#1967

ESTIMATION OF FISHING AND NATURAL MORTALITY WHEN A TAGGING STUDY IS COMBINED WITH A CREEL SURVEY OR PORT SAMPLING

Kenneth H. Pollock

Department of Statistics

Box 8203

North Carolina State University

Raleigh, North Carolina 27695-8203 U.S.A.

John M. Hoenig

Canada Department of Fisheries and Oceans

P.O. Box 5667

St. Johns Newfoundland

Canada A1C 5X1

Cynthia M. Jones

Department of Oceanography

Old Dominion University

Norfolk, Virginia 23529 U.S.A.

Abstract — If we consider a multi-year tagging study where tag returns are obtained from a recreational or commercial fishery it is possible to estimate total annual survival rate. The methodology has been described in detail by Brownie et al. (1985). Fishery biologists would also like to be able to estimate natural and fishing mortality rates from these data but this is not possible without the additional assumption that all tags are reported. Sometimes high reward tags are used in the hope of satisfying this assumption. In this paper we review the theory of the tagging models and then show how to estimate the reporting rate of tags by conducting a creel survey or port sample in conjunction with the tagging study. It is then possible to partition total mortality into fishing and natural mortality. The question of additive versus compensatory mortality processes can then be addressed.

In recent years there has been a lot of work on the analysis of multi-year banding studies for migratory birds. The methodology has been described in detail by Brownie et al. (1985). Although this methodology has been developed in a wildlife context it is just as applicable to fisheries tagging studies. In fact, it was partly a study on lake trout (see Youngs and Robson 1975) that led to much of the recent work. Pollock and O'Connell (1989) apply the Brownie models to Pacific Halibut (Hippoglossus stenolepis) tagging studies.

In this paper we first review the Brownie models emphasizing model structure and assumptions. We then discuss the use of reward tags as a method of estimating reporting rate of regular tags; this allows conversion of recovery rates to fishing mortality rates. Following this, we consider the most important work in our paper which is how to use a creel survey or port sample to estimate reporting rate as an alternative to use of reward tags. Finally we discuss the important implications of this approach which allows separate estimation of fishing and natural mortality rates.

REVIEW OF TAGGING MODELS

Concepts

To begin our review of the tagging models described by Brownie et al. (1985) let us consider the possible fates of a fish tagged at the start of the year based on the diagrams in Brownie et al. (1985, p. 14) (Figure 1). Our notation for mortality rates follows Ricker (1975).

We have: $S =$ the finite survival rate or the probability of surviving the year,

$u =$ the finite exploitation rate or the probability of being harvested,

and $\lambda =$ the tag reporting rate, or the probability that a tag will be found and reported to the fisheries biologist given that the fish has been harvested.

If we can further assume that all fish killed are returned by the anglers we have

$$v = 1 - S - u$$

which is the finite natural mortality rate or the probability of dying from natural causes. Note that the type of data we analyze supplies information directly about only those fish which are harvested and their tags reported. Therefore, only the product $f=\lambda u$ which is called the tag recovery rate is estimable and the component rates λ and u are not estimable without additional information such as from use of reward tags or creel surveys (or port samples) as we discuss later. A modified diagram given in Figure 2.

Model Structure

The data involve multiple year taggings and recoveries. For data with this structure, Brownie et al. (1985, Chapter 2) consider a set of 4 models if the animals are not stratified by age class. The most general model is Model 0 which has the following matrix of expected recovery numbers if there are 3 tagging years and 3 recovery years:

Year tagged	No. tagged	Year of Recovery 1	2	3
1	N_1	$N_1f_1^*$	$N_1S_1f_2$	$N_1S_1S_2f_3$
2	N_2		$N_2f_2^*$	$N_2S_2f_3$
3	N_3			$N_3f_3^*$

where S_i is the year specific annual survival rate,

f_i is the year specific annual recovery rate for previously tagged fish,

and f_i^* is the year specific annual recovery rate for newly tagged fish.

