Interreg Baltic Sea Region | Co-funded by the European Union

SUSTAINABLE WATERS OpenRisk II

INTERNATIONAL APPROACH TO RISK MANAGEMENT

THE IALA RISK MANAGEMENT TOOLBOX

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Deputy Secretary General

03/04/2025

The NEW IALA Convention entered into force 22. August 2024

21 Aug 2024

IALA TAKES ON NEW POWERFUL POSITION TO DEVELOP, HARMONIZE AND ENHANCE WORLDWIDE SAFETY OF NAVIGATION, EFFICIENCY AND PROTECTION OF THE MARINE ENVIRONMENT.

PRESS RELEASE

For immediate release

Saint-Germain-en-Laye, France, August 2024 – After more than ten years of work and four diplomatic conferences, The International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) is proud to announce that, effective August 22, 2024, we will officially change our status from a non-governmental organization (NGO) to an Intergovernmental Organization (IGO). Based on a Convention ratified or acceded to by 34 States to date, the new status represents a significant victory for multilateralism and ocean governance, marking an important step toward enhancing worldwide safety of navigation, efficiency and protection of the marine environment.

International Organization for Marine Aids to Navigation (IGO)

Singapore, Norway, Japan, Malaysia, India, Panama, The Netherlands, Slovenia, Ireland, Sweden, Albania, Australia, Uruguay

The United Kingdom, Canada, Spain, Romania, Saudi Arabia, Republic of Korea, France, Denmark, Finland, Cuba,

Tunisia, Mexico, Oman, Germany, China, Portugal, Bulgaria, Croatia, Egypt, Brazil, Qatar, Belgium, Türkiye, Solomon Islands, Chile,

Cooperation and task delineation between IMO and other IGO's

Regulatory work

Non-binding standards, recommendations and guidelines and input into the regulatory work

IMO INTERNATIONAL MARITIME ORGANIZATION

IALA

IHO International Hydrographic Organization

… and other IGO's

Our new Headquarters

Headquarters agreement signed on 4 March 2025


IALA/AISM
BUREAUX
LOGEMENTS
HÔTEL 3*
IALA/AISM
SIÈGE ACTUEL

SALLE PLÉNIÈRE ▶ **300 M²** SDP
+ 117 M² (HALL + RÉCEPTION)

IMMEUBLE PRINCIPAL /SIÈGE ▶ **1 600 M²** SDP
+ ROOFTOP

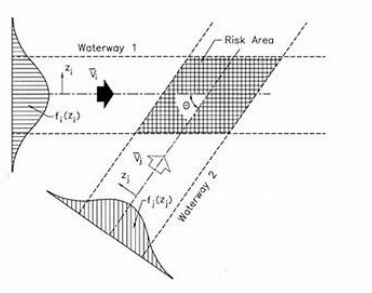
THE IALA RISK MANAGEMENT TOOLBOX

The IALA Risk Management Toolbox

- What is it?
- Why does it exist?
- How was it developed?
- What tools does it contain?
- Future developments?
- Use cases

What is the IALA Risk Management Toolbox?

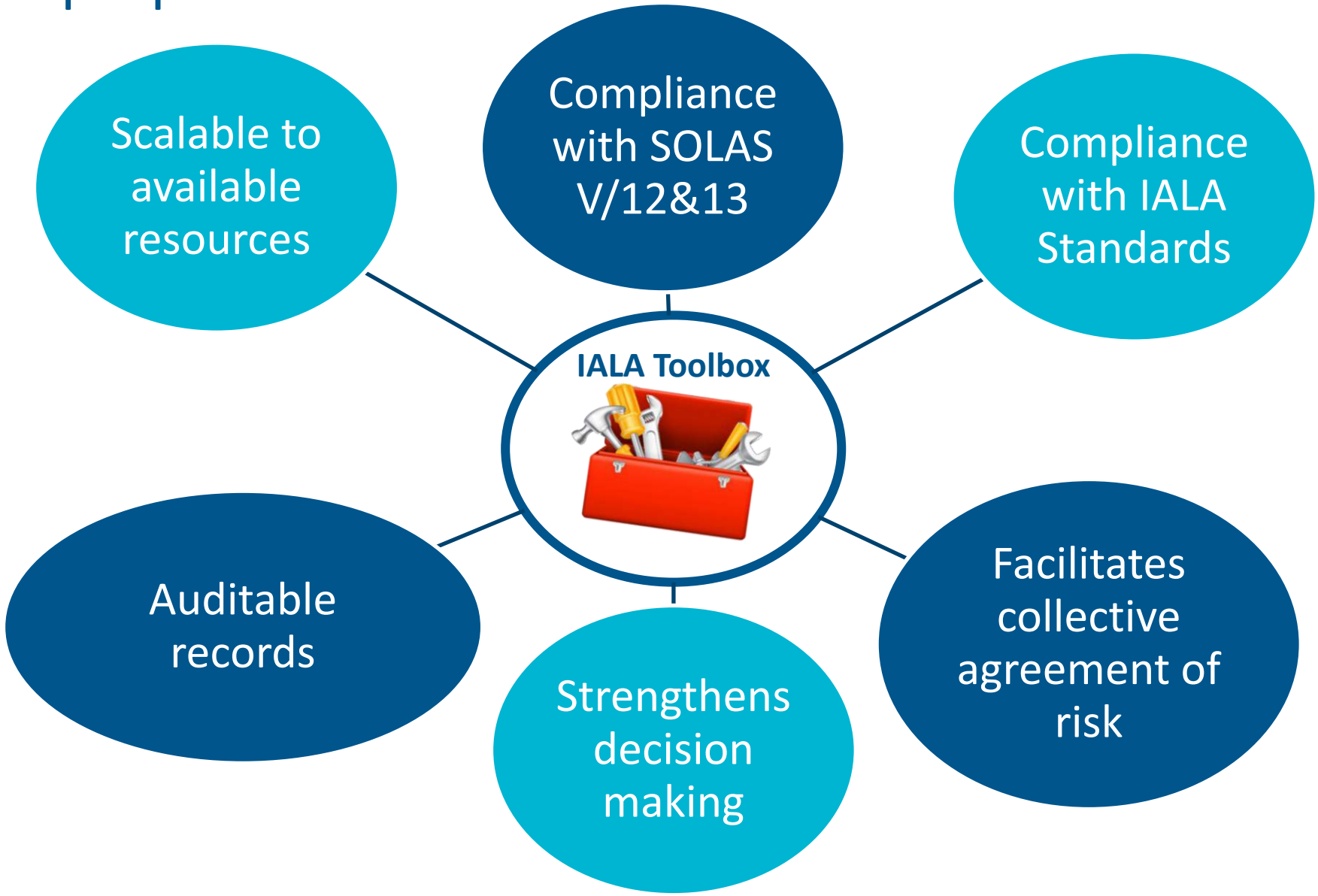
- Quantitative and qualitative methods



- Reflect a range of user risk assessment maturity

- Developed collaboratively – IALA committees and World-Wide Academy

Toolbox purposes



Toolbox development milestones

IWRAP Mk II and PAWSA released

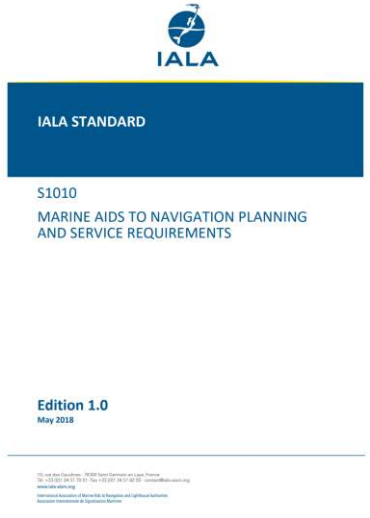
IALA World-Wide Academy established

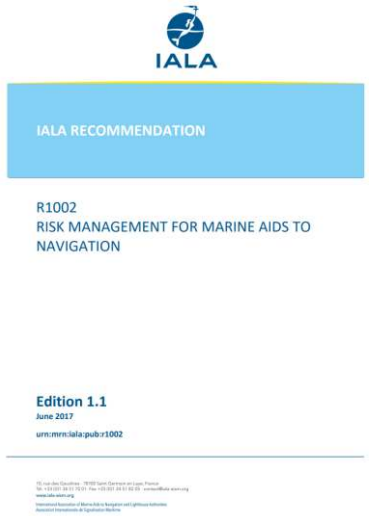
Revised PAWSA tool published by IALA

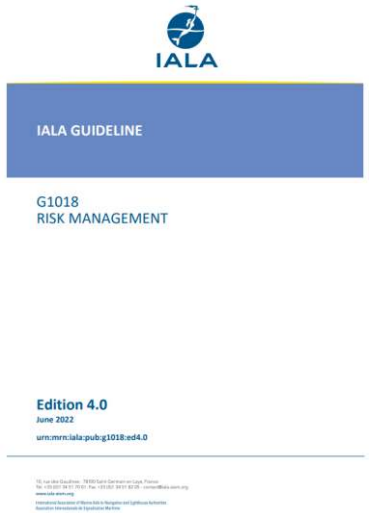
SIRA method published

Review of all Risk related recommendations and guidelines including Simulation and IRMAS G1018

Hierarchy of IALA Risk Related documentation







Standard S1010

Identifies the recommendations and guidelines covering Marine Aids to Navigation planning and service requirements (including R1002)

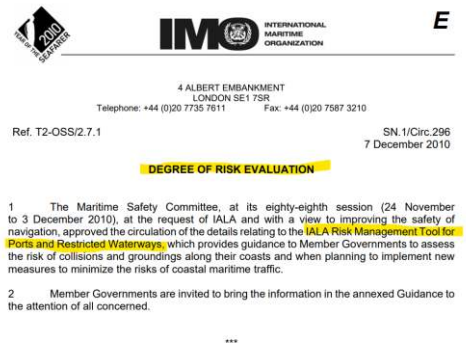
Recommendation R1002

Recommends using the risk management and IALA risk management tools (including G1018)

Guideline G1018

Risk Management

SN.1/Circ.296



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Ref. T2-OSS/2.7.1

SN.1/Circ.296
7 December 2010

DEGREE OF RISK EVALUATION

1 The Maritime Safety Committee, at its eighty-eighth session (24 November to 3 December 2010), at the request of IALA and with a view to improving the safety of navigation, approved the circulation of the details relating to the IALA Risk Management Tool for Ports and Restricted Waterways, which provides guidance to Member Governments to assess the risk of collisions and groundings along their coasts and when planning to implement new measures to minimize the risks of coastal maritime traffic.

