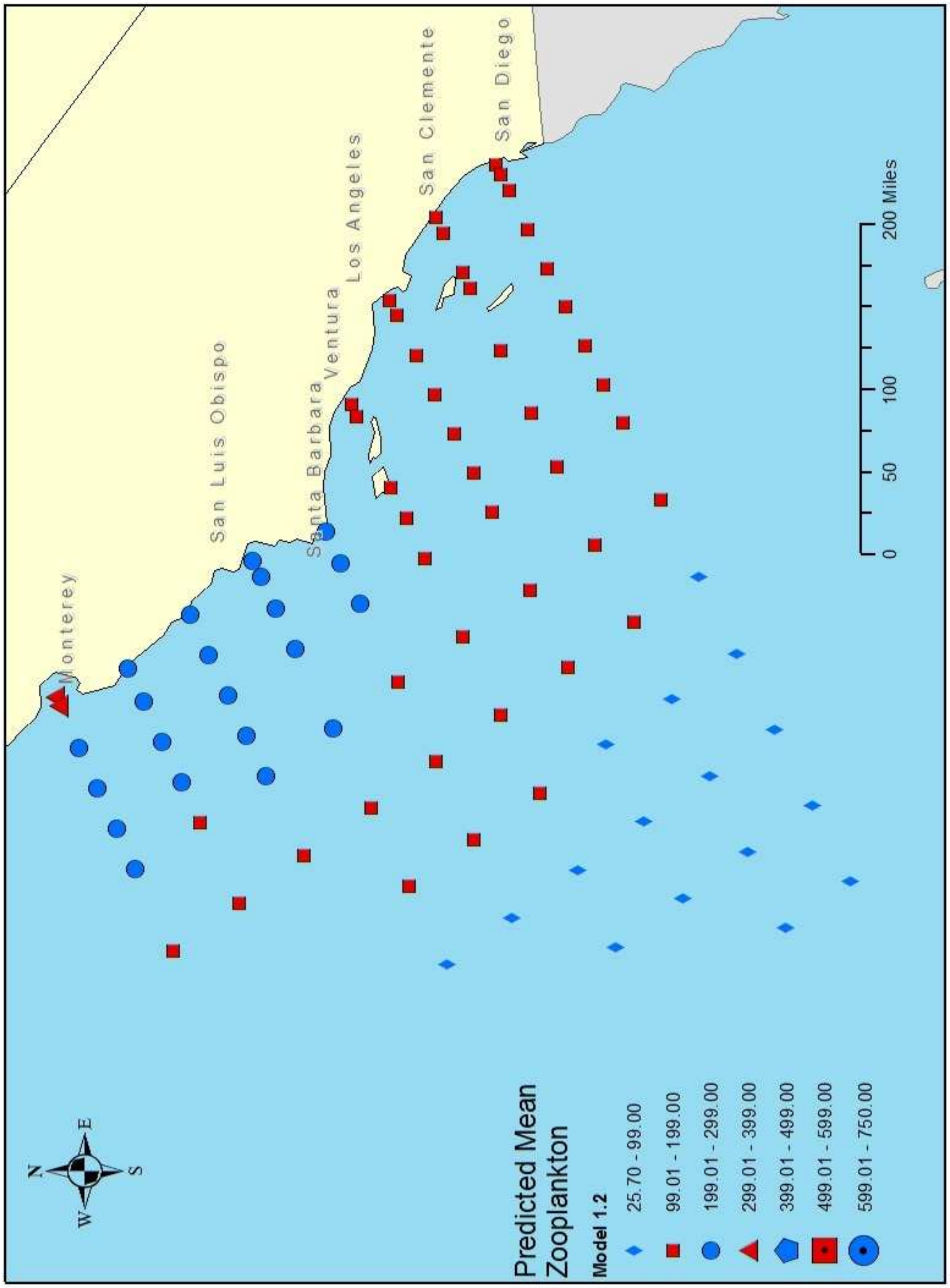


Figure J.2i: Model 1.2 Predicted Sampling Site Mean Zooplankton Yields: September.

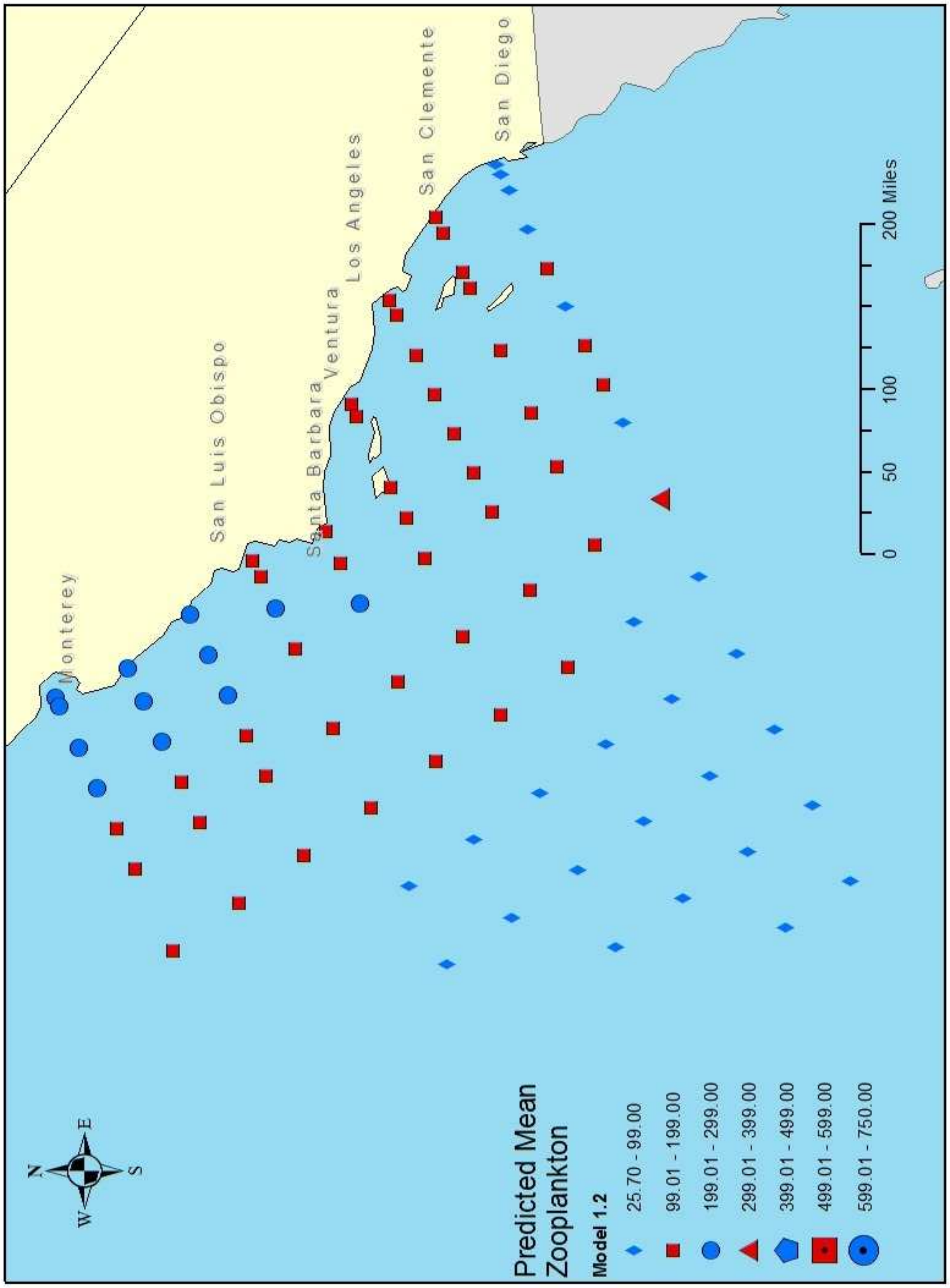


Figure J.2j: Model 1.2 Predicted Sampling Site Mean Zooplankton Yields: October.

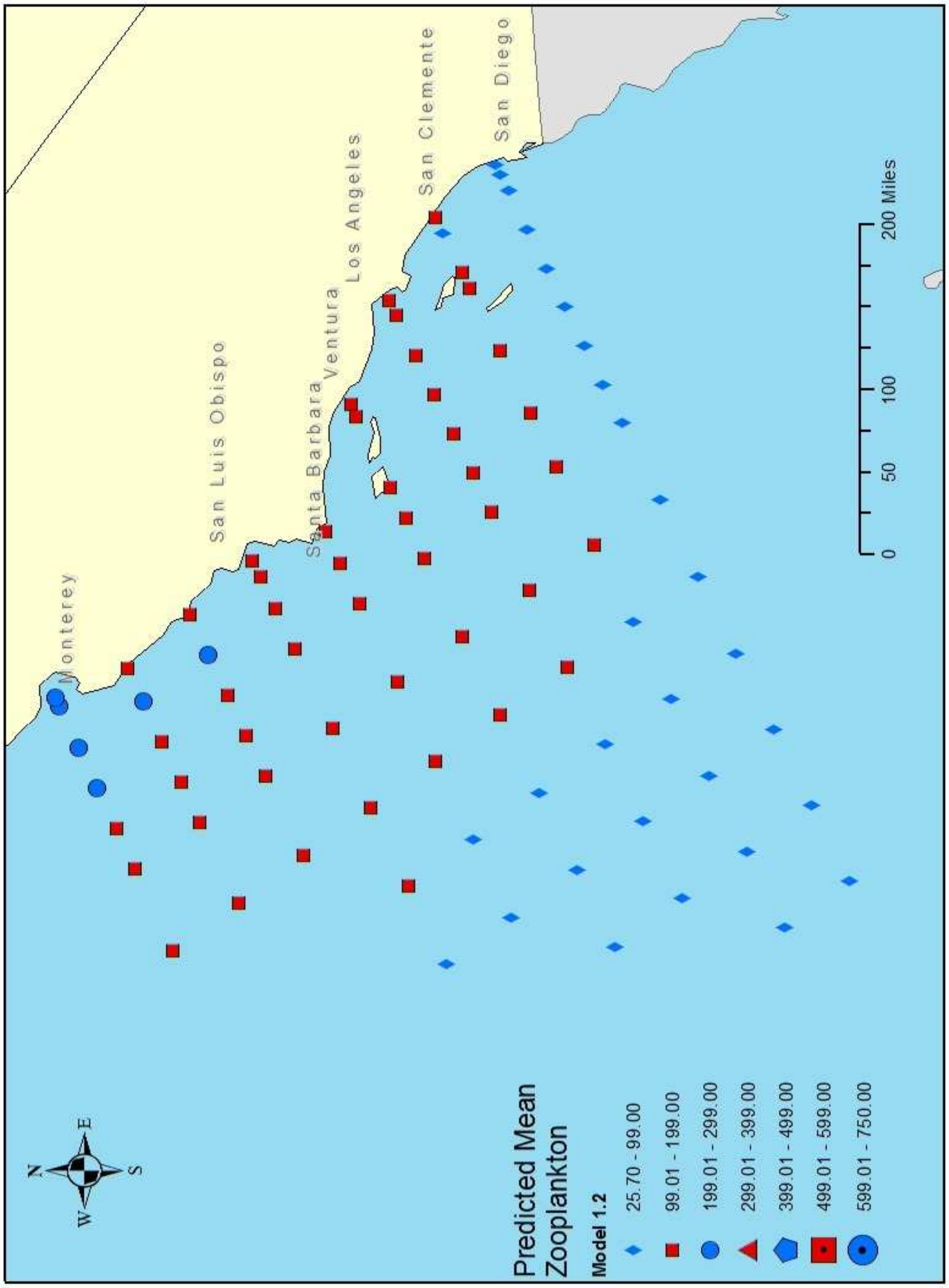


Figure J.2k: Model 1.2 Predicted Sampling Site Mean Zooplankton Yields: November.

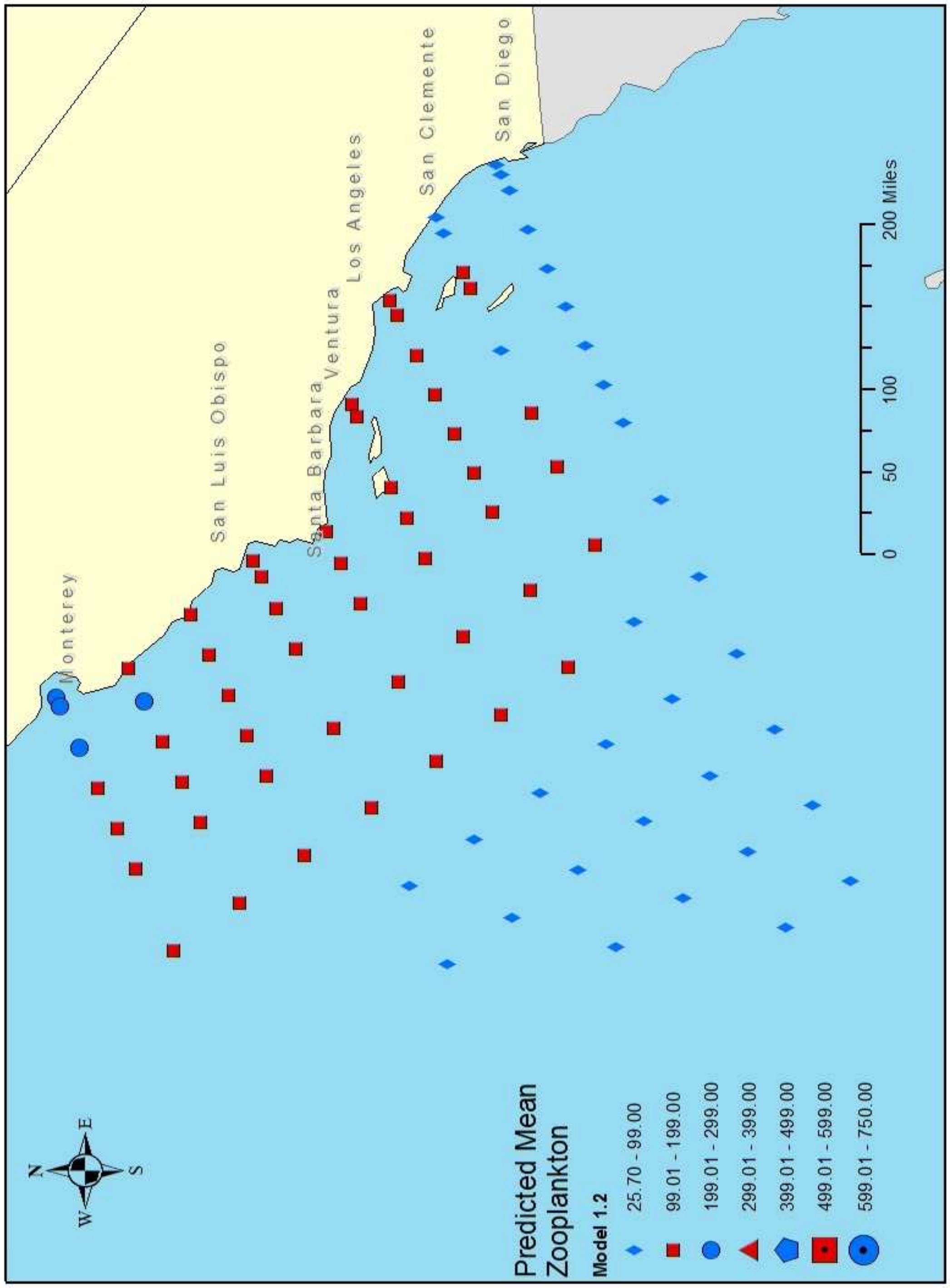


Figure J.2l: Model 1.2 Predicted Sampling Site Mean Zooplankton Yields: December.

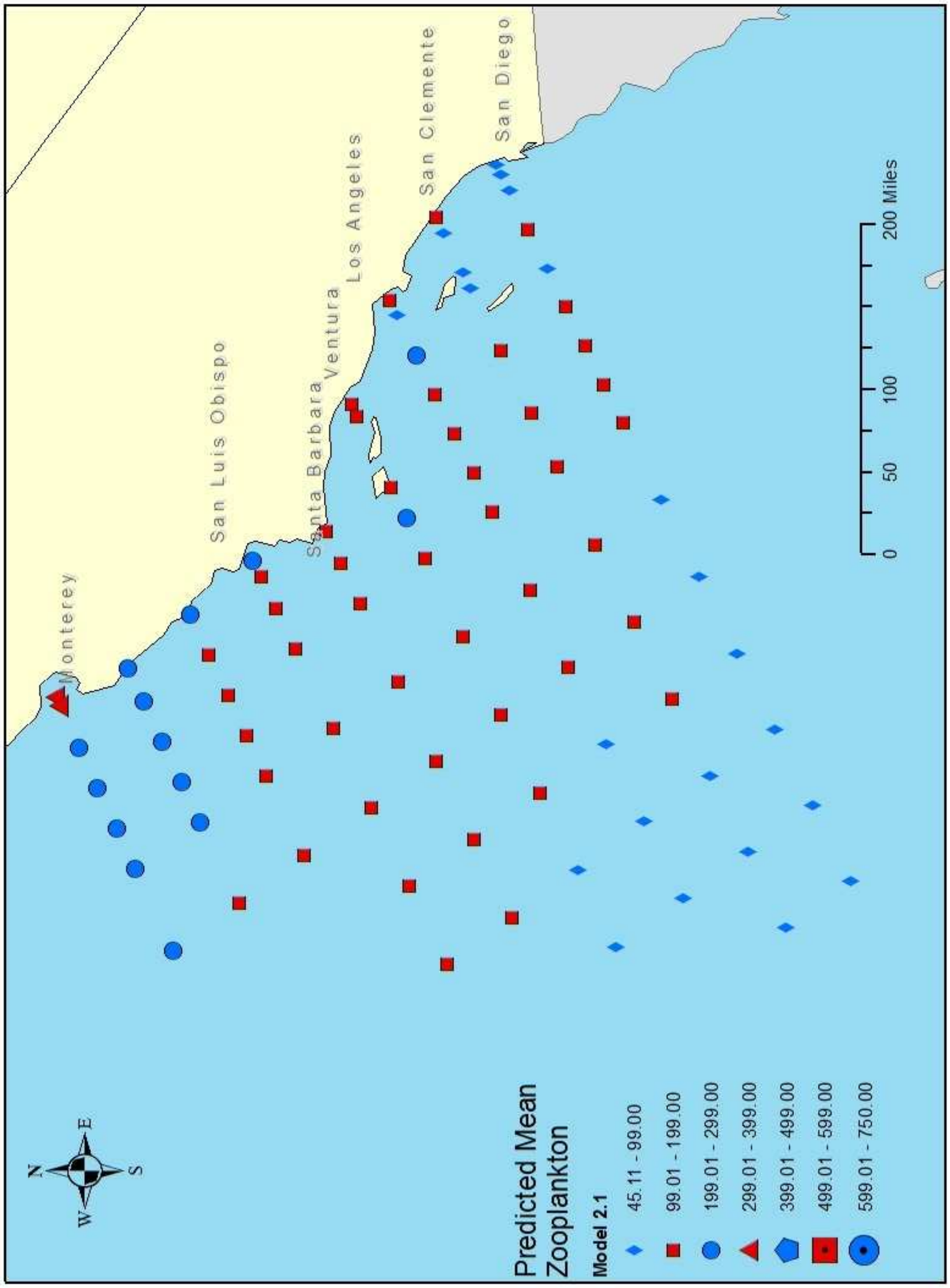


Figure J.3a: Model 2.1 Predicted Sampling Site Mean Zooplankton Yields: January.

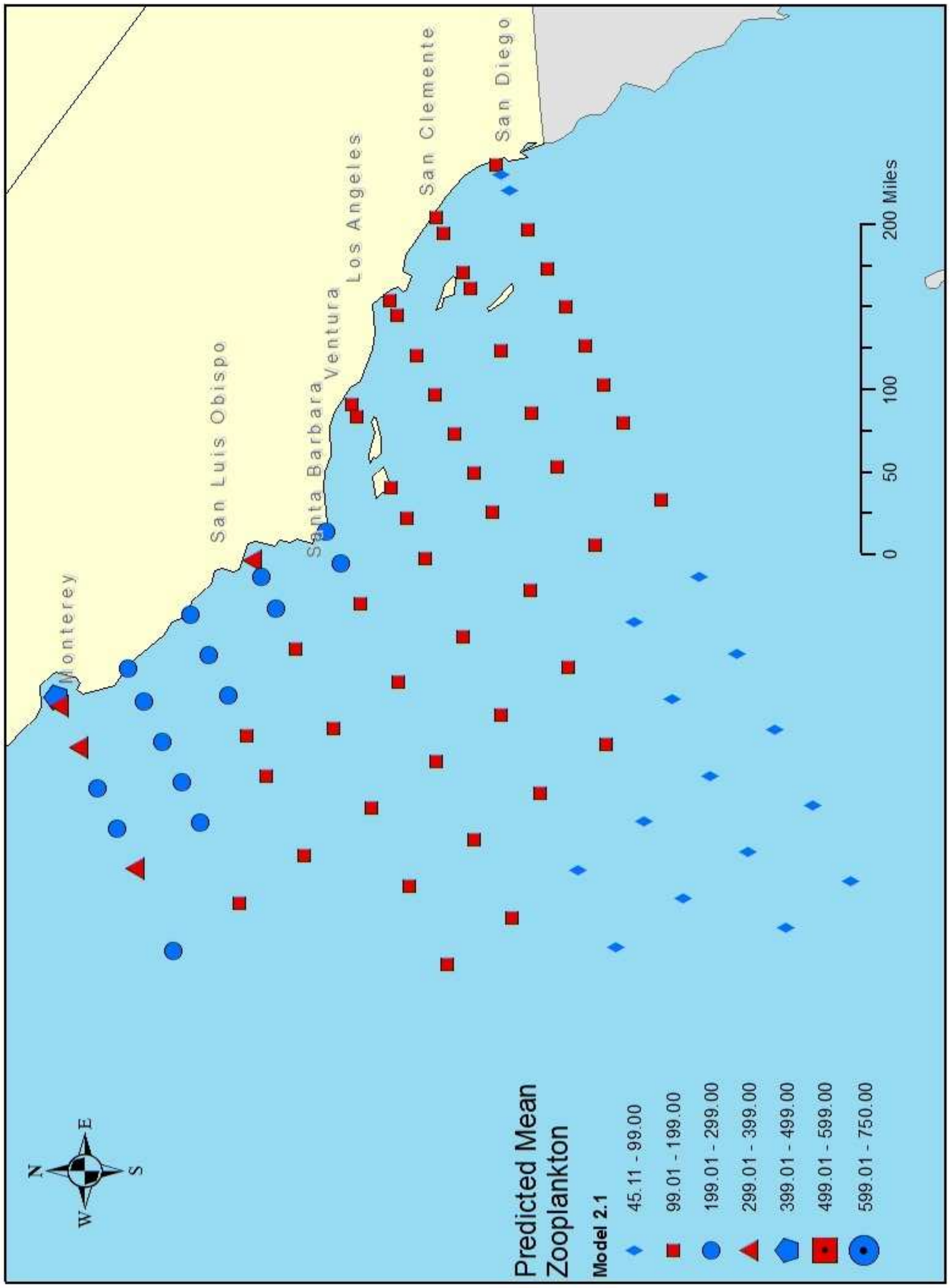


Figure J.3b: Model 2.1 Predicted Sampling Site Mean Zooplankton Yields: February.

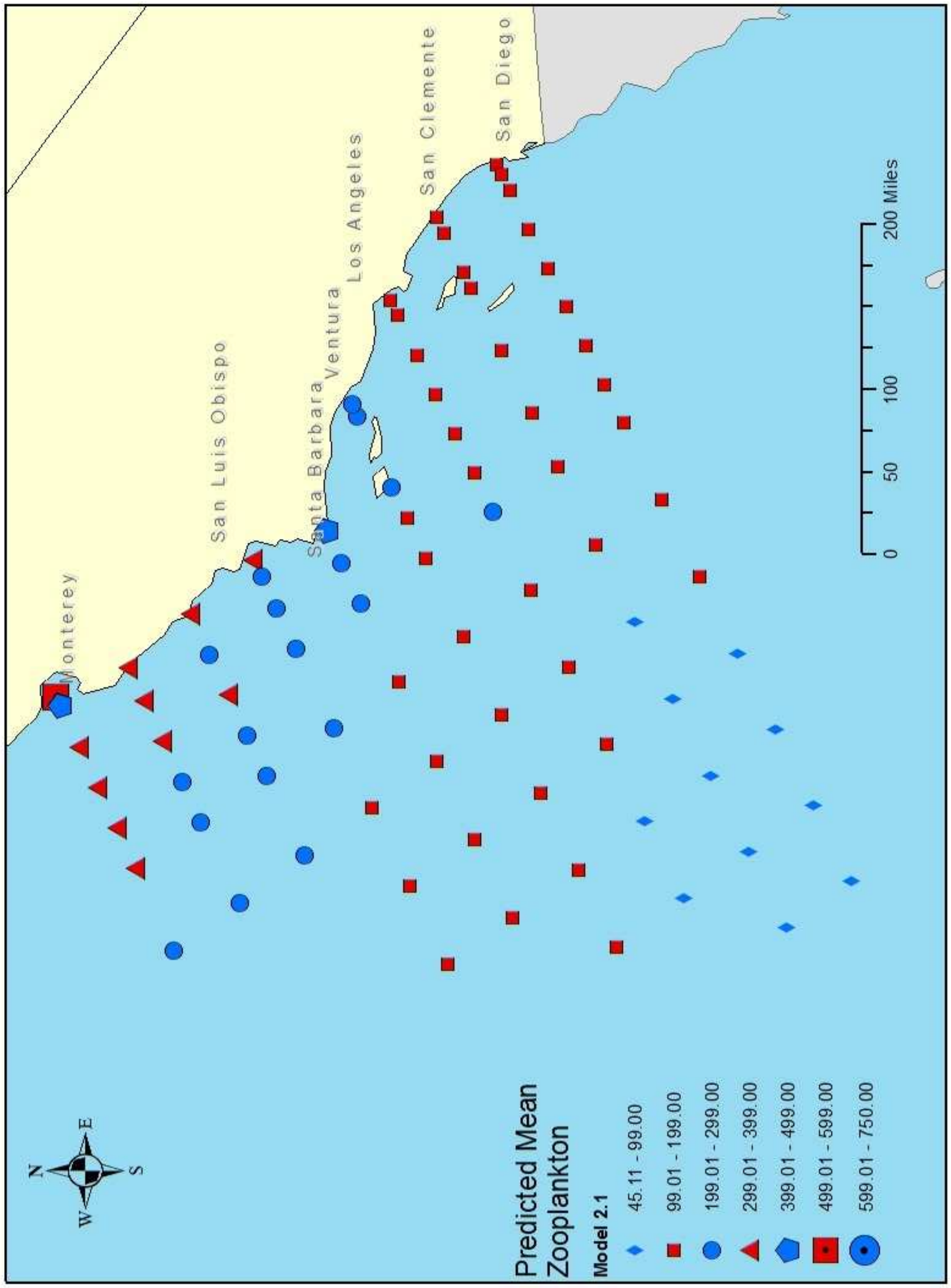


Figure J.3c: Model 2.1 Predicted Sampling Site Mean Zooplankton Yields: March.

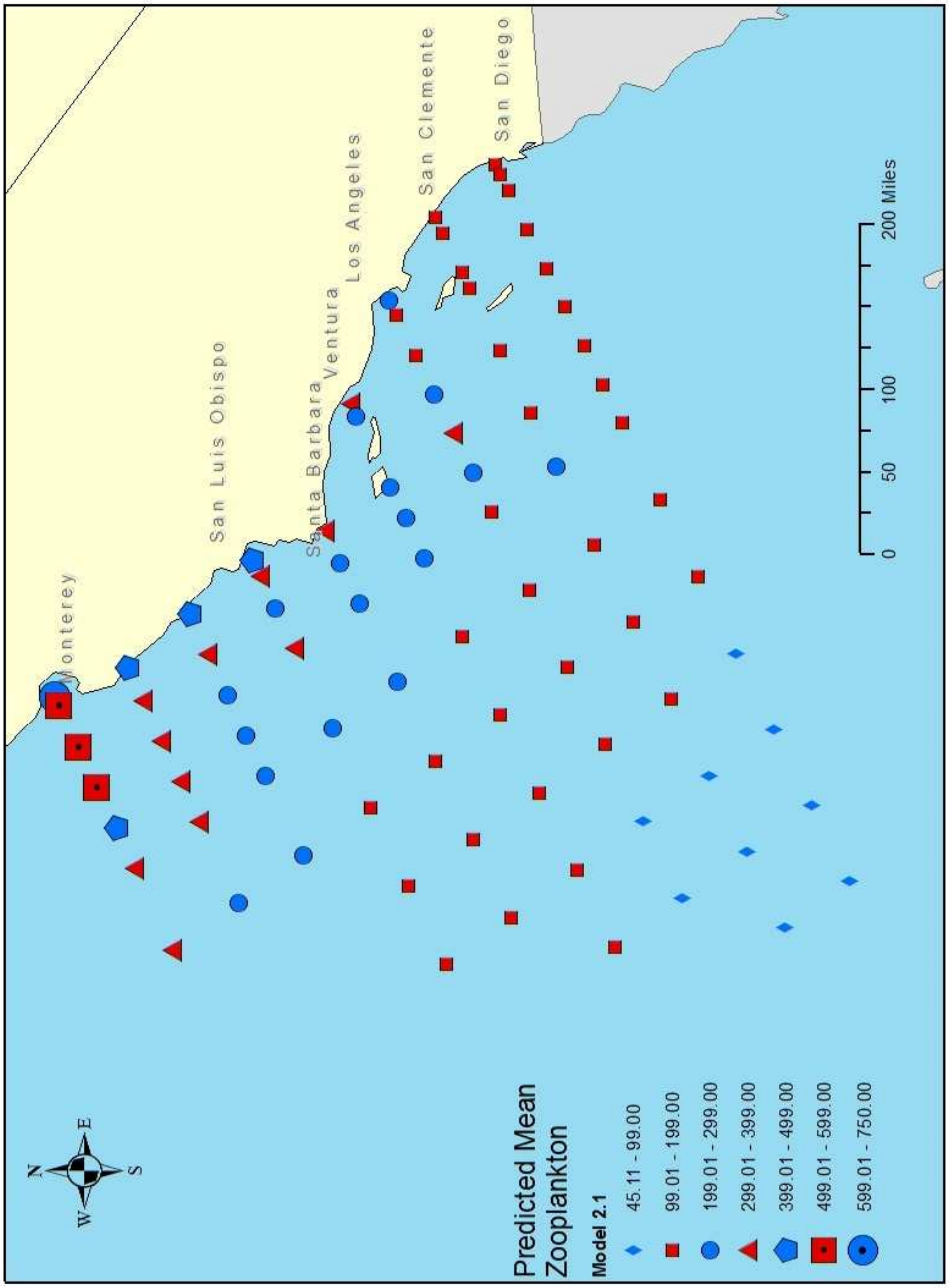


Figure J.3d: Model 2.1 Predicted Sampling Site Mean Zooplankton Yields: April.

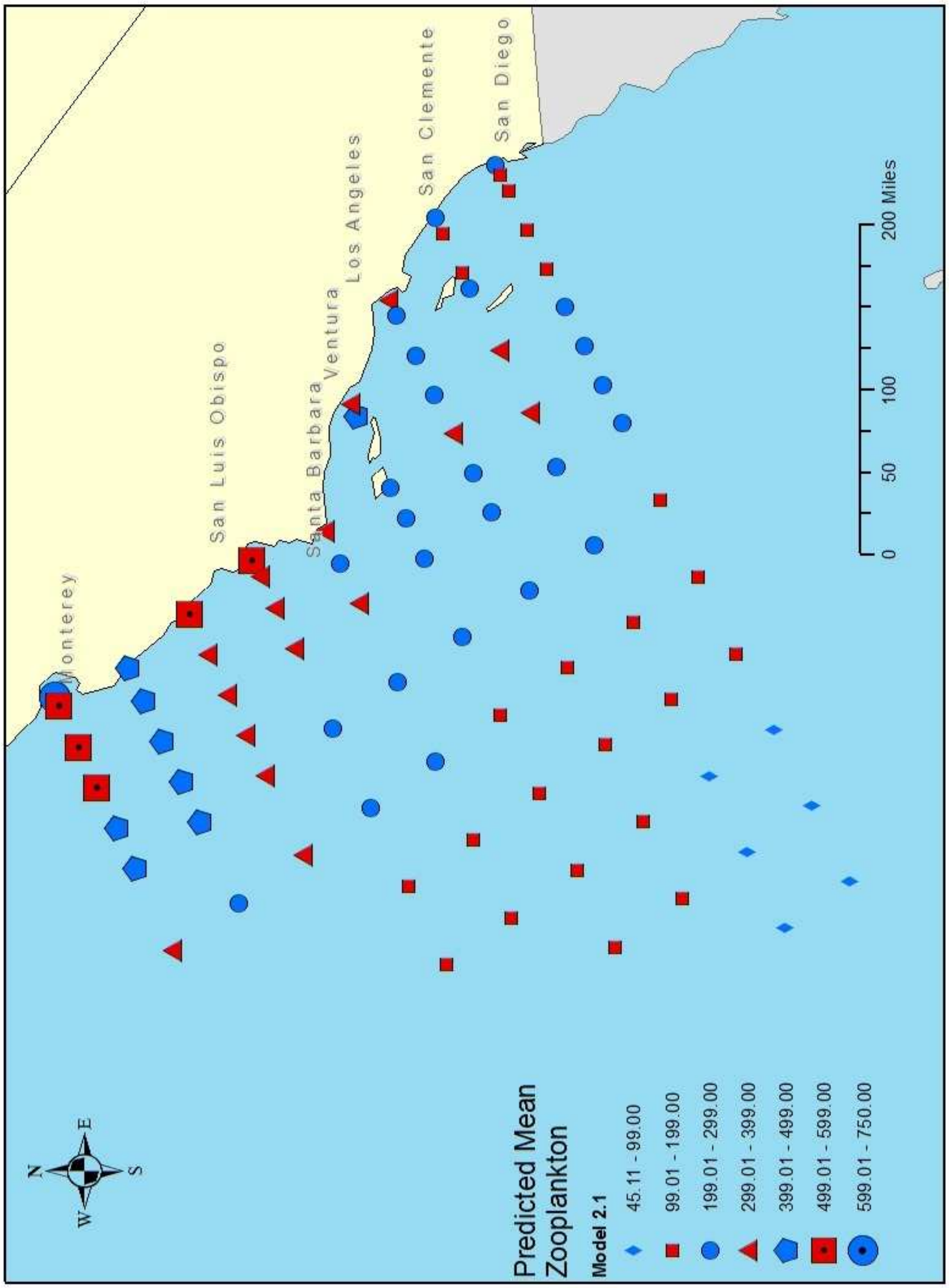


Figure J.3e: Model 2.1 Predicted Sampling Site Mean Zooplankton Yields: May.

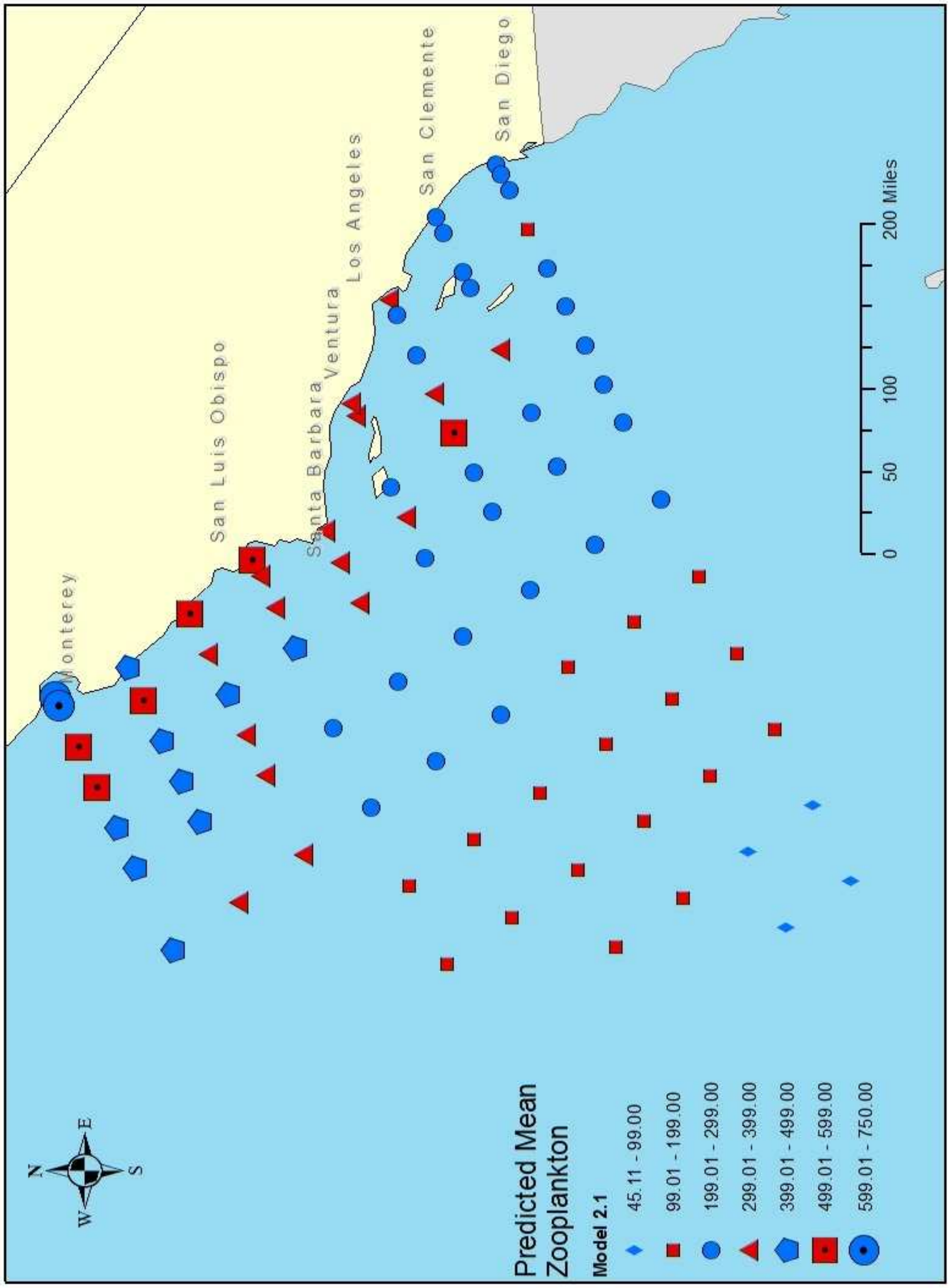


Figure J.3f: Model 2.1 Predicted Sampling Site Mean Zooplankton Yields: June.

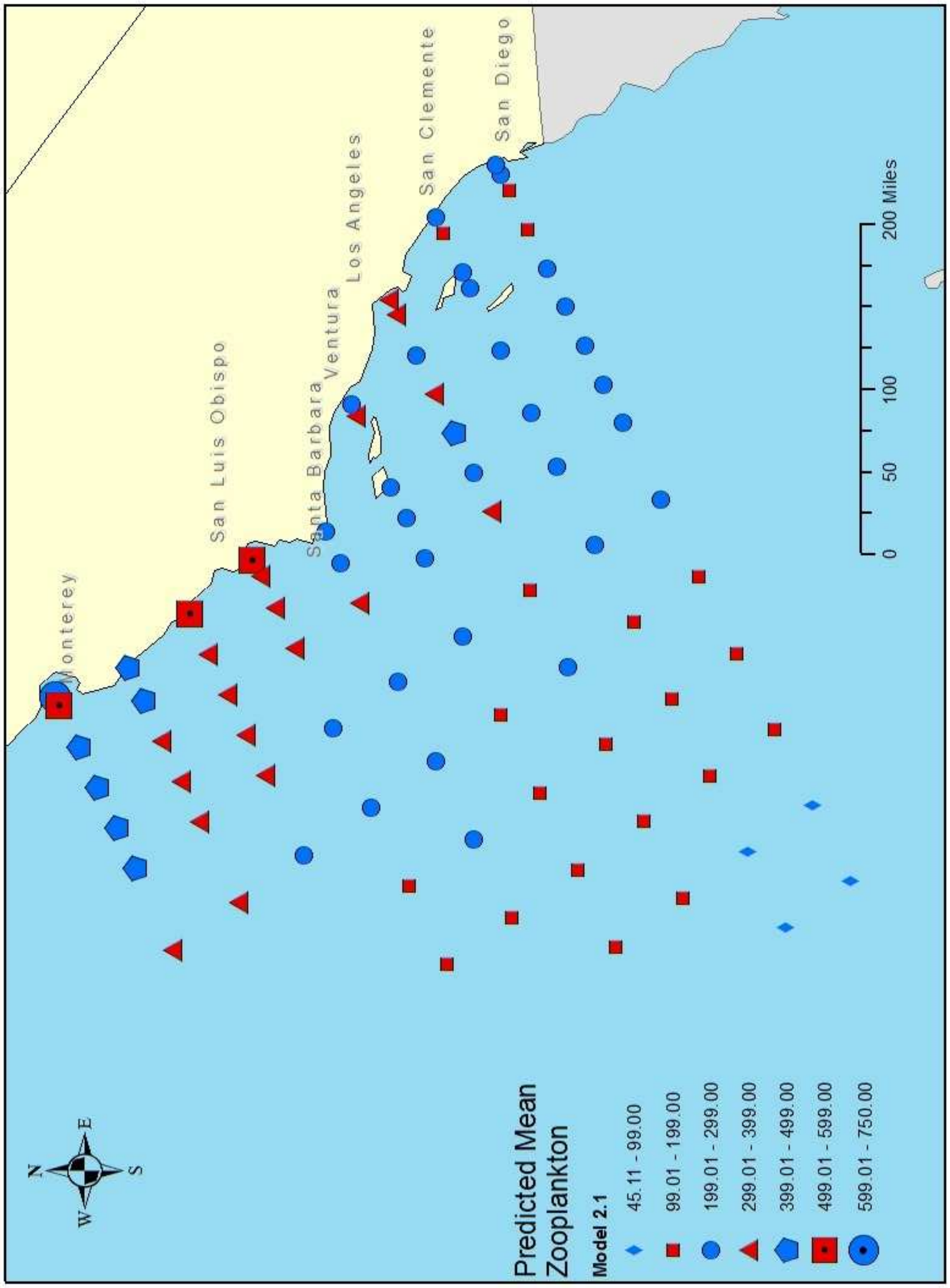


Figure J.3g: Model 2.1 Predicted Sampling Site Mean Zooplankton Yields: July.

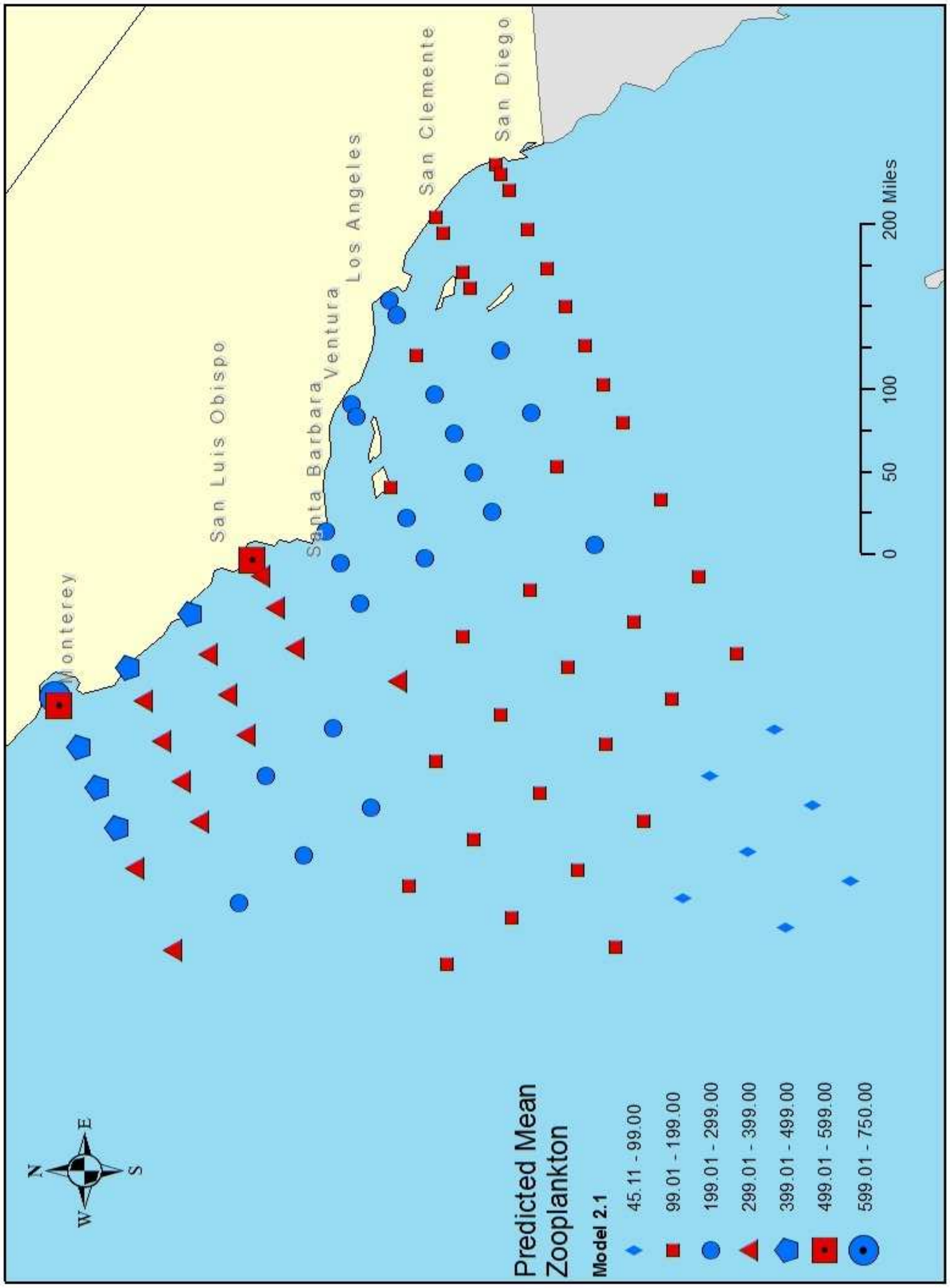


Figure J.3h: Model 2.1 Predicted Sampling Site Mean Zooplankton Yields: August.

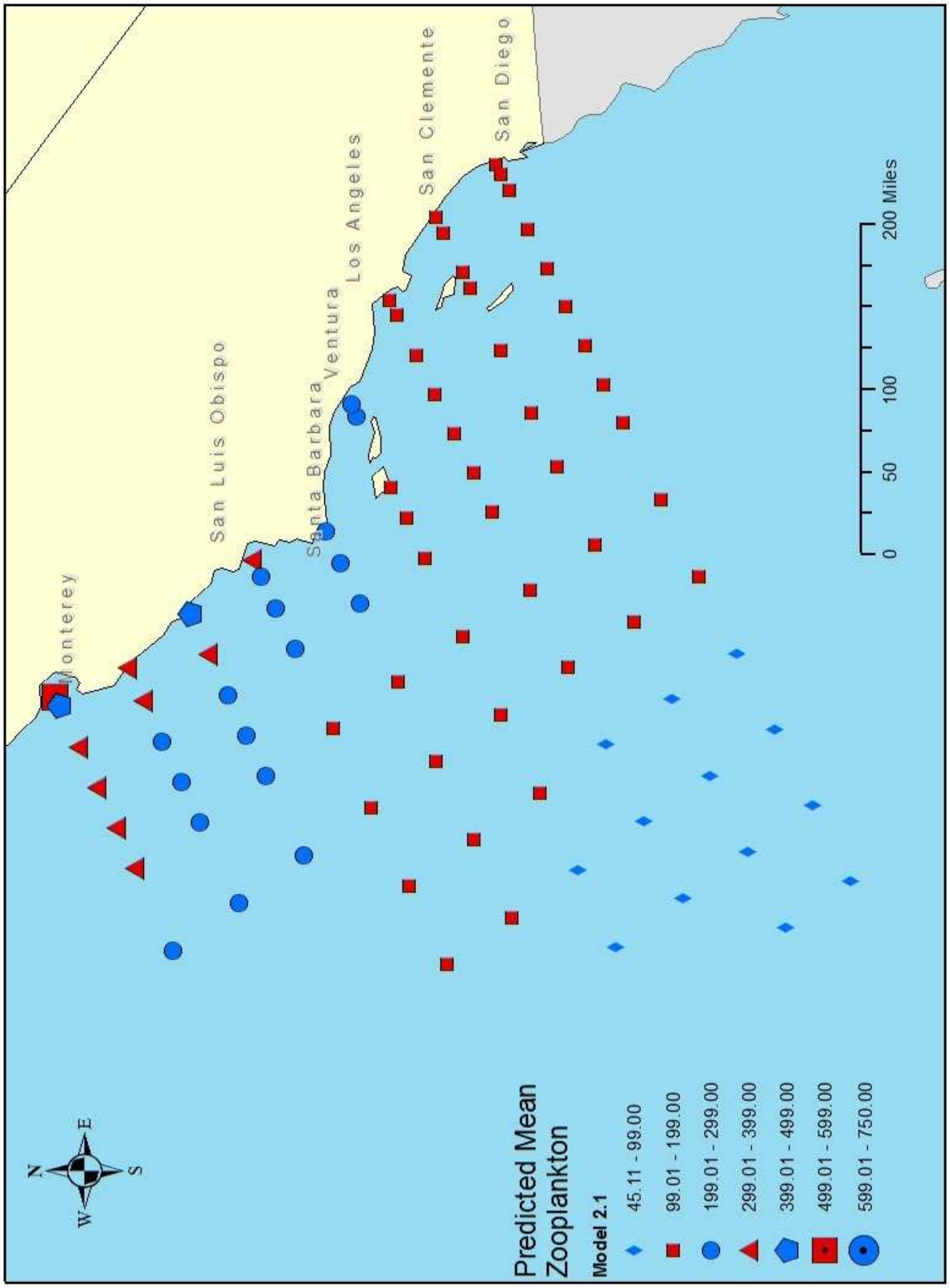


Figure J.3i: Model 2.1 Predicted Sampling Site Mean Zooplankton Yields: September.

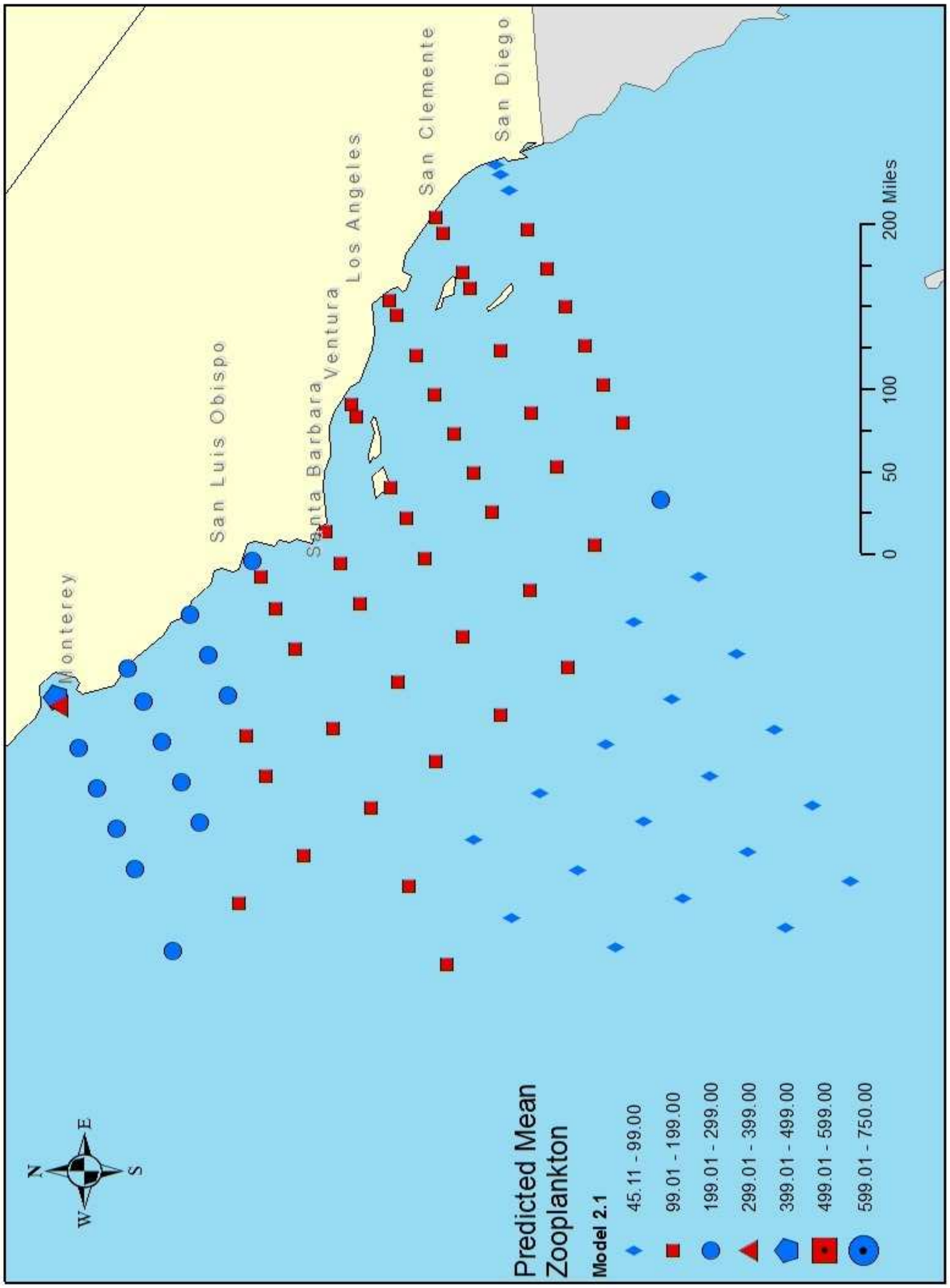


Figure J.3j: Model 2.1 Predicted Sampling Site Mean Zooplankton Yields: October.

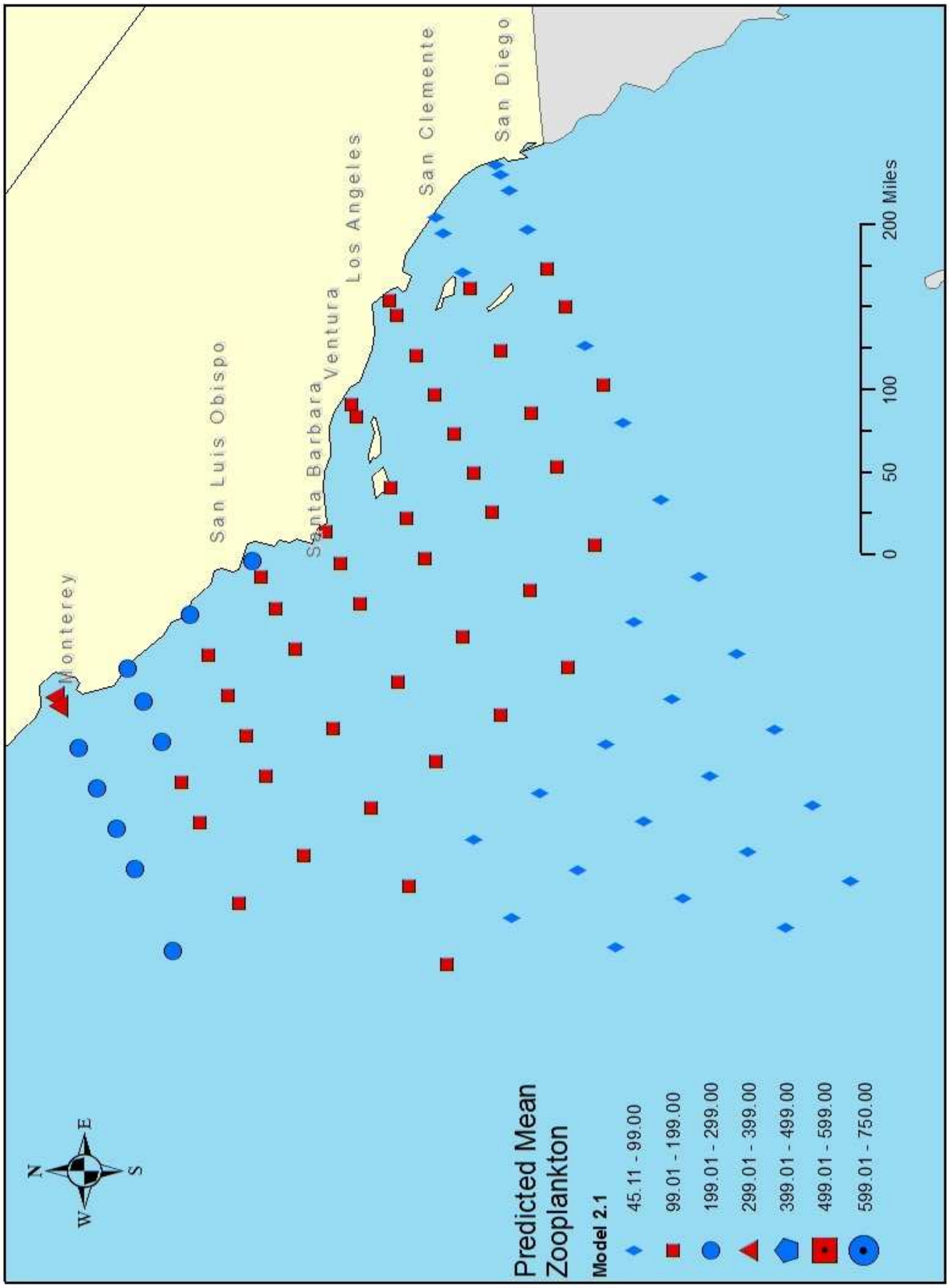


Figure J.3k: Model 2.1 Predicted Sampling Site Mean Zooplankton Yields: November.

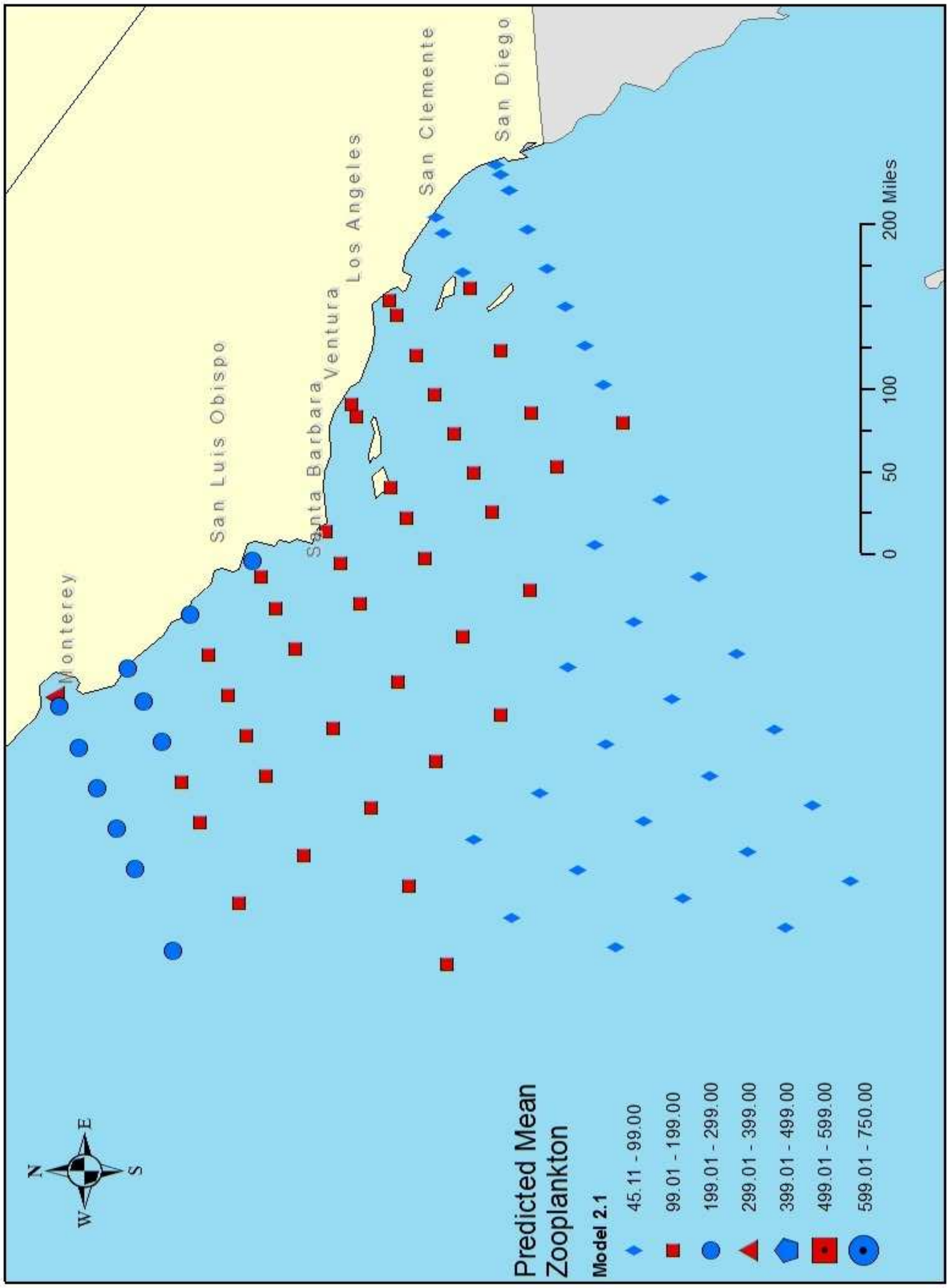


Figure J.3l: Model 2.1 Predicted Sampling Site Mean Zooplankton Yields: December.

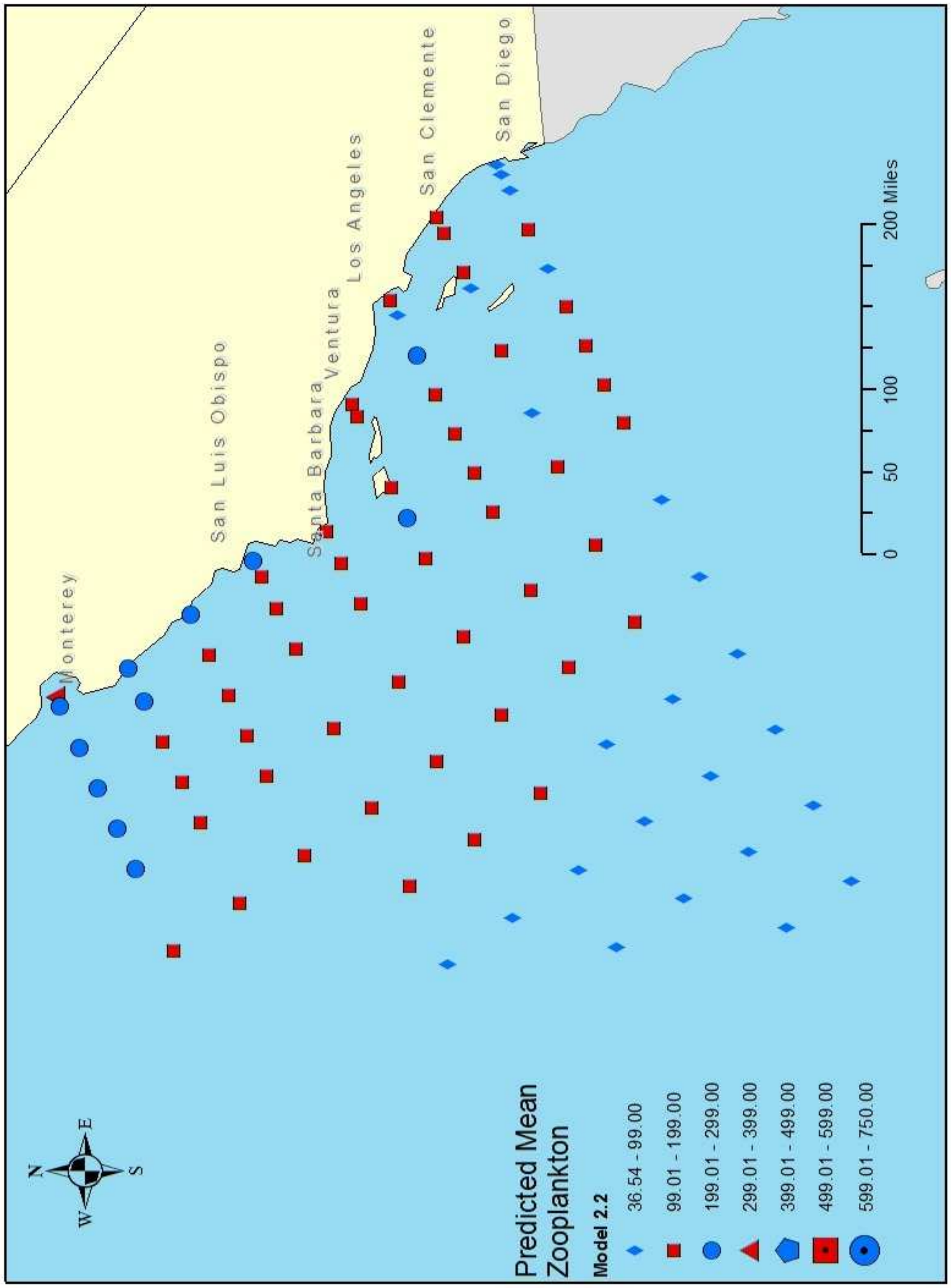


Figure J.4a: Model 2.2 Predicted Sampling Site Mean Zooplankton Yields: January.

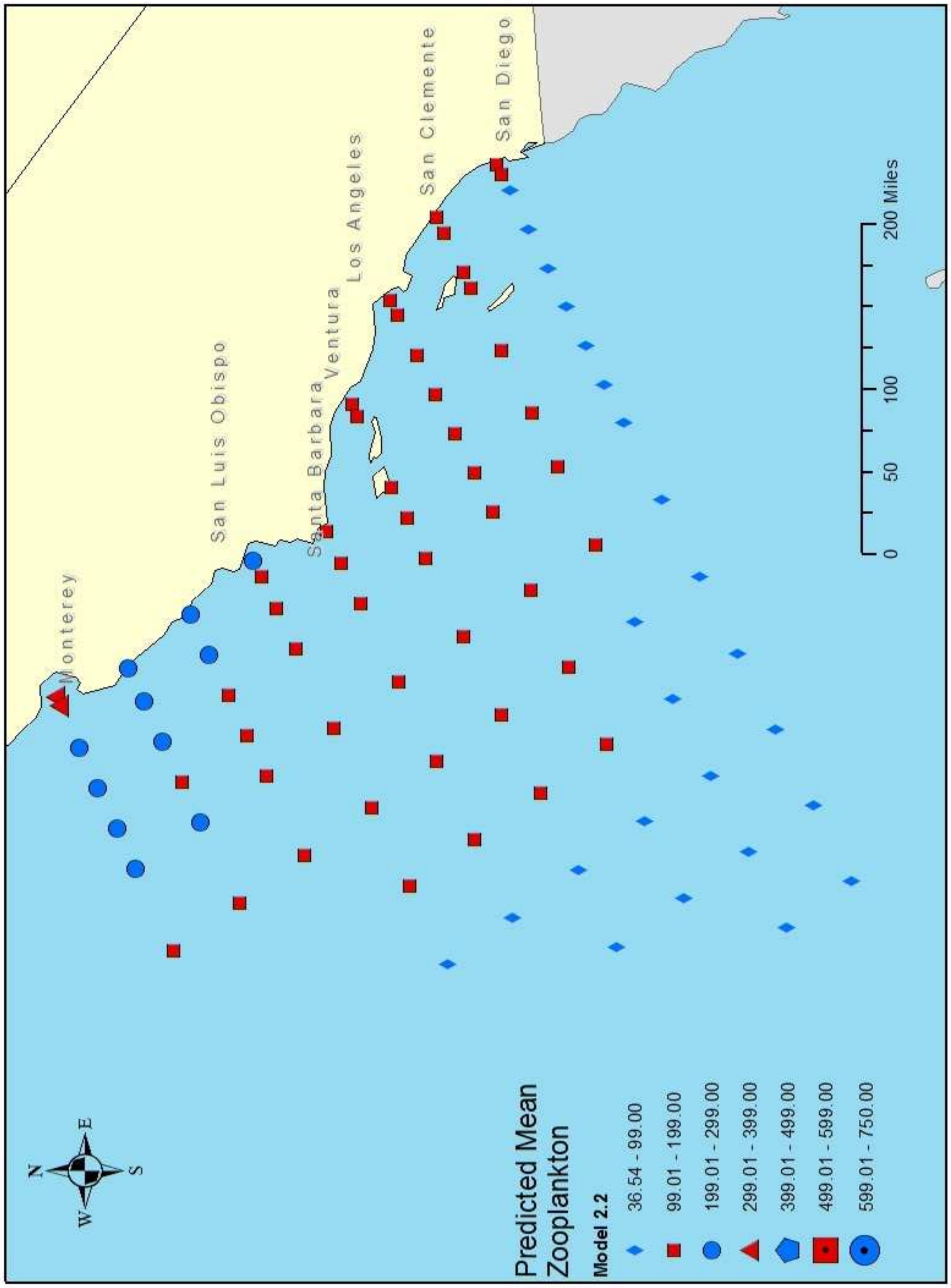


Figure J.4b: Model 2.2 Predicted Sampling Site Mean Zooplankton Yields: February.

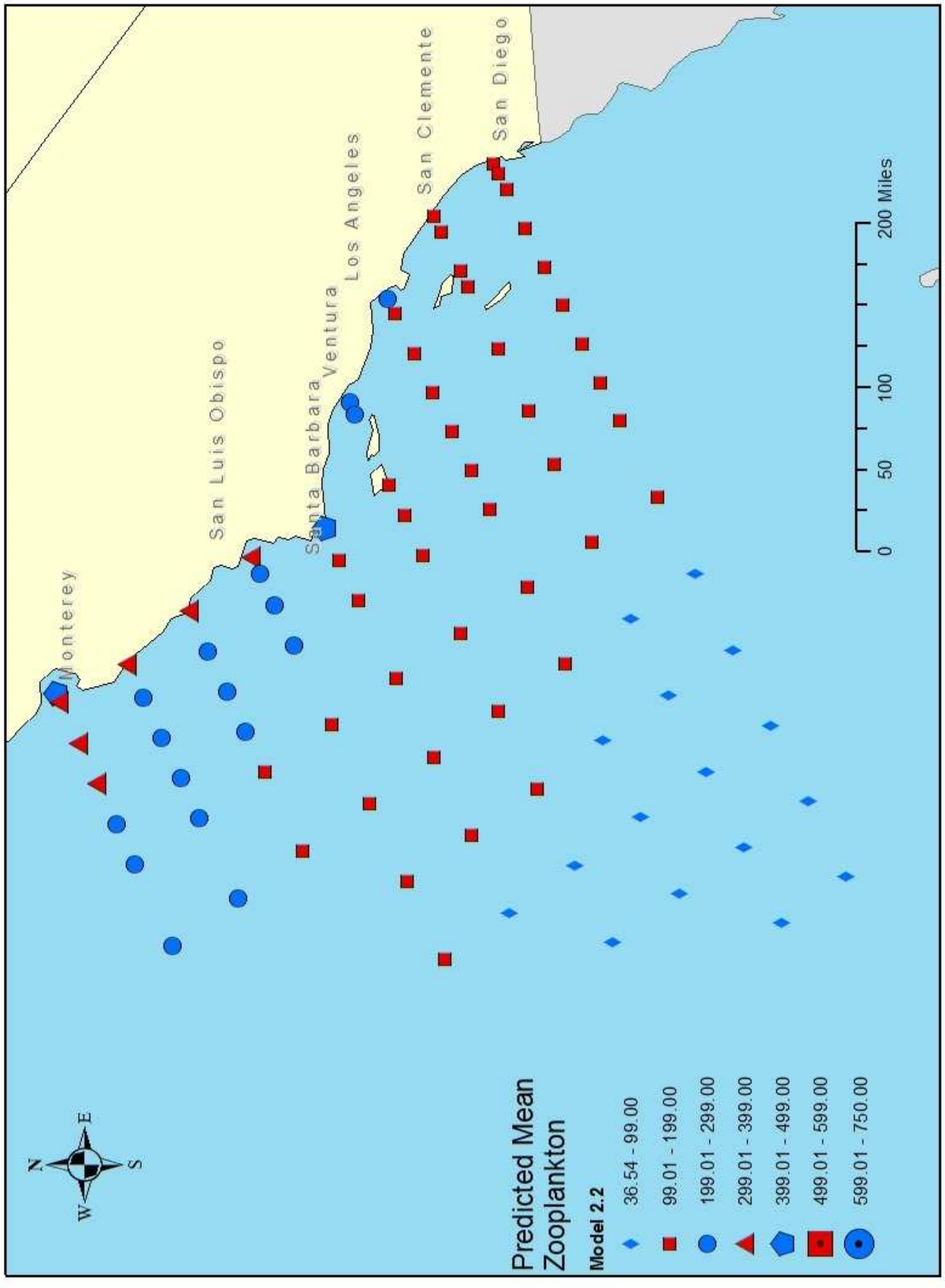


Figure J.4c: Model 2.2 Predicted Sampling Site Mean Zooplankton Yields: March.