There may be a need to have separate recovery rates f_i and f_i^* for previously and newly tagged fish because fishing may begin before all tagging is completed or because the newly tagged fish may not be so readily available for capture.

Various restricted models can be specified by forcing certain parameters to remain constant over the years or over the cohorts.

Model 1 is a restriction of Model 0, where $f_i^* = f_i$. That is all tagged fish have equal recovery rates in a given year irrespective of whether they are newly tagged or previously tagged.

Model 2 is a restriction of Model 1 where $S_i = S$ for all years. That is all tagged fish have constant annual survival over all years in the study.

Model 3 is a restriction of Model 2 where $f_i = f$ for all years. That is all tagged fish have constant annual survival and constant annual recovery over all years in the study.

Brownie et al. (1985) therefore present a set of four nested models going from the most general, Model 0 to the most restrictive, Model 3. They also note that it is possible to have more recovery than tagging years but not all survival and recovery rates are estimable in that situation. Brownie et al. (1985) provide a computer program ESTIMATE which provides tests for deciding which is the best model and also provides estimates of survival and recovery rate parameters under the appropriate model. Most fisheries tagging studies are likely to require Model 0 or Model 1. Model 2 and Model 3 tend to be too restrictive. Pollock and O'Connell (1989) found Pacific Halibut to require Model 0.

Brownie et al. (1985) also consider more general models for situations where age classes are allowed to have differential survival and recovery rates. However, these models require that the animals be of known age.

Model Assumptions

There are numerous assumptions behind the multi-year tagging models discussed in this article (Brownie et al. 1985, p. 6, Pollock and Raveling 1982, Nichols et al. 1982). First we list these assumptions and then discuss them generally with reference to fish tagging data.

(1) The tagged sample is representative of the target population.

(2) There is no tag loss.

(3) Survival rates are not influenced by the tagging process itself.

(4) The year that the tag is recovered is correctly tabulated (sometimes tags may be kept and turned back in a later fishing season).

(5) The fate of each tagged fish is independent of the fate of all other tagged fish.

(6) All tagged fish within an identifiable class (size, age, sex, etc.) have the same annual survival and recovery probabilities.

1. The Sample is Representative of the Target Population

This assumption is obvious but very important especially if heterogeneity of survival and recovery rates (Assumption 6) occurs. If tagging, for example, tended to take place in areas with very heavy fishing pressure then this could give the appearance of high recovery rates and low survival rates for the whole region under study. This suggests designing tagging studies so that the tagging is dispersed over a wide area of each region under study. Alternatively one is implicitly assuming that the tagged fish mix thoroughly throughout the whole area which is usually unrealistic.

2. There is No Tag Loss

Nelson et al. (1980) examined this assumption using simulation and found that there is a negative bias on survival estimates that is worse for species with high survival rates. The recovery rates estimates will also be negatively biased. There is often the need for double tagging study to obtain estimates of tag loss so that survival and recovery rates estimates can be adjusted (Seber 1982, p. 94).

3. Survival Rates are Not Influenced by Tagging

This assumption is obviously important because if there is substantial mortality due to the tagging process, the survival estimates would not apply to the untagged fish. Sometimes it is practical to consider holding experiments to evaluate short term tagging mortality.

4. The Year (Fishing Season) of Tag Recovery is Correctly Tabulated

Sometimes an angler may report tags in a later year than when the fish was actually caught. We do not know how likely this is for many fisheries but to the extent such incidents occur, they operate to produce a positive bias on survival estimates.

5. The Fate of Each Tagged Fish is Independent on the Fate of Other Tagged Fish

This assumption is probably violated in almost all practical applications of tag return models. Fish are not independent entities in terms of survival or other characteristics. This will not bias any estimators, but will mean that true sampling variances are larger than those given by the statistical models. Thus, any calculated confidence intervals will be narrower than they should be.

A simple (albeit unrealistic) example for illustration is to consider a population composed of independent pairs of fish that behave as though they are a single individual. A sample of n individuals from this population is effectively only one half of n and, hence, any sampling variances will be twice those for the models that assume the sample is n independent individuals. The actual situation in real populations is much more complex, with many partially dependent members, but the effective sample size will still be much less than the actual sample size.

6. All Tagged Fish within an Identifiable Class have the Same Annual Survival and Recovery Probabilities

We believe heterogeneity of survival and recovery rates is likely to occur in practice but we do not know how serious it will be in fish tagging studies. Pollock and Raveling (1982) and Nichols et al. (1982) examined this assumption using analytical methods and simulation. They found that if only recovery rates are heterogeneous then there is no bias in survival estimates and the recovery rate estimates can be viewed as averages for the population (assuming that the tagging sample is random). If survival probabilities are heterogeneous over the population, there is likely to be a strong positive relationship between the survival probabilities of an individual from year to year. There is also likely to be a negative relationship between survival and recovery probabilities for an individual. In this situation, survival rate estimators will generally have a negative bias. The negative bias will be more serious when the average survival rate is high and the study is of short duration. It is theoretically possible for the survival rate estimators to have a positive bias. This could occur if there were segments of the population with markedly different survival rates but similar recovery rates. This implies that the difference in survival of the segments would have to be mostly due to differences in natural mortality. This might occur if drastically different environmental conditions were encountered by the segments (eg. disease level, food supply, water temperature, etc.). Some of these factors may vary on a local or regional scale.

SEPARATION OF FISHING AND NATURAL MORTALITY ESTIMATES

Background

In the previous section we emphasized that it is possible to estimate survival rate ($\hat{S}$) and recovery rate ($\hat{f}$) from a multi-year study. If one were to also estimate the reporting rate of tags ($\hat{\lambda}$) it would be possible to estimate the fishing mortality or exploitation rate ($\hat{u}$) using the relationship

$$\hat{u} = \hat{f}/\hat{\lambda}. \tag{1}$$

It is then also possible to estimate natural mortality by subtraction from the total mortality $(1 - \hat{S})$ so that

$$\hat{v} = 1 - \hat{S} - \hat{u}. \tag{2}$$

Given that $\text{var}(\hat{S})$, $\text{var}(\hat{f})$ and $\text{cov}(\hat{S},\hat{f})$ are available from program ESTIMATE and $\text{var}(\hat{\lambda})$ is available from an independent reporting rate study, we have by the Taylor's series method (Seber 1982 p. 7) that

$$\hat{\text{var}}(\hat{u}) \simeq \left(\frac{\hat{f}}{\hat{\lambda}}\right)^2 \left[\frac{\hat{\text{var}}(\hat{f})}{\hat{f}^2} + \frac{\hat{\text{var}}(\hat{\lambda})}{\hat{\lambda}^2}\right] \tag{3}$$

$$\hat{\text{var}}(\hat{v}) \simeq \hat{\text{var}}(\hat{S}) + \hat{\text{var}}(\hat{u}) + \frac{2}{\hat{\lambda}}\,\hat{\text{cov}}(\hat{S},\hat{f}) \tag{4}$$

$$\hat{\text{cov}}(\hat{u},\hat{v}) = -\left[\frac{1}{\hat{\lambda}}\,\hat{\text{cov}}(\hat{S},\hat{f}) + \hat{\text{var}}(\hat{u})\right] \tag{5}$$

Note that we assume that $\hat{\lambda}$ is independent of $\hat{f}$ and $\hat{S}$ because it is based on a separate study.

We also note that sometimes the fisheries biologist will only be able to do a single year tagging study. In that case $\hat{f}$ will just be the observed proportion of tags recovered and it will still be possible to estimate the exploitation rate $(\hat{u})$ from equation 1 and the $\hat{\text{var}}(\hat{u})$ from equation (3). In this case the $\hat{\text{var}}(\hat{f})$ used in equation (3) will be simply the binomial variance, $\hat{\text{var}}(\hat{f}) = \hat{f}(1-\hat{f})/N$, where N is the number of fish tagged in that one year. With one years data, however, it is not possible to estimate the total survival rate $(\hat{S})$ or the natural mortality rate $(\hat{v})$.