2 Member Governments are invited to bring the information in the annexed Guidance to the attention of all concerned.

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Current tools

OPRA

One page risk assessment

SIRA

Simplified IALA risk assessment

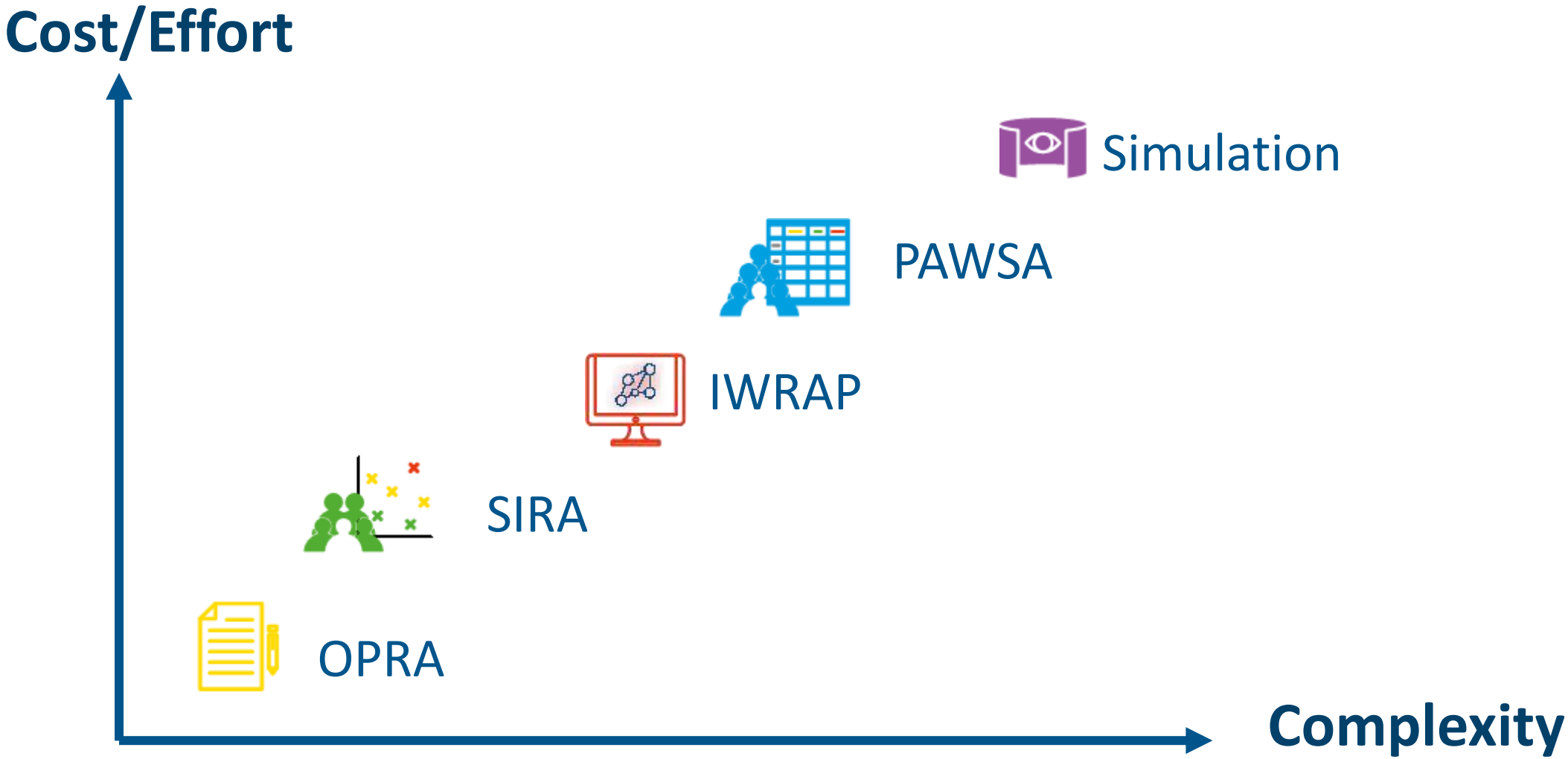
PAWSA

Ports and Waterways Safety Assessment

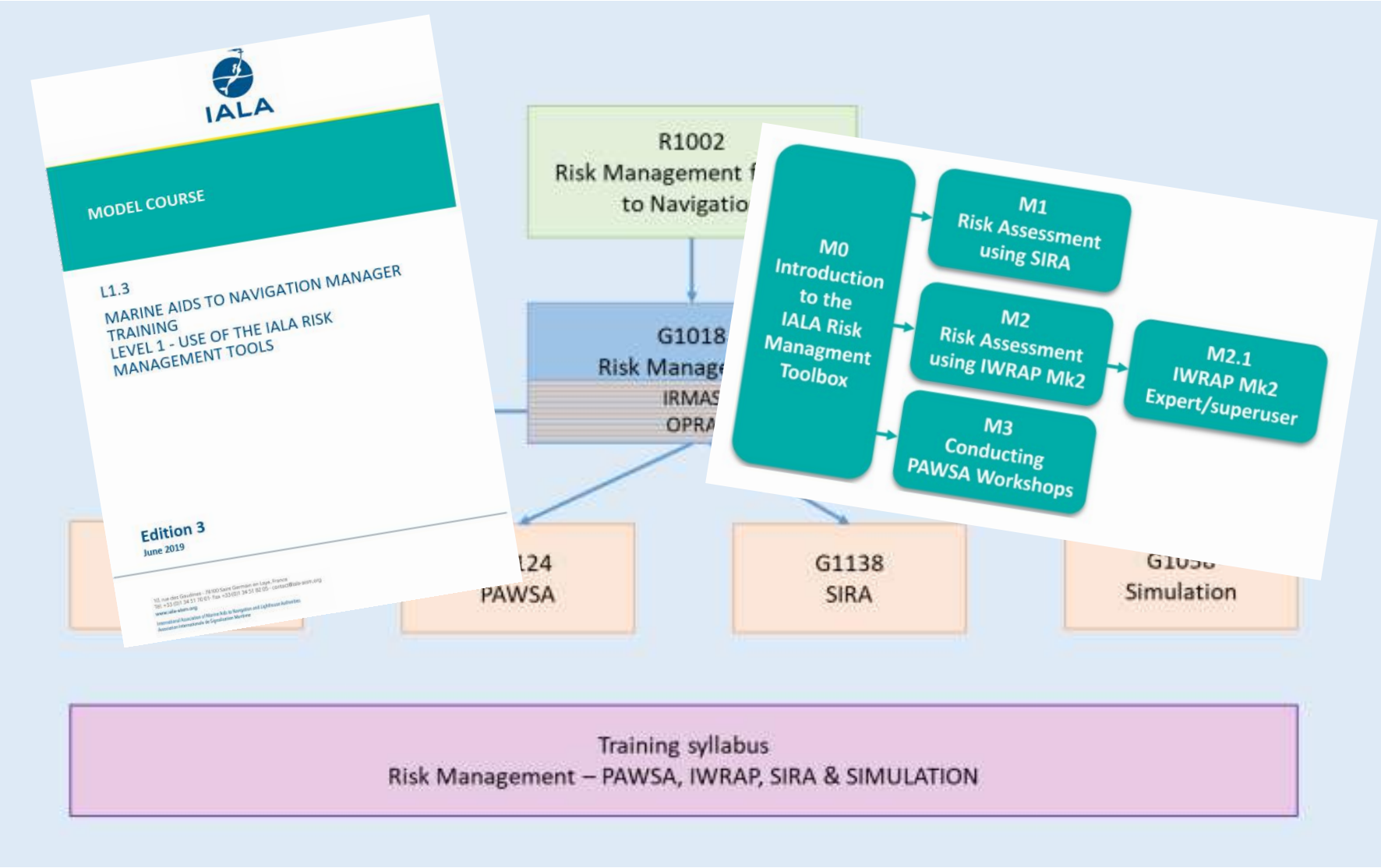
IWRAP

IALA Waterway Risk Assessment Programme

Simulation


Cost/Effort
Simulation
PAWSA
IWRAP
SIRA
OPRA
Complexity

Risk Guidelines and Model Courses



https://academy.iala-aism.org/wwa/training/course-schedules/

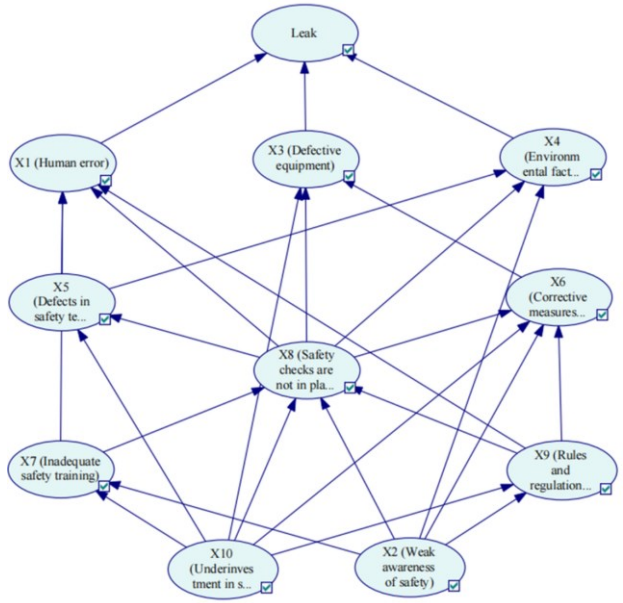
Developments

Participation conditions	Probability of *not* participating	Reported by
Mandatory	$1 \cdot 10^{-4}$	Japanese studies
Mandatory in domestic waters	$1 \cdot 10^{-3}$	Canadian Coast Guard
Voluntary in domestic waters	0.01 to 0.4	U.S. Coast Guard
Voluntary in the Dover Strait	0.2	U.K. Department of Transport

- Improve causation factor modelling

- Continue to refine existing tools

- Consequence modelling



- More simulation tools

ONE PAGE RISK ASSESSMENT - OPRA

One Page Risk Assessment - OPRA

IRMAS / OPRA

Section 1: Risk Assessment Details

Assessor Name:	John Smith	Date:	01-01-2021
Department.:	Aids to Navigation Department	Organization:	Lighthouse Authority
Assessment Name:	Marking of sunken container	ID #:	0001
Assessment Overview:		Location:	Sandy Bay
A recent incident report from the master of a cargo vessel notified the Lighthouse Authority that a container was lost overboard in adverse weather on 31-01-20 whilst on transit through Sandy Bay. The manifest shows the container was loaded with spare engine parts and machinery.		Co-ordinates:	Lat: 48.892950° Long: 2.072148°
Incident Details:	Container resting on seabed in shallow water.	Incident (ref. # / link)	#001

Section 2: Documentation of Assessment Approach

Type of assessment		OPRA	Hazards Assessed (cross out not applicable)	~~Collision~~	Tools Used (cross out not applicable)	~~Vessel Analysis~~
Mitigation Measures Identified	Buoy	X		Allision		PAWSA
	Light	X		~~Grounding~~		IWRAP Mkll
	Info.	X		~~Foundering~~		SIRA
				~~Other~~		~~Simulation~~
	Other					OPRA (see below)
Confidence in Assessment Findings		Very High	~~High~~	~~Medium~~	~~Low~~	~~Other (please specify)~~

Review of Results - Results as shown below in OPRA sections

Section 3: OPRA Risk Assessment

# Hazard	Description/Causes	Outcomes	Risk Score (before mitigation)	Risk Mitigation Measures	Risk Score (after mitigation)
1: Allision with submerged container – Recreational Vessel	Sunken container in area of high recreational vessel density.	Allision causing damage to vessel and environment and may leading to sinking involving loss of life.	L = 3 C = 4 Score = 12	1. Deploy lighted isolated danger buoy. 2. Issue Notices to Mariners (consider promulgation to local clubs) and Marine Information Notice.	L = 2 C = 4 Score = 8
2: Allision with submerged container – Commercial Vessel	Sunken container in area of low commercial vessel density.	Allision causing damage to vessel and environment.	L = 2 C = 3 Score = 6	1. Deploy lighted isolated danger buoy. 2. Issue Notices to Mariners and Marine Information Notice.	L = 1 C = 3 Score = 3
3:					
OPRA Assessment Results Recommendations		Date:	01-01-21	Signature:	John Smith

The assessment demonstrates the need for risk mitigation measures to ensure navigation risk remains at acceptable levels.
Removal of the container will be undertaken following agreement with vessel insurers once salvors are appointed.

Section 4: Actions / Documentation

	#	Action	Completion Date	Person/Entity Responsible
Actions	1.	Deploy lighted isolated danger buoy – ASAP	02-01-21	John Smith
	2.	Issue Notices to Mariners (and ensure promulgation to local recreational clubs) and ensure Marine Information Notice is broadcast	01-01-21	John Smith
	3.	Removal of container when possible	31-03-21	Salvors
	4.	Archive IRMAS / OPRA assessment on removal of container	17-04-21	John Smith
	5.			

Section 3: OPRA Risk Assessment

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3:					
OPRA Assessment Results Recommendations		Date:	01-01-21	Signature:	John Smith

The assessment demonstrates the need for risk mitigation measures to ensure navigation risk remains at acceptable levels.
Removal of the container will be undertaken following agreement with vessel insurers once salvors are appointed.

RISK MATRIX		LIKELIHOOD				
		Very Rare	Rare	Occasional	Frequent	Very frequent
		1	2	3	4	5
CONSEQUENCE	Catastrophic - 5	5	10	15	20	25
	Major - 4	4	8	12	16	20
	Severe - 3	3	6	9	12	15
	Minor - 2	2	4	6	8	10
	Insignificant - 1	1	2	3	4	5

PORT AND WATERWAY SAFETY ASSESSMENT - PAWSA

PAWSA – waterways risk model

The PAWSA Waterways Risk Model includes the 24 specific risk factors

that are discussed and then evaluated by the workshop participants.

Waterway Risk Model					
Vessel Conditions	**Traffic Conditions**	**Navigational Conditions**	**Waterway Conditions**	**Immediate Consequences**	**Subsequent Consequences**
Deep Draft Vessel Quality	Volume of Commercial Traffic	Winds	Visibility Impediments	Personnel Injuries	Health and Safety
Shallow Draft Vessel Quality	Volume of Small Craft Traffic	Water Movement	Dimensions	Petroleum Discharge	Environmental
Commercial Fishing Vessel Quality	Traffic Mix	Visibility Restrictions	Bottom Type	Hazardous Materials Release	Aquatic Resources
Small Craft Quality	Congestion	Obstructions	Configuration	Mobility	Economic

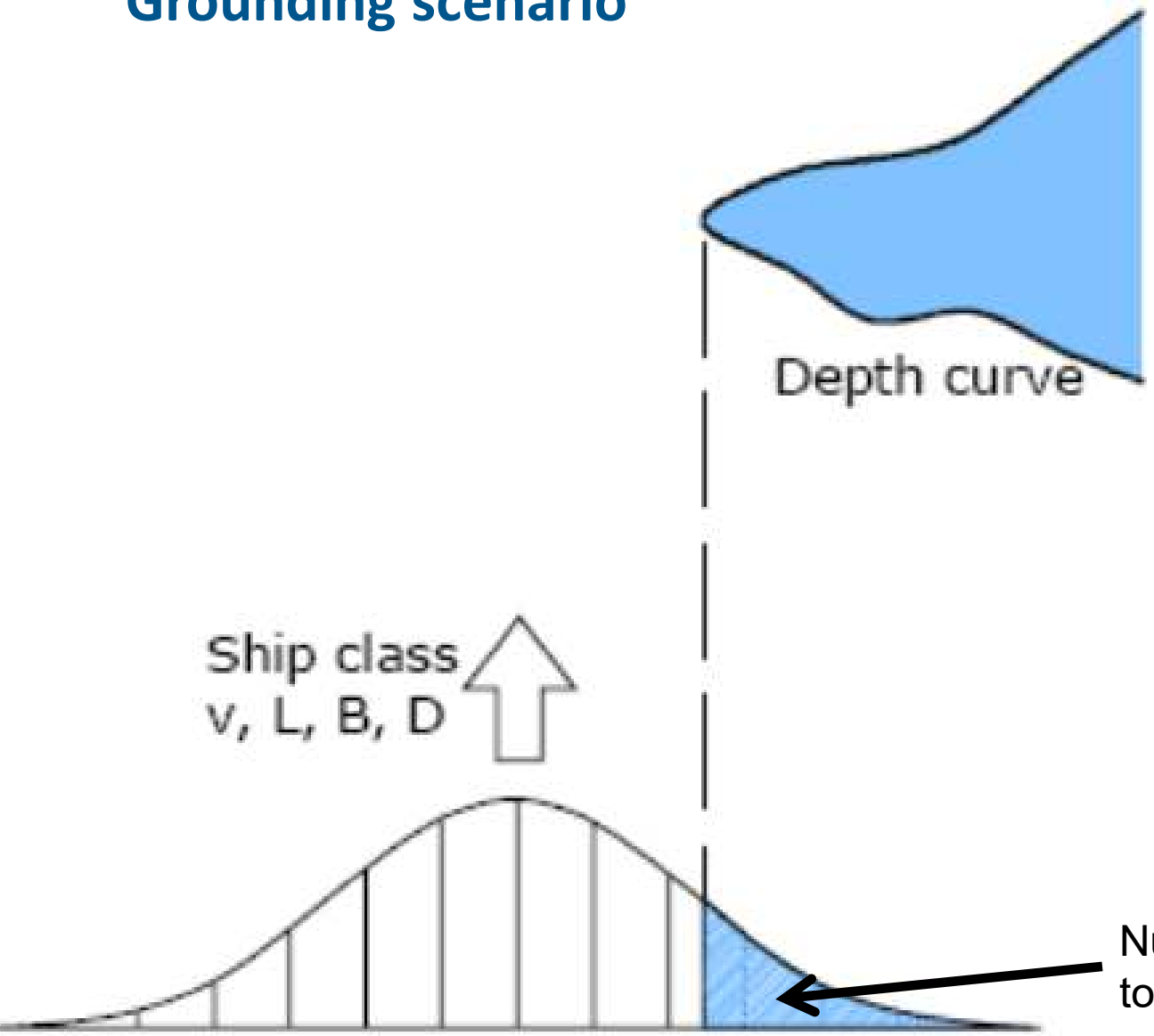
IALA WATERWAY RISK ASSESSMENT PROGRAMME - IWRAP

IWRAP basic algorithm

1. First determine the (average) number of possible incidents, assuming that no evasive action is taken (blind navigation).

