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Perspectives

Willingness to Participate and Bids in a Fishing Vessel Buyout Program: A Case Study of New England Groundfish

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Abstract *An experimental fishing vessel buyout program was initiated in 1995 to remove vessels from the Northeast United States groundfish fishery. Information provided by the applicants to this program was used to evaluate the likely participation and potential cost of an expanded buyout initiative. This paper describes the pilot buyout program and the econometric procedures used to forecast participation and bids at various levels of program spending. Program participation and bid levels were modeled in two stages using participation and bid functions. The expanded buyout program, completed in April 1998, provided a unique opportunity to evaluate initial participation and cost forecasts. Methods used in this study are also applicable to modeling other fishery related economic decisions, such as the trading of individual transferable quota shares.*

Key words Buyout, capacity, groundfish.

Introduction

Accumulated growth in U.S. domestic and international fishing capacity has received increasing attention over the past several years. At an international level, these concerns have been codified in the General Principles of the Food and Agriculture Organization (FAO) Code of Conduct and addressed within the FAO International Plan of Action for Managing Fishing Capacity (FAO 1995; 1999). The U.S. is a signatory to these agreements and has identified excess capacity as an impediment to sustainable fisheries (NOAA 1997). While these agreements and statements of policy provide a formal statement of the problem and need for capacity reduction, they do not endorse any particular reduction mechanism.

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Mechanisms for capacity reduction have been characterized as being incentive blocking or incentive-adjusting methods (FAO 1998). Incentive-blocking methods include license limitation, vessel catch limits, and buyout; while incentive-adjusting methods could include taxes or various forms of rights-based management.[1] A clear preference has emerged among economists for the latter (FAO 1998; Gates, Holland, and Gudmundsson 1996), while fishery management governing bodies have tended to opt for the former. Among the incentive blocking methods, vessel buybacks have been implemented in a variety of fisheries (Read and Buck 1997; Gates, Holland, and Gudmundsson 1996), but usually not until overfishing has resulted in a resource crisis. In the Northeast groundfish fishery, a crisis point was reached in 1995 when several key groundfish stocks had either collapsed or were on the verge of collapse (Wang and Rosenberg 1997). In anticipation of the stringent management measures that would be required to rebuild these stocks and their accompanying economic effects, a suite of financial assistance programs were developed by Congressional mandate, among which was a vessel buyout.

As noted previously, the efficacy of buyouts to achieve either conservation or financial assistance objectives has been questioned. These issues were raised at the time of the New England buyout by the Department of Commerce's Inspector General (1997). Subsequent assessments of the effectiveness of the buyout have focused on its potential short- and long-term effects (NMFS 2000) and the level of capacity that remained in the groundfish fishery even after the buyout had been completed (United States General Accounting Office 2000). While these studies, and others like them, have important implications for buyout program design, we focus on a set of methods that were used, and may be used by others, to forecast willingness to participate and costs, given that a policy decision has been made to implement a buyout.

The vessel buyout program in the Northeast groundfish fishery was implemented in two stages, beginning with a $2 million pilot buyout followed by a larger $23 million buyout. The pilot was implemented to test various qualification and administrative aspects of a buyout and to reveal industry interest. The pilot program provided an opportunity: (*a*) to develop predictive models of willingness to participate and reservation prices for a full-scale buyout, and (*b*) to compare model predictions to actual performance in the expanded buyout. This paper provides a description of the pilot and expanded buyout programs, and the statistical models developed to predict participation and costs for the expanded program. The paper is organized as a chronology beginning with a brief overview of groundfish management and the buildup of the Northeast groundfish fleet. This overview is followed by a description of the pilot buyout program and a description of the statistical models. The last section provides a description of the expanded buyout program and compares predicted with actual participation and program costs.

