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Susan S. Hanna [a] & Courtland L. Smith [b]

[a] Department of Agricultural and Resource Economics, Oregon State University, Corvallis, Oregon, 97331, USA

[b] Department of Anthropology, Oregon State University, USA

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Attitudes of Trawl Vessel Captains about Work, Resource Use, and Fishery Management

SUSAN S. HANNA

Department of Agricultural and Resource Economics, Oregon State University Corvallis, Oregon 97331, USA

COURTLAND L. SMITH

Department of Anthropology, Oregon State University

Abstract.—The fisheries literature embodies critical assumptions about fisherman attitudes and motivations. Common assumptions are that populations of fishermen are homogeneous in motivation and decision making and that they behave in a myopic fashion, ignoring the effects of their fishing activities on the fishery resource. The results of a survey of trawl vessel captains challenge these assumptions. We document a heterogeneous population of captains who hold a diverse set of views toward work, risk, and the ocean environment. We discuss the implications of these survey results for the design and implementation of fishery regulations, and for the rationalization of fisheries. We note the potential costs of misrepresenting fishermen in models of fishery resource use.

Implicit in models of open-access fisheries are assumptions about the behavior of resource users. Basic assumptions of Gordon's (1954) model of a common-property fishery and Hardin's later (1968) model of common-property resources are that resource users are homogeneous in motivation and decision making, and operate without an appreciation for either long-term resource availability or the aggregate effect of individual resource use activities. Although both Gordon and Hardin refer to common-property resources, they are more accurately describing commons with unregulated access, or what are generally called open-access resources. Entry to and exit from such resources are assumed to be free.

The homogeneity assumption is also implicit in the behavioral determinism of the "tragedy of the commons" model of fisheries. This model dictates that because property rights to fish are based on capture, fishermen behave in a single-minded, myopic fashion, ignoring both the long-term and the collective effects of their fishing effort. Even under various degrees of regulation, open-access fisheries are assumed to be trapped in a remorseless tragedy in which fishermen pursue their goal to maximize short-term profits to the detriment of long-term sustainability.

Strengthening the argument for the tragedy model is the fact that most open-access fisheries in industrialized economies have evolved to a current state of heavy capitalization, tightened resource constraints, and widened overlaps between fishing activities. Management entities are spending increasing amounts of time developing regulations directed at controlling the human impact on fish stocks.

A substantial amount of both theoretical and applied fishery economics literature adopts the behavioral assumptions of the Gordon and Hardin models of common-property resources in analyzing the efficacy of fishery regulatory techniques. At the same time, a growing body of literature is calling into question the accuracy of the assumptions regarding fishermen's behavior and the determinism of the commons.

The diversity of use arrangements in open-access fisheries worldwide is now well documented (National Research Council 1986; McCay and Acheson 1987; Berkes 1989; McGoodwin 1990). In addition, the conditions under which even private ownership may not provide the proper incentive structure for efficient resource use have been detailed (Scott 1955; Clark 1973). The assumption of free entry and exit has been shown not to hold for fisheries with strong cultural and ethnic identification (Anderson and Wadel 1972; Acheson 1975; Terkla et al. 1988). Gatewood and McCay (1990) demonstrated heterogeneity among commercial fishermen in the degree of job satisfaction realized in different New Jersey fisheries. Wilson (1990) noted the array of contextual institutional factors that should be reflected in "efficiency" goals for a particular fishery. The importance of appropriate representations of fisherman behavior to the design of efficient fishery regulations has also been noted (Wilen 1979).

TABLE 1.—Demographic characteristics of the sample of trawl vessel captains ($N = 68$).

Demographic characteristic	Number of captains	% of sample
Home port		
Astoria	24	35
Coos Bay	18	26
Newport	26	38
Education level		
1 = some high school; high school degree	33	49
2 = degree from vocational, technical, or community college; some college education	28	41
3 = baccalaureate degree; post-baccalaureate education	7	10
Age		
<25	2	3
25–34	23	34
35–44	22	33
45–54	14	21
55–64	7	10

Despite the increasing documentation of diversity among fishermen and among resource use arrangements, the operating assumption of homogeneity continues to exist in fishery management systems, particularly in well-developed, single-gear, capital-intensive fisheries. In this paper we present survey results that document diversity in a single-gear fleet. We portray a population of fishermen who deviate from the behavioral assumptions of the tragedy model in their perceptions about appropriate resource use and in their perceived role in the fishery ecosystem. We discuss the role of the incentive structure in shaping fisherman behavior.