2. Then adjust this number by multiplying it with the probability that an evasive action fails
(thinning with Fujii type causation factors)

Grounding scenario



$$X_{Gnd} = N_{Geo} \cdot P_C$$

N_{Gnd}	=	Numer of Annual Groundings
P_c	=	Causation Probability
X_{Geo}	=	Number of grounding candidates

Number of grounding candidates N_{GEO} is proportional to the portional area under the curve times traffic volume

IWRAP Mk2 Analysis of Proposal for Skagerrak and Kattegat

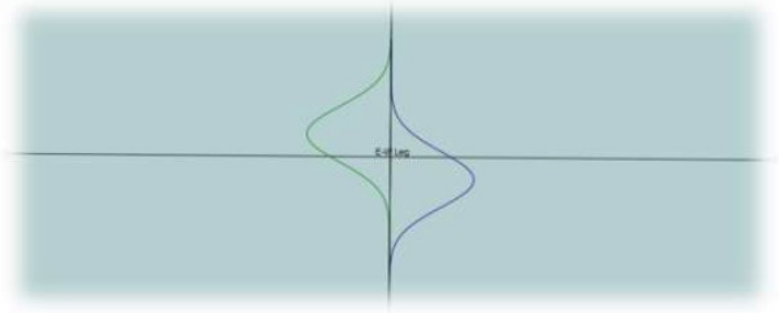
A comparative ship traffic analysis conducted, using the IALA Waterways Risk Assessment Program Mk2 (IWRAP),
in which the current transit traffic through Kattegat,
from the Skaw to the Great Belt and the Sound,
is compared with a predicted scenario
when a proposed new routeing system is implemented.

IWRAP can calculate the following types of scenarios:

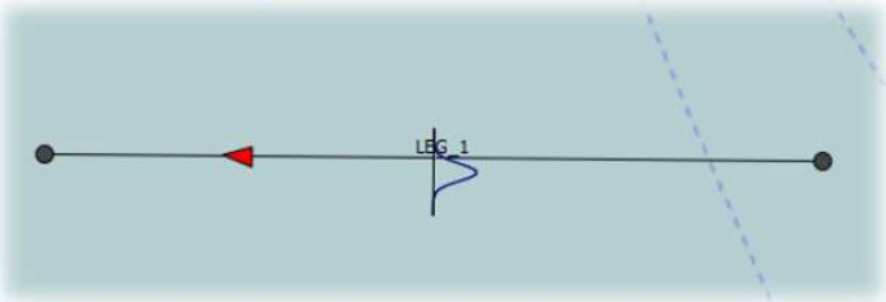
1. Head-on, i.e. ships sailing straight or almost straight at each other.
2. Overtaking collision
3. Crossing collision
4. Merging collision, i.e. ships from several legs merge at a waypoint
5. Bend collision, i.e. a ship makes a turn at a waypoint on to a new leg
6. Area traffic collision (ships not on routes, e.g. fishing)
7. Powered grounding
8. Drifting grounding

Collision scenarios

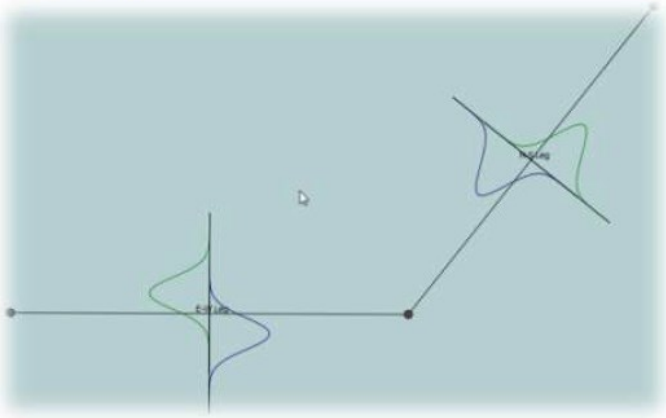
Head-on



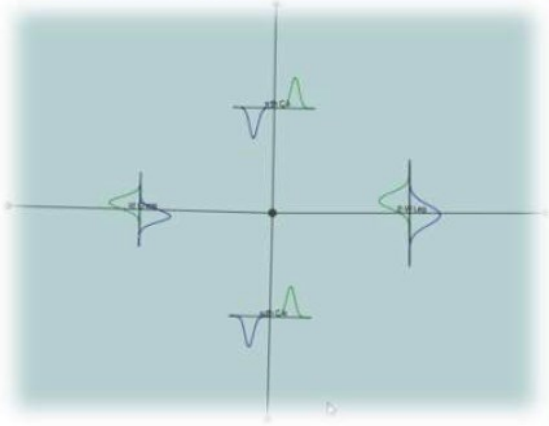
Overtaking



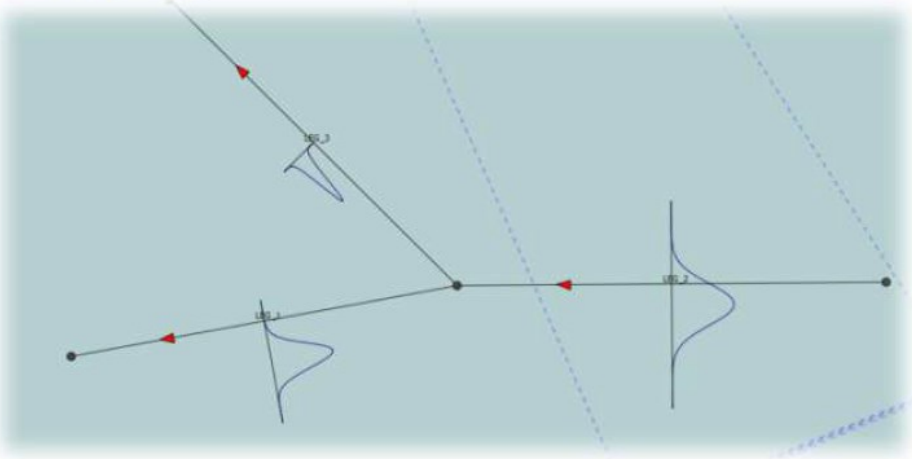
Bend



Crossing

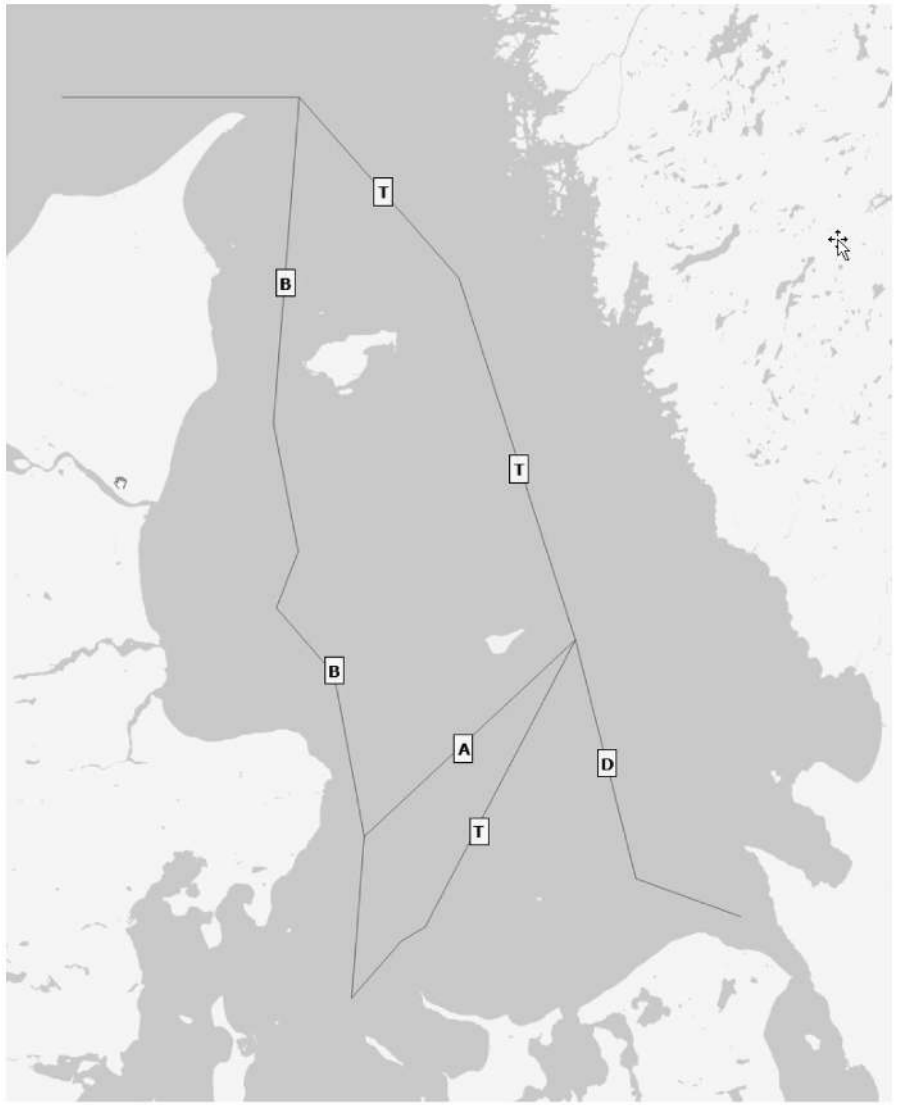


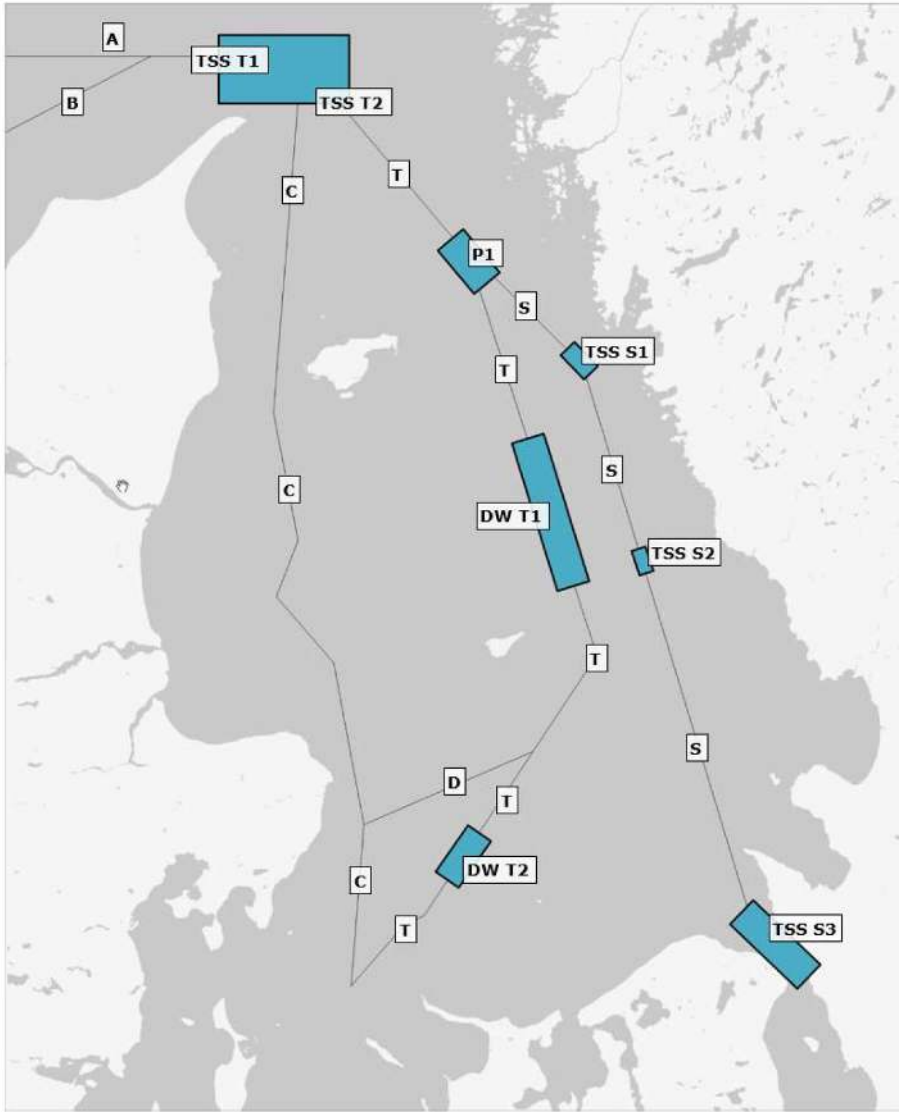
Merging



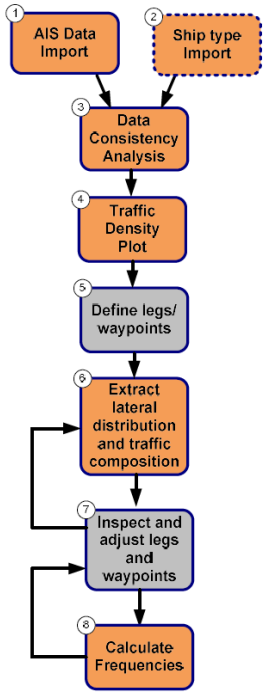
Area traffic collision (ships not on routes, e.g. fishing) (not included in this analysis)

