METHOD FOR PROJECTING TOTAL FISHERMAN DAYS USE
OVER THE LIFE OF WATER DEVELOPMENT PROJECTS

Thomas H. Leik
Wildlife Statistician
Montana Fish and Game Department

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Definition of Problem

Evaluation of land and water development projects is partially dependent on the value of sport fishing created or destroyed in the project area. It is recognized that from the aspect of recreational fishing, each body of water will sustain a certain maximum level of fishing pressure. This level has not been reached in most of the waters throughout the western United States. Therefore, it is necessary to project the total possible use on any body of water and when this might occur.

It is possible through creel census and related surveys to estimate the current fisherman use. The maximum use in the future must be based on the biological characteristics of the water area and its potential maximum use by fishermen. Using these limits of present and maximum days per year, it is possible to estimate the total fisherman days on a project area if the life of the project is stated.

The population growth estimates used here are geometric progressions. It is recognized that this represents a generalization of the over-all model. However, the Gompertz, Pearl-Reed or similar growth models which require an additional effort in calculation would not necessarily be any more effective since the minimum and maximum fisherman days represent an "educated guess" in many instances. With these two variables not precisely fixed it seems unnecessary to go to a model that is more sophisticated. As Simpson, Roe and Lewontin (1960) suggest (in reference to growth) a more complex function does not necessarily convey

more information.

With this thought, to keep the estimates reasonable but workable, the geometric model was chosen. Tables of compound interest are easily obtained. Their use is frequently more readily understood than the more infrequently used logarithmic calculations.

This approach then is predicated on the assumptions that the model is a reasonable fit to the geometric progression, that it is widely understood, and that tables for computation are readily accessible. As our ability to predict biological parameters improves, a more sophisticated model may be justified.

Assumptions

1. The number of fishermen days in Montana will increase at the same rate as the national growth rate.

2. That a 2.75% increase in fishermen days, compounded annually, is a working approximation of the national growth.

Type of Problems

Two situations can exist:

TYPE I ESTIMATE: The potential fishing pressure will increase from its present level to a maximum level that is previously dictated before the project is completed and then remain at the maximum level for the duration of the life of the project.

TYPE I CURVE

Life of Project (Years)
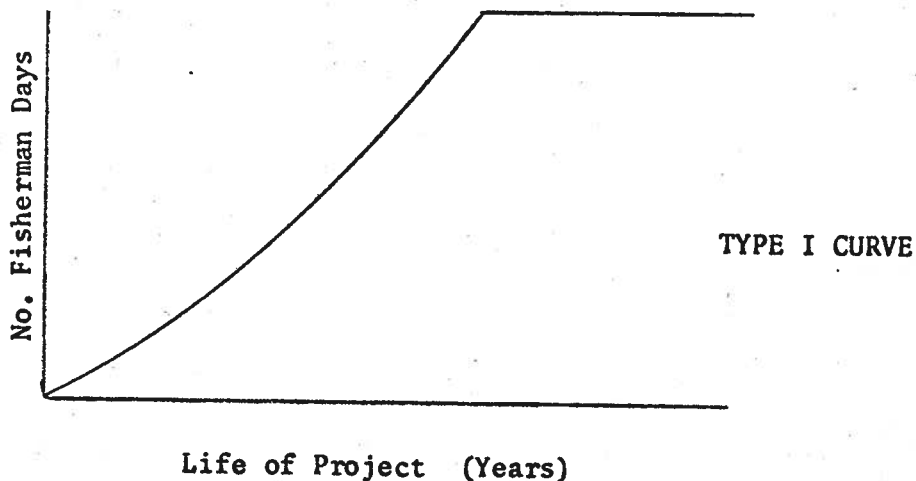
TYPE II ESTIMATE: The potential maximum fishing pressure will be reached at the termination of, or following the termination of, the project under consideration.