Northeast Groundfish Management and Buildup of the Fleet

Since the passage of the Magnuson Act in 1977, the groundfish fishery in the northeastern U.S. has been managed under three fishery management plans (FMPs) developed by the New England Fishery Management Council (Council) and NOAA's National Marine Fisheries Service (NMFS). Between 1977 and 1982, the fishery was managed primarily by quotas for cod, haddock, and yellowtail flounder. During this

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[1] A case could be made for classifying a buyout as an incentive adjusting method because it provides an incentive to exit the fishery.

period, stocks began rebuilding following overfishing by foreign fleets. Even as the foreign fishery was being eliminated, the U.S. domestic fleet was experiencing a marked increase in new vessel construction stimulated by the economic opportunity created by the displacement of the foreign fleets, increased stock abundance, and rising consumer demand for seafood. The expansion of the domestic fleet was also influenced, to a lesser extent, by a suite of direct assistance and tax incentive programs promoting the replacement and new construction of fishing vessels (Federal Fisheries Investment Task Force 1999).

Due to database changes, a consistent time series illustrating the pattern of vessel entry into the Northeast groundfish fishery can only be constructed using data from three New England states (Maine, Massachusetts, and Rhode Island). These states account for the majority of vessels and landings of groundfish in the Northeast and are likely to be representative of the Northeast region as a whole. From 1965 until 1973, an average of 581 vessels per year participated in the New England groundfish fishery (figure 1). Approximately 50 vessels that had not previously been identified in any prior year were added annually to the fleet. However, as new vessels were being added, other vessels were leaving the fishery, so the net average increase in the groundfish fleet was only nine vessels per year. There was an average of 38 newly constructed or documented New England vessels per year from 1965 to 1973.[2]

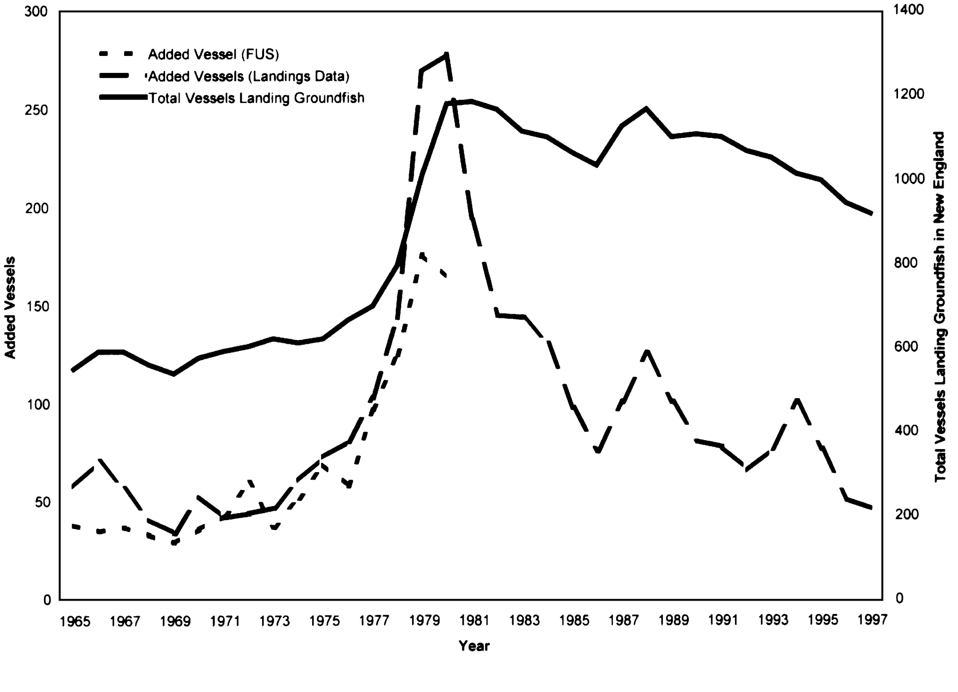

Figure 1. Additions to the New England Fishing Fleet (1965 to 1980) and Number of Vessels Landing Groundfish in Maine, Massachusetts, or Rhode Island (1965 to 1997)

[2] Reported data from *Fisheries of the United States* (FUS) (issued annually; covering 1964–82). Issues prior to 1970 were prepared by U.S. Fish and Wildlife Service and are available via interlibrary loan. Issues since 1970 are available from Superintendent of Documents, U.S. Government Printing Office, Washington D.C.