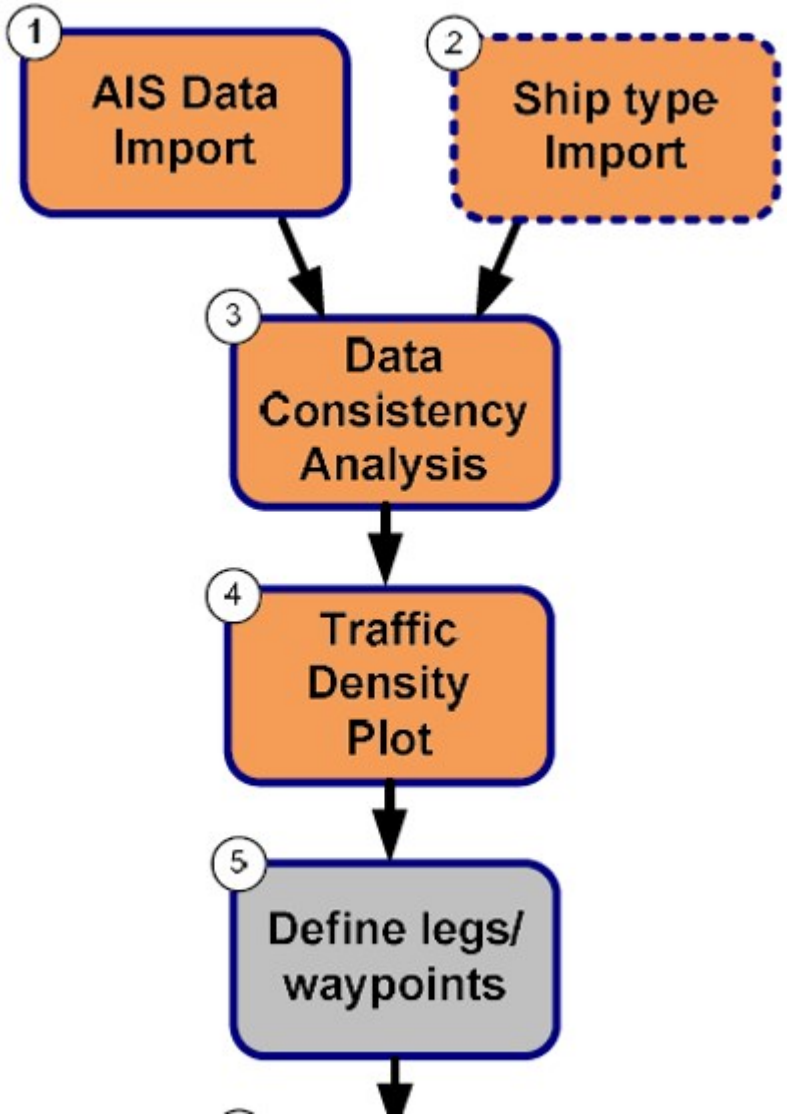
Current and proposed future route layout

