Measuring Fishing Capacity and Utilization with Commonly Available Data: An Application to Alaska Fisheries

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Introduction

Current regulations limit the amount of time catcher vessels and catcher-processor vessels may fish, which often precludes vessels from operating at their full, productive capacity (Weninger and Strand, 2003). At present, it's unclear what the level of catch would be if the existing fleet of vessels that operate in Federally managed Alaska fisheries were allowed to fish for longer periods of time during the year (under normal operating conditions).[1] A first step toward addressing this question is to compare existing capacity to actual catch. A significant difference between the two indicates that there is likely more investment in the fishery than that which maximizes the net benefits to the nation, and it may signal the need for implementing measures to diminish or eliminate the incentives for, and presence of, excess capacity (FAO, 1998).[2]

The process of estimating potential catch, in the presence of regulations, essentially requires one to examine past and present fishing activity to determine the extent to which current effort, and catch, could and/or would increase if existing conditions or regulations changed.[3] The capacity measures computed in this paper were constructed using data on catch (in metric tons, (t)), participation (in weeks), and vessel characteristics of catcher vessels and catcher-processor vessels that operated in Federally managed Alaska commercial fisheries from 1990 to 2001. In addition to computing the capacity estimates, we also illustrate how utilization of individual fisheries, total weeks of participation, and sizes of particular fleets have varied over the last decade. The specific data sources include Alaska Department of Fish and Game (ADFG) fish tickets, Federal blend data (which includes data from both observer reports and weekly production reports), ADFG vessel-registration files, and Federal vessel-registration files.

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ABSTRACT—Due to a lack of data on vessel costs, earnings, and input use, many of the capacity assessment models developed in the economics literature cannot be applied in U.S. fisheries. This incongruity between available data and model requirements underscores the need for developing applicable methodologies. This paper presents a means of assessing fishing capacity and utilization (for both vessels and fish stocks) with commonly available data, while avoiding some of the shortcomings associated with competing "frontier" approaches (such as data envelopment analysis).

[1]Thus, the capacity estimates reflect what could be caught in all Alaska commercial fisheries (state and Federally managed) by Federal fishery participants; the capacity of vessels that participated only in state fisheries was not estimated. As is the case in most fisheries, the capacity estimates are in terms of retained catch (not retained and discarded catch).

[2]The incentives that often give rise to over investment, and thus, excess capacity, are related to the restricted open-access management used in most fisheries and the associated race for fish (Kula, 1992).

[3]For example, one might want to know how much the existing fleet would catch, given existing stock levels, if all existing total allowable catch (TAC) limits were removed. Or, one might want to find the cost-minimizing or profit-maximizing level of catch associated with the existing fleet. There are several other capacity-related questions of interest, which, unfortunately, are often unanswerable given the existing data. The estimates computed here essentially reflect what could by caught by existing boats, with current technologies and stocks, if they fished the most number of weeks they have since 1990. An additional variant, allowing vessels to fish as much as their peers have in certain fisheries, is also provided. The following section provides more details.

Notions Underlying Capacity Measurement

In addition to the current fishing regulations, there are technological and economic constraints that limit the amount of fish that fishermen are willing and able to catch. Generally speaking, technological constraints can be thought of as "physical" limits on the maximum amount of fish that fishermen could catch (based on the gear used, the size and power of the vessel, the health of the stocks, weather, fishing skill, etc.). Economic constraints are those factors that affect fishermen's decisions over how much effort to exert and which species to catch (i.e. costs of fuel, bait, and labor; opportunity costs of participating in other fisheries; and ex-vessel prices).

Ideally, one could compute capacity measures that reflect the maximum amount of fish that could and would be caught by fishermen, given existing technological, biological, and economic constraints, if all regulatory restrictions governing catch were relaxed (NMFS, in press). Such measures would indicate the realistic "catching power" of the fleet, and could then be compared to actual catch in order to gauge excess capacity (indicating the extent to which current production differs from an economically optimal level).

Similarly, one could compare existing capacity to some optimal, desired level of capacity at the current stock conditions or another reference point (such as when stocks are rebuilt to levels corresponding to maximum economic yield or maximum sustainable yield) to obtain a measure of overcapacity.[4]

Unfortunately, both endeavors require a great deal of information, most of which is lacking for Federally managed Alaska fisheries (as well as in most other fisheries); measurement of overcapacity requires the most information (and speculation) and is thus impractical for nearly all fisheries with current data collection practices. Notably, there is a general absence of data on production costs and input use (Felthoven, 2002).[5]

One approach that could be undertaken with the existing data is to construct "technical" capacity estimates using data envelopment analysis (DEA) or stochastic production frontier (SPF) models. Such analyses essentially focus on the maximum level of catch that vessels could obtain if they operated with full (and often heightened) technical efficiency and unrestricted use of variable inputs (Dupont et al., 2002). Typically, however, the maximum technical/physical level of catch exceeds that which would occur when economic factors (such as costs) are accounted for, and thus may overstate the amount that would be caught. For this reason, this paper does not derive technical capacity estimates. Rather, we attempt to purge the major constraints that limit fishing effort, while still accounting for the impacts of technological and economic constraints implicit in the data on catch and effort (another benefit of this approach is that we do not impute potential technical efficiency increases in the capacity estimates).

Put another way, the observed effort and catch histories for Alaska fisheries are a result of the regulatory, technical, and economic constraints that have typically existed. For example, catch levels reflect the relative prices paid for each target species, the technological tradeoffs of catching one species instead of another, and bycatch caps that limit the catch of prohibited species (which are joint in the production technology due to imperfect gear selectivity (Larson et al., 1998)).

The approach used to estimate current fishing capacity in this paper attempts to account for the decreases in effort, catch, and participation that have occurred over time due to decreases in the total allowable catch (TAC), which limit both catch and effort. While the capacity estimates still embody many of the spatial restrictions and bycatch constraints, they essentially reflect what would and could be caught by the fleet under normal operating conditions, given 2001 targeting strategies and the existing technical and economic constraints.

It is too complex a task to successfully mimic the removal of all existing regulatory constraints that limit catch, given the multitude of interactions and targeting strategies that arise in response to those regulations. In some cases, regulations for a species may generate direct regulatory and indirect economic impacts (such as area closures that force vessels to travel further out to sea) that can be very difficult to disentangle. For these reasons, no attempt is made to purge such effects in this study. Similarly, we do not speculate what could be caught under stock levels larger than those observed during 1990 to 2001. More detail on the exact procedures used in the process to estimate capacity will be provided later in the paper.

There are wide ranges of fishing activities, vessel sizes, targeting strategies, and gear configurations in the various Federally managed Alaska fisheries. Generally speaking, however, groups can be established that are likely to share similar technological, economic, and regulatory (TAC's, closures, seasonal delineation) constraints. In an attempt to establish such groups, vessel characteristics, fishery participation, and processing data (for catcher-processor vessels) were examined. As a result, 12 catcher vessel groups and 10 catcher-processor vessel groups were formed (hereafter referred to as "subgroups"). Each of these subgroups is comprised of similarly equipped and similarly sized vessels that engage in a common set of fisheries (in the case of catcher-processor vessels, they also produce a similar set of finished products). Such a grouping allows us to present the capacity estimates on a fleet-by-fleet basis, which more clearly elucidates the sources of fishing capacity.

In addition, by categorizing the vessels into homogeneous subgroups one has a more realistic idea of what vessels in each subgroup could have caught, even for those vessels that have exhibited very little activity. This in part allows one to account for latency in the capacity estimates, although we make no other attempt to account for latent capacity of inactive vessels in our estimates, as our focus is on active participants. However, one could easily estimate the capacity of the latent vessels with techniques similar to those illustrated here.

By focusing on the range of effort for a set of well defined, comparable peers, one can reasonably determine the effort levels that the less active vessels were capable of exerting (if economic incentives arose that led them to do so). Although care was taken defining and refining the 22 vessel subgroups designated in this paper, it is worth noting that the validity of these types of peer comparisons can be compromised by unobserved heterogeneity among vessels in each subgroup (FAO, 1998). For this reason, the estimator $\hat{C}_j^i$ avoids such comparisons (it is based solely on each vessel's historic participation) and should be interpreted as the more conservative capacity estimator. Alternatively, the estimator $\tilde{C}_j^i$ does involve comparisons among vessels within each subgroup, and thus it should

[4]National Marine Fisheries Service. 2001. Report of the Expert Group on Fish Harvesting Capacity. Final report to the National Oceanic and Atmospheric Administration, Contract #40-AA-NF-109717.

