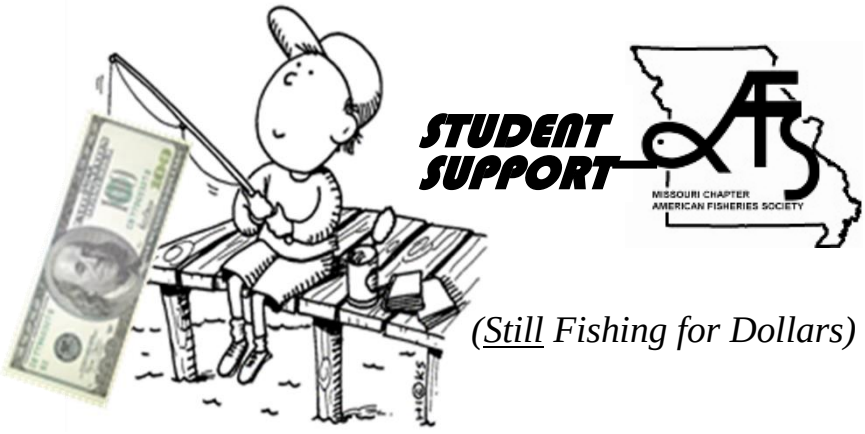
Missouri Chapter of the American Fisheries Society

Student Support Trust Fund Investment Management Plan

2020 Review and Investment Options



(Still Fishing for Dollars)

Submitted to: MOAFS Executive Committee and SSTF Advisory Panel
Submitted by: M. A. Zurbrick, member, SSTF Advisory Panel
Submitted on: 18 December 2020

INTRODUCTION

Initial Investment Plan and Performance

In 2010, after two decades of fund-raising, the Missouri Chapter of the American Fisheries Society (MOAFS) reached its goal of having $100,000 to provide financial support to aquatic resource and fisheries students. For the next five years, this Student Support Trust Fund (SSTF) money was invested solely in Certificates of Deposit (CDs) resulting in the chapter being able to annually award between $700 and $1,300 in student support. During this same timeframe, the chapter's Finance and Student Support Committees agreed that the SSTF investment strategy needed to produce a minimum of $1,000 per year, with a "preferred" target of $3,000.

At the February 2015 annual meeting of the MOAFS, the membership considered five new investment strategies for the SSTF. A majority of the MOAFS membership voted for a moderate risk and moderate return strategy termed the "Half-N-Half" plan, with a portfolio comprised of approx. 50% in CDs, 45% in two total market indexed equity mutual funds, and the remaining 5% in a Money Market (MM) account. The strategy was designed to provide approx. $3,200 per year to fund student support activities.

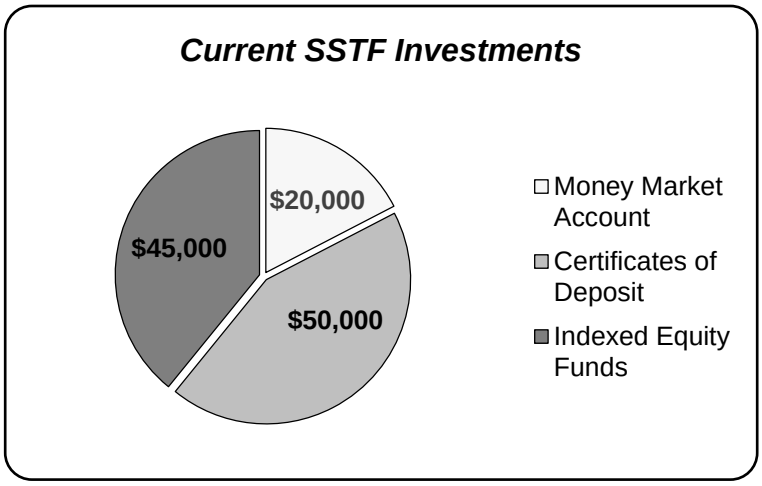
More details about these past processes and plans are found in the following reports: *Student Support Trust Fund Investment Analysis, Options, and Recommendations* (Dec 2014), *Student Support Trust Fund Potential Investment Strategies, Fishing For Dollars* (Jan 2015), *Issues, Recommendations, and Timeline for Implementation of the Recently Adopted Student Support Trust Fund Plan* (Feb 2015), *Student Support Trust Fund Investment Plan* (Mar 2015), *Mutual Fund Profit Taking Strategy Analysis for the Student Support Trust Fund Investment Plan* (Dec 2016), *and The Student Support Trust Fund Investment Management Plan* (May 2017).

In August 2018, Jennifer Girondo, chair of the MOAFS Student Support Committee, asked her committee members, along with others involved with the SSTF, whether the amount of financial support offered to fisheries and aquatic resource students in Missouri could be increased beyond the plan's target of $3,200 per year.

After a review of returns and additional analysis of the current "Half-N-Half" plan, it was determined that this strategy might provide up to approximately $4,500 per year in student support. This more optimistic prediction of income was based on the most recent five-year period that exhibited an average annual return of 10.7% on our equities investment, which was substantially higher than the 6.5% return used for calculation when the original plan for $3,200 of revenue was designed.

As part of this same 2018 review, it was suggested to increase the amount of cash in the money market buffer account ("rainy day" fund) from $10,000 to $18,000. It was calculated that this increase would allow at least four years of student support if there were an extended downturn in the stock market. This buffer fund modification was implemented in the fall of 2018 resulting in a modified plan currently comprised of approx. 15% in the MM buffer fund, 45% in CDs, and 40% in total equity market mutual funds (Figure 1). These modifications allowed for the full funding of the undergraduate scholarship, increases in the MNRC poster and paper awards, and support of the Hutton Fund.

Figure 1. SSTF investment distribution as of 1 Jan 2019.



In 2019, the modified plan performed as desired. The MOAFS Treasurer reported earnings from SSTF investments for that calendar year of approx. $5,460, with a portfolio balance of approx. $120,710.

Economic Downturns and Recoveries

After more than a decade of growth in stock values, the market began to decline on 19 February 2020 in response to the worldwide Coronavirus pandemic. At the close of trading on 23 March, the Standard and Poor's 500 (S&P500) had fallen by 33.9%. This represents the fastest market decline recorded since 1933 during the Great Depression.

First, there is no way to know when, or if, the price of stocks will fall again, where a decline would bottom out, or how long it would take to recover. Anyone who tells you otherwise is unintentionally delusional or intentionally lying. If someone truly had answers to these questions, they would be richer than Bill Gates and Warren Buffett, combined.

The S&P500 is a stock market index that has tracked the performance of the largest capitalized companies in the United States for more than nine decades. The S&P500 is one of the most commonly used benchmarks of overall stock market trends. A review of daily S&P500 data, for the past fifty years, finds that the stock market has experienced 5 recessions and 21 corrections since 1970. A "recession" is defined as a market downturn of more than 20.0%, while a market downturn of between 10.0% and 19.9% is termed a "correction". A summary of these market downturns is shown in Table 1.

Table 1. Stock market downturns and duration, 1970-2020.

Year	Percent Decline	Days Duration		
		Start of Decline to End of Decline	End of Decline to Full Recovery	Start of Decline to Full Recovery
1971	10.7	104	163	267
1971	11	77	28	105
1973	**48.2**	**631**	**2112**	**2743**
1974	13.6	30	53	83
1975	14.1	63	145	208
1976	19.4	532	191	723
1978	13.6	64	270	334
1979	10.2	34	73	107
1980	17.1	44	103	147
1980	**27.1**	**623**	**84**	**707**
1983	14.4	289	182	471
1987	**33.5**	**102**	**601**	**703**
1990	10.2	28	112	140
1990	19.9	87	124	211
1997	10.8	20	38	58
1998	19.3	46	110	156
1999	12.1	91	31	122
2000	**49.1**	**929**	**1806**	**2735**
2002	14.7	105	78	183
2007	**56.8**	**517**	**1485**	**2002**
2010	16.0	70	126	196
2011	19.4	158	145	303
2015	12.4	97	322	419
2015	13.3	101	118	219
2018	10.2	13	177	190
2018	19.8	95	120	215
2020	**33.8**	**37**	**142**	**179**

Note: Recessions **in gray and bold**

It is a depressed market and lack of equity revenues that the SSTF buffer fund was designed to handle. In mid-March, a brief report titled *Projection of Student Support Trust Fund Balance in Response to Recent Stock Market Downturn* was submitted to the MOAFS SSTF Financial Advisory Panel. The report concluded that the SSTF would be able to sustain annual expenditures of $4,900 for the next five years, while maintaining the total SSTF balance of greater than $100,000.