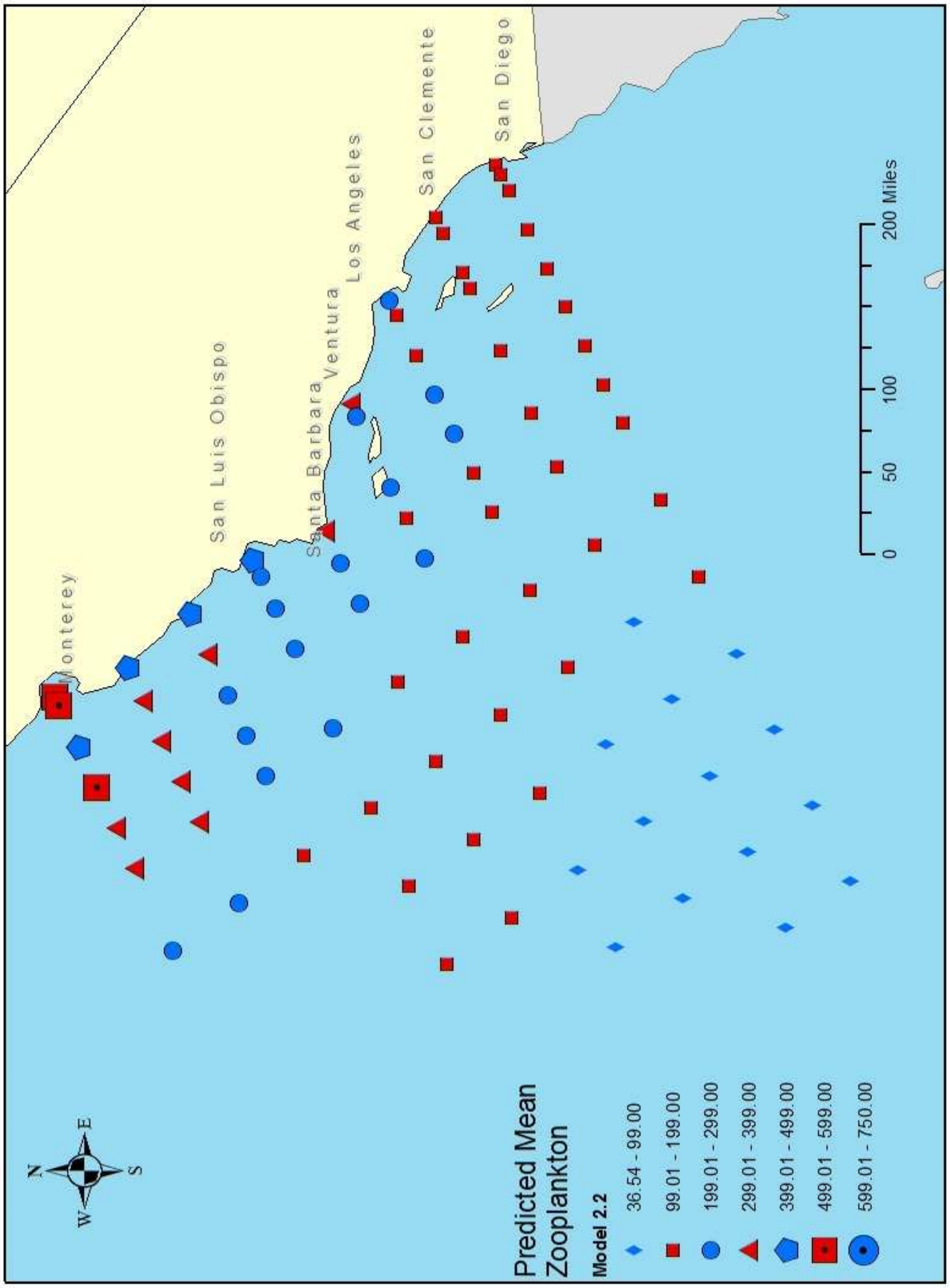


Figure J.4d: Model 2.2 Predicted Sampling Site Mean Zooplankton Yields: April.

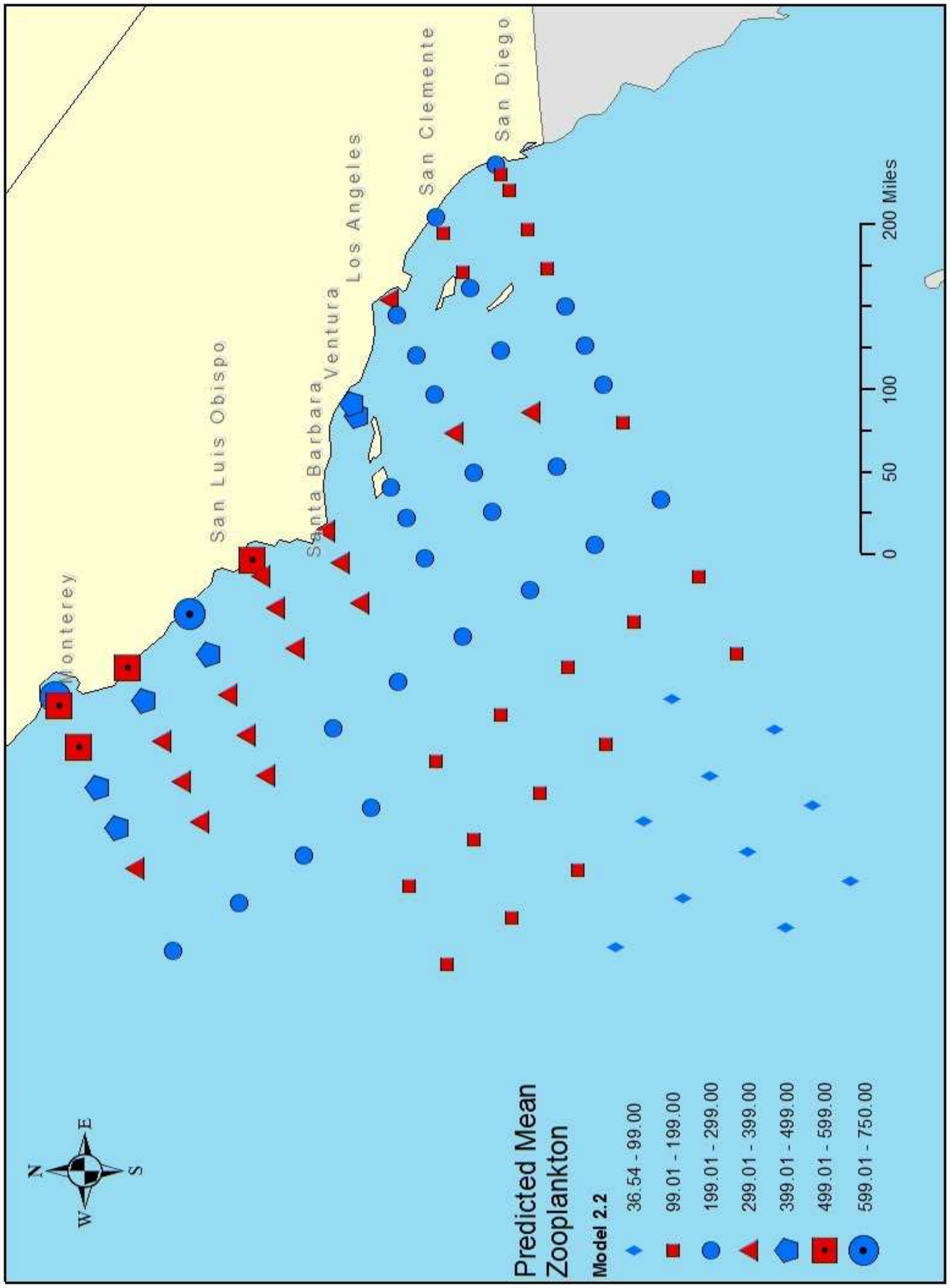


Figure J.4e: Model 2.2 Predicted Sampling Site Mean Zooplankton Yields: May.

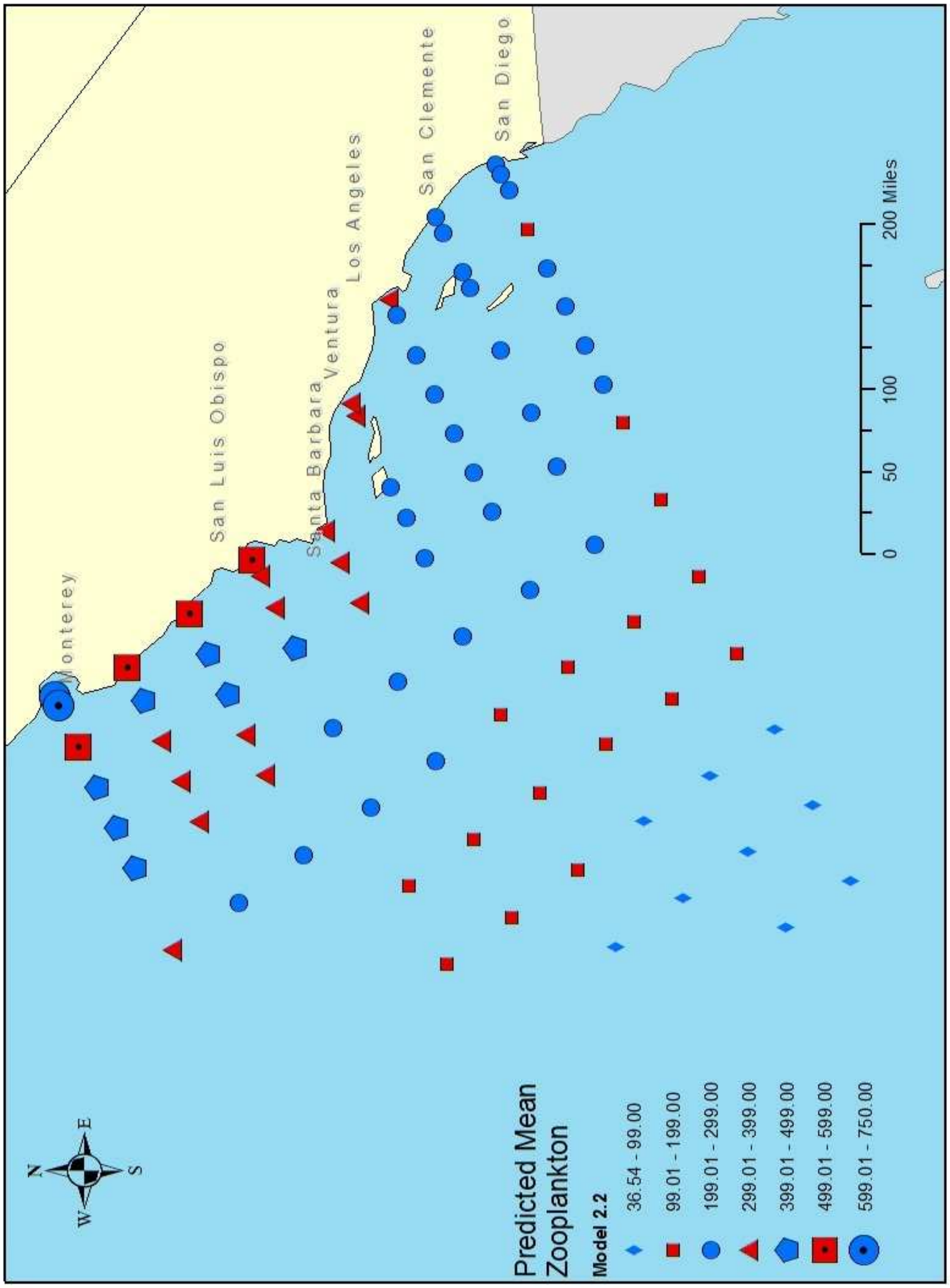


Figure J.4f: Model 2.2 Predicted Sampling Site Mean Zooplankton Yields: June.

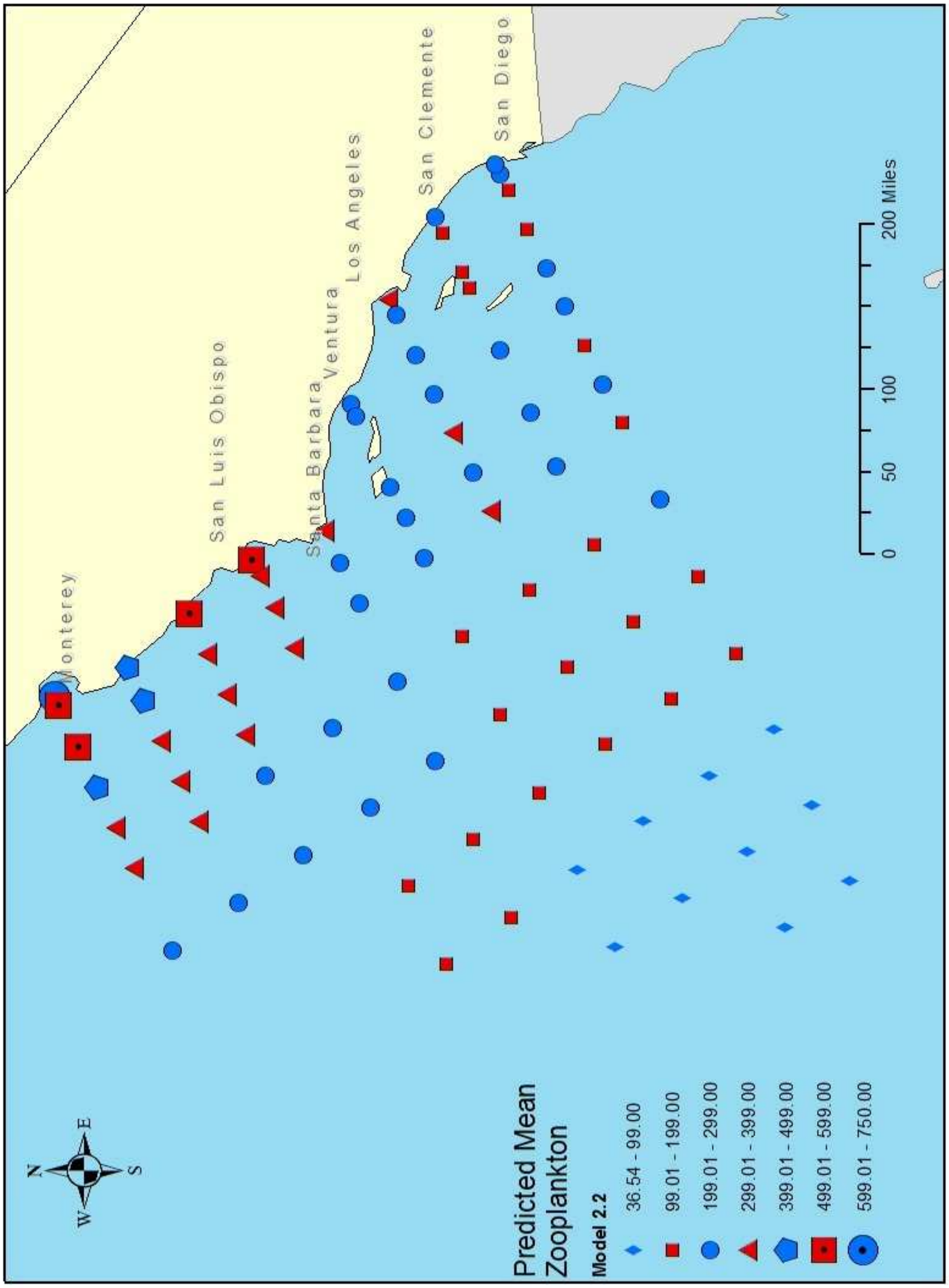


Figure J.4g: Model 2.2 Predicted Sampling Site Mean Zooplankton Yields: July.

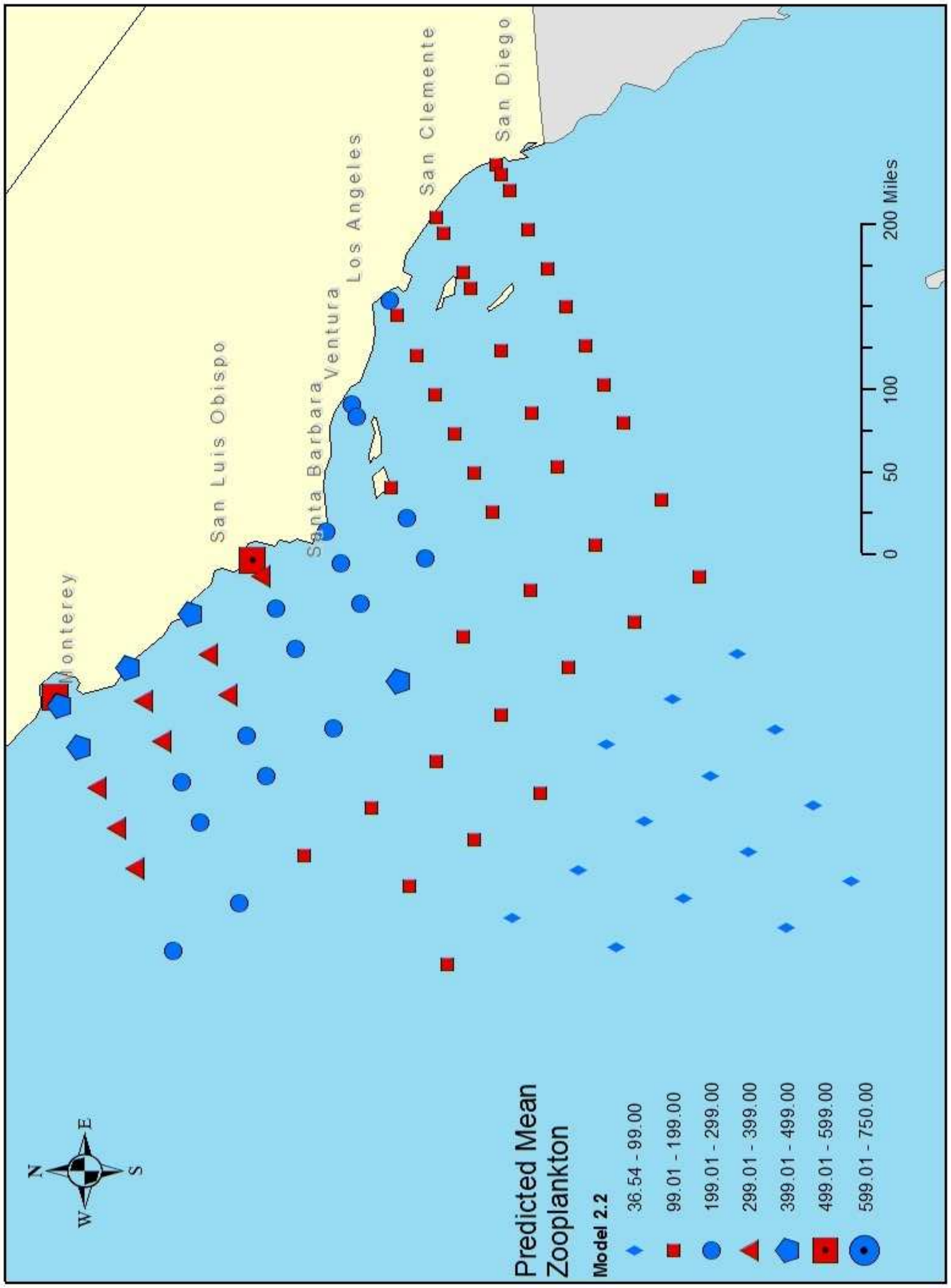


Figure J.4h: Model 2.2 Predicted Sampling Site Mean Zooplankton Yields: August.

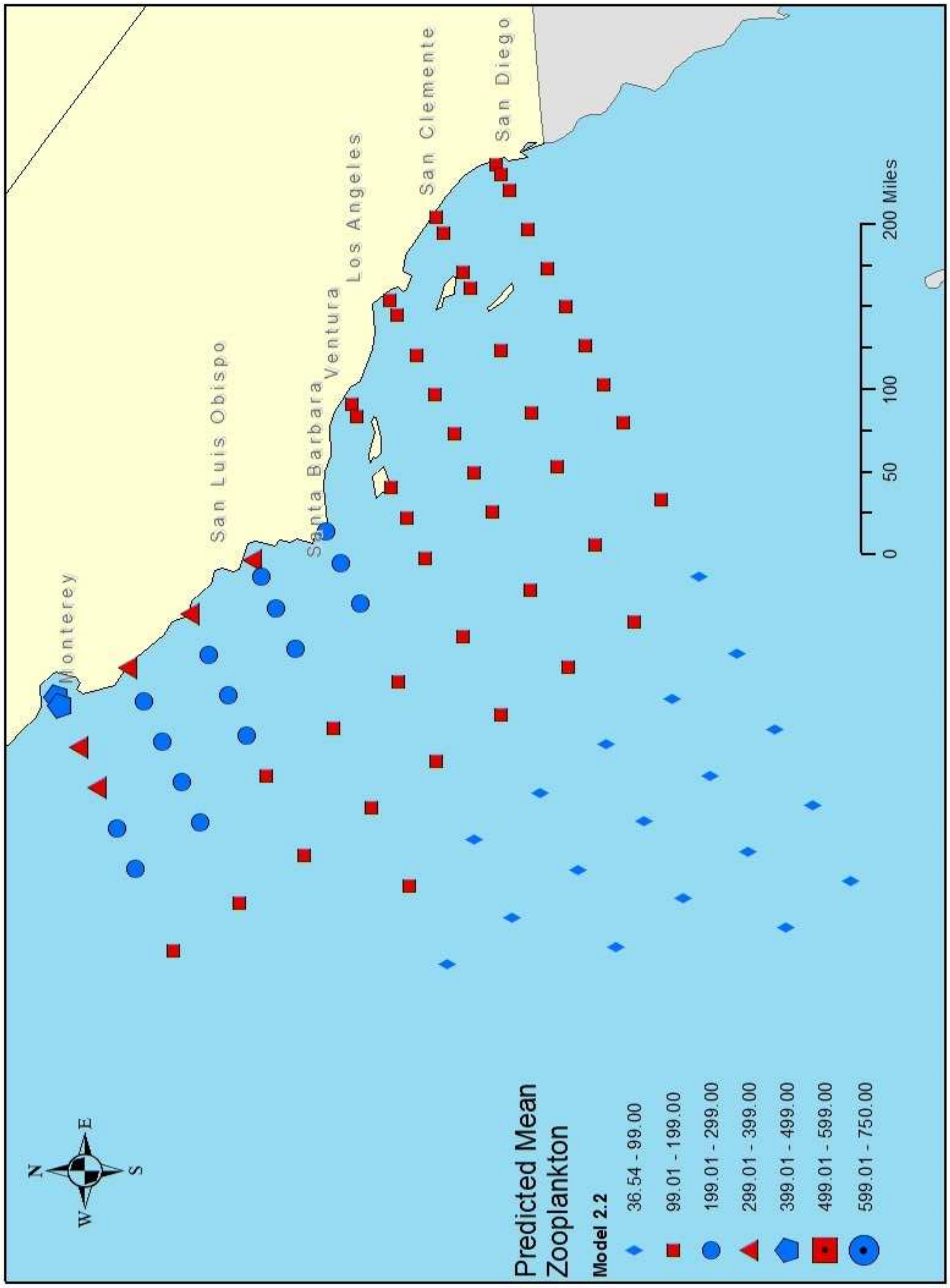


Figure J.4i: Model 2.2 Predicted Sampling Site Mean Zooplankton Yields: September.

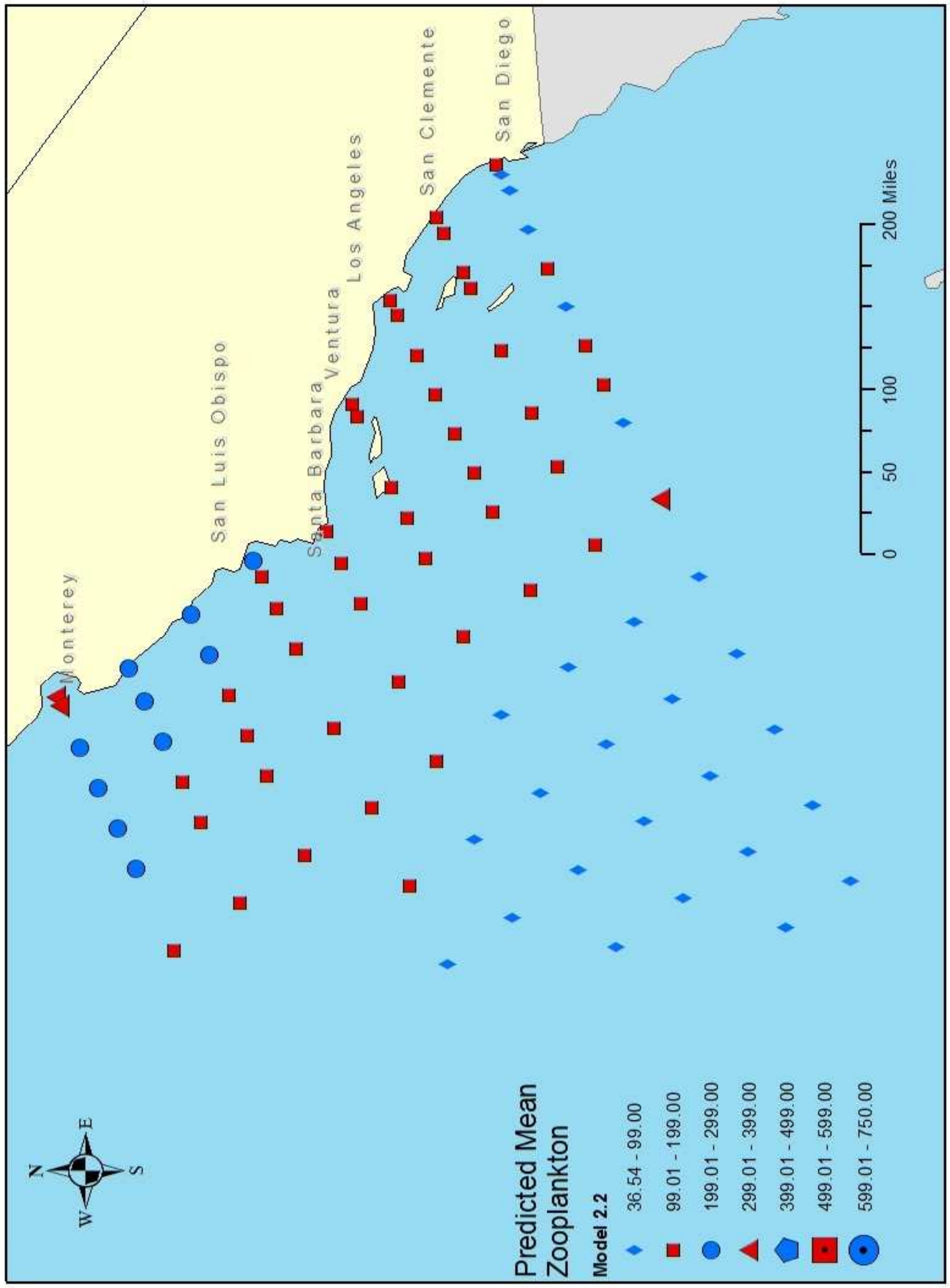


Figure J.4j: Model 2.2 Predicted Sampling Site Mean Zooplankton Yields: October.

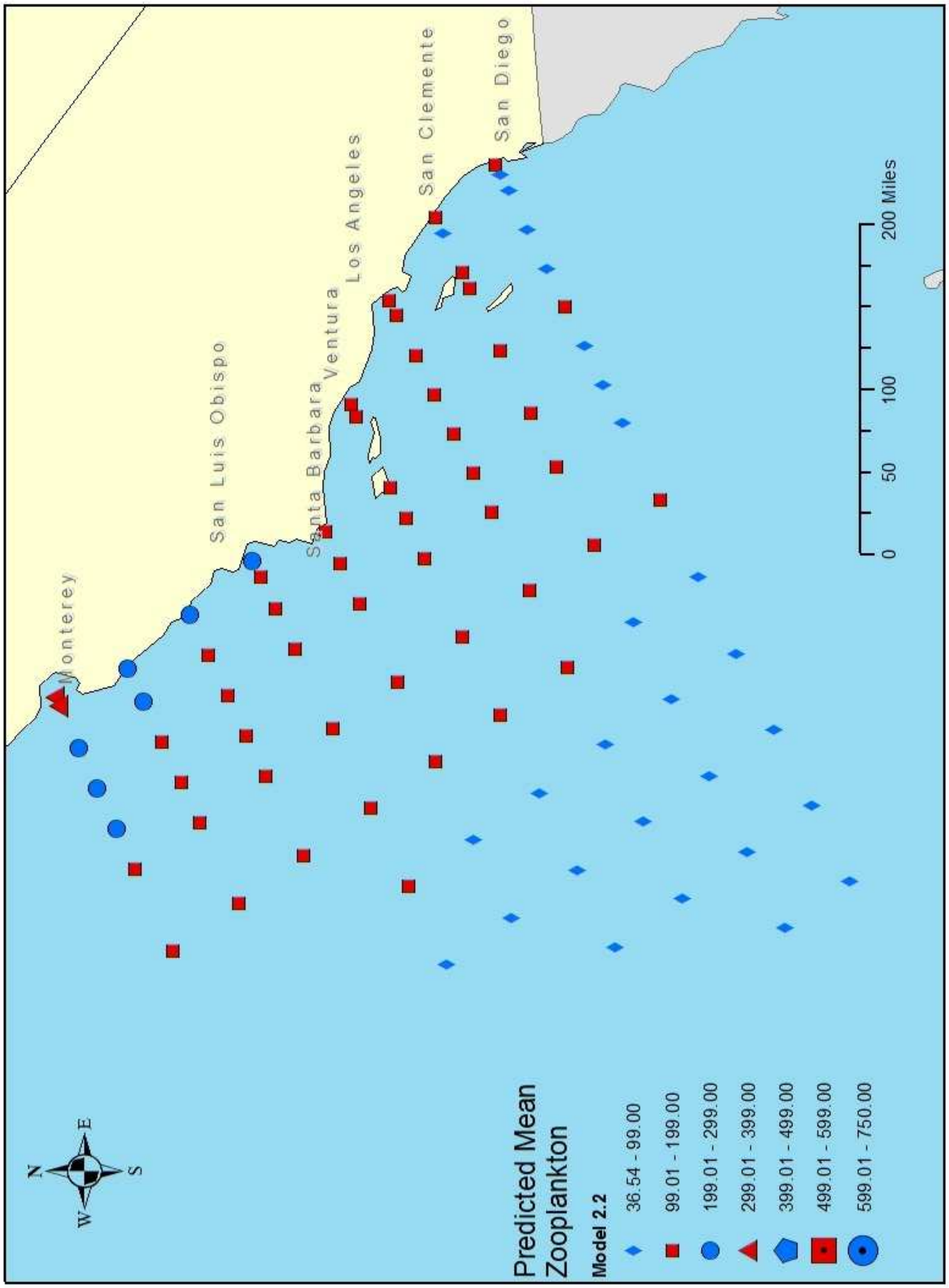


Figure J.4k: Model 2.2 Predicted Sampling Site Mean Zooplankton Yields: November.

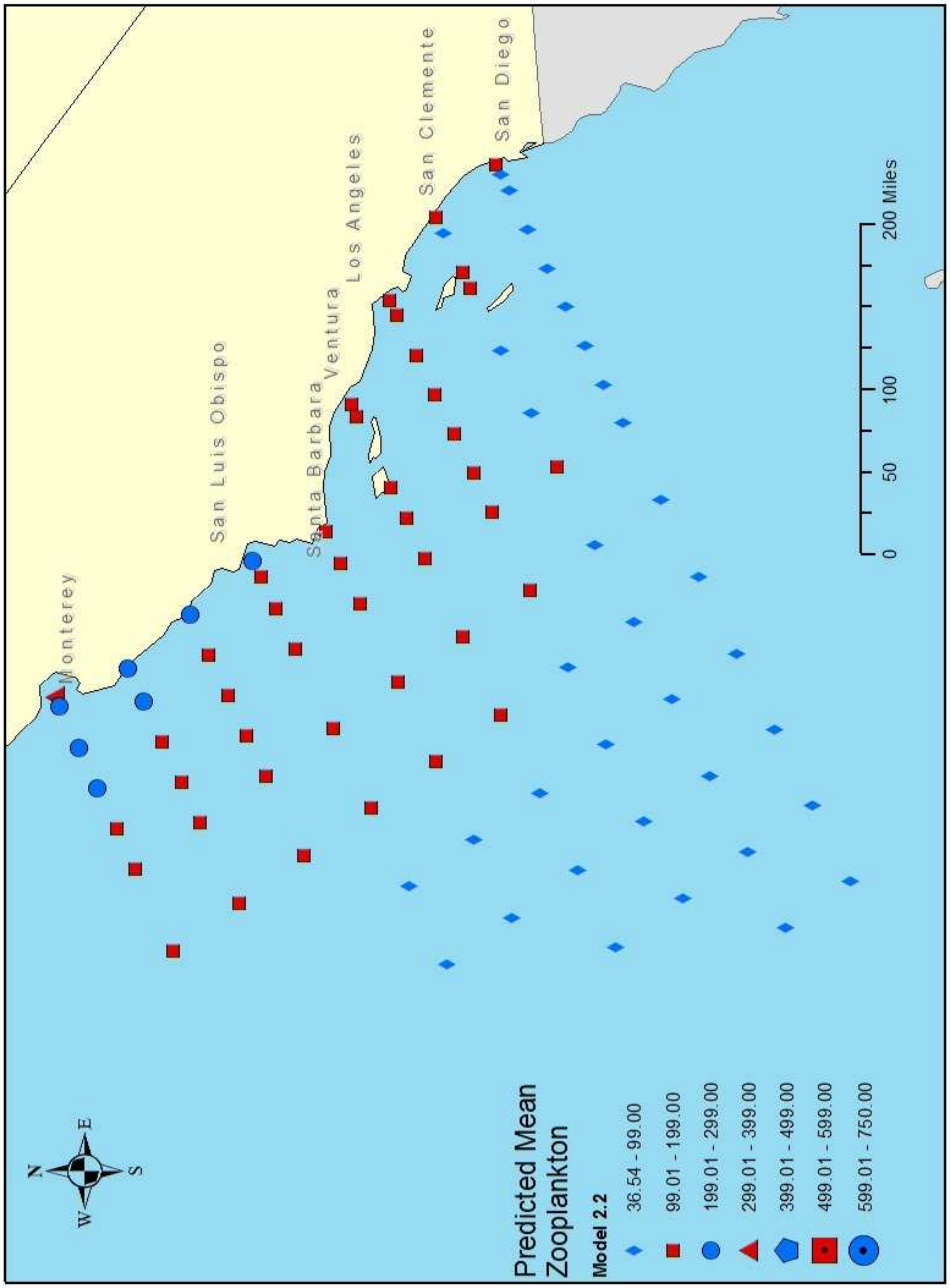


Figure J.4l: Model 2.2 Predicted Sampling Site Mean Zooplankton Yields: December.

APPENDIX K

PREDICTED SAMPLING SITE MONTHLY MEAN ZOOPLANKTON YIELDS

Table K.1: Model 1.1 Predicted Sampling Site Monthly Mean Zooplankton Yields.

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
66.7-80, January	126.73	0.0405	14.03	0.0356	53.5	5
66.7-80, February	160.78	0.0552	16	0.0462	165.88	8
66.7-80, March	179.66	0.0641	19.75	0.0603	86.33	3
66.7-80, April	237.17	0.0639	21.02	0.0524	273	14
66.7-80, May	243.33	0.091	26.91	0.0685	137	5
66.7-80, June	250.89	0.0878	28	0.0673	121	4
66.7-80, July	243.64	0.0775	23.96	0.0623	278.56	9
66.7-80, August	215.12	0.0773	22.7	0.0516	623	1
66.7-80, September	172.76	0.0594	19.31	0.0515	0	0
66.7-80, October	143.15	0.0495	14.61	0.0349	175.67	6
66.7-80, November	135.83	0.0464	13.38	0.0361	907	1
66.7-80, December	121.03	0.0425	13.44	0.0387	105	2
66.7-70, January	158.59	0.0567	18.95	0.0438	121.57	7
66.7-70, February	239.76	0.0635	20.48	0.0515	542.67	9
66.7-70, March	253.34	0.0831	26.93	0.0737	772	3
66.7-70, April	296.33	0.0936	30.32	0.0797	318.95	14
66.7-70, May	318.25	0.1143	36.39	0.1028	363.43	7
66.7-70, June	333.02	0.111	38.78	0.1124	402.63	4
66.7-70, July	300.25	0.1007	32.8	0.0855	349.22	9
66.7-70, August	267.48	0.0888	30.54	0.0756	531.75	2
66.7-70, September	216.47	0.0872	27.56	0.0659	0	0
66.7-70, October	179.41	0.0616	20.21	0.0551	241.83	6
66.7-70, November	149.48	0.055	18.3	0.0496	171	2
66.7-70, December	149.83	0.0526	17.26	0.0456	293	3
66.7-65, January	187.68	0.0666	21.61	0.0577	237.5	3
66.7-65, February	223.78	0.0717	25.08	0.058	497.5	4
66.7-65, March	270.38	0.1028	31.42	0.089	496	3
66.7-65, April	346.05	0.1686	45.53	0.1591	369.29	7
66.7-65, May	384.08	0.136	45.31	0.1265	540.7	5
66.7-65, June	395.83	0.1323	41.85	0.1218	704.43	7

Table K.1 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
66.7-65, July	342.53	0.1154	36.7	0.1025	386.5	10
66.7-65, August	310.7	0.1121	34	0.0994	447.5	6
66.7-65, September	289.83	0.094	30.11	0.0746	3250	1
66.7-65, October	203.98	0.0733	24.44	0.0644	281	4
66.7-65, November	167.91	0.0687	20.9	0.0542	172.88	4
66.7-65, December	165.8	0.0624	20.85	0.0552	158	2
66.7-60, January	195.97	0.0635	19.57	0.0588	229.31	16
66.7-60, February	224.23	0.0787	26.76	0.0635	221.31	8
66.7-60, March	284.53	0.1086	34.48	0.0886	395.75	4
66.7-60, April	457.62	0.1136	36.11	0.102	651.85	19
66.7-60, May	419.2	0.1517	46.07	0.1272	629.42	8
66.7-60, June	408.59	0.1738	46.16	0.1269	525.88	8
66.7-60, July	399.75	0.125	39.06	0.114	547.93	14
66.7-60, August	319.28	0.1416	40.89	0.1067	75	1
66.7-60, September	269.34	0.1144	35.3	0.0983	191	1
66.7-60, October	214.57	0.0764	27.07	0.0786	151.33	6
66.7-60, November	190.51	0.071	23.54	0.0612	326	2
66.7-60, December	181.37	0.0646	22.03	0.0587	282.33	3
66.7-55, January	225.02	0.0676	20.29	0.0611	303.06	17
66.7-55, February	242.15	0.0832	28.6	0.0698	260.81	8
66.7-55, March	316.66	0.1172	36.07	0.0859	642.5	4
66.7-55, April	426.18	0.0987	36.21	0.1126	465.65	24
66.7-55, May	440.23	0.149	45.45	0.1312	582.08	13
66.7-55, June	411.3	0.1475	47.79	0.1265	449.23	11
66.7-55, July	398.87	0.1442	39.24	0.1137	413.44	17
66.7-55, August	356.07	0.1308	39.7	0.1044	572.42	6
66.7-55, September	278.81	0.1056	35.28	0.1049	355	2
66.7-55, October	229.07	0.0743	26.01	0.0731	284.44	9
66.7-55, November	201.09	0.0769	24.67	0.0688	263.5	4
66.7-55, December	197.72	0.0623	23.84	0.0619	442.5	2
66.7-50, January	217.88	0.0699	21.19	0.0568	260.82	14
66.7-50, February	270.47	0.0916	28.33	0.078	378.13	8
66.7-50, March	305.55	0.1113	35.68	0.0969	214.9	5
66.7-50, April	445.83	0.1046	35.26	0.0868	470.99	21
66.7-50, May	421.4	0.1299	44.43	0.1071	448.67	12
66.7-50, June	409.38	0.1451	47.24	0.1151	331.85	10
66.7-50, July	411.85	0.1355	41.18	0.1068	473	13
66.7-50, August	350.63	0.1263	39.99	0.1031	334.17	6
66.7-50, September	287.95	0.1094	34.64	0.078	203.5	2
66.7-50, October	230.75	0.08	25.99	0.0628	213.44	9
66.7-50, November	225.66	0.0806	24.35	0.0642	449.75	4
66.7-50, December	200.47	0.0881	23.74	0.0642	198	3
66.7-49, January	212.27	0.0803	25.31	0.0649	96.5	4
66.7-49, February	261.24	0.0975	31.02	0.0756	115	1
66.7-49, March	319.55	0.113	37.59	0.0844	0	0
66.7-49, April	407.94	0.1231	43.11	0.1202	453.03	8
66.7-49, May	441.18	0.1681	50.59	0.1428	761	1

Table K.1 - continued

LS-Month	**Mean**	**MCSE$_{\text{Mean}}$**	**SD**	**MCSE$_{\text{SD}}$**	**OBS Mean**	**OBS Count**
66.7-49, June	436.22	0.1575	51.2	0.1107	301	2
66.7-49, July	421.5	0.1552	48.37	0.1299	361	2
66.7-49, August	365.29	0.1249	42.85	0.1011	0	0
66.7-49, September	297.7	0.1086	35.11	0.0939	0	0
66.7-49, October	243.3	0.0866	28.52	0.0681	143	1
66.7-49, November	220.85	0.0782	26.32	0.057	0	0
66.7-49, December	207.61	0.0768	24.05	0.0528	253	2
70-80, January	158.71	0.0342	10.5	0.0263	267.5	17
70-80, February	140.2	0.0486	14.98	0.0412	121.06	8
70-80, March	191.7	0.0601	18.26	0.0468	416.92	6
70-80, April	233.25	0.0551	18.26	0.0482	295.79	19
70-80, May	215.01	0.0663	23.66	0.0586	160.12	13
70-80, June	254.72	0.0764	24.26	0.0723	356.7	10
70-80, July	280.93	0.0681	20.85	0.0533	417.44	18
70-80, August	191.8	0.0622	21.06	0.0523	180.9	5
70-80, September	155.26	0.0557	17.62	0.0513	114	3
70-80, October	126.59	0.0353	12.85	0.0348	140.8	10
70-80, November	113.03	0.0389	12.45	0.0309	105.25	6
70-80, December	116.93	0.0392	12.25	0.0317	243.33	3
70-70, January	186.81	0.0482	15.18	0.0474	280.11	18
70-70, February	196.57	0.0647	22.38	0.0604	281.81	8
70-70, March	237.84	0.0896	27.2	0.0728	298.83	6
70-70, April	356.82	0.0809	25.37	0.0708	491.23	22
70-70, May	376.33	0.0969	34.5	0.0928	750.53	15
70-70, June	369.14	0.1198	36.15	0.097	688.1	10
70-70, July	334.68	0.0833	29.14	0.0718	473.5	19
70-70, August	255.12	0.0971	31.23	0.0891	340.6	5
70-70, September	215.14	0.082	26.31	0.0776	453.33	3
70-70, October	179.16	0.0615	18.97	0.0554	263.09	11
70-70, November	145.94	0.0637	18.71	0.0486	147.17	6
70-70, December	151.31	0.0539	18	0.0434	358.33	3
70-65, January	184.46	0.0787	22.51	0.0646	265	3
70-65, February	204.87	0.0897	27.4	0.0747	219.75	4
70-65, March	261.97	0.1033	32.97	0.1	382.88	4
70-65, April	336.07	0.1241	39.35	0.1182	422.69	8
70-65, May	394.35	0.1685	48.34	0.1362	603.2	5
70-65, June	383.08	0.1762	50.4	0.1355	376.67	3
70-65, July	360.82	0.1558	45.09	0.1316	322.63	8
70-65, August	295.03	0.1243	39.72	0.1013	219	2
70-65, September	245.95	0.1069	34.1	0.0926	0	0
70-65, October	200.61	0.0853	27.28	0.0716	94	3
70-65, November	173.09	0.0745	23.66	0.0732	173.33	3
70-65, December	172.16	0.0782	23.4	0.0731	212.5	2
70-60, January	193.57	0.0593	21.06	0.0569	222.8	18
70-60, February	235.71	0.0998	30.08	0.0849	282.71	7
70-60, March	304.84	0.1291	36.07	0.0995	428.53	6
70-60, April	320.06	0.1189	36.85	0.1124	290.01	22

Table K.1 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
70-60, May	427.64	0.1731	47.03	0.1437	627.04	15
70-60, June	401.46	0.1529	49.4	0.1441	478.5	10
70-60, July	363.01	0.1236	41.3	0.1468	392.43	20
70-60, August	318.86	0.1406	43.39	0.1294	329.5	5
70-60, September	262.89	0.1258	36.94	0.1035	279.33	3
70-60, October	217.8	0.0891	28.7	0.0909	219.22	9
70-60, November	187.16	0.0864	26.05	0.0769	173.67	6
70-60, December	189.85	0.0899	24.41	0.0694	420.33	3
70-55, January	200.83	0.0869	26.34	0.0673	130.63	8
70-55, February	239.29	0.1118	32.89	0.0922	47	2
70-55, March	286.13	0.1265	39.14	0.1106	219	1
70-55, April	344.98	0.133	43.62	0.1288	265.92	13
70-55, May	435.57	0.1925	56.67	0.1632	518.06	8
70-55, June	490.32	0.1916	57.38	0.1727	890.14	7
70-55, July	411.84	0.1456	46.84	0.1458	558.36	11
70-55, August	369.24	0.1628	48.29	0.1419	1414	1
70-55, September	280.41	0.1166	39.91	0.0934	176.5	2
70-55, October	233.25	0.1004	31.4	0.0828	206.8	5
70-55, November	197.03	0.087	27.56	0.0773	117	1
70-55, December	195	0.0884	27.04	0.0741	0	0
70-51, January	221.87	0.0494	17.41	0.0471	371.88	13
70-51, February	224.18	0.0724	23.49	0.074	291	6
70-51, March	276.01	0.092	31.14	0.0777	217	1
70-51, April	403.8	0.1035	33.3	0.0973	537.54	13
70-51, May	405.38	0.1094	39.69	0.1111	547.69	8
70-51, June	379.52	0.1403	43.29	0.111	254.2	5
70-51, July	376.22	0.129	37.17	0.1046	407.18	11
70-51, August	322.87	0.118	34.81	0.0844	422.38	4
70-51, September	256.57	0.1068	29.89	0.0705	94	1
70-51, October	210.66	0.0629	23.62	0.0597	191.75	4
70-51, November	177.49	0.0589	20.16	0.0518	141.1	5
70-51, December	173.8	0.0632	19.29	0.0444	210	3
73.3-80, January	140.07	0.036	12.03	0.0339	275.81	8
73.3-80, February	150.4	0.0469	14.14	0.0349	264.5	7
73.3-80, March	158.08	0.0539	17.09	0.042	188.5	5
73.3-80, April	194.62	0.0631	20.08	0.0553	179	13
73.3-80, May	260.77	0.0612	23.19	0.0599	510.78	9
73.3-80, June	254.29	0.0826	25.98	0.0749	590.5	4
73.3-80, July	235.86	0.0776	21.92	0.065	372.95	10
73.3-80, August	181.16	0.071	21.12	0.0541	109.25	2
73.3-80, September	148.72	0.0561	17.3	0.0504	0	0
73.3-80, October	142.91	0.0448	13.19	0.0399	335.83	6
73.3-80, November	111.71	0.0361	12.21	0.0277	237	2
73.3-80, December	104.02	0.0357	12.05	0.0287	62.5	2
73.3-70, January	147.61	0.0534	17.85	0.0495	142.32	11
73.3-70, February	161.78	0.0692	21.09	0.0483	118.65	10
73.3-70, March	202.14	0.0776	26.13	0.0765	175.33	6

Table K.1 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
73.3-70, April	269.14	0.0987	31	0.094	259.19	16
73.3-70, May	361.44	0.1016	35.38	0.1033	746.2	10
73.3-70, June	312.17	0.1245	42.29	0.1191	323.25	4
73.3-70, July	306.73	0.1198	33.76	0.0982	466.32	11
73.3-70, August	249.44	0.0982	33.55	0.0981	338.75	2
73.3-70, September	198.27	0.0932	27.44	0.0821	0	0
73.3-70, October	160.2	0.063	21.01	0.0603	155.5	6
73.3-70, November	139.45	0.0574	19.06	0.0537	117.5	2
73.3-70, December	140.46	0.0588	18.13	0.0441	227.67	3
73.3-65, January	178.5	0.0743	22.58	0.0653	377.33	3
73.3-65, February	192.67	0.1064	26.96	0.0766	157.25	4
73.3-65, March	273.25	0.0949	33.45	0.0975	613.63	4
73.3-65, April	301.03	0.1224	41.94	0.1436	191.25	6
73.3-65, May	350.27	0.1588	48.66	0.1665	372.75	4
73.3-65, June	374.3	0.1721	55.31	0.1573	178	1
73.3-65, July	339.15	0.156	47.54	0.1614	223.1	5
73.3-65, August	298.39	0.1366	44.42	0.1261	122	2
73.3-65, September	243.5	0.1236	36.44	0.1107	0	0
73.3-65, October	192.58	0.0976	28.22	0.0994	125.67	3
73.3-65, November	174.97	0.0777	24.41	0.083	385	2
73.3-65, December	165.77	0.0751	23.55	0.0731	231	2
73.3-60, January	184.92	0.078	23.66	0.0757	170.57	17
73.3-60, February	221.96	0.1051	29.84	0.1015	239.15	10
73.3-60, March	314.65	0.1043	36.74	0.12	470.57	7
73.3-60, April	301.78	0.138	41.85	0.1883	238.22	20
73.3-60, May	364.15	0.1656	50.1	0.1665	381.83	13
73.3-60, June	418.08	0.1841	50.41	0.1759	648.2	10
73.3-60, July	354.5	0.166	48.93	0.2053	364.53	15
73.3-60, August	347.82	0.1445	46.77	0.1373	653.97	5
73.3-60, September	297.77	0.1346	40.34	0.1218	1267	2
73.3-60, October	215.34	0.0979	29.71	0.1053	220.5	12
73.3-60, November	190.03	0.0909	27.8	0.094	217.75	4
73.3-60, December	180.49	0.0892	26.36	0.1035	232	3
73.3-55, January	197.65	0.0978	28.16	0.0886	94.4	5
73.3-55, February	234.7	0.118	33.41	0.1032	127.75	4
73.3-55, March	303.16	0.1557	43.65	0.1424	121	2
73.3-55, April	344.27	0.1558	49.25	0.1594	103.6	5
73.3-55, May	400.11	0.2172	56.96	0.1814	367.8	5
73.3-55, June	410.46	0.2244	60.37	0.2099	326.2	5
73.3-55, July	382.63	0.1628	55.48	0.1869	346.2	5
73.3-55, August	361.96	0.1873	54.9	0.1907	0	0
73.3-55, September	325.05	0.1558	45.74	0.1415	1979	1
73.3-55, October	242.86	0.106	33.96	0.1025	304.25	4
73.3-55, November	198.23	0.0957	29.5	0.103	158	1
73.3-55, December	188.97	0.0882	28.23	0.0873	0	0
73.3-50, January	195.31	0.0419	16.08	0.0399	308.91	11
73.3-50, February	206.61	0.0713	20.53	0.0495	252.31	8

Table K.1 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
73.3-50, March	255.91	0.0976	26.92	0.0619	600.17	3
73.3-50, April	328.98	0.0822	28.78	0.0654	373.11	14
73.3-50, May	475.15	0.1074	33.45	0.1035	1047.32	11
73.3-50, June	394.31	0.1029	36.86	0.0884	651.88	8
73.3-50, July	402.42	0.0997	31.2	0.0809	657.65	13
73.3-50, August	318.81	0.0954	30.69	0.0727	512.4	5
73.3-50, September	300.62	0.0805	26.41	0.0655	2055	2
73.3-50, October	196.01	0.0588	19.97	0.0547	310.1	5
73.3-50, November	168.95	0.0606	18.05	0.0431	267.83	3
73.3-50, December	159.48	0.0522	17.49	0.0454	188.33	3
76.7-100, January	74	0.0248	7.72	0.0193	55.6	10
76.7-100, February	83.53	0.0277	9.21	0.0239	41.45	11
76.7-100, March	99.83	0.0343	11.14	0.0283	33	3
76.7-100, April	110.9	0.0431	12.68	0.0363	43.59	17
76.7-100, May	130.71	0.0446	14.75	0.0394	37	4
76.7-100, June	138.91	0.0478	15.59	0.0364	0	0
76.7-100, July	140.45	0.0434	14.12	0.0336	114.77	13
76.7-100, August	111.68	0.0388	12.35	0.0314	69.17	6
76.7-100, September	92.71	0.0315	10.43	0.0258	36.5	2
76.7-100, October	77.81	0.0282	8.4	0.0219	46.1	10
76.7-100, November	75.58	0.0276	7.41	0.0178	93.75	8
76.7-100, December	68.96	0.0221	7.66	0.0177	0	0
76.7-90, January	104.88	0.0366	10.48	0.0261	114.3	15
76.7-90, February	113.78	0.0424	13.47	0.0363	74.29	14
76.7-90, March	133.5	0.0482	15.89	0.0435	101.25	8
76.7-90, April	147.95	0.0522	18.18	0.0453	83.64	24
76.7-90, May	177.19	0.0648	20.06	0.0586	194.95	11
76.7-90, June	173.23	0.0716	22.54	0.061	105.6	5
76.7-90, July	173.75	0.0642	18.26	0.0551	159.5	23
76.7-90, August	139.72	0.0655	18.32	0.055	62.22	9
76.7-90, September	119.07	0.0446	15.45	0.0398	36.5	2
76.7-90, October	103.34	0.039	11.91	0.03	95.15	13
76.7-90, November	105.9	0.0314	10.82	0.0287	138.38	13
76.7-90, December	91.66	0.0338	11.54	0.0289	103	1
76.7-80, January	126.98	0.0477	14.17	0.0445	129.91	16
76.7-80, February	146.3	0.0701	18.05	0.0565	112.57	15
76.7-80, March	167.27	0.0713	21.82	0.0667	138.36	7
76.7-80, April	179.19	0.084	24.47	0.0779	103.87	27
76.7-80, May	259.07	0.0957	26.91	0.0879	368.04	14
76.7-80, June	234.76	0.1094	32.27	0.0917	216.4	5
76.7-80, July	237.61	0.0981	26.86	0.0998	224.22	23
76.7-80, August	192.37	0.0869	26.77	0.0746	110.35	10
76.7-80, September	156.88	0.0716	22.25	0.0691	89.5	2
76.7-80, October	123.47	0.0583	17.23	0.0549	74	15
76.7-80, November	126.95	0.0496	15.57	0.0466	136.15	13
76.7-80, December	119.59	0.0541	16.36	0.0577	134.5	2
76.7-70, January	163.81	0.0603	18.37	0.0687	169.25	18

Table K.1 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
76.7-70, February	168.58	0.0717	23.63	0.0799	98.58	18
76.7-70, March	211.78	0.1039	29.19	0.1047	172.39	9
76.7-70, April	239.51	0.1124	33.83	0.1393	145.94	27
76.7-70, May	290.55	0.1325	36.54	0.1537	304.88	16
76.7-70, June	296.03	0.1493	43.43	0.1477	277	7
76.7-70, July	289.51	0.1426	37.65	0.1341	259.09	23
76.7-70, August	267.69	0.1152	36.72	0.1302	209.36	11
76.7-70, September	200.77	0.0911	30.9	0.1117	183	2
76.7-70, October	155.95	0.0818	24.12	0.0851	98.57	14
76.7-70, November	145.51	0.0691	21.55	0.0997	118.46	13
76.7-70, December	147.66	0.0806	21.52	0.0904	196.75	4
76.7-60, January	181.99	0.0901	25.25	0.1185	150.17	18
76.7-60, February	210.2	0.1067	31.11	0.1359	142.18	19
76.7-60, March	277.99	0.1404	40.66	0.1638	231.81	9
76.7-60, April	328.01	0.1817	46.98	0.2376	225.89	26
76.7-60, May	356.57	0.2102	54.46	0.2763	339.87	17
76.7-60, June	500.05	0.2145	58.34	0.3628	1186.89	9
76.7-60, July	384.4	0.2172	57.14	0.2983	319.28	24
76.7-60, August	357.85	0.219	55.48	0.2423	301.17	12
76.7-60, September	273.71	0.1631	47.12	0.2031	105	2
76.7-60, October	203.75	0.123	36.03	0.1748	105.64	14
76.7-60, November	187.69	0.1079	30.95	0.1373	139.67	15
76.7-60, December	186.19	0.0949	29.42	0.1088	280.5	4
76.7-55, January	182.19	0.0832	24.57	0.1099	159.81	24
76.7-55, February	220.78	0.1169	31.81	0.1396	149.48	20
76.7-55, March	268.27	0.135	40.35	0.1646	207.41	11
76.7-55, April	316.96	0.174	45.5	0.2271	231.67	33
76.7-55, May	367.56	0.1993	52.47	0.3731	345.9	20
76.7-55, June	371.2	0.2029	58.12	0.2816	312.54	13
76.7-55, July	388.66	0.2217	54.53	0.3021	345.68	28
76.7-55, August	341.08	0.2092	51.79	0.2385	309.37	15
76.7-55, September	314.37	0.169	46.65	0.1964	774.25	4
76.7-55, October	215.23	0.1195	35.35	0.1994	164.62	21
76.7-55, November	196.11	0.1172	31.14	0.1542	159.97	17
76.7-55, December	182.46	0.1003	29.27	0.1306	218	3
76.7-51, January	180.33	0.0726	19.85	0.0564	179.64	21
76.7-51, February	216.48	0.0882	26.69	0.0798	189.03	17
76.7-51, March	257.34	0.1172	33.68	0.0895	212.44	9
76.7-51, April	306.88	0.126	38.92	0.1234	205.86	26
76.7-51, May	375.39	0.1492	44.68	0.1252	387.35	10
76.7-51, June	386.17	0.1558	51.48	0.1648	485.75	4
76.7-51, July	352.98	0.1779	47.21	0.1862	250.08	18
76.7-51, August	325.03	0.1684	44.68	0.1431	259.14	11
76.7-51, September	257.9	0.138	36.99	0.1092	184	2
76.7-51, October	198.18	0.0886	27.22	0.1014	155.5	14
76.7-51, November	166.1	0.0725	23.72	0.0706	109.07	14
76.7-51, December	161.35	0.0766	22.5	0.0672	204	3

Table K.1 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
76.7-49, January	145.39	0.0565	15.75	0.0434	79.33	9
76.7-49, February	194.7	0.0482	18.62	0.0416	224.67	9
76.7-49, March	224.95	0.0736	24.02	0.0597	237.5	2
76.7-49, April	284.41	0.0876	26.3	0.0569	251.17	18
76.7-49, May	322.21	0.1069	31.93	0.0757	640.33	3
76.7-49, June	312.86	0.1124	33.8	0.0757	151	1
76.7-49, July	321.81	0.0978	30.56	0.075	303.75	12
76.7-49, August	344.15	0.093	27.05	0.071	789.75	8
76.7-49, September	209.77	0.0778	22.64	0.0594	173.5	2
76.7-49, October	163.12	0.0566	17.57	0.0423	98.25	8
76.7-49, November	139.63	0.051	15.47	0.0442	60.6	10
76.7-49, December	138.87	0.0518	15.34	0.0399	0	0
80-100, January	89.76	0.0248	7.91	0.0192	111.89	18
80-100, February	93.95	0.0338	8.96	0.0237	112.15	13
80-100, March	99.84	0.0328	10.88	0.0289	108.8	5
80-100, April	130.32	0.0364	11.67	0.0315	123.24	23
80-100, May	117.49	0.0447	13.72	0.0343	48.21	7
80-100, June	126.1	0.0461	14.63	0.0357	87.6	5
80-100, July	123.03	0.05	13.73	0.0429	79.95	19
80-100, August	95.89	0.0366	11.54	0.0297	37.27	11
80-100, September	83.08	0.0329	9.65	0.0274	47.08	6
80-100, October	68.8	0.0251	7.71	0.0185	37.79	14
80-100, November	64.28	0.0224	7.14	0.0196	43.73	11
80-100, December	65.12	0.0237	7.49	0.0189	0	0
80-90, January	167.31	0.0346	8.89	0.0258	239.64	28
80-90, February	122.43	0.0411	12.11	0.047	138.41	23
80-90, March	129.79	0.0458	14.43	0.0389	138.22	16
80-90, April	147.82	0.0517	15.36	0.0617	131.77	34
80-90, May	152.53	0.0633	18.93	0.0632	141.81	18
80-90, June	186.52	0.0748	22.63	0.0753	233.5	12
80-90, July	205.3	0.0565	16.87	0.0637	229.7	32
80-90, August	133.44	0.0594	19.08	0.0607	81.13	15
80-90, September	109.72	0.05	15.69	0.05	59.39	9
80-90, October	89.19	0.0387	12.23	0.0412	59.57	23
80-90, November	94.79	0.038	11.44	0.0429	92.82	17
80-90, December	88.09	0.0413	12.39	0.0425	68.5	8
80-80, January	130.02	0.0462	12.71	0.056	136.88	30
80-80, February	160.58	0.0614	16.48	0.0767	180.52	27
80-80, March	146.09	0.0621	19.91	0.0831	138.08	18
80-80, April	150.89	0.0875	21.91	0.1345	113.13	36
80-80, May	215.67	0.0989	27.72	0.1296	255.25	18
80-80, June	227.28	0.1264	33.3	0.1717	235	13
80-80, July	214.96	0.0941	26.95	0.1352	182.38	32
80-80, August	207.86	0.1037	28.52	0.1265	200	16
80-80, September	154.47	0.0792	24.06	0.1064	136.15	10
80-80, October	119.11	0.0677	19.54	0.0974	72.23	22
80-80, November	151.58	0.0593	17.69	0.0862	206.53	17

Table K.1 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
80-80, December	123.19	0.0604	18.54	0.0747	137.89	9
80-70, January	173.22	0.0679	17.19	0.0983	191.19	31
80-70, February	167.67	0.0818	21.84	0.1047	162.42	25
80-70, March	192.41	0.092	27.99	0.1543	194.75	18
80-70, April	281.31	0.1319	31.2	0.2009	278.13	37
80-70, May	273.18	0.1606	39.86	0.3292	285.3	20
80-70, June	297.74	0.1781	45.57	0.269	356.46	13
80-70, July	276.41	0.1527	40.52	0.2703	235.69	31
80-70, August	421.02	0.1453	40.28	0.2332	824	16
80-70, September	198.47	0.1151	35.18	0.2092	162.15	10
80-70, October	174.69	0.1084	28.78	0.2366	157	22
80-70, November	151.64	0.0874	25.35	0.138	131.8	20
80-70, December	146.68	0.0791	26.19	0.1197	117.56	9
80-60, January	168.84	0.1062	24.92	0.2809	151.26	32
80-60, February	206.13	0.122	31.39	0.2211	188.75	24
80-60, March	259.11	0.1609	40.59	0.3271	270.75	20
80-60, April	279.13	0.2184	48.61	0.3818	214.15	37
80-60, May	385.19	0.2101	60.68	0.5086	439.81	20
80-60, June	369.26	0.2946	69	0.6064	355.14	14
80-60, July	428.24	0.2632	63.29	0.483	439.48	30
80-60, August	322.96	0.2033	61.48	0.5231	308.58	16
80-60, September	265.67	0.1993	53.01	0.3878	243.3	10
80-60, October	226.4	0.1869	42.89	0.3951	204.08	24
80-60, November	193.02	0.1473	37.86	0.2376	148.55	20
80-60, December	181.2	0.1029	33.2	0.1495	179	9
80-55, January	202.74	0.0993	25.43	0.2208	208.07	29
80-55, February	260.23	0.1259	30.75	0.2395	318.12	25
80-55, March	253.81	0.1765	41.01	0.3116	242.37	19
80-55, April	289.99	0.2167	48.84	0.4064	225.54	38
80-55, May	322.56	0.219	59.64	0.416	248.45	21
80-55, June	408.45	0.2745	68.66	0.4776	488.86	14
80-55, July	325.61	0.2556	63.25	0.59	235.73	31
80-55, August	304.29	0.2258	60.04	0.4724	242.03	15
80-55, September	258.93	0.1997	52.67	0.427	203.06	9
80-55, October	203.15	0.1716	41.7	0.2921	146.04	23
80-55, November	178.61	0.1469	37.93	0.2525	106.05	20
80-55, December	181.33	0.1375	35.36	0.1825	178	8
80-51, January	149.67	0.0645	16.85	0.0828	150.4	26
80-51, February	253.22	0.0813	22.59	0.0913	359.7	20
80-51, March	474.17	0.1102	30.88	0.1052	780.54	14
80-51, April	373.14	0.1119	33.03	0.1237	393.83	33
80-51, May	342.58	0.1502	41.35	0.1701	323.14	18
80-51, June	325.51	0.1547	46.85	0.1659	277.8	10
80-51, July	296.62	0.1485	40.14	0.1894	235.93	29
80-51, August	284.37	0.1398	38.04	0.1628	303.96	14
80-51, September	227.3	0.1142	33.76	0.1382	223.31	8
80-51, October	166.83	0.0951	25.45	0.1322	124.19	21

Table K.1 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
80-51, November	134.38	0.084	23.69	0.095	48.47	17
80-51, December	135.84	0.0752	21.58	0.0842	77.75	8
83.3-110, January	59.86	0.02	5.69	0.0131	73.4	10
83.3-110, February	63.11	0.0197	6.61	0.0155	58.25	8
83.3-110, March	70.67	0.0226	7.95	0.0195	21.75	2
83.3-110, April	85.52	0.029	8.79	0.0213	62.63	16
83.3-110, May	92	0.0375	10.43	0.0252	47	1
83.3-110, June	96.51	0.0343	10.94	0.0258	0	0
83.3-110, July	86.93	0.0339	10.16	0.022	29.2	10
83.3-110, August	77.54	0.0294	8.8	0.0223	38.57	7
83.3-110, September	64.38	0.0237	7.36	0.0178	14.33	3
83.3-110, October	55.55	0.0182	5.91	0.0149	40.09	11
83.3-110, November	48.7	0.0191	5.4	0.0136	29.71	7
83.3-110, December	48.35	0.0174	5.44	0.0139	0	0
83.3-100, January	81.82	0.0266	9.11	0.0255	90.46	13
83.3-100, February	91.05	0.0381	11.25	0.0333	77.56	9
83.3-100, March	97.96	0.0412	12.87	0.0335	53.7	5
83.3-100, April	101.65	0.0433	13.25	0.0359	45.85	17
83.3-100, May	118.7	0.0518	15.95	0.0483	68	3
83.3-100, June	125.89	0.0581	17.18	0.046	12	1
83.3-100, July	116.84	0.0532	16.57	0.0511	44	13
83.3-100, August	99.94	0.0428	14.3	0.0425	17.5	8
83.3-100, September	86.59	0.0337	11.78	0.034	39.33	3
83.3-100, October	69.32	0.0291	9.42	0.0242	27.42	12
83.3-100, November	78.31	0.0267	8.92	0.0246	117.63	8
83.3-100, December	67.45	0.0296	9.09	0.0238	12	1
83.3-90, January	111.04	0.0352	10.88	0.0401	124.98	22
83.3-90, February	118.67	0.0507	14.68	0.0537	120.68	17
83.3-90, March	129.34	0.056	17.48	0.0561	102.3	10
83.3-90, April	119.41	0.0572	15.98	0.0661	93.08	31
83.3-90, May	169.3	0.072	20.69	0.085	201.97	16
83.3-90, June	163.4	0.0805	23.2	0.0881	158.38	13
83.3-90, July	163.91	0.0697	20.1	0.0791	150.31	26
83.3-90, August	133.91	0.0692	21.58	0.0706	50.95	11
83.3-90, September	114.15	0.0556	17.25	0.0649	92	5
83.3-90, October	89.06	0.0442	13.61	0.0513	57	23
83.3-90, November	95.27	0.0459	13.47	0.0543	98.78	9
83.3-90, December	90.76	0.0477	13.93	0.0519	75	3
83.3-80, January	128.09	0.0487	15.1	0.0659	127.11	23
83.3-80, February	131.82	0.0729	20.05	0.0793	103.75	16
83.3-80, March	146.83	0.0855	24.84	0.1109	75.17	12
83.3-80, April	147.92	0.0893	23.51	0.1838	115.48	34
83.3-80, May	193.58	0.1205	30.39	0.2072	183.47	16
83.3-80, June	225.15	0.1224	33.75	0.1711	255.5	14
83.3-80, July	210.07	0.1091	30.88	0.1918	183.63	28
83.3-80, August	185.27	0.111	32.11	0.1421	105.32	11
83.3-80, September	147.84	0.0905	26.36	0.1336	81	6

Table K.1 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
83.3-80, October	119.35	0.0766	21.56	0.1678	76.43	23
83.3-80, November	144.44	0.0594	20.57	0.1079	247.56	9
83.3-80, December	117.7	0.068	20.84	0.1157	69	3
83.3-70, January	171.26	0.0775	20.33	0.1477	195.94	24
83.3-70, February	162.59	0.1042	26.05	0.209	125.88	20
83.3-70, March	191.89	0.1182	30.42	0.2116	209.31	13
83.3-70, April	194.56	0.1345	33.92	0.3379	155.3	37
83.3-70, May	236.09	0.18	42.88	0.3248	198	20
83.3-70, June	274.07	0.1898	47.56	0.3362	288.38	13
83.3-70, July	248.17	0.1639	45.85	0.5335	194.64	29
83.3-70, August	234.32	0.1813	44.72	0.3177	152.75	12
83.3-70, September	198.05	0.1411	38.44	0.2598	167.5	6
83.3-70, October	161.79	0.1213	31.47	0.2358	129	21
83.3-70, November	157.19	0.1027	29.14	0.1987	177.18	11
83.3-70, December	145.7	0.1042	30.86	0.1917	48.17	3
83.3-60, January	171.43	0.1059	26.38	0.2499	173.92	28
83.3-60, February	217.95	0.1505	33.13	0.354	235.35	26
83.3-60, March	225.5	0.1852	44.59	0.3706	192.26	16
83.3-60, April	281.18	0.2409	53.72	0.6884	231.74	37
83.3-60, May	337.94	0.2789	64.25	0.5696	361.26	22
83.3-60, June	360.68	0.2997	74.38	0.6118	355.36	14
83.3-60, July	354.81	0.2892	69.86	0.7099	319.37	31
83.3-60, August	291.69	0.2705	67.82	0.7074	186.48	14
83.3-60, September	228.98	0.2164	58.26	0.5312	102	8
83.3-60, October	179.91	0.2016	48.23	0.4086	99.42	26
83.3-60, November	179.15	0.175	43.75	0.3546	138.88	16
83.3-60, December	190.45	0.1453	39.8	0.2407	238.87	10
83.3-55, January	229.94	0.1163	27.33	0.216	282.73	26
83.3-55, February	196.39	0.1573	35.88	0.4436	147.74	23
83.3-55, March	234.38	0.2004	47.71	0.4338	128.63	12
83.3-55, April	249.29	0.2361	55.83	0.5755	150.83	36
83.3-55, May	318.7	0.2735	66.96	0.5755	272.65	20
83.3-55, June	442.63	0.3108	77.75	0.8081	638.57	14
83.3-55, July	328.28	0.301	72.15	0.6924	251.85	31
83.3-55, August	283.46	0.276	68.7	0.5299	147.79	14
83.3-55, September	233.29	0.2303	58.89	0.4731	138.44	9
83.3-55, October	201.07	0.1888	48.48	0.4109	145.6	25
83.3-55, November	174.9	0.164	44.91	0.3714	116.5	14
83.3-55, December	177.44	0.1608	42.72	0.2659	156.22	9
83.3-51, January	137.81	0.0836	20.5	0.1157	111.73	28
83.3-51, February	171.49	0.1183	27.09	0.1821	124.29	24
83.3-51, March	235.47	0.1261	37.49	0.2433	190.07	14
83.3-51, April	312.15	0.1783	42.7	0.3188	258.78	36
83.3-51, May	301.34	0.1981	51.59	0.3709	196.45	20
83.3-51, June	337.63	0.2215	58.69	0.3094	248.46	13
83.3-51, July	285.34	0.2085	51.47	0.4071	225.49	31
83.3-51, August	240.87	0.1889	50.09	0.3423	83.93	14

Table K.1 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
83.3-51, September	201.73	0.1481	41.75	0.2122	99	8
83.3-51, October	155.61	0.1261	32.97	0.2099	94.11	27
83.3-51, November	142.22	0.1059	31.01	0.1877	67.18	17
83.3-51, December	133.6	0.0995	27.91	0.1741	64.09	11
83.3-42, January	121.81	0.0559	16.35	0.0543	65	16
83.3-42, February	151.34	0.0565	19.17	0.0549	85.12	13
83.3-42, March	202.01	0.0719	23.93	0.062	184.25	8
83.3-42, April	259.22	0.0822	28.92	0.0827	207.1	21
83.3-42, May	392.76	0.1016	31.38	0.0771	536.77	11
83.3-42, June	300.45	0.1291	38.98	0.1031	338	1
83.3-42, July	264.68	0.1046	31.58	0.0887	171.03	16
83.3-42, August	218.88	0.0957	28.6	0.0836	98.05	10
83.3-42, September	182.46	0.0782	24.09	0.0629	109.67	3
83.3-42, October	138.1	0.0594	19.44	0.0542	54.36	14
83.3-42, November	118.85	0.0578	16.86	0.051	40.92	12
83.3-42, December	120.44	0.0513	16.49	0.0517	60.33	3
83.3-40.6, January	135.44	0.0541	15.63	0.0483	108.1	15
83.3-40.6, February	154.08	0.0502	17.97	0.0538	104.04	13
83.3-40.6, March	199.71	0.061	21.94	0.0532	249.5	6
83.3-40.6, April	275.22	0.0795	26.16	0.0674	261.85	21
83.3-40.6, May	366.91	0.0958	28.5	0.0762	562.5	11
83.3-40.6, June	272.23	0.1089	34.54	0.0853	36	1
83.3-40.6, July	249.53	0.0932	28.17	0.0746	195.75	16
83.3-40.6, August	224.68	0.0929	26.81	0.0681	162.95	10
83.3-40.6, September	181.12	0.0697	23.32	0.0593	66.67	3
83.3-40.6, October	151.25	0.0533	19.54	0.0583	96.57	14
83.3-40.6, November	115.84	0.0452	15.69	0.0486	37.42	12
83.3-40.6, December	118.87	0.0511	15.43	0.0393	61	2
86.7-110, January	52.28	0.0162	5.41	0.0125	48.9	10
86.7-110, February	56.32	0.0207	6.18	0.0144	43.5	8
86.7-110, March	63.26	0.0211	7.35	0.0176	12.75	2
86.7-110, April	68.96	0.0225	8.2	0.0206	26.33	15
86.7-110, May	81.26	0.0282	9.45	0.0238	23	1
86.7-110, June	86.89	0.0372	10.11	0.0268	0	0
86.7-110, July	81.56	0.0319	9.55	0.0214	37.1	10
86.7-110, August	71.48	0.026	8.27	0.0196	38.29	7
86.7-110, September	59.64	0.0217	6.94	0.0182	20.33	3
86.7-110, October	50.87	0.0157	5.57	0.0157	34.55	11
86.7-110, November	45.1	0.0149	5.07	0.0138	29.63	8
86.7-110, December	44.64	0.0149	5.13	0.0131	0	0
86.7-100, January	69.64	0.032	8.81	0.0255	57.69	13
86.7-100, February	80.62	0.0384	10.53	0.0304	51.89	9
86.7-100, March	88.06	0.0366	11.87	0.0323	48.3	5
86.7-100, April	96.79	0.0424	13.75	0.0408	46.03	18
86.7-100, May	102.91	0.0453	13.92	0.0426	69.67	3
86.7-100, June	112.01	0.0512	15.45	0.0472	0	0
86.7-100, July	113.37	0.0503	16.19	0.0488	52.08	13

