# Market Integration and the Distribution of Ecological Knowledge within an Ecuadorian Fishing Community

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## Abstract

*Scholars typically depict traditional ecological knowledge as a vanishing resource, negatively correlated with the capitalization of a community. The default view also tends to conceptualize such knowledge as one cohesive system, unitarily responsive to external forces. Using data from an artisanal shrimping community in Ecuador, this paper argues that current views are not sufficient to capture the complexity of socially distributed knowledge and need to be expanded. In particular, I show that integration into a market economy does not necessarily erode local knowledge about the natural world, but can actually foster the development of a new body of ecological knowledge. This finding brings into question current conceptions of traditional ecological knowledge and suggests that various types of such knowledge likely exist that are differentially subject to evolutionary forces and trajectories.*


The relationship between ethnoecological knowledge and incorporation into the global economy is generally depicted by anthropologists as antagonistic, and the process of modernization as eroding a disappearing resource in need of preservation (Zent 1999, Ruddle 1994, Hunn 1999, Dove 1999). However, market incorporation is not by default the harbinger of destruction of local knowledge in subsistence communities. In this report I will demonstrate, using consensus analysis data from fishers of Palestina, Ecuador, that engagement with the market economy can accelerate the acquisition of ethnoecological knowledge. This finding is significant because it is the first study describing a pattern that is counter to prevailing models of local ecological knowledge as a necessarily dwindling and endangered resource (Zent 1999, Dove 1999, Plotkin and Famolare 1992, Posey 1990, Ruddle 1994, Hunn 1999, Berkes 1993, Ohmagari and Berkes 1997). This study also brings into question how traditional ecological knowledge is defined and conceptualized in the current literature.

In recent years, anthropologists have increasingly recognized the importance of local ecological knowledge in advancing theory (Gragson and Blount 1999), improving natural resource management (Rhoades and Harlan 1999, Berkes 1999, Nazarea et al. 1998), empowering local communities (Posey 1999), and resolving conflicts (Haenn 1999). Authors also identify understanding knowledge systems in local populations as a first step in these endeavors (Gragson and Blount 1999, Atran 1999). Here, I examine which factors promote knowledge about the local ecosystem. I specifically test for the role of age, sex, length of residence, and formal education in acquiring knowledge, and compare these variables with the degree of experience in commercial shrimp fishing, an activity recently introduced to the area as a result of integration into national and international economies. These variables were chosen because previous studies have implicated them in the acquisition and social distribution of ecological knowledge (Boster and Johnson 1989; Boster 1986, 1991; Acheson and Steneck 1998; Zent 1999; Ohmagari and Berkes 1997; Chipeniuk 1995).

While the data presented below support many of the premises in the above studies, it demonstrates that while what is considered "traditional" ecological knowledge may degrade as a community changes, new local knowledge is created and

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socially distributed in the process. The data also suggest that such new knowledge is locally distinct and can be acquired within a relatively short time frame.

**Research Setting**

Palestina is a fishing community of approximately 2000 people, situated at the mouth of the Rio Verde river on the coast of northern Ecuador (Figure 1). Until two decades ago it had been relatively isolated from the rest of the country and external markets (Phelan 1967, Whitten 1965). Poor infrastructure prevented the outflow of products, and discouraged economic development or population growth in the area. Local livelihoods centered primarily on subsistence, comprised of fishing, hunting, and limited horticulture (Thomsen 1969, Guest 1999). All this changed in 1978, however, when crews built a road from the port city of Esmeraldas to the estuary (Montano-Toledo 1997), opening access to markets and allowing for the influx of technology and people from other areas.

This new infrastructure paved the way for the introduction of mariculture into the region. While shrimp farming had been ongoing in Ecuador since the early 1960s, the first ponds did not reach the Palestina area until 1983. In the ensuing years, the region has been transformed from a subsistence-based community to a regional mariculture center. The estuary now has over 300 hectares of shrimp farms that line the river upstream of Palestina and six shrimp post-larva hatcheries scattered in and around the town. The town is also home to several centers for the collection and distribution of wild shrimp post-larva.

Post-larva are juvenile shrimp, ranging 1-7 mm in length, that supply the nation's shrimp farms, which are 2-3 meter deep pools replenished with water from local estuaries. Once transported to these farms, post-larva are raised for 90 days, harvested as adults, and exported to international markets. Post-larva hatched in laboratories—the source of which are gravid female shrimp caught in gill nets at sea—differ little from their wild coun-

