MLD Visualization

In [8]:
```
import pandas as pd
import numpy as np

df_mld = pd.read_csv('mld_means_new.csv')
df_mld.sample(5)
```

Out[8]:

	Lat	Long	Year	mld_09	mld_10	mld_11	mld_12	mld_01	mld_02	mld_04	mld_05	mld_06	mld_07
27851	85.130000	-150.100000	2004	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
24324	-53.583000	149.298000	2002	131.247990	117.021190	77.375790	61.464188	40.685440	69.604710	85.205890	111.676570	108.085530	117.880330
23880	-49.393000	150.389000	1999	154.046110	138.263580	110.081390	60.175407	56.818960	74.987236	129.418820	203.046880	195.944060	182.051100
25032	-49.393000	150.389000	2007	130.276960	128.302760	94.973440	62.438824	49.911537	70.163260	100.360860	96.325485	216.694170	113.814644
9789	-21.383333	-114.283333	2015	62.993843	42.302597	37.278122	31.571268	18.048435	34.572000	33.426777	64.821540	72.289024	85.209114

In [9]:
```
month_name = ["01","02","03","04","05","06","07","08","09","10","11","12"]
for month in month_name:
    unique_values = df_mld['mld_' + month].unique()
    print(f"Unique values in mld_{month}: {unique_values}")
df_mld['yearly_mean_mld'] = df_mld[['mld_' + month for month in month_name]].mean(axis=1)
```

```
Unique values in mld_01: [      nan 59.190742 74.78616  ... 52.03397  56.460392 29.661045]
Unique values in mld_02: [      nan 49.773827 35.400013 ... 60.       61.673435 37.826736]
Unique values in mld_03: [        nan  46.68332    49.884098   38.184013   31.833996   30.288898
  17.02741    12.002083   26.825031   26.181917   26.030293   93.04824
  80.38718    72.32047    24.185448   56.322937   33.22253    83.10309
 100.92002   103.811066   52.168526   37.515858   20.897945   14.418519
  32.599373   16.160042   11.540199   12.323704   20.374668   11.457884
  13.94981    11.977362   11.862844   11.447563   12.123527   18.625072
  16.815994   19.163023   13.573595   63.92895    51.077114   52.32264
  34.726547   48.35926    34.37816    29.334148   43.83156    39.03835
  15.920845   12.362115   14.100921   13.29261    17.283278   16.540775
  17.33564    23.95749    50.37726    55.224663   51.95207    30.566118
  29.68642    28.577381   24.702831   11.061262   33.36479    34.150272
  33.60605    78.41152    65.080635   70.14343    15.915667   76.70798
  29.557009   71.788635   94.443146   92.75221    63.558002   67.923904
  21.33516    16.390392   32.970474   12.609028   11.081683   13.654188
  17.988289   11.004198   13.96397    12.18118    11.306923   10.869328
  13.252601   15.720172   14.152401   17.822493   16.453873   43.94004
  42.63427    43.3705     35.318478   41.962383   31.668152   36.476177
  38.186897   38.741646   15.316448   11.180578   13.126181   12.145503
  14.598671   15.014437   17.958092   28.207222   49.13414    67.69017
  42.858658   28.96141    30.56711    26.866621   19.410261   10.239864
  35.637238   32.960636   15.638529   88.882034   95.396225   71.03752
  21.985825   56.84028    30.344213   90.03328   100.69904    86.32275
  54.135635   34.84503    18.477564   13.850554   29.828133   15.801043
  13.606934   15.467265   12.774769   11.489546   12.02545    11.834646
  11.277831   11.516845   13.68969    13.730432   15.3076     20.335733
  12.587433   55.250996   54.74045    39.98867    28.922535   46.981903
  32.873085   37.729446   32.6529     31.333      16.281578   12.6219635
  13.710141   13.2013645  16.41327    14.735512   15.505895   23.784622
  43.81012    48.82713    41.51069    27.043816   37.630703   29.035809
  27.613533   10.402879   29.260057   28.899536   21.146149  102.14203
  78.137505   74.12517    14.690193   60.032913   29.630009   97.76229
  97.5387     89.08707    57.93315    64.59768    18.16858    12.289931
  22.260088   14.563419   11.238113   19.088863   16.786629   10.205648
  11.93749    11.251547   13.726524   12.347916   15.555095   20.920021
  13.000104   18.083693   16.77168    42.679737   42.609463   39.83705
  36.38923    52.081474   52.580505   46.553185   41.89772    34.442917
  16.320782   12.736565   15.635392   14.954952   13.815558   14.481466
  15.963743   24.496094   44.53227    45.11705    34.52865    30.691652
  22.272566   22.128416   35.703983   10.649602   31.760994   28.27356
  46.86721    73.34161    70.33372    56.44673    27.567007   54.730415
  27.67414    67.73166    83.859436  167.87724    74.78989    35.402718
  29.983028   18.12189    25.165836   23.643148   11.953906   14.867546
  18.996878   10.943403   13.692637   11.767998   15.448111   10.838652
  17.012245   12.640356   13.944568   25.64437    17.931345   38.060295
  33.528175   29.420294   29.276869   40.706104   25.527157   56.612286
  30.62378    32.744873   18.297026   13.375544   15.865741   14.247347
  16.983227   16.815523   21.060104   25.317524   37.602104   57.685925
  35.157295   33.497375   32.266804   31.323578   41.20026    10.491228
  31.728638   31.547215   18.852026   62.70542    74.43291    67.56932
  19.303944  100.21544    33.86123    65.88552    62.87404    43.159447