Between 1974 and 1980, an unprecedented increase in fleet size occurred. In 1979 alone, 176 vessels were added to the groundfish fishery, and in 1980, 1,185 vessels landed groundfish in New England. Since 1980, the New England groundfish fleet has gradually declined, but presently is nearly 60% larger than during the pre-Magnuson Act period.

The buildup in the fishing capacity during the late 1970s resulted in an increasing number of vessels fishing on annual quotas (TACs). Lacking a basis for controlling the number of participants (for example, limited entry or property rights), the groundfish quotas were rapidly attained, leading to volatile market conditions and a number of management and enforcement problems. At the same time, resource impacts were becoming evident. Dissatisfaction with TACs led to their replacement in 1982 with indirect controls on fishing effort. These indirect controls (gear restrictions and minimum fish sizes) were implemented under the Interim Plan. This plan was designed to provide resource protection, while a more comprehensive and effective approach could be developed. However, such technical measures were not sufficient, and groundfish stocks continued to decline.

The current Northeast Multispecies Fishery Management Plan (Multispecies Plan) was implemented in 1986. The Plan added seven more species to the management unit (three more species were added through the amendment process in 1991) and instituted a number of regulatory changes. However, the basic framework of indirect effort control was retained. Presently, 11 of the species managed under the plan are defined as regulated or “large-mesh” species: cod, haddock, pollock, yellowtail flounder, winter or blackback flounder, witch flounder, American plaice, redfish, white hake, Atlantic halibut, and windowpane flounder. The three remaining “small-mesh”species are red hake, silver hake, and ocean pout.

Without direct controls on fishing mortality, groundfish stocks declined to record low levels. In May 1994, Amendment 5 to the plan was enacted which capped the number of vessels in the fishery through a limited-access program and controlled the amount of time vessels could spend at sea. A Secretarial action in 1994 also resulted in large-scale area closures. Subsequently, the Council developed further modifications to the Multispecies Plan to rebuild the groundfish stocks. Amendment 7 was implemented July 1996 and included a more rigorous days-at-sea (DAS) reduction schedule, removal of most exemptions from DAS controls, and a more flexible adjustment process to respond to specific resource conditions.

To mitigate the economic impacts of Amendment 7 management measures on fishing industries and marine-dependent communities, several financial assistance programs were implemented by Congressional action. One of these was the Fishing Capacity Reduction Demonstration Program ($2 million), hereafter referred to as the pilot buyout program, enacted in June, 1995. Subsequently, $23 million was made available for the Fishing Capacity Reduction Initiative, hereafter referred to as the expanded buyout program. Although the primary objective of these programs was to provide financial assistance, the buyouts were also designed to provide conservation benefits for the groundfish fishery.

The pilot buyout program was designed to evaluate the level of interest in a vessel buyout program and to test a variety of implementation protocols (such as bidding procedures, scrapping provisions, and eligibility/selection criteria). The pilot buyout program was concluded in February, 1996, with the selection of 11 vessels from a pool of 114 applicants.

Prior to funds being appropriated for the expanded buyout program, analyses were conducted to estimate how many and what kind of vessels could be removed in a full-scale buyout initiative. In the pilot buyout program, the bids submitted by the 114 applicants totaled nearly $52 million.

To develop forecasts of the number of applicants and program costs for a full-scale buyout, data from the pilot buyout were used to model participation and bid prices. The expanded buyout program was implemented in September, 1996, and concluded in April, 1998. In this paper, we describe the methods used to develop forecasts for the expanded buyout. We also compare our forecasts of participation and program costs to actual program performance.

Description of the Pilot Buyout Program

Eligibility for the pilot buyout program was limited in the following ways: (*i*) participation was limited to two of the six different multispecies limited-access permit categories; (*ii*) vessel owners were required to demonstrate that at least 65% of their fishing revenue was derived from combined landings of the ten regulated large-mesh groundfish in three of four years from 1991 to 1994; and (*iii*) vessel owners were required to demonstrate that their vessel was capable of fishing under its own power in federal waters.