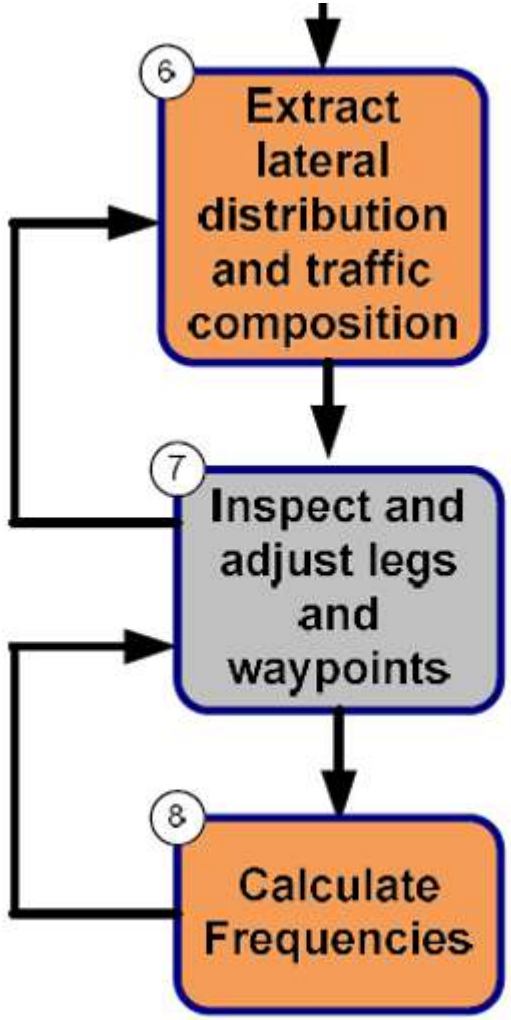




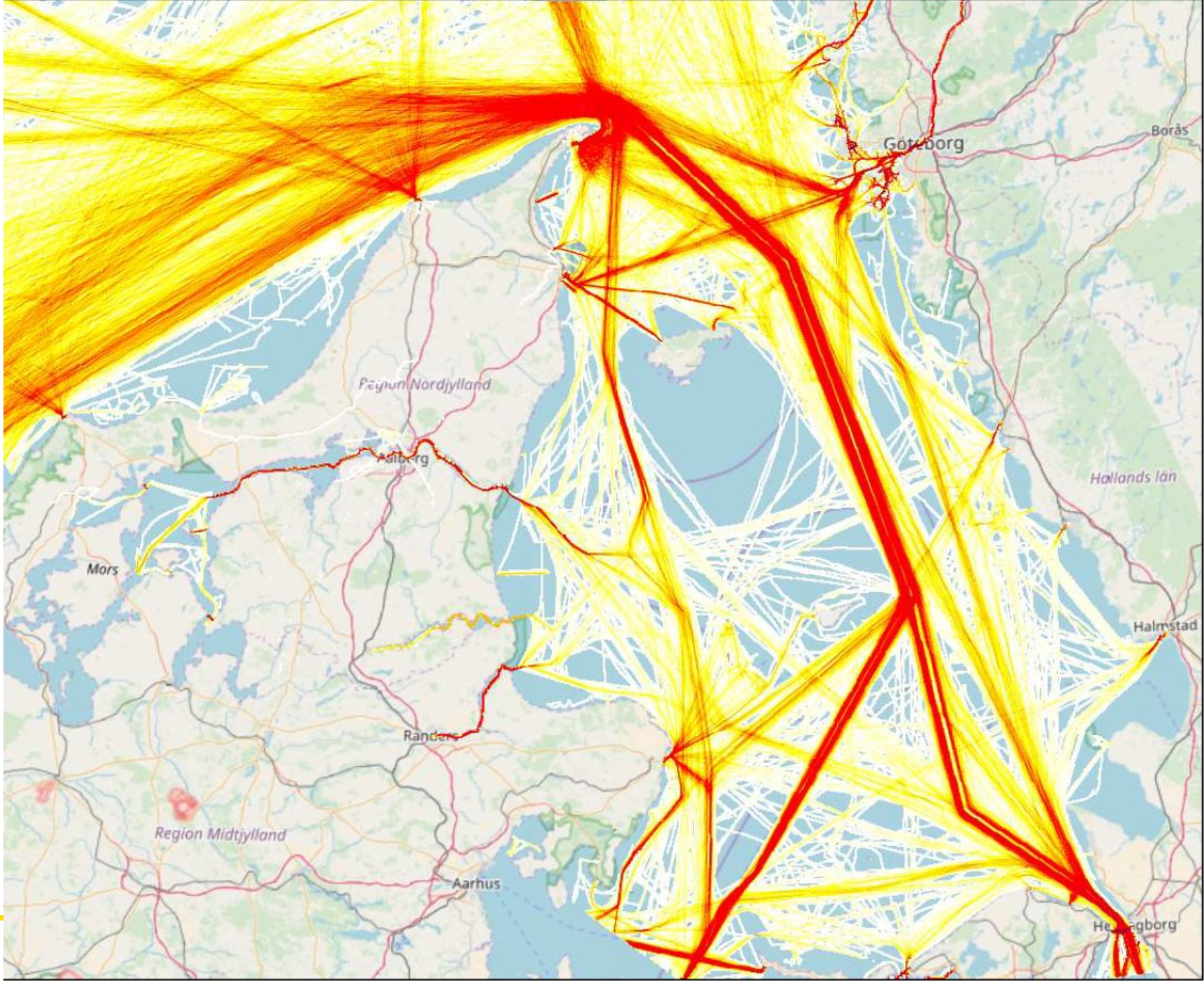
IWRAP Workflow



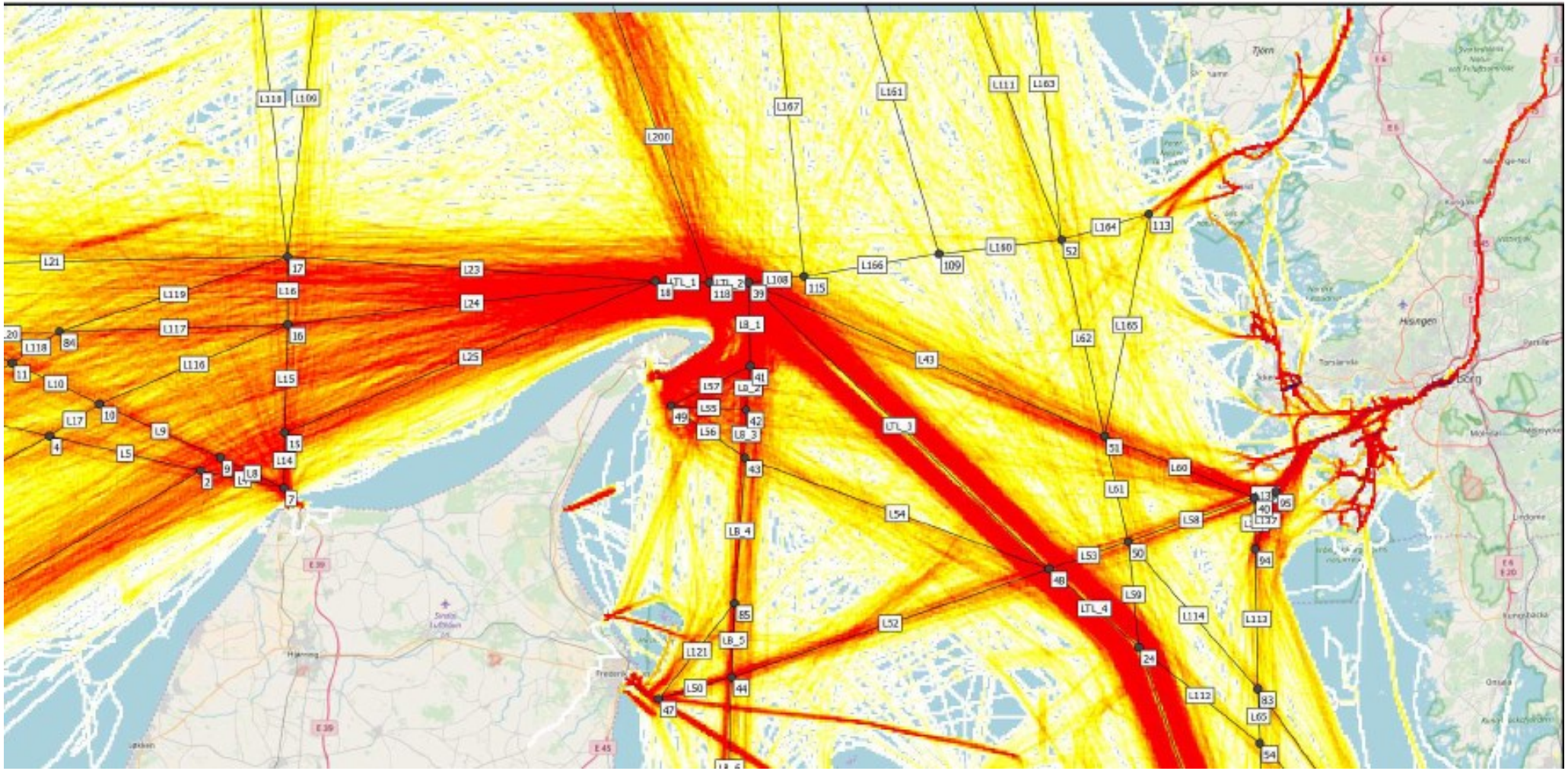




IWRAP Density plot

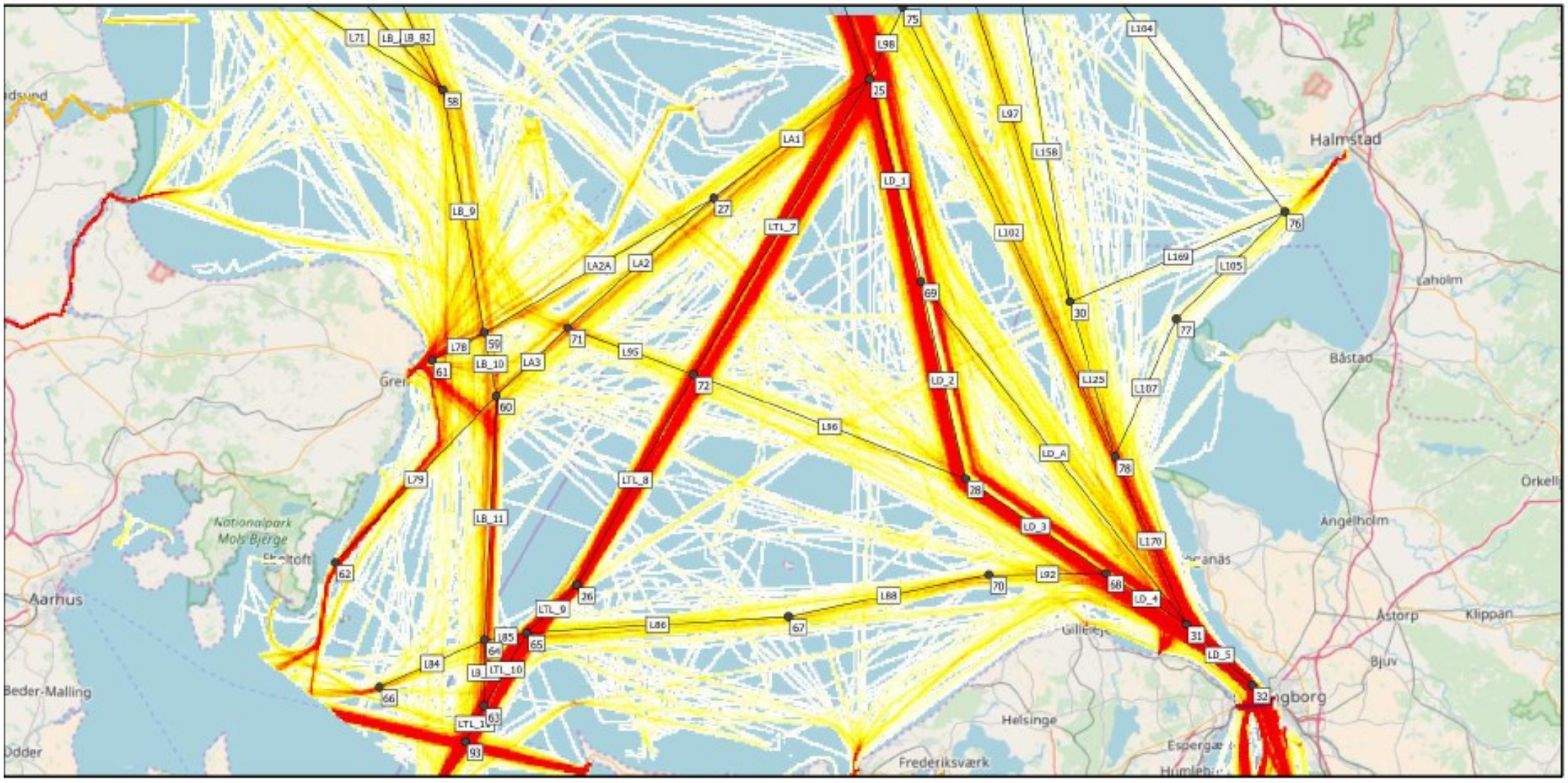


Northern area populated with route segments (legs)

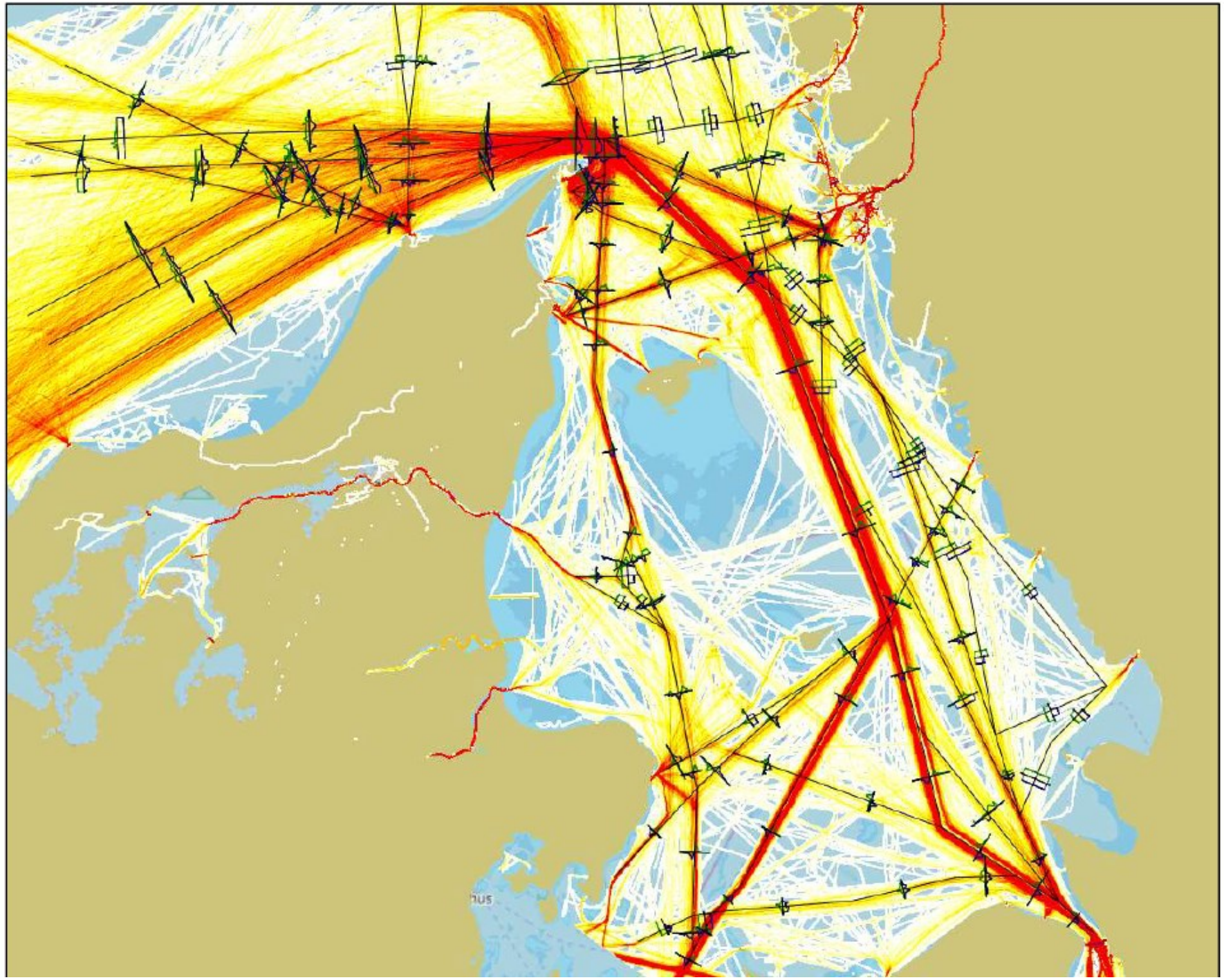


Mid-section populated with route segments (legs)

Southern area populated with route segments (legs)

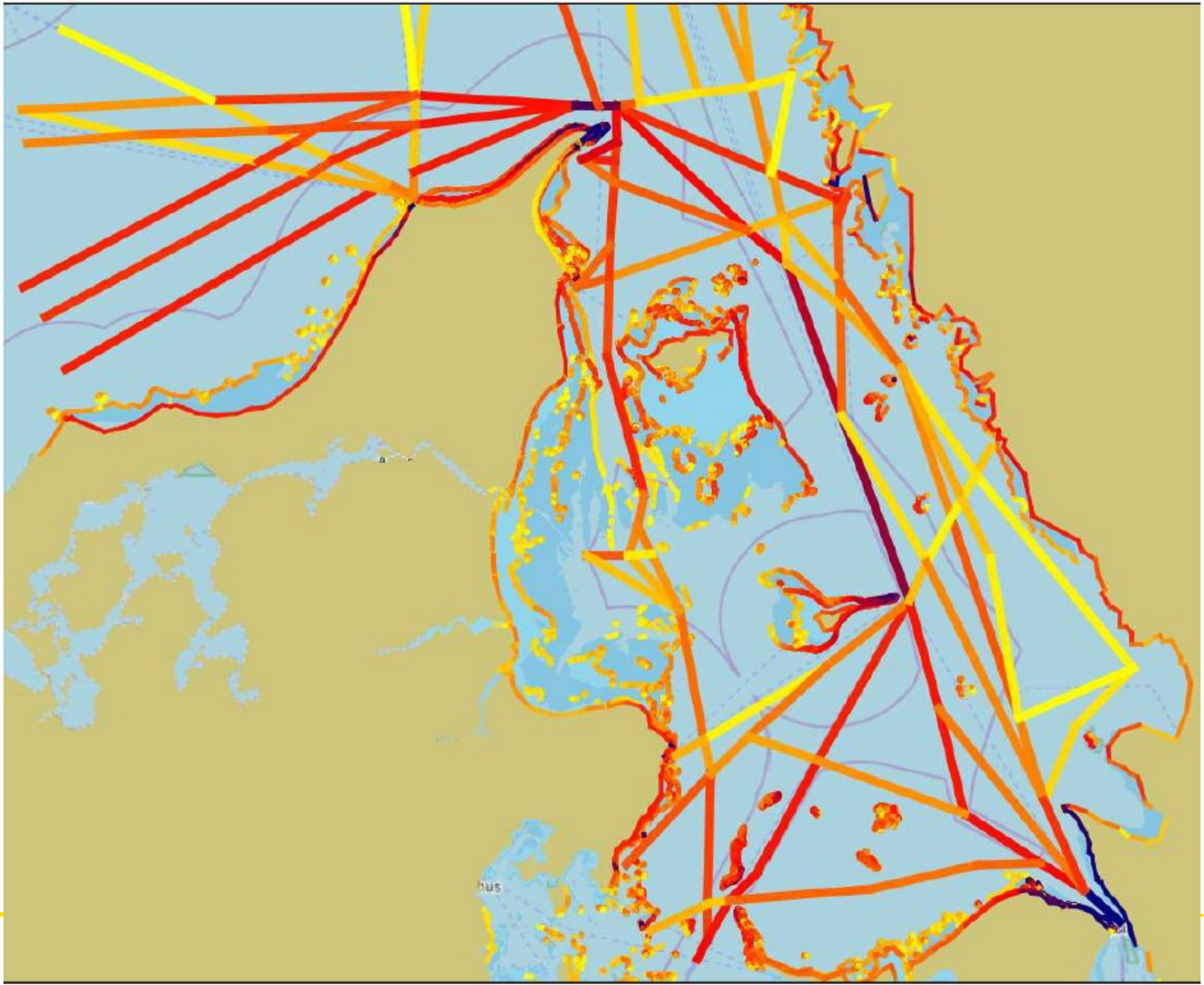


Complete Model



Complete Model

Frequency Analysis



Complete Model

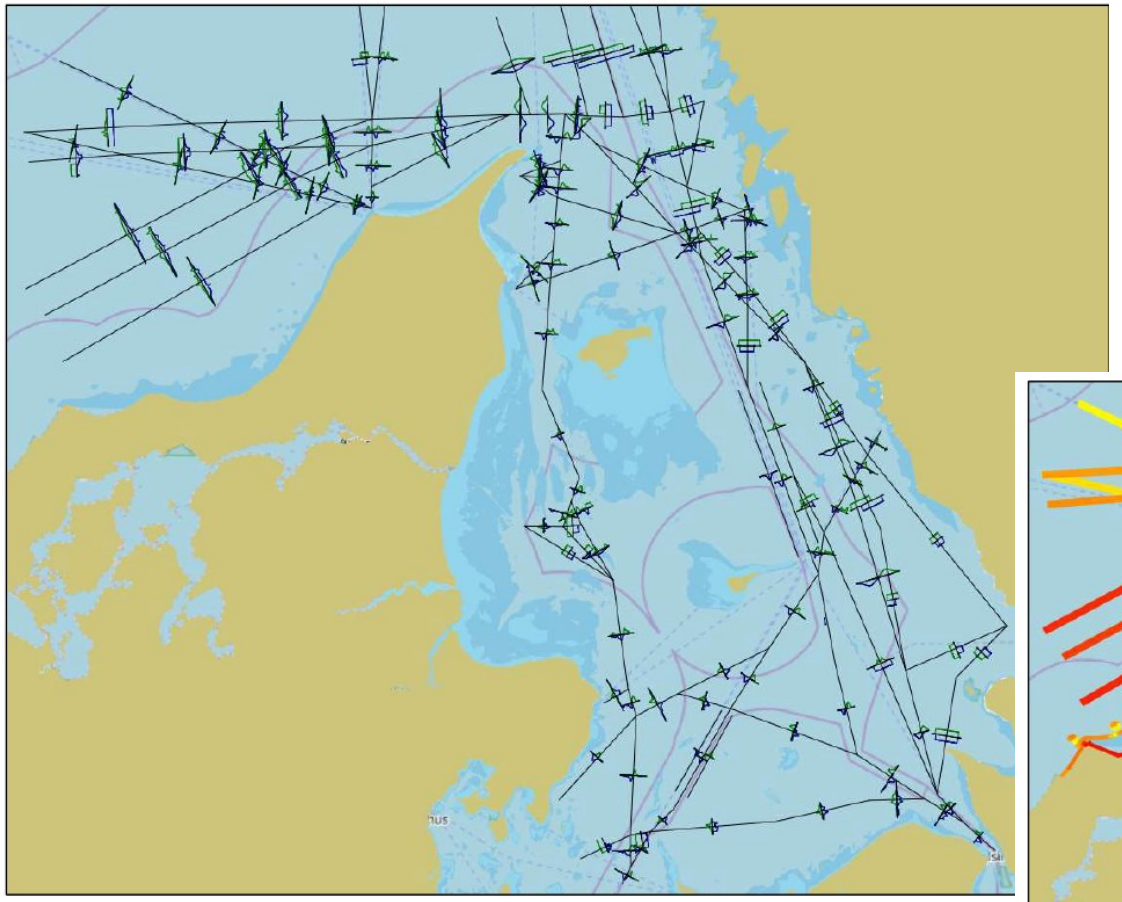
Frequency Analysis

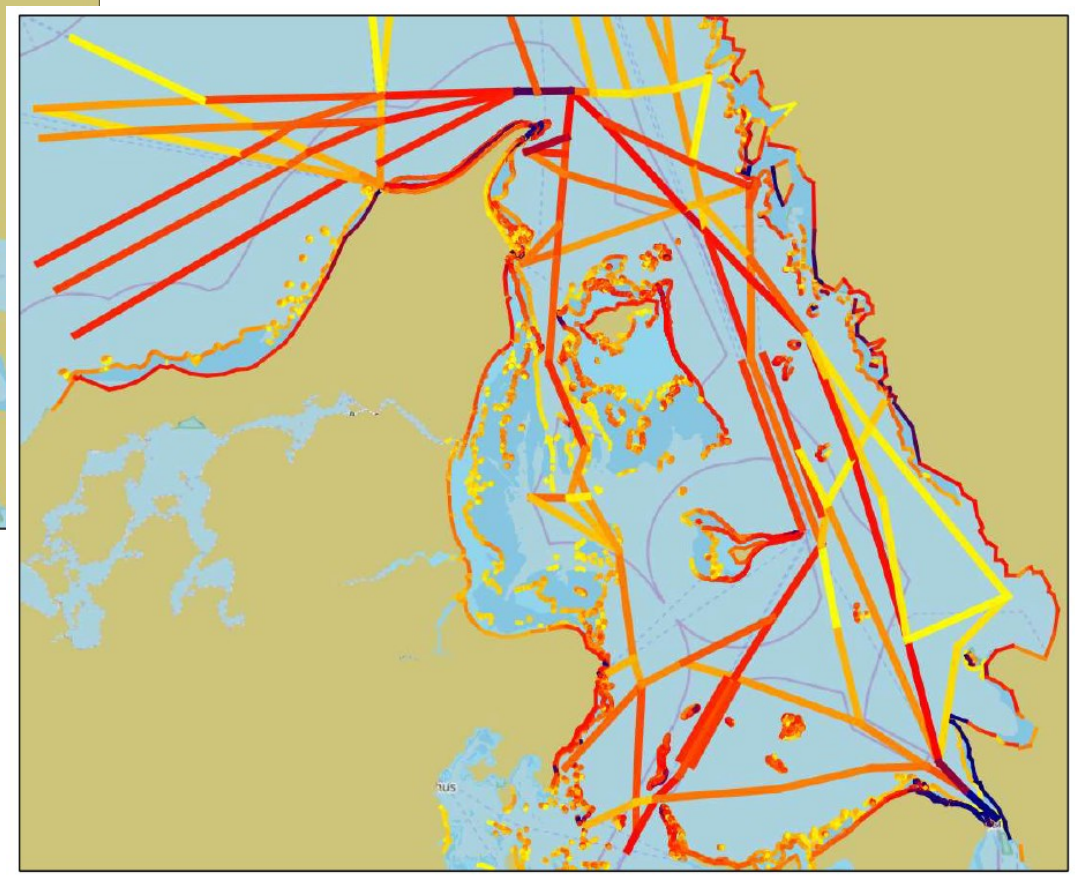
	Current
Powered Grounding	1,25417
Drifting Grounding	1,76821
Total Groundings	3,02238
Overtaking	0,111065
Head-on	0,055507
Crossing	0,087895
Merging	0,079356
Bend	0,164958
Total Collisions	**0,498781**

Table 1 Incidents per year

Complete Model

Proposed New Layout





Complete Model

Proposed New Layout

Frequency Analysis

	Proposed
Powered Grounding	1,0223000000
Drifting Grounding	1,7269300000
Total Groundings	2,7492300000
Overtaking	0,1147760000
Head-on	0,0490831000
Crossing	0,0861842000
Merging	0,0712218000
Bend	0,1377430000
Total Collisions	**0,4590070000**

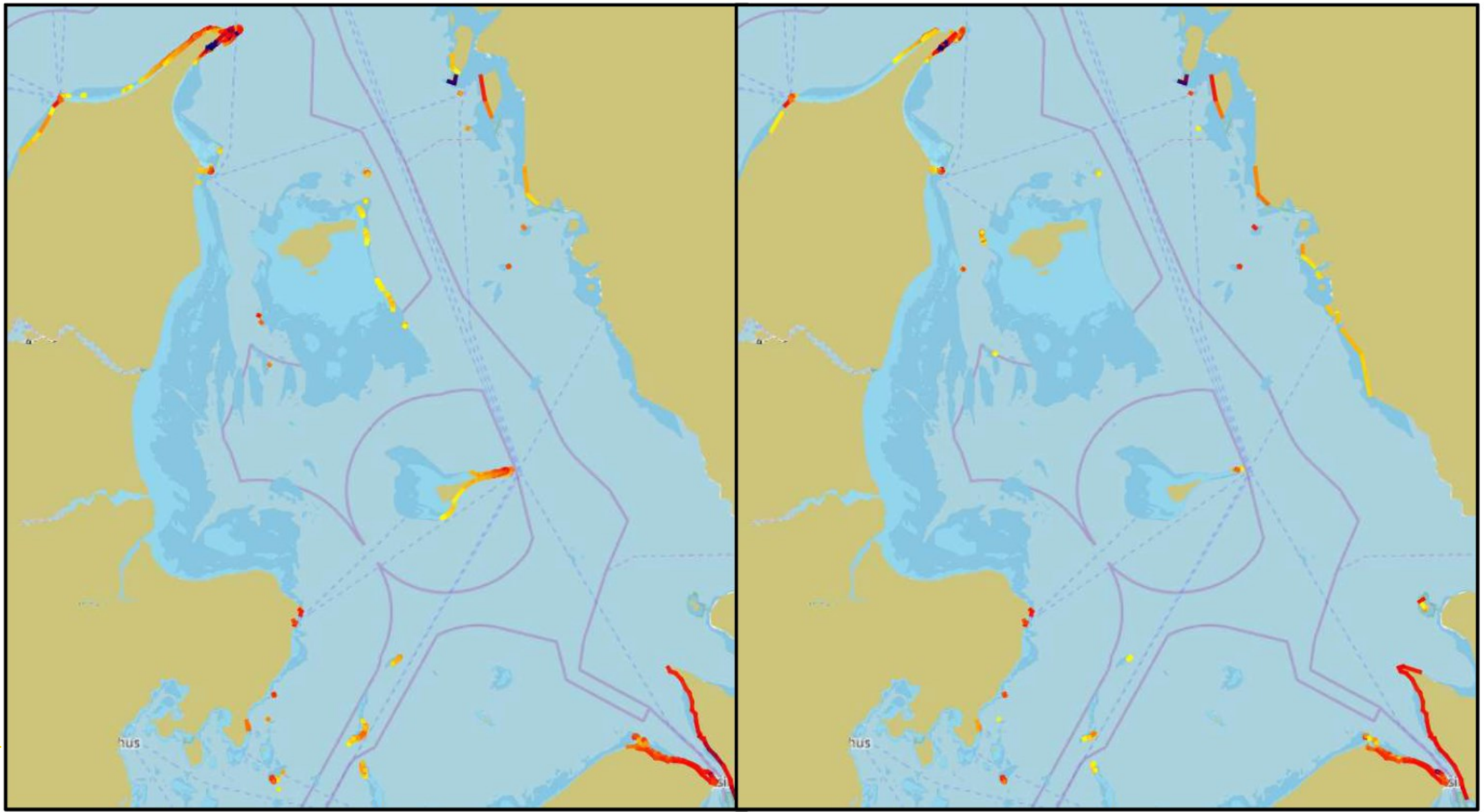
Table 4 Incidents per year

Comparison between curren and proposed new route layout

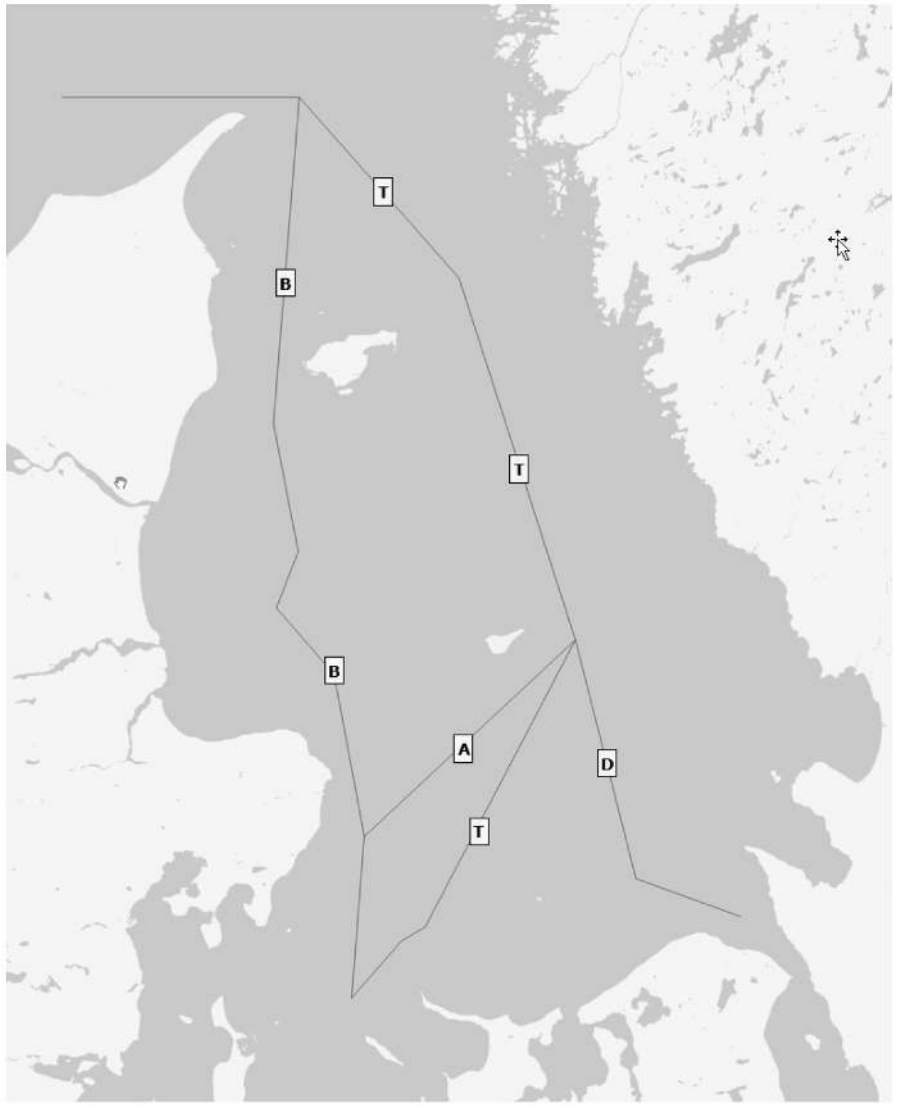
	Current	Proposed	Percentage increase
Powered Grounding	1,25417	1,02230	-18,488%
Drifting Grounding	1,76821	1,72693	-2,335%
Total Groundings	3,02238	2,74923	-9,038%
Overtaking	0,111065	0,11477	3,341%
Head-on	0,055507	0,04908	-11,573%
Crossing	0,087895	0,08618	-1,947%
Merging	0,079356	0,07122	-10,250%
Bend	0,164958	0,13774	-16,498%
Total Collisions	**0,498781**	**0,459007**	**-7,974%**