Table K.1 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
86.7-100, August	96.76	0.0494	13.59	0.0353	45.43	7
86.7-100, September	80.7	0.0375	11.13	0.0298	36.33	3
86.7-100, October	66.23	0.0281	8.96	0.0277	32.58	12
86.7-100, November	61.51	0.0269	8.36	0.0237	37	7
86.7-100, December	62.4	0.0228	8.66	0.0302	0	0
86.7-90, January	89.54	0.0437	13.79	0.0562	58.71	21
86.7-90, February	122.84	0.0405	12.31	0.0479	150.17	18
86.7-90, March	112.55	0.0531	16.23	0.0572	87.65	10
86.7-90, April	163.17	0.0528	14.52	0.0746	182.19	32
86.7-90, May	128.08	0.0556	17.99	0.071	123.66	16
86.7-90, June	135.45	0.0763	20.78	0.0846	98.91	11
86.7-90, July	159.92	0.0652	18.54	0.0766	162.02	27
86.7-90, August	124.63	0.0687	20.61	0.1093	40.8	10
86.7-90, September	103.54	0.053	16.38	0.0674	51.8	5
86.7-90, October	88.07	0.0444	12.59	0.0486	68.05	22
86.7-90, November	85.12	0.0419	12.12	0.0464	83	11
86.7-90, December	82.77	0.0403	13.06	0.0544	60	1
86.7-80, January	138.26	0.0496	14.09	0.0634	177.64	21
86.7-80, February	124.72	0.0603	17.53	0.0729	99.7	20
86.7-80, March	131.11	0.0707	20.8	0.0929	79.17	12
86.7-80, April	145.95	0.0746	20.79	0.1475	124.05	33
86.7-80, May	174.24	0.0832	25.92	0.1591	175.62	17
86.7-80, June	185.42	0.1096	30.3	0.1635	146.58	12
86.7-80, July	219.95	0.0971	28.05	0.129	220.57	27
86.7-80, August	172.09	0.1184	29.76	0.1675	100.1	10
86.7-80, September	138.55	0.0816	23.91	0.1195	101.33	6
86.7-80, October	115.79	0.0619	18.84	0.1044	91.1	21
86.7-80, November	113.41	0.0581	17.88	0.0882	120.27	11
86.7-80, December	107.22	0.0678	19.06	0.0829	107.75	2
86.7-70, January	143.82	0.0882	25.33	0.11	94.7	20
86.7-70, February	139.97	0.0814	20.41	0.1335	126.07	22
86.7-70, March	153.43	0.0982	26.11	0.1736	114.09	11
86.7-70, April	212.14	0.1053	28.32	0.2107	196.61	35
86.7-70, May	240.99	0.1421	36.06	0.275	267.13	19
86.7-70, June	272.07	0.1473	41.81	0.3682	382.23	13
86.7-70, July	223.59	0.1452	40.97	0.3093	164.92	30
86.7-70, August	210.42	0.1541	40.02	0.2369	128.2	10
86.7-70, September	169.7	0.1185	32.73	0.1812	109.29	7
86.7-70, October	167.26	0.0854	26.59	0.2011	172.59	22
86.7-70, November	134.94	0.0854	25.1	0.1928	117.9	10
86.7-70, December	134.85	0.0833	25.49	0.1419	262.5	3
86.7-60, January	164.29	0.089	21.52	0.1691	190.79	25
86.7-60, February	165.24	0.1174	26.49	0.2193	148.62	27
86.7-60, March	283.94	0.1342	36.41	0.2408	512.93	14
86.7-60, April	212.78	0.1934	44.42	0.4604	155.13	34
86.7-60, May	292.52	0.2049	52.28	0.4029	314.25	21
86.7-60, June	324.02	0.2525	62.25	0.5957	347.27	15

Table K.1 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
86.7-60, July	413.1	0.2218	57.12	0.4863	458.84	32
86.7-60, August	259.91	0.2435	55.59	0.4234	200.06	11
86.7-60, September	210.13	0.1965	48.23	0.4749	166.67	9
86.7-60, October	167.86	0.1378	39.32	0.3048	116.36	25
86.7-60, November	151.7	0.1242	36.02	0.2763	105.06	17
86.7-60, December	153.17	0.1217	34.4	0.2127	146.29	8
86.7-55, January	147.42	0.0938	24.02	0.2047	118.61	25
86.7-55, February	160.91	0.1213	29.65	0.2773	115.87	23
86.7-55, March	227.89	0.1677	46.67	0.2521	138.73	13
86.7-55, April	245.96	0.2277	51.59	0.6041	153.34	30
86.7-55, May	326.27	0.2347	55.93	0.5155	315.38	20
86.7-55, June	333.18	0.2692	66.23	0.4823	329.64	14
86.7-55, July	292.51	0.2409	60.6	0.4815	222.83	32
86.7-55, August	268.05	0.2415	58.79	0.474	190.5	10
86.7-55, September	214.76	0.1885	50.59	0.4367	150.67	9
86.7-55, October	186.1	0.1626	40.93	0.2877	151.56	25
86.7-55, November	161.94	0.1279	37.79	0.3081	114.27	15
86.7-55, December	177.36	0.1119	33.96	0.2116	299.67	9
86.7-50, January	139.68	0.0653	19.49	0.09	120.58	26
86.7-50, February	195.59	0.0762	22.86	0.1286	227.74	23
86.7-50, March	203.63	0.1252	32.06	0.1734	154.09	17
86.7-50, April	344.8	0.1633	41.31	0.2254	330.65	35
86.7-50, May	404.4	0.1759	42.14	0.2926	496.17	21
86.7-50, June	562.46	0.2146	57	0.2427	1114.93	15
86.7-50, July	439.31	0.1702	45.54	0.3214	482.66	31
86.7-50, August	254.51	0.1553	44.42	0.1999	159.54	12
86.7-50, September	206.35	0.1393	37.43	0.224	193	10
86.7-50, October	187.33	0.0973	29.2	0.2047	183.68	25
86.7-50, November	148.6	0.1091	28.98	0.1394	87.69	13
86.7-50, December	164.07	0.0872	23.97	0.1476	302	10
86.7-45, January	118.61	0.0522	15.38	0.0542	91.28	25
86.7-45, February	142.94	0.058	18.36	0.0715	118.62	21
86.7-45, March	178.5	0.0762	23.86	0.0871	135.34	16
86.7-45, April	224.01	0.1061	32.42	0.1437	157.78	30
86.7-45, May	305.06	0.1041	30.21	0.1021	310.55	20
86.7-45, June	324.47	0.1419	42.5	0.1463	376.14	14
86.7-45, July	345.88	0.1096	29.98	0.1314	374.25	32
86.7-45, August	230.41	0.102	32.11	0.1022	183.42	12
86.7-45, September	166.13	0.0819	25.2	0.0814	118.1	10
86.7-45, October	133.5	0.0654	18.85	0.0752	100.5	26
86.7-45, November	130.45	0.0685	20.16	0.0714	89.8	15
86.7-45, December	132.82	0.0578	17.91	0.0564	200.67	9
86.7-40, January	206.17	0.0365	11.58	0.0353	289.34	28
86.7-40, February	156.76	0.0443	13.62	0.0353	185.34	25
86.7-40, March	142.71	0.0466	18.29	0.0534	87.18	17
86.7-40, April	176.73	0.0646	19.39	0.0795	141.94	34
86.7-40, May	231.62	0.0823	23.88	0.0686	243.92	19

Table K.1 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
86.7-40, June	235.66	0.0911	30.61	0.0837	181.79	14
86.7-40, July	240.35	0.069	22.23	0.0651	227.03	31
86.7-40, August	189.94	0.0781	25.13	0.0627	119.9	10
86.7-40, September	152.44	0.0685	20.08	0.0609	135.38	8
86.7-40, October	116.39	0.0471	14.19	0.0457	93.26	23
86.7-40, November	110.65	0.0491	15.27	0.0517	74.77	13
86.7-40, December	111	0.0515	15.88	0.0644	109.6	10
86.7-35, January	92.09	0.0418	12.08	0.0424	53.36	28
86.7-35, February	114.92	0.0343	11.96	0.0352	97.21	24
86.7-35, March	141.25	0.0542	16.25	0.038	97.94	16
86.7-35, April	182.45	0.0507	16.48	0.0516	156.51	34
86.7-35, May	211.63	0.0706	21.26	0.063	187.37	19
86.7-35, June	224.22	0.0826	25.99	0.0757	194.46	13
86.7-35, July	345.15	0.0547	19.3	0.0477	426.39	31
86.7-35, August	179.5	0.0723	21.73	0.0559	124.33	12
86.7-35, September	148.45	0.0499	17.32	0.0457	140.33	9
86.7-35, October	118.41	0.0353	11.89	0.0369	105.8	25
86.7-35, November	101.51	0.0434	12.94	0.0336	50	12
86.7-35, December	95.43	0.0375	11.72	0.0263	69.7	10
86.7-33, January	105.25	0.0238	9.04	0.0237	103.26	21
86.7-33, February	123.6	0.0384	11.37	0.0309	143.67	12
86.7-33, March	162.82	0.0476	14.91	0.0356	191.35	10
86.7-33, April	242.43	0.0519	16.45	0.0426	290.3	22
86.7-33, May	255.88	0.0688	20.7	0.0468	373.61	9
86.7-33, June	290.47	0.0728	23.1	0.0509	1007.2	5
86.7-33, July	275.94	0.073	22.15	0.0587	306.7	23
86.7-33, August	204.09	0.056	18.91	0.0509	318.86	7
86.7-33, September	156.87	0.0501	14.76	0.0408	259.43	7
86.7-33, October	115.38	0.0299	10.89	0.03	103.22	18
86.7-33, November	120.45	0.0327	10.82	0.0266	197.33	9
86.7-33, December	106.46	0.0335	10.03	0.0245	193.5	5
90-120, January	36.86	0.0102	3.24	0.0077	36.6	20
90-120, February	38.63	0.0139	4.12	0.0105	29.13	8
90-120, March	43.66	0.014	4.89	0.0114	17.79	7
90-120, April	49.68	0.0153	5.1	0.0133	35.24	21
90-120, May	59.57	0.0192	6.55	0.0153	40.42	6
90-120, June	64.46	0.0211	6.97	0.0168	78	2
90-120, July	56.54	0.0211	6.12	0.0163	34	17
90-120, August	50.19	0.0182	5.55	0.013	28.06	9
90-120, September	43.43	0.0148	4.64	0.0115	35.14	7
90-120, October	35.14	0.0104	3.54	0.0092	27.94	16
90-120, November	32.09	0.012	3.47	0.0099	21.25	8
90-120, December	33.04	0.0102	3.44	0.0075	118	1
90-110, January	55.82	0.0176	5.2	0.0139	67	17
90-110, February	54.59	0.0212	6.25	0.0175	66.57	7
90-110, March	57.83	0.0241	7.37	0.021	32.44	9
90-110, April	61.6	0.025	7.98	0.0247	33.28	18

Table K.1 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
90-110, May	73.42	0.0307	9.67	0.0284	32.92	6
90-110, June	81.4	0.0309	10.55	0.032	63.5	3
90-110, July	75.75	0.0324	10.02	0.0307	32.67	15
90-110, August	66.75	0.0256	8.5	0.0207	44.81	8
90-110, September	55.85	0.0267	7.13	0.0189	29.67	6
90-110, October	48.51	0.0158	5.52	0.013	43.25	12
90-110, November	41.83	0.0183	5.31	0.0143	22.25	8
90-110, December	42.45	0.0163	5.31	0.0146	63	1
90-100, January	58.72	0.0237	6.67	0.023	49.76	25
90-100, February	65.75	0.0281	7.71	0.0211	61.5	13
90-100, March	79.88	0.0274	9.4	0.0329	95.55	10
90-100, April	76.07	0.0377	11.08	0.0346	44.91	29
90-100, May	91.72	0.0335	11.43	0.0396	79.33	12
90-100, June	103.81	0.0442	14.24	0.0471	70.81	8
90-100, July	98.42	0.0422	14.33	0.0364	44.5	22
90-100, August	81.04	0.0365	11.94	0.0324	28.91	11
90-100, September	69.75	0.0309	9.52	0.0312	39	7
90-100, October	57.59	0.0229	7.05	0.0229	46.89	18
90-100, November	53.11	0.0209	7.14	0.0216	33	9
90-100, December	54.39	0.022	7.27	0.0208	69	2
90-90, January	99.95	0.0251	7.42	0.0259	126.02	28
90-90, February	74.15	0.0314	8.91	0.0272	57.96	21
90-90, March	86.92	0.0338	10.25	0.0323	85.98	20
90-90, April	109.67	0.0373	11.14	0.0436	104.72	33
90-90, May	102.05	0.0435	14.11	0.0513	79.03	21
90-90, June	132.27	0.0519	15.3	0.0586	164.62	14
90-90, July	147.26	0.048	14.57	0.0583	149.1	31
90-90, August	107.22	0.0569	16.49	0.0522	50.23	13
90-90, September	86.1	0.0379	12.61	0.0426	56.3	10
90-90, October	65.39	0.031	9.07	0.0327	46.52	24
90-90, November	69.03	0.0312	9.46	0.0374	58	11
90-90, December	66.73	0.033	9.78	0.0366	45.83	6
90-80, January	118.52	0.0304	8.36	0.0297	147.53	30
90-80, February	91.12	0.0353	10.61	0.0588	89.26	23
90-80, March	97.04	0.0455	13.3	0.0499	77.7	20
90-80, April	106.8	0.0553	14.93	0.0631	78.95	33
90-80, May	178.01	0.0562	18.58	0.0725	208.61	22
90-80, June	159.69	0.0729	20.2	0.1079	171.53	16
90-80, July	149.11	0.0739	21.68	0.0957	104.32	31
90-80, August	142.59	0.0787	23.94	0.089	79.12	13
90-80, September	118.28	0.0546	16.82	0.0585	126.5	10
90-80, October	88.83	0.0411	12.21	0.0535	73.08	24
90-80, November	91.35	0.043	12.34	0.051	100.85	13
90-80, December	84.15	0.0477	12.63	0.0657	84.44	9
90-70, January	106.25	0.0357	10.47	0.0687	113.07	30
90-70, February	157.22	0.0461	12.61	0.0589	216.13	26
90-70, March	127.18	0.0605	16.56	0.0721	124.33	21

Table K.1 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
90-70, April	145.96	0.0734	18.38	0.0998	125.85	35
90-70, May	227.21	0.0846	23.16	0.1045	320.57	21
90-70, June	264.84	0.1005	27	0.1558	313.94	16
90-70, July	218.04	0.0788	23.97	0.1761	221.44	32
90-70, August	224.05	0.0839	24.04	0.1226	373.6	15
90-70, September	131.23	0.0711	21.57	0.0836	83.32	14
90-70, October	108.05	0.0523	15.4	0.0861	96.58	24
90-70, November	103.67	0.0461	15.86	0.0726	90.38	16
90-70, December	96.98	0.0481	14.98	0.0805	89.27	11
90-60, January	119.12	0.0488	13.37	0.0759	119.84	31
90-60, February	127.24	0.0684	16.64	0.0895	123.41	25
90-60, March	153.99	0.088	21.4	0.2565	151.26	23
90-60, April	215.12	0.1103	27.04	0.2007	205.7	33
90-60, May	247.55	0.115	31.47	0.217	292.7	22
90-60, June	257.46	0.1454	36.77	0.1838	295.24	17
90-60, July	244.53	0.1186	34.04	0.2258	211.24	33
90-60, August	207.04	0.138	32.65	0.1898	179.18	15
90-60, September	154.64	0.1049	28.54	0.1167	75.4	14
90-60, October	131.43	0.0796	21.33	0.1421	113.52	27
90-60, November	130.88	0.0734	21.13	0.1251	126.11	18
90-60, December	125.27	0.0723	19.37	0.0935	152.59	13
90-53, January	124.72	0.0515	15.95	0.0747	116.21	28
90-53, February	163.15	0.0729	20.34	0.1273	201.88	17
90-53, March	180.15	0.1033	29.9	0.131	96.32	14
90-53, April	207.77	0.1284	35.53	0.196	119.47	25
90-53, May	330.82	0.1372	37.39	0.2185	377.92	13
90-53, June	297.54	0.164	46.13	0.2185	241.94	9
90-53, July	266.48	0.1549	41.79	0.1972	180.19	26
90-53, August	228.4	0.1296	37.97	0.1631	127.73	11
90-53, September	166.92	0.0996	31.68	0.1754	75.56	9
90-53, October	131.92	0.0892	24.04	0.134	80.96	23
90-53, November	132.68	0.0776	22.67	0.1306	136.87	15
90-53, December	113.84	0.0768	20.77	0.1125	55.5	6
90-45, January	105.97	0.0404	11.34	0.0444	99.39	31
90-45, February	135.49	0.0458	14.36	0.0538	140.54	25
90-45, March	139.09	0.0605	19.07	0.0617	95.91	23
90-45, April	175.86	0.0893	27.15	0.1309	123.23	35
90-45, May	337.81	0.0861	25.59	0.0996	382.83	23
90-45, June	335.4	0.1269	37.46	0.1521	487.44	16
90-45, July	262.22	0.0914	28.16	0.0935	242.59	32
90-45, August	206.76	0.0857	28.6	0.0863	184.92	12
90-45, September	158.78	0.081	23.66	0.0751	110.31	13
90-45, October	142.59	0.0505	16.65	0.0709	137.13	28
90-45, November	159.24	0.0611	19.34	0.0765	200.89	18
90-45, December	105.49	0.0559	16.1	0.0748	88.04	14
90-37, January	96.76	0.0281	9.79	0.0336	88.2	32
90-37, February	114.74	0.0384	11.69	0.041	114.63	24

Table K.1 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
90-37, March	121.23	0.0433	15.5	0.0447	81.36	22
90-37, April	142.85	0.0573	17	0.0628	106.08	35
90-37, May	233.07	0.0667	21.63	0.0649	200	22
90-37, June	209.3	0.0785	27.08	0.081	162.47	16
90-37, July	200.42	0.0757	21.44	0.0771	169.09	34
90-37, August	177.82	0.0759	22.19	0.0655	157.75	14
90-37, September	136.47	0.0495	18.44	0.0526	94.87	13
90-37, October	103.24	0.0353	12.21	0.0342	80.26	29
90-37, November	114.32	0.0401	13.13	0.0411	122.24	17
90-37, December	108.93	0.0379	12.91	0.0453	136.29	14
90-35, January	99.3	0.0412	13.3	0.0457	68	14
90-35, February	113.1	0.0544	15.03	0.0401	59	7
90-35, March	126.87	0.0514	16.56	0.041	59.83	6
90-35, April	152.13	0.0563	18.8	0.0451	93.88	16
90-35, May	195.42	0.0713	23.27	0.0602	202.5	6
90-35, June	214.58	0.0919	28.91	0.0823	113.67	3
90-35, July	196.55	0.0827	27.59	0.0823	81.47	15
90-35, August	171.94	0.066	24	0.064	90.71	7
90-35, September	134.97	0.0542	18.65	0.0506	44.5	4
90-35, October	106.54	0.0417	13.97	0.0399	56.29	14
90-35, November	98.9	0.0438	13.8	0.0363	55	9
90-35, December	97.5	0.0415	13.4	0.0416	56.5	2
90-30, January	91.69	0.0334	11.51	0.0443	69.36	25
90-30, February	102.8	0.0355	11.47	0.0302	71.37	19
90-30, March	121.68	0.0435	13.94	0.0374	84.97	18
90-30, April	154.85	0.0544	15.28	0.0443	127.02	27
90-30, May	176.92	0.0633	18.6	0.0507	145.92	18
90-30, June	207.9	0.0762	23.57	0.065	202.83	11
90-30, July	182.8	0.0575	19.23	0.049	143.19	25
90-30, August	168.86	0.0614	17.71	0.0518	197	13
90-30, September	122.82	0.049	15.81	0.044	50.88	8
90-30, October	96.69	0.0339	10.9	0.0325	70.91	23
90-30, November	84.33	0.036	10.48	0.0272	48.33	15
90-30, December	80.28	0.0335	9.96	0.0332	57	10
90-28, January	100.45	0.0223	7.42	0.0188	112.84	28
90-28, February	103.1	0.0277	9.49	0.0271	101.43	23
90-28, March	127.17	0.04	12.86	0.0378	115.03	19
90-28, April	165.96	0.0471	12.95	0.0383	157.8	33
90-28, May	197.71	0.0521	16.61	0.0517	197.75	22
90-28, June	232.24	0.0623	19.96	0.0512	325.03	15
90-28, July	201.17	0.0487	14.88	0.0516	206.82	33
90-28, August	159.18	0.0485	17.43	0.049	145.46	14
90-28, September	122.71	0.0417	13.11	0.0367	126.46	13
90-28, October	88.27	0.0239	8.96	0.0265	70.7	30
90-28, November	87.69	0.026	9.29	0.0228	81.44	16
90-28, December	77.04	0.0303	9.02	0.0286	51.54	14
93.3-120, January	30.97	0.0094	3.08	0.0074	25.13	15

Table K.1 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
93.3-120, February	35.84	0.0111	3.45	0.0082	50.71	7
93.3-120, March	37.84	0.0135	4.24	0.0109	14.25	6
93.3-120, April	42.98	0.0151	4.86	0.0111	16.65	13
93.3-120, May	52.06	0.0198	5.87	0.0129	11.17	3
93.3-120, June	56.54	0.0203	6.13	0.0146	57.5	2
93.3-120, July	49.44	0.0169	5.57	0.014	21.87	15
93.3-120, August	44.5	0.0135	4.89	0.0121	22.86	7
93.3-120, September	37.41	0.0127	4.09	0.0101	22.17	6
93.3-120, October	32.17	0.0116	3.21	0.0077	27.08	13
93.3-120, November	28.28	0.0098	3	0.0086	21	8
93.3-120, December	27.68	0.0089	2.97	0.0072	53	1
93.3-110, January	41.95	0.0166	4.42	0.0132	39.79	14
93.3-110, February	43.04	0.0155	4.76	0.0118	47.25	8
93.3-110, March	46.56	0.0211	5.8	0.0156	19.79	7
93.3-110, April	52.43	0.0209	6.77	0.0193	17.61	14
93.3-110, May	63.36	0.0251	7.97	0.0207	18.33	3
93.3-110, June	69.92	0.0292	8.9	0.026	32.25	2
93.3-110, July	64.1	0.0238	8.26	0.0247	25.93	14
93.3-110, August	55.78	0.0209	6.92	0.0159	27.71	7
93.3-110, September	48.43	0.02	5.77	0.0124	40	6
93.3-110, October	41.2	0.0151	4.6	0.0115	33.83	12
93.3-110, November	35.44	0.013	4.28	0.0116	23.25	8
93.3-110, December	35.37	0.0126	4.26	0.0109	64	1
93.3-100, January	51.15	0.0194	5.2	0.0158	47.98	20
93.3-100, February	48.94	0.0194	5.55	0.0166	42.38	13
93.3-100, March	54.89	0.0227	7.02	0.0186	26.8	10
93.3-100, April	65.35	0.0255	8.14	0.0237	41.83	20
93.3-100, May	73.63	0.0275	9	0.0234	56.5	8
93.3-100, June	94.58	0.0345	12.02	0.0434	143.75	4
93.3-100, July	88.73	0.0325	10.44	0.0344	69.55	20
93.3-100, August	69.62	0.0272	8.82	0.0233	42.44	8
93.3-100, September	56.8	0.0218	7.19	0.0187	30	7
93.3-100, October	50.65	0.0167	5.24	0.0139	51.85	17
93.3-100, November	49.91	0.0151	5.32	0.0132	72.11	9
93.3-100, December	42.72	0.0169	5.44	0.0137	19	2
93.3-90, January	61.7	0.0171	5.25	0.0147	64.44	27
93.3-90, February	66.19	0.024	6.53	0.0212	59.53	19
93.3-90, March	66.43	0.0269	8.17	0.0213	51.83	15
93.3-90, April	79.38	0.0247	7.76	0.0218	70.89	31
93.3-90, May	104.8	0.033	9.83	0.0292	127.64	18
93.3-90, June	137.13	0.032	10.81	0.032	277.27	13
93.3-90, July	111.42	0.0281	9.94	0.0313	112.6	30
93.3-90, August	83.39	0.034	11.32	0.031	41.33	9
93.3-90, September	67.89	0.0262	8.59	0.022	46.33	9
93.3-90, October	59.3	0.0189	6.13	0.014	59.74	19
93.3-90, November	51.86	0.0208	6.39	0.0186	38.73	11
93.3-90, December	54.54	0.0226	6.32	0.0182	103.5	4

Table K.1 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
93.3-80, January	59.68	0.0199	6.14	0.0192	51.2	28
93.3-80, February	80.81	0.0279	8.14	0.0217	90.24	19
93.3-80, March	92.11	0.0313	9.73	0.0271	107.15	17
93.3-80, April	98.42	0.0338	11.17	0.0327	77.53	32
93.3-80, May	183.45	0.0413	13.02	0.0385	323.94	18
93.3-80, June	115	0.0456	13.03	0.0378	119.3	15
93.3-80, July	158.77	0.0331	11.25	0.0339	185.03	31
93.3-80, August	106.8	0.038	13.24	0.0364	100.14	11
93.3-80, September	79	0.0323	10.19	0.0283	54.9	10
93.3-80, October	76.44	0.0221	7.36	0.0247	86.47	19
93.3-80, November	63.58	0.0245	7.39	0.0209	63.15	13
93.3-80, December	59.9	0.0227	6.98	0.0193	81.25	6
93.3-70, January	75.59	0.0216	6.91	0.0212	69.87	31
93.3-70, February	103.69	0.0232	8.18	0.0234	143.63	20
93.3-70, March	112.69	0.0271	9.51	0.0269	141.36	22
93.3-70, April	115.74	0.0425	12	0.0395	102.03	33
93.3-70, May	175.41	0.0488	14.27	0.0426	246.76	19
93.3-70, June	175.71	0.0532	15.8	0.051	277.94	16
93.3-70, July	187.79	0.0424	14.64	0.044	218.55	29
93.3-70, August	120.77	0.0511	15.75	0.0447	84.77	11
93.3-70, September	94.05	0.0431	12.53	0.0386	66.68	11
93.3-70, October	275.19	0.0261	8.63	0.0244	649.87	19
93.3-70, November	76.71	0.0272	8.96	0.0304	82.86	14
93.3-70, December	68.97	0.0271	8.12	0.0216	100.9	5
93.3-60, January	116.31	0.0272	8.19	0.025	132.72	32
93.3-60, February	103.87	0.0295	9.25	0.035	124.3	23
93.3-60, March	105.98	0.0457	11.84	0.0401	92.31	22
93.3-60, April	127.51	0.0471	13.82	0.0419	107.38	32
93.3-60, May	190.51	0.0519	16.36	0.051	260.68	20
93.3-60, June	189.49	0.0675	19.26	0.0694	243.42	17
93.3-60, July	199.69	0.0623	17.76	0.0644	213.83	30
93.3-60, August	139.54	0.0586	18.66	0.0507	86.91	11
93.3-60, September	112.53	0.0548	14.68	0.0428	92.67	11
93.3-60, October	89.92	0.0335	10.1	0.0343	82.73	22
93.3-60, November	81.49	0.0357	10.51	0.0296	68.11	14
93.3-60, December	83.49	0.0312	9.96	0.0276	139	6
93.3-55, January	106.96	0.0375	11.2	0.0344	102.33	26
93.3-55, February	100.4	0.0375	12.3	0.0317	75.72	16
93.3-55, March	120.96	0.0499	14.66	0.0403	101.22	16
93.3-55, April	135.24	0.0548	15.9	0.0511	104.14	28
93.3-55, May	235.17	0.0769	19.66	0.0757	357.97	18
93.3-55, June	234.49	0.0709	20.98	0.0705	370.56	16
93.3-55, July	205.43	0.0603	19.43	0.0665	209.53	30
93.3-55, August	158.44	0.0638	19.78	0.0501	145.28	9
93.3-55, September	121.4	0.0609	15.94	0.0509	103.43	10
93.3-55, October	104.76	0.0339	10.51	0.0388	127.24	23
93.3-55, November	83.5	0.0311	11.24	0.0351	61.08	12

Table K.1 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
93.3-55, December	78.87	0.0325	10.48	0.0374	76	5
93.3-50, January	133.37	0.0297	9.27	0.0304	147.83	35
93.3-50, February	101.74	0.0336	10.26	0.0292	106.07	23
93.3-50, March	120.35	0.0473	13.18	0.0395	110.46	23
93.3-50, April	141.42	0.0555	17.19	0.0576	107.06	32
93.3-50, May	219.9	0.0624	18.77	0.0587	263.45	20
93.3-50, June	245.72	0.0841	23.3	0.0716	323.32	17
93.3-50, July	208.14	0.0693	18.5	0.0664	209.55	33
93.3-50, August	158.78	0.0666	19.7	0.0576	137.5	13
93.3-50, September	118.31	0.0583	16.74	0.0444	69.55	14
93.3-50, October	112.91	0.0385	10.56	0.0378	123.44	27
93.3-50, November	86.08	0.0356	12.03	0.0371	51.75	14
93.3-50, December	85.22	0.0305	10.29	0.0344	85.32	11
93.3-45, January	103.47	0.0282	9.07	0.0254	101.9	29
93.3-45, February	99.21	0.0365	11.41	0.0345	78.03	17
93.3-45, March	118.46	0.0453	14.56	0.0373	73.79	17
93.3-45, April	147.67	0.0654	17.78	0.0656	110.07	27
93.3-45, May	255.08	0.0632	18.91	0.0563	312.68	19
93.3-45, June	217.48	0.0814	23.82	0.0685	247.78	16
93.3-45, July	272.32	0.0574	17.46	0.0572	326.28	32
93.3-45, August	160.84	0.0683	21.85	0.0615	76.83	9
93.3-45, September	127.34	0.0637	16.29	0.0533	99.47	12
93.3-45, October	99.89	0.0357	11.17	0.036	101.46	23
93.3-45, November	98.12	0.0362	12.4	0.0384	86.83	12
93.3-45, December	85.61	0.0376	11.31	0.0364	73.67	6
93.3-40, January	91.72	0.0244	7.54	0.0245	86.76	36
93.3-40, February	101.16	0.0303	9.46	0.0264	106.35	24
93.3-40, March	105.57	0.0393	12.55	0.0382	70.02	23
93.3-40, April	134.95	0.0514	14.36	0.0489	109.16	32
93.3-40, May	168.31	0.0625	17.67	0.0509	161.13	20
93.3-40, June	197.63	0.0664	21.24	0.0634	205.38	16
93.3-40, July	223.74	0.0499	16.5	0.0508	244.47	32
93.3-40, August	157.82	0.0643	19.04	0.0501	127.65	13
93.3-40, September	122.86	0.0476	15.58	0.0461	92.74	14
93.3-40, October	133.78	0.0325	9.47	0.0268	178.18	28
93.3-40, November	89.45	0.0366	11.66	0.0344	59.86	14
93.3-40, December	86.04	0.0343	10.2	0.0334	95.64	11
93.3-35, January	123.03	0.0231	8.35	0.0205	151.2	28
93.3-35, February	92.74	0.0335	10.49	0.0296	74.03	17
93.3-35, March	102.49	0.0418	12.99	0.0351	47	16
93.3-35, April	125.04	0.048	14.3	0.0409	88.7	28
93.3-35, May	181.33	0.0522	17.15	0.0472	186.72	18
93.3-35, June	180.18	0.068	19.55	0.0585	170.69	16
93.3-35, July	156.55	0.0399	15.07	0.0443	137.44	32
93.3-35, August	169.9	0.0571	17.31	0.0429	248.09	11
93.3-35, September	115.43	0.0438	14.41	0.0436	78.26	13
93.3-35, October	96.67	0.0301	9.85	0.0305	103.11	22

Table K.1 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
93.3-35, November	88.99	0.0315	10.59	0.0286	74.69	13
93.3-35, December	82.15	0.034	9.97	0.0287	71.5	7
93.3-30, January	79.54	0.0212	6.84	0.0218	71.18	36
93.3-30, February	88.25	0.0268	8.59	0.0228	82.43	23
93.3-30, March	100.76	0.0358	11.31	0.033	72.9	24
93.3-30, April	120.71	0.0361	11.91	0.0338	98.64	33
93.3-30, May	161.33	0.0501	16.16	0.0445	163.47	18
93.3-30, June	188.3	0.0594	17.69	0.0515	221.78	16
93.3-30, July	147.34	0.0459	14.33	0.044	126.55	33
93.3-30, August	139.25	0.0544	15.55	0.0396	135.73	13
93.3-30, September	106.4	0.0387	12.39	0.0311	81	15
93.3-30, October	82.75	0.0244	8.26	0.0248	74.28	27
93.3-30, November	76.88	0.0312	9.17	0.0202	53.69	13
93.3-30, December	72.74	0.0267	8.33	0.0201	64.08	12
93.3-28, January	82.15	0.0228	7.07	0.0196	80.33	27
93.3-28, February	88.2	0.0308	9.07	0.0238	86.27	13
93.3-28, March	106.88	0.0357	11.39	0.0277	83.32	17
93.3-28, April	127.26	0.0405	12.99	0.0371	97.48	23
93.3-28, May	156.3	0.052	18.02	0.0515	124.69	8
93.3-28, June	169.65	0.0595	19.53	0.0489	153.75	8
93.3-28, July	218.5	0.0485	15.43	0.0394	283	24
93.3-28, August	129.77	0.0498	15.68	0.0425	76.5	9
93.3-28, September	98.87	0.0373	11.74	0.0307	64.36	11
93.3-28, October	74	0.0248	8.31	0.0211	54.33	18
93.3-28, November	72.99	0.0259	8.79	0.0216	41.89	9
93.3-28, December	70.1	0.0251	8.3	0.0225	52.83	6
93.3-26.7, January	68.98	0.0232	7.03	0.0184	42.95	20
93.3-26.7, February	85.86	0.0302	8.69	0.0248	94.8	5
93.3-26.7, March	112.88	0.0329	10.56	0.0253	137.11	9
93.3-26.7, April	142.46	0.0404	12.48	0.0309	140.35	17
93.3-26.7, May	155.72	0.0429	15.14	0.0353	176.4	5
93.3-26.7, June	171.45	0.0488	16.24	0.039	272.5	3
93.3-26.7, July	170.99	0.0421	15.66	0.0359	160.19	16
93.3-26.7, August	121.38	0.043	13.09	0.0325	86.5	6
93.3-26.7, September	101.21	0.0329	10.3	0.0254	98.14	7
93.3-26.7, October	78.09	0.0255	8.01	0.0194	56.05	11
93.3-26.7, November	73.74	0.0215	7.22	0.0178	80.89	9
93.3-26.7, December	67.12	0.0231	7.03	0.0191	79.83	3

Table K.2: Model 1.2 Predicted Sampling Site Monthly Mean Zooplankton Yields.

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
66.7-80, January	110.67	0.0386	13.16	0.0319	53.5	5
66.7-80, February	142.81	0.0475	14.5	0.0408	165.88	8
66.7-80, March	151.83	0.0548	17.8	0.0409	86.33	3
66.7-80, April	221.58	0.0608	19.97	0.0444	288.5	12
66.7-80, May	224.23	0.0785	26.79	0.057	137.5	2
66.7-80, June	232.51	0.0919	27.98	0.0627	183.5	2
66.7-80, July	224.89	0.0725	23.75	0.0591	329.8	5
66.7-80, August	191.12	0.0748	21.48	0.0592	623	1
66.7-80, September	146.69	0.0549	17.59	0.0438	0	0
66.7-80, October	122.82	0.0432	13.51	0.0394	162	4
66.7-80, November	123.05	0.0332	12.51	0.0237	907	1
66.7-80, December	108.02	0.0429	12.83	0.0317	105	2
66.7-70, January	160.73	0.0641	20.53	0.0526	127.83	6
66.7-70, February	245.11	0.071	20.76	0.0567	542.67	9
66.7-70, March	246.39	0.0812	26.91	0.0816	772	3
66.7-70, April	294.1	0.087	31.61	0.0767	334.17	13
66.7-70, May	330.03	0.1117	40.92	0.122	482.25	4
66.7-70, June	342.9	0.1497	43.31	0.1071	640.25	2
66.7-70, July	311.63	0.1036	37.48	0.0822	407.8	5
66.7-70, August	272.11	0.0859	32.94	0.0778	531.75	2
66.7-70, September	211.64	0.0852	28.17	0.069	0	0
66.7-70, October	181.81	0.0634	21.48	0.053	309.75	4
66.7-70, November	153.12	0.0679	20.11	0.0594	171	2
66.7-70, December	154.97	0.0572	18.81	0.0453	293	3
66.7-65, January	188.16	0.0697	22.85	0.0619	318.25	2
66.7-65, February	216.22	0.082	25.05	0.0638	497.5	4
66.7-65, March	254.19	0.0997	30.3	0.0821	496	3
66.7-65, April	328.33	0.1314	47.14	0.1338	361.25	4
66.7-65, May	367.51	0.1627	50.14	0.127	324	1
66.7-65, June	374.92	0.1541	48.22	0.1267	660.5	2
66.7-65, July	333.03	0.1189	43.1	0.121	254	3
66.7-65, August	307.67	0.1291	37.03	0.104	628	2
66.7-65, September	232.85	0.1031	31.82	0.0867	0	0
66.7-65, October	192.29	0.0939	26.07	0.0764	112.5	2
66.7-65, November	168.56	0.0739	23.16	0.0705	140	2
66.7-65, December	167.3	0.0718	22.5	0.068	158	2
66.7-60, January	188.02	0.0627	20.28	0.0662	212.14	14
66.7-60, February	211.92	0.071	26.15	0.0683	221.31	8
66.7-60, March	269.24	0.1134	33.83	0.0902	395.75	4
66.7-60, April	478.17	0.1299	38.5	0.1121	699.36	17
66.7-60, May	424.26	0.1781	53.11	0.1396	621.07	5
66.7-60, June	422.36	0.1545	55.33	0.1598	482	4
66.7-60, July	431.76	0.1607	49.02	0.1336	625.25	8
66.7-60, August	334.58	0.1685	45.72	0.1333	75	1
66.7-60, September	271.57	0.1151	37.21	0.1049	191	1
66.7-60, October	220.71	0.1	29.78	0.0858	160.5	4

Table K.2 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
66.7-60, November	200.65	0.0846	26.68	0.0719	326	2
66.7-60, December	188.24	0.0748	24.27	0.0632	282.33	3
66.7-55, January	200.59	0.0645	21.66	0.0677	223.21	14
66.7-55, February	230.67	0.1002	27.93	0.0926	260.81	8
66.7-55, March	307.14	0.1174	35.99	0.0895	642.5	4
66.7-55, April	438.9	0.1211	42.52	0.1155	490.79	17
66.7-55, May	489.22	0.172	56.03	0.1529	968.3	5
66.7-55, June	455.81	0.192	59.51	0.1639	557.88	4
66.7-55, July	449.25	0.1684	52.98	0.1523	431.31	8
66.7-55, August	360.64	0.1552	48.48	0.1337	250.75	2
66.7-55, September	293.58	0.1286	40.22	0.0941	179	1
66.7-55, October	243.79	0.0901	30.99	0.0923	294.4	5
66.7-55, November	215.98	0.0851	28.64	0.0817	337	2
66.7-55, December	208.66	0.0873	26.53	0.0718	442.5	2
66.7-50, January	214.88	0.0692	21.03	0.0566	273.27	13
66.7-50, February	253.42	0.0759	26.46	0.0845	378.13	8
66.7-50, March	280.18	0.0977	34.07	0.0753	214.9	5
66.7-50, April	467.26	0.1257	39.04	0.1084	537.52	15
66.7-50, May	435.73	0.1407	52.44	0.1402	427.8	5
66.7-50, June	451.05	0.1624	56.99	0.1497	337.63	4
66.7-50, July	437.38	0.19	50.27	0.1467	452.38	8
66.7-50, August	373.9	0.1575	47.12	0.1179	240	2
66.7-50, September	300.8	0.1285	38.78	0.1009	106	1
66.7-50, October	241.84	0.097	29.01	0.0784	232	6
66.7-50, November	235.8	0.0884	26.71	0.0727	743.5	2
66.7-50, December	200.36	0.0845	25.01	0.0675	198	3
66.7-49, January	202.59	0.0745	25.96	0.0769	96.5	4
66.7-49, February	232.54	0.0928	29.49	0.0667	115	1
66.7-49, March	286.82	0.1042	36.1	0.0772	0	0
66.7-49, April	402.12	0.1359	44.4	0.1213	453.03	8
66.7-49, May	455.13	0.1709	55.49	0.1377	761	1
66.7-49, June	473.65	0.1817	59.28	0.1711	301	2
66.7-49, July	459.71	0.1547	56.56	0.1348	361	2
66.7-49, August	384.38	0.1549	48.75	0.1162	0	0
66.7-49, September	301.71	0.1371	38.5	0.1014	0	0
66.7-49, October	251.05	0.1081	31.18	0.0789	143	1
66.7-49, November	219.16	0.0756	28.05	0.0675	0	0
66.7-49, December	202.59	0.0753	24.99	0.0743	253	2
70-80, January	147.64	0.0363	11.09	0.0293	242.25	14
70-80, February	130.45	0.0447	14.84	0.0409	121.06	8
70-80, March	183.93	0.0601	17.97	0.0457	481.3	5
70-80, April	214.48	0.0649	19.52	0.0533	267.29	14
70-80, May	220.05	0.0832	27.19	0.068	151.5	5
70-80, June	243.42	0.085	28.01	0.0752	397.67	3
70-80, July	208.75	0.0812	23.76	0.0662	191.7	10
70-80, August	186.54	0.077	22.31	0.0547	201.75	2
70-80, September	150.98	0.0613	18.38	0.0506	203	1

Table K.2 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
70-80, October	121.54	0.0463	14.12	0.0357	128.4	5
70-80, November	110.45	0.0442	13.33	0.0401	112.67	3
70-80, December	117.17	0.0389	13	0.0353	243.33	3
70-70, January	171.39	0.0555	16.26	0.0454	231.67	15
70-70, February	194.53	0.0674	23.17	0.061	281.81	8
70-70, March	230.68	0.0837	27.51	0.0711	315.8	5
70-70, April	352.94	0.0949	28.64	0.0795	532.6	15
70-70, May	324.52	0.1333	41.53	0.1196	454.21	7
70-70, June	349.07	0.1321	43.45	0.1295	876.67	3
70-70, July	310.37	0.1246	36.95	0.1116	405.05	10
70-70, August	253.64	0.0989	33.86	0.1002	432	2
70-70, September	197.59	0.092	28.04	0.0787	193	1
70-70, October	165.18	0.0742	21.61	0.0539	195.5	6
70-70, November	146.44	0.0716	20.9	0.065	121.33	3
70-70, December	159.06	0.0646	20.16	0.0561	358.33	3
70-65, January	181.18	0.07	23.28	0.0648	265	3
70-65, February	191.77	0.0822	26.99	0.0679	219.75	4
70-65, March	246.31	0.0989	32.28	0.0924	382.88	4
70-65, April	317.68	0.1301	41.02	0.1141	455.75	6
70-65, May	390.85	0.1519	53.3	0.1606	775.33	3
70-65, June	379.9	0.1862	56.87	0.1699	195	1
70-65, July	341.72	0.1344	48.01	0.1393	256.6	5
70-65, August	286.45	0.1286	42.25	0.1248	219	2
70-65, September	230.55	0.1147	34.44	0.1052	0	0
70-65, October	193.79	0.089	28.8	0.0888	129	2
70-65, November	176.42	0.0863	26.45	0.0852	173.33	3
70-65, December	176.14	0.0669	25.83	0.0716	212.5	2
70-60, January	193.72	0.0637	21.34	0.0695	236.9	16
70-60, February	221.17	0.0888	29.1	0.0922	282.71	7
70-60, March	291.4	0.1081	34.86	0.1017	500.63	5
70-60, April	308.99	0.1235	39.72	0.1059	283.15	15
70-60, May	385.01	0.1844	53.53	0.1775	482.24	7
70-60, June	396.29	0.1854	56.28	0.1459	559.67	3
70-60, July	354.78	0.1633	49.69	0.1632	330.97	11
70-60, August	306.82	0.133	46.1	0.1596	226	2
70-60, September	249.12	0.111	37.65	0.1037	164	1
70-60, October	211.28	0.0981	31.27	0.0919	177.5	4
70-60, November	189.24	0.0821	29.19	0.0879	151.33	3
70-60, December	191.76	0.0873	26.17	0.079	420.33	3
70-55, January	204.69	0.0924	28.56	0.0858	131.5	6
70-55, February	230.22	0.1103	33.61	0.0998	47	2
70-55, March	274.34	0.1344	39.86	0.1144	219	1
70-55, April	360.72	0.1554	50.41	0.1422	273.33	6
70-55, May	480.03	0.2327	69.5	0.1995	0	0
70-55, June	468.94	0.2378	70.38	0.1931	0	0
70-55, July	411.26	0.2002	60.38	0.1948	270	3
70-55, August	373.42	0.166	54.87	0.1827	0	0

Table K.2 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
70-55, September	292.71	0.1513	44.09	0.1223	191	1
70-55, October	245.59	0.1197	36.25	0.1006	192.5	2
70-55, November	210.8	0.103	31.84	0.0891	0	0
70-55, December	207.6	0.1013	30.59	0.0817	0	0
70-51, January	232.85	0.0589	18.93	0.058	371.88	13
70-51, February	214.51	0.0644	23.95	0.0643	291	6
70-51, March	270.14	0.1033	33.24	0.0851	217	1
70-51, April	431.27	0.1227	36.64	0.0972	574.67	12
70-51, May	452.98	0.149	47.2	0.1151	693.75	6
70-51, June	425.92	0.1823	52.32	0.1444	297	4
70-51, July	419.27	0.147	46.37	0.1157	407.11	9
70-51, August	355.71	0.1357	42.86	0.1106	482.75	2
70-51, September	279.39	0.1154	35.16	0.0883	0	0
70-51, October	230.48	0.0867	27.74	0.0699	191.75	4
70-51, November	189.93	0.0778	23.98	0.0625	133	3
70-51, December	183.31	0.0675	22.24	0.058	210	3
73.3-80, January	142.89	0.042	12.68	0.0373	275.81	8
73.3-80, February	146.96	0.0451	14.06	0.0327	264.5	7
73.3-80, March	148.48	0.0549	17.03	0.0481	188.5	5
73.3-80, April	186.37	0.06	20.25	0.0659	194	11
73.3-80, May	236.23	0.0707	25.02	0.057	485.8	5
73.3-80, June	227.18	0.0792	28.7	0.0778	222	1
73.3-80, July	206.54	0.0789	24.49	0.07	219.92	6
73.3-80, August	177.26	0.0766	21.82	0.0545	109.25	2
73.3-80, September	143.95	0.0639	17.98	0.0475	0	0
73.3-80, October	133.74	0.0464	14.13	0.0366	310.25	4
73.3-80, November	111.24	0.0388	13.13	0.0321	237	2
73.3-80, December	104.19	0.0376	13.18	0.0369	62.5	2
73.3-70, January	149.15	0.0598	19.04	0.052	146.15	10
73.3-70, February	159.21	0.0753	22.07	0.0632	123.06	9
73.3-70, March	193.51	0.0801	26.47	0.0769	175.33	6
73.3-70, April	265.1	0.1079	33.41	0.0972	249.54	13
73.3-70, May	370.04	0.1179	41.02	0.1276	912.5	6
73.3-70, June	325.97	0.1457	49.1	0.1393	368	1
73.3-70, July	298.51	0.1386	40.63	0.1209	358.25	6
73.3-70, August	248.16	0.1182	35.22	0.1009	338.75	2
73.3-70, September	200.16	0.092	29.6	0.0861	0	0
73.3-70, October	156.25	0.0783	23.1	0.0623	85.75	4
73.3-70, November	144	0.0762	21.38	0.0678	117.5	2
73.3-70, December	151.4	0.0616	21.17	0.0589	227.67	3
73.3-65, January	184.46	0.0833	24.41	0.0769	377.33	3
73.3-65, February	186.37	0.0924	27.25	0.081	157.25	4
73.3-65, March	269.37	0.1109	33.65	0.1181	613.63	4
73.3-65, April	287.63	0.1516	43.34	0.1387	193.13	4
73.3-65, May	357.88	0.185	54.07	0.1827	451	3
73.3-65, June	388.38	0.221	63.99	0.199	178	1
73.3-65, July	344.12	0.1668	52.86	0.163	244.5	3

Table K.2 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
73.3-65, August	285.73	0.138	45.55	0.1357	122	2
73.3-65, September	234.12	0.1126	36.79	0.1115	0	0
73.3-65, October	192.04	0.093	30.24	0.096	134.5	2
73.3-65, November	189.08	0.0934	29.01	0.1064	385	2
73.3-65, December	177.06	0.0858	27.34	0.0896	231	2
73.3-60, January	175.69	0.0804	22.61	0.0776	179.44	15
73.3-60, February	200.83	0.0908	26.75	0.0775	256.17	9
73.3-60, March	296.7	0.1088	33.72	0.1017	470.57	7
73.3-60, April	276.53	0.1514	42.07	0.1658	196.32	14
73.3-60, May	373.59	0.1784	55.56	0.2046	444.05	7
73.3-60, June	435.01	0.2007	58.22	0.2015	874.6	5
73.3-60, July	372.31	0.1778	57.79	0.2071	337.25	8
73.3-60, August	309.03	0.1794	49.75	0.1646	141.67	2
73.3-60, September	255.12	0.1286	40.9	0.1266	0	0
73.3-60, October	203.59	0.0943	31.5	0.0988	180.57	7
73.3-60, November	190.29	0.0975	29.6	0.1086	344.5	2
73.3-60, December	179.2	0.0965	27.85	0.0909	232	3
73.3-55, January	192.76	0.0814	28.74	0.0761	100	3
73.3-55, February	218.2	0.1184	32.24	0.104	143.67	3
73.3-55, March	285.12	0.1417	43.29	0.1367	67	1
73.3-55, April	338.67	0.1515	51.04	0.1703	125.33	3
73.3-55, May	427.63	0.1948	64.41	0.2018	909	1
73.3-55, June	436.3	0.2272	70.04	0.2225	161	1
73.3-55, July	397.43	0.1827	63.54	0.208	0	0
73.3-55, August	341.97	0.1637	54.07	0.1511	0	0
73.3-55, September	277.16	0.141	44.21	0.1348	0	0
73.3-55, October	237.38	0.1076	34.75	0.1054	455	2
73.3-55, November	201.39	0.0982	31.94	0.0975	0	0
73.3-55, December	193.42	0.1052	30.55	0.0941	0	0
73.3-50, January	205.88	0.068	17.54	0.0449	308.91	11
73.3-50, February	203.94	0.0703	21.26	0.0567	252.31	8
73.3-50, March	259.21	0.0939	28.81	0.0779	600.17	3
73.3-50, April	370.49	0.1035	34.51	0.0906	485.85	10
73.3-50, May	555.33	0.1292	43.13	0.1175	1507.21	7
73.3-50, June	436.22	0.1486	48.3	0.1132	817.67	3
73.3-50, July	413.14	0.1282	42.57	0.1116	508.56	8
73.3-50, August	363.7	0.1151	38.63	0.1015	849	2
73.3-50, September	268.53	0.1054	32.8	0.0847	0	0
73.3-50, October	221.46	0.0745	24.25	0.0583	446.83	3
73.3-50, November	188.75	0.0712	21.59	0.052	375.5	2
73.3-50, December	174.86	0.0656	20.78	0.0547	188.33	3
76.7-100, January	66.12	0.0224	7.21	0.0197	55.6	10
76.7-100, February	71.81	0.0291	8.37	0.0209	41.45	11
76.7-100, March	83.81	0.0293	10.03	0.027	33	3
76.7-100, April	97.85	0.0358	11.81	0.0293	43.59	17
76.7-100, May	116.3	0.0419	14.08	0.0383	37	4
76.7-100, June	126.44	0.0524	15.26	0.0401	0	0

Table K.2 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
76.7-100, July	130.03	0.0385	13.45	0.035	114.77	13
76.7-100, August	99.67	0.0353	11.7	0.0259	69.17	6
76.7-100, September	79.99	0.0307	9.58	0.0241	36.5	2
76.7-100, October	69.68	0.025	7.89	0.0184	46.1	10
76.7-100, November	69.08	0.022	7.02	0.0199	93.75	8
76.7-100, December	61.63	0.0249	7.38	0.0193	0	0
76.7-90, January	97.5	0.0306	9.37	0.0232	114.3	15
76.7-90, February	101.78	0.0367	12.4	0.0362	74.29	14
76.7-90, March	116.31	0.0449	14.16	0.0422	96.43	7
76.7-90, April	132.33	0.05	16.12	0.0454	87.19	22
76.7-90, May	150.58	0.063	19.6	0.0548	123.19	8
76.7-90, June	165.59	0.0708	22.9	0.0615	96	1
76.7-90, July	156.48	0.0612	19.2	0.0503	119.86	18
76.7-90, August	125.04	0.0575	17.24	0.0495	62.22	9
76.7-90, September	107.14	0.047	14.51	0.0352	36.5	2
76.7-90, October	94.85	0.0304	11.23	0.0325	91.33	12
76.7-90, November	100.17	0.0337	10.17	0.0324	143.17	12
76.7-90, December	84.32	0.0429	11.26	0.0279	103	1
76.7-80, January	124.05	0.0398	13.83	0.0397	129.91	16
76.7-80, February	140	0.0531	17.87	0.0569	112.57	15
76.7-80, March	155.13	0.065	20.81	0.0598	138.36	7
76.7-80, April	166.3	0.0736	22.93	0.0762	106.34	25
76.7-80, May	233.44	0.1023	30.52	0.1019	236.28	9
76.7-80, June	239.34	0.116	35.55	0.0925	173	1
76.7-80, July	230.02	0.0949	30.68	0.0932	171.28	18
76.7-80, August	186.85	0.0908	26.99	0.0773	110.35	10
76.7-80, September	157.6	0.0753	23.35	0.0617	89.5	2
76.7-80, October	120.41	0.0601	18.19	0.0586	62.85	13
76.7-80, November	128.29	0.0518	16.34	0.0471	136.15	13
76.7-80, December	124.4	0.0642	18.32	0.0556	134.5	2
76.7-70, January	161.42	0.0567	17.62	0.0492	172.21	17
76.7-70, February	159.52	0.0743	23.54	0.0849	99.85	17
76.7-70, March	195.76	0.0947	27.03	0.0822	172.39	9
76.7-70, April	220.01	0.091	30.71	0.1157	148.89	25
76.7-70, May	285.9	0.1318	40.36	0.1319	242.86	11
76.7-70, June	299.76	0.1521	47.23	0.1425	242	3
76.7-70, July	261.22	0.1419	41.65	0.1439	150.11	18
76.7-70, August	260.92	0.1119	36.47	0.1066	209.36	11
76.7-70, September	203.42	0.1112	31.83	0.0893	183	2
76.7-70, October	154.92	0.0922	25.13	0.0939	91	12
76.7-70, November	148.42	0.0924	23.01	0.0962	118.92	12
76.7-70, December	156.4	0.0849	24.45	0.0844	210.33	3
76.7-60, January	162.5	0.0815	21.39	0.0722	156.13	16
76.7-60, February	180.44	0.0862	25.47	0.1079	146.56	17
76.7-60, March	241.28	0.1016	33.44	0.1362	231.81	9
76.7-60, April	289.05	0.1241	38.54	0.1698	231.89	24
76.7-60, May	338.57	0.1867	52.07	0.2047	300.67	11

Table K.2 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
76.7-60, June	486.18	0.1812	55.36	0.166	1973	4
76.7-60, July	353.37	0.1842	54.42	0.2158	282.43	18
76.7-60, August	308.41	0.1721	46.18	0.1574	302	11
76.7-60, September	238.64	0.1309	40.58	0.1384	105	2
76.7-60, October	184.85	0.1137	32.35	0.1607	112.17	12
76.7-60, November	178.84	0.1019	29.28	0.1137	146.57	14
76.7-60, December	176.82	0.0838	29.6	0.1183	262.33	3
76.7-55, January	161.2	0.0774	21.89	0.0748	142.43	20
76.7-55, February	196.36	0.0865	26.62	0.0898	162.5	17
76.7-55, March	239.03	0.1095	34.76	0.111	221.65	10
76.7-55, April	267.63	0.138	41.5	0.168	168.73	26
76.7-55, May	365.53	0.1763	53.3	0.2096	318.46	12
76.7-55, June	372.99	0.2112	59.62	0.2032	282.8	5
76.7-55, July	357.34	0.1853	55.65	0.2331	255.68	19
76.7-55, August	297.77	0.1708	49.03	0.1639	183.64	11
76.7-55, September	254.14	0.1221	43.05	0.1383	76	2
76.7-55, October	201.79	0.12	33.7	0.1514	144.27	15
76.7-55, November	195.19	0.1025	31.2	0.1316	168.43	14
76.7-55, December	183.7	0.0986	31.22	0.1313	268	2
76.7-51, January	178.74	0.0619	19.36	0.0664	179.64	21
76.7-51, February	198.81	0.0914	23.92	0.0832	189.03	17
76.7-51, March	243.92	0.1087	33.42	0.0915	212.44	9
76.7-51, April	301.07	0.1185	39.63	0.1203	205.86	26
76.7-51, May	392.71	0.1594	48.59	0.1673	387.35	10
76.7-51, June	399.58	0.1615	56.82	0.1807	485.75	4
76.7-51, July	325.67	0.1471	44.76	0.1419	250.08	18
76.7-51, August	326.24	0.1439	47.06	0.1668	259.14	11
76.7-51, September	253.19	0.1106	38.37	0.1133	184	2
76.7-51, October	193.17	0.0817	28.24	0.0957	155.5	14
76.7-51, November	170.62	0.0812	26.18	0.0883	109.07	14
76.7-51, December	167.43	0.0771	24.47	0.0729	204	3
76.7-49, January	150.48	0.0534	17.63	0.0458	79.33	9
76.7-49, February	195.52	0.0648	19.7	0.0522	224.67	9
76.7-49, March	227.91	0.0781	26.07	0.0619	237.5	2
76.7-49, April	303.62	0.0977	30.12	0.0778	251.17	18
76.7-49, May	364.11	0.1209	39.23	0.0957	640.33	3
76.7-49, June	358.07	0.1216	42.34	0.1173	151	1
76.7-49, July	344.98	0.1188	36.46	0.102	303.75	12
76.7-49, August	394.49	0.1154	33.74	0.0832	789.75	8
76.7-49, September	227.48	0.0814	26.58	0.0662	173.5	2
76.7-49, October	173.77	0.0706	20.37	0.0513	98.25	8
76.7-49, November	149.23	0.0586	17.96	0.0521	60.6	10
76.7-49, December	149.2	0.0568	17.77	0.0395	0	0
80-100, January	84.94	0.0234	7.43	0.0208	120	15
80-100, February	75.5	0.023	8.59	0.0241	69.18	11
80-100, March	83.01	0.0276	9.8	0.0227	89	3
80-100, April	107.39	0.0337	11	0.0314	92.13	19

Table K.2 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
80-100, May	110.34	0.0423	13.76	0.0361	53.13	4
80-100, June	118.89	0.0474	14.74	0.0351	96	1
80-100, July	116.46	0.0424	13.35	0.0352	86.31	16
80-100, August	87.75	0.0354	11.28	0.0267	31.56	9
80-100, September	75.14	0.0295	9.34	0.0276	43.67	3
80-100, October	62.04	0.0256	7.38	0.0206	38.54	13
80-100, November	57.87	0.0218	6.91	0.019	41.22	9
80-100, December	60.2	0.0261	7.54	0.0216	0	0
80-90, January	152.83	0.0287	9.07	0.0302	224.23	22
80-90, February	112.35	0.0394	12.43	0.0387	129.44	17
80-90, March	110.16	0.0457	14.46	0.0422	91.05	10
80-90, April	125.49	0.0501	15.93	0.0566	93.37	25
80-90, May	149.54	0.0599	19.96	0.0668	140.22	10
80-90, June	159.5	0.0651	23.55	0.056	119	4
80-90, July	190.54	0.0481	18.23	0.0602	213.1	23
80-90, August	122.92	0.0644	18.55	0.0579	64.17	12
80-90, September	104.17	0.048	15.15	0.0383	60.4	5
80-90, October	83.38	0.0438	11.76	0.039	56.82	17
80-90, November	88.66	0.0374	11.33	0.0346	87.79	14
80-90, December	88.76	0.0488	13.16	0.0481	97.33	3
80-80, January	122.53	0.0423	12.65	0.0471	131.52	22
80-80, February	154.77	0.0513	16.6	0.0594	193.83	18
80-80, March	134.72	0.071	19.38	0.0638	112.65	10
80-80, April	137.15	0.0724	21.24	0.0855	87.02	27
80-80, May	203.25	0.0911	28.55	0.1056	234.2	10
80-80, June	217.15	0.097	32.72	0.0918	263.2	5
80-80, July	218.09	0.0879	26.41	0.099	186.65	23
80-80, August	184.5	0.0902	26.05	0.0974	160.25	12
80-80, September	141.19	0.0685	21.63	0.0649	122	6
80-80, October	110.19	0.0622	17.74	0.0943	70.47	17
80-80, November	142.32	0.0609	17.12	0.0645	194.21	14
80-80, December	122.84	0.0698	19.59	0.0826	180.67	3
80-70, January	167.42	0.0446	16.17	0.0725	193.65	23
80-70, February	149.99	0.0666	20.27	0.076	136.78	16
80-70, March	158.39	0.0894	25.53	0.0958	93.45	10
80-70, April	202.71	0.088	27.09	0.1298	164.46	28
80-70, May	245.69	0.1222	36.34	0.1371	216.58	12
80-70, June	259.01	0.1583	42.7	0.1525	211	6
80-70, July	260.7	0.1266	36.86	0.136	199.98	22
80-70, August	447.81	0.1164	35.71	0.1444	1047.67	12
80-70, September	185.83	0.1039	30.21	0.1054	158.83	6
80-70, October	169.02	0.0907	24.2	0.1005	176.5	16
80-70, November	148.68	0.0886	24.28	0.1242	130.21	14
80-70, December	149.3	0.0848	26.95	0.1387	159	3
80-60, January	153.48	0.0633	19.24	0.075	142.89	24
80-60, February	178.98	0.0894	24.73	0.1093	159.13	15
80-60, March	198.5	0.1146	31.97	0.1396	140.83	12

Table K.2 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
80-60, April	229.49	0.1271	36.45	0.1585	155.52	28
80-60, May	370.5	0.1849	49.82	0.2345	486.68	12
80-60, June	335.29	0.185	55.82	0.2186	307.17	6
80-60, July	315.04	0.1735	50.71	0.2359	243.06	22
80-60, August	270.91	0.1503	45.76	0.2466	224.61	12
80-60, September	235.7	0.1479	39.76	0.1573	250	6
80-60, October	203.31	0.1147	32.63	0.1663	201.28	18
80-60, November	180.47	0.1139	32.23	0.1584	148.92	13
80-60, December	181.35	0.1047	32.56	0.1511	353.33	3
80-55, January	200.32	0.0742	20.78	0.0827	230.23	22
80-55, February	189.46	0.0837	25.51	0.1035	192.44	16
80-55, March	203.75	0.1009	34.03	0.1166	106.27	11
80-55, April	275.71	0.1177	39.31	0.2138	214.29	29
80-55, May	331.63	0.1879	52.27	0.2072	251.71	12
80-55, June	361.27	0.2132	60.38	0.2123	277.67	6
80-55, July	323.58	0.1868	52.27	0.2308	227.52	22
80-55, August	280.99	0.1537	47.38	0.1784	201.96	12
80-55, September	240.51	0.1456	42.72	0.1756	161.6	5
80-55, October	187.49	0.1224	33.9	0.1633	131.94	17
80-55, November	178.13	0.1208	34.7	0.2041	110.23	13
80-55, December	180.54	0.118	33.09	0.1655	279	3
80-51, January	153.18	0.0562	17.57	0.0554	156.93	20
80-51, February	181.32	0.074	22.9	0.0721	166.21	14
80-51, March	482.99	0.1026	31.98	0.0961	1003.19	8
80-51, April	367.75	0.1094	34.96	0.1242	377.9	26
80-51, May	386.42	0.156	47.29	0.1388	392.05	11
80-51, June	372.03	0.1925	54.19	0.1727	363.25	4
80-51, July	313.06	0.1409	44.66	0.1349	215.76	21
80-51, August	293.1	0.1244	40.16	0.109	259.21	12
80-51, September	248.18	0.1202	35.56	0.1159	364	4
80-51, October	176.71	0.0873	26.4	0.1034	128.94	16
80-51, November	149.46	0.0839	26.48	0.1067	49.08	12
80-51, December	153.75	0.0807	24.3	0.0954	143	3
83.3-110, January	53.5	0.0158	5	0.0125	73.4	10
83.3-110, February	53.16	0.0157	5.67	0.0148	58.25	8
83.3-110, March	56.05	0.0212	6.72	0.0157	21.75	2
83.3-110, April	72.97	0.0202	7.46	0.016	62.63	16
83.3-110, May	78.71	0.0312	9.52	0.0239	47	1
83.3-110, June	83.79	0.0283	10.16	0.026	0	0
83.3-110, July	73.54	0.0322	9.1	0.0218	29.2	10
83.3-110, August	65.42	0.0236	7.77	0.0228	38.57	7
83.3-110, September	53.23	0.0183	6.47	0.016	14.33	3
83.3-110, October	47.78	0.0177	5.21	0.0129	40.09	11
83.3-110, November	41.46	0.0146	4.78	0.012	29.71	7
83.3-110, December	40.71	0.015	4.87	0.0121	0	0
83.3-100, January	76.09	0.0276	8.4	0.0254	90.46	13
83.3-100, February	80.77	0.0291	10.23	0.0275	77.56	9

Table K.2 - continued

LS-Month	**Mean**	**$MCSE_{Mean}$**	**SD**	**$MCSE_{SD}$**	**OBS Mean**	**OBS Count**
83.3-100, March	83.35	0.0307	11.34	0.0316	53.7	5
83.3-100, April	87.65	0.0356	12.11	0.0347	45.85	17
83.3-100, May	109.86	0.0524	15.53	0.0403	68	3
83.3-100, June	116.04	0.0479	16.46	0.052	12	1
83.3-100, July	102.28	0.0432	14.78	0.0435	44	13
83.3-100, August	86.82	0.0402	12.98	0.0359	17.5	8
83.3-100, September	76.24	0.038	10.71	0.0293	39.33	3
83.3-100, October	61.19	0.0277	8.75	0.0288	27.42	12
83.3-100, November	74.31	0.0252	8.45	0.0286	117.63	8
83.3-100, December	61.49	0.0281	8.93	0.0274	12	1
83.3-90, January	105.77	0.0335	9.68	0.0416	122.83	20
83.3-90, February	108.22	0.0395	12.52	0.0379	124.66	16
83.3-90, March	114.18	0.0503	14.84	0.0425	96.89	9
83.3-90, April	108.95	0.0575	16.16	0.0561	70.54	23
83.3-90, May	171.81	0.0618	20.48	0.0673	274.44	9
83.3-90, June	152.31	0.0795	23.19	0.0719	126	5
83.3-90, July	138.64	0.061	19.12	0.0686	106.26	23
83.3-90, August	115.43	0.0738	18.82	0.0611	35.45	10
83.3-90, September	103.6	0.0517	15.45	0.0505	92	5
83.3-90, October	79.75	0.0361	12.2	0.0429	55.05	20
83.3-90, November	90.53	0.0385	12.84	0.0474	98.78	9
83.3-90, December	85.62	0.0423	13.63	0.0425	69.5	2
83.3-80, January	120.55	0.0421	12.3	0.0468	130.74	21
83.3-80, February	114.57	0.0492	16.44	0.0571	107.6	15
83.3-80, March	121.84	0.0604	19.47	0.0634	65.2	10
83.3-80, April	144.92	0.066	20.98	0.0802	113.57	25
83.3-80, May	185.81	0.0796	27.68	0.0986	193.89	9
83.3-80, June	198.52	0.1252	31.92	0.1225	167.17	6
83.3-80, July	194.86	0.0802	26.25	0.1044	176.27	24
83.3-80, August	160.27	0.0868	25.68	0.0914	97.85	10
83.3-80, September	130.37	0.074	21.61	0.0673	81	6
83.3-80, October	104.98	0.0588	17.75	0.0725	74.25	20
83.3-80, November	140.36	0.0617	18.36	0.0768	247.56	9
83.3-80, December	109.79	0.0654	19.47	0.0971	69	3
83.3-70, January	165.07	0.0515	16.31	0.0683	205.07	21
83.3-70, February	138.83	0.0569	19.21	0.0674	129.71	19
83.3-70, March	145.55	0.0772	24.97	0.0864	65.7	10
83.3-70, April	171.3	0.0895	26.53	0.1267	123.64	28
83.3-70, May	235.7	0.1106	36.27	0.1552	215.33	12
83.3-70, June	261	0.1406	42.31	0.1869	258	6
83.3-70, July	218.95	0.118	35.68	0.1758	167.44	24
83.3-70, August	213.77	0.1073	35.8	0.1902	149	11
83.3-70, September	183.25	0.0965	30.19	0.1083	167.5	6
83.3-70, October	148.54	0.0812	24.26	0.1225	129.83	18
83.3-70, November	153.37	0.0869	25.31	0.1356	177.18	11
83.3-70, December	141.96	0.0915	29.35	0.1561	48.17	3
83.3-60, January	148.07	0.0628	17.49	0.0775	168.6	21

Table K.2 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
83.3-60, February	182.76	0.0815	21.62	0.1038	217.26	19
83.3-60, March	173.39	0.1039	29.35	0.1224	97.22	10
83.3-60, April	232.88	0.1198	32.87	0.1862	195.87	28
83.3-60, May	304	0.1603	44.03	0.2116	388.32	13
83.3-60, June	307.39	0.1812	51.53	0.2289	296.71	7
83.3-60, July	309.88	0.1614	44.54	0.2375	299.6	24
83.3-60, August	234.05	0.1492	41.71	0.1897	162.06	12
83.3-60, September	183.41	0.1206	36.45	0.1749	54.4	5
83.3-60, October	149.5	0.0978	29.44	0.2058	101.52	21
83.3-60, November	159.93	0.1105	32.42	0.2257	144.82	11
83.3-60, December	163	0.1149	34.76	0.2454	193.92	4
83.3-55, January	222.72	0.0625	18.6	0.1116	313.86	22
83.3-55, February	157.67	0.0892	22.71	0.1161	141.11	19
83.3-55, March	183.92	0.104	31.2	0.1079	101.28	9
83.3-55, April	211.05	0.1347	35.73	0.166	141	29
83.3-55, May	292.64	0.1573	46.82	0.3163	271.67	12
83.3-55, June	334.76	0.198	54.77	0.2449	357.14	7
83.3-55, July	281.16	0.1618	46.88	0.2347	213.19	24
83.3-55, August	236.87	0.1325	43.22	0.1931	143.75	12
83.3-55, September	196.16	0.1287	38.35	0.1774	90	5
83.3-55, October	166.27	0.1018	30.57	0.2082	130	21
83.3-55, November	157.82	0.1152	33.99	0.1897	105.9	10
83.3-55, December	162.16	0.1246	37.02	0.2336	163.5	4
83.3-51, January	134.2	0.0568	17.14	0.0651	121.61	22
83.3-51, February	153.56	0.076	21.57	0.0725	122.06	17
83.3-51, March	211.89	0.1044	30.99	0.1027	195.33	9
83.3-51, April	296.46	0.1109	34.56	0.1657	257.84	29
83.3-51, May	307.74	0.1472	46.45	0.1667	216.54	13
83.3-51, June	333.53	0.1653	53.08	0.1846	261.86	7
83.3-51, July	269.9	0.1236	42.04	0.1552	190.89	24
83.3-51, August	220.06	0.1295	39.36	0.1432	72.33	12
83.3-51, September	193.81	0.1171	34.55	0.1107	90.6	5
83.3-51, October	150.09	0.0786	25.22	0.123	106.29	21
83.3-51, November	140.38	0.102	28.38	0.1346	59.25	12
83.3-51, December	139.5	0.0886	27.41	0.1525	71	5
83.3-42, January	126.31	0.0607	18.5	0.0548	65	16
83.3-42, February	149.99	0.0664	20.15	0.0658	85.12	13
83.3-42, March	202.04	0.0749	24.72	0.0642	184.25	8
83.3-42, April	267.52	0.1023	30.33	0.0875	207.1	21
83.3-42, May	430.09	0.1189	34.7	0.093	536.77	11
83.3-42, June	320.16	0.1424	43.69	0.1132	338	1
83.3-42, July	268.45	0.1011	33.42	0.0909	171.03	16
83.3-42, August	220.65	0.094	30.12	0.0835	98.05	10
83.3-42, September	185.59	0.0755	25.66	0.0739	109.67	3
83.3-42, October	144.18	0.0707	21.52	0.0537	54.36	14
83.3-42, November	126.01	0.0554	19.28	0.059	40.92	12
83.3-42, December	131.47	0.0616	19.2	0.0533	60.33	3

Table K.2 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
83.3-40.6, January	146.88	0.0533	18.61	0.0608	108.1	15
83.3-40.6, February	154.7	0.0696	19.21	0.0502	104.04	13
83.3-40.6, March	206.73	0.0614	24.16	0.0602	249.5	6
83.3-40.6, April	290.94	0.0939	28.91	0.0858	261.85	21
83.3-40.6, May	408.26	0.1083	33.23	0.1078	562.5	11
83.3-40.6, June	305.18	0.1274	40.84	0.1123	36	1
83.3-40.6, July	264.88	0.0956	31.89	0.0922	195.75	16
83.3-40.6, August	236.01	0.0989	29.6	0.0777	162.95	10
83.3-40.6, September	188.03	0.0674	25.72	0.0682	66.67	3
83.3-40.6, October	165.86	0.0743	22.52	0.0691	96.57	14
83.3-40.6, November	126.61	0.0598	18.64	0.0477	37.42	12
83.3-40.6, December	133.77	0.0584	18.73	0.0552	61	2
86.7-110, January	47.87	0.0155	5.16	0.0139	48.9	10
86.7-110, February	49.32	0.0183	5.67	0.0152	43.5	8
86.7-110, March	52.71	0.0195	6.57	0.0173	12.75	2
86.7-110, April	58.96	0.0227	7.42	0.0212	26.33	15
86.7-110, May	73.42	0.0308	9.26	0.024	23	1
86.7-110, June	79.76	0.0335	10.02	0.0282	0	0
86.7-110, July	72.9	0.0297	9.07	0.0219	37.1	10
86.7-110, August	63.57	0.0239	7.77	0.0208	38.29	7
86.7-110, September	52.23	0.0194	6.47	0.0181	20.33	3
86.7-110, October	45.02	0.0148	5.12	0.0139	34.55	11
86.7-110, November	40.33	0.015	4.77	0.0114	29.63	8
86.7-110, December	40.17	0.0147	5.05	0.0128	0	0
86.7-100, January	64.47	0.0239	8.51	0.0296	57.69	13
86.7-100, February	72.22	0.0311	9.77	0.0276	51.89	9
86.7-100, March	74.61	0.0367	10.25	0.0312	48.3	5
86.7-100, April	77.41	0.0358	10.89	0.0317	46.03	18
86.7-100, May	95.96	0.0484	13.86	0.0395	69.67	3
86.7-100, June	106.21	0.0543	15.46	0.0378	0	0
86.7-100, July	98.49	0.0427	14.49	0.0444	52.08	13
86.7-100, August	85.09	0.0399	12.33	0.0357	45.43	7
86.7-100, September	71.43	0.0334	10.2	0.0266	36.33	3
86.7-100, October	58.42	0.0252	8.19	0.0219	32.58	12
86.7-100, November	55.86	0.0244	7.93	0.0252	37	7
86.7-100, December	57.73	0.0272	8.74	0.0262	0	0
86.7-90, January	82.13	0.0371	13.23	0.0534	59.05	20
86.7-90, February	115.26	0.0328	9.52	0.0329	155.79	17
86.7-90, March	95.57	0.0451	13.34	0.0408	88.06	9
86.7-90, April	91.52	0.0422	13.8	0.0557	57.88	24
86.7-90, May	126.54	0.0661	17.78	0.0592	148.06	9
86.7-90, June	135.61	0.0692	21.08	0.0723	115	4
86.7-90, July	131.39	0.0547	16.6	0.0624	120.63	23
86.7-90, August	103.77	0.0551	16.87	0.0627	39.22	9
86.7-90, September	89.63	0.0474	13.9	0.0439	51.8	5
86.7-90, October	80.63	0.0355	10.98	0.0377	68.79	19
86.7-90, November	78.84	0.0419	11.21	0.046	83	11

Table K.2 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
86.7-90, December	76.88	0.0399	12.89	0.0569	0	0
86.7-80, January	119.5	0.0371	11.65	0.0355	140.53	20
86.7-80, February	107.73	0.0408	13.03	0.044	106.31	18
86.7-80, March	112.14	0.0533	17.68	0.0589	64.9	10
86.7-80, April	127.8	0.0597	19.05	0.0773	93.74	24
86.7-80, May	179.49	0.0909	25.51	0.0826	221.61	9
86.7-80, June	189.54	0.0973	30.35	0.0931	149.75	4
86.7-80, July	202.81	0.075	23.75	0.0846	206.19	24
86.7-80, August	154.89	0.0897	24.96	0.0867	100.67	9
86.7-80, September	124.9	0.0632	19.57	0.0601	101.33	6
86.7-80, October	105.07	0.0543	16.01	0.0894	85.89	18
86.7-80, November	108.55	0.0509	15.92	0.0694	120.27	11
86.7-80, December	102.99	0.0649	18.43	0.0762	107.75	2
86.7-70, January	138.74	0.0936	25.71	0.1323	98.32	19
86.7-70, February	109.22	0.0537	16.1	0.0673	89.21	19
86.7-70, March	134.4	0.0603	21.65	0.0705	87.13	8
86.7-70, April	162.14	0.0854	23.1	0.1045	122.05	26
86.7-70, May	242.13	0.1143	32.1	0.1099	332.95	11
86.7-70, June	246.37	0.1144	37.74	0.1262	355.6	5
86.7-70, July	202.79	0.0943	30.17	0.1582	168.14	25
86.7-70, August	183.26	0.105	31.12	0.2011	125.44	9
86.7-70, September	148.82	0.0932	24.62	0.0994	109.29	7
86.7-70, October	153.46	0.0633	20.48	0.1238	171.05	19
86.7-70, November	125.52	0.072	20.78	0.0918	117.9	10
86.7-70, December	129.52	0.0792	23.29	0.1316	262.5	3
86.7-60, January	133.88	0.0482	15.11	0.076	150.33	20
86.7-60, February	138.1	0.0701	17.87	0.0799	130.98	20
86.7-60, March	148.06	0.0844	24.6	0.095	93	10
86.7-60, April	160.08	0.0947	28.2	0.1141	100.54	25
86.7-60, May	253.87	0.1305	36.54	0.1562	290.68	12
86.7-60, June	271.92	0.1396	44.86	0.1748	276.67	6
86.7-60, July	342.77	0.1257	37.21	0.2007	387.12	25
86.7-60, August	216.09	0.1171	35.59	0.1955	190.96	9
86.7-60, September	175.32	0.0974	29.87	0.122	157.43	7
86.7-60, October	139.29	0.0731	24.01	0.125	111.26	19
86.7-60, November	128.15	0.0832	25.4	0.1322	96.33	12
86.7-60, December	133.31	0.0915	28.12	0.1601	129.44	3
86.7-55, January	131.07	0.0525	16.18	0.0702	126.51	22
86.7-55, February	134.26	0.0672	19.89	0.0882	111.39	18
86.7-55, March	159.32	0.1006	27.29	0.0993	80.15	10
86.7-55, April	201.85	0.1233	33	0.1502	149.51	26
86.7-55, May	310.71	0.1263	39.86	0.2112	321.63	12
86.7-55, June	309.01	0.1664	51.41	0.1869	330.17	6
86.7-55, July	266.65	0.1335	41.16	0.2144	213.54	25
86.7-55, August	214.36	0.1398	38.38	0.1725	98.25	8
86.7-55, September	183.09	0.1083	33.83	0.1788	124.71	7
86.7-55, October	153	0.0883	26.07	0.1629	128.45	20

Table K.2 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
86.7-55, November	145.67	0.1099	30.03	0.1772	100.27	11
86.7-55, December	155.17	0.1028	29.9	0.1997	326.25	4
86.7-50, January	127.34	0.058	15.88	0.0607	119.45	22
86.7-50, February	174.2	0.0571	18.86	0.0711	214.29	17
86.7-50, March	174.63	0.0994	27.12	0.0822	109.55	10
86.7-50, April	265.6	0.1189	34.15	0.1613	233.8	26
86.7-50, May	361.01	0.1032	35.24	0.1114	502.17	12
86.7-50, June	321.31	0.1648	50.8	0.1795	401.17	6
86.7-50, July	349.92	0.1073	33.09	0.1231	386.85	24
86.7-50, August	199.05	0.1025	32.15	0.0996	116.05	10
86.7-50, September	174.65	0.0812	28.74	0.1184	151.43	7
86.7-50, October	170.06	0.0653	21.28	0.0872	191.3	20
86.7-50, November	136.78	0.0749	25.15	0.0968	83	9
86.7-50, December	160.08	0.0635	22.43	0.0836	524.5	4
86.7-45, January	110.34	0.0391	13.62	0.044	94.09	23
86.7-45, February	130.89	0.0477	16.07	0.0562	123.22	18
86.7-45, March	161.27	0.0676	21.98	0.0621	128.86	11
86.7-45, April	204.76	0.0835	28.26	0.1305	158.56	26
86.7-45, May	288.1	0.0819	29.81	0.0931	317.5	12
86.7-45, June	276.55	0.1422	41.36	0.129	309.67	6
86.7-45, July	250.99	0.0814	26.94	0.0844	220.26	25
86.7-45, August	197.56	0.0901	27.13	0.0811	177.4	10
86.7-45, September	148.95	0.0671	23.15	0.0732	87.57	7
86.7-45, October	119.86	0.054	16.46	0.0653	99	21
86.7-45, November	121.85	0.0597	20.05	0.0646	66.8	10
86.7-45, December	130.22	0.0563	17.98	0.0622	319.75	4
86.7-40, January	225.96	0.0327	12.63	0.0414	356.98	21
86.7-40, February	156.16	0.0524	14.46	0.0434	208.44	17
86.7-40, March	138.07	0.0572	19.22	0.056	72.9	10
86.7-40, April	167.27	0.0587	20.93	0.0641	123	25
86.7-40, May	224.35	0.083	26.32	0.0721	237.15	10
86.7-40, June	225.09	0.094	32.23	0.09	151.5	6
86.7-40, July	225.94	0.0775	22.24	0.0662	211	25
86.7-40, August	170.75	0.0827	23.75	0.073	101.25	8
86.7-40, September	140.67	0.0607	20.06	0.0604	97.6	5
86.7-40, October	115.41	0.0418	14.1	0.0409	102.05	19
86.7-40, November	112.68	0.05	16.7	0.043	77.13	8
86.7-40, December	114.58	0.0574	17.65	0.0665	135	4
86.7-35, January	98.72	0.0444	14.1	0.0457	52.86	22
86.7-35, February	117.03	0.0432	13.35	0.0407	98.44	18
86.7-35, March	143.54	0.0601	18.02	0.0472	98.36	11
86.7-35, April	185.09	0.0613	18.84	0.0546	153.39	27
86.7-35, May	211.94	0.0695	24.54	0.0663	169.29	12
86.7-35, June	225.73	0.0923	29.44	0.0805	170	6
86.7-35, July	268.72	0.0674	20.73	0.0612	286.12	26
86.7-35, August	174.69	0.0679	22.6	0.0661	112.56	9
86.7-35, September	146.83	0.0596	18.44	0.0501	131.14	7

Table K.2 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
86.7-35, October	126.7	0.0446	13.26	0.0418	118	21
86.7-35, November	110.39	0.0472	14.89	0.0396	56.11	9
86.7-35, December	105.32	0.0381	14.28	0.0457	65.6	5
86.7-33, January	116.4	0.0331	11.09	0.0291	103.26	21
86.7-33, February	132.99	0.0509	13.25	0.0357	143.67	12
86.7-33, March	175.97	0.0563	17.27	0.0411	191.35	10
86.7-33, April	265.46	0.0585	19.08	0.0546	290.3	22
86.7-33, May	278.61	0.0814	24.18	0.0664	373.61	9
86.7-33, June	318.88	0.0843	26.78	0.0647	1007.2	5
86.7-33, July	287.86	0.0662	22.71	0.0671	306.7	23
86.7-33, August	215.53	0.0638	20.79	0.051	318.86	7
86.7-33, September	167.38	0.0621	16.68	0.0487	259.43	7
86.7-33, October	126.42	0.0424	12.94	0.0306	103.22	18
86.7-33, November	138.91	0.0435	13.51	0.0384	197.33	9
86.7-33, December	124.75	0.0365	12.84	0.0288	193.5	5
90-120, January	34.95	0.0087	3.07	0.008	36.26	19
90-120, February	32.97	0.0121	3.83	0.0082	22.14	7
90-120, March	38.48	0.0144	4.63	0.0121	16.58	6
90-120, April	42.05	0.015	4.92	0.0126	23.56	18
90-120, May	53.37	0.0214	6.53	0.0166	10.5	3
90-120, June	60.1	0.0222	6.96	0.0168	78	2
90-120, July	52.55	0.0198	5.98	0.0152	34	17
90-120, August	46.27	0.0174	5.42	0.0144	28.06	9
90-120, September	39.59	0.013	4.42	0.0109	38	6
90-120, October	32.27	0.0096	3.32	0.0094	27.94	16
90-120, November	28.84	0.0103	3.29	0.0083	21.25	8
90-120, December	28.95	0.0087	3.19	0.0085	118	1
90-110, January	42.16	0.015	5.06	0.0137	30.87	15
90-110, February	48.39	0.0192	5.79	0.0145	61.67	6
90-110, March	51.27	0.022	6.88	0.021	31.75	8
90-110, April	55.35	0.024	7.28	0.0184	30.53	15
90-110, May	66.75	0.0338	9.43	0.025	14.5	3
90-110, June	76.63	0.0316	10.27	0.0288	77.75	2
90-110, July	70.17	0.0313	9.72	0.0263	32.93	14
90-110, August	61.48	0.0266	8.23	0.0244	44.81	8
90-110, September	50.28	0.0194	6.78	0.0171	27.6	5
90-110, October	45.18	0.0152	5.24	0.0153	43.25	12
90-110, November	37.62	0.0152	5.08	0.0148	22.25	8
90-110, December	37.1	0.0162	4.96	0.0124	63	1
90-100, January	53.01	0.0206	6.67	0.0247	41.83	23
90-100, February	62.74	0.0248	7.34	0.0221	63.38	12
90-100, March	74.48	0.0276	8.81	0.0259	100.28	9
90-100, April	64.82	0.0292	9.19	0.0303	41.14	25
90-100, May	85.76	0.0383	12.69	0.0299	33.13	8
90-100, June	102.59	0.0448	14.09	0.0443	78.9	5
90-100, July	93.73	0.0496	14.47	0.0501	44.65	20
90-100, August	74.07	0.0383	11.38	0.0316	27	10

Table K.2 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
90-100, September	65.25	0.0284	9.4	0.0258	35.17	6
90-100, October	55.42	0.0216	6.97	0.0202	46.89	18
90-100, November	50.95	0.0226	7.28	0.0221	33	9
90-100, December	53.42	0.0242	7.74	0.0226	83	1
90-90, January	72.93	0.0234	6.66	0.022	79.94	24
90-90, February	68.97	0.0293	8.95	0.0273	51.89	16
90-90, March	77.83	0.0384	11.21	0.0398	57.04	12
90-90, April	83.24	0.0442	12.19	0.0455	51.66	24
90-90, May	100.52	0.0501	15.53	0.0564	56.64	12
90-90, June	126.01	0.0471	16.99	0.0549	137.83	8
90-90, July	137.59	0.0493	15.6	0.0473	129.5	24
90-90, August	101.46	0.0529	15.52	0.0497	54.55	11
90-90, September	81.74	0.0374	12.03	0.036	58.78	9
90-90, October	63.11	0.0291	9.22	0.0282	41.24	19
90-90, November	66.8	0.029	9.49	0.0343	58	11
90-90, December	64.98	0.0334	10.28	0.0385	32.33	3
90-80, January	106.63	0.0288	8.02	0.0287	129.48	25
90-80, February	78.09	0.0367	10.99	0.0345	57.57	15
90-80, March	92.93	0.0487	13.9	0.0463	64.42	12
90-80, April	100.7	0.0467	15.4	0.0546	60.85	25
90-80, May	164.06	0.0561	19.46	0.0603	188.73	13
90-80, June	159.06	0.0674	21.42	0.0768	186.63	8
90-80, July	134.23	0.0652	20.16	0.0708	87	24
90-80, August	123.95	0.0657	19.09	0.0617	79.41	11
90-80, September	112.58	0.0429	15.29	0.0568	135.67	9
90-80, October	85.93	0.0382	11.72	0.0392	71.05	19
90-80, November	86.14	0.0412	12.19	0.0487	90	11
90-80, December	79.08	0.0434	12.89	0.0473	45.75	4
90-70, January	106.79	0.034	10.59	0.0389	111.42	24
90-70, February	126.17	0.0413	13.38	0.0488	160.12	17
90-70, March	125.48	0.061	17.72	0.0608	112.25	12
90-70, April	145.84	0.0682	19.04	0.0752	118.34	26
90-70, May	248.14	0.0774	26.49	0.1036	401.23	13
90-70, June	287.53	0.0942	29	0.1001	458.38	8
90-70, July	183.14	0.085	27.16	0.1028	127.42	24
90-70, August	160.06	0.0637	24.09	0.0708	121.64	11
90-70, September	130.95	0.0652	20.33	0.0665	93.11	9
90-70, October	112.56	0.0476	15.76	0.0568	98.75	16
90-70, November	105.07	0.049	16.18	0.0933	95.75	12
90-70, December	101.72	0.0576	16.95	0.0752	73.4	5
90-60, January	108.9	0.0345	11.84	0.0427	106.52	25
90-60, February	113.42	0.0524	14.9	0.0552	107.29	16
90-60, March	129.3	0.071	18.75	0.0641	110.21	14
90-60, April	150.73	0.0773	22.59	0.0905	104.43	24
90-60, May	225.61	0.0937	28.35	0.0999	272.41	13
90-60, June	249.98	0.1112	34.36	0.1128	351.25	8
90-60, July	228.08	0.0961	30.52	0.1019	188.21	24

Table K.2 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
90-60, August	170.64	0.0801	25.46	0.075	121.15	11
90-60, September	133.2	0.0764	21.88	0.075	82.44	9
90-60, October	117.21	0.0537	16.76	0.0692	104.22	18
90-60, November	108.05	0.0561	18.32	0.0812	85.33	12
90-60, December	121.84	0.0588	19.06	0.0914	221.53	5
90-53, January	97.96	0.037	11.71	0.0431	89.33	24
90-53, February	150.47	0.0488	15.43	0.0601	226.5	14
90-53, March	134.06	0.0711	20.87	0.0675	81.46	12
90-53, April	171.95	0.0887	26.99	0.1243	119.55	23
90-53, May	322.87	0.0914	30.56	0.1058	414.45	11
90-53, June	271.72	0.1303	39.75	0.1153	252.07	7
90-53, July	233.72	0.0947	33.24	0.1035	178.13	24
90-53, August	181.51	0.0893	27.65	0.0931	93.56	9
90-53, September	139.66	0.0735	23.42	0.077	79.14	7
90-53, October	111.9	0.0586	17.3	0.0631	82.65	20
90-53, November	121.6	0.0624	18.69	0.1279	133.54	13
90-53, December	104.4	0.0595	18.8	0.0897	60.6	5
90-45, January	104.55	0.0348	10.64	0.0336	106.5	24
90-45, February	130.28	0.0395	13.36	0.0432	164.03	16
90-45, March	128.57	0.0561	17.92	0.0622	91.57	14
90-45, April	163.69	0.0786	24.6	0.1057	116.46	26
90-45, May	300.05	0.0844	25.52	0.0782	333.36	14
90-45, June	250.29	0.1146	36.5	0.1399	276.57	7
90-45, July	252.98	0.0696	25.94	0.0779	257.63	24
90-45, August	163.22	0.0745	23.86	0.0646	115.13	8
90-45, September	135.09	0.0592	19.88	0.0639	132.63	8
90-45, October	120.73	0.0527	14.66	0.0512	117.97	19
90-45, November	137.11	0.0593	18.43	0.0545	178.75	12
90-45, December	95.19	0.0442	16.05	0.0633	54.92	6
90-37, January	98.19	0.0348	11.22	0.0365	84.86	25
90-37, February	112.72	0.0372	13.03	0.0385	110.81	16
90-37, March	124.47	0.0557	17.07	0.0469	81.31	13
90-37, April	150.74	0.0611	18.95	0.0613	111.03	26
90-37, May	240.87	0.0743	23.53	0.0678	233.64	14
90-37, June	204.9	0.0919	29.87	0.0844	116.07	7
90-37, July	186.62	0.0738	23.32	0.08	141.96	25
90-37, August	166.16	0.0698	21.78	0.0621	146.05	10
90-37, September	130.56	0.0535	18.04	0.0539	121	8
90-37, October	104.66	0.0394	13.38	0.0457	79.98	21
90-37, November	113.33	0.0452	14.66	0.0455	121.27	11
90-37, December	116.75	0.0484	15.02	0.0466	215.5	6
90-35, January	105.52	0.0505	15.26	0.0502	68	14
90-35, February	114.73	0.048	16.56	0.0507	59	7
90-35, March	130.95	0.0564	18.53	0.0515	59.83	6
90-35, April	158.9	0.0555	21.31	0.0622	93.88	16
90-35, May	199.24	0.0877	26.79	0.0752	129	5
90-35, June	217.99	0.1007	31.02	0.0968	65	2

Table K.2 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
90-35, July	189.77	0.093	27.12	0.0883	81.47	15
90-35, August	162.98	0.0757	23.05	0.0686	90.71	7
90-35, September	134.84	0.0616	19.42	0.045	44.5	4
90-35, October	111.11	0.0597	15.67	0.0474	56.29	14
90-35, November	105.85	0.0571	15.75	0.0483	55	9
90-35, December	108.26	0.0598	16.07	0.0463	56.5	2
90-30, January	107.58	0.0461	14.82	0.0488	72.56	18
90-30, February	112.56	0.0426	14.21	0.0375	60.4	10
90-30, March	129.3	0.0507	17.19	0.0436	56.61	9
90-30, April	155.48	0.0639	19.38	0.0573	90.03	19
90-30, May	188.6	0.0813	23.17	0.0578	127.25	10
90-30, June	217.39	0.0922	29.44	0.0753	56.17	3
90-30, July	186.96	0.0692	22.88	0.063	116.27	17
90-30, August	160.34	0.0637	19.75	0.0514	132.1	10
90-30, September	128.28	0.0595	17.65	0.0516	28.5	4
90-30, October	105.58	0.0419	13.44	0.0403	65.07	15
90-30, November	97.19	0.0462	13.11	0.0355	47.5	10
90-30, December	93.74	0.0428	12.8	0.0389	44.4	5
90-28, January	120.52	0.0295	10.93	0.0282	124.93	22
90-28, February	118.58	0.0369	12.97	0.0347	109.73	15
90-28, March	143.08	0.0537	17.25	0.0482	112.23	11
90-28, April	183.27	0.0503	18.1	0.0468	155.06	26
90-28, May	214.85	0.0695	22.81	0.0686	187.25	14
90-28, June	238.26	0.0878	27.6	0.0735	255.36	7
90-28, July	211.95	0.0639	19.84	0.0603	198.56	25
90-28, August	169.96	0.0605	20.03	0.0543	146.05	11
90-28, September	142.27	0.0513	16.42	0.0478	173.5	8
90-28, October	104.38	0.0387	12.32	0.0343	73.17	21
90-28, November	105.38	0.04	12.97	0.0341	79.27	11
90-28, December	97.92	0.0385	12.76	0.0381	53.93	7
93.3-120, January	29.4	0.0096	3.04	0.0091	25.13	15
93.3-120, February	33.05	0.0074	3.25	0.0077	50.71	7
93.3-120, March	33.72	0.011	4.04	0.0102	14.25	6
93.3-120, April	38.35	0.0156	4.64	0.0116	16.65	13
93.3-120, May	48.88	0.018	5.98	0.0151	11.17	3
93.3-120, June	54.22	0.019	6.3	0.012	57.5	2
93.3-120, July	46.59	0.0197	5.65	0.0156	21.87	15
93.3-120, August	42.25	0.0156	4.99	0.0123	22.86	7
93.3-120, September	34.73	0.0117	4.03	0.0105	21.2	5
93.3-120, October	29.84	0.009	3.06	0.0075	27.08	13
93.3-120, November	26.49	0.0093	2.99	0.0075	21	8
93.3-120, December	25.7	0.01	2.92	0.0079	53	1
93.3-110, January	42.26	0.0146	4.61	0.0129	39.79	14
93.3-110, February	40.91	0.0152	4.7	0.0116	47.25	8
93.3-110, March	44.14	0.0187	5.92	0.0159	19.79	7
93.3-110, April	49.46	0.0214	6.77	0.0194	17.61	14
93.3-110, May	62.81	0.0289	8.47	0.0231	18.33	3

Table K.2 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
93.3-110, June	70.17	0.0307	9.35	0.0264	32.25	2
93.3-110, July	63.36	0.0264	8.63	0.023	25.93	14
93.3-110, August	56.02	0.0235	7.4	0.0199	27.71	7
93.3-110, September	48.54	0.02	6.13	0.0159	41.8	5
93.3-110, October	41.42	0.0157	4.87	0.0131	33.83	12
93.3-110, November	35.05	0.0145	4.49	0.0103	23.25	8
93.3-110, December	35	0.0141	4.49	0.0127	64	1
93.3-100, January	52.67	0.0179	5.61	0.018	47.98	20
93.3-100, February	47.6	0.0165	5.56	0.0148	42.38	13
93.3-100, March	53.65	0.0236	7.31	0.02	26.8	10
93.3-100, April	62.17	0.0258	7.96	0.0206	41.83	20
93.3-100, May	76.18	0.0344	10.42	0.0284	41	7
93.3-100, June	95.4	0.0332	11.44	0.0308	143.75	4
93.3-100, July	88.47	0.033	10.34	0.0296	69.55	20
93.3-100, August	72.22	0.0316	9.69	0.0311	42.44	8
93.3-100, September	58.8	0.0228	7.87	0.0192	29.5	6
93.3-100, October	52.31	0.0172	5.69	0.0147	51.85	17
93.3-100, November	52.17	0.0202	5.79	0.0176	72.11	9
93.3-100, December	44.35	0.0204	6.04	0.0166	17	1
93.3-90, January	63.2	0.0178	5.66	0.0166	62.64	25
93.3-90, February	67.86	0.0214	6.64	0.0201	62.94	17
93.3-90, March	66.01	0.0291	8.49	0.0242	51.46	12
93.3-90, April	69.96	0.0307	9.77	0.0314	37.72	23
93.3-90, May	111.63	0.0362	12.38	0.0375	135.14	11
93.3-90, June	109.68	0.0416	13.36	0.0384	137.36	7
93.3-90, July	99.64	0.0424	12.4	0.0367	72.04	23
93.3-90, August	87.46	0.0379	12.31	0.0338	39.38	8
93.3-90, September	71.49	0.0284	9.53	0.0251	46.63	8
93.3-90, October	60.7	0.0198	6.67	0.02	57.83	18
93.3-90, November	54	0.0216	7.33	0.0182	34.9	10
93.3-90, December	58.48	0.022	7.15	0.0225	136.67	3
93.3-80, January	61.08	0.0211	6.64	0.0236	50.22	25
93.3-80, February	77.38	0.0264	7.79	0.0226	88.03	16
93.3-80, March	88.74	0.0303	10.28	0.031	100.81	13
93.3-80, April	92.59	0.0336	11.57	0.0377	64.92	24
93.3-80, May	149.56	0.056	16.79	0.0483	212.4	10
93.3-80, June	129.32	0.0586	17.35	0.0475	110.07	7
93.3-80, July	132.53	0.0439	14.38	0.0482	118	24
93.3-80, August	116.38	0.045	14.68	0.0394	112.28	9
93.3-80, September	85.61	0.0381	11.55	0.032	58.67	9
93.3-80, October	81.48	0.0268	8.24	0.0262	88.18	17
93.3-80, November	66.03	0.0233	8.86	0.0244	48	10
93.3-80, December	62.17	0.026	8.15	0.0205	60.88	4
93.3-70, January	78.28	0.0233	7.63	0.0209	69.3	27
93.3-70, February	92.82	0.0293	9.63	0.0298	100.22	16
93.3-70, March	112.94	0.0424	11.57	0.0348	138.29	14
93.3-70, April	104.58	0.0483	14.31	0.0426	63.38	24

Table K.2 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
93.3-70, May	204.48	0.0551	18.07	0.0514	362.05	11
93.3-70, June	157.94	0.0752	21.29	0.0624	139.29	7
93.3-70, July	199.52	0.0628	17.37	0.0535	221.96	23
93.3-70, August	134.01	0.0559	17.61	0.0523	97.39	9
93.3-70, September	103.92	0.0479	14.44	0.0396	71.56	9
93.3-70, October	318.94	0.033	9.89	0.0289	718.97	17
93.3-70, November	85.14	0.0336	10.82	0.0333	85.64	11
93.3-70, December	75.9	0.0318	9.77	0.0282	111.17	3
93.3-60, January	94.97	0.0235	7.68	0.0249	101.3	27
93.3-60, February	82.38	0.0295	9.68	0.0258	77.2	15
93.3-60, March	97.06	0.0374	12.3	0.0386	74.19	15
93.3-60, April	120.85	0.0398	14.64	0.0467	92	23
93.3-60, May	179.86	0.0604	18.57	0.059	262.86	11
93.3-60, June	180.03	0.0739	21.94	0.0581	221.27	8
93.3-60, July	162.39	0.0549	17.45	0.0551	149.04	24
93.3-60, August	132.38	0.0548	17.43	0.0488	94.33	9
93.3-60, September	108.68	0.0458	14.61	0.0458	92.67	9
93.3-60, October	87.71	0.0316	9.71	0.0273	85.67	18
93.3-60, November	78.74	0.0364	10.78	0.032	63.77	11
93.3-60, December	87.7	0.0399	10.83	0.0359	252.33	3
93.3-55, January	103.54	0.0293	10.36	0.0354	104.94	25
93.3-55, February	89.21	0.0308	10.56	0.0293	79.23	15
93.3-55, March	111.61	0.0449	13.47	0.0408	106.17	15
93.3-55, April	135.48	0.0588	16.65	0.0397	102.48	23
93.3-55, May	239.78	0.0744	20.86	0.0626	443.41	11
93.3-55, June	197.93	0.0801	24.83	0.0701	216.25	8
93.3-55, July	192.38	0.0651	19.54	0.0528	187.46	24
93.3-55, August	151.48	0.0522	18.43	0.0506	155.94	8
93.3-55, September	111.56	0.0538	15.45	0.0399	71	8
93.3-55, October	100.26	0.0316	10.66	0.0326	104.66	19
93.3-55, November	85.21	0.0376	11.8	0.0356	64.3	10
93.3-55, December	80.6	0.041	11.68	0.0349	47	3
93.3-50, January	98.06	0.0347	10.01	0.0338	93.33	27
93.3-50, February	89.29	0.0327	10.3	0.0298	88.75	14
93.3-50, March	106.73	0.0466	12.99	0.0396	89.43	15
93.3-50, April	123.56	0.0545	17.04	0.052	76.43	23
93.3-50, May	212.62	0.0551	19.76	0.0519	295.91	11
93.3-50, June	210.51	0.0724	23.73	0.0761	268.56	8
93.3-50, July	185.01	0.0594	18.44	0.0581	183.79	24
93.3-50, August	123.72	0.0517	17.27	0.0454	60.72	9
93.3-50, September	102.93	0.0466	14.49	0.0428	72.67	9
93.3-50, October	103.49	0.0294	10.19	0.0302	119.61	19
93.3-50, November	81.65	0.0402	11.89	0.0368	52.8	10
93.3-50, December	84.7	0.0302	10.98	0.0337	104.38	4
93.3-45, January	102.75	0.0262	8.23	0.028	104.68	28
93.3-45, February	89.61	0.0294	10.07	0.0309	80.77	15
93.3-45, March	107.32	0.0423	13.14	0.0384	77.83	15

Table K.2 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
93.3-45, April	129.35	0.0534	16.79	0.0539	89.61	23
93.3-45, May	256.19	0.0664	20.08	0.0582	382.82	11
93.3-45, June	191.19	0.074	24.32	0.0759	200.06	8
93.3-45, July	217.18	0.0525	17.65	0.0524	248.79	24
93.3-45, August	132.59	0.0541	18.19	0.0496	75.94	8
93.3-45, September	109.98	0.0444	14.41	0.0426	99.22	9
93.3-45, October	87.11	0.035	10.33	0.0306	75.13	19
93.3-45, November	93.23	0.0369	11.86	0.0426	97.1	10
93.3-45, December	81.55	0.0326	11.51	0.0353	74	4
93.3-40, January	94.59	0.0257	8.39	0.0227	91.16	28
93.3-40, February	97.35	0.032	10.11	0.0291	111.63	15
93.3-40, March	102.77	0.0401	13.13	0.0392	66.17	15
93.3-40, April	122.79	0.0397	15.49	0.0402	83.17	23
93.3-40, May	174.31	0.0625	20.01	0.0539	189.95	11
93.3-40, June	186.78	0.071	22.92	0.0604	184.06	8
93.3-40, July	204.66	0.0638	17.87	0.0472	223.13	23
93.3-40, August	144.99	0.053	17.85	0.0582	136.17	9
93.3-40, September	109.57	0.0421	14.42	0.0463	94.89	9
93.3-40, October	110.34	0.0326	10.21	0.0355	132.45	19
93.3-40, November	83.49	0.0368	11.66	0.0304	54.5	10
93.3-40, December	83.81	0.0403	11.23	0.0353	102.75	4
93.3-35, January	133.76	0.0313	8.92	0.0262	156.72	27
93.3-35, February	91.76	0.0387	10.77	0.0318	79.57	15
93.3-35, March	101.39	0.0435	13.68	0.0378	51.64	14
93.3-35, April	123.46	0.051	15.37	0.0468	83.63	23
93.3-35, May	188.38	0.063	19.76	0.0593	222.1	10
93.3-35, June	182.68	0.0727	22.16	0.0739	185.13	8
93.3-35, July	163.09	0.0606	17.11	0.0478	144.33	24
93.3-35, August	135.67	0.0555	17.31	0.0431	103	9
93.3-35, September	109.25	0.0513	14.18	0.0411	84.3	10
93.3-35, October	91.61	0.0335	10.48	0.0307	80.81	18
93.3-35, November	92.24	0.0373	11.57	0.0344	86.7	10
93.3-35, December	87.96	0.0353	11.35	0.0314	99.63	4
93.3-30, January	87.27	0.0294	8.88	0.0275	73.02	28
93.3-30, February	94.96	0.0338	10.78	0.0273	87.36	14
93.3-30, March	105.57	0.0461	13.9	0.0362	57.37	15
93.3-30, April	128.1	0.0518	15.05	0.0473	92.04	24
93.3-30, May	159.91	0.06	20.07	0.0516	118.22	9
93.3-30, June	193.11	0.0675	21.57	0.0537	226.94	8
93.3-30, July	155.37	0.0506	17.57	0.0472	123.75	24
93.3-30, August	131.22	0.0546	17.04	0.0447	85.28	9
93.3-30, September	106.42	0.0409	13.8	0.0358	70.9	10
93.3-30, October	92.02	0.035	10.42	0.0289	81.72	18
93.3-30, November	85.76	0.032	11.14	0.0303	59.11	9
93.3-30, December	82.55	0.0295	10.9	0.0271	57.6	5
93.3-28, January	91.54	0.0272	8.84	0.0276	80.33	27
93.3-28, February	97.59	0.0336	10.99	0.0271	93.13	12

Table K.2 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
93.3-28, March	115.6	0.0447	13.52	0.0361	88.03	16
93.3-28, April	136.24	0.0514	15.44	0.0448	99.86	22
93.3-28, May	168.48	0.0633	20.75	0.0571	135.64	7
93.3-28, June	183.3	0.079	22.15	0.0589	172.86	7
93.3-28, July	240.22	0.0551	17.7	0.0555	293.43	23
93.3-28, August	135.43	0.0567	17.1	0.05	83.94	8
93.3-28, September	103.98	0.0437	13.62	0.0377	56.6	10
93.3-28, October	82.46	0.0311	10.34	0.0339	56.06	17
93.3-28, November	84.94	0.0354	11.18	0.0298	42.88	8
93.3-28, December	83.52	0.0383	10.8	0.0301	60.8	5
93.3-26.7, January	84.17	0.0342	9.81	0.0246	42.95	20
93.3-26.7, February	104.52	0.0355	11.6	0.0277	94.8	5
93.3-26.7, March	133.45	0.042	13.71	0.0386	137.11	9
93.3-26.7, April	166.34	0.0476	16.1	0.0383	140.35	17
93.3-26.7, May	185.08	0.0619	19.61	0.0536	176.4	5
93.3-26.7, June	206.26	0.0741	21.16	0.0578	272.5	3
93.3-26.7, July	198.28	0.0591	19.84	0.0529	160.19	16
93.3-26.7, August	138.92	0.0528	16.14	0.0361	86.5	6
93.3-26.7, September	118.41	0.0423	13.16	0.0319	98.14	7
93.3-26.7, October	93.43	0.0315	10.61	0.025	56.05	11
93.3-26.7, November	92.13	0.0287	10.17	0.0243	80.89	9
93.3-26.7, December	87.09	0.0342	9.96	0.0252	79.83	3

Table K.3: Model 2.1 Predicted Sampling Site Monthly Mean Zooplankton Yields.

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
66.7-80, January	216.95	0.1355	41.81	0.1718	53.5	5
66.7-80, February	245.48	0.1614	43.27	0.1806	165.88	8
66.7-80, March	282.05	0.1413	50.31	0.1496	86.33	3
66.7-80, April	330.52	0.1932	53.38	0.2123	273	14
66.7-80, May	378.87	0.2236	70.29	0.2528	137	5
66.7-80, June	399.02	0.2567	73.57	0.336	121	4
66.7-80, July	378.17	0.2215	68.14	0.2373	278.56	9
66.7-80, August	344.85	0.1993	62.85	0.2192	623	1
66.7-80, September	289.14	0.1783	53.91	0.2314	0	0
66.7-80, October	232.56	0.1433	42.43	0.1792	175.67	6
66.7-80, November	217.32	0.1259	37.74	0.1419	907	1
66.7-80, December	203.67	0.1105	38.01	0.143	105	2
66.7-70, January	226.58	0.1013	34.82	0.1129	121.57	7
66.7-70, February	305.63	0.1064	36.57	0.117	542.67	9
66.7-70, March	333.52	0.1381	45.15	0.1312	772	3
66.7-70, April	381.1	0.1833	51.73	0.2262	318.95	14
66.7-70, May	425.81	0.1799	62.49	0.211	363.43	7

Table K.3 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
66.7-70, June	448.83	0.2177	66.14	0.1751	402.63	4
66.7-70, July	407.02	0.2013	60.31	0.205	349.22	9
66.7-70, August	371.86	0.1836	55.2	0.1803	531.75	2
66.7-70, September	309.86	0.151	48.32	0.1862	0	0
66.7-70, October	251.96	0.1086	37.64	0.1277	241.83	6
66.7-70, November	215.15	0.1065	33.32	0.1024	171	2
66.7-70, December	209.01	0.0979	31.07	0.0875	293	3
66.7-65, January	242.57	0.1156	33.87	0.1155	237.5	3
66.7-65, February	286.51	0.138	39.04	0.1278	497.5	4
66.7-65, March	343.8	0.1558	46.98	0.1361	496	3
66.7-65, April	421.36	0.2172	61.08	0.2115	369.29	7
66.7-65, May	482.15	0.2006	67.95	0.2095	540.7	5
66.7-65, June	496.12	0.1868	65.5	0.1898	704.43	7
66.7-65, July	437.75	0.1981	60.8	0.2137	386.5	10
66.7-65, August	406.36	0.1882	55.99	0.1848	447.5	6
66.7-65, September	380.31	0.1549	49.72	0.1371	3250	1
66.7-65, October	275.63	0.1188	40.33	0.1158	281	4
66.7-65, November	228.83	0.093	34.28	0.1035	172.88	4
66.7-65, December	222.33	0.1067	32.93	0.1232	158	2
66.7-60, January	236.8	0.096	29.8	0.1013	229.31	16
66.7-60, February	279.75	0.1387	39.35	0.1336	221.31	8
66.7-60, March	355.61	0.1602	49.19	0.1394	395.75	4
66.7-60, April	529.52	0.1695	53.81	0.1773	651.85	19
66.7-60, May	519.2	0.215	69.59	0.1944	629.42	8
66.7-60, June	503.62	0.2162	67.92	0.195	525.88	8
66.7-60, July	493.4	0.2187	62.54	0.2035	547.93	14
66.7-60, August	416.01	0.1869	61.37	0.1797	75	1
66.7-60, September	353.42	0.1694	52.83	0.146	191	1
66.7-60, October	284.56	0.1346	42.09	0.1123	151.33	6
66.7-60, November	250.14	0.1331	35.89	0.1039	326	2
66.7-60, December	230.9	0.1076	32.43	0.0997	282.33	3
66.7-55, January	265.49	0.0889	31.17	0.1238	303.06	17
66.7-55, February	299.73	0.1089	41.96	0.1129	260.81	8
66.7-55, March	385.05	0.1557	51.27	0.1554	642.5	4
66.7-55, April	502.28	0.167	56.77	0.1736	465.65	24
66.7-55, May	522.61	0.1965	67.14	0.2257	582.08	13
66.7-55, June	512.03	0.2513	71.91	0.2271	449.23	11
66.7-55, July	493.48	0.1963	64.29	0.2087	413.44	17
66.7-55, August	449.01	0.2104	61.78	0.2046	572.42	6
66.7-55, September	368.86	0.1668	54.29	0.1802	355	2
66.7-55, October	294.91	0.1244	41.2	0.1171	284.44	9
66.7-55, November	257.98	0.1107	36.82	0.108	263.5	4
66.7-55, December	243.9	0.0896	34.04	0.0995	442.5	2
66.7-50, January	308.95	0.202	61.56	0.5432	260.82	14
66.7-50, February	384.09	0.2426	74.04	0.3643	378.13	8
66.7-50, March	445.87	0.2645	89.43	0.4379	214.9	5
66.7-50, April	598.07	0.3439	99.8	0.5006	470.99	21

Table K.3 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
66.7-50, May	596.93	0.3601	117.85	0.5299	448.67	12
66.7-50, June	609.24	0.3891	127.99	0.7603	331.85	10
66.7-50, July	597.7	0.371	118.81	0.5677	473	13
66.7-50, August	522.87	0.3153	108.62	0.4675	334.17	6
66.7-50, September	445.13	0.2835	92.28	0.4147	203.5	2
66.7-50, October	355.08	0.2217	72.92	0.4174	213.44	9
66.7-50, November	326	0.1897	62.58	0.2517	449.75	4
66.7-50, December	296.89	0.1924	60.5	0.2555	198	3
66.7-49, January	366.22	0.3052	93.81	0.6172	96.5	4
66.7-49, February	433.12	0.3552	106.28	0.5302	115	1
66.7-49, March	529.76	0.4473	126.62	0.7939	0	0
66.7-49, April	649.91	0.4305	148.31	0.8742	453.03	8
66.7-49, May	730.99	0.4883	172.23	1.1104	761	1
66.7-49, June	747.46	0.5194	181.6	1.1422	301	2
66.7-49, July	711.83	0.5064	174.09	1.0936	361	2
66.7-49, August	624.4	0.4971	153.61	1.1173	0	0
66.7-49, September	518.94	0.4188	127.27	0.7009	0	0
66.7-49, October	424.75	0.3138	103.11	0.6338	143	1
66.7-49, November	372.45	0.2548	89.85	0.5241	0	0
66.7-49, December	346.97	0.2668	86.02	0.5319	253	2
70-80, January	196.49	0.0776	21.72	0.0685	267.5	17
70-80, February	197.33	0.0837	29.81	0.0907	121.06	8
70-80, March	256.54	0.1004	35.12	0.099	416.92	6
70-80, April	283.5	0.1005	35.01	0.1342	295.79	19
70-80, May	283.53	0.1312	44.18	0.128	160.12	13
70-80, June	325.13	0.1534	45.36	0.1646	356.7	10
70-80, July	345.72	0.1449	41.71	0.1763	417.44	18
70-80, August	270.82	0.1383	42.25	0.1236	180.9	5
70-80, September	226.8	0.1203	35.68	0.1201	114	3
70-80, October	179.86	0.0851	27.47	0.0782	140.8	10
70-80, November	164.85	0.0768	25.23	0.0781	105.25	6
70-80, December	165.5	0.0754	24.36	0.0794	243.33	3
70-70, January	208.65	0.0628	19.34	0.0645	280.11	18
70-70, February	231.55	0.0947	27.24	0.0837	281.81	8
70-70, March	277.31	0.1017	32.31	0.1039	298.83	6
70-70, April	386.58	0.102	31.26	0.0983	491.23	22
70-70, May	415.69	0.1284	41.06	0.1299	750.53	15
70-70, June	412.79	0.1315	43.02	0.1142	688.1	10
70-70, July	379.24	0.1204	38.79	0.1275	473.5	19
70-70, August	306.77	0.1235	39.13	0.1078	340.6	5
70-70, September	262.52	0.0926	33.36	0.0823	453.33	3
70-70, October	215.49	0.0836	25.4	0.0891	263.09	11
70-70, November	180.81	0.0591	23.78	0.0637	147.17	6
70-70, December	181.09	0.0742	22.01	0.0584	358.33	3
70-65, January	200.24	0.0791	24.02	0.0629	265	3
70-65, February	226.36	0.0948	28.39	0.0901	219.75	4
70-65, March	285.29	0.0968	33.66	0.0819	382.88	4

Table K.3 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
70-65, April	352.06	0.1213	39.92	0.114	422.69	8
70-65, May	410.55	0.1518	48.45	0.1161	603.2	5
70-65, June	406.69	0.1486	50.84	0.1444	376.67	3
70-65, July	389.85	0.1325	47.7	0.1344	322.63	8
70-65, August	332.5	0.1348	43.2	0.12	219	2
70-65, September	279.88	0.121	36.95	0.0815	0	0
70-65, October	226.77	0.0886	29.77	0.0803	94	3
70-65, November	197.19	0.0771	25.38	0.0697	173.33	3
70-65, December	190.58	0.0794	24.34	0.0719	212.5	2
70-60, January	206.47	0.0711	21.41	0.0684	222.8	18
70-60, February	251.2	0.0864	29.4	0.0846	282.71	7
70-60, March	320.73	0.1022	34.6	0.0886	428.53	6
70-60, April	338.6	0.1234	37.27	0.1204	290.01	22
70-60, May	448.36	0.1483	45.8	0.14	627.04	15
70-60, June	424.25	0.1642	48.02	0.1393	478.5	10
70-60, July	394.2	0.1495	43.37	0.1335	392.43	20
70-60, August	349.87	0.1437	43.72	0.1272	329.5	5
70-60, September	290.23	0.1219	37.44	0.0905	279.33	3
70-60, October	238.92	0.0966	29.01	0.0835	219.22	9
70-60, November	206.49	0.0856	26.16	0.0702	173.67	6
70-60, December	204.66	0.0778	24.01	0.0668	420.33	3
70-55, January	211.38	0.095	26.3	0.0724	130.63	8
70-55, February	249.45	0.0977	31.78	0.0962	47	2
70-55, March	299.02	0.1311	37.88	0.1039	219	1
70-55, April	363.11	0.1598	43.64	0.1373	265.92	13
70-55, May	443.1	0.1728	54.05	0.154	518.06	8
70-55, June	513.46	0.1842	55.72	0.1483	890.14	7
70-55, July	451.68	0.1824	50.4	0.1486	558.36	11
70-55, August	394.51	0.1501	48.74	0.1326	1414	1
70-55, September	309.93	0.1367	40.63	0.103	176.5	2
70-55, October	253.1	0.0965	31.98	0.0842	206.8	5
70-55, November	215.76	0.0844	27.74	0.083	117	1
70-55, December	205.29	0.0808	26.32	0.0723	0	0
70-51, January	261.99	0.0989	29.59	0.0825	371.88	13
70-51, February	278.83	0.1127	39.32	0.1478	291	6
70-51, March	348.88	0.1426	49.98	0.1369	217	1
70-51, April	481.92	0.1699	56.13	0.173	537.54	13
70-51, May	498.46	0.1742	66.15	0.1783	547.69	8
70-51, June	496.81	0.2428	74.32	0.2763	254.2	5
70-51, July	479.33	0.2183	66.84	0.206	407.18	11
70-51, August	417.15	0.1695	60.93	0.2191	422.38	4
70-51, September	342.38	0.1826	51.99	0.1565	94	1
70-51, October	273.71	0.1321	40.82	0.1188	191.75	4
70-51, November	227.74	0.107	33.67	0.1051	141.1	5
70-51, December	216.36	0.1007	31.34	0.109	210	3
73.3-80, January	177.47	0.0643	21.06	0.0597	275.81	8
73.3-80, February	193.17	0.0728	24.27	0.0621	264.5	7

Table K.3 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
73.3-80, March	203.31	0.09	28.51	0.0883	188.5	5
73.3-80, April	240.54	0.0948	33.28	0.0988	179	13
73.3-80, May	315.71	0.1222	38.63	0.1185	510.78	9
73.3-80, June	316.86	0.1506	42.25	0.1253	590.5	4
73.3-80, July	289.26	0.1261	37.51	0.1234	372.95	10
73.3-80, August	243.05	0.1115	36.42	0.1038	109.25	2
73.3-80, September	203.23	0.0991	30.42	0.0903	0	0
73.3-80, October	184.22	0.065	23.72	0.0667	335.83	6
73.3-80, November	153.01	0.0738	21.59	0.0697	237	2
73.3-80, December	144.9	0.0769	20.83	0.065	62.5	2
73.3-70, January	163.6	0.0677	19.36	0.0498	142.32	11
73.3-70, February	178.1	0.0701	22.05	0.0613	118.65	10
73.3-70, March	219.93	0.0907	26.89	0.0751	175.33	6
73.3-70, April	285.42	0.0999	30.96	0.1272	259.19	16
73.3-70, May	379.12	0.112	35.34	0.1001	746.2	10
73.3-70, June	333.72	0.1419	41.65	0.1309	323.25	4
73.3-70, July	327.81	0.1061	35.11	0.1025	466.32	11
73.3-70, August	273.38	0.1078	34.49	0.0896	338.75	2
73.3-70, September	221.08	0.1023	28.88	0.0855	0	0
73.3-70, October	179.6	0.0742	22.62	0.0688	155.5	6
73.3-70, November	157.19	0.0622	20.12	0.053	117.5	2
73.3-70, December	155.49	0.0623	18.84	0.0474	227.67	3
73.3-65, January	183.69	0.0747	20.82	0.0534	377.33	3
73.3-65, February	195.82	0.0767	24.03	0.0714	157.25	4
73.3-65, March	272.73	0.0891	29.05	0.0768	613.63	4
73.3-65, April	298.27	0.116	36.25	0.1158	191.25	6
73.3-65, May	343.54	0.1231	41.57	0.1182	372.75	4
73.3-65, June	362.76	0.1622	45.8	0.1267	178	1
73.3-65, July	340.47	0.1411	42.24	0.1201	223.1	5
73.3-65, August	299.06	0.1095	38.26	0.103	122	2
73.3-65, September	244.96	0.1083	31.34	0.0847	0	0
73.3-65, October	198.21	0.0805	25.18	0.0694	125.67	3
73.3-65, November	180.65	0.0785	21.66	0.0578	385	2
73.3-65, December	169.89	0.0667	20.86	0.0639	231	2
73.3-60, January	183.41	0.0614	19.65	0.0563	170.57	17
73.3-60, February	217.85	0.0776	24.2	0.0718	239.15	10
73.3-60, March	305.21	0.105	29.44	0.0883	470.57	7
73.3-60, April	291.3	0.1041	32.62	0.1042	238.22	20
73.3-60, May	353.32	0.1241	39.79	0.1392	381.83	13
73.3-60, June	406.29	0.1314	39.96	0.1186	648.2	10
73.3-60, July	353.4	0.1369	39.83	0.1151	364.53	15
73.3-60, August	345.09	0.1119	38.13	0.1081	653.97	5
73.3-60, September	295.23	0.107	32.75	0.0906	1267	2
73.3-60, October	214.72	0.0839	24.4	0.0753	220.5	12
73.3-60, November	187.7	0.0718	22.72	0.0577	217.75	4
73.3-60, December	176.58	0.0651	21.17	0.0637	232	3
73.3-55, January	192.28	0.0828	23.8	0.0622	94.4	5

Table K.3 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
73.3-55, February	225.88	0.0879	27.65	0.0638	127.75	4
73.3-55, March	277.45	0.1079	34.1	0.0845	121	2
73.3-55, April	327.8	0.1205	40.14	0.0993	103.6	5
73.3-55, May	384.73	0.138	45.82	0.1413	367.8	5
73.3-55, June	394.16	0.1522	48.65	0.1198	326.2	5
73.3-55, July	378.78	0.1555	46.31	0.1477	346.2	5
73.3-55, August	346.51	0.1413	43.97	0.1115	0	0
73.3-55, September	312.18	0.1182	36.29	0.1003	1979	1
73.3-55, October	240.73	0.0932	28.32	0.0761	304.25	4
73.3-55, November	193.57	0.0798	24.14	0.0675	158	1
73.3-55, December	181.61	0.0716	22.76	0.0593	0	0
73.3-50, January	238.26	0.1174	33.01	0.1486	308.91	11
73.3-50, February	268.38	0.1594	42.56	0.1616	252.31	8
73.3-50, March	341.36	0.1745	55.3	0.211	600.17	3
73.3-50, April	429.96	0.2174	65.3	0.2503	373.11	14
73.3-50, May	594.89	0.2467	75.61	0.3585	1047.32	11
73.3-50, June	551.1	0.3181	85.33	0.4307	651.88	8
73.3-50, July	526.89	0.2706	75.58	0.3186	657.65	13
73.3-50, August	441.26	0.218	71.12	0.2481	512.4	5
73.3-50, September	406.39	0.1873	60.66	0.2482	2055	2
73.3-50, October	272.18	0.1388	47.24	0.2441	310.1	5
73.3-50, November	228.13	0.1503	39.69	0.1531	267.83	3
73.3-50, December	214.4	0.1194	37.44	0.1205	188.33	3
76.7-100, January	111.03	0.0679	22.99	0.1543	55.6	10
76.7-100, February	125.34	0.0735	23.07	0.0969	41.45	11
76.7-100, March	145.54	0.0896	27.2	0.1177	33	3
76.7-100, April	159.42	0.0963	31.37	0.1116	43.59	17
76.7-100, May	177.58	0.1082	35.25	0.1431	37	4
76.7-100, June	188.79	0.1191	37.27	0.1717	0	0
76.7-100, July	185.53	0.0988	34.86	0.1441	114.77	13
76.7-100, August	158.48	0.099	31.44	0.1299	69.17	6
76.7-100, September	132.75	0.0811	26.19	0.1243	36.5	2
76.7-100, October	114.03	0.0765	21.93	0.0923	46.1	10
76.7-100, November	108.13	0.0744	19.43	0.0824	93.75	8
76.7-100, December	102.78	0.0569	18.87	0.0837	0	0
76.7-90, January	122.7	0.056	16.81	0.0653	114.3	15
76.7-90, February	137.58	0.0594	19.21	0.0551	74.29	14
76.7-90, March	156.93	0.0677	22.4	0.067	101.25	8
76.7-90, April	172.63	0.0883	26	0.0754	83.64	24
76.7-90, May	196.56	0.0969	27.89	0.089	194.95	11
76.7-90, June	195.78	0.0995	31.57	0.1101	105.6	5
76.7-90, July	192.88	0.0998	27.66	0.1176	159.5	23
76.7-90, August	166.31	0.0813	27.2	0.1095	62.22	9
76.7-90, September	141.38	0.085	22.57	0.0802	36.5	2
76.7-90, October	124.92	0.0623	18.73	0.0853	95.15	13
76.7-90, November	125.11	0.0562	16.69	0.0685	138.38	13
76.7-90, December	111.34	0.0575	16.26	0.0541	103	1

Table K.3 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
76.7-80, January	131.49	0.0441	14.02	0.0438	129.91	16
76.7-80, February	150.56	0.0549	16.89	0.0482	112.57	15
76.7-80, March	169.34	0.068	20.2	0.054	138.36	7
76.7-80, April	181.48	0.0759	23	0.0711	103.87	27
76.7-80, May	258.15	0.0733	24.66	0.0741	368.04	14
76.7-80, June	235.58	0.0911	30.03	0.0813	216.4	5
76.7-80, July	240.7	0.0858	25.69	0.0805	224.22	23
76.7-80, August	199.77	0.0763	26.05	0.0729	110.35	10
76.7-80, September	164.5	0.0743	21.75	0.0597	89.5	2
76.7-80, October	132.48	0.0556	17.32	0.0516	74	15
76.7-80, November	133.05	0.0465	15.35	0.0415	136.15	13
76.7-80, December	124.89	0.0555	15.4	0.0503	134.5	2
76.7-70, January	160.24	0.0482	15.08	0.0504	169.25	18
76.7-70, February	163.97	0.0612	19.12	0.0519	98.58	18
76.7-70, March	204.16	0.0834	22.92	0.0695	172.39	9
76.7-70, April	229.65	0.0847	26.16	0.0807	145.94	27
76.7-70, May	278.67	0.0887	27.33	0.0832	304.88	16
76.7-70, June	276.44	0.1096	32.39	0.0873	277	7
76.7-70, July	279.92	0.1096	28.7	0.0864	259.09	23
76.7-70, August	257.08	0.0973	28.63	0.0841	209.36	11
76.7-70, September	196.67	0.0823	24.47	0.0676	183	2
76.7-70, October	153.17	0.0613	18.91	0.0498	98.57	14
76.7-70, November	141	0.0581	16.67	0.0548	118.46	13
76.7-70, December	143.08	0.0456	16.97	0.0456	196.75	4
76.7-60, January	168.64	0.0578	17.49	0.0508	150.17	18
76.7-60, February	190.79	0.0655	20.6	0.0562	142.18	19
76.7-60, March	249.69	0.0871	26.76	0.0872	231.81	9
76.7-60, April	300.45	0.0885	30.28	0.0775	225.89	26
76.7-60, May	326.28	0.1146	34.73	0.0972	339.87	17
76.7-60, June	467.43	0.1204	37.2	0.1104	1186.89	9
76.7-60, July	354.92	0.1196	36.63	0.1124	319.28	24
76.7-60, August	323.92	0.1125	36.74	0.0944	301.17	12
76.7-60, September	244.01	0.1075	30.75	0.0844	105	2
76.7-60, October	181.61	0.0728	22.29	0.0662	105.64	14
76.7-60, November	167.83	0.057	19.1	0.0582	139.67	15
76.7-60, December	165.59	0.0613	18.91	0.0506	280.5	4
76.7-55, January	168.28	0.0512	16.37	0.0542	159.81	24
76.7-55, February	199.35	0.0642	21.31	0.0588	149.48	20
76.7-55, March	238.37	0.0819	26.4	0.0787	207.41	11
76.7-55, April	290.14	0.0832	28.02	0.0852	231.67	33
76.7-55, May	337.46	0.1002	32.21	0.1121	345.9	20
76.7-55, June	334.77	0.127	37.06	0.0987	312.54	13
76.7-55, July	358.24	0.1177	32.76	0.1109	345.68	28
76.7-55, August	308.26	0.1127	33.01	0.0948	309.37	15
76.7-55, September	281.89	0.0976	29.7	0.085	774.25	4
76.7-55, October	193.96	0.0716	21.66	0.066	164.62	21
76.7-55, November	176.53	0.0634	19.45	0.0612	159.97	17

Table K.3 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
76.7-55, December	161.38	0.0636	19.25	0.0538	218	3
76.7-51, January	175.85	0.0546	16.98	0.0576	179.64	21
76.7-51, February	211.9	0.0698	22.88	0.0648	189.03	17
76.7-51, March	253.75	0.092	29.38	0.0798	212.44	9
76.7-51, April	307.5	0.1242	35.24	0.1156	205.86	26
76.7-51, May	375.41	0.1273	40.43	0.1169	387.35	10
76.7-51, June	386.81	0.1554	46.06	0.1235	485.75	4
76.7-51, July	343.75	0.1339	41.14	0.1103	250.08	18
76.7-51, August	312.15	0.1243	38.03	0.1037	259.14	11
76.7-51, September	250.8	0.1064	32.51	0.1156	184	2
76.7-51, October	194.45	0.0839	24.49	0.0728	155.5	14
76.7-51, November	162.31	0.0657	20.74	0.0619	109.07	14
76.7-51, December	154.65	0.0551	19.1	0.0557	204	3
76.7-49, January	244.92	0.2067	62.17	0.3895	79.33	9
76.7-49, February	304.62	0.2007	68.89	0.3325	224.67	9
76.7-49, March	384.21	0.2618	88.81	0.4895	237.5	2
76.7-49, April	466.39	0.3557	107.88	0.688	251.17	18
76.7-49, May	560.95	0.4711	129.27	0.7211	640.33	3
76.7-49, June	597.71	0.4551	141.14	0.6165	151	1
76.7-49, July	574.05	0.4285	132.78	0.7588	303.75	12
76.7-49, August	545.52	0.3559	113.56	0.5776	789.75	8
76.7-49, September	381.07	0.2715	93.51	0.5825	173.5	2
76.7-49, October	277.31	0.2537	72.95	0.6262	98.25	8
76.7-49, November	234.54	0.1853	61.51	0.3581	60.6	10
76.7-49, December	229.24	0.1989	57.5	0.3224	0	0
80-100, January	112.93	0.0507	17.3	0.0833	111.89	18
80-100, February	116.24	0.0511	15.72	0.0477	112.15	13
80-100, March	124.25	0.0624	18.48	0.0546	108.8	5
80-100, April	152.91	0.0594	20.13	0.0559	123.24	23
80-100, May	142.11	0.0706	23.26	0.0766	48.21	7
80-100, June	152.6	0.084	25.61	0.1027	87.6	5
80-100, July	147.87	0.0722	24.7	0.0807	79.95	19
80-100, August	122.27	0.07	21.3	0.0733	37.27	11
80-100, September	104.5	0.0559	17.28	0.0589	47.08	6
80-100, October	88.9	0.0502	14.54	0.0596	37.79	14
80-100, November	82.12	0.0446	13.33	0.0481	43.73	11
80-100, December	85.48	0.0436	13.54	0.0513	0	0
80-90, January	167.3	0.0286	8.41	0.0273	239.64	28
80-90, February	126.59	0.0368	12.18	0.0366	138.41	23
80-90, March	130.82	0.0429	14	0.0437	138.22	16
80-90, April	148.86	0.0485	15.05	0.047	131.77	34
80-90, May	150.41	0.053	18.13	0.0612	141.81	18
80-90, June	187.86	0.0728	22.46	0.0819	233.5	12
80-90, July	205.69	0.0503	16.98	0.0642	229.7	32
80-90, August	139.43	0.0624	19.54	0.0717	81.13	15
80-90, September	111.29	0.0561	15.7	0.0614	59.39	9
80-90, October	94.14	0.0406	12.93	0.0434	59.57	23

Table K.3 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
80-90, November	98.18	0.0356	11.84	0.04	92.82	17
80-90, December	92.84	0.0455	12.95	0.0519	68.5	8
80-80, January	124.7	0.0299	9.23	0.0301	136.88	30
80-80, February	153.23	0.0384	11.94	0.04	180.52	27
80-80, March	135.57	0.0462	14.11	0.0471	138.08	18
80-80, April	141.3	0.0544	15.28	0.0629	113.13	36
80-80, May	201.51	0.0659	19.62	0.067	255.25	18
80-80, June	210.21	0.0749	24.1	0.0754	235	13
80-80, July	203.9	0.0643	18.62	0.07	182.38	32
80-80, August	197	0.0743	20.93	0.0584	200	16
80-80, September	143.45	0.0472	17.43	0.0513	136.15	10
80-80, October	115.24	0.0504	14.86	0.0542	72.23	22
80-80, November	144.52	0.0391	12.93	0.0399	206.53	17
80-80, December	116.28	0.0451	13.73	0.0374	137.89	9
80-70, January	163.5	0.0312	10.35	0.0367	191.19	31
80-70, February	152.53	0.0427	12.91	0.0441	162.42	25
80-70, March	174.42	0.049	16.53	0.0491	194.75	18
80-70, April	261.76	0.0482	16.36	0.0625	278.13	37
80-70, May	247.19	0.0694	22.08	0.0698	285.3	20
80-70, June	265.66	0.0794	26.37	0.0781	356.46	13
80-70, July	252.64	0.0731	21.59	0.0745	235.69	31
80-70, August	394.12	0.0716	23.2	0.0627	824	16
80-70, September	175.54	0.0606	20.39	0.0532	162.15	10
80-70, October	157.24	0.0509	16	0.0519	157	22
80-70, November	135.3	0.0423	14.62	0.0503	131.8	20
80-70, December	128.92	0.0499	16.19	0.0518	117.56	9
80-60, January	151.38	0.0317	11.98	0.0342	151.26	32
80-60, February	180.98	0.0476	15.12	0.042	188.75	24
80-60, March	225.33	0.0561	19.03	0.0534	270.75	20
80-60, April	245.18	0.062	20.51	0.0663	214.15	37
80-60, May	338.92	0.0907	27.1	0.0832	439.81	20
80-60, June	314.42	0.1038	32.29	0.0956	355.14	14
80-60, July	381.84	0.0988	26.96	0.094	439.48	30
80-60, August	273.21	0.0898	27.25	0.076	308.58	16
80-60, September	218.29	0.0798	24.29	0.0686	243.3	10
80-60, October	190.09	0.0586	17.78	0.0529	204.08	24
80-60, November	159.25	0.0634	16.94	0.0574	148.55	20
80-60, December	149.1	0.0532	16.71	0.0525	179	9
80-55, January	185.39	0.0438	13.33	0.0407	208.07	29
80-55, February	235	0.0571	15.2	0.0529	318.12	25
80-55, March	217.59	0.0673	20.34	0.0536	242.37	19
80-55, April	254.24	0.062	21.27	0.0757	225.54	38
80-55, May	275.21	0.0891	27.5	0.0839	248.45	21
80-55, June	349.23	0.0918	32.69	0.0902	488.86	14
80-55, July	277.61	0.0888	27.61	0.1002	235.73	31
80-55, August	252.49	0.079	27.44	0.0824	242.03	15
80-55, September	209.13	0.0916	24.99	0.0727	203.06	9

Table K.3 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
80-55, October	168.72	0.0623	18.47	0.066	146.04	23
80-55, November	145.52	0.0639	17.77	0.0678	106.05	20
80-55, December	150.63	0.0639	18.85	0.0631	178	8
80-51, January	143.32	0.0413	12.96	0.0403	150.4	26
80-51, February	246.08	0.0643	17.94	0.0494	359.7	20
80-51, March	467.6	0.0755	24.98	0.0663	780.54	14
80-51, April	367.87	0.0904	26.38	0.0869	393.83	33
80-51, May	334.75	0.1045	32.93	0.1031	323.14	18
80-51, June	312.5	0.1169	37.47	0.1234	277.8	10
80-51, July	287.89	0.0965	31.68	0.1004	235.93	29
80-51, August	270.02	0.0923	29.76	0.1072	303.96	14
80-51, September	213.61	0.098	26.46	0.0861	223.31	8
80-51, October	156.99	0.0638	19.45	0.082	124.19	21
80-51, November	124.1	0.0549	18.11	0.0613	48.47	17
80-51, December	123.43	0.0523	16.38	0.0518	77.75	8
83.3-110, January	86.95	0.0473	15.43	0.0692	73.4	10
83.3-110, February	90.55	0.0558	16.04	0.0653	58.25	8
83.3-110, March	100.64	0.0567	18.7	0.0689	21.75	2
83.3-110, April	115.25	0.0748	21.02	0.0727	62.63	16
83.3-110, May	123.55	0.0781	24.16	0.096	47	1
83.3-110, June	130.4	0.0834	26.21	0.0855	0	0
83.3-110, July	122.07	0.0874	25.72	0.1394	29.2	10
83.3-110, August	110.42	0.0789	22.36	0.1012	38.57	7
83.3-110, September	94.31	0.0563	18.53	0.0753	14.33	3
83.3-110, October	80.38	0.0438	15.25	0.0555	40.09	11
83.3-110, November	72.17	0.044	13.64	0.0495	29.71	7
83.3-110, December	73.37	0.0445	13.42	0.0438	0	0
83.3-100, January	89.55	0.04	11	0.0343	90.46	13
83.3-100, February	97.65	0.0412	12.44	0.0354	77.56	9
83.3-100, March	103.81	0.0456	13.98	0.0424	53.7	5
83.3-100, April	110.04	0.044	15.29	0.0473	45.85	17
83.3-100, May	122.34	0.057	17.56	0.0522	68	3
83.3-100, June	130.51	0.0606	19.44	0.0641	12	1
83.3-100, July	122.92	0.0547	19.23	0.0628	44	13
83.3-100, August	107.79	0.0563	16.63	0.0521	17.5	8
83.3-100, September	93.32	0.0415	13.53	0.0485	39.33	3
83.3-100, October	77.42	0.0318	11.32	0.0333	27.42	12
83.3-100, November	84.11	0.0301	10.27	0.0326	117.63	8
83.3-100, December	74.01	0.0316	10.28	0.0305	12	1
83.3-90, January	107.04	0.0273	8.73	0.0242	124.98	22
83.3-90, February	114.84	0.0424	12.1	0.0329	120.68	17
83.3-90, March	121.35	0.0462	13.79	0.0411	102.3	10
83.3-90, April	115.2	0.0473	13.02	0.0492	93.08	31
83.3-90, May	159.27	0.0544	16.25	0.0527	201.97	16
83.3-90, June	153.49	0.0591	18.99	0.0624	158.38	13
83.3-90, July	155.73	0.0545	16.1	0.0563	150.31	26
83.3-90, August	128.05	0.056	18.11	0.0541	50.95	11

Table K.3 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
83.3-90, September	107.82	0.0469	14.28	0.0495	92	5
83.3-90, October	87.02	0.0366	11.4	0.036	57	23
83.3-90, November	91.7	0.0383	11.07	0.0329	98.78	9
83.3-90, December	86.95	0.0382	11.43	0.0393	75	3
83.3-80, January	117.27	0.0305	9.89	0.0269	127.11	23
83.3-80, February	115.94	0.0454	13.15	0.0407	103.75	16
83.3-80, March	124.75	0.0509	15.69	0.0521	75.17	12
83.3-80, April	134.17	0.0497	13.71	0.0541	115.48	34
83.3-80, May	171.6	0.059	18.44	0.0527	183.47	16
83.3-80, June	200.36	0.0623	20.88	0.0678	255.5	14
83.3-80, July	189.73	0.0677	18.38	0.0608	183.63	28
83.3-80, August	163.24	0.0643	20.43	0.0586	105.32	11
83.3-80, September	129.42	0.0515	16.6	0.0463	81	6
83.3-80, October	106.96	0.0457	13.2	0.0456	76.43	23
83.3-80, November	130.28	0.0386	12.96	0.0337	247.56	9
83.3-80, December	102.55	0.0392	13.44	0.0405	69	3
83.3-70, January	154.7	0.0387	11.54	0.0376	195.94	24
83.3-70, February	139.7	0.0488	15.18	0.0431	125.88	20
83.3-70, March	164.86	0.0527	15.84	0.0478	209.31	13
83.3-70, April	170.84	0.0513	14.5	0.0534	155.3	37
83.3-70, May	204.36	0.0686	20.61	0.0692	198	20
83.3-70, June	232.74	0.0658	23.52	0.0678	288.38	13
83.3-70, July	212.55	0.0711	20.78	0.074	194.64	29
83.3-70, August	194.19	0.0694	22.53	0.0666	152.75	12
83.3-70, September	165.84	0.0699	19.59	0.057	167.5	6
83.3-70, October	137	0.0452	14.74	0.049	129	21
83.3-70, November	132.78	0.0444	14.25	0.0497	177.18	11
83.3-70, December	118.99	0.0545	16.65	0.0639	48.17	3
83.3-60, January	150.3	0.0355	11.27	0.0375	173.92	28
83.3-60, February	188.08	0.0456	13.16	0.0407	235.35	26
83.3-60, March	186.21	0.0605	18.48	0.0642	192.26	16
83.3-60, April	239.63	0.0551	17.86	0.0547	231.74	37
83.3-60, May	287.77	0.0774	23.64	0.0683	361.26	22
83.3-60, June	295.25	0.0902	29.57	0.0858	355.36	14
83.3-60, July	298.34	0.0741	23.05	0.0732	319.37	31
83.3-60, August	229.63	0.0798	25.62	0.0721	186.48	14
83.3-60, September	171.77	0.075	21.37	0.0587	102	8
83.3-60, October	136.86	0.0538	16.08	0.0517	99.42	26
83.3-60, November	137.14	0.0445	15.39	0.0559	138.88	16
83.3-60, December	150.88	0.0514	16.06	0.0592	238.87	10
83.3-55, January	207.46	0.04	12.73	0.0374	282.73	26
83.3-55, February	162.31	0.0554	16.03	0.0488	147.74	23
83.3-55, March	183.46	0.0659	21.14	0.0578	128.63	12
83.3-55, April	202.69	0.0689	20.94	0.0668	150.83	36
83.3-55, May	261.25	0.0792	24.98	0.0668	272.65	20
83.3-55, June	368.49	0.0937	30.2	0.0972	638.57	14
83.3-55, July	268.93	0.088	24.29	0.0981	251.85	31

Table K.3 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
83.3-55, August	216.72	0.0814	25.75	0.0711	147.79	14
83.3-55, September	176.2	0.0687	21.86	0.0688	138.44	9
83.3-55, October	157.55	0.0461	16.55	0.0584	145.6	25
83.3-55, November	134.79	0.0532	16.71	0.0599	116.5	14
83.3-55, December	138.58	0.0622	18.95	0.0743	156.22	9
83.3-51, January	123.81	0.0427	11.97	0.0415	111.73	28
83.3-51, February	151.93	0.0566	15.99	0.0514	124.29	24
83.3-51, March	206.35	0.0735	22.22	0.0687	190.07	14
83.3-51, April	285.04	0.0774	23.45	0.0708	258.78	36
83.3-51, May	265.58	0.0984	29.54	0.0797	196.45	20
83.3-51, June	286.25	0.1101	33.19	0.102	248.46	13
83.3-51, July	249.37	0.0922	26.2	0.1031	225.49	31
83.3-51, August	196.99	0.0784	26.45	0.0829	83.93	14
83.3-51, September	163.24	0.0773	22.41	0.0736	99	8
83.3-51, October	129.36	0.0494	16.38	0.0509	94.11	27
83.3-51, November	114.73	0.051	16.09	0.0585	67.18	17
83.3-51, December	107.95	0.0498	15	0.0531	64.09	11
83.3-42, January	134.03	0.0769	22.78	0.0989	65	16
83.3-42, February	162.18	0.0726	24.59	0.0762	85.12	13
83.3-42, March	222.38	0.0949	30.83	0.0966	184.25	8
83.3-42, April	286.79	0.13	41.73	0.1718	207.1	21
83.3-42, May	416.26	0.1351	40.68	0.1312	536.77	11
83.3-42, June	354.35	0.1999	56.08	0.2026	338	1
83.3-42, July	301.33	0.1486	45.04	0.1838	171.03	16
83.3-42, August	243.27	0.1277	39.38	0.1357	98.05	10
83.3-42, September	201.87	0.1064	33.52	0.137	109.67	3
83.3-42, October	153.93	0.0856	27.59	0.1015	54.36	14
83.3-42, November	132.57	0.0732	24.34	0.0994	40.92	12
83.3-42, December	131.02	0.0838	23.15	0.1044	60.33	3
83.3-40.6, January	150.07	0.0744	24.03	0.1007	108.1	15
83.3-40.6, February	168.93	0.0817	24.47	0.0878	104.04	13
83.3-40.6, March	222.14	0.1034	30.47	0.1185	249.5	6
83.3-40.6, April	301.49	0.1271	38.96	0.1506	261.85	21
83.3-40.6, May	389.77	0.1279	40.09	0.1653	562.5	11
83.3-40.6, June	324.07	0.1673	52.15	0.2122	36	1
83.3-40.6, July	286.18	0.1311	43.43	0.1773	195.75	16
83.3-40.6, August	246.78	0.1335	39.32	0.1678	162.95	10
83.3-40.6, September	201.63	0.1114	34.49	0.1863	66.67	3
83.3-40.6, October	165.75	0.0949	28.8	0.1143	96.57	14
83.3-40.6, November	133.03	0.0872	25.6	0.1111	37.42	12
83.3-40.6, December	133.81	0.0874	24.5	0.1059	61	2
86.7-110, January	69.2	0.0305	10.69	0.0387	48.9	10
86.7-110, February	71.75	0.0341	10.97	0.0372	43.5	8
86.7-110, March	79.02	0.0443	12.76	0.0464	12.75	2
86.7-110, April	85.55	0.0495	14.67	0.0536	26.33	15
86.7-110, May	99.29	0.0528	17.09	0.0699	23	1
86.7-110, June	106.83	0.0561	18.56	0.0611	0	0

Table K.3 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
86.7-110, July	102.91	0.057	18.14	0.0711	37.1	10
86.7-110, August	92.31	0.0528	15.95	0.0535	38.29	7
86.7-110, September	79	0.0477	13.22	0.0535	20.33	3
86.7-110, October	66.79	0.0301	10.8	0.0343	34.55	11
86.7-110, November	59.89	0.0304	9.53	0.0313	29.63	8
86.7-110, December	59.71	0.0304	9.27	0.0319	0	0
86.7-100, January	72.79	0.0264	8.99	0.0264	57.69	13
86.7-100, February	81.36	0.035	10.41	0.0284	51.89	9
86.7-100, March	90.27	0.0331	11.96	0.0408	48.3	5
86.7-100, April	97.3	0.0413	13.61	0.0451	46.03	18
86.7-100, May	105.58	0.0523	14.82	0.0492	69.67	3
86.7-100, June	114.59	0.0514	16.66	0.0542	0	0
86.7-100, July	114.79	0.0512	17.23	0.0532	52.08	13
86.7-100, August	101.57	0.0458	14.93	0.0419	45.43	7
86.7-100, September	85.77	0.0398	12.28	0.0367	36.33	3
86.7-100, October	71.08	0.0326	9.93	0.0298	32.58	12
86.7-100, November	65.03	0.0296	8.94	0.0289	37	7
86.7-100, December	65.32	0.0251	8.74	0.0248	0	0
86.7-90, January	84.42	0.0352	10.99	0.0399	58.71	21
86.7-90, February	116.99	0.0291	9.44	0.027	150.17	18
86.7-90, March	106.93	0.0397	13.19	0.0359	87.65	10
86.7-90, April	158.71	0.0434	11.33	0.045	182.19	32
86.7-90, May	118.78	0.0425	13.77	0.048	123.66	16
86.7-90, June	123.89	0.0478	16.2	0.0453	98.91	11
86.7-90, July	151.35	0.0403	14.22	0.0457	162.02	27
86.7-90, August	117.7	0.0501	16.85	0.0508	40.8	10
86.7-90, September	97.35	0.0429	13.18	0.036	51.8	5
86.7-90, October	85.25	0.0286	10.31	0.037	68.05	22
86.7-90, November	80.85	0.0298	9.64	0.0294	83	11
86.7-90, December	76.84	0.0317	10.17	0.0296	60	1
86.7-80, January	128.96	0.0287	9.41	0.0258	177.64	21
86.7-80, February	112.05	0.0406	11.88	0.0387	99.7	20
86.7-80, March	116.44	0.0416	13.93	0.0373	79.17	12
86.7-80, April	134.56	0.0443	12.64	0.047	124.05	33
86.7-80, May	157.18	0.0555	16.33	0.0511	175.62	17
86.7-80, June	163.97	0.0654	19.48	0.052	146.58	12
86.7-80, July	199.54	0.0576	16.98	0.0553	220.57	27
86.7-80, August	152.83	0.0625	19.61	0.0639	100.1	10
86.7-80, September	123.53	0.0498	15.49	0.0461	101.33	6
86.7-80, October	104.84	0.0362	11.85	0.0421	91.1	21
86.7-80, November	102.51	0.0376	11.55	0.0316	120.27	11
86.7-80, December	93.8	0.0351	12.48	0.0456	107.75	2
86.7-70, January	120.67	0.044	14.65	0.0497	94.7	20
86.7-70, February	122.84	0.0329	11.57	0.0341	126.07	22
86.7-70, March	131.43	0.0445	14.68	0.0448	114.09	11
86.7-70, April	193.53	0.0382	13.79	0.0493	196.61	35
86.7-70, May	218.8	0.0662	20.11	0.0612	267.13	19

Table K.3 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
86.7-70, June	240.49	0.0709	21.96	0.0579	382.23	13
86.7-70, July	191.73	0.0626	20.92	0.0692	164.92	30
86.7-70, August	178.1	0.0849	22.53	0.0676	128.2	10
86.7-70, September	145.22	0.0545	17.87	0.054	109.29	7
86.7-70, October	146.93	0.0397	13.13	0.0429	172.59	22
86.7-70, November	117.21	0.0421	13.7	0.0412	117.9	10
86.7-70, December	113.02	0.0456	13.68	0.0471	262.5	3
86.7-60, January	147.59	0.0311	10.17	0.0337	190.79	25
86.7-60, February	142.15	0.0376	11.36	0.0417	148.62	27
86.7-60, March	247.9	0.0578	16.55	0.0494	512.93	14
86.7-60, April	179.69	0.0496	17.28	0.0556	155.13	34
86.7-60, May	250.99	0.0665	21.03	0.0714	314.25	21
86.7-60, June	272.85	0.0932	26.93	0.0885	347.27	15
86.7-60, July	368.21	0.0635	20.63	0.0725	458.84	32
86.7-60, August	209.9	0.0718	23.2	0.0587	200.06	11
86.7-60, September	164.73	0.064	19.27	0.0605	166.67	9
86.7-60, October	133.28	0.0433	14.45	0.0671	116.36	25
86.7-60, November	118.23	0.046	14.1	0.0468	105.06	17
86.7-60, December	121.46	0.0546	15.57	0.0697	146.29	8
86.7-55, January	127.73	0.0361	12.07	0.0357	118.61	25
86.7-55, February	133.12	0.0451	13.53	0.0419	115.87	23
86.7-55, March	173.71	0.0711	21.46	0.0769	138.73	13
86.7-55, April	199.69	0.0798	21.75	0.0747	153.34	30
86.7-55, May	281.04	0.0708	21.72	0.0718	315.38	20
86.7-55, June	269	0.0889	27.98	0.0773	329.64	14
86.7-55, July	242.48	0.075	22.43	0.083	222.83	32
86.7-55, August	209.74	0.0714	24.17	0.0801	190.5	10
86.7-55, September	165.76	0.0634	20.18	0.0558	150.67	9
86.7-55, October	149.74	0.0473	14.77	0.0562	151.56	25
86.7-55, November	125.89	0.0528	15.21	0.0532	114.27	15
86.7-55, December	145.25	0.0462	14.83	0.061	299.67	9
86.7-50, January	129.55	0.0351	13.08	0.0393	120.58	26
86.7-50, February	180.59	0.0476	13.93	0.042	227.74	23
86.7-50, March	181.91	0.0534	20.07	0.0569	154.09	17
86.7-50, April	320	0.0733	23.93	0.0866	330.65	35
86.7-50, May	377.85	0.0802	24.84	0.0904	496.17	21
86.7-50, June	519.6	0.1145	35.24	0.11	1114.93	15
86.7-50, July	411.93	0.0805	26.42	0.0867	482.66	31
86.7-50, August	222.15	0.0898	27.45	0.0751	159.54	12
86.7-50, September	178.54	0.0761	22.05	0.0753	193	10
86.7-50, October	166.85	0.0517	15.84	0.0571	183.68	25
86.7-50, November	125.81	0.0565	16.91	0.0609	87.69	13
86.7-50, December	145.56	0.0448	13.99	0.0431	302	10
86.7-45, January	113.85	0.0387	12.99	0.0442	91.28	25
86.7-45, February	135.07	0.0514	15.11	0.0533	118.62	21
86.7-45, March	169.69	0.0553	19.87	0.0626	135.34	16
86.7-45, April	215.05	0.0885	26.9	0.1025	157.78	30

Table K.3 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
86.7-45, May	296.27	0.0862	26.2	0.1016	310.55	20
86.7-45, June	309.02	0.1218	35.89	0.1235	376.14	14
86.7-45, July	341.55	0.0796	26.94	0.0922	374.25	32
86.7-45, August	221.06	0.0881	27.9	0.1081	183.42	12
86.7-45, September	159.14	0.0714	22.47	0.0854	118.1	10
86.7-45, October	131.04	0.059	17.35	0.0813	100.5	26
86.7-45, November	123.87	0.0476	16.88	0.0633	89.8	15
86.7-45, December	124.75	0.052	14.46	0.064	200.67	9
86.7-40, January	203.85	0.0384	11.49	0.0478	289.34	28
86.7-40, February	156.04	0.0426	13.89	0.0558	185.34	25
86.7-40, March	141.18	0.0543	18.39	0.0586	87.18	17
86.7-40, April	178.47	0.0687	21.03	0.0958	141.94	34
86.7-40, May	227.82	0.0885	25.25	0.1085	243.92	19
86.7-40, June	234.7	0.1048	31.41	0.1069	181.79	14
86.7-40, July	244.93	0.0917	26.42	0.1413	227.03	31
86.7-40, August	187.92	0.0892	26.81	0.1101	119.9	10
86.7-40, September	153.38	0.0713	22.58	0.0865	135.38	8
86.7-40, October	119.74	0.0591	17.5	0.1137	93.26	23
86.7-40, November	112.98	0.0576	18.08	0.0814	74.77	13
86.7-40, December	116.34	0.0645	20.47	0.0956	109.6	10
86.7-35, January	94.17	0.0457	15.5	0.0565	53.36	28
86.7-35, February	119.69	0.0539	16.14	0.073	97.21	24
86.7-35, March	149.61	0.0687	21.63	0.0962	97.94	16
86.7-35, April	191.64	0.0802	24.32	0.1255	156.51	34
86.7-35, May	224.92	0.0966	30.77	0.1556	187.37	19
86.7-35, June	253.33	0.1184	38.13	0.1486	194.46	13
86.7-35, July	365.53	0.1048	31.36	0.139	426.39	31
86.7-35, August	203.27	0.0979	33.21	0.1494	124.33	12
86.7-35, September	166.65	0.0874	26.9	0.1149	140.33	9
86.7-35, October	129.8	0.0648	19.8	0.096	105.8	25
86.7-35, November	110.55	0.0579	19.32	0.0881	50	12
86.7-35, December	101.1	0.0533	16.95	0.0786	69.7	10
86.7-33, January	113.55	0.0514	16.77	0.0933	103.26	21
86.7-33, February	142.03	0.0698	21.87	0.1107	143.67	12
86.7-33, March	194.6	0.102	28.95	0.117	191.35	10
86.7-33, April	274.79	0.1111	34.63	0.213	290.3	22
86.7-33, May	309.66	0.1582	44.32	0.3321	373.61	9
86.7-33, June	365.75	0.1785	51.29	0.2862	1007.2	5
86.7-33, July	336.84	0.1882	53.02	0.2856	306.7	23
86.7-33, August	263.16	0.1364	43.17	0.1621	318.86	7
86.7-33, September	194.99	0.112	33.29	0.1567	259.43	7
86.7-33, October	139.79	0.081	24.91	0.1308	103.22	18
86.7-33, November	140.47	0.071	22.53	0.0899	197.33	9
86.7-33, December	122.46	0.0599	19.33	0.1033	193.5	5
90-120, January	51.77	0.0301	9.44	0.0552	36.6	20
90-120, February	55.93	0.0381	11.17	0.0601	29.13	8
90-120, March	62.27	0.0393	13.33	0.0591	17.79	7

Table K.3 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
90-120, April	70.22	0.0486	15.47	0.0735	35.24	21
90-120, May	83.22	0.0544	18.3	0.0953	40.42	6
90-120, June	90.58	0.0686	20.16	0.1107	78	2
90-120, July	83.91	0.057	19.36	0.0919	34	17
90-120, August	76.56	0.0561	16.99	0.0818	28.06	9
90-120, September	66.96	0.045	14.19	0.1193	35.14	7
90-120, October	53.49	0.0399	11.48	0.0829	27.94	16
90-120, November	50.43	0.031	10.09	0.0347	21.25	8
90-120, December	50.99	0.0293	9.53	0.0332	118	1
90-110, January	62.15	0.0233	6.87	0.0219	67	17
90-110, February	60.7	0.0248	8.08	0.0225	66.57	7
90-110, March	64.74	0.0306	9.73	0.0329	32.44	9
90-110, April	71.74	0.0347	11.35	0.0411	33.28	18
90-110, May	82.85	0.0455	13.35	0.0508	32.92	6
90-110, June	91.1	0.0468	14.86	0.0565	63.5	3
90-110, July	87.68	0.0462	14.44	0.0516	32.67	15
90-110, August	79.52	0.0409	12.63	0.0476	44.81	8
90-110, September	67.81	0.0316	10.44	0.0336	29.67	6
90-110, October	58.23	0.0243	8.29	0.0261	43.25	12
90-110, November	50.97	0.0259	7.47	0.0302	22.25	8
90-110, December	50.12	0.023	7.06	0.0214	63	1
90-100, January	60.49	0.0237	6.8	0.0227	49.76	25
90-100, February	67.98	0.0253	8.02	0.0303	61.5	13
90-100, March	82.34	0.0315	9.96	0.0275	95.55	10
90-100, April	79.57	0.045	11.66	0.0431	44.91	29
90-100, May	94.55	0.0428	12.21	0.0413	79.33	12
90-100, June	105.75	0.0492	15.38	0.0444	70.81	8
90-100, July	99.86	0.0506	15.32	0.0531	44.5	22
90-100, August	87.82	0.0445	13.41	0.0393	28.91	11
90-100, September	76.33	0.0336	10.91	0.0363	39	7
90-100, October	63.4	0.0267	8.32	0.0287	46.89	18
90-100, November	57.58	0.027	7.76	0.024	33	9
90-100, December	57.35	0.0275	7.47	0.0213	69	2
90-90, January	99.03	0.0193	6.52	0.0205	126.02	28
90-90, February	72.88	0.0267	7.8	0.0223	57.96	21
90-90, March	84.59	0.0245	8.88	0.0295	85.98	20
90-90, April	109.15	0.0379	10.19	0.04	104.72	33
90-90, May	99.91	0.0429	12.63	0.0465	79.03	21
90-90, June	126.48	0.0461	13.45	0.0494	164.62	14
90-90, July	143.89	0.0392	12.82	0.0491	149.1	31
90-90, August	108.49	0.045	15.2	0.0443	50.23	13
90-90, September	87.61	0.0352	11.86	0.0409	56.3	10
90-90, October	66.35	0.0262	8.63	0.0339	46.52	24
90-90, November	68.66	0.0283	8.6	0.0307	58	11
90-90, December	65.55	0.0279	8.64	0.0266	45.83	6
90-80, January	116.49	0.0186	6.7	0.0216	147.53	30
90-80, February	88.29	0.0258	8.4	0.0269	89.26	23

Table K.3 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
90-80, March	92.96	0.0337	10.53	0.0329	77.7	20
90-80, April	104.46	0.0418	11.97	0.0441	78.95	33
90-80, May	173.4	0.0456	14.77	0.0498	208.61	22
90-80, June	151.84	0.0499	15.69	0.0637	171.53	16
90-80, July	138.98	0.0525	15.99	0.0512	104.32	31
90-80, August	134.13	0.057	18.14	0.0619	79.12	13
90-80, September	117.28	0.0426	14	0.0477	126.5	10
90-80, October	88.28	0.0315	10.03	0.0372	73.08	24
90-80, November	89.14	0.0313	9.86	0.0319	100.85	13
90-80, December	81.43	0.0306	9.93	0.0355	84.44	9
90-70, January	104.19	0.0247	7.99	0.0284	113.07	30
90-70, February	153.08	0.0295	9.24	0.031	216.13	26
90-70, March	121.96	0.0371	12.16	0.0411	124.33	21
90-70, April	139.24	0.0424	12.72	0.0468	125.85	35
90-70, May	221.58	0.0563	16.9	0.0503	320.57	21
90-70, June	257.1	0.0722	20.17	0.0565	313.94	16
90-70, July	209.06	0.0521	16.65	0.0597	221.44	32
90-70, August	217.83	0.0575	17.78	0.0553	373.6	15
90-70, September	129.37	0.0546	16.89	0.0524	83.32	14
90-70, October	105.12	0.0415	11.18	0.053	96.58	24
90-70, November	99.39	0.0373	11.38	0.0356	90.38	16
90-70, December	91.67	0.0332	10.62	0.0405	89.27	11
90-60, January	112.78	0.0271	8.68	0.0295	119.84	31
90-60, February	118.1	0.0305	10.52	0.0334	123.41	25
90-60, March	140.63	0.048	13.07	0.0426	151.26	23
90-60, April	201.86	0.048	16.18	0.0569	205.7	33
90-60, May	232.3	0.0577	19.23	0.0687	292.7	22
90-60, June	239.62	0.0702	23.58	0.0673	295.24	17
90-60, July	225.55	0.0588	20.5	0.0736	211.24	33
90-60, August	189.45	0.0678	20.36	0.0569	179.18	15
90-60, September	140.09	0.0606	18.59	0.0535	75.4	14
90-60, October	120.25	0.0401	12.49	0.047	113.52	27
90-60, November	120.46	0.0451	13.25	0.0528	126.11	18
90-60, December	114.19	0.0417	12.42	0.0436	152.59	13
90-53, January	114.42	0.0316	10.22	0.0315	116.21	28
90-53, February	149.04	0.0418	13.31	0.0438	201.88	17
90-53, March	153.75	0.0607	19.36	0.0616	96.32	14
90-53, April	184.72	0.0674	23.61	0.0725	119.47	25
90-53, May	307.15	0.0932	24.69	0.0726	377.92	13
90-53, June	260.49	0.0993	30.75	0.0926	241.94	9
90-53, July	237.88	0.0923	27.63	0.0845	180.19	26
90-53, August	200.47	0.0834	24.89	0.0772	127.73	11
90-53, September	147.26	0.0578	20.25	0.058	75.56	9
90-53, October	117.14	0.0413	14.77	0.0496	80.96	23
90-53, November	117.81	0.0466	13.7	0.0517	136.87	15
90-53, December	99.36	0.0409	13.39	0.0418	55.5	6
90-45, January	102.57	0.0312	9.59	0.0296	99.39	31

Table K.3 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
90-45, February	130.99	0.0363	12.08	0.0486	140.54	25
90-45, March	133.83	0.0513	16.35	0.0626	95.91	23
90-45, April	172.24	0.0867	23.35	0.099	123.23	35
90-45, May	331.95	0.079	22.78	0.0937	382.83	23
90-45, June	326.41	0.0947	32.42	0.1162	487.44	16
90-45, July	257.21	0.0764	25.19	0.101	242.59	32
90-45, August	199.82	0.0727	25.3	0.0812	184.92	12
90-45, September	154.41	0.066	21.13	0.0864	110.31	13
90-45, October	141.33	0.0453	15.3	0.062	137.13	28
90-45, November	150.28	0.0481	15.32	0.0544	200.89	18
90-45, December	99.96	0.0387	13.33	0.0479	88.04	14
90-37, January	95.47	0.033	9.64	0.0387	88.2	32
90-37, February	113.07	0.0389	11.61	0.0502	114.63	24
90-37, March	119.61	0.0545	15.38	0.0588	81.36	22
90-37, April	144.03	0.0676	18.5	0.0947	106.08	35
90-37, May	229.91	0.0755	22.66	0.0876	200	22
90-37, June	209.88	0.0866	28.15	0.1136	162.47	16
90-37, July	205.37	0.0782	24.36	0.1021	169.09	34
90-37, August	180.43	0.0784	23.89	0.1134	157.75	14
90-37, September	139.77	0.0668	20.11	0.0686	94.87	13
90-37, October	107.37	0.0492	14.82	0.0626	80.26	29
90-37, November	115.27	0.039	14.44	0.0559	122.24	17
90-37, December	108.85	0.0474	13.65	0.0559	136.29	14
90-35, January	94.49	0.0394	12.23	0.041	68	14
90-35, February	107.76	0.0483	14.26	0.0515	59	7
90-35, March	126.26	0.0513	16.93	0.0574	59.83	6
90-35, April	154.33	0.07	20.24	0.0883	93.88	16
90-35, May	197.09	0.0927	24.9	0.1086	202.5	6
90-35, June	215.82	0.1026	29.43	0.0958	113.67	3
90-35, July	200.43	0.1084	29.24	0.0981	81.47	15
90-35, August	175.24	0.0819	25.89	0.1039	90.71	7
90-35, September	139.79	0.0646	20.81	0.0712	44.5	4
90-35, October	110.68	0.0566	16.27	0.0551	56.29	14
90-35, November	97.24	0.0412	14.49	0.0496	55	9
90-35, December	93.08	0.0477	13.22	0.0517	56.5	2
90-30, January	91.27	0.0369	12.95	0.0524	69.36	25
90-30, February	106.29	0.0457	14.74	0.081	71.37	19
90-30, March	128.86	0.0559	18.43	0.0925	84.97	18
90-30, April	162.24	0.0781	22.02	0.1352	127.02	27
90-30, May	190.3	0.0962	26.96	0.1192	145.92	18
90-30, June	228.84	0.1125	33.08	0.115	202.83	11
90-30, July	198.9	0.0925	29.33	0.1382	143.19	25
90-30, August	184.26	0.0798	26.68	0.1378	197	13
90-30, September	136.98	0.0756	23.08	0.1084	50.88	8
90-30, October	105.37	0.0524	17.19	0.0888	70.91	23
90-30, November	89.84	0.0478	15.16	0.072	48.33	15
90-30, December	85.28	0.0413	13.88	0.0621	57	10

Table K.3 - continued

LS-Month	**Mean**	**$\mathbf{MCSE_{Mean}}$**	**SD**	**$\mathbf{MCSE_{SD}}$**	**OBS Mean**	**OBS Count**
90-28, January	102.81	0.0369	10.87	0.0639	112.84	28
90-28, February	109.52	0.044	14.17	0.0833	101.43	23
90-28, March	139.45	0.0599	19.33	0.0975	115.03	19
90-28, April	178.12	0.0762	22.1	0.162	157.8	33
90-28, May	216.42	0.0973	27.43	0.1522	197.75	22
90-28, June	264.39	0.1091	32.45	0.1596	325.03	15
90-28, July	221.54	0.0953	28.52	0.2896	206.82	33
90-28, August	184.3	0.1013	29.42	0.3367	145.46	14
90-28, September	141.25	0.0758	23.05	0.1451	126.46	13
90-28, October	100.32	0.0609	17.46	0.1061	70.7	30
90-28, November	94.46	0.0438	15.61	0.0726	81.44	16
90-28, December	87.79	0.0503	15.58	0.0844	51.54	14
93.3-120, January	47.52	0.0262	9.12	0.0313	25.13	15
93.3-120, February	51.82	0.0276	10.03	0.0602	50.71	7
93.3-120, March	56.48	0.0359	12.37	0.0803	14.25	6
93.3-120, April	64.09	0.0521	14.87	0.085	16.65	13
93.3-120, May	75.6	0.0578	17.1	0.081	11.17	3
93.3-120, June	81.63	0.0615	18.64	0.0831	57.5	2
93.3-120, July	76.82	0.0553	17.99	0.1031	21.87	15
93.3-120, August	69.99	0.0474	15.95	0.0843	22.86	7
93.3-120, September	60.14	0.0387	13	0.0603	22.17	6
93.3-120, October	49.87	0.0347	10.54	0.0535	27.08	13
93.3-120, November	45.84	0.029	9.3	0.0417	21	8
93.3-120, December	45.11	0.0269	8.82	0.0336	53	1
93.3-110, January	54.16	0.0252	8.11	0.0238	39.79	14
93.3-110, February	54.47	0.0279	8.51	0.0287	47.25	8
93.3-110, March	59.31	0.0362	10.37	0.037	19.79	7
93.3-110, April	66.76	0.0373	12.54	0.0479	17.61	14
93.3-110, May	78.3	0.0438	14.2	0.052	18.33	3
93.3-110, June	85.75	0.049	16.1	0.0646	32.25	2
93.3-110, July	83.29	0.0549	15.85	0.068	25.93	14
93.3-110, August	75.34	0.046	13.8	0.0569	27.71	7
93.3-110, September	65.88	0.0329	11.36	0.0475	40	6
93.3-110, October	54.64	0.0288	9.03	0.0397	33.83	12
93.3-110, November	48.62	0.0275	7.99	0.0276	23.25	8
93.3-110, December	47.81	0.0276	7.56	0.031	64	1
93.3-100, January	60.1	0.0224	7.87	0.0223	47.98	20
93.3-100, February	58.74	0.0277	8.62	0.0297	42.38	13
93.3-100, March	65.98	0.0343	10.72	0.0392	26.8	10
93.3-100, April	76.62	0.0416	12.55	0.0407	41.83	20
93.3-100, May	84.98	0.0438	13.48	0.0578	56.5	8
93.3-100, June	106.49	0.05	17.07	0.0639	143.75	4
93.3-100, July	105.89	0.0521	17.04	0.078	69.55	20
93.3-100, August	89.43	0.0491	15.01	0.0539	42.44	8
93.3-100, September	74.28	0.0376	12.13	0.05	30	7
93.3-100, October	63.39	0.0322	9.21	0.0321	51.85	17
93.3-100, November	62.05	0.0273	8.46	0.0257	72.11	9

Table K.3 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
93.3-100, December	54.75	0.0247	8.18	0.024	19	2
93.3-90, January	69.97	0.0222	7.62	0.0233	64.44	27
93.3-90, February	75.49	0.0273	9.32	0.0337	59.53	19
93.3-90, March	76.19	0.0411	11.36	0.0363	51.83	15
93.3-90, April	87.93	0.0403	11.34	0.0508	70.89	31
93.3-90, May	114.33	0.0433	13.68	0.0542	127.64	18
93.3-90, June	146.98	0.0445	14.91	0.0556	277.27	13
93.3-90, July	124.39	0.0403	14.95	0.0612	112.6	30
93.3-90, August	105.87	0.0534	17.56	0.0687	41.33	9
93.3-90, September	86.63	0.0409	13.41	0.0551	46.33	9
93.3-90, October	72.02	0.033	9.96	0.0392	59.74	19
93.3-90, November	64.42	0.0295	9.52	0.0361	38.73	11
93.3-90, December	66.76	0.0237	9	0.024	103.5	4
93.3-80, January	69.22	0.0282	8.66	0.0261	51.2	28
93.3-80, February	91.25	0.0301	11.06	0.0341	90.24	19
93.3-80, March	102.98	0.0437	12.75	0.0493	107.15	17
93.3-80, April	109.01	0.0465	14.61	0.0475	77.53	32
93.3-80, May	196.74	0.0542	17.16	0.0516	323.94	18
93.3-80, June	129.74	0.0572	17.61	0.0666	119.3	15
93.3-80, July	172.29	0.0536	16.06	0.0572	185.03	31
93.3-80, August	136.43	0.0731	20.87	0.0886	100.14	11
93.3-80, September	102.93	0.0562	15.76	0.0532	54.9	10
93.3-80, October	91.51	0.0368	11.39	0.0455	86.47	19
93.3-80, November	78.45	0.0379	10.58	0.0332	63.15	13
93.3-80, December	72.25	0.0279	9.25	0.0253	81.25	6
93.3-70, January	85.02	0.0278	9.31	0.0308	69.87	31
93.3-70, February	113.25	0.0331	10.57	0.0358	143.63	20
93.3-70, March	123.87	0.0378	12.57	0.0406	141.36	22
93.3-70, April	133.96	0.0536	17.83	0.0674	102.03	33
93.3-70, May	192.99	0.0701	19	0.0722	246.76	19
93.3-70, June	200.02	0.076	21.89	0.075	277.94	16
93.3-70, July	210.57	0.0831	22.56	0.0976	218.55	29
93.3-70, August	161.82	0.0718	26.09	0.0974	84.77	11
93.3-70, September	130.19	0.0609	21.11	0.0713	66.68	11
93.3-70, October	293.21	0.0449	12.93	0.0493	649.87	19
93.3-70, November	97.45	0.0471	13.69	0.0469	82.86	14
93.3-70, December	84.77	0.035	10.75	0.0303	100.9	5
93.3-60, January	125.56	0.0329	10.52	0.0406	132.72	32
93.3-60, February	112.35	0.0386	11.59	0.0452	124.3	23
93.3-60, March	116.29	0.0477	14.53	0.0506	92.31	22
93.3-60, April	140.36	0.0524	17.42	0.0638	107.38	32
93.3-60, May	207.77	0.0678	20.79	0.0693	260.68	20
93.3-60, June	213.61	0.0753	24.81	0.0832	243.42	17
93.3-60, July	226.53	0.078	26.19	0.099	213.83	30
93.3-60, August	175.7	0.0746	27.17	0.0874	86.91	11
93.3-60, September	140.89	0.0685	21.31	0.078	92.67	11
93.3-60, October	106.23	0.0486	14.47	0.0579	82.73	22

Table K.3 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
93.3-60, November	98.68	0.0492	14.61	0.0671	68.11	14
93.3-60, December	99.83	0.0449	13.54	0.0557	139	6
93.3-55, January	116.7	0.0464	14.45	0.0527	102.33	26
93.3-55, February	112.6	0.0459	15.36	0.0516	75.72	16
93.3-55, March	136.6	0.0527	18.38	0.0545	101.22	16
93.3-55, April	152.93	0.063	20.14	0.0744	104.14	28
93.3-55, May	249.99	0.0694	23.63	0.0818	357.97	18
93.3-55, June	259.68	0.088	27.12	0.0988	370.56	16
93.3-55, July	234.61	0.0918	27.79	0.1046	209.53	30
93.3-55, August	194.55	0.1068	27.98	0.0901	145.28	9
93.3-55, September	149.84	0.0765	22.47	0.0747	103.43	10
93.3-55, October	119.08	0.0471	14.93	0.0708	127.24	23
93.3-55, November	99.02	0.0492	15.11	0.0604	61.08	12
93.3-55, December	93.12	0.0433	13.85	0.0541	76	5
93.3-50, January	138.31	0.0335	11.54	0.0546	147.83	35
93.3-50, February	108.47	0.0397	12.89	0.043	106.07	23
93.3-50, March	128.66	0.0545	16.79	0.0685	110.46	23
93.3-50, April	157.78	0.0787	23.84	0.1275	107.06	32
93.3-50, May	231.55	0.0769	23.66	0.0917	263.45	20
93.3-50, June	268.39	0.096	30.98	0.1199	323.32	17
93.3-50, July	227.02	0.0844	25.3	0.1064	209.55	33
93.3-50, August	179.19	0.0709	25.6	0.0883	137.5	13
93.3-50, September	138.23	0.0628	22.96	0.0814	69.55	14
93.3-50, October	121.56	0.0441	14.64	0.0643	123.44	27
93.3-50, November	96.73	0.0487	16.03	0.0676	51.75	14
93.3-50, December	92.49	0.0406	13.36	0.0546	85.32	11
93.3-45, January	107.54	0.0371	11.09	0.0453	101.9	29
93.3-45, February	105	0.0408	14.04	0.0533	78.03	17
93.3-45, March	128.03	0.0592	18.2	0.0677	73.79	17
93.3-45, April	164.12	0.0864	25.47	0.1396	110.07	27
93.3-45, May	266.51	0.0909	24.77	0.1076	312.68	19
93.3-45, June	244.65	0.1105	34.33	0.1367	247.78	16
93.3-45, July	289.67	0.0863	25.37	0.1179	326.28	32
93.3-45, August	189.37	0.0874	30.49	0.1146	76.83	9
93.3-45, September	148.21	0.0704	23.53	0.0827	99.47	12
93.3-45, October	112.12	0.0495	16.89	0.0789	101.46	23
93.3-45, November	110.16	0.057	16.92	0.0781	86.83	12
93.3-45, December	94.67	0.0554	15.14	0.055	73.67	6
93.3-40, January	92.77	0.0343	9.45	0.0474	86.76	36
93.3-40, February	104.83	0.0344	12.34	0.0527	106.35	24
93.3-40, March	111.64	0.043	16.1	0.0664	70.02	23
93.3-40, April	142.87	0.0575	19.59	0.1246	109.16	32
93.3-40, May	177.94	0.0833	24.04	0.1025	161.13	20
93.3-40, June	214.82	0.1023	28.7	0.1276	205.38	16
93.3-40, July	240.37	0.0845	25.15	0.1454	244.47	32
93.3-40, August	178.75	0.0935	26.97	0.1057	127.65	13
93.3-40, September	141.7	0.0808	23.36	0.0914	92.74	14

Table K.3 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
93.3-40, October	142.21	0.0491	15.48	0.0806	178.18	28
93.3-40, November	100.58	0.0576	17.35	0.081	59.86	14
93.3-40, December	93.11	0.0513	14.92	0.0769	95.64	11
93.3-35, January	125	0.0376	10.45	0.0498	151.2	28
93.3-35, February	99.49	0.0433	14.05	0.0537	74.03	17
93.3-35, March	109.2	0.0602	16.72	0.0699	47	16
93.3-35, April	133.23	0.0652	19.77	0.1117	88.7	28
93.3-35, May	189.62	0.0701	23.34	0.1022	186.72	18
93.3-35, June	195.22	0.1	27.26	0.1287	170.69	16
93.3-35, July	170.8	0.0805	23.63	0.1273	137.44	32
93.3-35, August	184.72	0.0766	24.28	0.093	248.09	11
93.3-35, September	131.92	0.0616	21.64	0.0803	78.26	13
93.3-35, October	105.82	0.0531	15.3	0.0712	103.11	22
93.3-35, November	96.62	0.0447	14.69	0.0549	74.69	13
93.3-35, December	88.4	0.0387	12.83	0.0417	71.5	7
93.3-30, January	81.08	0.0312	9.48	0.0692	71.18	36
93.3-30, February	92.11	0.0421	11.94	0.0644	82.43	23
93.3-30, March	107.82	0.0559	15.7	0.0792	72.9	24
93.3-30, April	126.74	0.0604	18.19	0.0995	98.64	33
93.3-30, May	173.15	0.0714	23.85	0.0969	163.47	18
93.3-30, June	202.56	0.0883	26.62	0.1267	221.78	16
93.3-30, July	162.88	0.078	24.02	0.1418	126.55	33
93.3-30, August	153.96	0.0801	24.04	0.1358	135.73	13
93.3-30, September	120.64	0.0624	19.97	0.1144	81	15
93.3-30, October	90.28	0.0491	14.35	0.105	74.28	27
93.3-30, November	82.51	0.0469	13.48	0.0682	53.69	13
93.3-30, December	77.96	0.0373	11.99	0.0468	64.08	12
93.3-28, January	84.77	0.035	10.33	0.052	80.33	27
93.3-28, February	95.06	0.0447	13.24	0.0649	86.27	13
93.3-28, March	118.06	0.0534	17.38	0.0892	83.32	17
93.3-28, April	138.68	0.0723	20.62	0.0994	97.48	23
93.3-28, May	179.36	0.0875	28.18	0.1206	124.69	8
93.3-28, June	202.55	0.1023	32.48	0.1204	153.75	8
93.3-28, July	239.62	0.0935	27.04	0.1643	283	24
93.3-28, August	154.86	0.0909	27.28	0.1281	76.5	9
93.3-28, September	114.7	0.0648	20.61	0.0933	64.36	11
93.3-28, October	83.63	0.05	15.6	0.0827	54.33	18
93.3-28, November	79.25	0.0452	14.18	0.0697	41.89	9
93.3-28, December	77.34	0.0385	13.01	0.0632	52.83	6
93.3-26.7, January	81.22	0.0522	16.06	0.1284	42.95	20
93.3-26.7, February	101.84	0.0616	18.12	0.09	94.8	5
93.3-26.7, March	137	0.0718	23.12	0.112	137.11	9
93.3-26.7, April	169.59	0.0991	28.47	0.1662	140.35	17
93.3-26.7, May	201.97	0.11	36.03	0.1688	176.4	5
93.3-26.7, June	231.89	0.1598	41.85	0.256	272.5	3
93.3-26.7, July	217.78	0.141	40.54	0.2178	160.19	16
93.3-26.7, August	168.33	0.1193	34.73	0.2004	86.5	6

Table K.3 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
93.3-26.7, September	131.36	0.0965	26.58	0.14	98.14	7
93.3-26.7, October	98.23	0.076	20.92	0.1488	56.05	11
93.3-26.7, November	87.42	0.0627	17.79	0.1505	80.89	9
93.3-26.7, December	82.11	0.0475	16.73	0.0786	79.83	3

Table K.4: Model 2.2 Predicted Sampling Site Monthly Mean Zooplankton Yields.

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
66.7-80, January	154.67	0.0988	30.61	0.14	53.5	5
66.7-80, February	177.8	0.088	30.48	0.1244	165.88	8
66.7-80, March	201.87	0.1153	36.71	0.109	86.33	3
66.7-80, April	262.59	0.1165	39.95	0.1346	288.5	12
66.7-80, May	295.85	0.1704	56.55	0.1993	137.5	2
66.7-80, June	304.73	0.2095	57.57	0.2024	183.5	2
66.7-80, July	285.17	0.1549	50.57	0.1725	329.8	5
66.7-80, August	242.7	0.136	43.82	0.1588	623	1
66.7-80, September	192.06	0.1099	36.03	0.1226	0	0
66.7-80, October	157.9	0.0952	28.71	0.1159	162	4
66.7-80, November	158.94	0.0875	27.02	0.1107	907	1
66.7-80, December	148.36	0.0851	28.4	0.0995	105	2
66.7-70, January	199.62	0.1171	31.89	0.1011	127.83	6
66.7-70, February	276.19	0.1006	30.7	0.0922	542.67	9
66.7-70, March	286.85	0.1283	38.56	0.1182	772	3
66.7-70, April	335.3	0.1387	45.73	0.1546	334.17	13
66.7-70, May	390.83	0.1819	59.61	0.1765	482.25	4
66.7-70, June	408.88	0.1896	63.21	0.1991	640.25	2
66.7-70, July	369.37	0.1896	56.44	0.2003	407.8	5
66.7-70, August	318.07	0.1568	47.69	0.1332	531.75	2
66.7-70, September	253.5	0.1239	40.51	0.1084	0	0
66.7-70, October	213.71	0.113	31.59	0.0904	309.75	4
66.7-70, November	189.64	0.0993	30.41	0.0831	171	2
66.7-70, December	186.73	0.0941	27.92	0.0855	293	3
66.7-65, January	218.57	0.0906	31.28	0.091	318.25	2
66.7-65, February	247.97	0.1032	33.44	0.1113	497.5	4
66.7-65, March	287.66	0.1128	39.19	0.1284	496	3
66.7-65, April	361.95	0.1514	56.36	0.1683	361.25	4
66.7-65, May	424.75	0.2375	65.85	0.1705	324	1
66.7-65, June	431.4	0.2192	64.24	0.197	660.5	2
66.7-65, July	385.8	0.2024	58.38	0.158	254	3
66.7-65, August	347.99	0.1545	49.33	0.1936	628	2
66.7-65, September	269.89	0.1371	42.3	0.121	0	0
66.7-65, October	222.71	0.1089	34.83	0.0977	112.5	2
66.7-65, November	201.15	0.115	31.54	0.1093	140	2

Table K.4 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
66.7-65, December	196.84	0.0914	30.08	0.0915	158	2
66.7-60, January	205.13	0.0914	25.42	0.0867	212.14	14
66.7-60, February	236.74	0.0987	32.81	0.0927	221.31	8
66.7-60, March	305.59	0.1237	42.69	0.1179	395.75	4
66.7-60, April	515.14	0.1818	49.65	0.158	699.36	17
66.7-60, May	486.27	0.2311	71.61	0.2613	621.07	5
66.7-60, June	483.27	0.2516	70.75	0.2123	482	4
66.7-60, July	489.77	0.2108	65.46	0.2002	625.25	8
66.7-60, August	385.23	0.1984	59.18	0.2045	75	1
66.7-60, September	310.89	0.1555	47.85	0.117	191	1
66.7-60, October	256.21	0.1384	39.44	0.1181	160.5	4
66.7-60, November	234.95	0.1219	34.7	0.1016	326	2
66.7-60, December	214.67	0.1026	30.53	0.0945	282.33	3
66.7-55, January	218.93	0.0842	27.7	0.0925	223.21	14
66.7-55, February	256.83	0.1074	35.59	0.1027	260.81	8
66.7-55, March	341.09	0.1329	44.71	0.1353	642.5	4
66.7-55, April	485.71	0.206	56.11	0.2024	490.79	17
66.7-55, May	544.24	0.2518	72.21	0.1954	968.3	5
66.7-55, June	525.36	0.2369	77.67	0.2182	557.88	4
66.7-55, July	511.8	0.1974	70.59	0.2188	431.31	8
66.7-55, August	409.66	0.1866	62.61	0.1836	250.75	2
66.7-55, September	335.29	0.1601	51.06	0.1514	179	1
66.7-55, October	279.11	0.1226	40.94	0.11	294.4	5
66.7-55, November	250.72	0.1356	37.03	0.1097	337	2
66.7-55, December	232.77	0.1007	32.95	0.0819	442.5	2
66.7-50, January	267.12	0.1404	46.84	0.2221	273.27	13
66.7-50, February	321.6	0.1697	57.61	0.2108	378.13	8
66.7-50, March	368.88	0.2261	72.17	0.294	214.9	5
66.7-50, April	563.16	0.303	87.48	0.4943	537.52	15
66.7-50, May	571.88	0.3183	114.3	0.4198	427.8	5
66.7-50, June	611.78	0.3901	126.31	0.5403	337.63	4
66.7-50, July	580.88	0.3894	117.32	0.4895	452.38	8
66.7-50, August	493.55	0.377	103	0.4231	240	2
66.7-50, September	401.35	0.2749	82.55	0.3286	106	1
66.7-50, October	323.55	0.2167	66.09	0.2373	232	6
66.7-50, November	306.01	0.1915	57.71	0.1946	743.5	2
66.7-50, December	268.13	0.1863	53.99	0.261	198	3
66.7-49, January	309.33	0.2505	75.58	0.3088	96.5	4
66.7-49, February	342.02	0.2452	81.97	0.3766	115	1
66.7-49, March	428.1	0.3197	99.33	0.4853	0	0
66.7-49, April	568.2	0.444	125.53	1.1398	453.03	8
66.7-49, May	675.95	0.4991	155.97	0.8737	761	1
66.7-49, June	722.1	0.5366	171.55	0.7148	301	2
66.7-49, July	687.62	0.5493	165.46	0.8832	361	2
66.7-49, August	570.31	0.4376	139.33	0.9227	0	0
66.7-49, September	446.33	0.3193	108.19	0.4478	0	0
66.7-49, October	377.53	0.273	89.66	0.3817	143	1

Table K.4 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
66.7-49, November	326.03	0.2436	78.37	0.3728	0	0
66.7-49, December	301.55	0.2172	73.04	0.3831	253	2
70-80, January	163.08	0.0561	17.39	0.07	242.25	14
70-80, February	156.35	0.0807	24.15	0.0891	121.06	8
70-80, March	212.18	0.0901	27.55	0.083	481.3	5
70-80, April	235.29	0.0987	29.27	0.0902	267.29	14
70-80, May	258.37	0.1235	41.56	0.1349	151.5	5
70-80, June	273.54	0.1358	41.53	0.1358	397.67	3
70-80, July	242.52	0.126	38.15	0.1409	191.7	10
70-80, August	215.03	0.1026	33.86	0.1121	201.75	2
70-80, September	175.48	0.0933	27.68	0.0851	203	1
70-80, October	144.66	0.0718	22.66	0.0678	128.4	5
70-80, November	135.87	0.0702	21.21	0.0682	112.67	3
70-80, December	140.75	0.0701	20.75	0.0703	243.33	3
70-70, January	175.65	0.0529	16.69	0.0456	231.67	15
70-70, February	205.72	0.0846	23.98	0.0708	281.81	8
70-70, March	243.56	0.0899	28.24	0.0836	315.8	5
70-70, April	360.04	0.0882	29.18	0.1008	532.6	15
70-70, May	344.44	0.1417	43.66	0.1288	454.21	7
70-70, June	363.4	0.1583	44.46	0.1229	876.67	3
70-70, July	325.81	0.1233	39.82	0.1215	405.05	10
70-70, August	266.15	0.1051	35.12	0.092	432	2
70-70, September	206.18	0.0806	28.47	0.0726	193	1
70-70, October	175.8	0.0783	22.94	0.0619	195.5	6
70-70, November	160.1	0.0738	22.13	0.0694	121.33	3
70-70, December	170.08	0.0656	20.84	0.0567	358.33	3
70-65, January	183.03	0.0685	22.2	0.0666	265	3
70-65, February	195.48	0.071	25.01	0.0713	219.75	4
70-65, March	248.39	0.0824	29.37	0.0656	382.88	4
70-65, April	312.93	0.1123	36.71	0.103	455.75	6
70-65, May	387.49	0.161	48.25	0.1321	775.33	3
70-65, June	378.53	0.1854	51.27	0.1565	195	1
70-65, July	347.93	0.1463	45.44	0.1435	256.6	5
70-65, August	292.91	0.1142	39.86	0.123	219	2
70-65, September	233.47	0.0965	31.44	0.0835	0	0
70-65, October	198.19	0.0823	26.97	0.0745	129	2
70-65, November	185	0.082	25.09	0.071	173.33	3
70-65, December	178.5	0.0725	23.61	0.0649	212.5	2
70-60, January	194.48	0.059	18.92	0.0525	236.9	16
70-60, February	223.08	0.0808	25.99	0.0763	282.71	7
70-60, March	290.22	0.0966	30.68	0.0761	500.63	5
70-60, April	309.43	0.1056	35.42	0.1061	283.15	15
70-60, May	383.87	0.144	46.98	0.124	482.24	7
70-60, June	393.62	0.1547	49.28	0.1167	559.67	3
70-60, July	358.03	0.1569	44.82	0.1296	330.97	11
70-60, August	308.76	0.1235	41.62	0.1286	226	2
70-60, September	247.28	0.1095	33.14	0.079	164	1

Table K.4 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
70-60, October	212	0.102	28.05	0.0679	177.5	4
70-60, November	193.96	0.0844	26.3	0.0667	151.33	3
70-60, December	192.99	0.08	22.96	0.0656	420.33	3
70-55, January	204.09	0.0885	26.22	0.0757	131.5	6
70-55, February	226.32	0.0999	29.68	0.0798	47	2
70-55, March	270.65	0.1233	35.56	0.0957	219	1
70-55, April	362.86	0.1528	46.05	0.1247	273.33	6
70-55, May	464.44	0.2211	60.96	0.1475	0	0
70-55, June	469.59	0.2205	62.85	0.1778	0	0
70-55, July	429.88	0.1853	57.19	0.1619	270	3
70-55, August	373.1	0.1745	50.19	0.1296	0	0
70-55, September	296.47	0.1403	39.93	0.1203	191	1
70-55, October	247.97	0.1253	32.96	0.0828	192.5	2
70-55, November	217.32	0.1006	29.33	0.0703	0	0
70-55, December	205.98	0.0891	27.01	0.0779	0	0
70-51, January	254.24	0.0943	26.66	0.0876	371.88	13
70-51, February	243.96	0.1301	33.84	0.1089	291	6
70-51, March	312.01	0.1423	46	0.1312	217	1
70-51, April	476.96	0.1893	52.52	0.1756	574.67	12
70-51, May	508.1	0.209	65.47	0.1849	693.75	6
70-51, June	510.19	0.2529	77.81	0.2307	297	4
70-51, July	489.95	0.2603	70.3	0.2213	407.11	9
70-51, August	407.6	0.2082	62.25	0.2038	482.75	2
70-51, September	321.25	0.129	49.57	0.1461	0	0
70-51, October	264.6	0.1336	39.81	0.1216	191.75	4
70-51, November	220.32	0.1113	34.03	0.1137	133	3
70-51, December	207.52	0.083	30.51	0.0867	210	3
73.3-80, January	158.8	0.062	17.99	0.0529	275.81	8
73.3-80, February	165.21	0.0737	19.75	0.0587	264.5	7
73.3-80, March	165.73	0.0761	23.21	0.0643	188.5	5
73.3-80, April	197.85	0.0791	26.06	0.0764	194	11
73.3-80, May	257.25	0.1004	33.51	0.0998	485.8	5
73.3-80, June	250.37	0.1172	37.86	0.1087	222	1
73.3-80, July	227.7	0.0966	33.6	0.0989	219.92	6
73.3-80, August	196.23	0.0811	29.02	0.0799	109.25	2
73.3-80, September	160.59	0.0702	24.16	0.0665	0	0
73.3-80, October	150.04	0.0622	19.69	0.0613	310.25	4
73.3-80, November	131.07	0.0627	18.96	0.0608	237	2
73.3-80, December	125.92	0.0667	18.95	0.0602	62.5	2
73.3-70, January	148.89	0.0551	17.12	0.0429	146.15	10
73.3-70, February	159.33	0.0654	19.96	0.0588	123.06	9
73.3-70, March	192.51	0.0752	23.62	0.0674	175.33	6
73.3-70, April	265.14	0.0958	29.8	0.0839	249.54	13
73.3-70, May	368.96	0.1089	37.02	0.0991	912.5	6
73.3-70, June	320.84	0.143	42.72	0.0997	368	1
73.3-70, July	298.9	0.1227	37.28	0.1088	358.25	6
73.3-70, August	248.24	0.1001	32.35	0.0882	338.75	2

Table K.4 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
73.3-70, September	198.15	0.0807	26.69	0.0775	0	0
73.3-70, October	158.63	0.0661	21.52	0.0628	85.75	4
73.3-70, November	147.24	0.0663	19.63	0.0618	117.5	2
73.3-70, December	153.84	0.0637	19.14	0.0506	227.67	3
73.3-65, January	179.86	0.0665	20.44	0.0573	377.33	3
73.3-65, February	179.46	0.0743	22.41	0.0538	157.25	4
73.3-65, March	257.45	0.0806	26.89	0.0764	613.63	4
73.3-65, April	278.17	0.1106	35.74	0.093	193.13	4
73.3-65, May	338.48	0.151	43.52	0.1318	451	3
73.3-65, June	358.6	0.1597	48.84	0.1503	178	1
73.3-65, July	328.62	0.1526	43.25	0.1076	244.5	3
73.3-65, August	276.41	0.1104	37.06	0.0876	122	2
73.3-65, September	223.27	0.0903	29.21	0.0845	0	0
73.3-65, October	188.46	0.0836	24.83	0.0644	134.5	2
73.3-65, November	185.43	0.0765	23.6	0.0648	385	2
73.3-65, December	172.34	0.0608	22.1	0.0612	231	2
73.3-60, January	170.01	0.05	17.51	0.0426	179.44	15
73.3-60, February	195.04	0.0689	21.1	0.0517	256.17	9
73.3-60, March	285.48	0.0759	25.93	0.0711	470.57	7
73.3-60, April	268.63	0.101	32.87	0.0925	196.32	14
73.3-60, May	362.34	0.1386	43.85	0.129	444.05	7
73.3-60, June	418.28	0.1553	45.02	0.1368	874.6	5
73.3-60, July	364.97	0.1456	46.49	0.139	337.25	8
73.3-60, August	301.35	0.1261	39.84	0.1041	141.67	2
73.3-60, September	244.8	0.0897	31.86	0.082	0	0
73.3-60, October	197.24	0.0809	24.31	0.0643	180.57	7
73.3-60, November	183.94	0.0686	22.71	0.0614	344.5	2
73.3-60, December	172.03	0.0683	21.24	0.0637	232	3
73.3-55, January	182.65	0.0778	23.42	0.0668	100	3
73.3-55, February	206.39	0.0842	26.17	0.066	143.67	3
73.3-55, March	254.6	0.1031	32.59	0.0779	67	1
73.3-55, April	322.37	0.1314	41.43	0.1112	125.33	3
73.3-55, May	406.62	0.1383	50.98	0.1361	909	1
73.3-55, June	410.76	0.1902	54.82	0.1596	161	1
73.3-55, July	387.58	0.1925	51.14	0.1455	0	0
73.3-55, August	328.67	0.1317	43.53	0.1137	0	0
73.3-55, September	263.37	0.1272	34.61	0.1017	0	0
73.3-55, October	228.54	0.0764	27.53	0.0741	455	2
73.3-55, November	191.56	0.0849	25.06	0.0716	0	0
73.3-55, December	181.91	0.081	23.73	0.0678	0	0
73.3-50, January	231.79	0.1015	30.45	0.0979	308.91	11
73.3-50, February	244.5	0.1375	37.96	0.1435	252.31	8
73.3-50, March	318.47	0.1596	51.18	0.1702	600.17	3
73.3-50, April	444.02	0.2119	64.96	0.2255	485.85	10
73.3-50, May	649.4	0.3003	81.52	0.3435	1507.21	7
73.3-50, June	567.83	0.3057	92.78	0.2765	817.67	3
73.3-50, July	512.1	0.2395	83.22	0.3091	508.56	8

Table K.4 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
73.3-50, August	440.09	0.2642	72.42	0.2249	849	2
73.3-50, September	338.62	0.2063	60.86	0.2052	0	0
73.3-50, October	268.39	0.1431	45.91	0.1502	446.83	3
73.3-50, November	230.83	0.1324	40.69	0.1451	375.5	2
73.3-50, December	216.69	0.1317	38.7	0.1322	188.33	3
76.7-100, January	81.56	0.0417	14.56	0.054	55.6	10
76.7-100, February	91.31	0.0534	16.73	0.0621	41.45	11
76.7-100, March	103.88	0.0604	19.25	0.0655	33	3
76.7-100, April	115.42	0.0778	22.27	0.0873	43.59	17
76.7-100, May	133.93	0.0819	25.7	0.0829	37	4
76.7-100, June	144.83	0.0988	28.26	0.095	0	0
76.7-100, July	145.11	0.0782	25.7	0.1276	114.77	13
76.7-100, August	117.92	0.0773	22.72	0.0865	69.17	6
76.7-100, September	93.9	0.0538	17.49	0.0894	36.5	2
76.7-100, October	85.5	0.045	15.95	0.0655	46.1	10
76.7-100, November	86.45	0.0464	15.28	0.0733	93.75	8
76.7-100, December	83.27	0.0412	15.69	0.0611	0	0
76.7-90, January	102.01	0.0327	11.34	0.0303	114.3	15
76.7-90, February	113.24	0.052	15.67	0.0503	74.29	14
76.7-90, March	124.73	0.0538	17.3	0.0528	96.43	7
76.7-90, April	137.05	0.0632	19.45	0.0557	87.19	22
76.7-90, May	154.89	0.0735	23.47	0.0751	123.19	8
76.7-90, June	170.9	0.0861	27.89	0.0823	96	1
76.7-90, July	163.25	0.0716	24.86	0.0959	119.86	18
76.7-90, August	132.94	0.0726	21.58	0.0715	62.22	9
76.7-90, September	112.09	0.0518	17.23	0.0485	36.5	2
76.7-90, October	104.56	0.0421	14.96	0.0454	91.33	12
76.7-90, November	110.03	0.0441	13.77	0.0596	143.17	12
76.7-90, December	98.45	0.0537	14.82	0.0516	103	1
76.7-80, January	122.28	0.0424	12.18	0.0316	129.91	16
76.7-80, February	138.54	0.0482	15.61	0.0398	112.57	15
76.7-80, March	150.67	0.0638	17.93	0.0422	138.36	7
76.7-80, April	160.39	0.0681	19.66	0.0608	106.34	25
76.7-80, May	224.95	0.0763	26.45	0.0692	236.28	9
76.7-80, June	228.6	0.1049	31.01	0.0889	173	1
76.7-80, July	224.36	0.0822	27.09	0.0823	171.28	18
76.7-80, August	182.49	0.0783	23.6	0.0679	110.35	10
76.7-80, September	152.01	0.0626	20.18	0.0513	89.5	2
76.7-80, October	121.83	0.0502	16.55	0.056	62.85	13
76.7-80, November	128.39	0.0479	14.68	0.0467	136.15	13
76.7-80, December	125.72	0.0508	16.25	0.0457	134.5	2
76.7-70, January	154.8	0.0423	13.73	0.0347	172.21	17
76.7-70, February	152.71	0.0588	18.29	0.0539	99.85	17
76.7-70, March	185.49	0.0691	20.52	0.0593	172.39	9
76.7-70, April	209	0.0728	22.83	0.0603	148.89	25
76.7-70, May	270.13	0.1155	30.46	0.0889	242.86	11
76.7-70, June	274.43	0.1085	35.16	0.0921	242	3

Table K.4 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
76.7-70, July	247.96	0.0921	31.62	0.1019	150.11	18
76.7-70, August	248.09	0.0928	27.71	0.07	209.36	11
76.7-70, September	191.62	0.0752	24.3	0.0661	183	2
76.7-70, October	148.63	0.0622	19.29	0.057	91	12
76.7-70, November	141.88	0.0538	17.38	0.0435	118.92	12
76.7-70, December	149.42	0.0542	18.75	0.048	210.33	3
76.7-60, January	155.94	0.0492	15.79	0.04	156.13	16
76.7-60, February	169.6	0.0543	17.9	0.0494	146.56	17
76.7-60, March	223.88	0.077	23.11	0.0612	231.81	9
76.7-60, April	277.05	0.0829	26.77	0.0752	231.89	24
76.7-60, May	320.92	0.1063	37.75	0.1162	300.67	11
76.7-60, June	461.16	0.1173	38.61	0.1109	1973	4
76.7-60, July	334.64	0.1136	38.57	0.1395	282.43	18
76.7-60, August	287.32	0.0978	31.74	0.0884	302	11
76.7-60, September	217.27	0.0711	27.71	0.0736	105	2
76.7-60, October	168.93	0.0629	21.11	0.0671	112.17	12
76.7-60, November	164.44	0.0659	19.13	0.0642	146.57	14
76.7-60, December	160.76	0.0631	19.95	0.0584	262.33	3
76.7-55, January	152.16	0.0495	15.49	0.0488	142.43	20
76.7-55, February	181.45	0.0571	18.32	0.0501	162.5	17
76.7-55, March	218.73	0.0759	24.31	0.0746	221.65	10
76.7-55, April	252.34	0.102	28.58	0.0791	168.73	26
76.7-55, May	340.23	0.1204	36.75	0.1022	318.46	12
76.7-55, June	340.21	0.1366	41.31	0.1051	282.8	5
76.7-55, July	328.8	0.1303	37.42	0.1158	255.68	19
76.7-55, August	269.87	0.1035	33.46	0.0913	183.64	11
76.7-55, September	226.02	0.0842	29.18	0.0741	76	2
76.7-55, October	184.1	0.0736	22.24	0.0636	144.27	15
76.7-55, November	178.49	0.0677	20.44	0.0571	168.43	14
76.7-55, December	164.51	0.0588	20.89	0.0595	268	2
76.7-51, January	173.44	0.0476	15.8	0.0434	179.64	21
76.7-51, February	192.26	0.0646	19.46	0.0553	189.03	17
76.7-51, March	234.38	0.0916	27.5	0.0829	212.44	9
76.7-51, April	297.21	0.1011	33.78	0.0959	205.86	26
76.7-51, May	384.68	0.1344	41.3	0.1233	387.35	10
76.7-51, June	391.53	0.1313	48.53	0.1268	485.75	4
76.7-51, July	317.94	0.1141	38.12	0.1171	250.08	18
76.7-51, August	314.59	0.1302	40.66	0.1303	259.14	11
76.7-51, September	238.62	0.1041	31.8	0.0966	184	2
76.7-51, October	184.39	0.0683	23.77	0.0755	155.5	14
76.7-51, November	163.65	0.0641	21.54	0.0586	109.07	14
76.7-51, December	157.56	0.0584	19.72	0.0554	204	3
76.7-49, January	224.91	0.1886	57.22	0.3229	79.33	9
76.7-49, February	269.26	0.1837	59.92	0.3106	224.67	9
76.7-49, March	343.44	0.2465	79.88	0.3451	237.5	2
76.7-49, April	442.92	0.335	101.05	0.5027	251.17	18
76.7-49, May	554.08	0.4018	130.54	0.7165	640.33	3

Table K.4 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
76.7-49, June	584.06	0.477	143.15	0.6218	151	1
76.7-49, July	534.51	0.4249	127.54	0.7479	303.75	12
76.7-49, August	537.47	0.3654	112.24	0.5852	789.75	8
76.7-49, September	340.66	0.2405	83.79	0.436	173.5	2
76.7-49, October	245.18	0.2154	66.88	0.7151	98.25	8
76.7-49, November	217.72	0.1937	57.91	0.4007	60.6	10
76.7-49, December	216.26	0.1643	54.67	0.2377	0	0
80-100, January	93.05	0.0351	11.27	0.0462	120	15
80-100, February	88.18	0.0396	12.86	0.039	69.18	11
80-100, March	94.31	0.043	13.98	0.0437	89	3
80-100, April	113.85	0.0494	15.14	0.0513	92.13	19
80-100, May	116.16	0.0589	18.54	0.0538	53.13	4
80-100, June	124.05	0.0582	19.69	0.064	96	1
80-100, July	120.2	0.0524	18.51	0.0614	86.31	16
80-100, August	94.95	0.0518	15.86	0.0505	31.56	9
80-100, September	80.25	0.0394	12.82	0.0413	43.67	3
80-100, October	68.81	0.0313	10.88	0.0426	38.54	13
80-100, November	66.47	0.0332	10.57	0.0345	41.22	9
80-100, December	73.45	0.0357	11.94	0.0412	0	0
80-90, January	151.41	0.0263	8.04	0.0277	224.23	22
80-90, February	115.77	0.0366	11.98	0.0382	129.44	17
80-90, March	108.58	0.0419	13.09	0.0393	91.05	10
80-90, April	122.82	0.0449	14.53	0.0503	93.37	25
80-90, May	143.08	0.059	17.79	0.0691	140.22	10
80-90, June	152.28	0.0619	21.37	0.059	119	4
80-90, July	184.41	0.0522	16.26	0.0566	213.1	23
80-90, August	120.89	0.0519	17.12	0.0584	64.17	12
80-90, September	98.37	0.041	13.27	0.0381	60.4	5
80-90, October	83.5	0.0355	11.12	0.0383	56.82	17
80-90, November	90.15	0.0359	11.02	0.0399	87.79	14
80-90, December	93.86	0.0391	13.24	0.0461	97.33	3
80-80, January	118.38	0.0293	9.69	0.0263	131.52	22
80-80, February	148.61	0.0378	12.64	0.0328	193.83	18
80-80, March	124.97	0.0436	14.38	0.0403	112.65	10
80-80, April	128.06	0.051	15.75	0.0499	87.02	27
80-80, May	189.78	0.0661	21.25	0.0638	234.2	10
80-80, June	199.68	0.0863	25.36	0.0787	263.2	5
80-80, July	206.46	0.0668	19.3	0.0599	186.65	23
80-80, August	172.88	0.0651	19.61	0.0608	160.25	12
80-80, September	130	0.045	16.09	0.0502	122	6
80-80, October	106.38	0.0442	13.72	0.0443	70.47	17
80-80, November	137.23	0.0401	13.05	0.038	194.21	14
80-80, December	118.56	0.0417	15.09	0.0455	180.67	3
80-70, January	161.02	0.0343	11.29	0.033	193.65	23
80-70, February	138.48	0.0391	13.79	0.0348	136.78	16
80-70, March	146.2	0.06	17.63	0.0438	93.45	10
80-70, April	188.96	0.055	17.41	0.0514	164.46	28

Table K.4 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
80-70, May	226.11	0.0851	24.44	0.0702	216.58	12
80-70, June	233.79	0.095	28.95	0.0836	211	6
80-70, July	244.58	0.083	24.77	0.075	199.98	22
80-70, August	429.73	0.0686	23.75	0.0684	1047.67	12
80-70, September	172.09	0.067	20.56	0.0548	158.83	6
80-70, October	159.13	0.0509	16.21	0.0448	176.5	16
80-70, November	138.08	0.0557	16.1	0.0535	130.21	14
80-70, December	136.87	0.0578	18.43	0.0586	159	3
80-60, January	145.69	0.0388	12.87	0.0329	142.89	24
80-60, February	165.65	0.0485	16.2	0.0441	159.13	15
80-60, March	180.3	0.0625	20.44	0.0536	140.83	12
80-60, April	214.35	0.0753	22.25	0.0651	155.52	28
80-60, May	345.76	0.0994	31.45	0.0796	486.68	12
80-60, June	308.49	0.1137	36.43	0.0999	307.17	6
80-60, July	289.63	0.1089	30.48	0.1012	243.06	22
80-60, August	245.78	0.0912	27.75	0.0795	224.61	12
80-60, September	212.16	0.0742	24.39	0.0665	250	6
80-60, October	185.22	0.0603	18.41	0.0494	201.28	18
80-60, November	160.84	0.053	18.73	0.0542	148.92	13
80-60, December	159.66	0.0574	19.21	0.0541	353.33	3
80-55, January	191.11	0.0467	13.99	0.0411	230.23	22
80-55, February	173.12	0.0541	16.32	0.0499	192.44	16
80-55, March	179.89	0.0703	21.83	0.0535	106.27	11
80-55, April	255.35	0.0751	23.88	0.0682	214.29	29
80-55, May	300.6	0.1077	32.91	0.0825	251.71	12
80-55, June	319.35	0.1252	38.22	0.1083	277.67	6
80-55, July	291.75	0.1067	31.8	0.0929	227.52	22
80-55, August	250.36	0.0925	29.18	0.0827	201.96	12
80-55, September	208.17	0.0757	25.95	0.0707	161.6	5
80-55, October	167.74	0.0578	20.03	0.0632	131.94	17
80-55, November	155.47	0.0628	20.31	0.0602	110.23	13
80-55, December	159.65	0.0648	21.09	0.0844	279	3
80-51, January	145.99	0.0426	13.68	0.0448	156.93	20
80-51, February	176.03	0.0665	18.65	0.0543	166.21	14
80-51, March	476.57	0.0751	26.29	0.0669	1003.19	8
80-51, April	365.14	0.0931	29.11	0.0865	377.9	26
80-51, May	379.11	0.1308	38.91	0.1067	392.05	11
80-51, June	354.09	0.1429	43.43	0.1219	363.25	4
80-51, July	300.8	0.1164	35.93	0.1017	215.76	21
80-51, August	277.85	0.0999	32.32	0.0928	259.21	12
80-51, September	229.59	0.0848	27.95	0.0809	364	4
80-51, October	165.83	0.063	21.03	0.0697	128.94	16
80-51, November	138.09	0.0613	20.51	0.0724	49.08	12
80-51, December	139.03	0.0558	18.54	0.0607	143	3
83.3-110, January	66.82	0.0342	10.31	0.035	73.4	10
83.3-110, February	65.9	0.0295	10.93	0.0386	58.25	8
83.3-110, March	69.43	0.0332	12.45	0.0385	21.75	2

Table K.4 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
83.3-110, April	82.56	0.039	13.51	0.0507	62.63	16
83.3-110, May	87.66	0.0464	16.42	0.0515	47	1
83.3-110, June	92.84	0.0531	17.69	0.0689	0	0
83.3-110, July	83.86	0.0499	16.66	0.0713	29.2	10
83.3-110, August	75.18	0.0443	13.97	0.0486	38.57	7
83.3-110, September	64.21	0.0397	11.94	0.0577	14.33	3
83.3-110, October	57.14	0.0268	9.95	0.0364	40.09	11
83.3-110, November	52.72	0.0331	9.41	0.0353	29.71	7
83.3-110, December	55.19	0.0319	9.72	0.0334	0	0
83.3-100, January	77.74	0.0294	8.44	0.0246	90.46	13
83.3-100, February	82.34	0.0319	10.23	0.0267	77.56	9
83.3-100, March	83.41	0.0353	10.94	0.0281	53.7	5
83.3-100, April	88.06	0.0396	11.98	0.0348	45.85	17
83.3-100, May	103.24	0.0436	14.55	0.0362	68	3
83.3-100, June	108.38	0.0547	15.36	0.0504	12	1
83.3-100, July	98.08	0.0477	14.56	0.0451	44	13
83.3-100, August	84.68	0.0397	12.54	0.0317	17.5	8
83.3-100, September	74.13	0.0346	10.37	0.0306	39.33	3
83.3-100, October	62.4	0.0276	8.96	0.0291	27.42	12
83.3-100, November	75.51	0.0231	8.6	0.0266	117.63	8
83.3-100, December	65.64	0.0284	9.37	0.0259	12	1
83.3-90, January	103.07	0.0238	7.78	0.0243	122.83	20
83.3-90, February	107.21	0.0338	10.75	0.0323	124.66	16
83.3-90, March	108.82	0.0379	11.75	0.0348	96.89	9
83.3-90, April	104.78	0.0403	13.18	0.0391	70.54	23
83.3-90, May	160.92	0.0473	15.99	0.0471	274.44	9
83.3-90, June	137	0.064	18.22	0.0634	126	5
83.3-90, July	129.77	0.0468	14.93	0.0468	106.26	23
83.3-90, August	106.86	0.0511	14.92	0.0452	35.45	10
83.3-90, September	95.03	0.04	12.11	0.0379	92	5
83.3-90, October	76.69	0.0354	9.96	0.0379	55.05	20
83.3-90, November	87.29	0.0346	10.5	0.0369	98.78	9
83.3-90, December	84.32	0.0395	11.43	0.0354	69.5	2
83.3-80, January	114.93	0.0319	8.9	0.0275	130.74	21
83.3-80, February	106.61	0.0394	11.91	0.034	107.6	15
83.3-80, March	111.09	0.0432	13.77	0.0363	65.2	10
83.3-80, April	135.03	0.047	14.52	0.0456	113.57	25
83.3-80, May	168.83	0.061	19.29	0.0505	193.89	9
83.3-80, June	175.62	0.0717	22.12	0.0551	167.17	6
83.3-80, July	180.55	0.0596	17.57	0.0523	176.27	24
83.3-80, August	145.36	0.049	17.85	0.0495	97.85	10
83.3-80, September	116.5	0.0492	14.74	0.0378	81	6
83.3-80, October	96.94	0.0357	12.09	0.0392	74.25	20
83.3-80, November	130.35	0.0403	12.66	0.0436	247.56	9
83.3-80, December	100.09	0.0452	13.49	0.0462	69	3
83.3-70, January	157.13	0.0386	11	0.034	205.07	21
83.3-70, February	126.08	0.0401	12.28	0.0359	129.71	19

Table K.4 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
83.3-70, March	129.33	0.0506	16.31	0.0434	65.7	10
83.3-70, April	157.23	0.0504	16.25	0.0549	123.64	28
83.3-70, May	213.69	0.0743	23.1	0.0604	215.33	12
83.3-70, June	229.41	0.0909	26.88	0.0739	258	6
83.3-70, July	198.47	0.0703	21.34	0.0692	167.44	24
83.3-70, August	191.03	0.0606	22.09	0.0521	149	11
83.3-70, September	165.04	0.0597	19.41	0.0587	167.5	6
83.3-70, October	135.84	0.0453	14.84	0.0497	129.83	18
83.3-70, November	139.12	0.0495	15.39	0.0541	177.18	11
83.3-70, December	125.67	0.0587	18.87	0.0673	48.17	3
83.3-60, January	139.86	0.0296	11.01	0.0322	168.6	21
83.3-60, February	169.2	0.0399	13.19	0.0398	217.26	19
83.3-60, March	156.79	0.0661	18.75	0.0472	97.22	10
83.3-60, April	215.43	0.0667	18.63	0.0571	195.87	28
83.3-60, May	283.22	0.0889	26.41	0.0896	388.32	13
83.3-60, June	276.75	0.1066	32.06	0.0877	296.71	7
83.3-60, July	284.55	0.0751	24.32	0.0729	299.6	24
83.3-60, August	208.49	0.0752	24.26	0.0633	162.06	12
83.3-60, September	156.95	0.076	20.46	0.0583	54.4	5
83.3-60, October	130.62	0.0496	15.15	0.0473	101.52	21
83.3-60, November	137.99	0.0525	16.86	0.0569	144.82	11
83.3-60, December	139.32	0.0662	18.44	0.0737	193.92	4
83.3-55, January	213.93	0.036	11.66	0.0353	313.86	22
83.3-55, February	143.37	0.0449	13.86	0.0418	141.11	19
83.3-55, March	158.39	0.056	19	0.0579	101.28	9
83.3-55, April	190.85	0.0687	20.31	0.0676	141	29
83.3-55, May	262.14	0.0884	27.77	0.1157	271.67	12
83.3-55, June	291.15	0.1174	32.93	0.0956	357.14	7
83.3-55, July	251.86	0.0762	25.99	0.0798	213.19	24
83.3-55, August	205.68	0.0797	24.98	0.0638	143.75	12
83.3-55, September	166.38	0.0693	22.02	0.0599	90	5
83.3-55, October	145.82	0.048	15.87	0.0547	130	21
83.3-55, November	135.53	0.0549	18.48	0.0613	105.9	10
83.3-55, December	140.22	0.0756	21.88	0.0969	163.5	4
83.3-51, January	125.53	0.0384	11.88	0.0348	121.61	22
83.3-51, February	142.26	0.0531	15.02	0.0374	122.06	17
83.3-51, March	194.54	0.0676	21.71	0.0543	195.33	9
83.3-51, April	280.82	0.0706	23.29	0.0795	257.84	29
83.3-51, May	283.56	0.1015	32.29	0.0847	216.54	13
83.3-51, June	294.48	0.1144	35.87	0.0963	261.86	7
83.3-51, July	246.47	0.0812	28.03	0.1085	190.89	24
83.3-51, August	192.28	0.1022	26.4	0.0985	72.33	12
83.3-51, September	165.82	0.08	22.86	0.0738	90.6	5
83.3-51, October	134.09	0.052	16.22	0.0627	106.29	21
83.3-51, November	120.5	0.0561	18.16	0.0597	59.25	12
83.3-51, December	118.56	0.0524	17.3	0.0538	71	5
83.3-42, January	133.89	0.0765	23.49	0.0821	65	16

Table K.4 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
83.3-42, February	155.65	0.0836	24.05	0.0855	85.12	13
83.3-42, March	217.13	0.1015	30.47	0.0775	184.25	8
83.3-42, April	291.71	0.1196	42.3	0.1661	207.1	21
83.3-42, May	444.31	0.1264	41	0.1415	536.77	11
83.3-42, June	364.25	0.2067	58.84	0.1914	338	1
83.3-42, July	286.53	0.1425	41.36	0.1335	171.03	16
83.3-42, August	227.13	0.1021	35.43	0.1046	98.05	10
83.3-42, September	191.4	0.1003	30.84	0.1187	109.67	3
83.3-42, October	149.53	0.0885	26.88	0.1056	54.36	14
83.3-42, November	135.33	0.0907	25.85	0.1144	40.92	12
83.3-42, December	138.28	0.0837	25.26	0.1002	60.33	3
83.3-40.6, January	156.53	0.0701	25.73	0.0906	108.1	15
83.3-40.6, February	165	0.0793	24.27	0.083	104.04	13
83.3-40.6, March	222.45	0.1021	30.68	0.1047	249.5	6
83.3-40.6, April	314.06	0.1225	40.67	0.1861	261.85	21
83.3-40.6, May	423.42	0.1396	41.53	0.1233	562.5	11
83.3-40.6, June	349.88	0.1943	57.5	0.2327	36	1
83.3-40.6, July	286.94	0.1379	42.15	0.133	195.75	16
83.3-40.6, August	242.85	0.1265	36.64	0.1467	162.95	10
83.3-40.6, September	197.79	0.0986	32.88	0.1204	66.67	3
83.3-40.6, October	170.35	0.0889	29.11	0.1104	96.57	14
83.3-40.6, November	141.63	0.0821	28.14	0.1193	37.42	12
83.3-40.6, December	145.6	0.0807	27.71	0.1175	61	2
86.7-110, January	55.72	0.0285	7.84	0.0225	48.9	10
86.7-110, February	55.44	0.0264	8.07	0.0202	43.5	8
86.7-110, March	58.07	0.028	9.01	0.0295	12.75	2
86.7-110, April	63.67	0.0346	10.44	0.0357	26.33	15
86.7-110, May	76.46	0.0375	12.69	0.0436	23	1
86.7-110, June	82.89	0.0429	13.69	0.0506	0	0
86.7-110, July	77.56	0.0409	12.76	0.0407	37.1	10
86.7-110, August	68.52	0.0323	10.83	0.0274	38.29	7
86.7-110, September	58.99	0.0315	9.27	0.0264	20.33	3
86.7-110, October	50.3	0.0227	7.57	0.0244	34.55	11
86.7-110, November	47.45	0.0222	7.28	0.0254	29.63	8
86.7-110, December	49.36	0.0279	7.78	0.0322	0	0
86.7-100, January	63.65	0.0216	7.57	0.0236	57.69	13
86.7-100, February	68.93	0.0289	8.59	0.0222	51.89	9
86.7-100, March	72.28	0.0308	9.23	0.0265	48.3	5
86.7-100, April	76.83	0.0266	10.23	0.0291	46.03	18
86.7-100, May	89.72	0.0372	12.53	0.0405	69.67	3
86.7-100, June	97.76	0.0421	13.87	0.0456	0	0
86.7-100, July	92.47	0.0317	13.02	0.039	52.08	13
86.7-100, August	81.18	0.0337	11.12	0.0391	45.43	7
86.7-100, September	69.24	0.0319	9.4	0.0288	36.33	3
86.7-100, October	57.33	0.0245	7.65	0.0197	32.58	12
86.7-100, November	55.68	0.0234	7.52	0.0225	37	7
86.7-100, December	58.62	0.03	8.17	0.0237	0	0

Table K.4 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
86.7-90, January	78.42	0.0365	10.51	0.0392	59.05	20
86.7-90, February	111.56	0.0259	7.27	0.0239	155.79	17
86.7-90, March	90.19	0.0339	10.42	0.03	88.06	9
86.7-90, April	86.8	0.0341	10.81	0.0356	57.88	24
86.7-90, May	115.42	0.0427	13.54	0.036	148.06	9
86.7-90, June	119.09	0.0553	15.77	0.0466	115	4
86.7-90, July	124.12	0.0382	12.94	0.0506	120.63	23
86.7-90, August	95.2	0.0444	13.19	0.0367	39.22	9
86.7-90, September	81.96	0.0362	10.71	0.028	51.8	5
86.7-90, October	77.51	0.0278	8.71	0.0288	68.79	19
86.7-90, November	75.34	0.0287	8.83	0.0277	83	11
86.7-90, December	73	0.0363	10.18	0.0349	0	0
86.7-80, January	115.05	0.0261	8.59	0.0204	140.53	20
86.7-80, February	101.84	0.0293	9.3	0.0275	106.31	18
86.7-80, March	103.86	0.0389	12.78	0.0301	64.9	10
86.7-80, April	119.75	0.045	13.61	0.0434	93.74	24
86.7-80, May	164.52	0.0544	18.18	0.0511	221.61	9
86.7-80, June	169.27	0.0811	21.63	0.0593	149.75	4
86.7-80, July	191.32	0.0612	16.51	0.0585	206.19	24
86.7-80, August	143.35	0.0548	18.05	0.0545	100.67	9
86.7-80, September	114.2	0.0452	13.89	0.0396	101.33	6
86.7-80, October	98.42	0.0332	11.23	0.0336	85.89	18
86.7-80, November	101.97	0.034	11.28	0.0367	120.27	11
86.7-80, December	94.76	0.0397	13.01	0.047	107.75	2
86.7-70, January	121.22	0.0424	15.28	0.0591	98.32	19
86.7-70, February	101.22	0.0366	10.8	0.0332	89.21	19
86.7-70, March	121.46	0.0467	14.74	0.0459	87.13	8
86.7-70, April	151.54	0.0479	15.06	0.0499	122.05	26
86.7-70, May	225.65	0.0677	21.96	0.0685	332.95	11
86.7-70, June	220.7	0.0783	25.04	0.0715	355.6	5
86.7-70, July	186.5	0.059	19.03	0.0621	168.14	25
86.7-70, August	165.62	0.0603	20.14	0.0589	125.44	9
86.7-70, September	134.92	0.0579	16.34	0.0453	109.29	7
86.7-70, October	142.74	0.0403	12.77	0.0422	171.05	19
86.7-70, November	117.48	0.0398	13.81	0.0399	117.9	10
86.7-70, December	115.96	0.0408	14.33	0.0539	262.5	3
86.7-60, January	127.23	0.0349	10.1	0.0318	150.33	20
86.7-60, February	126.77	0.0375	10.92	0.0344	130.98	20
86.7-60, March	131.15	0.0511	15.49	0.0382	93	10
86.7-60, April	146.47	0.0561	17.07	0.0553	100.54	25
86.7-60, May	232.81	0.0692	22.81	0.0629	290.68	12
86.7-60, June	245.8	0.0869	29.32	0.0828	276.67	6
86.7-60, July	322.53	0.0556	21.68	0.0586	387.12	25
86.7-60, August	195.95	0.066	22.1	0.0659	190.96	9
86.7-60, September	155.45	0.0536	18.22	0.0498	157.43	7
86.7-60, October	123.64	0.0328	13.42	0.0401	111.26	19
86.7-60, November	111.22	0.0431	14.11	0.0541	96.33	12

Table K.4 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
86.7-60, December	114.23	0.0524	16.51	0.0606	129.44	3
86.7-55, January	125.3	0.0337	10.98	0.0328	126.51	22
86.7-55, February	121.97	0.0475	12.66	0.0373	111.39	18
86.7-55, March	139.91	0.0576	17.4	0.0396	80.15	10
86.7-55, April	186.02	0.0658	20.56	0.0646	149.51	26
86.7-55, May	286.93	0.0782	24.7	0.084	321.63	12
86.7-55, June	269.98	0.0995	32.22	0.0944	330.17	6
86.7-55, July	243.6	0.0707	24.4	0.0778	213.54	25
86.7-55, August	188.9	0.0756	24.09	0.0696	98.25	8
86.7-55, September	159.48	0.0677	20.31	0.0593	124.71	7
86.7-55, October	137.09	0.0417	14.61	0.044	128.45	20
86.7-55, November	126.22	0.0587	17.08	0.061	100.27	11
86.7-55, December	137.03	0.0548	17.04	0.0591	326.25	4
86.7-50, January	123.22	0.0455	12.06	0.0406	119.45	22
86.7-50, February	165.88	0.0416	13.52	0.0396	214.29	17
86.7-50, March	163.37	0.0665	19.95	0.0615	109.55	10
86.7-50, April	253.25	0.0823	23.75	0.0819	233.8	26
86.7-50, May	344.32	0.0851	25.64	0.0654	502.17	12
86.7-50, June	292.15	0.1146	35.56	0.0979	401.17	6
86.7-50, July	335.13	0.077	23.49	0.072	386.85	24
86.7-50, August	181.81	0.0783	22.97	0.067	116.05	10
86.7-50, September	158.62	0.0664	20.14	0.0723	151.43	7
86.7-50, October	159.39	0.0495	14.71	0.0526	191.3	20
86.7-50, November	124.13	0.0516	17.66	0.056	83	9
86.7-50, December	148.36	0.0445	15.29	0.0499	524.5	4
86.7-45, January	109.14	0.0432	11.88	0.0454	94.09	23
86.7-45, February	127.19	0.042	13.4	0.0462	123.22	18
86.7-45, March	156.73	0.058	18.58	0.0628	128.86	11
86.7-45, April	203.33	0.0695	25.05	0.0873	158.56	26
86.7-45, May	281.35	0.0781	25.48	0.0938	317.5	12
86.7-45, June	265.52	0.1419	34.85	0.1321	309.67	6
86.7-45, July	246.11	0.0697	23.19	0.0718	220.26	25
86.7-45, August	187.41	0.0748	22.45	0.0653	177.4	10
86.7-45, September	141.8	0.07	19.37	0.0547	87.57	7
86.7-45, October	117.51	0.0469	14.94	0.0516	99	21
86.7-45, November	117.59	0.0497	17.11	0.0607	66.8	10
86.7-45, December	125.59	0.0511	14.91	0.0495	319.75	4
86.7-40, January	222.57	0.037	11.55	0.0433	356.98	21
86.7-40, February	152.92	0.0464	13.4	0.038	208.44	17
86.7-40, March	132.4	0.0581	17.41	0.0512	72.9	10
86.7-40, April	163.31	0.0643	19.65	0.0736	123	25
86.7-40, May	212.31	0.0793	23.75	0.0748	237.15	10
86.7-40, June	216.98	0.0948	29.56	0.0879	151.5	6
86.7-40, July	220.46	0.0693	21.03	0.0738	211	25
86.7-40, August	158.86	0.0719	21.06	0.0587	101.25	8
86.7-40, September	134.21	0.0594	19.05	0.058	97.6	5
86.7-40, October	113.68	0.0478	14.77	0.0546	102.05	19

Table K.4 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
86.7-40, November	113.19	0.0587	18.11	0.0714	77.13	8
86.7-40, December	120.71	0.0704	22.36	0.0927	135	4
86.7-35, January	98.64	0.05	16.99	0.0709	52.86	22
86.7-35, February	116.81	0.0412	15.81	0.055	98.44	18
86.7-35, March	144.88	0.0753	21.28	0.078	98.36	11
86.7-35, April	187.54	0.0842	23.61	0.1121	153.39	27
86.7-35, May	218.26	0.0992	30.4	0.0993	169.29	12
86.7-35, June	250.06	0.1277	38.65	0.1323	170	6
86.7-35, July	277.79	0.0839	27.08	0.1138	286.12	26
86.7-35, August	188.82	0.0818	29.52	0.1041	112.56	9
86.7-35, September	158.06	0.0693	24.29	0.0898	131.14	7
86.7-35, October	131.02	0.0545	18.19	0.0713	118	21
86.7-35, November	116.26	0.0696	20.38	0.0851	56.11	9
86.7-35, December	109.21	0.0592	19.09	0.0827	65.6	5
86.7-33, January	123.49	0.0644	18.77	0.074	103.26	21
86.7-33, February	146.95	0.0671	22.63	0.0944	143.67	12
86.7-33, March	201.6	0.1032	30.21	0.1237	191.35	10
86.7-33, April	290.76	0.115	35.37	0.1387	290.3	22
86.7-33, May	327.62	0.1416	46.08	0.1799	373.61	9
86.7-33, June	387.93	0.1648	51.92	0.1513	1007.2	5
86.7-33, July	333.74	0.1435	46.94	0.1656	306.7	23
86.7-33, August	259.76	0.1272	39.76	0.1617	318.86	7
86.7-33, September	197.59	0.0967	32.29	0.1347	259.43	7
86.7-33, October	146.28	0.0816	25.51	0.1095	103.22	18
86.7-33, November	157.1	0.0822	25.51	0.1284	197.33	9
86.7-33, December	140.71	0.0839	22.74	0.0969	193.5	5
90-120, January	42.9	0.024	7.11	0.0313	36.26	19
90-120, February	41.66	0.0245	7.82	0.0306	22.14	7
90-120, March	45.91	0.0268	9.08	0.0322	16.58	6
90-120, April	48.54	0.0344	10.04	0.0606	23.56	18
90-120, May	60.84	0.0384	12.58	0.0527	10.5	3
90-120, June	67.64	0.0423	13.55	0.0648	78	2
90-120, July	62.02	0.0378	12.58	0.0871	34	17
90-120, August	56.05	0.0365	11.13	0.0468	28.06	9
90-120, September	49.09	0.027	9.06	0.0327	38	6
90-120, October	39.7	0.0235	7.3	0.0308	27.94	16
90-120, November	38.75	0.0237	7.21	0.0286	21.25	8
90-120, December	39.03	0.0223	6.84	0.0239	118	1
90-110, January	44.3	0.0213	5.6	0.0168	30.87	15
90-110, February	49.19	0.0202	6.13	0.0203	61.67	6
90-110, March	51.68	0.0249	7.23	0.0205	31.75	8
90-110, April	56.38	0.0243	8.08	0.0267	30.53	15
90-110, May	64.97	0.034	9.93	0.0266	14.5	3
90-110, June	73.27	0.0284	10.87	0.0338	77.75	2
90-110, July	69.68	0.031	10.34	0.0317	32.93	14
90-110, August	62.4	0.0283	8.92	0.027	44.81	8
90-110, September	52.37	0.0243	7.42	0.0228	27.6	5

Table K.4 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
90-110, October	47.19	0.0174	6.03	0.0196	43.25	12
90-110, November	41.5	0.017	5.83	0.0159	22.25	8
90-110, December	40.08	0.0159	5.49	0.0148	63	1
90-100, January	51.94	0.019	5.73	0.0208	41.83	23
90-100, February	61.32	0.0216	6.58	0.0217	63.38	12
90-100, March	72.46	0.025	7.95	0.0257	100.28	9
90-100, April	63.66	0.0239	8.67	0.0298	41.14	25
90-100, May	81.64	0.0358	11.56	0.0366	33.13	8
90-100, June	95.38	0.0424	12.69	0.0381	78.9	5
90-100, July	87.17	0.0358	12.6	0.0374	44.65	20
90-100, August	71.71	0.0331	10.53	0.033	27	10
90-100, September	64.06	0.025	8.73	0.0233	35.17	6
90-100, October	55.71	0.0194	6.76	0.0213	46.89	18
90-100, November	52.51	0.022	7.06	0.0233	33	9
90-100, December	54.21	0.0204	7.24	0.0207	83	1
90-90, January	71.72	0.0185	5.64	0.0199	79.94	24
90-90, February	65.93	0.0246	7.35	0.0235	51.89	16
90-90, March	74.29	0.0281	9.35	0.0261	57.04	12
90-90, April	80.16	0.0295	10.37	0.0328	51.66	24
90-90, May	94.71	0.0441	13	0.0395	56.64	12
90-90, June	116.36	0.0461	13.85	0.0508	137.83	8
90-90, July	132.79	0.0466	13.49	0.0452	129.5	24
90-90, August	98.36	0.0418	13.37	0.0389	54.55	11
90-90, September	78.2	0.035	10.12	0.03	58.78	9
90-90, October	62.05	0.0253	8.02	0.0239	41.24	19
90-90, November	65.69	0.0253	8.25	0.0249	58	11
90-90, December	64	0.0283	8.93	0.0291	32.33	3
90-80, January	104.23	0.0192	6.36	0.0206	129.48	25
90-80, February	74.45	0.0257	8.76	0.0242	57.57	15
90-80, March	88.67	0.04	11.08	0.0327	64.42	12
90-80, April	97.78	0.0409	12.53	0.0364	60.85	25
90-80, May	157.06	0.0507	15.46	0.0493	188.73	13
90-80, June	148.58	0.0581	16.76	0.0556	186.63	8
90-80, July	128	0.049	16.35	0.0639	87	24
90-80, August	118.78	0.0503	15.24	0.0389	79.41	11
90-80, September	108.4	0.0374	12.23	0.0351	135.67	9
90-80, October	84.63	0.0307	9.7	0.0335	71.05	19
90-80, November	83.98	0.031	9.91	0.0287	90	11
90-80, December	77.14	0.0348	10.5	0.0365	45.75	4
90-70, January	104.8	0.0262	8.36	0.0252	111.42	24
90-70, February	122.11	0.031	10.43	0.0283	160.12	17
90-70, March	119.77	0.0437	13.7	0.0412	112.25	12
90-70, April	139.73	0.0485	14.43	0.0531	118.34	26
90-70, May	241.43	0.0607	20.48	0.0605	401.23	13
90-70, June	275.7	0.0667	22.05	0.0646	458.38	8
90-70, July	173.3	0.0704	20.49	0.0652	127.42	24
90-70, August	152.58	0.0603	18.68	0.0564	121.64	11

Table K.4 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
90-70, September	126.97	0.0498	16.04	0.0485	93.11	9
90-70, October	109.56	0.0376	12.32	0.0411	98.75	16
90-70, November	102.15	0.0377	12.52	0.041	95.75	12
90-70, December	97.15	0.0377	12.67	0.0501	73.4	5
90-60, January	106.4	0.0299	9.12	0.0261	106.52	25
90-60, February	107.7	0.0346	10.94	0.0292	107.29	16
90-60, March	120.54	0.0448	13.44	0.0386	110.21	14
90-60, April	144.85	0.0542	16.79	0.0537	104.43	24
90-60, May	216.95	0.0609	21.4	0.0615	272.41	13
90-60, June	239.46	0.0706	26.06	0.0695	351.25	8
90-60, July	214	0.0725	21.78	0.068	188.21	24
90-60, August	160.7	0.0574	18.53	0.047	121.15	11
90-60, September	125.24	0.0499	16.04	0.0464	82.44	9
90-60, October	111.39	0.0363	12.16	0.0437	104.22	18
90-60, November	102.23	0.041	13.33	0.0412	85.33	12
90-60, December	114.13	0.0413	13.79	0.056	221.53	5
90-53, January	94.91	0.032	8.88	0.0272	89.33	24
90-53, February	143.33	0.0358	11.27	0.0341	226.5	14
90-53, March	126.16	0.049	15.83	0.0455	81.46	12
90-53, April	163.38	0.0631	20.81	0.0713	119.55	23
90-53, May	309.57	0.0831	22.93	0.0736	414.45	11
90-53, June	247.43	0.097	29.22	0.0979	252.07	7
90-53, July	218.16	0.0864	24.56	0.0809	178.13	24
90-53, August	167.04	0.0694	20.32	0.0538	93.56	9
90-53, September	128.6	0.0553	17.28	0.0497	79.14	7
90-53, October	106.06	0.0339	12.77	0.0389	82.65	20
90-53, November	111.88	0.0416	13.26	0.0426	133.54	13
90-53, December	96.13	0.0451	13.51	0.0521	60.6	5
90-45, January	101.67	0.0303	8.88	0.0305	106.5	24
90-45, February	126.55	0.033	11.01	0.0354	164.03	16
90-45, March	124.52	0.0476	15.04	0.048	91.57	14
90-45, April	161.6	0.0671	21.95	0.0863	116.46	26
90-45, May	293.74	0.0714	21.48	0.073	333.36	14
90-45, June	243.31	0.1094	31.84	0.1146	276.57	7
90-45, July	244.06	0.0694	21.18	0.0574	257.63	24
90-45, August	154.54	0.0589	19.67	0.062	115.13	8
90-45, September	130.6	0.0518	16.92	0.0503	132.63	8
90-45, October	119.77	0.0429	13.19	0.046	117.97	19
90-45, November	129.28	0.0509	14.7	0.0498	178.75	12
90-45, December	92.58	0.0417	13.52	0.0473	54.92	6
90-37, January	96	0.0324	10.25	0.0348	84.86	25
90-37, February	108.1	0.0341	11.54	0.0351	110.81	16
90-37, March	118.87	0.0545	15.24	0.0455	81.31	13
90-37, April	146.88	0.063	17.74	0.0652	111.03	26
90-37, May	233.27	0.0742	21.46	0.0643	233.64	14
90-37, June	199.96	0.0957	27.93	0.0865	116.07	7
90-37, July	181.4	0.0618	21.07	0.061	141.96	25

Table K.4 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
90-37, August	159.51	0.0608	19.6	0.0529	146.05	10
90-37, September	127.93	0.0626	17.04	0.0458	121	8
90-37, October	104.39	0.0433	13.63	0.0491	79.98	21
90-37, November	112.34	0.0508	14.67	0.0504	121.27	11
90-37, December	115.72	0.0496	15.09	0.0616	215.5	6
90-35, January	99.19	0.0499	13.28	0.0419	68	14
90-35, February	105.82	0.0397	14.3	0.0375	59	7
90-35, March	123.55	0.0524	16.84	0.0568	59.83	6
90-35, April	152.85	0.058	19.86	0.0616	93.88	16
90-35, May	192.08	0.0653	25.33	0.0707	129	5
90-35, June	212.14	0.0828	28.92	0.0903	65	2
90-35, July	184.14	0.0756	25.49	0.0758	81.47	15
90-35, August	156.28	0.0678	21.52	0.0577	90.71	7
90-35, September	130.44	0.0602	18.74	0.0586	44.5	4
90-35, October	108.9	0.0499	15.74	0.0543	56.29	14
90-35, November	101.05	0.0505	15.32	0.057	55	9
90-35, December	101.21	0.0476	14.88	0.0472	56.5	2
90-30, January	106.52	0.0485	16.35	0.0614	72.56	18
90-30, February	112.04	0.0563	16.4	0.0559	60.4	10
90-30, March	131.12	0.0614	20.64	0.0742	56.61	9
90-30, April	157.34	0.0772	23.88	0.1119	90.03	19
90-30, May	197.03	0.0862	29.65	0.1076	127.25	10
90-30, June	233.23	0.113	36.26	0.1019	56.17	3
90-30, July	194.78	0.1027	29.29	0.0978	116.27	17
90-30, August	164.81	0.0759	24.46	0.0919	132.1	10
90-30, September	132.91	0.0705	22	0.0838	28.5	4
90-30, October	108.31	0.0542	17.4	0.0649	65.07	15
90-30, November	97.51	0.0494	16.5	0.0679	47.5	10
90-30, December	95.3	0.049	16.21	0.0611	44.4	5
90-28, January	121.02	0.0487	14.87	0.1036	124.93	22
90-28, February	119.9	0.0519	17.21	0.1198	109.73	15
90-28, March	149.1	0.0724	22.97	0.1213	112.23	11
90-28, April	188.89	0.0912	25.56	0.1281	155.06	26
90-28, May	229.23	0.1116	33.02	0.1825	187.25	14
90-28, June	271.56	0.1322	39.89	0.1401	255.36	7
90-28, July	225.75	0.0875	29.99	0.1243	198.56	25
90-28, August	183.74	0.0871	28.38	0.0896	146.05	11
90-28, September	151.85	0.0741	23.7	0.1476	173.5	8
90-28, October	110.73	0.0593	18.88	0.128	73.17	21
90-28, November	106.33	0.059	18.1	0.0757	79.27	11
90-28, December	104.02	0.0593	19.14	0.0873	53.93	7
93.3-120, January	38.8	0.0262	7.14	0.0388	25.13	15
93.3-120, February	40.49	0.0216	6.9	0.0281	50.71	7
93.3-120, March	41.63	0.0265	8.41	0.0361	14.25	6
93.3-120, April	45.09	0.0288	9.47	0.0363	16.65	13
93.3-120, May	56.9	0.042	12.23	0.0567	11.17	3
93.3-120, June	61.93	0.043	12.85	0.0519	57.5	2

Table K.4 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
93.3-120, July	57.38	0.0378	12.32	0.049	21.87	15
93.3-120, August	52.28	0.0352	10.92	0.0538	22.86	7
93.3-120, September	44.25	0.0304	8.71	0.0325	21.2	5
93.3-120, October	37.23	0.0225	6.78	0.0283	27.08	13
93.3-120, November	36.7	0.0238	7	0.0333	21	8
93.3-120, December	36.54	0.0224	6.74	0.0263	53	1
93.3-110, January	48.31	0.0223	6.76	0.0219	39.79	14
93.3-110, February	45.29	0.0254	6.58	0.024	47.25	8
93.3-110, March	48.39	0.0286	8.11	0.0273	19.79	7
93.3-110, April	53.24	0.0284	9.4	0.0278	17.61	14
93.3-110, May	65.21	0.0399	11.42	0.042	18.33	3
93.3-110, June	71.75	0.0386	12.5	0.0456	32.25	2
93.3-110, July	68.66	0.0397	12.06	0.0467	25.93	14
93.3-110, August	62.09	0.0348	10.5	0.0369	27.71	7
93.3-110, September	54.91	0.0297	8.69	0.029	41.8	5
93.3-110, October	47.03	0.0252	7.31	0.0265	33.83	12
93.3-110, November	42.71	0.0194	6.78	0.0227	23.25	8
93.3-110, December	42.61	0.0234	6.51	0.0231	64	1
93.3-100, January	55.98	0.0238	6.93	0.0238	47.98	20
93.3-100, February	50.05	0.0211	6.8	0.0231	42.38	13
93.3-100, March	55.81	0.0262	8.85	0.0296	26.8	10
93.3-100, April	64.28	0.0326	9.95	0.0402	41.83	20
93.3-100, May	77.91	0.0409	12.75	0.0464	41	7
93.3-100, June	94.6	0.0447	13.62	0.0472	143.75	4
93.3-100, July	92.46	0.0463	13.14	0.0446	69.55	20
93.3-100, August	77.23	0.0365	12.15	0.0372	42.44	8
93.3-100, September	64.28	0.0276	9.97	0.0307	29.5	6
93.3-100, October	57.07	0.0259	7.79	0.0283	51.85	17
93.3-100, November	58.7	0.026	7.72	0.0311	72.11	9
93.3-100, December	51.57	0.024	7.78	0.026	17	1
93.3-90, January	65.99	0.0251	6.74	0.0225	62.64	25
93.3-90, February	70.27	0.0254	7.85	0.0272	62.94	17
93.3-90, March	67.48	0.0313	9.79	0.0318	51.46	12
93.3-90, April	73.83	0.038	11.95	0.0451	37.72	23
93.3-90, May	113.36	0.047	14.53	0.0537	135.14	11
93.3-90, June	108.89	0.0493	15.12	0.0484	137.36	7
93.3-90, July	104.58	0.0465	15.34	0.052	72.04	23
93.3-90, August	92.81	0.0417	14.83	0.047	39.38	8
93.3-90, September	76.79	0.0366	11.44	0.0394	46.63	8
93.3-90, October	63.98	0.0255	8.26	0.0303	57.83	18
93.3-90, November	61.1	0.0273	9.3	0.0319	34.9	10
93.3-90, December	65.36	0.0251	8.86	0.0279	136.67	3
93.3-80, January	64.71	0.0226	7.78	0.0258	50.22	25
93.3-80, February	80.54	0.0271	9.09	0.0311	88.03	16
93.3-80, March	93.36	0.0418	12.1	0.0431	100.81	13
93.3-80, April	99.25	0.0462	14.15	0.0479	64.92	24
93.3-80, May	154.92	0.0657	19.61	0.0676	212.4	10

Table K.4 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
93.3-80, June	135.17	0.0648	20.24	0.0617	110.07	7
93.3-80, July	138.17	0.0593	17.66	0.0715	118	24
93.3-80, August	127.35	0.0524	18.07	0.0508	112.28	9
93.3-80, September	94.59	0.0433	14.01	0.0465	58.67	9
93.3-80, October	86.52	0.0338	10.09	0.0331	88.18	17
93.3-80, November	74.64	0.0352	11.09	0.0368	48	10
93.3-80, December	67.52	0.0272	9.21	0.0257	60.88	4
93.3-70, January	82.19	0.0306	8.94	0.0457	69.3	27
93.3-70, February	96.59	0.0312	10.9	0.0359	100.22	16
93.3-70, March	116.92	0.044	13.28	0.0542	138.29	14
93.3-70, April	117.32	0.0612	18.52	0.0582	63.38	24
93.3-70, May	211.51	0.0589	20.9	0.0684	362.05	11
93.3-70, June	173.04	0.08	25.8	0.085	139.29	7
93.3-70, July	204.6	0.0698	20.25	0.0779	221.96	23
93.3-70, August	151.22	0.0679	22.11	0.065	97.39	9
93.3-70, September	124.61	0.0666	20.73	0.0784	71.56	9
93.3-70, October	325.61	0.0373	11.89	0.037	718.97	17
93.3-70, November	99.55	0.0498	15.11	0.0667	85.64	11
93.3-70, December	83.47	0.0366	11.13	0.0378	111.17	3
93.3-60, January	99.26	0.0342	9.29	0.0379	101.3	27
93.3-60, February	87.51	0.0394	11.2	0.0348	77.2	15
93.3-60, March	101.8	0.0463	13.76	0.0483	74.19	15
93.3-60, April	129.47	0.0566	17.1	0.0536	92	23
93.3-60, May	190.98	0.0664	21.73	0.0677	262.86	11
93.3-60, June	196.97	0.0742	26.12	0.0694	221.27	8
93.3-60, July	171.78	0.0691	20.57	0.0834	149.04	24
93.3-60, August	145.28	0.0609	20.31	0.0548	94.33	9
93.3-60, September	122.39	0.0593	18.22	0.0563	92.67	9
93.3-60, October	93.95	0.0382	11.66	0.0419	85.67	18
93.3-60, November	88.23	0.049	13.6	0.0533	63.77	11
93.3-60, December	97.55	0.0416	13.3	0.0414	252.33	3
93.3-55, January	105.39	0.0338	11.4	0.0379	104.94	25
93.3-55, February	94.59	0.0382	12.25	0.0366	79.23	15
93.3-55, March	116.85	0.0504	15.26	0.0498	106.17	15
93.3-55, April	147.27	0.0619	19.79	0.0663	102.48	23
93.3-55, May	250.07	0.0716	24.23	0.075	443.41	11
93.3-55, June	217.9	0.0906	29.84	0.094	216.25	8
93.3-55, July	204.48	0.0802	23.19	0.0814	187.46	24
93.3-55, August	164.79	0.0657	21.54	0.0664	155.94	8
93.3-55, September	123.95	0.0646	18.92	0.0639	71	8
93.3-55, October	105.73	0.0406	12.83	0.0371	104.66	19
93.3-55, November	93.58	0.0511	14.71	0.0598	64.3	10
93.3-55, December	90.02	0.0408	14.4	0.0553	47	3
93.3-50, January	101.12	0.0393	11.71	0.0577	93.33	27
93.3-50, February	93.31	0.0396	11.95	0.0433	88.75	14
93.3-50, March	111.51	0.0534	15.4	0.058	89.43	15
93.3-50, April	136.09	0.069	22.34	0.0676	76.43	23

Table K.4 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
93.3-50, May	218.97	0.0727	22.75	0.0761	295.91	11
93.3-50, June	229.02	0.1051	29.83	0.0965	268.56	8
93.3-50, July	195	0.0671	21.98	0.0734	183.79	24
93.3-50, August	132.31	0.0614	19.88	0.0552	60.72	9
93.3-50, September	112.32	0.0557	18.24	0.066	72.67	9
93.3-50, October	107.25	0.0375	12.36	0.0424	119.61	19
93.3-50, November	89.39	0.0512	15.31	0.0547	52.8	10
93.3-50, December	91.39	0.0427	13.69	0.0454	104.38	4
93.3-45, January	104.27	0.0311	9.27	0.0336	104.68	28
93.3-45, February	91.48	0.0342	11.33	0.0383	80.77	15
93.3-45, March	111.98	0.0506	15.22	0.0517	77.83	15
93.3-45, April	141.78	0.0821	22.87	0.0879	89.61	23
93.3-45, May	262.96	0.0832	23.48	0.0836	382.82	11
93.3-45, June	217.27	0.1188	33.61	0.129	200.06	8
93.3-45, July	224.22	0.0657	20.92	0.0652	248.79	24
93.3-45, August	143.8	0.0863	22.2	0.0673	75.94	8
93.3-45, September	118.9	0.0502	17.95	0.0604	99.22	9
93.3-45, October	92.72	0.0411	13.4	0.0581	75.13	19
93.3-45, November	99.92	0.0486	14.82	0.058	97.1	10
93.3-45, December	90.63	0.0491	14.87	0.05	74	4
93.3-40, January	94.31	0.0281	9.43	0.036	91.16	28
93.3-40, February	98.47	0.034	11.54	0.0432	111.63	15
93.3-40, March	105.38	0.0521	15.16	0.0575	66.17	15
93.3-40, April	126.02	0.0564	18.13	0.0595	83.17	23
93.3-40, May	179.07	0.0767	23.8	0.0897	189.95	11
93.3-40, June	199.76	0.0879	27.56	0.085	184.06	8
93.3-40, July	212.71	0.0694	21.98	0.0757	223.13	23
93.3-40, August	152.65	0.0641	20.95	0.0672	136.17	9
93.3-40, September	118.23	0.0593	19.16	0.074	94.89	9
93.3-40, October	113.69	0.0408	13.29	0.0634	132.45	19
93.3-40, November	90.78	0.0506	16.38	0.0707	54.5	10
93.3-40, December	90.12	0.0538	15.36	0.0669	102.75	4
93.3-35, January	133.22	0.0364	10.25	0.045	156.72	27
93.3-35, February	95.27	0.0423	13.65	0.0434	79.57	15
93.3-35, March	102.39	0.0508	15.79	0.0668	51.64	14
93.3-35, April	124.83	0.06	18.35	0.0707	83.63	23
93.3-35, May	188.62	0.0769	22.86	0.0762	222.1	10
93.3-35, June	191.35	0.0794	26.27	0.0771	185.13	8
93.3-35, July	168	0.072	21.1	0.1022	144.33	24
93.3-35, August	140.17	0.0738	20.12	0.0596	103	9
93.3-35, September	113.84	0.0619	17.36	0.0583	84.3	10
93.3-35, October	94.46	0.0373	13.42	0.0492	80.81	18
93.3-35, November	95.47	0.0446	14.49	0.0674	86.7	10
93.3-35, December	92.88	0.0412	13.76	0.042	99.63	4
93.3-30, January	87.34	0.0387	11.07	0.0403	73.02	28
93.3-30, February	95.4	0.0463	13.18	0.0558	87.36	14
93.3-30, March	108.36	0.0537	17.3	0.0615	57.37	15

Table K.4 - continued

LS-Month	Mean	$MCSE_{Mean}$	SD	$MCSE_{SD}$	OBS Mean	OBS Count
93.3-30, April	127.82	0.0625	19.05	0.0943	92.04	24
93.3-30, May	165.14	0.0783	25.61	0.109	118.22	9
93.3-30, June	200.46	0.08	27.39	0.1184	226.94	8
93.3-30, July	163.5	0.0701	23.66	0.0979	123.75	24
93.3-30, August	136.28	0.0672	21.66	0.0732	85.28	9
93.3-30, September	111.13	0.0517	18.02	0.0695	70.9	10
93.3-30, October	93.9	0.0409	14.27	0.077	81.72	18
93.3-30, November	86.72	0.0462	14.36	0.0562	59.11	9
93.3-30, December	84.89	0.0491	13.92	0.0443	57.6	5
93.3-28, January	92.79	0.043	12.17	0.0675	80.33	27
93.3-28, February	99.75	0.0445	14.59	0.0589	93.13	12
93.3-28, March	121.64	0.0648	18.91	0.1013	88.03	16
93.3-28, April	139.74	0.0755	21.95	0.1498	99.86	22
93.3-28, May	181.53	0.0881	29.05	0.114	135.64	7
93.3-28, June	203.65	0.1023	32.34	0.1444	172.86	7
93.3-28, July	249.41	0.0798	25.64	0.159	293.43	23
93.3-28, August	148.18	0.0712	25.15	0.086	83.94	8
93.3-28, September	111.23	0.0656	20.01	0.0818	56.6	10
93.3-28, October	86.17	0.0459	15.98	0.0955	56.06	17
93.3-28, November	85.78	0.0534	15.85	0.0787	42.88	8
93.3-28, December	87.56	0.0442	15.45	0.0538	60.8	5
93.3-26.7, January	95.9	0.0571	20.23	0.0826	42.95	20
93.3-26.7, February	116.19	0.0664	22.13	0.1053	94.8	5
93.3-26.7, March	154.14	0.1008	28.01	0.204	137.11	9
93.3-26.7, April	187.25	0.1112	32.8	0.2052	140.35	17
93.3-26.7, May	225.59	0.1412	41.15	0.1994	176.4	5
93.3-26.7, June	259.4	0.1594	46.19	0.2131	272.5	3
93.3-26.7, July	236.58	0.1368	44.36	0.2246	160.19	16
93.3-26.7, August	176.55	0.1205	35.72	0.1439	86.5	6
93.3-26.7, September	143.11	0.0888	28.79	0.1119	98.14	7
93.3-26.7, October	110.62	0.0752	23.48	0.1069	56.05	11
93.3-26.7, November	103.62	0.0646	21.8	0.1126	80.89	9
93.3-26.7, December	101.26	0.0742	21.34	0.1029	79.83	3

APPENDIX L

DIFFERENCE OF WCAR AND HCAR PREDICTED SAMPLING SITE MONTHLY MEAN ZOOPLANKTON YIELDS MAPS

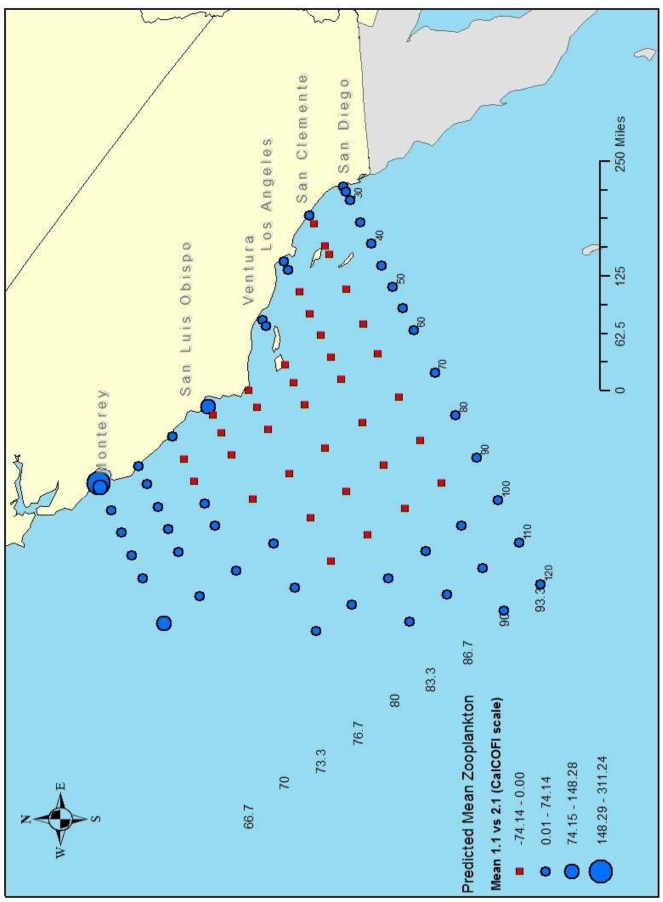


Figure L.1a: Difference of WCAR and HCAR Predicted Sampling Sites Mean Zooplankton Yields (Model 2.1 minus Model 1.1): January.

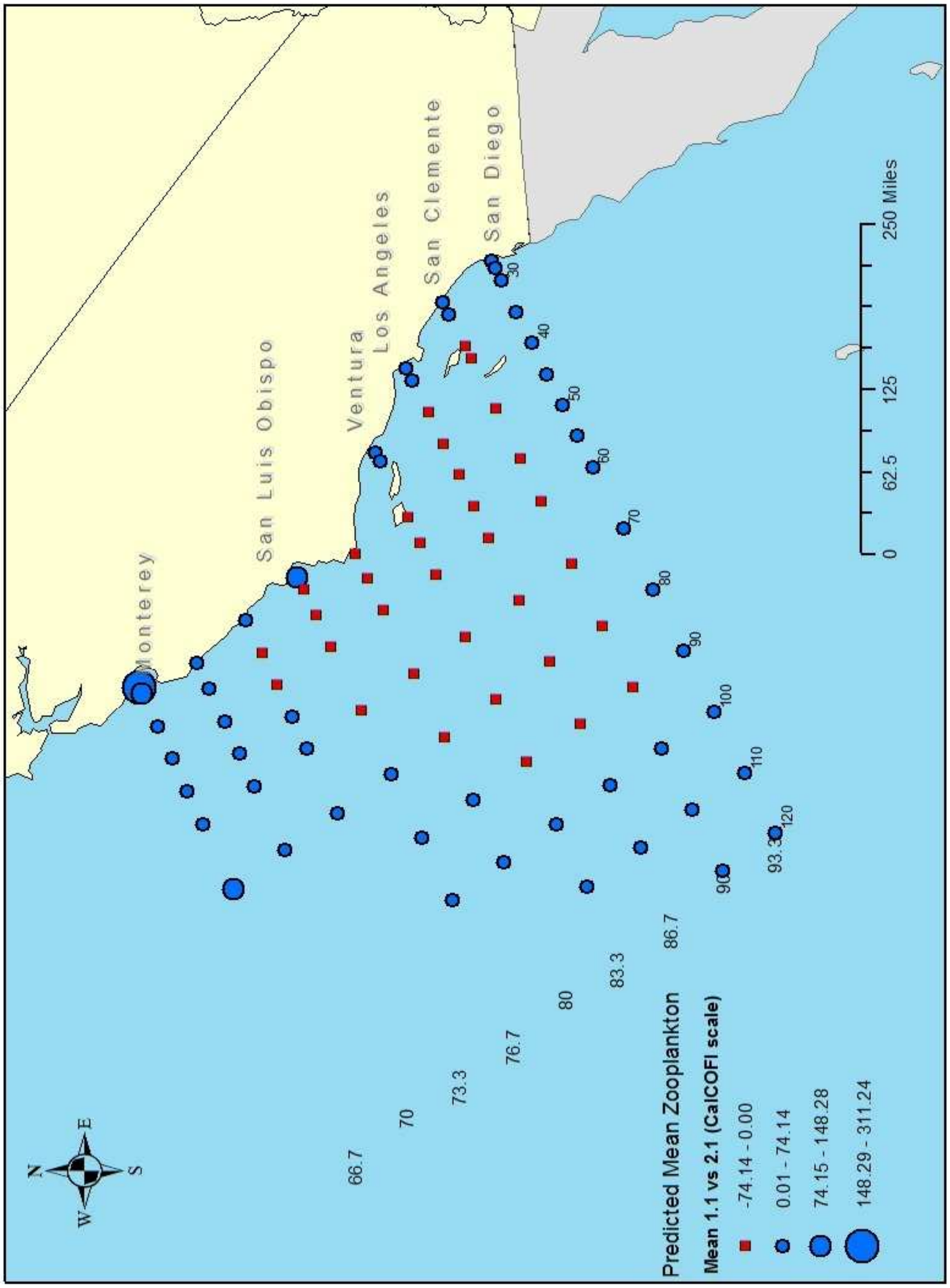


Figure L.1b: Difference of WCAR and HCAR Predicted Sampling Sites Mean Zooplankton Yields (Model 2.1 minus Model 1.1): February.

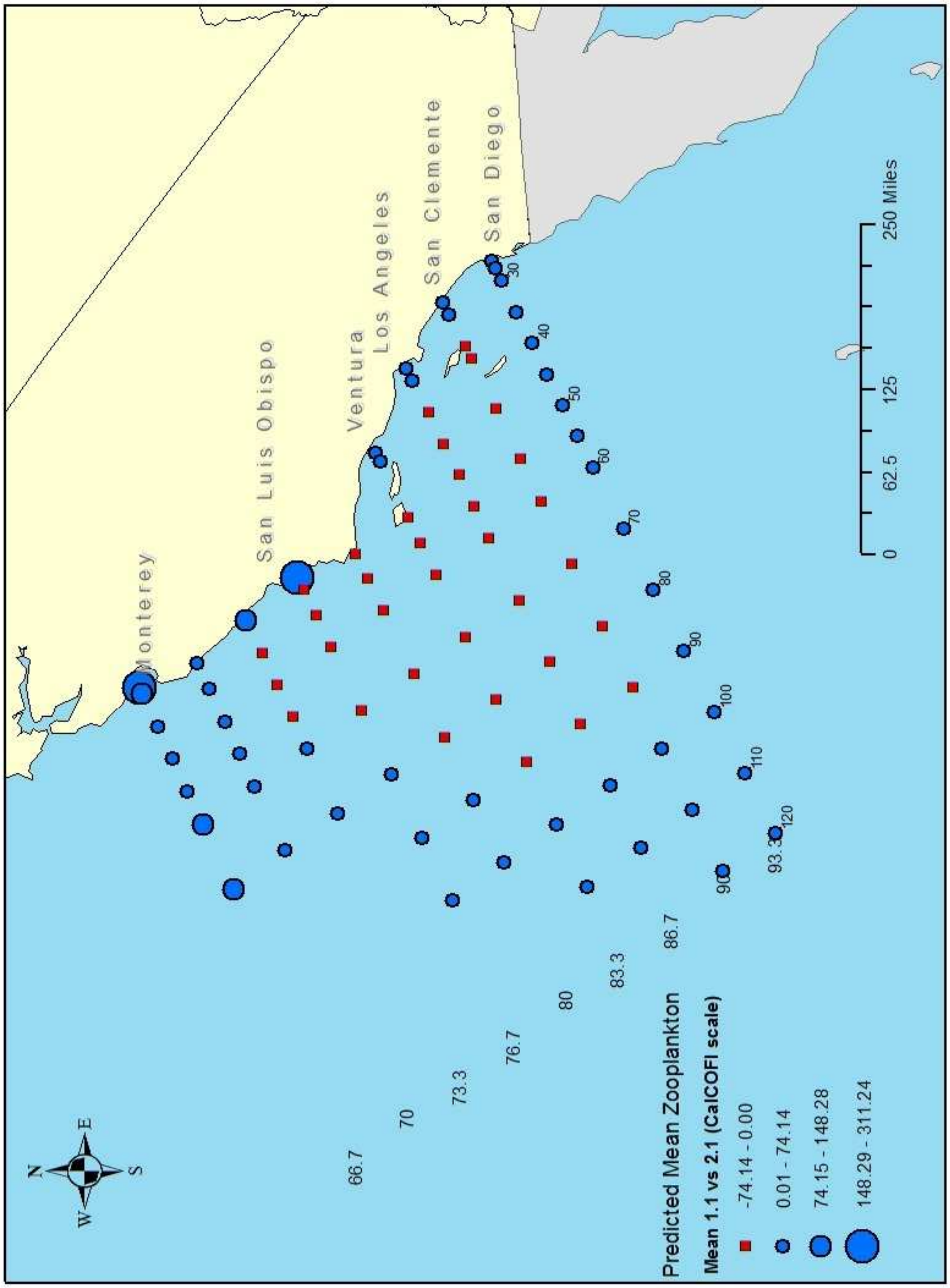


Figure L.1c: Difference of WCAR and HCAR Predicted Sampling Sites Mean Zooplankton Yields (Model 2.1 minus Model 1.1): March.

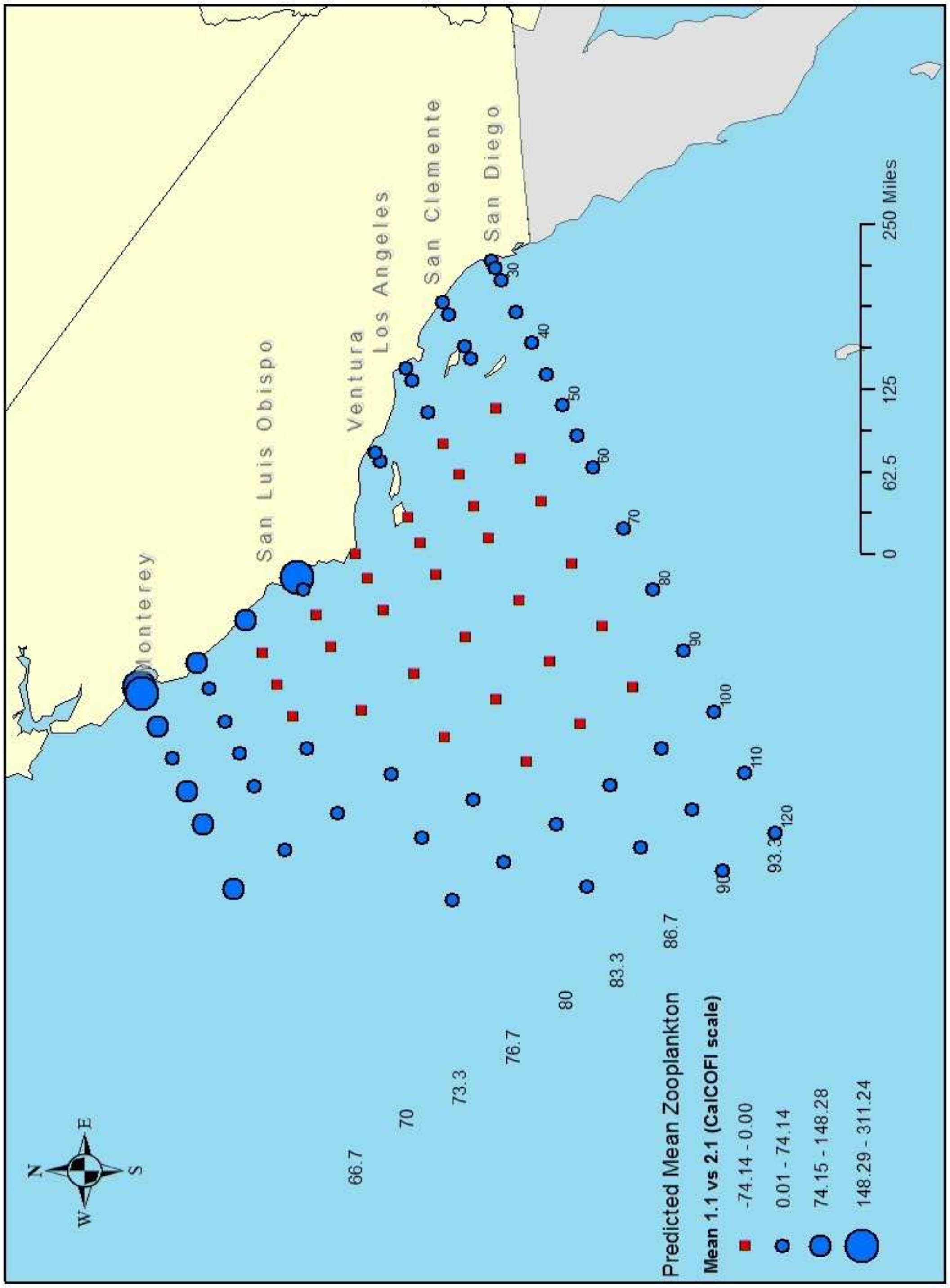


Figure L.1d: Difference of WCAR and HCAR Predicted Sampling Sites Mean Zooplankton Yields (Model 2.1 minus Model 1.1): April.

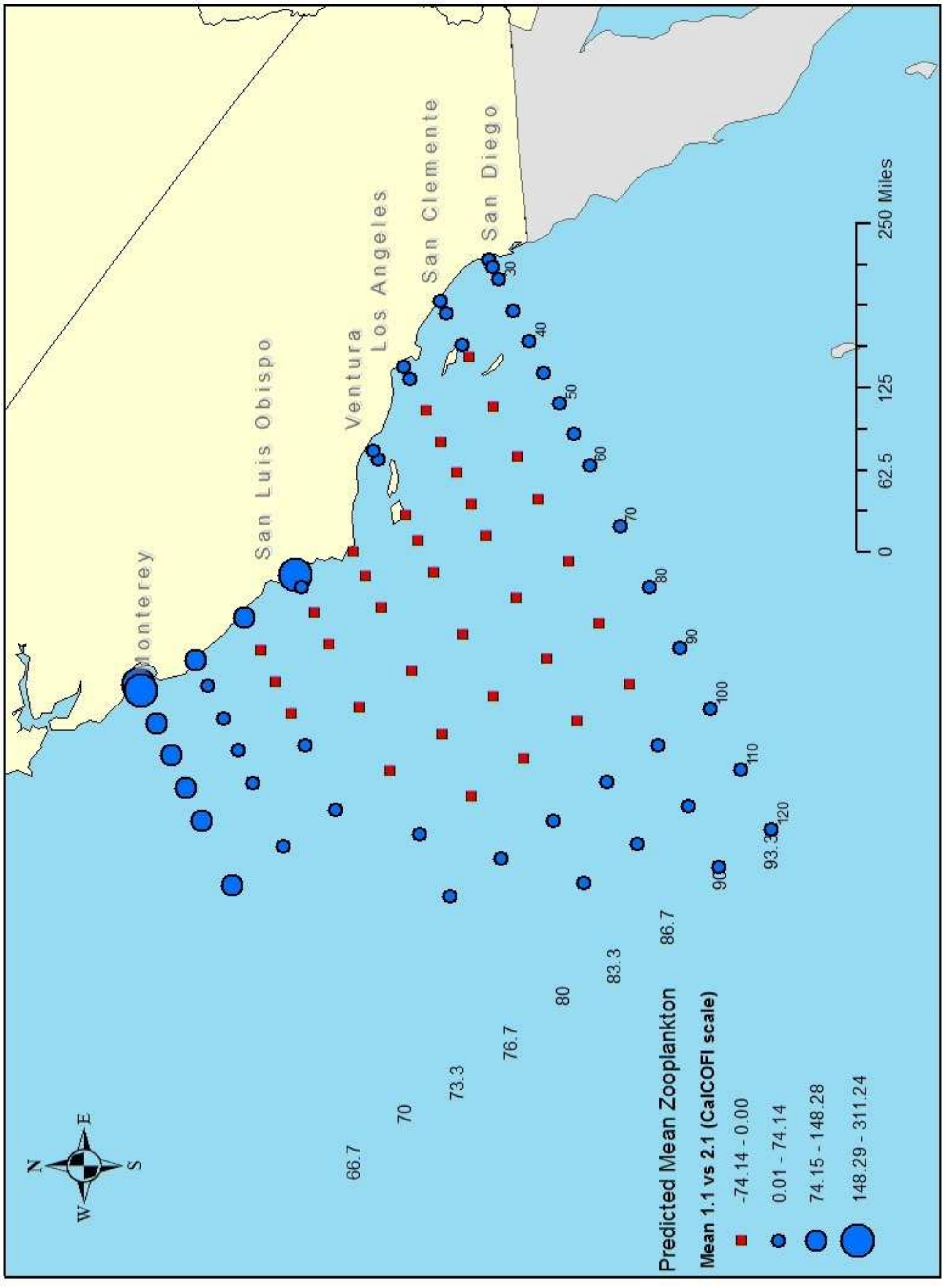


Figure L.1e: Difference of WCAR and HCAR Predicted Sampling Sites Mean Zooplankton Yields (Model 2.1 minus Model 1.1): May.

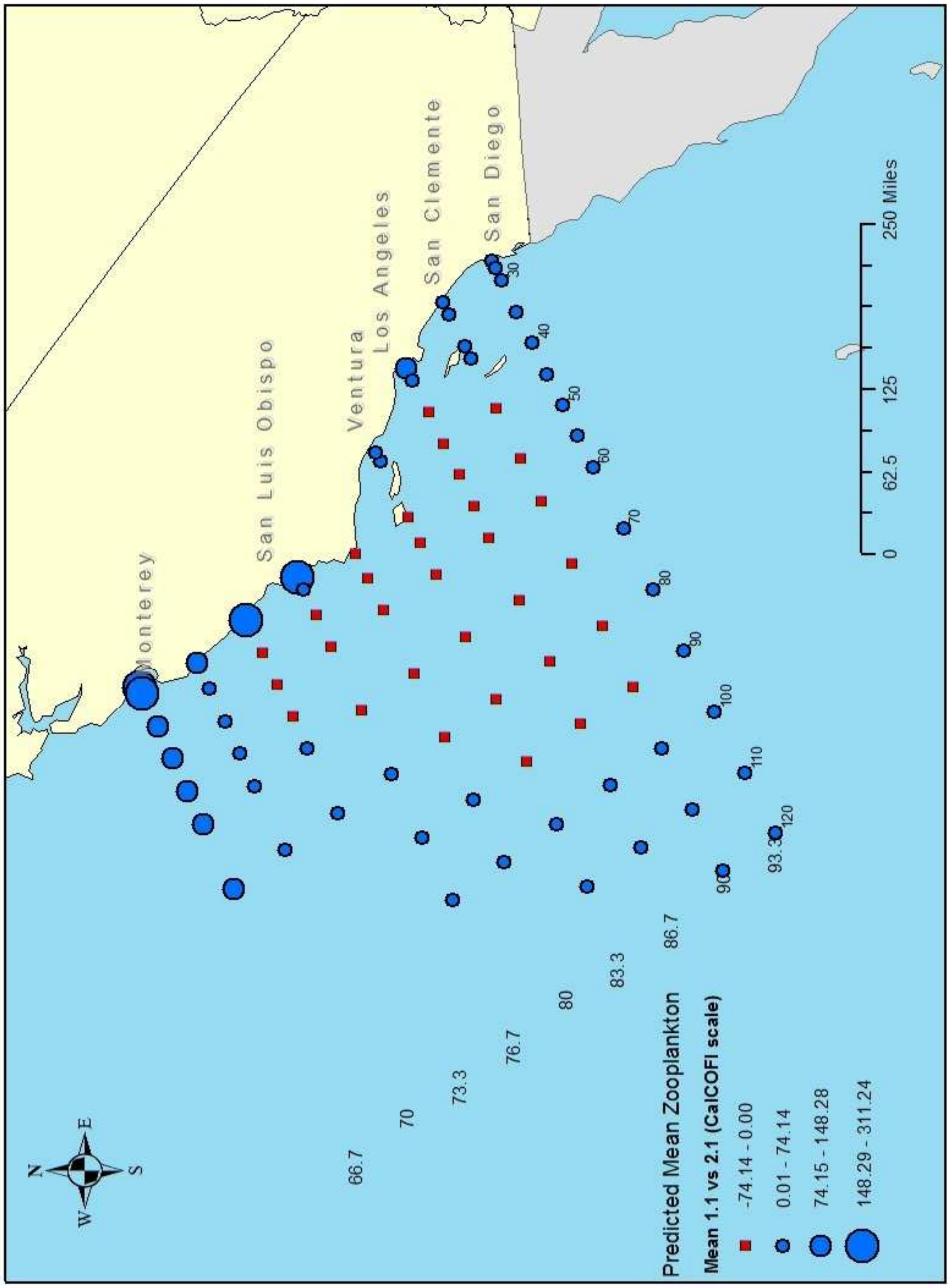


Figure L.1f: Difference of WCAR and HCAR Predicted Sampling Sites Mean Zooplankton Yields (Model 2.1 minus Model 1.1): June.

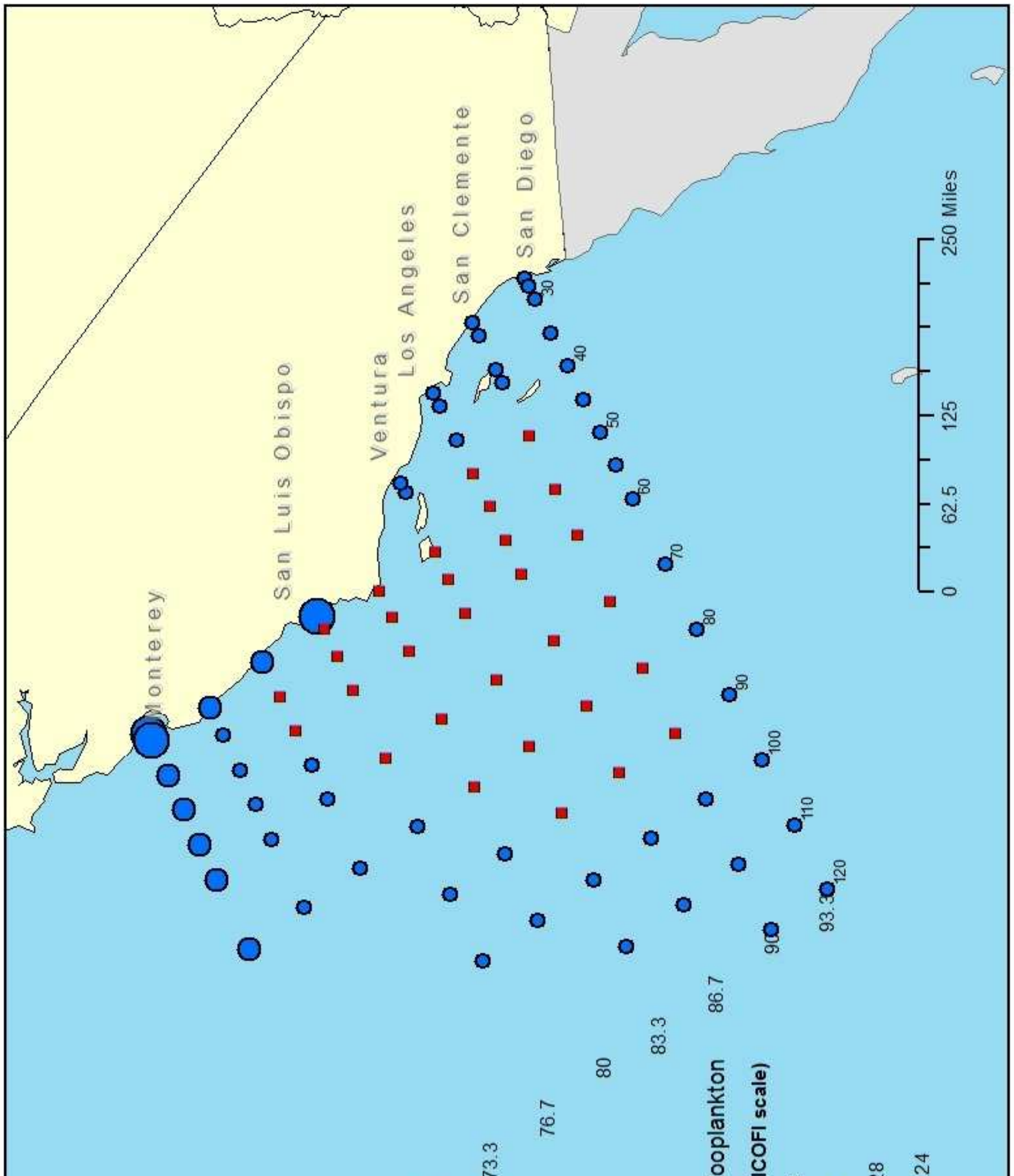


Figure L.1g: Difference of WCAR and HCAR Predicted Sampling Sites Mean Zooplankton Yields (Model 2.1 minus Model 1.1): July.

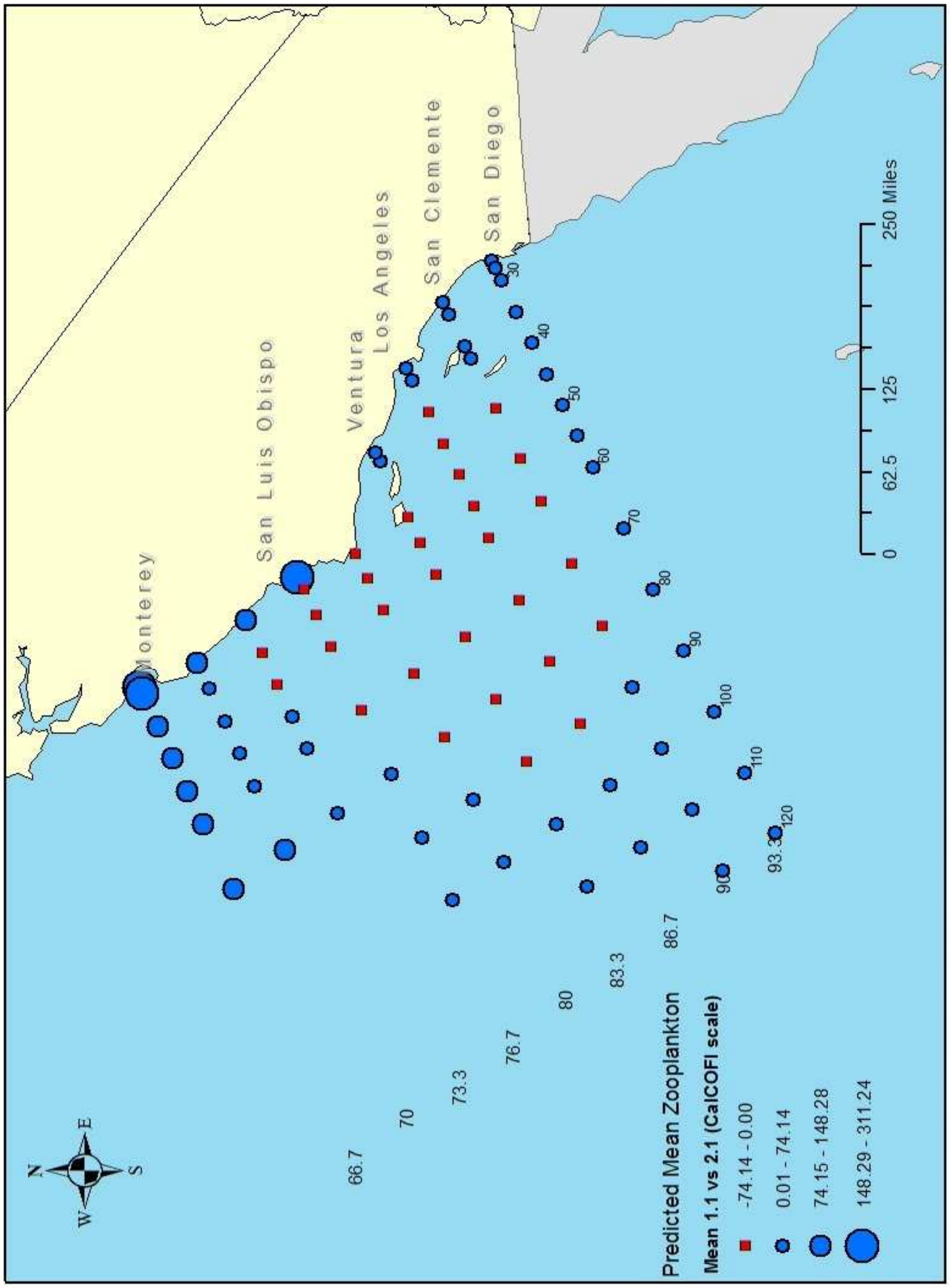


Figure L.1h: Difference of WCAR and HCAR Predicted Sampling Sites Mean Zooplankton Yields (Model 2.1 minus Model 1.1): August.

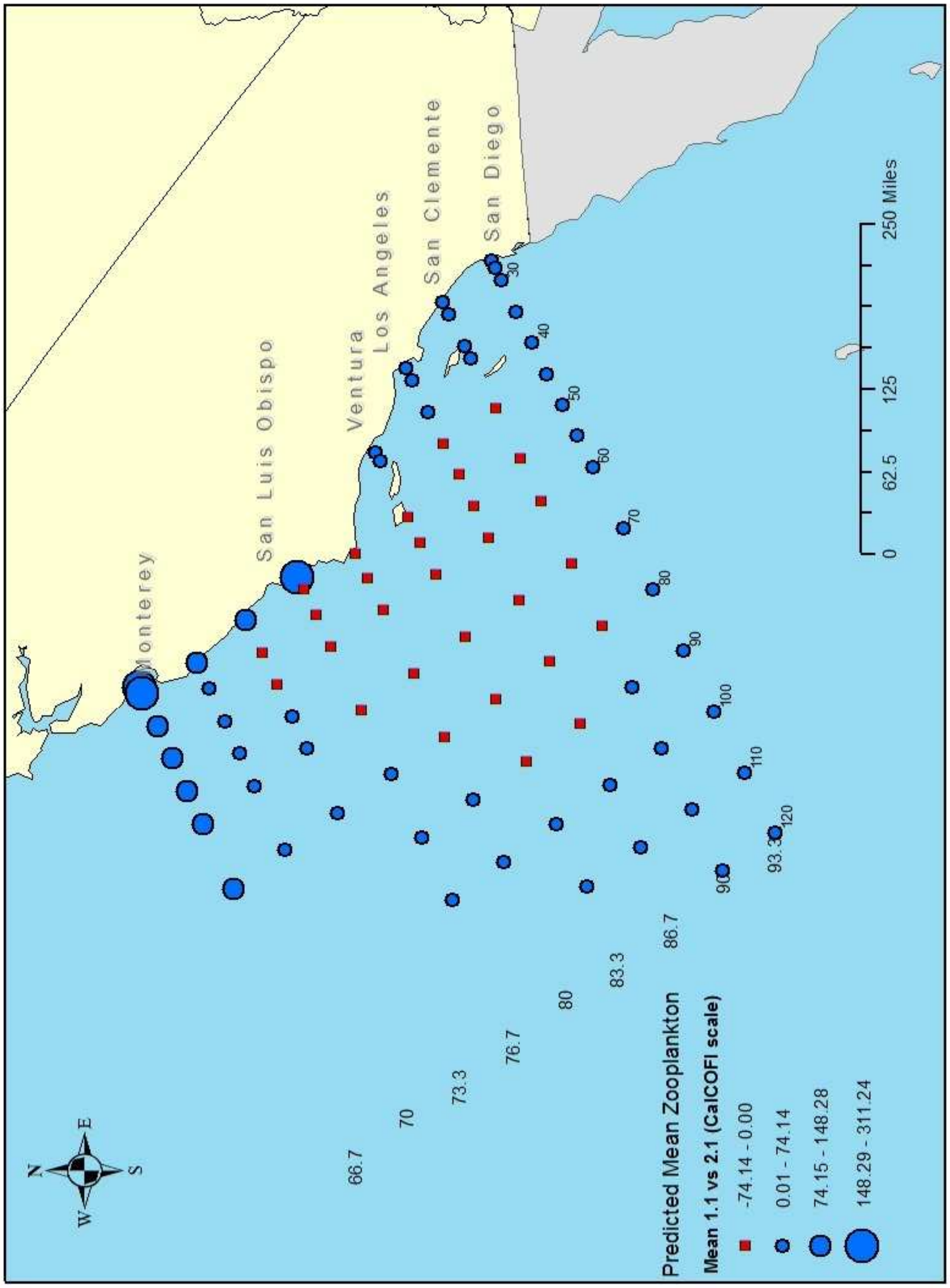


Figure L.1i: Difference of WCAR and HCAR Predicted Sampling Sites Mean Zooplankton Yields (Model 2.1 minus Model 1.1): September.

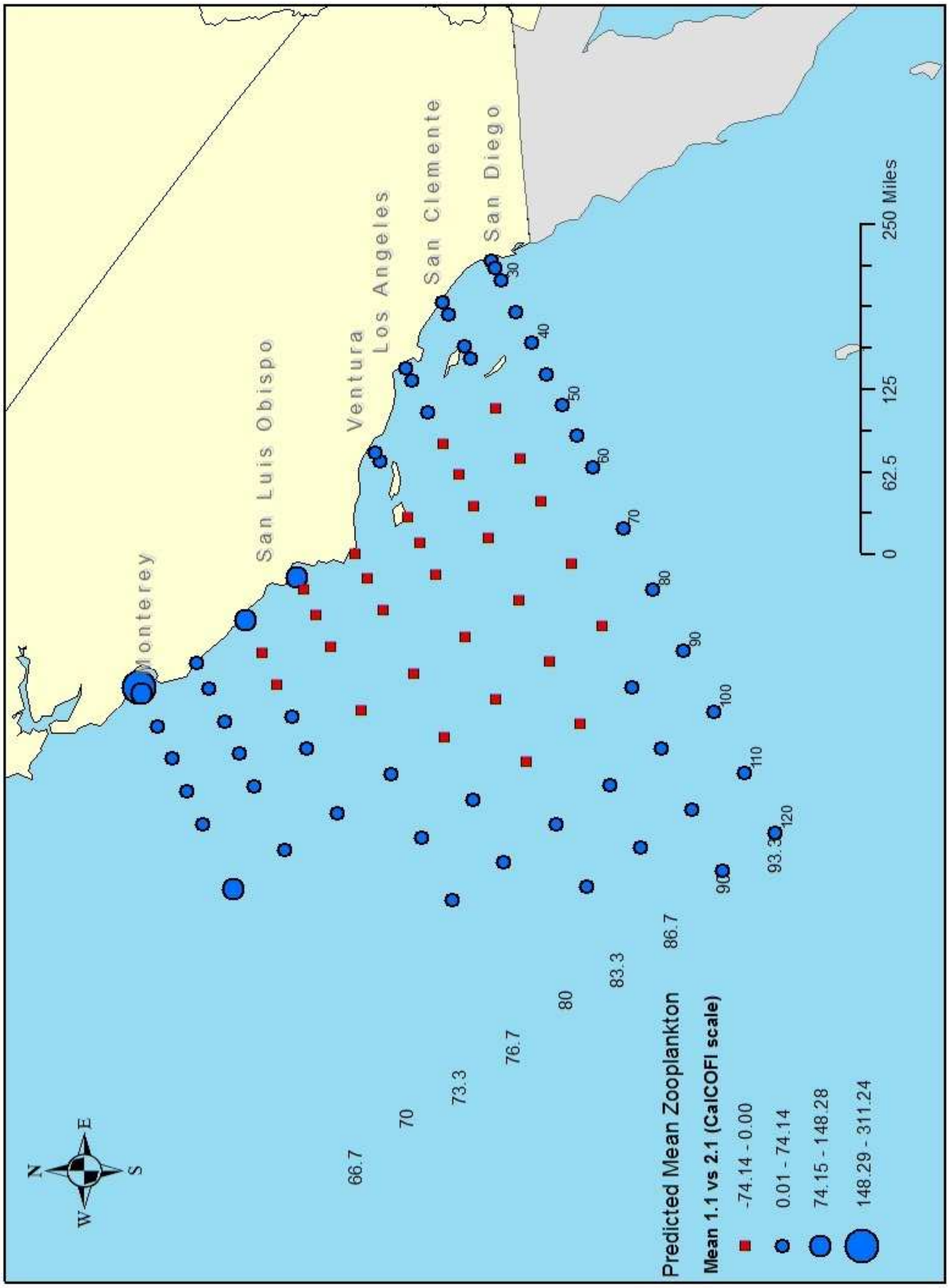


Figure L.1j: Difference of WCAR and HCAR Predicted Sampling Sites Mean Zooplankton Yields (Model 2.1 minus Model 1.1): October.