Participation in the buyout was voluntary and bids were solicited through a reverse auction, whereby each vessel owner prepared a bid or price at which he/she would be willing to render the vessel in an unfishable condition and surrender all federal fishing permits. Vessel selection was based on the ratio of the bid to the vessel's groundfish revenue, where vessels with low ratios placed higher in the rankings. Bids were not subject to negotiation upon acceptance by the government. However, owners of the selected vessels were given an opportunity to reconsider their decision to participate in the buyout. Successful bidders that then decided not to participate were removed from further consideration and the next highest ranked vessel was selected. Vessel owners were not required to surrender their right to reenter the multispecies fishery or enter any other fishery provided they could purchase a vessel with the appropriate permits.

Decision Modeling

Presented with a buyout opportunity, a vessel owner faces two sequential (and possibly interrelated) decisions: (*i*) whether or not to apply for the buyout; and (*ii*) what dollar amount to declare as a bid. The first stage is a discrete choice to submit an application or not. In the second stage, the owner must choose a bid that is worthwhile and competitive. Although bids were observed only from those that chose to participate, landings, vessel characteristics, and permit data were available for the pool of vessels that met the eligibility criteria. These data formed the basis for modeling of buyout program participation and bidding.

Several alternative statistical methods were available for modeling the bidding process. The participation stage could easily be modeled using standard Logit or Probit regression techniques. These give the likelihood that an individual with a certain set of characteristics will participate in the buyout program. However, predicting the likely size of the bid in the population is not as straightforward. Bids from individuals who did not participate were not observed, and the qualification criteria restricted access to the buyout program to a subset of limited-access permit holders. A simple, linear regression approach could, therefore, not be used due to the correlation between regression errors and the explanatory variables (Maddala 1983). To overcome this problem, three alternative statistical models were considered: the Tobit model (Tobin 1958), Cragg's double-hurdle model (Cragg 1971), and Heckman's sample selection model (Heckman 1976). Due to space considerations, we discuss these models only in very general terms.

In the Tobit model, the predicted bid is given by the expected bid conditional on a positive bid being observed, times the probability that a positive bid will be observed. A Tobit model can be estimated by including in the bid regression the inverse Mills ratio (IMR) obtained from a first-stage Probit that uses the same regressors as the bid function (with standard errors appropriately adjusted for the presence of a fitted value as a regressor). The inclusion of the IMR effectively accounts for the correlation between the errors and regressors. Although the Tobit model is extensively used in demand analysis, it was rejected for our purposes because the same factors are assumed to affect the probability of bidding and the expected magnitude of the bid, given that a bid is made. For example, an owner with an older vessel might be more likely to submit a bid than someone with a newer vessel with a longer expected useful life. Asset theory suggests that the value (hence the reservation price) of the older vessel should be lower than the newer vessel. However, the Tobit model does not accommodate these opposite effects among the explanatory variables. To address this, we first considered the double hurdle model suggested by Cragg (1971). In this model, the variables affecting the probability of a positive bid are allowed to differ from those affecting the expected bid.

In the usual formulation of the Cragg model, the probability and bid regressions are assumed to be independent. This somewhat unrealistic assumption permits estimation to proceed in two steps, whereby the probability of a positive bid is estimated using a Probit or Logit regression, and the coefficients of the bid function are estimated by a truncated regression of the positive bids. In cases where the variables in each regression are identical, Cragg's model collapses to a Tobit. The Cragg model may be appropriate in instances where truncated values are observed. For example, in contingent valuation studies, zero bids may be observed when a respondent indicates a zero willingness to pay.

In the pilot buyout, bids were only observed for owners with eligible vessels that chose to submit a bid in the reverse auction. In this instance, bids by owners with eligible vessels that did not participate were unobserved. Under these circumstances Heckman's two-stage model best approximates the decision process for the vessel buyout. Heckman's model also allows the variables influencing each decision to differ, but does not require that the two equations be independent. As with a Tobit model, the Heckman model can be estimated by including in the bid regression the IMR obtained from a first-stage Probit model. However, in the Heckman model, the bid function need not contain the same regressors as the probability model.