  44.024418   46.09613    18.621643   11.894947   21.826162   16.580418
  11.410844   11.522807   12.971571   10.299462   17.705149   12.459601
  14.177959   12.421661   16.426285   15.777992   11.424084   15.923822
  13.126342   40.86251    40.976494   31.486725   27.653378   36.968613
  41.6904     29.291164   28.940727   26.417686   17.993      10.610989
  12.860018   11.331513   14.838426   14.467826   18.568813   33.401157
  39.888824   40.157524   75.47687    58.77908    52.529484   48.52508
  42.71496    82.903984   87.62325   270.28723    94.88211    18.12834
  17.17894    14.587991   45.272404   31.2422     38.889427   33.770226
  39.6777     35.415676   24.587427  150.50912    55.69331    49.086338
  50.840847   33.280098   40.80266    28.447828   73.777626   46.527752
  45.849346   82.65818    77.10479    88.227516   83.214035   71.715744
  82.07949   218.10837    87.61901    17.806362   17.815285   15.567294
  36.63142    34.7304     24.626076   34.588917   37.78976    33.560616
  26.743141  200.22025   102.63633    69.577835   84.774345   54.354362
  33.814102   33.249718   81.1691     50.61573    76.52467    85.551
  63.48659    61.80553    42.860188   91.41139    62.987137  399.68558
  62.470448   18.224997   18.11895    14.450679   35.77406    27.899052
  31.359735   31.182379   33.477085   29.662216   20.656092  193.2743
  96.95215    67.34224    74.10622    38.490967   29.26565    24.33581
  74.742744   68.36346    63.29127    72.20084    70.65854    69.868225
  67.33255    50.802128   67.63814   261.43732    67.82506    18.805313
  18.15773    15.122427   26.658173   35.236053   32.53841    34.828125
  35.342407   29.89152    24.46597   111.57527    54.266018   51.912678
  55.98564    42.376614   30.250658   22.92851    61.965134   61.711803
  80.11076    70.2779     80.88376    82.15735    78.86055   105.509636
  68.67624   299.93964    62.281635   23.847729   25.286201   20.086746
  18.403952   32.761044   23.708704   30.19468    34.500267   33.2527
  22.804293  264.65195   130.68063    79.34828    93.09299    46.69384
```

```
  31.881697   33.09513    78.85542    50.42646    70.213      53.689407
  56.087395   53.84992    70.863785   76.56824    78.426765  317.97742
  70.46883    20.525375   21.0591     19.562641   26.424696   29.636038
  30.617859   29.99942    34.268593   33.993256   14.442732  346.375
  66.634964   42.913986   77.80798    53.968105   25.029003   29.026928
  43.091484   47.465626   30.07672    44.41519    41.193947   59.002975
  57.120667   33.92782    43.698204   44.176247   35.404312   31.688866
  94.84898    50.073357   64.70474    57.753666   28.5886     46.341026
  40.034523   78.96427    76.30058    88.286026   77.65579    92.46178
  69.41588    52.70084    62.588463   44.81572    52.935997   75.45704
  59.710846   77.557755   79.250015   84.91603    65.39437    77.11854
  48.824257   53.957317   53.90949    50.39672    47.069332   74.49314
  55.22364    89.01294    68.65846    85.122574   83.064026   78.511215
  64.83432    38.74573    47.02197    51.849564   56.633743   71.945526
  51.301643   78.42591    59.949364   63.60362    63.11573    76.36619
  67.50949    45.796974   50.970108   47.325333   61.23971    63.442802
  50.42344    79.69373    74.15845    71.76153    68.22099    71.54631
  66.193275   40.53823    99.915924   46.70443    69.43073    58.646866
  38.666176   71.890335   81.905174   53.731487   70.28738    61.848656
  56.031654   27.037727   45.366203   39.681816   49.538773   41.79024
  36.120728   18.483051   34.527348   34.563736   36.919933   39.997803
  27.995497   44.87967    53.982346   19.453651   21.424091   26.136286
  22.720448   19.548307   44.905098   35.305817   24.130838   13.26565
  14.722732   20.85156    18.432291   44.930073   46.24465    43.317158
  25.71245    16.706652   20.909798   24.77006    20.677132   32.723568
  32.37201    15.095542   26.139425   12.046389   13.192694   15.13933
  15.4079895  41.649345   61.730183   63.94348    46.216827   11.494131
  14.018851   20.386786   17.64575    50.736443   46.847565   70.08035
  68.37741    26.166395 ]
Unique values in mld_04: [      nan 44.65589  42.84558  ... 60.065083 61.28432  29.450932]
Unique values in mld_05: [      nan 34.855434 27.71458  ... 60.870667 60.682606 21.377972]
Unique values in mld_06: [      nan 31.309702 31.371567 ... 20.30401  24.228731 12.53417 ]
Unique values in mld_07: [      nan 28.587702 20.42932  ... 10.161933 22.982924 10.586878]
Unique values in mld_08: [      nan 28.293474 21.498158 ... 11.352995 30.780376 10.42367 ]
Unique values in mld_09: [34.264526 28.403645 15.140156 ... 14.382504 37.82218  19.463236]
Unique values in mld_10: [32.723934 32.41229  19.495127 ... 26.024498 43.935303 38.688454]
Unique values in mld_11: [32.89129  40.468742 18.960192 ... 37.603374 47.111786 32.160187]
Unique values in mld_12: [35.58445  48.187347 35.324955 ... 46.18387  50.637802 27.500666]
```