Reward Tags

One approach to estimating the tag reporting rate (λ) discussed in the previous section is to use two different types of tags in a special study. One tag (control) is the standard type tag while another tag has a special high reward for its return. The data consist of recoveries of tags of both the control and reward types. The basic estimates of reporting rate (λ) was developed by Henny and Burnham (1976) and applied to mallard ducks. It was also discussed by Conroy and Blandin (1984) and applied to black ducks. The estimates are given by

$$\hat{\lambda} = \frac{R_h/N}{R^1/N^1 - R_s/N} \tag{6}$$

with

$$v\hat{a}r(\hat{\lambda}) = (\hat{\lambda})^2\left[\frac{1}{R_h} + \left(\frac{\hat{\lambda}}{R_h}\right)^2\left\{\left(\frac{N}{N^1}\right)^2 R^1 + R_s\right\}\right] \tag{7}$$

where

λ = the reporting rate of control bands,

R_h = the number of first year direct recoveries of control tags from anglers,

R_s = the number of first year direct recoveries of control tags solicited by the fisheries scientist,

R^1 = the number of first year direct recoveries of reward tags,

N = the number of control tags applied, and

N^1 = the number of reward tags applied.

The above situation corresponds to the simplest reward tag experiment which consists of one tagged sample (N, N^1) and one recovered sample (R_h, R_s, R^1). The estimate depends critically on the assumption that all of the special reward tags are reported. If this assumption is violated then it causes a potentially serious positive bias on the reporting rate estimator. The estimator allows for some tags to be solicited from anglers by the fisheries scientist conducting the study. It is also assumed that these tags are all reported. Recently wildlife scientists have been attempting to establish the level of reward necessary to have a perfect reporting of reward tags. If reward tags of three or more values are used, one can model recovery rate as a function of the reward level. As the reward increases the recovery rate approaches an asymptote corresponding to 100% reporting (Nichols et al. 1990). We strongly urge that fisheries scientists abandon the practice of using lotteries. This increases the reporting rate but does not allow its estimation.

Use of Creel Surveys or Port Samples

Another approach to estimating the tag reporting rate (λ) discussed earlier is to use a creel survey or port sample. When the survey agent is interviewing anglers or commercial fishermen we can assume that there is a probability of 1.0 of a tag being reported while when the survey agent is not interviewing the angler or commercial fisherman reports the tag with probability λ.

The estimate is given by

$$\hat{\lambda} = \frac{R_h}{\hat{R} - R_s} \tag{8}$$

$$\text{with } \hat{\text{var}}(\hat{\lambda}) \simeq \frac{\hat{\lambda}(1 - \hat{\lambda})}{\hat{R} - R_s} + \frac{\hat{\lambda}(1 - \hat{\lambda})\, \hat{\text{var}}(\hat{R})}{(\hat{R} - R_s)^3} \tag{9}$$

where

R_h = the number of tags recovered by anglers or commercial fishermen which are reported to the fisheries scientist,

R = the total number of tags recovered by anglers or commercial fishermen,

R_s = the number of tags recovered by anglers or commercial fishermen which were solicited by the survey agent,

and therefore

$R - R_s$ = the number of tags recovered by anglers or commercial fishermen which are available to be reported with probability λ.

Notice that R, the total number of tags recovered by anglers or commercial fishermen, has to be estimated from the creel survey or port sample which runs concurrent with the tagging study (or at least part of it). The method of estimation of R and its variance depends on the exact nature of the survey sampling scheme used. Basically the fisheries scientist expands the number of tags found by the agent to the number that would have been found if the agent were present all the time (i.e. to the case where the agent or agents carry out a complete census of the fishery). The variance of $\hat{\lambda}$ given in (9) is found using a Taylor's series method (Seber 1982, p. 7). It should be a reassurable approximation unless R, the total number of tags recovered, is small.

It is important to realize that this method depends on several important assumptions:

(i) The agent and the angler or commercial fisherman do not miss any tags on fish that are examined.

(ii) The angler or commercial fisherman does not purposefully mislead or evade the agent so that the solicited tags are all reported.

