



ReefWhisper

Shiny App User Guide

ReefWhisper Home Page

The sidebar on the left contains the following navigation items:

- ReefWhisper (with a soundwave icon)
- Home (highlighted with a pink background)
- Team
- Proposal
- Storyboard
- Data Preparation
- ShinyApp >

VAST Challenge 2025 - Mini Challenge 3

Over the past decade, the community of Oceanus has faced numerous transformations and challenges evolving from its fishing-centric origins. Following major crackdowns on illegal fishing activities, suspects have shifted investments into more regulated sectors such as the ocean tourism industry, resulting in growing tensions. This increased tourism has recently attracted the likes of international pop star Sailor Shift, who announced plans to film a music video on the island.

Clepper Jessen, a former analyst at FishEye and now a seasoned journalist for the Hacklee Herald, has been keenly observing these rising tensions. Recently, he turned his attention towards the temporary closure of Nemo Reef. By listening to radio communications and utilizing his investigative tools, Clepper uncovered a complex web of expedited approvals and secretive logistics. These efforts revealed a story involving high-level Oceanus officials, Sailor Shift's team, local influential families, and local conservationist group The Green Guardians, pointing towards a story of corruption and manipulation.

This project aims to develop new and novel visualizations and visual analytics approaches to help Clepper get to the bottom of this story.



This page introduces the VAST Challenge 2025 - Mini Challenge 3 and sets the context:

🎥 Embedded Video

- Watch a short intro video highlighting the environmental stakes and urgency

🧭 What to Do Next

Use the sidebar to explore:

- Team – Key players
- Proposal – Investigation plan
- Storyboard – Timeline of events
- Data Preparation – Message cleaning
- ShinyApp – Interactive analysis

Data Preparation

The sidebar on the left shows a dark theme with white text. At the top is the 'ReefWhisper' logo with a soundwave icon. Below it are several navigation items: 'Home', 'Team', 'Proposal', 'Storyboard', 'Data Preparation' (which is highlighted with a pink background), and 'ShinyApp'. A small 'ShinyApp' icon is next to the 'ShinyApp' text.

Data Preparation

AUTHOR
ReefWhispers Team

PUBLISHED
June 29, 2025

MODIFIED
July 4, 2025

On this page
1 Analytical Toolkit:
RStudio
2 Data

1 Analytical Toolkit: RStudio

RStudio and Quarto are used as the primary analytical tools for this challenge. The data will be analyzed and visualized using the `tidyverse` suite and advanced network visualization packages to explore the knowledge graph and temporal communication dynamics.

Install `pacman` package

Before we get started, it is important for us to ensure that the required R packages have been installed. If you have yet to install `pacman`, install it by typing below in the Console:

▶ Code

We then load the following R packages using the `pacman::p_load()` function:

▶ Code

2 Data

The core dataset is a knowledge graph derived from radio communications intercepted over a two-week period on Oceanus. Each node in the graph represents an entity such as a person, vessel, pseudonym, or organization. Edges represent interactions or co-occurrences in communications. Edge attributes include timestamp, topic, message type, and possible pseudonym use.

Supplementary information from the story given on the Mini Challenge page includes:

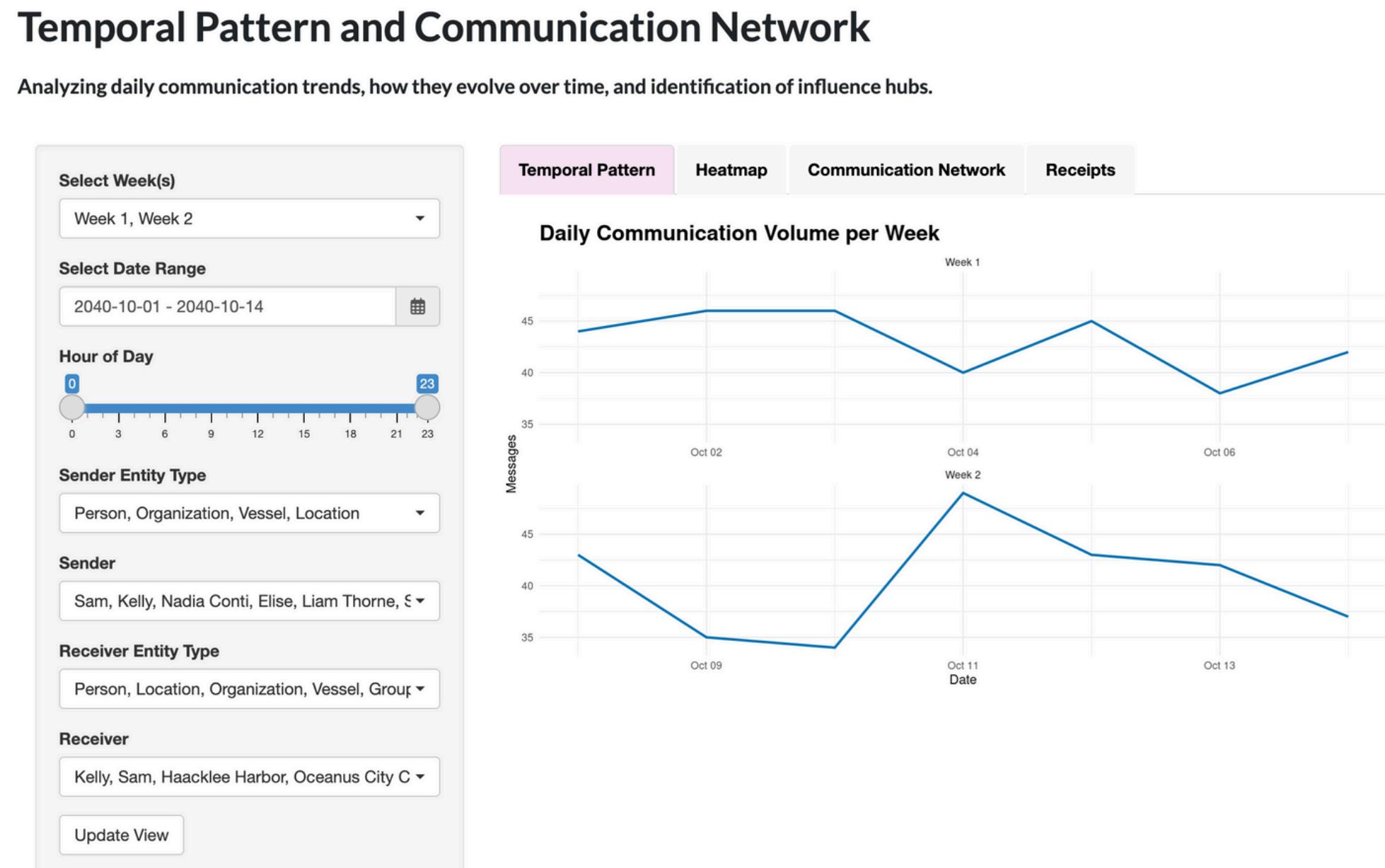
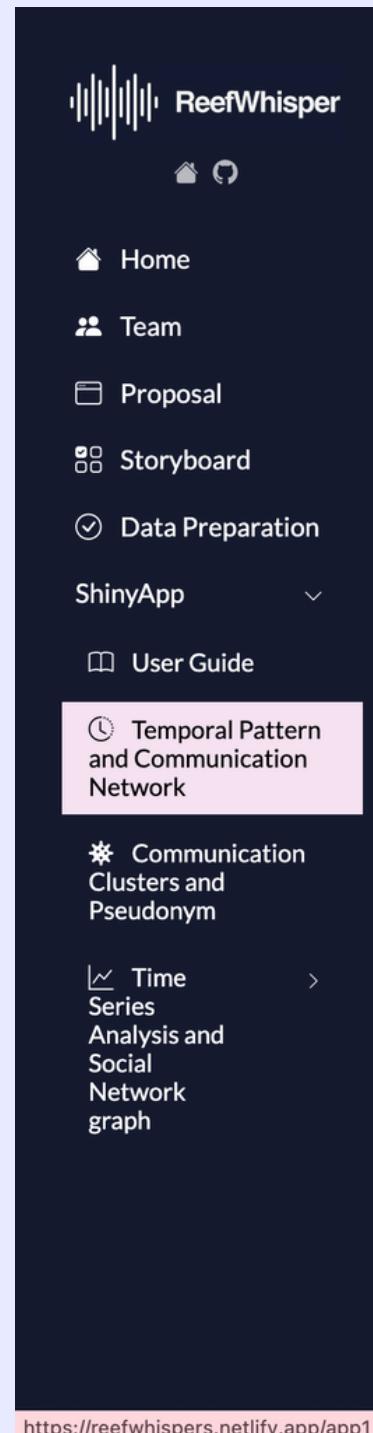
- Entity roles and affiliations (e.g., Green Guardians, Sailor Shift's crew).

<https://reefwhispers.netlify.app/dataprep>

This page provides the step-by-step data cleaning process to prepare the dataset for analysis

Temporal Pattern and Communication Network

Temporal Patterns

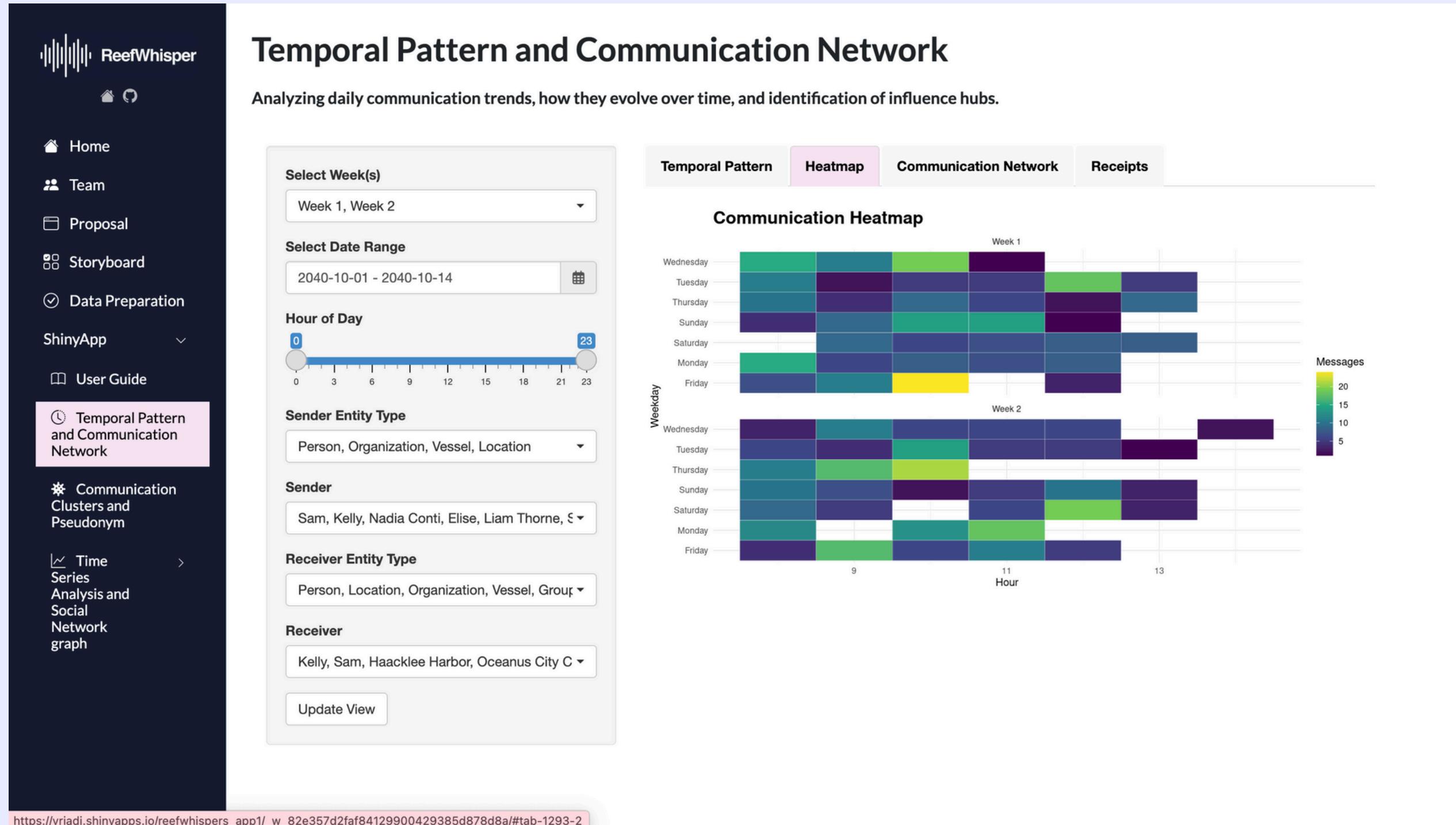


This page analyzes daily communication patterns, explore time-based trends, and identify influential senders/receivers.

Filters:

- Week Selector – Choose one or more weeks (e.g., Week 1, Week 2)
 - Date Range – Manually select custom dates
 - Hour of Day Slider – Filter messages by time of day (0–23)
 - Sender/Receiver Entity Type – Filter by type (e.g., Person, Organization, Vessel, Location)
 - Sender / Receiver – Select individuals or groups involved in communication
- Click other sub-tabs switch
- Click "Update View" after adjusting filters to refresh results.

Temporal Pattern and Communication Network Heatmap



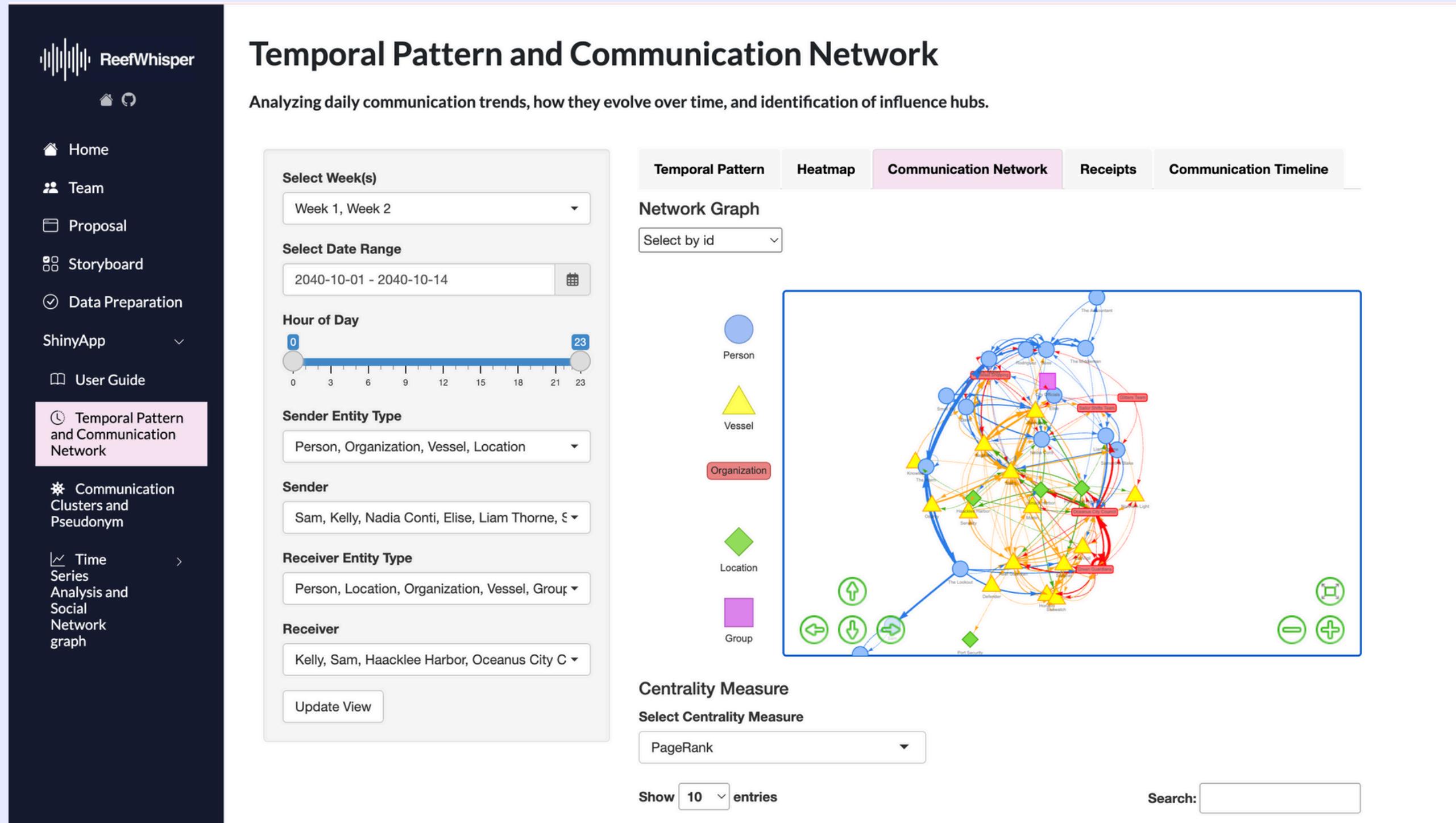
This page analyzes daily communication patterns, explores time-based trends, and identifies influential senders/receivers.

Filters (same as previous tab):

- Week(s), Date Range, Hour of Day
 - Sender & Receiver Entity Types
 - Specific individuals/locations/orgs involved
- Click other sub-tabs switch
- Click "Update View" after adjusting filters to refresh results.

Temporal Pattern and Communication Network

Communication Network (Part 1)



This page visualizes who is talking to whom. Detect key influencers, dense clusters, and isolated groups based on communication flow.

Filters (same as previous tab):

- Week(s), Date Range, Hour of Day
- Sender & Receiver Entity Types
- Specific individuals/locations/orgs involved

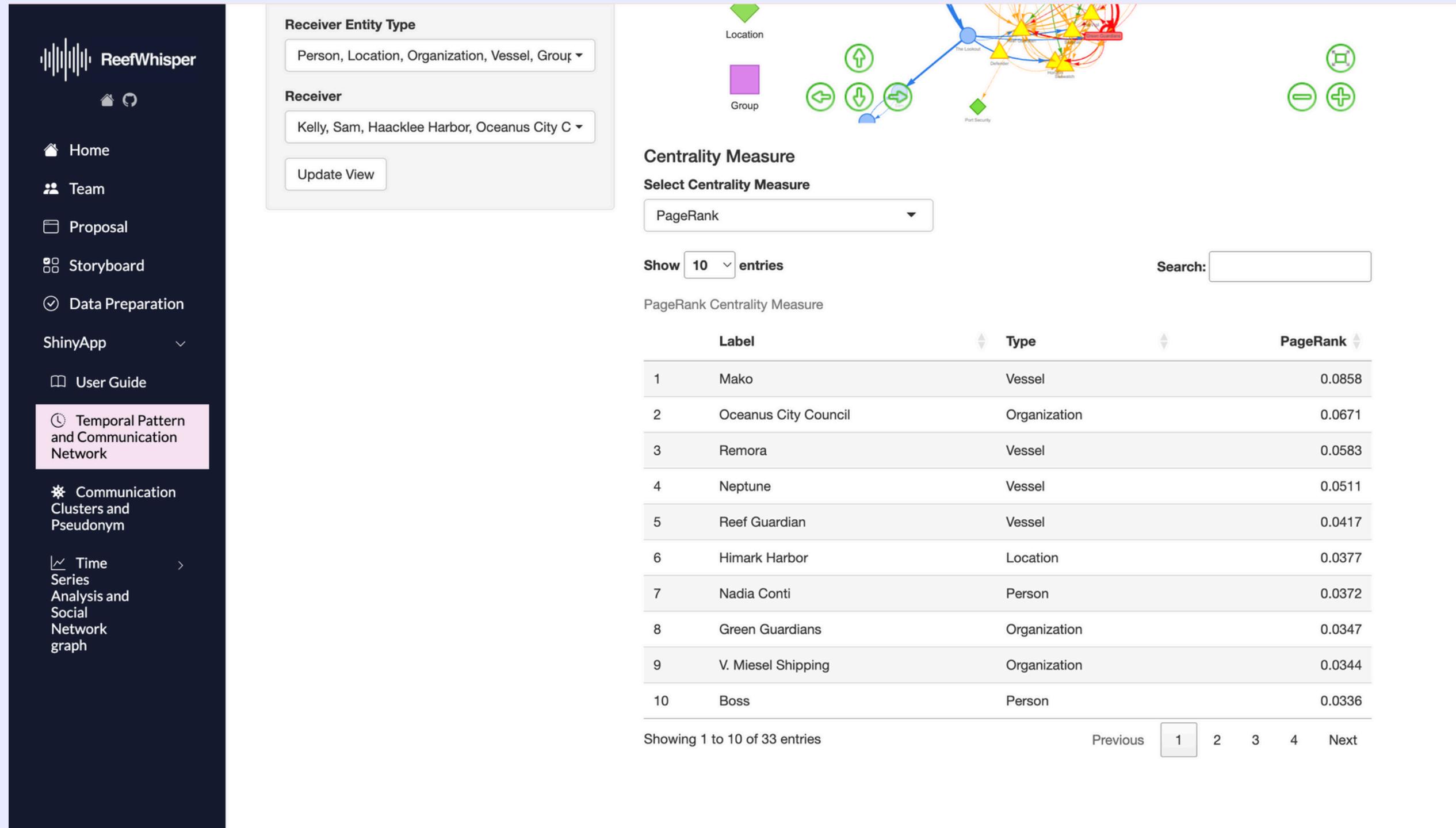
Network Visualization:

- Nodes = entities (people, orgs, vessels, locations)
- Edges = messages sent between them
- Node size = likely reflects activity or centrality
- Color = indicates group membership or role
- Controls: Zoom, drag, pan, and center options

Hover over nodes for ID; use dropdown to highlight specific ones.

Temporal Pattern and Communication Network

Communication Network (Part 2)



This page analyzes which nodes are most central in the communication network, helping identify influence hubs, active messengers, or information bridges.

Centrality Measure Table

- Choose from centrality types (e.g., PageRank, Degree, Betweenness...)
- Table shows:
 - Label: Entity name
 - Type: Vessel, Organization, Person, etc.
 - PageRank Score: Higher = more influential or connected
- You can search, sort, and paginate results
- Helps you understand who holds influence in the network

Temporal Pattern and Communication Network

Receipts (Message Viewer)

ReefWhisper

- Home
- Team
- Proposal
- Storyboard
- Data Preparation
- ShinyApp
 - Temporal Pattern and Communication Network
- User Guide

Communication Clusters and Pseudonym

Time Series Analysis and Social Network graph

https://vriadi.shinyapps.io/reefwhispers_app1/_w_82e357d2faf84129900429385d878d8a/#tab-1293-4

Temporal Pattern and Communication Network

Analyzing daily communication trends, how they evolve over time, and identification of influence hubs.

Select Week(s): Week 1, Week 2

Select Date Range: 2040-10-01 - 2040-10-14

Hour of Day: 0 to 23

Sender Entity Type: Person, Organization, Vessel, Location

Sender: Sam, Kelly, Nadia Conti, Elise, Liam Thorne, S

Receiver Entity Type: Person, Location, Organization, Vessel, Group

Receiver: Kelly, Sam, Haacklee Harbor, Oceanus City C

Update View

Temporal Pattern | Heatmap | Communication Network | Receipts

Show 10 entries | Search:

	sender	message_id	type.x	receiver	type.y	timestamp	content
1	Sam	Event_Communication_370	sent	Kelly	received	2040-10-05T10:48:00Z	Hey Kelly, it's Sam. This permit approval seems fishy. Could you get details on who signed off on it while you're at the harbor? I need to understand these 'special access corridors' before my meeting with Elise tomorrow.
2	Kelly	Event_Communication_3	sent	Sam	received	2040-10-01T08:13:00Z	Sam, it's Kelly! Let's meet at Sunrise Point at 7 AM for birdwatching. Bring your new binoculars and some water. I've heard there might be some

This page reads detailed sender-receiver communications tied to specific dates and times

Displayed Columns

- Sender / Receiver – Who sent and who received
- Message ID – Unique identifier
- Type (x/y) – 'sent' and 'received' tags
- Timestamp – Date & time of message
- Content – Full text of the message

Features

- Search bar – Quickly filter by name or keyword
- Entries dropdown – Choose how many rows to display
- Scroll through to read full conversations
- Filter by date, hour, entity type (left panel)

💡 Useful for reconstructing specific events or building a timeline of suspicious exchanges.

Temporal Pattern and Communication Network

Receipts (Message Viewer)

ReefWhisper

Home Team Proposal Storyboard Data Preparation ShinyApp User Guide Temporal Pattern and Communication Network Communication Clusters and Pseudonym Time Series Analysis and Social Network graph

Temporal Pattern and Communication Network

Analyzing daily communication trends, how they evolve over time, and identification of influence hubs.

Select Week(s): Week 1, Week 2

Select Date Range: 2040-10-01 - 2040-10-14

Hour of Day: 0 to 23

Sender Entity Type: Person, Organization, Vessel, Location

Sender: Sam, Kelly, Nadia Conti, Elise, Liam Thorne, &

Receiver Entity Type: Person, Location, Organization, Vessel, Group

Receiver: Kelly, Sam, Haackle Harbor, Oceanus City C

Update View

Temporal Pattern Heatmap Communication Network Receipts **Communication Timeline**

Friday, October 05 2040, 00:00

Monday, October 01 2040, 00:00

Sunday, October 07 2040, 00:00

Friday, October 05 2040,

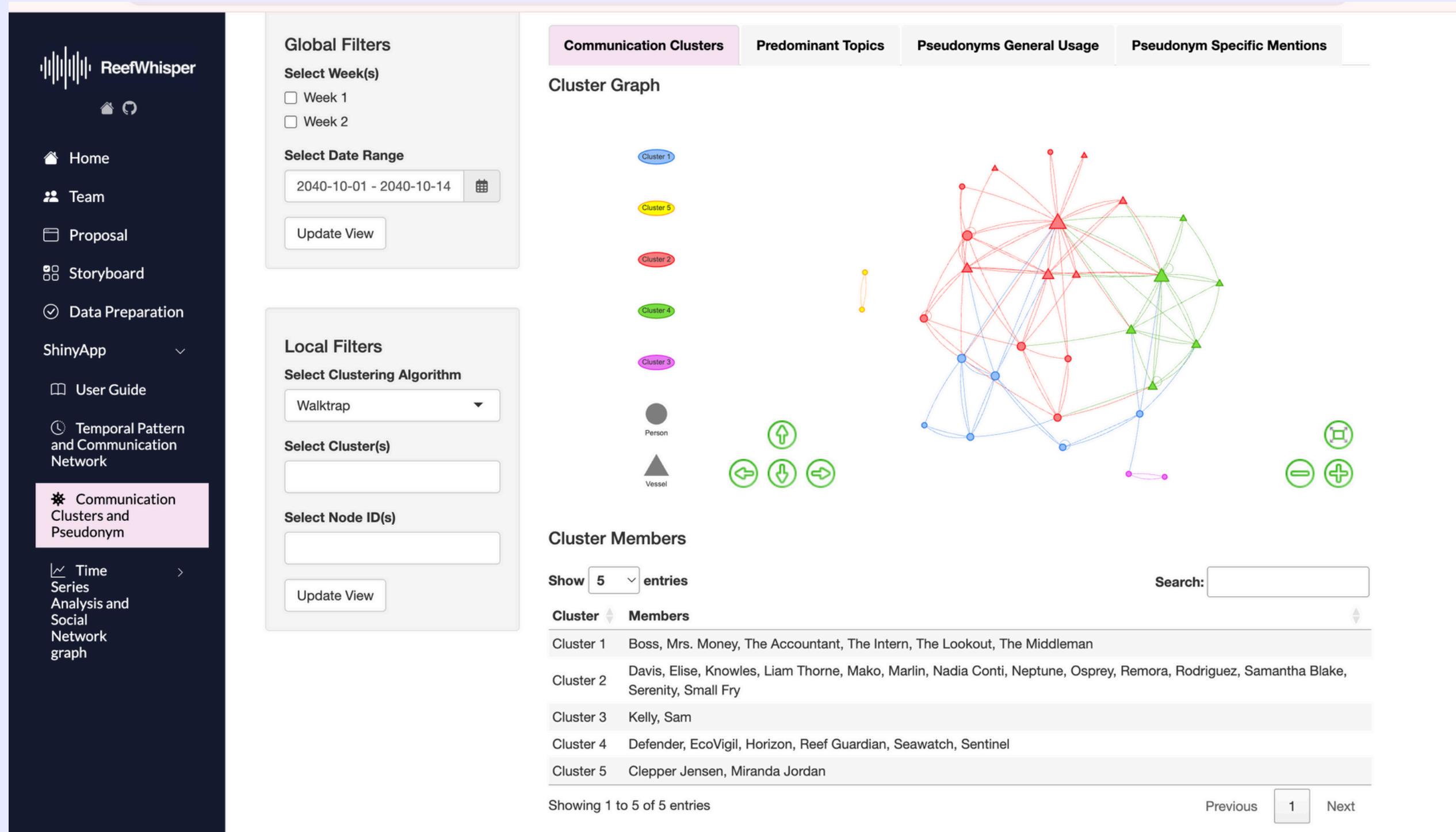
This page visualizes when communication events occurred during the selected period. Helps uncover temporal patterns and key moments of activity.

Filters (same as previous tab):

- Week(s), Date Range, Hour of Day
- Sender & Receiver Entity Types
- Specific individuals/locations/orgs involved

Communication Cluster and Pseudonym

Communication Clusters



This page detects communication communities based on message flow. Useful for identifying tight-knit groups, coordinated actors, or information silos.

Global Filters (Top Left)

- Select Week(s) and Date Range to focus on a time window
- Click Update View to refresh the network

Local Filters (Bottom Left)

- Select Clustering Algorithm:
 - e.g., Walktrap detects clusters based on message paths
- Select Cluster(s): Focus on specific group(s)
- Select Node ID(s): Zoom into individual users or vessels
- Use Update View after setting filters

Communication Cluster and Pseudonym

Predominant Topics

ReefWhisper

Home Team Proposal Storyboard Data Preparation ShinyApp User Guide Temporal Pattern and Communication Network Communication Clusters and Pseudonym Time Series Analysis and Social Network graph

Communication Cluster and Pseudonym

Identifying closely-associated groups, their predominant topics, and pseudonym usage & exploration.

Global Filters

Select Week(s)
 Week 1
 Week 2

Select Date Range
2040-10-01 - 2040-10-14

Update View

Local Filters

Select Cluster
1

Update View

Predominant Topics

Communication Clusters Predominant Topics Pseudonyms General Usage Pseudonym Specific Mentions

Show 10 entries Search:

cluster	No.	Word	Frequency
1	1	reef	78
1	2	nemo	61
1	3	equipment	45
1	4	harbor	44
1	5	council	31
1	6	mako	30
1	7	vessels	29
1	8	neptune	24
1	9	city	22
1	10	closure	22

Showing 1 to 10 of 10 entries Previous 1 Next

https://vriadi.shinyapps.io/reefwhispers_app2/_w_f3fc0d67fadb498cbf74b72b861c6da7/#tab-2171-2

This page identifies the most frequently discussed topics within each communication cluster.

Table Display

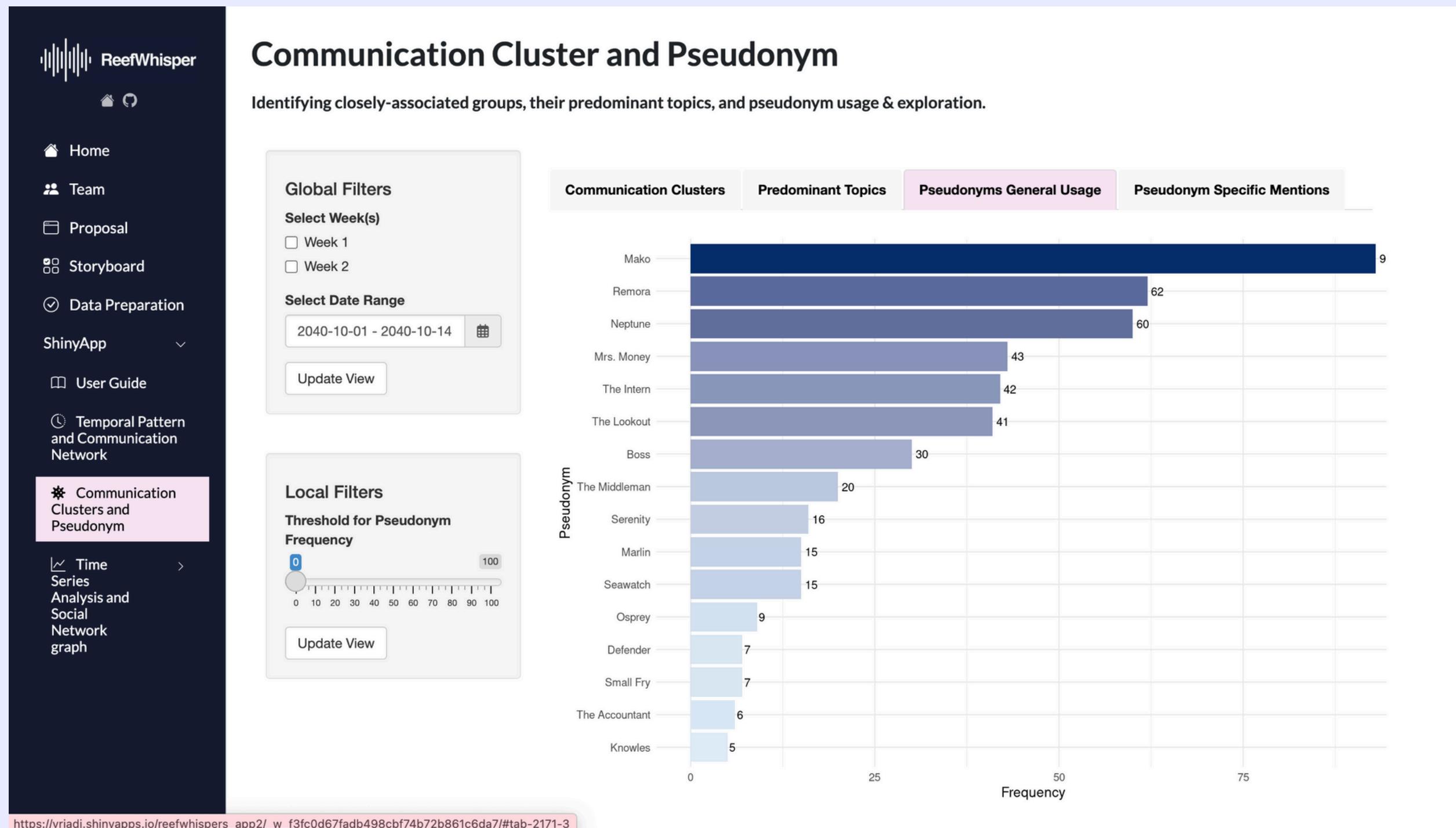
- Cluster – Cluster ID from network visualization
- No. – Rank of the keyword within that cluster
- Word – Frequently used term
- Frequency – Number of occurrences in messages

Features

- Search bar – Filter by keyword
- Cluster selector – Focus on specific cluster topics (left panel)
- Sortable columns – Rank topics by importance or count
- 💡 Use this tab to reveal what each group is primarily talking about (e.g., reef, nemo, equipment, council).

Communication Cluster and Pseudonym

Pseudonyms General Usage



This page tracks how frequently pseudonyms are used in communications across all clusters.

Bar Chart:

- Shows pseudonym frequency (e.g., Mako, Remora, Mrs. Money)
- Sorted in descending order for quick identification of the most active aliases

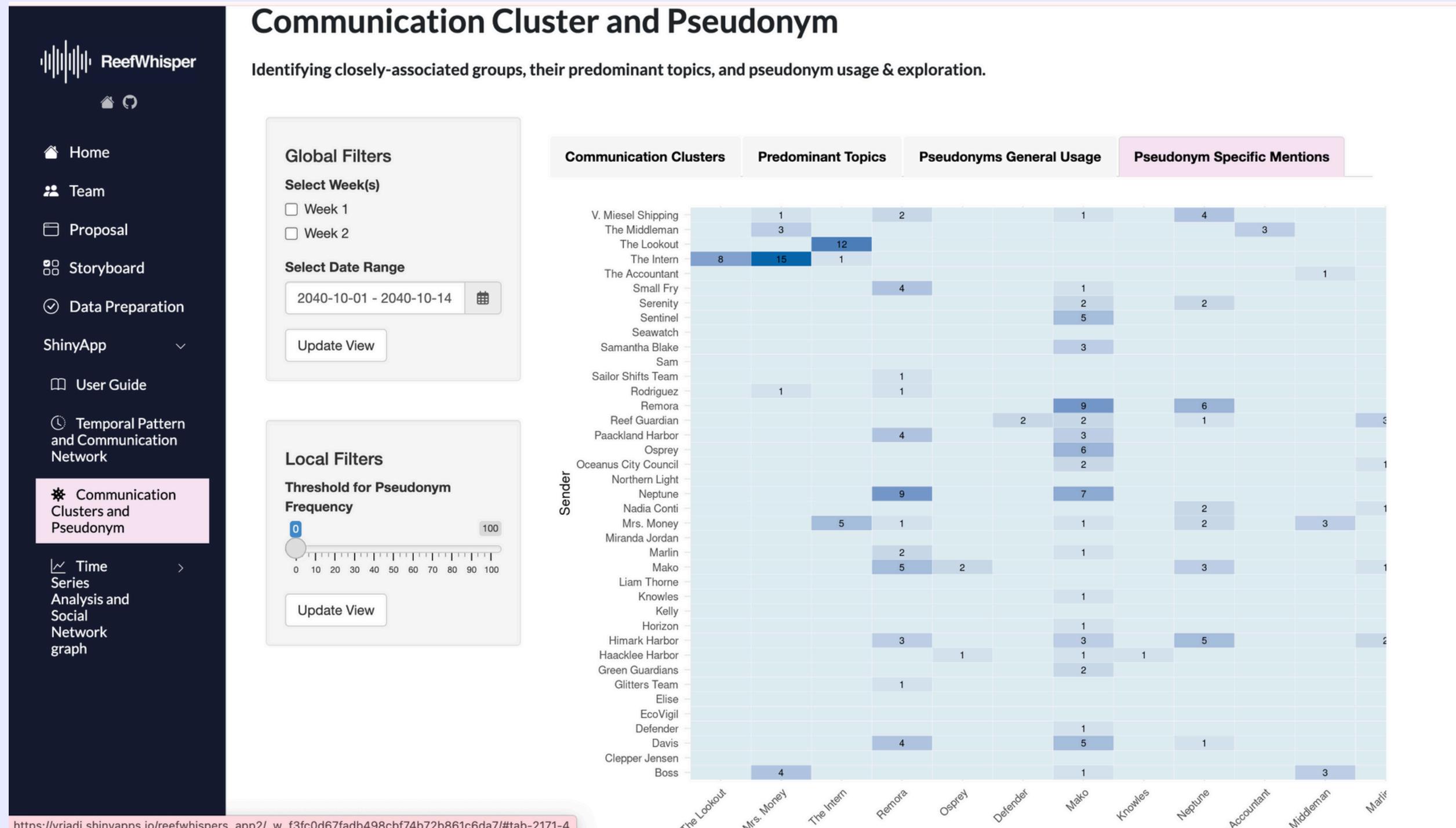
Filters

- Date Range & Week Selector – Filter messages by time
- Threshold Slider – Adjust minimum usage count to focus on high-frequency pseudonyms

💡 Use this tab to flag pseudonyms that may represent hidden or influential actors.

Communication Cluster and Pseudonym

Pseudonyms Specific Mentions



This page reveals who mentioned which pseudonyms, and how often

Heatmap:

- Rows = Senders
- Columns = Pseudonyms
- Cell values = Frequency of mentions
- Shading = Darker = more frequent

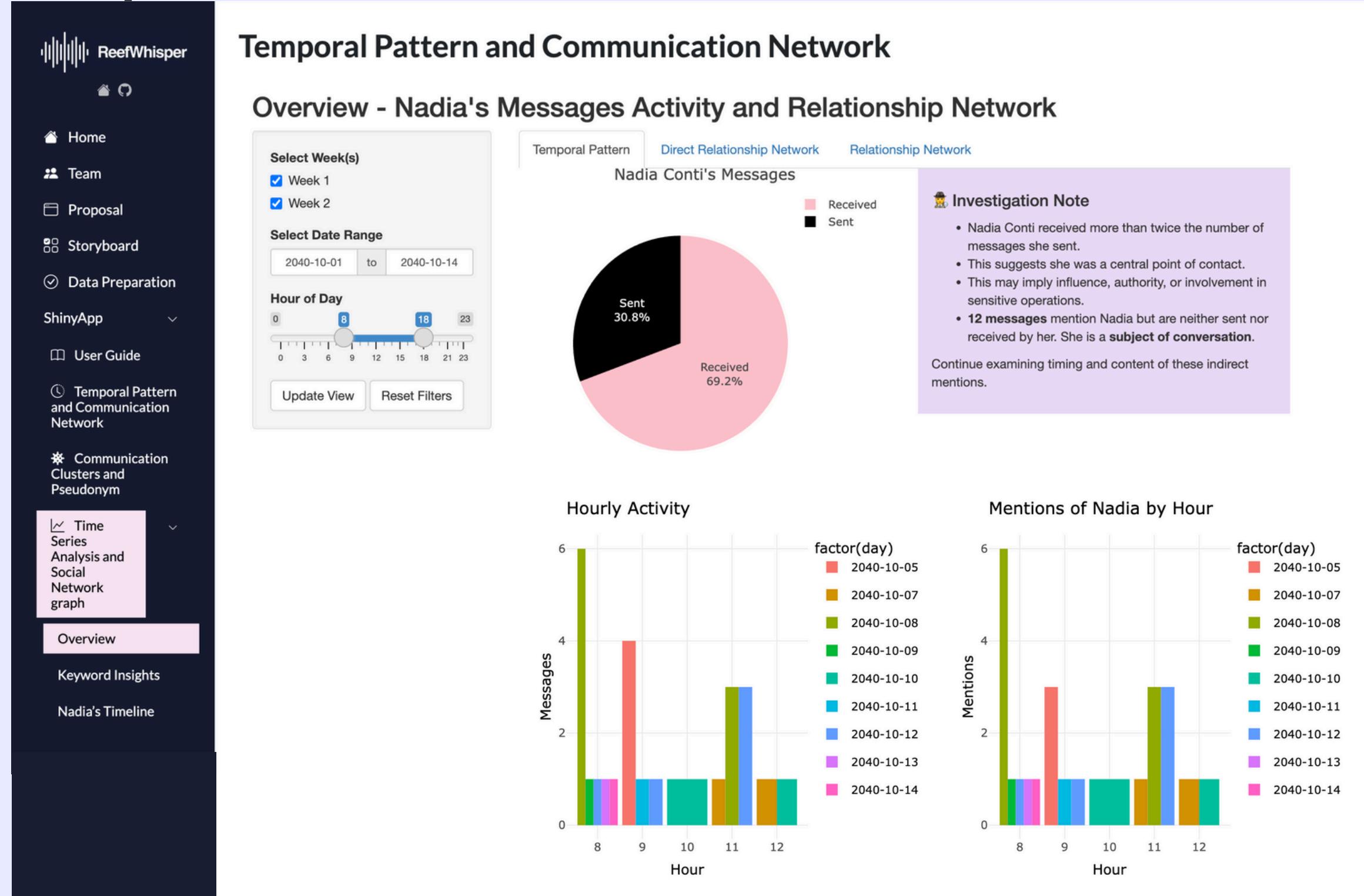
Filters

- Date Range & Week Selection
- Threshold Slider – Set minimum mention count
- 💡 Use this to trace who might know or reference secret identities across clusters.

Time Series Analysis and Social Network Graph

Overview - Nadia's Messages Activity and Relationship Network

Temporal Patterns



This page explores Nadia Conti's communication patterns, including messages she sent, received, and when she was indirectly mentioned.

Pie Chart – Sent vs. received messages

- Nadia received 2x more messages than she sent
- Suggests she is a central figure in the network

Hourly Activity Bar Chart – When Nadia was active (by day/hour)

Mentions by Hour Chart – When Nadia was mentioned by others (even if not directly involved)