In [10]:

```
df_mld.sample(5)
```

Out[10]:

	Lat	Long	Year	mld_09	mld_10	mld_11	mld_12	mld_01	mld_02	mld_04	mld_05	mld_06	mld_07	mld_0
2896	15.000000	-107.0000	2002	16.903954	16.984198	19.306920	21.439137	16.497860	23.557991	22.905160	18.071108	15.481211	20.696335	22.2675
7189	15.000000	-107.0000	2010	13.071715	10.950776	15.594679	16.348997	26.245897	18.353033	17.849016	17.438065	22.289875	13.407757	14.7816
22076	42.241817	-19.1961	2021	24.715183	34.133858	38.718925	53.666298	101.153350	84.525930	50.515840	25.594824	15.047014	13.807727	16.0873
14992	42.241817	-19.1961	1998	25.190685	32.255085	47.185516	69.096250	164.372300	102.731964	98.633650	24.717926	17.227640	13.716379	14.0148
24199	-67.189000	145.7210	2001	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	Na

In [11]:

```
for col in df_mld.columns:
    if 'mld' in col:
        print(f"Correlation between 'Cr_nmol/kg' and '{col}': {df_mld['Cr_nmol/kg'].corr(df_mld[col])}")
```

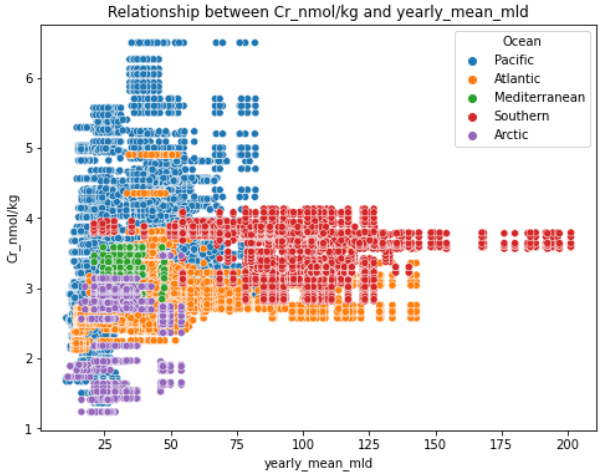
```
Correlation between 'Cr_nmol/kg' and 'mld_09': 0.18894732169041442
Correlation between 'Cr_nmol/kg' and 'mld_10': 0.1714894678008805
Correlation between 'Cr_nmol/kg' and 'mld_11': 0.10920656108655881
Correlation between 'Cr_nmol/kg' and 'mld_12': -0.00878505665673678
Correlation between 'Cr_nmol/kg' and 'mld_01': -0.06255206450950722
Correlation between 'Cr_nmol/kg' and 'mld_02': -0.036047074439683836
Correlation between 'Cr_nmol/kg' and 'mld_04': 0.06599786236657355
Correlation between 'Cr_nmol/kg' and 'mld_05': 0.17803507014595613
Correlation between 'Cr_nmol/kg' and 'mld_06': 0.20501011864004795
Correlation between 'Cr_nmol/kg' and 'mld_07': 0.19838237152518817
Correlation between 'Cr_nmol/kg' and 'mld_08': 0.192596327685962
Correlation between 'Cr_nmol/kg' and 'mld_03': -0.012898459732326674
Correlation between 'Cr_nmol/kg' and 'yearly_mean_mld': 0.15284549984126186
```

In [12]:

```
import seaborn as sns
import matplotlib.pyplot as plt

mld_cols = ['yearly_mean_mld']

for col in mld_cols:
    plt.figure(figsize=(8, 6))
    sns.scatterplot(data=df_mld, x=col, y='Cr_nmol/kg', hue='Ocean')
    plt.title(f'Relationship between Cr_nmol/kg and {col}')
    plt.show()
```


Relationship between Cr_nmol/kg and yearly_mean_mld
Ocean
Pacific
Atlantic
Mediterranean
Southern
Arctic
Cr_nmol/kg
yearly_mean_mld
1
2
3
4
5
6
25
50
75
100
125
150
175
200

In [ ]: