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Economic Valuation of Critical Habitat Closures

Fisheries Centre, University of British Columbia, Canada

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Director's Foreword

Humans have developed fisheries spanning entire oceans, and have the capability to overexploit the resources in any region within a very short time, as attested by numerous now-defunct fisheries. Therefore, a consensus is slowly emerging that management of fisheries, rather than focusing only on the amount of fishing effort deployed, also needs to be structured in space, with different ocean areas being targeted differently, and/or at different times, depending on the resources and habitat that they provide. In fact, ocean zoning is emerging as a major element of Ecosystem-Based (Fisheries) Management, because ecosystems are spatial entities.

Ecosystem-Based (Fisheries) Management implies, among other things, redirecting fishing effort away from previously fished areas to protect animals or habitats whose continued existence is considered crucial. For the eastern North Pacific ocean, the rookeries and haulouts of Steller sea lions and the feeding areas surrounding them provide a clear example of areas that need protection.

The cost to the fisheries of closing such areas can be evaluated and balanced against the risk of damage to natural resources in the area. This cost will be some fraction of the value of the catch that could be made in the areas to be closed, its value depending on the extent to which substitute areas are available to the fishery. This report presents a spatial model of fleet operations through which such costs can be evaluated; as such, it is of interest to anyone interested in spatial management and marine protected areas.

Some colleagues claim not to know what Ecosystem-Based (Fisheries) Management means, or even that it does not mean anything concrete. This report shows what Ecosystem-Based (Fisheries) Management can mean, and it poses questions and proposes an approach for answering them that would not have seen the light of day when single-species approaches reigned. So, gradually, we are getting there.

Daniel Pauly
Director, UBC Fisheries Centre

ABSTRACT

We developed methods to estimate the spatial variation in economic values of ocean fisheries, and applied the methods to estimate the cost of closing groundfish fisheries in Steller sea lion Critical Habitat in the Bering Sea and Gulf of Alaska. The research addressed two related goals: (1) explicitly linking spatial variability of fisheries biomass and profitability over time to environmental variables; and (2) developing estimates of opportunity costs of time and area closures to the fishing industry at scales relevant to management. The approach involved two stages of statistical analyses. First, environmental conditions measured at 3 km and 9 km spatial scales and two-week and one-month intervals were used to predict fish biomass and fisheries catch per unit of effort (CPUE). Environmental variables included bathymetry, remotely sensed physical and biological observations, and output from a physical oceanographic circulation model. Second, we used predicted CPUE and spatial regulatory and cost factors to explain the spatial distribution of fishing effort over time. Our results suggested that 2001 Critical Habitat closures cost the North Pacific groundfish trawl fisheries 5-40 percent of their total potential net earnings. The improved methods for estimating opportunity costs of fisheries closures we present have direct applications to evaluating boundary changes to marine protected areas and other spatial management decisions. Limitations include the extensive data requirements and the need to bootstrap confidence intervals. If further research demonstrates the robustness and stability of the estimated relationships over time, the methods could project spatial fishery effects of climate variability and change, leading to dynamic spatial models linking fisheries with ecosystems.

INTRODUCTION

Resource managers are increasingly requested to make decisions to restrict commercial fishing for the benefit of protected species, with uncertainty about the value of the reserved habitat to the fishing industry, and to the species at risk. Critical Habitat designations for Steller sea lions (SSLs; *Eumetopias jubatus*) since 2000 in the Gulf of Alaska and Bering Sea have been especially disruptive to fisheries for pollock (*Theragra chalcogramma*), Atka mackerel (*Pleurogrammus monopterygius*), and other groundfish (National Marine Fisheries Service 2001a). However, claims of high annual losses by fisheries organizations cannot be independently evaluated due to the absence of a scientifically defensible method to estimate the cost of the closures around critical habitat areas. The main official study documenting the economic impact of SSL critical habitat designation (National Marine Fisheries Service 2001a) contains only qualitative analyses of the closures on industry profits. Pending proposals to close additional areas to fishing in the North Pacific to protect 'essential fish habitat' or 'habitat areas of particular concern', and possible future closures to protect other marine species could further reduce the area available for fishing. The controversy surrounding these actions suggests that there is an urgent need to develop objective methods to quantify their cost.

Quantitative economic analyses of North Pacific habitat closures have largely been limited to describing what has become known as 'revenue at risk' (National Marine Fisheries Service 2001a; Tetra Tech 2004; North Pacific Fishery Management Council 2004). Revenue at risk represents an estimate of the ex-vessel gross revenue that could reasonably be expected to derive from fishing in the area proposed to be closed, based on historic catches when the area was open to fishing. This is a completely inadequate measure of the losses that the industry – and society – would endure from such closures. Under fisheries regulated by Total Allowable Catch (TAC), fishing effort generally moves from closed areas to areas that remain open. Total catch and gross revenue will remain the same as before unless the restrictions are so severe that some TAC remains uncaught, an unlikely outcome for overcapitalized fisheries like those of the North Pacific. True ex-vessel gross revenue losses are probably close to zero in most cases.

Although most habitat closures are unlikely to substantially affect total catches, market value, and gross revenues, the expansion of time and area closures on the fishery nevertheless imposes real costs on the industry. Such costs may include higher travel costs to reach open areas, higher operating costs from lower catch rates and interrupted trawls, search costs and costs of learning how to fish profitably in new areas. These costs are described qualitatively in regulatory review documents (National Marine Fisheries Service 2001a; Tetra Tech 2004; North Pacific Fishery Management Council (2004). While these industry costs represent real losses to society, they are not closely related to the so-called revenue at risk.

Methods do exist for estimating the costs of fishery time and area closures based on extensions of the Random Utility Model (RUM; McFadden 1981). RUM was initially developed to model transportation mode choice (Ben-Akiva and Lerman 1985; Domencich and McFadden 1975). Early applications to natural resources focused on estimating demand for recreational fisheries and associated non-market values (Bockstael 1989). RUM was first extended to commercial fisheries by Bockstael (1983), and has increasingly been used to model spatial economic decisions in fisheries (Dupont 1993; Holland and Sutinen 2000). Haynie and Layton (2004) estimated a spatial choice model for groundfish trawl fishing in the Bering Sea, establishing an initial milestone toward quantifying the cost of critical habitat closures. In this project we addressed two specific limitations of the standard approach used by Haynie and Layton (2004) – generality and usefulness to management.

First, Haynie and Layton (2004) did not address costs for a large offshore fishing fleet. The second, and more fundamental, limitation arises from the imposition of an unrealistic choice set on fishers. Haynie and Layton (2004) divided the fishing ground into 29 geographic areas, based on statistical reporting, of which 18 contained most of the fishing. This artificial division is unlikely to correspond to actual fleet choices. The Bering Sea/Aleutian Islands area is a huge expanse with a complex coastal and subsurface geography; a realistic choice set for the trawl fleet would contain a much larger set of more precise locations. The theoretical justification for RUM requires that the choices represent a complete set of discrete, independent, and available alternatives (McFadden 1981). Empirical applications of RUM are appropriate to the extent that they model a realistic decision-making problem for individual agents. Like the applications to recreational fishing, commercial fishing applications work best when they involve specific alternative fisheries and discrete alternative fishing sites (Berman, Haley, and Kim 1997).

We therefore aimed to develop a realistic method of valuing habitat-driven fishery closures. To be useful to managers, the method must satisfy four criteria. It must:

1. Be consistent with RUM, benefiting from RUM's theoretical and practical advantages;

2. Differentiate among a large number of small areas distributed over a large geographic space, so that it is relevant to decisions regarding marine mammal critical habitat;

3. Recognize costs of reduced fishing flexibility to an at-sea processing fleet as well as the shore-based fleet;

4. Provide estimates of impacts on fisheries linked directly to ecological variables that are consistent with habitat models for SSLs and other protected species potentially interacting with fisheries. In this way, estimated fisheries values can be compared directly to habitat requirements, both of which may vary over time.

This work could therefore be considered a test of two primary hypotheses about Bering Sea and Gulf of Alaska fisheries:

1. Data on measured and modeled environmental variables can predict spatial variation in the density of catchable fish biomass at the small temporal and spatial scales relevant to realistic modeling of fishing fleet choice sets and management needs; and

2. Resulting predictions of fish biomass, along with data on prices and indicators of fishing costs, can predict spatial choices of the shore-based and offshore fishing fleet in a way that can be used to derive profit functions under the assumptions of RUM.

Of course, closing marine habitat to fishing may benefit fisheries in the long run, enabling higher future catches outside the boundaries of the closed areas as stocks rebuild. These benefits could be significant, but estimating such benefits is outside the modest scope of this project. We also did not attempt to estimate the value of protected species saved through closures to fisheries. We addressed only the short-term cost to the fishery of foregone fishing opportunities – the cost that often poses the main obstacle to the creation of such reserves.

Our goal was to design and demonstrate a method to quantify the net cost to the fishing industry of closing areas to fishing that satisfies the above four criteria. Our intent was to improve existing economic models of spatial choice in fisheries by relaxing unrealistic restrictions on spatial decision-making while incorporating detailed and flexible geographic scales. The research plan included four specific objectives:

- Develop and test a scientifically defensible method to value commercially fished areas at flexible temporal and spatial scales relevant to management decisions;

- Demonstrate a specific application of the method by estimating the cost to Bering Sea and Gulf of Alaska groundfish trawl fisheries of changes in Steller sea lion critical habitat closures;

- Create maps of relative fisheries values for comparison to maps of relative importance to SSL recovery, in order to assist management decision-making under uncertainty;

- Generalize the method to evaluate fishery time and area closures for any protected species, or for marine conservation generally.

METHODS

Theoretical approach

For this study, cost of habitat protection means the opportunity costs, or profits foregone, from time and area closures and gear restrictions. Valuing this cost started with a model of fishing fleet decision-making consistent with the assumptions of RUM. The RUM has been widely used to model spatial economic decisions in fisheries (Dupont 1993; Holland and Sutinen 2000). Its advantages include the ability to model choices among multiple spatial alternatives, straightforward computation using maximum likelihood techniques, and direct derivation of welfare estimates under a reasonable set of assumptions. We extended the RUM approach to address the goals of the project by making the following five assumptions:

1. The probability of use of each alternative (when it is open to fishing) is based on the RUM;
2. Modeled alternatives are small geographic units with similar fish habitat;
3. Expected catch in each alternative unit depends on predicted fish density times geographic area;
4. Since alternatives are very small in relation to the total fishery area, the probability that any vessel uses a given area during each fishing day is small (generally < 1%);
5. A large number of vessel-days per month are observed in each modeled fishery (generally > 100).

Under these assumptions, the number of landings in an area during a specified time can be approximated by the Poisson probability distribution. Using probabilistic models of count data to approximate the RUM is new for commercial fisheries, but analogous to an approach proposed by Guimares et al. (2003) to model siting decisions regarding industrial facilities. Since the underlying choice probabilities conform to the assumptions of RUM, we may invoke it to estimate the value of each small choice area from the estimated parameters of the profit function, following Small and Rosen (1981).

Berman (2006) describes the specific technical approach developed under the project for implementing the extension of RUM to commercial fisheries, consistent with the above five assumptions. Suppose the utility that an agent in group *i* derives from selecting choice *j* at occasion *k*, is

$$U_{ijk} = V_{ijk} + [\eta_{ijk} + \varepsilon_{ijk}] \tag{1}$$

where V_{ijk} represents the profit for alternative *k*, η_{ijk} is a random term with a zero mean whose distribution may be correlated with observed data, and η_{ijk} is a random term with a zero mean with an independently and identically distributed type one extreme value distribution. The random variable η may, for example, model systematic but unobserved differences in operating costs or other information that varies among vessels in a fishery. For a given value of η_{ijk}, the conditional probability π_{ijk} that a fisher from group i chooses area $j \in J_k$ is given by:

$$\log \pi_{ijk} = \alpha V_{ijk} + \eta_{ijk} - \gamma'_{ik} \tag{2}$$

Where

$$\gamma_{ik} = \log \sum_{j \in J_k} e^{\alpha V_{ijk}} + \eta_{ijk} \tag{3}$$

Under the five assumptions listed above, the conditional probability for the number of vessels y_{ijk} from group *i* observed catch in area *j* during occasion k may be approximated by a Poisson distribution:

$$prob(y_{ijk} = y) = \lambda_{ijk} y \exp(-\lambda_{ijk}) / y! \quad (4)$$

where

$$\lambda_{jk} = n_k \exp(x_{jk}\beta + \eta_{ijk} - \gamma'_k) \quad (5)$$

The unconditional probability distribution for y_{jk} depends on the distribution of η. However, equations (4) and (5) represent a form of "overdispersion" in the Poisson model (Cameron and Trivedi 1986). For example, if e^{η} is assumed to have a gamma distribution, the Poisson approximation to the mixed logit becomes a negative binomial model, whose parameters can be estimated easily with conventional maximum likelihood.

Since the underlying choice probabilities conform to the assumptions of RUM, we may invoke RUM to estimate the conditional value of an area from the estimated parameters δ, ε, and g_k following Small and Rosen (1981). Given that the vessel has chosen to take a fishing trip, the ex-vessel price, and the relevant geographical information, the difference in value between two subsets J_{1k} and J_{2k} of the choice set J_k is related to the parameter γ'_{ik}:

$$S_{J_{1k}} - S_{J_{2k}} = -(n_k / \alpha) \log \sum_{j \in J_{1k}} e^{\alpha V_{ijk}} + \eta_{ijk} - (n_k / \alpha) \sum_{j \in J_{2k}} e^{\alpha V_{ijk}} + \eta_{ijk} \quad (6)$$

The opportunity cost of closing area *j* to fishing during choice occasion *k* reduces to:

$$-n_k \log[1/(1 - \pi_{jk})] / \alpha \quad (7)$$

Since the expected value of $\eta_{ijk} = 0$, a point estimate of the opportunity cost may be derived by evaluating the coefficients of a negative binomial regression for Equation (2). However, the complexities that Hensher and Greene (2003) outline for derivation of welfare estimates with mixed logit models apply here. In general, bootstrapping is necessary to generate confidence intervals around the point estimate.

Data sources

This was a data-intensive project. Although we did not generate new data from field observations, much of the work on the project involved processing primary data, including environmental indicators, fish catch and effort, fisheries openings and habitat regulations, and indicators of prices and costs.

Spatial resolution: A key issue that had to be determined at the start of the project was the identification of the appropriate spatial and temporal scales for the analysis. Three criteria drove the decision: realistic behavioural choices of fishing fleets, management needs, and the resolution of the available environmental data. We decided to analyse the data at multiple scales, with different types of analyses at each scale. The three scales selected were:

1. The Alaska Department of Fish and Game (ADF&G) statistical area (statarea). Each statarea measures one-half degree of latitude by one degree of longitude (roughly 30 x 40 km), with the areas further subdivided in coastal areas around landforms. In any given year, about 700 of approximately 1,700 statareas report some groundfish fishing activity. The statarea was used for testing the feasibility of the approach (Berman 2006), but the available data support more detailed spatial scales, which also better represent fishing decisions and satisfy management needs;

2. A 9 x 9 km^2 grid, covering the entire Gulf of Alaska and Bering Sea regions. This geography was selected as the finest scale that was supported when considering the resolution of the available satellite data. There were approximately 45,000 9 x 9 km^2 grid cells within the U.S. Exclusive Economic Zone (EEZ) in the Bering Sea and Gulf of Alaska; and

3. Within the Gulf of Alaska, we analysed the data on a 3 x 3 km^2 grid. This downscaling was possible for the Gulf of Alaska because of the availability of oceanographic model output (described below). The area contained within the model area inside the U.S. EEZ contained about 36,000 3 x 3 km^2 cells.

Environmental indicators: Environmental indicators used in the project included bathymetry, remote sensing data, and oceanographic model output. Data sources on fish biomass density and fishing effort provided some limited additional environmental measurements, as described below.

Remote sensing data were obtained for four indicators: sea surface temperature, sea surface height, wind, and chlorophyll-*a*. Each indicator has its own strengths and weaknesses. Temperature is a basic habitat indicator for most species. However, cloudiness disrupts satellite measurements, and the limitation of remotely sensed temperature to surface waters compromises the utility of this indicator for bottom-dwelling fish. Sea surface height is measured as an anomaly from mean sea level. Sea surface height is affected by salinity, temperature, and persistent atmospheric pressure anomalies, all of which could indicate habitat variation. However satellite measurements of sea surface height tend to produce inaccurate readings near shallow coastlines affected by tidal action. Wind, inferred from satellite readings of wave height, indicates surface mixing and could be an important indicator of surface enrichment. However, interference with land causes wind data to be unavailable in coastal areas where significant fishing takes place. Chlorophyll-*a* provides a measure of primary production. However because it is derived from colour images, clouds and low light conditions in winter combine to yield few if any valid readings in December and January. Sea ice also affects both colour and radar satellite measurements. We derived monthly climatologies from available remotely sensed data, beginning in 1993, except for chlorophyll data, which began in 1997.

For the Gulf of Alaska, Al Hermann and Dave Musgrave provided output from a Regional Ocean Modeling System (ROMS) model developed for the Gulf of Alaska (Hermann et al. 2002; Hermann and Stabeno 1996). Model outputs were provided at a 3 x 3 km^2 resolution, summarized as 2-week averages, for all of calendar year 2001. ROMS model indicators included temperature, salinity, and velocity vectors in three directions at 30 different vertical levels. In addition, the model also calculated a mixed layer depth and sea surface height anomaly.

Each of the three types of environmental indicators has advantages and disadvantages. The ROMS output has the ability to 'see' the ocean in three dimensions, as well as infer ocean dynamics through currents and eddies. However, it is difficult to validate the model to assess its accuracy at the fine scale we used. (For example, modeled and remote-sensed sea surface height are positively correlated, but the correlation coefficient is only 0.3, so we included both indicators for the 3 x 3 km^2 Gulf of Alaska analyses.) ROMS model output was available only for a portion of the Gulf of Alaska (GOA). Remotely sensed data provide direct measurements of dynamic environmental conditions. However, as discussed above, sea ice, clouds, and low light conditions reduce the spatial and temporal extent of these data. Bathymetry provided the best quality and coverage, and served as an important but limited habitat indicator.

For the statistical analyses, we extracted four levels from the ROMS output: surface, bottom, and the levels immediately above and below the mixed layer depth. We calculated horizontal velocity from the two horizontal vectors. In addition, to reduce collinearity of variables at different depths, we represented the surface and bottom values as differences from the level below the mixed layer. Remotely sensed data generally supported monthly climatologies at 7 – 10 km resolutions. After selecting a minimum usable quality level based on available quality flags, we interpolated the remote sensing data to common 9 x 9 km^2 (entire study area) and 3 x 3 km^2 (GOA) grids. Metadata (Gregr and Coatta 2008) contain the technical specifications for the sources and processing of the environmental data.

After developing the five data sets of environmental climatologies, we generated slopes (rates of change across space) for bathymetry, sea surface temperature (SST), and sea surface height (SSH). The formula (using SSH as an example), was :

$$sshslope = (180/3.14159)*\arctan\{ [((SSH_n-SSH_s)/2)^2 + ((SSH_w-SSH_e)/2)^2]^{1/2} \} \quad (8)$$

The subscripts n, s, e, w denote the adjacent cells to the north , south, east and west, respectively.

Since bathymetry is measured in metres, and horizontal distances in kilometres, we divided the formula result by 1000 to obtain bottom slope in degrees. Slopes for SST and SSH represent fronts that could indicate areas of unique habitat. We used linear interpolation as needed to map the 12 monthly climatolgies onto 26 2-week intervals for the 3 x 3 km^2 GOA study area.

Data on fish density and fishing effort: We derived data measuring spatial fish density and fishing effort from three sources. ADF&G landings data provide information on effort and catch (including bycatch and discards) delivered to shore-based processors at the spatial resolution of the ADF&G statarea. Data provided by ADF&G include round weight and number of boats, summarized by species, gear, port landed, and month for two calendar years (1998 and 2002). Complete data are available when data represent more than three vessels in an observation. ADF&G also indicated which statareas in a given month had at least one but less than three vessels delivering a given species, gear, port, month combination. We combined all trawl and all fixed gears to increase the number of data points. Since completing a fish ticket is voluntary for the offshore sector, we used only onshore landings in the statistical analysis. ADF&G data were used for testing the methods for mapping spatial fisheries values (Berman 2006), but had insufficient spatial resolution to value fisheries closures related to SSL critical habitat.

Alaska Fisheries Science Center personnel kindly provided NMFS trawl biomass survey data for the Gulf of Alaska in 2001 (Alaska Fisheries Science Center 2001). NMFS uses the survey for area-wide stock assessments. The survey records represent individual trawl hauls at over 500 points, providing considerable spatial variation. However, the survey had limited spatial and temporal coverage. All data points lie west of Middleton Island in the Central Gulf. The survey was taken in late spring and early summer, starting in mid-May and ending in mid-July. The survey moved systematically from west to east. Trawl depths for the survey were limited to less than 600 metres. Despite these limitations, the NMFS survey data do provide a spatially random sample taken with standard gear over a large geographic area. The survey data included 421 points that fell within the ROMS model spatial coverage. In addition to haul weight by species and haul duration, each haul also recorded time and location, surface temperature and gear temperature.

The fishery catch and effort data used for the 9 x 9 km^2 study came from the NMFS fisheries observer program. NMFS made available to the project individual haul records for the North Pacific groundfish fishery from 1993 through 2003. Geographic coverage for the observer data extends to the entire Alaskan fishing grounds. The data include all gears and all species caught, including bycatch and discards. For 2001, approximately 44,000 hauls were observed, including 100 percent of hauls in the Bering Sea and about 30 percent of the hauls in the Gulf of Alaska. Data on species round weights in each haul were estimated from sampling portions of each observed haul. Most observed hauls included bottom depth and fishing depth as well as time and location.

In order to join the different data sets spatially, we related the survey locations and GOA observer trawl ending locations and dates to the ROMS model 3 x 3 km^2 grid and two-week time step. We also aggregated all observer data to the 9 x 9 km^2 grid and at a monthly time step. Observed catch locations may represent a spatially biased sample of fish density, since the fishing fleet is preferentially targeting (or may be avoiding in the case of unwanted bycatch) areas of the ocean where concentrations of fish are more likely to be found. However, one can test and correct for this bias arising from nonrandom spatial selection at the scale of grid, although not at finer scales.

Data on fisheries openings and habitat regulations: Fishing seasons, and in-season time and area closures by gear and sector (inshore vs. offshore where different) were derived from public sources (National Marine Fisheries Service 2001b; 2001c). The primary spatial reference for most in-season fisheries regulations is the NMFS three-digit management area. We also obtained information on seasonal time and area closures and gear restrictions related to bycatch, Steller sea lion critical habitat, and other environmental regulations from applicable sections of the Code of Federal Regulations archived on the NMFS Alaska region website (National Marine Fisheries Service 2001d). NMFS management support personnel provided digital spatial data delimiting the geographic boundaries applicable to each separate environmental regulation. In all, we mapped 78 separate closures, each applying to different gears, fisheries, and time periods. We interpolated where necessary to address spatial and temporal overlap between closed areas and periods and the modeled spatial grid cells and time periods.

Indicators of prices and costs: Primary economic factors relating to the value of catch opportunities consisted of targeted fish species prices and the distance traveled to access fishing areas. Ex-vessel prices for trawl and fixed gear landings in the GOA and Bering Sea were obtained from Alaska Fisheries Science Center (2003). For all fisheries, we calculated distance to port as the one-way distance from the catch grid cell to the grid cell of the nearest port used by any vessel of that gear type (trawl or fixed gear), based on ADF&G landings data. Although fixed-gear boats land catch at numerous ports, trawl vessels landed nearly all their catch at eight Alaska ports in 2001: Dutch Harbor, Akutan, King Cove, Sand Point, Kodiak, Kenai, and Cordova. For offshore fisheries, we also considered the distance between consecutive offshore hauls, but rejected that measure in favour of a different approach, which we describe below.

Statistical methods

We conducted our analyses at three different spatial scales, using increasingly detailed information about the oceanic environment and fishing-related costs and revenues as we moved from coarser to finer spatial scales. We first estimated monthly results for the Bering Sea and Gulf of Alaska at the resolution of ADF&G statistical areas with data for calendar year 1998. Fishing was relatively unregulated in terms of spatial closures in 1998, with the exception of regulations set by NMFS management areas. After this year, habitat closures, which could not be modeled adequately at this coarse a spatial resolution, increasingly began to affect fishing location choices.

We then estimated results for the Bering Sea and Gulf of Alaska at 9 km resolution, using a monthly time step for calendar year 2001. This was the year NMFS adjusted the Steller sea lion regulatory regime to comply with a court order. We had originally hoped to examine these data for additional years, in order to determine the stability of the relationships over the years. However, the complexity of fisheries and environmental regulations, which changed spatially and temporally each year, made this impractical. Finally, we estimated results for the Gulf of Alaska, 2001, at a 3 km resolution using the ROMS output to predict environmental conditions at fishing locations.

We estimated equations to explain variation in CPUE as a function of the environmental variables available at each particular scale. For both the 9 and 3 km analyses, data from the NMFS observer program included all species caught in each haul, regardless of whether that species was targeted or not. Consequently, a catch of zero could be inferred for hauls that did not report any catch of a given species. In order to use the zero-landings information to improve predictions of the spatial distribution of different species, we estimated CPUE equations from the observer data using censored regressions (tobit). On the other hand, data available from ADF&G were not available by individual vessel or haul, and included information only from vessels that reported landings of that species. Since it was not possible to infer zero catches from such data, we estimated CPUE for the statareas using ordinary least squares. For all CPUE equations, we obtained a large improvement in the statistical fit by using a loglinear specification, or more precisely (to accommodate the zero observations), the natural logarithm of CPUE + 1. For the 9 and 3 km analyses, we tested and corrected for sample selection bias as necessary to take into account potential correlation between the spatial distribution of variables determining fish distribution and the distribution of fishing effort.

To quantify how predicted CPUE, economic variables, and regulatory factors influenced the distribution of fishing effort, we estimated Poisson and negative binomial regressions (Berman 2006). Berman (2006) also illustrated how closely the Poisson regression approximates the multinomial logit model, using example fisheries estimated from the ADF&G statareas. For the 9 and 3 km studies, all equations were estimated using standard maximum likelihood techniques.

RESULTS

Statistical analysis proceeded sequentially in three stages. First we estimated censored normal (tobit) regression equations explaining the spatial distribution of CPUE in the data source at each time step, using the coefficients to project variation in expected CPUE over the entire study area. Second, we estimated Poisson and negative binomial regressions explaining the spatial distribution of fishing effort at each time step as a function of projected CPUE and economic factors, to obtain a set of spatial profit functions. Third, we used the coefficients from the spatial profit functions to estimate the opportunity cost to the fishery of closing specific areas related to designation of Critical Habitat for Steller sea lions.

Berman (2006) discussed the analysis at the level of the ADF&G statarea. This resolution was ideal for developing the theoretical method, and demonstrating the ability of the Poisson regression to approximate closely the multinomial logit equation for the large number of alternatives needed to model site choice realistically. Although Berman (2006) estimated a distribution of value for onshore groundfish fisheries across more than 1,000 statareas in the North Pacific, the spatial resolution of the statarea was too coarse to apply to evaluating the complex spatial geography of Steller sea lion habitat closures, so we do not discuss it further here. Instead, we focus on results obtained for the Bering Sea/Aleutian Islands and Gulf of Alaska (North Pacific) at a 9 km resolution, based on remote sensed environmental data, and for the Gulf of Alaska (GOA) at a 3 km resolution, using output of the GOA ROMS model in addition to the remote sensing data.

Spatial fish density

Results from the GOA 2001 bottom trawl survey. Because the trawl survey is a spatially random sample taken during a relatively brief (approximately 2-month) time period, estimating CPUE is straightforward. The spatial sampling is stratified to improve accuracy (National Marine Fisheries Service 2001c). Since our interest is in understanding spatial variation fish density rather than total area-wide biomass, we ignored the strata weights in our analysis. The 2001 GOA survey contains 521 sample points, of which 415 observations lie within the boundary of the ROMS model. Nearly all the 106 excluded sample points were in the west end of the GOA (western portion of NMFS regulatory area 610). Figure 1 displays the geographic location of 2001 trawl survey points in comparison to the observed hauls in that year. The 2001 Gulf of Alaska trawl survey was conducted from May 20 through July 23. Oceanographic model outputs were obtained for 14-day periods. The Julian days representing the start of each model period, determined by the correspondence between the available survey data and the ROMS model output, are 137, 151, 165, 179, and 193.

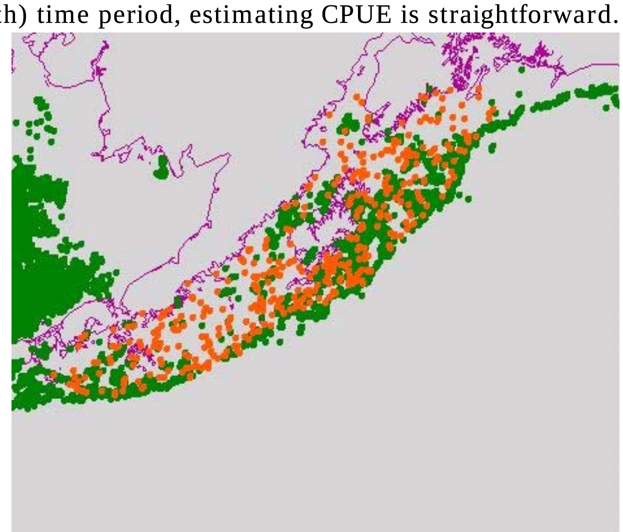

Figure 1. Location of 2001 GOA trawl survey points (orange) and observed haul locations (green).

Table 1 contains the precise definition of variables included in the 3 km Gulf of Alaska CPUE analysis using the survey data. The dependent variable is the natural logarithm of CPUE, defined as total round weight for each species divided by trawl duration (kg/hour). Individual species considered included pollock, Pacific cod, black cod, and halibut. In addition, we aggregated all flatfish and rockfish species into two species group categories. These represent the main target and bycatch fisheries for groundfish vessels in the GOA. We estimated separate equations for all hauls, and for hauls with average fish weight greater than a given threshold (representing hauls with likely commercial value), derived from the distribution of average fish weights in hauls for each species or species group. Wind data were available for only about two-thirds of the observations. Consequently, we estimated separate equations with and without wind. This yielded four equations for each species: all and large fish, with and without wind.

Appendix A contains the complete set of CPUE equation results estimated from the 2001 trawl survey for the Gulf of Alaska study. Equations were estimated as censored normal regressions (tobit), by maximum likelihood. Due to high collinearity of the set of modeled and observed environmental variables, we dropped variables with a probability > 0.3 (absolute value of t-statistic approximately equal to 1) from the equations to increase robustness of the predictions. With separate intercepts for each time period, coefficients should be interpreted as effects of spatial anomalies. In other words, coefficients, except for those for the time periods and constant term, would be identical if all variables were transformed to represent deviations from the respective time-period mean. Since only one observation had wind data in the first time period, the wind equations combine intercepts for the first two periods.

The tables in Appendix A display the respective CPUE equations in pairs. The bottom equation on the page is the censored regression; the top equation reports the corresponding ordinary least squares regression for reference. Censoring the equation at a minimum of zero is necessary to avoid generating predictions of negative CPUE, especially in the equations for large fish. Unfortunately, no generally recognized measure of goodness of fit such as R^2 exists for the censored equations, which combine a probit and a linear regression.

Figure 2 summarizes the results in Appendix A by displaying the level of statistical significance and direction of effect of the set of environmental variables in the multivariate analysis for all fish. Quadratic associations imply an optimal habitat that lies within the range of observations for that variable. The equations fit best for black cod and rockfish, and least well for Pacific cod. The linear regression equations excluding small fish have lower R^2 than the corresponding equations for all fish, but not necessarily a worse fit if censoring is taken into account. In general, the equations show a different pattern of significant variables across species, suggesting habitat selection. Several modeled environmental variables such as salinity, temperature at depth and velocity variables have significant estimated effects for each species, suggesting that the ROMS model successfully enables downscaling the CPUE analysis to the 3km scale.

Table 1. Environmental variables used for 3 km Gulf of Alaska CPUE equations.

Variable	*Definition*	*Source*
constant	constant term (intercept for period 12)	calculated
herm13	dummy variable for two-week period starting with julian day 151	trawl survey date
herm14	dummy variable for two-week period starting with julian day 165	trawl survey date
herm15	dummy variable for two-week period starting with julian day 179	trawl survey date
herm16	dummy variable for two-week period starting with julian day 193	trawl survey date
ldepth	natural logarithm of bottom depth, in metres	trawl survey
l2dep	square of nat. log of bottom depth	calculated
timeldep	julian day times ldepth	trawl survey
lslope	natural logarithm of slope at 3km resolution	NOAA bathymetry
l2slope	square of nat. log of slope	calculated
lmld	natural logarithm of mixed layer depth, in metres	Hermann model
lmld_dep	nat. log. of mixed layer depth times nat. log. of bottom depth	calculated
surftemp	surface temperature	trawl survey
geartemp	gear temperature at fishing depth	trawl survey
gtemp2	square of gear temperature	calculated
tempdep	temperature at first model level below mixed layer depth	Hermann model
mstemp	temperature at depth minus surface temp	Hermann model
bmtemp	bottom temperature minus temperature at depth	Hermann model
lstem	natural logarithm of surface temperature	trawl survey
lgtem	natural logarithm of gear temperature at fishing depth	trawl survey
l2gtem	square of natural logarithm of gear temperature	calculated
lmtem	natural logarithm of temperature below mixed layer depth	Hermann model
lmstem	nat. log of temperature at depth minus nat. log of surface temp	Hermann model
lbmtem	nat. log of bottom temperature minus nat. log of temp at depth	Hermann model
lmsal	natural logarithm of salinity below mixed layer depth	Hermann model
lmssal	nat. log of salinity at depth minus nat. log of surface salinity	Hermann model
lbmsal	nat. log of bottom salinity minus nat. log of salinity at depth	Hermann model
vervelbm	vertical velocity at level below mixed layer depth (10^{-3}m/s)	Hermann model
msvervel	vertical velocity at depth minus vertical vel. at surface (cm/s)	Hermann model
bmvervel	vertical velocity on bottom minus vertical vel. at depth (cm/s)	Hermann model
horvelbm	horizontal velocity at level below mixed layer depth (cm/s)	Hermann model
mshorvel	horizontal velocity at depth minus hor. vel. at surface (cm/s)	Hermann model
bmhorvel	horizontal velocity on bottom minus hor. vel. at depth (cm/s)	Hermann model
ssh	modeled sea surface height, in metres	Hermann model
sshrs	average monthly sea surface height, in metres x 10^{-2}	Remote-sensed
lchla	natural logarithm of chlorophyll, current period	Remote-sensed
lchla1	natural logarithm of chlorophyll, one-period (14-day) lag	Remote-sensed
lchla2	natural logarithm of chlorophyll, two-period (28-day) lag	Remote-sensed
lwind	natural logarithm of average wind speed	Remote-sensed

Equations including wind

Variable		*P. cod*	*pollock*	*black cod*	*halibut*	*flatfish*	*rockfish*
Modeled environment							
	Bottom depth	22	++	22	--	22	22
	Bottom slope			+	+	++	
	Mixed layer depth		++		--		
	Bottom temp.	22	22		-	+	
	Temp. gradient	+	++	++		+	-
	Salinity at mld	22	2	++		-	+
	Salinity gradient	-	--	+		++	
	Vertical velocity			-			
	Vert. vel. gradient			+			
	Horiz. velocity				++	--	
	Hor. vel. gradient			-	+	--	
	Sea surface height	+					
Remote sensed environment							
	Sea surface temp.	--				-	
	Sea surface height			++	+	-	
	Chlorophyll-*a*		++	++			++
	Lagged chl-*a*	+		+	--		
	Wind	+		-			-
R sq. OLS		0.28	0.33	0.64	0.35	0.30	0.45

Equations excluding wind

Variable		*P. cod*	*pollock*	*black cod*	*halibut*	*flatfish*	*rockfish*
Modeled environment							
	Bottom depth	22	++	+	--	22	2
	Bottom slope	2		+	+	++	
	Mixed layer depth		++		--		
	Bottom temp.	22	22	22	-	+	
	Temp. gradient	+	++	++		+	--
	Salinity at mld	22	2	2		-	2
	Salinity gradient	-	--			++	++
	Vertical velocity						
	Vert. vel. gradient			++			-
	Horiz. velocity			--	++	--	
	Hor. vel. gradient			--	+	--	
	Sea surface height	+					
Remote sensed environment							
	Sea surface temp.	--				-	
	Sea surface height				+	-	
	Chlorophyll-*a*	++	++	++			++
	Lagged chl-*a*	+		--	--		
R sq. OLS		0.27	0.33	0.58	0.35	0.30	0.48
Significant positive association			+	Positive association < .01			++
Significant negative association			-	Positive association < .01			--
Significant quadratic association			2	Quadratic association < .01			22

Figure 2. Variables explaining the spatial distribution of fishing effort, Gulf of Alaska, Summer 2001: Equations including wind (top panel) and excluding wind (bottom panel). Red denotes a significant positive association, blue a significant negative association, and purple a significant quadratic effect.

Results from the North Pacific 2001 NMFS observer bottom trawl hauls. NMFS observer data provided a large sample of CPUE taken over the entire area and time period used by the fishery. However, unlike the trawl survey, the observer data – indeed any data derived from commercial fishing activity – do not constitute a spatially random sample. One would assume that the fishing fleet preferentially samples areas of the ocean that have target and desired bycatch species present. The fleet may also avoid areas with concentrations of unwanted bycatch species. Not taking this correlation into account could lead to the classic problem of sample selection bias, where the explanatory variables in the relationship predicting CPUE are correlated with the error term. We included all hauls in each CPUE equations, not just those hauls targeting the given modeled species, and ignored the differential rate of observer sampling in the GOA vs. BSAI regions. Including all hauls, rather than just those hauls targeting the given modeled species, increases the sample size and geographic dispersion, as well as reducing the effect of selection bias. However, one must assume that selection may still exist.

The simplest method to correct for selection bias is to apply the Heckman (1979) procedure. The Heckman correction involves a two-step process. First one estimates a probit equation for the probability that a grid cell has observed fishing activity. This is essentially a reduced-form equation that combines the variables predicting CPUE with those predicting distribution of fishing effort. From the probit equation, one calculates the inverse Mills ratio (IMR), defined as the ratio of the standard normal density to the cumulative probability for each observation, and includes the IMR as an additional explanatory variable in the CPUE equation. Heckman (1979) discusses how to adjust the standard errors for the second step equation.

A more statistically-efficient method would be to estimate the combined probit selection equation and CPUE equation using full information maximum likelihood (FIML). This approach would be preferred in theory where the CPUE equation is a censored regression (observed hauls with zero catch of a given species). In the present case, however, the situation is more complex. The FIML procedure considers the joint probability of the fishing location and presence of a species at that location jointly as a bivariate normal distribution. Applying FIML to estimate CPUE for each species would yield a different set of coefficients for the probit selection equation for each species, based on correlation with the particular CPUE equation. However, the probit equation models the same location choice for all species, so its coefficients should be the same across all species. This more accurately models the process when the species addressed in the CPUE equation represents the dominant target species for the entire fishery (such as pollock in pelagic trawl hauls). On the other hand, applying the Heckman (1979) procedure to a censored regression would estimate the probability that a species is present, along with the CPUE, given the probability of a haul occurring at that location. This more closely models the process when there are many target species represented in the data set of hauls (as is the case for bottom trawl hauls). In theory one could estimate FIML results for the system of equations for all the species combined, along with a single probit selection equation. However, since each species would have its own correlation coefficient with the probit, the FIML multivariate normal equation would be infeasible to estimate in practice.

Table 2. Environmental variables for the 9 km Bering Sea/Aleutian Islands and Gulf of Alaska CPUE equations.

Variable	*Definition*	*Source*
constant	constant term (intercept for January)	calculated
feb	dummy variable for observation in February	observer haul date
mar	dummy variable for observation in March	observer haul date
apr	dummy variable for observation in April	observer haul date
may	dummy variable for observation in May	observer haul date
jun	dummy variable for observation in June	observer haul date
jul	dummy variable for observation in July	observer haul date
aug	dummy variable for observation in August	observer haul date
sep	dummy variable for observation in September	observer haul date
oct	dummy variable for observation in October	observer haul date
nov	dummy variable for observation in November	observer haul date
dec	dummy variable for observation in December	observer haul date
goa	dummy variable for observation in Gulf of Alaska	observer data
ldepth	natural logarithm of bottom depth, in metres	observer data
l2dep	square of nat. log of bottom depth	calculated
timeldep	month times ldepth	calculated
slope	slope at 3km resolution, in degrees	NOAA bathymetry
2slope	square slope	calculated
sst	surface temperature, degrees C	remote sensed
sst2	square of absolute value of surface temperature	calculated
sstslope	square of sea surface temperature, in degrees	calculated
ssh	average monthly sea surface height, in metres x 10^{-2}	remote sensed
sshslope	slope of sea surface height, in degrees	calculated
lwind	natural logarithm of average wind speed	remote sensed
mwind	natural log. of average wind speed, monthly means for missing values	calculated
mchla	natural logarithm of chlorophyll, monthly means for missing values	remote sensed
mchla1	previous month's value for mchla	remote sensed
gtimelde	goa times timeldep	calculated
gsst	goa times sst	calculated
gssh	goa times ssh	calculated
glwind	goa times lwind	calculated
gmwind	goa times mwind	calculated
gmchla	goa times mchla	calculated
gmchla1	goa times mchla1	calculated
bottomt	observer haul location (=1 if haul observed; 0 if no haul observed)	observer data
imrx	inverse Mills ratio from applicable probit equation number x	calculated
portdist	distance to port	calculated
xxxtrawl	openings for trawl fishery xxx: pol=pollock, cod=P. cod, atk=Atka mackerel	NMFS regulations
xxxtssl	habitat closures for trawl fishery xxx: same as above, plus mix=other trawl	NMFS regulations

Using the 2001 observer haul data, we estimated censored CPUE regressions both with the Heckman method and using FIML for the main target and desired bycatch species for trawl fisheries. As defined above, these are pollock, Pacific cod, Atka mackerel, black cod, and rockfish and flatfish species groups. Where multiple hauls were observed in the same grid cell during the same month, we averaged the CPUE for the respective hauls. We estimated separate equations for winter and summer seasons, where summer is defined as the months of May through October, in order to allow for different behaviour of groundfish during spawning and non-spawning seasons. Table 2 summarizes the exact definition of the explanatory variables available for this analysis, including those needed to estimate the selection probit equations.

As in the previous analysis using survey data, the dependent variable is the natural logarithm of CPUE plus one, where CPUE is defined as total weight (extrapolated to the haul from observed samples) divided by haul duration. CPUE units in the observer equations are tonnes per hour. Although the survey CPUE is measured with standard gear, heterogeneity of the trawl fishing fleet could affect measured CPUE. We created a measure of 'standard CPUE', defined as the CPUE for a standard, or average-sized boat. We computed standard CPUE in two steps. First, we created an inferred capacity from the maximum haul weight for all species combined, observed for each vessel over the entire year. Then we created standard CPUE by multiplying observed CPUE by the ratio of the average inferred capacity for the fleet (113.8 tonnes) to the inferred capacity of the vessel. For all species, equations for standard CPUE showed a significantly better fit. As discussed in the next section, however, while the environmental data produced a much better fit for the standard CPUE equations for Pacific cod than for the equations for raw CPUE, predictions from the raw CPUE equations provided a much better prediction of the distribution of the Pacific cod fishing fleet. We therefore report both standard and raw CPUE equations for Pacific cod.

We included only data from bottom trawl hauls, in order to maintain as much consistency as possible. Since the pollock fishery is primarily a pelagic trawl fishery (exclusively so by regulation in the Bering Sea), we also estimated equations for pollock from pelagic trawl hauls. Pollock CPUE equations estimated for the two gear groups produced very similar results. We therefore report only the bottom trawl results.

Appendix B shows the complete estimation results for three sets of equations for each species each season: (1) ordinary least squares using the Heckman (1979) procedure (with corrected standard errors); (2) censored regressions using the Heckman approach, and (3) FIML results. The tables leave out the FIML probit coefficients, which differ slightly for each species. Instead, we show the very similar probit equations for the first stage Heckman selection process. Including all hauls, rather than just those hauls targeting the given modeled species, reduced the effect of selection bias. Indeed, the selection effect, as measured by the coefficient on the IMR, is not significantly different from zero in many of the CPUE equations, and the three specifications often yielded conflicting results regarding the significance and direction of selection bias .

Although the selection effect is not robust among the specifications, the three equations generally yielded similar effects for the set of environmental variables. Figure 3 summarizes the results for the censored regressions (second specification) in Appendix B.

Winter months

Variable	*pollock*	*P. cod*	*A. mackerel*	*black cod*	*rockfish*	*flatfish*
Measured environment						
Bottom depth		22	22	22	22	22
Depth over time	+	+	--			++
Bottom slope	22	22	22		22	22
Remote sensed environment						
Sea surface temp.	22	22			22	22
SST slope	-	-	+			-
Sea surface height	++	++	--	++	--	++
SSH slope		++		++		
Wind speed	+		--		--	
Chlorophyll-*a*		--				++
Lagged chl-*a*		-			-	
R sq. OLS	0.20	0.38	0.48	0.32	0.31	0.30
Selection bias		+	+	--		-

Summer months

Variable	*pollock*	*P. cod*	*A. mackerel*	*black cod*	*rockfish*	*flatfish*
Measured environment						
Bottom depth	22	22	22	+	22	22
Depth over time	+					+
Bottom slope	22	--	22	--	22	22
Remote sensed environment						
Sea surface temp.		+	22	22	22	
SST slope					+	
Sea surface height			+	-	++	++
SSH slope				+		
Wind speed				-		
Chlorophyll-*a*		--		-	++	
Lagged chl-*a*		-	--	-	--	
R sq. OLS	0.24	0.23	0.39	0.36	0.50	0.29
Selection bias	-	--		--	++	-
Significant positive association		+	Positive association < .01			++
Significant negative association		-	Positive association < .01			--
Significant quadratic association		2	Quadratic association < .01			22

Figure 3. Variables explaining spatial distribution of fishing effort, Bering Sea/Aleutian Islands and Gulf of Alaska, 2001: Winter months (top panel) and Summer months (bottom panel). Red denotes a significant positive association, blue a significant negative association, and purple a significant quadratic effect.

Source: Appendix B

The observer CPUE equations fit best for Atka mackerel in winter and rockfish in summer, and least well for pollock in both seasons, and Pacific cod in summer. One might expect that the habitat indicators would have less ability to explain location and density of more mobile species. The equations differ significantly between summer and winter for most species, especially with respect to the direction and significance of the remote-sensed variables. Since the environmental variables change strongly between summer and winter, as noted in means and standard deviations displayed with the equation results, the different equation coefficients do not necessarily imply that the fish have moved far between summer and winter habitats.

Spatial distribution of effort

The aim of the statistical analysis is to derive a profit function – that is, a relationship for V_{ijk} (Equation 2) based on associating the spatial distribution of observing fishing effort with a set of factors representing spatial variation in fishing costs and revenues. We hypothesized that spatial variation in predicted CPUE – whether derived from survey data or from the fishing fleet as a whole – would be highly correlated with spatial variation in revenues from fishing. Important spatial cost factors (discussed above) include distance to port and fishery regulations creating time and area closures and gear restrictions.

Each statistical relationship that predicts the spatial distribution of CPUE for a given species can potentially generate an estimated equation for the spatial distribution of effort. We first discuss results derived from the Gulf of Alaska 2001 bottom trawl survey, and then examine results estimated using CPUE predictions derived from fisheries observer data.

Results from the GOA 2001 bottom trawl survey. In practice, limits on spatial and temporal scales and geographic extents in available predictions of CPUE determine the scale and boundaries of the analyses that can be performed for spatial distribution of effort. The Gulf of Alaska 2001 bottom trawl survey generates profit functions at a very fine spatial scale (3 x 3 km^2 grid). However, our analyses using the trawl survey are limited in spatial extent by the geographic coverage of the GOA oceanographic model since the CPUE predictions rely on the model output. For the GOA, we also limited the choice set to the bottom depths included in the survey (less than 600 m), which also approximates the deepest trawl haul observed in the GOA fisheries.

The time frame for the survey data collection also limited the GOA effort analysis. The 2001 survey was conducted during the summer months – late May through late July. The only fisheries open for a substantial portion of the survey period were the sablefish and halibut longline fisheries, and some flatfish trawl fisheries. Rockfish trawling was open during a three-week period in July. To estimate equations relevant to the pollock and Pacific cod trawl fisheries – the largest GOA fisheries and the ones mainly affected by Steller sea lion critical habitat designations – we had to project the CPUE equations past the end of the range of the data used to estimate those relationships. We hypothesized that the relationship of the environmental variables to CPUE estimated during the survey period held for the duration of trawl fishing in 2001 (late August to late October). Examining whether an equation estimated from early summer data predicts the distribution of fishing effort in fall, controlling for other relevant factors, tests the hypothesis of stability of the relationship, providing a mechanism to validate the overall method. One could in theory also project the CPUE equations forward into the early spring and winter months. However, we doubt that such an out-of-season prediction would be valid, due to possible behavioural changes in groundfish during the spawning season.

Whether or not the equations are used to predict CPUE beyond the time horizon of the data used to estimate the relationships, generating predictions for the entire Gulf of Alaska involves projecting outside the range of the independent variables observed in the roughly 400 survey sample locations. This is basically a problem of boundary conditions. The range of modeled temperature and salinity, as well as remote-sensed variables such as chlorophyll-*a* and sea surface temperature, extends beyond the range of these variables in sampled areas. This is particularly a problem in estuaries and other coastal environments. The problem is magnified by the fact that the CPUE equations are estimated as loglinear equations (which yields a much better fit), so the errors, after converting to CPUE units, are exponential. One way of handling the data range problem is to limit the CPUE predictions to the range of the observations on the independent variables within the sampled points. This approach would be appropriate for handling out-of-sample prediction within the time horizon of the survey data set. Unfortunately, such an approach becomes problematic when extending predictions over time, as the ranges of the variables change seasonally.

We opted instead to use the predictions generated by the equations for large fish, and censor a small percentage of high CPUE predictions. In essence, this approach assumes that the CPUE equations generate good predictions of suitable habitat for mature fish, but cannot predict high abundance locations within that habitat. The rationale is based on the scale of spatial aggregations of fish compared to the spatial scale of the data. Within any 9x9 km^2 area representing a grid cell, we expected that the trawl survey would find the species present in significant numbers if environmental conditions favour it, but would only randomly find large aggregations within suitable habitat. The fishery, on the other hand, will search for such aggregations within the local area.

Given the censoring approach, there remains the question of how to choose the limit for each fishery. We determined the censor with a stepwise process based on the log likelihood of the equation for the distribution of fishing effort. We reduced the upper limit of predicted CPUE by one integer level of predicted natural logarithm of CPUE at a time, until the log likelihood stopped increasing. This occurred for pollock at a value of 7, and at a value of 3 for Pacific cod. One test of the validity of such an approach is whether the profit functions it generates appear reasonable. Table 3 shows the best-fitting negative binomial regressions for the distribution of GOA shore-based pollock and Pacific cod trawl fishing effort during fall 2001, as a function of censored CPUE predictions generated from the 2001 bottom trawl survey. The shore-based pollock and Pacific cod fisheries are the main GOA fisheries affected by the final Steller sea lion regulations, which went into effect on July 17 of that year.

Because average CPUE changes each time period, often along with fisheries and habitat regulations, a separate intercept term is required for each time period to represent the overall value of fishing opportunities during the period: the parameter γ_k in Equation (5). The constant term represented the intercept for model period 19 (August 23-September 5), the first summer period during which any landings were recorded for either fishery. Coefficients for the other periods represented effects relative to period 19. Pacific cod trawling occurred in the GOA in period 19, but was closed for the duration of period 21. Fishing ended for both fisheries on October 31 (period 23).

The negative binomial equations in Table 3 exhibit a high degree of dispersion: the variance scale factor is around 100: that is, the variance is 100 times the mean. The high variance creates convergence problems for the algorithm, as small changes in the scale factor have little effect on the log likelihood or the other equation coefficients. The variance multiplier for pollock had to be approximated by estimating the equation with a fixed value for the scale factor, changing the value until the log likelihood stopped increasing. Nevertheless, the equation results for both pollock and Pacific cod appeared reasonable. The coefficients on expected censored CPUE are positive and significant, and the coefficients on distance to port are significant and negative. We excluded grid cells from the choice set that were subject to regulatory closures during the entire model period. For pollock, some hauls occurred in areas that were open for a portion of the period. The coefficients on the regulatory variables – the fraction of the time included in a fishery opening and the fraction of the time subject to a habitat closure, respectively – have the expected signs and are highly significant. For Pacific cod, hardly any hauls were observed in such partially closed areas, so no coefficients could be estimated.

GOA directed trawl fisheries besides pollock and Pacific cod include rockfish and flatfish fisheries. These fisheries are covered under a diverse set of regulations and are exempt from most, but not all the Steller sea lion habitat regulations. A distinguishing characteristic of these fisheries is the dependence on retained bycatch for valuable species – primarily black cod, but also rockfish for some vessels when the directed fishery is closed – for additional revenue. For the shore-based fishery in particular, it is often difficult to determine what the target species is for a given vessel based on an individual observed haul. Consequently, we estimate a single equation for ‘other’ mixed trawl fisheries.

Table 4 shows the best-fitting negative binomial regressions for the distribution of fishing effort estimated for GOA other trawl fisheries. For the shore-based fisheries, large rockfish, black cod, and flatfish all significantly predict location choice. Using the same censoring procedure as before, the best fit is achieved at a censor of 3 for rockfish, 4 for flatfish and black cod, and 6 for pollock. The constant term represents period 12; the intercepts for the remaining periods represent effects relative to period 12. Port distance is again negative as expected, and highly significant. Pollock is abundant in the GOA, but of lower value, especially for smaller fish. The coefficient on all pollock is negative and significant. With the variety of desired and unwanted species, a tradeoff between expected revenue and CPUE for other onshore trawl fisheries similar to those displayed in Figure 4 was not straightforward to construct. However, the coefficient on port distance was similar to those for the other two shore-based fisheries. Several offshore trawl fisheries operate in the Gulf of Alaska. All GOA pollock is allocated to the shore-based sector, and too little Pacific cod is allocated to the offshore sector to estimate a choice equation. No mother ships operated in the GOA in 2001, but a number of trawl catcher-processors prosecuted the rockfish and flatfish fisheries. During the period in summer that rockfish was permitted as a target species (model periods 15 and 16), enough hauls (279) were observed to estimate a choice equation for offshore fishing effort. The primary target for most of these hauls appeared to be rockfish. However, black cod, which has a high market value, remains an important bycatch species.

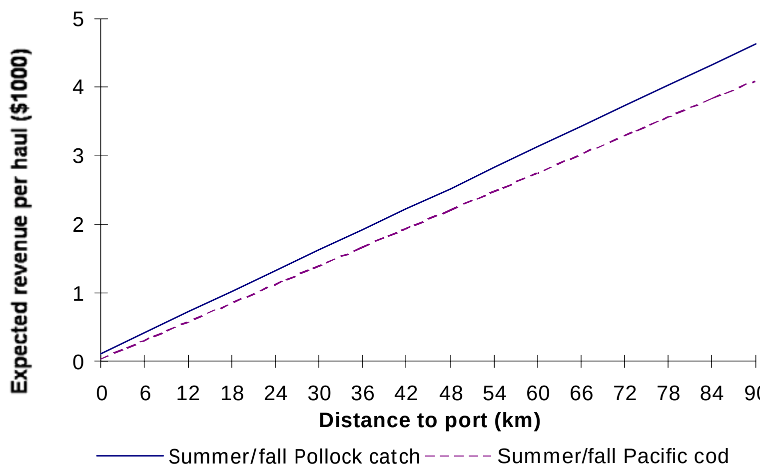

Figure 4. Profitability tradeoffs implied by the distribution of fishing effort: Gulf of Alaska 2001.

Distance to port is not important for GOA offshore fisheries, since no portion of the Gulf lies particularly far from at least one port with ability to accommodate a mid-sized trawl catcher-processor. As mentioned above, we considered the distance between consecutive offshore hauls as a measure of travel cost. While highly significant when included in the equation, such an approach to measuring travel cost is of little practical value, for two reasons. First, modeling distance between hauls requires constructing a separate choice set for each grid cell in which a haul is observed, since that cell becomes the starting point from which to measure distance to the next haul. One would have to construct thousands of choice sets, which, even with sampling, would involve millions of observations in order to model the fishery. In other words, it negates the advantage of the count models for partial aggregation of the large spatial choice set. Second, knowing that a cell was selected because it was close to a previous haul location provides insufficient information for predicting spatial values. One would need to model the set of consecutive hauls in a nested choice framework.

In particular, one might assume a nested choice model, where the probability of selecting a grid cell is a function of that cell's CPUE and the "inclusive value" (McFadden 1981), representing the value of the set of future opportunities from the series of consecutive future hauls. The inclusive value at each level depends on the value of the unknown parameter for the inclusive value at a lower choice level (corresponding to the next haul). With dozens of consecutive hauls during a fishery, and with thousands of choices for each haul, the likelihood function would be infeasible to compute, even if one could construct the set of inclusive values data set.

Given these challenges, we decided to experiment with a simple approach that addressed travel distance conceptually in a nested model, but in a way that was easy to understand conceptually and straightforward to estimate. The inclusive value at each stage (haul) is a function of CPUE, the distance to a subsequent haul, and the subsequent haul's inclusive value. If travel distance between hauls is typically low, much of the variance in inclusive value will be captured with a measure of average CPUE in the neighbourhood around the grid cell in question.

Table 3. Negative binomial regressions for distribution of Fall 2001 Gulf of Alaska onshore pollock and Pacific cod trawl fishing effort: Maximum likelihood estimates (t-statistics in parentheses). The dependent variable was the number of target fishery hauls observed.

	pollock	Pacific cod
Constant	-8.791 ***	-4.517 ***
	(-6.35)	(-11.0)
Period 20	1.929 ***	--
	(2.64)	
Period 21	0.9192	-2.281 ***
	(0.79)	(-5.17)
Period 22	-1.110 ***	0.6378 ***
	(-4.84)	(2.61)
Period 23	-0.5618 **	-0.6534 **
	(-2.05)	(-2.02)
Fishery regulatory opening	5.5433 ***	
	(3.91)	
Fishery SSL habitat closure	-1.4517 ***	
	(-5.39)	
Expected survey CPUE	0.0007414 ***	0.07873 ***
	(3.02)	(3.49)
Distance to port (km)	-0.01665 ***	-0.01223 ***
	(-14.36)	(-7.46)
Variance Scale	100	136.28 ***
	--	(6.42)
Log-likelihood	-898.5455	-875.1
Initial Log-Likelihood	-1350.877	-1312.6
Likelihood ratio squared	904.7	875.0
Observations	105,205	93,219

** $p < 0.05$
*** $p < 0.01$

Table 4. Negative binomial regressions for distribution of Summer and Fall 2001 Gulf of Alaska onshore and offshore 'Other' trawl fishing effort: Maximum likelihood estimates (t-statistics in parentheses). The dependent variable was the number of target fishery hauls observed.

	onshore	*offshore*
Constant	-5.6947 ***	-6.6377 ***
	(-4.92)	(-25.67)
Period 13	-1.7916 *	
	(-1.86)	
Period 14	-1.9221 *	
	(-1.86)	
Period 15	0.25172	
	(0.28)	
Period 16	0.37629	0.3170
	(0.56)	(1.59)
Period 17	0.05481	
	(0.08)	
Period 19	-0.04711	
	(-0.07)	
Period 21	-3.1653	
	(-1.35)	
Period 22	-0.08453	
	(-0.12)	
Period 23	-1.6386	
	(-1.53)	
Expected CPUE, rockfish	0.09464 *	0.02694 ***
	(1.73)	(3.06)
Expected CPUE, flatfish	0.03951 **	
	(2.15)	
Expected CPUE, black cod	0.02056 *	2.082E-04 *
	(1.69)	(1.83)
Expected CPUE, pollock	-0.01313 **	
	(-2.07)	
Expected neighbourhood CPUE, rockfish		0.06038 **
		(2.94)
Distance to port (km)	-0.01282 ***	
	(-5.40)	
Variance Scale	50	150
	--	--
Log-likelihood	-308.0	-946.5
Initial Log-Likelihood	-2840	-1246
Likelihood ratio squared	5064 ***	599.7 ***
Observations	22,403	42,435

*p < 0.1
** p < 0.05
***p < 0.01

In the hauls observed from the North Pacific trawl fisheries in 2001, travel distance between hauls was less than 30 km about 80% of the time. We constructed a measure of rockfish neighbourhood CPUE that was a simple average of the predicted CPUE of all grid cells within 30 km of each cell. Cells within this range that were on land or otherwise unavailable for fishing – for example, with water depths deeper than 600 m – were included in the average with a zero value. The second column of coefficients in Table 4 shows the results of estimating the negative binomial equation for spatial choice for the GOA offshore 'Other' trawl fishery. The constant term for the offshore fishery represents period 15; the intercept for period 16 represents an effect relative to period 15. The censoring procedure produced the highest log likelihood at a value of 4 for the natural log of rockfish CPUE, 8 for black cod, and 3 for the 30 km rockfish neighbourhood CPUE. The coefficient on rockfish CPUE, black cod bycatch, and the rockfish neighbourhood CPUE are all positive and significant.

Results for the 2001 North Pacific trawl fisheries at 9 km resolution. Scaling up to the North Pacific and moving from the oceanographic model output to remote-sensed observations as the basis for predicting CPUE required several additional factors to be addressed. In particular, the offshore fisheries in the Bering Sea are large and complex. The Atka mackerel fishery is an important offshore fishery that is specifically included in the Steller sea lion habitat regulations. A number of large mother ship fleets operate in the Bering Sea. However, observers on mother ships cannot determine exactly where the haul was caught, and many hauls could have occurred in a grid cell other than the one recorded for the mother ship when the haul was brought aboard. Consequently, we consider only catcher-processors to represent the offshore fleet.

The larger catcher processors that operate in the Bering Sea can trawl to deeper levels. We therefore used 700 m as the maximum depth. We did not censor the CPUE predictions, since they derive from equations estimated from the fisheries with the same data set. The larger grid cell size, however, limits the flexibility of the neighbourhood CPUE calculation. Neighbourhood CPUE for the offshore fisheries in the 9 km analysis averaged CPUE in all grid cells within 20 km of the target cell, and excluded the central cell from the calculation. In addition, we used data for all 12 months of the year, so the choice equations included hauls for the entire period in 2001 during which directed fishing for that target species was permitted.

Tables 5 and 6 show the negative binomial regression results for the distribution of fishing effort for 2001 Bering Sea and Gulf of Alaska shore-based and offshore trawl fisheries, respectively. We considered pollock, Pacific cod, Atka mackerel (offshore only), and rockfish target fisheries. The fishing regulations for the diverse Bering Sea flatfish fisheries are so complex that we did not attempt to estimate equations for this fishery, but rather used rockfish as a basis from which to generalize to the other trawl fisheries. The constant term represents the month of January; the other months represent effects relative to January for each month where hauls were observed. In addition to separate intercepts for each time period, we used a separate intercept for GOA grid cells to represent the effects of a difference in the observer coverage, as well as differences in fishery regulations in the Gulf of Alaska. Where a t-statistic is missing for the variance scale factor, the scale was estimated iteratively, as discussed above. Partial months' fishery openings and habitat closures (as discussed above for the GOA) again significantly explain the distribution of effort for pollock, as well as the offshore Atka mackerel fishery. Offshore pollock fishing is prohibited within the Catcher Vessel Operating Area (CVOA). The positive, significant coefficient for the CVOA suggests a congestion effect, or some pathway by which competition with the offshore fishery affects profitability of the onshore fleet.

Table 5. Negative binomial regressions for the distribution of 2001 Bering Sea and Gulf of Alaska shore-based trawl fisheries maximum likelihood estimates (t-statistics in parentheses). Dependent variable: number of target fishery hauls observed.

	pollock	*P. cod*	*rockfish*
Constant	-1.2498 * (-1.90)	-4.6277 *** (-6.14)	-6.8094 *** (-4.25)
February	2.4079 ** (2.39)	2.0584 ** (2.19)	1.231 (0.97)
March	3.6583 *** (3.33)	5.4063 *** (4.73)	4.3474 ** (2.34)
April	-0.74609 (-0.69)	3.4613 *** (3.56)	4.5357 ** (2.35)
May			2.112 * (1.75)
June	-2.2732 *** (-2.69)		0.59191 (0.46)
July	-0.4371 (-0.42)	0.26946 (0.31)	2.9205 (1.30)
August	-2.6464 * (-1.80)	-0.6889 (-0.42)	2.8411 (1.33)
September	-2.5728 * (-1.66)	0.62073 (0.62)	3.7546 ** (2.03)
October	-3.0826 * (-1.95)	0.29461 (0.18	2.3453 * (1.90)
GOA	-2.5295 *** (-4.48)	-0.9924 (-0.83)	2.587 ** (2.24)
GOA*February	-0.95673 (-1.09)	-0.6407 (-0.40)	
GOA*March	-1.2965 (-1.12)	-4.5917 ** (-2.10)	-3.2224 ** (-2.07)
GOA*April			-1.6775 (-1.04)
GOA*July			-0.0331 (-0.02)

Table 5 (continued). Negative binomial regressions for the distribution of 2001 Bering Sea and Gulf of Alaska shore-based trawl fisheries.

	pollock	*P. cod*	*rockfish*
GOA*August	4.1665 **		-2.4645
	(2.51)		(-1.25)
GOA*September	3.5723 **	0.11671	-1.9815
	(2.12)	(0.08)	(-1.29)
GOA*October	3.3818 **	1.9185	
	(2.13)	(0.98)	
Fishery opening	0.46144		
	(0.32)		
Habitat closure	-7.4125 **		
	(-2.32)		
Catcher Vessel Op. Area	3.2991 **		
	(2.59)		
Expected target CPUE	0.94094 ***	1.0686 ***	0.54686 ***
	(3.62)	(2.75)	(2.72)
Distance to port (km)	-0.01415 ***	-0.00984 ***	-0.01252 ***
	(-6.40)	(-6.36)	(-7.42)
Variance Scale	22.052 ***	108.43 ***	38.552 ***
	(10.17)	(5.23)	(4.51)
Log-likelihood	-1029.8	-363.89	-375.82)
Initial Log-Likelihood	-18566	-6594.6	-3831.8
Likelihood ratio squared	35073 ***	12461 ***	6912.0 ***
Observations	14,504	15,800	18,732

*p < 0.1
** p < 0.05
***p < 0.01

Table 6. Negative binomial regressions for the distribution of 2001 Bering Sea and Gulf of Alaska offshore trawl fisheries maximum likelihood estimates (t-statistics in parentheses). Dependent variable: number of target fishery hauls observed.

	pollock	*P. cod CPUE*	*P. cod standard*	*Atka mackerel*	*rockfish*
Constant	-5.3002 ***	-5.8285 ***	-5.4243 ***	-4.8533 ***	-2.2217 ***
	(-3.42)	(-6.14)	(-6.08)	(-3.06)	(-8.87)
February	-3.3406	1.4846	1.6753 *	-3.8038	0.86159 ***
	(-1.40)	(1.57)	(1.78)	(-1.48)	(2.95)
March	-2.2833	3.3841 ***	3.5669 ***	2.0219	1.9069 ***
	(-0.96)	(3.16)	(3.46)	(1.00)	(4.68)
April	-2.6535	1.4848	1.5528		2.9953 **
	(-1.11)	(1.20)	(1.34)		(8.45)
May	-9.195 ***	-0.5648	-0.5947		0.54855
	(-3.30)	(-0.41)	(-0.44)		(1.29)
June	-4.564 *	0.70685	0.8148		1.0766 ***
	(-1.90)	(0.77)	(0.95)		(3.23)
July	-3.5481	0.58327	0.61193		1.9931 ***
	(-1.48)	(0.59)	(0.68)		(5.25)
August	-3.4948	0.87803	0.75062		2.7179 ***
	(-1.45)	(0.85)	(0.78)		(7.19)
September	-2.463	0.02562	-0.2418	-2.1931	2.2756 ***
	(-1.03)	(0.02)	(-0.21	(-1.01)	(6.76)
October	-3.4555	0.93725	0.70636		2.5314 ***
	(-1.44)	(0.62)	(0.50		(6.29)
GOA		-3.7882 **	-4.0564 ***		-4.2784 ***
		(-2.55)	(-2.92		(-10.28)
GOA*February					1.4902 ***
					(2.69)
GOA*March					0.41813
					(0.57)
GOA*April		2.8132 *	3.3909 **		0.88828 **
		1.95	2.59		(1.98)
GOA*May		3.9998 **	4.3063 ***		4.0211 ***
		2.40	2.65		(7.63)

Table 6 (continued). Negative binomial regressions for the distribution of 2001 Bering Sea and Gulf of Alaska offshore trawl fisheries.

	pollock	*P. cod CPUE*	*P. cod standard*	*Atka mackerel*	*rockfish*
GOA*July					1.126 **
					(2.02)
GOA*September					-0.9723
					(-0.87)
Fishery opening	6.9813 *			9.2642 *	
	(1.79)			(1.885)	
Habitat closure	-6.2714				
	(-1.29)				
Exp. target CPUE	0.91187 ***	2.0902 **	0.68025 *	0.32935 **	1.3225 ***
	(4.91)	(2.45)	(1.75)	(2.006)	(6.30)
Neighbour CPUE	0.88797 ***				
	(3.39)				
Dist. to port (km)	-0.00521 ***	-0.00370 ***	-0.00337 ***	-0.00306 *	-0.00560 ***
	(-12.60)	(-3.95)	(-3.80)	(-1.853)	(-16.40)
Variance Scale	18.678 ***	100	100	35	24.25 ***
	(15.02)	--	--	--	(12.62)
Log-likelihood	-2412.55	-299.26	-306.46	-78.062	-1978.9
Initial Log-Likelihood	-18440.5	-3231.2	-3231.2	-1688.2	-15879
Likelihood ratio squared	32056 ***	5863.9 ***	5849.5 ***	3220.33 ***	27799 ***
Observations	11,832	16,556	16,556	370	17,824

*p < 0.1
** p < 0.05
***p < 0.01

The coefficients on expected target CPUE are all positive and significant. For onshore Pacific cod, we show the equation estimated with raw CPUE as well as the equations for standard CPUE used for the other fisheries. For reasons that we cannot explain, the equation for raw CPUE fits much better for shore-based Pacific cod. The coefficients on distance to port are all negative and highly significant in the onshore fisheries. Interestingly, the coefficients on port distance are also significant and negative for all the offshore fisheries as well. However, the magnitude of the coefficients for the shore-based fishery is about three times as large as for the offshore fishery.

Figures 5 and 6 illustrate the tradeoff between distance to port and expected revenues per standard haul implied by the spatial distribution of fishing effort for the onshore and offshore fisheries, respectively. For the onshore fisheries, rockfish and Pacific cod appear to be more sensitive to distance from port than pollock. However, the expected revenue measure assumed average annual ex-vessel prices for pollock. During the winter season, roe adds significant value to the pollock fishery, but we lack reliable data on the implied ex-vessel value of roe. If roe values were included, the slope for pollock would be steeper, implying less, if any, difference between pollock and the other fisheries.

The slopes of the profitability tradeoffs implied by the choice equations are much lower across the board than those for the onshore fisheries. The scales of the two figures are identical to facilitate the comparison. The offshore fisheries include an additional target species, Atka mackerel. The Atka mackerel target fishery is a geographically and temporally compressed fishery that is heavily constrained by Steller sea lion regulations. The combination of fisheries and habitat regulations left relatively few cell-months available for fishing, so results for this fishery should be considered less reliable than those for the other fisheries. Nevertheless, the tradeoffs shown in Figure 6 suggest that the estimated profit functions for Atka mackerel imply similar economic tradeoffs between remoteness and expected CPUE as the other offshore fisheries.

The neighbourhood CPUE variable is positive and highly significant for the offshore pollock fishery. Indeed, the coefficient on the neighbourhood expected CPUE does not differ significantly from the coefficient on the cell's expected CPUE. The neighbourhood CPUE did not explain the distribution of effort for the other three offshore fisheries modelled. Since nearly half of all consecutive hauls took place within 9 km of the previous haul, the results suggest that the spatial scale might be too coarse to pick up the neighbourhood effect for these less mobile fisheries. Instead, the coefficient for expected CPUE for the target cell includes whatever neighbourhood effect may exist.

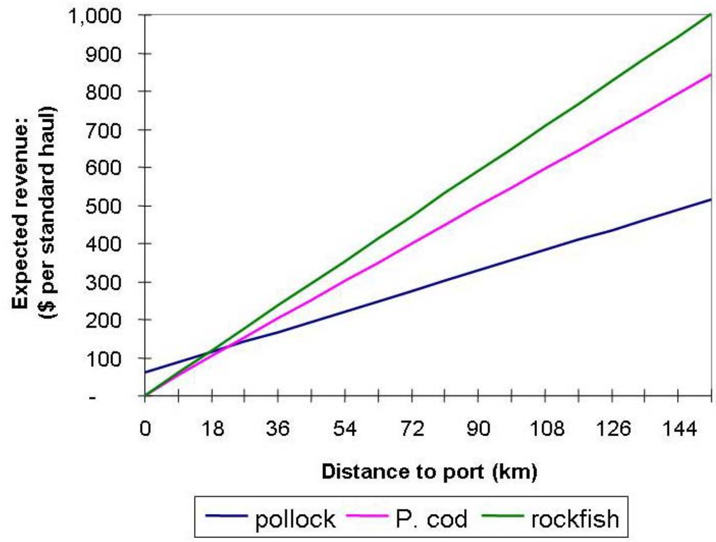

Figure 5. Profitability tradeoffs implied by the distribution of fishing effort: 2001 Onshore trawl fisheries.

Spatial values and the cost of habitat protection

The negative binomial regression equations (Tables 3 through 6) generated estimates of the spatial distribution of fishery values for the various target fisheries and fleet sectors. The equations estimated for the GOA at a 3 km resolution may be considered more accurate representations of the spatial relationships, but are more limited to the GOA summer fisheries. The 3 km GOA results best illustrate the fine-scales effect of regulations and effects of changes to boundaries of individual closure units. The 9 km results best illustrate the overall impact of the Endangered Species Act Critical Habitat program as a whole on the North Pacific groundfish fleet.

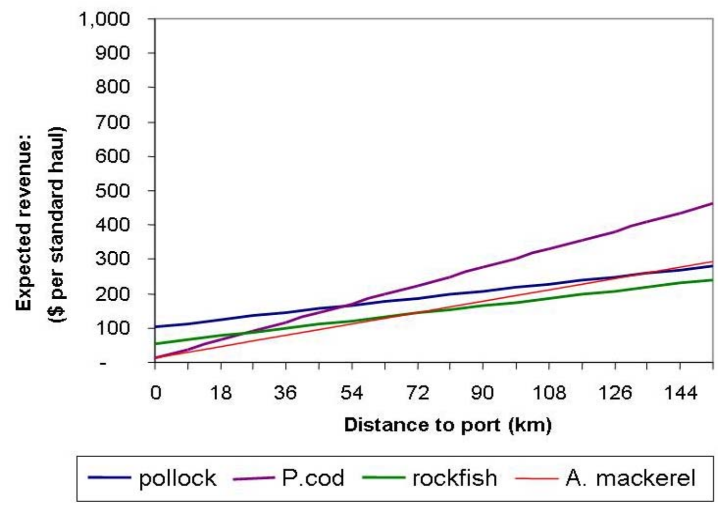

Figure 6. Profitability tradeoffs implied by the distribution of fishing effort: 2001 Offshore trawl fisheries.

To assess the impact of the Steller sea lion habitat closures, one must first establish a baseline for comparison. Since the North Pacific groundfish fisheries are regulated under a total allowable catch (TAC) regime, one may make the assumption that any expansion or contraction of fishing opportunities would result in only a slight change in the number of hauls made by the fleet during the year. Instead, there would be a redistribution of a fixed level of fishing effort and catch among available fishing locations. Consequently, one may assume that habitat regulations do not change the number of hauls, and focus on estimated changes in the value per haul.

The equations for fishing location choice were estimated based on the fisheries openings and habitat closures in effect during 2001, so the 2001 regime would ordinarily become the baseline for the analysis. However, the Steller sea lion regulatory regime actually changed twice during 2001, first in June 10, due to the expiration of the congressionally mandated delay in implementing the judicial order requiring a revision to the Reasonable and Prudent Alternatives (RPA), and again on July 17 when NMFS completed the regulations to comply with the order. This created an unstable baseline that complicated the analysis. To address this moving baseline, we estimated the spatial distribution of relative values by evaluating Equations (6) and (7) assuming that fishery TAC and bycatch regulations remained as they were in 2001, but that all Steller sea lion habitat regulations were removed. Hypothetically removing the Critical Habitat fishing restrictions inflates the estimated total value of the fishery above that actually realized by the fleet under the habitat regulations in effect during 2001. However, it provides a constant baseline with which to compare changes in *relative* value caused by the imposition of the habitat regulations.

GOA 3 km resolution. As mentioned above, trawl fishing was effectively closed in the GOA in the summer of 2001 until July 17. Figure 7 shows the estimated baseline net value of summer fishing in the Gulf of Alaska in 2001, assuming that all Steller sea lion Critical Habitat Closures were removed. We computed the estimates in the table by evaluating Equation (7) with the coefficients shown in Tables 3 and 4, and applying a scale factor unique to each fishery. To scale the values, we first converted the scale from expected trawl survey CPUE to expected catch per fishery haul by multiplying by ratio of average catch of the target species in trawl fishery hauls to predicted survey CPUE for the grid cells where hauls were observed. This adjusted for the difference between survey CPUE and expected fishery catch. We then multiplied by average ex-vessel prices to convert the units from tons of fish per haul to dollars per haul. Finally, we scaled up to total fishery value by multiplying the result for each month by the number of hauls observed during that month in summer 2001, divided by the estimated percentage of hauls in the GOA sampled by observers.[1]

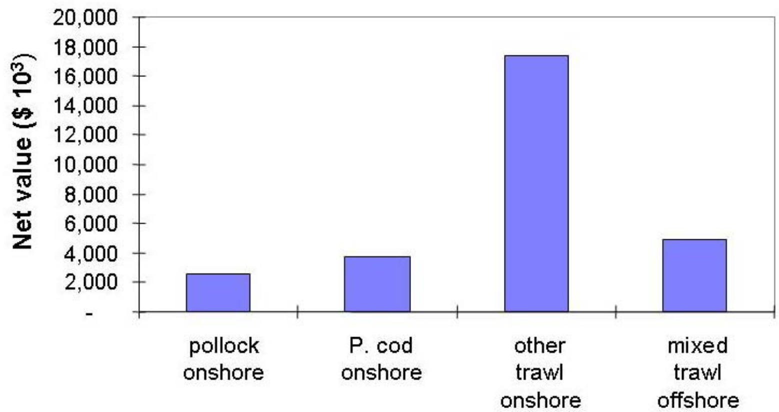

Figure 7. Net value of summer 2001 Gulf of Alaska trawl fisheries.

The estimates in Figure 7 suggest that the mixed trawl offshore fishery is more profitable than any of the onshore fisheries. However, the mixed trawl fishery includes values for sablefish bycatch, for which reliable ex-vessel price data do not exist. Using the estimates in Figure 7 as a base, it is possible to estimate the opportunity cost to the summer and fall 2001 fisheries of the Steller sea lion habitat closures that came into effect on July 17. Figure 8 shows the estimated costs for the three shore-based trawl fisheries, as well as for the offshore rockfish trawl fishery. The numbers are computed by evaluating Equation (6) with J_{1k} representing the

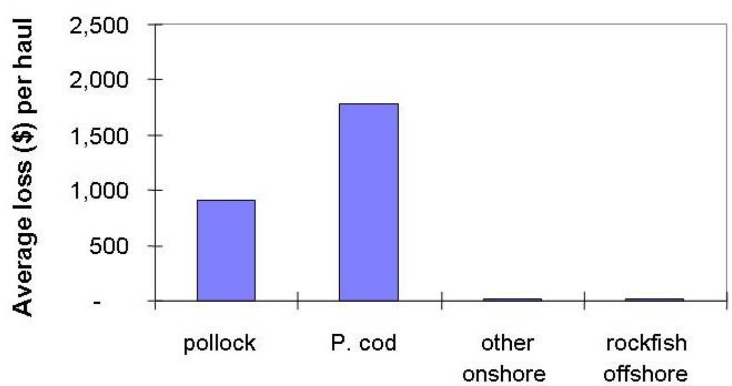

Figure 8. Estimated cost per haul of Steller sea lion closures for onshore Gulf of Alaska trawl fisheries, summer and fall, 2001.

[1] According to the National Marine Fisheries Service, "The portion of the catch sampled by observers varies by region, vessel-type, gear-type, and target fishery. Since 2001, vessels with observers in the BSAI have accounted for approximately 90% of the groundfish tonnage caught and observers have sampled the catch from about three-fourths of the hauls/sets. Vessels with observers in the GOA have accounted for approximately 40% of the groundfish tonnage caught and observers have sampled the catch from about two-thirds of the hauls/sets." (http://www.afsc.noaa.gov/FMA/spatial_data.htm)

choice set that would have been available if fishing had been permitted within the Steller sea lion closure areas, and J_{2k} equals the choice set actually available for each fishery and time period. Since we only have an approximate figure for the estimated number of hauls for each target fishery, Figure 8 shows the cost in terms of dollars per haul. The estimated cost for Pacific cod shore-based trawl fishery is quite large: around $1,800 per haul. The estimated cost for the pollock fishery is about half, but still substantial. These are the two main fisheries affected by the Steller sea lion closures. The estimated costs for the other onshore and offshore fisheries are small. The Steller sea lion regulations closed relatively few areas of the Gulf of Alaska to all trawl fishing, and those areas – such as three nautical mile no fishing zones around rookeries and haulouts – were of relatively little importance to these fisheries.

Figure 9 shows the relative importance of the Steller sea lion closure areas compared to the areas remaining open by expressing the costs in terms of the percentage of baseline values. The figures suggest that the closures cost the Pacific cod trawl fishery about 38% of the profit per haul, and the pollock fishery about 28%. The cost to the other trawl fisheries was slight: 0.2% of the operating profits. The numbers in Figure 9 are measured as a percentage of the potential profit, defined as the baseline profits in Figure 7. The baseline, as discussed above, represents a somewhat arbitrary standard. Nevertheless, the results suggest that the cost to the two fisheries specifically targeted for regulation to protect Steller sea lion foraging around rookeries and haulouts in the GOA is substantial, while the cost to other trawl fisheries is slight.

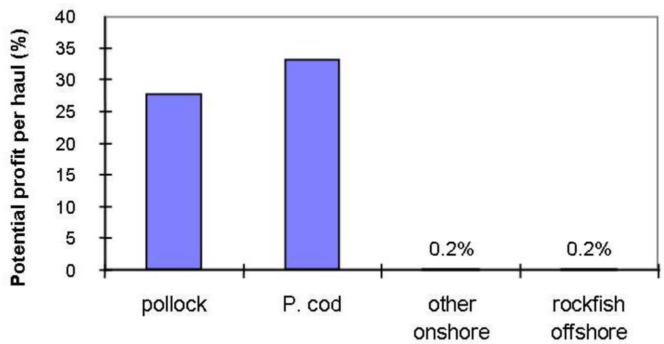

Figure 9. Estimated cost of Steller sea lion closures as percentage of profit for onshore Gulf of Alaska trawl fisheries, summer and fall, 2001.

The spatially detailed analysis for the GOA provided an opportunity to measure the change in the cost to the fisheries resulting from relatively small changes in the boundaries to the closed areas. We chose the Chiniak Gully research area to illustrate the capabilities of the method. The Chiniak Gully closure was a relatively small area of the GOA off Kodiak Island that was closed to all trawling during the month of August 2001 so that NMFS could conduct research on the effect of fishing on localized depletion of fish stocks. Figure 10 shows the estimated cost of the August 2001 research trawl closure, using the methods described. The cost is measured in terms of the average cost per haul during the portion of the closure period that the respective target fishery was open to trawl fishing in the GOA. Again, the estimated cost is highest for the Pacific cod fishery: nearly $200 per haul. It turns out the Chiniak Gully was a highly profitable area for the Pacific cod trawl fishery during this time, as it had both high expected CPUE values and was close to the major fishing port of Kodiak. The cost to the pollock fishery was much less, but still significant. The cost for the other shore-based trawl fisheries was relatively small. In this case, the other most valuable trawl target fisheries in the Chiniak Gully area (rockfish) was closed in the GOA. The trawl

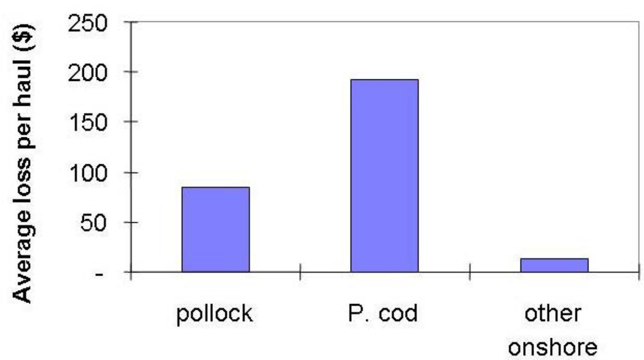

Figure 10. Estimated cost per haul of August 2001 Chiniak Gulley trawl closure for onshore Gulf of Alaska trawl fisheries.

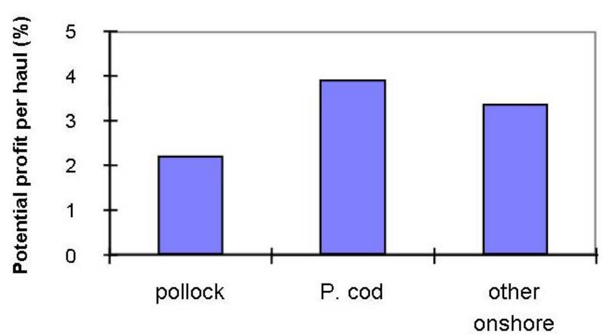

Figure 11. Estimated cost of August 2001 Chiniak Gulley trawl closure as percentage of profit for onshore Gulf of Alaska trawl fisheries.

sablefish bycatch allowance had also already been reached. While flatfish trawling was still permitted, estimated profitability for this target fishery was much lower in the GOA in summer and fall.

To illustrate this point, Figure 11 shows the costs of the Chiniak Gully closure expressed as the percentage change in the value per haul. The percentage costs are much more closely aligned. According to these estimates, the research trawl closure cost the trawl fisheries about 2-4 percent of profits, with the lowest percentage cost falling on the pollock fishery, and the highest on the Pacific cod fishery.

North Pacific, 9 km resolution. We projected CPUE for the 9 km study of the North Pacific as a whole from equations estimated from the trawl fishery itself, unlike the 3 km GOA results which were derived independently from the NMFS trawl survey. However, CPUE for each species was estimated from the groundfish fishing fleet as a whole, using data on all bottom trawl hauls from all fisheries rather than just from hauls targeting that particular species. This means that the projections of CPUE from the statistical equations do not represent the magnitude of target fishery hauls likely to be realized by any particular component of the fishery prosecuting a target species, even though we believe the relative CPUE estimates are valid. For example, the expected CPUE from a standard bottom trawl haul is likely to underestimate expected catches of very large pollock catcher-processors, and over-predict CPUE of smaller Pacific cod catcher vessels. Because of the selection bias discussed above, there is no simple procedure for adjusting the expected standard bottom trawl haul CPUE for all fisheries to the expected target fishery haul. This created a scale problem that made it difficult to estimate a baseline value, as presented for the GOA in Figure 7, or even a cost per haul, as described for Figure 8.

With Atka mackerel, we have the additional problem of a small number of hauls and limited geographic dispersion, making the estimated equation imprecise. However, since the method of estimating changes in net fisheries values relies on evaluating the difference in a logarithmic function (Equation 6), changing the scale factor for the base value has only a slight effect on the resulting change in value. Consequently, we showed the estimated costs of Steller sea lion habitat closures in terms of the percentage change in value per haul. Scaling issues with assessing the percentage change in values are basically limited to uncertainty in weighting of GOA values relative to the generally much larger BSAI values.

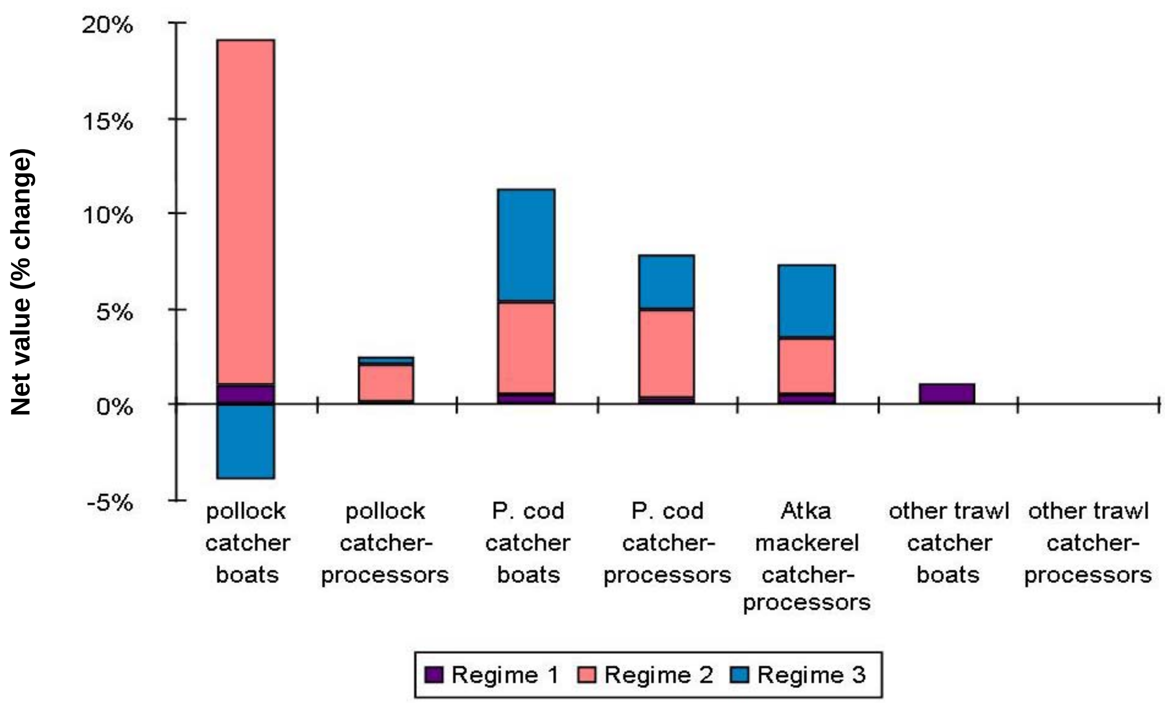

Figure 12. Estimated percentage change in net value of North Pacific trawl fisheries with three Steller sea lion habitat protection regimes.

As mentioned, the Steller sea lion regulatory regime changed twice in 2001: first when the Congressional moratorium expired on June 10, and again on July 17, when NMFS completed work on the new regime. We assessed the effect of the changing regulatory environment on the fisheries by estimating the relative fisheries values associated with a set of successive regulatory regimes. The hypothetical baseline regime involved no Steller sea lion habitat closures, but retained trawl fishery closures associated with other management objectives (for example, crab bycatch), as well as the general fishery TAC and bycatch-related closures. We defined the first regime as the set of restrictions that related to all trawl fisheries. Most were in place before NMFS designated Critical Habitat for Steller sea lions. We defined Regime 2 as the set of regulations in place on January 1, 2001, and Regime 3 as the set of regulations that went into effect on July 17, 2001. Only minor adjustments to the Steller sea lion regulations have occurred since 2001. Trawl fishing was effectively closed between June 10 and July 17, so we made no attempt to value that intervening period.

Table 7 shows the results of evaluating Equation (6) for the three regimes. The results appear quite different from those shown for the GOA. Figure 12 illustrates the relative magnitude of the changes for different fisheries and regulatory regimes.

Table 7. Estimated cost of three regimes of Steller sea lion protective measures as a percentage of net profit per haul: Bering Sea/Aleutian Islands and Gulf of Alaska trawl fisheries, 2001.

Fleet	Regime 1 (%)	Regime 1 to regime 2 (%)	Regime 2 to regime 3 (%)	Cumulative, three regimes (%)
Pollock catcher boats	1.0	18.1	-3.9	15.2
Pollock catcher-processors	0.2	2.0	0.3	2.5
P. cod catcher boats	0.6	4.8	5.9	11.3
P. cod catcher-processors	0.4	4.6	2.8	7.8
Atka mackerel catcher-processors	0.5	3.0	3.8	7.3
Other trawl catcher boats	1.1	--	--	1.1
Other trawl catcher processors	0.04	--	--	0.04

Our estimates suggested that the largest cost of the Steller sea lion regulations for the North Pacific fisheries has fallen on pollock catcher boats, as a result of the shift from Regime 1 to Regime 2. The revised regulations in summer 2001 actually mitigated some of that cost for the onshore pollock fleet, while increasing the cost substantially for the Pacific cod and Atka mackerel fleets. The costs to the offshore fleets are smaller across the board than the costs estimated for the shore-based fleets. In particular, the costs for the offshore pollock fleet appear relatively small: almost an order of magnitude smaller than the costs to the shore-based fleet. One important regulatory closure areas affecting the offshore pollock fleet is the large Steller Sea Lion Conservation Area (SSLCA) in the southeastern Bering Sea. In 2001, SSLCA catch limits did not affect pollock catcher-processors. Pollock fishing within the SSLCA closed early for the mother ship sector in the pollock A season, which might have led to a substantial estimated cost. However, as discussed above, we cannot estimate a reliable equation for mother ships, so we cannot estimate the cost to that sector of the fleet.

DISCUSSION

This report presented an exploratory study designed to develop a new set of methods for estimating spatial values of ocean fisheries at fine spatial scales, and to apply the methods to estimate the cost to the North Pacific groundfish fisheries of spatial closures. As an exploratory study, the criteria for success should be somewhat different from what they might be for a more applied study that was designed to provide findings more readily applicable to management decisions. The two general hypotheses – that environmental conditions explain and can predict the spatial distribution of fish density, and that predicted spatial fish densities predict the distribution of fishing effort at fine spatial scales – received strong empirical support.

The estimates of the cost of habitat closures developed from the statistical analyses appear plausible. The cost estimates varied widely for different sectors of the trawl fleet, ranging, for all North Pacific fisheries, from a 10-15% loss of profits for pollock and Pacific cod catcher boats, to negligible or modest for pollock catcher processors and the rockfish and flatfish fisheries. Estimated costs for Atka mackerel and Pacific cod catcher-processors lay midway between the two extremes. Using a different and spatially more precise data set for estimating CPUE in the GOA, we found that the estimated regulatory costs to the Pacific cod and pollock shore-based trawl fisheries were even greater: about twice as high as for the North Pacific.

The question that arises is how confident we can be that these estimates reflect true conditions for the fishing fleet. As discussed above, confidence intervals can only be derived from bootstrapping. In this case, bootstrapping is very cumbersome, since we have in essence a three-stage statistical procedure. The CPUE equations for the North Pacific involved a two-stage sample selection bias correction. The predictions then feed into a third-stage probabilistic count model, which itself was only an approximation, albeit one likely to be accurate, for a multinomial logit model that underlies the derived welfare estimates. Since our goal was to demonstrate the method rather than derive numerically precise values, we did not attempt such a computationally complex procedure to generate confidence intervals, and leave this for further research.

Nevertheless, the empirical results for the different statistical analyses, combined with general characteristics of the RUM approach, provided some insights into the likely nature and magnitude of the uncertainty in the estimates. First, the coefficient on CPUE in the negative binomial regressions becomes a multiplicative scale factor in Equations (6) and (7) for the estimated values. The total values and values per haul are inversely proportional to the magnitude of this coefficient. Confidence intervals around this coefficient are quite precise (t-statistics around 3) for all fisheries except offshore Pacific cod and Atka mackerel. Estimated costs for these fisheries were in the intermediate range. However, the coefficient on CPUE scales total values estimated both with and without the habitat regulations. The estimated values are relatively insensitive to the magnitude of the coefficient (Figure 7). A much bigger source of uncertainty in the estimates derived from uncertainty in the predictions of CPUE itself. The equations explaining the distribution of pollock and Pacific cod spatial densities were generally less precise than those of the other fisheries. Further work to improve the ability to explain and predict pollock and Pacific cod spatial distribution would have priority for improving the accuracy of the estimates of the cost of fisheries closures.

Another question that arises is whether the statistical results and the cost estimates that follow from them represent an artifact of special conditions present in 2001, or whether the relationships are stable over time. It was our original intent to test the stability of CPUE predictions across a number of years. The requirement to compile, analyze, and code the extremely complex and continuously-changing spatial regulatory environment for the North Pacific fisheries in order to correct for selection bias in the CPUE equations made it impossible for us to conduct such stability tests. Clearly, this remains a high priority for future research.

As an exploratory study, the refinements discussed here should be undertaken before applying the results in a management context. Once questions about the stability and robustness of the results are resolved, the analysis can be applied directly in a management context to estimate the costs and benefits of all proposed regulatory changes that involve time and area closures for the groundfish fleet. The analysis of the Chiniak Gully research closure provided a simple example of the kind of information that the analysis can provide to management and the public.

CONCLUSIONS

The project aimed to design and demonstrate a method to quantify the net cost to industry of closing protected areas to fishing that (1) could take advantage of RUM's theoretical and practical advantages; (2) could be applied at a spatial scale relevant to decisions regarding marine protected areas; (3) included estimates of costs of reduced fishing flexibility to an at-sea processing fleet as well as the shore-based fleet; and (4) provided estimates of fisheries impacts linked directly to environmental variables relevant to habitat models for Steller sea lions and other protected species potentially interacting with fisheries. Our goal was to improve existing economic models of spatial choice in fisheries by relaxing unrealistic restrictions on spatial decision-making while incorporating detailed and flexible geographic scales.

We successfully addressed the four stated objectives. We developed and tested a scientifically defensible method to value fishery use areas at flexible temporal and spatial scales relevant to management decisions. The method produced predictions of relative value across the entire U.S. EEZ in the North Pacific at a detailed spatial scale in different seasons. The method could easily be generalized to evaluate fishery time and area closures for any protected species or for marine conservation generally. Finally, we demonstrated an application of the method to estimate cost to Bering Sea and GOA groundfish trawl fisheries of changes to Steller sea lion critical habitat closures.

The method generated plausible statistical results that distinguished relatively costly regulations from those involving relatively modest or negligible costs, and the relative burdens on different sectors of the fishing fleet. This approach provides management with credible independent estimates of the effect of regulations on net profits for the first time. While the actual magnitude of the estimated costs may remain uncertain, the percentage changes in costs are likely to be reliable. Further research will be required to demonstrate the robustness and stability of the estimated relationships over time, as well as to compute bootstrapped confidence intervals around estimates of values and costs.

The main weakness of the method is its requirement for managing and analyzing large volumes of spatially explicit data. The constraint is both a problem of computational resources and one of human resources. Taking the next step towards implementing the method as a standard practice for NMFS as part of the regulatory review process would require that the agency make an institutional commitment to developing the analytical capability to manage and process large environmental and regulatory datasets. While the agency certainly has this capability, it has in the past been deployed to other research and management tasks.

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APPENDICES

APPENDIX A. EQUATIONS FOR SPATIAL DISTRIBUTION OF CATCH PER UNIT OF EFFORT (CPUE), ESTIMATED FROM THE SUMMER 2001 NMFS GULF OF ALASKA BOTTOM TRAWL SURVEY

1. Equations with Wind (only shown if absolute value of t for wind > 1)

Pacific cod, average weight > 0.5 kg

Limited Dependent Variable Model - CENSORED regression

Ordinary least squares regression. Dep. Variable		LBPCOD		
Observations	264	Weights	ONE	
Mean of LHS	0.1617331E+01	Std.Dev of LHS	0.2134344E+01	
StdDev of resid.	0.1898167E+01	Sum of squares	0.8791417E+03	
R-squared	0.2662060E+00	Adj. R-squared	0.2090663E+00	
F[19, 244]	0.4658862E+01	Prob value	0.3991631E-08	
Log-likelihood	-0.5333954E+03	Restr.(b=0) Log-l	-0.5742529E+03	
Amemiya Pr. Criter.	0.3875997E+01	Akaike Info.Crit.	0.4192389E+01	
ANOVA	Source	Variation	Deg. freedom	Mean Square
	Regression	0.3189352E+03	19.	0.1678607E+02
	Residual	0.8791417E+03	244.	0.3603040E+01
	Total	0.1198077E+04	263.	0.4555426E+01

N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	3651.8	1333.	2.739	0.0062		
J162	2.2328	0.8727	2.559	0.0105	0.2765	0.4481
J177	2.5571	1.467	1.743	0.0814	0.2500	0.4338
J192	3.6429	2.045	1.781	0.0749	0.2462	0.4316
LDEPTH	21.023	5.532	3.800	0.0001	4.8944	0.5090
L2DEP	-1.9598	0.5609	-3.494	0.0005	24.2132	5.0025
LSTEM	-3.1445	1.299	-2.420	0.0155	2.3164	0.1872
LGTEM	33.528	21.26	1.577	0.1148	1.7553	0.1431
LSLOPE	0.35871	0.3821	0.939	0.3478	3.2087	0.9759
L2SLOPE	-0.69028E-01	0.7476E-01	-0.923	0.3559	11.2445	5.3610
LMTEM	-0.64826	4.017	-0.161	0.8718	2.0037	0.1970
LMSTEM	19.805	6.670	2.969	0.0030	-0.0902	0.0553
LMSAL	-2138.6	776.6	-2.754	0.0059	3.4659	0.0278
LBMSAL	-46.985	13.30	-3.532	0.0004	0.0383	0.0242
BMHORVEL	0.51526E-01	0.5817E-01	0.886	0.3757	2.8017	2.9325
SSHRE	0.36187E-01	0.1089	0.332	0.7397	-3.4680	1.6767
LWIND	1.4795	1.103	1.342	0.1796	1.7965	0.1697
L2GTEM	-8.2877	5.829	-1.422	0.1550	3.1014	0.5184
L2MSAL	306.44	113.3	2.705	0.0068	12.0132	0.1912
LMLD_DEP	-0.12687	0.1491	-0.851	0.3949	7.2535	3.0037

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Limited Dependent Variable Model - CENSORED regression
Maximum Likelihood Estimates
Log-Likelihood............. -363.32
Threshold values for the model: Lower 0.0000 Upper **********
N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	11000.	3022.	3.640	0.0003		
J162	5.4903	2.000	2.745	0.0061	0.2765	0.4481
J177	7.8656	3.386	2.323	0.0202	0.2500	0.4338
J192	11.843	4.843	2.445	0.0145	0.2462	0.4316
LDEPTH	82.904	18.82	4.404	0.0000	4.8944	0.5090
L2DEP	-7.9522	1.898	-4.189	0.0000	24.2132	5.0025
LSTEM	-8.4387	2.728	-3.093	0.0020	2.3164	0.1872
LGTEM	159.31	61.83	2.577	0.0100	1.7553	0.1431
LSLOPE	2.7343	1.409	1.941	0.0523	3.2087	0.9759
L2SLOPE	-0.48996	0.2570	-1.906	0.0566	11.2445	5.3610
LMTEM	-14.693	9.276	-1.584	0.1132	2.0037	0.1970
LMSTEM	44.992	15.32	2.936	0.0033	-0.0902	0.0553
LMSAL	-6532.9	1765.	-3.702	0.0002	3.4659	0.0278
LBMSAL	-109.08	30.66	-3.558	0.0004	0.0383	0.0242
BMHORVEL	0.14673	0.1244	1.179	0.2384	2.8017	2.9325
SSHRE	0.29768	0.2418	1.231	0.2182	-3.4680	1.6767
LWIND	2.9177	2.369	1.232	0.2181	1.7965	0.1697
L2GTEM	-39.537	16.70	-2.367	0.0179	3.1014	0.5184
L2MSAL	942.04	257.4	3.660	0.0003	12.0132	0.1912
LMLD_DEP	-0.38099	0.3333	-1.143	0.2530	7.2535	3.0037
Sigma	3.3130	0.2491	13.300	0.0000		

Pollock, average weight > 0.25 kg

Limited Dependent Variable Model - CENSORED regression

Ordinary	least squares regression.	Dep. Variable	LBPOLL	
Observations	263	Weights	ONE	
Mean of LHS	0.8345154E+00	Std.Dev of LHS	0.1541075E+01	
StdDev of resid.	0.1293798E+01	Sum of squares	0.4034130E+03	
R-squared	0.3516626E+00	Adj. R-squared	0.2951685E+00	
F[21,	241]	0.6224763E+01	Prob value	0.0000000E+00
Log-likelihood	-0.4294374E+03	Restr.(b=0) Log-l	-0.4864222E+03	
Amemiya Pr. Criter.	0.1813936E+01	Akaike Info.Crit.	0.3432984E+01	
ANOVA	Source	Variation	Deg. freedom	Mean Square
	Regression	0.2188139E+03	21.	0.1041971E+02
	Residual	0.4034130E+03	241.	0.1673913E+01
	Total	0.6222269E+03	262.	0.2374912E+01

N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	-4281.5	1321.	-3.240	0.0012		
J162	0.79908	0.6140	1.301	0.1931	0.2776	0.4487
J177	0.44705	1.052	0.425	0.6710	0.2510	0.4344
J192	0.27878E-01	1.474	0.019	0.9849	0.2433	0.4299
LDEPTH	3.3759	4.608	0.733	0.4638	4.8978	0.5069
L2DEP	-0.49393E-01	0.4374	-0.113	0.9101	24.2447	4.9856
LSTEM	-0.93955	0.8902	-1.055	0.2912	2.3153	0.1868
LGTEM	33.014	14.54	2.271	0.0232	1.7545	0.1428
LMLD	4.3831	1.636	2.680	0.0074	1.5058	0.6399
LMTEM	1.9085	2.834	0.673	0.5007	2.0028	0.1968
LMSTEM	-10.846	5.027	-2.157	0.0310	-0.0900	0.0553
LMSAL	2462.0	767.5	3.208	0.0013	3.4665	0.0261
LBMSAL	16.422	9.721	1.689	0.0912	0.0380	0.0236
HORVELM	-0.72220E-01	0.3501E-01	-2.063	0.0391	15.3185	11.0040
MSHORVEL	0.57074E-01	0.3631E-01	1.572	0.1159	12.8499	10.7104
BMHORVEL	0.63602E-01	0.4546E-01	1.399	0.1618	2.8098	2.9352
SSHRE	0.85775E-01	0.7878E-01	1.089	0.2762	-3.4664	1.6797
LCHLA	0.27958	0.2416	1.157	0.2471	0.7104	0.4982
LWIND	-1.4766	0.7600	-1.943	0.0520	1.7980	0.1683
L2GTEM	-8.5751	4.008	-2.139	0.0324	3.0986	0.5174
L2MSAL	-357.96	111.5	-3.211	0.0013	12.0172	0.1800
LMLD_DEP	-0.60579	0.3453	-1.755	0.0793	7.2726	2.9935

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Limited Dependent Variable Model - CENSORED regression
Maximum Likelihood Estimates
Log-Likelihood............. -229.59
Threshold values for the model: Lower 0.0000 Upper **********
N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	-11936.	4863.	-2.454	0.0141		
J162	1.0769	1.963	0.549	0.5832	0.2776	0.4487
J177	-3.0453	3.449	-0.883	0.3773	0.2510	0.4344
J192	-5.0420	4.815	-1.047	0.2951	0.2433	0.4299
LDEPTH	70.138	23.28	3.013	0.0026	4.8978	0.5069
L2DEP	-5.6319	2.157	-2.611	0.0090	24.2447	4.9856
LSTEM	-3.4402	2.771	-1.242	0.2144	2.3153	0.1868
LGTEM	145.78	78.76	1.851	0.0642	1.7545	0.1428
LMLD	16.865	7.083	2.381	0.0173	1.5058	0.6399
LMTEM	18.050	8.915	2.025	0.0429	2.0028	0.1968
LMSTEM	-25.364	16.00	-1.585	0.1129	-0.0900	0.0553
LMSAL	6797.1	2819.	2.411	0.0159	3.4665	0.0261
LBMSAL	-37.846	34.58	-1.094	0.2738	0.0380	0.0236
HORVELM	-0.16061	0.1148	-1.400	0.1616	15.3185	11.0040
MSHORVEL	0.12218	0.1142	1.070	0.2848	12.8499	10.7104
BMHORVEL	0.14484	0.1442	1.004	0.3152	2.8098	2.9352
SSHRE	0.23584	0.2197	1.073	0.2831	-3.4664	1.6797
LCHLA	1.5638	0.7075	2.210	0.0271	0.7104	0.4982
LWIND	-3.9803	2.408	-1.653	0.0984	1.7980	0.1683
L2GTEM	-40.774	23.23	-1.755	0.0792	3.0986	0.5174
L2MSAL	-997.94	409.5	-2.437	0.0148	12.0172	0.1800
LMLD_DEP	-2.5134	1.402	-1.793	0.0730	7.2726	2.9935
Sigma	2.5898	0.2373	10.916	0.0000		

Black cod, average weight > 0.75 kg

Limited Dependent Variable Model - CENSORED regression

Ordinary	least squares regression.	Dep. Variable	LBBCOD	
Observations	263	Weights	ONE	
Mean of LHS	0.1955044E+01	Std.Dev of LHS	0.2467206E+01	
StdDev of resid.	0.1637353E+01	Sum of squares	0.6487836E+03	
R-squared	0.5931938E+00	Adj. R-squared	0.5595734E+00	
F[20,	242]	0.1764389E+02	Prob value	0.1147677E-35
Log-likelihood	-0.4919181E+03	Restr.(b=0) Log-l	-0.6101916E+03	
Amemiya Pr. Criter.	0.2894990E+01	Akaike Info.Crit.	0.3900518E+01	
ANOVA	Source	Variation	Deg. freedom	Mean Square
	Regression	0.9460386E+03	20.	0.4730193E+02
	Residual	0.6487836E+03	242.	0.2680924E+01
	Total	0.1594822E+04	262.	0.6087107E+01

N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	982.14	1653.	0.594	0.5524		
J162	1.4588	0.7794	1.872	0.0612	0.2776	0.4487
J177	2.9388	1.288	2.282	0.0225	0.2510	0.4344
J192	3.2753	1.809	1.811	0.0701	0.2433	0.4299
LDEPTH	1.1602	4.030	0.288	0.7735	4.8978	0.5069
L2DEP	0.36078	0.3653	0.988	0.3234	24.2447	4.9856
LGTEM	1.4113	1.407	1.003	0.3159	1.7545	0.1428
LSLOPE	0.85200E-01	0.1255	0.679	0.4973	3.2086	0.9778
LMLD	2.9710	2.025	1.467	0.1423	1.5058	0.6399
LMTEM	-9.6338	3.446	-2.795	0.0052	2.0028	0.1968
LMSTEM	6.5858	5.942	1.108	0.2677	-0.0900	0.0553
LMSAL	-594.38	961.2	-0.618	0.5363	3.4665	0.0261
LMSSAL	30.364	11.99	2.532	0.0113	0.0127	0.0195
VERTVEL	-6.7201	4.589	-1.464	0.1431	-0.0032	0.0232
HORVELM	-0.96752E-01	0.4494E-01	-2.153	0.0313	15.3185	11.0040
MSHORVEL	0.71843E-01	0.4711E-01	1.525	0.1273	12.8499	10.7104
SSHRE	0.29249	0.1014	2.884	0.0039	-3.4664	1.6797
LCHLA	0.69575	0.3049	2.282	0.0225	0.7104	0.4982
LWIND	-1.3734	0.9021	-1.523	0.1279	1.7980	0.1683
L2MSAL	90.307	139.8	0.646	0.5184	12.0172	0.1800
LMLD_DEP	-0.76351	0.4338	-1.760	0.0784	7.2726	2.9935

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Limited Dependent Variable Model - CENSORED regression
Maximum Likelihood Estimates
Log-Likelihood............. -289.92
Threshold values for the model: Lower 0.0000 Upper **********
N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	4045.1	3639.	1.112	0.2663		
J162	3.7377	1.571	2.379	0.0174	0.2776	0.4487
J177	8.5246	2.728	3.125	0.0018	0.2510	0.4344
J192	8.7241	3.771	2.313	0.0207	0.2433	0.4299
LDEPTH	67.698	11.49	5.892	0.0000	4.8978	0.5069
L2DEP	-5.3179	1.044	-5.091	0.0000	24.2447	4.9856
LGTEM	12.842	3.608	3.560	0.0004	1.7545	0.1428
LSLOPE	0.31280	0.2515	1.244	0.2137	3.2086	0.9778
LMLD	7.5796	5.144	1.473	0.1406	1.5058	0.6399
LMTEM	-25.431	6.902	-3.685	0.0002	2.0028	0.1968
LMSTEM	34.202	12.47	2.744	0.0061	-0.0900	0.0553
LMSAL	-2525.1	2113.	-1.195	0.2322	3.4665	0.0261
LMSSAL	66.766	20.31	3.288	0.0010	0.0127	0.0195
VERTVEL	-12.226	7.999	-1.529	0.1264	-0.0032	0.0232
HORVELM	-0.17359	0.8271E-01	-2.099	0.0358	15.3185	11.0040
MSHORVEL	0.12531	0.8490E-01	1.476	0.1399	12.8499	10.7104
SSHRE	0.79853	0.1900	4.204	0.0000	-3.4664	1.6797
LCHLA	1.4385	0.5722	2.514	0.0119	0.7104	0.4982
LWIND	-7.3941	2.844	-2.600	0.0093	1.7980	0.1683
L2MSAL	378.44	307.1	1.232	0.2179	12.0172	0.1800
LMLD_DEP	-2.0157	1.010	-1.995	0.0461	7.2726	2.9935
Sigma	2.2199	0.1569	14.152	0.0000		

Halibut, all

Limited Dependent Variable Model - CENSORED regression

Ordinary	least squares regression.	Dep. Variable	LHAL	
Observations	263	Weights	ONE	
Mean of LHS	0.3605741E+01	Std.Dev of LHS	0.2128749E+01	
StdDev of resid.	0.1730145E+01	Sum of squares	0.7303901E+03	
R-squared	0.3848164E+00	Adj. R-squared	0.3394340E+00	
F[18,	244]	0.8479421E+01	Prob value	0.1578245E-16
Log-likelihood	-0.5074982E+03	Restr.(b=0) Log-l	-0.5713854E+03	
Amemiya Pr. Criter.	0.3209655E+01	Akaike Info.Crit.	0.4003788E+01	
ANOVA	Source	Variation	Deg. freedom	Mean Square
	Regression	0.4568817E+03	18.	0.2538232E+02
	Residual	0.7303901E+03	244.	0.2993402E+01
	Total	0.1187272E+04	262.	0.4531572E+01

N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	44.989	14.16	3.177	0.0015		
J162	0.75663	0.8639	0.876	0.3811	0.2776	0.4487
J177	0.33069	1.355	0.244	0.8072	0.2510	0.4344
J192	1.5001	1.870	0.802	0.4224	0.2433	0.4299
L2DEP	-0.37442	0.1345	-2.784	0.0054	24.2447	4.9856
TIMELDEP	-0.75653E-02	0.5589E-02	-1.354	0.1759	864.3330	121.2768
LSTEM	-1.6490	1.288	-1.280	0.2006	2.3153	0.1868
LGTEM	-35.150	14.24	-2.468	0.0136	1.7545	0.1428
LSLOPE	0.14877	0.1247	1.193	0.2328	3.2086	0.9778
LMLD	-6.5972	1.900	-3.473	0.0005	1.5058	0.6399
LMTEM	4.6740	2.798	1.671	0.0948	2.0028	0.1968
LMSTEM	-8.2449	6.496	-1.269	0.2043	-0.0900	0.0553
LMSSAL	-23.534	11.02	-2.135	0.0328	0.0127	0.0195
VERTVEL	-8.3319	4.776	-1.745	0.0811	-0.0032	0.0232
LCHLA1	0.92643	0.5006	1.851	0.0642	0.8483	0.4133
LCHLA2	-0.59286	0.4783	-1.239	0.2152	0.7532	0.4622
LWIND	-1.0785	0.9022	-1.195	0.2319	1.7980	0.1683
L2GTEM	9.2649	3.838	2.414	0.0158	3.0986	0.5174
LMLD_DEP	1.5925	0.4067	3.916	0.0001	7.2726	2.9935

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Limited Dependent Variable Model - CENSORED regression
Maximum Likelihood Estimates
Log-Likelihood............. -494.55
Threshold values for the model: Lower 0.0000 Upper **********
N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	54.944	17.38	3.162	0.0016		
J162	1.0732	1.055	1.017	0.3090	0.2776	0.4487
J177	0.45641	1.651	0.276	0.7822	0.2510	0.4344
J192	1.9509	2.286	0.853	0.3935	0.2433	0.4299
L2DEP	-0.53155	0.1676	-3.172	0.0015	24.2447	4.9856
TIMELDEP	-0.93874E-02	0.6829E-02	-1.375	0.1693	864.3330	121.2768
LSTEM	-2.2799	1.565	-1.456	0.1453	2.3153	0.1868
LGTEM	-42.553	17.52	-2.429	0.0151	1.7545	0.1428
LSLOPE	0.18518	0.1520	1.218	0.2232	3.2086	0.9778
LMLD	-9.7177	2.423	-4.010	0.0001	1.5058	0.6399
LMTEM	6.4038	3.458	1.852	0.0640	2.0028	0.1968
LMSTEM	-10.717	7.975	-1.344	0.1790	-0.0900	0.0553
LMSSAL	-31.531	14.04	-2.247	0.0247	0.0127	0.0195
VERTVEL	-9.1408	5.735	-1.594	0.1110	-0.0032	0.0232
LCHLA1	1.2576	0.6193	2.031	0.0423	0.8483	0.4133
LCHLA2	-0.85596	0.5911	-1.448	0.1476	0.7532	0.4622
LWIND	-1.4691	1.079	-1.361	0.1735	1.7980	0.1683
L2GTEM	11.049	4.707	2.347	0.0189	3.0986	0.5174
LMLD_DEP	2.3412	0.5258	4.452	0.0000	7.2726	2.9935
Sigma	2.0556	0.1081	19.013	0.0000		

Halibut, average weight > 1 kg

Limited Dependent Variable Model - CENSORED regression

Ordinary	least squares regression.	Dep. Variable	LBHAL	
Observations	263	Weights	ONE	
Mean of LHS	0.3518902E+01	Std.Dev of LHS	0.2186825E+01	
StdDev of resid.	0.1869869E+01	Sum of squares	0.8531244E+03	
R-squared	0.3191008E+00	Adj. R-squared	0.2688706E+00	
F[18,	244]	0.6352760E+01	Prob value	0.8742407E-12
Log-likelihood	-0.5279236E+03	Restr.(b=0) Log-l	-0.5784645E+03	
Amemiya Pr. Criter.	0.3749004E+01	Akaike Info.Crit.	0.4159115E+01	
ANOVA	Source	Variation	Deg. freedom	Mean Square
	Regression	0.3998135E+03	18.	0.2221186E+02
	Residual	0.8531244E+03	244.	0.3496411E+01
	Total	0.1252938E+04	262.	0.4782206E+01

N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	11.477	26.56	0.432	0.6657		
J162	2.0763	0.7037	2.951	0.0032	0.2776	0.4487
J177	2.2745	0.7962	2.857	0.0043	0.2510	0.4344
J192	3.8644	1.145	3.374	0.0007	0.2433	0.4299
LDEPTH	7.9750	6.291	1.268	0.2049	4.8978	0.5069
L2DEP	-1.3080	0.6029	-2.169	0.0301	24.2447	4.9856
LSTEM	-2.4061	1.214	-1.982	0.0475	2.3153	0.1868
LGTEM	-45.552	20.23	-2.252	0.0244	1.7545	0.1428
LSLOPE	0.14587	0.1339	1.089	0.2760	3.2086	0.9778
LMLD	-6.8059	2.245	-3.031	0.0024	1.5058	0.6399
LMSAL	8.8554	7.039	1.258	0.2084	3.4665	0.0261
LMSSAL	-15.872	12.68	-1.252	0.2106	0.0127	0.0195
VERTVEL	-8.6660	5.158	-1.680	0.0929	-0.0032	0.0232
LCHLA	-0.46292	0.4457	-1.039	0.2990	0.7104	0.4982
LCHLA1	1.5084	0.7001	2.155	0.0312	0.8483	0.4133
LCHLA2	-0.99361	0.5437	-1.827	0.0676	0.7532	0.4622
LWIND	-0.90053	0.9947	-0.905	0.3653	1.7980	0.1683
L2GTEM	11.884	5.566	2.135	0.0327	3.0986	0.5174
LMLD_DEP	1.6428	0.4881	3.366	0.0008	7.2726	2.9935

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Limited Dependent Variable Model - CENSORED regression
Maximum Likelihood Estimates
Log-Likelihood.............. -507.60
Threshold values for the model: Lower 0.0000 Upper **********
N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	10.845	33.49	0.324	0.7460		
J162	2.9686	0.8959	3.314	0.0009	0.2776	0.4487
J177	3.2217	1.005	3.205	0.0014	0.2510	0.4344
J192	5.4084	1.453	3.722	0.0002	0.2433	0.4299
LDEPTH	10.045	7.874	1.276	0.2021	4.8978	0.5069
L2DEP	-1.7466	0.7566	-2.309	0.0210	24.2447	4.9856
LSTEM	-3.2524	1.516	-2.146	0.0319	2.3153	0.1868
LGTEM	-57.220	25.20	-2.271	0.0232	1.7545	0.1428
LSLOPE	0.18943	0.1675	1.131	0.2581	3.2086	0.9778
LMLD	-10.747	2.949	-3.644	0.0003	1.5058	0.6399
LMSAL	12.680	9.100	1.393	0.1635	3.4665	0.0261
LMSSAL	-22.188	16.42	-1.351	0.1766	0.0127	0.0195
VERTVEL	-9.7879	6.355	-1.540	0.1235	-0.0032	0.0232
LCHLA	-0.68626	0.5705	-1.203	0.2290	0.7104	0.4982
LCHLA1	2.1564	0.8975	2.403	0.0163	0.8483	0.4133
LCHLA2	-1.4602	0.6995	-2.087	0.0369	0.7532	0.4622
LWIND	-1.3376	1.243	-1.076	0.2819	1.7980	0.1683
L2GTEM	14.752	6.915	2.133	0.0329	3.0986	0.5174
LMLD_DEP	2.5799	0.6495	3.972	0.0001	7.2726	2.9935
Sigma	2.2760	0.1224	18.602	0.0000		