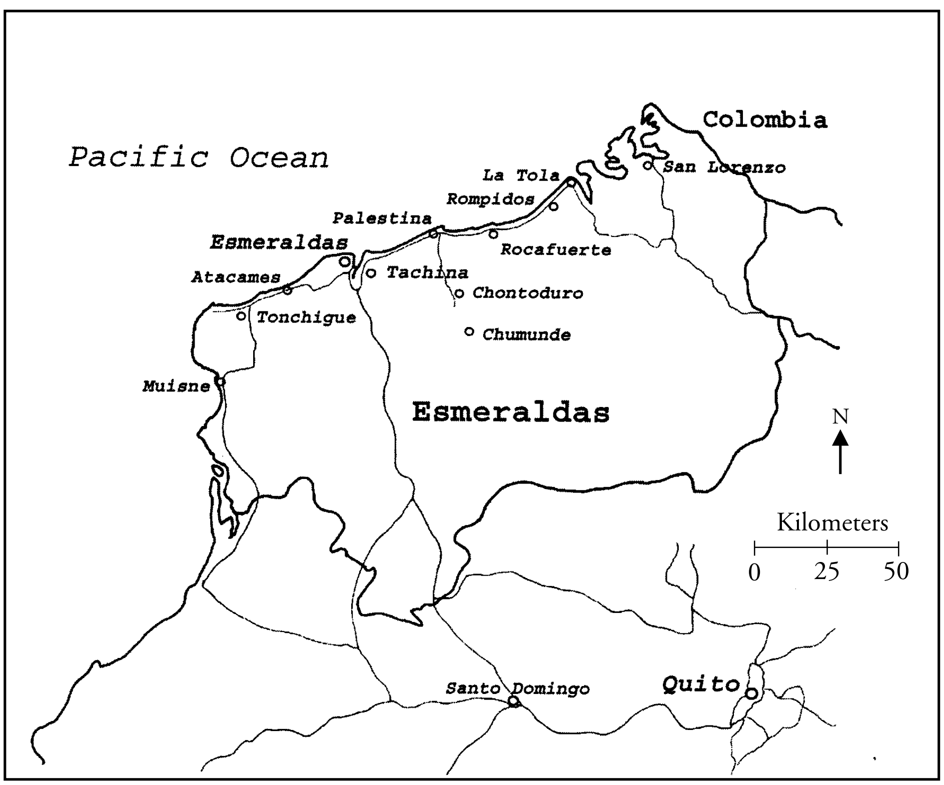


**FIGURE 1. THE COAST OF NORTHERN ECUADOR.**

terparts and are also sent to shrimp farms when they reach the appropriate size. People in the industry, however, say the wild caught variety is hardier and has a higher survival rate once transported to farms. While the ultimate destination of the commodity is the same for both systems, post-larva fishers are generally not involved with hatcheries and their catch passes through various levels of middlemen before reaching the farms. In Palestina, the activity of post-larva fishing was spurred by the arrival of a fisher from Manabi province in 1980, who brought with him the gear and knowledge to capture this previously unheard of commodity.

Motorized shrimp trawling, while exploiting adult specimens of different species thanthat used in mariculture, shares a similar history. In 1978, a fisher from another province brought to Palestina a new style of canoe (**lancha**), an outboard motor and a trawl net, none of which had been previously used for fishing in this area. Before this time, fishers in Palestina caught adult shrimp in hand-held nets from small manually powered boats called **bongos**. The infusion of new technology revolutionized fishing in the region, and today the majority of fishers in the area use an outboard motor and trawl gear.

Today, numerous commercial fisheries exist in the area. As indicated in Table 1 below, the most common fisheries are post-larva and shrimp trawling, with more than 950 and 70 nets respectively. The standard boat for the in-shore trawl fishing is the 10-12 foot wooden **lancha** and a 40 hp motor. A few of the smaller, 3 meter long **bongos** fish with hook and line in-shore, and are powered by oar or plastic sail. Both of these smaller craft types stay within the 13 meter depth contour. More seaworthy fiberglass boats (**fibras**) with 75hp motors are used exclusively for off-shore fishing.

**Table 1. Estimated gear count–Palestina.**

| Gear | Estimated Number |
|---|---|
| Lancha | 77+ |
| Fibra | 6 |
| Bongo | 11 |
| Trawl Net | 70+ |
| Gill Net | 55+ |
| Post-larva Net | 950+ |

**Post-larva Fishery**

*Penaeus vannamei* is the targeted species for the mariculture industry and is the basis of the post-larva fishery (Gaibor 1997). Post-larva fishing entails dragging a 7-10 meter long nylon net in 1 meter deep surf, and emptying its contents every 15-20 minutes into a plastic pail on the beach, where the catch is "cleaned" of debris and unwanted larva of other marine species. This process requires identifying *P. vannamei* post-larva from that of other shrimp species. The catch is then sold to buyers in town or on the beach. Post-larva fishers, or **larveros**, usually harvest post-larva during the spring tide (**aguaje**)—which lasts from 7-8 days and occurs twice per lunar cycle. Survey data from 106 households in Palestina shows a range of 1-8 fishing days per **aguaje**, with an average of 5.4 days. Hours fished per day range from 2-14 hours and average 6 hours. Generally, the more abundant the post-larva, the more effort is expended, both in terms of number of fishers and days/hours fished.