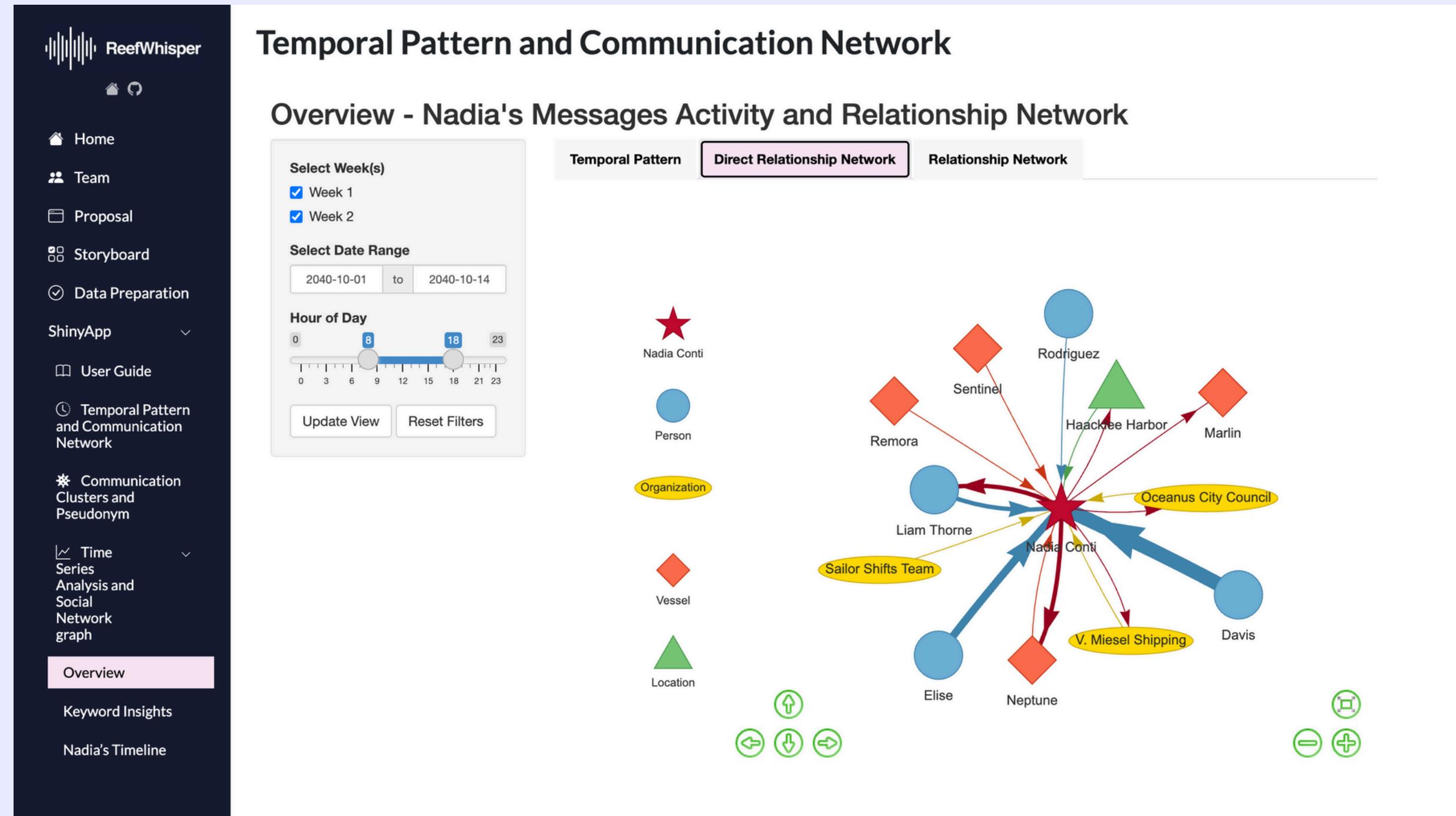
Filters

- Week Selector, Date Range, Hour Slider
 - Update View / Reset Filters buttons
- 💡** Start here to understand Nadia's role and timeline in the communication web.

Time Series Analysis and Social Network Graph

Overview - Nadia's Messages Activity and Relationship Network

Direct Relationship Network



This page visualizes all connections involving Nadia, including direct and indirect messaging patterns across people, vessels, locations, and organizations.

- Node Colors by entities types
- Arrow Direction: Shows message flow (\rightarrow sent, \leftarrow received)
- Arrow Thickness: Indicates message volume between two entities

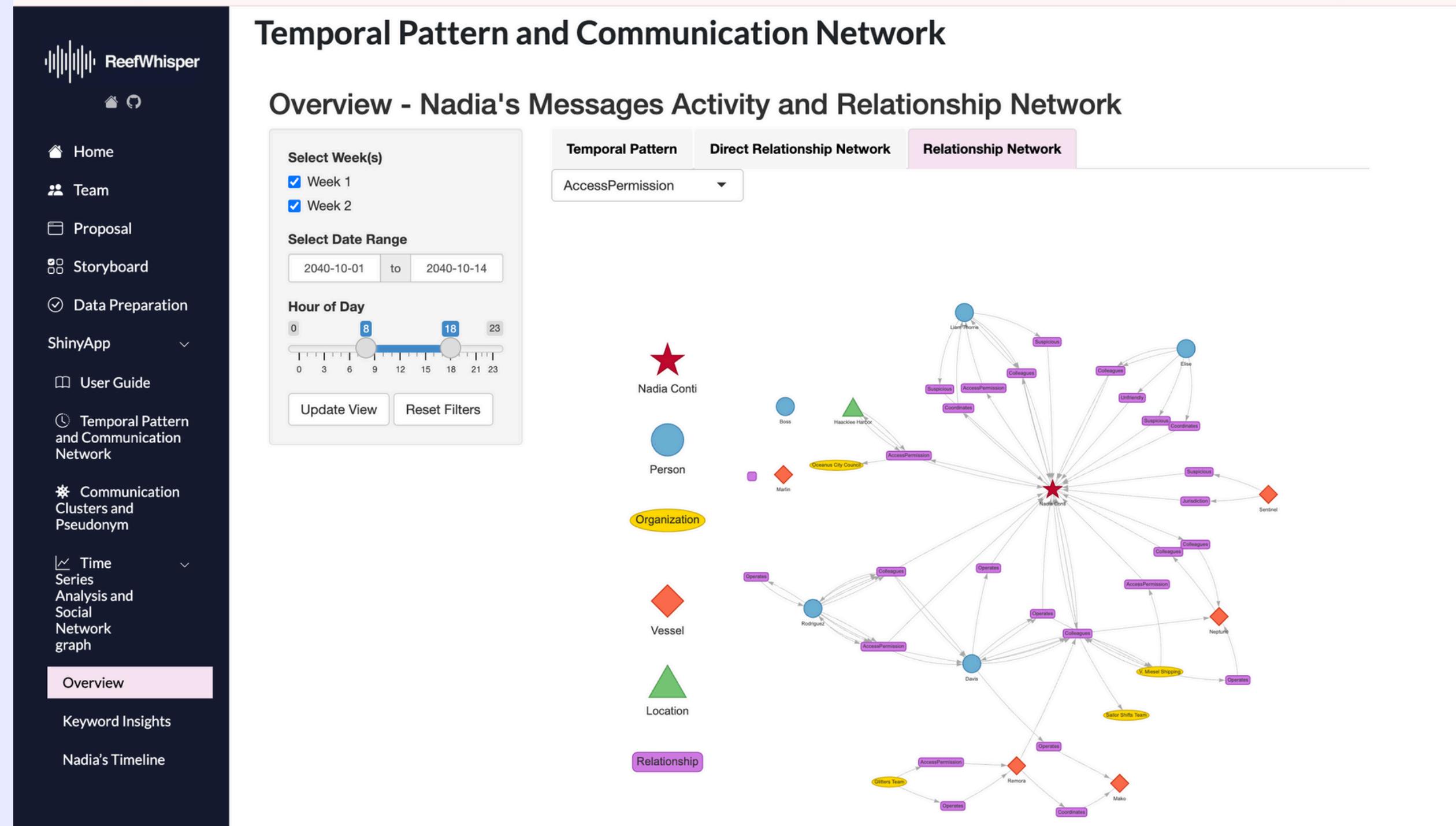
Filters

- Week & date range
 - Hour of day
 - Buttons to zoom, pan, and reset view
- 💡 Use this view to understand Nadia's role in the broader network and identify possible alliances or power clusters.

Time Series Analysis and Social Network Graph

Overview - Nadia's Messages Activity and Relationship Network

Relationship Network



This page visualizes explicit relationships and interactions connected to Nadia Conti based on specific attributes (e.g., AccessPermission).

- Nodes: Entities involved (people, vessels, orgs, locations)
- Edges: Labeled arrows indicating direct relationships
- Node Shapes: Entities types