Life of Project   (Years)
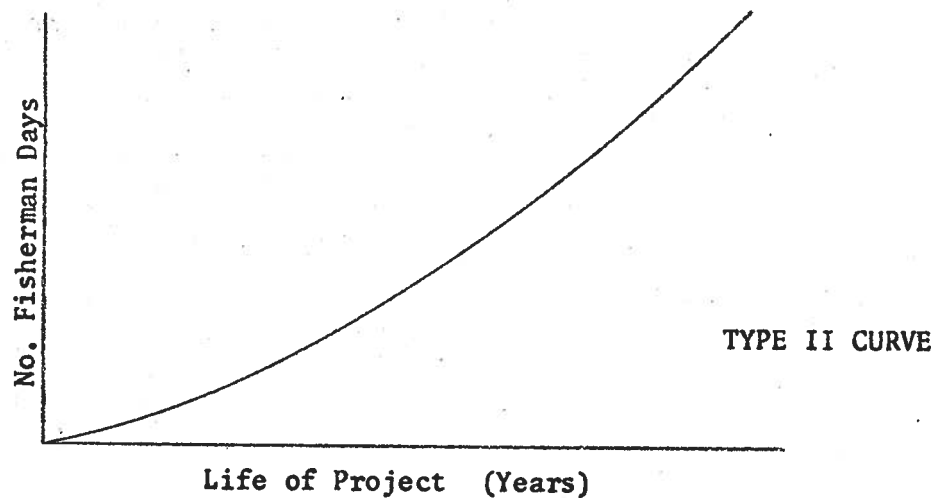
Estimation óf Values

TYPE I PROBLEM:

1. For body of water under consideration determine: (1) present fisherman use per year in man days and (2) the potential fisherman use (maximum number of man days).

2. Divide the potential fisherman use by present fisherman use to determine the ratio of increase (i.e. 2400 + 600 = 4.0 or a ratio of 4.0).

3. Refer to a standard compound interest table at the level 0.0275 (2.75%) interest compounded annually (table attached). By inspection find the value most nearly equal to the ratio (Item 2 above). The year associated with this value is the year in which the potential fishing pressure will be reached (i.e. 51 years).

4. Determine the total number of fishermen from first year of project to year when maximum potential fisherman use will be reached by the computational formula:

$$(1.0275L-A) \times 36.3636*$$

Where:

A = Estimated number of fisherman days for 1st year of project.

L = Potential maximum fishing pressure expressed as man days.

S = Summation or total number of days occurring until potential is reached.

5. Determine the number of years left in the project at maximum pressure and the number of fisherman days this means to the project. This is merely a subtraction of the number of years that it took to grow to the maximum from the total life of the project (i.e. 100-51=49). The number of years of maximum use is then multiplied times the maximum annual fishermen days.

6. Combine the fisherman days during the period of fisherman-use growth and during the period of maximum fishing effort. This will be the total fisherman days allowable on this project.

Example

TYPE I PROBLEM:

An impoundment is to be constructed on the Big Sky River. The fishing pressure there is presently light. Statewide surveys indicate that 600 man days fishing per mile per year are spent on this productive trout river. It

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*This is a computational formula derived from the standard formula for summation of geometric progressions:

$$S = \frac{L \ R - A}{R - 1}$$

Where: A is the first term of the series
         L is the last term of the series
         R is the rate of increase

is judged that it is capable of a maximum potential of 2,400 man days per mile per year. The impoundment that is to be adjacent and for which the Big Sky River is to be evaluated is being justified on the basis of 100 years. Estimate the total number of fisherman days that are expected during the next 100 years on Big Sky River if the impoundment is not built.

Using the formula for determining fishermen days during the period of growth:

$$(1.0275L - A) \times 36.3636$$

Where:

A = 600 fisherman days per mile for first year of project.

L = 2,400 potential fisherman days per mile.

Then:

$$S = ((1.0275)(2,400) - 600) \quad (36.3636) = 67,854$$

Total fisherman days.

The next step is to look in the table for a value nearest to the common ratio. The common ratio is 2400 ÷ 600 = 4.00. The value nearest to 4.00 is 3.98908562. The year corresponding to this value in the table is 51 years. Therefore, we know it took 51 years for our initial 600 fishermen days use to grow to 2400 fishermen days use per year. If the life of the project is based on 100 years then there are 49 years left at a maximum use (i.e. 100 - 51 = 49). If the maximum use is 2,400 fisherman days per year then the remainder of the project (49 years) will sustain 117,600 fisherman days (i.e. 2400 X 49). Adding this fisherman use with the earlier use during the periods of growth we have a total of 185,454 (i.e. 67,854 + 117,600) fisherman days in the 100 years of the project.

TYPE II PROBLEM:

Assume the same Big Sky River with its present fishing pressure of 600

fisherman days per year and a maximum fishing pressure of 2,400 man days per year and the project is to have a "life" that is to be justified in 40 years. Turning to a table of compound interst (2 3/4% attached) it is seen that for 40 years the table value is 2.95987399. We determine the number of fishermen days in the fortieth year (or L) by:

$$L = A \ (2.960)$$

Where:

$$A = 600 \ \text{Fisherman Days}$$

$$2.960 = \text{Rounded Value for } 2.95987399$$

Then:

$$L = 600 \ (2.960)$$

$$L = 1776$$

Then using the standard computational formula referred to previously $[(1.0275 \ L -A) \ X \ 36.3636]$ the total number of fisherman days spent during the 40 years of the project may be determined.

It is as follows:

$$\text{Total} = (1.0275 \ L - A \ (36.3636)$$

$$= (1.0275(1776) - 600) \ (36.3636)$$

$$= 44,540 \ \text{Total Fisherman Days in 40 years}$$

In the case above, the maximum fisherman days is never reached before the life of the project is terminated so no further calculations are necessary.

LITERATURE REFERENCES

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AMOUNT COMPOUNDED ANNUALLY $(1 + i)^n$

Years n	.0275 (2-3/4%)	Years n	.0275 (2-3/4%)
		50	3.88232177
1	1.02750000	51	3.98908562
2	1.05575625	52	4.09878547
3	1.08478955	53	4.21150208
4	1.11462126	54	4.32731838
5	1.14527334	55	4.44631964
6	1.17676836	56	4.56859343
7	1.20912949	57	4.69422975
8	1.24238055	58	4.82332107
9	1.27654602	59	4.95596239
10	1.31165103	60	5.09225136
11	1.34772144	61	5.23228827
12	1.38478378	62	5.37617620
13	1.42286533	63	5.52402105
14	1.46199413	64	5.67593162
15	1.50219896	65	5.83201974
16	1.54350944	66	5.99240029
17	1.58595595	67	6.15719130
18	1.62956973	68	6.32651406
19	1.67438290	69	6.50049319
20	1.72042843	70	6.67925676
21	1.76774021	71	6.86293632
22	1.81635307	72	7.05166706
23	1.86630278	73	7.24558791
24	1.91762610	74	7.44484158
25	1.97036082	75	7.64957472
26	2.02454575	76	7.85993802
27	2.08022075	77	8.07608632
28	2.13742682	78	8.29817869
29	2.19620606	79	8.52637861
30	2.25660173	80	8.76085402
31	2.31865828	81	9.00177751
32	2.38242138	82	9.24932639
33	2.44793797	83	9.50368286
34	2.51525626	84	9.76503414
35	2.58442581	85	10.0335726
36	2.65549752	86	10.3094958
37	2.72852370	87	10.5930070
38	2.80355810	88	10.8843147
39	2.88065595	89	11.1836333
40	2.95987399	90	11.4911832
41	3.04127052	91	11.8071908
42	3.12490546	92	12.1318885
43	3.21084036	93	12.4655154
44	3.29913847	94	12.8083171
45	3.38986478	95	13.1605458
46	3.48308606	96	13.5224608
47	3.57887093	97	13.8943285
48	3.67728988	98	14.2764226
49	3.77841535	99	14.6690242
50	3.88232177	100	15.0724223