The primary season for post-larva in the northern region is January to August, with March and April as peak months, but this can vary with anomalous climatic conditions such as El Niño. In the off-season, **larveros** will seek temporary employment or engage in some form of small business, such as making nets, digging and selling clams, or cleaning trawl catches. Given the dearth of capital and economic opportunity in the region, however, residents spend much of the off season in leisure, relaxing in a hammock or socializing with friends.

Post-larva fishing is a group enterprise. The most common work group is the family, but friends, especially teenagers, also fish together. Fishing in groups is advantageous because the catch can be constantly cleaned, and it allows for social interaction. What is unique about the post-larva fishery is the variation in age and sex. While fishing from a boat is an exclusively male domain, and involves only post-adolescents (younger boys may watch, but do not participate), post-larva fishing can be done by virtually anyone healthy and strong enough to pull a net through the water. Children as young as four years old can be seen pulling nets through the surf or on the beach cleaning the catch. The demographic composition of **larveros** in Palestina is illustrated in Table 2. Notice the age range and relatively equal number of males and females compared to traditional fisheries, which are exclusively male.

**Table 2: Larvero demographics.**

| | |
|---|---|
| Number of **Larveros** - Total | 972 |
| Number of **Larveros** - Male | 593 (61%) |
| Number of **Larveros** - Female | 379 (39%) |
| Age Range (years) | 4 - 80 |
| Average age (years) | 28.7 |

Because the mariculture industry is such a recent development in the area, the majority of post-larva fishers are recent entrants to the fishery. Out of 82 **larveros** surveyed in 1999, only 15 percent had been fishing for ten or more years, and the longest reported time was 15 years. Almost 57 percent had only recently entered the fishery in the last five years, and 37 percent in the last two.

### Shrimp Trawling

The artisanal trawling industry in Palestina exploits two smaller species of shrimp—*Protrachypene precipua* and *Xiphopenaeus riveti* (collectively called **pomada** in the vernacular). Shrimpers trawl for these diminutive varieties with 15 x 2 meter nets between 2 and 6 meters of water and always stay within the 13 meter contour. Unless a fisher's motor is damaged, he will fish Monday through Saturday, from 6 a.m. to 1 p.m. throughout the entire year. If catch rates are exceptionally low, and he has extra gear, a fisher may set gill nets for fin fish until shrimp catch rates increase to profitable levels.

The composition of the shrimp trawling industry in Palestina is similar to that observed in other fisheries of the world. Fishing activity is an exclusively male domain, and trawler's wives will typically look after the finances and marketing of the catch. Most (75%) of Palestina's shrimp trawlers work with a friend or family member, but the remainder prefer to fish alone. Boys as young as five years old, typically a fisher's son or nephew, sometimes accompany a fisher to sea and help clean the catch on the boat. It is not until a boy is able to carry the heavy 40 hp motor by himself that he is allowed to captain a boat or fish by himself. Young men typically achieve this rite of passage between the ages of 15 and 17.

### Migration and Education

Given the completion of the road in 1978, it should come as no surprise that Palestina's growth rate has increased dramatically within the last 30 years, mostly in the form of in-migration. Data from a household survey in Palestina show that by far the majority of Palestina's new residents are from small communities up river, and education of children is the reason most often cited for moving. Although the quality of education in Palestina cannot compete with Quito or Esmeraldas city it is still better than the education available in the smaller communities up-river, and is relatively affordable to local residents. For the same reason, the few families in Palestina who have enough money, will either move or send their children to larger cities for a better education.

The vast majority of families do not have such options, however. The best they can hope for is to pay for one or two of their children to complete private high school in the local area. The Palestina/Rio Verde area has a combined total of three primary schools (grades one through six), and one secondary school (grades seven through nine). The only school to offer grades ten through twelve is in the town of Rocafuerte, a 20 minute bus ride to the north, and a cost prohibitive endeavor for most of the area's residents.

While low relative to Western standards, the average level of formal education reached by residents in Palestina is increasing. The histogram below (Figure 2) shows a clear trend toward an increase in the average number of years of education over time. Residents 61 years of age or older average less than four years of formal education, while the youngest group averages over six.

Despite this trend in formal education, much of a child's knowledge about the natural world is

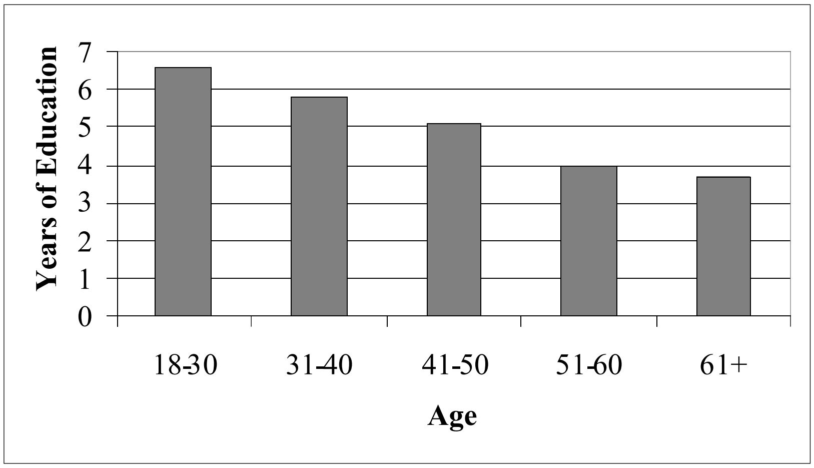


**FIGURE 2. AGE GROUPS AND AVERAGE LEVEL OF EDUCATION.**

derived from daily interaction outside of the classroom. Many of the town's children do not attend grade school and spend their days fishing from the river bank, digging for clams, cleaning shrimp catches, or working with their families collecting post-larva or trawling. With the exception of trawling, these activities are highly social and facilitate frequent interaction and communication between individuals.

### Research Design and Data Collection

Because post-larva collecting is a group activity and typically involves children at an early age my working hypothesis was that an individual's knowledge of shrimp ecology is correlated more strongly with this activity than age, sex, length of residence, and education. I used trawling experience as a control to see if the type of fishing made a difference in knowledge acquisition. To measure knowledge, I created a consensus analysis instrument by first conducting semi-structured interviews and asking informants to talk about what they knew about the behavior of the three commercially harvested shrimp in the region—*Penaeus vannamei*, *Protrachypene precipua* and *Xiphopenaeus riveti*. I initially interviewed three shrimp trawlers, two post-larva fishers, and two Ecuadorian marine biologists. All interviews were taped. These data were supplemented with statements derived from observation of conversations between fishers. While the instrument covered all three species it was weighted more towards *Penaeus vannamei*, the species collected in the post-larva industry.

Two local assistants helped extract and collate statements from the above sources that were amenable to a true/false format (Romney et al. 1986). We pre-tested the survey instrument and collaborated in deleting redundant or confusing statements. The final instrument consisted of 55 true/false statements about shrimp life-cycles, predator-prey relationships, species/climatic dynamics, and abiotic interactions. It was administered to a random sample of 49 adult residents of Palestina, containing 33 men and 16 women, ranging in age from 17 to 67 years old (mean age of 34, SD of 10.6), and representing a diversity of occupational groups. Eighty eight percent of those surveyed fish post-larva and 67 percent had trawled for shrimp at least one year. The data derived were then analyzed by the consensus analysis routine using Anthropac software (Borgatti 1996).

Consensus analysis is a theoretical model which posits that agreement in a given domain can provide a valid and reliable measure of cultural knowledge (Romney et al. 1986). The model makes two assumptions: 1) an external truth exists in the domain being studied, and 2) individuals answer independently of each other. Factor analysis is used to ascertain the degree of coherence among individual responses, and according to the model, if the eigen value for the first factor is at least three times the second eigenvalue, shared knowledge exists. That is to say, shared knowledge is the driving force behind the first factor.

The consensus analysis routine in Anthropac provides eigen value ratios and competency, or knowledge, scores for each individual. Competency scores, which range from 0 to 1, reflect the degree to which an individual's response pattern correlates with the aggregate, thus showing the amount of knowledge they possess in the specified domain relative to others. The higher the score, the more knowledge an individual is assumed to possess. In order to test for the predictive value numeric variables have for knowledge scores I employed linear and quadratic regression models to the data. For the categorical variable of sex, I compared mean knowledge scores between men and women.

## Results and Discussion

After completion of data analysis, the hypothesis that post-larva fishing is conducive to acquisition of knowledge of shrimp ecology was not rejected for the following reasons. First, the data show that there exists a shared body of knowledge in the community in the domain of shrimp ecology. The factor analysis produced a ratio of 6.06 to 1.0 from the first to second eigen values, supporting the consensus model. Second, competency scores were more strongly correlated with post-larva fishing experience than all other variables. Sex did not significantly influence knowledge: the mean score for men was 0.67 and women 0.59, not a statistically significant difference based on a comparison of means ($p = 0.105$). The relationship between competency scores and numeric variables are presented in Table 3. Competency scores ranged from 0.16 to 0.87 with a mean of 0.65 and SD of 17.1.