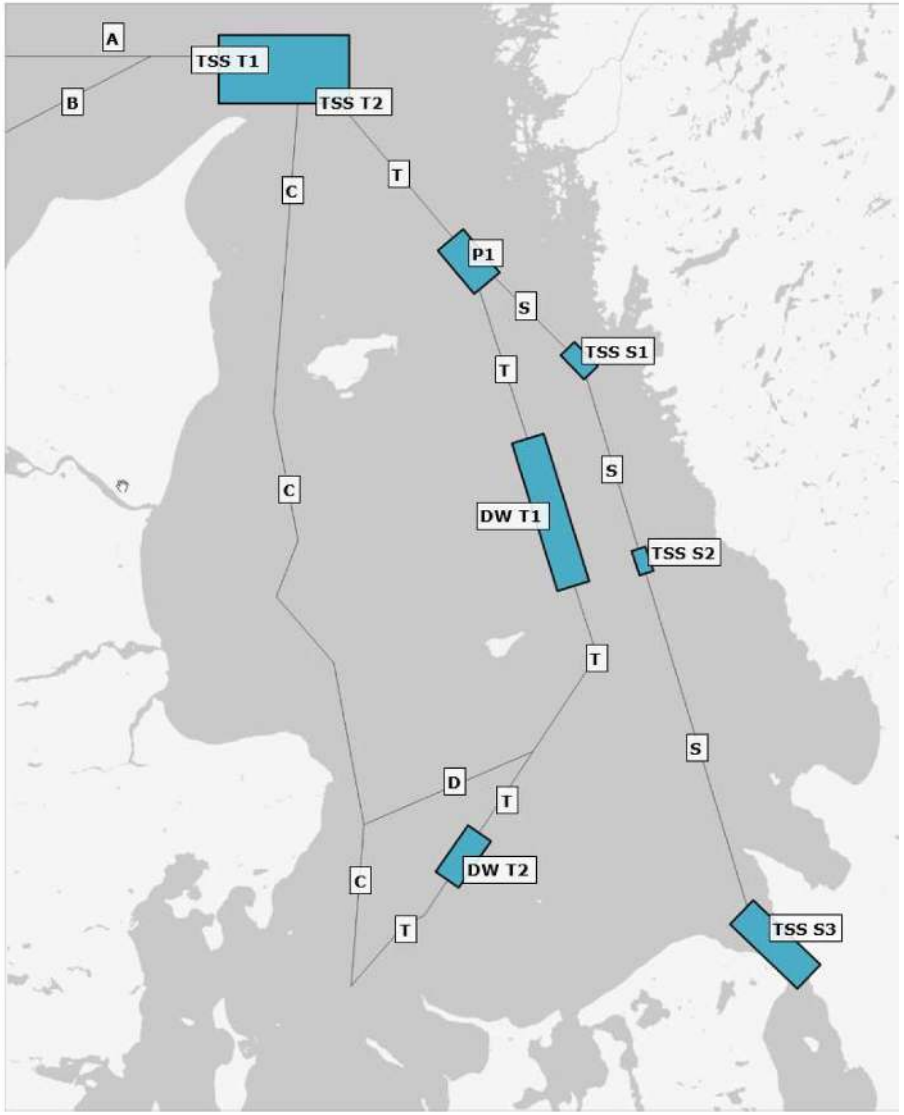
Table 8 Incidents per year comparison

Comparison between current and proposed new route layout



Current and proposed future route layout





SIMPLIFIED IALA RISK ASSESSMENT METHOD – SIRA

Fiji Case

Causality

Risk = P * C

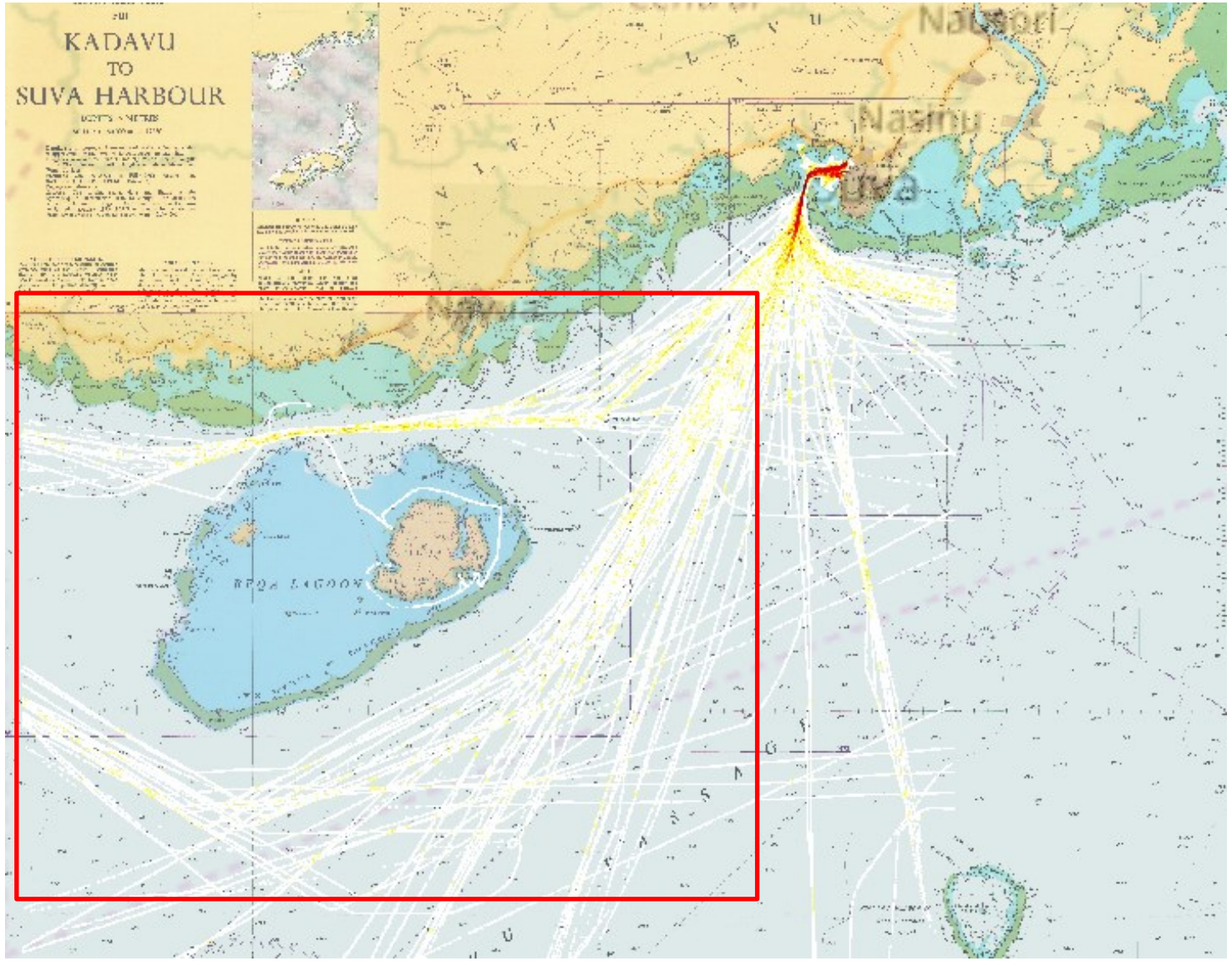
Risk Value Matrix

		PROBABILITY OR LIKELIHOOD				
		Very Rare (1)	Rare (2)	Occasional (3)	Frequent (4)	Very frequent (5)
CONSEQUENCE OR IMPACT	Catastrophic (5)	5	10	15	20	25
	Major (4)	4	8	12	16	20
	Severe (3)	3	6	9	12	15
	Minor (2)	2	4	6	8	10
	Insignificant (1)	1	2	3	4	5

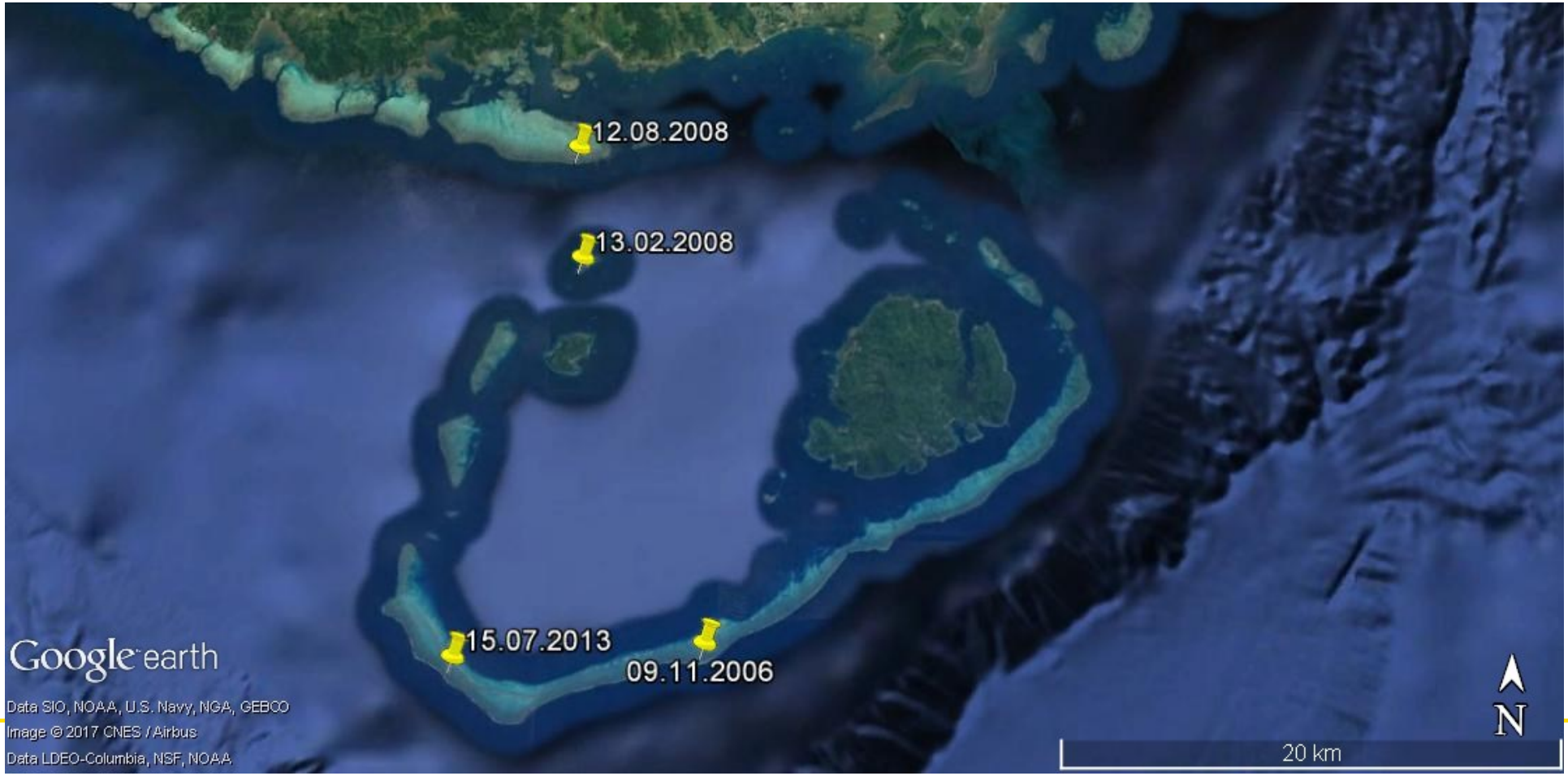
SIRA Process

1. Select waterway to be analysed
2. Define zones and describe each area
3. Identify hazards in zone and develop scenarios
4. Assess probability and consequence of each scenario
5. Identify (specify) and prioritize risk control options
6. Produce comprehensive report (decide)
7. Communicate result to decision makers (act)