Flatfish, all

Limited Dependent Variable Model - CENSORED		regression		
Ordinary	least squares regression.	Dep. Variable	LFLAT	
Observations	263	Weights	ONE	
Mean of LHS	0.5386837E+01	Std.Dev of LHS	0.1870004E+01	
StdDev of resid.	0.1406774E+01	Sum of squares	0.4789211E+03	
R-squared	0.4772697E+00	Adj. R-squared	0.4340689E+00	
F[20,	242]	0.1104769E+02	Prob value	0.2508541E-23
Log-likelihood	-0.4519995E+03	Restr.(b=0) Log-l	-0.5373022E+03	
Amemiya Pr. Criter.	0.2137033E+01	Akaike Info.Crit.	0.3596955E+01	
ANOVA	Source	Variation	Deg. freedom	Mean Square
	Regression	0.4372705E+03	20.	0.2186353E+02
	Residual	0.4789211E+03	242.	0.1979013E+01
	Total	0.9161916E+03	262.	0.3496915E+01

N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	-2358.9	1289.	-1.830	0.0672		
J162	0.66428	0.5854	1.135	0.2565	0.2776	0.4487
J177	-0.42864	1.012	-0.424	0.6719	0.2510	0.4344
J192	-1.4083	1.426	-0.988	0.3232	0.2433	0.4299
LDEPTH	32.631	4.354	7.495	0.0000	4.8978	0.5069
L2DEP	-2.8540	0.4220	-6.763	0.0000	24.2447	4.9856
TIMELDEP	-0.62780E-02	0.4152E-02	-1.512	0.1306	864.3330	121.2768
LGTEM	-16.487	15.51	-1.063	0.2878	1.7545	0.1428
LSLOPE	0.33820	0.1084	3.119	0.0018	3.2086	0.9778
LMTEM	4.7554	2.765	1.720	0.0854	2.0028	0.1968
LMSAL	1384.7	747.8	1.852	0.0641	3.4665	0.0261
LBMSAL	-58.652	10.65	-5.509	0.0000	0.0380	0.0236
VERTVEL	4.4290	3.923	1.129	0.2590	-0.0032	0.0232
HORVELM	-0.10453	0.3921E-01	-2.666	0.0077	15.3185	11.0040
MSHORVEL	0.91852E-01	0.4088E-01	2.247	0.0246	12.8499	10.7104
BMHORVEL	-0.17495	0.4726E-01	-3.702	0.0002	2.8098	2.9352
LCHLA1	0.48358	0.4142	1.167	0.2430	0.8483	0.4133
LCHLA2	-0.76722	0.4142	-1.852	0.0640	0.7532	0.4622
LWIND	1.6687	0.7756	2.151	0.0314	1.7980	0.1683
L2GTEM	5.6575	4.273	1.324	0.1855	3.0986	0.5174
L2MSAL	-209.67	108.5	-1.932	0.0534	12.0172	0.1800

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Limited Dependent Variable Model - CENSORED		regression		
Maximum Likelihood Estimates				
Log-Likelihood.............	-455.13			
Threshold values for the model: Lower		0.0000	Upper	**********

N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	-2443.5	1278.	-1.913	0.0558		
J162	0.52961	0.5841	0.907	0.3645	0.2776	0.4487
J177	-0.84760	1.020	-0.831	0.4060	0.2510	0.4344
J192	-1.9431	1.432	-1.357	0.1749	0.2433	0.4299
LDEPTH	35.563	4.490	7.920	0.0000	4.8978	0.5069
L2DEP	-3.1205	0.4350	-7.173	0.0000	24.2447	4.9856
TIMELDEP	-0.67135E-02	0.4128E-02	-1.626	0.1039	864.3330	121.2768
LGTEM	-19.705	15.49	-1.272	0.2032	1.7545	0.1428
LSLOPE	0.33531	0.1075	3.119	0.0018	3.2086	0.9778
LMTEM	5.8421	2.774	2.106	0.0352	2.0028	0.1968
LMSAL	1434.7	741.2	1.935	0.0529	3.4665	0.0261
LBMSAL	-62.703	10.64	-5.892	0.0000	0.0380	0.0236
VERTVEL	4.6344	3.903	1.187	0.2351	-0.0032	0.0232
HORVELM	-0.96556E-01	0.3916E-01	-2.465	0.0137	15.3185	11.0040
MSHORVEL	0.85591E-01	0.4072E-01	2.102	0.0355	12.8499	10.7104
BMHORVEL	-0.18795	0.4721E-01	-3.981	0.0001	2.8098	2.9352
LCHLA1	0.46835	0.4126	1.135	0.2563	0.8483	0.4133
LCHLA2	-0.76605	0.4146	-1.848	0.0646	0.7532	0.4622
LWIND	1.6930	0.7700	2.199	0.0279	1.7980	0.1683
L2GTEM	6.6162	4.270	1.549	0.1213	3.0986	0.5174
L2MSAL	-217.59	107.6	-2.022	0.0431	12.0172	0.1800
Sigma	1.3934	0.6260E-01	22.258	0.0000		

Rockfish, all

Ordinary	least squares regression.		Dep. Variable		LROCK	
Observations	263		Weights		ONE	
Mean of LHS	0.3033271E+01		Std.Dev of LHS		0.2706313E+01	
StdDev of resid.	0.2062773E+01		Sum of squares		0.1021207E+04	
R-squared	0.4678222E+00		Adj. R-squared		0.4190393E+00	
F[22,	240]		0.9589869E+01		Prob value	0.1974883E-21
Log-likelihood	-0.5515720E+03		Restr.(b=0) Log-l		-0.6345193E+03	
Amemiya Pr. Criter.	0.4627143E+01		Akaike Info.Crit.		0.4369369E+01	
ANOVA	Source		Variation		Deg. freedom	Mean Square
	Regression		0.8977141E+03		22.	0.4080519E+02
	Residual		0.1021207E+04		240.	0.4255031E+01
	Total		0.1918921E+04		262.	0.7324128E+01

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	1504.2	1944.	0.774	0.4390		
J162	-0.75671	0.8060	-0.939	0.3478	0.2776	0.4487
J177	-0.27890	1.490	-0.187	0.8515	0.2510	0.4344
J192	-0.76191	2.095	-0.364	0.7162	0.2433	0.4299
LDEPTH	-2.5107	6.417	-0.391	0.6956	4.8978	0.5069
L2DEP	0.28820	0.6328	0.455	0.6488	24.2447	4.9856
TIMELDEP	0.78801E-02	0.6279E-02	1.255	0.2095	864.3330	121.2768
LGTEM	22.477	22.86	0.983	0.3254	1.7545	0.1428
LSLOPE	-0.70144E-01	0.1629	-0.430	0.6669	3.2086	0.9778
LMTEM	-6.4377	5.463	-1.178	0.2387	2.0028	0.1968
LBMTEM	-6.5865	2.821	-2.335	0.0196	-0.1522	0.1850
LMSAL	-916.79	1128.	-0.813	0.4163	3.4665	0.0261
LMSSAL	24.445	15.53	1.574	0.1154	0.0127	0.0195
LBMSAL	29.658	15.83	1.874	0.0610	0.0380	0.0236
VERTVEL	-7.7301	5.687	-1.359	0.1740	-0.0032	0.0232
HORVELM	-0.32319E-01	0.1793E-01	-1.802	0.0715	15.3185	11.0040
BMHORVEL	0.94278E-01	0.7277E-01	1.296	0.1951	2.8098	2.9352
SSHRE	-0.61026E-01	0.1284	-0.475	0.6345	-3.4664	1.6797
LCHLA	1.4035	0.5139	2.731	0.0063	0.7104	0.4982
LCHLA1	-1.0980	0.4983	-2.203	0.0276	0.8483	0.4133
LWIND	0.34816	1.214	0.287	0.7742	1.7980	0.1683
L2GTEM	-6.3082	6.300	-1.001	0.3167	3.0986	0.5174
L2MSAL	138.63	163.6	0.847	0.3969	12.0172	0.1800

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Limited Dependent Variable Model - CENSORED regression
Maximum Likelihood Estimates
Log-Likelihood............. -479.26
Threshold values for the model: Lower 0.0000 Upper **********
N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	2518.5	2439.	1.032	0.3019		
J162	-0.94423	1.057	-0.894	0.3715	0.2776	0.4487
J177	-0.23051	2.011	-0.115	0.9087	0.2510	0.4344
J192	-0.70044	2.845	-0.246	0.8056	0.2433	0.4299
LDEPTH	16.379	12.49	1.311	0.1899	4.8978	0.5069
L2DEP	-1.5830	1.226	-1.291	0.1967	24.2447	4.9856
TIMELDEP	0.82648E-02	0.8136E-02	1.016	0.3097	864.3330	121.2768
LGTEM	52.069	41.42	1.257	0.2088	1.7545	0.1428
LSLOPE	-0.22848	0.2106	-1.085	0.2781	3.2086	0.9778
LMTEM	-8.2066	6.995	-1.173	0.2407	2.0028	0.1968
LBMTEM	-11.663	3.758	-3.104	0.0019	-0.1522	0.1850
LMSAL	-1560.6	1416.	-1.102	0.2705	3.4665	0.0261
LMSSAL	24.014	19.63	1.224	0.2211	0.0127	0.0195
LBMSAL	49.506	22.24	2.226	0.0260	0.0380	0.0236
VERTVEL	-8.9489	7.202	-1.243	0.2140	-0.0032	0.0232
HORVELM	-0.41086E-01	0.2331E-01	-1.763	0.0779	15.3185	11.0040
BMHORVEL	0.19113	0.9863E-01	1.938	0.0527	2.8098	2.9352
SSHRE	-0.16915	0.1654	-1.023	0.3064	-3.4664	1.6797
LCHLA	1.6080	0.6656	2.416	0.0157	0.7104	0.4982
LCHLA1	-1.3805	0.6614	-2.087	0.0369	0.8483	0.4133
LWIND	2.5312	2.195	1.153	0.2487	1.7980	0.1683
L2GTEM	-15.351	11.72	-1.310	0.1902	3.0986	0.5174
L2MSAL	233.79	205.7	1.136	0.2558	12.0172	0.1800
Sigma	2.4862	0.1358	18.308	0.0000		

2. Equations without wind

Pacific cod, all

Limited Dependent Variable Model - CENSORED regression

Ordinary	least squares regression.	Dep. Variable	LPCOD	
Observations	377	Weights	ONE	
Mean of LHS	0.1951593E+01	Std.Dev of LHS	0.2121660E+01	
StdDev of resid.	0.1870424E+01	Sum of squares	0.1259456E+04	
R-squared	0.2558793E+00	Adj. R-squared	0.2228073E+00	
F[16,	360]	0.7737031E+01	Prob value	0.8994911E-15
Log-likelihood	-0.7623066E+03	Restr.(b=0) Log-l	-0.8180181E+03	
Amemiya Pr. Criter.	0.3656244E+01	Akaike Info.Crit.	0.4134252E+01	
ANOVA	Source	Variation	Deg. freedom	Mean Square
	Regression	0.4330865E+03	16.	0.2706791E+02
	Residual	0.1259456E+04	360.	0.3498488E+01
	Total	0.1692542E+04	376.	0.4501442E+01

N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	1423.6	690.7	2.061	0.0393		
J162	0.52740	0.3813	1.383	0.1666	0.3263	0.4695
J177	0.55088	0.4990	1.104	0.2696	0.2334	0.4236
J192	0.90287	0.5848	1.544	0.1226	0.2334	0.4236
LDEPTH	12.498	3.273	3.818	0.0001	4.8044	0.5626
L2DEP	-1.1314	0.3373	-3.354	0.0008	23.3976	5.3509
LSTEM	-2.6242	0.8848	-2.966	0.0030	2.2955	0.1867
LGTEM	46.412	11.78	3.941	0.0001	1.7873	0.1745
LSLOPE	0.43460	0.3255	1.335	0.1818	3.2026	0.9801
L2SLOPE	-0.66421E-01	0.6250E-01	-1.063	0.2879	11.2148	5.3014
LMSAL	-846.40	402.8	-2.101	0.0356	3.4545	0.0358
LMSSAL	-19.928	8.351	-2.386	0.0170	0.0135	0.0274
LBMSAL	-28.354	7.911	-3.584	0.0003	0.0410	0.0305
MSHORVEL	-0.95601E-02	0.1150E-01	-0.831	0.4060	10.9195	10.0521
LCHLA2	0.47311	0.2280	2.075	0.0380	0.8487	0.5049
L2GTEM	-11.400	3.124	-3.649	0.0003	3.2248	0.6559
L2MSAL	119.69	58.60	2.042	0.0411	11.9349	0.2450

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Limited Dependent Variable Model - CENSORED regression
Maximum Likelihood Estimates
Log-Likelihood............. -614.09
Threshold values for the model: Lower 0.0000 Upper **********
N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	2375.4	1188.	2.000	0.0455		
J162	0.37777	0.6423	0.588	0.5564	0.3263	0.4695
J177	-0.32678E-01	0.8509	-0.038	0.9694	0.2334	0.4236
J192	0.46898	1.010	0.464	0.6424	0.2334	0.4236
LDEPTH	33.600	6.485	5.181	0.0000	4.8044	0.5626
L2DEP	-3.2230	0.6741	-4.781	0.0000	23.3976	5.3509
LSTEM	-4.5960	1.464	-3.140	0.0017	2.2955	0.1867
LGTEM	107.99	22.11	4.885	0.0000	1.7873	0.1745
LSLOPE	1.5487	0.7957	1.946	0.0516	3.2026	0.9801
L2SLOPE	-0.25802	0.1450	-1.780	0.0751	11.2148	5.3014
LMSAL	-1448.1	692.3	-2.092	0.0365	3.4545	0.0358
LMSSAL	-35.562	14.72	-2.416	0.0157	0.0135	0.0274
LBMSAL	-45.527	12.99	-3.504	0.0005	0.0410	0.0305
MSHORVEL	-0.29942E-01	0.2054E-01	-1.458	0.1449	10.9195	10.0521
LCHLA2	0.88429	0.3869	2.286	0.0223	0.8487	0.5049
L2GTEM	-26.392	5.780	-4.566	0.0000	3.2248	0.6559
L2MSAL	204.76	100.7	2.034	0.0420	11.9349	0.2450
Sigma	2.7979	0.1501	18.634	0.0000		

Pacific cod, average weight > 0.5 kg

Limited Dependent Variable Model - CENSORED regression

Ordinary	least squares regression.	Dep. Variable	LBPCOD	
Observations	381	Weights	ONE	
Mean of LHS	0.1749955E+01	Std.Dev of LHS	0.2159548E+01	
StdDev of resid.	0.1960828E+01	Sum of squares	0.1391835E+04	
R-squared	0.2146230E+00	Adj. R-squared	0.1755711E+00	
F[18,	362]	0.5495840E+01	Prob value	0.1895555E-10
Log-likelihood	-0.7874233E+03	Restr.(b=0) Log-l	-0.8334465E+03	
Amemiya Pr. Criter.	0.4036584E+01	Akaike Info.Crit.	0.4233193E+01	
ANOVA	Source	Variation	Deg. freedom	Mean Square
	Regression	0.3803519E+03	18.	0.2113066E+02
	Residual	0.1391835E+04	362.	0.3844847E+01
	Total	0.1772186E+04	380.	0.4663649E+01

N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	224.30	555.1	0.404	0.6862		
J162	1.5314	0.6262	2.445	0.0145	0.3228	0.4682
J177	1.6346	0.9857	1.658	0.0972	0.2336	0.4237
J192	1.8798	1.395	1.347	0.1778	0.2257	0.4186
LDEPTH	11.891	3.224	3.688	0.0002	4.7937	0.5688
L2DEP	-1.0322	0.3354	-3.077	0.0021	23.3024	5.3937
LSTEM	-1.7338	0.9764	-1.776	0.0758	2.2923	0.1872
LGTEM	46.860	12.18	3.848	0.0001	1.7847	0.1747
LSLOPE	0.42390	0.3414	1.242	0.2144	3.2009	0.9755
L2SLOPE	-0.56517E-01	0.6615E-01	-0.854	0.3929	11.1949	5.2778
LMTEM	-1.4291	2.297	-0.622	0.5338	1.9673	0.2118
LMSTEM	6.0243	3.853	1.564	0.1179	-0.0912	0.0537
LMSAL	-145.42	324.5	-0.448	0.6540	3.4544	0.0352
LBMSAL	-33.179	8.041	-4.126	0.0000	0.0403	0.0301
HORVELM	0.53499E-01	0.4454E-01	1.201	0.2297	12.9840	10.5078
MSHORVEL	-0.64555E-01	0.4692E-01	-1.376	0.1689	10.7954	10.0679
LCHLA	0.39234	0.2179	1.801	0.0718	0.7226	0.5474
L2GTEM	-11.733	3.220	-3.644	0.0003	3.2155	0.6557
L2MSAL	17.370	47.43	0.366	0.7142	11.9342	0.2413

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Limited Dependent Variable Model - CENSORED regression
Maximum Likelihood Estimates
Log-Likelihood............. -570.80
Threshold values for the model: Lower 0.0000 Upper **********
N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	1189.3	1114.	1.067	0.2858		
J162	3.5561	1.311	2.713	0.0067	0.3228	0.4682
J177	4.8798	2.087	2.338	0.0194	0.2336	0.4237
J192	5.9164	2.954	2.003	0.0452	0.2257	0.4186
LDEPTH	32.248	7.843	4.112	0.0000	4.7937	0.5688
L2DEP	-2.8980	0.8139	-3.561	0.0004	23.3024	5.3937
LSTEM	-4.0984	1.988	-2.061	0.0393	2.2923	0.1872
LGTEM	218.32	42.14	5.181	0.0000	1.7847	0.1747
LSLOPE	1.4928	1.027	1.453	0.1463	3.2009	0.9755
L2SLOPE	-0.20927	0.1871	-1.119	0.2633	11.1949	5.2778
LMTEM	-9.4971	5.004	-1.898	0.0577	1.9673	0.2118
LMSTEM	15.221	8.363	1.820	0.0687	-0.0912	0.0537
LMSAL	-805.20	651.8	-1.235	0.2167	3.4544	0.0352
LBMSAL	-62.086	16.83	-3.689	0.0002	0.0403	0.0301
HORVELM	0.13319	0.9186E-01	1.450	0.1471	12.9840	10.5078
MSHORVEL	-0.16556	0.9713E-01	-1.705	0.0883	10.7954	10.0679
LCHLA	0.47038	0.4492	1.047	0.2951	0.7226	0.5474
L2GTEM	-56.370	11.21	-5.028	0.0000	3.2155	0.6557
L2MSAL	110.77	95.23	1.163	0.2448	11.9342	0.2413
Sigma	3.4294	0.2084	16.455	0.0000		

Pollock, all

Limited Dependent Variable Model - CENSORED regression

Ordinary	least squares regression.	Dep. Variable	LPOLL	
Observations	380	Weights	ONE	
Mean of LHS	0.1580394E+01	Std.Dev of LHS	0.2058696E+01	
StdDev of resid.	0.1726682E+01	Sum of squares	0.1079278E+04	
R-squared	0.3280923E+00	Adj. R-squared	0.2965386E+00	
F[17,	362]	0.1039791E+02	Prob value	0.0000000E+00
Log-likelihood	-0.7375332E+03	Restr.(b=0) Log-l	-0.8130837E+03	
Amemiya Pr. Criter.	0.3122657E+01	Akaike Info.Crit.	0.3976490E+01	
ANOVA	Source	Variation	Deg. freedom	Mean Square
	Regression	0.5270111E+03	17.	0.3100065E+02
	Residual	0.1079278E+04	362.	0.2981431E+01
	Total	0.1606289E+04	379.	0.4238230E+01

N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	-1937.3	643.6	-3.010	0.0026		
J162	0.92638	0.4346	2.131	0.0330	0.3237	0.4685
J177	1.2384	0.5070	2.443	0.0146	0.2342	0.4241
J192	0.76996	0.7230	1.065	0.2869	0.2237	0.4173
LDEPTH	3.8528	0.6249	6.166	0.0000	4.7950	0.5690
LGTEM	38.828	8.212	4.728	0.0000	1.7844	0.1748
LSLOPE	-0.82837E-01	0.1030	-0.804	0.4211	3.1984	0.9756
LMLD	2.5593	1.333	1.920	0.0548	1.5198	0.6260
LMSAL	1139.0	375.3	3.035	0.0024	3.4550	0.0336
LBMSAL	-27.278	7.020	-3.886	0.0001	0.0399	0.0287
VERTVEL	5.4075	4.504	1.201	0.2299	-0.0025	0.0202
HORVELM	-0.19863E-01	0.1096E-01	-1.812	0.0700	13.0181	10.5005
BMHORVEL	0.45647E-01	0.4401E-01	1.037	0.2996	2.7418	2.9262
LCHLA	0.72940	0.2705	2.696	0.0070	0.7227	0.5481
LCHLA1	-0.23812	0.2881	-0.826	0.4086	0.9196	0.4705
L2GTEM	-9.7652	2.148	-4.547	0.0000	3.2144	0.6562
L2MSAL	-171.94	54.64	-3.147	0.0016	11.9379	0.2306
LMLD_DEP	-0.50035	0.3005	-1.665	0.0960	7.1724	2.8464

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Limited Dependent Variable Model - CENSORED regression
Maximum Likelihood Estimates
Log-Likelihood............. -628.14
Threshold values for the model: Lower 0.0000 Upper **********
N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	-3281.3	1050.	-3.126	0.0018		
J162	1.0767	0.6594	1.633	0.1025	0.3237	0.4685
J177	1.6396	0.7861	2.086	0.0370	0.2342	0.4241
J192	0.80336	1.106	0.727	0.4675	0.2237	0.4173
LDEPTH	5.8535	0.9975	5.868	0.0000	4.7950	0.5690
LGTEM	60.649	13.48	4.498	0.0000	1.7844	0.1748
LSLOPE	-0.16146	0.1544	-1.045	0.2958	3.1984	0.9756
LMLD	4.2850	2.116	2.025	0.0428	1.5198	0.6260
LMSAL	1919.7	611.2	3.141	0.0017	3.4550	0.0336
LBMSAL	-38.469	10.70	-3.596	0.0003	0.0399	0.0287
VERTVEL	9.0343	6.867	1.316	0.1883	-0.0025	0.0202
HORVELM	-0.36579E-01	0.1690E-01	-2.164	0.0304	13.0181	10.5005
BMHORVEL	0.12661	0.6929E-01	1.827	0.0677	2.7418	2.9262
LCHLA	0.88612	0.4046	2.190	0.0285	0.7227	0.5481
LCHLA1	-0.44773	0.4311	-1.038	0.2991	0.9196	0.4705
L2GTEM	-15.501	3.570	-4.342	0.0000	3.2144	0.6562
L2MSAL	-287.83	89.00	-3.234	0.0012	11.9379	0.2306
LMLD_DEP	-0.86254	0.4681	-1.843	0.0654	7.1724	2.8464
Sigma	2.4187	0.1218	19.859	0.0000		

Pollock, average weight > 0.25 kg

Limited Dependent Variable Model - CENSORED regression

Ordinary	least squares regression.	Dep. Variable	LBPOLL	
Observations	380	Weights	ONE	
Mean of LHS	0.1134761E+01	Std.Dev of LHS	0.1956043E+01	
StdDev of resid.	0.1648476E+01	Sum of squares	0.9918778E+03	
R-squared	0.3159901E+00	Adj. R-squared	0.2897541E+00	
F[14,	365]	0.1204414E+02	Prob value	0.4875549E-22
Log-likelihood	-0.7214881E+03	Restr.(b=0) Log-l	-0.7936468E+03	
Amemiya Pr. Criter.	0.2824742E+01	Akaike Info.Crit.	0.3876253E+01	
ANOVA	Source	Variation	Deg. freedom	Mean Square
	Regression	0.4582150E+03	14.	0.3272964E+02
	Residual	0.9918778E+03	365.	0.2717473E+01
	Total	0.1450093E+04	379.	0.3826102E+01

N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	-1348.8	592.5	-2.276	0.0228		
J162	0.89908	0.4101	2.192	0.0284	0.3237	0.4685
J177	1.1277	0.4548	2.480	0.0132	0.2342	0.4241
J192	1.2104	0.6751	1.793	0.0730	0.2237	0.4173
LDEPTH	3.9858	0.5955	6.693	0.0000	4.7950	0.5690
LGTEM	34.701	7.729	4.490	0.0000	1.7844	0.1748
LMLD	3.2231	1.268	2.542	0.0110	1.5198	0.6260
LMSAL	797.98	345.8	2.308	0.0210	3.4550	0.0336
LBMSAL	-31.406	6.667	-4.711	0.0000	0.0399	0.0287
HORVELM	-0.11829E-01	0.9293E-02	-1.273	0.2031	13.0181	10.5005
LCHLA	0.95612	0.2569	3.721	0.0002	0.7227	0.5481
LCHLA1	-0.45142	0.2729	-1.654	0.0981	0.9196	0.4705
L2GTEM	-8.6805	2.021	-4.296	0.0000	3.2144	0.6562
L2MSAL	-122.34	50.37	-2.429	0.0151	11.9379	0.2306
LMLD_DEP	-0.59225	0.2860	-2.071	0.0384	7.1724	2.8464

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Limited Dependent Variable Model - CENSORED regression
Maximum Likelihood Estimates
Log-Likelihood............. -421.77
Threshold values for the model: Lower 0.0000 Upper **********
N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	-4805.1	1799.	-2.672	0.0075		
J162	3.1049	1.175	2.643	0.0082	0.3237	0.4685
J177	3.4288	1.305	2.628	0.0086	0.2342	0.4241
J192	4.6284	1.930	2.399	0.0165	0.2237	0.4173
LDEPTH	12.433	2.086	5.961	0.0000	4.7950	0.5690
LGTEM	127.18	30.49	4.171	0.0000	1.7844	0.1748
LMLD	12.360	4.333	2.853	0.0043	1.5198	0.6260
LMSAL	2799.5	1046.	2.676	0.0075	3.4550	0.0336
LBMSAL	-82.426	18.95	-4.350	0.0000	0.0399	0.0287
HORVELM	-0.35186E-01	0.2606E-01	-1.350	0.1769	13.0181	10.5005
LCHLA	2.7487	0.7121	3.860	0.0001	0.7227	0.5481
LCHLA1	-1.6501	0.7357	-2.243	0.0249	0.9196	0.4705
L2GTEM	-33.342	8.316	-4.009	0.0001	3.2144	0.6562
L2MSAL	-423.15	152.5	-2.775	0.0055	11.9379	0.2306
LMLD_DEP	-2.1187	0.9060	-2.339	0.0194	7.1724	2.8464
Sigma	3.5479	0.2618	13.551	0.0000		

Black cod, all

Limited Dependent Variable Model - CENSORED regression

Ordinary	least squares regression.	Dep. Variable	LBCOD	
Observations	380	Weights	ONE	
Mean of LHS	0.1691693E+01	Std.Dev of LHS	0.2331162E+01	
StdDev of resid.	0.1611987E+01	Sum of squares	0.9458542E+03	
R-squared	0.5407595E+00	Adj. R-squared	0.5218347E+00	
F[15,	364]	0.2857420E+02	Prob value	0.0000000E+00
Log-likelihood	-0.7124609E+03	Restr.(b=0) Log-l	-0.8603153E+03	
Amemiya Pr. Criter.	0.2707911E+01	Akaike Info.Crit.	0.3834005E+01	
ANOVA	Source	Variation	Deg. freedom	Mean Square
	Regression	0.1113751E+04	15.	0.7425007E+02
	Residual	0.9458542E+03	364.	0.2598500E+01
	Total	0.2059605E+04	379.	0.5434315E+01

N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	-11.569	14.36	-0.806	0.4204		
J162	1.5302	0.5078	3.013	0.0026	0.3237	0.4685
J177	2.0762	0.8046	2.580	0.0099	0.2342	0.4241
J192	3.0962	1.111	2.786	0.0053	0.2237	0.4173
LDEPTH	2.6106	0.2619	9.967	0.0000	4.7950	0.5690
LGTEM	-3.8113	7.670	-0.497	0.6193	1.7844	0.1748
LSLOPE	0.53129E-01	0.9596E-01	0.554	0.5798	3.1984	0.9756
LMTEM	-4.5406	1.910	-2.377	0.0175	1.9668	0.2118
LMSTEM	10.651	3.081	3.457	0.0005	-0.0907	0.0529
LBMTEM	-4.4453	1.154	-3.851	0.0001	-0.1087	0.1885
LMSAL	3.2199	4.153	0.775	0.4381	3.4550	0.0336
VERTVEL	-6.2213	4.241	-1.467	0.1424	-0.0025	0.0202
HORVELM	-0.62759E-01	0.3714E-01	-1.690	0.0911	13.0181	10.5005
MSHORVEL	0.47594E-01	0.3944E-01	1.207	0.2275	10.8239	10.0659
LCHLA1	0.49223	0.1937	2.541	0.0111	0.9196	0.4705
L2GTEM	1.1889	2.007	0.592	0.5536	3.2144	0.6562

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Limited Dependent Variable Model - CENSORED regression
Maximum Likelihood Estimates
Log-Likelihood............. -427.20
Threshold values for the model: Lower 0.0000 Upper **********
N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	-186.07	37.80	-4.923	0.0000		
J162	3.5569	1.245	2.856	0.0043	0.3237	0.4685
J177	6.3356	2.073	3.056	0.0022	0.2342	0.4241
J192	9.0142	2.881	3.129	0.0018	0.2237	0.4173
LDEPTH	6.9424	0.7007	9.908	0.0000	4.7950	0.5690
LGTEM	132.99	27.97	4.754	0.0000	1.7844	0.1748
LSLOPE	0.27057	0.2252	1.202	0.2295	3.1984	0.9756
LMTEM	-15.878	4.536	-3.500	0.0005	1.9668	0.2118
LMSTEM	16.773	8.181	2.050	0.0403	-0.0907	0.0529
LBMTEM	-9.3727	2.637	-3.555	0.0004	-0.1087	0.1885
LMSAL	16.582	9.264	1.790	0.0735	3.4550	0.0336
VERTVEL	-9.2226	8.656	-1.066	0.2866	-0.0025	0.0202
HORVELM	-0.19006	0.7697E-01	-2.469	0.0135	13.0181	10.5005
MSHORVEL	0.15606	0.7938E-01	1.966	0.0493	10.8239	10.0659
LCHLA1	1.2566	0.4294	2.927	0.0034	0.9196	0.4705
L2GTEM	-36.502	7.835	-4.659	0.0000	3.2144	0.6562
Sigma	2.5864	0.1625	15.913	0.0000		

Black cod, average weight > 0.75 kg

Limited Dependent Variable Model - CENSORED regression

Ordinary	least squares regression.	Dep. Variable	LBBCOD	
Observations	374	Weights	ONE	
Mean of LHS	0.1696323E+01	Std.Dev of LHS	0.2349267E+01	
StdDev of resid.	0.1628311E+01	Sum of squares	0.9438974E+03	
R-squared	0.5414875E+00	Adj. R-squared	0.5195922E+00	
F[17,	356]	0.2473081E+02	Prob value	0.0000000E+00
Log-likelihood	-0.7038005E+03	Restr.(b=0) Log-l	-0.8496170E+03	
Amemiya Pr. Criter.	0.2779005E+01	Akaike Info.Crit.	0.3859895E+01	
ANOVA	Source	Variation	Deg. freedom	Mean Square
	Regression	0.1114710E+04	17.	0.6557120E+02
	Residual	0.9438974E+03	356.	0.2651397E+01
	Total	0.2058608E+04	373.	0.5519056E+01

N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	-15.959	20.30	-0.786	0.4317		
J162	1.7021	0.5732	2.969	0.0030	0.3289	0.4704
J177	2.2423	0.8924	2.513	0.0120	0.2353	0.4248
J192	3.2224	1.185	2.719	0.0065	0.2273	0.4196
LDEPTH	2.9182	0.3463	8.427	0.0000	4.8091	0.5586
LGTEM	-10.021	8.246	-1.215	0.2242	1.7859	0.1739
LSLOPE	0.11155	0.9676E-01	1.153	0.2490	3.1972	0.9813
LMTEM	-2.0865	1.928	-1.082	0.2792	1.9714	0.2087
LMSTEM	8.5575	3.145	2.721	0.0065	-0.0915	0.0528
LMSAL	4.6443	6.711	0.692	0.4889	3.4556	0.0334
LMSSAL	9.1180	6.368	1.432	0.1522	0.0127	0.0241
LBMSAL	-9.0701	6.851	-1.324	0.1855	0.0404	0.0286
HORVELM	-0.56622E-01	0.3755E-01	-1.508	0.1316	13.1751	10.4944
MSHORVEL	0.51108E-01	0.3954E-01	1.293	0.1962	10.9839	10.0643
SSHRE	0.12401	0.5373E-01	2.308	0.0210	-3.5265	1.8770
LCHLA1	0.83496	0.3605	2.316	0.0206	0.9176	0.4615
LCHLA2	-0.43952	0.3528	-1.246	0.2128	0.8485	0.5044
L2GTEM	2.6929	2.173	1.239	0.2153	3.2197	0.6533

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Limited Dependent Variable Model - CENSORED regression

Maximum Likelihood Estimates

Log-Likelihood............. -391.25

Threshold values for the model: Lower 0.0000 Upper **********

N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	-466.94	89.95	-5.191	0.0000		
J162	4.1629	1.509	2.759	0.0058	0.3289	0.4704
J177	7.3562	2.529	2.909	0.0036	0.2353	0.4248
J192	8.7336	3.343	2.613	0.0090	0.2273	0.4196
LDEPTH	7.1558	0.9911	7.220	0.0000	4.8091	0.5586
LGTEM	115.82	32.66	3.546	0.0004	1.7859	0.1739
LSLOPE	0.31719	0.2308	1.374	0.1694	3.1972	0.9813
LMTEM	-10.210	5.835	-1.750	0.0801	1.9714	0.2087
LMSTEM	13.796	8.799	1.568	0.1169	-0.0915	0.0528
LMSAL	97.421	29.22	3.334	0.0009	3.4556	0.0334
LMSSAL	34.048	15.62	2.180	0.0292	0.0127	0.0241
LBMSAL	70.359	31.05	2.266	0.0234	0.0404	0.0286
HORVELM	-0.17467	0.8019E-01	-2.178	0.0294	13.1751	10.4944
MSHORVEL	0.13521	0.7991E-01	1.692	0.0906	10.9839	10.0643
SSHRE	0.17729	0.1218	1.455	0.1456	-3.5265	1.8770
LCHLA1	2.1955	0.8847	2.482	0.0131	0.9176	0.4615
LCHLA2	-1.1974	0.8400	-1.425	0.1540	0.8485	0.5044
L2GTEM	-31.303	9.360	-3.344	0.0008	3.2197	0.6533
Sigma	2.4939	0.1595	15.633	0.0000		

Halibut, all

Limited Dependent Variable Model - CENSORED regression

Ordinary	least squares regression.	Dep. Variable	LHAL	
Observations	374	Weights	ONE	
Mean of LHS	0.3650597E+01	Std.Dev of LHS	0.2093095E+01	
StdDev of resid.	0.1690549E+01	Sum of squares	0.1020290E+04	
R-squared	0.3756375E+00	Adj. R-squared	0.3476549E+00	
F[16,	357]	0.1342395E+02	Prob value	0.4611915E-27
Log-likelihood	-0.7183536E+03	Restr.(b=0) Log-l	-0.8064352E+03	
Amemiya Pr. Criter.	0.2987862E+01	Akaike Info.Crit.	0.3932372E+01	
ANOVA	Source	Variation	Deg. freedom	Mean Square
	Regression	0.6138407E+03	16.	0.3836505E+02
	Residual	0.1020290E+04	357.	0.2857955E+01
	Total	0.1634131E+04	373.	0.4381047E+01

N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	9.9394	13.38	0.743	0.4577		
J162	1.4329	0.4986	2.874	0.0041	0.3289	0.4704
J177	1.8114	0.7062	2.565	0.0103	0.2353	0.4248
J192	3.0988	1.052	2.946	0.0032	0.2273	0.4196
LDEPTH	-3.5200	1.056	-3.332	0.0009	4.8091	0.5586
TIMELDEP	-0.65529E-02	0.4476E-02	-1.464	0.1432	846.4649	124.6727
LGTEM	-1.8108	0.9826	-1.843	0.0653	1.7859	0.1739
LSLOPE	0.26355	0.9636E-01	2.735	0.0062	3.1972	0.9813
LMLD	-6.3529	1.375	-4.621	0.0000	1.5095	0.6250
LMSAL	4.6533	3.664	1.270	0.2041	3.4556	0.0334
LMSSAL	-5.7320	6.048	-0.948	0.3433	0.0127	0.0241
VERTVEL	-6.9483	4.442	-1.564	0.1177	-0.0025	0.0202
SSHRE	0.91710E-01	0.5381E-01	1.704	0.0883	-3.5265	1.8770
LCHLA	-0.44326	0.2856	-1.552	0.1206	0.7189	0.5424
LCHLA1	0.50492	0.4884	1.034	0.3013	0.9176	0.4615
LCHLA2	-0.43661	0.3964	-1.102	0.2707	0.8485	0.5044
LMLD_DEP	1.5506	0.3099	5.004	0.0000	7.1526	2.8620

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Limited Dependent Variable Model - CENSORED regression

Maximum Likelihood Estimates

Log-Likelihood............. -704.05

Threshold values for the model: Lower 0.0000 Upper **********

N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	11.614	16.40	0.708	0.4788		
J162	1.8384	0.6079	3.024	0.0025	0.3289	0.4704
J177	2.3043	0.8580	2.686	0.0072	0.2353	0.4248
J192	4.0739	1.286	3.167	0.0015	0.2273	0.4196
LDEPTH	-5.0082	1.320	-3.795	0.0001	4.8091	0.5586
TIMELDEP	-0.80978E-02	0.5475E-02	-1.479	0.1391	846.4649	124.6727
LGTEM	-2.6236	1.198	-2.189	0.0286	1.7859	0.1739
LSLOPE	0.31328	0.1187	2.640	0.0083	3.1972	0.9813
LMLD	-9.5375	1.780	-5.358	0.0000	1.5095	0.6250
LMSAL	6.6920	4.539	1.474	0.1404	3.4556	0.0334
LMSSAL	-12.453	8.046	-1.548	0.1217	0.0127	0.0241
VERTVEL	-7.7724	5.352	-1.452	0.1465	-0.0025	0.0202
SSHRE	0.11360	0.6591E-01	1.723	0.0848	-3.5265	1.8770
LCHLA	-0.59920	0.3528	-1.698	0.0894	0.7189	0.5424
LCHLA1	0.71807	0.5988	1.199	0.2304	0.9176	0.4615
LCHLA2	-0.57077	0.4851	-1.177	0.2394	0.8485	0.5044
LMLD_DEP	2.2913	0.4032	5.683	0.0000	7.1526	2.8620
Sigma	2.0165	0.8828E-01	22.841	0.0000		

Halibut, average weight > 1 kg

Limited Dependent Variable Model - CENSORED regression

Ordinary	least squares regression.	Dep. Variable	LBHAL	
Observations	374	Weights	ONE	
Mean of LHS	0.3444155E+01	Std.Dev of LHS	0.2216326E+01	
StdDev of resid.	0.1933219E+01	Sum of squares	0.1323016E+04	
R-squared	0.2779140E+00	Adj. R-squared	0.2391580E+00	
F[19,	354]	0.7170858E+01	Prob value	0.0000000E+00
Log-likelihood	-0.7669414E+03	Restr.(b=0) Log-l	-0.8278307E+03	
Amemiya Pr. Criter.	0.3937192E+01	Akaike Info.Crit.	0.4208243E+01	
ANOVA	Source	Variation	Deg. freedom	Mean Square
	Regression	0.5091980E+03	19.	0.2679990E+02
	Residual	0.1323016E+04	354.	0.3737335E+01
	Total	0.1832214E+04	373.	0.4912103E+01