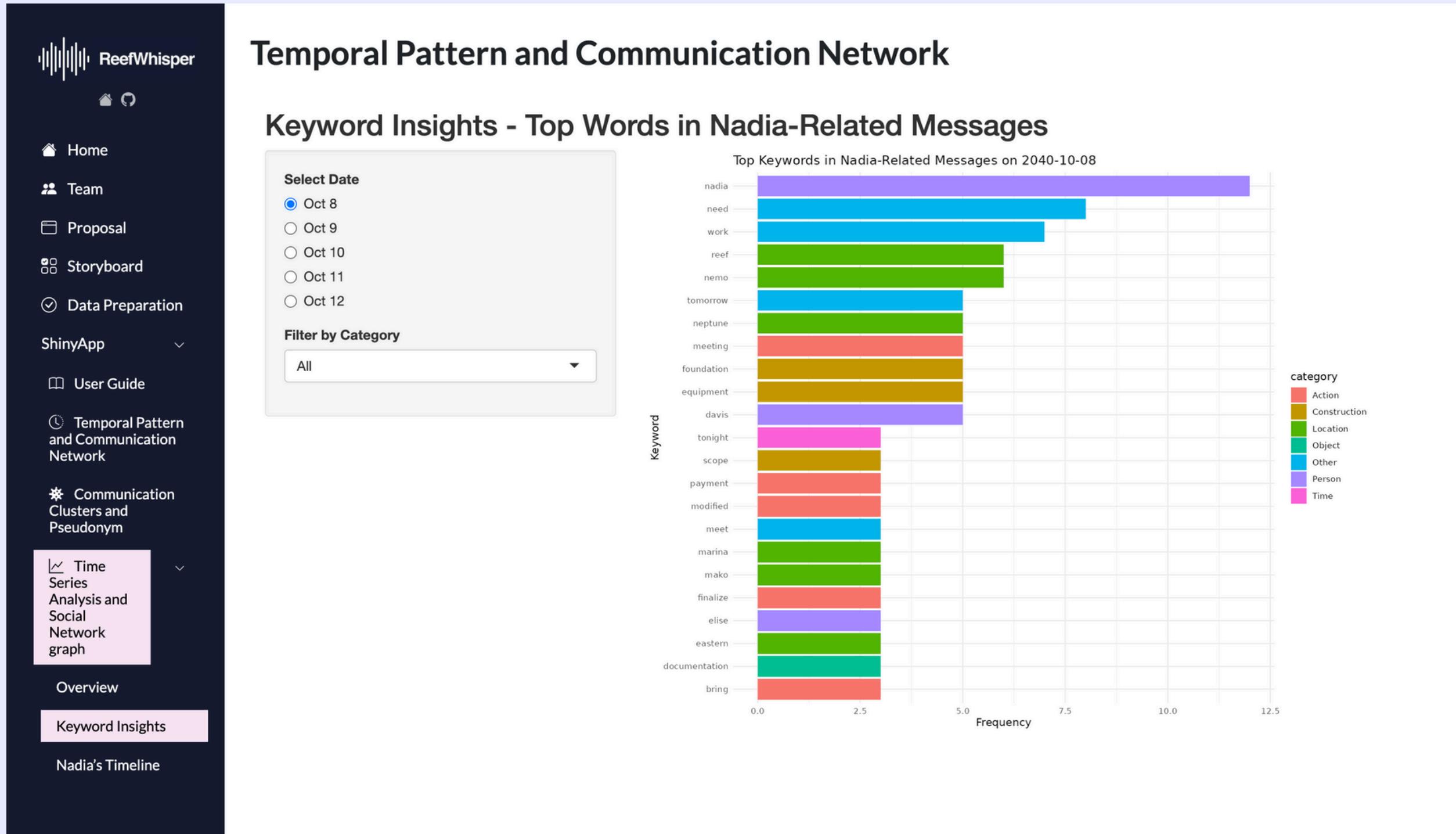
Filters

- Dropdown: Choose a relationship type (e.g., AccessPermission)
- Week, date, and hour filters
- Zoom & pan controls

This view helps confirm how individuals and groups are formally or informally connected, aiding deeper narrative discovery.

Time Series Analysis and Social Network Graph

Keyword Insights - Top Words in Nadia - Related Messages



This page identifies key terms and topics associated with Nadia Conti in message content, by date.

Bar Chart:

- Top keywords in messages that mention Nadia
- Color-coded by Category (legend on right)

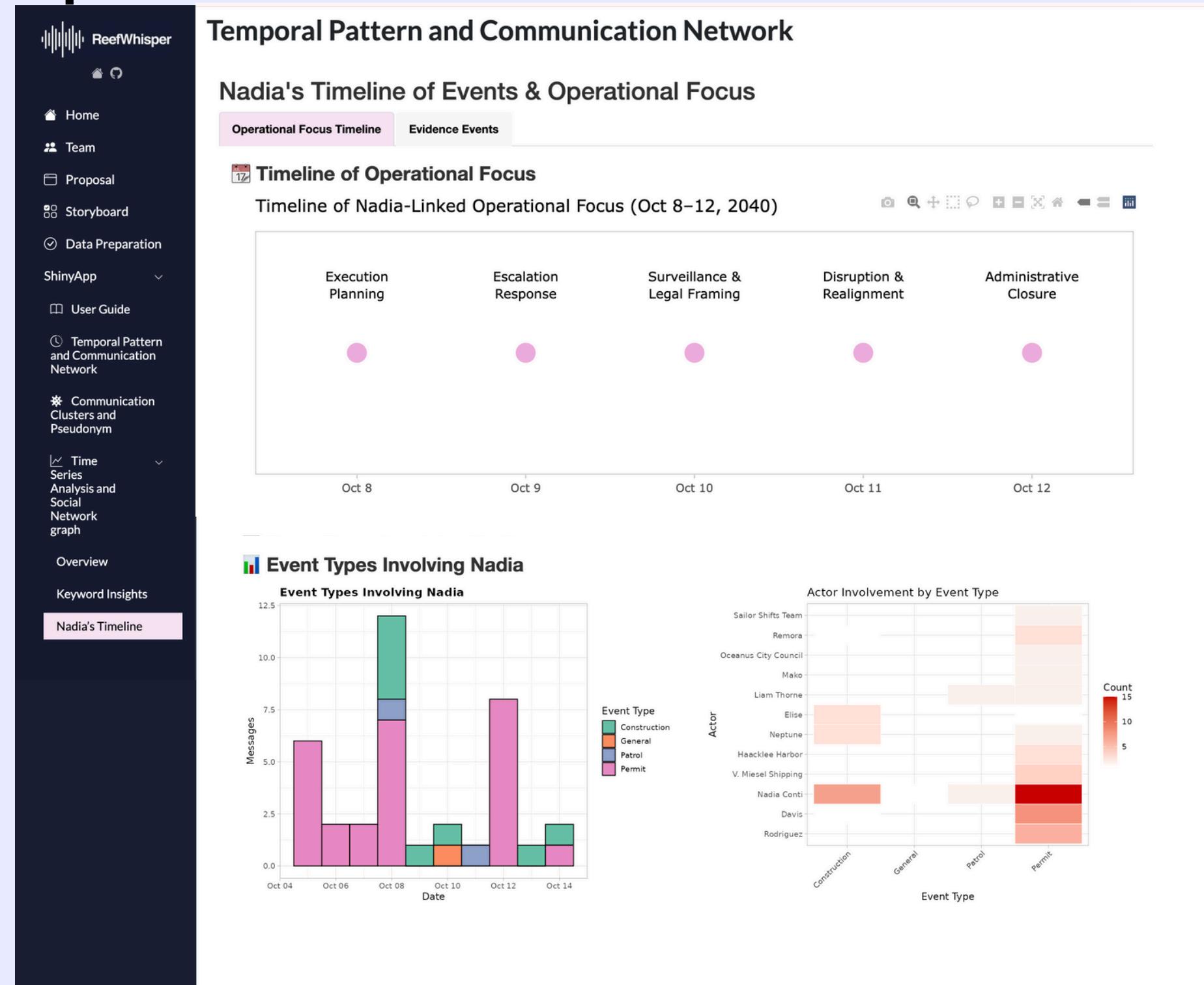
Filters:

- Select Date – Choose a specific day (Oct 8–12)
- Filter by Category – Narrow keyword list by type
 - 💡 Use this tab to track shifting narratives and detect action-related discussions involving Nadia.

Time Series Analysis and Social Network Graph

Nadia's Timeline of Events and Operational Focus

Operational Focus Timeline



This page tracks Nadia's operational involvement across key phases and uncover event types she's linked to.

Operational Focus Timeline: Visualizes Nadia's engagement across five strategic phases (Oct 8–12):

- Execution Planning
- Escalation Response
- Surveillance & Legal Framing
- Disruption & Realignment
- Administrative Closure

💡 Dots indicate days linked to specific phases of operation.

Bar Chart: Shows volume of messages by event type (e.g., Permit, Construction, Patrol, General)

Heatmap: Maps actor involvement across event types

- Darker red = higher involvement
- Helps pinpoint who coordinated with Nadia and when

Time Series Analysis and Social Network Graph

Nadia's Timeline of Events and Operational Focus

Timeline of Evidence Events Involving Nadia



This page highlights suspicious patterns across different event types that suggest Nadia's involvement in concealment or coordination.

- **Y-axis:** Evidence Type
 - Administrative, Assessment, Movement, Patrol, Surveillance
 - **X-axis:** Date (Oct 5–13)
 - Color-coded by Theme
- This timeline helps investigators spot temporal alignment of covert actions linked to Nadia.