FOCI FY 1996 Shelikof Strait Recruitment Prediction

'96 Year Class Predicted to Recruit in Average Numbers

On July 31, 1996, FOCI made preliminary forecasts of recruitment for walleye pollock in Shelikof Strait, Alaska for the 1996 year class and for the 1995 year class (revised forecast). In the near future, with the availability of further information, we may publish changes to these forecasts.

1996 FORECAST

This forecast is based on four elements. Three are physical properties: 1. observed Kodiak rainfall, 2. wind mixing energy at [57N, 156W] computed from sea-level pressure gradient analyses, and 3. advection of ocean water in the vicinity of Shelikof Strait as inferred from drogued drifters deployed during the spring of 1996. The fourth element is an index determined from a biological survey: 4. rough counts of pollock larvae from a survey conducted during late May 1996.

1. KODIAK RAINFALL - According to FOCI's conceptual model of survival, above average precipitation in late winter (Jan, Feb, Mar) indicates greater frequency of storms (and increased circulation because of their winds) and greater stored water for spring and summer runoff. These factors promote good recruitment. Above average spring and early summer rainfall (Apr, May, Jun) favors increased baroclinity after spawning. Because baroclinity is associated with eddy formation, above average spring/early summer rainfall is also considered good for recruitment.

1996 Kodiak rainfall statistics

During 1996 all months except April there was below average precipitation:

Jan	41% of average (1962-1991)
Feb	36%
Mar	36%
Apr	231%
May	31%
Jun	43%

These figures indicate that this year's precipitation has not been conducive to larval survival. Using an empirical model that relates monthly deviation of Kodiak's precipitation from the 30-year mean to FOCI's conceptual model of survival, we compute that the 1996 Shelikof Strait year class of walleye pollock will experience, based on Kodiak precipation, weak to average recruitment (numerical score of 1.72 in the continuum of 1 (weak) to 3 (strong).

2. WIND MIXING - FOCI's conceptual model suggests that strong wind mixing prior to spawning is beneficial because it "conditions" the water for larval feeding. After hatching, weak

wind mixing is advantageous as demonstrated by Bailey and Macklin (Marine Ecology Progress Series, 1994).

1996 wind mixing statistics

During 1996 wind mixing was generally counter to that expected to promote survival of young fish. The exception was in February when mixing energy was about twice the 30-year average.

Jan	69% of average (1962-1991)
Feb	193%
Mar	29%
Apr	147%
May	107%
Jun	108%

Using a similar mathematical expression of the conceptual model for mixing deviation from the 30-year mean, the 1996 year class of Shelikof Strait walleye pollock will experience, based on wind mixing criteria only, weak to average recruitment (numerical score of 1.67 in the recruitment continuum of 1 (weak) to 3 (strong).

3. ADVECTION - We examined trajectories of drifters drogued at typical larval depths that were released during spring 1996 in the Shelikof Strait region. Circulation was sluggish with long-lasting eddies. Because transport was so low, this physical process would retain pollock larvae on the shelf, and that, we feel, is beneficial to larval survival. However, it is not clear that such circulation would allow larvae to reach the Shumagin Islands, and that may be an important destination for survival. Also, based on wind mixing calculations, the pre-spawn circulation may not have been very vigorous. Based on advection only, the potential is for an average to strong year class.

4. LARVAL ABUNDANCE - It can be argued that strong recruitment cannot occur if year class larval abundance is low. On the contrary, post-late-larval-stage mortality on an initially abundant year class could lead to low recruitment. FOCI has conducted larval surveys since the mid-1980s and has developed an abundance index from these surveys.

1996 larval abundance statistics

From a FOCI survey of late larvae conducted during the last part of May 1996, rough counts of late-stage pollock larvae are relatively evenly distributed over the survey grid, and show abundance that is categorized as average to strong (~450 larvae per 10 square meters).

RECRUITMENT FORECAST FOR THE 1996 YEAR CLASS

Based on these four elements and their weights as assigned in the table below, the preliminary FOCI forecast of the 1996 year class is average ("a").

Element	Weight	Rank	Score	Total
Time series model	0.000	----	0.00	0.00
Time sequence	0.000	----	0.00	0.00
Hydro length	0.000	----	0.00	0.00
Rain	0.250	w-a	1.72	0.43
Mixing	0.250	w-a	1.67	0.42
Advection	0.250	a-s	2.50	0.63
Larval abundance	0.250	a-s	2.50	0.63
Puffin diet	0.000	----	0.00	0.00
Total	1.000			2.10
Forecast				a

This forecast is subject to change.

1995 REVISED FORECAST

With the addition of information from the hydroacoustic and associated trawl survey conducted during spring 1996, FOCI is able to include the "Hydro length" element into the 1995 recruitment forecast. Preliminary survey results put the 1995 year class in the LOW category as determined by McKelvey (unpublished, TR 10113-2, Juvenile walleye pollock distribution and abundance in Shelikof Strait). For its revised prediction FOCI scores this as weak.

Because we do not account for later (post birth year) environmental affects on recruitment, the 1995 and earlier forecasts based on rainfall, wind mixing, and advection are unchanged. Puffin diet information is not yet available to us.

Incorporating the hydro length forecast rank and adjusting the weights of the forecast elements gives a revised forecast of average ("a") recruitment for the 1995 year class of walleye pollock in Shelikof Strait.

REVISED RECRUITMENT FORECAST FOR THE 1995 YEAR CLASS

Element	Weight	Rank	Score	Total
Time series model	0.150	a	2.00	0.30
Time sequence	0.150	s	3.00	0.45
Hydro length	0.300	w	1.00	0.30
Rain	0.100	a-s	2.50	0.25
Mixing	0.100	a	2.00	0.20
Advection	0.100	a	2.00	0.20
Larval abundance	0.100	s	3.00	0.30
Puffin diet	0.000	----	0.00	0.00
Total	1.000			2.00
Forecast				a

This forecast is subject to change.