N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	-17.851	16.40	-1.089	0.2763		
J162	2.1568	0.5878	3.669	0.0002	0.3289	0.4704
J177	2.9741	0.8362	3.557	0.0004	0.2353	0.4248
J192	4.6804	1.250	3.745	0.0002	0.2273	0.4196
LDEPTH	6.9992	3.233	2.165	0.0304	4.8091	0.5586
L2DEP	-1.0170	0.2741	-3.710	0.0002	23.4383	5.3224
TIMELDEP	-0.85529E-02	0.5611E-02	-1.524	0.1274	846.4649	124.6727
LSTEM	-1.2177	0.9641	-1.263	0.2066	2.2942	0.1865
LGTEM	-2.2955	1.137	-2.019	0.0435	1.7859	0.1739
LSLOPE	0.20461	0.1130	1.811	0.0702	3.1972	0.9813
LMLD	-6.5637	1.674	-3.921	0.0001	1.5095	0.6250
LMSAL	6.1386	4.272	1.437	0.1508	3.4556	0.0334
LMSSAL	-5.4676	7.412	-0.738	0.4607	0.0127	0.0241
VERTVEL	-6.1099	5.097	-1.199	0.2306	-0.0025	0.0202
BMHORVEL	0.73806E-01	0.4734E-01	1.559	0.1190	2.7209	2.9310
SSHRE	0.12446	0.6225E-01	1.999	0.0456	-3.5265	1.8770
LCHLA	-0.29316	0.3297	-0.889	0.3739	0.7189	0.5424
LCHLA1	0.49847	0.5590	0.892	0.3725	0.9176	0.4615
LCHLA2	-0.53682	0.4543	-1.182	0.2374	0.8485	0.5044
LMLD_DEP	1.6323	0.3694	4.419	0.0000	7.1526	2.8620

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Limited Dependent Variable Model - CENSORED regression
Maximum Likelihood Estimates
Log-Likelihood............. -730.62
Threshold values for the model: Lower 0.0000 Upper **********
N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	-26.168	21.25	-1.231	0.2182		
J162	2.9904	0.7632	3.918	0.0001	0.3289	0.4704
J177	4.0626	1.084	3.747	0.0002	0.2353	0.4248
J192	6.5508	1.633	4.013	0.0001	0.2273	0.4196
LDEPTH	9.6981	4.345	2.232	0.0256	4.8091	0.5586
L2DEP	-1.4655	0.3729	-3.930	0.0001	23.4383	5.3224
TIMELDEP	-0.11694E-01	0.7292E-02	-1.604	0.1088	846.4649	124.6727
LSTEM	-1.5266	1.247	-1.224	0.2209	2.2942	0.1865
LGTEM	-3.3208	1.476	-2.250	0.0244	1.7859	0.1739
LSLOPE	0.24185	0.1470	1.646	0.0998	3.1972	0.9813
LMLD	-10.655	2.305	-4.624	0.0000	1.5095	0.6250
LMSAL	8.7282	5.634	1.549	0.1213	3.4556	0.0334
LMSSAL	-13.145	10.58	-1.242	0.2141	0.0127	0.0241
VERTVEL	-7.1632	6.462	-1.108	0.2677	-0.0025	0.0202
BMHORVEL	0.10196	0.6190E-01	1.647	0.0995	2.7209	2.9310
SSHRE	0.16483	0.8050E-01	2.048	0.0406	-3.5265	1.8770
LCHLA	-0.44976	0.4303	-1.045	0.2959	0.7189	0.5424
LCHLA1	0.81429	0.7266	1.121	0.2624	0.9176	0.4615
LCHLA2	-0.77288	0.5905	-1.309	0.1906	0.8485	0.5044
LMLD_DEP	2.6076	0.5114	5.099	0.0000	7.1526	2.8620
Sigma	2.4188	0.1108	21.824	0.0000		

Flatfish, all (obervations where wind data available)

Limited Dependent Variable Model - CENSORED regression

Ordinary	least squares regression.	Dep. Variable	LFLAT	
Observations	263	Weights	ONE	
Mean of LHS	0.5386837E+01	Std.Dev of LHS	0.1870004E+01	
StdDev of resid.	0.1417238E+01	Sum of squares	0.4880812E+03	
R-squared	0.4672717E+00	Adj. R-squared	0.4256181E+00	
F[19,	243]	0.1121803E+02	Prob value	0.0000000E+00
Log-likelihood	-0.4544909E+03	Restr.(b=0) Log-l	-0.5373022E+03	
Amemiya Pr. Criter.	0.2161307E+01	Akaike Info.Crit.	0.3608296E+01	
ANOVA	Source	Variation	Deg. freedom	Mean Square
	Regression	0.4281105E+03	19.	0.2253213E+02
	Residual	0.4880812E+03	243.	0.2008564E+01
	Total	0.9161916E+03	262.	0.3496915E+01

N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	-2553.6	1295.	-1.972	0.0487		
J162	0.77812	0.5873	1.325	0.1852	0.2776	0.4487
J177	-0.23570	1.016	-0.232	0.8165	0.2510	0.4344
J192	-1.4423	1.436	-1.004	0.3152	0.2433	0.4299
LDEPTH	33.119	4.380	7.561	0.0000	4.8978	0.5069
L2DEP	-2.9114	0.4243	-6.862	0.0000	24.2447	4.9856
TIMELDEP	-0.66245E-02	0.4180E-02	-1.585	0.1130	864.3330	121.2768
LGTEM	-19.776	15.55	-1.272	0.2034	1.7545	0.1428
LSLOPE	0.33226	0.1092	3.042	0.0023	3.2086	0.9778
LMTEM	4.0266	2.764	1.457	0.1452	2.0028	0.1968
LMSAL	1494.1	751.6	1.988	0.0468	3.4665	0.0261
LBMSAL	-52.429	10.32	-5.079	0.0000	0.0380	0.0236
VERTVEL	3.9298	3.946	0.996	0.3193	-0.0032	0.0232
HORVELM	-0.10193	0.3948E-01	-2.582	0.0098	15.3185	11.0040
MSHORVEL	0.88084E-01	0.4114E-01	2.141	0.0323	12.8499	10.7104
BMHORVEL	-0.16235	0.4724E-01	-3.437	0.0006	2.8098	2.9352
LCHLA1	0.47578	0.4173	1.140	0.2542	0.8483	0.4133
LCHLA2	-0.74886	0.4172	-1.795	0.0726	0.7532	0.4622
L2GTEM	6.5509	4.285	1.529	0.1263	3.0986	0.5174
L2MSAL	-224.49	109.1	-2.057	0.0397	12.0172	0.1800

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Limited Dependent Variable Model - CENSORED regression
Maximum Likelihood Estimates
Log-Likelihood............. -457.53
Threshold values for the model: Lower 0.0000 Upper **********
N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	-2642.8	1286.	-2.055	0.0399		
J162	0.63877	0.5875	1.087	0.2770	0.2776	0.4487
J177	-0.66665	1.027	-0.649	0.5162	0.2510	0.4344
J192	-1.9952	1.446	-1.380	0.1677	0.2433	0.4299
LDEPTH	36.156	4.533	7.976	0.0000	4.8978	0.5069
L2DEP	-3.1888	0.4389	-7.266	0.0000	24.2447	4.9856
TIMELDEP	-0.70319E-02	0.4163E-02	-1.689	0.0912	864.3330	121.2768
LGTEM	-23.145	15.55	-1.488	0.1367	1.7545	0.1428
LSLOPE	0.32942	0.1085	3.036	0.0024	3.2086	0.9778
LMTEM	5.1148	2.779	1.840	0.0657	2.0028	0.1968
LMSAL	1546.6	746.4	2.072	0.0383	3.4665	0.0261
LBMSAL	-56.455	10.35	-5.457	0.0000	0.0380	0.0236
VERTVEL	4.0933	3.931	1.041	0.2977	-0.0032	0.0232
HORVELM	-0.93561E-01	0.3952E-01	-2.367	0.0179	15.3185	11.0040
MSHORVEL	0.81467E-01	0.4106E-01	1.984	0.0473	12.8499	10.7104
BMHORVEL	-0.17543	0.4729E-01	-3.709	0.0002	2.8098	2.9352
LCHLA1	0.45520	0.4164	1.093	0.2743	0.8483	0.4133
LCHLA2	-0.74056	0.4183	-1.771	0.0766	0.7532	0.4622
L2GTEM	7.5530	4.289	1.761	0.0782	3.0986	0.5174
L2MSAL	-232.77	108.4	-2.148	0.0317	12.0172	0.1800
Sigma	1.4064	0.6318E-01	22.259	0.0000		

Flatfish, all, full sample

Limited Dependent Variable Model - CENSORED regression

Ordinary	least squares regression.	Dep. Variable	LFLAT	
Observations	381	Weights	ONE	
Mean of LHS	0.5595923E+01	Std.Dev of LHS	0.1801840E+01	
StdDev of resid.	0.1528464E+01	Sum of squares	0.8503779E+03	
R-squared	0.3107195E+00	Adj. R-squared	0.2804214E+00	
F[16,	364]	0.1025543E+02	Prob value	0.1805557E-20
Log-likelihood	-0.6935645E+03	Restr.(b=0) Log-l	-0.7644509E+03	
Amemiya Pr. Criter.	0.2440443E+01	Akaike Info.Crit.	0.3729997E+01	
ANOVA	Source	Variation	Deg. freedom	Mean Square
	Regression	0.3833403E+03	16.	0.2395877E+02
	Residual	0.8503779E+03	364.	0.2336203E+01
	Total	0.1233718E+04	380.	0.3246627E+01

N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	66.658	16.34	4.078	0.0000		
J162	0.57483	0.3955	1.453	0.1462	0.3228	0.4682
J177	0.47079	0.4818	0.977	0.3285	0.2336	0.4237
J192	-0.32654	0.6573	-0.497	0.6193	0.2257	0.4186
LDEPTH	11.020	2.312	4.767	0.0000	4.7937	0.5688
L2DEP	-0.98788	0.2190	-4.510	0.0000	23.3024	5.3937
LGTEM	1.7617	0.9067	1.943	0.0520	1.7847	0.1747
LSLOPE	0.30548	0.9090E-01	3.361	0.0008	3.2009	0.9755
LMLD	-1.7468	1.243	-1.405	0.1601	1.5147	0.6330
LMSTEM	6.0196	3.273	1.839	0.0659	-0.0912	0.0537
LMSAL	-26.729	4.994	-5.353	0.0000	3.4544	0.0352
LBMSAL	-22.951	5.972	-3.843	0.0001	0.0403	0.0301
HORVELM	-0.11637	0.3563E-01	-3.266	0.0011	12.9840	10.5078
MSHORVEL	0.90229E-01	0.3723E-01	2.423	0.0154	10.7954	10.0679
BMHORVEL	-0.97203E-01	0.3809E-01	-2.552	0.0107	2.7609	2.9459
LCHLA	-0.26639	0.1685	-1.581	0.1139	0.7226	0.5474
LMLD_DEP	0.31329	0.2699	1.161	0.2457	7.1489	2.8796

****

Limited Dependent Variable Model - CENSORED regression
Maximum Likelihood Estimates
Log-Likelihood............. -700.72
Threshold values for the model: Lower 0.0000 Upper **********
N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	68.759	16.44	4.183	0.0000		
J162	0.54184	0.3975	1.363	0.1729	0.3228	0.4682
J177	0.41089	0.4848	0.848	0.3967	0.2336	0.4237
J192	-0.40207	0.6611	-0.608	0.5431	0.2257	0.4186
LDEPTH	11.118	2.323	4.786	0.0000	4.7937	0.5688
L2DEP	-0.99673	0.2202	-4.527	0.0000	23.3024	5.3937
LGTEM	1.8515	0.9121	2.030	0.0424	1.7847	0.1747
LSLOPE	0.30430	0.9130E-01	3.333	0.0009	3.2009	0.9755
LMLD	-1.9632	1.255	-1.564	0.1178	1.5147	0.6330
LMSTEM	6.2444	3.290	1.898	0.0577	-0.0912	0.0537
LMSAL	-27.404	5.023	-5.456	0.0000	3.4544	0.0352
LBMSAL	-23.924	6.012	-3.979	0.0001	0.0403	0.0301
HORVELM	-0.11518	0.3585E-01	-3.213	0.0013	12.9840	10.5078
MSHORVEL	0.88527E-01	0.3744E-01	2.364	0.0181	10.7954	10.0679
BMHORVEL	-0.10137	0.3833E-01	-2.645	0.0082	2.7609	2.9459
LCHLA	-0.28096	0.1695	-1.658	0.0973	0.7226	0.5474
LMLD_DEP	0.34779	0.2720	1.278	0.2011	7.1489	2.8796
Sigma	1.5348	0.5703E-01	26.914	0.0000		

Flatfish, average weight > 0.5 kg

Limited Dependent Variable Model - CENSORED regression

Ordinary	least squares regression.	Dep. Variable	LBFLAT	
Observations	380	Weights	ONE	
Mean of LHS	0.3833270E+01	Std.Dev of LHS	0.3136294E+01	
StdDev of resid.	0.2825974E+01	Sum of squares	0.2882993E+04	
R-squared	0.2266596E+00	Adj. R-squared	0.1880997E+00	
F[18,	361]	0.5878116E+01	Prob value	0.1970590E-11
Log-likelihood	-0.9242151E+03	Restr.(b=0) Log-l	-0.9730520E+03	
Amemiya Pr. Criter.	0.8385436E+01	Akaike Info.Crit.	0.4964290E+01	
ANOVA	Source	Variation	Deg. freedom	Mean Square
	Regression	0.8449811E+03	18.	0.4694340E+02
	Residual	0.2882993E+04	361.	0.7986130E+01
	Total	0.3727974E+04	379.	0.9836343E+01

N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	2245.4	1293.	1.737	0.0824		
J162	2.2061	0.9116	2.420	0.0155	0.3237	0.4685
J177	2.9253	1.484	1.971	0.0487	0.2342	0.4241
J192	4.1548	2.011	2.066	0.0389	0.2237	0.4173
LDEPTH	-10.339	4.653	-2.222	0.0263	4.7950	0.5690
L2DEP	1.3349	0.4847	2.754	0.0059	23.3147	5.3955
LGTEM	71.379	17.96	3.974	0.0001	1.7844	0.1748
LSLOPE	0.60310	0.1700	3.548	0.0004	3.1984	0.9756
LMLD	-1.5218	0.7217	-2.109	0.0350	1.5198	0.6260
LMTEM	-4.4718	3.565	-1.254	0.2097	1.9668	0.2118
LMSTEM	19.905	6.696	2.973	0.0030	-0.0907	0.0529
LMSAL	-1312.3	753.6	-1.741	0.0816	3.4550	0.0336
LMSSAL	-25.502	14.33	-1.779	0.0752	0.0125	0.0240
LBMSAL	-23.659	11.77	-2.010	0.0444	0.0399	0.0287
HORVELM	-0.13246	0.6602E-01	-2.006	0.0448	13.0181	10.5005
MSHORVEL	0.11947	0.6950E-01	1.719	0.0856	10.8239	10.0659
LCHLA1	0.70629	0.3459	2.042	0.0412	0.9196	0.4705
L2GTEM	-18.465	4.740	-3.896	0.0001	3.2144	0.6562
L2MSAL	188.68	109.7	1.720	0.0855	11.9379	0.2306

****

Limited Dependent Variable Model - CENSORED regression
Maximum Likelihood Estimates
Log-Likelihood............. -794.34
Threshold values for the model: Lower 0.0000 Upper **********
N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	3835.4	1951.	1.966	0.0493		
J162	3.0538	1.387	2.202	0.0277	0.3237	0.4685
J177	4.3090	2.286	1.885	0.0594	0.2342	0.4241
J192	6.6923	3.094	2.163	0.0306	0.2237	0.4173
LDEPTH	-21.097	7.160	-2.947	0.0032	4.7950	0.5690
L2DEP	2.5970	0.7463	3.480	0.0005	23.3147	5.3955
LGTEM	125.55	28.99	4.330	0.0000	1.7844	0.1748
LSLOPE	0.98501	0.2755	3.575	0.0003	3.1984	0.9756
LMLD	-2.5635	1.111	-2.308	0.0210	1.5198	0.6260
LMTEM	-7.6277	5.537	-1.378	0.1683	1.9668	0.2118
LMSTEM	30.724	10.13	3.034	0.0024	-0.0907	0.0529
LMSAL	-2244.3	1138.	-1.973	0.0485	3.4550	0.0336
LMSSAL	-42.533	21.92	-1.941	0.0523	0.0125	0.0240
LBMSAL	-41.613	18.34	-2.269	0.0233	0.0399	0.0287
HORVELM	-0.19004	0.1014	-1.874	0.0610	13.0181	10.5005
MSHORVEL	0.17784	0.1062	1.674	0.0941	10.8239	10.0659
LCHLA1	1.0526	0.5328	1.976	0.0482	0.9196	0.4705
L2GTEM	-32.519	7.659	-4.246	0.0000	3.2144	0.6562
L2MSAL	323.27	165.6	1.952	0.0510	11.9379	0.2306
Sigma	4.0471	0.2044	19.798	0.0000		

Rockfish, all

Limited Dependent Variable Model - CENSORED regression

Ordinary	least squares regression.	Dep. Variable	LROCK	
Observations	415	Weights	ONE	
Mean of LHS	0.2230611E+01	Std.Dev of LHS	0.2518493E+01	
StdDev of resid.	0.1838761E+01	Sum of squares	0.1359179E+04	
R-squared	0.4823993E+00	Adj. R-squared	0.4669485E+00	
F[12,	402]	0.3122170E+02	Prob value	0.2573607E-49
Log-likelihood	-0.8350287E+03	Restr.(b=0) Log-l	-0.9716781E+03	
Amemiya Pr. Criter.	0.3486955E+01	Akaike Info.Crit.	0.4086885E+01	
ANOVA	Source	Variation	Deg. freedom	Mean Square
	Regression	0.1266743E+04	12.	0.1055619E+03
	Residual	0.1359179E+04	402.	0.3381043E+01
	Total	0.2625922E+04	414.	0.6342808E+01

N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	1422.6	369.8	3.847	0.0001		
J162	-1.2637	0.3160	-3.999	0.0001	0.3108	0.4634
J177	-1.3701	0.4226	-3.242	0.0012	0.2578	0.4380
J192	-1.3041	0.5398	-2.416	0.0157	0.2217	0.4159
LDEPTH	-3.6561	2.092	-1.748	0.0805	4.7674	0.5731
L2DEP	0.57280	0.2187	2.619	0.0088	23.0556	5.4133
L2SLOPE	-0.13411E-01	0.1962E-01	-0.684	0.4942	11.1722	5.3092
LBMTEM	-3.8807	1.039	-3.734	0.0002	-0.1073	0.1828
LMSAL	-846.88	216.5	-3.911	0.0001	3.4529	0.0380
LBMSAL	10.041	5.904	1.701	0.0890	0.0399	0.0320
VERTVEL	-8.6183	4.686	-1.839	0.0659	-0.0024	0.0196
BMHORVEL	0.52898E-01	0.4025E-01	1.314	0.1888	2.6973	2.8813
L2MSAL	126.49	31.69	3.991	0.0001	11.9241	0.2597

****

Limited Dependent Variable Model - CENSORED regression

Maximum Likelihood Estimates

Log-Likelihood............. -668.81

Threshold values for the model: Lower 0.0000 Upper **********

N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	1841.9	550.6	3.345	0.0008		
J162	-1.8584	0.5091	-3.650	0.0003	0.3108	0.4634
J177	-1.8095	0.7284	-2.484	0.0130	0.2578	0.4380
J192	-2.2790	0.9834	-2.318	0.0205	0.2217	0.4159
LDEPTH	11.207	4.418	2.537	0.0112	4.7674	0.5731
L2DEP	-0.84570	0.4490	-1.883	0.0596	23.0556	5.4133
L2SLOPE	-0.51155E-01	0.3195E-01	-1.601	0.1093	11.1722	5.3092
LBMTEM	-5.8966	1.814	-3.250	0.0012	-0.1073	0.1828
LMSAL	-1131.7	322.8	-3.506	0.0005	3.4529	0.0380
LBMSAL	30.484	10.56	2.887	0.0039	0.0399	0.0320
VERTVEL	-12.762	6.933	-1.841	0.0656	-0.0024	0.0196
BMHORVEL	0.14213	0.6724E-01	2.114	0.0345	2.6973	2.8813
L2MSAL	170.48	47.33	3.602	0.0003	11.9241	0.2597
Sigma	2.5557	0.1232	20.744	0.0000		

Rockfish, average weight > 0.5 kg

Limited Dependent Variable Model - CENSORED regression

Ordinary	least squares regression.	Dep. Variable	LBROCK	
Observations	391	Weights	ONE	
Mean of LHS	0.1339421E+01	Std.Dev of LHS	0.2389698E+01	
StdDev of resid.	0.2223165E+01	Sum of squares	0.1853424E+04	
R-squared	0.1678070E+00	Adj. R-squared	0.1345193E+00	
F[15,	375]	0.5041109E+01	Prob value	0.3734648E-08
Log-likelihood	-0.8590191E+03	Restr.(b=0) Log-l	-0.8949307E+03	
Amemiya Pr. Criter.	0.5144713E+01	Akaike Info.Crit.	0.4475801E+01	
ANOVA	Source	Variation	Deg. freedom	Mean Square
	Regression	0.3737325E+03	15.	0.2491550E+02
	Residual	0.1853424E+04	375.	0.4942464E+01
	Total	0.2227156E+04	390.	0.5710657E+01

N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	-64.247	20.25	-3.173	0.0015		
J162	-0.74014	0.5727	-1.292	0.1962	0.3171	0.4660
J177	-0.74802	0.7823	-0.956	0.3390	0.2302	0.4215
J192	-1.8074	1.160	-1.558	0.1193	0.2327	0.4231
TIMELDEP	0.93623E-02	0.3178E-02	2.946	0.0032	842.1405	126.7421
LSTEM	0.11830	1.023	0.116	0.9079	2.2926	0.1903
LGTEM	11.193	10.23	1.094	0.2741	1.7858	0.1758
L2SLOPE	-0.22014E-01	0.2438E-01	-0.903	0.3664	11.2754	5.3109
LMLD	1.7334	1.323	1.311	0.1900	1.5073	0.6411
LMSAL	14.083	6.198	2.272	0.0231	3.4524	0.0389
LBMSAL	6.4959	7.952	0.817	0.4140	0.0410	0.0323
VERTVEL	-13.389	5.760	-2.324	0.0201	-0.0024	0.0200
MSHORVEL	-0.13167E-01	0.1447E-01	-0.910	0.3629	10.5688	10.0444
BMHORVEL	0.79452E-01	0.5379E-01	1.477	0.1397	2.7515	2.9133
L2GTEM	-3.0617	2.711	-1.130	0.2587	3.2198	0.6594
LMLD_DEP	-0.45503	0.2926	-1.555	0.1199	7.1040	2.9228

****

Limited Dependent Variable Model - CENSORED regression
Maximum Likelihood Estimates
Log-Likelihood............. -471.12
Threshold values for the model: Lower 0.0000 Upper **********
N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	-410.09	86.33	-4.750	0.0000		
J162	-1.9281	1.745	-1.105	0.2692	0.3171	0.4660
J177	-1.3962	2.429	-0.575	0.5655	0.2302	0.4215
J192	-7.0661	3.660	-1.931	0.0535	0.2327	0.4231
TIMELDEP	0.37971E-01	0.1029E-01	3.689	0.0002	842.1405	126.7421
LSTEM	-6.2988	3.264	-1.930	0.0536	2.2926	0.1903
LGTEM	171.57	49.20	3.487	0.0005	1.7858	0.1758
L2SLOPE	-0.87869E-01	0.7214E-01	-1.218	0.2232	11.2754	5.3109
LMLD	8.5802	4.772	1.798	0.0722	1.5073	0.6411
LMSAL	69.276	23.65	2.929	0.0034	3.4524	0.0389
LBMSAL	58.733	29.96	1.961	0.0499	0.0410	0.0323
VERTVEL	-33.644	16.27	-2.068	0.0386	-0.0024	0.0200
MSHORVEL	-0.63866E-01	0.4067E-01	-1.570	0.1163	10.5688	10.0444
BMHORVEL	0.30568	0.1795	1.703	0.0886	2.7515	2.9133
L2GTEM	-47.574	13.63	-3.491	0.0005	3.2198	0.6594
LMLD_DEP	-2.1410	1.009	-2.121	0.0339	7.1040	2.9228
Sigma	5.0184	0.3764	13.334	0.0000		

APPENDIX B. EQUATIONS FOR SPATIAL DISTRIBUTION OF CATCH PER UNIT OF EFFORT (CPUE) FOR SUMMER AND WINTER, BERING SEA/ALEUTIAN ISLANDS AND GULF OF ALASKA, ESTIMATED FROM 2001 NMFS BOTTOM TRAWL FISHERIES OBSERVER DATA

1. Winter bottom trawl

Selection equation, equations with chlorophyll (IMR2)

Binomial Probit Model
Maximum Likelihood Estimates
Log-Likelihood............. -803.90
Restricted (Slopes 0) Log-L. -4647.4
Chi-Squared (29)............ 7687.1
Significance Level.......... 0.32173E-13
N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	-8.0095	1.824	-4.392	0.0000		
FEB	-0.58440	0.2262	-2.583	0.0098	0.1770	0.3817
MAR	-0.27818	0.2437	-1.141	0.2537	0.1625	0.3689
APR	-0.33022	0.2787	-1.185	0.2361	0.1592	0.3659
NOV	-0.51956	0.2642	-1.967	0.0492	0.1691	0.3748
DEC	-1.3110	0.2641	-4.963	0.0000	0.1633	0.3697
GOA	-0.28827	0.1897	-1.520	0.1285	0.2505	0.4333
LDEPTH	3.9029	0.6864	5.686	0.0000	4.4569	0.9573
L2DEP	-0.45071	0.7256E-01	-6.212	0.0000	20.7804	8.8173
SLOPE	0.25926E-01	0.1530E-01	1.694	0.0902	3.9482	8.2979
SLOPE2	0.17093E-03	0.3905E-03	0.438	0.6616	84.4372	287.8697
SST	0.21348	0.8084E-01	2.641	0.0083	2.4452	2.6567
SST2	-0.50597E-01	0.1390E-01	-3.641	0.0003	11.6614	14.7372
SSTSLOPE	0.22275E-02	0.3028E-02	0.736	0.4620	13.8289	13.0156
SSH	-0.12662E-01	0.1032E-01	-1.227	0.2198	-3.4514	7.7605
SSHSLOPE	-0.20823E-02	0.2055E-02	-1.013	0.3110	32.0651	19.2719
MWIND	-0.43418	0.3434	-1.264	0.2061	2.4399	0.1314
MCHLA	-0.30384	0.1549	-1.962	0.0498	0.3811	0.3658
MCHLA1	0.16545	0.1648	1.004	0.3153	0.4223	0.3927
DWIND	-0.32717	0.1485	-2.204	0.0276	0.2554	0.4361
DCHLA	-0.38978	0.1410	-2.765	0.0057	0.4946	0.5000
DCHLA1	-0.27557	0.1247	-2.211	0.0271	0.6494	0.4772
POLTRAWL	-0.18045	0.1398	-1.291	0.1967	0.4259	0.4510
CODTRAWL	0.64341	0.1811	3.552	0.0004	0.7303	0.3938
ATKTRAWL	1.4558	0.3287	4.429	0.0000	0.0193	0.1173
POLTSSL	0.23449E-01	0.1772	0.132	0.8947	0.1648	0.3710
CODTSSL	0.48325	0.2669	1.810	0.0702	0.1515	0.3577
ATKTSSL	-0.84069	0.3077	-2.732	0.0063	0.1387	0.3448
MIXTSSL	-1.1763	0.3151	-3.733	0.0002	0.0913	0.2871
PORTDIST	-0.17414E-01	0.2034E-02	-8.562	0.0000	63.9429	39.7322

Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

	Predicted		
Actual	0	1	TOTAL
0	9161	3	9164
1	1652	13	1665
Total	10813	16	10829

Selection equation, equations without chlorophyll (IMR3)

Binomial Probit Model
Maximum Likelihood Estimates
Log-Likelihood............. -827.24
Restricted (Slopes 0) Log-L. -4125.9
Chi-Squared (24)............ 6597.3
Significance Level.......... 0.32173E-13
N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	-8.2873	1.709	-4.848	0.0000		
FEB	-0.36374	0.1918	-1.897	0.0579	0.1912	0.3933
MAR	0.20799	0.1758	1.183	0.2369	0.1597	0.3663
APR	0.19676	0.1960	1.004	0.3154	0.1459	0.3530
NOV	-0.46857E-01	0.1865	-0.251	0.8016	0.1877	0.3905
DEC	-0.73421	0.2215	-3.314	0.0009	0.1502	0.3573
GOA	-0.16994	0.1915	-0.887	0.3749	0.2269	0.4189
LDEPTH	3.6863	0.6554	5.624	0.0000	4.6349	0.8986
L2DEP	-0.42507	0.6937E-01	-6.127	0.0000	22.2899	8.6848
SLOPE	0.23553E-01	0.1582E-01	1.489	0.1366	4.6016	9.0754
SLOPE2	0.22750E-03	0.4127E-03	0.551	0.5815	103.5289	316.6736
SST	0.29195	0.8387E-01	3.481	0.0005	2.9045	2.1915
SST2	-0.62001E-01	0.1418E-01	-4.371	0.0000	12.8857	13.7415
SSTSLOPE	0.29445E-02	0.3113E-02	0.946	0.3442	13.5910	12.1874
SSH	-0.13987E-01	0.1072E-01	-1.304	0.1922	-3.2951	6.6821
SSHSLOPE	-0.29155E-02	0.2061E-02	-1.415	0.1572	30.6658	18.2006
LWIND	-0.45863	0.3288	-1.395	0.1631	2.4428	0.1455
POLTRAWL	-0.13340	0.1389	-0.960	0.3368	0.4196	0.4519
CODTRAWL	0.58830	0.1838	3.201	0.0014	0.7504	0.3823
ATKTRAWL	1.7320	0.3335	5.194	0.0000	0.0221	0.1248
POLTSSL	0.58119E-01	0.1852	0.314	0.7536	0.1396	0.3466
CODTSSL	0.35259	0.2944	1.198	0.2311	0.1300	0.3351
ATKTSSL	-0.69082	0.3294	-2.097	0.0360	0.1257	0.3305
MIXTSSL	-1.1321	0.3149	-3.595	0.0003	0.0785	0.2675
PORTDIST	-0.18465E-01	0.2015E-02	-9.165	0.0000	59.9196	38.0269

Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

	Predicted		
Actual	0	1	TOTAL
0	7101	3	7104
1	1577	7	1584
Total	8678	10	8688

Pollock, standard CPUE

Sample Selection Model

Two stage least squares regression.		Dep. Variable	LOGPOLLS			
Observations	1653	Weights	ONE			
Mean of LHS	0.4938884E+00		Std.Dev of LHS		0.5930371E+00	
StdDev of resid.	0.5295141E+00	Sum of squares	0.4547848E+03			
R-squared	0.2022732E+00	Adj. R-squared	0.1875187E+00			
F[30,	1622]	0.1370925E+02	Prob value	0.3217295E-13		
Log-likelihood	-0.1278888E+04		Restr.(b=0) Log-l		-0.1481315E+04	
Amemiya Pr. Criter.		0.2856435E+00	Akaike Info.Crit.		0.1584862E+01	
Standard error corrected for selection.....			0.52995			
Correlation of disturbance in regression						
and Selection Criterion (Rho).............			0.44612E-01			
N(0,1) used for significance levels.						
Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	1.1154	1.140	0.979	0.3278		
FEB	-0.15042	0.1829	-0.822	0.4108	0.1506	0.3578
MAR	-0.37005	0.3468	-1.067	0.2859	0.3315	0.4709
APR	-0.65578	0.5082	-1.290	0.1969	0.2989	0.4579
NOV	-2.2821	1.489	-1.532	0.1255	0.0901	0.2865
DEC	-2.4468	1.622	-1.509	0.1314	0.0321	0.1762
GOA	-1.3082	1.051	-1.245	0.2130	0.1688	0.3747
TIMELDEP	0.50111E-01	0.3452E-01	1.452	0.1466	17.6167	11.9465
LDEPTH	-0.36414	0.4314	-0.844	0.3986	4.5252	0.4984
L2DEP	-0.46261E-03	0.4333E-01	-0.011	0.9915	20.7261	4.8625
SLOPE	-0.25176E-01	0.5478E-02	-4.595	0.0000	3.9975	8.9265
SLOPE2	0.37079E-03	0.1313E-03	2.825	0.0047	95.6138	342.6782
SST	0.16426	0.4515E-01	3.638	0.0003	3.1065	1.3323
SST2	-0.30844E-01	0.1080E-01	-2.856	0.0043	11.2998	7.7299
SSTSLOPE	-0.28840E-02	0.1265E-02	-2.279	0.0227	13.1123	11.4851
SSH	0.12895E-01	0.5204E-02	2.478	0.0132	-5.3569	5.1763
SSHSLOPE	-0.95708E-03	0.8205E-03	-1.166	0.2434	26.4713	17.4774
MWIND	0.34503	0.1548	2.229	0.0258	2.3861	0.1216
MCHLA	0.87458E-01	0.9232E-01	0.947	0.3435	0.4752	0.3091
MCHLA1	-0.80405E-01	0.9173E-01	-0.877	0.3807	0.4445	0.3390
DWIND	0.12052	0.6758E-01	1.783	0.0745	0.0490	0.2159
DCHLA	-0.12035	0.6483E-01	-1.856	0.0634	0.2390	0.4266
DCHLA1	-0.30161E-02	0.5271E-01	-0.057	0.9544	0.3696	0.4829
GLDEPTH	0.93711	0.1131	8.286	0.0000	0.8006	1.7913
GTIMELDE	-0.86798E-01	0.2006E-01	-4.326	0.0000	2.3168	5.6658
GSST	-0.85188E-01	0.9814E-01	-0.868	0.3854	0.8209	1.8344
GSSH	-0.27424E-01	0.1321E-01	-2.075	0.0380	-0.6570	2.5355
GMWIND	-0.79279	0.3654	-2.170	0.0300	0.3997	0.8888
GMCHLA	-0.12001	0.1420	-0.845	0.3981	0.0888	0.2504
GMCHLA1	0.34060	0.3861	0.882	0.3777	0.0497	0.1298
IMR2	0.23642E-01	0.5027E-01	0.470	0.6381	1.8333	0.4828

Pollock, standard CPUE (cont.)

Limited Dependent Variable Model - CENSORED regression
Maximum Likelihood Estimates
Log-Likelihood............. -1398.2
Threshold values for the model: Lower 0.0000 Upper **********
N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	1.0848	1.336	0.812	0.4167		
FEB	-0.25756	0.2090	-1.232	0.2179	0.1508	0.3579
MAR	-0.65751	0.3979	-1.652	0.0985	0.3317	0.4710
APR	-1.0791	0.5832	-1.850	0.0643	0.2979	0.4575
NOV	-3.7238	1.715	-2.171	0.0299	0.0899	0.2861
DEC	-4.0426	1.869	-2.162	0.0306	0.0320	0.1760
GOA	-2.3676	1.303	-1.817	0.0692	0.1683	0.3742
TIMELDEP	0.85701E-01	0.3983E-01	2.152	0.0314	17.5926	11.9387
LDEPTH	-0.38976	0.5074	-0.768	0.4424	4.5262	0.4981
L2DEP	-0.69750E-02	0.5060E-01	-0.138	0.8904	20.7345	4.8581
SLOPE	-0.41843E-01	0.6649E-02	-6.293	0.0000	4.0358	8.9858
SLOPE2	0.56804E-03	0.1606E-03	3.537	0.0004	96.9843	345.8335
SST	0.16687	0.5200E-01	3.209	0.0013	3.1077	1.3310
SST2	-0.34356E-01	0.1227E-01	-2.800	0.0051	11.3046	7.7231
SSTSLOPE	-0.33352E-02	0.1474E-02	-2.262	0.0237	13.0894	11.4765
SSH	0.16015E-01	0.6061E-02	2.642	0.0082	-5.3576	5.1789
SSHSLOPE	-0.10924E-02	0.9511E-03	-1.149	0.2507	26.5137	17.5059
MWIND	0.43538	0.1826	2.385	0.0171	2.3863	0.1215
MCHLA	0.98047E-01	0.1037	0.945	0.3445	0.4746	0.3089
MCHLA1	-0.74557E-01	0.1026	-0.727	0.4672	0.4437	0.3389
DWIND	0.10749	0.8102E-01	1.327	0.1846	0.0489	0.2156
DCHLA	-0.14061	0.7484E-01	-1.879	0.0603	0.2394	0.4269
DCHLA1	0.14144E-01	0.5972E-01	0.237	0.8128	0.3703	0.4830
GLDEPTH	1.5109	0.1392	10.853	0.0000	0.7982	1.7891
GTIMELDE	-0.14220	0.2449E-01	-5.807	0.0000	2.3099	5.6586
GSST	-0.27316	0.1174	-2.326	0.0200	0.8184	1.8322
GSSH	-0.47740E-01	0.1682E-01	-2.838	0.0045	-0.6551	2.5319
GMWIND	-0.90118	0.4478	-2.013	0.0442	0.3985	0.8878
GMCHLA	-0.27502	0.2025	-1.358	0.1744	0.0885	0.2501
GMCHLA1	0.58058	0.4593	1.264	0.2062	0.0496	0.1296
IMR2	-0.31325E-01	0.5813E-01	-0.539	0.5900	1.8289	0.4856
Sigma	0.58721	0.1127E-01	52.082	0.0000		

Pollock, standard CPUE (cont.)

ML Estimates of Selection Model
Maximum Likelihood Estimates
Log-Likelihood............. -4626.4
LHS is CENSORED. Tobit Model fit by MLE.
FIRST 30 estimates are probit equation.
N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	-4.1264	1.232	-3.349	0.0008		
FEB	0.98613E-01	0.1709	0.577	0.5639		
MAR	0.37777	0.3067	1.232	0.2181		
APR	0.58488	0.4458	1.312	0.1895		
NOV	1.1308	1.270	0.891	0.3731		
DEC	1.3228	1.384	0.956	0.3393		
GOA	-0.14458	1.335	-0.108	0.9138		
TIMELDEP	-0.34752E-01	0.2935E-01	-1.184	0.2364		
LDEPTH	1.7974	0.4519	3.977	0.0001		
L2DEP	-0.22567	0.4269E-01	-5.287	0.0000		
SLOPE	-0.19990E-01	0.8378E-02	-2.386	0.0170		
SLOPE2	0.56498E-03	0.2294E-03	2.463	0.0138		
SST	0.36798	0.4871E-01	7.554	0.0000		
SST2	-0.53505E-01	0.1187E-01	-4.509	0.0000		
SSTSLOPE	0.14164E-03	0.1674E-02	0.085	0.9325		
SSH	0.21621E-01	0.6149E-02	3.516	0.0004		
SSHSLOPE	-0.33315E-02	0.1036E-02	-3.214	0.0013		
MWIND	0.53113E-01	0.2104	0.252	0.8007		
MCHLA	0.12475E-01	0.1135	0.110	0.9125		
MCHLA1	0.19246	0.1211	1.590	0.1119		
DWIND	-0.18806	0.7618E-01	-2.468	0.0136		
DCHLA	-0.37030	0.7953E-01	-4.656	0.0000		
DCHLA1	-0.27602	0.6146E-01	-4.491	0.0000		
GLDEPTH	1.1358	0.1040	10.921	0.0000		
GTIMELDE	-0.11683	0.2030E-01	-5.755	0.0000		
GSST	-0.35817	0.8837E-01	-4.053	0.0001		
GSSH	-0.43281E-01	0.1345E-01	-3.217	0.0013		
GMWIND	-1.0219	0.4806	-2.126	0.0335		
GMCHLA	-0.11160	0.2064	-0.541	0.5888		
GMCHLA1	-0.41817	0.3863	-1.082	0.2791		
SIGMA(1)	0.88965	0.1663E-01	53.499	0.0000		
RHO(1,2)	0.97103	0.5738E-02	169.218	0.0000		

Pacific Cod, CPUE

Sample Selection Model

Two stage least squares regression.		Dep. Variable	LOGPCOD			
Observations	1653	Weights	ONE			
Mean of LHS	0.4016436E+00	Std.Dev of LHS	0.4578468E+00			
StdDev of resid.	0.3778806E+00		Sum of squares		0.2316115E+03	
R-squared	0.3183967E+00	Adj. R-squared	0.3057900E+00			
F[30,	1622]	0.2525611E+02	Prob value	0.3217295E-13		
Log-likelihood	-0.7211968E+03		Restr.(b=0) Log-l		-0.1053648E+04	
Amemiya Pr. Criter.		0.1454717E+00	Akaike Info.Crit.		0.9100990E+00	
Standard error corrected for selection.....			0.37804			
Correlation of disturbance in regression						
and Selection Criterion (Rho).............			-0.34165E-01			
N(0,1) used for significance levels.						
Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	-0.34035	0.8704	-0.391	0.6958		
FEB	0.26840	0.1298	2.067	0.0387	0.1506	0.3578
MAR	0.27857	0.2469	1.128	0.2592	0.3315	0.4709
APR	0.21542	0.3635	0.593	0.5535	0.2989	0.4579
NOV	-0.38747	1.065	-0.364	0.7159	0.0901	0.2865
DEC	-0.59297	1.157	-0.512	0.6084	0.0321	0.1762
GOA	0.60395	0.7511	0.804	0.4214	0.1688	0.3747
TIMELDEP	0.87670E-02	0.2468E-01	0.355	0.7225	17.6167	11.9465
LDEPTH	0.60747	0.3311	1.835	0.0665	4.5252	0.4984
L2DEP	-0.91019E-01	0.3371E-01	-2.700	0.0069	20.7261	4.8625
SLOPE	0.31871E-01	0.4234E-02	7.528	0.0000	3.9975	8.9265
SLOPE2	-0.56813E-03	0.9254E-04	-6.140	0.0000	95.6138	342.6782
SST	-0.26935	0.3413E-01	-7.892	0.0000	3.1065	1.3323
SST2	0.43395E-01	0.7856E-02	5.524	0.0000	11.2998	7.7299
SSTSLOPE	-0.15933E-02	0.9065E-03	-1.758	0.0788	13.1123	11.4851
SSH	0.16291E-01	0.3711E-02	4.390	0.0000	-5.3569	5.1763
SSHSLOPE	0.14028E-02	0.5978E-03	2.347	0.0189	26.4713	17.4774
MWIND	0.11299	0.1097	1.030	0.3032	2.3861	0.1216
MCHLA	-0.43405	0.6560E-01	-6.616	0.0000	0.4752	0.3091
MCHLA1	-0.19937	0.6630E-01	-3.007	0.0026	0.4445	0.3390
DWIND	0.16400	0.4901E-01	3.347	0.0008	0.0490	0.2159
DCHLA	0.11784E-01	0.4757E-01	0.248	0.8043	0.2390	0.4266
DCHLA1	-0.79232E-01	0.3865E-01	-2.050	0.0404	0.3696	0.4829
GLDEPTH	-0.45225	0.8058E-01	-5.612	0.0000	0.8006	1.7913
GTIMELDE	0.16988E-01	0.1431E-01	1.187	0.2351	2.3168	5.6658
GSST	0.61049E-01	0.6931E-01	0.881	0.3784	0.8209	1.8344
GSSH	0.28799E-02	0.9423E-02	0.306	0.7599	-0.6570	2.5355
GMWIND	0.39574	0.2607	1.518	0.1291	0.3997	0.8888
GMCHLA	0.24716	0.1015	2.436	0.0149	0.0888	0.2504
GMCHLA1	-0.45681	0.2783	-1.642	0.1007	0.0497	0.1298
IMR2	-0.12916E-01	0.6029E-01	-0.214	0.8304	1.1629	0.3469

Pacific Cod, CPUE (cont.)

Limited Dependent Variable Model - CENSORED regression
Maximum Likelihood Estimates
Log-Likelihood............. -836.10
Threshold values for the model: Lower 0.0000 Upper **********
N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	-4.5811	0.9639	-4.753	0.0000		
FEB	0.45632	0.1401	3.257	0.0011	0.1510	0.3581
MAR	0.63246	0.2668	2.370	0.0178	0.3309	0.4707
APR	0.75070	0.3913	1.919	0.0550	0.2983	0.4577
NOV	1.1011	1.152	0.956	0.3393	0.0900	0.2862
DEC	1.0698	1.255	0.853	0.3938	0.0320	0.1761
GOA	1.5165	0.8081	1.877	0.0606	0.1685	0.3744
TIMELDEP	-0.26526E-01	0.2670E-01	-0.994	0.3204	17.5967	11.9453
LDEPTH	2.3686	0.3710	6.385	0.0000	4.5260	0.4983
L2DEP	-0.27027	0.3711E-01	-7.283	0.0000	20.7325	4.8607
SLOPE	0.30314E-01	0.4177E-02	7.257	0.0000	4.0364	8.9912
SLOPE2	-0.50497E-03	0.9921E-04	-5.090	0.0000	97.0856	346.0301
SST	-0.24102	0.3388E-01	-7.114	0.0000	3.1073	1.3317
SST2	0.39899E-01	0.8133E-02	4.906	0.0000	11.3035	7.7274
SSTSLOPE	-0.94942E-03	0.9545E-03	-0.995	0.3199	13.0978	11.4800
SSH	0.20636E-01	0.3927E-02	5.255	0.0000	-5.3587	5.1819
SSHSLOPE	0.10670E-02	0.6211E-03	1.718	0.0858	26.4999	17.4975
MWIND	0.80353E-01	0.1154	0.696	0.4863	2.3863	0.1216
MCHLA	-0.45601	0.6975E-01	-6.537	0.0000	0.4747	0.3091
MCHLA1	-0.18075	0.6914E-01	-2.614	0.0089	0.4438	0.3390
DWIND	0.15257	0.5143E-01	2.966	0.0030	0.0489	0.2158
DCHLA	-0.28402E-01	0.4859E-01	-0.585	0.5588	0.2397	0.4271
DCHLA1	-0.12141	0.3971E-01	-3.057	0.0022	0.3708	0.4832
GLDEPTH	-0.71826	0.9939E-01	-7.226	0.0000	0.7991	1.7900
GTIMELDE	0.44300E-02	0.1623E-01	0.273	0.7849	2.3127	5.6615
GSST	0.73247E-01	0.7624E-01	0.961	0.3367	0.8194	1.8331
GSSH	-0.55089E-02	0.1040E-01	-0.530	0.5963	-0.6558	2.5334
GMWIND	0.49946	0.2768	1.805	0.0711	0.3990	0.8882
GMCHLA	0.34294	0.1083	3.166	0.0015	0.0886	0.2502
GMCHLA1	-0.46969	0.3011	-1.560	0.1188	0.0496	0.1297
IMR2	0.93349E-01	0.3800E-01	2.457	0.0140	1.8293	0.4856
Sigma	0.39417	0.7186E-02	54.851	0.0000		

Pacific Cod, CPUE (cont.)

ML Estimates of Selection Model
Maximum Likelihood Estimates
Log-Likelihood............. -4088.5
LHS is CENSORED. Tobit Model fit by MLE.
FIRST 30 estimates are probit equation.
N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	-7.2310	0.8258	-8.756	0.0000		
FEB	0.45676	0.1256	3.637	0.0003		
MAR	0.82684	0.2313	3.575	0.0004		
APR	1.1856	0.3407	3.480	0.0005		
NOV	2.5329	0.9725	2.605	0.0092		
DEC	2.6828	1.051	2.553	0.0107		
GOA	0.73664	0.6481	1.137	0.2557		
TIMELDEP	-0.64675E-01	0.2215E-01	-2.920	0.0035		
LDEPTH	3.4550	0.3167	10.908	0.0000		
L2DEP	-0.38971	0.2937E-01	-13.270	0.0000		
SLOPE	0.37766E-01	0.4092E-02	9.228	0.0000		
SLOPE2	-0.44846E-03	0.9988E-04	-4.490	0.0000		
SST	0.77759E-02	0.2956E-01	0.263	0.7925		
SST2	-0.10414E-04	0.8001E-02	-0.001	0.9990		
SSTSLOPE	0.55426E-03	0.9146E-03	0.606	0.5445		
SSH	0.21176E-01	0.4207E-02	5.033	0.0000		
SSHSLOPE	-0.41704E-03	0.6674E-03	-0.625	0.5321		
MWIND	-0.69156E-01	0.1025	-0.675	0.5000		
MCHLA	-0.38958	0.7398E-01	-5.266	0.0000		
MCHLA1	-0.38286E-02	0.9325E-01	-0.041	0.9673		
DWIND	-0.71155E-01	0.4193E-01	-1.697	0.0897		
DCHLA	-0.16925	0.4913E-01	-3.445	0.0006		
DCHLA1	-0.25188	0.4418E-01	-5.702	0.0000		
GLDEPTH	-0.37785	0.7760E-01	-4.869	0.0000		
GTIMELDE	0.16939E-01	0.1290E-01	1.313	0.1892		
GSST	-0.15007E-01	0.5949E-01	-0.252	0.8008		
GSSH	0.13846E-01	0.7467E-02	1.854	0.0637		
GMWIND	0.40362	0.2273	1.776	0.0757		
GMCHLA	0.14655	0.8716E-01	1.681	0.0927		
GMCHLA1	-0.79825	0.2400	-3.326	0.0009		
SIGMA(1)	0.60701	0.1138E-01	53.345	0.0000		
RHO(1,2)	0.96156	0.5675E-02	169.443	0.0000		

Pacific cod, standard CPUE

Sample Selection Model

Two stage least squares regression.	Dep. Variable	LOGPCODS		
Observations	1653	Weights	ONE	
Mean of LHS	0.5852257E+00	Std.Dev of LHS	0.6311426E+00	
StdDev of resid.	0.4941459E+00	Sum of squares	0.3960602E+03	
R-squared	0.3866361E+00	Adj. R-squared	0.3752915E+00	
F[30,	1622]	0.3408112E+02	Prob value	0.3217295E-13
Log-likelihood	-0.1164618E+04		Restr.(b=0) Log-l	-0.1584256E+04
Amemiya Pr. Criter.		0.2487594E+00	Akaike Info.Crit.	0.1446604E+01
Standard error corrected for selection.....			0.51396	
Correlation of disturbance in regression				
and Selection Criterion (Rho).............			0.32420	
N(0,1) used for significance levels.				

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	-1.8615	1.131	-1.646	0.0997		
FEB	0.23511	0.1699	1.384	0.1665	0.1506	0.3578
MAR	-0.50209E-01	0.3220	-0.156	0.8761	0.3315	0.4709
APR	-0.34159	0.4737	-0.721	0.4709	0.2989	0.4579
NOV	-2.3463	1.384	-1.695	0.0901	0.0901	0.2865
DEC	-2.6294	1.505	-1.747	0.0806	0.0321	0.1762
GOA	2.2027	0.9816	2.244	0.0248	0.1688	0.3747
TIMELDEP	0.47112E-01	0.3206E-01	1.470	0.1417	17.6167	11.9465
LDEPTH	1.3597	0.4333	3.138	0.0017	4.5252	0.4984
L2DEP	-0.19238	0.4435E-01	-4.338	0.0000	20.7261	4.8625
SLOPE	0.32883E-01	0.5784E-02	5.686	0.0000	3.9975	8.9265
SLOPE2	-0.54462E-03	0.1239E-03	-4.396	0.0000	95.6138	342.6782
SST	-0.25440	0.4350E-01	-5.848	0.0000	3.1065	1.3323
SST2	0.41775E-01	0.1022E-01	4.087	0.0000	11.2998	7.7299
SSTSLOPE	-0.24015E-02	0.1207E-02	-1.989	0.0467	13.1123	11.4851
SSH	0.32392E-01	0.4910E-02	6.597	0.0000	-5.3569	5.1763
SSHSLOPE	0.21011E-02	0.7808E-03	2.691	0.0071	26.4713	17.4774
MWIND	0.16945	0.1458	1.163	0.2450	2.3861	0.1216
MCHLA	-0.48255	0.8668E-01	-5.567	0.0000	0.4752	0.3091
MCHLA1	-0.17339	0.8625E-01	-2.010	0.0444	0.4445	0.3390
DWIND	0.91711E-01	0.6415E-01	1.430	0.1528	0.0490	0.2159
DCHLA	-0.98280E-01	0.6258E-01	-1.570	0.1163	0.2390	0.4266
DCHLA1	-0.18044	0.5224E-01	-3.454	0.0006	0.3696	0.4829
GLDEPTH	-0.59690	0.1053	-5.668	0.0000	0.8006	1.7913
GTIMELDE	0.15717E-01	0.1872E-01	0.840	0.4011	2.3168	5.6658
GSST	-0.79708E-01	0.9060E-01	-0.880	0.3790	0.8209	1.8344
GSSH	0.11185E-01	0.1230E-01	0.909	0.3633	-0.6570	2.5355
GMWIND	0.41358	0.3414	1.211	0.2258	0.3997	0.8888
GMCHLA	0.62346E-01	0.1325	0.471	0.6380	0.0888	0.2504
GMCHLA1	-0.32412	0.3622	-0.895	0.3709	0.0497	0.1298
IMR2	0.16663	0.7790E-01	2.139	0.0324	1.1639	0.3593

Pacific cod, standard CPUE (cont.)

Limited Dependent Variable Model - CENSORED regression
Maximum Likelihood Estimates
Log-Likelihood............. -1251.5
Threshold values for the model: Lower 0.0000 Upper **********
N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	-6.3956	1.267	-5.048	0.0000		
FEB	0.45232	0.1837	2.462	0.0138	0.1510	0.3581
MAR	0.34229	0.3499	0.978	0.3280	0.3309	0.4707
APR	0.24404	0.5131	0.476	0.6344	0.2983	0.4577
NOV	-0.61666	1.511	-0.408	0.6833	0.0900	0.2862
DEC	-0.69585	1.646	-0.423	0.6724	0.0320	0.1761
GOA	3.2275	1.058	3.050	0.0023	0.1685	0.3744
TIMELDEP	0.79667E-02	0.3502E-01	0.228	0.8200	17.5967	11.9453
LDEPTH	3.2265	0.4874	6.620	0.0000	4.5260	0.4983
L2DEP	-0.37358	0.4863E-01	-7.681	0.0000	20.7325	4.8607
SLOPE	0.24030E-01	0.5474E-02	4.390	0.0000	4.0364	8.9912
SLOPE2	-0.43733E-03	0.1301E-03	-3.363	0.0008	97.0856	346.0301
SST	-0.25286	0.4443E-01	-5.691	0.0000	3.1073	1.3317
SST2	0.40570E-01	0.1066E-01	3.804	0.0001	11.3035	7.7274
SSTSLOPE	-0.20002E-02	0.1252E-02	-1.597	0.1102	13.0978	11.4800
SSH	0.36651E-01	0.5154E-02	7.111	0.0000	-5.3587	5.1819
SSHSLOPE	0.20999E-02	0.8134E-03	2.582	0.0098	26.4999	17.4975
MWIND	0.18850	0.1513	1.246	0.2127	2.3863	0.1216
MCHLA	-0.47418	0.9140E-01	-5.188	0.0000	0.4747	0.3091
MCHLA1	-0.19012	0.9065E-01	-2.097	0.0360	0.4438	0.3390
DWIND	0.11420	0.6719E-01	1.700	0.0892	0.0489	0.2158
DCHLA	-0.97964E-01	0.6375E-01	-1.537	0.1244	0.2397	0.4271
DCHLA1	-0.16553	0.5207E-01	-3.179	0.0015	0.3708	0.4832
GLDEPTH	-0.92506	0.1280	-7.229	0.0000	0.7991	1.7900
GTIMELDE	-0.69064E-02	0.2118E-01	-0.326	0.7443	2.3127	5.6615
GSST	-0.63529E-01	0.9966E-01	-0.637	0.5238	0.8194	1.8331
GSSH	-0.16994E-02	0.1360E-01	-0.125	0.9005	-0.6558	2.5334
GMWIND	0.60086	0.3624	1.658	0.0973	0.3990	0.8882
GMCHLA	0.19110	0.1419	1.347	0.1779	0.0886	0.2502
GMCHLA1	-0.67475E-01	0.3927	-0.172	0.8636	0.0496	0.1297
IMR2	0.81921E-01	0.4980E-01	1.645	0.1000	1.8293	0.4856
Sigma	0.51663	0.9425E-02	54.815	0.0000		

Pacific cod, standard CPUE (cont.)

ML Estimates of Selection Model
Maximum Likelihood Estimates
Log-Likelihood............. -4566.3
LHS is CENSORED. Tobit Model fit by MLE.
FIRST 30 estimates are probit equation.
N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	-6.3867	1.286	-4.966	0.0000		
FEB	0.45635	0.2193	2.081	0.0375		
MAR	0.37182	0.4336	0.858	0.3911		
APR	0.31363	0.6440	0.487	0.6263		
NOV	-0.32962	1.885	-0.175	0.8612		
DEC	-0.38884	2.036	-0.191	0.8486		
GOA	3.3144	0.9396	3.527	0.0004		
TIMELDEP	0.14914E-02	0.4311E-01	0.035	0.9724		
LDEPTH	3.2197	0.4993	6.448	0.0000		
L2DEP	-0.36956	0.4759E-01	-7.765	0.0000		
SLOPE	0.25667E-01	0.4666E-02	5.501	0.0000		
SLOPE2	-0.47429E-03	0.1005E-03	-4.718	0.0000		
SST	-0.26058	0.4351E-01	-5.989	0.0000		
SST2	0.41794E-01	0.1195E-01	3.497	0.0005		
SSTSLOPE	-0.20963E-02	0.1247E-02	-1.681	0.0927		
SSH	0.35638E-01	0.5527E-02	6.448	0.0000		
SSHSLOPE	0.21735E-02	0.8050E-03	2.700	0.0069		
MWIND	0.20655	0.1310	1.576	0.1149		
MCHLA	-0.45320	0.1115	-4.064	0.0000		
MCHLA1	-0.19234	0.1506	-1.277	0.2014		
DWIND	0.11284	0.4940E-01	2.284	0.0224		
DCHLA	-0.90226E-01	0.6071E-01	-1.486	0.1372		
DCHLA1	-0.15534	0.5928E-01	-2.621	0.0088		
GLDEPTH	-0.94200	0.1275	-7.389	0.0000		
GTIMELDE	-0.40522E-02	0.2032E-01	-0.199	0.8420		
GSST	-0.66750E-01	0.9346E-01	-0.714	0.4751		
GSSH	-0.28497E-03	0.1100E-01	-0.026	0.9793		
GMWIND	0.60259	0.3084	1.954	0.0507		
GMCHLA	0.19075	0.1428	1.336	0.1817		
GMCHLA1	-0.87730E-01	0.3621	-0.242	0.8085		
SIGMA(1)	0.51882	0.8805E-02	58.922	0.0000		
RHO(1,2)	0.13195	0.1042	1.266	0.2054		

Atka mackerel, standard CPUE

Sample Selection Model

Two stage least squares regression.		Dep. Variable	LOGATKAS			
Observations	1581	Weights	ONE			
Mean of LHS	0.9712528E-01	Std.Dev of LHS	0.5179737E+00			
StdDev of resid.	0.3773482E+00	Sum of squares	0.2217039E+03			
R-squared	0.4770010E+00	Adj. R-squared	0.4692753E+00			
F[23,	1557]	0.6174180E+02	Prob value	0.3217295E-13		
Log-likelihood	-0.6904281E+03		Restr.(b=0) Log-l		-0.1202811E+04	
Amemiya Pr. Criter.		0.1445532E+00	Akaike Info.Crit.		0.9037674E+00	
ANOVA	Source	Variation	Deg. freedom			Mean Square
	Regression	0.2022049E+03		23.	0.8791520E+01	
	Residual	0.2217039E+03		1557.	0.1423917E+00	
	Total	0.4239088E+03		1580.	0.2682967E+00	

N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	-2.5075	0.7676	-3.267	0.0011		
FEB	0.36633	0.1212	3.023	0.0025	0.1467	0.3540
MAR	0.71386	0.2365	3.018	0.0025	0.3302	0.4704
APR	1.4063	0.3496	4.023	0.0001	0.3017	0.4591
NOV	7.2145	1.047	6.891	0.0000	0.0942	0.2923
DEC	7.5766	1.158	6.542	0.0000	0.0335	0.1801
GOA	0.24173	0.7217	0.335	0.7377	0.1569	0.3638
TIMELDEP	-0.18106	0.2456E-01	-7.371	0.0000	17.8641	12.1146
LDEPTH	1.2558	0.2925	4.293	0.0000	4.5226	0.4979
L2DEP	-0.73829E-01	0.2914E-01	-2.534	0.0113	20.7017	4.8728
SLOPE	0.41723E-01	0.4121E-02	10.125	0.0000	3.6965	8.5220
SLOPE2	-0.46303E-03	0.1018E-03	-4.548	0.0000	86.2419	319.1512
SST	0.47862E-01	0.3521E-01	1.359	0.1741	3.1015	1.2961
SST2	0.15012E-02	0.7932E-02	0.189	0.8499	11.2162	7.6731
SSTSLOPE	0.19233E-02	0.9740E-03	1.975	0.0483	12.9840	11.0375
SSH	-0.55611E-01	0.3852E-02	-14.438	0.0000	-5.4090	5.1606
SSHSLOPE	0.13469E-02	0.6036E-03	2.231	0.0257	25.7042	17.0200
LWIND	-0.21809	0.1102	-1.979	0.0478	2.3851	0.1233
GLDEPTH	-0.46192	0.7445E-01	-6.205	0.0000	0.7443	1.7397
GTIMELDE	0.80349E-01	0.1155E-01	6.956	0.0000	2.1758	5.5440
GSST	-0.48696E-01	0.7236E-01	-0.673	0.5010	0.7697	1.7962
GSSH	0.59079E-01	0.1065E-01	5.548	0.0000	-0.5913	2.3521
GLWIND	0.47128	0.2537	1.858	0.0632	0.3706	0.8612
IMR3	-0.27612E-01	0.3475E-01	-0.795	0.4268	1.8369	0.4658

Atka mackerel, standard CPUE (cont.)

Limited Dependent Variable Model - CENSORED regression
Maximum Likelihood Estimates
Log-Likelihood............. -301.66
Threshold values for the model: Lower 0.0000 Upper **********
N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	-34.660	11.60	-2.988	0.0028		
FEB	3.8767	1.453	2.669	0.0076	0.1467	0.3540
MAR	7.4859	2.822	2.653	0.0080	0.3302	0.4704
APR	11.374	4.143	2.745	0.0060	0.3017	0.4591
NOV	38.969	26.25	1.485	0.1376	0.0942	0.2923
DEC	47.706	13.72	3.477	0.0005	0.0335	0.1801
GOA	-8.4889	9.698	-0.875	0.3814	0.1569	0.3638
TIMELDEP	-1.0691	0.2922	-3.659	0.0003	17.8641	12.1146
LDEPTH	14.818	4.787	3.095	0.0020	4.5226	0.4979
L2DEP	-1.2947	0.4866	-2.661	0.0078	20.7017	4.8728
SLOPE	0.17656	0.2213E-01	7.978	0.0000	3.6965	8.5220
SLOPE2	-0.25598E-02	0.4588E-03	-5.580	0.0000	86.2419	319.1512
SST	0.21850	0.2181	1.002	0.3165	3.1015	1.2961
SST2	0.31178E-01	0.5390E-01	0.578	0.5630	11.2162	7.6731
SSTSLOPE	0.20967E-01	0.6283E-02	3.337	0.0008	12.9840	11.0375
SSH	-0.14980	0.2583E-01	-5.799	0.0000	-5.4090	5.1606
SSHSLOPE	0.84141E-02	0.4288E-02	1.962	0.0497	25.7042	17.0200
LWIND	-1.7169	0.5096	-3.369	0.0008	2.3851	0.1233
GLDEPTH	-0.73699	0.9166	-0.804	0.4214	0.7443	1.7397
GTIMELDE	0.72536E-01	0.1191	0.609	0.5426	2.1758	5.5440
GSST	-2.0576	0.6663	-3.088	0.0020	0.7697	1.7962
GSSH	0.39086E-01	0.1059	0.369	0.7120	-0.5913	2.3521
GLWIND	8.2018	3.358	2.442	0.0146	0.3706	0.8612
IMR3	0.14239	0.2502	0.569	0.5692	1.8369	0.4658
Sigma	1.2081	0.8352E-01	14.466	0.0000		

Atka mackerel, standard CPUE (cont.)

ML Estimates of Selection Model
Maximum Likelihood Estimates
Log-Likelihood............. -3700.3
LHS is CENSORED. Tobit Model fit by MLE.
FIRST 25 estimates are probit equation.
N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	-25.650	16.27	-1.577	0.1149		
FEB	2.5945	1.996	1.300	0.1936		
MAR	5.3704	3.816	1.407	0.1594		
APR	7.8817	5.663	1.392	0.1640		
NOV	30.922	4108.	0.008	0.9940		
DEC	38.664	18.61	2.078	0.0377		
GOA	4.7623	6.405	0.743	0.4572		
TIMELDEP	-0.86924	0.3946	-2.203	0.0276		
LDEPTH	11.894	6.859	1.734	0.0829		
L2DEP	-1.0056	0.7298	-1.378	0.1682		
SLOPE	0.17329	0.2808E-01	6.172	0.0000		
SLOPE2	-0.29793E-02	0.5322E-03	-5.598	0.0000		
SST	0.23424	0.1940	1.207	0.2273		
SST2	-0.19454E-01	0.5202E-01	-0.374	0.7084		
SSTSLOPE	0.89657E-02	0.5497E-02	1.631	0.1029		
SSH	-0.11840	0.2624E-01	-4.513	0.0000		
SSHSLOPE	0.11803E-01	0.5106E-02	2.312	0.0208		
LWIND	-1.8455	0.5698	-3.239	0.0012		
GLDEPTH	-0.77086	1.749	-0.441	0.6594		
GTIMELDE	0.55854E-01	0.1737	0.321	0.7478		
GSST	-1.3869	0.8370	-1.657	0.0975		
GSSH	0.35503E-01	0.1585	0.224	0.8227		
GLWIND	1.8487	0.5711	3.237	0.0012		
SIGMA(1)	1.5309	0.1964	7.796	0.0000		
RHO(1,2)	-0.64896	0.1448	-4.482	0.0000		

Black cod, standard CPUE

Sample Selection Model
Two stage least squares regression. Dep. Variable LOGBCODS
Observations 1653 Weights ONE
Mean of LHS 0.1877368E-01 Std.Dev of LHS 0.1331380E+00
StdDev of resid. 0.1099445E+00 Sum of squares 0.1960639E+02
R-squared 0.3176522E+00 Adj. R-squared 0.3050317E+00
F[30, 1622] 0.2516956E+02 Prob value 0.3217295E-13
Log-likelihood 0.1319602E+04 Restr.(b=0) Log-l 0.9880533E+03
Amemiya Pr. Criter. 0.1231448E-01 Akaike Info.Crit. -0.1559107E+01
Standard error corrected for selection..... 0.11313
Correlation of disturbance in regression
and Selection Criterion (Rho)............. -0.28055
N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	2.4274	0.2362	10.276	0.0000		
FEB	0.79184E-02	0.3793E-01	0.209	0.8346	0.1506	0.3578
MAR	0.53221E-01	0.7198E-01	0.739	0.4597	0.3315	0.4709
APR	0.61085E-01	0.1059	0.577	0.5639	0.2989	0.4579
NOV	0.35221	0.3101	1.136	0.2560	0.0901	0.2865
DEC	0.39322	0.3375	1.165	0.2440	0.0321	0.1762
GOA	0.78183E-01	0.2188	0.357	0.7208	0.1688	0.3747
TIMELDEP	-0.80420E-02	0.7177E-02	-1.121	0.2625	17.6167	11.9465
LDEPTH	-1.0480	0.8925E-01	-11.742	0.0000	4.5252	0.4984
L2DEP	0.12000	0.8940E-02	13.423	0.0000	20.7261	4.8625
SLOPE	0.19162E-03	0.1173E-02	0.163	0.8703	3.9975	8.9265
SLOPE2	-0.15904E-04	0.2722E-04	-0.584	0.5591	95.6138	342.6782
SST	-0.62122E-02	0.9342E-02	-0.665	0.5061	3.1065	1.3323
SST2	0.24332E-02	0.2249E-02	1.082	0.2792	11.2998	7.7299
SSTSLOPE	0.78424E-04	0.2648E-03	0.296	0.7671	13.1123	11.4851
SSH	-0.12560E-03	0.1084E-02	-0.116	0.9078	-5.3569	5.1763
SSHSLOPE	0.22311E-03	0.1731E-03	1.289	0.1974	26.4713	17.4774
MWIND	-0.29226E-01	0.3219E-01	-0.908	0.3639	2.3861	0.1216
MCHLA	0.27555E-01	0.1913E-01	1.441	0.1497	0.4752	0.3091
MCHLA1	-0.29923E-01	0.1915E-01	-1.562	0.1182	0.4445	0.3390
DWIND	-0.21355E-01	0.1412E-01	-1.513	0.1303	0.0490	0.2159
DCHLA	-0.62132E-02	0.1338E-01	-0.464	0.6424	0.2390	0.4266
DCHLA1	-0.65625E-02	0.1078E-01	-0.609	0.5427	0.3696	0.4829
GLDEPTH	0.32166E-01	0.2342E-01	1.374	0.1696	0.8006	1.7913
GTIMELDE	0.14320E-01	0.4161E-02	3.442	0.0006	2.3168	5.6658
GSST	-0.81180E-01	0.2034E-01	-3.992	0.0001	0.8209	1.8344
GSSH	0.65528E-02	0.2737E-02	2.394	0.0167	-0.6570	2.5355
GMWIND	0.40875E-01	0.7596E-01	0.538	0.5905	0.3997	0.8888
GMCHLA	-0.70419E-01	0.2949E-01	-2.388	0.0170	0.0888	0.2504
GMCHLA1	-0.18011	0.8041E-01	-2.240	0.0251	0.0497	0.1298
IMR2	-0.31739E-01	0.1040E-01	-3.053	0.0023	1.1205	0.4131

Black cod, standard CPUE (cont.)

Limited Dependent Variable Model - CENSORED regression
Maximum Likelihood Estimates
Log-Likelihood............. -220.25
Threshold values for the model: Lower 0.0000 Upper **********
N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	3.8818	1.656	2.345	0.0190		
FEB	0.10332	0.2868	0.360	0.7187	0.1514	0.3586
MAR	-0.22769E-01	0.5783	-0.039	0.9686	0.3329	0.4714
APR	-0.18441	0.8442	-0.218	0.8271	0.2969	0.4570
NOV	-2.5711	7.886	-0.326	0.7444	0.0895	0.2856
DEC	-2.2801	16.09	-0.142	0.8873	0.0319	0.1757
GOA	-0.62586	1.308	-0.478	0.6323	0.1683	0.3742
TIMELDEP	0.43199E-01	0.5101E-01	0.847	0.3970	17.5742	11.9220
LDEPTH	-1.9790	0.6414	-3.085	0.0020	4.5267	0.4973
L2DEP	0.24043	0.6431E-01	3.739	0.0002	20.7384	4.8504
SLOPE	-0.26325E-02	0.1051E-01	-0.251	0.8022	4.0268	8.9715
SLOPE2	-0.24089E-03	0.3034E-03	-0.794	0.4272	96.6545	345.2532
SST	-0.99882E-01	0.7856E-01	-1.271	0.2036	3.1098	1.3297
SST2	0.25173E-01	0.1688E-01	1.491	0.1359	11.3145	7.7193
SSTSLOPE	-0.45292E-03	0.2235E-02	-0.203	0.8394	13.0559	11.4707
SSH	0.33618E-01	0.1035E-01	3.248	0.0012	-5.3600	5.1714
SSHSLOPE	0.29973E-02	0.1254E-02	2.391	0.0168	26.4905	17.4916
MWIND	-0.14052	0.2238	-0.628	0.5301	2.3863	0.1215
MCHLA	0.26636	0.2143	1.243	0.2140	0.4744	0.3084
MCHLA1	-0.70390	0.3591	-1.960	0.0500	0.4432	0.3385
DWIND	-0.54923	0.2197	-2.500	0.0124	0.0487	0.2153
DCHLA	0.11690	0.9831E-01	1.189	0.2344	0.2386	0.4263
DCHLA1	-0.29439E-01	0.1487	-0.198	0.8431	0.3720	0.4835
GLDEPTH	0.23380	0.1471	1.589	0.1120	0.7980	1.7888
GTIMELDE	-0.64460E-02	0.2493E-01	-0.259	0.7959	2.3070	5.6523
GSST	-0.21247	0.1357	-1.566	0.1174	0.8186	1.8326
GSSH	-0.52664E-01	0.1856E-01	-2.838	0.0045	-0.6535	2.5277
GMWIND	0.23113	0.4277	0.540	0.5889	0.3985	0.8879
GMCHLA	-0.84100E-01	0.2490	-0.338	0.7356	0.0885	0.2498
GMCHLA1	-0.17378	0.6210	-0.280	0.7796	0.0494	0.1294
IMR2	-0.28799	0.8733E-01	-3.298	0.0010	1.8280	0.4850
Sigma	0.37722	0.2295E-01	16.440	0.0000		

Black cod, standard CPUE (cont.)

ML Estimates of Selection Model
Maximum Likelihood Estimates
Log-Likelihood............. -3543.2
LHS is CENSORED. Tobit Model fit by MLE.
FIRST 30 estimates are probit equation.
N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	2.9620	2.057	1.440	0.1499		
FEB	0.11760	0.3187	0.369	0.7121		
MAR	0.42049E-03	0.6920	0.001	0.9995		
APR	-0.19232	0.9516	-0.202	0.8398		
NOV	-2.4524	1232.	-0.002	0.9984		
DEC	-1.6980	327.3	-0.005	0.9959		
GOA	-0.37774	1.709	-0.221	0.8251		
TIMELDEP	0.38390E-01	0.4995E-01	0.769	0.4422		
LDEPTH	-1.5918	0.7620	-2.089	0.0367		
L2DEP	0.19778	0.7363E-01	2.686	0.0072		
SLOPE	-0.51571E-02	0.1535E-01	-0.336	0.7368		
SLOPE2	-0.10672E-03	0.4393E-03	-0.243	0.8080		
SST	-0.77259E-01	0.1102	-0.701	0.4833		
SST2	0.25042E-01	0.2403E-01	1.042	0.2973		
SSTSLOPE	-0.23213E-03	0.2909E-02	-0.080	0.9364		
SSH	0.34729E-01	0.1487E-01	2.336	0.0195		
SSHSLOPE	0.29496E-02	0.1493E-02	1.975	0.0482		
MWIND	-0.23381	0.3027	-0.773	0.4398		
MCHLA	0.22720	0.3550	0.640	0.5222		
MCHLA1	-0.64249	0.6993	-0.919	0.3582		
DWIND	-0.55175	0.3753	-1.470	0.1415		
DCHLA	0.60389E-01	0.1296	0.466	0.6413		
DCHLA1	-0.10837	0.2019	-0.537	0.5914		
GLDEPTH	0.22527	0.1480	1.522	0.1281		
GTIMELDE	-0.80087E-02	0.2776E-01	-0.289	0.7729		
GSST	-0.26293	0.1854	-1.418	0.1562		
GSSH	-0.54842E-01	0.2298E-01	-2.386	0.0170		
GMWIND	0.21476	0.5189	0.414	0.6789		
GMCHLA	-0.12324	0.4085	-0.302	0.7629		
GMCHLA1	-0.31465	0.9677	-0.325	0.7451		
SIGMA(1)	0.41090	0.4339E-01	9.471	0.0000		
RHO(1,2)	-0.41769	0.2496	-1.674	0.0942		

Rockfish, standard CPUE

Sample Selection Model

Two stage least squares regression.		Dep. Variable	LOGROCKS			
Observations	1653	Weights	ONE			
Mean of LHS	0.9454465E-01	Std.Dev of LHS	0.3560142E+00			
StdDev of resid.	0.2955764E+00	Sum of squares	0.1417067E+03			
R-squared	0.3102881E+00	Adj. R-squared	0.2975315E+00			
F[30,	1622]	0.2432356E+02	Prob value	0.3217295E-13		
Log-likelihood	-0.3151357E+03		Restr.(b=0) Log-l		-0.6378122E+03	
Amemiya Pr. Criter.		0.8900384E-01	Akaike Info.Crit.		0.4187970E+00	
Standard error corrected for selection.....			0.29652			
Correlation of disturbance in regression						
and Selection Criterion (Rho).............			-0.94950E-01			
N(0,1) used for significance levels.						
Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	0.85655	0.6326	1.354	0.1757		
FEB	0.83449E-02	0.1019	0.082	0.9348	0.1506	0.3578
MAR	-0.53336E-01	0.1937	-0.275	0.7830	0.3315	0.4709
APR	-0.29167E-01	0.2848	-0.102	0.9184	0.2989	0.4579
NOV	0.81535	0.8349	0.977	0.3288	0.0901	0.2865
DEC	0.82764	0.9089	0.911	0.3625	0.0321	0.1762
GOA	-0.88707	0.5878	-1.509	0.1313	0.1688	0.3747
TIMELDEP	-0.21835E-01	0.1932E-01	-1.130	0.2585	17.6167	11.9465
LDEPTH	-0.17497	0.2391	-0.732	0.4643	4.5252	0.4984
L2DEP	0.31109E-01	0.2394E-01	1.299	0.1938	20.7261	4.8625
SLOPE	0.36580E-01	0.3118E-02	11.732	0.0000	3.9975	8.9265
SLOPE2	-0.61869E-03	0.7224E-04	-8.565	0.0000	95.6138	342.6782
SST	-0.11381E-01	0.2497E-01	-0.456	0.6486	3.1065	1.3323
SST2	0.51224E-02	0.6026E-02	0.850	0.3953	11.2998	7.7299
SSTSLOPE	-0.60695E-03	0.7056E-03	-0.860	0.3897	13.1123	11.4851
SSH	-0.19526E-01	0.2901E-02	-6.731	0.0000	-5.3569	5.1763
SSHSLOPE	0.90913E-03	0.4612E-03	1.971	0.0487	26.4713	17.4774
MWIND	-0.21572	0.8579E-01	-2.514	0.0119	2.3861	0.1216
MCHLA	0.32825E-01	0.5114E-01	0.642	0.5210	0.4752	0.3091
MCHLA1	-0.68217E-02	0.5122E-01	-0.133	0.8941	0.4445	0.3390
DWIND	-0.66462E-01	0.3771E-01	-1.763	0.0780	0.0490	0.2159
DCHLA	0.29790E-01	0.3571E-01	0.834	0.4042	0.2390	0.4266
DCHLA1	-0.17345E-01	0.2874E-01	-0.603	0.5462	0.3696	0.4829
GLDEPTH	-0.29733E-02	0.6303E-01	-0.047	0.9624	0.8006	1.7913
GTIMELDE	0.20665E-01	0.1119E-01	1.847	0.0648	2.3168	5.6658
GSST	0.66855E-01	0.5470E-01	1.222	0.2217	0.8209	1.8344
GSSH	0.16746E-01	0.7368E-02	2.273	0.0230	-0.6570	2.5355
GMWIND	0.17361	0.2040	0.851	0.3947	0.3997	0.8888
GMCHLA	-0.27873E-01	0.7928E-01	-0.352	0.7252	0.0888	0.2504
GMCHLA1	-0.11691	0.2161	-0.541	0.5885	0.0497	0.1298
IMR2	-0.28155E-01	0.2768E-01	-1.017	0.3091	1.1206	0.4129

Rockfish, standard CPUE (cont.)

Limited Dependent Variable Model - CENSORED regression
Maximum Likelihood Estimates
Log-Likelihood............. -513.72
Threshold values for the model: Lower 0.0000 Upper **********
N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	-11.694	3.018	-3.875	0.0001		
FEB	-0.41568	0.5026	-0.827	0.4082	0.1510	0.3582
MAR	-1.2020	0.9679	-1.242	0.2143	0.3339	0.4718
APR	-2.1255	1.460	-1.456	0.1455	0.2972	0.4572
NOV	-5.9906	15.44	-0.388	0.6979	0.0897	0.2858
DEC	-7.1441	28.30	-0.252	0.8007	0.0319	0.1758
GOA	2.3880	1.931	1.237	0.2163	0.1685	0.3744
TIMELDEP	0.11025	0.9308E-01	1.184	0.2362	17.5917	11.9199
LDEPTH	4.4729	1.162	3.850	0.0001	4.5260	0.4973
L2DEP	-0.38035	0.1172	-3.246	0.0012	20.7319	4.8508
SLOPE	0.77617E-01	0.8660E-02	8.963	0.0000	3.9858	8.9047
SLOPE2	-0.12622E-02	0.1915E-03	-6.592	0.0000	95.1317	341.8117
SST	-0.22672	0.8609E-01	-2.634	0.0084	3.1086	1.3300
SST2	0.60631E-01	0.2358E-01	2.572	0.0101	11.3079	7.7204
SSTSLOPE	-0.35217E-02	0.2518E-02	-1.399	0.1619	13.0662	11.4736
SSH	-0.67012E-01	0.1124E-01	-5.961	0.0000	-5.3578	5.1643
SSHSLOPE	0.18710E-02	0.1694E-02	1.104	0.2694	26.4753	17.4747
MWIND	-0.96248	0.3144	-3.061	0.0022	2.3861	0.1214
MCHLA	-0.39986	0.4040	-0.990	0.3223	0.4748	0.3084
MCHLA1	-0.73409	0.6102	-1.203	0.2289	0.4438	0.3384
DWIND	0.11798E-01	0.1161	0.102	0.9191	0.0487	0.2154
DCHLA	0.24601	0.1559	1.578	0.1145	0.2377	0.4258
DCHLA1	0.34102E-01	0.1879	0.182	0.8560	0.3706	0.4831
GLDEPTH	-1.0949	0.2173	-5.038	0.0000	0.7990	1.7896
GTIMELDE	0.97137E-01	0.3384E-01	2.871	0.0041	2.3097	5.6551
GSST	-0.11523	0.1893	-0.609	0.5426	0.8195	1.8335
GSSH	0.77479E-01	0.2297E-01	3.373	0.0007	-0.6543	2.5291
GMWIND	1.0618	0.6392	1.661	0.0967	0.3990	0.8884
GMCHLA	0.55717	0.4411	1.263	0.2066	0.0886	0.2500
GMCHLA1	-0.25825	0.7854	-0.329	0.7423	0.0495	0.1295
IMR2	-0.39212E-01	0.9918E-01	-0.395	0.6926	1.8279	0.4850
Sigma	0.67367	0.2677E-01	25.163	0.0000		

Rockfish, standard CPUE (cont.)