**Table 3. Coefficients of determination ($r^2$) - knowledge scores and numeric variables.**

| Variable | $r^2$ - linear/significance | $r^2$ - quadratic/significance |
|---|---|---|
| Age (mean = 33.8, SD = 10.6) | 0.010 / ns | 0.020 / ns |
| Years of formal education (mean = 6.8, SD = 3.3) | 0.010 / ns | 0.127 / ns |
| Years living in Palestina (mean = 19.0, SD = 12.1) | 0.171 / $p = 0.005$ | 0.179 / ns |
| Years trawl fishing (mean = 5.1, SD = 5.3) | 0.275 / $p = 0.000$ | 0.287 / $p = 0.001$ |
| Years post-larva fishing (mean = 7.0, SD = 4.9) | 0.339 / $p = 0.000$ | 0.463 / $p = 0.000$ |
| Years post-larva fishing + Years trawl fishing | 0.434 / $p = 0.000$ | |
| Years post-larva fishing + Years living in Palestina | 0.415 / $p = 0.000$ | |
| Years post-larva fishing + Years living in Palestina + Years trawl fishing | 0.463 / $p = 0.000$ | |

The regression models show that formal education and age do not predict knowledge of shrimp ecology, accounting for no more than 13 percent of the variation at best. The number of years living in the area fares only slightly better in explaining the observed variation in knowledge, at less than 15 percent. The data do suggest a strong relationship between knowledge and years of fishing experience, particularly post-larva fishing. The number of years post-larva fishing is a better predictor of ethnozoological knowledge than years trawl fishing, accounting for 46 percent of the variation under a quadratic model compared to 29 percent for trawling.

To check for co-variance, three multiple regression models were also tested (last three rows of Table 3), rendering only slightly higher $r^2$ values. Further, a direct correlation of all variables does not render any values greater than $r = 0.60$. All of these measures support an uni-variate solution, with years of post-larva fishing experience explaining the majority of variance.

Figures 3 through 5 show several interesting trends. First, although each show a positive correlation, all data sets exhibit a high degree of variation in the initial portion of the *x* axis, indicating that an individual can hold a certain degree of knowledge without engaging in a particular fishing activity or having lived in the area long. What is interesting, however, is that there is a limit to the amount of knowledge one can acquire in the absence of post-larva fishing experience: individuals with no post-larva fishing experience possess competency scores well below the mean of 0.65 (Figure 3).

The data also indicate that local ecological knowledge can be acquired relatively quickly if engaged in post-larva fishing. This is demonstrated graphically in Figure 3, in which a quadratic equation best fits the data. Knowledge acquisition for those who engage in post-larva fishing occurs mostly in the first ten years and is a rather rapid process. In comparison, the rate of acquisition through trawl fishing appears to be less, but still follows an asymptotic pattern (Figure 4). Simply living in the area indicates a linear process, occurring over a longer time period (Figure 5).