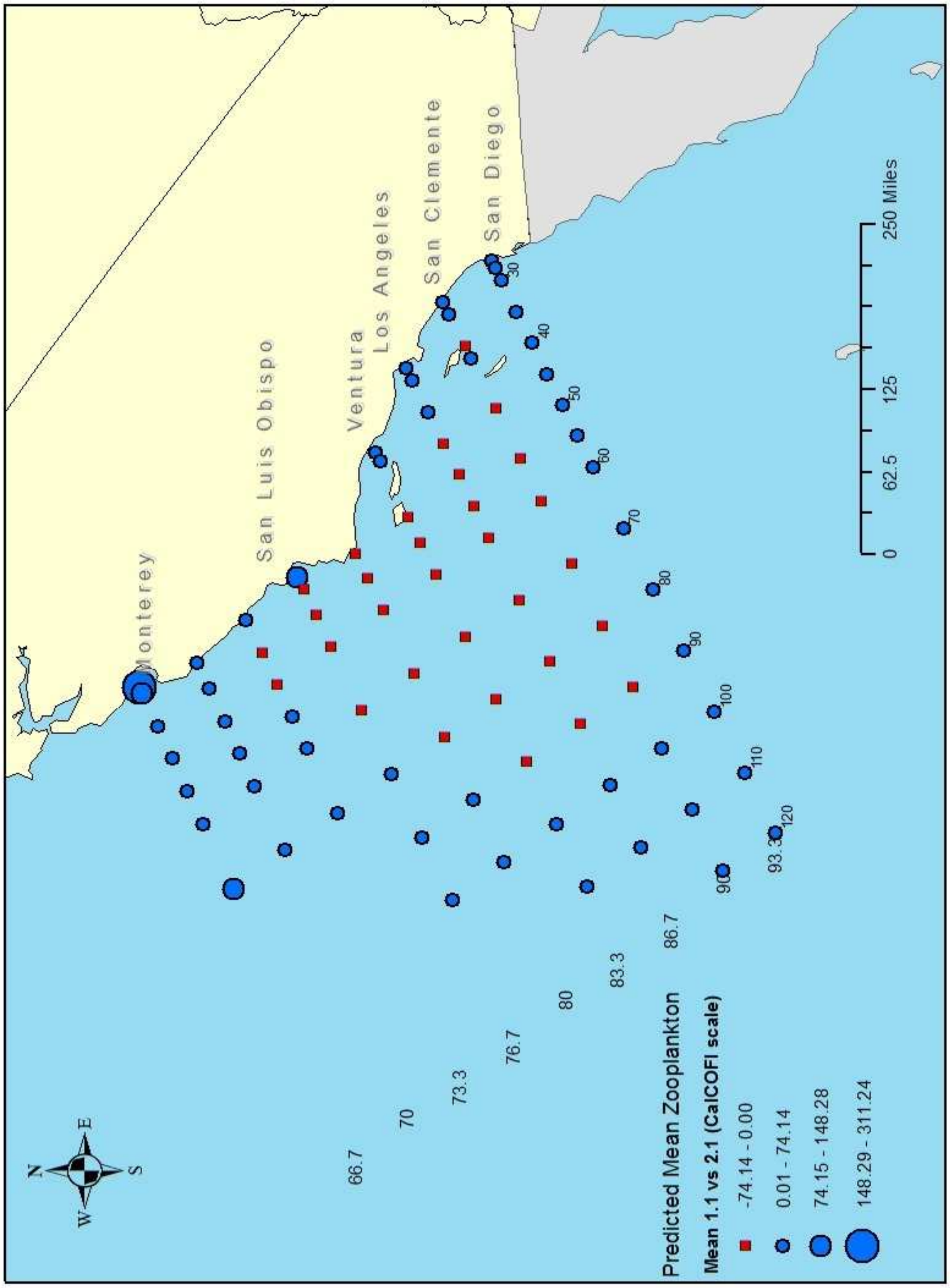


Figure L.1k: Difference of WCAR and HCAR Predicted Sampling Sites Mean Zooplankton Yields (Model 2.1 minus Model 1.1): November.

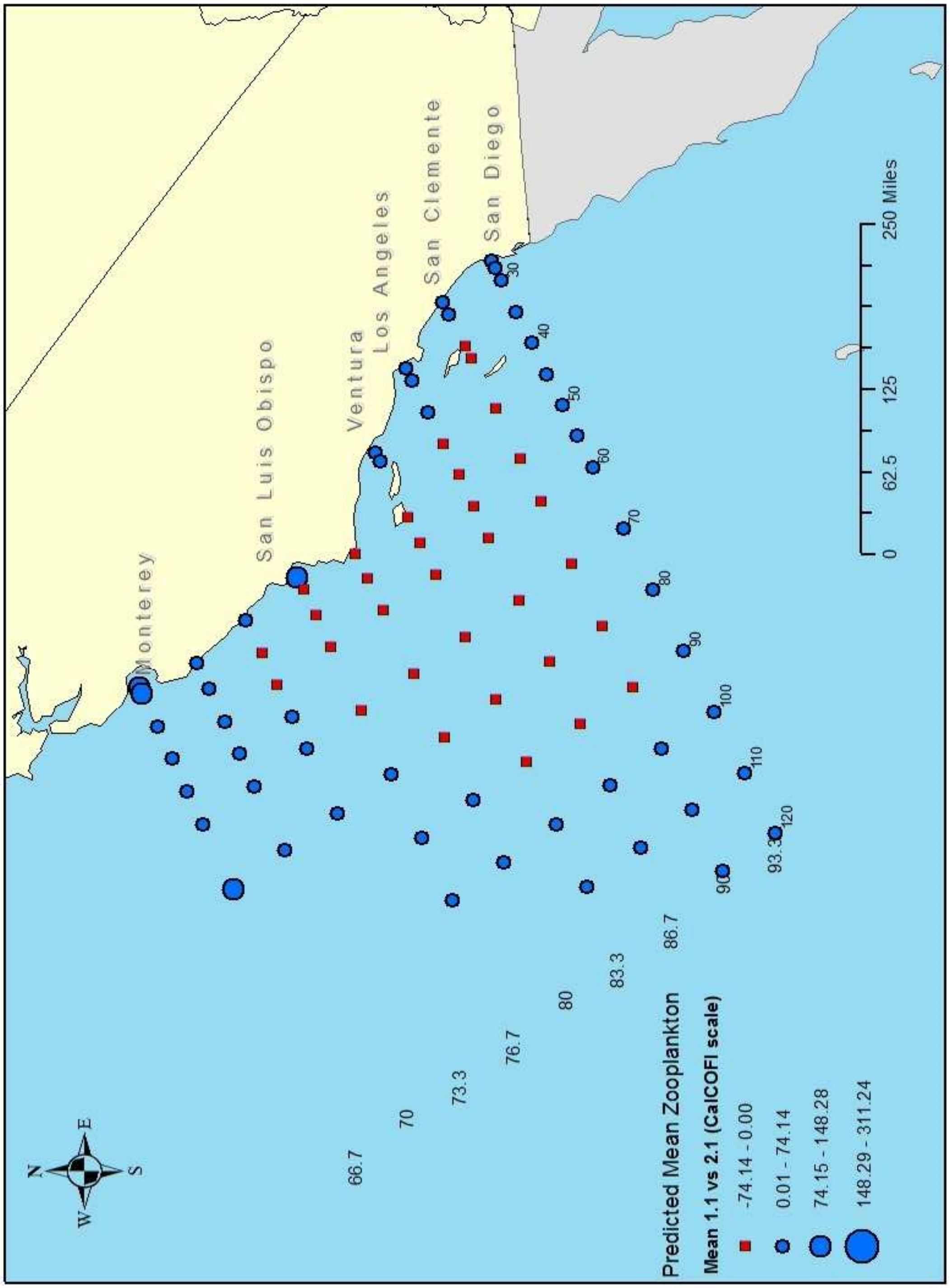


Figure L.1l: Difference of WCAR and HCAR Predicted Sampling Sites Mean Zooplankton Yields (Model 2.1 minus Model 1.1): December.

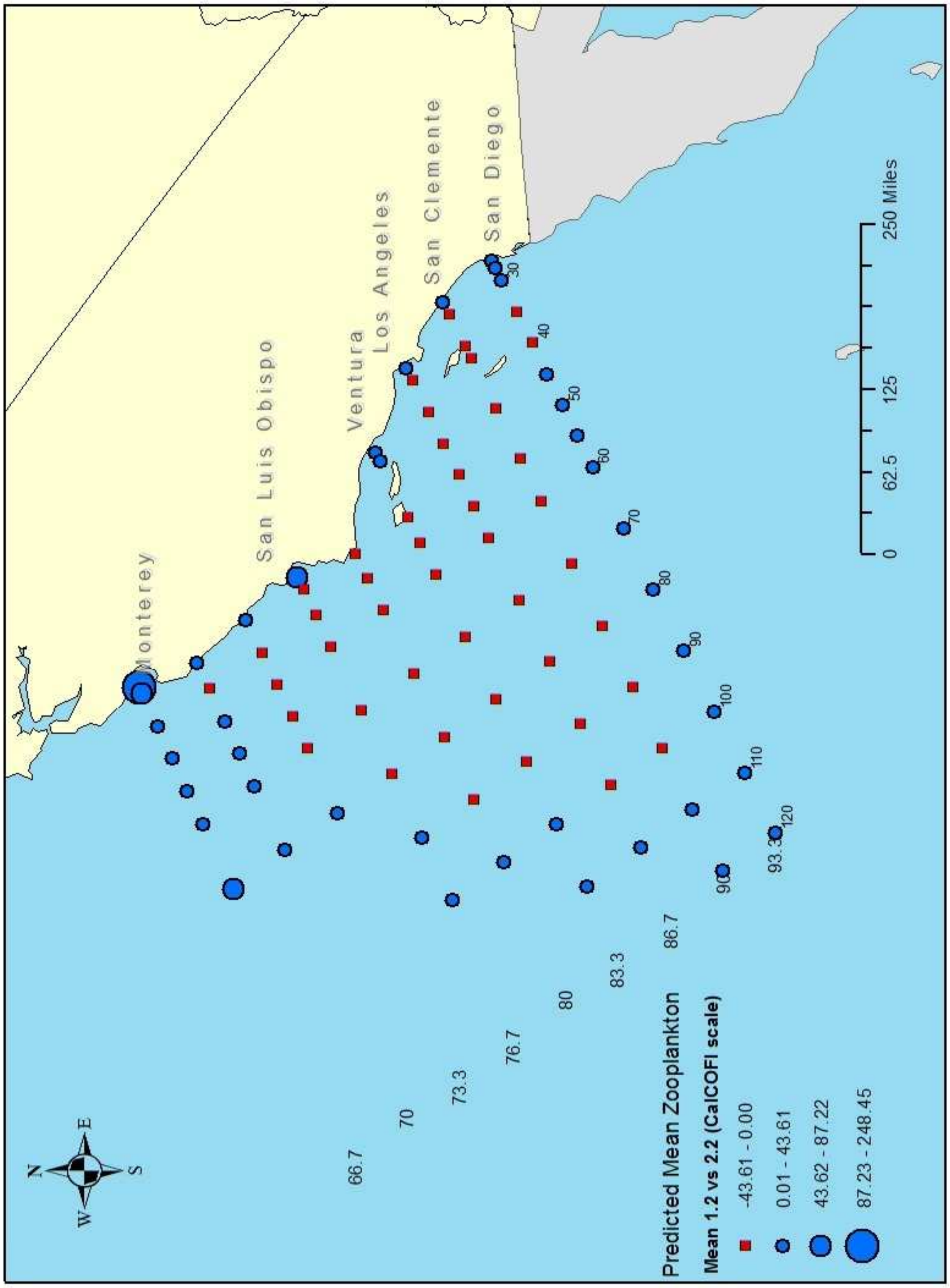


Figure L.2a: Difference of WCAR and HCAR Predicted Sampling Sites Mean Zooplankton Yields (Model 2.2 minus Model 1.2): January.

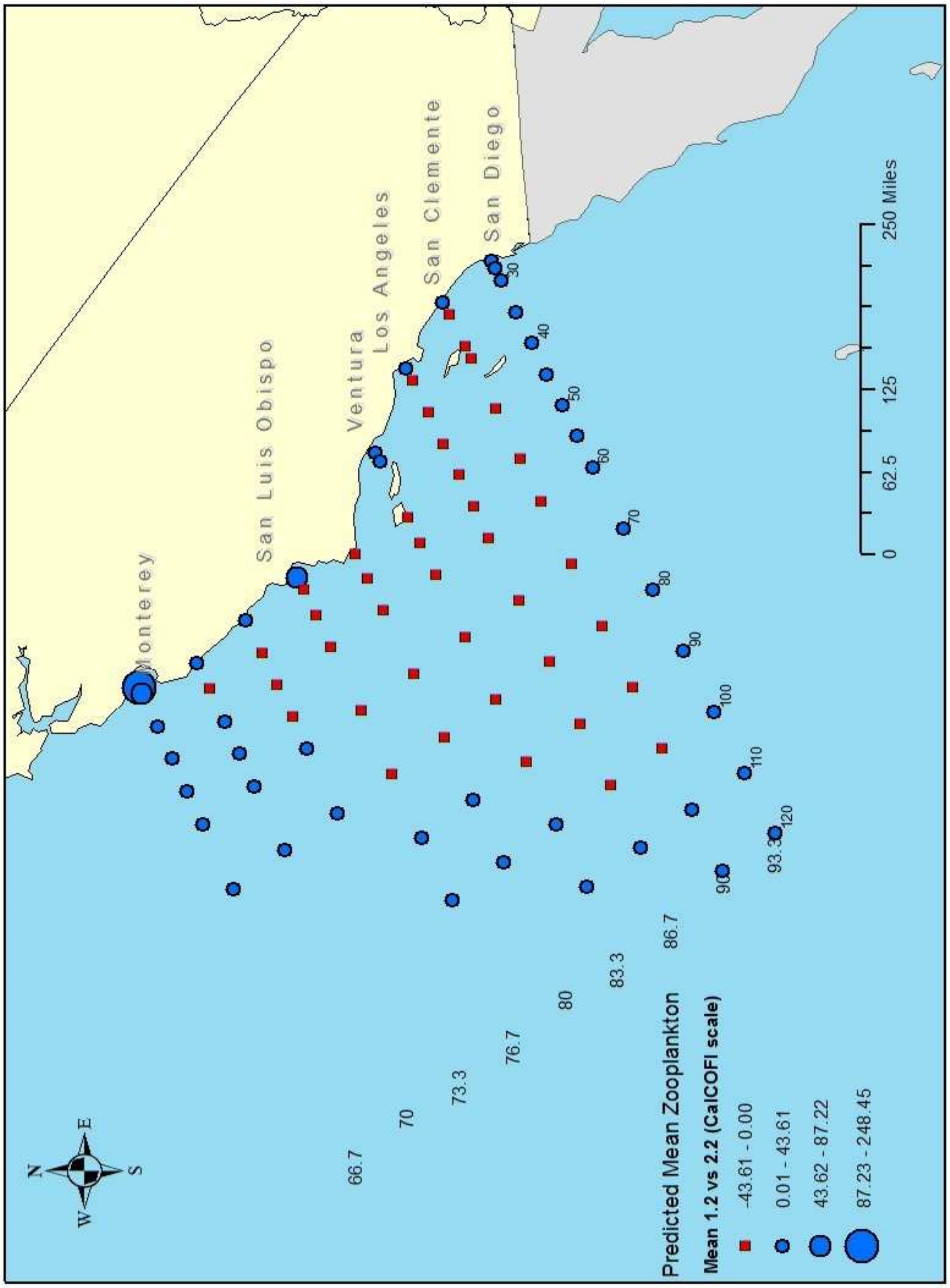


Figure L.2b: Difference of WCAR and HCAR Predicted Sampling Sites Mean Zooplankton Yields (Model 2.2 minus Model 1.2): February.

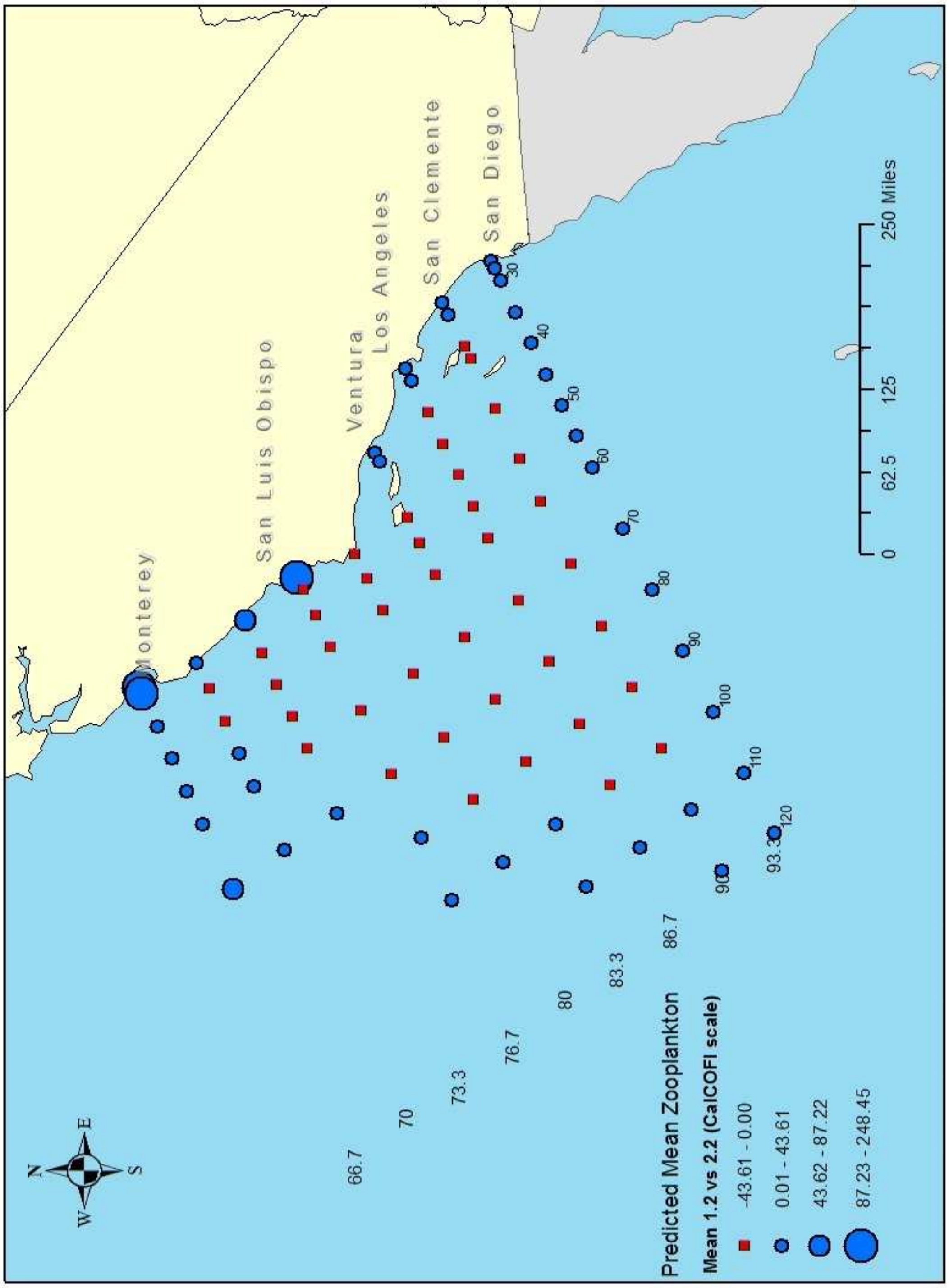


Figure L.2c: Difference of WCAR and HCAR Predicted Sampling Sites Mean Zooplankton Yields (Model 2.2 minus Model 1.2): March.

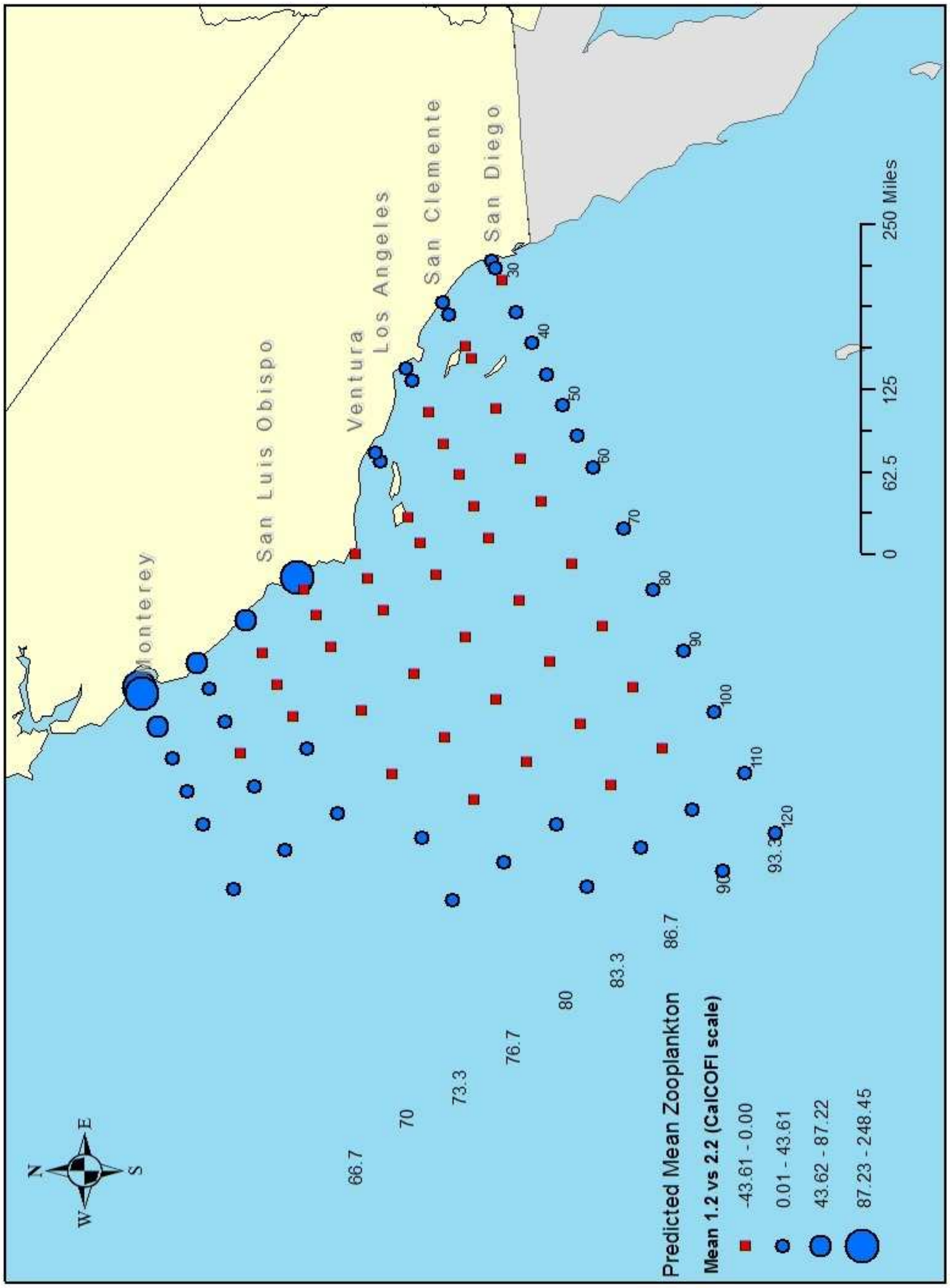


Figure L.2d: Difference of WCAR and HCAR Predicted Sampling Sites Mean Zooplankton Yields (Model 2.2 minus Model 1.2): April.

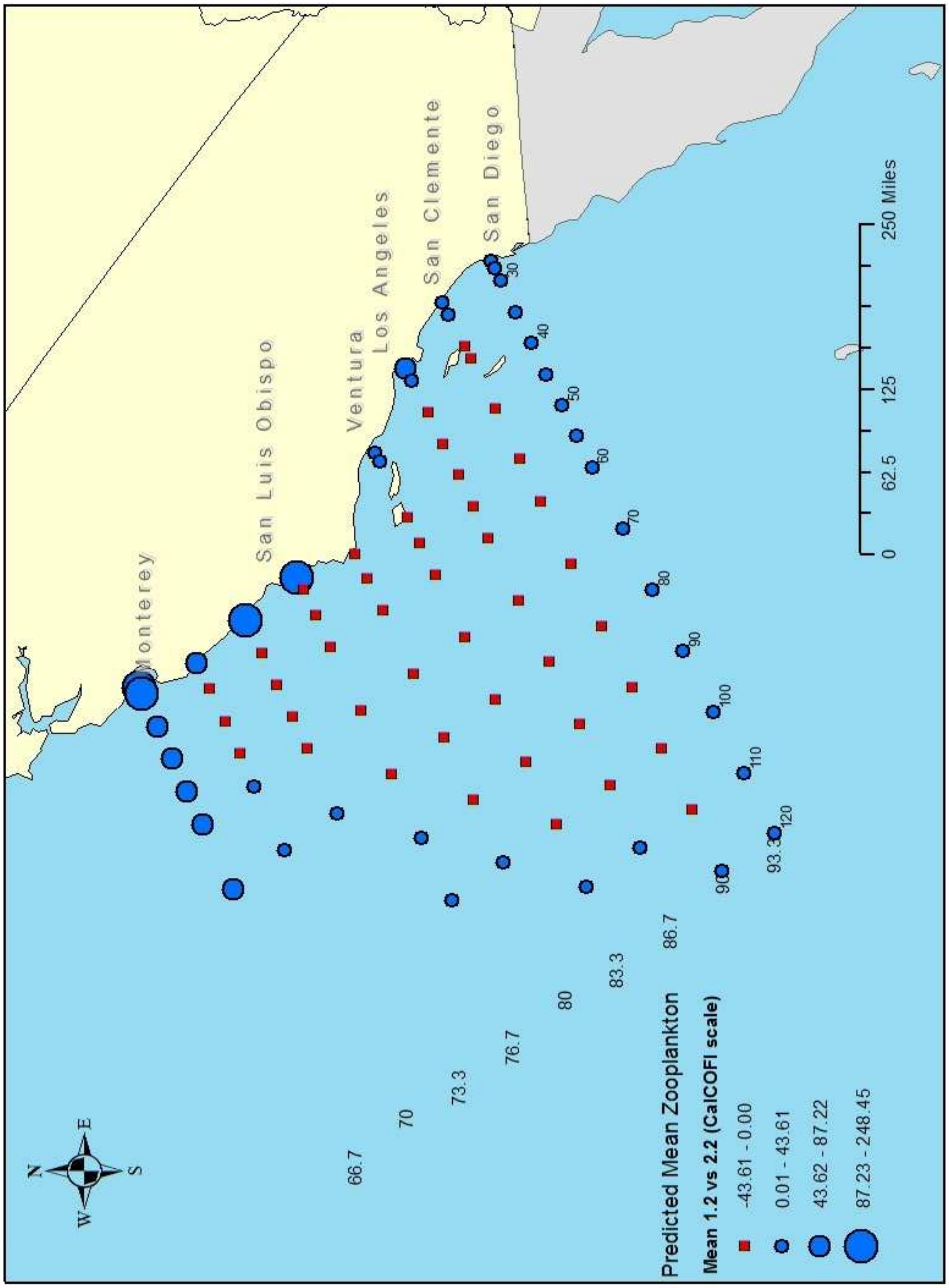


Figure L.2e: Difference of WCAR and HCAR Predicted Sampling Sites Mean Zooplankton Yields (Model 2.2 minus Model 1.2): May.

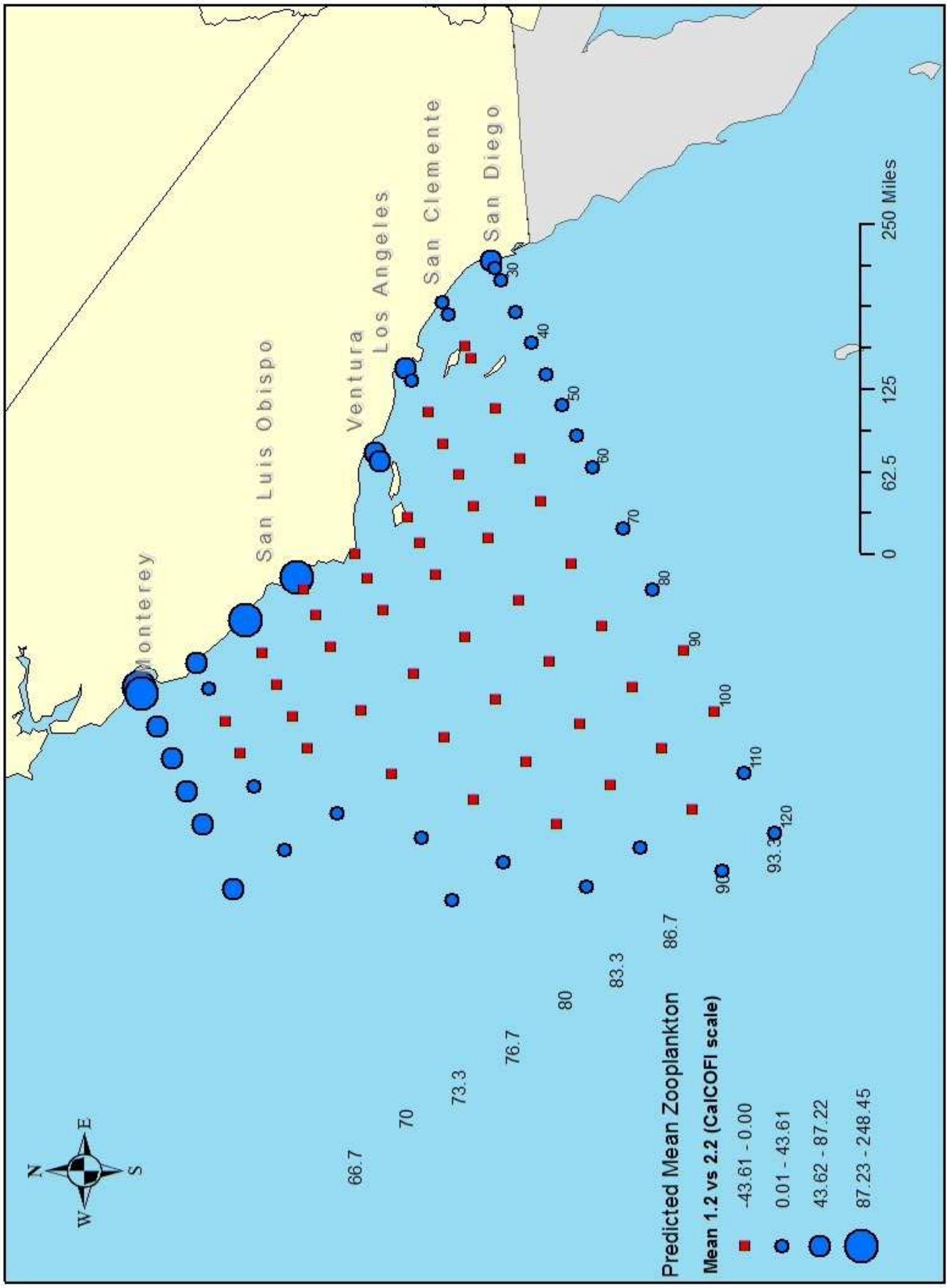


Figure L.2f: Difference of WCAR and HCAR Predicted Sampling Sites Mean Zooplankton Yields (Model 2.2 minus Model 1.2): June.

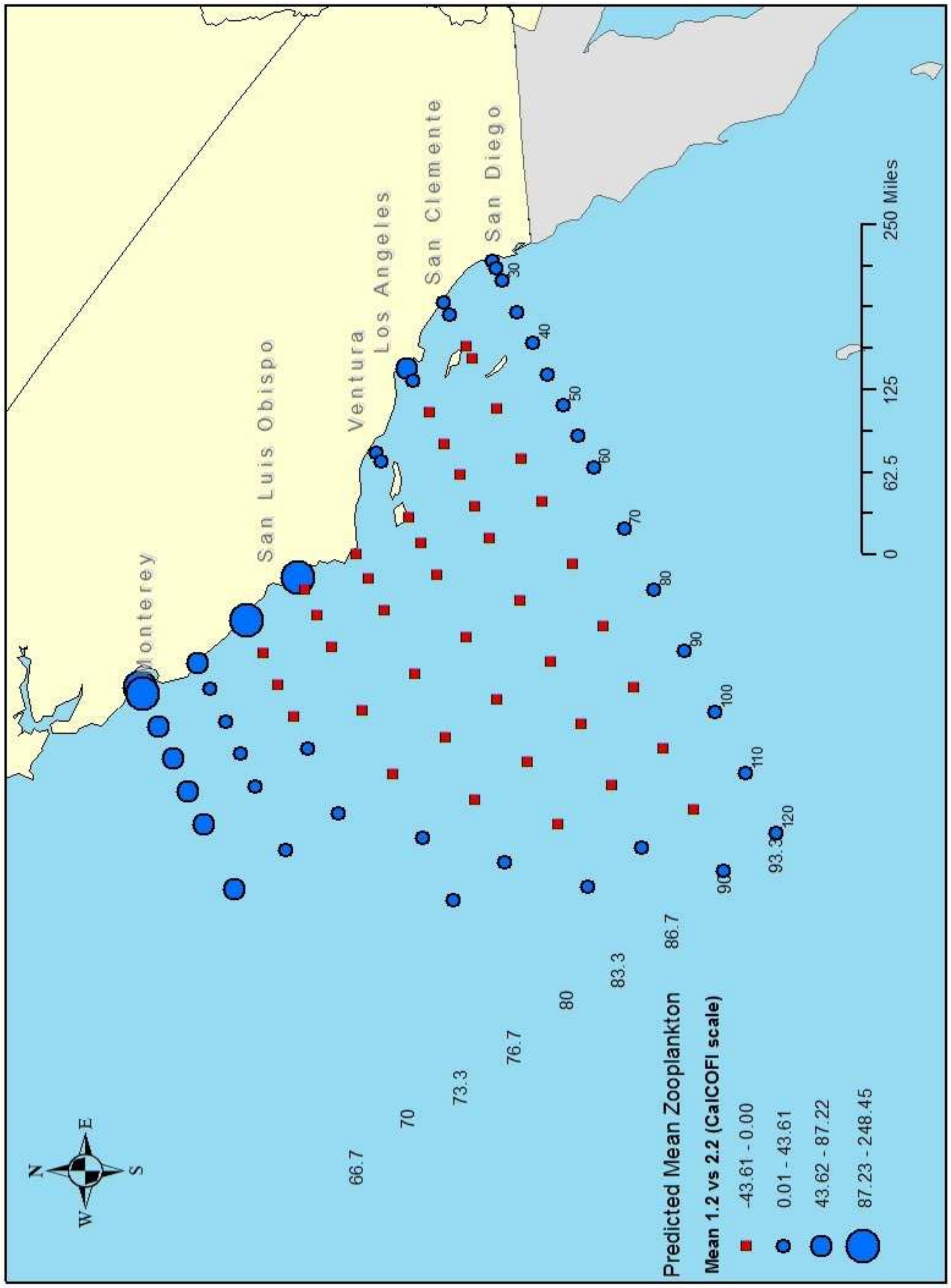


Figure L.2g: Difference of WCAR and HCAR Predicted Sampling Sites Mean Zooplankton Yields (Model 2.2 minus Model 1.2): July.

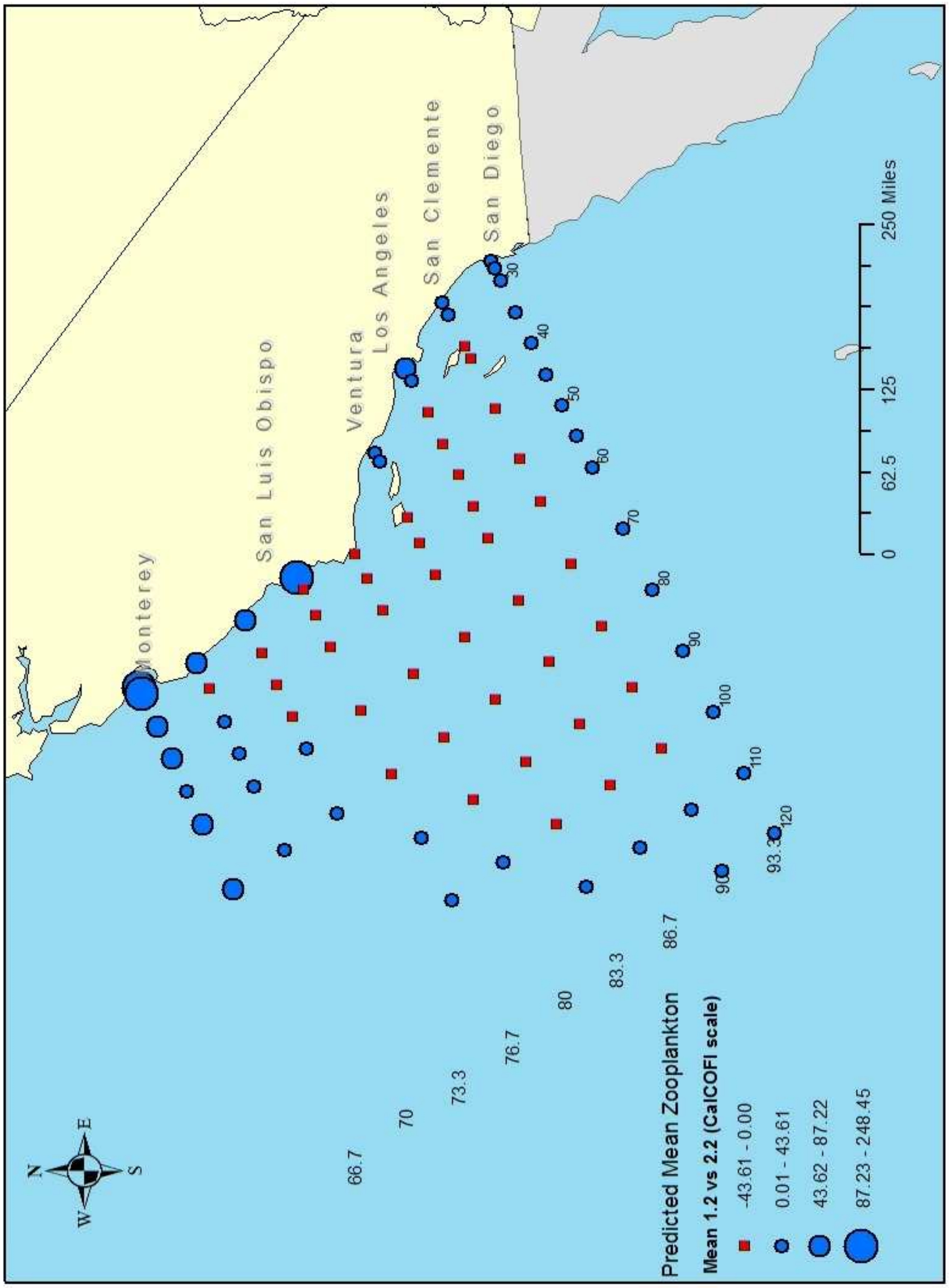


Figure L.2h: Difference of WCAR and HCAR Predicted Sampling Sites Mean Zooplankton Yields (Model 2.2 minus Model 1.2): August.

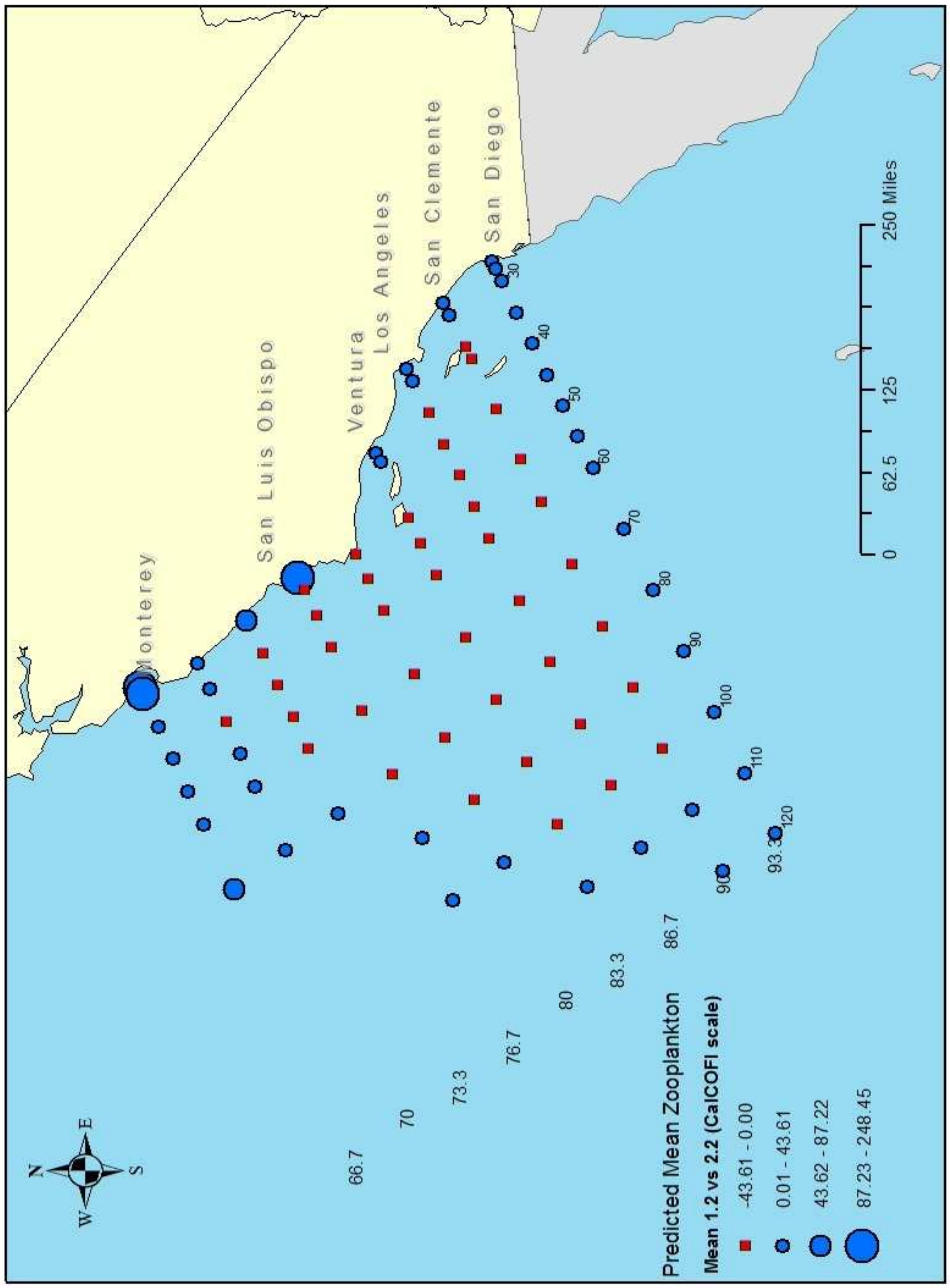


Figure L.2i: Difference of WCAR and HCAR Predicted Sampling Sites Mean Zooplankton Yields (Model 2.2 minus Model 1.2): September.

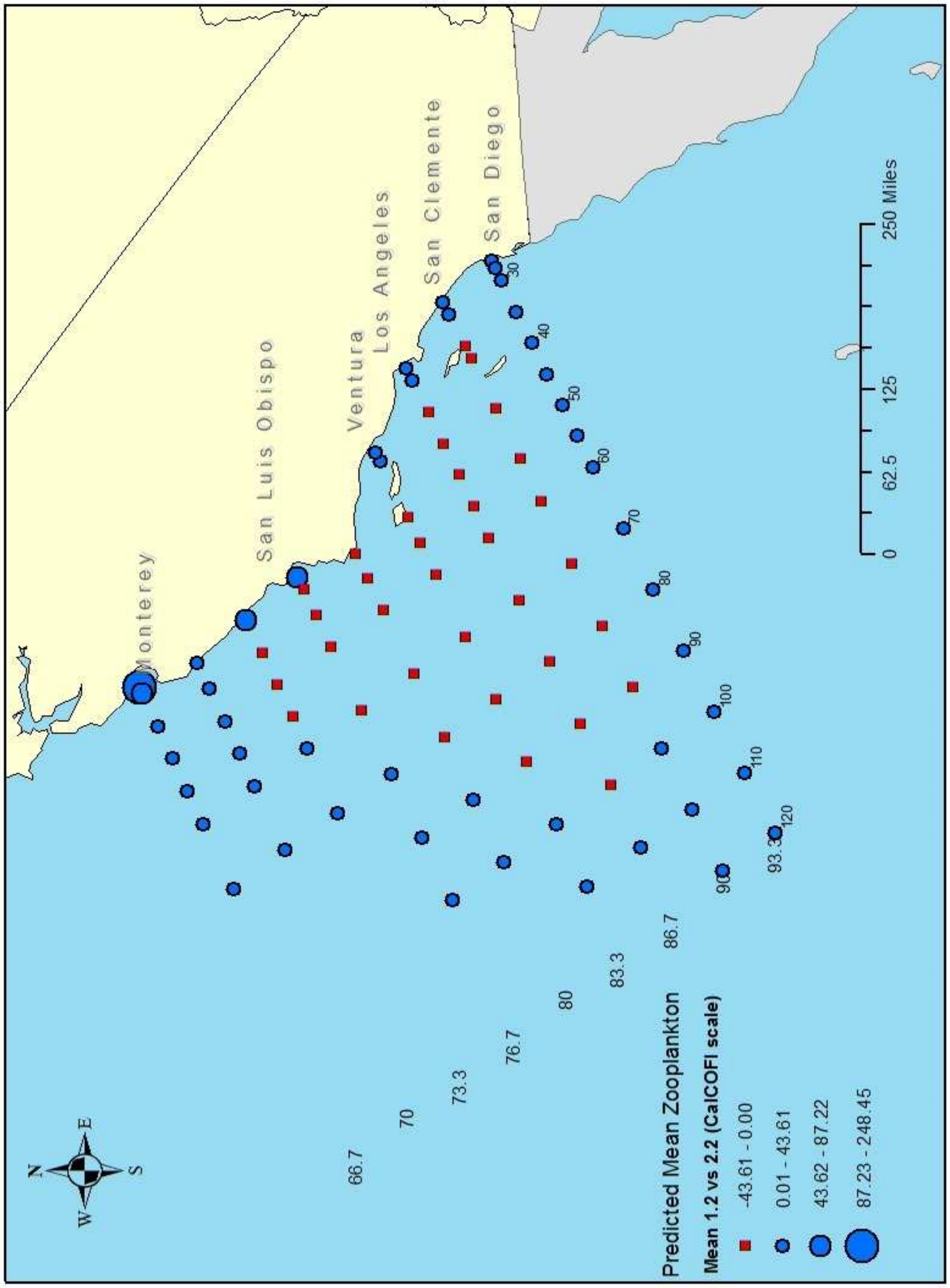


Figure L.2j: Difference of WCAR and HCAR Predicted Sampling Sites Mean Zooplankton Yields (Model 2.2 minus Model 1.2): October.

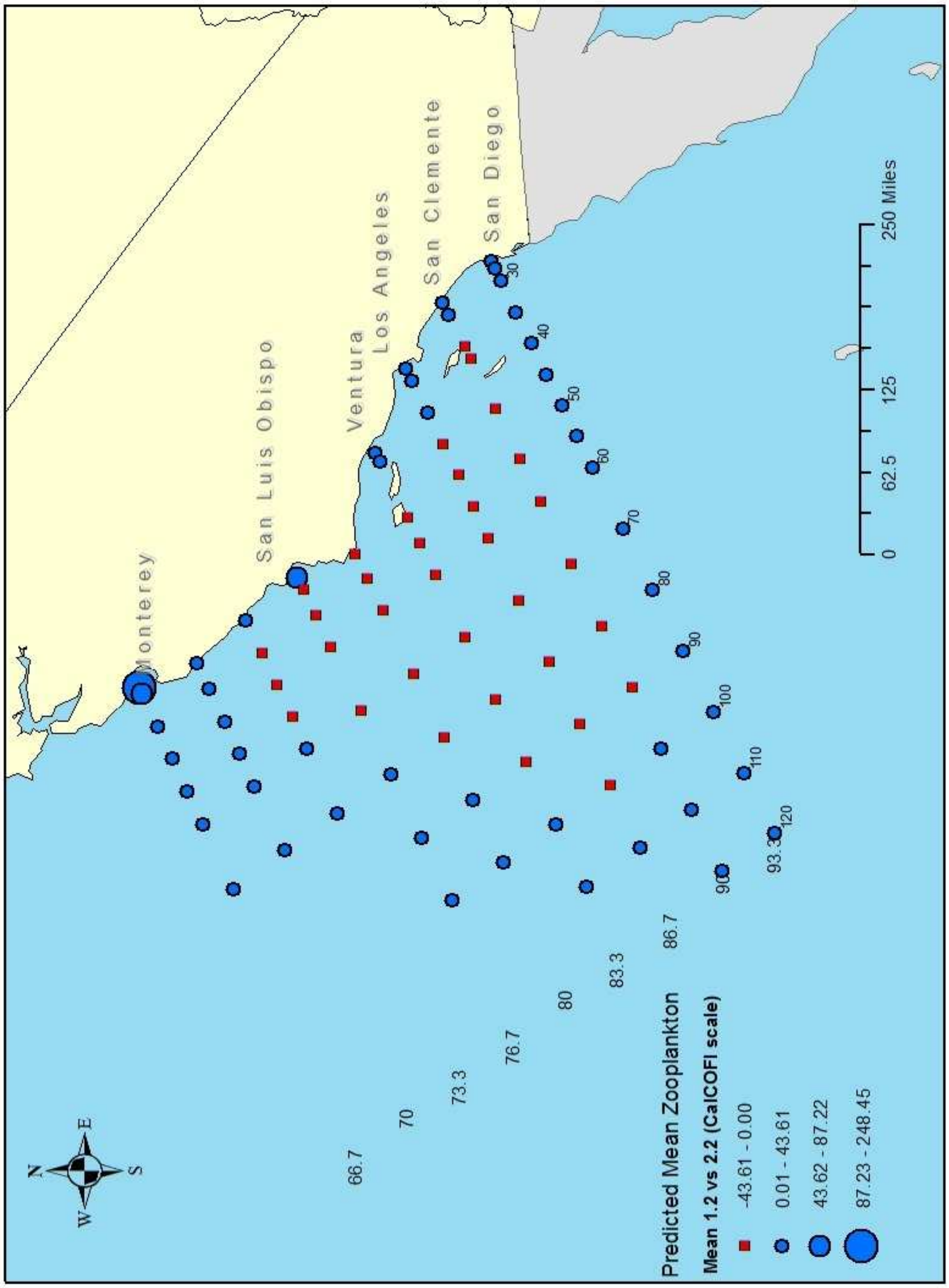


Figure L.2k: Difference of WCAR and HCAR Predicted Sampling Sites Mean Zooplankton Yields (Model 2.2 minus Model 1.2): November.

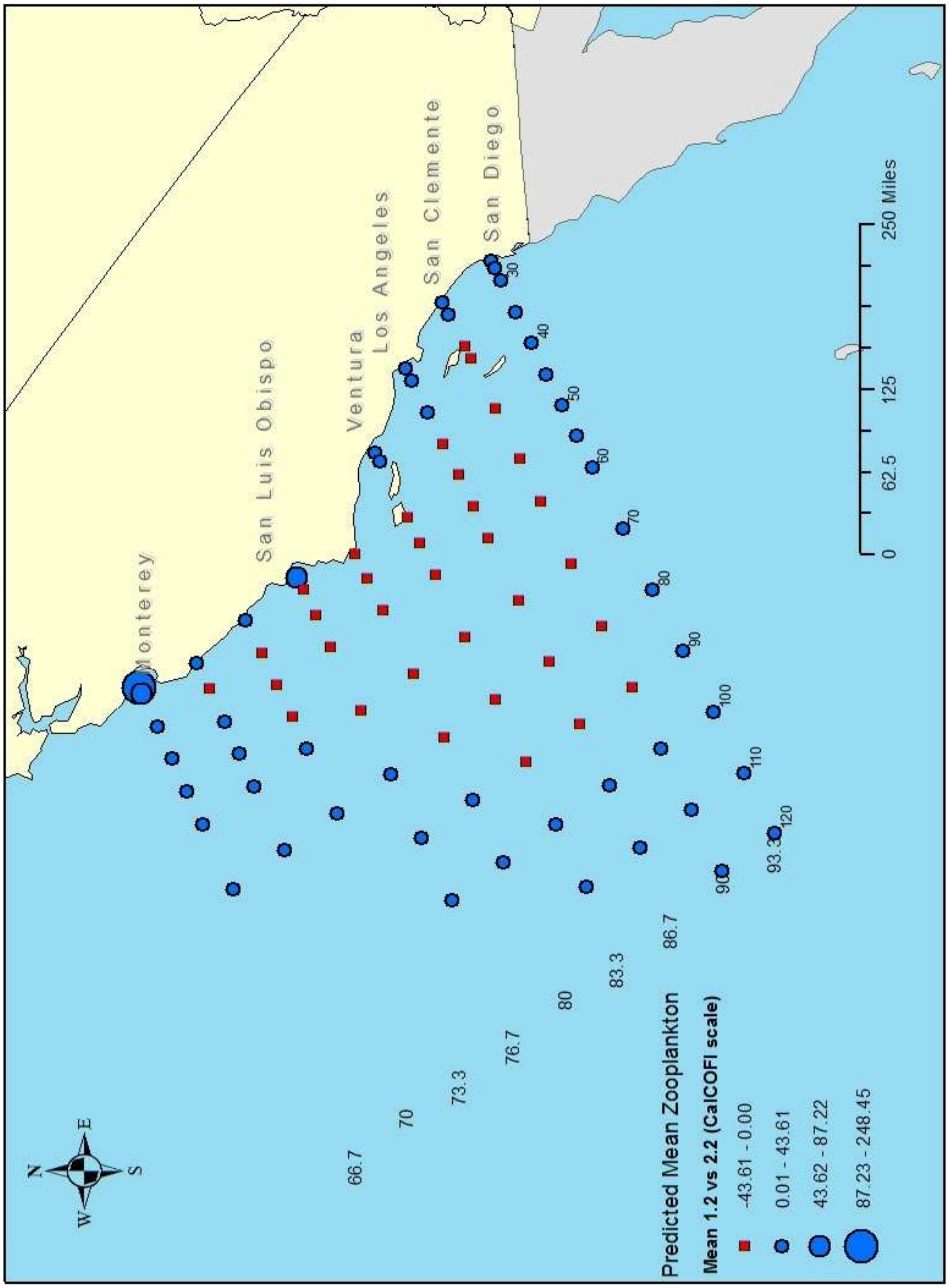


Figure L.2l: Difference of WCAR and HCAR Predicted Sampling Sites Mean Zooplankton Yields (Model 2.2 minus Model 1.2): December.

APPENDIX M

DIFFERENCE OF WCAR AND HCAR PREDICTED SAMPLING SITE MONTHLY MEAN ZOOPLANKTON YIELDS STANDARD DEVIATIONS

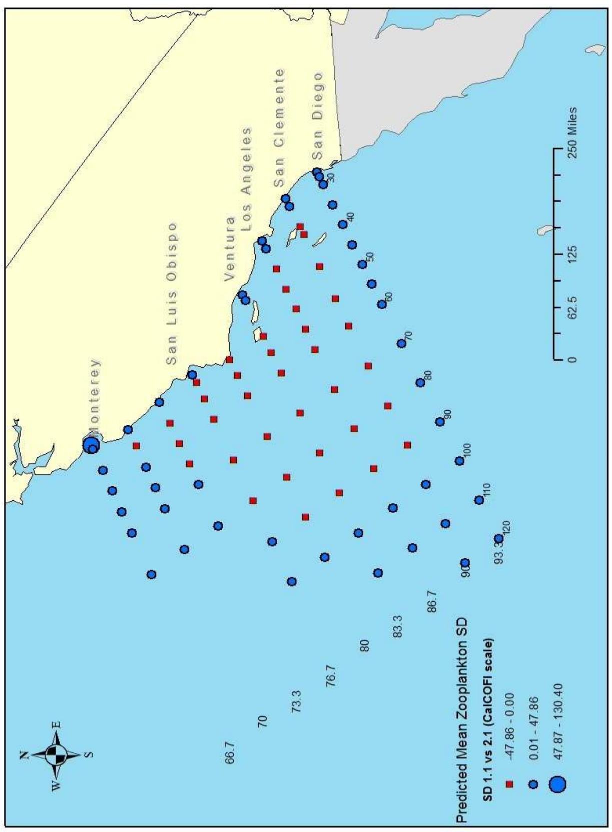


Figure M.1a: Difference of WCAR and HCAR Predicted Sampling Sites Mean Zooplankton Yields SD (Model 2.1 minus Model 1.1): January.

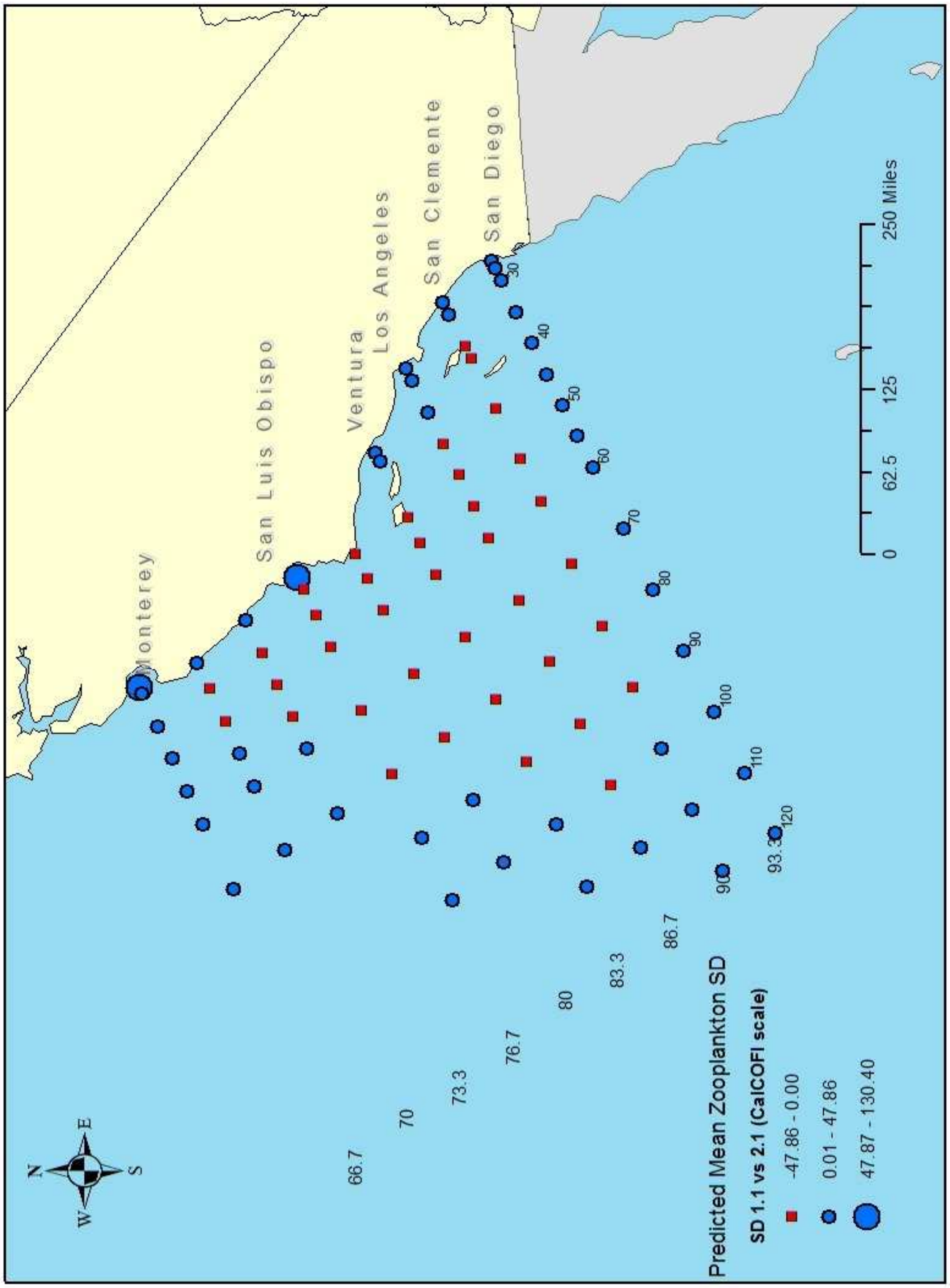


Figure M.1b: Difference of WCAR and HCAR Predicted Sampling Sites Mean Zooplankton Yields SD (Model 2.1 minus Model 1.1): February.

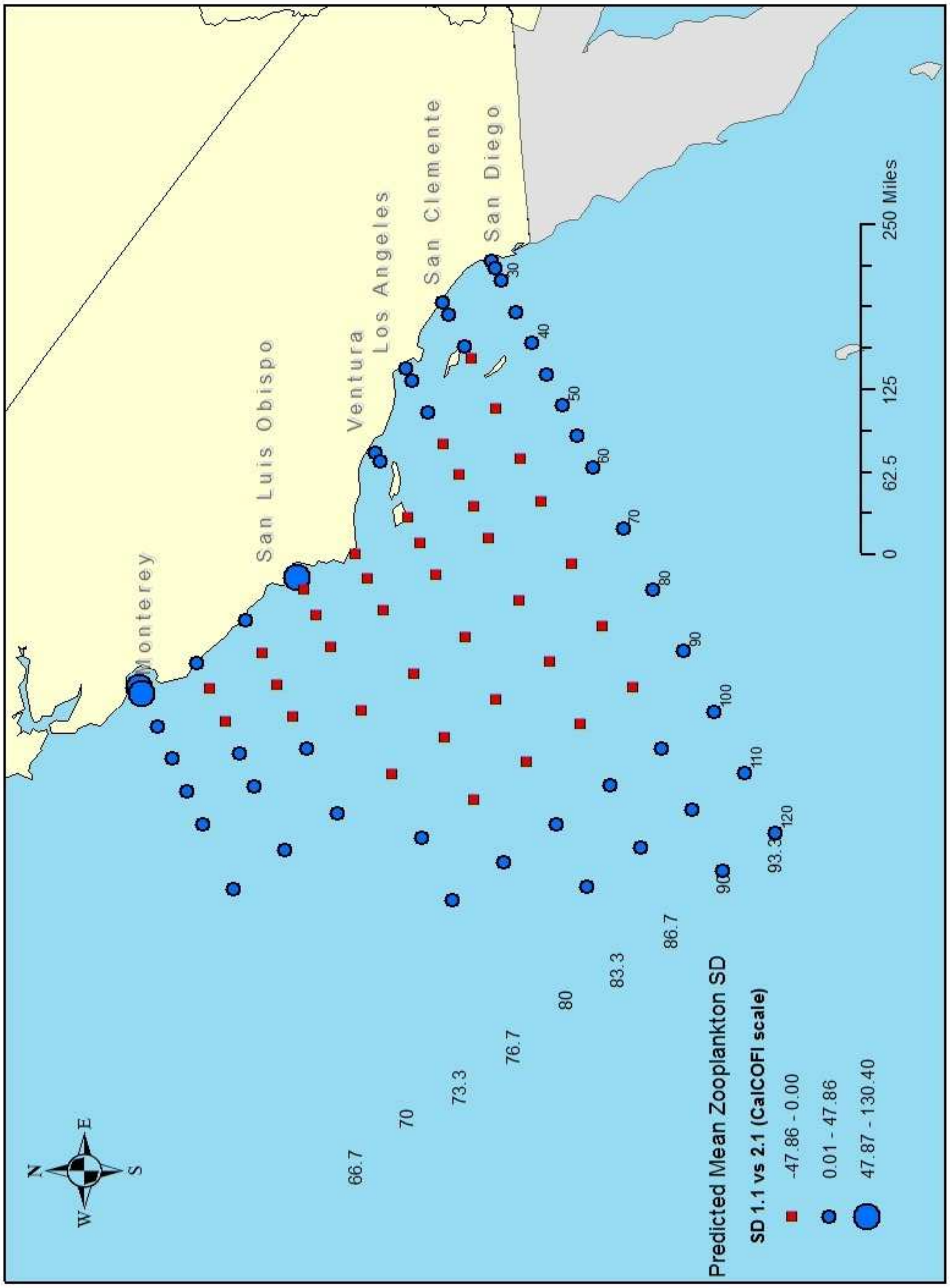


Figure M.1c: Difference of WCAR and HCAR Predicted Sampling Sites Mean Zooplankton Yields SD (Model 2.1 minus Model 1.1): March.

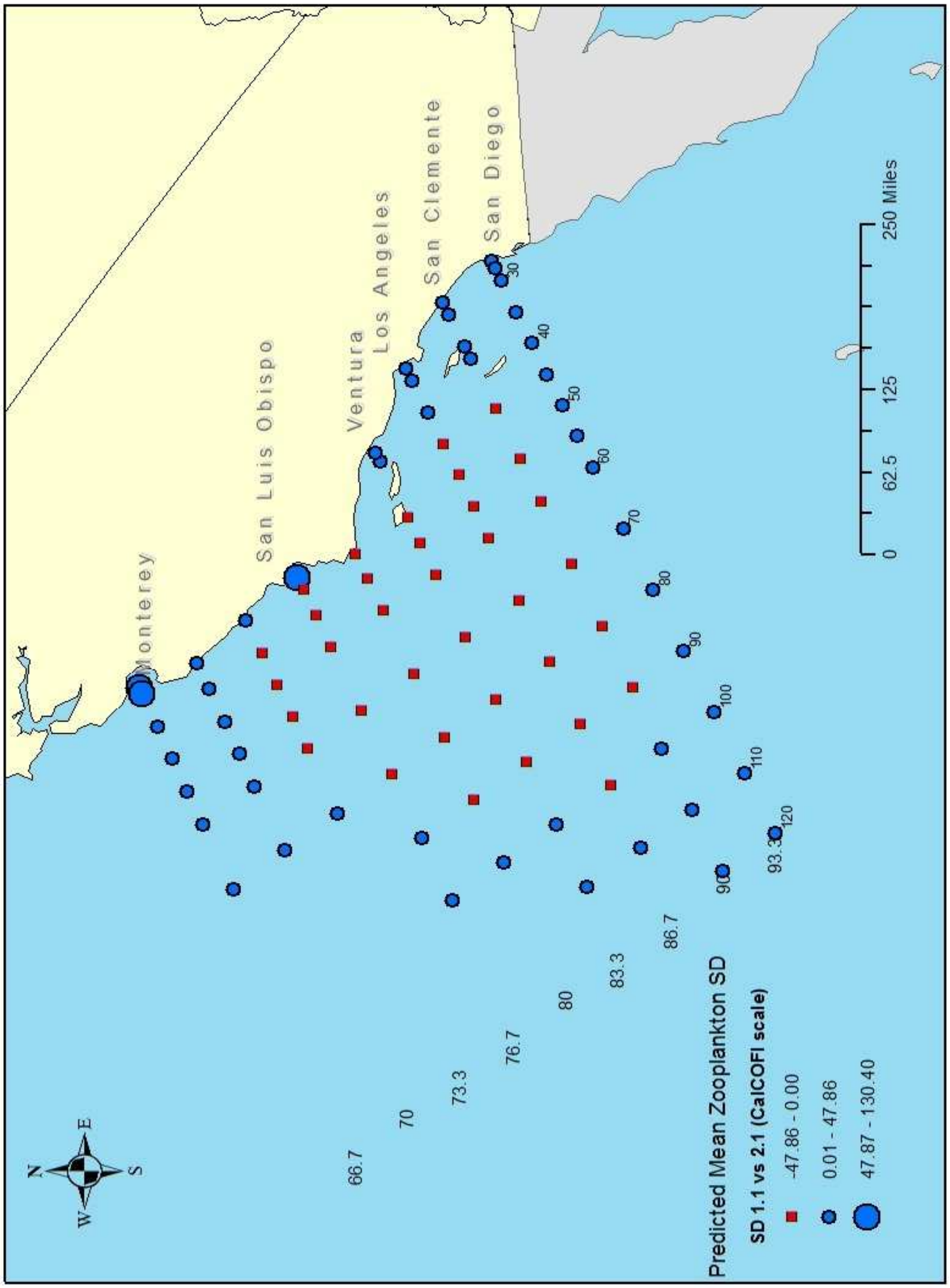


Figure M.1d: Difference of WCAR and HCAR Predicted Sampling Sites Mean Zooplankton Yields SD (Model 2.1 minus Model 1.1): April.

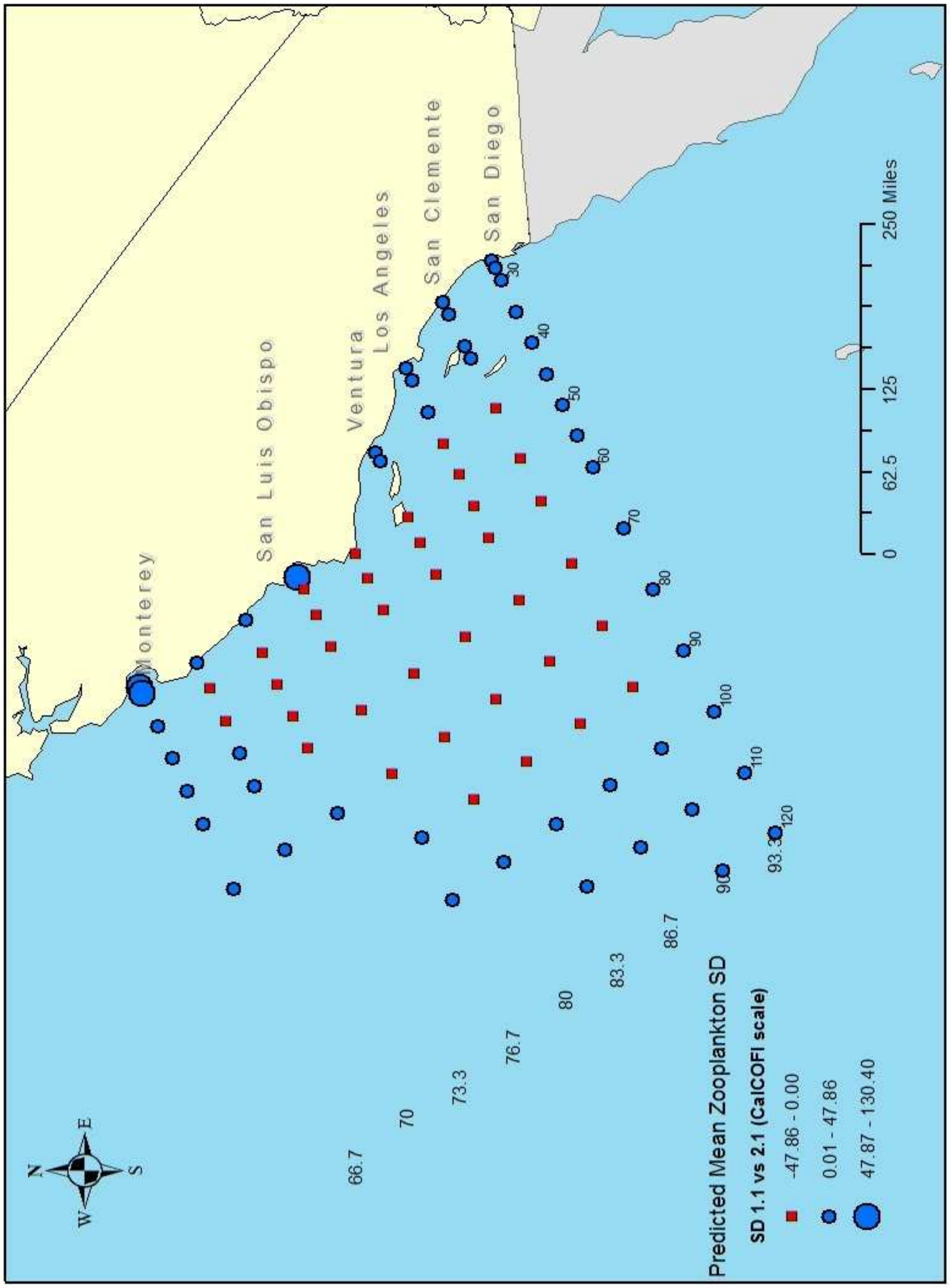


Figure M.1e: Difference of WCAR and HCAR Predicted Sampling Sites Mean Zooplankton Yields SD (Model 2.1 minus Model 1.1): May.