ML Estimates of Selection Model
Maximum Likelihood Estimates
Log-Likelihood............. -3838.3
LHS is CENSORED. Tobit Model fit by MLE.
FIRST 30 estimates are probit equation.
N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.
Constant	-11.433	3.360	-3.403	0.0007
FEB	-0.44676	0.5944	-0.752	0.4523
MAR	-1.1717	1.155	-1.015	0.3103
APR	-2.1339	1.771	-1.205	0.2283
NOV	-5.5952	487.8	-0.011	0.9908
DEC	-6.9311	3230.	-0.002	0.9983
GOA	2.1761	2.591	0.840	0.4011
TIMELDEP	0.11665	0.1176	0.992	0.3214
LDEPTH	4.3433	1.333	3.259	0.0011
L2DEP	-0.36760	0.1366	-2.692	0.0071
SLOPE	0.74790E-01	0.9806E-02	7.627	0.0000
SLOPE2	-0.12404E-02	0.2055E-03	-6.037	0.0000
SST	-0.22718	0.1004	-2.264	0.0236
SST2	0.60625E-01	0.2731E-01	2.220	0.0264
SSTSLOPE	-0.37243E-02	0.3075E-02	-1.211	0.2258
SSH	-0.67868E-01	0.1097E-01	-6.185	0.0000
SSHSLOPE	0.18257E-02	0.1723E-02	1.059	0.2894
MWIND	-0.93293	0.2593	-3.598	0.0003
MCHLA	-0.42820	0.3984	-1.075	0.2824
MCHLA1	-0.85148	0.8477	-1.004	0.3151
DWIND	0.24351E-01	0.1556	0.157	0.8756
DCHLA	0.25822	0.1700	1.519	0.1288
DCHLA1	0.97265E-01	0.2350	0.414	0.6790
GLDEPTH	-1.0709	0.2429	-4.409	0.0000
GTIMELDE	0.95116E-01	0.4150E-01	2.292	0.0219
GSST	-0.94056E-01	0.2143	-0.439	0.6607
GSSH	0.77905E-01	0.2516E-01	3.096	0.0020
GMWIND	1.0637	0.8297	1.282	0.1998
GMCHLA	0.59288	0.4589	1.292	0.1964
GMCHLA1	-0.22814	1.057	-0.216	0.8292
SIGMA(1)	0.68102	0.2746E-01	24.803	0.0000
RHO(1,2)	-0.17018	0.1592	-1.069	0.2851

Flatfish, standard CPUE

Sample Selection Model

Two stage least squares regression.		Dep. Variable	LOGFLATS			
Observations	1653	Weights	ONE			
Mean of LHS	0.1157577E+01	Std.Dev of LHS	0.8117898E+00			
StdDev of resid.	0.6808442E+00		Sum of squares		0.7518762E+03	
R-squared	0.2961645E+00	Adj. R-squared	0.2831466E+00			
F[30,	1622]	0.2275053E+02	Prob value	0.3217295E-13		
Log-likelihood	-0.1694409E+04		Restr.(b=0) Log-l		-0.2000332E+04	
Amemiya Pr. Criter.		0.4722421E+00	Akaike Info.Crit.		0.2087609E+01	
Standard error corrected for selection.....			0.68107			
Correlation of disturbance in regression						
and Selection Criterion (Rho).............			-0.30324E-01			
N(0,1) used for significance levels.						
Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	6.1487	1.457	4.221	0.0000		
FEB	-0.97080	0.2348	-4.135	0.0000	0.1506	0.3578
MAR	-2.0991	0.4461	-4.706	0.0000	0.3315	0.4709
APR	-3.2206	0.6562	-4.908	0.0000	0.2989	0.4579
NOV	-8.5532	1.924	-4.447	0.0000	0.0901	0.2865
DEC	-8.8377	2.094	-4.221	0.0000	0.0321	0.1762
GOA	-3.5439	1.354	-2.618	0.0089	0.1688	0.3747
TIMELDEP	0.19577	0.4452E-01	4.397	0.0000	17.6167	11.9465
LDEPTH	-2.0645	0.5506	-3.750	0.0002	4.5252	0.4984
L2DEP	0.21101	0.5513E-01	3.827	0.0001	20.7261	4.8625
SLOPE	-0.73404E-01	0.7173E-02	-10.233	0.0000	3.9975	8.9265
SLOPE2	0.11978E-02	0.1661E-03	7.209	0.0000	95.6138	342.6782
SST	0.24649	0.5749E-01	4.288	0.0000	3.1065	1.3323
SST2	-0.74073E-01	0.1388E-01	-5.338	0.0000	11.2998	7.7299
SSTSLOPE	-0.25282E-02	0.1624E-02	-1.557	0.1195	13.1123	11.4851
SSH	0.40100E-01	0.6678E-02	6.005	0.0000	-5.3569	5.1763
SSHSLOPE	-0.12754E-02	0.1061E-02	-1.202	0.2295	26.4713	17.4774
MWIND	-0.25255	0.1974	-1.279	0.2008	2.3861	0.1216
MCHLA	1.1488	0.1177	9.757	0.0000	0.4752	0.3091
MCHLA1	0.86893E-01	0.1179	0.737	0.4612	0.4445	0.3390
DWIND	-0.22258	0.8680E-01	-2.564	0.0103	0.0490	0.2159
DCHLA	-0.13774	0.8220E-01	-1.676	0.0938	0.2390	0.4266
DCHLA1	-0.88872E-01	0.6615E-01	-1.344	0.1791	0.3696	0.4829
GLDEPTH	0.14648	0.1452	1.009	0.3130	0.8006	1.7913
GTIMELDE	0.88725E-02	0.2577E-01	0.344	0.7307	2.3168	5.6658
GSST	0.38910	0.1260	3.088	0.0020	0.8209	1.8344
GSSH	-0.65376E-01	0.1697E-01	-3.852	0.0001	-0.6570	2.5355
GMWIND	0.50701	0.4698	1.079	0.2805	0.3997	0.8888
GMCHLA	-1.0678	0.1826	-5.847	0.0000	0.0888	0.2504
GMCHLA1	0.56283	0.4977	1.131	0.2581	0.0497	0.1298
IMR2	-0.20653E-01	0.6372E-01	-0.324	0.7458	1.1206	0.4129

Flatfish, standard CPUE (cont.)

Limited Dependent Variable Model - CENSORED regression
Maximum Likelihood Estimates
Log-Likelihood............. -1721.2
Threshold values for the model: Lower 0.0000 Upper **********
N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	6.8473	1.489	4.600	0.0000		
FEB	-1.0425	0.2388	-4.366	0.0000	0.1511	0.3582
MAR	-2.2391	0.4534	-4.939	0.0000	0.3311	0.4708
APR	-3.4395	0.6642	-5.178	0.0000	0.2985	0.4577
NOV	-9.4973	1.947	-4.878	0.0000	0.0900	0.2863
DEC	-9.8708	2.121	-4.655	0.0000	0.0320	0.1761
GOA	-3.6358	1.371	-2.653	0.0080	0.1686	0.3745
TIMELDEP	0.22064	0.4513E-01	4.889	0.0000	17.6044	11.9448
LDEPTH	-2.3806	0.5638	-4.223	0.0000	4.5258	0.4984
L2DEP	0.24184	0.5660E-01	4.273	0.0000	20.7312	4.8619
SLOPE	-0.81900E-01	0.7336E-02	-11.164	0.0000	4.0238	8.9794
SLOPE2	0.12876E-02	0.1759E-03	7.321	0.0000	96.7721	345.8994
SST	0.22309	0.5891E-01	3.787	0.0002	3.1071	1.3321
SST2	-0.73641E-01	0.1409E-01	-5.226	0.0000	11.3031	7.7297
SSTSLOPE	-0.28536E-02	0.1661E-02	-1.718	0.0858	13.1029	11.4816
SSH	0.46324E-01	0.6920E-02	6.694	0.0000	-5.3603	5.1831
SSHSLOPE	-0.12551E-02	0.1076E-02	-1.166	0.2436	26.4725	17.4673
MWIND	-0.19251	0.2035	-0.946	0.3442	2.3863	0.1216
MCHLA	1.1717	0.1205	9.726	0.0000	0.4749	0.3090
MCHLA1	0.66035E-01	0.1195	0.552	0.5806	0.4441	0.3390
DWIND	-0.18149	0.8857E-01	-2.049	0.0404	0.0489	0.2158
DCHLA	-0.11872	0.8521E-01	-1.393	0.1635	0.2393	0.4268
DCHLA1	-0.48766E-01	0.6881E-01	-0.709	0.4785	0.3704	0.4831
GLDEPTH	0.16995	0.1475	1.152	0.2492	0.7996	1.7904
GTIMELDE	0.51625E-02	0.2618E-01	0.197	0.8437	2.3140	5.6629
GSST	0.42715	0.1283	3.331	0.0009	0.8199	1.8335
GSSH	-0.69744E-01	0.1727E-01	-4.039	0.0001	-0.6562	2.5341
GMWIND	0.47162	0.4768	0.989	0.3226	0.3992	0.8884
GMCHLA	-1.0817	0.1852	-5.839	0.0000	0.0887	0.2503
GMCHLA1	0.59237	0.5041	1.175	0.2400	0.0496	0.1297
IMR2	-0.10502	0.6598E-01	-1.592	0.1114	1.8292	0.4858
Sigma	0.68992	0.1216E-01	56.747	0.0000		

Flatfish, standard CPUE (cont.)

ML Estimates of Selection Model
Maximum Likelihood Estimates
Log-Likelihood............. -5040.6
LHS is CENSORED. Tobit Model fit by MLE.
FIRST 30 estimates are probit equation.
N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	6.1914	1.555	3.981	0.0001		
FEB	-0.95373	0.2786	-3.423	0.0006		
MAR	-2.0431	0.5603	-3.646	0.0003		
APR	-3.1565	0.8300	-3.803	0.0001		
NOV	-8.6509	2.469	-3.504	0.0005		
DEC	-8.9204	2.686	-3.321	0.0009		
GOA	-3.4433	1.535	-2.244	0.0249		
TIMELDEP	0.19935	0.5732E-01	3.478	0.0005		
LDEPTH	-2.1238	0.5971	-3.557	0.0004		
L2DEP	0.21786	0.6183E-01	3.524	0.0004		
SLOPE	-0.82142E-01	0.7867E-02	-10.441	0.0000		
SLOPE2	0.13501E-02	0.1894E-03	7.129	0.0000		
SST	0.23645	0.6877E-01	3.438	0.0006		
SST2	-0.72843E-01	0.1542E-01	-4.725	0.0000		
SSTSLOPE	-0.26437E-02	0.1914E-02	-1.381	0.1672		
SSH	0.46902E-01	0.7795E-02	6.017	0.0000		
SSHSLOPE	-0.14632E-02	0.1132E-02	-1.293	0.1960		
MWIND	-0.23509	0.1815	-1.295	0.1952		
MCHLA	1.1495	0.1240	9.271	0.0000		
MCHLA1	0.85693E-01	0.1634	0.525	0.5999		
DWIND	-0.20470	0.1068	-1.917	0.0552		
DCHLA	-0.14862	0.9172E-01	-1.620	0.1052		
DCHLA1	-0.83526E-01	0.6834E-01	-1.222	0.2216		
GLDEPTH	0.17628	0.1497	1.177	0.2391		
GTIMELDE	0.48022E-02	0.2465E-01	0.195	0.8456		
GSST	0.37656	0.1239	3.039	0.0024		
GSSH	-0.70388E-01	0.1600E-01	-4.401	0.0000		
GMWIND	0.46083	0.5310	0.868	0.3855		
GMCHLA	-1.0867	0.2070	-5.250	0.0000		
GMCHLA1	0.50834	0.5185	0.980	0.3269		
SIGMA(1)	0.69040	0.1242E-01	55.593	0.0000		
RHO(1,2)	-0.93186E-02	0.1119	-0.083	0.9336		

2. Summer bottom trawl selection equation (IMR7)

Binomial Probit Model
Maximum Likelihood Estimates

Log-Likelihood.............	-1125.6
Restricted (Slopes 0) Log-L.	-5571.7
Chi-Squared (29)............	8892.3
Significance Level..........	0.32173E-13

N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	-8.5656	1.161	-7.379	0.0000		
JUN	-0.56585	0.1549	-3.652	0.0003	0.1624	0.3689
JUL	0.14640	0.1579	0.927	0.3538	0.1657	0.3718
AUG	0.25194	0.1892	1.331	0.1831	0.1720	0.3774
SEP	0.64802E-01	0.1891	0.343	0.7318	0.1658	0.3719
OCT	0.32963	0.1780	1.852	0.0641	0.1670	0.3730
GOA	-0.58712	0.2235	-2.627	0.0086	0.2506	0.4334
LDEPTH	3.5841	0.4522	7.927	0.0000	4.4273	0.9897
L2DEP	-0.40491	0.4853E-01	-8.344	0.0000	20.5808	9.0589
SLOPE	0.27611E-01	0.1268E-01	2.178	0.0294	3.8647	8.1433
SLOPE2	0.13874E-03	0.3151E-03	0.440	0.6597	81.2443	275.9448
SST	0.14330	0.5170E-01	2.772	0.0056	6.9487	3.5439
SST2	-0.80494E-02	0.3063E-02	-2.628	0.0086	60.6119	47.4101
SSTSLOPE	-0.12476E-02	0.1904E-02	-0.655	0.5123	21.5992	16.9362
SSH	-0.52594E-02	0.9747E-02	-0.540	0.5895	-3.5008	4.7903
SSHSLOPE	-0.25610E-02	0.1810E-02	-1.415	0.1571	27.8622	18.4854
MWIND	-0.55131	0.2237	-2.464	0.0137	2.0435	0.2532
MCHLA	0.18774	0.6358E-01	2.953	0.0031	1.0271	0.5401
MCHLA1	0.18947	0.5607E-01	3.379	0.0007	1.0011	0.5225
DWIND	-0.46088	0.1402	-3.288	0.0010	0.1624	0.3689
DCHLA	-0.19016	0.1275	-1.491	0.1360	0.0892	0.2850
DCHLA1	-0.25206	0.1414	-1.783	0.0746	0.1103	0.3133
POLTRAWL	-0.41931	0.1364	-3.074	0.0021	0.6967	0.4456
CODTRAWL	0.34204	0.2689	1.272	0.2034	0.7855	0.3899
ATKTRAWL	1.0861	0.3081	3.525	0.0004	0.0105	0.0962
POLTSSL	-0.68190	0.2108	-3.235	0.0012	0.1797	0.3654
CODTSSL	0.21356	0.2041	1.046	0.2955	0.1739	0.3605
ATKTSSL	0.30112	0.1609	1.872	0.0613	0.1545	0.3416
MIXTSSL	-1.7791	0.3092	-5.755	0.0000	0.0891	0.2847
PORTDIST	-0.13200E-01	0.1235E-02	-10.686	0.0000	66.4344	40.5635

Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

	Predicted		
Actual	0	1	TOTAL
0	9883	8	9891
1	2096	9	2105
Total	11979	17	11996

Pollock , standard CPUE

Sample Selection Model

Two stage least squares regression.		Dep. Variable	LOGPOLLS		
Observations	2084	Weights	ONE		
Mean of LHS	0.5367812E+00	Std.Dev of LHS	0.6599354E+00		
StdDev of resid.	0.5753294E+00	Sum of squares	0.6795509E+03		
R-squared	0.2396060E+00		Adj. R-squared		0.2284945E+00
F[30,	2053]	0.2156386E+02	Prob value	0.3217295E-13	
Log-likelihood	-0.1789390E+04		Restr.(b=0) Log-l		-0.2090430E+04
Amemiya Pr. Criter.		0.3359276E+00	Akaike Info.Crit.		0.1747015E+01
Standard error corrected for selection.....			0.57811		
Correlation of disturbance in regression					
and Selection Criterion (Rho).............			-0.10700		
N(0,1) used for significance levels.					

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	-4.9508	0.8283	-5.977	0.0000		
JUN	-0.14520	0.1470	-0.988	0.3232	0.0614	0.2402
JUL	-0.33695	0.2141	-1.574	0.1155	0.2692	0.4436
AUG	-0.64359	0.3005	-2.141	0.0322	0.2116	0.4085
SEP	-1.0007	0.3844	-2.603	0.0092	0.1569	0.3638
OCT	-1.4103	0.4666	-3.022	0.0025	0.1934	0.3950
GOA	-3.6998	0.7372	-5.019	0.0000	0.2404	0.4274
TIMELDEP	0.53041E-01	0.2063E-01	2.571	0.0101	35.5014	7.3817
LDEPTH	2.0966	0.3288	6.376	0.0000	4.5578	0.5740
L2DEP	-0.25616	0.3397E-01	-7.541	0.0000	21.1029	5.4919
SLOPE	-0.27787E-01	0.5262E-02	-5.280	0.0000	4.3812	9.3259
SLOPE2	0.31872E-03	0.1174E-03	2.715	0.0066	106.1247	364.6537
SST	0.10120	0.3953E-01	2.560	0.0105	8.1178	2.4189
SST2	-0.57602E-02	0.2925E-02	-1.969	0.0489	71.7304	37.6320
SSTSLOPE	-0.13557E-02	0.9203E-03	-1.473	0.1407	20.1822	15.0117
SSH	-0.29468E-02	0.6169E-02	-0.478	0.6329	-3.7809	3.8750
SSHSLOPE	0.20828E-02	0.8658E-03	2.406	0.0161	22.9680	16.3217
MWIND	0.34110E-01	0.1392	0.245	0.8065	2.0168	0.2648
MCHLA	-0.70842E-01	0.4116E-01	-1.721	0.0852	1.0076	0.4184
MCHLA1	0.42190E-02	0.2952E-01	0.143	0.8864	1.0345	0.5422
DWIND	0.88128E-01	0.8618E-01	1.023	0.3065	0.0288	0.1673
DCHLA	0.18086	0.6690E-01	2.703	0.0069	0.0509	0.2198
DCHLA1	-0.18743	0.7207E-01	-2.601	0.0093	0.0398	0.1956
GLDEPTH	0.34532	0.8189E-01	4.217	0.0000	1.1783	2.1088
GTIMELDE	0.11532E-01	0.8576E-02	1.345	0.1787	8.5557	15.7173
GSST	-0.16840E-01	0.2986E-01	-0.564	0.5728	2.3308	4.3117
GSSH	-0.19891E-02	0.1075E-01	-0.185	0.8532	-0.8258	2.2383
GMWIND	0.42804	0.2508	1.707	0.0879	0.4961	0.8907
GMCHLA	0.27099	0.8707E-01	3.112	0.0019	0.2574	0.4944
GMCHLA1	0.80668E-01	0.8036E-01	1.004	0.3155	0.2479	0.4876
IMR7	-0.61856E-01	0.4819E-01	-1.284	0.1993	1.9159	0.4657

Pollock , standard CPUE (cont.)

Limited Dependent Variable Model - CENSORED regression
Maximum Likelihood Estimates
Log-Likelihood............. -1922.1
Threshold values for the model: Lower 0.0000 Upper **********
N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	-7.8763	1.039	-7.581	0.0000		
JUN	-0.12605	0.1785	-0.706	0.4800	0.0612	0.2398
JUL	-0.29978	0.2642	-1.135	0.2566	0.2697	0.4439
AUG	-0.57325	0.3724	-1.539	0.1238	0.2109	0.4080
SEP	-0.89335	0.4775	-1.871	0.0614	0.1573	0.3642
OCT	-1.2361	0.5789	-2.135	0.0327	0.1937	0.3953
GOA	-6.5638	0.9770	-6.719	0.0000	0.2425	0.4287
TIMELDEP	0.48001E-01	0.2536E-01	1.893	0.0583	35.5104	7.3774
LDEPTH	3.4986	0.4334	8.072	0.0000	4.5577	0.5732
L2DEP	-0.39135	0.4309E-01	-9.083	0.0000	21.1014	5.4836
SLOPE	-0.38735E-01	0.6325E-02	-6.125	0.0000	4.4027	9.3546
SLOPE2	0.45389E-03	0.1403E-03	3.234	0.0012	106.8498	365.4387
SST	0.38036E-01	0.4857E-01	0.783	0.4335	8.1238	2.4194
SST2	-0.11547E-02	0.3548E-02	-0.325	0.7448	71.8300	37.6711
SSTSLOPE	-0.13083E-02	0.1065E-02	-1.229	0.2191	20.1950	15.0092
SSH	-0.45853E-02	0.7180E-02	-0.639	0.5231	-3.7775	3.8726
SSHSLOPE	0.16441E-02	0.1022E-02	1.609	0.1077	23.0271	16.3453
MWIND	-0.79378E-01	0.1617	-0.491	0.6235	2.0169	0.2647
MCHLA	-0.43299E-01	0.4703E-01	-0.921	0.3572	1.0078	0.4181
MCHLA1	-0.31080E-02	0.3347E-01	-0.093	0.9260	1.0345	0.5419
DWIND	-0.40418E-01	0.1086	-0.372	0.7098	0.0287	0.1670
DCHLA	0.21986	0.7699E-01	2.856	0.0043	0.0507	0.2194
DCHLA1	-0.19798	0.8351E-01	-2.371	0.0177	0.0397	0.1953
GLDEPTH	0.63679	0.1047	6.085	0.0000	1.1873	2.1130
GTIMELDE	0.11580E-01	0.1060E-01	1.092	0.2748	8.6344	15.7704
GSST	-0.33178E-01	0.3736E-01	-0.888	0.3745	2.3526	4.3267
GSSH	-0.18198E-01	0.1383E-01	-1.316	0.1881	-0.8332	2.2430
GMWIND	0.84511	0.3283	2.574	0.0100	0.5004	0.8934
GMCHLA	0.48930	0.1085	4.508	0.0000	0.2599	0.4961
GMCHLA1	0.19610	0.9800E-01	2.001	0.0454	0.2504	0.4896
IMR7	-0.11926	0.5738E-01	-2.078	0.0377	1.9109	0.4671
Sigma	0.64576	0.1118E-01	57.744	0.0000		

Pollock , standard CPUE (cont.)

ML Estimates of Selection Model
Maximum Likelihood Estimates
Log-Likelihood............. -6240.2
LHS is CENSORED. Tobit Model fit by MLE.
FIRST 30 estimates are probit equation.
N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	-8.8557	1.161	-7.624	0.0000		
JUN	-0.21361	0.2191	-0.975	0.3297		
JUL	-0.34851	0.3123	-1.116	0.2645		
AUG	-0.64471	0.4357	-1.480	0.1390		
SEP	-0.97808	0.5669	-1.725	0.0845		
OCT	-1.3192	0.6900	-1.912	0.0559		
GOA	-6.4392	1.170	-5.503	0.0000		
TIMELDEP	0.55940E-01	0.2903E-01	1.927	0.0540		
LDEPTH	3.8321	0.4988	7.682	0.0000		
L2DEP	-0.43531	0.4700E-01	-9.261	0.0000		
SLOPE	-0.34657E-01	0.7108E-02	-4.876	0.0000		
SLOPE2	0.42922E-03	0.1748E-03	2.456	0.0141		
SST	0.53129E-01	0.6353E-01	0.836	0.4030		
SST2	-0.17815E-02	0.4292E-02	-0.415	0.6781		
SSTSLOPE	-0.10514E-02	0.1149E-02	-0.915	0.3600		
SSH	-0.48489E-02	0.6528E-02	-0.743	0.4576		
SSHSLOPE	0.15819E-02	0.1004E-02	1.576	0.1151		
MWIND	-0.19282	0.1593	-1.210	0.2261		
MCHLA	-0.27358E-02	0.5160E-01	-0.053	0.9577		
MCHLA1	0.13265E-01	0.3232E-01	0.410	0.6815		
DWIND	-0.10874	0.9448E-01	-1.151	0.2498		
DCHLA	0.17846	0.7966E-01	2.240	0.0251		
DCHLA1	-0.22222	0.7962E-01	-2.791	0.0053		
GLDEPTH	0.62990	0.1295	4.864	0.0000		
GTIMELDE	0.84452E-02	0.1222E-01	0.691	0.4893		
GSST	-0.36456E-01	0.4259E-01	-0.856	0.3920		
GSSH	-0.19688E-01	0.1557E-01	-1.264	0.2061		
GMWIND	0.86262	0.3922	2.199	0.0279		
GMCHLA	0.47273	0.1117	4.233	0.0000		
GMCHLA1	0.20261	0.1042	1.944	0.0519		
SIGMA(1)	0.64627	0.8627E-02	74.912	0.0000		
RHO(1,2)	0.35777E-01	0.9503E-01	0.376	0.7066		

Pacific cod, CPUE

Sample Selection Model					
Two stage least squares regression.	Dep. Variable	LOGPCOD			
Observations	2084	Weights	ONE		
Mean of LHS	0.2972981E+00	Std.Dev of LHS	0.3440143E+00		
StdDev of resid.	0.3100060E+00		Sum of squares		0.1973010E+03
R-squared	0.1875518E+00	Adj. R-squared	0.1756797E+00		
F[30,	2053]	0.1579768E+02	Prob value	0.3217295E-13	
Log-likelihood	-0.5007468E+03		Restr.(b=0) Log-l		-0.7327900E+03
Amemiya Pr. Criter.		0.9753332E-01	Akaike Info.Crit.		0.5103137E+00
Standard error corrected for selection.....			0.32875		
Correlation of disturbance in regression					
and Selection Criterion (Rho)..............			-0.39356		
N(0,1) used for significance levels.					

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	-1.2723	0.4103	-3.101	0.0019		
JUN	0.11579	0.7965E-01	1.454	0.1460	0.0614	0.2402
JUL	-0.41659E-01	0.1154	-0.361	0.7181	0.2692	0.4436
AUG	-0.58546E-01	0.1618	-0.362	0.7175	0.2116	0.4085
SEP	0.93405E-01	0.2067	0.452	0.6514	0.1569	0.3638
OCT	0.67453E-01	0.2510	0.269	0.7881	0.1934	0.3950
GOA	1.4409	0.3975	3.625	0.0003	0.2404	0.4274
TIMELDEP	-0.17606E-01	0.1107E-01	-1.590	0.1118	35.5014	7.3817
LDEPTH	0.81896	0.1703	4.809	0.0000	4.5578	0.5740
L2DEP	-0.78711E-01	0.1749E-01	-4.501	0.0000	21.1029	5.4919
SLOPE	0.47438E-02	0.2890E-02	1.642	0.1007	4.3812	9.3259
SLOPE2	-0.15830E-03	0.6482E-04	-2.442	0.0146	106.1247	364.6537
SST	0.43391E-01	0.2125E-01	2.042	0.0411	8.1178	2.4189
SST2	-0.10287E-02	0.1575E-02	-0.653	0.5137	71.7304	37.6320
SSTSLOPE	0.83700E-05	0.5032E-03	0.017	0.9867	20.1822	15.0117
SSH	-0.68258E-02	0.3352E-02	-2.036	0.0417	-3.7809	3.8750
SSHSLOPE	0.12321E-02	0.4771E-03	2.582	0.0098	22.9680	16.3217
MWIND	0.19648E-01	0.7717E-01	0.255	0.7990	2.0168	0.2648
MCHLA	-0.75122E-01	0.2270E-01	-3.309	0.0009	1.0076	0.4184
MCHLA1	-0.28885E-01	0.1600E-01	-1.805	0.0711	1.0345	0.5422
DWIND	0.27416	0.4677E-01	5.862	0.0000	0.0288	0.1673
DCHLA	0.45396E-01	0.3648E-01	1.244	0.2134	0.0509	0.2198
DCHLA1	-0.75853E-02	0.3905E-01	-0.194	0.8460	0.0398	0.1956
GLDEPTH	-0.36074	0.4416E-01	-8.169	0.0000	1.1783	2.1088
GTIMELDE	0.21356E-01	0.4631E-02	4.612	0.0000	8.5557	15.7173
GSST	-0.33675E-01	0.1607E-01	-2.096	0.0361	2.3308	4.3117
GSSH	0.25757E-01	0.5804E-02	4.438	0.0000	-0.8258	2.2383
GMWIND	-0.12599	0.1353	-0.931	0.3518	0.4961	0.8907
GMCHLA	0.10916	0.4694E-01	2.325	0.0200	0.2574	0.4944
GMCHLA1	0.42643E-01	0.4329E-01	0.985	0.3246	0.2479	0.4876
IMR7	-0.12938	0.2677E-01	-4.833	0.0000	1.1542	0.4255

Pacific cod, CPUE (cont.)

Limited Dependent Variable Model - CENSORED regression
Maximum Likelihood Estimates
Log-Likelihood............. -752.97
Threshold values for the model: Lower 0.0000 Upper **********
N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	-3.7195	0.5497	-6.767	0.0000		
JUN	0.73074E-01	0.9327E-01	0.783	0.4334	0.0614	0.2400
JUL	-0.94603E-01	0.1408	-0.672	0.5017	0.2694	0.4438
AUG	-0.16166	0.2004	-0.807	0.4198	0.2114	0.4084
SEP	-0.51867E-01	0.2574	-0.201	0.8403	0.1572	0.3641
OCT	-0.86989E-01	0.3124	-0.278	0.7807	0.1932	0.3949
GOA	2.2360	0.4688	4.770	0.0000	0.2407	0.4276
TIMELDEP	-0.12539E-01	0.1385E-01	-0.905	0.3654	35.5039	7.3800
LDEPTH	1.9559	0.2269	8.621	0.0000	4.5580	0.5738
L2DEP	-0.21204	0.2374E-01	-8.933	0.0000	21.1043	5.4895
SLOPE	0.52226E-02	0.3241E-02	1.611	0.1071	4.3922	9.3408
SLOPE2	-0.16501E-03	0.7142E-04	-2.310	0.0209	106.5008	365.0076
SST	0.40015E-01	0.2453E-01	1.632	0.1028	8.1200	2.4204
SST2	-0.66932E-03	0.1811E-02	-0.370	0.7117	71.7742	37.6846
SSTSLOPE	0.41485E-03	0.5517E-03	0.752	0.4521	20.1927	15.0243
SSH	-0.51768E-02	0.3694E-02	-1.401	0.1611	-3.7785	3.8752
SSHSLOPE	0.88669E-03	0.5294E-03	1.675	0.0940	22.9994	16.3473
MWIND	0.38426E-01	0.8328E-01	0.461	0.6445	2.0166	0.2648
MCHLA	-0.67076E-01	0.2473E-01	-2.712	0.0067	1.0074	0.4183
MCHLA1	-0.35456E-01	0.1760E-01	-2.015	0.0439	1.0342	0.5422
DWIND	0.28878	0.5112E-01	5.649	0.0000	0.0288	0.1672
DCHLA	0.36174E-01	0.4144E-01	0.873	0.3827	0.0508	0.2197
DCHLA1	-0.19423E-01	0.4524E-01	-0.429	0.6677	0.0398	0.1955
GLDEPTH	-0.49552	0.5405E-01	-9.168	0.0000	1.1795	2.1094
GTIMELDE	0.21449E-01	0.5321E-02	4.031	0.0001	8.5635	15.7202
GSST	-0.48657E-01	0.1829E-01	-2.660	0.0078	2.3350	4.3166
GSSH	0.31160E-01	0.6686E-02	4.660	0.0000	-0.8271	2.2387
GMWIND	-0.16473	0.1553	-1.061	0.2888	0.4965	0.8907
GMCHLA	0.14357	0.5368E-01	2.675	0.0075	0.2577	0.4945
GMCHLA1	0.63966E-01	0.4930E-01	1.297	0.1945	0.2481	0.4877
IMR7	-0.11801	0.2947E-01	-4.005	0.0001	1.9112	0.4671
Sigma	0.33502	0.5614E-02	59.678	0.0000		

Pacific cod, CPUE (cont.)

ML Estimates of Selection Model
Maximum Likelihood Estimates
Log-Likelihood............. -5068.9
LHS is CENSORED. Tobit Model fit by MLE.
FIRST 30 estimates are probit equation.
N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	-4.2442	0.6238	-6.804	0.0000		
JUN	0.60673E-01	0.9264E-01	0.655	0.5125		
JUL	-0.10202	0.1355	-0.753	0.4516		
AUG	-0.17891	0.1959	-0.913	0.3611		
SEP	-0.81157E-01	0.2507	-0.324	0.7461		
OCT	-0.11978	0.3072	-0.390	0.6966		
GOA	2.2362	0.4178	5.352	0.0000		
TIMELDEP	-0.97058E-02	0.1348E-01	-0.720	0.4717		
LDEPTH	2.1088	0.2630	8.018	0.0000		
L2DEP	-0.22970	0.2727E-01	-8.424	0.0000		
SLOPE	0.61017E-02	0.3329E-02	1.833	0.0668		
SLOPE2	-0.17241E-03	0.7232E-04	-2.384	0.0171		
SST	0.44229E-01	0.2528E-01	1.750	0.0802		
SST2	-0.79041E-03	0.1924E-02	-0.411	0.6812		
SSTSLOPE	0.46403E-03	0.6213E-03	0.747	0.4551		
SSH	-0.52626E-02	0.3588E-02	-1.467	0.1425		
SSHSLOPE	0.10845E-02	0.5087E-03	2.132	0.0330		
MWIND	0.22658E-01	0.8935E-01	0.254	0.7998		
MCHLA	-0.63126E-01	0.2815E-01	-2.243	0.0249		
MCHLA1	-0.30799E-01	0.2229E-01	-1.382	0.1670		
DWIND	0.27695	0.3481E-01	7.956	0.0000		
DCHLA	0.30429E-01	0.5056E-01	0.602	0.5473		
DCHLA1	-0.31148E-01	0.4778E-01	-0.652	0.5144		
GLDEPTH	-0.49579	0.5434E-01	-9.123	0.0000		
GTIMELDE	0.20498E-01	0.5050E-02	4.059	0.0000		
GSST	-0.49139E-01	0.1878E-01	-2.616	0.0089		
GSSH	0.31766E-01	0.5106E-02	6.221	0.0000		
GMWIND	-0.15793	0.1317	-1.199	0.2306		
GMCHLA	0.14375	0.4085E-01	3.519	0.0004		
GMCHLA1	0.61543E-01	0.4136E-01	1.488	0.1367		
SIGMA(1)	0.34485	0.7897E-02	43.669	0.0000		
RHO(1,2)	-0.27904	0.9210E-01	-3.030	0.0024		

Pacific cod, standard CPUE

Sample Selection Model
Two stage least squares regression. Dep. Variable LOGPCODS
Observations 2084 Weights ONE
Mean of LHS 0.4752573E+00 Std.Dev of LHS 0.5026082E+00
StdDev of resid. 0.4405847E+00 Sum of squares 0.3985179E+03
R-squared 0.2312093E+00 Adj. R-squared 0.2199752E+00
F[30, 2053] 0.2058093E+02 Prob value 0.3217295E-13
Log-likelihood -0.1233296E+04 Restr.(b=0) Log-l -0.1522892E+04
Amemiya Pr. Criter. 0.1970024E+00 Akaike Info.Crit. 0.1213336E+01
Standard error corrected for selection..... 0.47276
Correlation of disturbance in regression
and Selection Criterion (Rho)............. -0.42883
N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	-3.0312	0.5839	-5.191	0.0000		
JUN	0.10253E-01	0.1133	0.090	0.9279	0.0614	0.2402
JUL	-0.34272	0.1640	-2.089	0.0367	0.2692	0.4436
AUG	-0.49949	0.2300	-2.172	0.0299	0.2116	0.4085
SEP	-0.43265	0.2937	-1.473	0.1408	0.1569	0.3638
OCT	-0.63212	0.3566	-1.773	0.0763	0.1934	0.3950
GOA	1.5999	0.5649	2.832	0.0046	0.2404	0.4274
TIMELDEP	0.74061E-02	0.1573E-01	0.471	0.6378	35.5014	7.3817
LDEPTH	1.4534	0.2422	6.001	0.0000	4.5578	0.5740
L2DEP	-0.15923	0.2490E-01	-6.395	0.0000	21.1029	5.4919
SLOPE	-0.47634E-02	0.4127E-02	-1.154	0.2484	4.3812	9.3259
SLOPE2	-0.87827E-04	0.9267E-04	-0.948	0.3433	106.1247	364.6537
SST	0.98077E-01	0.3022E-01	3.246	0.0012	8.1178	2.4189
SST2	-0.36883E-02	0.2240E-02	-1.647	0.0996	71.7304	37.6320
SSTSLOPE	0.35150E-03	0.7179E-03	0.490	0.6244	20.1822	15.0117
SSH	0.63242E-04	0.4775E-02	0.013	0.9894	-3.7809	3.8750
SSHSLOPE	0.15362E-02	0.6806E-03	2.257	0.0240	22.9680	16.3217
MWIND	0.10685	0.1100	0.972	0.3313	2.0168	0.2648
MCHLA	-0.12999	0.3234E-01	-4.020	0.0001	1.0076	0.4184
MCHLA1	-0.36242E-01	0.2283E-01	-1.588	0.1123	1.0345	0.5422
DWIND	0.38428	0.6654E-01	5.775	0.0000	0.0288	0.1673
DCHLA	0.12941	0.5197E-01	2.490	0.0128	0.0509	0.2198
DCHLA1	-0.27154E-01	0.5566E-01	-0.488	0.6257	0.0398	0.1956
GLDEPTH	-0.44470	0.6278E-01	-7.084	0.0000	1.1783	2.1088
GTIMELDE	0.25827E-01	0.6586E-02	3.921	0.0001	8.5557	15.7173
GSST	-0.35985E-01	0.2283E-01	-1.576	0.1150	2.3308	4.3117
GSSH	0.35849E-01	0.8251E-02	4.345	0.0000	-0.8258	2.2383
GMWIND	-0.37602E-01	0.1924	-0.195	0.8450	0.4961	0.8907
GMCHLA	0.10319	0.6673E-01	1.546	0.1220	0.2574	0.4944
GMCHLA1	0.71789E-01	0.6151E-01	1.167	0.2432	0.2479	0.4876
IMR7	-0.20273	0.3795E-01	-5.342	0.0000	1.1540	0.4264

Pacific cod, standard CPUE (cont.)

Limited Dependent Variable Model - CENSORED regression
Maximum Likelihood Estimates
Log-Likelihood............. -1400.0
Threshold values for the model: Lower 0.0000 Upper **********
N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	-6.3560	0.7936	-8.009	0.0000		
JUN	-0.62224E-01	0.1325	-0.470	0.6387	0.0614	0.2400
JUL	-0.46524	0.1995	-2.332	0.0197	0.2694	0.4438
AUG	-0.70861	0.2837	-2.497	0.0125	0.2114	0.4084
SEP	-0.71877	0.3645	-1.972	0.0486	0.1572	0.3641
OCT	-0.95623	0.4424	-2.161	0.0307	0.1932	0.3949
GOA	2.5754	0.6638	3.880	0.0001	0.2407	0.4276
TIMELDEP	0.19013E-01	0.1958E-01	0.971	0.3314	35.5039	7.3800
LDEPTH	3.0260	0.3295	9.184	0.0000	4.5580	0.5738
L2DEP	-0.34505	0.3424E-01	-10.076	0.0000	21.1043	5.4895
SLOPE	-0.64795E-02	0.4597E-02	-1.409	0.1587	4.3922	9.3408
SLOPE2	-0.75276E-04	0.1015E-03	-0.742	0.4581	106.5008	365.0076
SST	0.86105E-01	0.3538E-01	2.434	0.0149	8.1200	2.4204
SST2	-0.28320E-02	0.2598E-02	-1.090	0.2757	71.7742	37.6846
SSTSLOPE	0.90923E-03	0.7848E-03	1.159	0.2466	20.1927	15.0243
SSH	0.24922E-02	0.5253E-02	0.474	0.6352	-3.7785	3.8752
SSHSLOPE	0.99416E-03	0.7513E-03	1.323	0.1858	22.9994	16.3473
MWIND	0.14132	0.1184	1.194	0.2326	2.0166	0.2648
MCHLA	-0.12416	0.3519E-01	-3.528	0.0004	1.0074	0.4183
MCHLA1	-0.53522E-01	0.2503E-01	-2.138	0.0325	1.0342	0.5422
DWIND	0.40964	0.7310E-01	5.604	0.0000	0.0288	0.1672
DCHLA	0.13303	0.5882E-01	2.262	0.0237	0.0508	0.2197
DCHLA1	-0.29947E-01	0.6410E-01	-0.467	0.6403	0.0398	0.1955
GLDEPTH	-0.61108	0.7630E-01	-8.009	0.0000	1.1795	2.1094
GTIMELDE	0.26484E-01	0.7525E-02	3.520	0.0004	8.5635	15.7202
GSST	-0.55655E-01	0.2602E-01	-2.139	0.0325	2.3350	4.3166
GSSH	0.42989E-01	0.9458E-02	4.545	0.0000	-0.8271	2.2387
GMWIND	-0.78227E-01	0.2201	-0.355	0.7223	0.4965	0.8907
GMCHLA	0.13823	0.7603E-01	1.818	0.0690	0.2577	0.4945
GMCHLA1	0.10721	0.6978E-01	1.537	0.1244	0.2481	0.4877
IMR7	-0.22882	0.4230E-01	-5.410	0.0000	1.9112	0.4671
Sigma	0.47643	0.7996E-02	59.582	0.0000		

Pacific cod, standard CPUE (cont.)

