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Income Periodicity and Expectations of Goal Attainment Among Small-Scale Fishermen in The Gulf of Nicoya, Costa Rica

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Income Periodicity and Expectations of Goal Attainment Among Small-Scale Fishermen in the Gulf of Nicoya, Costa Rica[1]

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Introduction There is a large and growing literature in the behavioral sciences which shows that peoples' subjective perceptions and evaluations of their life-situations and their expectations and plans for the future are essential ingredients in any research paradigm which seeks to explain a sizeable proportion of their behavior.[2]

Important to this perspective is the notion that people inhabit and adapt to 'meaningful environments' as well as objective sets of circumstances. That is, people simultaneously exist in multiple environments, both subjective and objective, and the degree of congruence between them is at best problematic. Accordingly, a group of individuals living in ostensibly similar objective situations may, or may not, all be in the same subjective 'psychological situation.' The obverse of course is also true. Assuming this enables us conceptually to cope with the fact that people in similar objective situations, say social locations (e.g. social classes, occupations, marital and legal statuses, residences, etc.) need not a priori be expected to all think and feel the same way, nor engage in the same behavior (e.g. remain in these locations for the same duration; follow similar alternative courses of action; respond the same to the same stimulii, etc.). This is because at least some of the variation in peoples mental and outward behavior (especially optative as opposed to coerced behavior), can be presumed to be governed by their available knowledge, evaluations of their situations and perceived opportunities and expectations concerning

the future. In other words, because part of their behavior is determined by their subjective environment.

An important consequence of this perspective is that it allows research aimed at assessing the 'psychological situation' to achieve parity with research aimed at assessing 'ecological,' 'demographic,' 'economic' and 'sociological' situations because variables and data drawn from all these approaches (and perhaps others) are normally required to complete a full understanding of human behavior in any given instance. It also forces us to realize that the 'definition of a situation' imparted to it by 'analysts', 'development-agents' and 'applied behavioral scientists' may be at odds with the definition of the situation imparted to it by the target populations themselves. Finally, it makes the search for the nature and correlates of subjective psychological dispositions of fundamental concern.

Goal of the Present Study With these thoughts in mind we intend to examine the relationship between objective economic conditions existing among small-scale fishermen in Costa Rica and their subjective expectations of life-goal attainment. Our definition of 'expectations' follows Inkeles, who has described them as expressions of "...the subjective probability that events, including some that are aspired to, will actually occur" (1976:25).

Although fishing as a way of life has many desirable qualities associated with it, Alexander (1977:235) has observed correctly that "fishing is everywhere regarded as an industry of great risk and uncertainty" (cf. Poggie, Pollnac, and Gersuny 1976; Pollnac, 1976). Among other things, yields fluctuate drastically and market conditions are unstable. Investments in equipment are high and subject to severe damage, loss and depreciation. Replacement and recurring costs are considerable and subject to inflation. And personal safety

is often jeopardized to some extent.

However, within this framework of risk there is some degree of variation in the extent to which all fishermen experience these conditions. Some for example, for a variety of reasons, simply manage to be more consistently successful than others (Poggie 1977,n.d.). So, while there are undoubtedly many demonstrable similarities among all fishermen, when compared to other occupational groups (cf. Aronoff 1967; Poggie and Gersuny 1974) there is also some variation among fishermen themselves; and not all of them can be expected to perceive their situations in exactly the same way nor share the same expectations about the future.

Since fishing is primarily an economic venture, we believe it is reasonable to assume that periodicity of income received from fishing should be a critical factor shaping the lives and outlooks of fishermen (cf. Pollnac, Gersuny, and Poggie 1975). In particular we shall concentrate on exploring the relation between income periodicity and expectations of most desired life-goal attainment.

Heuristically, one way to examine the nature of this relationship is in terms of economic security. Other things being equal (e.g. total income earned) one can assume that fishermen who experience relatively low income periodicity will feel more secure and thus be relatively more optimistic about attaining the goals they aspire to than fishermen experiencing higher income periodicity. According to this view, people adjust their expectations to what they know they will objectively get and value what they have more than what they do not have (Inkeles 1976:27; Bluhm 1975:234). Economic security and predictability are thus conceived as potentiating factors which enable them to achieve these ends, especially if these ends involve or depend upon economic resources.

While on the surface this view seems quite reasonable, and is certainly

worthy of consideration, closer inspection of the matter allows us to frame an alternative proposition. If we start by assuming that peoples' expectations are only loosely tied to reality and involve desires for improving their existence and attaining things not presently possessed, as well as simply retaining present satisfactions, the picture changes. From this angle, fishermen with low income periodicity might not necessarily be expected to be particularly optimistic. In fact they might be expected to be rather 'inertial.' That is they may feel rather secure in thinking they will remain about where they are but not be particularly optimistic about attaining goals they presently do not possess. In fact, if they perceive their relatively 'fixed-income' as a 'bind' they might feel rather pessimistic about attaining them at all.

On the other hand, those experiencing high income periodicity might be less 'inertial' and either more optimistic or pessimistic. That is, their fluctuating income could mean either opportunity or failure. A directional prediction is difficult to make. However, since fishing in general is an occupation of considerable risk, being optimistic would seem to be the most likely adaptive psychological strategy. In fact optimism could be considered a rationalization and affirmation of persistence in the face of known viccissitudes. Hence, we would predict that, under conditions of high income periodicity, fishermen will tend to be more optimistic than pessimistic. To feel otherwise would be 'cognitively dissonant' (Festinger 1957) and probably lead them to leave fishing and turn to other jobs.

With this as background two alternative hypotheses were formulated. Namely that, within the limits of random error, and overall income being roughly equal:

I. Fishermen experiencing relatively low income periodicity will display comparatively more optimism in their expectations of most desired life-goal attainment than fishermen experiencing high income periodicity.

II. Fishermen experiencing relatively high income periodicity will display comparatively more optimism in their expectations of most desired life-goal attainment than fishermen with low income periodicity.

Methods

Sample: Data for this paper are based on interviews conducted in Spanish with 125 small-scale fishermen from the Gulf of Nicoya, Costa Rica. A sample of 75 was drawn from Barrio el Carmen, Puntarenas. Puntarenas, the major Pacific port of Costa Rica, is located on a thin finger of land jutting westward into the Gulf of Nicoya approximately 110 kilometers west of San Jose. Barrio el Carmen is at the extreme western end of Puntarenas and is inhabited primarily by small-scale fishermen. A sample of 50 small-scale fishermen were interviewed at Costa de Pajaros, a concentration of fishermen in a rural region approximately 21 air-kilometers from Puntarenas on the coast of the Gulf of Nicoya. In both areas most small-scale fishermen fish from motorized wooden plank or dugout vessels from 15 to 30 feet in length using handlines and/or nets. Some still use sail or oars. Surplus production (i.e. that not used for subsistence) is sold to middlemen who distribute it to other middlemen or retailers. Mean age and formal education for the sample are 30.6 and 3.7 years respectively. The average fisherman has 3.4 dependents and has been

fishing for 12 years. 52 percent of the fishermen interviewed had fathers who were fishermen in contrast to only 26 percent who came from farming families.

Several important situational factors distinguish the rural and urban areas. Individuals in the rural area are much less tied into the cash economy than those in the urban area. In the rural area many small-scale fishermen have subsistence plots and domestic animals (usually pigs and chickens). Additionally, food can be bought or bartered from family, friends, or local farmers at much lower prices than in the city. In the urban area fishermen are locked into the cash economy. There is much less space for subsistence plots and domestic animals; thus, almost all non-fish food is purchased from local shopkeepers. Finally, electricity is available in Puntarenas but not at Costa de Pajaros. Consequently, numerous shops in Puntarenas are stocked with luxury goods such as stereos, televisions, blenders and refrigerators which depend upon electricity; thus, increasing the salience of expensive, non-productive goods among the urban fishermen.

Income periodicity: Periodicity of income (IP) was measured by asking individual fishermen how much income they earned from fishing in both maximum and minimum months and dividing the difference by the maximum or

$$IP = \frac{x - y}{x}$$

where x is the maximum and y is the minimum. This ratio varies between zero (no periodicity) and one (maximum periodicity). For purposes of analysis the sample was divided at the mean producing two subgroups: (1) High Periodicity Group - hereafter HPG with an income periodicity $\geq$ .75 (n = 60); and (2) Low Periodicity Group - hereafter LPG with a periodicity ratio $<$ .75 (n = 57).

Table 1 contains income information on these two groups. First, there is no significant difference between their (a) annual fishing income (b) annual income from other sources (c) total income (a + b combined) and (d) income from the month immediately preceding the interview. Second, they do differ significantly in (a) maximum months income from fishing (HPG higher) and (b) minimum months income (LPG higher). Third, they differ significantly, as expected, in periodicity of income (HPG higher). In sum, while overall income and fishing income is about the same, HPG have higher maximum months of earnings from fishing but also lower minimums. The opposite is true of LPG.

Table 1. Mean Incomes of Costa Rican Fishermen

Income	Hi Periodicity Group	Lo Periodicity Group	F	df*	P
Total**	137.74	116.53	0.379	1/38	> .05
Fishing**	118.7	108.74	0.101	1/40	> .05
Other**	15.73	10.78	0.466	1/90	> .05
Maximum Month***	231.64	162.95	4.414	1/115	< .05
Minimum Month***	26.97	67.32	23.863	1/115	< .001
Previous Month***	65.94	69.68	0.067	1/99	> .05
Periodicity	0.59	0.872	226.95	1/115	< .001

* df varies due to missing income data

** measured in 100's of Colones (one U.S. Dollar equals approximately 8.5 Colones)

*** measured in 10's of Colones

Table 2 compares these two groups on other variables which might be conceived as potentially affecting expectations of goal attainment.

Table 2. Comparison of High and Low Periodicity Fishermen on Selected Variables

Variable	Lo Periodicity Group	Hi Periodicity Group	F	df	p
Age	30.9	30.2	0.090	1/115	$>.05$
Years fishing	11.5	12.7	0.496	1/115	$>.05$
Dependents	3.3	3.5	0.134	1/115	$>.05$
Formal Education	4.0	3.5	0.942	1/115	$>.05$
Mass Media Exposure*	12.7	11.2	1.263	1/115	$>.05$
Material Style of Life**	3.4	2.5	5.800	1/115	$<.05$

* Scale formed by summing number of days per week exposed to television, radio, newspapers, magazines, and cinema. Item total correlations for each scale item ranged between 0.41 and 0.63 ($p < .01$).

** Scale formed by determining total number of items from the set (running water, electricity, radio, television, refrigerator, sewing machine, indoor toilet) present in household. Item total correlations range between 0.21 and 0.83 ($p < .05$).

Table 2 indicates that the two groups differ with respect to material style of life. Surprisingly, those with the lowest periodicity (and the lowest income) manifest a more elaborate material style of life. This can probably be explained by the fact that a steady income is more conducive to the purchase of large scale household items on credit. There is no significant difference between the two groups with respect to age, years fishing experience, number of dependents, years of formal education, or exposure to mass media.

<u>Expectations of Goal Attainment</u>: This variable was measured with the Ladder

of Life Test (Cantril 1963). This test consists of showing a respondent a ladder diagram with ten rungs. At the top (10) he is to imagine the best possible life and at the bottom (1) the worst possible life. He is then asked to indicate where he is on the ladder at present, where he was five years ago, and where he expects to be 5 years in the future. In the present study "optimism" is defined as expecting to be on a higher rung in the future than at present. "Pessimism" is defined as expecting to be on a lower rung than at present and "Inertia" is defined as expecting to remain in the same position in the future as one is at present (more on this below). This test is considered useful for comparative purposes because it is "self-anchoring" that is, a respondent determines for himself what is the "best" and "worst" possible life and positions himself accordingly at each time period.

As a means of providing some cultural content to ladder diagram responses, perceptions of the best possible life were determined by asking each fishermnn to describe the best thing that could happen in the future. Categorized responses to this question can be found in Table 3. Overall, the majority of responses concern economic factors including attainment of things not presently possessed.

Table 3. Fishermen's Perceptions of the Best Thing that Could Happen in Their Future.

Response	Percent Distribution
More or better fishing equipment	34
Own home or property	15
Better, more happy, comfortable life	14
Have enough money to buy what I want	13
Be healthy	06
Be in another occupation	04
Have work	03
Other	10

Further information which may be of value in interpreting responses to the ladder question can be found in Table 4 which provides categorized response frequencies to a question concerning fishermen's perceptions of factors influencing their attainment of goals (i.e. where the fisherman expects to be on the ladder of life 5 years in the future).

Table 4. Fishermen's Perceptions of Factors Influencing Goal Attainment.

Response	Percent Distribution
Work hard	27
Save	19
Fishing Equipment	18
Things (fishing) getting worse	09
Find help (partner, etc.)	08
As it is, it is good	08
Other	12

As can be seen in Table 4, the two highest frequency response categories refer to factors which are basically under control of the individual fisherman, and the third highest, the attainment of the tools of production to build toward and maintain life goals.

During the interview 15 respondents or 25% of the HPG refused to guess their position five years in the future and 20 respondents or 35% of LPG also refused. This difference is not statistically significant ($\underline{X}^2 = 1.42$, $\underline{p} > .05$). This reduced the size of the HPG subsample to 45 and the LPG subsample to 37. The HPG is 51.1% rural and the LPG is 40.5% rural. This difference is also not statistically significant ($\underline{X}^2 = .91$, $\underline{p} > .05$).

In Table 5 we present the mean ladder positions of both of these groups at each time period and the difference of means between the future and the present and the present and past for both groups. In each instance there is no significant difference between them.

Table 5. Mean Ladder of Life Comparisons

Ladder Position	Hi Periodicity Group	Lo Periodicity Group	F	df*	P
Present (time t)	4.39	4.57	.13	1/115	>.05
Past (time t-1)	4.26	4.63	.482	1/115	>.05
Future (time t+1)	7.02	7.28	.164	1/80	>.05
Future - Present	2.19	2.76	1.112	1/80	>.05
Present - Past	0.131	-0.054	.091	1/115	>.05

* df varies because of refusal to guess t + 1

Analysis We shall use a stochastic process model to examine the relative predictive efficacy of the two alternative propositions. In so doing we shall conceptualize expectations of life goal attainment (or responses to the ladder of life test) as a probabilistic temporal process. "...In a processual model or stochastic process a phenomenon is represented as a set of states that are maintained over time or are altered in accordance with a set of transition probabilities" (White 1974:373). A major advantage in doing so is that this does not restrict comparisons of perceived and expected degree of goal attainment to a single point in time. Since the propositions themselves call for a comparison of tendencies toward change (optimism -- expected ascent on the ladder, and pessimism -- expected descent on the ladder) or stability (inertia -- no expected change on the ladder) over time in expected goal attainment between

HPG and LPG this method may reveal differences that would not otherwise be apparent if only single time periods were considered (cf. Robbins, Robbins, and Pollnac 1977).

Several conditions make this mode of analysis appropriate for the present study. (1) The number of positions (or "states" in the language of stochastic processes) on the Ladder of Life Test is finite. This is given by the nature of the choice task. (2) Observations of respondent's perceptions of their positions at more than one, equally spaced, time interval (5 year period) are available. This is given by the nature of the "synthetic" panel design. (3) A transition probability matrix can be constructed from the proportion of respondents expecting to be in a specific position, or state on the Ladder of Life Test, at one time period (e.g. future) according to their perceived position, or state, at another (e.g. present). And (4) the mathematical machinery of Markov chains can be employed to model the process of expected life-goal attainment (cf. Kemeny and Snell 1960). The Markov model assumes that (a) the number of positions, or 'states' is finite, (b) observations are available at more than one time interval, (c) a respondent's state at time $\underline{t} + 1$ depends at most upon his state at time $\underline{t}$, and (d) transition probabilities among states remain constant over time. Assumptions (c) and (d) are of course subject to doubt and normally require empirical verification. In the present study however, this matters little since we do not intend to use the actual longitudinal projections extrapolated from the model. Rather, we are interested in detecting certain consequences that would result <u>if</u> transitions among states, determined by a matrix of transition probabilities, governed an infinite period. These ultimate consequences are interpreted as tendencies implicit in the nature of the transition matrices of expected goal attainment. In other words,

the utility of the model is not contingent upon whether or not the empirical patterns "fit" a Markov Chain process, but rather on its value as a frame of reference for analyzing the cross-sectional data and for comparing the structure of potential shifts between the two groups.[3]

We shall use this model to examine differences between the HPG and LPG groups, and test the two alternative propositions, in three inter-related ways: (1) Compare the structure and content of the transition probability matrices to determine which group is proportionately more optimistic, pessimistic and inertial. (2) Extrapolate and compare the relative distance: (a) each group as a whole is from ultimately attaining its life-goals, (b) and individuals in each group are from attaining their life-goals according to their present position. And (3) Compare the velocity of the process of goal attainment of each group.

<u>Results</u> In Table 6 we present probability vectors of LPG and HPG at time <u>t</u> (present) time <u>t</u> - 1 (past or 5 years ago) and time <u>t</u> + 1 (future or 5 years in the future). The components of three vectors specify the proportion of respondents in each ladder position (or state) at the three time periods.[4] A two-sample Kolmogorov-Smirnov test (Siegel 1956) revealed no significant differences (at .05 level) between the LPG and HPG at each separate time period. These results are similar to those reported in Table 5 which showed no significant differences between these groups in mean ladder positions at each time period. Focusing on each time period separately then few differences are apparent.

Table 6. Probability Vectors at Ladder Positions at Each Time Period*

Past

	S_1	S_2	S_3	S_4	S_5
HPG	.422 (19)	.156 (7)	.178 (8)	.133 (6)	.111 (5)
LPG	.243 (9)	.189 (7)	.298 (11)	.135 (5)	.135 (5)

Present

	S_1	S_2	S_3	S_4	S_5
HPG	.288 (13)	.267 (12)	.20 (9)	.178 (8)	.067 (3)
LPG	.216 (8)	.135 (5)	.324 (12)	.18 (7)	.135 (5)

Future

	S_1	S_2	S_3	S_4	S_5
HPG	.067 (3)	.111 (5)	.222 (10)	.156 (7)	.444 (20)
LPG	.108 (4)	.082 (3)	.135 (5)	.243 (9)	.432 (16)

* numbers in parentheses

Table 7 displays the transition probability matrices from present to future for each group. Each p_{ij} element in the matrices indicates the proportion of the sample who expect to be in a specific state in the future (t + 1) according to where they perceive themselves to be at present (t). For example, consider the top row of the LPG transition matrix. The proportion of LPG at position 1 (S_1) at present who expect to remain at position 1 (S_1) in the future is .375.

Table 7. Transition Probability Matrices from Present to Future

Hi Periodicity Group

To: Future

From: Present	S_1	S_2	S_3	S_4	S_5
S_1	.231	.231	.231	.154	.154
S_2	.00	.083	.417	.00	.50
S_3	.00	.00	.00	.556	.444
S_4	.00	.125	.25	.00	.625
S_5	.00	.00	.00	.00	1.00

Lo Periodicity Group

To: Future

From: Present	S_1	S_2	S_3	S_4	S_5
S_1	.375	.00	.25	.25	.125
S_2	.20	.60	.00	.20	.00
S_3	.00	.00	.25	.417	.333
S_4	.00	.00	.00	.143	.857
S_5	.00	.00	.00	.00	1.00

The proportion of LPG at position 1 (S_1) at present who expect to be at position 2 (S_2) in the future is .00, at position 3 (S_3) and 4 (S_4) in the future .25, at position 5 (S_5) .125 and so on. Since all rows in the matrices sum to 1 these proportions are mathematically equivalent to probabilities. Each matrix then specifies the probabilities of the five possible transitions from state to state over one five-year interval. Hence, it is called a 'transition probability matrix'. With the data transformed into these arrays it is possible to begin our comparison of the relative degree of optimism, pessimism and inertia of each group. For example, the proportions of each sample above, below, and on the main diagonal provide an approximate, but convenient, index of the relative amount of optimism, pessimism, and inertia respectively between the two groups. These figures are provided in Table 8.

Table 8. Matrix Index of Optimism

Present to Future*

Measure I

	Optimistic	Inertial	Pessimistic
HPG	.778 (35)	.156 (7)	.067 (3)
LPG	.568 (21)	.405 (15)	.027 (1)

Measure II

	Optimistic	Inertial	Pessimistic
HPG	.844 (38)	.022 (1)	.133 (6)
LPG	.703 (26)	.189 (7)	.108 (4)

* number in parentheses

Two different techniques were used to calculate the values in Table 8. At the top are the percentages with those remaining in S_1 and S_5 included in the measure of inertia. Below are found the same figures but with those remaining in S_5 included in the measure of optimism and those remaining in S_1 included in the measure of pessimism. This latter measure is perhaps more reasonable since S_5 is the highest step on the ladder and confidence in remaining there 5 years into the future should indicate some optimism. Likewise expecting to remain on the bottom should indicate some pessimism. These results tend to show some differences between the two groups. While for the most part both groups are predominantly optimistic, viewed either way, there is a greater tendency for HPG to display significantly more optimism and less pessimism and inertia with regard to attaining their most desired life-goals than LPG. Using a chi-square test the groups differ significantly on the first measure ($\underline{X}^2 = 6.68$, $\underline{df}$ 2, $\underline{p} < .05$) and the second ($\underline{X}^2 = 6.43$, $\underline{df}$ 2, $\underline{p} < .05$). These findings support Hypothesis II.

Some further comparisons can also be made. In the transition probability matrices of both groups S_5 (element $\underline{p}_{55}$) is a terminal, or absorbing, state which once entered is never left (i.e. the probability of remaining is S_5 is 1.00). Since it is possible to reach this state from every other state (though not necessarily in one transition or five-year interval) we are dealing with absorbing (as opposed to <u>regular</u>) Markov chains (Kemeny and Snell 1960:35-39). This guarantees an important consequence -- the probability that the groups will eventually be absorbed is 1. That is, if the process of life goal attainment were to continue as it started, then everyone in both groups will eventually reach their highest or most desired life goal or state ($\underline{S}_5$) and remain in it.[5] The procedure for demonstrating this is straight forward and can be accomplished using a little matrix algebra. If $\underline{p}$ is a row vector,

the components of which specify the proportion of the population in each state at the present time I (see Table 6), and $\underline{P}$ is the matrix of transition probabilities from time $\underline{t}$ (present) to $\underline{t}$ + 1 (future) (see Table 7), then

$$\underline{p}^{(\underline{t} + 1)} = \underline{p}^{(\underline{t})}\underline{P} \qquad (1)$$

where $\underline{p}^{(\underline{t} + 1)}$ is the future vector the components of which specify the proportion of the population in each of the states at $\underline{t}$ + 1 (5 years in the future) (see Table 6). It can also be shown recursively that

$$\underline{p}^{(\underline{t} + n)} = \underline{p}^{(\underline{t})}\underline{P}^n \qquad (2)$$

that is, by raising $\underline{P}$ to the $\underline{n}^{th}$ power and then premultiplying by $\underline{p}^{(\underline{t})}$ one obtains the proportion in each state at time $\underline{n}$. For example, to extrapolate the proportion of the population in each of the states at time $\underline{t}$ + 2 (10 years into the future) we use the equation

$$\underline{p}^{(\underline{t} + 2)} = \underline{p}^{(\underline{t})}\underline{P}^2 \qquad (3)$$

To determine if the process will eventually terminate in an absorbing state and, the number of time intervals this will take, we can simply estimate, by successive exponentiation of the matrices in Table 7, the time intervals in the future (or powers of $\underline{P}$) where each column has the same values to one significant digit (see Table 9). In the case of LPG this occurs at the 14th power of $\underline{P}$ (or $\underline{P}^{14}$) -- all the elements of the first 4 columns of $\underline{P}^{14}$ are .000, and all the elements of the fifth column are 1.000 (see Table 9). Thus, in accordance with the absorbing nature of the transition matrix, everyone in the LPG sample can be expected to reach the most desired life goal (or state S_5) and remain there after 14 time intervals. For the HPG this occurs at the 8th power or $\underline{P}$ or ($\underline{P}^8$). We can conclude from this therefore that the entire

Table 9. Absorbing - State Matrix

$$\lim_{n \to \infty} \underline{P}^{(n)} = \begin{array}{c} \\ S_1 \\ S_2 \\ S_3 \\ S_4 \\ S_5 \end{array} \begin{array}{c} \begin{array}{ccccc} S_1 & S_2 & S_3 & S_4 & S_5 \end{array} \\ \begin{pmatrix} .00 & .00 & .00 & .00 & 1.00 \\ .00 & .00 & .00 & .00 & 1.00 \\ .00 & .00 & .00 & .00 & 1.00 \\ .00 & .00 & .00 & .00 & 1.00 \\ .00 & .00 & .00 & .00 & 1.00 \end{pmatrix} \end{array}$$

HPG will attain their most desired life state before (or faster) than the entire LPG. These results also support Hypothesis II.

To compare (1) average individual distances of members of each group from their most desired life-goals according to their position at present and (2) the expected number of time-intervals (5 year periods) they will spend in other positions before they reach this state, we compute $\underline{N}$ the fundamental equation of an absorbing Markov chain (Kemeny and Snell 1960:45-58)

$$\underline{N} = (\underline{I} - \underline{Q})^{-1} \qquad (4)$$

where $\underline{I}$ is an identity matrix with 1's in the main diagonal and 0's elsewhere and $\underline{Q}$ is the matrix of transition probabilities among the nonabsorbing states (S_1, S_2, S_3, S_4; see Table 7). Thus the quantity $(\underline{I} - \underline{Q})^{-1}$ is the inverse of the difference of $(\underline{I} - \underline{Q})$. The $\underline{N}$ matrices of both groups are displayed in Table 10.

The $\underline{n}_{ij}$ elements in Table 10 display the expected number of time-intervals a person will remain in each position before reaching S_5 (the absorbing state)

Table 10. Fundamental Matrices for Present to Future Absorbing Chains

Hi Periodicity Group

$\underline{N}$ =

	S_1	S_2	S_3	S_4	Row Sums
S_1	1.3	.41	.469	.614	2.793
S_2	0	1.14	.475	.352	1.967
S_3	0	.105	1.044	.775	1.924
S_4	0	.189	.079	1.393	1.661
					8.345

Lo Periodicity Group

$\underline{N}$ =

	S_1	S_2	S_3	S_4	Row Sums
S_1	1.6	0	.532	.728	2.86
S_2	.8	2.5	.266	.95	4.516
S_3	0	0	1.33	.65	1.93
S_4	0	0	0	1.17	1.17
					10.526

according to their starting state, or position on the ladder at present. Each row sum ($\sum_{j=1}^{4} \underline{n}_{ij}$) specifies the expected total number of time-intervals it will take for a person to reach S_5 depending on their starting state. For example consider the top row of the LPG $\underline{N}$ matrix. On the average a fisherman who perceives himself to be in S_1 at present on the ladder of life can be ex-

pected to spend 1.6 time-intervals at that state, 0 time intervals at S_2, .532 intervals at S_3 and .728 intervals at S_4 in the future before reaching S_5, the most desired life state. The sum of these elements = 2.86 and gives the average number of time-intervals it will take for that person to reach S_5 (i.e. 2.86 x 5 = 14.3 years). Comparing the LPG and HPG $\underline{N}$ matrices we see that they are quite similar. However there is (with the exception of S_4) a tendency for the average time to S_5 to be shorter for the HPG. In fact taking the sum of all the elements of each matrix ($\sum_{i=1}^{n} \sum_{j=1}^{n} \underline{n}_{ij}$) and comparing them shows that the total number of time-intervals for LPG before reaching S_5 is 10.526 whereas for HPG this sum is 8.345. This shows that on the average HPG individuals are less distant from their most desired life than LPG individuals. We interpret this as further evidence in favor of Hypothesis II.

Let us now summarize the results of this analysis. So far we have shown that: (1) at each separate time-period: past, present and future there is no significant difference in the proportional distribution of each group in the state-set vectors (Table 6); (2) constructing a transition probability matrix for each group (by classifying individuals in a state they expect to be in in the future according to where they perceive themselves to be at present) reveals that significantly more HPG expect to be in higher states than LPG who in turn expect to be more in either the same or lower states (Table 8) the "matrix index of optimism" therefore allows us to infer that HPG are more optimistic than LPG. This supports Hypothesis II; (3) Since the transition probability matrices of both groups can be defined as an absorbing Markov chain, both groups can be expected to eventually reach their most desired life-goals if the process continues as it began. Using equation (2) we can further extrapolate that all HPG can be expected to attain their most desired life-goals,

or S_5, faster (after 8 five-year time intervals) than LPG (after 11 five-year time intervals). These results also support Hypothesis II because HPG are more optimistic about attaining their life-goals faster than LPG expect to attain theirs'. (4) finally we have used equation 3 to compute an average individual goal distance measure. Comparing the measures of both groups again shows that with the exception of S_4 the distance to S_5 is somewhat shorter for HPG than LPG (Table 10). This also supports Hypothesis II. In sum the results of the stochastic process analysis of the period from present to future reveals that HPG are more optimistic than LPG.

We now briefly turn to an analysis of the positions of the two groups in the past and present. Here we shall examine the way in which fishermen retrospectively compare their past positions on the ladder (5 years ago) with their present positions. Since we now suspect that HPG are more optimistic than LPG about expecting to attain their most desired life-goals in the future it should prove interesting to see how they perceive their past in relation to their present. As we will see this should also serve to enlarge our perspective of their relative degree optimism about the future.

We can construct another pair of transition probability matrices by classifying individuals in the present according to where they were in the past (5 years ago). These appear in Table 11. Using the entries in these arrays we can again derive another 'index of optimism'. This appears in Table 12. Of interest is the fact that both groups are quite similar on both measures. Chi-square tests reveal no significant differences between them on the first ($\underline{X}^2$ = 2.597, $\underline{df}$ 2, $\underline{p}$ >.05) or second measure ($\underline{X}^2$ = 3.397, $\underline{df}$ 2, $\underline{p}$ >.05).

Table 11. Transition Probability Matrices

From Past to Present

Hi Periodicity Group

	S_1	S_2	S_3	S_4	S_5
S_1	.369	.263	.158	.105	.105
S_2	.286	.286	.286	.142	.00
S_3	.25	.375	.25	.125	.00
S_4	.333	.333	.167	.167	.00
S_5	.00	.00	.20	.60	.20

Lo Periodicity Group

	S_1	S_2	S_3	S_4	S_5
S_1	.556	.222	.111	.111	.00
S_2	.00	.143	.571	.143	.143
S_3	.091	.091	.454	.273	.091
S_4	.00	.20	.20	.40	.20
S_5	.40	.00	.20	.00	.40

Table 12. Matrix Index of Optimism

Past to Present*

Measure I

	Optimism	Inertia	Pessimism
HPG	.356 (16)	.289 (13)	.356 (16)
LPG	.405 (15)	.405 (15)	.189 (7)

Measure II

	Optimism	Inertia	Pessimism
HPG	.378 (17)	.111 (5)	.511 (23)
LPG	.459 (17)	.216 (8)	.324 (12)

* number in parentheses

Examining the nature of the transition matrices reveals that both can be defined as regular Markov chains. That is a Markov chain whereby some power of the transition matrix has all positive, non-zero elements (Kemeny and Snell 1960:69). This indicates that there is always some probability of going from any state to any other state at any transition (i.e. after any 5 year interval elapses) and this includes the highest state S_5. This means that although there is always some probability of attaining (and remaining in) S_5, the most desired life state, there is also always an associated probability of leaving it. Because this is a regular (as opposed to an absorbing) chain, it further guarantees the fact that at no time will all individuals attain and remain in the highest Ladder of Life state. Instead, if the transition probabilities remain the same, a fixed point or equilibrium vector ($\underline{p}^e$), will be reached wherein some proportion

of the sample will always be distributed in other states as well. These proportions will always remain invariant when further multiplied by the transition matrix[6] or

$$\underline{p}^e = \underline{p}^e \underline{P} \qquad (5)$$

These are presented for the LPG and HPG in Table 13. These equilibrium vectors abstract the ultimate fate of the transition matrices and process of goal attainment of each group. A two sample Komolgorov-Smirnov test revealed no significant difference between them. Thus far then, both groups appear to display rather similar retrospective comparisons of their past and present positions on the Ladder of Life.

Table 13. Equilibrium Vectors Past to Present

	S_1	S_2	S_3	S_4	S_5
HPG	.209	.204	.219	.149	.039
LPG	.198	.133	.311	.210	.149

In order to compare their distance from their most desired life goals (S_5) another quantity was deduced from the regular Markov chain model. This is $\underline{M}$ the 'Mean First Passage Time' and is derived from $\underline{Z}$ the fundamental equation of regular Markov chains (Kemeny and Snell 1960:75-82).[7] Mean First Passage Time estimates specify the average number of transitions (time-intervals) it will take to reach a state for the first time from any other state. The diagonal entries specify the mean first-return times. Table 14 presents $\underline{M}$ matrices for each group. For example consider the top row of the mean first passage times for the HPG. The $\underline{m}_{15}$ element 27.21 indicates it will take a person

Table 14. Mean First Passage Time Past to Present

Hi Periodicity Group

$$M = \begin{array}{c} \\ S_1 \\ S_2 \\ S_3 \\ S_4 \\ S_5 \end{array} \begin{array}{c} \begin{array}{ccccc} S_1 & S_2 & S_3 & S_4 & S_5 \end{array} \\ \begin{pmatrix} 3.35 & 3.65 & 5.1 & 6.72 & 27.21 \\ 3.53 & 3.4 & 4.44 & 6.91 & 30.73 \\ 3.65 & 3.1 & 4.57 & 7.03 & 30.86 \\ 3.34 & 3.28 & 5.02 & 6.71 & 30.55 \\ 4.67 & 4.48 & 5.01 & 3.01 & 25.5 \end{pmatrix} \end{array}$$

Lo Periodicity Group

$$M = \begin{array}{c} \\ S_1 \\ S_2 \\ S_3 \\ S_4 \\ S_5 \end{array} \begin{array}{c} \begin{array}{ccccc} S_1 & S_2 & S_3 & S_4 & S_5 \end{array} \\ \begin{pmatrix} 5.06 & 5.89 & 4.61 & 6.51 & 10.11 \\ 9.3 & 7.51 & 2.65 & 5.92 & 7.95 \\ 8.75 & 7.63 & 3.22 & 5.19 & 8.4 \\ 9.21 & 6.92 & 4.13 & 4.77 & 7.12 \\ 4.58 & 8.14 & 4.74 & 7.74 & 6.72 \end{pmatrix} \end{array}$$

who was in S_1 in the past an average of 27.21 time intervals to first reach S_5 the most desired life state. The $\underline{m}_{11}$ element 3.35 specifies the expected number of time intervals it will take a person who is in S_1 to again be in S_1. The $\underline{M}$ matrices thus provide a useful comparative measure of distance from expected goal-attainment when dealing with a <u>regular</u> chain. If we compare the $\underline{M}$ matrices of each group it is apparent that, particularly with respect to the initial distance to S_5 (see column 5), the LPG are on the average about three times closer to first attainment of their most desired goals than HPG. And they are for the most part somewhat further from the bottom (S_1). This suggests that although the groups are similar in their ultimate state-set distribution specified by the equilibrium vectors $\underline{p}^e$ (see Table 13), LPG individuals appear to be less distant from their most desired goals than HPG. This further suggests that LPG perceive less disparity between their past and present than do HPG. Coupled with what we now know about the present to future transition probabilities this indicates that overall LPG see relatively more continuity, or stability, between their past, present and future than HPG, who in turn probably see themselves as having come a long way from past to present, and who expect to go a long way in the future.

Thus we may further hypothesize that the velocity of change in goal attainment is slower for LPG than HPG. If this is so we will then have a further piece of evidence that HPG are more optimistic than LPG. One way to test this directly is to compute and compare the ratio $\underline{R}$. Beauchamp (1966) has suggested that we take the ratio of the sum of the elements of the matrix $\underline{N}$ for an earlier period to the sum of the elements of a matrix $\underline{N}$ for a later period (designated $\underline{N}'$) to arrive at an overall measure of the rate of change of an absorbing Markov chain process, $\underline{R} = \underline{N}/\underline{N}'$ (i.e. a ratio of the total of the

average times to absorption from all nonabsorbing states for each time period). If $\underline{N} = \underline{N}'$ then the ratio $\underline{R} = 1$ indicates no change between periods. If $\underline{N}$ is greater than $\underline{N}'$ then the ratio $\underline{R} > 1$ indicates the process is accelerating. If $\underline{N}$ is less than $\underline{N}'$ then the ratio $\underline{R} < 1$ indicates that the rate of change is decelerating. Since we have already computed $\underline{N}'$ for the period from present to future for both groups (see Table 10) all that remains is to compute $\underline{N}$ for the period past to present. Here we confront a problem. Since the matrix for the past to present period is regular we cannot directly compute $\underline{N}$ which is the fundamental matrix for absorbing matrices. If however we are willing to confine our interest simply to the initial attainment of S_5, and forget for the moment the corresponding probabilities of leaving S_5 once it is attained, we may fruitfully apply absorbing chain theory to regular chains and compute $\underline{N}$ (cf. Kemeny and Snell, 1960:196). To do this all we need do is convert S_5 in the matrices in Table 11 to absorbing states by making the $\underline{p}_{55}$ elements 1.00 and all other elements in the fifth rows .00 (i.e. $\underline{p}_{51}$, $\underline{p}_{52}$, $\underline{p}_{53}$, $\underline{p}_{54}$). Table 15 contains these quantities calculated from equation number 4. The sum of the elements in the LPG matrix $\underline{N}$ is 33.78. The sum of the elements in the HPG matrix $\underline{N}$ is 119.37. Recalling that $\underline{N}'$ for the LPG and HPG (present to future) was 10.53 and 8.345 respectively, we can compute $\underline{R} = \underline{N}/\underline{N}'$ for both groups and compare them to see which groups' process is changing at a faster rate. For the LPG $\underline{R} = 33.78/10.53 = 3.29$. For the HPG $\underline{R} = 119.37/8.345 = 14.3$. These results rather clearly support our hypothesis that the process of expected goal attainment is changing faster for the HPG. Thus the HPG manifests a much sharper discontinuity between the periods past to present, and present to future, than the LPG. These results allow us to infer that they see themselves as having come a longer way from past to present in goal attainment

Table 15. Fundamental Matrices for

Past to Present Absorbing Chain Conversions

Hi Periodicity Group

$$\underline{N} = \begin{array}{c} \\ S_1 \\ S_2 \\ S_3 \\ S_4 \end{array} \begin{array}{c} \begin{array}{cccc} S_1 & S_2 & S_3 & S_4 \end{array} \\ \begin{pmatrix} 9.52 & 8.26 & 5.93 & 3.5 \\ 9.52 & 10.27 & 6.85 & 4 \\ 9.52 & 9.5 & 7.85 & 4 \\ 9.52 & 9.35 & 6.68 & 5 \end{pmatrix} \end{array} \quad \begin{array}{c} \text{Row Sums} \\ 27.21 \\ 30.74 \\ 30.87 \\ 30.55 \\ \hline 119.37 \end{array}$$

Lo Periodicity Group

$$\underline{N} = \begin{array}{c} \\ S_1 \\ S_2 \\ S_3 \\ S_4 \end{array} \begin{array}{c} \begin{array}{cccc} S_1 & S_2 & S_3 & S_4 \end{array} \\ \begin{pmatrix} 2.9 & 1.6 & 3.18 & 2.38 \\ .64 & 2.4 & 3.12 & 2.05 \\ .84 & 1.19 & 4.08 & 2.29 \\ .49 & 1.11 & 2.4 & 3.11 \end{pmatrix} \end{array} \quad \begin{array}{c} \text{Row Sums} \\ 10.06 \\ 8.21 \\ 8.4 \\ 7.11 \\ \hline 33.78 \end{array}$$

than the HPG. And, as our earlier results show, they are more optimistic about attaining their most desired life goals in the future at a faster rate.

Summary and Conclusion We began this paper by taking cognizance of the importance of studying people's perceptions of their life-situation and expectations concerning the future. In particular we have been concerned with fishermen's subjective evaluations of their chances of attaining their most desired life-goals. Our focus has been on economic factors which may shape their relative degree of optimism, pessimism or inertia. Given the precarious and uncertain nature of fishing we postulated that a prime factor which should influence fishermen's goal expectations is income periodicity. Two alternative hypotheses were advanced (1) that low-income periodicity would be related to optimism and (2) that high-income periodicity would be related to optimism. Hypothesis I was based on the assumption that low periodicity is related to economic security which in turn conditions fishermen to be optimistic about goal-attainment. Hypothesis II is based on the assumption that economic opportunity is related to high income periodicity and those with more income periodicity will be more optimistic. The alternative possibility that high periodicity could also be associated with failure and therefore pessimism was ruled out on the grounds it would probably produce too much cognitive dissonance.

To examine the relative value of these hypotheses a sample of fishermen from Costa Rica were subdivided into two groups, a low periodicity group (LPG) and a high periodicity group (HPG) on the basis of the periodicity of their income from fishing. Data and analysis revealed they did not differ in their overall annual income, income from fishing nor income during the month preceding the interview. The HPG however did have higher maximum months and lower minimums

than LPG. Using Cantril's Ladder of Life Test to measure optimism about expectations of most desired life-goal attainment, and a stochastic process model, it was found that:

1. There is no significant difference between LPG and HPG in their ladder positions in the past, present and future. That is, they are proportionately distributed in similar ways in ladder positions at each time period.

2. HPG are significantly more optimistic about being in higher positions (closer to their goals) in the future, according to their present position than LPG.

3. HPG as a group expect to attain their goals faster than LPG.

4. Individual HPG fishermen are closer to attaining their goals than individual LPG fishermen.

5. HPG have come a longer way from past to present than LPG toward attaining their goals and expect to go further in the future.

In sum, the results favor Hypothesis II over Hypothesis I. These results are obviously tentative, however, pending more research with larger samples and more replications. They nonetheless suggest, at the very least, that high-income periodicity is not inimical to maintaining optimistic expectations about life-goal attainment. On the other hand we are <u>not</u> in a position to conclude that low-income periodicity <u>is</u> iniminical to optimism. Afterall the results show <u>both</u> groups to be predominantly optimistic. What we have discovered is some degree of difference.

We are likewise not in a position to delineate the underlying causal dynamics.

Income periodicity can be postulated to be an antecedent factor contributing to degree of optimism but the reverse is also tenable. That is, degree of optimism could also be antecedent to income periodicity. For example, we could argue that optimistic fishermen are more likely to manifest more exploratory behavior and search out new fishing areas. This strategy could result in either very large catches (exploiting previously untouched stocks) or failure to find any fish at all; hence, resulting in greater periodicity of income than a strategy that concentrates on known stocks of reliable but lower productivity. In either case numerous other variables could be postulated to intervene and modulate these relationships.

We do believe the results are interesting and should be followed up. Income periodicity, expectations of life-goal attainment, and stochastic process models for analysis, all show promise for further study. Actual longitudinal, panel studies, where groups are observed over time, would be a logical next step.

We would also suggest that the results of this study support the position that peoples' life-goals are probably only loosely tied to reality and for the most part involve attainment of things not presently possessed (cf. Table 3, above). Optimism about attaining these goals seems to be more related to economic opportunity, as indicated by higher income periodicity, than to economic security, as indicated by lower income periodicity. In this regard it should be re-emphasized however, that this generalization can only be claimed to apply to situations where overall income is roughly similar. Clearly, if high-periodicity of income were associated with low overall income different results might obtain. An important goal of future research will be to explore the relationship of overall income differences to degree of optimism about life goal

attainment and then compare the effects of periodicity. Finally, we would urge others to investigate the correlates and consequences of other aspects of the 'psychological situation' for as W.I. Thomas has said of 'definitions of the situation' in his famous dictum: "if men define situations as real, they are real in their consequences" (1928.572).

NOTES

1. We want to thank Andy Walker and Craig Sturdevant for their help with the computer analysis of these data. Computer facilities of both the University of Missouri and The University of Rhode Island were used.

2. No effort will be made to review this literature here. Readers are referred to Burgers (1975) and Bennett (1976), for representative theoretical statements, to Graves (1973), Graves and Van Arsdale (1966), Johnson (1974), Fliegel et. al. (1968) and Bluhm (1975) for representative empirical applications and to Spradley (1972) and Jessor and Jessor (1973) for both.

3. Fuguitt (1965) has employed Markov chain models in a similar way to study demographic trends in small towns. He observes this is analogous to using the 'net reproduction rate' as a descriptive measure of fertility at a single point time even though it is couched in longitudinal terms.

4. The 10-step ladder was collapsed to 5 steps: 1 + 2 = 1, 3 + 4 = 2, 5 + 6 = 3, 7 + 8 = 4, 9 + 10 = 5. This was done so that the number of matrix entries would not be inoperatively small. No appreciable difference between the two groups resulted from this.

5. A major theorem of absorbing Markov chains is that the probability that the process will eventually be absorbed is 1. Kemeny and Snell (1960:43-65) provide a proof of this theorem.

6. The equilibrium vector ($\underline{p}^e$) can be discovered by solving a system of linear equations. Since $\underline{P}$ is regular we know it has a unique fixed-vector $\underline{p}^e$ associated with it, the components of which are all positive. Further, the values of the components of $\underline{p}^e$ will not change when multiplied by any power

of $\underline{P}$ or $\underline{p}^e = \underline{p}^e\ \underline{P}$ (equation 5). Therefore the following matrix equation will hold

$$(x_1, x_2 \ldots x_n)^e \begin{pmatrix} p_{11} & p_{12} & \cdot & \cdot & \cdot & p_{1n} \\ p_{21} & p_{22} & \cdot & \cdot & \cdot & p_{2n} \\ \cdot & \cdot & & & & \cdot \\ \cdot & \cdot & & & & \cdot \\ \cdot & \cdot & & & & \cdot \\ p_{n1} & p_{n2} & \cdot & \cdot & \cdot & p_{nn} \end{pmatrix} = (x_1, x_2 \ldots x_n)^e$$

Let $\underline{P}$ = the LPG matrix in Table 11. Then the following system of linear equations can be derived.

$$\begin{aligned}
x_1 - x_2 + x_3 + x_4 + x_5 &= 1 \\
.55x_1 + 0x_2 + .091x_3 + 0x_4 + .4x_5 &= x_1 \\
.222x_1 + .143x_2 + .091x_3 + .2x_4 + 0x_5 &= x_2 \\
.111x_1 + .571x_2 + .454x_3 + .2x_4 + .2x_5 &= x_3 \\
.111x_1 + .143x_2 + .273x_3 + .4x_4 + 0x_5 &= x_4 \\
0x_1 + .143x_2 + .091x_3 + .2x_4 + .4x_5 &= x_5
\end{aligned}$$

from which we compute

$$\underline{p}^e = (.198, .133, .311, .21, .149)$$

7. The fundamental equation of a regular Markov chain is

$$\underline{Z} = (\underline{I} - \underline{P} + \underline{A})^{-1} \qquad (6)$$

where $\underline{I}$ is an identity matrix, $\underline{P}$ is the transition probability matrix and $\underline{A}$ is a fixed-state matrix with each row equal to $\underline{p}^e$ as defined by equation 5. The Mean First Passage Time is given by

$$\underline{M} = (\underline{I} - \underline{Z} + \underline{E}\underline{Z}_{dg})\underline{D} \qquad (7)$$

where $\underline{I}$ is again an identity matrix, $\underline{Z}$ is defined in equation (6), $\underline{E}$ is a matrix with all entries 1, $\underline{Z}_{dg}$ is a diagonal matrix with $\underline{j}$-th entry as in $\underline{Z}$ and zero's elsewhere and $\underline{D}$ is a diagonal matrix with $\underline{j}$-th entry $1/a_j$ (the reciprocals of the diagonal elements of $\underline{A}$).

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