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Abundant Resources, but Scarce Fishermen

Commercial utilization of inland fish resources can constitute an important addition to other economic activities in rural communities. Based on a case study of commercial whitefish fishery in Lake Femund, a mountain lake in southeastern Norway, this article outlines experience gained and indicates some of the general problems related to this type of economic activity. They concern aspects such as resource biology, product development and marketing, economic management, and staff recruitment. An initial hypothesis of the study was that commercial fishery would have a significant impact on the whitefish stock, causing fluctuations in yield and consequent variations in the economy of the fishery. Therefore, the study included an analysis of marketing possibilities for whitefish products, as well as of the social and socioeconomic conditions sustaining whitefish fishery in the local community. Nearly 20 years of data show that commercial fishery in Lake Femund, with a yield of up to 1 kg per ha, has a low to moderate exploitation rate. Thus, fishery itself does not generate fluctuations in the fish population that would influence yields. The major restrictions on the enterprise are related to other aspects, such as problems of economic and technical management of this specialized small-scale industry, difficulties in the recruitment of fishermen to a short-season fishery in a time when the employment pattern in the community is changing from seasonal activities in agriculture to full-time employment in manufacturing and services, and the challenge of developing and marketing competitive products for a niche market.

Keywords: *Fishery; whitefish;* Coregonus lavaretus*; small-scale industry; niche market; labor shortage; Norway.*

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Introduction

Rural communities in areas only marginally suited for agricultural production may look to harvesting from natural ecosystems as a basis for economic activities to sustain local communities. However, harvesting from natural populations often produces more variable yields than cultivated production systems. Natural populations usually vary in size, and the harvesting methods may depend on favorable weather conditions in order to succeed (Bell et al 1977; Lekang 1998).

In order to utilize the harvested products in a modern market economy, raw materials need to be processed into products that can be transported to markets, that are attractive to customers, and that may fetch a good price. This requires investments to establish a processing and business enterprise. Moreover, commercial production of food for human consumption must meet defined hygiene and sanitation standards regardless of the expected production volume. Consequently, in a small-scale operation, investments may be inordinately high in relation to production volume.

Major reasons for the failure of small-scale businesses based on raw materials from natural ecosystems appear to be small and variable production volumes, along with market prices that are too low to cover investment, production and transport costs. A traditional model of extractive production does not appear to be feasible in local small-scale industry (Power 1996; Reese and Rosenfeld 2002). An alternative and seemingly promising way of processing harvested products is small-scale production of high-quality niche products with a local and somewhat exotic flavor for an affluent market segment. However, this type of production may present new challenges to communities, organizations and institutions that are more familiar with large-scale production focusing on quantity. This is to some extent the case in Norwegian agricultural production (Eymard-Duvernay 1995; Reinert 1997; Almås et al 1998; Forbord 2003).

In order to improve our understanding of the challenges facing small-scale rural businesses specialized in processing harvested natural resources, we studied resource biology and socioeconomic characteristics of the relatively successful Femund Fiskerlag (Femund Fishers' Association). This small-scale operation buys, processes and markets European whitefish (*Coregonus lavaretus*) from Lake Femund, a mountain lake in southeastern Norway. Femund Fiskerlag's experience is discussed with a view to providing a set of potential "lessons learnt" for similar rural industries.

Material and methods

The natural resource

Lake Femund is an oligotrophic mountain lake. Since 1981 the harvesting of whitefish from the lake has been organized in a commercial fishery (Figure 1). Up to the 1950s or early 1960s, subsistence fishery for whitefish, Arctic charr and other species was probably quite intensive in the lake. Catches were sold locally or bartered for other goods (Sandlund 1986; Eknæs 1979).

Data on whitefish fishery in Lake Femund were collected annually from 1981 to 1999. Catch per unit effort (CPUE) was obtained by recording the total catch in kilograms and the number of gillnets used. The age structure of the whitefish population was estimated by ageing the sampled fish by their otoliths (Ugedal et al 2002).

FIGURE 1 Lifting gillnets on Lake Femund. The lake contains 8 fish species: European whitefish (*Coregonus lavaretus*), Arctic charr (*Salvelinus alpinus*), brown trout (*Salmo trutta*), grayling (*Thymallus thymallus*), Eurasian perch (*Perca fluviatilis*), northern pike (*Esox lucius*), burbot (*Lota lota*), and European minnow (*Phoxinus phoxinus*). (Photo by Odd Terje Sandlund)

The community

Lake Femund (62°0′N, 11°55′E) is divided among the 3 municipalities of Engerdal and Os in Hedmark County, and Røros in Sør-Trøndelag County (Figure 2). The main lake area lies within the municipality of Engerdal. The same is true of the village of Elgå, where the fish processing plant is located. The area around Lake Femund is thinly populated. Elgå is the largest village. Apart from Elgå and a few scattered farms, there are four small villages along the lakeshore. One of them, the community of Sørvika, situated on the northern end of the lake in the municipality of Røros, has not been involved in the activities of Femund Fiskerlag. This is mainly due to its remote location and the resulting difficulties in communication.

