Exercise 1: Monitoring climate change

How can I print an exercise to PDF format?

Technical note

For this exercise, use the latest version of one of these browsers:

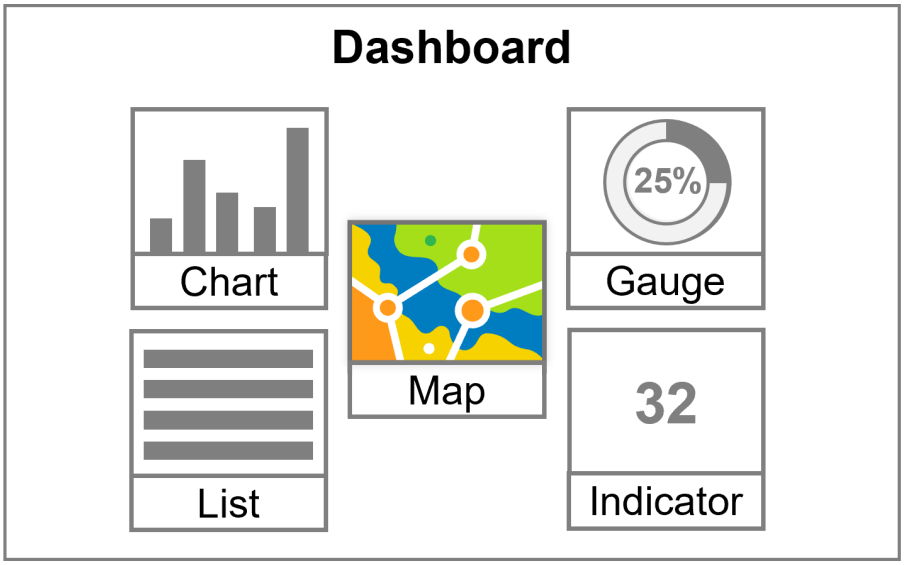
- Apple Safari
- Google Chrome
- Microsoft Edge
- Mozilla Firefox

This exercise was developed using Google Chrome. If you use a different web browser, your results might differ slightly from the results that are shown.

Introduction

One way that stakeholders and communities can take climate action is by monitoring real-time geographic information on climate-hazard risks or climate change in a specific area.

A dashboard created in ArcGIS Dashboards can be an effective tool for monitoring climate change. Dashboards present location-based analytics using interactive data visualizations that are easy to interpret. Dashboards include configurable elements that display the data in intuitive ways. The central element in most dashboards is a map, which gives geographic context to the location-based analytics. However, data can be displayed through many other types of dashboard elements, including charts, numeric indicators, gauges, and lists.



A dashboard consists of elements that display location data in intuitive ways. Examples of elements are maps, charts, indicators, gauges, and lists.

Creating a dashboard to monitor climate change has several key benefits:

- A dashboard can provide live climate information that can be used to make informed decisions based on current conditions.
- A dashboard can present analytical information for climate data using numbers, charts, and other data visualization techniques.
- A dashboard can empower communities by letting users slice data to better understand climate risks at various scales.

Scenario

Imagine the following scenario: You are an oceanographer who is monitoring global coral-bleaching events. You want to create a dashboard that can be used by communities around the world to better understand the impact of rising ocean temperatures on coral reefs. The dashboard will be powered by a dataset that is updated daily, so users will be able to monitor the real-time health of coral reefs. You will also configure interactive functionality for the dashboard so that the displayed analytics reflect the current map extent. This functionality will allow users to understand the health of coral reefs at local, regional, and global scales.

In this exercise, you will be recreating aspects of the Coral Bleaching Locations dashboard that you viewed in Section 1.

Note: The exercises in this course include View Result links. Click these links to confirm that your results match what is expected.

Estimated completion time in minutes: 75 to 100 minutes

Expand all steps | Collapse all steps

- Step 1: Prepare a web map for a dashboard

Web maps add geographic context and data, allowing dashboards to provide location-based analytics. Before being used to create a dashboard, a web map may require some preparation.

A web map displays geographic information through operational layers and a basemap. Operational layers provide interactivity to the map, such as enabling pop-ups that display when a feature is selected. The basemap shows reference information, such as administrative boundaries, landmarks, and topology. In a dashboard, web maps are used in two key ways:

- **To configure a map element.** When interpreting location-based analytics, you must understand the study area, or extent of the data. Web maps can be added to a dashboard as a map element to provide geographic context for the charts, lists, and other elements.
- **To provide data for elements.** A web map can be used as the data source for any element in the dashboard. By making a web map the data source for all the elements in a dashboard, you can configure data-driven actions that supply advanced interactivity. For example, you could set an action that would update the data displayed in a list, chart, and indicator to reflect the current map extent.

In this step, you will use Map Viewer to prepare a web map for a dashboard.

First, you will sign in to ArcGIS Online and find a feature layer that you can use to monitor the health of coral reefs. This feature layer will serve as the operational layer in your web map.

a In a web browser, go to www.arcgis.com.

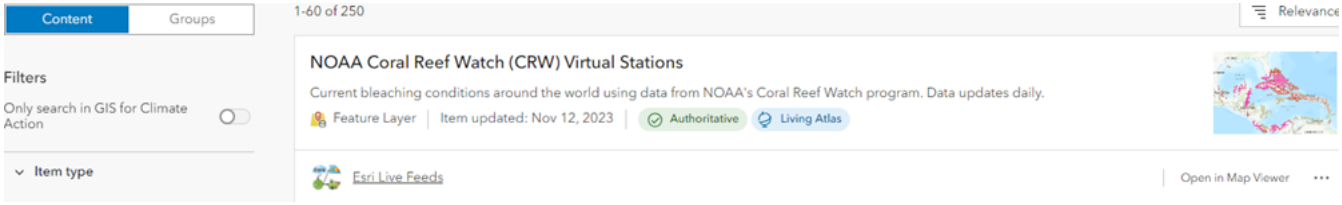
b Click Sign In.

c Under ArcGIS Login, type or copy and paste your course ArcGIS account username (ending in _CLIM) and password.

d Click Sign In.

e At the top of the page, click the Search button and, in the search field, type **NOAA Coral Reef Watch** and press Enter.

f On the Search page, under Filters, turn off the option to only search in your organization.



*Step 1f***: Prepare a web map for a dashboard.*

You will use Map Viewer to prepare your web map for a dashboard.

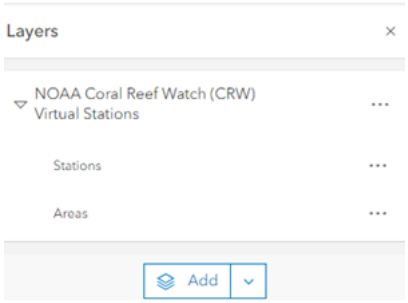
g In the search results, for the NOAA Coral Reef Watch (CRW) Virtual Stations feature layer owned by Esri Live Feeds, click Open In Map Viewer.

Map Viewer includes two vertical toolbars: the Contents (dark) toolbar on the left and the Settings (light) toolbar on the right. The Contents toolbar is used to manage and view the map content and work with the map. The Settings toolbar is used to access options for configuring and interacting with map layers and other map components.

The NOAA Coral Reef Watch (CRW) Virtual Stations feature layer contains points and polygons. The points in the map represent virtual stations where ocean temperature is being monitored. The temperature is collected daily at each virtual station using 5-kilometer resolution raster data from a satellite. The polygons in the map represent the coral reef areas that are associated with each virtual station.

Because the data in the web map will be used to configure the elements in your dashboard, you will review the attributes of the Station layer to ensure that you have the required fields.

h In the Layers pane, for NOAA Coral Reef Watch (CRW) Virtual Stations, click the Expand button to view the layers in this group.



*Step 1h***: Prepare a web map for a dashboard.*

i To the right of Stations, click the Options button and choose Show Table.

You will use two key fields in the attribute table to configure your dashboard:

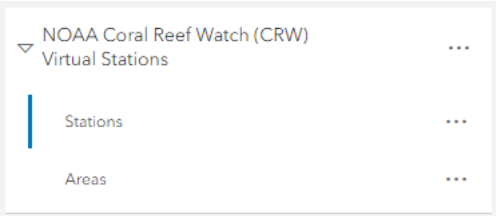
1. **Degree Heating Weeks,** which represents the heat stress that has accumulated at this location over the past 12 weeks.

2. **Alert Level,** which has five alert levels, ranging from 0 (no bleaching) to 4 (severe bleaching), and is calculated based on the HotSpots (number of degrees above coral's threshold tolerance), Surface Temp, and Degree Heating Weeks fields. The values in this field are defined as follows:
    - 0 = No Alert: No heat stress or bleaching present
    - 1 = Watch: Low-level heat stress is present
    - 2 = Warning: Heat stress is accumulating, which may lead to bleaching
    - 3 = Level 1: Significant coral bleaching due to heat stress is likely
    - 4 = Level 2: Severe bleaching and significant mortality is likely

j In the table, click the Close button ✕.

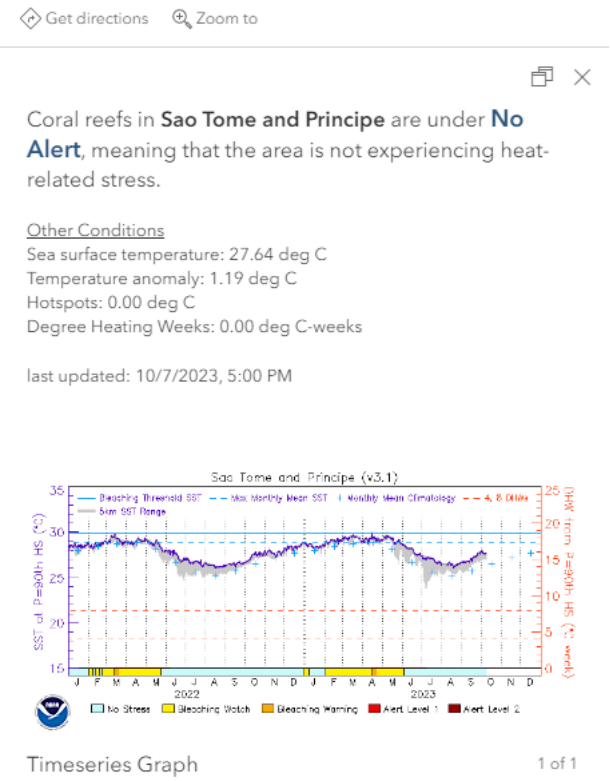
You will now configure pop-ups that will display detailed information and charts when users select a station in the map.

k In the Layers pane, verify that Stations is the active layer.