Methods

In total, we interviewed 68 Oregon trawler captains from June to December 1986 as part of an Oregon State University Sea Grant research project (Smith 1985; Pikitch et al. 1985, 1987). Initially, we selected a stratified random sample of the 1985 population of licensed Oregon trawl captains; strata were defined for major fishing activities. The initial sample consisted of 81 vessel owners. Fifty-two interviews were completed from this sample. The uninterviewed portion of the sample consisted of captains who had left the area, lost their vessels, or refused interviews. Next, a replacement sample was randomly selected within the underrepresented strata. Sixteen additional interviews were conducted for a total of 68. The final sample represented one-third of the entire licensed Oregon trawl fleet in 1985 and included vessel captains primarily targeting groundfishes—flatfishes (*Microstomus, Pleuronectes, Eopsetta, Atheresthes, Errex,* and others), rockfishes (*Sebastes* and *Sebastolobus*), and roundfishes (*Anoplopoma, Ophiodon,* and others)—and shrimp (*Pandalus*) (Harman 1988).

We collected data on fishing patterns, annual operating costs, vessel characteristics, and each captain's age, education, and experience. Trawler captains were asked to rate the importance of certain factors affecting fishing practices and fishery management problems in general. We also included open-ended survey questions on attitudes toward the fishery resource, resource management, and perceptions of the risks and rewards of fishing as an occupation. Interviews took an average of 90 min and were conducted in three major Oregon ports: Astoria, Newport, and Coos Bay.

We tested for port, level of formal education, and age as factors contributing to significant differences ($P \leq 0.05$) in the perceived importance of the following as problems needing attention: stock levels, the number of fishermen, management procedures, and access to fishing opportunities. To test for attitude heterogeneity, we performed two-way analysis of variance on ranked answers. Frequencies of responses were reported for various categories (port, education level, and age). Analysis of variance and frequency calculations were performed with Shazam Econometrics software.

Results

Demographic and Fishery Characteristics

The survey respondents' experience as captains ranged from less than 1 to 44 years, averaging 12 years. All captains were male. A majority (81%) of captains were owner–operators. Ages ranged from less than 25 to 64 (Table 1). Levels of formal education ranged from some high-school education to postbaccalaureate degree. Unlike fisheries elsewhere, strong ethnic associations do not characterize Oregon trawl fisheries.

Captains spent an average of 150 d fishing each year. The average estimated 1986 market value of vessels was US$265,000. Average replacement value—the cost to rebuild a lost or damaged vessel—was $441,000. In all cases, the market value of vessels was less than the replacement value. Vessels averaged 352 horsepower.

Sample fishermen participated in a variety of fishing activities, including shrimp trawling, nearshore groundfish trawling, deepwater groundfish

trawling, and joint venture midwater trawling. Some trawl fishermen combined more than one of these activities into patterns such as groundfish and shrimp trawling, and midwater trawl and deepwater groundfish fishing.

Fishing took place throughout the year, but the major activity was between April and October. The majority of fishermen fished out of a single port and had a stable selling arrangement with a processor: almost two-thirds sold their fish to a single processor in a given year.

Attitudes toward Work

To test the hypothesis that fishermen are homogeneous in motivation and decision making, we asked a series of open-ended questions about the rewards of work, expectations of work tenure, and perceptions of the risk of fishing. Answers to these questions identified an array of attitudes about the rewards of work, expectations for work tenure, and factors creating risk. Responses revealed both homogeneity and heterogeneity in these factors.

In one question, we asked the captains to list the rewards received from their work. For the majority, the most important attribute of their work was the independence that fishing provides. Various forms of independence were listed as important rewards of work by 69% of the captains, the primary aspects of which were being one's own boss, having control over one's time, and making one's own decisions.