The main municipality of the study area, Engerdal, is a fairly typical rural community dominated by the primary industries. From the census of 1990 to that of 2001, the total population in the municipality declined by approximately 10%. Employment in the primary industries declined by 38%, and the proportion of employed individuals working in the primary industries decreased from 20% to 13%. The slight decline in total population masks a substantial redistribution of people within the municipality. A large number of people moved to Drevsjø, the largest settlement of the municipality. Of the 15 census tracts within the municipality, Drevsjø was the only one to record an increase in population. While the number of its inhabitants increased by 30%, the second largest settlement, Engerdal, recorded a population decline of 12% (Table 1).

Economically, Engerdal shows figures similar to the national average (Table 2). The growth of the munici-

FIGURE 2 Lake Femund, with villages and borders between municipalities. (Map source: Norwegian Mapping Authority, Hønefoss)

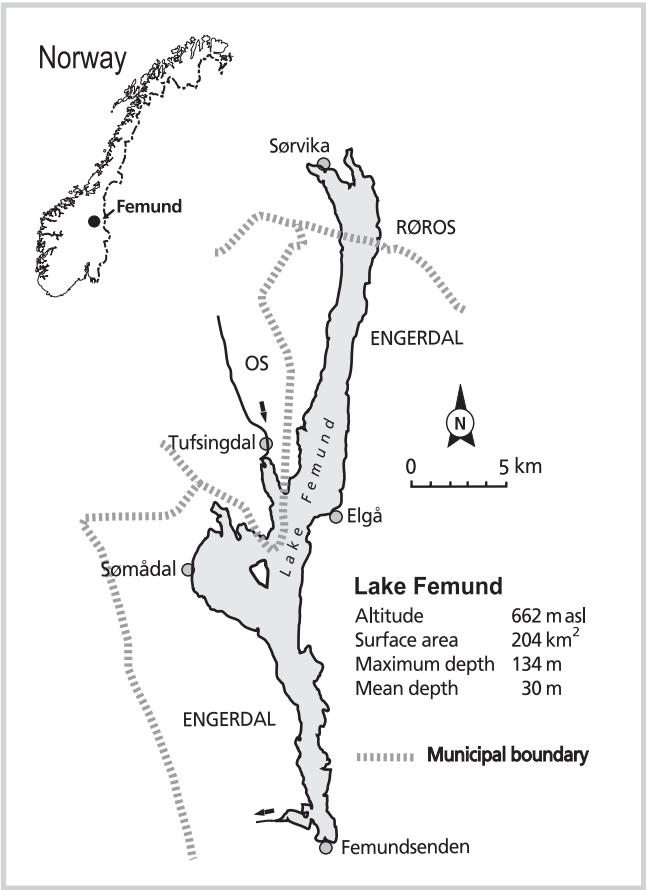


TABLE 1 The development of population and employment in Engerdal municipality between 1990 and 2001. Due to the slightly wider age interval used to record employment in 2001, the figures of decline are conservative estimates while figures of increase are inflated. Drevsjø and Engerdal are the largest semi-urban settlements ("villages") in the municipality. (Source: "Folke og boligtelling 1990 kommunehefte 0434 Engerdal," and "Folke og boligtelling 2001: kommune 0434 Engerdal," respectively, from Statistics Norway, Kongsvinger.)

Engerdal municipality (sum of 15 census tracts)	1990 Census Ages 16–66	2001 Census Ages 16–74	Relative change, 1990–2001
Employed in agriculture, forestry, fishery	219 (20%)	135 (13.1%)	–38.4%
Employed elsewhere	665 (60.8%)	593 (57.7%)	–10.8%
Unemployed	212 (19.3%)	300 (29.2%)	+41.5%
Total workforce	1096 (100%)	1028 (100%)	–6.2%
Total population	1673	1514	–9.5%
Population aged 67 and above	293	295	+0.7%
Population of Drevsjø (Census tract no 0203)	352	460	+30.7%
Population of Engerdal (Census tract no 0103)	322	281	–12.7%

pality's average income between 1996 and 2000 amounts to 30%, which is only slightly below the national growth of 33%. However, the average income in Engerdal lies approximately 29% below the national income. The slowly widening income level gap between rural communities and the national average is a long-term national trend, reflecting the differences between central and peripheral municipalities.