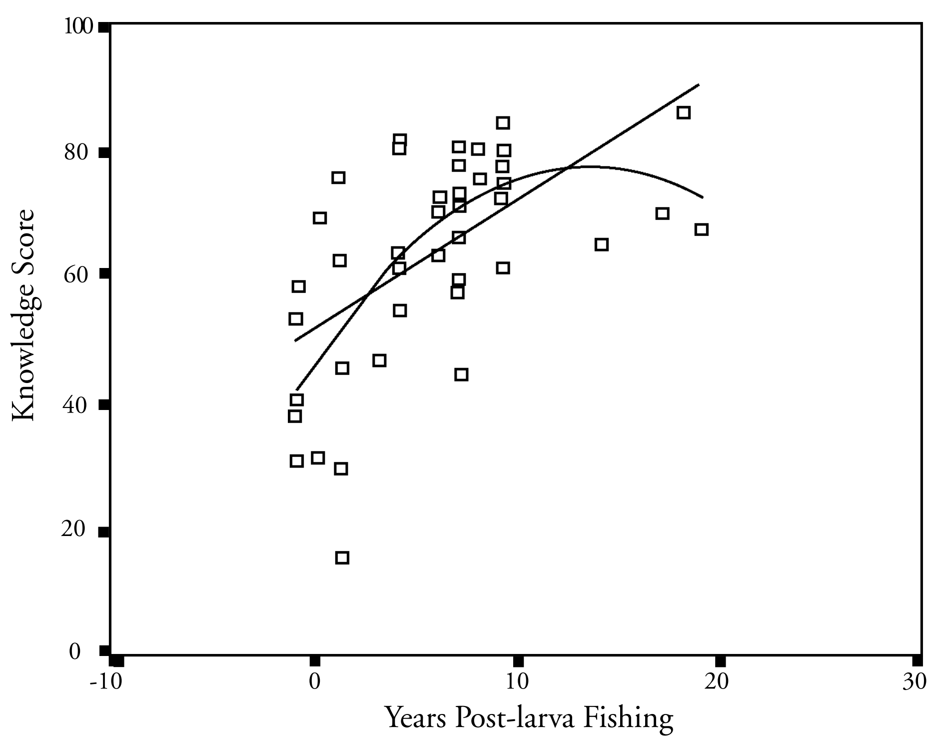


**Figure 3. Regression of knowledge scores on years post-larva fishing (linear and quadratic equations).**

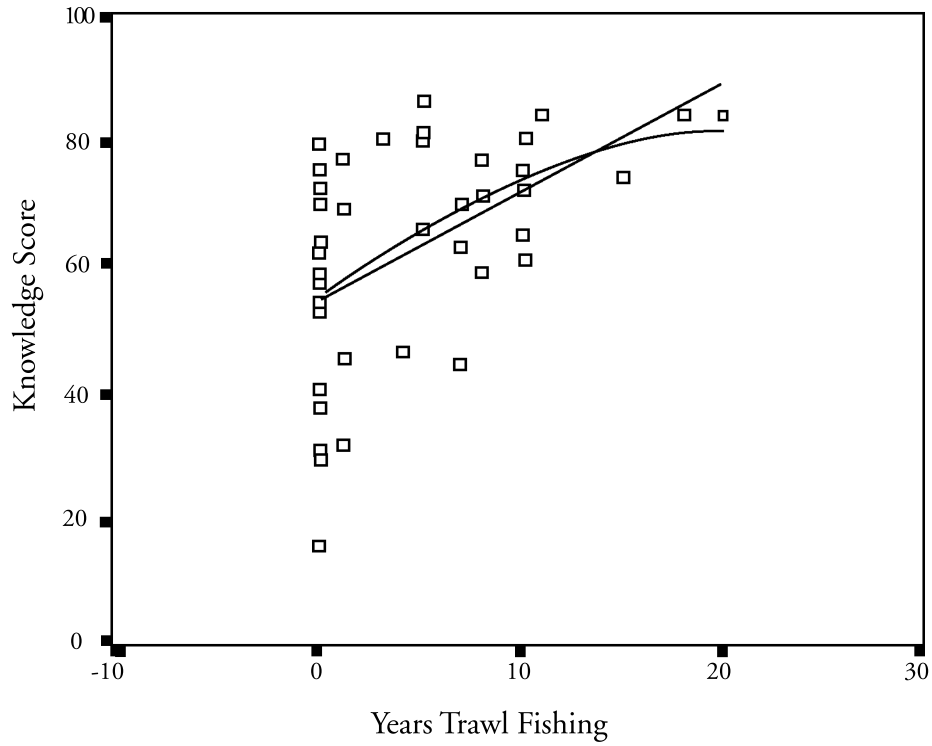


**Figure 4. Regression of knowledge scores on years trawl fishing (linear and quadratic equations).**

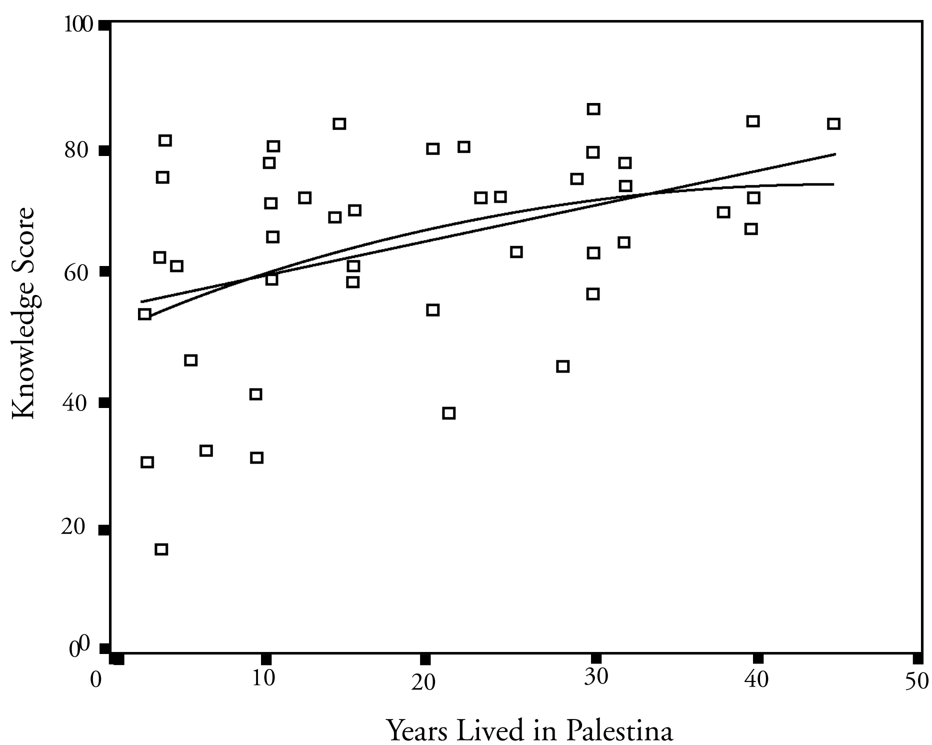


**Figure 5. Regression of knowledge scores on number of years lived in Palestina (linear and quadratic equations).**

The ethnographic data support the above findings. Post-larva fishing is an activity characterized by frequent environmental and social interaction. **Larveros** are in constant contact with the ocean and other fishers. Such interaction would be expected to lead to the development and dissemination of a knowledge base surrounding shrimp. Because the activity is shared by the majority of community members information can be passed on quickly.