[5]One promising area where data availability may markedly improve is in the Bering Sea and Aleutian Islands crab fisheries. In March 2004, Congress approved a rationalization plan for these fisheries that included a mandatory data collection program. The program will collect vessel- and plant-level cost, earnings, and effort data. Therefore, it is likely that "economic" measures of capacity may be developed for these fisheries, which will aid in assessing the effects of the rationalization plan.

be interpreted more cautiously. Note, however, that in most cases the resulting estimates from the two estimators turned out to be quite similar, as illustrated by the tables at the end of this report. Further details on the estimators $\hat{C}_j^i$ and $\tilde{C}_j^i$ are given below.

Formulation of Capacity Estimators

There are several ways in which one could estimate the potential level of effort and catch of a fishing vessel, each of which could generate different estimates of capacity output. However, with the aim of providing realistic estimates of what could (and would) actually be caught, we base our analysis on each vessel's historical participation and effort in each of the Alaska commercial fisheries.

Specifically, we compare the total number of weeks each vessel fished in 2001 with the most weeks it fished over the 1990–2001 period (where 52 weeks is the greatest number of weeks each vessel could theoretically participate in a given year). If effort (in weeks) exceeded the 2001 effort in another year, it is assumed that the existing capacity of the vessel should be based upon that higher level of effort (which would instead be exerted upon the observed 2001 species composition). This process thus involves radially scaling up the observed 2001 catch statistics by the ratio of maximum operating weeks for 1990–2001 to observed operating weeks in 2001. This approach thus assumes constant returns to scale and Leontief input-output separability (Chambers, 1988).[6]

An issue that arises in basing the calculations on total annual effort is that one may generate participation levels in a specific fishery that are above any exhibited in the past. For example, if a vessel is now operating half as many total weeks as in a former year (and targets groundfish and crab), our approach would compute capacity as twice the size of the observed 2001 catch levels for groundfish and crab. If, however, groundfish effort had remained relatively stable over time and the drop in annual operating time was solely attributable to diminished crab participation, the implied increase in groundfish effort would be unrealistic.

We alleviate such potential problems by monitoring the total effort of each vessel within eight generally classified fisheries: groundfish (including walleye pollock, *Theragra chalcogramma;* Pacific cod, *Gadus macrocephalus*; Atka mackerel, *Pleurogrammus monopterygius;* rockfish, *Sebastolobus* and *Sebastes* species; sablefish, *Anoplopoma fimbria;* flatfish, primarily Alaska plaice, or *Pleuronectes quadrituberculatus;* and "other groundfish[7]"); Pacific herring, *Clupea pallasi;* Pacific halibut, *Hippoglossus stenolepis;* Pacific salmon, *Oncorhynchus* spp.; crab (including red king crab, *Paralithodes camtshaticus*; golden king crab, *Lithodes aequispinus;* and Tanner/snow crab[8], *Chionoecetes opilio* and *C. bairdi);* scallops, *Patinopectin caurinus;* "other shellfish[9]", and "other species[10]." If the implied potential increase in total annual effort implies a number of weeks in any particular fishery that exceeds the most weeks historically fished by that vessel in that fishery, the radial scaling of effort is then limited to take on that vessel's observed maximum for that fishery.

This first estimator will be denoted as $\hat{C}_j^i = \hat{\theta}_j^k Y_j^i$, where $\hat{C}_j^i$ is the capacity of vessel j for species i, $\hat{\theta}_j^k$ is a scaling factor for vessel j in fishery k, and Y_j^i is the observed output of vessel j for species i in 2001. The scaling factor $\hat{\theta}_j^k$ indicates the amount by which observed output could be increased, and is given by:

$$\hat{\theta}_j^k = \min\left\{ \begin{bmatrix} \left(\dfrac{max.\ weeks_j}{weeks_j}\right), \\ \left(\dfrac{max.\ weeks_j^k}{weeks_j^k}\right) \end{bmatrix} \right\}.$$

Here, $max.\ weeks_j$ is the maximum number of weeks spent fishing by vessel j in any year for 1990–2001, $weeks_j$ is the observed number of weeks spent fishing by vessel j in 2001, $max.weeks_j^k$ is the maximum number of weeks spent fishing by vessel j in fishery k for 1990–2001, and $weeks_j^k$ is the number of weeks spent fishing by vessel j in fishery k for 2001. Note that θ_j^k is fishery-specific, not species-specific, and that each k^{th} fishery has a unique group of species i, i=1, … I. For example, the groundfish fishery includes seven species and the crab fishery includes four species (all other fisheries defined in this paper correspond to a single species or species "group").

If one broadens the scope of potential increases in an effort to incorporate information from a vessel's peers (i.e. their subgroup), a second, alternative capacity estimator can be generated. This estimator is formed by increasing each vessel's effort (in weeks) to its greatest historical level (as with the first estimator), subject to the constraint that the resulting implied number of weeks spent in each fishery does not exceed the most weeks in that fishery by any vessel in its subgroup for 1990–2001. This alternative formulation recognizes that the maximum historical weeks fished in a fishery by a vessel may not reflect the maximum level possible given the regulatory, technical, and economic constraints that are present. Rather, such a level may be better reflected by the maximum weeks fished in that fishery by another vessel in its subgroup. Thus, this second capacity estimator will generate estimates greater than or equal to the first estimator.

[6]Leontief output separability (i.e. that outputs move in fixed proportions) is also embodied in the capacity estimates generated by the commonly employed multi-output DEA and SPF capacity estimating models (FAO, 1998). Input separability assumes that the inputs used in fishing may be characterized by a composite variable such as days or weeks fished — common in the fisheries literature (Squires and Kirkley, 1991).

[7]This group includes yellowfin sole, *Limanda aspera;* Greenland turbot, *Reinhardtius hippoglossoides;* arrowtooth flounder, *Atheresthes stomias;* rock sole, *Lepidopsetta bilineata;* flathead sole, *Hippoglossoides ellassodon;* and Pacific Ocean perch, *Sebastes alutus*.

[8]Blue king crab, *Paralithodes platypus,* was also broken out as a separate category when analyzing production for the period of 1990 to 2001. However, because the vessels in this analysis caught no blue king crab in 2001, it is not represented in the capacity and capacity utilization estimates.

[9]This group is made up of clams, *Saxidomus giganteus, Spisula solidissima, Protothaca staminea;* shrimp, *Pandalus* spp.; abalone, *Haliotos kamtschatkana;* and other crab in the genus' *Lithodes, Paralithon*, and *Chionocetes*.

[10]This group is made up of lingcod, *Ophiodon elongates*; eels, genus *Anguilla*; and infrequently caught forage species.

The second capacity estimator will be denoted as $\tilde{C}_j^i = \tilde{\theta}_j^k Y_j^i$. The interpretation of the components of $\tilde{C}_j^i$ is the same as for $\hat{C}_j^i$, except that here, $\tilde{\theta}_j^k$ is defined as:

$$\tilde{\theta}_j^k = \min\left\{\begin{bmatrix}\left(\frac{max.\,weeks_j}{weeks_j}\right),\\ \left(\frac{max.\,weeks^k}{weeks_j^k}\right)\end{bmatrix}\right\}.$$

Thus, the ratio of

$$\frac{max.\,weeks_j^k}{weeks_j^k}$$

has been replaced with

$$\frac{max.\,weeks^k}{weeks_j^k}$$

where $max.weeks^k$ is the maximum number of weeks spent fishing by any of the vessels in this subgroup in fishery k for 1990–2001. Due to confidentiality requirements, and the sheer number of vessels involved in the fishery, this paper will present the values of

$$\hat{C}^i = \sum_{j=1}^{J} \hat{C}_j^i$$

and

$$\tilde{C}^i = \sum_{j=1}^{J} \tilde{C}_j^i$$

for each subgrouping of catcher vessels and catcher-processor vessels, where J= the number of vessels in each subgroup (the specific details of each subgroup are given below).

Formulation of Capacity Utilization and Fishery Utilization Measures

Typically, capacity utilization (CU) is defined as the ratio of observed output to capacity output (Morrison Paul, 1999). Following this convention, we will present two CU measures for each vessel subgroup, based on the $\hat{C}_j^i$ and $\tilde{C}_j^i$ capacity estimates for each species i. The first measure is defined as the ratio of observed catch by the vessel subgroup to capacity catch for the subgroup (where capacity is defined according to $\hat{C}_j^i$);

$$\hat{CU}^i = \left(\sum_{j=1}^{J} Y_j^i\right) \Bigg/ \left(\sum_{j=1}^{J} \hat{C}_j^i\right).$$

The second measure is defined as the ratio of total observed catch by the vessel subgroup to the second formulation of capacity catch for the subgroup:

$$\tilde{CU}^i = \left(\sum_{j=1}^{J} Y_j^i\right) \Bigg/ \left(\sum_{j=1}^{J} \tilde{C}_j^i\right).$$

Note that these aggregate subgroup-specific estimates of capacity utilization are in a sense catch-weighted, as vessels with a larger catch share of species i have a larger impact on the value of both $\hat{CU}^i$ and $\tilde{CU}^i$. It is worth noting again that these CU estimates embody the assumption that the 2001 catch composition for each vessel within each of the eight generally defined fisheries remains constant at capacity. Thus, the value of capacity for each species does not reflect what could or would be caught if all effort were exerted upon that particular species.

Rather, capacity (and the associated CU measures) for each species represents an estimate of what could be caught if all vessels increased their effort (according to the capacity estimators described above) and targeted their observed 2001 catch mix. This approach is thus more likely to generate realistic estimates of what could be caught within the bulk of Alaska fisheries by existing vessels.

Because the species-specific CU measures are not impacted by vessels that did not catch that particular species in 2001 (as both observed output and capacity output would be zero under our present methodology), they do not provide information on changes in annual participation. Instead, they indicate the intensity of effort, relative to past years, for those that are currently participating. Therefore, "fishery utilization" (FU) measures were constructed, which provide information on overall participation (in weeks), relative to past years, even in the absence of activity in a fishery in 2001.

These measures (FU_{Total}, $FU_{Groundfish}$, FU_{Salmon}, $FU_{Herring}$, $FU_{Halibut}$, $FU_{Scallop}$, FU_{Crab}, $FU_{Shellfish}$, $FU_{Other\ species}$) are simply defined as the ratio of weeks each vessel spent in each fishery in 2001 relative to the maximum ever observed for that vessel for 1990–2001 (averages are presented for each vessel subgroup). Note that FU_{Total} is the ratio of total weeks fished during the year in any activity in 2001 to the maximum number of total weeks fished during the year for 1990–2001. All other week-based FU measures reflect participation in individual fisheries (e.g. $FU_{Groundfish}$ is the ratio of the weeks a vessel spent in groundfish fisheries in 2001 to the most weeks it spent from 1990 to 2001 in groundfish fisheries). In summary, CU measures essentially represent vessel utilization by current fishery participants, while FU measures indicate the existing utilization of the fisheries, relative to past levels.

Measures of Capacity, Utilization, and Participation

The measures discussed and developed above will be presented in Tables 1 through 9 in various contexts. In some cases, measures will be expressed for the entire group of vessels in Federally managed Alaska fisheries, while in other cases the measures will focus on subsets (such as catcher-processor vessels, catcher vessels, or subgroups within each of these fleets). In order to fit the identifier for each catcher-processor vessel and catcher vessel subgroup in the tables below, abbreviated names, as developed for the environmental impact statements for Alaska groundfish fisheries, are used. The abbreviations used to identify each subgroup are defined as follows:

Catcher-Processor Vessels

ST-CP (surimi trawler catcher-processor): these factory trawlers have the necessary equipment to produce surimi from walleye pollock and other groundfish.

FT-CP (fillet trawler catcher-processor): these trawl vessels have the equipment to produce fillets (from walleye pollock, Pacific cod, and other groundfish), and are not surimi-capable according to past production records.

HT-CP (headed and gutted trawler catcher-processor): these factory trawlers do not process more than incidental amounts of fillets. Generally, they are limited to headed and gutted products. In general, they do not focus their efforts on walleye pollock, opting instead for flatfish, rockfish, Pacific cod, and Atka mackerel.

P-CP (pot catcher-processor): these vessels have been used primarily in the crab fisheries of the North Pacific, but as of late they have increased their participation in the Pacific cod fisheries. They generally use pot gear, but may also use longline gear. They produce whole or headed and gutted groundfish products.

L-CP (longline catcher-processor): these vessels (also known as freezer longliners) do not trawl or use pot gear, and typically use longline gear to catch mostly Pacific cod. Most of these vessels are limited to headed and gutted products.

Salmon CP, Crab CP, Halibut CP, Other Shellfish CP: these groups are comprised of vessels that do not fit into the other catcher-processor categories above, and spend a large proportion of their fishery-weeks in salmon, crab, halibut, or "other shellfish" (those other than crab and scallops), respectively.

Other CP: these vessels do not fit into the other catcher-processor categories above, and did not spend a disproportionate number of weeks operating in the salmon, crab, or "other shellfish" fisheries (and thus weren't included in those subgroups).

All CP: this group includes all catcher-processors from the categories above, and is included to give overall measures for the catcher-processor sector.

Table 1.—Actual catch (t), capacity estimates, excess capacity, and week-based FU measures, by species, for catcher-processor and catcher vessels, 2001.[1]

Species	Actual catch	$\hat{C}$	Excess capacity (%)	$\tilde{C}$	Excess capacity (%)	Week-based FU
Atka mackerel	57,167	66,886	17.00	66,893	17.01	0.404
Flatfish	118,542	149,009	25.70	149,330	25.97	0.404
Pacific cod	227,532	306,976	34.92	318,117	39.81	0.404
Walleye pollock	1,449,333	2,010,866	38.74	2,030,470	40.10	0.404
Rockfish	26,559	32,208	21.27	32,595	22.73	0.404
Sablefish	15,101	18,691	23.77	20,137	33.35	0.404
Other groundfish	5,987	7,757	29.56	7,861	31.30	0.404
Pacific salmon	288,850	366,036	26.72	404,572	40.06	0.645
Pacific herring	33,654	42,656	26.75	46,240	37.40	0.196
Pacific halibut	27,176	31,587	16.23	40,023	47.27	0.426
Scallops	251	306	21.91	470	87.25	0.024
Golden king crab	3,006	6,608	119.83	7,018	133.47	0.278
Red king crab	3,963	15,037	279.43	15,909	301.44	0.278
Tanner crab	11,335	44,660	294.00	48,194	325.18	0.278
Other shellfish	468	528	12.82	576	23.08	0.252
Other species	1,571	1,710	8.80	2,144	36.46	0.258
All species	2,270,495	3,101,521	36.60	3,190,549	40.52	0.661

[1]The week-based FU measures are (unweighted) averages of the ratio of each vessel's 2001 weeks in that fishery to its maximum weeks in that fishery for 1990–2001. Thus, the FU measures for groundfish and crab are the same for each species classified in those fisheries. Note also that the week-based FU estimates for "All species" reflect the ratio of each vessel's total 2001 weeks fishing to its maximum historical weeks fishing, not an average of the week-based CU scores from each fishery.

Catcher Vessels

TCV BSP 125: all vessels for which trawl catch accounts for > 15% of total catch value, value of Bering Sea pollock catch is greater than value of catch of all other species combined, vessel length is ≥ 125 feet, and total value of groundfish catch is > $5,000. All vessels fishing after 1998 are AFA-eligible.

TCV BSP 60-124: all vessels for which trawl catch accounts for > 15% of total catch value, value of Bering Sea pollock catch is greater than value of catch of all other species combined, vessel length is 60–124 feet, and total value of groundfish catch is > $5,000. All vessels fishing after 1998 are AFA-eligible.

TCV Div. AFA: all vessels that are AFA-eligible for which trawl catch accounts for > 15% of total catch value, value of Bering Sea pollock catch is less than value of catch of all other species combined, vessel length is ≥ 60 feet, and total value of groundfish catch is > $5,000.

TCV Non AFA: all vessels that are not AFA-eligible for which trawl catch accounts for > 15% of total catch value, value of Bering Sea pollock catch is less than value of catch of all other species combined, vessel length is ≥ 60 feet, and total value of groundfish catch is > $5,000.

TCV < 60: all vessels for which trawl catch accounts for > 15% of total catch value, vessel length is < 60 feet, and total value of groundfish catch is > $2,500.

PCV: all vessels that are not trawl CV's for which the value of pot catch is > 15% of total catch value, vessel length is ≥ 60 feet, and total value of groundfish catch is > $5,000.

LCV: all vessels that are not trawl CV's or pot CV's for which vessel length is ≥ 60 feet, and total value of groundfish catch is > $2,000, excluding Pacific halibut and state-water sablefish.

FGCV 33-59: all vessels that are not trawl CV's for which vessel length is 33–59 feet, and total value of groundfish catch is > $2,000.

FGCV 32: all vessels that are not trawl CV's for which vessel length is ≤ 32 feet, and total value of groundfish catch is > $1,000.

Salmon CV, Crab CV: these groups are comprised of vessels that do not

Table 2.—Catcher-processor vessel capacity estimates.