*Step 1k***: Prepare a web map for a dashboard.*

l On the Settings toolbar, click the Pop-ups button.



*Step 1l***: Prepare a web map for a dashboard.*

A preview of a customized pop-up is displayed in the map. This pop-up displays custom text populated by Arcade expressions and an image of a chart. In the Pop-ups pane, you will notice that the Enable Pop-ups option is turned on and that text and media have been configured. The owner of this feature layer has already customized the pop-ups in a manner that meets your dashboard needs, so you do not need to perform any additional configuration.

Note: Because the web map uses data from a live daily feed, the data that you see on your screen may differ slightly from the graphics in this exercise.

m Close the Pop-ups pane.

Next, you will update the basemap in your web map. You will choose a basemap with a dark theme to align with the desired visual aesthetic for your dashboard.

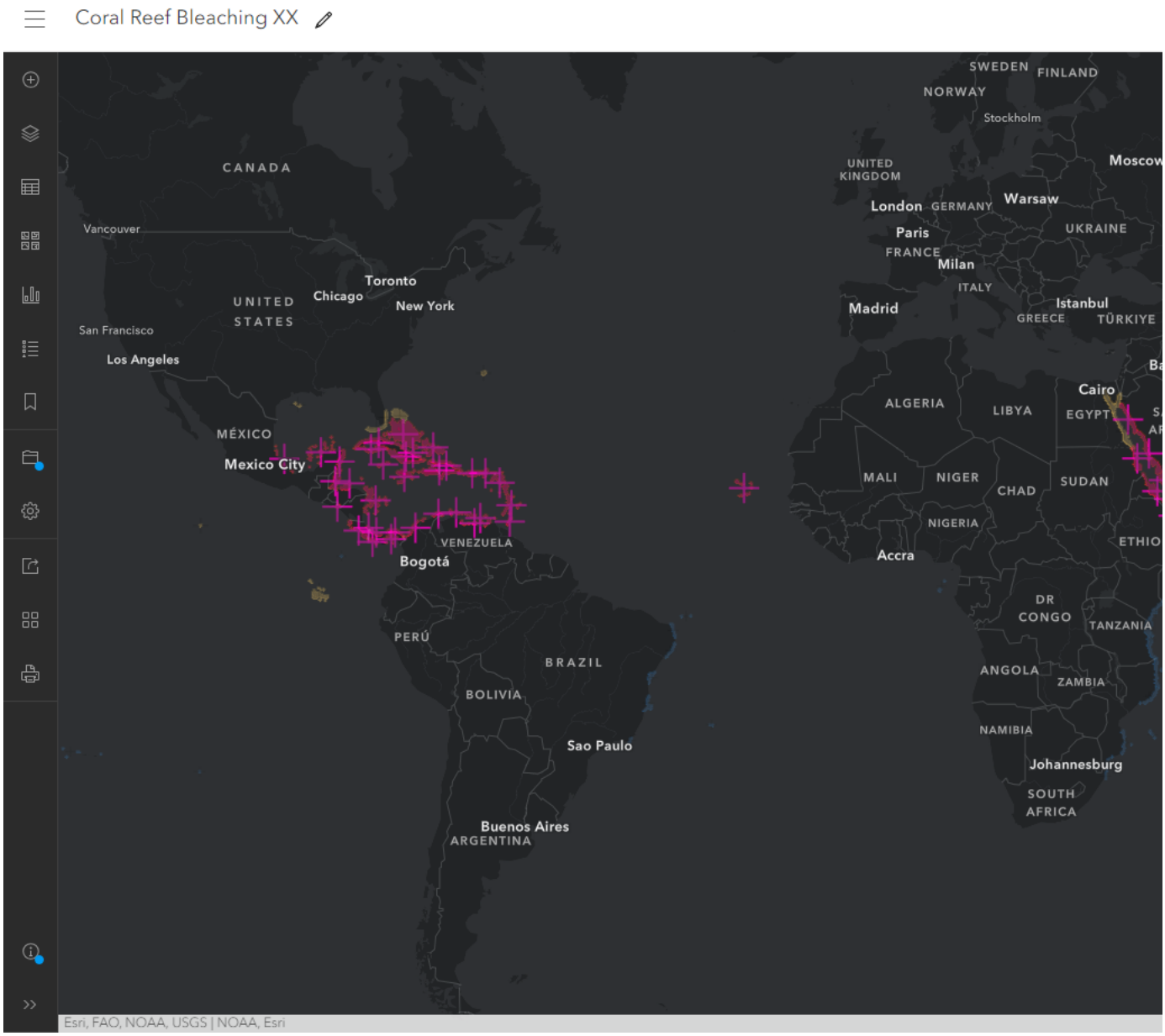
n On the Contents toolbar, click the Basemap button.

o Click Human Geography Dark Map to apply it to the map.

p Close the Basemap pane.

Finally, you will zoom in on the map to better display the data.

q Zoom in on the map so that the basemap fills the map view.



*Step 1q***: Prepare a web map for a dashboard.*

Now that you have configured the web map to be used in your dashboard, you will save the map.

r On the Contents toolbar, click the Save And Open button and choose Save As.

s In the Save Map dialog box, fill in the following information:

- Title: **Coral Reef Bleaching_<your first and last name>**
- Tags: **CLIM, Dashboard**

  - Hint

    Press Enter after typing Dashboard.

- Summary: **Current coral reef bleaching conditions around the world using data from NOAA's Coral Reef Watch program (Credits: NOAA, Esri).**

t Click Save.

You are now ready to use this web map in a dashboard.

- Step 2: Create a dashboard with a web map

Creating a dashboard from a web map in Map Viewer adds the web map to the dashboard as a map element, so you do not have to add the map element manually.

In this step, you will create a dashboard using your web map for the map element and as the data source for all the other dashboard elements.

a On the Contents toolbar, click the Create App button and choose Dashboards.

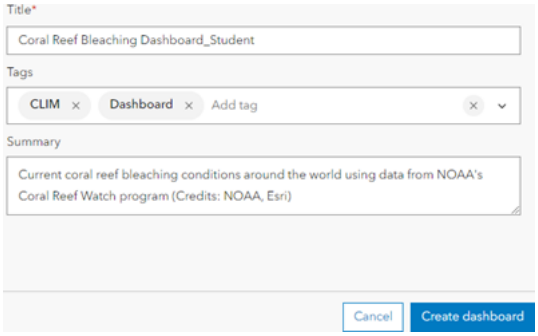
The Create New Dashboard page displays.

b For Title, type **Coral Reef Bleaching Dashboard _<your first and last name>**.

c For Tags, type the following tabs, pressing Tab or Enter after each:

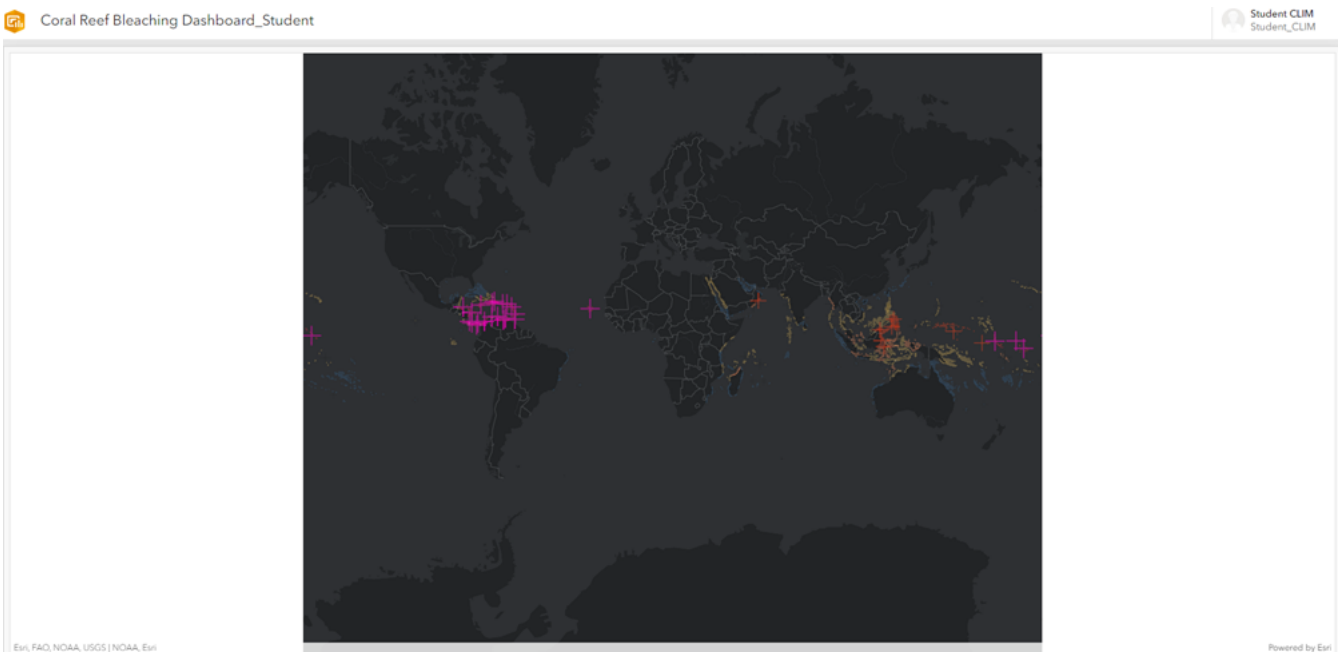
- **CLIM**
- **Dashboard**

d For Summary, accept the default text.



*Step 2d***: Create a dashboard with a web map.*

e Click Create Dashboard.



*Step 2e***: Create a dashboard with a web map.*

You will now set the theme for the dashboard. The theme should highlight the data and clearly convey the important information. For your coral-bleaching events dashboard, you will use a dark theme.

f On the Contents toolbar, click the Theme button .

g In the Theme pane, for Theme, click Dark.

Next, you will configure the Header to display the title for your dashboard.

h On the Contents toolbar, click the View button .