Trawl fishing may not be as strongly correlated to knowledge for several reasons. First, the activity itself is less social in nature and does not afford as many learning opportunities for young children. Second, shrimp movements are hidden from fishers in several meters of water and nets are not withdrawn frequently, so it is difficult to ascertain exactly where and when a school of shrimp is encountered. In contrast, post-larva are caught in the surf and nets withdrawn every 15-20 minutes, allowing fishers to make more accurate observations and associations. Knowledge gained through post-larva fishing would not necessarily be expected to be distributed in its entirety to trawl fishers since the two fisheries do not usually overlap.

## Types of Local Ecological Knowledge

After reviewing the data, a key question emerges: what type of knowledge is being acquired in Palestina? Based on Berkes (1993) definition, the observed knowledge could not be considered "traditional ecological knowledge" because it is missing the key attribute of "historical continuity." While fishers in Palestina undoubtedly pass on shrimp knowledge from one generation to the next, the activity associated with such knowledge is no more than one generation old, and most residents in the area are recent migrants. The relatively new nature of the fishery and knowledge it produces is also supported by the weak correlation between years lived in the area and knowledge scores.

Nor does the observed knowledge fit a Western scientific knowledge base. Data show that the number of years of formal education does not explain any of the observed variation, a trend that would be expected when learning scientific principles in the formal education system. Moreover, the same consensus instrument was given to 13 biologists and technicians who work for the National Fisheries Institute of Ecuador. They received significantly lower knowledge scores than residents of Palestina: 57 compared to 65, respectively.

Clearly, the knowledge measured in this study does not fit with current views of traditional knowledge systems. Such views typically depict traditional ecological knowledge as inexorably eroding under the encroachment of capitalism. They often tend to conceptualize ecological knowledge as one cohesive entity, failing to differentiate between types of ecological knowledge and the possibility of variation in responsiveness to external forces and subsequent evolutionary trajectories. Indeed, the findings in this study suggest that we need to move beyond simplistic and static classification schemes of knowledge. It is an axiom in anthropology that cultures are constantly in a state of change, so it would behoove researchers interested in epistemological issues to create models that can account for the dynamic and temporal nature of socially distributed knowledge. Perhaps the above data reflect the incipient stages of a knowledge system that will continue to develop for generations to come. Longitudinal data are needed to address this question.

We should also be mindful that different types of ecological knowledge may have distinct ontological properties. Some types of ethnobiological knowledge systems, such as those employed by ethnomedical specialists, are typically exclusive to a few select individuals and will likely have a different evolutionary trajectory than more overt knowledge systems. In fact, there is evidence to suggest that ethnozoological knowledge in Palestina that has a medicinal application is eroding. One such example is the vanishing art of making and administering an analgesic derived from poisonous centipedes.

## Conclusion

The case of shrimp post-larva fishers in Palestina shows that local integration into a global market economy does not necessarily undermine and instigate the decline of all forms of local ecological knowledge. Rather, it can spur it. While some forms of knowledge may be lost with such integration, economic activities themselves can also be conducive to learning about the natural world. This acquisition may also be a relatively rapid process.

This research also supports the assertion that engagement with the natural world is a better predictor of ethnoecological knowledge than previously reported demographic variables, which may actually prove proxies for ecological experience rather than explanatory in and of themselves. While some knowledge may be transmitted during general social interaction (i.e. years living in the area), activities which increase exposure to the natural world increase the rate at which knowledge is acquired.

These data support, in part, the findings of Zent (1999) and Ohmagari and Berkes (1997), whose research suggests that the amount of time exposed to the natural environment and oral transmission are important in acquiring and retaining knowledge; but they demonstrate further that experience with nature is not necessarily undermined by the forces of modernization. Increasing activities that bring individuals in closer contact with the natural world, through whatever means, can create a cohesive system of ethnoecological knowledge in a relatively short time.

A final point to be made pertains to the inadequacy of current models of cultural knowledge. The demarcation between knowledge that is traditional and knowledge that is scientific needs to be re-examined. Models need to be developed that depict ecological knowledge as multi-faceted and dynamic, and that move beyond the current typologies and assumptions of uni-linear erosion.

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**References Cited**

ACHESON, J., AND R. STENECK.
1998 Bust and boom dynamics in the Maine lobster industry: Perspectives of fishers and biologists. *North American Journal of Fisheries Management* 17:826-847.

ATRAN, S.
1999 "The value of local knowledge," in *Ethnoecology: Situated knowledge/located lives*. Edited by V. Nazarea, pp. 190-214. Tucson: The University of Arizona Press.

BERKES, F.
1999 *Sacred ecology: Traditional ecological knowledge and resource management*. Philadelphia: Taylor and Francis.