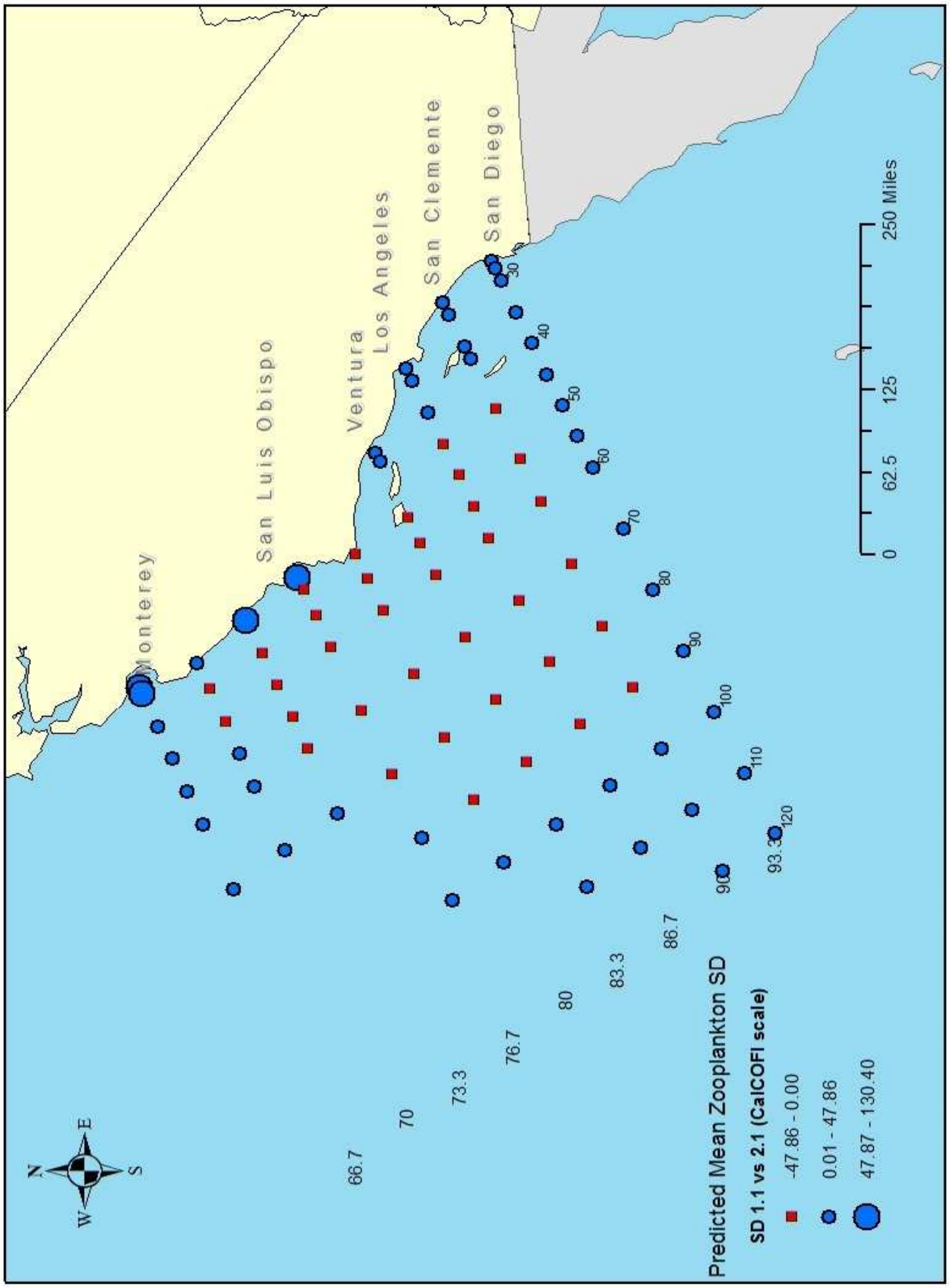


Figure M.1f: Difference of WCAR and HCAR Predicted Sampling Sites Mean Zooplankton Yields SD (Model 2.1 minus Model 1.1): June.

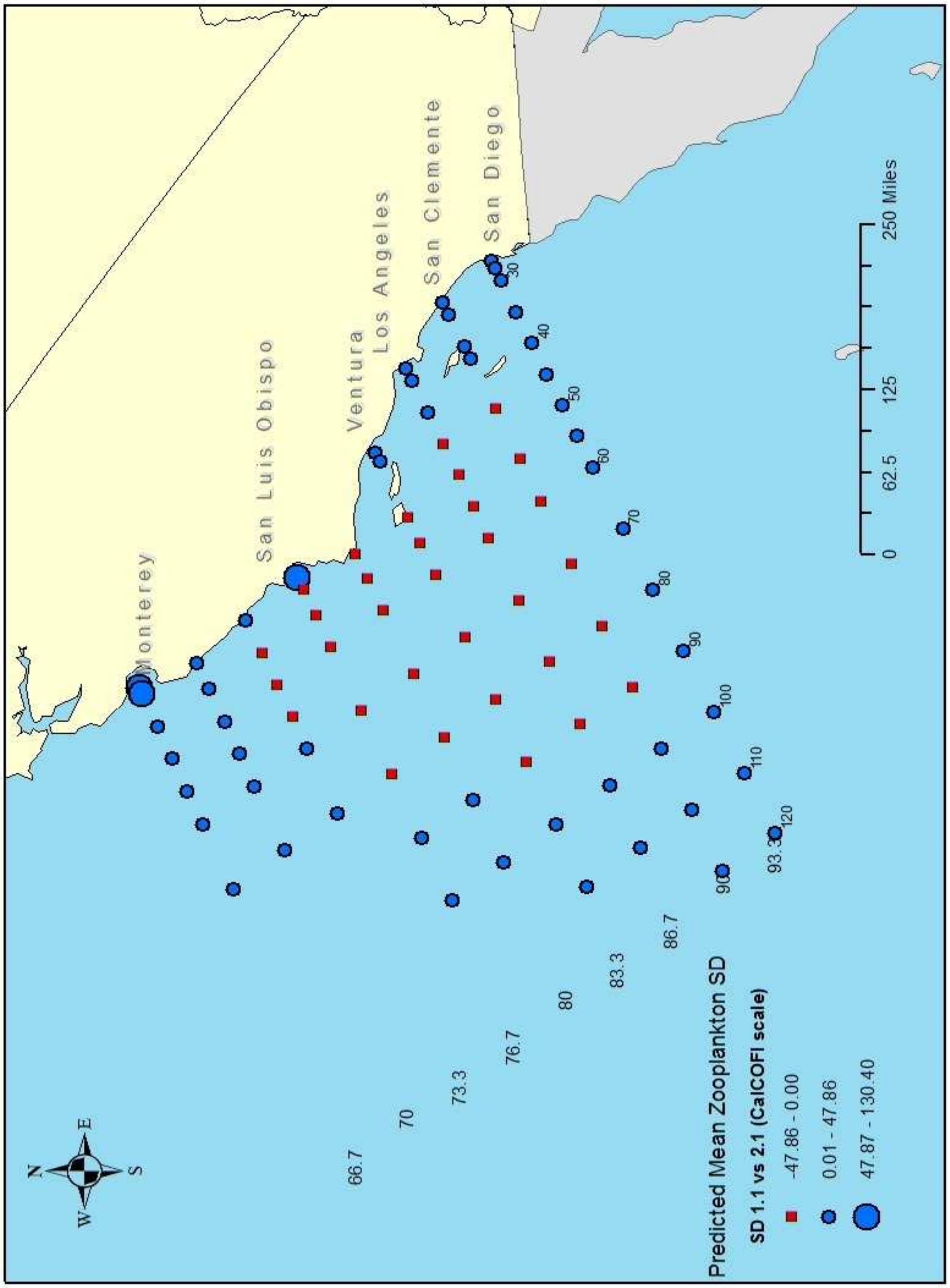


Figure M.1g: Difference of WCAR and HCAR Predicted Sampling Sites Mean Zooplankton Yields SD (Model 2.1 minus Model 1.1): July.

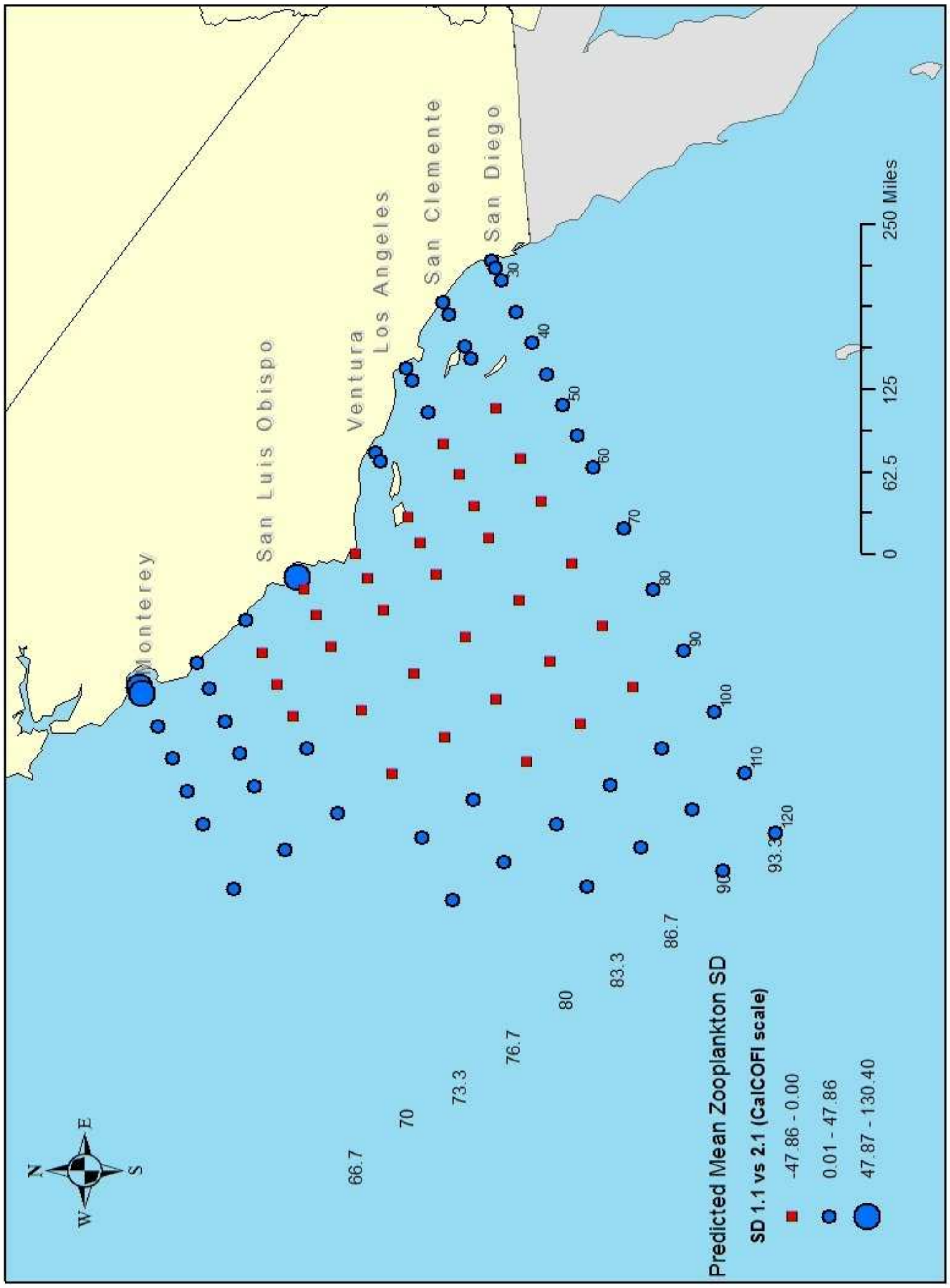


Figure M.1h: Difference of WCAR and HCAR Predicted Sampling Sites Mean Zooplankton Yields SD (Model 2.1 minus Model 1.1): August.

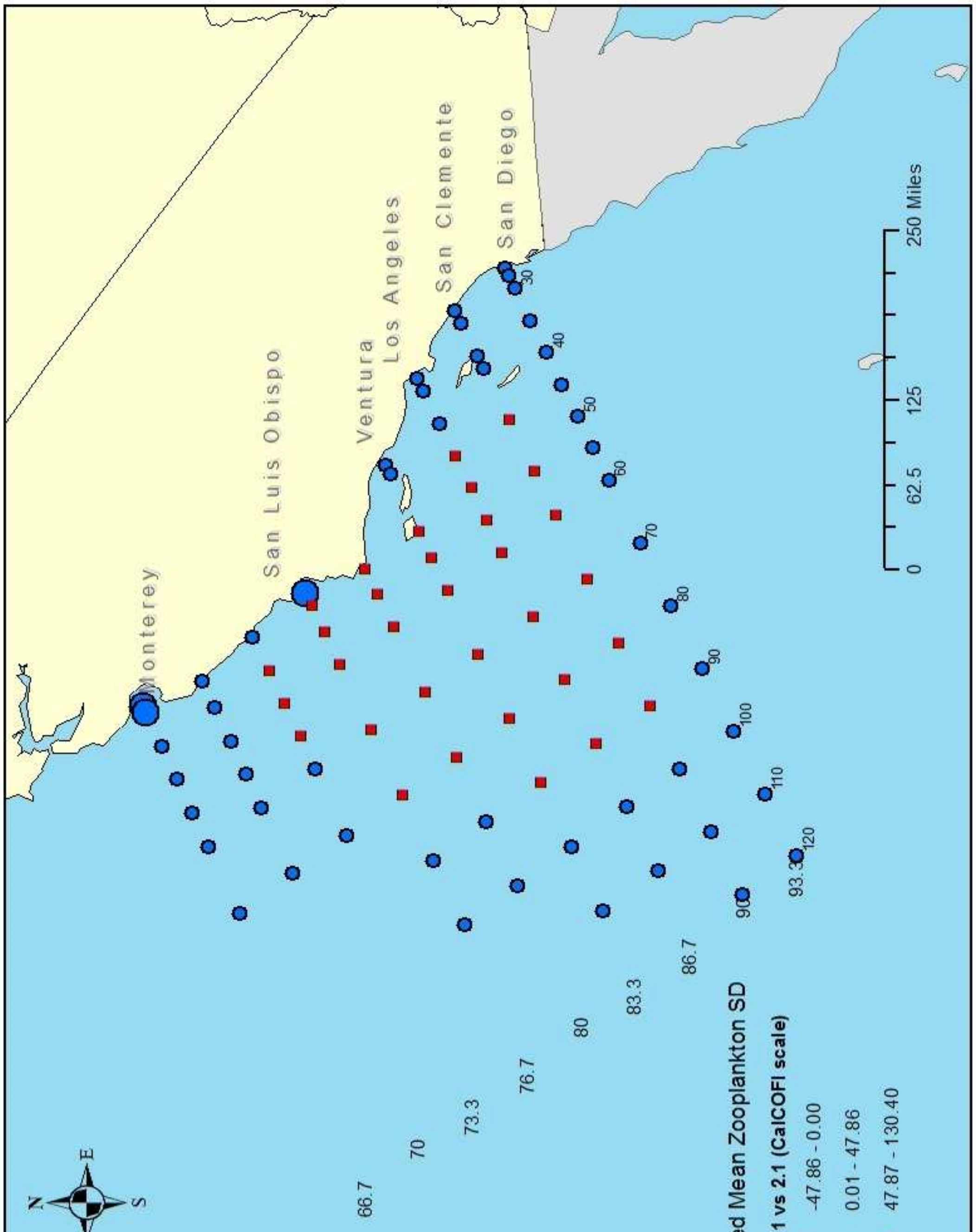


Figure M.1i: Difference of WCAR and HCAR Predicted Sampling Sites Mean Zooplankton Yields SD (Model 2.1 minus Model 1.1): September.

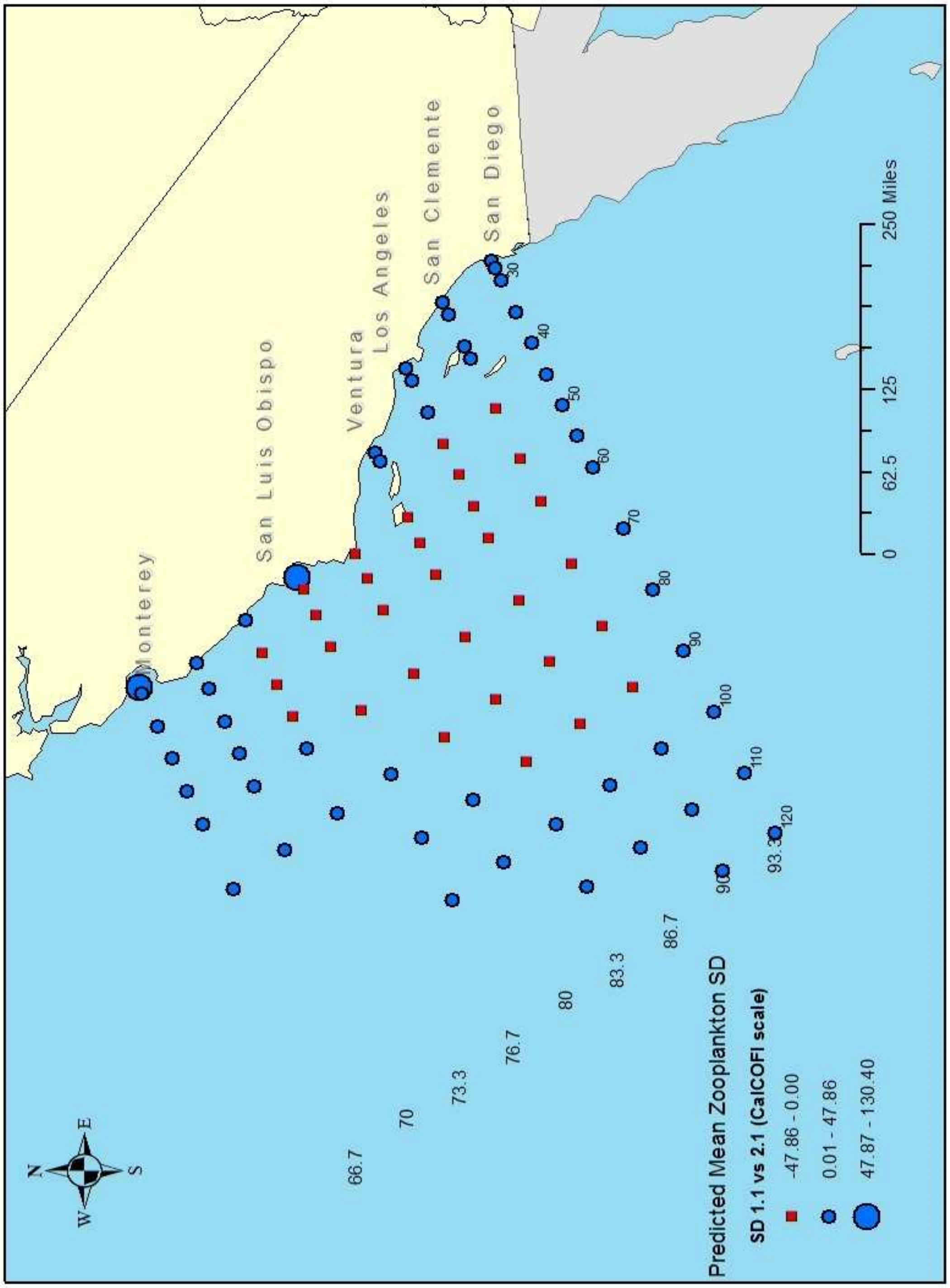


Figure M.1j: Difference of WCAR and HCAR Predicted Sampling Sites Mean Zooplankton Yields SD (Model 2.1 minus Model 1.1): October.

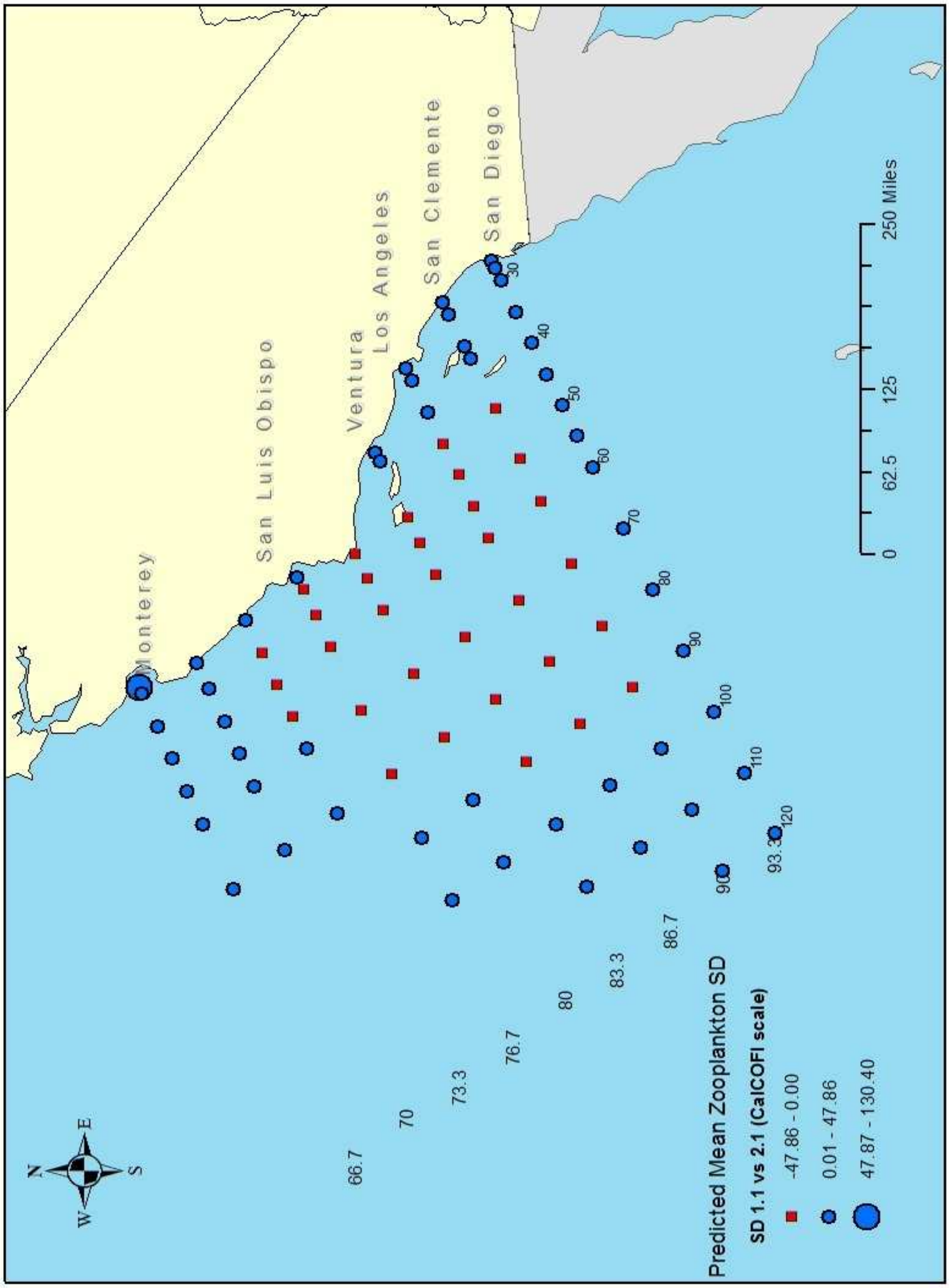


Figure M.1k: Difference of WCAR and HCAR Predicted Sampling Sites Mean Zooplankton Yields SD (Model 2.1 minus Model 1.1): November.

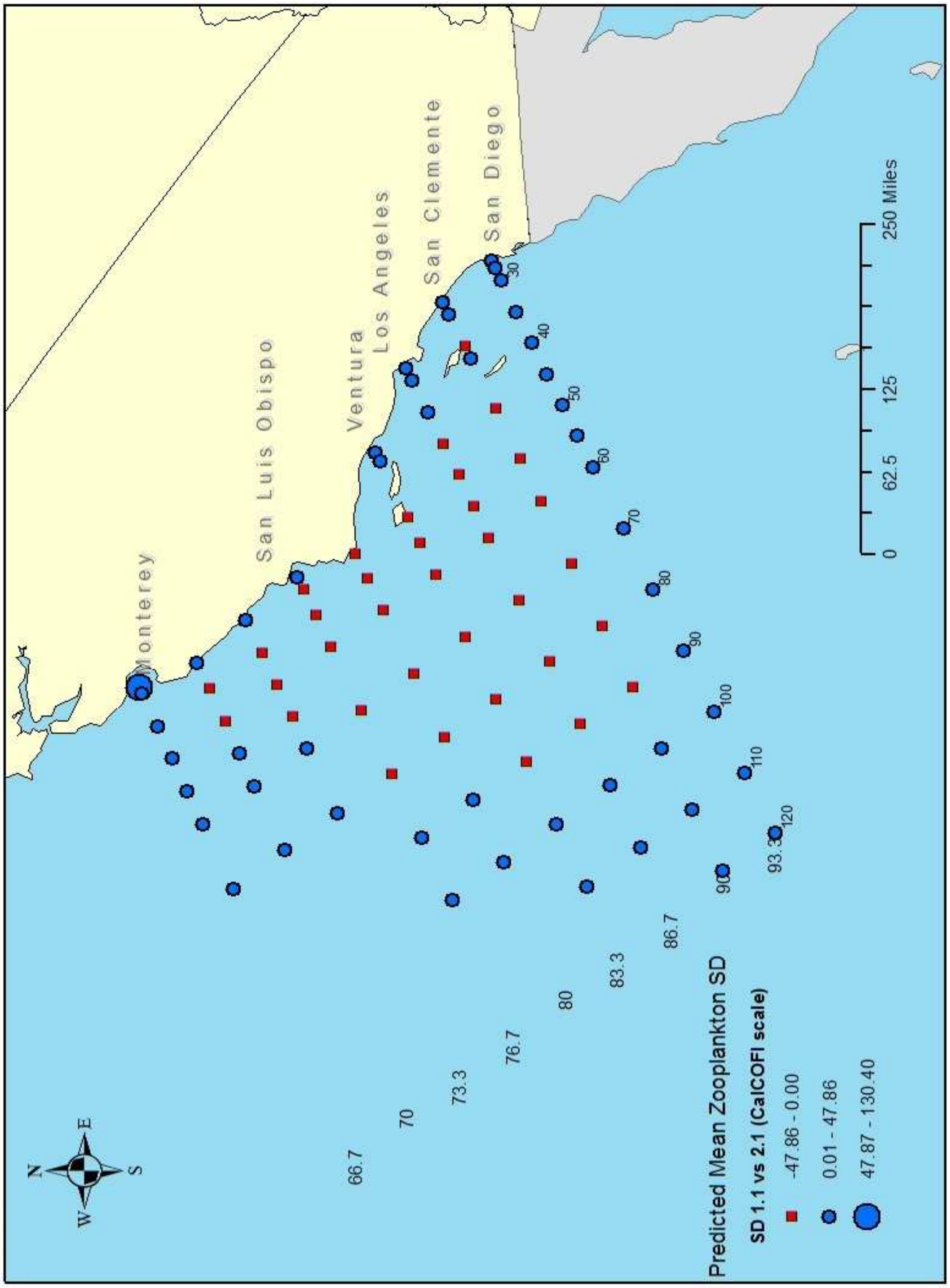


Figure M.1l: Difference of WCAR and HCAR Predicted Sampling Sites Mean Zooplankton Yields SD (Model 2.1 minus Model 1.1): December.

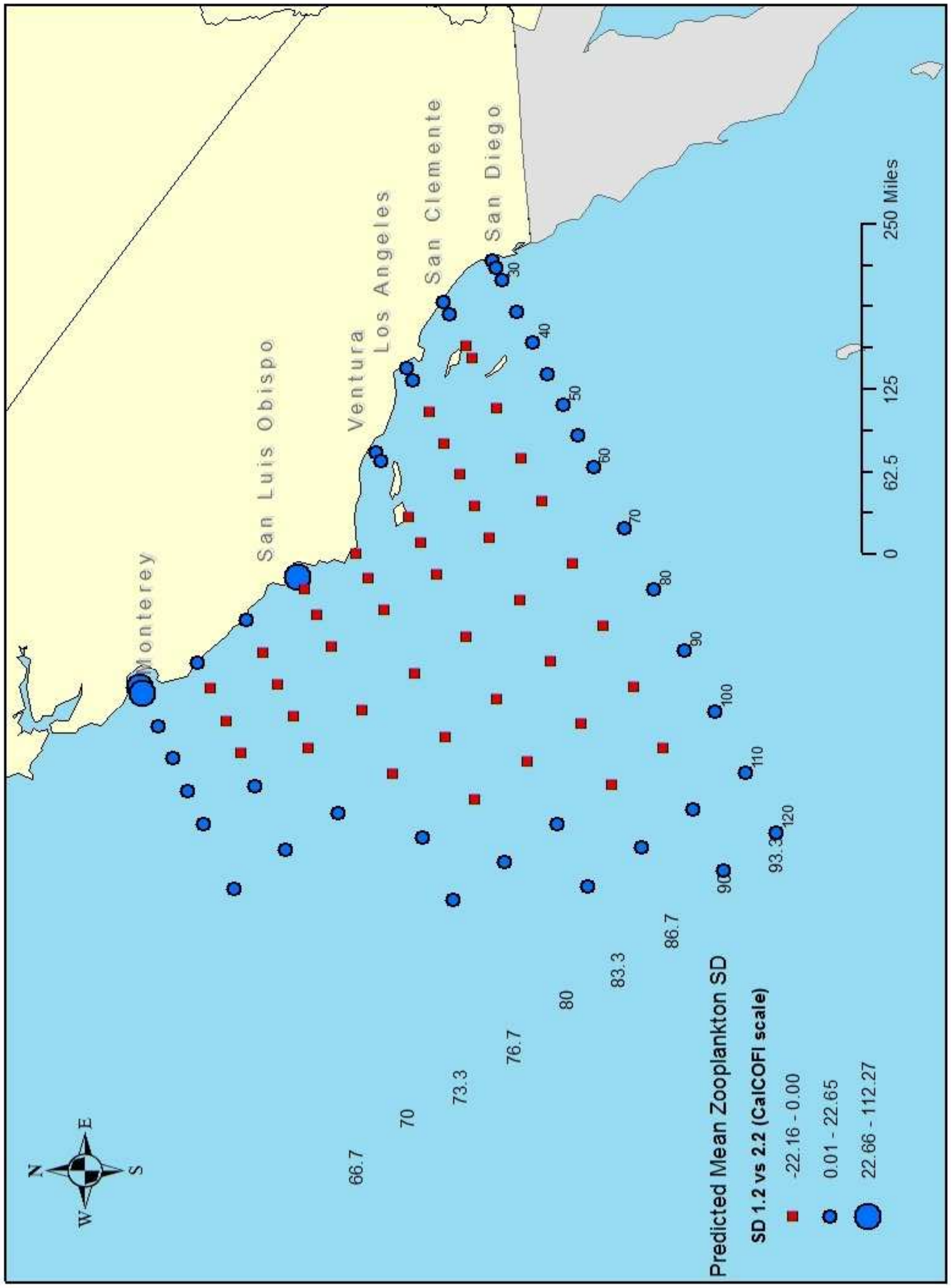


Figure M.2a: Difference of WCAR and HCAR Predicted Sampling Sites Mean Zooplankton Yields SD (Model 2.2 minus Model 1.2): January.

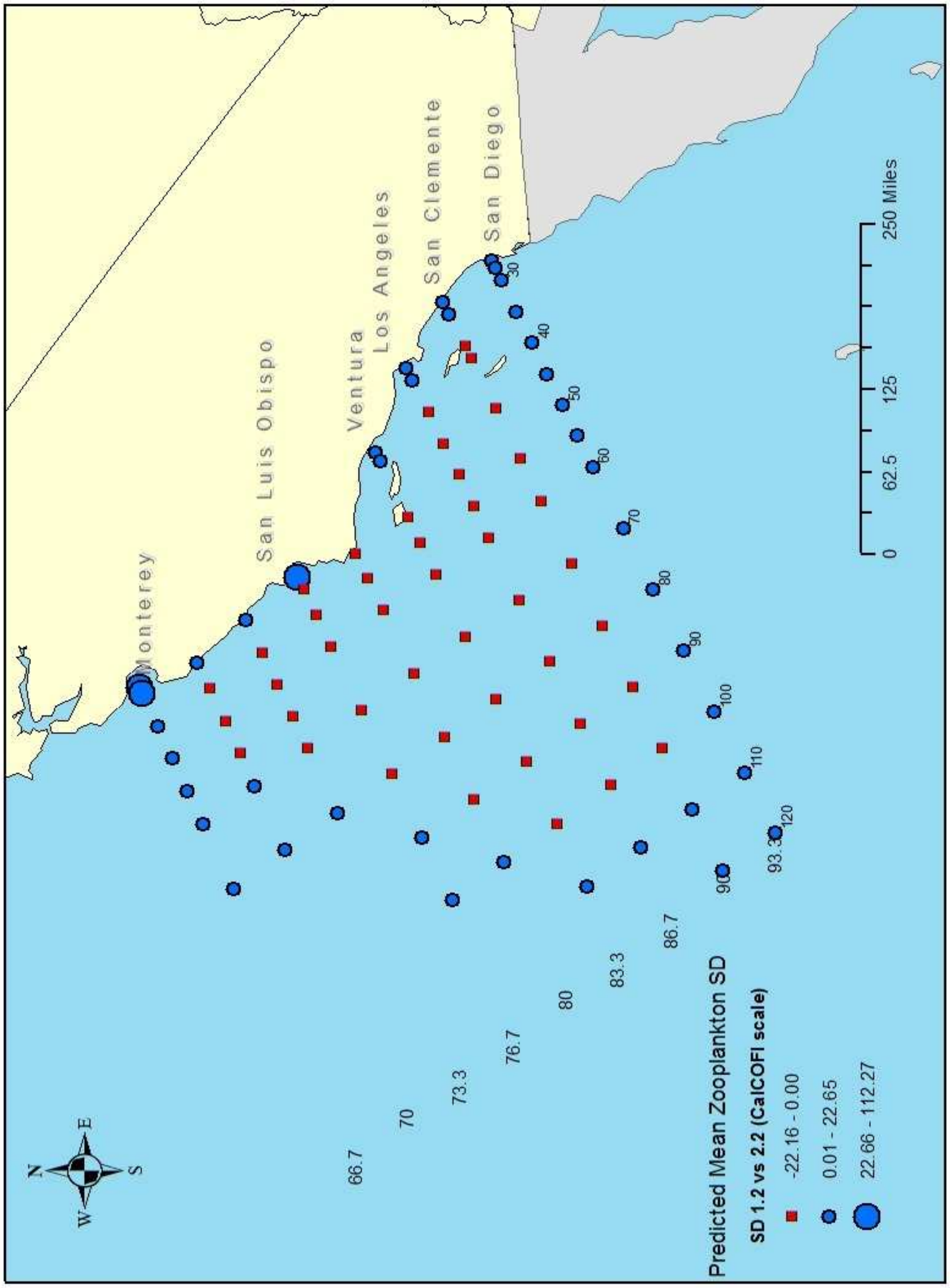


Figure M.2b: Difference of WCAR and HCAR Predicted Sampling Sites Mean Zooplankton Yields SD (Model 2.2 minus Model 1.2): February.

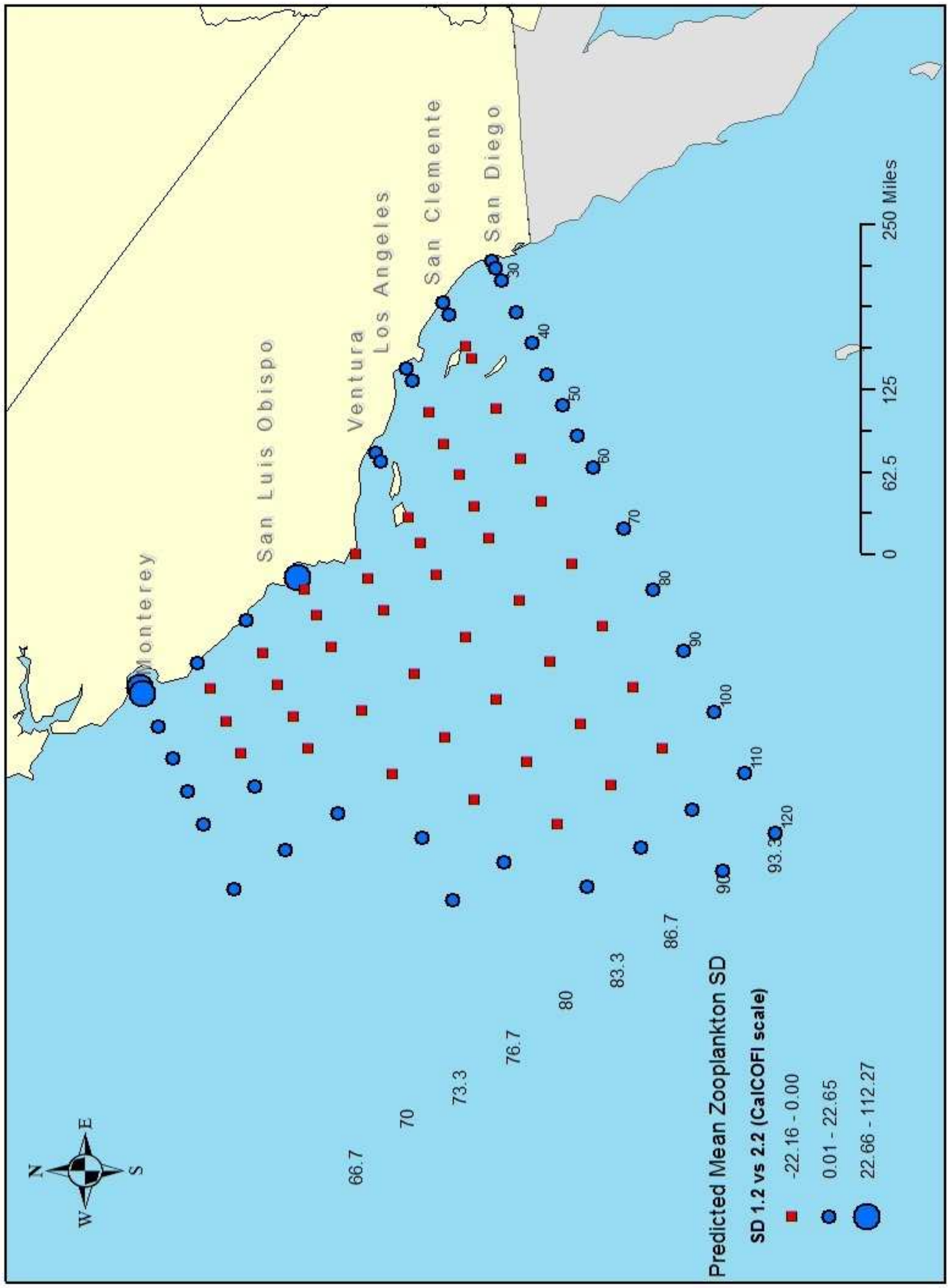


Figure M.2c: Difference of WCAR and HCAR Predicted Sampling Sites Mean Zooplankton Yields SD (Model 2.2 minus Model 1.2): March.

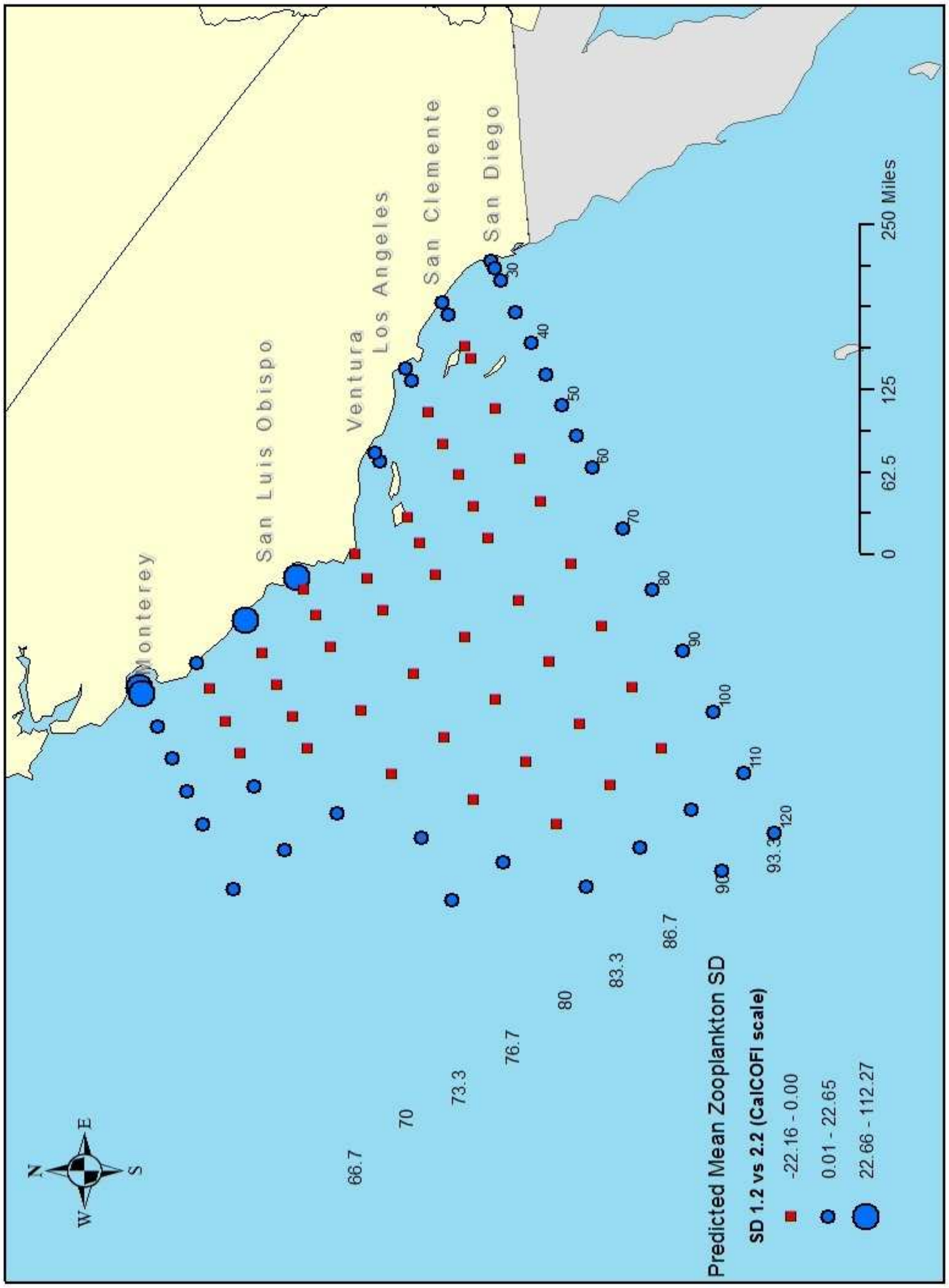


Figure M.2d: Difference of WCAR and HCAR Predicted Sampling Sites Mean Zooplankton Yields SD (Model 2.2 minus Model 1.2): April.

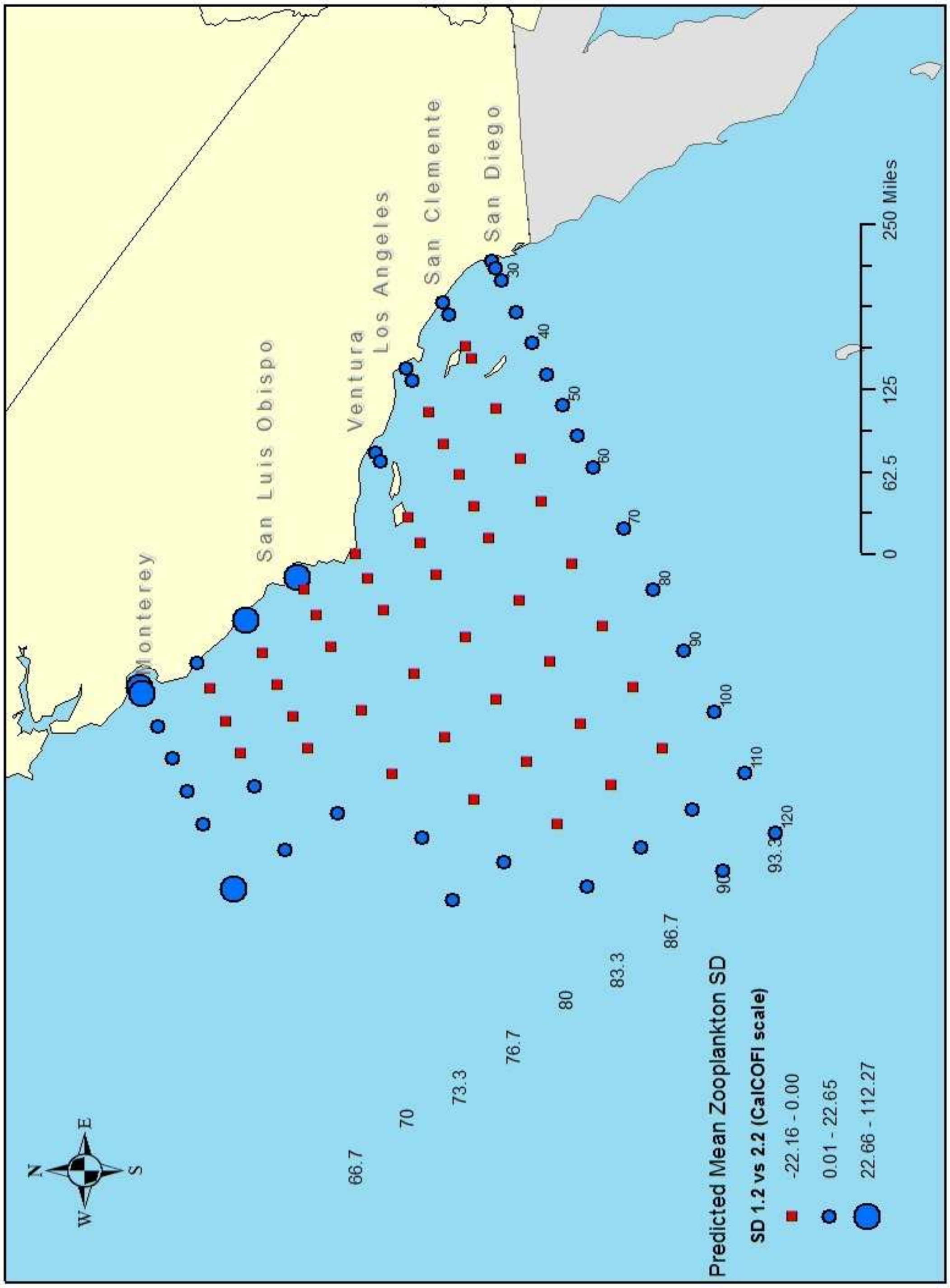


Figure M.2e: Difference of WCAR and HCAR Predicted Sampling Sites Mean Zooplankton Yields SD (Model 2.2 minus Model 1.2): May.

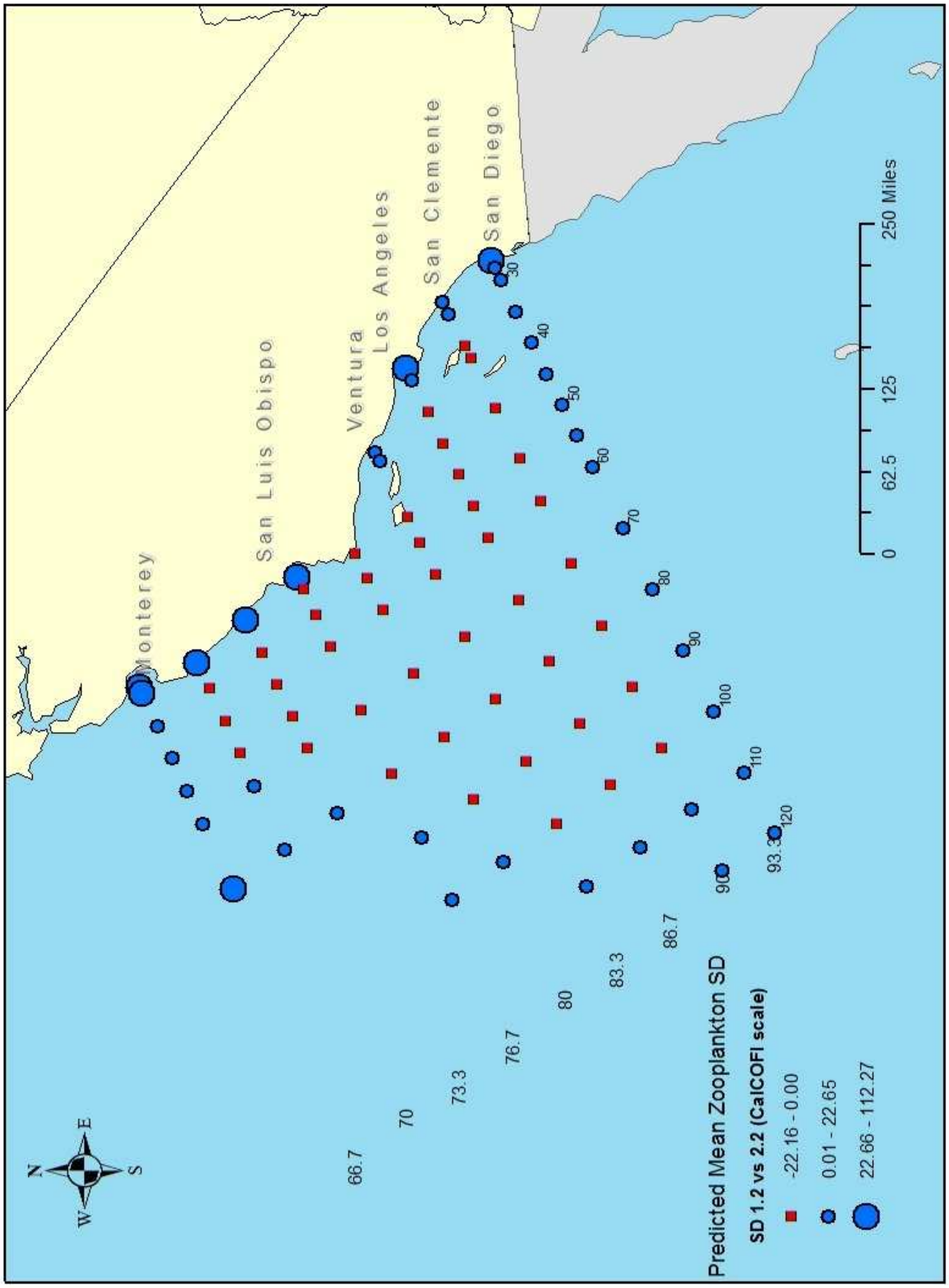


Figure M.2f: Difference of WCAR and HCAR Predicted Sampling Sites Mean Zooplankton Yields SD (Model 2.2 minus Model 1.2): June.

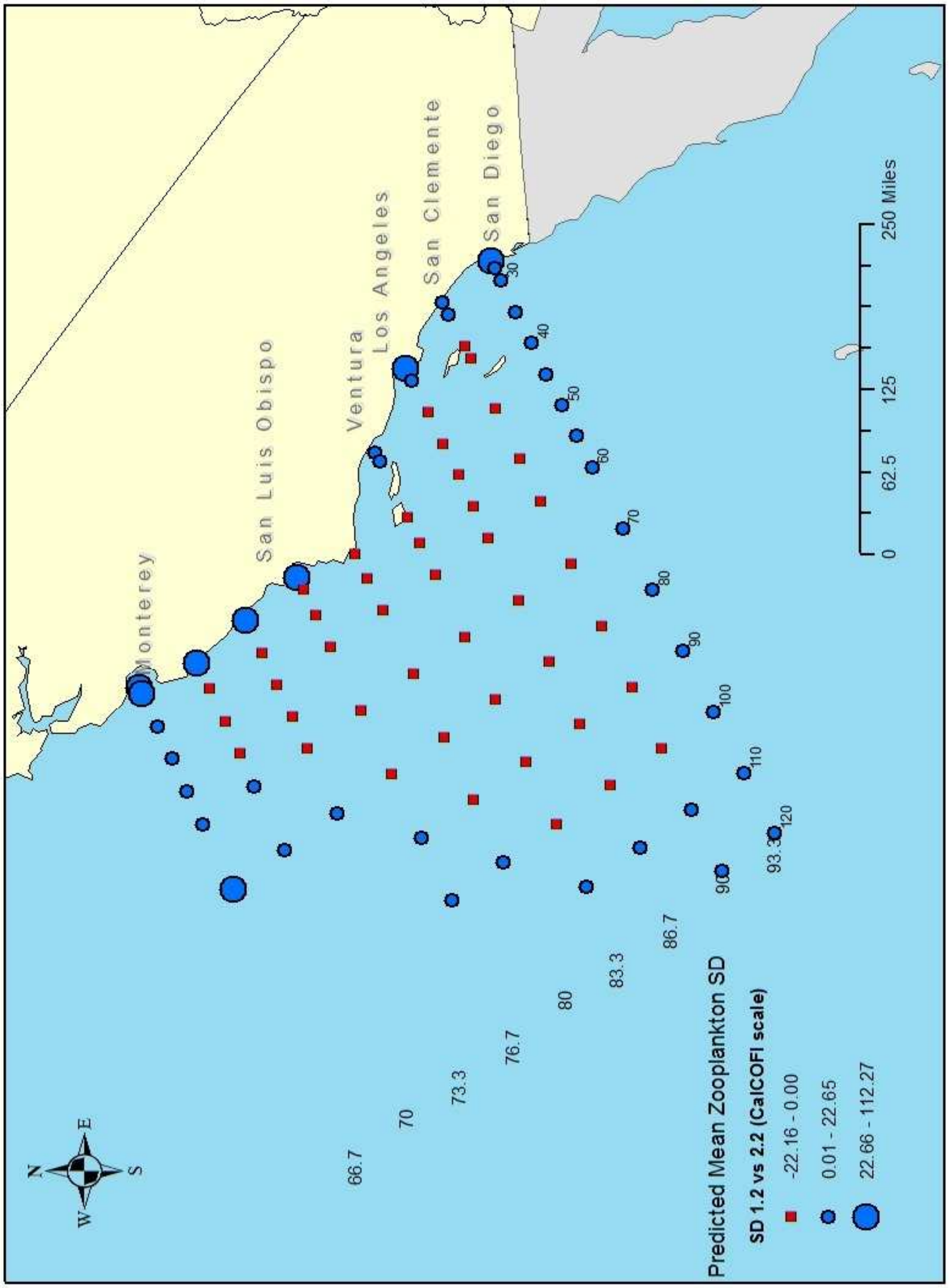


Figure M.2g: Difference of WCAR and HCAR Predicted Sampling Sites Mean Zooplankton Yields SD (Model 2.2 minus Model 1.2): July.

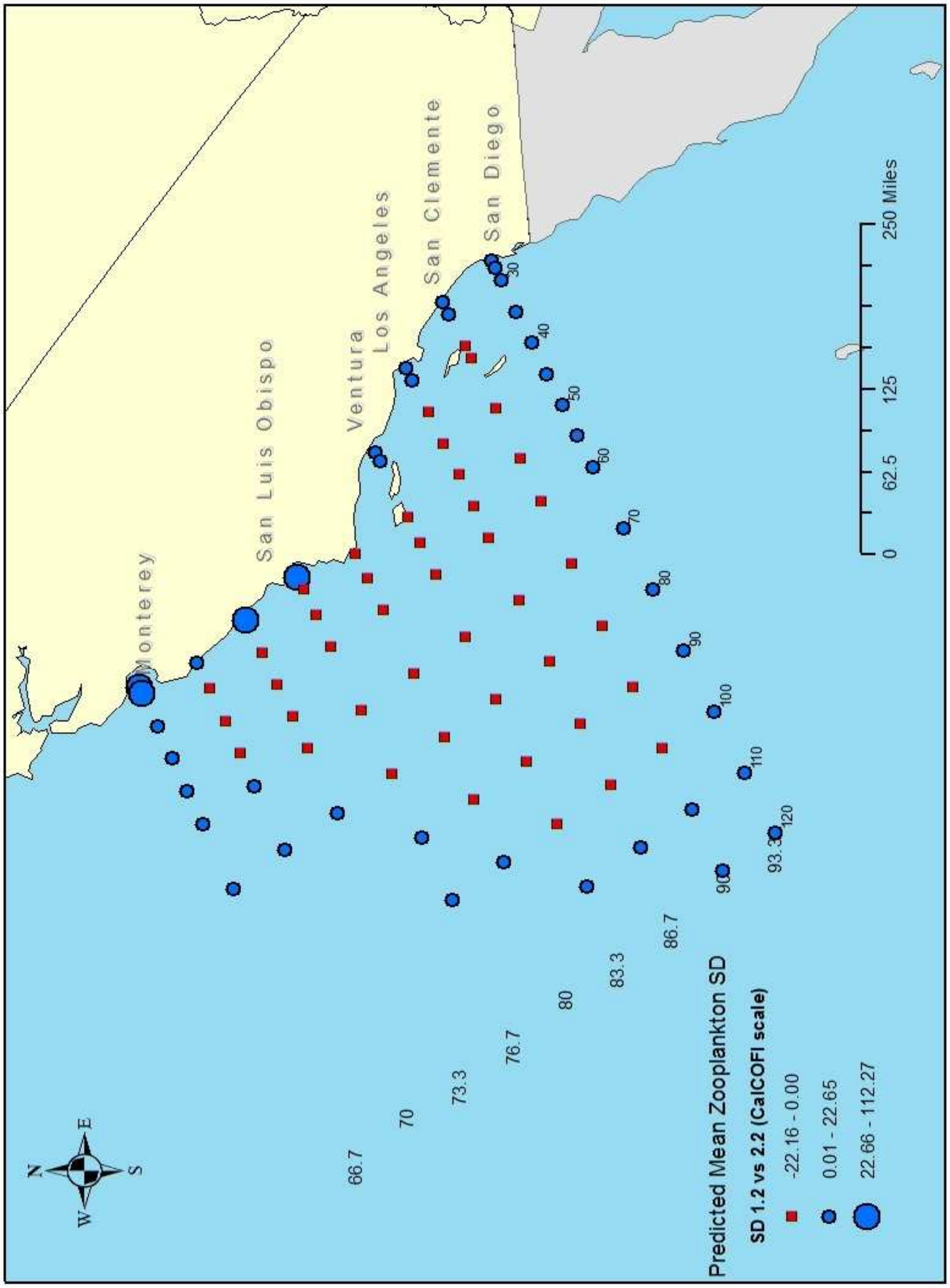


Figure M.2h: Difference of WCAR and HCAR Predicted Sampling Sites Mean Zooplankton Yields SD (Model 2.2 minus Model 1.2): August.

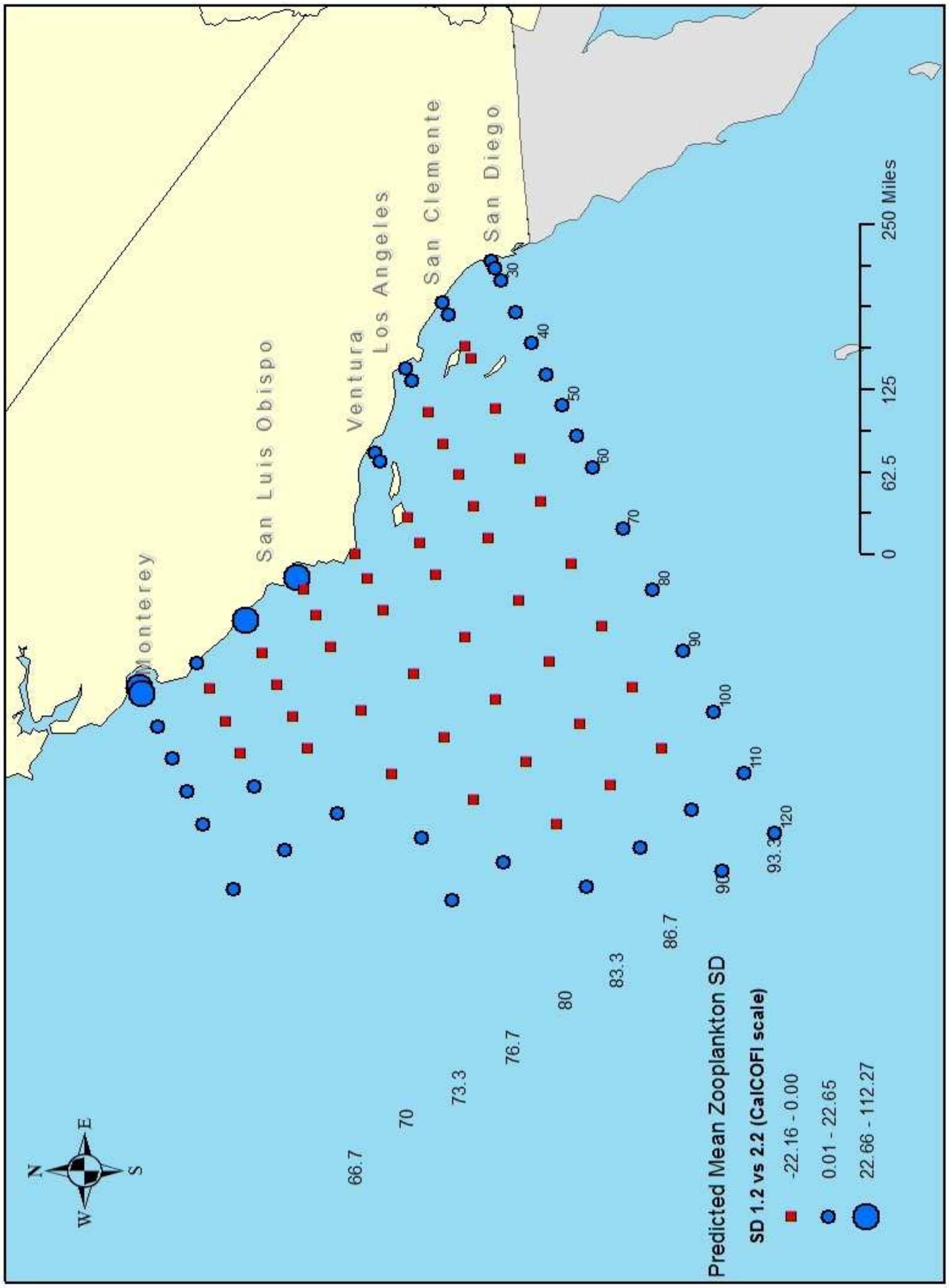


Figure M.2i: Difference of WCAR and HCAR Predicted Sampling Sites Mean Zooplankton Yields SD (Model 2.2 minus Model 1.2): September.

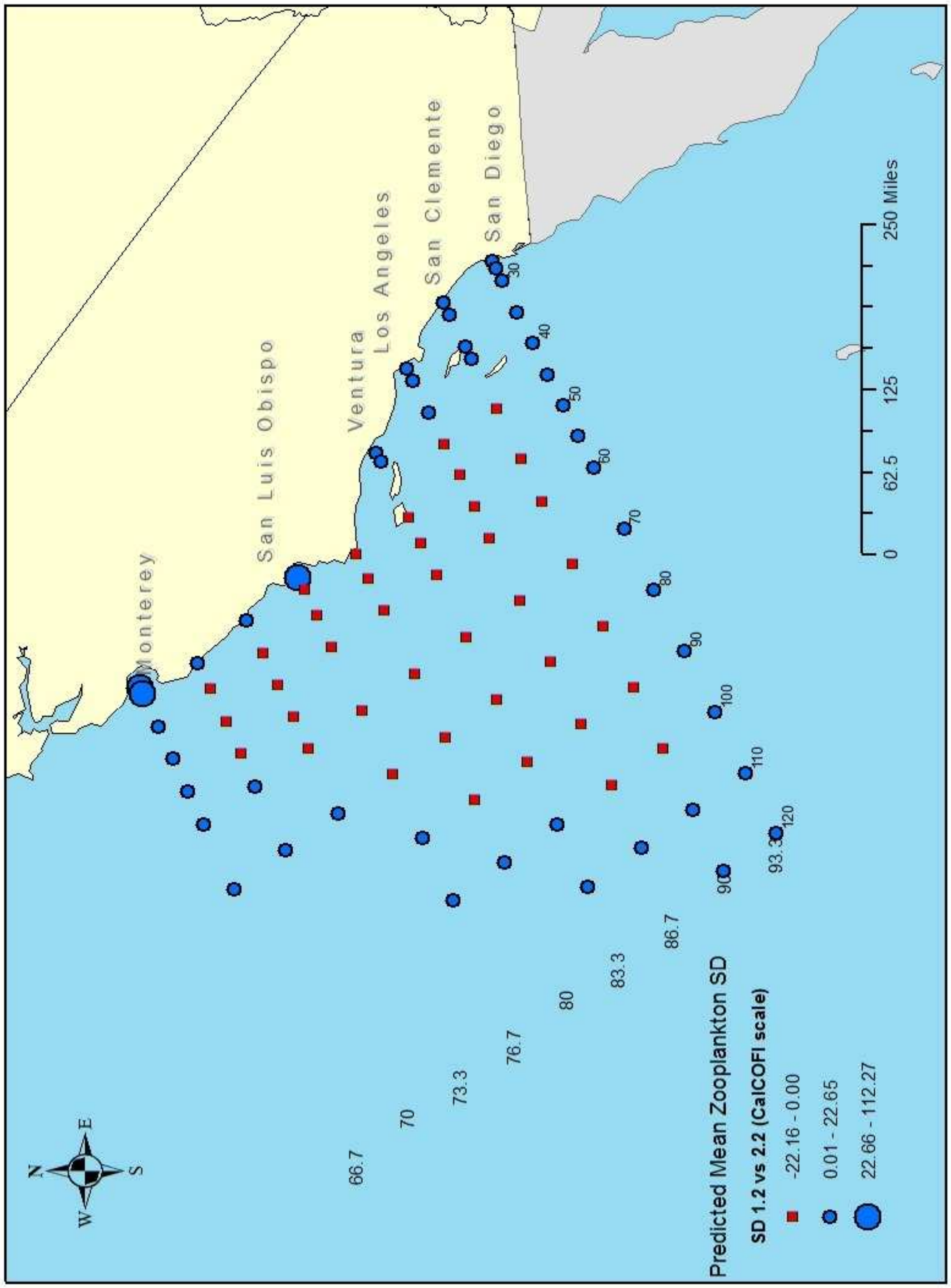


Figure M.2j: Difference of WCAR and HCAR Predicted Sampling Sites Mean Zooplankton Yields SD (Model 2.2 minus Model 1.2): October.

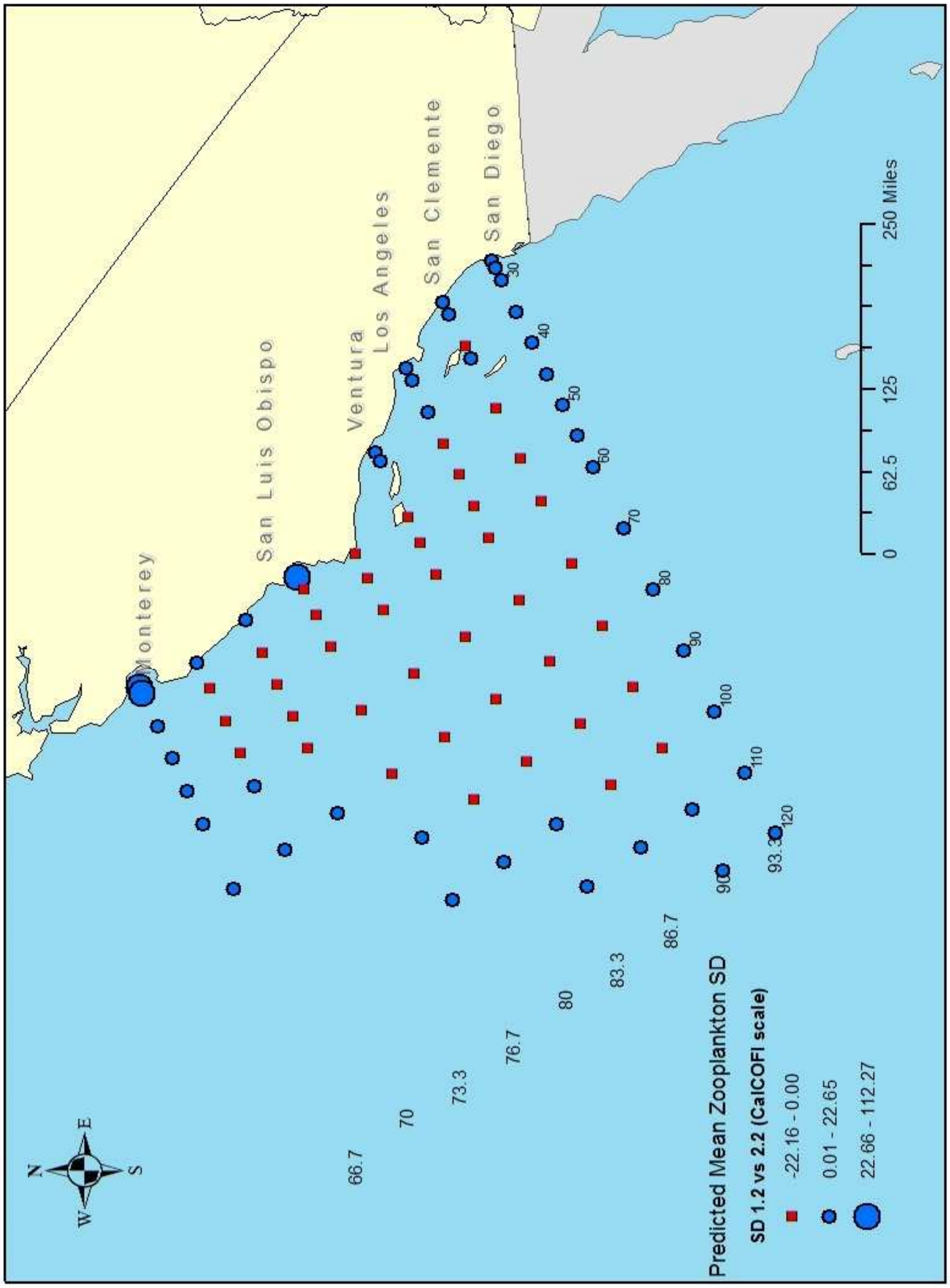


Figure M.2k: Difference of WCAR and HCAR Predicted Sampling Sites Mean Zooplankton Yields SD (Model 2.2 minus Model 1.2): November.

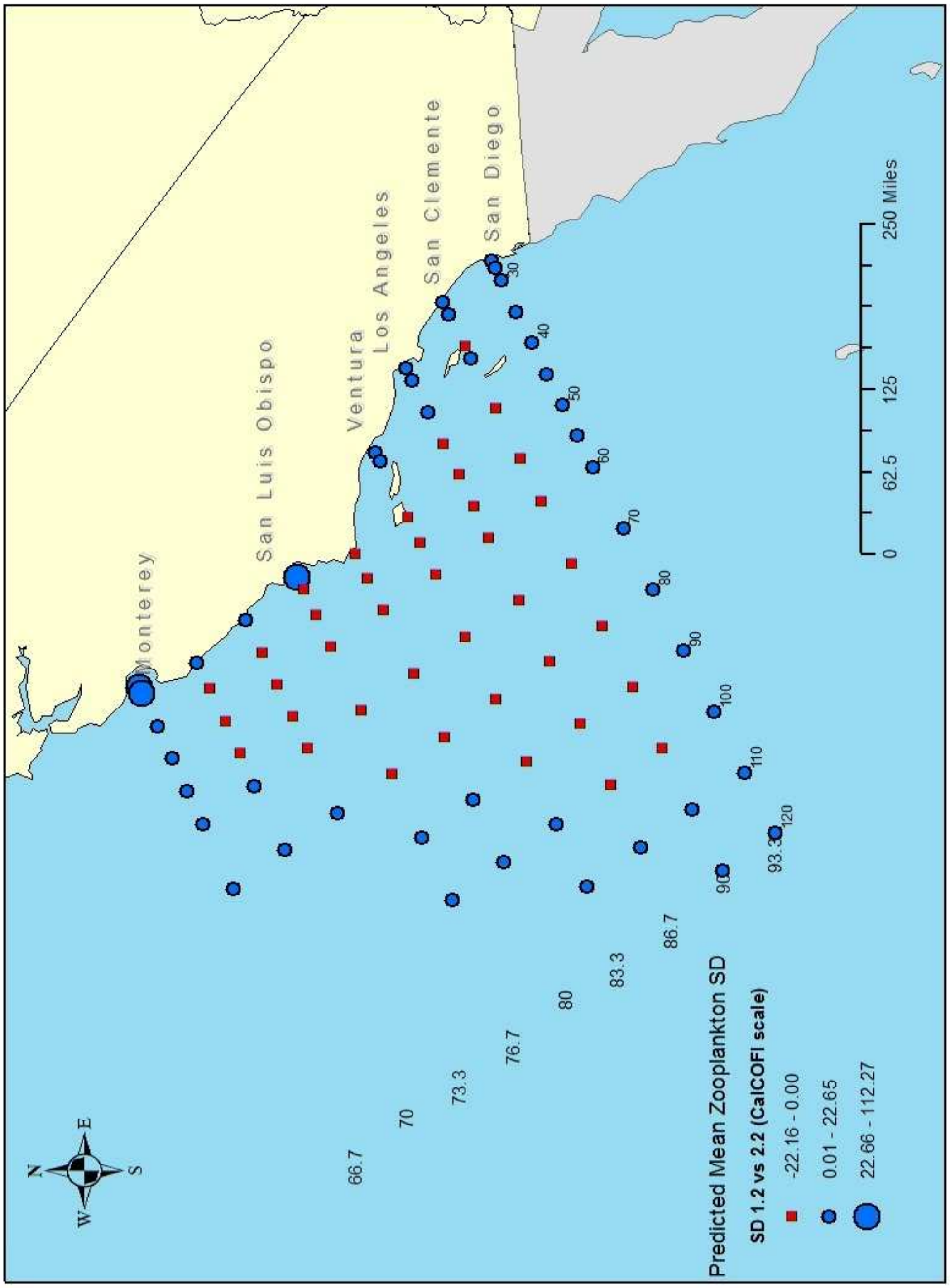


Figure M.2l: Difference of WCAR and HCAR Predicted Sampling Sites Mean Zooplankton Yields SD (Model 2.2 minus Model 1.2): December.

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BIOGRAPHICAL SKETCH

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