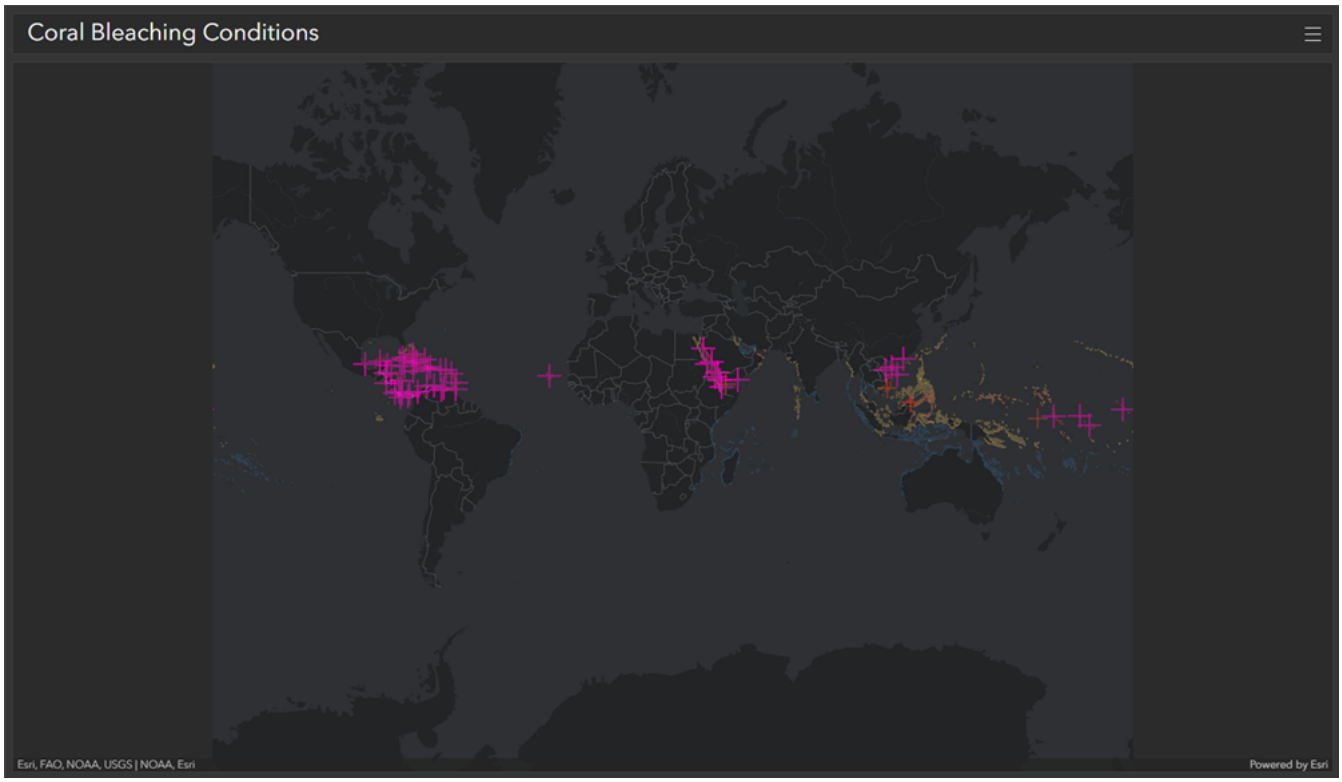
i In the View pane, click the Header tab.

j Click Add Header.

k In the Header window, for Title, type **Coral Bleaching Conditions**.

l At the bottom right of the window, click Done.

m On the Contents toolbar, click the Save button and choose Save.



*Step 2m***: Create a dashboard with a web map.*

You have created a dashboard using the web map that you configured.

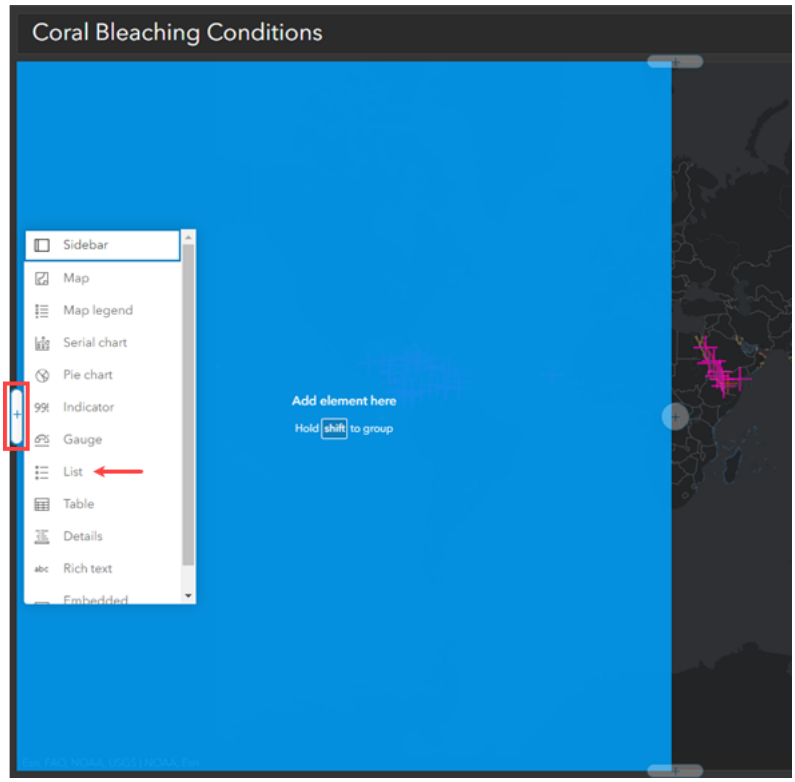
- Step 3: Add a list element

In a dashboard, list elements display a collection of features or rows from a data source.

In this step, you will add a list element to the dashboard to show the monitoring status at each virtual station (feature). The list will be sorted to show virtual stations with the highest accumulated heat stress at the top.

a On the Contents toolbar, click the Add Element button .

b Point to the map element and, on the left edge, click the Add button and choose List, as shown in the following graphic.



In the Select A Layer window, you will notice that you have three options for adding data:

- Layers from your web map
- Stand-alone layers, specifically feature layers in your organization
- Data expressions

In this case, you want all the elements in the dashboard to work together. For example, when users zoom in on the map, you want the list to update to show data only for the current extent. You also want users to be able to click an item in the list and see a pop-up in the map. These functionalities are referred to as "actions." Actions can only be configured between a map and other elements if their data source is the same.

c In the Select A Layer window, under Layers From 'Coral Reef Bleaching' Map, expand the NOAA Coral Reef Watch (CRW) Virtual Stations layer.

d Click Stations to select the layer.

The List dialog box opens, displaying the configuration options for the new element.

First, you will sort the list by Degree Heating Weeks, which represents accumulated heat stress. You want higher values, which represent the most heat stress, to display at the top of the list.

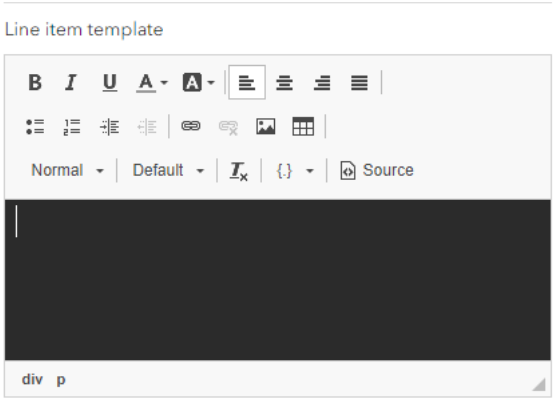
e For Sort By, click Add Field and choose Degree Heating Weeks.

f Click the Sort By button and choose Sort Descending.

Next, you will update the text in the list to dynamically show the monitoring status at each virtual station.

g On the left side of the List dialog box, click the List tab.

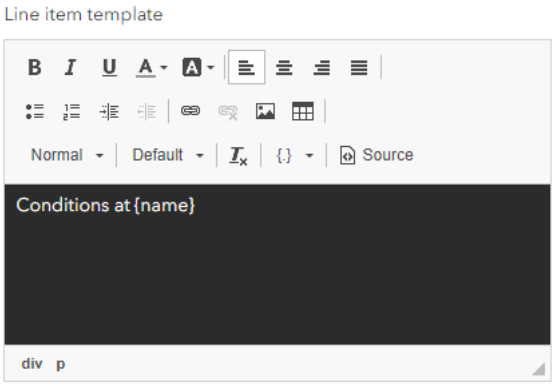
h Under Line Item Template, in the text editor box, delete {ObjectId}.



*Step 3h***: Add a list element.*

i In the text editor box, type **Conditions at**, and then press the Space bar.

j Click the Insert button {.} and choose Gauge Name.

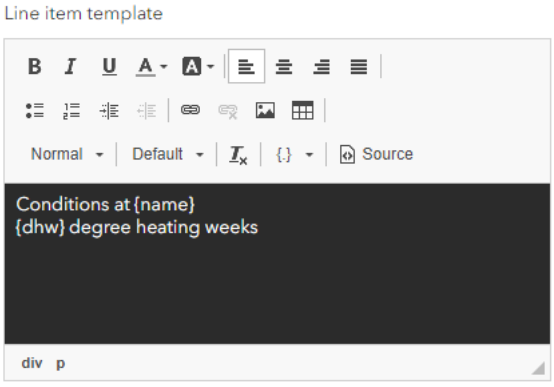


*Step 3j***: Add a list element.*

k Press Enter to add a line break.

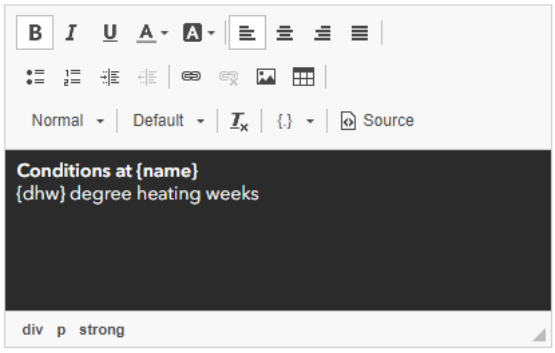
l Click the Insert button {.} and choose Degree Heating Weeks.

m Press the Space bar and type **degree heating weeks**.



*Step 3m***: Add a list element.*

n Highlight the text Conditions At {Name} and click the Bold button **B** .



*Step 3n***: Add a list element.*

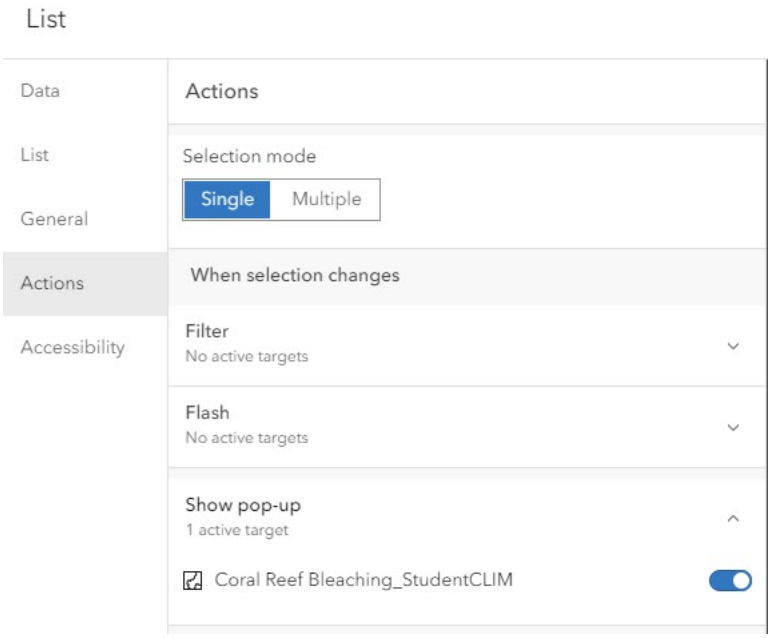
You have configured your list to show dynamic text.

o In the List Options pane, under Line Item Icon, click None to remove the symbols from the list.

You will now configure actions for the list so that users can select a virtual station in the list to open the pop-up in the map.

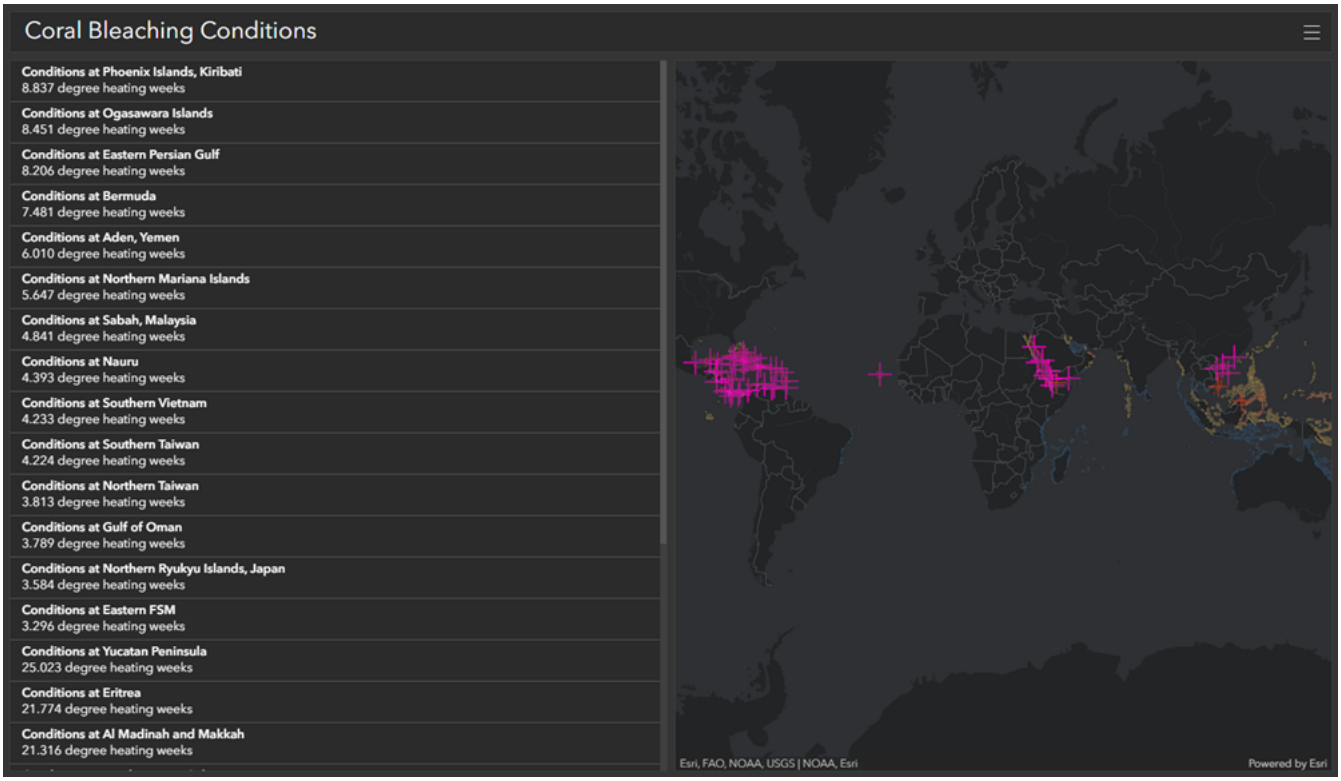
p Click the Actions tab to open the Action pane.

q In the Action pane, click Show Pop-Up to expand the section, and then turn on the Coral Reef Bleaching option.



*Step 3q***: Add a list element.*

r Click Done.

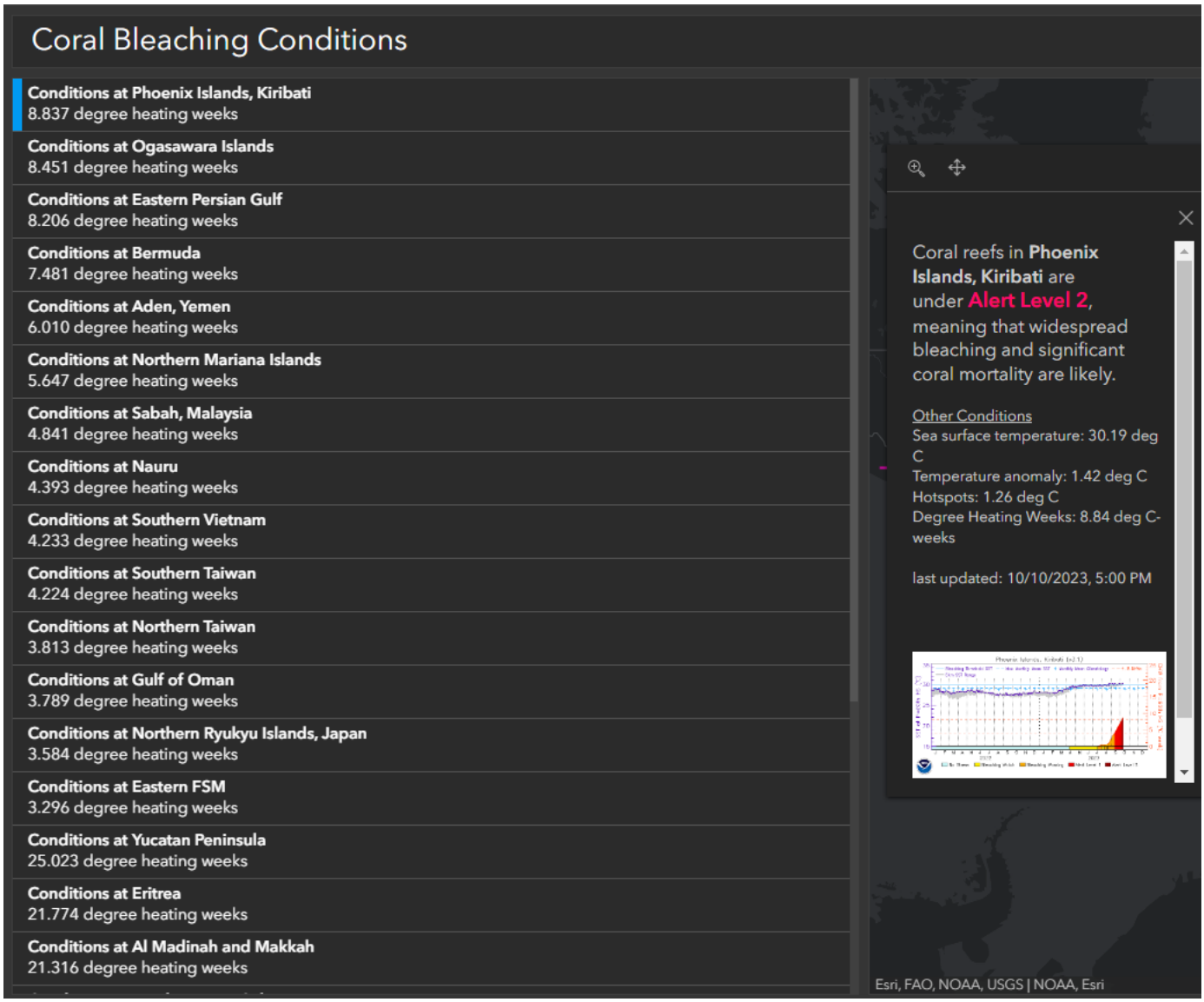


*Step 3r***: Add a list element.*

The list appears in your dashboard.

You will now test the configuration of the element by selecting an item in the list. This action should cause a pop-up to open in the map element.

s Click any item in the list.



*Step 3s***: Add a list element.*

A pop-up for the selected virtual station should appear in the map.

t Click the same item in the list to close the pop-up.

You have added a list element to your dashboard to display the monitoring status at each virtual station from most to least accumulated heat stress.

- Step 4: Add a serial chart element

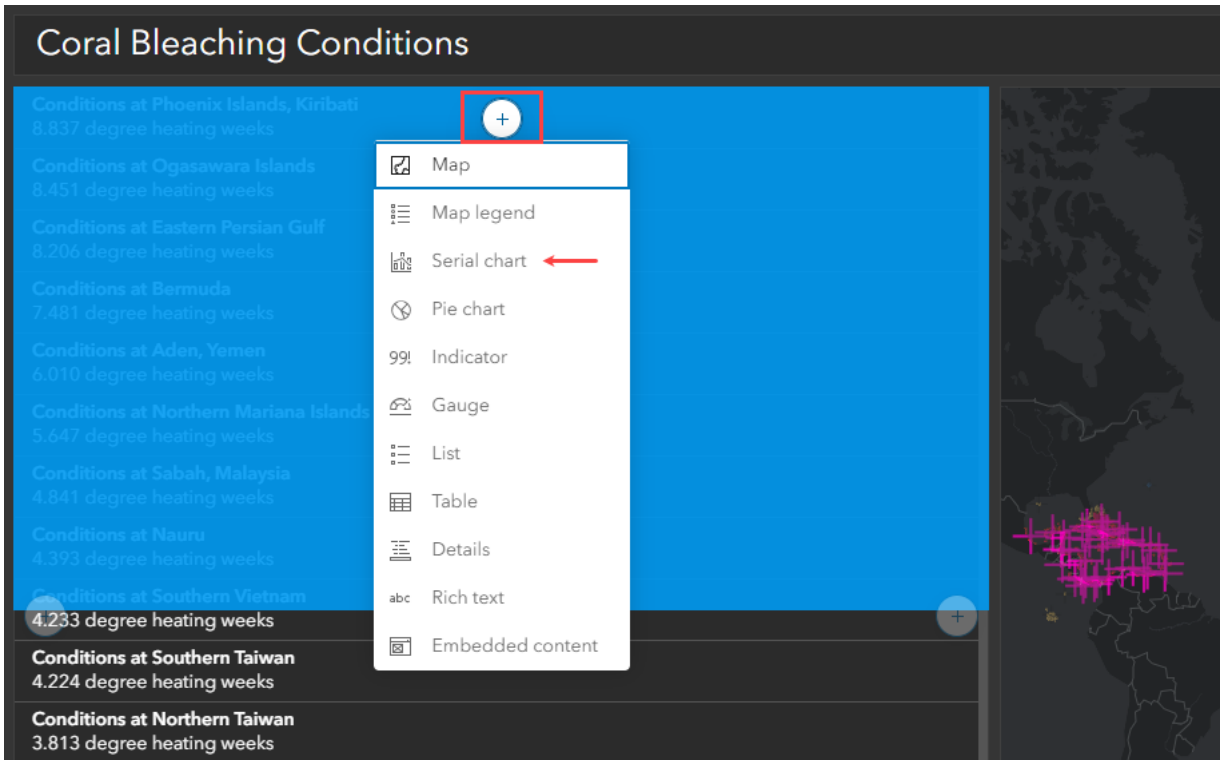
Serial chart elements are used to compare groupings of data, such as categories. The serial chart element in a dashboard can also be used to compare data over time.

In this step, you will add a serial chart to your dashboard to show the number of virtual stations by alert level. You will recall that the alert level is an index of the likelihood of coral bleaching, scaled from 0 (no bleaching) to 4 (severe bleaching).

a On the Contents toolbar, click the Add Element button.

b In the dashboard, point to the list.

c On top of the List element, click the Add button and choose Serial Chart, as shown in the following graphic.



Similar to the list element, you will select the Stations layer from the web map to provide the data for this element. Actions can be applied such that the serial chart is linked to other elements in the dashboard that share this dataset.

d Expand the NOAA Coral Reef Watch (CRW) Virtual Stations layer and click Stations.

The Serial Chart window opens, displaying the configuration options for the new element.

e In the Data Options pane, for Category Field, click the down arrow and choose Alert Level.

*Step 4e***: Add a serial chart element.*

In the preview, you will notice that the x-axis is labeled with coded values from 0 to 4. To make the chart easier to interpret, you will update the x-axis display to show descriptive labels for each alert level.

f On the left side of the window, click the Category Axis tab to open the Category Axis pane.

g For Title, type **Alert Level**.

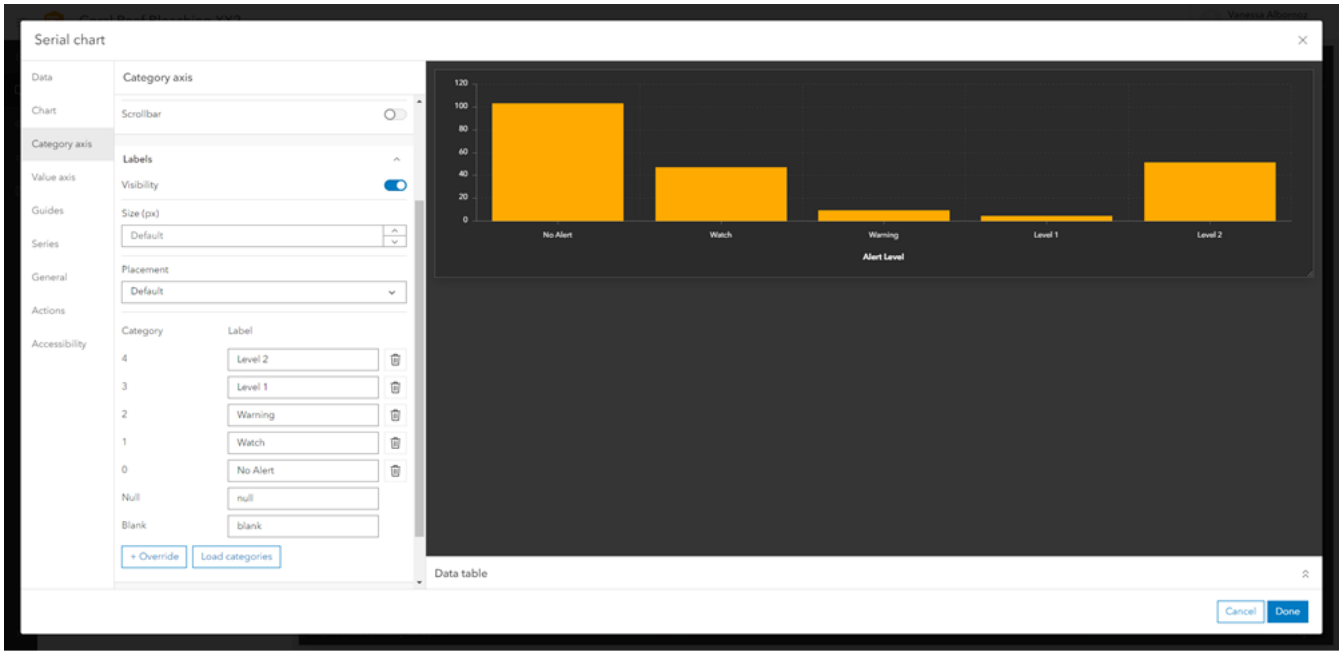
h Click Labels to expand the section.

i Click Load Categories, and then use the following table to update the Label column for each category.

Category	Label

4	Level 2
3	Level 1
2	Warning
1	Watch
0	No Alert

Note: The Null and Blank labels do NOT need to be changed.

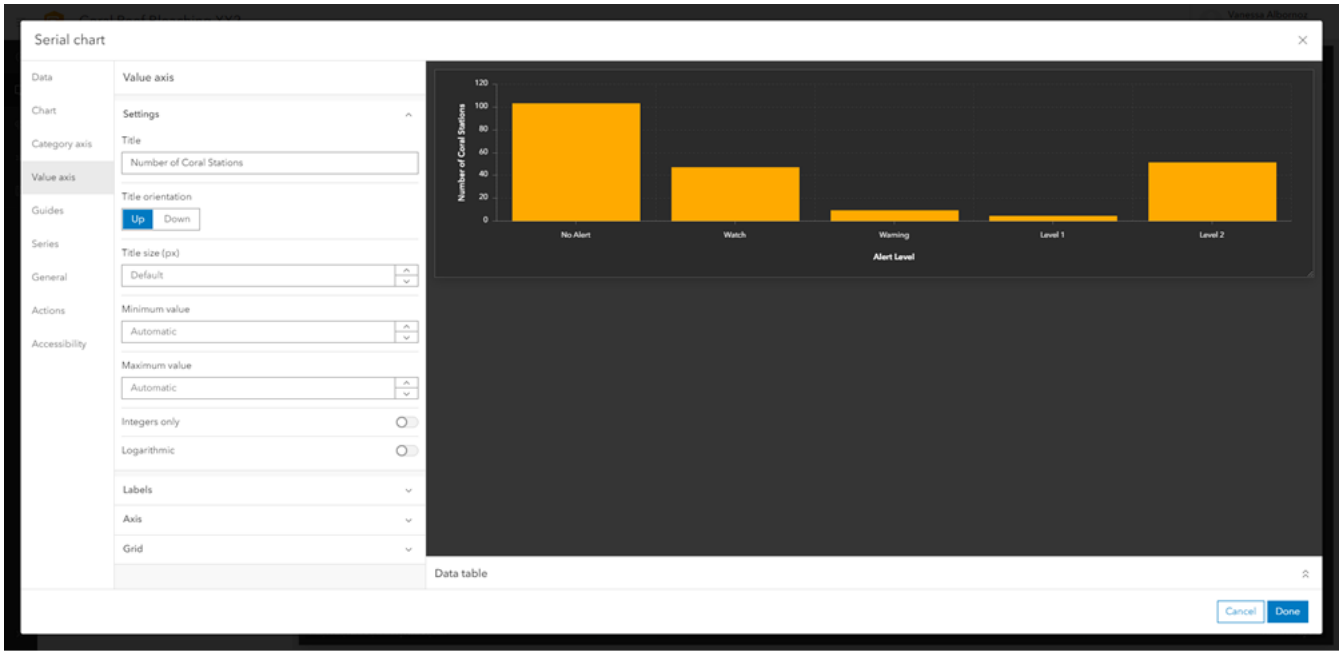


*Step 4i***: Add a serial chart element.*

Now that you have configured the x-axis labels, you will configure the y-axis labels.

j Click the Value Axis tab to open the Value Axis pane.

k For Title, type **Number of Coral Stations**.

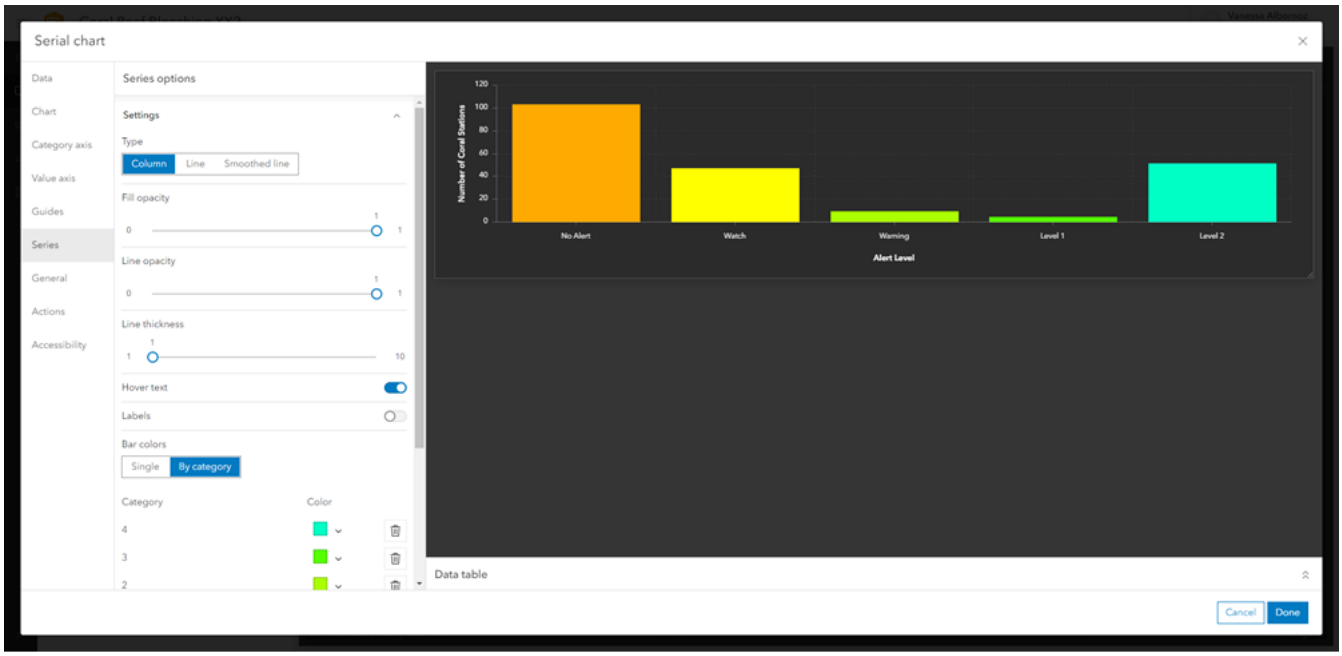


*Step 4k***: Add a serial chart element.*

Finally, you will change the colors of each bar in the series chart.

l Click the Series tab to open the Series pane.

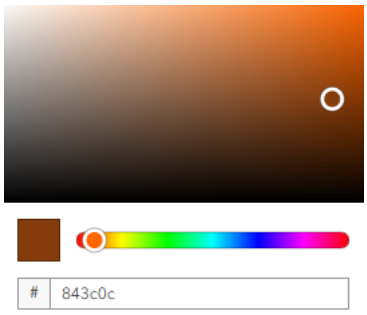
m For Bar Colors, click By Category.



*Step 4m***: Add a serial chart element.*

n For Category 4, click the Color symbol.

o For #, type **843C0C** and press Enter.



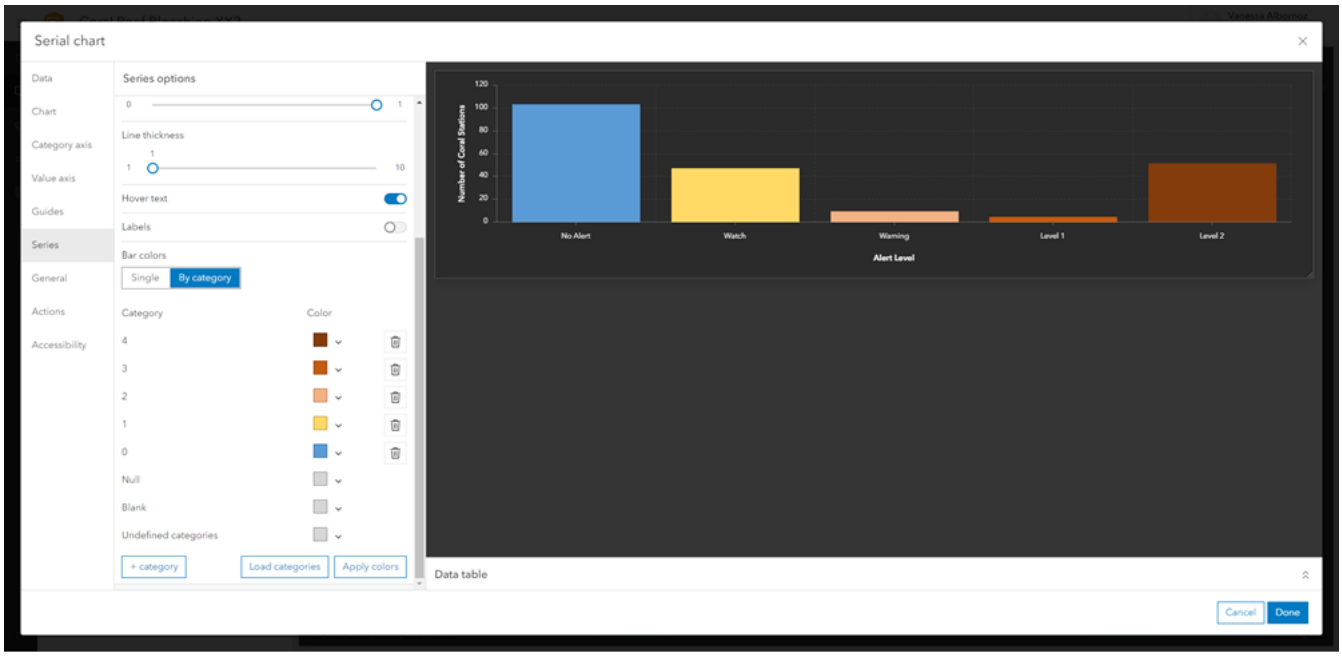
*Step 4o***: Add a serial chart element.*

p Using the same process and the following table, update the HEX code for the other four categories.

- Hint

  Remember to press Enter after typing the value to update the color.

Category	HEX code
3	C55A11
2	F4B183
1	FFD966
0	5B9BD5



*Step 4p***: Add a serial chart element.*

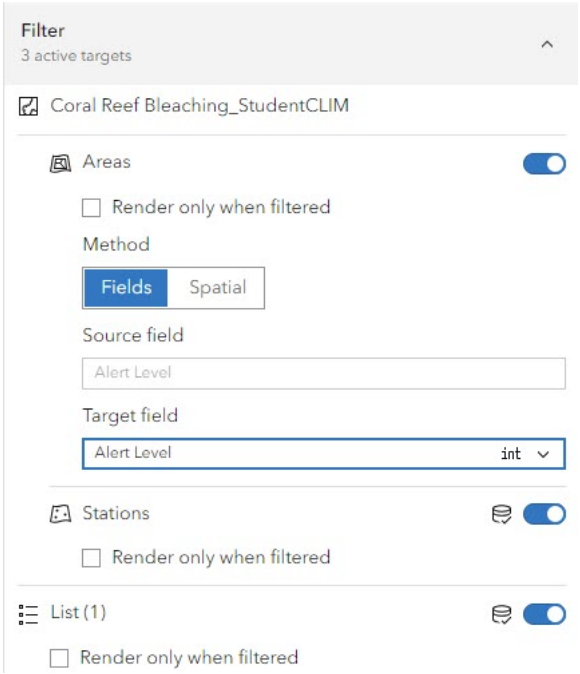
You will now configure an action so that when users click a bar in the chart, the map filters to show only the selected alert level.

q Click the Actions tab to open the Actions pane.

r On the Actions pane, click Filter to expand the section.

s Enable the filter option for Areas, Stations, and List (1).

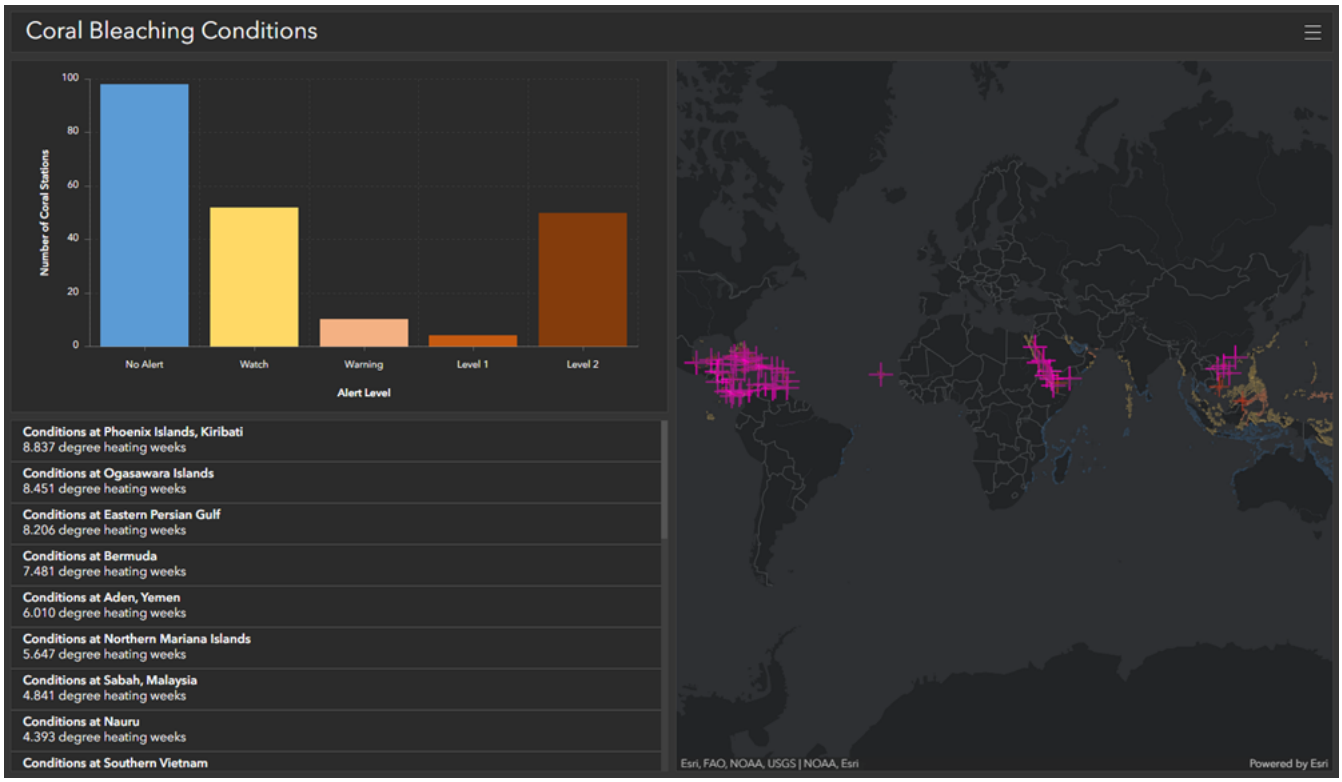
t Under Areas, for Target Field, choose Alert Level.



*Step 4t***: Add a serial chart element.*

For actions to work, the elements must share a data source or be mapped to the data source. The series chart element is populated by the Stations layer. Therefore, you do not need to map the data for the Stations layer in the map or the List element. However, the Areas layer in the map needs to be mapped to the Alert Level field in the Stations layer. In this case, the Areas layer also contains an Alert Level field, which is specified as the target field.

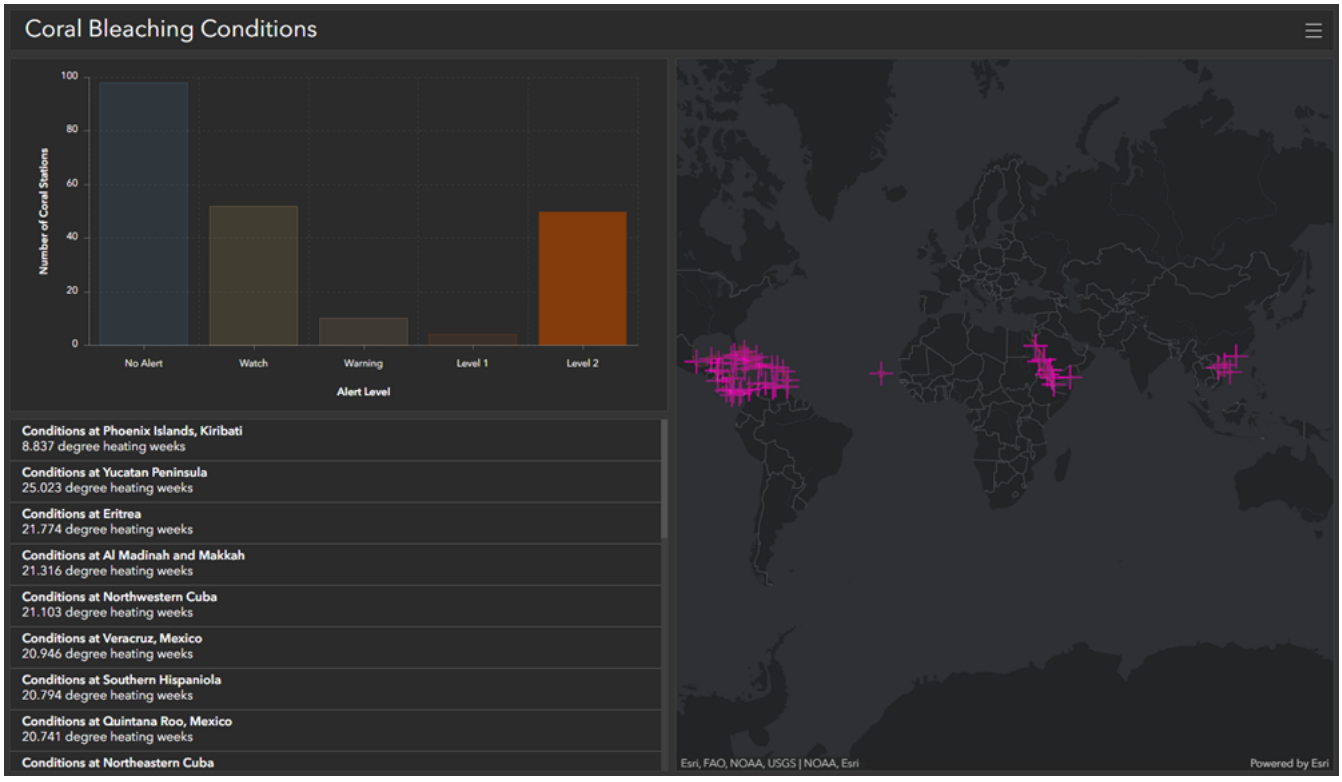
u Click Done.



*Step 4u***: Add a serial chart element.*

The serial chart element is added above the list element in the dashboard.

v In the chart, click the bar for Level 2 to filter the virtual station features and the areas associated with each station in the map.



*Step 4v***: Add a serial chart element.*

w Click the Level 2 bar again to remove the filter.

You have added a serial chart to the dashboard to show the number of virtual stations by alert level.

- Step 5: Add an indicator element

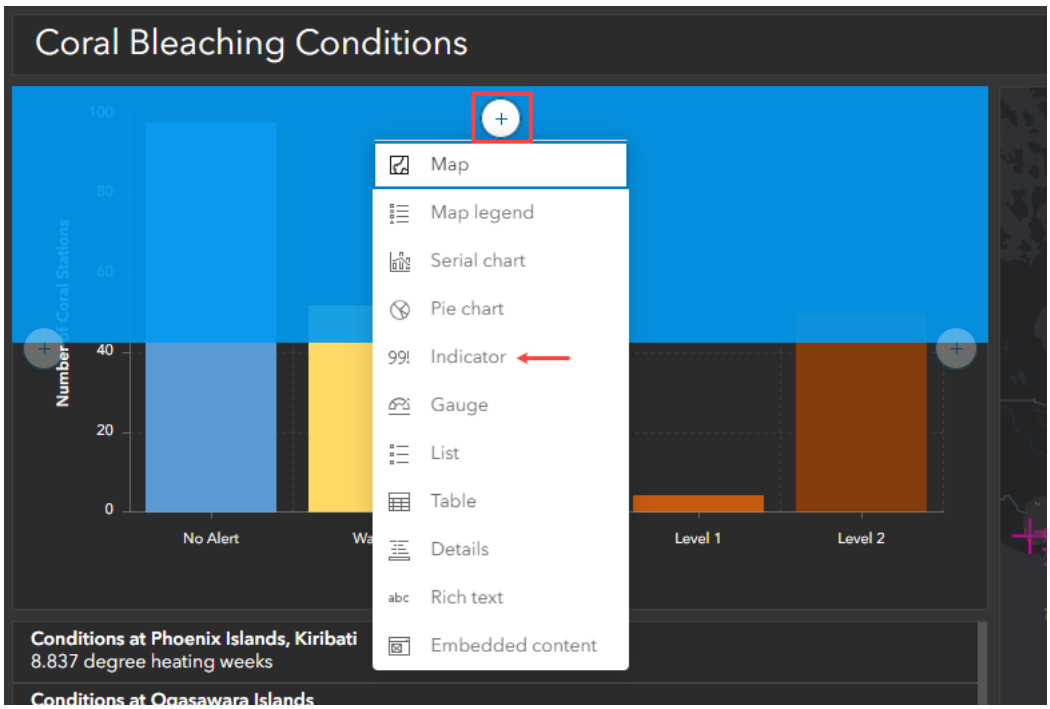
Indicator elements display dynamic summary statistics based on attribute fields in the data used for your dashboard.

In this step, you will add an indicator element to the dashboard to report the number of virtual stations showing that the coral reef is at risk of bleaching. To provide context for this statistic, you will include a reference number that shows the total number of virtual stations.

a On the Contents toolbar, click the Add Element button .

b In the dashboard, point to the chart.

c At the top of the chart element, click the Add button and choose Indicator.



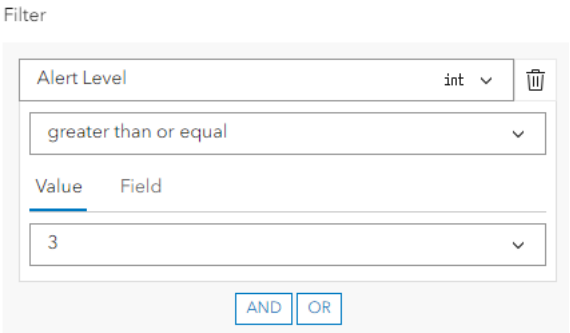
Similar to the serial chart and list elements, you will select the Stations layer from the web map to provide the data for this element. By selecting this dataset, the indicator can work with the other elements in the dashboard through actions.

d Expand the NOAA Coral Reef Watch (CRW) Virtual Stations layer, and then click Stations to select the layer.

You will configure the indicator to show the number of stations that have a Level 1 or 2 alert. You will use a filter to accomplish this task.

e In the Data Options pane, under Settings, click +Filter.

f Build the following expression: `Alert Level Greater Than Or Equal 3`.



*Step 5f***: Add an indicator element.*

g Under Statistic, verify the following parameters:

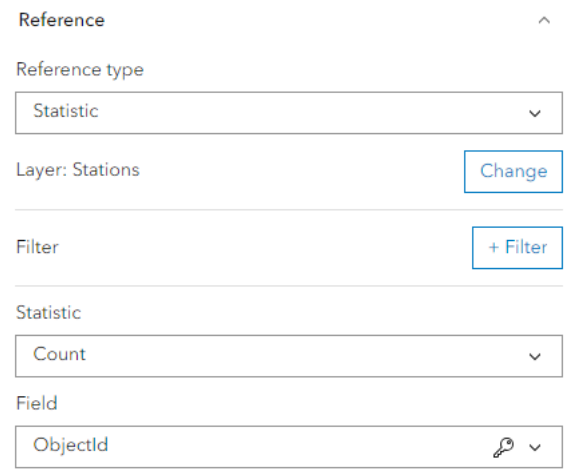
- Statistic: Count
- Field: ObjectId

The indicator now shows the count of virtual stations that have an alert level of 3 (Level 1) or 4 (Level 2).

Next, you will provide context for this value by adding the total count of virtual stations.

h Expand the Reference section.

i For Reference Type, choose Statistic.