(iii) The survey design is based on probability sampling so that the estimate of R does not suffer from model bias.

Example

Here we present a small hypothetical example based on part of a tagging study of lake trout reported by Youngs and Robson (1975). In Table 1 we present the tag-return data for the first three years of tagging and the first five recovery years. In Table 2 we present the survival and recovery rate estimates ($\hat{S}_i$ and $\hat{f}_i$ respectively) and their standard errors.

Suppose that during the first year a creel survey on the lake had been in operation with the following results:

$$R_h = 72,\ R_S = 14,\ \hat{R} = 381 \text{ and } \hat{\text{var}}(\hat{R}) = 912$$

The estimate of reporting rate $(\hat{\lambda})$ and its variance based on equations (8) and (9) would be:

$$\hat{\lambda} = \frac{R_h}{\hat{R} - R_S} = \frac{72}{381 - 15} = 0.197$$

$$\hat{\text{var}}(\hat{\lambda}) = \frac{\hat{\lambda}(1 - \hat{\lambda})}{(\hat{R} - R_S)} + \frac{\hat{\lambda}(1 - \hat{\lambda})\ \hat{\text{var}}(\hat{R})}{(\hat{R} - R_S)^3}$$

$$= \frac{0.197 \times 0.803}{381 - 15} + \frac{0.197 \times 0.803 \times 912}{(381 - 15)^3}$$

$$= 0.000432 + 0.000003$$

$$= 0.000435$$

Therefore we have

$$\hat{SE}(\hat{\lambda}) = \sqrt{\hat{\text{var}}(\hat{\lambda})} = 0.021$$

Notice that in this example the second term of the variance expression is negligible.

If we assume this estimate of reporting rate applies to all years we can obtain estimates of $\hat{u}_i$ and $\hat{v}_i$ using equations (1) and (2). These estimates are presented in Table 2. For example:

$$\hat{u}_1 = \hat{f}_1/\hat{\lambda}_1 = \frac{0.069}{0.197} = 0.350$$

$$\hat{v}_1 = 1 - \hat{S}_1 - \hat{u}_1 = 1 - 0.397 - 0.350 = 0.253$$

We can also obtain standard errors of the estimates based on equations (3) and (4) and these are also presented in Table 2.

DISCUSSION

In this article we have shown that the combination of a multi year tagging study with either reward tagging or a creel or port sample survey enables the fishery biologist to obtain estimates of both exploitation and natural mortality rates. This is very important for fisheries management. It is very difficult to obtain reasonable natural mortality estimates from other methods (Vetter 1988). (We note also that Youngs (1974) showed that it is possible to estimate reporting rate with the additional strong assumptions of constant natural mortality rates and reporting rates without any additional information).

In the wildlife area banding data has been used to study the question of whether natural and hunting mortality is additive or whether there is some degree of compensation. The first important paper was Anderson and Burnham (1976) on mallards for which the best banding data exists. Since then a lot of papers on mallards have been published (Anderson et al. 1982, Nichols and Hines, 1983, Burnham and Anderson, 1984, Burnham et al. 1984, Nichols et al. 1984). The evidence suggests some degree of compensation at least for some age-sex classes. Pollock et al. (1989) studied bobwhite quail and found evidence for additivity in a population with a late hunt. It would be interesting to attempt to apply similar analyses to fisheries tagging data. Many fisheries population dynamics models assume that natural mortality and fishing mortality are additive.

In this paper we have shown that reward tagging studies can be one approach to the separation of fishing and natural mortality. This approach depends critically on the assumption that reward tags are returned with probability one. This assumption needs to be investigated for important fisheries by studying the effect of reward size on recovery rate as has been done in wildlife studies (Nichols et al. 1990). We wish to emphasize that the common use of a lottery on the recovery tags is faulty. The money would be better spent on putting out high reward tags so that reporting rate can be estimated.

There is a need for future work on the utility of reward tagging compared to creel or port surveys to estimate reporting rate. Creel or port sampling surveys may be more expensive but they do provide a lot of additional information on the recreational or commercial fishery. In this time of scarce resources much thought should go into designing multi-method studies which give a better return on the dollars spent.

In this paper we have considered fisheries which are either recreational or commercial and suggested using a creel survey or a port sampling survey respectively. In practice there are many fisheries (such as the Chesapeake Bay Blue Crab fishery) where there are both recreational and commercial exploitation. In these fisheries there is a need for separate estimates of reporting rate for each group so that exploitation can be broken down into recreational and commercial components.

REFERENCES

Anderson, D.R. and K.P. Burnham. 1976. Population ecology of the mallard: VI. The effect of exploitation on survival. U.S. Fish and Wildlife Service, Resource Publication No. 128, Washington, D.C.

Anderson, D.R., K.P. Burnham, and G.C. White. 1982. The effect of exploitation on annual survival of mallard ducks: An ultrastructural model. Proceed. XI International Biometric Conference, Touluse, France.

Brownie, C., D.R. Anderson, K.P. Burnham, and D.S. Robson. 1985. Statistical inference from band recovery data: A handbook, U.S. Fish and Wildlife Service, Resource Publication No. 156, Washington, D.C.

Burnham, K.P. and D.R. Anderson. 1984. Tests of compensatory vs. additive hypotheses of mortality in mallards. *Ecology* 65, 105-112.

Burnham, K.P., G.C. White, and D.R. Anderson. 1984. Estimating the effect of hunting on annual survival rates of adult mallards. *J. Wildl. Manage.* 48, 350-361.

Conroy, M.J. and W.W. Blandin. 1984. Geographical and temporal differences in band reporting rates for American black ducks. *J. Wildl. Manage.* 48(1), 23-36.

Henny, C.J. and K.P. Burnham. 1976. A reward band study of mallards to estimate band reporting rates. *J. Wildl. Manage.* 40(1), 1-14.

Nelson, L.J., D.R. Anderson, and K.P. Burnham. 1980. The effect of band loss on estimates of annual survival. *J. Field Ornitho.* 51(1), 30-38.

Nichols, J.D., S.L. Stokes, J.E. Hines, and M.J. Controy. 1982. Additional comments on the assumptions of homogeneous survival rates in modern bird banding estimation models. *J. Wildl. Manage.* 46(4), 953-962.

Nichols, J.D. and J.E. Hines. 1983. The relationship between harvest rates and survival rates of mallards: A straightforward approach with randomly partitioned data sets. *J. Wildl. Manage.* 47(2), 334-348.

Nichols, J.D., M.J. Controy, D.R. Anderson, and K.P. Burnham. 1984. Compensatory mortality in waterfowl populations: A review of the evidence and implications for research and management. *Trans. N. Am. Wildl. & Natur. Resour. Conf.* 49, 535-554.

Nichols, J.D., R.J. Blohm, R.E. Reynolds, R.E. Trost, J.E. Hines, and J.P. Bladen. 1990. Band reporting rates for mallards with reward bands of different dollar values. *J. Wildl. Manage.* (In Review)

Pollock, K.H. and D.G. Raveling. 1982. Assumptions of modern band-recovery models with emphasis on heterogeneous survival rates. *J. Wildl. Manage.* 46(1), 88-98.

Pollock, K.H., C.T. Moore, W.R. Davidson, F.E. Kellog, and G.L. Doster. 1989. Survival rates of bobwhite quail based on band recovery analysis. *J. Wildl. Manage.* 53(1), 1-6.

Pollock, K.H., and M.A. O'Connell. 1989. Estimation of survival, exploitation and natural mortality rates for Pacific halibut from multi-year tagging studies, Institute of Statistics, North Carolina State University, Technical Report No. 1954.

Ricker, W.E. 1975. Computation and interpretation of biological statistics of fish populations. *Bull. Fish. Res. Bd. Canada No.* 191, 382 pp.

Seber, G.A.F. 1982. The estimation of animal abundance and related parameters. Second Edition. Macmillan Publishing Company Inc., New York, New York, 654 pp.

Vetter, E.F. 1988. Estimation of natural mortality in fish stocks: a review. *Fishery Bulletin* 86(1), 25-43.

Youngs, W.D. 1974. Estimation of the fraction of anglers returning tags. *Trans. Ann. Fish. Soc.* 103, 616-618.

Youngs, W.D. and D.S. Robson. 1975. Estimating survival rates from tag returns: model tests and sample size denominations, *J. Fish. Res. Bd. Canada* 32, 2365-2371.

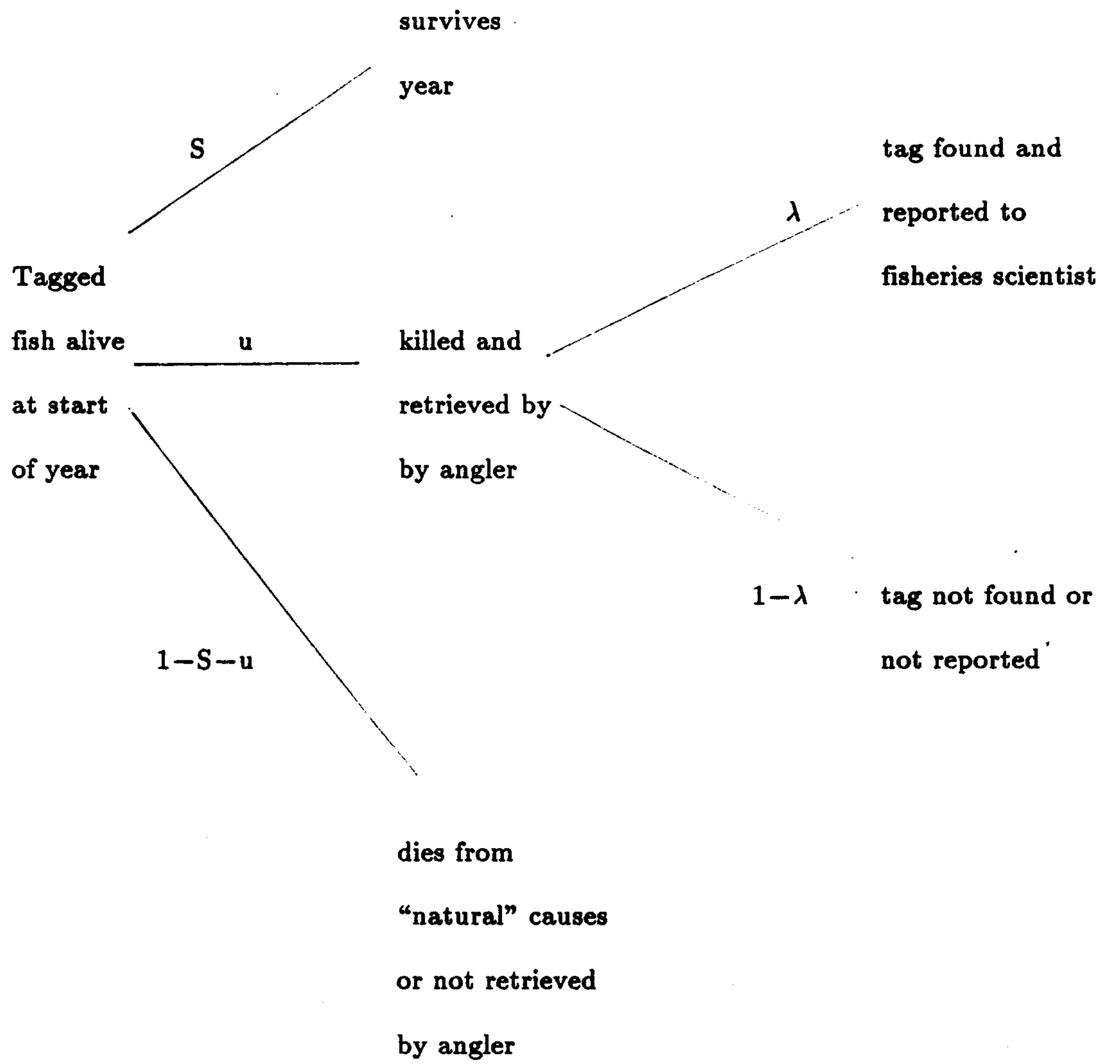

Figure 1: Possible fates of a fish tagged at the start of the year based on the diagrams in Brownie et al. (1985, p. 14). The notation is also defined more fully in the text.

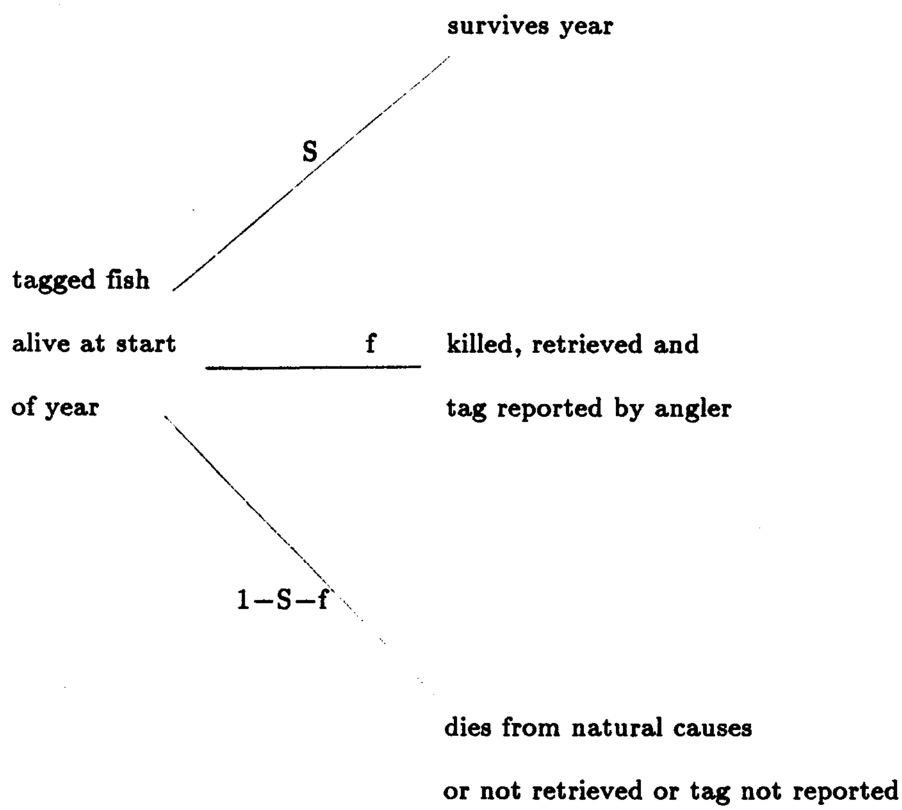

Figure 2: Modified diagram of possible fates of a fish tagged at the start of the year based on the diagrams in Brownie et al. (1985, p. 14). The notation is also defined more fully in the text.

Table 1: Array of anglers reported tag recoveries of tagged lake trout. This sample is based on part of a large data set reported by Robson and Youngs (1975).

Year	No.	Recovery Year				
Tagged	Tagged	1	2	3	4	5
1	1048	72	44	8	9	4
2	844		74	30	20	7
3	989			54	48	13

Table 2. Parameter estimates and standard errors based on tagging data and a creel survey. The tagging data is based on Robson and Youngs (1975). The creel survey is hypothetical

Year	Survival Rate($\hat{S}_i$)	Recovery Rate ($\hat{f}_i$)	Fishing Mortality Rate ($\hat{u}_i$)	Natural Mortality Rate ($\hat{v}_i$)
1	0.397 (0.057)	0.069 (0.008)	0.350 (0.055)	0.253 (0.078)
2	0.527 (0.078)	0.093 (0.001)	0.472 (0.068)	0.001 (0.107)
3	-	0.055 (0.006)	0.279 (0.042)	-