In 1996, 333 individuals aged above 18 lived in the census tracts comprising the communities along Lake Femund. For our study, 210 individuals were randomly selected for interviews among the 313 inhabitants aged above 18 in the riparian communities of Engerdal and Os. A total of 150 individuals completed the questionnaire and were interviewed. Of these, approximately one third may be classified as employed in the primary industries (agriculture, forestry, and fishing). The interviewees were presented with 4 main questions:

- Do you fish?
- Is your fishery a recreational fishery, a commercial fishery, or both?
- What are your reasons for fishing?
- Do you sell fish to Femund Fiskerlag?

Lake Femund is owned by the state, and all inhabitants of the riparian municipalities have equal exclusive rights to fishing. This system granting rights of use without property rights is called *statsallmenning*, which translates as "state commons" (Berge and Stenseth 1998). It is regulated by the so-called "Mountain Act" (Act no 31 of 6 June 1975).

Traditionally, people's livelihoods in the area around Lake Femund were based on a multitude of activities. Even today most inhabitants are engaged in fishing either for sale or for domestic needs (Flø 1998). Thus, the foundation of Femund Fiskerlag did not represent a major departure from previous and customary practice. It merely meant that some fishers would fish more intensively—using more efficient gear—during the 8-week fishing season from August to September. Additional harvest apart from the volume of fish sold to Femund Fiskerlag has continued to be an important part of the total harvest from the lake.

TABLE 2 Average gross annual income (in NOK) in Norway and in the Engerdal municipality, in 1996 and 2001. (Source: http://www3.ssb.no/Statistikkbanken/)

Gross income	Norway	Engerdal	Engerdal: % below national income
1996	178,900	128,300	–28.3%
2000	237,300	167,000	–29.6%
Increase	32.6%	30.2%	

Results

Whitefish population and yield

Commercial whitefish yields in the period from 1981 to 1999 varied between 6 and 22 tons (Figure 3A). The total effort (number of gillnet nights) in commercial fishery increased from approximately 5000 in 1981 to 11,000 in 1984, decreasing to 3000–5500 annually in the early 1990s (Ugedal et al 2002). The catch per unit effort (CPUE) exceeded 3 kg in 1982, 1983 and 1993, while it fluctuated between 1 and 2.5 kg in the remaining years. There was no correlation between total gillnet effort and CPUE. The recent decrease in total yield is mainly related to a decrease in total fishing effort.

The chief cause for the considerable CPUE fluctuations (Figure 3B) are fluctuations in the year class strength of the fish (Ugedal et al 2002). The dominant deepwater

FIGURE 3, A AND B A) Annual supplies (in metric tons) of whitefish (*Coregonus lavaretus*) from Lake Femund to Femund Fiskerlag's processing plant, 1981-1999. B) Catch per unit effort (CPUE, kg fish per net night) for the fishers selling fish to Femund Fiskerlag, 1982-1999. (Redrawn from Ugedal et al 2002)

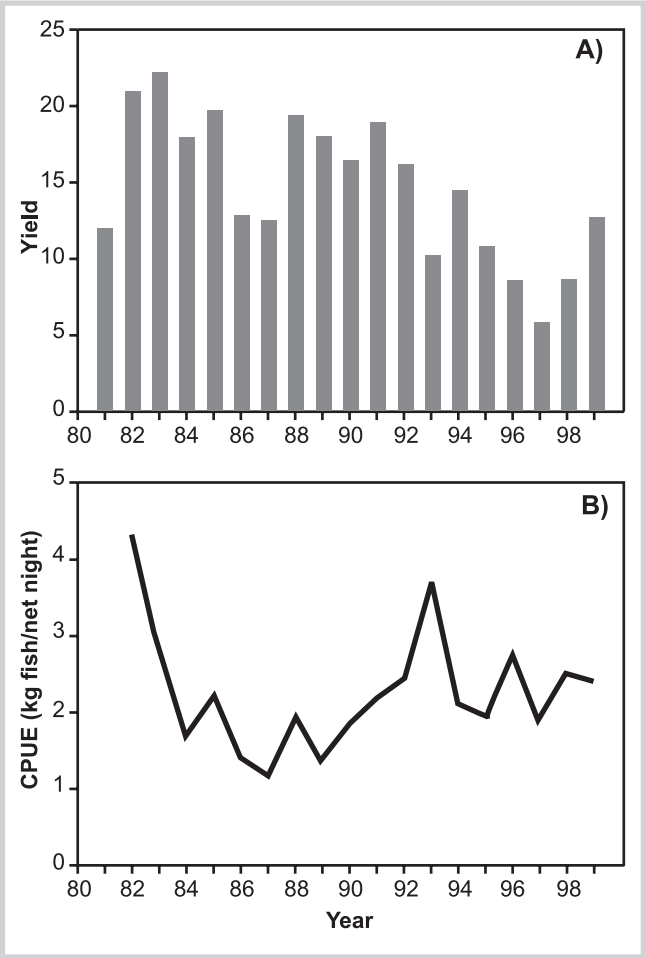
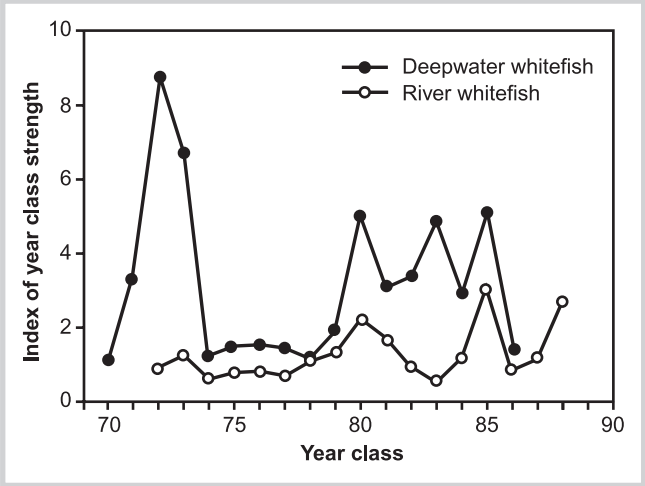


FIGURE 4 Relative year class strength of deepwater and river whitefish in Lake Femund. The whitefish stock in Lake Femund consists of 3 morphs (deepwater, river, and shallow water whitefish) which are recognized by morphological and ecological characters. Deepwater whitefish dominate the catches. (Redrawn from Ugedal et al 2002)



whitefish had relatively strong year classes from 1971 to 1973 and from 1980 to 1985 (Figure 4). Correspondingly, maximum CPUEs occurred when these year classes entered the catches, ie in 1982 and 1993, respectively.

Fishing had a small impact on the total mortality of the whitefish population. The adult annual survival rate for the year classes from 1970 to 1982 averaged 75%, varying between 54% and 91%. Annual survival rates in unexploited whitefish stocks have been estimated at 76% to 80%, those in moderately to heavily exploited stocks at 30% to 63% (Ugedal et al 2002).

Fishers

The majority of the adult population in the study area are engaged in fishing. Women are less actively involved and rarely catch more than 200 kg of fish per year. The survey revealed that 19 individuals (18.8% of the total) sold either part or all of their catch to Femund Fiskerlag (Table 3). Ten of these saw their fishing activity mainly as an income-generating activity and are therefore labeled professional fishers. The remaining 9 individuals fished for recreation or leisure and sold their surplus. Clearly, the professional fishers are most efficient. They make up about 10% of all fishers but catch approximately 65% of the fish.

If we define a "major fisher" as a person who catches more than 200 kg of whitefish per year, our sample includes 12 "major fishers" (10 men and 2 women). The average age among all fishers is 47 years, while "major fishers" have an average age of nearly 60 years. Only 7 of the 12 "major fishers" in our sample sold their catch to Femund Fiskerlag. In part this is due to the distance from the fishers' homes to the fish processing facility at Elgå. It may also be related to the fact that older fishers in general seem less likely to sell their catch to Femund Fiskerlag, preferring to supply friends and relatives with fish. Living on the farm as retired farmers, they want to provide something in return for the in-kind support they receive from their household. Formally this may be considered as a kind of hybrid between subsistence fishing and commercial fishing, since it is a form of barter (Flø 1998).

Femund Fiskerlag finds it difficult to recruit new fishers to professional fishery as the older fishers retire. From 1982 through 1989, 22 to 24 individuals fishing in Lake Femund sold whitefish to Femund Fiskerlag. In 1990, their number decreased to 15, and remained at that level until 1995. Since 1996, the number of fishers actively fishing for Femund Fiskerlag in Lake Femund has varied between 7 and 4.

The individuals classified as the "major fishers" of today are either small-scale farmers, or retired small-scale farmers (Flø 2000) who traditionally base their livelihood on multiple sources of income. This tradition requires that the various activities can be combined. Whitefish fishery combines perfectly with sheep farming since the fishing season falls exactly into the time slot between the fodder harvest and the transfer of the sheep from summer to winter pastures in the fall. Combining whitefish fishery

TABLE 3 Distribution of whitefish catches among the groups of fishers, based on information from interviews with 150 individuals, of whom 101 were fishing in Lake Femund in 1998 (Flø 1999). The four groups are: commercial fishers (C) who sell their catch to Femund Fiskerlag (FF), recreational or leisure fishers (R) who do not sell their catch to FF, commercial fishers who do not sell their catch to FF, and recreational or leisure fishers who sell their catch to FF. N indicates the number of fishers. Details on methods and questionnaire used in the interviews are given in Bjørkhaug and Flø (1998).

	Whitefish catch					
		Total				
Fisher category	N	kg	%	Sample mean [kg]	Standard deviation [kg]	Median [kg]
C, sell to FF	10	8000	55.5	795	895	265
R, sell to FF	9	1300	9.1	149	175	90
R, do not sell to FF	59	3200	22.2	53	109	30
C, do not sell to FF	23	2000	13.4	87	159	35
Total	101	14,400	100	143		367

with dairy farming is more difficult, as cattle require several hours of work every morning. With the disappearance of traditional family farms and more people working nine-to-four jobs, fewer people are able to engage in fishery.

Enterprise: Femund Fiskerlag

The main purpose of establishing the Femund Fiskerlag association was to create jobs for the local community through exploitation of the poorly utilized whitefish stock in Lake Femund. The enterprise would buy, process, and sell freshwater fish supplied mainly by the members of the association. The association is organized as a cooperative with limited liability, an organizational form that has a long tradition in rural Norway (Sandlund and Woldsnes 1986; Johnstad 1998).

The history of Femund Fiskerlag reveals an impressive collective effort to establish and develop the business. By 1992 the association had invested 4600 hours of free work, in addition to NOK 780,000 (approximately US$ 100,000), into building the facilities for receiving and processing the fish. In the following years, an additional project demanded even greater efforts: the association invested NOK 2 million and an estimated 8000 hours of free labor into the construction of the Bryggeloftet restaurant. Targeting tourists, the restaurant was thought to increase local economic activity based on the fish production. However, in economic terms the restaurant turned out to be a burden to Femund Fiskerlag.

Over the years, approximately 13,000 hours of free labor were provided by approximately 100 individuals (Flø 1998). However, according to working hour records, a small group of participants did most of the work. It appears that the greatest part of free manual labor was provided by individuals involved in the leadership of Femund Fiskerlag, along with the most active of the fishers. Thus, Femund Fiskerlag is a product of the efforts of a few enthusiasts, and recruiting new people has proved difficult.

The result of these efforts in terms of income generating labor varies between 2000 and 3000 hours per year, distributed among 3 to 5 individuals. The work is concentrated in the period from July to September. In the years 2000 to 2002 the mean annual turnover of Femund Fiskerlag was NOK 688,000. Of this sum, NOK 160,000 were paid to the fishers for the fish, while the gross salaries of the production plant staff amounted to NOK 270,000. Thus, 62.5% of the total turnover of Femund Fiskerlag constitutes income for local citizens.

Marketing and market demands

Beginning with fresh or frozen whitefish, the range of products widened gradually as the association developed (Sandlund and Næsje 1996). The complexity of product development and marketing, together with low market prices in relation to production costs, have been Femund Fiskerlag's most persistent market challenge since 1981. Although the association has tried various product development strategies, this factor can still be improved. Official rules regarding hygiene and sanitation during processing and transport have become increasingly strict and detailed over the last decades, substantially increasing production costs for the small enterprise.

The main market problem faced by Femund Fiskerlag may be formulated as "too many small and too few large customers." The market for white freshwater fish in Norway is relatively small. Several market analyses come to the common conclusion that freshwater fish needs to be marketed as a niche product with relatively high prices (Windjusveen and Trangsrud 1997; Jäggi 1998). However, the development of niche products is a complex and continuous process that may be called "negotiation of quality" (Eymard-Duvernay 1995). It is a process of interaction among and between local actors and the customers. Forbord (2003) shows that customizing manufacture and sales, along with developing a network, is an important success factor. He concludes that the economy of an enterprise depends on a complex pattern of ongoing interactions by actors in a business network (Wedin 2001).

Interviews show that both restaurants and fish vendors are highly interested in freshwater fish. However,

they require that the seasonal variation in supply be reduced (Flø 2000). Rapid and efficient distribution of small volumes of fresh fish induces high transport costs. Cooperation among freshwater fish producers may extend the season from early summer to late autumn, thus increasing supply stability and reducing costs.

White freshwater fish is a so-called "start block product." It fits nicely into current food trends, often bearing labels such as "ecological," "exotic," "regional," etc. Experts in food trends maintain that such products currently have a unique chance to enter markets (Wandel et al 1995). Never before have Norwegian consumers been more interested in alternative foods, and never before have they been more concerned about how they present themselves through the food they eat or serve their guests. At the same time, daily food should be as simple and ready-made as possible (Torjussen et al 1999).

Two elements in Femund Fiskerlag's marketing strategy have proved successful. One is the "Food from the mountain region" label, which was established by 7 local municipalities. It guarantees that the product originates within the region and is based on the regional food culture. These are two central ideas of the "start block products" concept. Another successful marketing element is a long-term cooperation with a fish wholesaler that began on a small scale in the early 1990s. The wholesaler buys relatively large volumes of fish from Femund Fiskerlag, thus freeing the association of the costs of further distribution.

Discussion

The resource base

Annual variations in potential and actual yields from harvesting of natural resources may be caused both by human action and by natural conditions. Separation of these factors requires time series data. Our data on the whitefish stock of Lake Femund span nearly 20 years, which enables us to understand some of the major factors causing variation in yields.

When Femund Fiskerlag started fishing with pelagic gillnets in 1981 (see Figure 1), some locals feared that the whitefish stock would not sustain the increased harvesting. The yield decline during the first few years—catches decreased by over 60% from 1982 to 1984—seemed to confirm this. The subsequent relative stabilization of catches supported the idea that during the first few years the commercial fishery had exploited an accumulated stock (Sandlund and Næsje 1989). However, increased catches during 1992 through 1994 demonstrated that good catches were caused by abundant year classes. The dominant whitefish form in Lake Femund matures at the age of 8 to 9 years, when it becomes vulnerable to the gillnets used. Thus, the year classes of 1971 to 1973 and 1980 to 1985 caused the good catches in 1982 to 1983 and in the early 1990s, respectively. A variable sequence of strong and weak year classes seems to be common dynamics in whitefish, and the amplitude of variation appears to increase with increasing fishing pressure (Bell et al 1977; Healey 1980). In Lake Femund, however, fishing has not influenced these variations, as annual survival in Lake Femund whitefish is similar to survival in unexploited whitefish stocks. The results indicate the need for long time series data in order to understand stock dynamics.

Although Lake Femund is a mountain lake with low fish productivity, the whitefish stock could sustain a larger harvest. Nevertheless, an upper limit must be accepted to ensure sustainability of yields, and whitefish from Lake Femund will always remain a small niche product on the national food market. The strategy of the Femund Fiskerlag business operation must reflect this. Quality goals in product development and targeting of groups in marketing have to be tailored to small volumes both in production and in distribution. This is probably best done in close cooperation with end users and consumers (Forbord 2003).

FIGURE 5 Femund Fiskerlag's processing plant at Elgå. (Photo by Biggles Nyrønning)

Fishers and supply of fish

When Femund Fiskerlag (Figure 5) was established in the early 1980s, the idea found strong and widespread support in the local community. By 1995, about 40% of the population in the riparian community (nearly 80% of the households) owned shares in the association, supporting job creation in the local community (Figure 6). The achievements of Femund Fiskerlag were widely reported on a very positive note in national media, creating a positive spinoff for the local community and the region. However, since the late 1990s, the local enthusiasm has declined. One important reason for this trend is the Bryggeloftet restaurant. Its construction required

FIGURE 6 Femund Fiskerlag's processing plant has provided important seasonal jobs for women. (Photo by Biggles Nyrønning)

a very great effort in the form of free labor, and the restaurant soon ran at a loss, causing economic problems also for the primary fish-processing activity of Femund Fiskerlag. The constant financial worries and the need to continuously provide free labor has resulted in declining support for Femund Fiskerlag among locals. This development suggests that the association might have benefited from more prudent and competent business advice.

A few fishers supply fish to the processing plant. They are active or retired farmers, and the fishing season from August to September fits into their tradition of multiple incomes. Recruitment of fishers is difficult because most young people in the area change from the tradition of multiple activities to full-time employment either within or outside the agricultural sector. The recruitment of fishers will remain a serious problem. One solution could be to change fishing technology from gillnets to trap nets. While gillnets must be lifted every day, fish traps can be left alone for a longer period, thus yielding a higher catch with less effort (Lekang 1998). Fish traps are relatively expensive, but suitable for cooperation between several fishers. Potential conflicts caused by the introduction of a new technology could probably be avoided through continued monitoring. A monitoring program helped ease the concerns regarding possible overfishing when the "new" pelagic gillnet method was introduced in the early 1980s (Flø 1998, 1999).

To compensate for decreasing supplies from Lake Femund, Femund Fiskerlag has during the last few years bought whitefish from other lakes in the area. This means that the economic activity is maintained in the district, although focus may partly shift away from Lake Femund.

The role of the community entrepreneur

The key role of local enthusiasts as seen in Femund Fiskerlag is typical for small-scale enterprises where the motivation is to provide jobs for the local community rather than individual profits. Uncharacteristically, Femund Fiskerlag was not funded by public subsidies. However, the initial investments as well as the current operation depend on the efforts of few very dedicated social entrepreneurs. The risk is usually that such enthusiasts are burned out and the enterprise collapses (Haveraaen 1993). Femund Fiskerlag has avoided this type of collapse, perhaps because it has the support of the local community and the economy is independent of state subsidies.

In an evaluation of Norwegian policy "experiments" to improve local communities, Haveraaen (1993) discusses how collective values may be secured when the motivations are a mixture of public service and private profit. The collective values created by Femund Fiskerlag are primarily linked to the concept of living in a vital local community, but also to the individual "good job" (Reese and Rosenfeld 2002). While the commercial part of the enterprise just barely sustains itself, the public goods produced through the joint effort obviously cannot. They are based on a disproportionate effort by a few enthusiasts. Norway does not have the legal instruments to encourage and protect entrepreneurial efforts outside politics or ordinary private business (Haveraaen 1993). It seems reasonable to ask whether it is possible to design legal instruments to protect the social entrepreneurs of a local community against the dissipation of future rent through free riders and the impact of global values requiring equitable distribution also of locally produced public goods ("club goods"). The institutional ways of legitimately protecting such values are of the most profound significance in shaping civic culture both locally and nationally (Douglas 1986; Soto 2000; Reese and Rosenfeld 2002).

Conclusions

The potential problem of overfishing has not occurred in Lake Femund. A long time series of data was necessary to demonstrate the true stock dynamics. Short-term investigations on fish species with complex life histories and population structures may produce misleading results.

Products based on Norwegian inland fisheries will always remain niche products, produced in small volumes at a relatively high price. The all too frequent bankruptcies in this industry indicate that successful product development and product marketing are problematic.

The Norwegian agricultural sector has focused on efficient production of large quantities of a single minimum quality, rather than a diversity of products and qualities (Almås et al 1998). This tradition has formed the main competence of extension services. In contrast, rural businesses today recognize that quality is not an absolute

and easily defined concept, but rather complex and diffuse (Reinert 1997). The "negotiation of quality" for niche products (Eymard-Duvernay 1995) requires continuous interaction among local actors and with customers (Forbord 2003). Thus, a new form of advice and support may be needed in this industry. The primary industry organizations need to pay more attention to niche product development and marketing, where signature products and label recognition are important concepts.

Femund Fiskerlag is a relative success in the arena of small-scale nature-based businesses in Norway. Nonetheless the association is burdened with several types of problems such as recruitment of fishers, restricted quantity of fish, marketing of high-priced niche products, and daily operations depending on a more or less continuous free extra effort.

The problem of acquiring a sufficient level of gross income from a restricted volume of products is shared with many small enterprises in rural Norway. The strategy promising the best chance of long-term survival may be cooperation among the enterprises and professional marketing assistance.

The general economic and social development in society may be the greatest challenge for such seasonal enterprises. As the number of small-scale farm households living from a multitude of seasonal economic activities decreases and the number of people with full-time jobs in manufacturing and services increases, the number of potential fishers in the community is reduced. This may to some extent be mitigated by applying more efficient fishing gear, actively recruiting fishers, and supplying fish from other lakes.

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REFERENCES

Almås R, Kvam GT, Stræte EP. 1998. From productivism to flexible specialization? Experiences from a restructuring process in the Norwegian dairy industry. *Journal of Rural Cooperation* 25:65–82.

Bell G, Handford P, Dietz C. 1977. Dynamics of an exploited population of lake whitefish (*Coregonus clupeaformis*). *Journal of the Fisheries Research Board of Canada* 34:942–953.

Berge E, Stenseth NC, editors. 1998. *Law and the Governance of Renewable Resources.* Oakland: ICS Press.

Bjørkhaug H, Flø BE. 1988. *Institutional Arrangements Focusing Management of Rural Resources. Frequency Report* [in Norwegian]. Trondheim, Norway: Institute for Sociology, Norwegian University of Science and Technology [NTNU].

Douglas M. 1986. *How Institutions Think*. London: Routledge & Kegan Paul.

Eknæs Å. 1979. *Inland Fisheries* [in Norwegian]. Oslo: Det Norske Samlaget.

Eymard-Duvernay F. 1995. La négociation de la qualité. *In:* Nicolas F, Valceschini E, editors. *Agro-alimentaire: Une économie de la qualité*. Paris: Institut National de la Recherche Agronomique [INRA] and Economica, pp 39–48.

Flø BE. 1998. *Institutional Arrangements Focusing on Management of Rural Resources: The Whitefish Fishery in Lake Femund. Report No 4, 1998* [in Norwegian]. Trondheim, Norway: Centre for Rural Research.

Flø BE. 1999. *Local Institutions and the Management of Common Property: A Case Study of a Successful Small-scale Fishery in Lake Femund, Norway. Paper No 4/99.* Trondheim, Norway: Centre for Rural Research.

Flø BE. 2000. *Commercial Whitefish Fisheries: Femund Fiskerlag AL and the Market. Report No 9, 2000* [in Norwegian]. Trondheim, Norway: Centre for Rural Research.

Forbord M. 2003. *New Uses of an Agricultural Product? A Case Study of Development in an Industrial Network* [PhD dissertation]. Trondheim, Norway: Department of Industrial Economics and Technology Management, Norwegian University of Science and Technology [NTNU].

Haveraaen M. 1993. *City, Residence, Community, Home. Four Papers Thinking Sociologically about Planning Problems* [PhD dissertation, in Norwegian]. Ås, Norway: Institute for Landscape Planning, Agricultural University of Norway.

Healey BA. 1980. Growth and recruitment in experimentally exploited lake whitefish (*Coregonus clupeaformis*) populations. *Canadian Journal of Fisheries and Aquatic Sciences* 37:255–267.

Jäggi S. 1998. Marketing of wild fish [in Norwegian]. *Norsk Innlandsfisk* 4(3/4):6–11.

Johnstad T. 1998. *Collaboration and Cooperation. Development and Organization of Cooperatives* [in Norwegian]. Oslo: Tano Aschehoug.

Lekang OI, editor. 1998. *Inland Fisheries* [in Norwegian]. Oslo: Landbruksforlaget.

Power TM. 1996. *Lost Landscapes and Failed Economies*. Washington, DC: Island Press.

Reese LA, Rosenfeld RA. 2002. *The Civic Culture of Local Economic Development.* Thousand Oaks, CA: Sage Publications.

Reinert ES. 1997. *Consequences for Norwegian Regional and Resource-Based Industries of the Shift in the Techno-economic Paradigm. Report No 1, 1997* [in Norwegian]. Oslo: Norsk Investorforum.
Sandlund OT. 1986. *The Whitefish Fisheries in the River Tufsinga. Yearbook No 11* [in Norwegian]. Elverum, Norway: Norwegian Museum for Forestry, Hunting and Fishing.
Sandlund OT, Næsje TF. 1989. Impact of a pelagic gillnet fishery on the polymorphic whitefish (*Coregonus lavaretus* L. sl.) population in Lake Femund, Norway. *Fisheries Research* 7:85–97.
Sandlund OT, Næsje TF. 1996. A successful small-scale fishery cooperative in a high-cost country: A case study. *In:* Neal RA, editor. *International Development. Proceedings of the World Fisheries Congress. Theme 4.* New Delhi: Oxford & IBH, pp 49–57.
Sandlund OT, Woldsnes ML. 1986. *Femund Fiskerlag: A Small-scale Cooperative in Modern Version. Rapport fra Innlandsfiskeprosjektet* [in Norwegian]. Skjetten, Norway: Royal Norwegian Society for Rural Development.
Soto de H. 2000. *The Mystery of Capital. Why Capitalism Triumphs in the West and Fails Everywhere Else.* New York: Basic Books.
Torjussen H, Nyberg A, Wandel M. 1999. *Ecologically Produced Food: The Consumers' Assessments and Consumption Patterns. Report No 5, 1999* [in Norwegian]. Lysaker, Norway: Norwegian Institute for Consumer Research.
Ugedal O, Næsje TF, Saksgård R, Sandlund OT, Østbye K. 2002. Do commercial gillnet fisheries impact polymorphic European whitefish in Lake Femund, Norway? *Archiv für Hydrobiologie* 57:563–576 [special issue on advances in limnology].
Wandel M, Bugge A, Ramm JS. 1995. *Change and Stability in Food Habits. Report No 4, 1995* [in Norwegian with English summary]. Lysaker, Norway: Norwegian Institute for Consumer Research.
Wedin T. 2001. *Network and Demand. The Use of Electricity in an Industrial Process* [PhD dissertation]. Uppsala, Sweden: Department of Business Studies, Uppsala University.
Windjusveen T, Trangsrud OJ. 1997. *Femund Whitefish: How to Improve Distribution and Increase Sales* [in Norwegian]. Hamar, Norway: Hedmark Bedriftsutvikling.