*Step 5i***: Add an indicator element.*

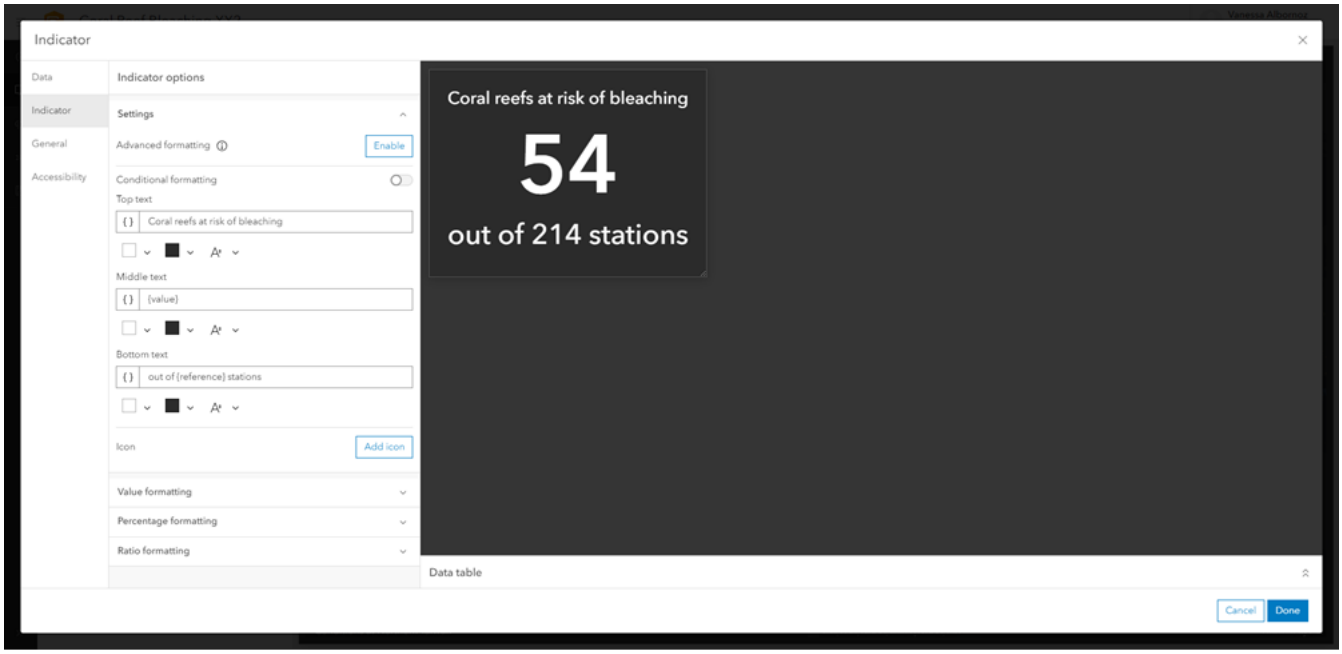
You will keep the default values for the reference statistic. No filter is applied to the reference value, so a count of all the virtual stations will be returned.

Next, you will add text to the indicator to provide context for the values.

j Click the Indicator tab to open the Indicator Options pane.

k In the Indicator Options pane, for Top Text, type **Coral reefs at risk of bleaching**.

l For Bottom Text, type **out of {reference} stations**.



*Step 5l***: Add an indicator element.*

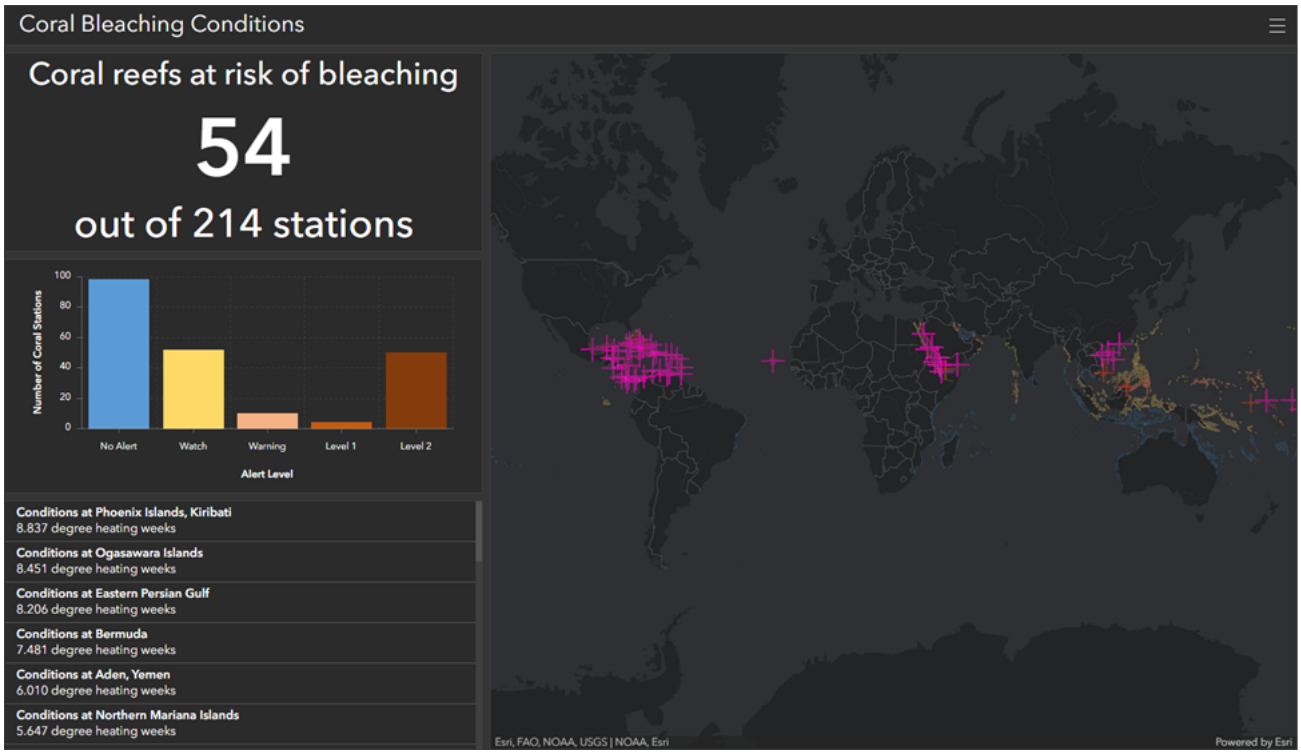
Because the indicator provides information about the data using dynamic text, users cannot interact with this element. However, in the next step of this exercise, you will configure actions to dynamically update the values in this element based on the current map extent set by the user.

m Click Done.

n Resize the dashboard sections to align with the following graphic.

- Hint

  In the dashboard, place your mouse over the section dividers to show the resize arrows that you can use to drag and adjust the size of the dashboard sections.



You have added an indicator element to the dashboard that reports the number of virtual stations showing coral reef at risk of bleaching.

- Step 6: Configure map actions

So far in this exercise, you have added list, serial chart, and indicator elements to a dashboard. When you added these elements, you configured actions so that the map view will update when users interact with the elements. You can also configure actions for the map so that interactions with the map update the other elements in the dashboard.

In this step, you will configure map actions to only show data based on the map's extent for the elements that you added to your dashboard. This functionality will help local communities monitor coral reef risk for their area of interest.

a If necessary, click the View button to open the View pane.

b In the View pane, click the Body tab.

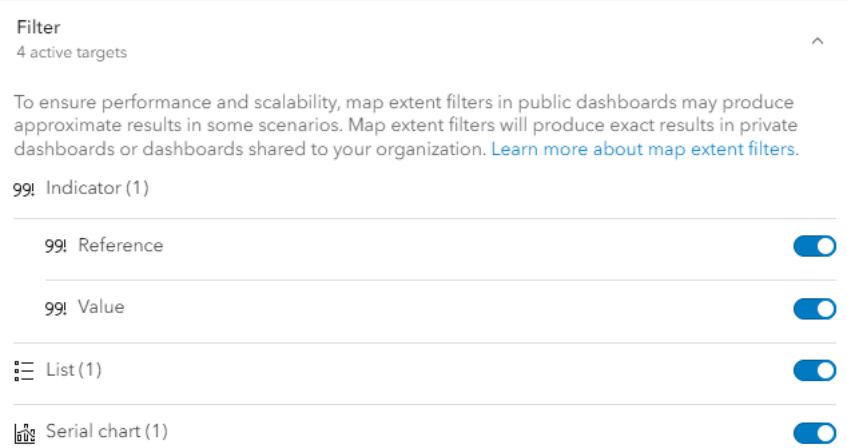
c Point to Coral Reef Bleaching, click the Options button, and choose Configure.

d In the Map dialog box, on the left, click the Map Actions tab.

e Expand the Filter section.

f Turn on the filter option for the following elements:

- Indicator (1): Reference
- Indicator (1): Value
- List
- Serial Chart



*Step 6f***: Configure map actions.*

g Click Done.

You have configured map actions to show data in your elements based on the map's extent.

h On the Contents toolbar, click the Save button and choose Save.

- Step 7: Use the dashboard to monitor climate change

You have finished creating your dashboard and want to test the map actions and elements by viewing the dashboard from the perspective of an end user.

In this step, you will use your dashboard to monitor climate change by answering questions.

a At the top left of the page, click the Menu button and choose Dashboards.

b On the ArcGIS Dashboards landing page, point to the thumbnail for Coral Reef Bleaching Dashboard and click Open.

c In the map view, zoom to an area with coral reefs that is near your community or that particularly interests you.

You will notice that the indicator, chart, and list update when you zoom to the area of interest because of the map actions that you configured.

d Click the Level 2 bar in the serial chart to show only virtual stations and their associated areas with a Level 2 alert status.

- Hint

  If there are no Level 2 alerts in the area, filter by the next highest alert.

You will notice that the indicator values do not change because the chart was only configured to filter the map layers and list.

e At your current map extent, answer the following questions.

? How many virtual stations indicate that the coral reef is at risk of bleaching?

- Answer

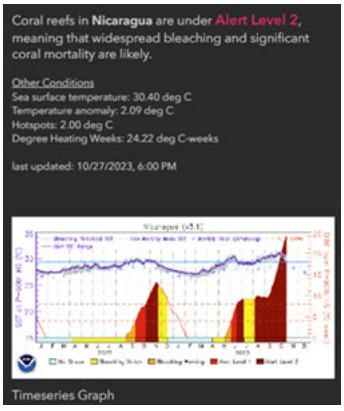
Answers will vary based on the map extent. In the following example, nine virtual stations indicate that the coral reef is at risk of bleaching.

f From the list, click the first location to open its pop-up.

? According to the pop-up, what is the sea surface temperature for the location.

- Answer

Answers will vary based on the map extent. In the following example, the sea surface temperature for the location is 30.40°C (86.72°F).



In this exercise, you created a dashboard that offers the following benefits:

- Live coral reef bleaching risk data that can be used to make informed decisions based on current conditions.
- Location-based analytics with an interactive map, a list, a chart, and an indicator that are all easy to interpret.
- Functionality that allows data to be sliced (through actions) to get specific answers and help empower communities.

g After you are finished, close all web browser tabs.