Subgroup	Atka mackerel			Flatfish			Pacific cod		
	Actual	$\hat{C}$	$\tilde{C}$	Actual	$\hat{C}$	$\tilde{C}$	Actual	$\hat{C}$	$\tilde{C}$
ST-CP (n=13)	7,112	7,959	7,959	8,910	10,623	10,623	4,119	5,063	5,063
FT-CP (n=4)	—[1]	—	—	0.07	0.10	0.10	3,774	15,940	15,940
HT-CP (n=23)	49,827	58,571	58,571	93,144	117,102	117,102	25,749	32,922	32,922
P-CP (n=9)	7.90	17.6	21.5	220	284	330	7,888	10,669	11,412
L-CP (n=43)	135	139	141	2,557	2,783	2,791	107,305	130,258	130,923
Salmon CP (n=102)	—	—	—	—	—	—	0.95	2.18	2.18
Crab CP (n=15)	—	—	—	—	—	—	40.4	40.4	40.4
Halibut CP (n=22)	—	—	—	—	—	—	—	—	—
Other shellfish CP (n=9)	—	—	—	—	—	—	—	—	—
Other CP (n=6)	—	—	—	—	—	—	—	—	—
All CP (n=246)	57,082	66,688	66,693	104,831	130,793	130,848	148,877	194,896	196,304

Subgroup	Walleye pollock			Rockfish			Sablefish		
	Actual	$\hat{C}$	$\tilde{C}$	Actual	$\hat{C}$	$\tilde{C}$	Actual	$\hat{C}$	$\tilde{C}$
ST-CP (n=13)	506,153	692,768	692,768	1,993	2,243	2,243	35.5	40.7	40.7
FT-CP (n=4)	98,104	141,398	141,398	0.7	1.0	1.0	0.4	0.5	0.5
HT-CP (n=23)	16,827	20,989	20,989	15,652	18,496	18,496	802	1,078	1,078
P-CP (n=9)	130	145	165	0.35	0.39	0.44	8.6	28.1	35.4
L-CP (n=43)	4,901	6,196	6,215	236	278	279	1,754	2,026	2,034
Salmon CP (n=102)	—	—	—	—	—	—	—	—	—
Crab CP (n=15)	—	—	—	—	—	—	—	—	—
Halibut CP (n=22)	—	—	—	0.07	0.07	0.07	—	—	—
Other shellfish CP (n=9)	—	—	—	—	—	—	—	—	—
Other CP (n=6)	—	—	—	—	—	—	—	—	—
All CP (n=246)	626,116	861,497	861,536	17,882	21,018	21,019	2,602	3,175	3,189

Subgroup	Other groundfish			Pacific salmon			Pacific herring		
	Actual	$\hat{C}$	$\tilde{C}$	Actual	$\hat{C}$	$\tilde{C}$	Actual	$\hat{C}$	$\tilde{C}$
ST-CP (n=13)	651	935	935	—	—	—	—	—	—
FT-CP (n=4)	0.43	0.66	0.66	—	—	—	—	—	—
HT-CP (n=23)	637	734	734	—	—	—	—	—	—
P-CP (n=9)	5.2	9.8	9.9	0.36	0.36	0.66	—	—	—
L-CP (n=43)	1,980	2,416	2,417	—	—	—	—	—	—
Salmon CP (n=102)	—	—	—	4,182	4,818	5,297	719	738	738
Crab CP (n=15)	—	—	—	24.1	24.1	24.1	196	196	196
Halibut CP (n=22)	—	—	—	62.2	65.3	70.2	—	—	—
Other shellfish CP (n=9)	—	—	—	142.8	147.1	151.1	3.89	3.89	4.09
Other CP (n=6)	—	—	—	19.6	29.4	32.6	—	—	—
All CP (n=246)	3,274	4,096	4,096	4,432	5,085	5,577	919	937	938

Subgroup	Pacific halibut			Scallops			Golden king crab		
	Actual	$\hat{C}$	$\tilde{C}$	Actual	$\hat{C}$	$\tilde{C}$	Actual	$\hat{C}$	$\tilde{C}$
ST-CP (n=13)	—	—	—	—	—	—	—	—	—
FT-CP (n=4)	—	—	—	—	—	—	—	—	—
HT-CP (n=23)	—	—	—	—	—	—	—	—	—
P-CP (n=9)	—	—	—	—	—	—	—	—	—
L-CP (n=43)	284	315	337	—	—	—	—	—	—
Salmon CP (n=102)	177	187	206	—	—	—	—	—	—
Crab CP (n=15)	0.65	0.65	0.65	—	—	—	462	595	595
Halibut CP (n=22)	259	305	317	4.69	4.69	5.27	—	—	—
Other shellfish CP (n=9)	28.5	29.1	29.8	4.2	7.2	7.2	—	—	—
Other CP (n=6)	10.6	19.8	19.8	242.4	294.8	458.3	—	—	—
All CP (n=246)	761	858	912	251	306	470	462	595	595

Subgroup	Red king crab			Tanner crab			Other shellfish			Other species		
	Actual	$\hat{C}$	$\tilde{C}$	Actual	$\hat{C}$	$\tilde{C}$	Actual	$\hat{C}$	$\tilde{C}$	Actual	$\hat{C}$	$\tilde{C}$
ST-CP (n=13)	—	—	—	—	—	—	—	—	—	4.11	4.11	4.11
FT-CP (n=4)	—	—	—	—	—	—	—	—	—	—	—	—
HT-CP (n=23)	—	—	—	—	—	—	—	—	—	6.03	6.27	6.31
P-CP (n=9)	172	366	493	1,270	2,905	3,289	—	—	—	—	—	—
L-CP (n=43)	82.1	85.3	85.3	393	409	409	—	—	—	1.87	1.87	1.87
Salmon CP (n=102)	1.84	1.84	1.84	6.1	6.1	16.9	34.4	34.8	36.0	26.5	28.1	28.2
Crab CP (n=15)	155	209	240	220	667	783	0.69	0.80	0.80	—	—	—
Halibut CP (n=22)	1.05	1.05	1.05	11.98	11.98	11.98	8.7	8.7	11.3	0.80	0.82	0.90
Other shellfish CP (n=9)	—	—	—	0.67	0.67	1.12	58.2	58.9	70.9	16.5	17.7	17.7
Other CP (n=6)	32.9	51.3	51.3	58.5	91.1	91.1	—	—	—	1.34	1.59	2.00
All CP (n=246)	446	716	874	1,962	4,093	4,604	102	103	119	57.2	60.5	61.1

[1] "—" entries indicate that the subgroup did not catch any of that species in 2001.

Table 3.—Catcher vessel capacity estimates.

	Atka mackerel			Flatfish			Pacific cod		
Subgroup	Actual	$\hat{C}$	$\tilde{C}$	Actual	$\hat{C}$	$\tilde{C}$	Actual	$\hat{C}$	$\tilde{C}$
TCV BSP 125 (n=30)	31.3	133.3	133.9	964	1,525	1,529	3,288	5,539	5,568
TCV BSP 60-124 (n=46)	32.6	43.4	44.1	887	1,253	1,282	8,126	11,058	11,503
TCV Div. AFA (n=29)	20.8	20.9	21.8	3,522	4,290	4,373	12,345	17,643	18,061
TCV Non-AFA (n=39)	—[1]	—	—	6,754	9,284	9,377	10,720	14,856	15,087
TCV < 60 (n=55)	—	—	—	930	1,132	1,164	10,348	12,566	13,366
PCV (n=162)	0.04	0.07	0.10	55.7	70.7	72.2	15,519	27,781	33,270
LCV (n=68)	0.01	0.01	0.01	57.3	58.6	60.4	726	772	774
FGCV 33-59 (n=939)	—	—	—	172	218	234	13,620	17,499	19,116
FGCV 32 (n=126)	—	—	—	5.2	18.4	22	853	1,086	1,177
Salmon CV (n=4,150)	—	—	—	5.6	5.6	5.6	404	405	459
Crab CV (n=49)	—	—	—	—	—	—	—	—	—
Other CV (n=993)	—	—	—	357.6	359	360	2,706	2,870	3,430
All CV (n=6,686)	85	198	200	13,711	18,216	18,482	78,655	112,080	121,813

	Walleye pollock			Rockfish			Sablefish		
Subgroup	Actual	$\hat{C}$	$\tilde{C}$	Actual	$\hat{C}$	$\tilde{C}$	Actual	$\hat{C}$	$\tilde{C}$
TCV BSP 125 (n=30)	358,557	551,224	553,671	89.4	132.7	134.0	24.6	37.7	37.8
TCV BSP 60-124 (n=46)	349,945	443,702	456,194	478	573	576	31.9	39.1	39.3
TCV Div. AFA (n=29)	62,424	86,081	88,007	2,744	3,318	3,362	163	191	194
TCV Non-AFA (n=39)	25,479	36,042	36,720	3,602	4,913	4,941	237	326	328
TCV < 60 (n=55)	21,319	26,114	27,551	23.0	24.4	24.6	276	303	304
PCV (n=162)	2.6	4.2	5.3	39.6	60.6	64.1	606	825	845
LCV (n=68)	7.2	9.1	9.1	263	304	328	3,808	4,403	4,732
FGCV 33-59 (n=939)	159	263	278	1,069	1,446	1,651	6,994	8,986	10,010
FGCV 32 (n=126)	124	728	849	50.2	72.4	97.9	36.3	52.3	74.9
Salmon CV (n=4,150)	1,419	1,419	1,419	33.4	37.5	51.0	61.8	61.8	82.2
Crab CV (n=49)	—	—	—	0.09	0.09	0.2	—	—	—
Other CV (n=993)	3,781	3,781	4,230	284.5	307	345	259	289	298
All CV (n=6,686)	823,217	1,149,369	1,168,934	8,677	11,190	11,576	12,499	15,516	16,948