Participation Model

Participation in the buyout may be assumed to be influenced by a vessel owner's past and expected future earnings from his/her vessel, vessel condition, the owner's financial status, alternative occupations, age, and other socioeconomic factors. Of these factors, data on vessel owner's financial status, demographic characteristics, or vessel condition are not routinely collected and were not collected as part of the pilot buyout application. Gross revenue data provided by the bid applicants were supplemented with landings and permit information (from NMFS databases) to develop the following first-stage decision model:

PART = *f*(RATIO, DAS, AGE, GILLNET)
Where PART = 1 if a bid was submitted; 0 otherwise
RATIO = total groundfish earnings divided by total earnings
DAS = allocated Amendment 7 fishing days
AGE = vessel age in years
GILLNET = 1 if gillnet gear; 0 otherwise

Since Amendment 7 management measures would have the greatest impact on vessels most dependent on groundfish, the ratio of groundfish revenue to gross revenues (RATIO) was used as an indicator of relative reliance on the groundfish fishery. It is expected that vessels with a higher ratio are more likely to participate in the pilot buyout. Further, since the selection criteria favored vessels with a high dependence on groundfish, RATIO also represented the expectation of being selected for buyout. The ratio variable was also used in examining alternative eligibility criteria based on relative groundfish dependence. Future earning potential from the groundfish fishery would be constrained by the vessel owner's allocated fishing effort. At the time of the pilot buyout, the timing of the effort reduction schedule was still under discussion, but the total effort reduction was known. Therefore, each vessel's fishing effort constraint was captured by its DAS allocation at the end of the Amendment 7 reduction schedule. Vessel age (AGE) was used as a proxy for a vessel's operating condition. Since fishing time was counted differently for gillnet vessels as compared to mobile gear, a dummy variable (GILLNET) was created to differentiate gillnet vessels from all other vessels. As suggested by an anonymous reviewer, this difference in accounting for fishing time may have affected the marginal participation probabilities, so the gillnet dummy variable was multiplied by each of the independent variables to create three interaction terms.

The participation data included all vessels for which a bid had been submitted to the pilot program (participants), as well as all vessels identified in the NMFS landings database as meeting the eligibility requirements (*i.e.*, 65% dependence on groundfish and the appropriate limited-access permit types). Of the 114 participants, 16 were not included in the analysis due to missing observations for one or more of the independent variables. The total number of eligible non-participants was 153 vessel owners.

Willingness to participate in the pilot buyout was positively related to vessel age (AGE) and dependence on groundfish (RATIO), and the coefficients for these two variables were statistically significant (table 1). The coefficient for allocated DAS was not statistically significant, but it was positively related to participation. The ratio interaction term (GILLNET*RATIO), and the age interaction term (GILLNET*AGE) were positively related to participation. Willingness to participate in the pilot buyout was negatively related to the days-at-sea interaction term (GILLNET*DAS). Although none of these interaction terms was statistically significant, their inclusion made a small improvement in the model's ability to predict participation.

Using the parameter estimates from the participation model, 187 of the 251 vessel owners (75%) were correctly classified as a buyout participant or nonparticipant

Table 1
Participation Model Results

Variable	Coefficient	Standard Error	t-ratio
Constant	–5.13	1.06	–4.84
RATIO [a]	4.91	1.12	4.37
DAS	$0.79E^{-3}$	$0.46E^{-2}$	0.17
AGE [a]	0.03	0.01	2.50
GILLNET*RATIO	8.94	6.22	1.44
GILLNET*DAS	–0.11	0.07	–1.67
GILLNET*AGE	0.04	0.05	0.80

[a] Significant at the 5% level.
Chi-Squared = 63.93.
n = 251

Table 2
Within Sample Predictions of Participation Model

	Model Predictions			
Actual	Non-participants	Participants	Total	% Correct
Non-participant	125	28	153	(82%)
Participants	36	62	98	(63%)
Total	161	90	251	

(table 2). Of the 153 nonparticipants, the model correctly predicted 125 as nonparticipants (82%). Of the 98 participants, the model correctly predicted 62 as participants (63%).

The participation model was better able to predict participation by gillnet vessel owners as opposed to owners of vessels with other gear types. Of the 73 gillnet vessel owners, participation classification was correct for 68 owners (93%). Of the 287 owners of vessels with other gear types, participation classification was correct for 202 owners (70%).

Bid Model

A vessel owner's bid was assumed to be equal to the present value of expected future net earnings plus the difference between the cost of scrapping the vessel and its salvage value:[3]

$$\text{Bid} = \sum_{t}^{T} \frac{\pi_t}{(1 + r)^t} + [\text{Scrap} - \text{Salvage}]$$

Thus, an owner's asking price is expected to be influenced primarily by factors that affect the future net earning potential of his/her vessel. These factors include the remaining years of serviceable life of the fishing vessel, the earning potential of the vessel, and vessel operating costs. Vessel level data for all of these factors (particularly operating costs) are not routinely collected, so the following proxies were used in the second-stage bid model:

BID = *f*(TOTREV, AGE, HP, GILLNET, DAS, IMR)
Where BID = the vessel owner's submitted bid
TOTREV = total revenue from all fisheries
AGE = vessel age
HP = vessel main engine horsepower
GILLNET = 1 if gillnet gear; 0 otherwise
DAS = Amendment 7 allocated fishing time
IMR = Inverse Mill's Ration from first-stage

[3] Selected vessel owners were required to scrap their vessel but were permitted to sell engines, winches, gear, electronics, and anything else that could be removed from the vessel prior to cutting up the hull.

Since recent past income levels provide some measure of future vessel performance, average annual gross revenues (TOTREV) from 1991 to 1994 were used as a proxy for expected future earnings. Vessel age (AGE) provides an indicator of the potential remaining serviceable life of the vessel. The main engine horsepower (HP) of a vessel was used as a proxy for vessel size. Larger vessels are more expensive to operate but also have greater range and effective fishing power. Thus, horsepower is an indicator of potential net income production in groundfish or alternative fisheries. A vessel's fishing effort allocation (DAS) was used to account for the vessel's income constraint with respect to groundfish. The dummy variable indicating gillnet gear (GILLNET) accounted for differences in value based on gear type, and the IMR was derived from the first-stage participation model.

The bid function was estimated using a double-log functional form, so the parameter estimates are interpreted as elasticities. For example, a 1% change in TOTREV results in a 0.19% increase in the offer price (table 3). Similarly, the elasticity of the marginal bid value of a day-at-sea, as measured by the DAS variable, was positive and near unity, suggesting that bid values are proportional to DAS allocations. The coefficient on HP is positive, which suggests that more powerful vessels are valued more highly. The coefficient for GILLNET was not statistically significant, but being positive suggests that gillnet vessels are valued more highly. The coefficient for vessel age (AGE) was not statistically significant but negative, indicating that older vessels are valued less than newer vessels.

Forecasts and Actual Participation in the Expanded Buyout Program

Based on the Pilot program results, several potential changes to the eligibility and administrative features of the expanded buyout program were considered. These included lowering the groundfish dependence requirement, expansion of the limited-access permit categories, and providing non-fishing alternatives to scrapping the vessel. Of these changes, the groundfish dependence criterion was maintained at 65%, but allowance for participation by all limited-access permit categories and greater flexibility to transfer vessels to non-fishing uses were adopted. In all other respects, the $23 million expanded buyout was administered in the same manner as the $2 million Pilot.

Table 3
Bid Model Result

	Heckman Model (Log-likelihood = –44.33)		
Variable	Coefficient	Standard Error	t–ratio
Constant [a]	–2.73	1.64	–1.67
TOTREV [a]	0.19	0.78	2.41
AGE	–0.21	0.12	–1.73
HP [a]	0.63	0.15	4.16
GILLNET	0.04	0.19	0.20
DAS [a]	0.90	0.29	3.09
IMR	–0.12	0.15	–0.82

[a] Significant at the 5% level or greater.
n = 98

Given the above criteria, 360 vessel owners were identified through NMFS permit and landings databases as being eligible to submit a bid in the expanded buyout program. Of the eligible vessel owners, 120 were predicted to submit a bid, while 140 vessels submitted bids to the expanded buyout (table 4). If all vessels could be removed, the projected program cost would have been $43.1 million for the 106 vessels, as compared to $52.7 million if all 140 participating vessels had been removed.

The average expected bid was estimated to be $358 thousand compared to the actual average bid of $376 thousand (table 4). Among forecasted buyout applicants, average vessel length, horsepower, and tonnage were 66 feet, 502 hp, and 99 tons, respectively. Average vessel size of actual buyout applicants was slightly larger at 67 feet, 535 hp, and 109 tons. The forecasted average ton days were 11.9 thousand, while average ton days for actual participants were 13.2 thousand.

The selection criterion for the expanded buyout was the same as that in the Pilot. Ordering vessels from lowest to highest bid to groundfish revenue ratio and summing to the $23 million program budget yielded a predicted 51 vessels that would be removed (table 5), at an average cost of $444 thousand. The actual number of removed vessels was 68, at an average cost of $332 thousand. Fewer vessels were forecasted to be removed under the $23 million budget constraint due to the tendency to select for larger vessels. Predicted average horsepower, length, gross tons, and allocated fishing time were all greater than actual removals.

Conclusions

The modeling procedures employed herein have some promise in evaluating and developing forecasts for vessel buyout program participation and expected costs. Similar modeling methods may be appropriate where surveys are used to ascertain interest in a vessel buyout. In the case of the Northeast groundfish buyout, the Pilot program participants were representative of the expanded population of vessel owners allowing forecasts to be developed of total program costs and the number of vessels that might be removed.

Table 4

Comparison of Predicted to Actual Expanded Buyout Program Applicants

	Decision Model Forecast	Actual Buyout Applicants
Number of vessels	120	140
Total cost (millions)	$43.1	$52.7
Average bid	$358,759	$376,200
Average ratio of groundfish revenue to total revenue	0.95	0.87
Average annual total revenue	$308,970	$391,100
Average annual groundfish revenue	$282,717	$351,400
Average allocated days-at-sea	110	113
Average vessel age	22	18
Average horse power	502	535
Average vessel length (feet)	66	67
Average gross tons	99	109
Average ton days	11,891	13,176
Total ton days (millions)	1.40	1.84

Table 5
Comparison of Predicted to Actual Vessels Removed in the Expanded Program

	Forecasted Removals	Actual Removals
Number of removed vessels	51	68
Average bid	$443,830	$331,600
Average ratio of groundfish revenue to total revenue	0.95	0.89
Average annual total revenue	$464,017	$344,500
Average annual groundfish revenue	$423,879	$326,900
Average annual allocated days-at-sea	116	112
Average vessel age	21	19
Average horse power	580	519
Average vessel length (feet)	75	66
Average gross tons	129	102
Average ton days	15,389	12,288
Total ton days (millions)	0.78	0.84

Differences in vessels predicted to participate in the expanded program, based on information from the pilot project, and the actual expanded program participants can partly be explained by the difference in expectations about the regulatory environment prior to the pilot project and prior to the expanded program. During the pilot project, major changes in fishing regulations (Amendment 7 to the Groundfish FMP) were being formulated, and there was considerable uncertainty about the severity of the restrictions. By the time the expanded program occurred, Amendment 7 was adopted and there was more certainty about the regulatory environment. This change in expectations may have altered the decision criteria of the expanded program participants. Also, expectations about the future of buyout programs were probably different at the time of the expanded program simply because the pilot program existed. This may have altered vessel owners' decisions in ways not accounted for in the models.

The availability of sufficient funds to conduct both a pilot and a full-scale buyout may be unlikely to recur for other proposed buyouts. This may leave design and implementation of a survey as the most likely vehicle for forecasting buyout participation and costs. While our analysis of the expanded New England buyout may have benefitted from the preferences revealed through the pilot program, a survey approach would offer a broader opportunity to gain deeper insights into the motivations for wanting to participate in a buyout and the factors which determine the reservation price for fishing vessels in overcapitalized fisheries. In either case (a survey or a pilot), the general decision modeling approach used for the New England case study would be appropriate.

To improve the ability to forecast behavior in future buyout programs, buyout administrators should consider collecting additional information from the buyout applicant or through a survey of potential program participants. Such information would certainly have improved our understanding of why some individuals chose to participate, while others did not. Information about the vessel owner's financial situation or indebtedness would have been particularly helpful since the buyout was implemented as part of an overall financial assistance program. In addition to financial information data should be collected on owner's demographic characteristics; owner's fishing experience, participation in other fisheries, and alternative occupational opportunities.

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