We found less agreement among the captains about other rewards of fishing: 40% of the captains liked the challenge of hard outdoor work, the competition, the adventure, the prestige, and the opportunity for self-development. Fewer (33%) of the captains saw the opportunity to be on the ocean as an important reward of fishing; they liked being in the ocean environment and in constant contact with nature.

We also asked about captains' expectations regarding the length of time they will continue to fish. We found a notable degree of homogeneity in expectations about work tenure. The majority of interviewed captains consider fishing a profession to which they have a lifelong commitment both as a business and as a way of life that provides independence and prestige. This common view was represented by the following comment from one of the captains: "I am first and foremost a dragger." Depending on age, the captains' expectations of tenure in the fishery ranged from 20 years to "forever." Seventy percent expected to fish until retirement or "until I die." When asked what alternative occupation they would pursue if they no longer could continue fishing, 43% of the captains said they had never considered an alternative.

The expectation of lifetime tenure reflects a stake in the health of the resource that is expressed in a concern for the long-run health of fish stocks and for the integrity of the management system. The life-tenure expectation is inconsistent with the hypothesis of fishermen as myopic. Just as Terkla et al. (1988) found that labor entry and exit is problematic in fisheries with strong cultural and ethnic identification, we found that exit is not free in a fishery where a large capital investment is required to fish, where alternative fishing opportunities are limited, and where a strong identification with the profession of fishing exists.

A third work-related question we posed was which factors create the greatest risk in fishing. The major risks articulated by the captains fall into three general categories: physical risks, economic risks, and resource-related risks. Physical risks resulting from bad weather or injury were identified by 77–100% of the captains in each port as the most important type of risk they face. Evaluation of weather as a major source of risk cut across all age-groups of captains, but declined with increasing levels of education. Fishery regulations also were seen as contributors to physical risk, as when weekly trip limits lead to fishing in unsafe weather conditions.

Economic risks identified by the sample group were possible increases in costs from gear loss and vessel damage, and possible increases in insurance premiums, fuel prices, and interest rates. Only 9% of the captains considered large debts or changing economic conditions to be major risks. Risks associated with variability in prices or markets were also less important to the captains than risks associated with costs, the status of the fishery resource, or management changes. In general, economic variability was not seen as a problem for management to worry about, but rather as a normal part of a fishing operation. Of the three major risk factors, economic risks were rated as the least important.

Perhaps most relevant to fishery management is the identification of resource risks from the captains' points of view. The captains in our sample varied in their perceptions of risks to the fishery resource. One-third of them saw resource-related risks as important. These risks included the existence of too many boats, overfishing, decreasing

TABLE 2.—Frequencies of and significant differences ($P \leq 0.05$) in trawler captains' responses, by port, education level, and age, to the question: How important are stock levels as a problem needing attention? The first values are percentages of the demographic category and the parenthetical values are numbers of responses.

Demographic category	Answer				Missing data	F	P
	Very	Somewhat	Neither[a]	Not			
Port						797.92	0.001
Astoria	62 (15)	4 (1)	4 (1)	21 (5)	8 (2)		
Coos Bay	55 (10)	11 (2)	5 (1)	5 (1)	22 (4)		
Newport	35 (9)	27 (7)	19 (5)	11 (3)	8 (2)		
Education[b]						10.232	0.005
1	48 (16)	12 (4)	12 (4)	18 (6)	9 (3)		
2	61 (17)	11 (3)	3 (1)	11 (3)	14 (4)		
3	28 (2)	43 (3)	28 (2)	0 (0)	0 (0)		
Age						810.00	0.001
<25	50 (1)	0 (0)	50 (1)	0 (0)	0 (0)		
25–34	52 (12)	26 (6)	9 (2)	4 (1)	9 (2)		
35–44	50 (11)	14 (3)	14 (3)	14 (3)	9 (2)		
45–54	57 (8)	0 (0)	7 (1)	14 (2)	21 (3)		
55–64	43 (3)	14 (1)	0 (0)	43 (3)	0 (0)		

[a] Neither important nor unimportant.
[b] Levels defined in Table 1.

resource availability, and the variability of stocks leading to an unpredictable supply. In particular, resource-related risks were considered important by only 6% of the high-school graduates, by 42% of the captains with some college or vocational schooling, and by 75% of the captains with baccalaureate degrees or postbaccalaureate education.

Attitudes toward Resource Use

We explored the extent to which the trawl vessel captains take a short-term, opportunistic view of resources by asking them to rate a range of fishery problems in terms of degree of importance. Perceptions of resource-related problems in our sample were evaluated in relation to three key factors: home port, level of formal education, and age. The highlighted quotes beginning many of the following paragraphs were taken from captains' responses to the survey's open-ended questions.

We wanted to know how the captains perceived the status of the resource. Stock levels were seen as a serious problem by many captains; two-thirds of all captains in our sample identified stock levels as either a "somewhat important" or a "very important" problem (Table 2). Significant differences in attitudes about the seriousness of stock levels as a problem existed between categories for port, education, and age. In Newport, a smaller percentage (35%) of captains rated stock levels as a very important problem than in Astoria (62%) or Coos Bay (55%). This result may be due to the character of the Newport trawl fleet, which is generally reputed to comprise innovative fishermen with a history of developing new fisheries. When counts of the "very important" and "somewhat important" assessments of the stock-level problem were combined, however, the difference between ports was lessened, indicating an overall concern about stock levels along the coast, albeit at different intensities in different ports.

The proportion of captains concerned about stock levels increased with the level of formal education. Sixty percent of captains with high-school educations rated stock levels as either very serious or somewhat serious problems, and more than 70% of captains with more formal education gave this rating.

A concern for the long-term survival of stocks was apparent in comments such as "Biologists need to know how to properly harvest the resource" and "We need to establish ways to prevent waste." Statements like "We need to spend more money on stock assessment research" questioned the reliability of stock estimates that are used to set quotas. Opinions of stock assessments ranged from "irritating" to "guesses on guesses" to "mysticism."

We also wanted to know whether captains ignore the effect of their activities on fishery resources, as theory would suggest, or whether they are aware of the linkage between the number of resource users and resource status. As in other areas covered by our survey, the captains exhibited a heterogeneous response (Table 3).

The percent of captains seeing the number of

TABLE 3.—Frequencies of and significant differences ($P \leq 0.05$) in trawler captains' responses, by port, education level, and age, to the question: How important is the number of fishermen as a problem needing attention? The first values are percentages of the demographic category and the parenthetical values are numbers of responses.

Demographic category	Answer						
	Very	Somewhat	Neither[a]	Not	Missing data	*F*	*P*
Port						52.515	0.001
Astoria	33 (8)	33 (8)	0 (0)	33 (8)	0 (0)		
Coos Bay	22 (4)	17 (3)	22 (4)	17 (3)	22 (4)		
Newport	27 (7)	27 (7)	19 (5)	19 (5)	8 (2)		
Education[b]						0.0087	>0.50
1	27 (9)	33 (11)	9 (3)	21 (7)	9 (3)		
2	25 (7)	21 (6)	11 (3)	32 (9)	11 (3)		
3	43 (3)	14 (1)	43 (3)	0 (0)	0 (0)		
Age						875.03	0.001
<25	50 (1)	0 (0)	0 (0)	50 (1)	0 (0)		
25–34	26 (6)	26 (6)	13 (3)	22 (5)	13 (3)		
35–44	14 (3)	32 (7)	18 (4)	32 (7)	4 (1)		
45–54	43 (6)	21 (3)	14 (2)	7 (1)	14 (2)		
55–64	43 (2)	28 (2)	0 (0)	28 (2)	14 (1)		

[a] Neither important nor unimportant.
[b] Levels defined in Table 1.

fishermen in the fishery as a very serious problem ranged by port, from 22% in Coos Bay to 33% in Astoria. Combining counts of the "very important" and "somewhat important" assessments of the stock-level problem changes the percentages to 66% for Astoria, 39% for Coos Bay, and 54% for Newport, emphasizing the difference between ports. This result suggests that geographic and other distinctions between ports affect the perception of the role played by the number of fishermen in contributing to resource problems.

The level of formal education did not significantly affect the perception of the impact of fishermen on the resource. In contrast, age differences in perception were significant. Of the fishermen under age 35, 52% felt that the number of fishermen was a very or somewhat serious problem. By contrast, 62% of those 45 and older saw the number of fishermen as a problem.

"The pie slices are getting smaller and smaller."—Over half of the total sample of trawler captains saw the number of people fishing as a problem. Captains recognized that an increase in the number of fishermen, combined with stable or decreasing quotas, results in a smaller average share for each fisherman. Within the sample group as a whole, concern for unlimited access overshadowed concern for either access to fishing opportunities (44%) or the profitability of fishing (33%).

"Having too many fishermen is bad news."—The perceptions of many of the captains in this survey were inconsistent with the assumption of a myopic, atomistic approach to resource exploitation. A majority of the trawl captains recognized the aggregate effect of individual effort decisions. That many captains continue to make investment and effort decisions as if they are myopic has more to do with the incentive structure under which they operate in regulated open-access fisheries. Under an open-access system, awareness that the number of fishermen in the fishery will have an impact cannot be translated into actions that control that impact.

Attitudes toward Fishery Management

Our final topic of investigation was whether captains differed in their views of fishery management procedures. Fishery management procedures were a concern of many trawl vessel captains. Port and age distinguished the captains' responses regarding the importance of management procedures as a problem (Table 4).

A greater proportion of captains in Astoria (58%) than in Coos Bay (28%) or Newport (31%) saw management procedures as a very important problem. However, although the level of importance assigned to problems with fishery management procedures increased with the level of formal education, the level of formal education did not play a significant role in this assessment.

Age of captains was a significant factor in the assessment of the degree of seriousness of fishery management procedures. More older captains than younger captains deemed fishery management procedures as very serious problems.

TABLE 4.—Frequencies of and significant differences ($P \leq 0.05$) in trawler captains' responses, by port, education level, and age, to the question: How important are management procedures as a problem needing attention? The first values are percentages of the demographic category and the parenthetical values are numbers of responses.

Demographic category	Answer				Missing data	F	P
	Very	Somewhat	Neither[a]	Not			
Port						40.096	0.001
Astoria	58 (14)	17 (4)	4 (1)	17 (4)	4 (1)		
Coos Bay	28 (5)	17 (3)	22 (4)	22 (4)	11 (2)		
Newport	31 (8)	23 (6)	31 (8)	11 (3)	4 (1)		
Education[b]						1.67	0.25
1	36 (12)	27 (9)	6 (2)	21 (7)	9 (3)		
2	39 (11)	11 (3)	32 (9)	14 (4)	3 (1)		
3	57 (4)	14 (1)	29 (2)	0 (0)	0 (0)		
Age						878.76	0.001
<25	0 (0)	100 (2)	0 (0)	0 (0)	0 (0)		
25–34	35 (8)	17 (4)	22 (5)	22 (5)	4 (1)		
35–44	36 (8)	18 (4)	18 (4)	18 (4)	9 (2)		
45–54	50 (7)	7 (1)	21 (3)	7 (1)	14 (2)		
55–64	57 (4)	14 (1)	14 (1)	14 (1)	0 (0)		

[a] Neither important nor unimportant.
[b] Levels defined in Table 1.

"Some management decisions are based on too much politics and too little biology."—The procedures used in fishery management were seen as an important resource management problem. This issue was identified by 59% of the respondents, who spent more time talking about this problem than about any other.

"Too many fish get thrown away."—Of particular concern was the waste of fish that results from minimum fish sizes in markets and from trip limits on individual species: "Dumping fish because of regulations is a pathetic waste." Species limited by trip quotas continue to be caught incidentally with other species after the allowable levels of catch are met, resulting in discards at sea.

"A few bureaucrats are making too many decisions."—Also listed as management-related problems were poor communication between managers, biologists, and fishermen, and a need to have a stronger contribution by fishermen to the management process. A greater cooperation between fishermen, managers, and processors to ensure regulations that are compatible with the economic aspects of the fishery was seen to be critical. A majority of the captains supported a cooperative approach to fishery management that includes fishermen, processors, and managers.

We wanted to determine how captains viewed their current and future access to fishing opportunities, a perspective related to expectations about work and tenure. Oregon trawl captains have experienced changing fishing opportunities in recent years. The initial increase in fishing capacity after the Magnuson Fishery Conservation and Management Act was passed in 1976 was supportable for a while by the surplus production of relatively unexploited groundfish stocks and the replacement of foreign fleets with domestic fishing vessels. The development of the fishery for widow rockfish *Sebastes entomelas* in the late 1970s diverted some fishing capacity into the large-volume midwater trawl fishery.

Fishing opportunities in Alaska, joint venture arrangements with foreign processors, and some good years in the shrimp fishery allowed the fishery to proceed, despite some intermediate declines, at a generally productive level. During the late 1980s, the number of fishing opportunities became more constrained. Groundfish stocks had been fished down to equilibrium levels, requiring increasingly stringent effort control measures. Alternative fishing options decreased as Alaska fisheries became fully capitalized, the widow rockfish fishery waned, and joint venture opportunities declined (Smith and Hanna 1990).

"Mother Nature used to take care of closures before the big boats came along."—The tightening constraints of fishing are reflected in a concern about the decline in flexibility of within-fishery operations and the decrease in numbers of alternative fisheries. In different ports, captains' ratings of the seriousness of limitations on access to fishing opportunities were consistent with their ratings of the problems with a number of resource users, although the differences were more exaggerated. Captains in Astoria saw limited fishing opportu-

TABLE 5.—Frequencies of and significant differences ($P \leq 0.05$) in trawler captains' response, by port, education level, and age, to the question: How important is access to fishing opportunities as a problem needing attention? The first values are percentages of the demographic category and the parenthetical values are numbers of responses.

Demographic category	Answer					F	P
	Very	Somewhat	Neither[a]	Not	Missing data		
Port						16.105	0.001
Astoria	54 (13)	12 (3)	8 (2)	25 (6)	0 (0)		
Coos Bay	5 (1)	11 (2)	11 (2)	5 (1)	67 (12)		
Newport	42 (11)	15 (4)	8 (2)	8 (2)	27 (7)		
Education[b]						3.11	0.10
1	33 (11)	15 (5)	6 (2)	15 (5)	30 (10)		
2	28 (8)	11 (3)	7 (2)	14 (4)	39 (11)		
3	71 (5)	14 (1)	14 (1)	0 (0)	0 (0)		
Age						645.08	0.001
<25	0 (0)	0 (0)	50 (1)	0 (0)	50 (1)		
25–34	30 (7)	13 (3)	13 (3)	9 (2)	35 (8)		
35–44	22 (5)	13 (3)	9 (2)	22 (5)	32 (7)		
45–54	57 (8)	7 (1)	0 (0)	7 (1)	28 (4)		
55–64	57 (4)	28 (2)	0 (0)	14 (1)	0 (0)		

[a] Neither important nor unimportant.
[b] Levels defined in Table 1.

nities as a more serious problem (54%) than did captains in the two other ports (Table 5). Few Coos Bay captains (5%) saw access as a serious problem.

The disparity in perceptions of Coos Bay and Astoria captains could be attributed to differences in the physical environment in which the captains work. Astoria captains, who have to cross the Columbia River Bar to get to their fishing grounds, are limited by severe restrictions on the number of days they can fish and thus by fewer catches of fish.

Formal education was weakly but not significantly related to perceptions about the seriousness of access to fishing opportunities. Captains at the highest education levels were more worried about access to fishing opportunities (71%) than were captains with lower levels of education (28–33%). Within the different age-groups, a greater proportion of captains who were 45–64 years old, and thus had the longest history in the fishery and had witnessed the greatest change, saw the problem as very serious.

Discussion

The results of our survey carry implications for models of fishing systems and for the design of fishery regulations. Our results do not support the common assumptions of the homogeneity of fishing fleets or myopic attitudes of fishermen. This study demonstrates that fishing fleet operations are far more complex and varied than model abstractions reflect.

Data collected in this survey describe a heterogeneous collection of professional fishermen who represent a range of ages, levels of education, choices of fishing strategies, and attitudes toward risk and the fishery resource. As in any profession, differences in experience, family associations, education, age, and place of residence all contribute to distinctions between captains in their view of work, risk, and the environment in which they work. Documentation of the heterogeneity of this population of trawl vessel captains stands as another challenge to the assumption of homogeneity of resource users.

Areas of homogeneity do exist within the Oregon trawl fleet. However, the areas of similarity we found also serve as qualifiers to open-access fishery models. A nearly uniform expectation of long-term tenure indicates a vested interest in resource sustainability denied by the assumption of myopic behavior in open-access fisheries. A substantial number of fishermen are aware of the collective effect of individual actions and think planning should incorporate these factors.

Our findings of within-fleet heterogeneity have implications for fishery management. Much of the literature on fishery management continues to lack context. The profit-maximizing motivations of fishermen and the incentive structure of open competition are seen universally as the root of fishery overexploitation. Various forms of regulation have been proposed to approximate efficient solutions. Our survey results indicate that application of textbook controls in the absence of context is risky. In the design, implementation, and

analysis of fishery regulations, the context of the fishery system is a critical aspect.

The major implication of our survey results for fishery management is that diversity in fishery user groups makes the regulation of the activities of these groups as intricate as tracking multispecies stock interactions. In the process of prescribing behavior through regulation, managers are governing a diverse group of people who are not well represented by standard fishery models. Those who are subject to regulation are dependent on long-term productivity of fish populations. Many have a commitment to resource management. Many also have a strong attachment to the lifestyle of fishing. Different fleet components will experience different effects of regulations, and thus will react in disparate ways. Policy design and implementation that ignore this diversity and longevity are destined to have unpredictable effects.

A second implication of fleet heterogeneity relates to programs attempting to limit exploitation of fisheries. Our survey results indicated that a majority of trawl captains recognize the fundamental inconsistency of a finite resource exploited by an unlimited number of users. Consistent with those results was the lack of strong resistance to the idea of limited access by the majority of the captains in our survey. A license limitation system has recently been developed for the West Coast groundfish fishery. Heterogeneity within the trawl fleet indicates that the form of a limited access program in this fishery will be critical to its success.

Our survey revealed attitudes that are common among captains and have positive implications for fishery management. Fishermen are available as human capital to be tapped by management. The majority of fishermen in our survey would support a more formal incorporation of fishermen into the management process, as they indicated in their statements:

- "We should have industry representation [in management]: people know what's going on and should be able to share their knowledge."
- "We need input from experienced and retired fishermen."
- "Listen to fishermen!"

Fishermen currently participate in the decision process through membership in advisory groups and through representation and testimony presentation at Pacific Fishery Management Council meetings.

Another positive implication of our results lies in the distinction between motivation and behavior of fishermen. Open-access models address a behavioral outcome in fisheries—overexploitation—by assuming a set of consistent motivations on the part of fishermen—short-term profit maximization. Our results indicate that the assumed motivations are simplistic and unrepresentative. In fact, the vested interests and motivations of many of the captains we interviewed are consistent with long-term sustainability of the fishery.

There is often a disjuncture between expressed attitudes and observed behavior. Fishermen's attitudes about what is good for the resource may not be expressed in action as long as the incentive structure of an open-access fishery rewards atomistic behavior. Nevertheless, our survey results indicate that positive attitudes toward long-term planning are already available for programs that promote sustainability.

The recognition by captains of finite expansion possibilities in fisheries leads us to examine other reasons for the problem of overcapitalization in the fishery. We observed that tax incentives and vessel construction funds that subsidize capitalization, combined with open access, work against the motives of even the most farsighted, conservation-minded fishermen. If fishery management can control the negative attributes of unlimited capital access to the fishery, it will then be possible to take advantage of fishermen's vested interest in sustainability in the design of institutions that promote long-term productivity.

To promote long-term fishery sustainability, research will still have to accommodate the diversity of a multipurpose, multispecies fleet. Fleet diversity complicates the biological assessment process. For example, if landings data are used to make inferences about stocks, a certain homogeneity is assumed in the linkage of a fishing trip to fishing effort. Our survey results instead suggest a heterogeneity of fishing effort. We found some trawlers who were selecting for quality fish and making more and shorter trips than average. Others made fewer trips, focusing their effort on quantity.

Finally, that successful implementation of management programs has often proven to be an elusive goal suggests that the misrepresentation of fishermen's motivations carries a cost. Part of the cost is the failure to take advantage of fishermen's vested interest in promoting long-term sustainability.

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