BERKES, F.
1993 "Traditional ecological knowledge in perspective," in *Traditional ecological knowledge: Concepts and cases*. Edited by J. Inglis, pp. 1-9. Ottawa: International Development Research Center.

BORGATTI, S.
1996 *Anthropac 4.0 methods guide*. Natick, MA: Analytic Technologies.

BOSTER, J.
1986 Exchange of varieties and information between Aguaruna manioc cultivators. *American Anthropologist* 88:428-436.
1991 "The information economy model applied to biological similarity judgment," in *Perspectives on socially shared cognition*. Edited by L. Resnick, J. Levine, and S. Teasley, pp. 203-225. Washington: American Psychological Association.

BOSTER, J., AND J. JOHNSON.
1989 Form or function: A comparison of expert and novice judgments of similarity among fish. *American Anthropologist* 91:866-889.

Chipeniuk, R.
1995 Childhood foraging as a means of acquiring competent human cognition about biodiversity. *Environment and Behavior* 27(4):490-512.

Dove, M.
1999 "The agronomy of memory and the memory of agronomy: Ritual conservation of archaic cultigens in contemporary farming systems," in *Ethnoecology: Situated knowledge/located lives*. Edited by V. Nazarea, pp. 45-70. Tucson: The University of Arizona Press.

Gaibor, N.
1997 Socio-economic, cultural and political aspects of the shrimp aquaculture industry in Ecuador: The shrimp post-larva fishery case. Masters thesis, Center for Coastal Resources, University of Rhode Island.

Gragson, T., and B. Blount.
1999 "Introduction," in *Ethnoecology: Knowledge, resources and rights*. Edited by T. Gragson and B. Blount, pp. vii-xviii. Athens, GA: University of Georgia Press.

Guest, G.
1999 Global vision and local lives: Policy, participation, and coastal management in Ecuador. *Culture and Agriculture* 21(1):1-13.

Haenn, N.
1999 The power of environmental knowledge: Ethnoecology and environmental conflicts in Mexican conservation. *Human Ecology* 27(3):477-491.

Hunn, E.
1999 "The value of subsistence for the future of the world," in *Ethnoecology: Situated knowledge/located lives*. Edited by V. Nazarea, pp. 23-36. Tucson: The University of Arizona Press.

Montano-Toledo, J.
1997 "Historia de las carreteras: Provincia de Esmeraldas, Ecuador." Esmeraldas, Ecuador: El Consejo Provincial de Esmeraldas.

Nazarea, V., R. Rhoades, E. Bontoyan, and G. Flora.
1998 Defining indicators which make sense to local people: Intra-cultural variation in perceptions of natural resources. *Human Organization* 57(2):159-170.

Ohmagari, K., and F. Berkes.
1997 Transmission of indigenous knowledge and bush skills among the Western James Bay Cree women of Subarctic Canada. *Human Ecology* 25(2):197-222.

Phelan, J.
1967 *The Kingdom of Quito in the Seventeenth Century*. Madison, WI: The University of Wisconsin Press.

Plotkin, M., and L. Famolare, Editors.
1992 *Sustainable harvest and marketing of rain forest products*. Washington DC: Island Press.

Posey, D.
1999 "Safeguarding traditional resource rights of indigenous peoples," in *Ethnoecology: Situated knowledge/located lives*. Edited by V. Nazarea, pp. 217-229. Tucson: The University of Arizona Press.

Posey, D.
1990 "The application of ethnobiology in the conservation of dwindling natural resources: Lost knowledge or options for the survival of the planet," in *Ethnobiology: Implications and applications*. Edited by D. Posey and W. Overal, pp. 47-59. Belem, Brazil: Museu Paraense Emilio Goeldi.

RHOADES, R., AND J. HARLAN.
1999 "Quo vadis? The promise of ethnoecology," in *Ethnoecology: Situated knowledge/located lives*. Edited by V. Nazarea, pp. 271-279. Tucson: The University of Arizona Press.

ROMNEY, A. K., S. WELLER, AND W. BATCHELDER.
1986 Culture as consensus: A theory of culture and informant accuracy. *American Anthropologist* 88:313-338.

RUDDLE, K.
1994 "Local knowledge in the folk management of fisheries and coastal marine environments," in *Folk management in the world's fisheries: Lessons for modern fisheries management*. Edited by C. Dyer and J. McGoodwin, pp. 161-206. Boulder: University Press of Colorado.

THOMSEN, M.
1969 *Living poor: A Peace Corps chronicle*. Seattle: University of Washington Press.

WHITTEN, JR., N.
1965 *Class, kingship, and power in an Ecuadorian town*. Stanford: Stanford University.

ZENT, S.
1999 "The quandary of conserving ethnoecological knowledge: A Piaroa example," in *Ethnoecology: Knowledge, resources and rights*. Edited by T. Gragson and B. Blount, pp. 90-124. Athens, GA: University of Georgia Press.