	Other groundfish			Pacific salmon			Pacific herring		
Subgroup	Actual	$\hat{C}$	$\tilde{C}$	Actual	$\hat{C}$	$\tilde{C}$	Actual	$\hat{C}$	$\tilde{C}$
TCV BSP 125 (n=30)	1,076	1,545	1,556	31.5	31.5	41.4	59.3	63.5	73.4
TCV BSP 60-124 (n=46)	404	541	588	29.9	30.2	36.4	89.0	93.1	105.8
TCV Div. AFA (n=29)	545	678	691	19.2	20.3	26.9	43.1	50.5	52.6
TCV Non-AFA (n=39)	433	581	590	6.6	6.8	8.6	5.3	5.3	6.4
TCV < 60 (n=55)	70.0	86.1	89.3	10,338	11,516	13,620	612	673	787
PCV (n=162)	36.3	59.8	71.2	1.0	1.0	1.2	—	—	—
LCV (n=68)	23.8	25	25	42.7	50.1	135.7	55.9	166	221
FGCV 33-59 (n=939)	64.0	81.1	84.1	91,277	107,803	129,207	8,039	10,082	11,228
FGCV 32 (n=126)	0.6	1.0	2.17	1,428	2,176	2,717	103	183	219
Salmon CV (n=4,150)	3.7	3.8	4.2	159,708	212,021	223,693	20,539	26,516	28,597
Crab CV (n=49)	—	—	—	—	—	—	47.8	47.8	47.8
Other CV (n=993)	55.7	58.9	64.5	21,535	27,293	29,506	3,141	3,838	3,962
All CV (n=6,686)	2,713	3,661	3,765	284,418	360,951	398,995	32,735	41,719	45,302

	Pacific halibut			Golden king crab			Red king crab		
Subgroup	Actual	$\hat{C}$	$\tilde{C}$	Actual	$\hat{C}$	$\tilde{C}$	Actual	$\hat{C}$	$\tilde{C}$
TCV BSP 125 (n=30)	40.7	40.7	48.0	—	—	—	92.0	125.7	148.5
TCV BSP 60-124 (n=46)	23.1	23.1	30.4	—	—	—	209	249	256
TCV Div. AFA (n=29)	144.5	144.5	196.7	—	—	—	43.8	135.0	135.0
TCV Non-AFA (n=39)	538	610	707	95.8	517.4	517.4	63.3	213.4	275.4
TCV < 60 (n=55)	622	672	765	—	—	—	2.7	3.5	3.5
PCV (n=162)	2,295	2,733	4,584	1,140	2,377	2,722	2,318	9,636	10,091
LCV (n=68)	5,541	5,987	6,879	49.0	140	140	47.3	108.8	108.8
FGCV 33-59 (n=939)	10,886	12,810	16,148	—	—	—	—	—	—
FGCV 32 (n=126)	825	974	1,223	—	—	—	—	—	—
Salmon CV (n=4,150)	961	1,154	1,367	—	—	—	—	—	—
Crab CV (n=49)	100	100	169	1,054	2,553	2,611	455	2,468	2,515
Other CV (n=993)	4,434	5,477	6,989	206	426	433	285	1,380	1,501
All CV (n=6,686)	26,415	30,729	39,111	2,544	6,013	6,423	3,517	14,321	15,035

	Tanner crab			Other shellfish			Other species		
Subgroup	Actual	$\hat{C}$	$\tilde{C}$	Actual	$\hat{C}$	$\tilde{C}$	Actual	$\hat{C}$	$\tilde{C}$
TCV BSP 125 (n=30)	78.7	103.3	103.3	0.3	0.3	0.5	358	360	521
TCV BSP 60-124 (n=46)	155	192	196	—	—	—	432	440	552
TCV Div. AFA (n=29)	16.9	33.7	33.7	0.04	0.04	0.04	128	128	177
TCV Non-AFA (n=39)	86.9	434.3	496.6	0.01	0.01	0.01	113	114	147
TCV < 60 (n=55)	—	—	—	—	—	—	28.5	28.5	36.7
PCV (n=162)	7,015	29,429	32,220	—	—	—	5.0	5.2	7.7
LCV (n=68)	127	275	275	2.1	3.5	3.5	15.7	16.9	17.7
FGCV 33-59 (n=939)	—	—	—	183	204	229	181	223	267
FGCV 32 (n=126)	—	—	—	—	—	—	2.1	4.0	5.0
Salmon CV (n=4,150)	—	—	—	126	142	145	96	122	124
Crab CV (n=49)	1,198	6,066	6,162	—	—	—	—	—	—
Other CV (n=993)	694	4,032	4,102	53.7	75.2	78.8	155.1	208.7	229.6
All CV (n=6,686)	9,373	40,567	43,590	366	425	457	1,514	1,649	2,083

[1] "—" entries indicate that the subgroup did not catch any of that species in 2001.

Table 4.—Catcher-processor vessel catch-based capacity utilization estimates.

Subgroup	Atka mackerel $\hat{CU}$	Atka mackerel $\tilde{CU}$	Flatfish $\hat{CU}$	Flatfish $\tilde{CU}$	Pacific cod $\hat{CU}$	Pacific cod $\tilde{CU}$
ST-CP (n=13)	0.894	0.894	0.839	0.839	0.814	0.814
FT-CP (n=4)	—[1]	—	0.700	0.700	0.237	0.237
HT-CP (n=23)	0.851	0.851	0.795	0.795	0.782	0.782
P-CP (n=9)	0.449	0.367	0.775	0.667	0.739	0.691
L-CP (n=43)	0.971	0.957	0.919	0.916	0.824	0.820
Salmon CP (n=102)	—	—	—	—	0.436	0.436
Crab CP (n=15)	—	—	—	—	1.000	1.000
Halibut CP (n=22)	—	—	—	—	—	—
Other shellfish CP (n=9)	—	—	—	—	—	—
Other CP (n=6)	—	—	—	—	—	—
All CP (n=246)	0.856	0.856	0.802	0.801	0.764	0.758

Subgroup	Walleye pollock $\hat{CU}$	Walleye pollock $\tilde{CU}$	Rockfish $\hat{CU}$	Rockfish $\tilde{CU}$	Sablefish $\hat{CU}$	Sablefish $\tilde{CU}$
ST-CP (n=13)	0.731	0.731	0.889	0.889	0.872	0.872
FT-CP (n=4)	0.694	0.694	0.700	0.700	0.800	0.800
HT-CP (n=23)	0.802	0.802	0.846	0.846	0.744	0.744
P-CP (n=9)	0.897	0.788	0.897	0.795	0.306	0.243
L-CP (n=43)	0.791	0.789	0.849	0.846	0.866	0.862
Salmon CP (n=102)	—	—	—	—	—	—
Crab CP (n=15)	—	—	—	—	—	—
Halibut CP (n=22)	—	—	1.000	1.000	—	—
Other shellfish CP (n=9)	—	—	—	—	—	—
Other CP (n=6)	—	—	—	—	—	—
All CP (n=246)	0.727	0.727	0.851	0.851	0.820	0.816

Subgroup	Other groundfish $\hat{CU}$	Other groundfish $\tilde{CU}$	Pacific salmon $\hat{CU}$	Pacific salmon $\tilde{CU}$	Pacific herring $\hat{CU}$	Pacific herring $\tilde{CU}$
ST-CP (n=13)	0.696	0.696	—	—	—	—
FT-CP (n=4)	0.652	0.652	—	—	—	—
HT-CP (n=23)	0.868	0.868	—	—	—	—
P-CP (n=9)	0.531	0.525	1.000	0.545	—	—
L-CP (n=43)	0.820	0.819	—	—	—	—
Salmon CP (n=102)	—	—	0.868	0.790	0.974	0.974
Crab CP (n=15)	—	—	1.000	1.000	1.000	1.000
Halibut CP (n=22)	—	—	0.953	0.886	—	—
Other shellfish CP (n=9)	—	—	0.971	0.945	1.000	0.951
Other CP (n=6)	—	—	0.667	0.601	—	—
All CP (n=246)	0.799	0.799	0.872	0.795	0.981	0.980

Subgroup	Pacific halibut $\hat{CU}$	Pacific halibut $\tilde{CU}$	Scallop $\hat{CU}$	Scallop $\tilde{CU}$	Golden king $\hat{CU}$	Golden king $\tilde{CU}$
ST-CP (n=13)	—	—	—	—	—	—
FT-CP (n=4)	—	—	—	—	—	—
HT-CP (n=23)	—	—	—	—	—	—
P-CP (n=9)	—	—	—	—	—	—
L-CP (n=43)	0.902	0.843	—	—	—	—
Salmon CP (n=102)	0.947	0.859	—	—	—	—
Crab CP (n=15)	1.000	1.000	—	—	0.776	0.776
Halibut CP (n=22)	0.849	0.817	1.000	0.890	—	—
Other shellfish CP (n=9)	0.979	0.956	0.583	0.583	—	—
Other CP (n=6)	0.535	0.535	0.822	0.529	—	—
All CP (n=246)	0.887	0.834	0.820	0.534	0.776	0.776

Subgroup	Red king $\hat{CU}$	Red king $\tilde{CU}$	Tanner crab $\hat{CU}$	Tanner crab $\tilde{CU}$	Other shellfish $\hat{CU}$	Other shellfish $\tilde{CU}$	Other species $\hat{CU}$	Other species $\tilde{CU}$
ST-CP (n=13)	—	—	—	—	—	—	1.000	1.000
FT-CP (n=4)	—	—	—	—	—	—	—	—
HT-CP (n=23)	—	—	—	—	—	—	0.962	0.956
P-CP (n=9)	0.470	0.349	0.437	0.386	—	—	—	—
L-CP (n=43)	0.962	0.962	0.961	0.961	—	—	1.000	1.000
Salmon CP (n=102)	1.000	1.000	1.000	0.361	0.989	0.956	0.943	0.940
Crab CP (n=15)	0.742	0.646	0.330	0.281	0.863	0.863	—	—
Halibut CP (n=22)	1.000	1.000	1.000	1.000	1.000	0.770	0.976	0.889
Other shellfish CP (n=9)	—	—	1.000	0.598	0.988	0.821	0.932	0.932
Other CP (n=6)	0.641	0.641	0.642	0.642	—	—	0.843	0.670
All CP (n=246)	0.623	0.510	0.479	0.426	0.990	0.857	0.945	0.936

[1] "—" entries indicate that the subgroup did not catch any of that species in 2001.

fit into the other catcher vessel categories above and spend a majority of their fishery-weeks in salmon or crab, respectively.

Other CV: these vessels do not fit into the other catcher vessel categories above and did not spend a disproportionate number of weeks operating in the salmon or crab fisheries (and thus weren't included in those subgroups). These vessels tend to spend similar amounts of time landing salmon, herring, and various shellfish, albeit in small quantities.

All CV: this group includes all catcher vessels from the categories above and is included to give overall measures for the catcher vessel sector.

The actual catch and the associated capacity estimates (for both the $\hat{C}_j^i$ and $\tilde{C}_j^i$ estimators discussed above), by species, for all catcher-processor vessels and catcher vessels that operated in Federally managed Alaska fisheries in 2001 are presented in Table 1. Note that in all tables, the reported catch and capacity estimates are in metric tons. Furthermore, for brevity, common names are used in place of scientific names (or genus for groupings of similar species). Table 1 also reports the implied excess capacity (the difference between actual catch and catch levels corresponding to full capacity), and the week-based FU estimates. The estimates indicate that current capacity, in terms of total catch of all species, exceeds actual catch by nearly 40%. However, species-specific excess-capacity estimates range widely—from 8% to > 300%. Fishery utilization is highest in the salmon and groundfish fisheries and lowest in the shellfish and herring fisheries. Further breakdowns, into catcher vessel and catcher-processor vessel fleets (and subgroups within each), are provided in the following tables.

Capacity estimates for the catcher-processor vessel fleet as a whole, and for each subgroup, by species, are given in Table 2. Table 3 presents the capacity estimates for the catcher vessel fleet as a whole, and for each subgroup, by species. A majority of the capacity in the catcher-processor vessel fleets is targeted toward pollock and Pacific cod, while most of the catcher vessel capacity is applied to pollock, salmon, and Pacific cod. As stated earlier, these estimates are based upon an assumed catch mix equal to that observed in 2001. Thus, for some species in Tables 2–5, the capacity estimate is given by a dash (-), which implies that no vessels in that subgroup caught that species in 2001.

CU estimates for the catcher-processor vessel fleet as a whole, and for each subgroup, by species, are contained in Table 4. Of all the primary target species, salmon and halibut targeting catcher-processor vessels have the highest levels of CU. Estimates of CU for catcher vessels in Table 5 reflect that CU is highest for halibut, sablefish, and salmon. It is interesting to note that both the halibut and sablefish fisheries operate under an Individual Transferable Quota (ITQ) system (which is often touted as a system that may decrease capacity in overcapitalized fisheries). Just as with the Tables 2 and 3, Tables 4 and 5 also have dashes for entries in cases where the specific subgroup did not catch any of that species in 2001. Note that the inverse of the CU scores (minus one) in Tables 4 and 5 yields an estimate of the percent by which capacity catch exceeds the actual catch observed in 2001.

Tables 6 and 7 present week-based FU estimates for the catcher-processor vessel and catcher vessel fleets (and their subgroups), respectively. Catcher-processor vessel FU is highest in groundfish and salmon fisheries, while salmon and halibut FU measures are the largest for catcher vessels. Entries with a dash in these tables imply that no members of that subgroup that fished in Federally managed fisheries in 2001 have participated in that specific fishery during 1990–2001. Entries with a zero imply that some vessels have participated in the past, but did not do so in 2001. The inverse of these FU scores (minus one) indicates the percent by which the vessels' annual participation in each fishery could increase, to match each vessel's historical maximum for the 1990–2001 period.

Finally, mean annual participation (in weeks) for the catcher-processor vessels

Table 5.—Catcher vessel catch-based capacity utilization estimates.

	Atka mackerel		Flatfish		Pacific cod	
Subgroup	$\hat{CU}$	$\tilde{CU}$	$\hat{CU}$	$\tilde{CU}$	$\hat{CU}$	$\tilde{CU}$
TCV BSP 125 (n=30)	0.235	0.234	0.632	0.630	0.594	0.591
TCV BSP 60-124 (n=46)	0.751	0.739	0.708	0.692	0.735	0.706
TCV Div. AFA (n=29)	0.995	0.954	0.821	0.805	0.700	0.684
TCV Non-AFA (n=39)	—[1]	—	0.727	0.720	0.722	0.711
TCV < 60 (n=55)	—	—	0.822	0.799	0.823	0.774
PCV (n=162)	0.571	0.400	0.788	0.771	0.559	0.466
LCV (n=68)	1.000	1.000	0.978	0.949	0.940	0.938
FGCV 33-59 (n=939)	—	—	0.789	0.735	0.778	0.712
FGCV 32 (n=126)	—	—	0.283	0.236	0.785	0.725
Salmon CV (n=4,150)	—	—	1.000	1.000	0.998	0.880
Crab CV (n=49)	—	—	—	—	—	—
Other CV (n=993)	—	—	0.996	0.993	0.943	0.789
All CV (n=6,686)	0.429	0.425	0.753	0.742	0.702	0.646
	Walleye pollock		**Rockfish**		**Sablefish**	
Subgroup	$\hat{CU}$	$\tilde{CU}$	$\hat{CU}$	$\tilde{CU}$	$\hat{CU}$	$\tilde{CU}$
TCV BSP 125 (n=30)	0.650	0.648	0.674	0.667	0.653	0.651
TCV BSP 60-124 (n=46)	0.789	0.767	0.834	0.830	0.816	0.812
TCV Div. AFA (n=29)	0.725	0.709	0.827	0.816	0.853	0.840
TCV Non-AFA (n=39)	0.707	0.694	0.733	0.729	0.727	0.723
TCV < 60 (n=55)	0.816	0.774	0.943	0.935	0.911	0.908
PCV (n=162)	0.619	0.491	0.653	0.618	0.735	0.717
LCV (n=68)	0.791	0.791	0.865	0.802	0.865	0.805
FGCV 33-59 (n=939)	0.605	0.572	0.739	0.647	0.778	0.699
FGCV 32 (n=126)	0.170	0.146	0.693	0.513	0.694	0.485
Salmon CV (n=4,150)	1.000	1.000	0.891	0.655	1.000	0.752
Crab CV (n=49)	—	—	1.000	0.450	—	—
Other CV (n=993)	1.000	0.894	0.927	0.825	0.896	0.869
All CV (n=6,686)	0.716	0.704	0.775	0.750	0.806	0.737
	Other groundfish		**Pacific salmon**		**Pacific herring**	
Subgroup	$\hat{CU}$	$\tilde{CU}$	$\hat{CU}$	$\tilde{CU}$	$\hat{CU}$	$\tilde{CU}$
TCV BSP 125 (n=30)	0.696	0.692	1.000	0.761	0.934	0.808
TCV BSP 60-124 (n=46)	0.747	0.687	0.990	0.821	0.956	0.841
TCV Div. AFA (n=29)	0.804	0.789	0.946	0.714	0.853	0.819
TCV Non-AFA (n=39)	0.745	0.734	0.971	0.767	1.000	0.828
TCV < 60 (n=55)	0.813	0.784	0.898	0.759	0.909	0.778
PCV (n=162)	0.607	0.510	1.000	0.833	—	—
LCV (n=68)	0.952	0.952	0.852	0.315	0.337	0.253
FGCV 33-59 (n=939)	0.789	0.761	0.847	0.706	0.797	0.716
FGCV 32 (n=126)	0.600	0.276	0.656	0.526	0.563	0.470
Salmon CV (n=4,150)	0.974	0.881	0.753	0.714	0.775	0.718
Crab CV (n=49)	—	—	—	—	1.000	1.000
Other CV (n=993)	0.946	0.864	0.789	0.730	0.818	0.793
All CV (n=6,686)	0.741	0.721	0.788	0.713	0.785	0.723
	Pacific halibut		**Golden king**		**Red king**	
Subgroup	*CU*	*CU*	*CU*	*CU*	*CU*	*CU*
TCV BSP 125 (n=30)	1.000	0.848	—	—	0.732	0.620
TCV BSP 60-124 (n=46)	1.000	0.760	—	—	0.839	0.816
TCV Div. AFA (n=29)	1.000	0.735	—	—	0.324	0.324
TCV Non-AFA (n=39)	0.882	0.761	0.185	0.185	0.297	0.230
TCV < 60 (n=55)	0.926	0.813	—	—	0.771	0.771
PCV (n=162)	0.840	0.501	0.480	0.419	0.241	0.230
LCV (n=68)	0.926	0.805	0.350	0.350	0.435	0.435
FGCV 33-59 (n=939)	0.850	0.674	—	—	—	—
FGCV 32 (n=126)	0.847	0.675	—	—	—	—
Salmon CV (n=4,150)	0.833	0.703	—	—	—	—
Crab CV (n=49)	1.000	0.592	0.413	0.404	0.184	0.181
Other CV (n=993)	0.810	0.634	0.484	0.476	0.207	0.190
All CV (n=6,686)	0.860	0.675	0.423	0.396	0.246	0.234
	Tanner crab		**Other shellfish**		**Other species**	
Subgroup	$\hat{CU}$	$\tilde{CU}$	$\hat{CU}$	$\tilde{CU}$	$\hat{CU}$	$\tilde{CU}$
TCV BSP 125 (n=30)	0.762	0.762	1.000	0.600	0.994	0.687
TCV BSP 60-124 (n=46)	0.807	0.791	—	—	0.982	0.783
TCV Div. AFA (n=29)	0.501	0.501	1.000	1.000	1.000	0.723
TCV Non-AFA (n=39)	0.200	0.175	1.000	1.000	0.991	0.769
TCV < 60 (n=55)	—	—	—	—	1.000	0.777
PCV (n=162)	0.238	0.218	—	—	0.962	0.649
LCV (n=68)	0.462	0.462	0.600	0.600	0.929	0.887
FGCV 33-59 (n=939)	—	—	0.897	0.799	0.812	0.678
FGCV 32 (n=126)	—	—	—	—	0.525	0.420
Salmon CV (n=4,150)	—	—	0.887	0.869	0.787	0.774
Crab CV (n=49)	0.197	0.194	—	—	—	—
Other CV (n=993)	0.172	0.169	0.714	0.681	0.743	0.676
All CV (n=6,686)	0.231	0.215	0.861	0.801	0.918	0.727

[1] "—" entries indicate that the subgroup did not catch any of that species in 2001.

Table 6.—Mean catcher-processor vessel week-based fishery utilization measures.

Subgroup	FU_{Total}	$FU_{Groundfish}$	FU_{Salmon}	$FU_{Herring}$	$FU_{Halibut}$	$FU_{Scallop}$	FU_{Crab}	$FU_{Shellfish}$	$FU_{Other\ species}$
ST-CP (n=13)	0.759	0.759	0[1]	—[2]	—	—	—	—	0.500
FT-CP (n=4)	0.572	0.572	—	—	—	—	—	—	—
HT-CP (n=23)	0.760	0.759	0	—	—	—	—	0	0.300
P-CP (n=9)	0.462	0.470	1.000	—	—	—	0.183	0	—
L-CP (n=43)	0.814	0.802	0	—	0.388	—	0.071	—	0.143
Salmon CP (n=102)	0.856	0.002	0.902	0.559	0.592	—	0.500	0.836	0.421
Crab CP (n=15)	0.883	0.333	1.000	1.000	1.000	—	0.931	0.583	—
Halibut CP (n=22)	0.700	0.071	0.618	0	0.714	1.000	1.000	0.400	0.464
Other Shellfish CP (n=9)	0.834	0	0.642	1.000	0.666	0.166	0.666	0.925	0.300
Other CP (n=6)	0.711	0	0.222	—	0.200	0.813	0.300	—	0.438
All CP (n=246)	0.799	0.479	0.793	0.642	0.588	0.655	0.551	0.690	0.378

[1] Entries with a zero imply that some vessels have participated in the past, but did not do so in 2001.
[2] "—" entries indicate that the vessels in this subgroup have not participated in this fishery during 1990–2001.

Table 7.—Catcher vessel week-based fishery utilization measures.

Subgroup	FU_{Total}	$FU_{Groundfish}$	FU_{Salmon}	$FU_{Herring}$	$FU_{Halibut}$	$FU_{Scallop}$	FU_{Crab}	$FU_{Shellfish}$	$FU_{Other\ species}$
TCV BSP 125 (n=30)	0.616	0.620	1.000	0.809	1.000	—[1]	0.742	0.642	0.925
TCV BSP 60-124 (n=46)	0.761	0.775	0.944	0.667	0.974	—	0.269	0.270	0.952
TCV Div. AFA (n=29)	0.734	0.738	0.933	0.608	1.000	0[2]	0.340	0.545	0.847
TCV Non-AFA (n=39)	0.669	0.664	0.741	0.395	0.869	0	0.622	0.250	0.848
TCV < 60 (n=55)	0.742	0.629	0.740	0.304	0.596	—	0.100	0	0.632
PCV (n=162)	0.351	0.311	0.080	0	0.399	0	0.180	0	0.252
LCV (n=68)	0.717	0.700	0.190	0.333	0.768	0	0.083	0.240	0.296
FGCV 33-59 (n=939)	0.635	0.402	0.579	0.142	0.399	—	0	0.211	0.234
FGCV 32 (n=126)	0.527	0.285	0.460	0.073	0.393	—	0	0	0.169
Salmon CV (n=4150)	0.669	0.295	0.686	0.140	0.184	—	0.111	0.279	0.122
Crab CV (n=49)	0.446	0.125	0	0.119	0.636	—	0.470	0	—
Other CV (n=993)	0.688	0.426	0.425	0.202	0.618	—	0.261	0.212	0.267
All CV (n=6686)	0.657	0.402	0.640	0.182	0.421	0	0.269	0.238	0.254

[1] "—" entries indicate that the vessels in this subgroup have not participated in this fishery during 1990–2001.
[2] Entries with a zero imply that some vessels have participated in the past, but did not do so in 2001.

Table 8.—Mean annual catcher-processor vessel fishing weeks, 1990–2001.[1]

Subgroup	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
ST-CP	34.6	30.5	22.6	19.5	19.2	18.0	17.6	16.1	17.8	20.4	24.2	28.4
(No. of vessels)	(20)	(20)	(20)	(18)	(20)	(20)	(18)	(16)	(16)	(12)	(11)	(13)
FT-CP	39.9	37.1	34.4	26.8	24.6	22.5	21.8	19.2	20.3	21.5	22.0	24.5
(No. of vessels)	(17)	(18)	(18)	(22)	(15)	(13)	(14)	(13)	(12)	(4)	(4)	(4)
HT-CP	32.2	29.9	35.4	34.9	30.8	26.5	31.1	31.2	31.9	30.4	31.9	32.8
(No. of vessels)	(25)	(29)	(28)	(25)	(27)	(35)	(33)	(32)	(29)	(29)	(30)	(23)
P-CP	21.0	30.2	28.8	11.3	9.0	19.2	19.9	16.6	18.9	19.9	12.3	15.8
(No. of vessels)	(10)	(14)	(15)	(13)	(12)	(15)	(16)	(17)	(11)	(14)	(16)	(9)
L-CP	30.8	27.7	25.8	20.4	20.6	23.6	21.7	25.7	26.3	25.4	25.1	31.1
(No. of vessels)	(37)	(52)	(65)	(68)	(66)	(62)	(62)	(56)	(54)	(53)	(56)	(43)
Salmon CP	12.0	12.9	11.8	13.9	14.4	14.1	13.2	12.4	12.7	13.9	12.0	11.7
(No. of vessels)	(24)	(31)	(34)	(57)	(73)	(93)	(111)	(75)	(92)	(105)	(131)	(102)
Crab CP	30.3	27.4	25.1	14.8	11.9	10.6	7.9	12.5	12.4	10.8	11.2	7.7
(No. of vessels)	(12)	(14)	(14)	(10)	(7)	(5)	(8)	(12)	(13)	(14)	(5)	(15)
Halibut CP	—[2]	—	—	3.5	—	5.1	5.2	4.2	7.1	7.9	—	6.5
(No. of vessels)	(0)	(0)	(0)	(8)	(0)	(19)	(13)	(12)	(25)	(20)	(0)	(22)
Other shellfish CP	13.0	18.0	16.8	—	7.0	16.8	12.5	15.1	18.9	20.5	18.8	15.7
(No. of vessels)	(4)	(4)	(6)	(0)	(10)	(4)	(13)	(7)	(7)	(4)	(6)	(9)
Scallop CP[3]	—	—	15.8	9.0	—	1.7	—	7.3	6.2	5.0	—	—
(No. of vessels)	(0)	(0)	(4)	(6)	(0)	(6)	(0)	(4)	(5)	(7)	(0)	(0)
Other species CP[4]	—	—	—	9.5	—	8.6	10.8	—	—	—	—	—
(No. of vessels)	(0)	(0)	(0)	(4)	(0)	(5)	(4)	(0)	(0)	(0)	(0)	(0)
Other CP	8.8	5.3	8.3	10.6	6.0	6.4	6.0	9.3	10.8	17.8	8.5	7.0
(No. of vessels)	(4)	(6)	(4)	(5)	(5)	(5)	(5)	(4)	(6)	(5)	(8)	(6)
All CP	27.9	26.0	24.6	18.9	18.2	17.5	17.3	18.3	17.8	18.0	17.7	17.6
(No. of vessels)	(153)	(188)	(208)	(236)	(235)	(282)	(297)	(248)	(270)	(267)	(267)	(246)

[1] The mean weeks listed represents the time spent in Alaska commercial fisheries (state and Federal), for the species listed in this report, by vessels that fished in Alaska's Federally managed fisheries during 1990–2001.
[2] "—" entries indicate that the vessels in this subgroup did not participate in the Federally managed Alaska commercial fisheries in that year.
[3] This group, which was not defined for the 2001 capacity measures due to a lack of activity in 2001, is comprised of vessels whose predominant target was scallops.
[4] This group, which was not defined for the 2001 capacity measures due to a lack of activity, is comprised of vessels whose predominant targets were lingcod, eels, and infrequently caught forage species.

Table 9.—Mean annual catcher vessel fishing weeks, 1990–2001.[1]

Subgroup	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
TCV BSP 125	16.8	22.1	22.3	17.5	17.2	17.3	17.3	17.1	19.5	18.0	19.7	19.2
(No. of vessels)	(16)	(13)	(22)	(23)	(23)	(23)	(30)	(32)	(30)	(35)	(31)	(30)
TCV BSP 60-124	24.9	25.1	23.9	17.0	19.3	17.4	16.8	16.6	17.0	16.7	20.6	21.3
(No. of vessels)	(25)	(32)	(48)	(51)	(48)	(61)	(59)	(52)	(45)	(40)	(46)	(46)
TCV Div. AFA	25.3	26.5	23.0	25.1	21.9	22.1	23.7	24.4	22.3	20.5	20.1	21.7
(No. of vessels)	(34)	(47)	(31)	(30)	(27)	(22)	(19)	(25)	(32)	(33)	(29)	(29)
TCV Non-AFA	17.8	16.7	15.9	17.7	17.2	15.5	20.2	19.8	18.1	17.6	16.3	17.0
(No. of vessels)	(39)	(53)	(47)	(42)	(34)	(35)	(33)	(33)	(41)	(40)	(37)	(39)
TCV < 60	14.8	15.5	16.4	15.3	16.5	15.8	17.0	16.2	18.0	19.2	18.5	17.5
(No. of vessels)	(52)	(62)	(67)	(73)	(70)	(65)	(66)	(65)	(67)	(61)	(55)	(55)
PCV	11.3	14.0	14.9	11.8	8.3	10.8	11.8	11.2	12.8	12.7	9.8	6.9
(No. of vessels)	(160)	(178)	(177)	(170)	(173)	(154)	(163)	(143)	(151)	(161)	(177)	(162)
LCV	7.2	7.4	8.3	6.5	5.7	7.7	7.9	7.9	8.1	9.3	8.4	10.4
(No. of vessels)	(119)	(128)	(131)	(119)	(136)	(108)	(94)	(94)	(98)	(92)	(75)	(68)
FGCV 33-59	11.7	12.0	13.2	12.0	11.5	12.3	11.8	12.0	12.3	13.3	12.4	12.3
(No. of vessels)	(1,175)	(1,252)	(1,221)	(1,180)	(1,174)	(1,088)	(1,014)	(1,014)	(980)	(967)	(986)	(939)
FGCV 32	9.1	8.7	10.5	8.7	9.2	9.8	8.7	8.9	9.0	8.9	8.7	7.9
(No. of vessels)	(172)	(186)	(193)	(180)	(184)	(172)	(156)	(162)	(153)	(144)	(138)	(126)
Salmon CV	7.2	6.6	7.4	6.9	7.1	7.0	6.9	6.7	6.4	6.6	6.4	6.8
(No. of vessels)	(6,388)	(6,108)	(5,869)	(5,756)	(5,559)	(5,603)	(4,857)	(4,937)	(4,855)	(4,839)	(4,753)	(4,150)
Crab CV	10.4	10.8	12.1	9.9	5.8	6.5	5.4	7.2	9.2	7.9	4.5	4.6
(No. of vessels)	(49)	(49)	(47)	(59)	(67)	(72)	(61)	(46)	(36)	(37)	(44)	(49)
Scallop CV[2]	10.5	15.5	—[3]	10.0	3.6	—	—	—	—	—	—	—
(No. of vessels)	(4)	(4)	(0)	(4)	(5)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Other CV	5.2	5.1	5.3	5.8	5.3	7.1	6.8	7.1	7.7	7.6	7.3	7.2
(No. of vessels)	(1,849)	(1,881)	(1,762)	(1,443)	(1,433)	(1,112)	(1,154)	(1,176)	(996)	(1,069)	(657)	(993)
All CV	7.7	7.5	8.3	7.8	7.7	8.1	7.9	7.9	7.9	8.1	7.8	8.0
(No. of vessels)	(10,082)	(9,993)	(9,615)	(9,130)	(8,933)	(8,515)	(7,706)	(7,779)	(7,484)	(7,518)	(7,028)	(6,686)

[1] The mean weeks listed represents the time spent in Alaska commercial fisheries (state and Federal), for the species listed in this report, by vessels that fished in Alaska Federally managed fisheries during 1990–2001.

[2] This group, which was not defined for the 2001 capacity measures due to a lack of activity in 2001, is comprised of vessels whose primary target was scallops.

[3] "—" entries indicate that the vessels in this subgroup did not participate in the federally managed Alaska commercial fisheries in that year.

and catcher vessels for 1990 to 2001 is given in Tables 8 and 9, respectively. The tables also show the total number of vessels present in the fisheries discussed in this paper in each year (by subgroup and for the catcher-processor vessel and catcher vessel fleets as a whole). The average annual weeks fished by catcher-processor vessels has consistently dropped from its peak in 1990, which is due in part to the corresponding large increase in vessels since that time. The number of catcher vessels has dropped significantly since 1990, although average annual weeks fished has remained stable.

Conclusion

This paper presents a methodology for assessing fishing capacity, capacity utilization, and fishery utilization with commonly available data. The estimates provided in the paper allow analysts and resource managers to analyze capacity and utilization measures in two distinct ways, depending on the relevant questions at hand. Specifically, one can focus on well-defined subgroups (or "fleets") of vessels sharing similar harvesting and/or processing technologies, or examine the capacity and utilization measures by species.

This approach is easily implemented in large fisheries with multiple species and modes of operation and is not computationally burdensome. The assumptions underlying the estimates are similar to those embodied in alternative capacity estimation methodologies (such as DEA), but do not impute potential gains in harvesting efficiency in the resulting estimates. For these reasons, this methodology may be useful for those looking for a manageable and reasonable way to measure fishing capacity and resource utilization with existing data.

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