However, as of this writing, there has been no need to resort to the buffer fund as shown in the last row of data in Table 1. The 2020 recession recovered three to 14 times quicker than the other five recessions in the past half century! In fact, by mid-December, the SSTF profit-taking strategies allowed MOAFS Treasurer, Joe McMullen, to sell shares for nearly $6,800 of profit.

While it appears that the current recession may be over, it is important to remember that, unlike the past 50 years of corrections and recessions caused by financial and economic factors, the most recent downturn was the result of a biological event. The Coronavirus-influenced market may not behave like that of past financial downturns and recoveries. Most reputable medical authorities are predicting a resurgence of the Coronavirus this fall and winter that will likely remain a significant health threat well into next year.

Included in the 2017 *Student Support Trust Fund Investment Management Plan* (SSTFIMP) was a recommendation that the current plan be reevaluate at the end of 2020. However, it was decided not to wait until the end of the year to begin a reevaluation of the current SSTFIMP given the volatility of the economy. An initial draft report was submitted to the SSTF Financial Advisory Panel at the end of May. Comments and edits of the panel resulted in a final draft being submitted to the Executive Committee (ExCom) in early July. By mid-August, the S&P500 had regained all of its lost value and the temporal predictions of how long the recession might last, along with predicted effects on investment performance, were no longer pertinent. Because of this, along with additional questions and comments from the ExCom, it was decided to scrap large portions of the original report and rework this document as if the market had returned to pre-Coronavirus conditions.

METHODS

Sources

Data used in this report was collected from a number of reputable government and commercial financial institutions such as; the Federal Reserve, TD Ameritrade, Morningstar, any others too numerous to remember and list. Data used in the report is current as of 1 October 2020. Most statistical analysis was performed using the Microsoft's Excel Data Analysis package.

Data Timeframes and Calculations

The remainder of this report is focused on the 20-year period from 2000 through 2019. The actual interest rates for 4-yr CDs offered by Conservation Employees Credit Union (CECU) were available only for the most recent six years; the earlier 14 years of CECU rates were derived from a strong positive relationship between the Federal Funds Rate (FFR) and CECU's CD rates, which is described in more detail further along in the report. The actual annual dividend rate for total market indexed bond fund is only available for the past 18 years. The annual percent increase in shares of total foreign and domestic market indexed equity funds were obtained for the entire 20-year period.

When available, values such as CD and bond interest rates and percentage return on equities are calculated to the second decimal place (0.01); however, results are usually reported to the nearest single decimal point (0.1) or in some cases, to the nearest whole number to help simplify comparisons. While all income calculations are done to the nearest dollar, the results are generally reported to the nearest $100.

Portfolio Selection Criteria

Potential investment portfolios were analyzed using and Excel-based model where all five potential investment vehicles described in the *Results* section were modeled in $5000 increments and based on a total portfolio balance of $115,000. Six criteria were employed to determine if a prospective portfolio might meet MOAFS's student support needs without excessive risk to the SSTF. The reasoning behind these criteria and their specified limits is discussed in more detail in the *Results & Discussion* section.

A potential SSTF investment portfolio must meet all of the following criteria:

- ***Contain at least $10,000 in a MM buffer fund.***
  A buffer fund's sole purpose is to provide student support when market downturns adversely affect equities income. A buffer fund <$10,000 would fall considerably short of fully covering student support needs during a market downturn similar to the 2008 recession.

- ***Utilize no more than three investment vehicles***.
  We currently use a three-vehicle portfolio, with the thought that a four-vehicle portfolio would place unjustified additional work upon the MOAFS Treasurer with little economic gain.

- ***Have a MM and CD portions of a portfolio not exceeding 60% ($70,000) of the total portfolio.***
  This represents the current portfolio's percentage that is invested in vehicles that are generating scant income.

- ***Provide an average annual revenue at least 15% more than the current portfolio ($5,000).***
  This would justify the work involved in changing the current portfolio, plus the additional income could either immediately provide additional annual student support or build the SSTF principle above its current $115,000 that would eventually create more annual income and allow for more student support.

- ***Have the ability to fund no less than five years and no more than seven and a half years of student support during periods of stock market downturns.***
  This will allow us to annually fund $4,500 in student support 92% of the time that a >10% market downturn occurs as shown in Table 1. The upper limit would cover 100% of historic market downturns, while discouraging having too much money "parked" in investment vehicles that have little earning power.

- ***Have a weighted Sharpe Ratio of risk of >1.0***
  As discussed in more detail further on in the report, an investment with a Sharpe Ratio of <1.0 is considered to be excessively risky exhibiting substantial volatility and increased chance income losses.

Of the 184 investment portfolios initially examined, only 27 met all six criteria... 28 if we include the current SSTF investment portfolio that was unable to meet the proposed $5,000 revenue target.

RESULTS and DISCUSSION

Five potential investment vehicles will be addressed in this section, each being consider on how much risk and reward each offers. An investment vehicle's risk can involve a number of factors such as losing value due to inflation, early withdraw penalties, or an actual decline in dividends or share price. An investment vehicle's reward is primarily determined by how much money it can generate in interest payment, dividends, or the sale of shares at a profit.

Money Market Account

The previously mentioned CECU MM account, holding approx. $25,000, presently earns 0.60% annually. Note that MM balances of less than $25,000 earn only 0.40%. There is no expectation that these rates will change in the foreseeable future. If we are not required to utilize this account during stock market downturns and revenue shortfalls, a $20,000 MM balance will provide **$90 per year, representing only 2% of our current annual income target of $4,500.**

There is no risk in losing actual dollars with federally-insured MM accounts; however, there is risk in losing overall value given that MM is only earning a quarter of the current inflation rate. Thus, the MM investment should be considered a **low risk/low reward** investment. We are using the MM not for reward, but rather a safe place to park money for use on a "rainy day" when other investments are not earning income.

Additional Buffer Fund Considerations

As previously discussed and shown in Table 1, there have been 27 market downturns of >10% in the past 50 years. In other words, there is better than a fifty-fifty chance that we could experience a substantial market downturn resulting in a lack of equity fund income for an extended time.

The duration of these market downturns and recoveries ranged from as quickly as two months for an 11% decline in 1997, to as long as seven and a half years for the 1973 and 2000 downturns that experienced 48 and 49% declines, respectively. The average market correction declined by approximately 20% and took about 17 months to fully recover.

In the original 2015 SSTF investment plan, we stated our desire to be able to provide $3,200 of student support and initially placed $5,000 in a MM account to provide about two years of student support when our stock market investments failed to produce income (Table 2). It should be noted that during an equities market downturn there would still be a limited amount of guaranteed income coming from interest on the MM account, interest from a 4-yr CD that matures each year, or dividends from a bond fund. These other income sources were incorporated into the calculations used to estimate how many years that a buffer fund could cover shortfalls in a prolonged equities market downturn.

Table 2. Buffer fund and income coverage for current investment portfolio.

Year of Implementation	Targeted Annual Income, $	Buffer Fund Balance, $	Est. Years Of Equities Income Shortfall That Buffer Fund Could Cover
2015	3,200	5,000	**2.1**
2017	3,200	10,000	**3.4**
2018	4,500	18,000	**5.2**
2020	4,500	20,000	**5.6**

In 2017, we decided to double the balance in the buffer fund to $10,000, which was intended to cover about a three-and-a-half-year period without other equity income (Table 2). In a review of the investment plan in 2018, we decided that our investments could earn $4,500 for student support and the $18,000 in the buffer fund could cover an equities market correction lasting a little more than five years. Increases in the buffer fund balance in the last two years to nearly $25,000 would now allow us to weather a market downturn lasting nearly seven years. This current target income and buffer fund balance would allow us to have weathered 25 of the 27 (92%) market corrections in the past half century, including the "great recession" of 2008.

If we reduced our current portfolio's MM balance by half to $10,000 we would still be able to cover a market downturn lasting up to two and three-quarters years; however, this reduced buffer fund balance would not be able to cover a recession similar in duration to 2008, let alone the recessions of 1973 and 2000.

An option to increasing the balance of the MM buffer fund would be to consider using the cash principle from a matured CD if a market downturn drained the MM fund completely. The $12,500 from a 4-yr CD would be able to fund an additional two and a half years of student support after the MM account was completely emptied.

Certificates of Deposit

Under the current SSTFIMP, we have a laddered portfolio of four 4-year CDs issued by the CECU. Income for student support is gained when an individual CD reaches maturity and is cashed out, thus MOAFS receives a single payment of a set amount, once per year. The maturity dates, annual percentage yield (APY), and income when cashed out, for the four currently held $12,500 CDs are shown in Table 3.

Table 3. SSTF CD maturity dates, APY, maturity and early withdrawal yields, as of 1 December 2020.

Maturity Date	APY	90-Day Early Withdrawal Penalty to nearest $10	Yield at Maturity to nearest $10	Yield if Cashed Out on 1 Mar 2021 to nearest $10
December 2020	1.39	0	710	710
November 2021	1.49	50	760	630
May 2022	1.72	50	880	620
December 2023	1.72	50	880	270

Past CECU 4-yr CD Performance

Information on CECU 4-yr CD rates was unavailable for years prior to 2014. In an attempt to reconstruct these rates, the relationship between what CECU offers as an interest rate and what the federal government offers as an interest rate to banks was examined. The Federal Reserve's, Federal Funds Rate (FFR), is the interest rate that banks charge one another for borrowing money. The FFR both reflects what is occurring in the overall economy and influences important aspects of the economy, including employment, economic growth, and inflation. This rate is also the primary determinant of the interest rates an individual bank is willing to offer to customers purchasing CDs.

In July 2007, the FFR had plateaued at approximately 5.2%; however, by the end of 2008, the FFR had plummeted to 0.1% due to the economic crash labeled the "Great Recession." The FFR remained below 0.2% until the end of 2015. In May of 2014, when the mean monthly FFR was at 0.08%, MOAFS purchased a 4-year CD from CECU for 1.25%. By December of 2016, the mean FFR was at 0.60% when MOAFS purchased a 4-year CD with an APY of 1.39%. The mean FFR was at 1.33% in November of 2017 when we purchased a 4-year CD with an APY of 1.49%. In May of 2018, the mean monthly FFR had risen to 1.83% when we purchased another 4-year CD with an APY of 1.72%. However, the mean FFR had declined in December of 2019 to 1.69% when we made our most recent 4-year CD purchase with an APY 1.72%.

Examining the FFR and CECU CD interest rates in Table 4, finds that there is a fairly strong positive correlation between the FFR and the APY that the CECU offers for a 4-yr CD. The equation for this relationship is CECU APY = 0.38*FFR + 1.08 with an $r^2 = 0.81$. This formula was used to determine CECU interest rates prior to 2014.

Table 4. Mean monthly federal fund and CECU 4-yr CD interest rates.

Date	Mean Monthly Federal Fund Rate	CECU 4-yr CD APY
May 2014	0.08	1.25
December 2016	0.60	1.39
November 2017	1.33	1.49
May 2018	1.83	1.72
Dec 2019	1.69	1.72
Nov 2020	0.09	0.80

In response to the Coronavirus pandemic, and its negative impacts on the economy, the FFR rapidly declined to 0.09% by August 2020 and remains at this level as of October. This current decline in the FFR is comparable to early in the Great Recession. As a result of the lowered FFR, CECU responded by lowering its interest rates on CDs. As of the end of November, the CECU is offering a 4-yr CD at an APY of only 0.80%, which is the lowest CECU rate documented in the past seven years, and perhaps the past several decades.

The 2014 *Student Support Trust Fund Investment Analysis, Options, and Recommendations* report, found that we could find 4-yr CD rates from other in-state and out-of-state banks that were 0.5 to 0.7% better than what was offered by CECU. Ultimately, we decided that these higher rates were not enough to justify leaving the local financial institution that had served MOAFS so well from the beginning. Interestingly, in a recent survey of other institution's 4-yr CD rates, only one bank offered a rate better than CECU's and it was only 0.1% better.

Predicted Future CECU 4-yr CD Performance

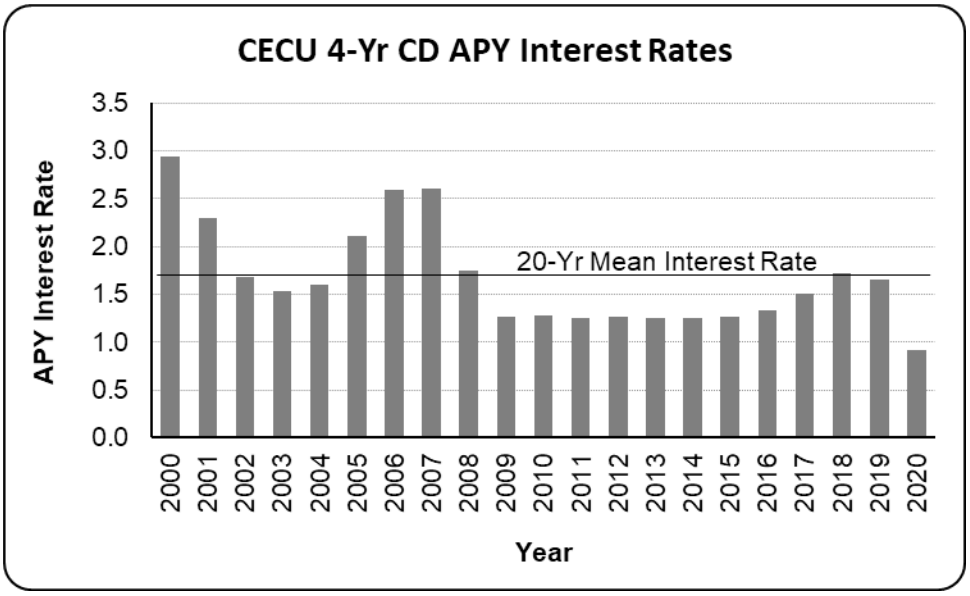
It took the stock market nearly five and a half years to fully recover from the Great Recession; however, it took nearly a decade for the FFR to fully recover from this same economic downturn. In July 2008, the FFR was 2.0%; however, by December of the same year, it had plummeted to less than 0.2%. It was not until October 2018 that the FFR rose back above 2.0%.

While the stock market, as reflected in the S&P500, had essentially recovered all of the market losses of March 2020 within six months, the Federal Reserve at its September 2020 meeting indicated that there is a good likelihood that the FFR will not be raised any time before the end of 2022. Many economists predict that if the Coronavirus pandemic continues resulting in another economic downturn, that the FFR may remain at 0.09% through 2027.

In order to compare CDs on a "level playing field" with other investment vehicles, interest rate data for the past 20 years is used to predict future CD performance and compare potential earnings from other investment vehicles, even though CD rates are not expected to increase significantly in the near future.

From 2000 through 2019, the APY for a 4-yr CD issued by CECU ranged from 1.25% to 2.94% with a **mean of 1.71% (**Figure 2). The standard deviation is about 0.53, with 0.95 confidence interval bounds of 1.46% and 1.96%.

Figure 2. CECU 4-yr CD APY Interest Rates, 2000-2020.



Based on the 20-year mean APY interest rate, our current laddered strategy for the four CD totaling $50,000, comprising approximately 45% of the current portfolio, can be expected to annually earn between approximately $750 and $1,010, with **an average expected income of approximately $880 per year, representing only 20% of our current annual income target of $4,500.**

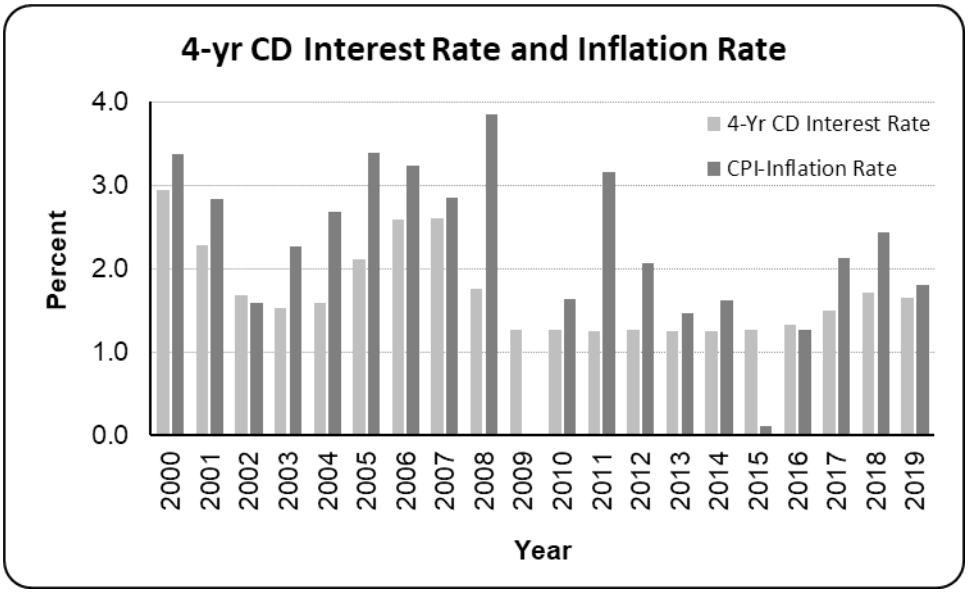
While there is no risk in losing actual dollars with CDs, like the MM investment, there is risk in losing overall value, given that CDs are currently earning only half of the current inflation rate (discussed in more detail in the next subsection). Prior to 2015, the MOAFS almost exclusively depended on CDs to provide student support. In the late 1990's CDs were yielding more than 5% APY and were truly moderate reward income producers. However, because of the recessions in 2000 and 2008, CD interest rates plummeted and have remained low to this day, to the point that we should no longer consider CDs as good income producer. Thus, the CD investment should be considered a **low risk/low reward** investment.

CD Yields and Inflation

While CD's are always guaranteed to yield an annual income, the purchasing power of this income is not guaranteed if the interest rate for the CD is less than the inflation rate for the same period. The U. S. Bureau of Labor Statistics monitors the average change in prices over time that consumers pay for a basket of goods and services, with the results being termed the Consumer Price Index (CPI). The upward price movement of these goods and services is termed "inflation", thus the CPI is widely used as a measure of inflation and the associated decrease in the purchasing power of money.

A review of the CECU 4-yr CD interest rates along with the corresponding annual CPI for the past two decades reveals that in 16 of the past 20 years the interest rate offered for a 4-yr CD was less than the inflation rate for that same year (Figure 3). As previously mentioned, the mean interest rate for a CECU 4-yr CD for the past twenty years was 1.71%. During this same period, the mean inflation rate was 2.17%.

Figure 3. CECU 4-yr CD Interest Rate and CPI Inflation Rates, 2000-2019



On average, in eight out of every ten years, **the interest earned from CD's was not able to outpace the loss of purchasing power due to inflation.** While CD's are unquestionably "safe" low risk investments (cannot lose principle), it can be argued that CD revenues are not able to preserve, let alone, increase the purchasing power of SSTF's invested dollars.

Total Market Indexed Bond Mutual Fund

Included in the 2014 report that looked at a host of investment management vehicles and options that could be used to gain more dollars for student support, was a discussion of using bonds to generate revenue. Ultimately, it was decided to continue using CDs, rather than a bond fund, as a "safer" revenue component.

The 2014 report also went into an extensive review of which companies offered the best total market mutual funds and it was decided to go with Vanguard. This report's examination will focus solely on the total market bond mutual fund offered by Vanguard with fund code of VBTLX.

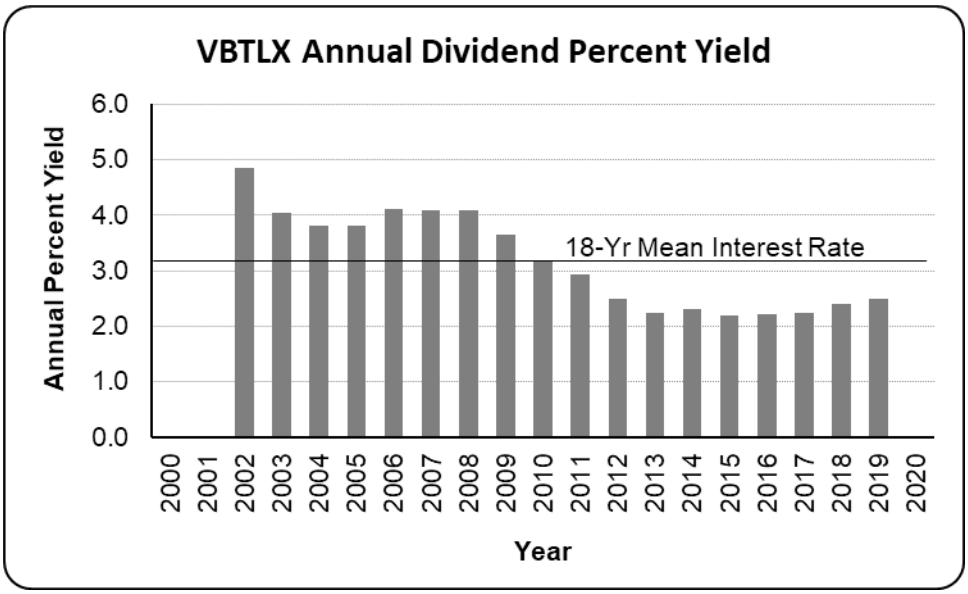
Income can be gained from holding shares of VBTLX in two ways. Income is earned from monthly cash payment of dividends, which can be direct deposited into either our SSTF MM or checking accounts. Income can also be derived from selling VBTLX shares; however, this can only be done profitably if shares are sold at a price greater than what they were initially purchased.

It should be noted that within the investment management community there is a well-recognized inverse (negative) relationship between interest rates and the bond market. As interest rates for CDs decline, the share prices of bond funds increase. Interestingly, in comparing the annual interest rates for 4-yr CECU CDs with the annual dividend yield for VBTLX, there is a weak (r^2 = 0.33) positive relationship meaning that as CD interest rates increase so do the dividends paid by bond funds.

Past Total Market Indexed Bond Mutual Fund Performance

VBTLX was established in 2002 and in the initial seven-year period provided investors with an annual dividend yield of between 3.82 and 4.86%. However, dividend yields began to decline beginning in 2009 as a result of the Great Recession. Annual yields steadily declined from 4.08% in 2008 until they bottomed out at 2.20% in 2015. The annual yield began to slowly recover, reaching a yield of 2.50% in 2019 (Figure 4).

Figure 4. VBTLX annual dividend yield, 2002-2019.



Predicted Future Total Market Indexed Bond Mutual Fund Performance

From 2002 through 2019, the annual dividend yield ranged from 2.20% to 4.86% with a **mean of 3.17%**. The standard deviation is about 0.88, with 0.95 confidence interval bounds of 2.73% and 3.61%. Based on the mean dividend yield for past 18 years, if we invested $50,000 in VBTLX shares representing approximately 45% of the current portfolio, we could expect to annually earn between approximately $1,360 and $1,800 **with an annual average of approximately $1,580 per year, representing 35% of our current annual income target of $4,500.**

Regarding bond fund investment risk, there are two ways of not earning as much money as we planned for: (1) if we are forced to sell shares at a price lower than what we purchased them for or (2) if market pressures result in lower than expected dividends. Past performance and the judgement of reputable investment institutions such as Morningstar classify total market indexed bond funds as possessing moderate risk. Thus, the bond fund investment should be considered a **moderate risk/moderate reward** investment.

Total Market Indexed Equities Mutual Fund

Under the current SSTFIMP, we have $45,000 invested in a portfolio with 75% invested in a total domestic equities market index fund (VTSAX) and 25% in a total foreign equities market index fund (VTIAX). Income is gained by selling shares of the two funds at a price that exceeds their purchase price. A detailed plan on when and how to take profits from this equities portfolio is found in *Mutual Fund Profit Taking Strategy Analysis for the Student Support Trust Fund Investment Plan* (Dec 2016).

Past Total Market Indexed Equities Mutual Fund Performance

Unlike CDs and bond funds, that have always offered investors a positive annual return on investment, equities do not offer such a "guarantee". Not only are annual returns on investments in the equities market not guaranteed, returns can be highly volatile from year to year. The year-to-year volatility of the equities market is best documented by what happened during the Great Recession, when the total equities market lost nearly 39% of their value by the end of 2008, only to increase their value by approximately 31% by the following year.

In examining the annual returns for the equities markets over the past 20 years, the total domestic market experienced negative returns for five of those years, while the total foreign market experienced no positive returns in eight years of those years (Table 5).

The shaded far right column of the Table 5 represents the historic return of a two-fund portfolio, which mirrors MOAFS's current 75/25 domestic/foreign equities portfolio. Had MOAFS held its current equities portfolio for the past two decades, we would have failed to earn a single penny on this investment in seven of the past twenty years. In other words, there is a one in three chance that in any given year, a total market equities portfolio will not yield any income to an investor.

Table 5. Annual return on investment of Vanguard total market funds and portfolio, 2000-2019

	Percent Yield on Investment		
Year	VTSAX	VTIAX	Combined Weighted
2000	-10.6	-15.6	**-11.9**
2001	-10.9	-20.1	**-13.2**
2002	-20.9	-15.1	**-19.5**
2003	31.4	40.3	**33.6**
2004	12.6	20.8	**14.7**
2005	6.1	15.6	**8.5**
2006	15.6	26.6	**18.4**
2007	5.6	15.5	**8.1**
2008	-37.0	-44.1	**-38.8**
2009	28.8	36.7	**30.8**
2010	17.3	11.1	**15.8**
2011	1.1	-14.6	**-2.8**
2012	16.4	18.1	**16.8**
2013	33.5	15.0	**28.9**
2014	12.6	-4.2	**8.4**
2015	0.4	-4.4	**-0.8**
2016	12.7	4.6	**10.7**
2017	21.2	27.4	**22.8**
2018	-5.2	-14.4	**-7.5**
2019	30.8	21.4	**28.5**

If an investor were to base their investment decisions solely on the probability of gaining consistent annual revenue, they might consider avoiding the purchase of equities shares. However, if we take a longer-term look at equities, we find that the accumulative years of increasing values overshadow the years of losses. The mean annual return on a 75/25 domestic/foreign total equities market portfolio held for the past twenty years is 7.49%, for the past fifteen years it is 9.83%, past ten years 12.06%, and for the most recent five years 10.71%.

While these mean annual returns for equities are more than twice the annual returns of CDs and bond funds during the same period, we still need to be cognizant of the fact that equity returns are also at least twenty times more volatile than CD and bond fund returns.

Predicted Future Total Market Indexed Equities Mutual Fund Performance

From 2000 through 2019, the annual return ranged from -38.8% to 33.6% with a **mean of 7.49%**. The standard deviation is about 18.8, with 0.95 confidence interval bounds of -1.33% and 16.31%. Based on the mean return for past twenty years, if we invested $45,000 in a 75/25 domestic/foreign total market portfolio we could expect to annually earn between approximately $0 and $7,340 **with an annual average of approximately $3,370 per year, representing 75% of our current targeted annual income of $4,500.**

Considering equities fund investment risk, there is only one way of losing actual money using this investment vehicle. It is important to remember, that the stock market can plunge by as much as 50%, yet we lose zero dollars as long as we do not sell shares during this market downturn. However, it is also important to remember that while we do not lose dollars, we are also unable to earn dollars in these market downturns. Moreover, as shown in Table 4, there is about a 1-in-3 chance that the stock market will not allow us to sell shares at a profit in any given year. For this reason, we should abide by the judgement of reputable investment institutions that classify total market indexed equity funds as being high risk. Thus, the equities fund investment vehicle could be considered a **high risk/high reward** investment.

Domestic Only Versus Domestic & Foreign Total Equities Market Portfolios

At the end of June 2020, MOAFS Treasurer, Joe McMullen, and the author discussed the Vanguard equities account during which the subject of the advantages and disadvantages of holding a total domestic market equity fund and a total foreign market equity fund as opposed to holding only a domestic market equity fund arose.

The pros and cons of a single index fund covering the entire domestic equities market, versus a two-fund portfolio that also includes an index fund covering the entire foreign equities market, was first examined in *Student Support Trust Fund Investment Analysis, Options, and Recommendations* (Dec 2014). This initial report stated that while a majority of financial advisors agree that foreign investments are an important component of any portfolio, there was a fair amount of variability in opinions of how much of a portfolio should be obligated to non-U.S. investments. A review of more than a dozen investment firm's allocation recommendations found an average ratio of domestic to foreign equities of about 3:1.

The Feb 2015 report, Issues, *Recommendations, and Timeline for Implementation of the Recently Adopted Student Support Trust Fund Plan,* further addressed the issue of the composition of the equities portfolio, reaffirming that investing in the total world market is considered the ultimate in diversification. Only about a quarter of the world's 40,000 companies are in the U.S., with more than half of the world's business capitalization located in countries outside the U.S.

The issue of a one or two-fund total market portfolio was again re-examined for this report looking at total market domestic and foreign equities annual returns for the period 2000 through 2019. This examination revealed that in the past two decades:

- The domestic market outperformed the foreign market in 9 of the 20 years.
- The domestic market experience 7 years of negative returns with a mean of -13.5%
- The domestic market experience 13 years of positive returns with a mean of 18.8%
- The foreign market experience 5 years of negative returns with a mean of -17.0%
- The foreign market experience 15 years of positive returns with a mean of 16.3%

In summary, in the past two decades, foreign stocks experienced a couple more years of positive return than did domestic stocks. However, in a positive market environment, domestic stocks tended to out-perform foreign stocks by an average of about 2.5 percentage points. Domestic stocks also fared better than foreign stocks in negative markets environments by an average of about 3.5 percentage points. The mean annual return for the past two decades for a 100% domestic portfolio was 8.0%, while a 75/25 domestic/foreign portfolio (similar to our current portfolio) was 7.5%.

If we choose to abandon the current 75/25 domestic/foreign total equities market portfolio in favor of a 100% domestic total equities market portfolio by selling all shares of VTIAX and buying addition shares of VTSAX, we could expect the $45,000 equities investment to generate, on average, an additional $225 of revenues each year.

Ultimately, the decision on whether to switch from a domestic/foreign two-fund portfolio to a domestic-only one-fund portfolio can be "boiled down" to two questions. First, is a relatively small gain in income worth decreasing diversification and increasing risk? Secondly, would the change from a two-fund portfolio to a one-fund portfolio result in less work for the Treasurer?

Upon the recommendation of the Treasurer and in consultation with the rest of the MOAFS ExCom, it was agreed that the chapter would continue to hold a two-fund domestic/foreign equities portfolio.

Investment Risk

The first draft of this report focused primarily on revenues derived from various investment options. In their review of this initial draft, members of the ExCom, ask that the risks associated with these investments be given more attention in this report.

Nearly every financial planner, investment company, or money management website will tell you that with reward comes risk. The common declaration being, "the more the risk, the more the reward". Investment risk is often described in qualitative terms of "low" "moderate" or "high" However, risk can also be quantified using statistical methods that are predictors of potential monetary loss and the volatility of returns.

One of the most commonly used formulas for quantifying risk and reward is the Sharpe Ratio (SR), developed by a Nobel laureate. The ratio is the average return earned in excess of the risk-free rate per unit of volatility or total risk. Standard deviation is used as a measure of volatility.

The Sharpe Ratios for the individual investment vehicles comprising prospective SSTF investment portfolios are as follows: CECU MM = 3.00, CECU 4-yr CD =3.00, VTSAX =0.53, VTIAX = -0.02, VTBLX = 0.99. The higher this ratio, the less risky the investment is considered. A SR <1.0 is generally considered "sub-optimal", a SR >1.0 is "acceptable", while a SR> 2.0 is "very good" and >3.0 is considered an "excellent" investment in terms of risk. The weighted Sharpe ratios for the five potential portfolio options discussed in the next section are shown in the gray-shaded right-hand column of Table 6.

Before leaving this discussion of quantified risk, it is important to remember that while equities are considered risky and often experience high volatility in their value (as quantified in the Sharpe Index) they are only risky if you must sell shares at a loss during a market downturn. An investor only risks losing money if he/she sells shares when prices are lower than what the shares were purchased for. If you do not sell during market downturns, you do not lose money, thus no realized risk. The buffer fund allows us to not sell in down markets, thus our VTSAX/VTIAX holdings while given a "high risk" Sharps value are of not risky in our portfolio if we manage them correctly (buy low/sell high).

Risk-Free Investment Portfolio Option

Because of the recent recession, some of MOAFS members may argue that we would be better off returning to less risky investments such as CDs (very good SR), or looking at a more stable indexed bond fund with consistent dividends (acceptable SR). Let us look at how much principle would be needed to gain $4,500 per year in income for these two low-risk investment vehicles.

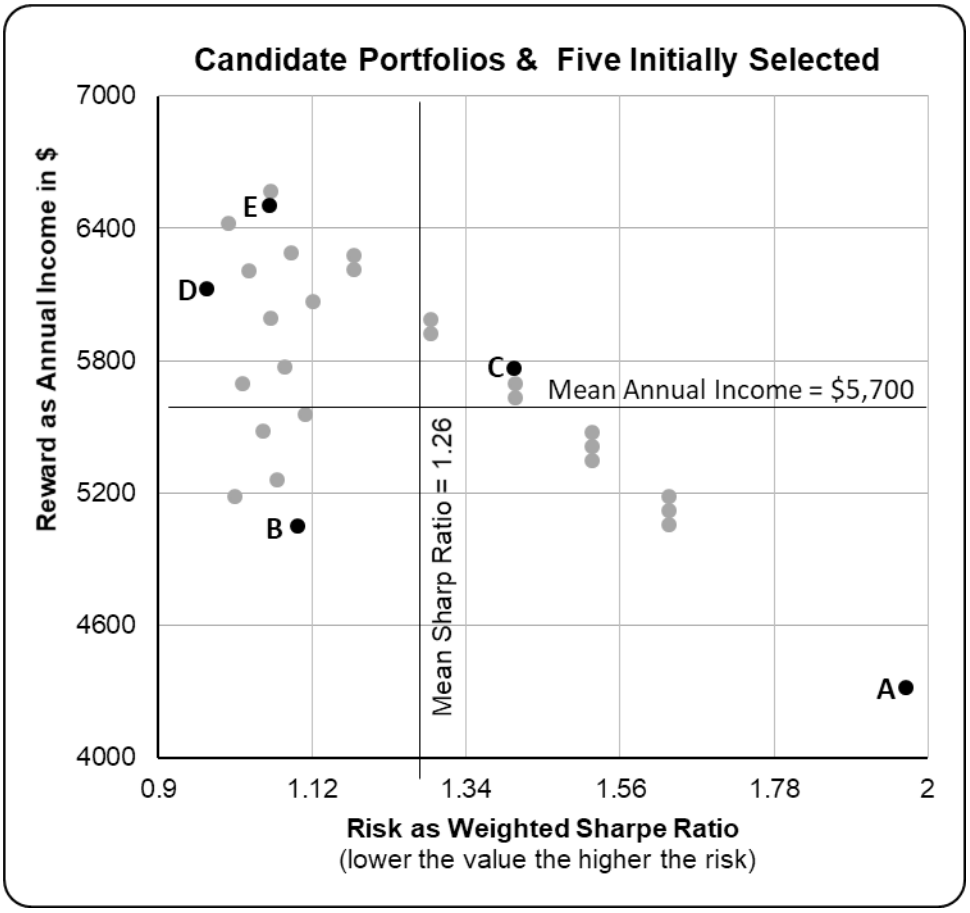
If we chose to fund $4,500 worth of student support solely with CDs backed up by a $20,000 MM buffer account, and applied a mean annual return on CDs of 1.71%, **we would need a total of approximately $257,000 invested in four 4-year CDs** (one becoming mature each year). Given that, it took MOAFS 20 years to build a principle of $100,000 (average of $5,000/year); it would take the chapter nearly three more decades of additional fund raising in order to support students using a CD-only portfolio.

Another way to look at this is to see how much less MOAFS would be willing to spend each year in support of fisheries students. Again, using returns for CDs of 1.71 with a $20,000 MM buffer and a total $95,000 invested in **four 4-yr CDs, we could expect an annual revenue of only $1,760**. Bottom-line, MOAFS could not come close to providing the current target of $4,500 in student support by exclusively using this essentially risk-free investment option.

Initial Portfolio Investment Options

As previously discussed in the *Methods* section, initial portfolio modeling resulted in 28 potential investment options with 14 being three-investment vehicles portfolios comprised of MM, CDs and equities, another 13 portfolios were three-investment vehicle portfolios comprised of MM, bonds and equities, with a single two-investment vehicle portfolio comprised of MM and equities. The initial 28 candidates are shown in Figure 5 in terms of their individual risk and reward characteristics.

Figure 5. Risk and reward of candidate portfolios.



The field of candidates was initially narrowed down to five portfolios that are good representatives of the three investment vehicle combinations; with two utilizing CDs and equities, two replacing CDs with bonds, and one that utilizes only equities to produce income. Note that each of the five candidates are all located in different quantiles indicating a diversity of choices (Figure 5). These five portfolios' weighted SRs are also well distributed within the 28-portfolios weighted SR values that ranged between 1.0 and 2.0 with mean weighted SR of 1.26. The candidate portfolios' are also well distributed in terms of income where annual incomes ranged from $4,300 to $6,600 with 28-portfolio mean income of approximately $5,700.

The attributes of these five SSTF investment portfolios selected for final consideration are shown in Table 6.

Table 6. Predicted range of mean annual revenues from five portfolios in future years.

	Total Investment to nearest $1,000				
Economic Scenario	Money Market	4-yr Laddered CDs	Total Market Bond Fund	Total Market Equity Funds	Est. Annual Income to nearest $100 and Wt. Sharpe Ratio
Portfolio A "45/40 CD & Equities" (CURRENT PLAN)					
$ Invested and Earned	20,000	50,000	0	45,000	**4,300**
Approx. % of Portfolio	15	45	0	40	
Sharpe Ratio	3.0	3.0	-	0.4*	**2.0**
Portfolio B "45/40 Bonds & Equities"					
$ Invested and Earned	20,000	0	50,000	45,000	**5,000**
Approx. % of Portfolio	15	0	45	40	
Sharpe Ratio	3.0	-	1.0	0.4*	**1.1**
Portfolio C "25/60 CDs & Equities"					
$ Invested and Earned	20,000	25,000	0	70,000	**5,800**
Approx. % of Portfolio	15	25	0	60	
Sharpe Ratio	3.0	3.0	-	0.4*	**1.4**
Portfolio D "25/60 Bonds & Equities"					
$ Invested and Earned	20,000	0	**25,000**	70,000	**6,100**
Approx. % of Portfolio	15	0	25	60	
Sharpe Ratio	3.0	-	1.0	0.4*	**1.0**
Portfolio E "25/75 MM & Equities"					
$ Invested and Earned	30,000	0	0	85,000	**6,500**
Approx. % of Portfolio	25	0	0	75	
Sharpe Ratio	3.0	-	-	0.4*	**1.1**

Notes: * This is weighted Sharpe Ratio for a 75% domestic/25% foreign equities portfolio

Portfolio A "45/40 CD & Equities"

Represents our current investment portfolio comprised of approximately 15% MM, 45% CDs, and 40% in the two total market equity funds. This portfolio easily met our original student support target of $3,200; however, based on the most recent data and revised calculations, this portfolio is only predicted to generate **$4,300 per year**, which is 4% below our current target revenue of $4,500. Of the five portfolios, Portfolio A is the least risky, with a weighted **SR of about 2.0** making it a "very good" portfolio in terms of risk.

Portfolio B "45/40 Bonds and Equities"

This portfolio would require that all CDs be cashed out and that $50,000 worth of the Vanguard total market bond mutual fund VBTLX be purchased. Approximately 40% of the portfolio would remain invested in the 75/25% domestic/foreign total market equities fund worth $45,000, along with the $20,000 in the MM account. Revenues from VBTLX would be derived from dividends rather than the sale of shares. It is estimated that this portfolio could generate **$5,000 per year** of income. This portfolio would produce about 17% more income than our currently held Portfolio A and would provide about 11% more income than the current target revenue of $4,500. Portfolio B's weighted **SR of 1.1** is 44% more risky than our current Portfolio A, making it a somewhat "acceptable" portfolio in terms of risk.

Portfolio C "25/60 CDs and Equities"

To implement this portfolio would require that two of the four CDs be cashed out and that an additional $18,750 worth of VTSAX and $6,250 of VTIAX be purchased. This would increase the 75/25% domestic/foreign total market equities fund value to $70,000 representing approximately 60% of the entire portfolio. Two CDs totaling $25,000 would remain with an additional $20,000 in the MM account. It is estimated that this portfolio could generate **$5,800 per year** of income, which is about 33% more than our current portfolio and is predicted to produce about 29% more income than our $4,500 target. This portfolio's weighted **SR of 1.4** makes it a readily "acceptable" investment portfolio in terms of risk. It is 28% more risky than Portfolio A.

Portfolio D "25/60 Bonds and Equities"

This would require that all CDs be cashed out and that $25,000 worth of the Vanguard total market bond mutual fund, VBTLX, be purchased, along the purchase an additional $18,750 worth of VTSAX and $6,250 of VTIAX. This would increase the 75/25% domestic/foreign total market equities fund value to $70,000. As in the three preceding portfolios, $20,000 would remain in the MM buffer account representing approximately 15% of the total portfolio. It is estimated that this portfolio could generate **$6,100 per year** of income, which is about 36% more than our current target. Portfolio D is predicted to produce about 42% more income compared to our currently held Portfolio A. This portfolio's weighted **SR of 0.9** places it as a somewhat "sub optimal" portfolio in terms of risk and it is 51% more risky than our current portfolio.

Portfolio E "25/75 MM and Equities"

This portfolio would require that all CDs be cashed out and that an additional $10,000 be placed in the MM account bringing its balance to $30,000 representing approximately a quarter of the entire portfolio. An additional $30,000 worth of VTSAX and $10,000 of VTIAX would be purchased increasing this domestic/foreign total market equities fund value to $85,000. It is estimated that this portfolio could generate **$6,500 per year** of income, which is about 44% more than our current student support target. Portfolio E is predicted to produce about 51% more income compared to our currently held Portfolio A. This portfolio's weighted **SR of 1.1** places barely into the category of "acceptable' in terms of risk. This portfolio is 46% more risky than our current portfolio.

Additional Comparisons of Potential Portfolios

Student Support During Market Downturns

Each portfolio will be able to fully fund $4,500 of annual student support in any market downturn lasting up to five years (Table 7). Portfolio B is expected to be able to fully support students in a market downturn lasting up to seven years. This is due to 45% of Portfolio B being comprised of a total market indexed bond fund that will yield some income via dividends.

Table 7. Risk and reward qualitative and quantitative ratings.

Portfolio	Years of student support in market downturn	Relative Description of Portfolio in terms of: Risk	Reward	% Increase in Risk compared to Portfolio A	% Increase in Reward compared to Portfolio A	% Increase in Reward/ % Increase in Risk
A "45/40 CD & Equities"	5.6	Low	Low	0	0	**0**
B "45/40 Bonds & Equities"	7.0	High	Moderately Low	44	17	**0.4**
C "25/60 CDs & Equities"	5.0	Moderate	Moderately High	28	33	**1.2**
D "25/60 Bonds & Equities"	5.6	High	High	51	42	**0.8**
E "25/75 MM & Equities"	5.8	High	High	46	51	**1.1**

Qualitative Description of Portfolio Risk and Reward

A qualitative description of each portfolio is based on where a portfolio's weighted SR and expected income falls within the five quantiles of each risk and reward parameter. A value falling in the lower 20% of values is termed "low", the next lowest 20% is termed "moderately low", a value falling within the middle quantile is termed "moderate", with the upper two quantiles termed "moderately high" and "high", respectively.

Our current SSTF investment portfolio, Portfolio A, when compared to the other initially proposed portfolios, can be described as being a low risk/low reward portfolio. This rating is a result of having 60% of the entire portfolio invested in MM and CDs that have no risk, but also produce very little income. At the opposite end of the investment spectrum, Portfolios D and E can be described as high risk/high reward. These two portfolios earn this rating due to having 60 to 75% of the portfolio being invested in equities that can produce high incomes, but are also susceptible to market downturns. Portfolio B is classified as being a high risk/moderately low reward portfolio. This is mainly due to Portfolio B lacking no-risk CDs and having more money invested in bonds that produce less income than the same amount of equities. Portfolio C is rated as having moderate risk and moderately high reward due to it retaining 40% of its portfolio in no-risk and limited income MM and CDs with the remaining 60% in high returning equities. These qualitative descriptors are summarized in Table 7.

Relative Increases in Risk and Reward

The percent increase in risk and revenues shown in Table 7 are calculated relative to our current investment Portfolio A. All four of the newly proposed investment options are projected to increase our revenues and meet our current annual goal of $4,500. Portfolios C, D, and E, which increase the percentage of equities, exhibit the largest percent increase in revenues. As expected, all four of the initial proposed investment options also increased our risk. Interestingly, incorporating a total market indexed bond fund as part of Portfolios B and D increased risk more than Portfolio C, which does not have a bond fund component. This is a result of Portfolios B and D being divested of all CDs, while Portfolios C retains some 25% of its assets in CDs.

While Portfolio A is the least risky of these five portfolios, it also is the poorest performer when it comes to generating revenue. As has already been discussed, Portfolio A is the only portfolio that is not expected to consistently meet our current revenue target of $4,500, let alone our proposed revenue target of $5,000.

Another way to look at the relationship between risk and reward is to look at the percentage of increase in revenues compared to the percentage of increase in risk. Dividing the percent increase in revenue by the percent increase in risk gives the values shown in the gray-shaded right column in Table 7. Values less than 1.0 indicate a portfolio that took on more risk than it gained in reward.

For every 1% increase in risk, the revenues for Portfolio B increase by only 0.4%. Portfolio D's increase in revenues was also less than its increase in risk resulting in an increase of only 0.8% in revenues for every 1% increase in risk. Portfolio C and E were the only investment options in which the percent increase in revenues outpaced the increase in risk. For every 1% increase in Portfolio C's risk there was a 1.2% increase in revenues, while Portfolio E managed to increase revenues by 1.1% for every 1% increase in risk.

ExCom Review of Investment Portfolios

The previous sections of this report were presented to the five members of the MOAFS ExCom in early December. The ExCom ranked the initial five portfolio previously presented. The results of their rankings and subsequent discussion and recommendations on how to manage the SSTF in the future follows.

Initial ExCom Rankings

Results and Discussion

The results of the 1 to 5 ranking of five potential portfolios are summarized below in Table 8. A ranking of 1 is a person's first preference, 2 their second preference, with a 5 being the least preferred of all five choices. The smaller the mean value shown in the gray-shaded bottom row of Table 8, the more favorably that the ExCom, as a whole, views a particular portfolio.

Table 8. Investment portfolios and their ranking by MOAFS ExCom.

	Percentage of SSTF by Investment Vehicle					
Investment Vehicle	**A**	**B**	**C**	**D**	**E**	**F**
Money Market, buffer account	15	15	15	15	25	n/a
Certificates of Deposit	45	0	25	0	0	n/a
Total Index Mutual Fund, bonds	0	45	0	25	0	n/a
Total Index Mutual Fund, equities	40	40	60	60	75	n/a
Expected Annual Revenue in $, original model	**4,300**	**5,000**	**5,800**	**6,100**	**6,500**	n/a
MOAFS ExCom Ranker						
Andy Turner	4	4	2	1	3	
Brandon Baumhoer	4	1	3	2	5	
Eric Rahm	2	4	1	3	5	
Joe McMullen	4	5	2	3	1	
Kyle Winders	2	5	1	4	3	
Mean Ranking	**3.2**	**3.8**	**1.8**	**2.6**	**3.4**	

Additional tabulations that are shown in Table 9. These were done to try to discern the collective view of the ExCom for a particular investment vehicle.

Table 9. MOAFS ExCom preference rankings for particular investment vehicles.

Investment Vehicle Attribute	Includes Portfolios	Mean Ranking by ExCom
Lower Safety with <30% in MM & CDs	B, D, E	**3.3**
Higher Safety with >35% in MM & CDs	A, C	**2.5**
Without CDs	B, D, E	**3.3**
With CDs	A, C	**2.5**
Without Bond Fund	A, C, E	**2.8**
With Bond Fund	B, D	**3.2**
Lower Earnings with <45% in Equity Funds	A, B	**3.5**
Higher Earnings with >55% in Equity Funds	C, D, E	**2.6**

The ExCom ranking results indicate that:

- Overall, Portfolio C was the most favored investment strategy, with no ExCom member ranking it at less than their third choice, with the four members ranking it as their first or second choice (Table 8).
- Portfolio D was the overall second choice of the ExCom. While two folks were pretty receptive to this portfolio, the majority were at best neutral (rank of 3) or not to supportive of this portfolio (Table8).
- Portfolios A, B, and E were less favored investment options by the ExCom as a whole; however, four members did chose one of these portfolios as their first or second choice (Table 8).
- The ExCom, as a group, viewed portfolios which have at least 35% of the portfolio in MM and CDs (safety net/buffer fund) as somewhat more acceptable than portfolios with MM and CD making up less than 30% of a portfolio (Table 9).
- The ExCom, as a group, viewed the incorporation of CDs into a portfolio as somewhat more acceptable than portfolios that exclude CDs (Table 2); however, at least one member stated that they would support a portfolio if CDs were replaced with MM.
- The ExCom, as a group, did not view the incorporation of a bond fund into a portfolio as a particularly appealing strategy, rather the group preferred portfolios without a bond fund somewhat more favorably (Table 9).
- The ExCom, as a group, substantially favored portfolios that were comprised of at least 55% in equity funds (Table 9); however, two members were definitely not in favor of a portfolio with 75% comprised of equities (Table 8).

Final Portfolio Selection

While there was a fairly clear group consensus that Portfolio C was a good option, the Treasurer suggested and other members agreed that the ExCom consider a modification of this portfolio that would drop the CDs component altogether and place all or a portion of this money into the MM account and equities shares. This resulted in a sixth potential investment option designated Portfolio F with the following attributes of 35% in MM and 65% in Equities. Yes, it looked similar to Portfolio E; however, Portfolio F better addressed the ExCom's desire to have a more robust buffer fund than Portfolio E offers, while also generating more revenue than Portfolio C could provide.

To aid in evaluation, the models were updated to account for recent changes in the SSTF total balance and changes in current interest rates. The revised models based on a SSTF balance of $120,000 rather than $115,000, a MM interest rate return of 0.60% (if we keep a minimum balance of $25,000 in the account) rather than the 0.45% if we hold less than $25,000 in the buffer account, and the current interest rate of 0.80% for a 4-yr CD. The revised revenue estimates for the five original A through E Portfolios, plus Portfolio F are shown in Table 10.

Table 10. Updated revenue projections for six potential SSTF portfolios.

Investment Vehicle	Percentage of SSTF by Investment Vehicle					
	A	**B**	**C**	**D**	**E**	**F**
Money Market, buffer account	15	15	15	15	25	35
Certificates of Deposit	45	0	25	0	0	0
Total Index Mutual Fund, bonds	0	45	0	25	0	0
Total Index Mutual Fund, equities	40	40	60	60	75	65
Wt. Sharpe Ratio of Risk	**2.0**	**1.1**	**1.5**	**1.0**	**1.0**	**1.2**
Expected Annual Revenue in $, updated model	**3,900**	**5,200**	**5,600**	**6,300**	**6,900**	**6,200**

A reader will note that the expected annual revenue values in Table 10 differ from the expected annual revenues shown in Table 8. The estimated revenues for Portfolios A and B were less in Table 10 compared to Table 8 due to the fact that these were the only portfolios with a CD component and that CD interest rates are now half of what they averaged for the past two decades. The increases in Portfolios B, D, and E are due to a $5,000 increase in the amount of money distributed in the various investment vehicles along with the increase in the MM interest rate by a third due to the account now holding in excess of $25,000.

The differences between Portfolio C and Portfolio F include:

- Managing a CD ladder consumes more of a Treasurer's time than a MM account.
- CDs are poor investment vehicles, which are currently, and for the foreseeable future, unable to even cover annual inflation rates.
- In the event of a market downturn, we can access MM funds without penalty, while cashing out a CD will incur penalties and lost interest.
- Portfolio C would have approximately $48,000 in two investment vehicles that will produce little revenue and exceed by $18,000 what is needed to cover a six-year downturn in the market.
- Portfolio F will have approximately $42,000 in a single easily accessed investment vehicle that will also cover a six-year market downturn, while reducing by $6,000 the excess buffer funds that could be earning more revenue in other investments.
- Portfolio F is predicted to generate $600 more revenue per year compared to Portfolio C.
- Portfolio F is predicted to generate $1,200 more annual revenue than the proposed revenue target of $5,000. This additional income would allow MOAFS to protect the SSTF from inflation degradation and also provide more student support flexibility and additional opportunities in the future.

After considering these points**,** the ExCom unanimously voted in favor of adding Portfolio F to the suite of portfolios under consideration**.**

Additional Considerations

In the course of this review of the SSTFIMP, the ExCom discussed other aspects related to managing SSTF investments and how to proceed and implement changes, if any.

Timing of Potential Portfolio Modifications

We should remember what happened after we initially bought shares of VTSAX and VTIAX in April of 2015, when share prices were rising. Unfortunately, a week after our purchase of these shares, there was an unforeseen market decline that lasted for more than ten months, taking an additional eight months to recover to pre-April 2015 values, thus preventing the MOAFS from selling shares at a profit for almost two years.

If it is decided that the SSTF investment plan should be modified by investing more in equity mutual funds, we could try to do so when the share price of VTSAX and VTIAX are depressed. However, as mentioned in the *Economic Downturns and Recoveries* section of this report, if we could predict when the market will experience the next significant downturn we would be billionaires. A common phrase often seen in investment management books and websites is that "market timing is a fool's errand". This claim is supported by a review of S&P 500 daily closing prices for the past fifty years (12,882 data points) found that the domestic stock market experienced a one-day downturn of more than 5% on only 24 occasions, representing a 1-in-537 chance of the market declining more than 5% on any particular day. We could be waiting a considerable amount of time in order to buy additional shares of total market indexed equities at a significantly reduced price.

The sooner (and hopefully the cheaper) we can buy additional shares, the quicker that we will be able to sell those new shares at a profit. If the membership decides that MOAFS should adopt Portfolio F, we should strive to purchase equity shares within a month of the vote.

Potential CD Cash Outs

If the membership decides to adopt Portfolio F that calls for an elimination of CDs as part of the portfolio, we must decide whether to cash out all of the CDs at the same time or wait for each CD to mature, causing the new portfolio to not be fully implemented until December of 2023.

We have a CD maturing in December of 2020. It is recommended that this CD not be replaced unless the membership decides to keep the current investment Portfolio A. We will only lose about $9 of interest for each month that we temporarily park this $12,500 in our checking account, rather than immediately purchase replacement 4-yr CD at the current paltry CECU rate of 0.80%.

If we go with Portfolio F and cash out the other three CDs within a month of membership approval, we will not lose any of our $37,500 in principle; however, as shown in Table 3, we would lose $150 in early-withdraw penalties and approximately $1,500 in interest not yet earned. The initial thought might be to wait for the three CDs to mature and gain $1,650 additional revenue over the next three years. However, if we cashed all three CDs out by 1 March 2021, and took the principle of $37,500 and invested $33,000 into equities fund and put $4,500 into the MM account, we could potentially gain more than $7,500 in revenues during that same three-year period.

Management of Revenues in Excess of Target Income

Depending on which investment portfolio is adopted, we may wish to re-examine how we manage potential earnings in excess of our revised annual target of $5,000 in revenues. Do we take all "excess" profits in cash? And if so, what do we do with them? Deposit these excess dollars in the MM buffer fund to be used in future market downturns when income is reduced, or immediately fund additional student support during times of bull markets? One alternative is to use excess revenues to purchase additional shares of the total equities market. Another alternative is to sell only enough equity shares to cover the $5,000 target, allowing the remaining excess shares to remain invested. By only "claiming" $5,000 in years when earnings are exceeding this target, we would be increasing the total SSTF balance, which would in turn help to increase future earnings and ultimately allow us to provide fisheries students with additional support.

In the first rendition of this report, drafted earlier this past summer, 95% confidence intervals were calculated for the mean annual revenue estimates to also provide "best-case" and "worse-case" estimates for each portfolio. While I agreed to the suggestion to remove best and worst case estimates from the second draft of the report because they kind of "bogged down" the main message, I think it worth pointing out again, that when considering and comparing the gray-shaded dollar figures in Table 10, that we remember that there is no guarantee that MOAFS will receive this amount of revenue each and every year.

If, for the sake of this discussion, we apply the 95% confidence intervals discussed in the *Predicted Future Total Market Indexed Equities Mutual Fund Performance* section of this report and use Portfolio F as an example, MOAFS could realize as little as $200 in revenues (solely from MM in a equities market downturn) or as much as $13,000 (very bullish equities market) in any given year. The point here is that we need to think about strategies for handling these fluctuations in revenue. We are in excellent shape regarding how we will handle revenue shortfalls with a well-funded MM buffer account, but we need to think about how to distribute and use the "extra" money when the equities market is thriving.

Back in 2015, such a revenue-distribution plan was developed. It was a dichotomous "if < do this, if >do that" matrix. It quietly fell to the wayside, and we now simply pull the trigger using the profit-taking strategy and deposit the gains in the MM account. An unchecked increase in the MM balance is a waste of opportunities to gain more revenues and fund more student support. The ExCom has agreed to consider reviving and modifying a revenue distribution strategy, where we would continue to provide the targeted student support needs, but also consider providing a funding base for special one-time projects like student conferences or workshops, and a way to grow the SSTF investment balance, which in turn, could increase its earnings potential. Philosophically, we should be increasing our SSTF balance by about 2% each year in order to keep pace with inflation and preserve the buying power of our trust fund dollars.

The ExCom has agreed that once the membership has voted and their SSTF investment portfolio preference is established, that the SSTF Advisory Panel in consultation with the ExCom will begin to address, in more detail, how to take and distribute portfolio revenues, how to manage and distribute money in the buffer account, etc. that will ultimately result in a "SSTF User Manual" to help guide future MOAFS ExCom members, Treasurers, and SSTF advisors.

Closing Thought

If you look at the seemingly infinite number of legitimate financial advisors, investment companies, asset managers, etc. that are out there, we can assume that there is also an infinite number of opinions on how to invest money. In finance (and in fisheries!) six people can look at the same dataset, analyze the numbers six different ways, and come up with six different conclusions and recommendations, of which more than one person's may be "correct". Also, it is one thing to make investment decisions for oneself and one's own money, but a much different matter when trying to decide how to invest other people's (MOAFS members) money.

Having a larger group of people deciding which investment portfolio is best to meet MOAFS's goal in helping to support our profession's future aquatic resource and fisheries managers and scientists is both wise and democratic. For these reasons, the ExCom will place the question of **whether to continue using Portfolio 1 or switch to Portfolio 2** (previously referred to in this report as Portfolios A and F, respectively) to the entire MOAFS membership via electronic vote, see Attachment A for sample ballot.

Attachment A. 2021 MOAFS ballot for selection of SSTF investment plan.

	Percent Composition of Portfolios	
Investment Vehicle	**Portfolio 1** Currently employed Portfolio	**Portfolio 2** Alternative Portfolio
Money Market, buffer account	15	35
Certificates of Deposit	45	0
Total Index Mutual Funds, equities	40	65
Estimated Mean Annual Return in $	**3,900**	**6,200**
Please place "**X**" in box for preferred option →		