ML Estimates of Selection Model
Maximum Likelihood Estimates
Log-Likelihood............. -5719.8
LHS is CENSORED. Tobit Model fit by MLE.
FIRST 30 estimates are probit equation.
N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	-7.4990	0.8471	-8.852	0.0000		
JUN	-0.10092	0.1376	-0.733	0.4634		
JUL	-0.48861	0.1929	-2.532	0.0113		
AUG	-0.75684	0.2736	-2.766	0.0057		
SEP	-0.79366	0.3505	-2.264	0.0235		
OCT	-1.0382	0.4283	-2.424	0.0154		
GOA	2.5939	0.5660	4.583	0.0000		
TIMELDEP	0.25656E-01	0.1893E-01	1.355	0.1754		
LDEPTH	3.3667	0.3535	9.525	0.0000		
L2DEP	-0.38555	0.3659E-01	-10.538	0.0000		
SLOPE	-0.41864E-02	0.4831E-02	-0.867	0.3861		
SLOPE2	-0.92706E-04	0.1096E-03	-0.845	0.3978		
SST	0.96412E-01	0.3881E-01	2.484	0.0130		
SST2	-0.31448E-02	0.2783E-02	-1.130	0.2585		
SSTSLOPE	0.10493E-02	0.8380E-03	1.252	0.2105		
SSH	0.23009E-02	0.5296E-02	0.434	0.6640		
SSHSLOPE	0.12845E-02	0.7238E-03	1.775	0.0760		
MWIND	0.10022	0.1332	0.753	0.4518		
MCHLA	-0.10925	0.4291E-01	-2.546	0.0109		
MCHLA1	-0.42077E-01	0.3249E-01	-1.295	0.1952		
DWIND	0.37687	0.5157E-01	7.309	0.0000		
DCHLA	0.11479	0.6983E-01	1.644	0.1002		
DCHLA1	-0.53688E-01	0.6483E-01	-0.828	0.4076		
GLDEPTH	-0.61036	0.7158E-01	-8.527	0.0000		
GTIMELDE	0.24273E-01	0.7297E-02	3.327	0.0009		
GSST	-0.57593E-01	0.2552E-01	-2.257	0.0240		
GSSH	0.44010E-01	0.7312E-02	6.019	0.0000		
GMWIND	-0.64972E-01	0.1895	-0.343	0.7318		
GMCHLA	0.13433	0.5970E-01	2.250	0.0244		
GMCHLA1	0.10391	0.5838E-01	1.780	0.0751		
SIGMA(1)	0.49707	0.1360E-01	36.545	0.0000		
RHO(1,2)	-0.32736	0.9276E-01	-3.529	0.0004		

Atka mackerel, standard CPUE

Sample Selection Model
Two stage least squares regression. Dep. Variable LOGATKAS
Observations 2084 Weights ONE
Mean of LHS 0.1138042E+00 Std.Dev of LHS 0.5121301E+00
StdDev of resid. 0.3874007E+00 Sum of squares 0.3081128E+03
R-squared 0.4275091E+00 Adj. R-squared 0.4191435E+00
F[30, 2053] 0.5110278E+02 Prob value 0.3217295E-13
Log-likelihood -0.9652031E+03 Restr.(b=0) Log-l -0.1562004E+04
Amemiya Pr. Criter. 0.1523118E+00 Akaike Info.Crit. 0.9560491E+00
Standard error corrected for selection..... 0.38994
Correlation of disturbance in regression
and Selection Criterion (Rho)............. -0.13468
N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	-3.4712	0.5074	-6.841	0.0000		
JUN	-0.67829	0.9920E-01	-6.838	0.0000	0.0614	0.2402
JUL	-1.1060	0.1442	-7.673	0.0000	0.2692	0.4436
AUG	-1.2967	0.2023	-6.411	0.0000	0.2116	0.4085
SEP	-1.5553	0.2586	-6.015	0.0000	0.1569	0.3638
OCT	-1.9524	0.3140	-6.219	0.0000	0.1934	0.3950
GOA	-0.97079	0.4965	-1.955	0.0506	0.2404	0.4274
TIMELDEP	0.79617E-01	0.1385E-01	5.747	0.0000	35.5014	7.3817
LDEPTH	1.5793	0.2108	7.492	0.0000	4.5578	0.5740
L2DEP	-0.24881	0.2161E-01	-11.515	0.0000	21.1029	5.4919
SLOPE	0.60933E-01	0.3525E-02	17.284	0.0000	4.3812	9.3259
SLOPE2	-0.81759E-03	0.7889E-04	-10.364	0.0000	106.1247	364.6537
SST	0.71823E-01	0.2647E-01	2.713	0.0067	8.1178	2.4189
SST2	-0.70958E-02	0.1965E-02	-3.611	0.0003	71.7304	37.6320
SSTSLOPE	-0.35416E-03	0.6188E-03	-0.572	0.5671	20.1822	15.0117
SSH	0.10969E-01	0.4147E-02	2.645	0.0082	-3.7809	3.8750
SSHSLOPE	0.13210E-02	0.5863E-03	2.253	0.0242	22.9680	16.3217
MWIND	-0.13900E-01	0.9491E-01	-0.146	0.8836	2.0168	0.2648
MCHLA	-0.95928E-01	0.2804E-01	-3.421	0.0006	1.0076	0.4184
MCHLA1	-0.77336E-02	0.1969E-01	-0.393	0.6945	1.0345	0.5422
DWIND	0.31106	0.5794E-01	5.368	0.0000	0.0288	0.1673
DCHLA	0.87823E-01	0.4508E-01	1.948	0.0514	0.0509	0.2198
DCHLA1	0.26594	0.4818E-01	5.520	0.0000	0.0398	0.1956
GLDEPTH	0.25282E-01	0.5511E-01	0.459	0.6464	1.1783	2.1088
GTIMELDE	-0.99106E-02	0.5767E-02	-1.718	0.0857	8.5557	15.7173
GSST	0.10888	0.2009E-01	5.419	0.0000	2.3308	4.3117
GSSH	-0.16702E-01	0.7246E-02	-2.305	0.0212	-0.8258	2.2383
GMWIND	-0.64004E-01	0.1689	-0.379	0.7047	0.4961	0.8907
GMCHLA	0.47865E-01	0.5866E-01	0.816	0.4145	0.2574	0.4944
GMCHLA1	0.81060E-01	0.5412E-01	1.498	0.1342	0.2479	0.4876
IMR7	-0.52518E-01	0.3285E-01	-1.599	0.1099	1.1538	0.4263

Atka mackerel, standard CPUE (cont.)

Limited Dependent Variable Model - CENSORED regression
Maximum Likelihood Estimates
Log-Likelihood............. -499.01
Threshold values for the model: Lower 0.0000 Upper **********
N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	-71.966	9.669	-7.443	0.0000		
JUN	-0.53299	0.7549	-0.706	0.4801	0.0633	0.2435
JUL	-0.26201	1.205	-0.217	0.8279	0.2678	0.4429
AUG	0.70599	1.787	0.395	0.6928	0.2117	0.4086
SEP	1.4722	2.293	0.642	0.5209	0.1560	0.3630
OCT	1.4626	2.851	0.513	0.6079	0.1946	0.3960
GOA	3.3275	3.532	0.942	0.3461	0.2436	0.4293
TIMELDEP	-0.57410E-01	0.1199	-0.479	0.6320	35.4982	7.3771
LDEPTH	28.726	4.040	7.110	0.0000	4.5562	0.5722
L2DEP	-2.8680	0.3611	-7.943	0.0000	21.0860	5.4745
SLOPE	0.16240	0.1591E-01	10.207	0.0000	4.3530	9.2912
SLOPE2	-0.23148E-02	0.3170E-03	-7.303	0.0000	105.2351	363.2146
SST	0.35657	0.1572	2.268	0.0233	8.1293	2.4187
SST2	-0.46840E-01	0.1205E-01	-3.887	0.0001	71.9170	37.6799
SSTSLOPE	0.35578E-02	0.4259E-02	0.835	0.4035	20.1658	14.9954
SSH	0.48134E-01	0.2299E-01	2.094	0.0363	-3.7812	3.8648
SSHSLOPE	0.11133E-02	0.3546E-02	0.314	0.7535	22.9580	16.2960
MWIND	0.45062	0.5215	0.864	0.3875	2.0168	0.2650
MCHLA	-0.34119	0.2358	-1.447	0.1478	1.0088	0.4175
MCHLA1	-0.33524	0.1792	-1.870	0.0614	1.0362	0.5414
DWIND	0.40500	0.2792	1.451	0.1469	0.0285	0.1666
DCHLA	0.33889	0.2470	1.372	0.1701	0.0504	0.2189
DCHLA1	0.74358	0.2210	3.365	0.0008	0.0395	0.1948
GLDEPTH	-1.2782	0.4338	-2.947	0.0032	1.1915	2.1141
GTIMELDE	-0.35227E-01	0.3543E-01	-0.994	0.3201	8.6620	15.7768
GSST	0.53089	0.1346	3.943	0.0001	2.3647	4.3352
GSSH	-0.97291E-01	0.5316E-01	-1.830	0.0672	-0.8373	2.2455
GMWIND	0.19559	1.123	0.174	0.8617	0.5022	0.8939
GMCHLA	-0.98987	0.4409	-2.245	0.0248	0.2617	0.4980
GMCHLA1	-0.17773	0.4437	-0.401	0.6887	0.2523	0.4920
IMR7	-0.23128E-01	0.1741	-0.133	0.8943	1.9113	0.4659
Sigma	1.1871	0.6330E-01	18.752	0.0000		

Atka mackerel, standard CPUE (cont.)

ML Estimates of Selection Model
Maximum Likelihood Estimates
Log-Likelihood............. -4808.5
LHS is CENSORED. Tobit Model fit by MLE.
FIRST 30 estimates are probit equation.
N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	-54.075	8.874	-6.094	0.0000		
JUN	0.35337	0.8760	0.403	0.6867		
JUL	0.11495	1.508	0.076	0.9392		
AUG	1.2717	2.289	0.556	0.5785		
SEP	1.7955	2.963	0.606	0.5445		
OCT	2.0186	3.662	0.551	0.5814		
GOA	1.0775	4.573	0.236	0.8137		
TIMELDEP	-0.10824	0.1534	-0.706	0.4804		
LDEPTH	21.902	3.711	5.901	0.0000		
L2DEP	-2.1076	0.3086	-6.830	0.0000		
SLOPE	0.13907	0.1884E-01	7.380	0.0000		
SLOPE2	-0.23223E-02	0.4010E-03	-5.792	0.0000		
SST	0.15489	0.2127	0.728	0.4665		
SST2	-0.31409E-01	0.1520E-01	-2.066	0.0389		
SSTSLOPE	-0.21312E-02	0.4937E-02	-0.432	0.6660		
SSH	0.39028E-01	0.2478E-01	1.575	0.1153		
SSHSLOPE	0.28872E-02	0.4043E-02	0.714	0.4752		
MWIND	1.1562	0.5865	1.972	0.0487		
MCHLA	-0.67795	0.2351	-2.883	0.0039		
MCHLA1	-0.49768	0.1921	-2.591	0.0096		
DWIND	0.91228	0.3394	2.688	0.0072		
DCHLA	0.73018	0.2850	2.562	0.0104		
DCHLA1	0.87158	0.2442	3.570	0.0004		
GLDEPTH	-1.1428	0.5303	-2.155	0.0312		
GTIMELDE	-0.13840E-01	0.4993E-01	-0.277	0.7816		
GSST	0.48191	0.1817	2.652	0.0080		
GSSH	-0.61423E-01	0.7320E-01	-0.839	0.4014		
GMWIND	0.64325	1.615	0.398	0.6905		
GMCHLA	-0.72321	0.5613	-1.289	0.1976		
GMCHLA1	-0.85615E-01	0.5399	-0.159	0.8740		
SIGMA(1)	1.6226	0.1807	8.979	0.0000		
RHO(1,2)	-0.82007	0.5919E-01	-13.855	0.0000		

Black cod, standard CPUE

Sample Selection Model
Two stage least squares regression. Dep. Variable LOGBCODS
Observations 2084 Weights ONE
Mean of LHS 0.7045839E-01 Std.Dev of LHS 0.2518961E+00
StdDev of resid. 0.2016822E+00 Sum of squares 0.8350725E+02
R-squared 0.3586414E+00 Adj. R-squared 0.3492694E+00
F[30, 2053] 0.3826724E+02 Prob value 0.3217295E-13
Log-likelihood 0.3951616E+03 Restr.(b=0) Log-l -0.8327635E+02
Amemiya Pr. Criter. 0.4128078E-01 Akaike Info.Crit. -0.3494833E+00
Standard error corrected for selection..... 0.21504
Correlation of disturbance in regression
and Selection Criterion (Rho)............. -0.41018
N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	1.8098	0.2727	6.635	0.0000		
JUN	0.14077	0.5192E-01	2.711	0.0067	0.0614	0.2402
JUL	0.16869	0.7505E-01	2.248	0.0246	0.2692	0.4436
AUG	0.19537	0.1052	1.857	0.0633	0.2116	0.4085
SEP	0.18826	0.1344	1.400	0.1614	0.1569	0.3638
OCT	0.16351	0.1632	1.002	0.3164	0.1934	0.3950
GOA	-1.0550	0.2586	-4.079	0.0000	0.2404	0.4274
TIMELDEP	-0.49002E-02	0.7198E-02	-0.681	0.4960	35.5014	7.3817
LDEPTH	-0.90681	0.1134	-7.995	0.0000	4.5578	0.5740
L2DEP	0.11537	0.1170E-01	9.863	0.0000	21.1029	5.4919
SLOPE	-0.69613E-02	0.1903E-02	-3.659	0.0003	4.3812	9.3259
SLOPE2	0.45571E-04	0.4235E-04	1.076	0.2819	106.1247	364.6537
SST	-0.29274E-01	0.1384E-01	-2.115	0.0344	8.1178	2.4189
SST2	0.86234E-03	0.1025E-02	0.841	0.4003	71.7304	37.6320
SSTSLOPE	0.52476E-04	0.3278E-03	0.160	0.8728	20.1822	15.0117
SSH	-0.42687E-04	0.2183E-02	-0.020	0.9844	-3.7809	3.8750
SSHSLOPE	0.58802E-03	0.3113E-03	1.889	0.0589	22.9680	16.3217
MWIND	0.11473	0.5041E-01	2.276	0.0229	2.0168	0.2648
MCHLA	-0.15123E-02	0.1481E-01	-0.102	0.9187	1.0076	0.4184
MCHLA1	-0.18364E-01	0.1042E-01	-1.762	0.0781	1.0345	0.5422
DWIND	0.53786E-01	0.3039E-01	1.770	0.0767	0.0288	0.1673
DCHLA	0.53918E-01	0.2379E-01	2.266	0.0234	0.0509	0.2198
DCHLA1	0.46058E-01	0.2544E-01	1.810	0.0703	0.0398	0.1956
GLDEPTH	0.20449	0.2873E-01	7.118	0.0000	1.1783	2.1088
GTIMELDE	0.11063E-02	0.3020E-02	0.366	0.7141	8.5557	15.7173
GSST	0.34821E-01	0.1044E-01	3.334	0.0009	2.3308	4.3117
GSSH	-0.49733E-02	0.3780E-02	-1.316	0.1883	-0.8258	2.2383
GMWIND	0.22938E-02	0.8804E-01	0.026	0.9792	0.4961	0.8907
GMCHLA	-0.74513E-01	0.3051E-01	-2.442	0.0146	0.2574	0.4944
GMCHLA1	-0.63518E-01	0.2817E-01	-2.255	0.0241	0.2479	0.4876
IMR7	-0.88207E-01	0.1802E-01	-4.896	0.0000	1.1568	0.4254

Black cod, standard CPUE (cont.)

Limited Dependent Variable Model - CENSORED regression
Maximum Likelihood Estimates
Log-Likelihood............. -475.33
Threshold values for the model: Lower 0.0000 Upper **********
N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	1.2131	2.136	0.568	0.5700		
JUN	0.54405	0.3012	1.806	0.0709	0.0632	0.2433
JUL	0.45107	0.3643	1.238	0.2157	0.2679	0.4430
AUG	0.42911	0.5001	0.858	0.3908	0.2114	0.4084
SEP	0.58552	0.6314	0.927	0.3538	0.1563	0.3632
OCT	0.47957	0.7677	0.625	0.5322	0.1943	0.3958
GOA	-1.4643	0.8430	-1.737	0.0824	0.2437	0.4294
TIMELDEP	0.20330E-01	0.3037E-01	0.669	0.5033	35.4959	7.3762
LDEPTH	-1.0072	0.8306	-1.213	0.2253	4.5567	0.5722
L2DEP	0.18929	0.7475E-01	2.532	0.0113	21.0905	5.4739
SLOPE	-0.94604E-02	0.7722E-02	-1.225	0.2205	4.3824	9.3282
SLOPE2	-0.43875E-03	0.2070E-03	-2.120	0.0340	106.1783	364.3158
SST	-0.13363	0.7330E-01	-1.823	0.0683	8.1266	2.4220
SST2	0.58258E-02	0.4761E-02	1.224	0.2211	71.8882	37.6890
SSTSLOPE	-0.19264E-02	0.1486E-02	-1.297	0.1948	20.1915	15.0350
SSH	-0.21699E-01	0.1219E-01	-1.779	0.0752	-3.7830	3.8678
SSHSLOPE	0.26229E-02	0.1163E-02	2.255	0.0241	23.0019	16.3287
MWIND	-0.41253	0.1958	-2.107	0.0351	2.0167	0.2648
MCHLA	-0.24595	0.1010	-2.436	0.0149	1.0086	0.4172
MCHLA1	-0.10473	0.6237E-01	-1.679	0.0931	1.0359	0.5412
DWIND	0.37205	0.1130	3.293	0.0010	0.0290	0.1678
DCHLA	0.28535	0.1020	2.797	0.0052	0.0504	0.2187
DCHLA1	0.14997	0.9825E-01	1.527	0.1269	0.0399	0.1958
GLDEPTH	0.32492	0.1238	2.625	0.0087	1.1919	2.1142
GTIMELDE	-0.43333E-01	0.1475E-01	-2.937	0.0033	8.6648	15.7758
GSST	0.52365E-01	0.3993E-01	1.311	0.1898	2.3660	4.3357
GSSH	0.19796E-01	0.1484E-01	1.334	0.1824	-0.8388	2.2465
GMWIND	0.95612	0.3191	2.996	0.0027	0.5024	0.8940
GMCHLA	0.15454	0.1236	1.250	0.2112	0.2619	0.4981
GMCHLA1	-0.13879E-01	0.9517E-01	-0.146	0.8841	0.2526	0.4922
IMR7	-0.59326	0.9035E-01	-6.566	0.0000	1.9115	0.4680
Sigma	0.48232	0.1793E-01	26.899	0.0000		

Black cod, standard CPUE (cont.)

ML Estimates of Selection Model
Maximum Likelihood Estimates
Log-Likelihood............. -4800.0
LHS is CENSORED. Tobit Model fit by MLE.
FIRST 30 estimates are probit equation.
N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	-1.8232	2.353	-0.775	0.4384		
JUN	0.55945	0.4032	1.387	0.1653		
JUL	0.48645	0.5183	0.938	0.3480		
AUG	0.48453	0.7006	0.692	0.4892		
SEP	0.52862	0.8851	0.597	0.5504		
OCT	0.35517	1.074	0.331	0.7409		
GOA	-1.3881	1.064	-1.305	0.1919		
TIMELDEP	0.35108E-01	0.4106E-01	0.855	0.3925		
LDEPTH	-0.19972	0.9987	-0.200	0.8415		
L2DEP	0.93209E-01	0.9095E-01	1.025	0.3054		
SLOPE	-0.17968E-02	0.8992E-02	-0.200	0.8416		
SLOPE2	-0.48634E-03	0.2269E-03	-2.143	0.0321		
SST	-0.11236	0.1066	-1.054	0.2918		
SST2	0.43708E-02	0.6897E-02	0.634	0.5262		
SSTSLOPE	-0.15135E-02	0.1960E-02	-0.772	0.4401		
SSH	-0.27004E-01	0.1562E-01	-1.729	0.0839		
SSHSLOPE	0.32944E-02	0.1333E-02	2.472	0.0134		
MWIND	-0.41676	0.2745	-1.518	0.1289		
MCHLA	-0.20416	0.1667	-1.225	0.2207		
MCHLA1	-0.60272E-01	0.9581E-01	-0.629	0.5293		
DWIND	0.29563	0.1353	2.185	0.0289		
DCHLA	0.23332	0.1148	2.032	0.0422		
DCHLA1	0.89461E-01	0.1318	0.679	0.4972		
GLDEPTH	0.35292	0.1715	2.057	0.0397		
GTIMELDE	-0.50061E-01	0.2251E-01	-2.224	0.0261		
GSST	0.56143E-01	0.6438E-01	0.872	0.3831		
GSSH	0.26269E-01	0.1766E-01	1.488	0.1368		
GMWIND	0.94383	0.4029	2.343	0.0191		
GMCHLA	0.13359	0.1906	0.701	0.4833		
GMCHLA1	-0.42591E-01	0.1296	-0.329	0.7425		
SIGMA(1)	0.60758	0.6781E-01	8.961	0.0000		
RHO(1,2)	-0.65815	0.1227	-5.366	0.0000		

Rockfish, standard CPUE

Sample Selection Model

Two stage least squares regression.		Dep. Variable	LOGROCKS			
Observations	2084	Weights	ONE			
Mean of LHS	0.3189948E+00	Std.Dev of LHS	0.8042483E+00			
StdDev of resid.	0.5704857E+00	Sum of squares	0.6681570E+03			
R-squared	0.4965948E+00		Adj. R-squared		0.4892387E+00	
F[30,	2053]	0.6750753E+02	Prob value	0.3217295E-13		
Log-likelihood	-0.1771771E+04	Restr.(b=0) Log-l		-0.2502574E+04		
Amemiya Pr. Criter.		0.3302952E+00		Akaike Info.Crit.		0.1730106E+01
Standard error corrected for selection.....			0.57731			
Correlation of disturbance in regression						
and Selection Criterion (Rho).............			0.18122			
N(0,1) used for significance levels.						
Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	-3.1113	0.7469	-4.165	0.0000		
JUN	-0.50678E-01	0.1460	-0.347	0.7285	0.0614	0.2402
JUL	0.18668	0.2123	0.879	0.3792	0.2692	0.4436
AUG	-0.19276	0.2978	-0.647	0.5175	0.2116	0.4085
SEP	-0.74679E-01	0.3807	-0.196	0.8445	0.1569	0.3638
OCT	0.28892	0.4623	0.625	0.5320	0.1934	0.3950
GOA	-1.9658	0.7314	-2.688	0.0072	0.2404	0.4274
TIMELDEP	0.42586E-02	0.2040E-01	0.209	0.8346	35.5014	7.3817
LDEPTH	1.5964	0.3102	5.147	0.0000	4.5578	0.5740
L2DEP	-0.16010	0.3176E-01	-5.041	0.0000	21.1029	5.4919
SLOPE	0.50755E-01	0.5203E-02	9.754	0.0000	4.3812	9.3259
SLOPE2	-0.45105E-03	0.1165E-03	-3.872	0.0001	106.1247	364.6537
SST	-0.17723	0.3899E-01	-4.546	0.0000	8.1178	2.4189
SST2	0.14955E-01	0.2894E-02	5.167	0.0000	71.7304	37.6320
SSTSLOPE	0.13599E-02	0.9128E-03	1.490	0.1363	20.1822	15.0117
SSH	0.23040E-01	0.6114E-02	3.769	0.0002	-3.7809	3.8750
SSHSLOPE	0.13567E-02	0.8649E-03	1.569	0.1167	22.9680	16.3217
MWIND	-0.26801	0.1398	-1.917	0.0552	2.0168	0.2648
MCHLA	0.23437E-01	0.4124E-01	0.568	0.5698	1.0076	0.4184
MCHLA1	-0.10672	0.2902E-01	-3.678	0.0002	1.0345	0.5422
DWIND	0.64795E-01	0.8539E-01	0.759	0.4480	0.0288	0.1673
DCHLA	0.24483	0.6637E-01	3.689	0.0002	0.0509	0.2198
DCHLA1	0.32186	0.7106E-01	4.529	0.0000	0.0398	0.1956
GLDEPTH	0.35931	0.8116E-01	4.427	0.0000	1.1783	2.1088
GTIMELDE	-0.31584E-01	0.8495E-02	-3.718	0.0002	8.5557	15.7173
GSST	0.89732E-01	0.2959E-01	3.033	0.0024	2.3308	4.3117
GSSH	-0.39775E-01	0.1067E-01	-3.728	0.0002	-0.8258	2.2383
GMWIND	0.18776	0.2487	0.755	0.4503	0.4961	0.8907
GMCHLA	-0.12895	0.8632E-01	-1.494	0.1352	0.2574	0.4944
GMCHLA1	0.19343	0.7970E-01	2.427	0.0152	0.2479	0.4876
IMR7	0.10462	0.4816E-01	2.172	0.0298	1.1547	0.4262

Rockfish, standard CPUE (cont.)

Limited Dependent Variable Model - CENSORED regression
Maximum Likelihood Estimates
Log-Likelihood............. -1058.7
Threshold values for the model: Lower 0.0000 Upper **********
N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	-59.038	4.225	-13.975	0.0000		
JUN	-0.15847E-01	0.4224	-0.038	0.9701	0.0633	0.2436
JUL	1.2045	0.6004	2.006	0.0448	0.2671	0.4426
AUG	1.1343	0.8765	1.294	0.1956	0.2119	0.4088
SEP	2.3211	1.119	2.074	0.0380	0.1562	0.3631
OCT	3.1534	1.383	2.281	0.0226	0.1948	0.3961
GOA	5.7371	1.695	3.385	0.0007	0.2429	0.4289
TIMELDEP	-0.84149E-01	0.5672E-01	-1.484	0.1379	35.5010	7.3800
LDEPTH	21.942	1.623	13.521	0.0000	4.5561	0.5725
L2DEP	-1.9408	0.1388	-13.979	0.0000	21.0856	5.4770
SLOPE	0.89567E-01	0.9907E-02	9.040	0.0000	4.3567	9.2949
SLOPE2	-0.97000E-03	0.2125E-03	-4.565	0.0000	105.3350	363.3731
SST	-0.18383	0.9804E-01	-1.875	0.0608	8.1259	2.4168
SST2	0.11912E-01	0.7003E-02	1.701	0.0890	71.8521	37.6225
SSTSLOPE	0.49697E-02	0.2508E-02	1.981	0.0475	20.1507	14.9848
SSH	0.32366E-01	0.1621E-01	1.997	0.0458	-3.7796	3.8661
SSHSLOPE	0.24707E-02	0.2035E-02	1.214	0.2248	22.9461	16.2950
MWIND	-0.46247	0.3564	-1.298	0.1944	2.0170	0.2650
MCHLA	0.45035	0.1383	3.257	0.0011	1.0089	0.4176
MCHLA1	-0.29367	0.9248E-01	-3.176	0.0015	1.0362	0.5416
DWIND	0.35857E-01	0.1803	0.199	0.8424	0.0286	0.1666
DCHLA	0.12472	0.1533	0.814	0.4158	0.0505	0.2190
DCHLA1	0.58706	0.1424	4.123	0.0000	0.0395	0.1949
GLDEPTH	-0.96351	0.1986	-4.852	0.0000	1.1882	2.1125
GTIMELDE	-0.56791E-01	0.1835E-01	-3.095	0.0020	8.6394	15.7671
GSST	0.18872	0.6882E-01	2.742	0.0061	2.3558	4.3273
GSSH	-0.69470E-01	0.2373E-01	-2.927	0.0034	-0.8329	2.2418
GMWIND	-0.18797E-01	0.5551	-0.034	0.9730	0.5009	0.8934
GMCHLA	-0.55850	0.1975	-2.829	0.0047	0.2612	0.4978
GMCHLA1	0.30757	0.1641	1.874	0.0609	0.2516	0.4917
IMR7	0.33952	0.1143	2.970	0.0030	1.9112	0.4661
Sigma	0.98623	0.2846E-01	34.654	0.0000		

Rockfish, standard CPUE (cont.)

ML Estimates of Selection Model
Maximum Likelihood Estimates
Log-Likelihood............. -5380.0
LHS is CENSORED. Tobit Model fit by MLE.
FIRST 30 estimates are probit equation.
N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	-56.474	4.850	-11.644	0.0000		
JUN	0.22905	0.4983	0.460	0.6458		
JUL	1.2618	0.6869	1.837	0.0662		
AUG	1.2949	1.002	1.292	0.1963		
SEP	2.4800	1.277	1.942	0.0521		
OCT	3.3829	1.587	2.132	0.0330		
GOA	5.2336	2.035	2.572	0.0101		
TIMELDEP	-0.10408	0.6720E-01	-1.549	0.1215		
LDEPTH	21.260	1.869	11.377	0.0000		
L2DEP	-1.8490	0.1647	-11.226	0.0000		
SLOPE	0.82802E-01	0.1053E-01	7.863	0.0000		
SLOPE2	-0.96891E-03	0.2243E-03	-4.319	0.0000		
SST	-0.22583	0.9279E-01	-2.434	0.0149		
SST2	0.14440E-01	0.6475E-02	2.230	0.0257		
SSTSLOPE	0.35699E-02	0.2713E-02	1.316	0.1882		
SSH	0.30588E-01	0.1629E-01	1.877	0.0605		
SSHSLOPE	0.26823E-02	0.2115E-02	1.268	0.2047		
MWIND	-0.33975	0.4520	-0.752	0.4523		
MCHLA	0.30897	0.1708	1.809	0.0705		
MCHLA1	-0.33693	0.1063	-3.171	0.0015		
DWIND	0.17681	0.1896	0.932	0.3512		
DCHLA	0.24109	0.1746	1.381	0.1674		
DCHLA1	0.64309	0.1702	3.778	0.0002		
GLDEPTH	-0.96905	0.2408	-4.025	0.0001		
GTIMELDE	-0.49021E-01	0.2095E-01	-2.340	0.0193		
GSST	0.19512	0.6870E-01	2.840	0.0045		
GSSH	-0.65231E-01	0.2516E-01	-2.593	0.0095		
GMWIND	0.53487E-01	0.6346	0.084	0.9328		
GMCHLA	-0.44256	0.2267	-1.952	0.0509		
GMCHLA1	0.30180	0.2029	1.487	0.1369		
SIGMA(1)	0.99435	0.2637E-01	37.712	0.0000		
RHO(1,2)	-0.36229E-01	0.1442	-0.251	0.8016		

Flatfish, standard CPUE

Sample Selection Model
Two stage least squares regression. Dep. Variable LOGFLATS
Observations 2084 Weights ONE
Mean of LHS 0.1443222E+01 Std.Dev of LHS 0.7989369E+00
StdDev of resid. 0.6750596E+00 Sum of squares 0.9355633E+03
R-squared 0.2857214E+00 Adj. R-squared 0.2752838E+00
F[30, 2053] 0.2737428E+02 Prob value 0.3217295E-13
Log-likelihood -0.2122535E+04 Restr.(b=0) Log-l -0.2488766E+04
Amemiya Pr. Criter. 0.4624842E+00 Akaike Info.Crit. 0.2066732E+01
Standard error corrected for selection..... 0.67523
Correlation of disturbance in regression
and Selection Criterion (Rho)............. -0.26454E-01
N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	8.5247	0.8862	9.619	0.0000		
JUN	-0.28334	0.1729	-1.639	0.1012	0.0614	0.2402
JUL	-0.42274	0.2512	-1.683	0.0924	0.2692	0.4436
AUG	-0.52272	0.3524	-1.483	0.1380	0.2116	0.4085
SEP	-0.68092	0.4506	-1.511	0.1308	0.1569	0.3638
OCT	-0.85019	0.5471	-1.554	0.1202	0.1934	0.3950
GOA	-0.88905	0.8652	-1.028	0.3042	0.2404	0.4274
TIMELDEP	0.66403E-01	0.2414E-01	2.751	0.0059	35.5014	7.3817
LDEPTH	-3.3393	0.3685	-9.061	0.0000	4.5578	0.5740
L2DEP	0.32054	0.3777E-01	8.486	0.0000	21.1029	5.4919
SLOPE	-0.76981E-01	0.6136E-02	-12.546	0.0000	4.3812	9.3259
SLOPE2	0.10598E-02	0.1371E-03	7.731	0.0000	106.1247	364.6537
SST	0.10518E-01	0.4612E-01	0.228	0.8196	8.1178	2.4189
SST2	-0.17401E-02	0.3424E-02	-0.508	0.6113	71.7304	37.6320
SSTSLOPE	0.19921E-02	0.1076E-02	1.851	0.0641	20.1822	15.0117
SSH	0.30263E-01	0.7218E-02	4.193	0.0000	-3.7809	3.8750
SSHSLOPE	0.46397E-03	0.1020E-02	0.455	0.6492	22.9680	16.3217
MWIND	-0.12633	0.1653	-0.764	0.4448	2.0168	0.2648
MCHLA	0.72674E-01	0.4883E-01	1.488	0.1367	1.0076	0.4184
MCHLA1	0.32083E-01	0.3426E-01	0.936	0.3491	1.0345	0.5422
DWIND	-0.43080E-01	0.1009	-0.427	0.6695	0.0288	0.1673
DCHLA	0.19638	0.7851E-01	2.501	0.0124	0.0509	0.2198
DCHLA1	-0.24133	0.8384E-01	-2.878	0.0040	0.0398	0.1956
GLDEPTH	0.43883	0.9601E-01	4.571	0.0000	1.1783	2.1088
GTIMELDE	-0.56250E-01	0.1005E-01	-5.598	0.0000	8.5557	15.7173
GSST	-0.38102E-01	0.3501E-01	-1.088	0.2764	2.3308	4.3117
GSSH	0.29712E-01	0.1263E-01	2.353	0.0186	-0.8258	2.2383
GMWIND	0.84513	0.2942	2.872	0.0041	0.4961	0.8907
GMCHLA	-0.21575	0.1022	-2.111	0.0348	0.2574	0.4944
GMCHLA1	-0.18307	0.9431E-01	-1.941	0.0523	0.2479	0.4876
IMR7	-0.17862E-01	0.5775E-01	-0.309	0.7571	1.1541	0.4255

Flatfish, standard CPUE (cont.)

Limited Dependent Variable Model - CENSORED regression
Maximum Likelihood Estimates
Log-Likelihood............. -2189.2
Threshold values for the model: Lower 0.0000 Upper **********
N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	10.023	0.9941	10.083	0.0000		
JUN	-0.17792	0.1766	-1.007	0.3137	0.0614	0.2401
JUL	-0.34136	0.2578	-1.324	0.1854	0.2695	0.4438
AUG	-0.37872	0.3620	-1.046	0.2954	0.2115	0.4085
SEP	-0.49852	0.4633	-1.076	0.2819	0.1568	0.3637
OCT	-0.64007	0.5624	-1.138	0.2550	0.1933	0.3950
GOA	-0.89924	0.8867	-1.014	0.3105	0.2408	0.4277
TIMELDEP	0.53463E-01	0.2489E-01	2.148	0.0317	35.5004	7.3800
LDEPTH	-3.8565	0.3947	-9.771	0.0000	4.5579	0.5739
L2DEP	0.38824	0.4089E-01	9.495	0.0000	21.1036	5.4907
SLOPE	-0.83725E-01	0.6378E-02	-13.128	0.0000	4.3791	9.3241
SLOPE2	0.11046E-02	0.1426E-03	7.748	0.0000	106.0738	364.5736
SST	-0.61101E-02	0.4745E-01	-0.129	0.8975	8.1203	2.4210
SST2	-0.10966E-02	0.3518E-02	-0.312	0.7553	71.7806	37.6925
SSTSLOPE	0.16883E-02	0.1102E-02	1.532	0.1254	20.1982	15.0259
SSH	0.30473E-01	0.7427E-02	4.103	0.0000	-3.7812	3.8741
SSHSLOPE	0.43550E-03	0.1040E-02	0.419	0.6755	22.9797	16.3266
MWIND	-0.45419E-01	0.1675	-0.271	0.7862	2.0167	0.2648
MCHLA	0.36737E-01	0.4934E-01	0.745	0.4565	1.0076	0.4183
MCHLA1	0.19910E-01	0.3539E-01	0.563	0.5737	1.0345	0.5421
DWIND	0.44944E-01	0.1032	0.435	0.6633	0.0288	0.1672
DCHLA	0.23501	0.8068E-01	2.913	0.0036	0.0508	0.2197
DCHLA1	-0.26924	0.8763E-01	-3.072	0.0021	0.0398	0.1956
GLDEPTH	0.43692	0.9853E-01	4.434	0.0000	1.1800	2.1098
GTIMELDE	-0.51209E-01	0.1033E-01	-4.959	0.0000	8.5676	15.7228
GSST	-0.40244E-01	0.3596E-01	-1.119	0.2631	2.3361	4.3173
GSSH	0.31127E-01	0.1292E-01	2.410	0.0160	-0.8275	2.2392
GMWIND	0.79485	0.3017	2.635	0.0084	0.4967	0.8909
GMCHLA	-0.18950	0.1047	-1.810	0.0703	0.2578	0.4945
GMCHLA1	-0.20333	0.9659E-01	-2.105	0.0353	0.2482	0.4878
IMR7	-0.14461	0.5784E-01	-2.500	0.0124	1.9115	0.4670
Sigma	0.69039	0.1092E-01	63.215	0.0000		

Flatfish, standard CPUE (cont.)

ML Estimates of Selection Model
Maximum Likelihood Estimates
Log-Likelihood............. -6509.3
LHS is CENSORED. Tobit Model fit by MLE.
FIRST 30 estimates are probit equation.
N(0,1) used for significance levels.

Variable	Coefficient	Std. Error	t-ratio	Prob.	Var. Mean	Var. st. dev.
Constant	8.8227	1.188	7.425	0.0000		
JUN	-0.23979	0.1790	-1.339	0.1805		
JUL	-0.35902	0.2652	-1.354	0.1758		
AUG	-0.41255	0.3767	-1.095	0.2735		
SEP	-0.54322	0.4816	-1.128	0.2593		
OCT	-0.67442	0.5914	-1.140	0.2542		
GOA	-0.83326	0.8942	-0.932	0.3514		
TIMELDEP	0.58686E-01	0.2602E-01	2.256	0.0241		
LDEPTH	-3.4442	0.5165	-6.668	0.0000		
L2DEP	0.33991	0.4794E-01	7.090	0.0000		
SLOPE	-0.81097E-01	0.6405E-02	-12.661	0.0000		
SLOPE2	0.10962E-02	0.1424E-03	7.696	0.0000		
SST	0.14665E-02	0.6364E-01	0.023	0.9816		
SST2	-0.12020E-02	0.4484E-02	-0.268	0.7887		
SSTSLOPE	0.20152E-02	0.1043E-02	1.932	0.0533		
SSH	0.30362E-01	0.6908E-02	4.395	0.0000		
SSHSLOPE	0.43279E-03	0.9993E-03	0.433	0.6650		
MWIND	-0.12628	0.1637	-0.771	0.4405		
MCHLA	0.71385E-01	0.5448E-01	1.310	0.1901		
MCHLA1	0.35210E-01	0.3798E-01	0.927	0.3539		
DWIND	-0.18057E-01	0.9320E-01	-0.194	0.8464		
DCHLA	0.20191	0.8879E-01	2.274	0.0230		
DCHLA1	-0.28890	0.9005E-01	-3.208	0.0013		
GLDEPTH	0.43885	0.9877E-01	4.443	0.0000		
GTIMELDE	-0.54051E-01	0.9655E-02	-5.598	0.0000		
GSST	-0.43807E-01	0.3895E-01	-1.125	0.2607		
GSSH	0.30922E-01	0.1132E-01	2.733	0.0063		
GMWIND	0.81385	0.3022	2.693	0.0071		
GMCHLA	-0.20505	0.9217E-01	-2.225	0.0261		
GMCHLA1	-0.20576	0.7758E-01	-2.652	0.0080		
SIGMA(1)	0.69119	0.1175E-01	58.815	0.0000		
RHO(1,2)	-0.44590E-01	0.9834E-01	-0.453	0.6502		