Area to be analysed



Fishing Vessel Groundings in the Beqa Lagoon area



November 9, 2006

February 13, 2008

August 12, 2008

July 15, 2013

Vessel name – Ming JVII FWU No. 16

SIRA Process

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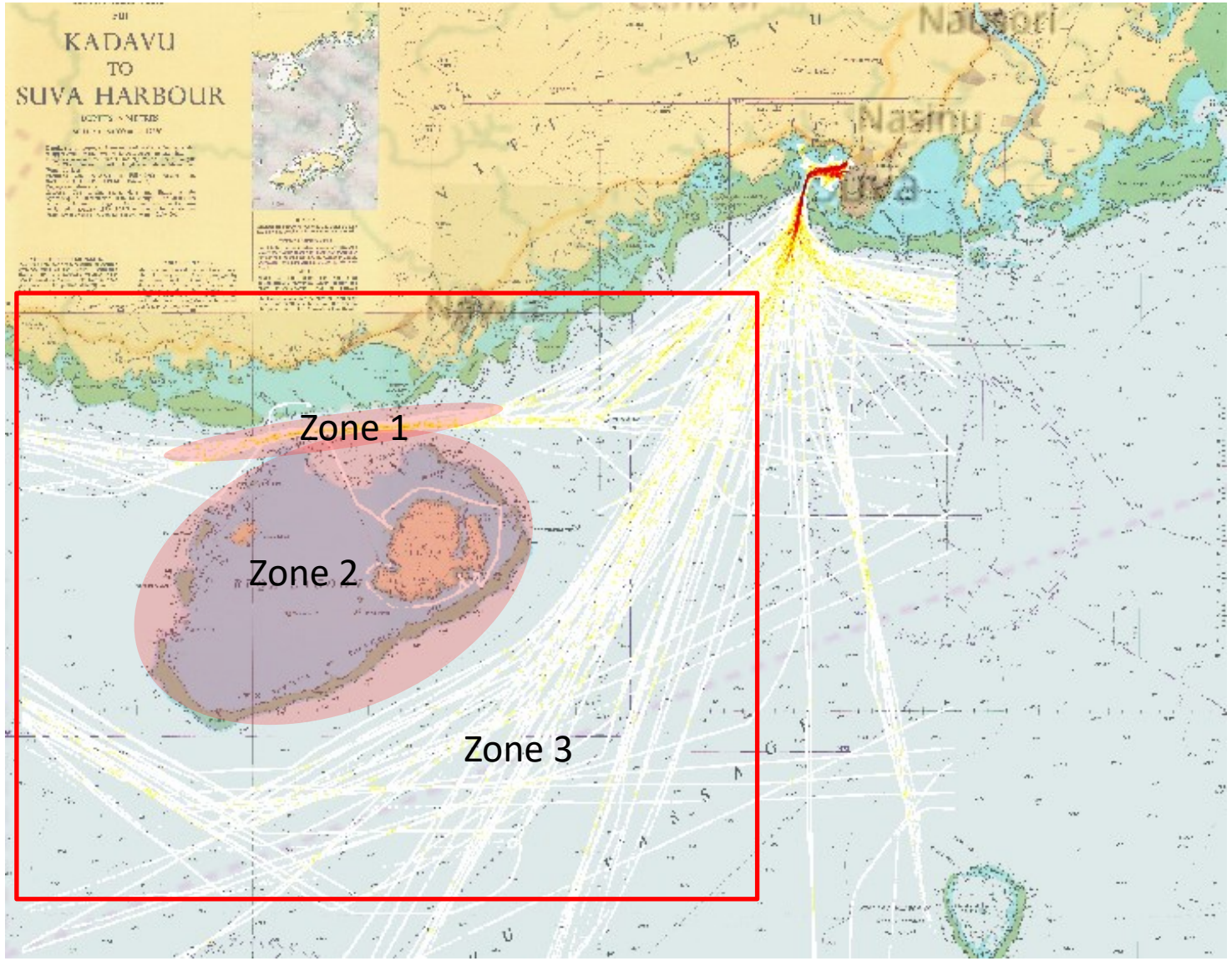
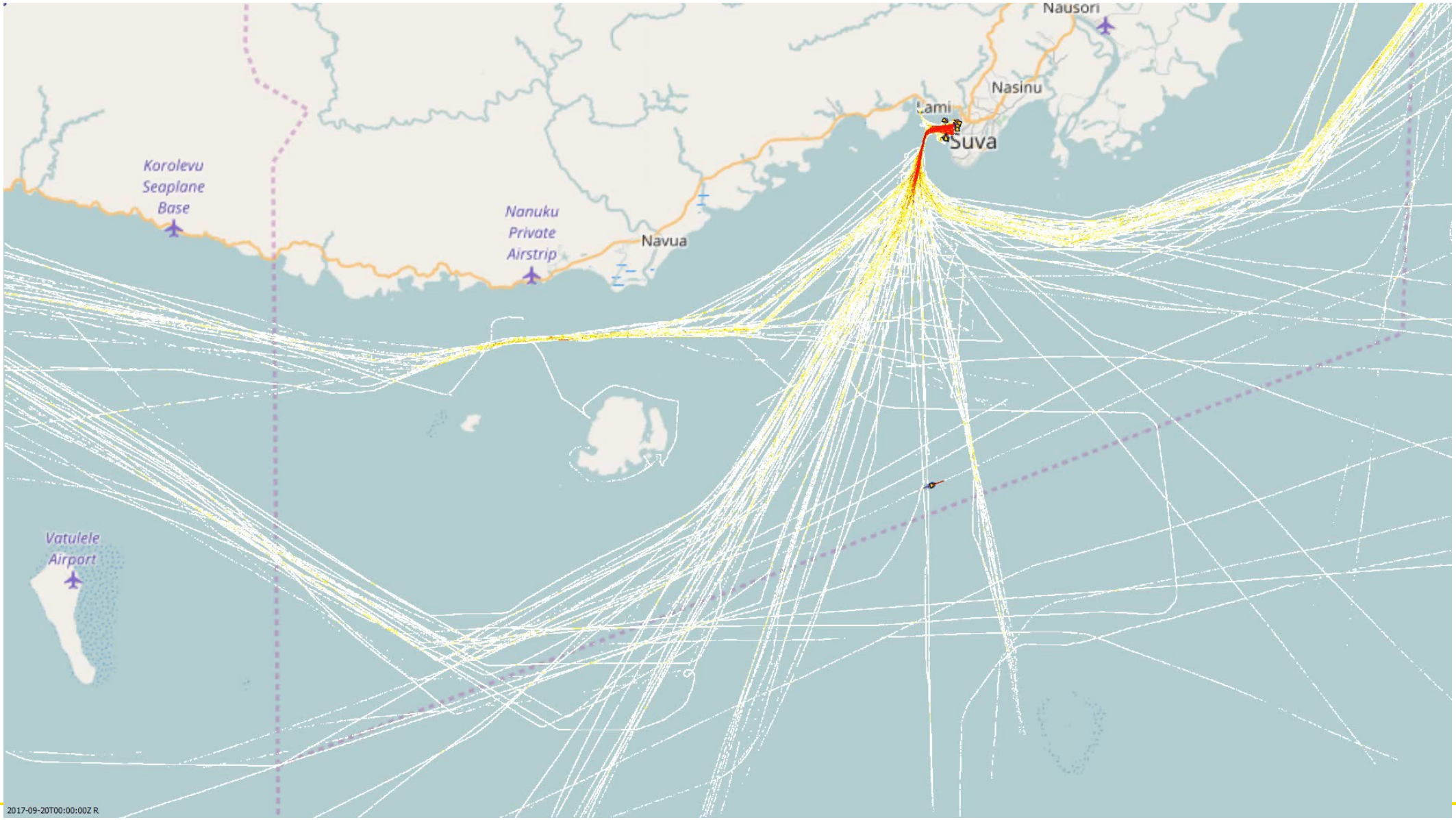
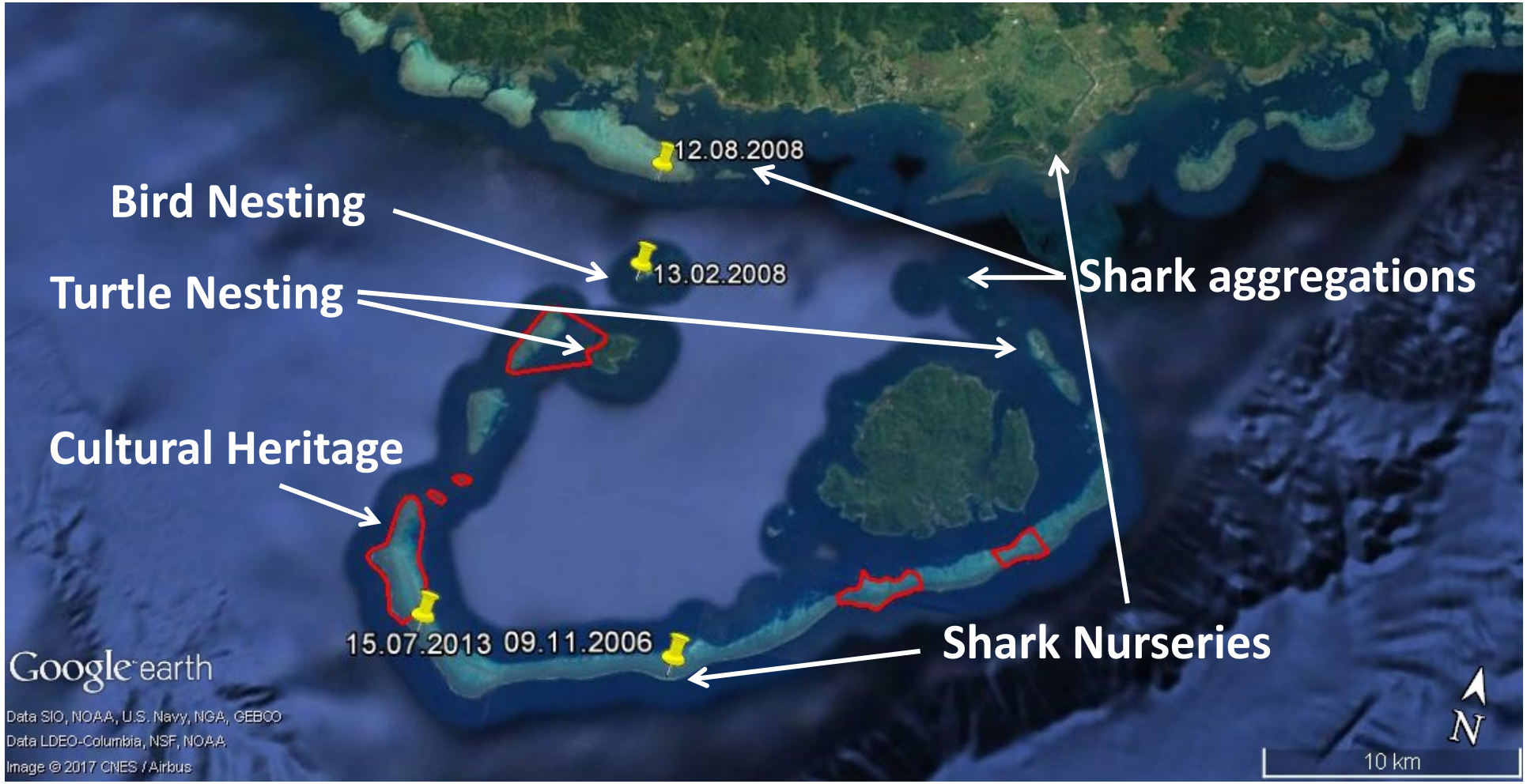
Area to be analysed



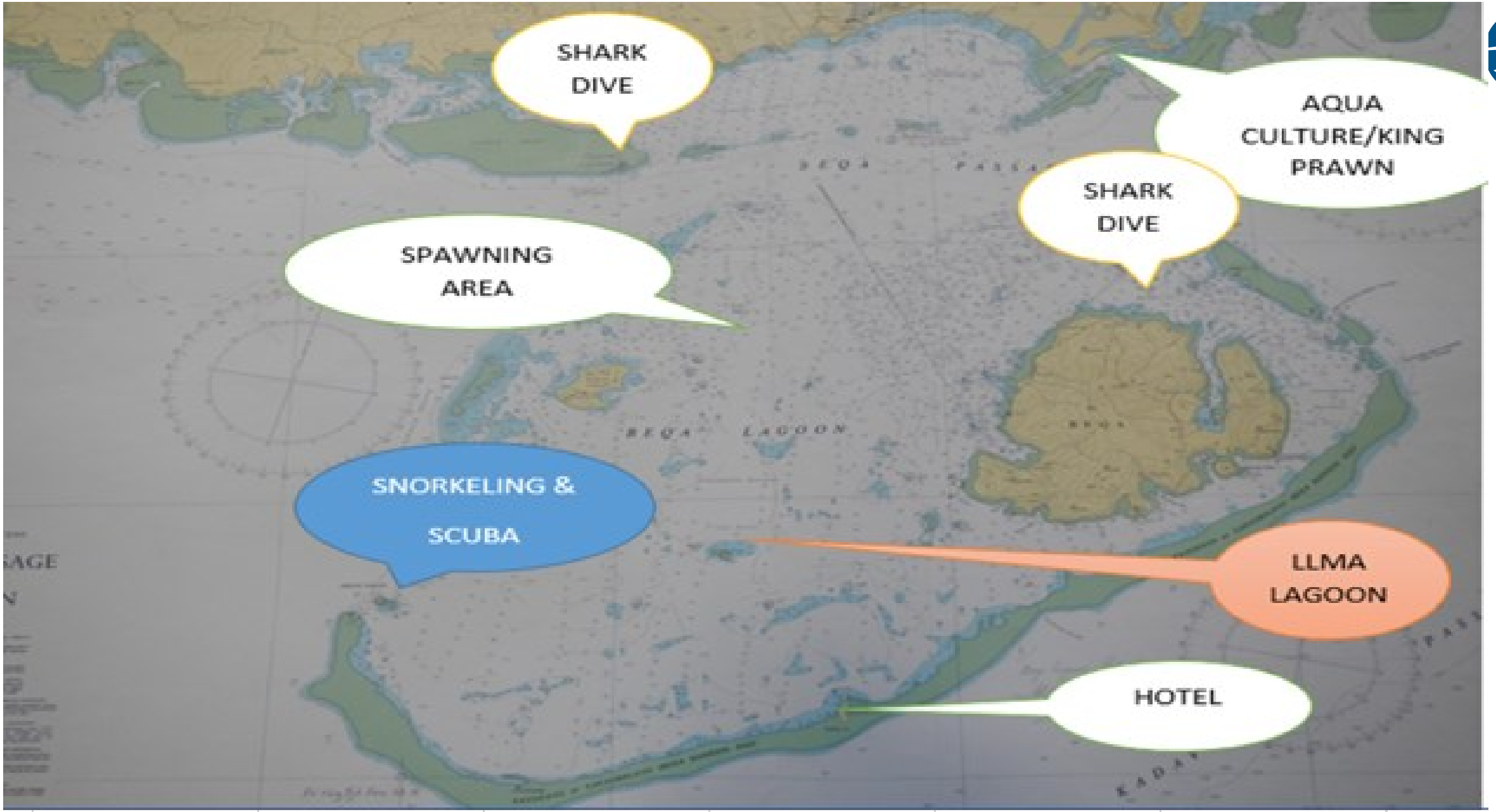
IWRAP Video (three days)



Ecological and Cultural Risks



- Tabu (Locally Marine Managed Areas) areas


SHARK DIVE
AQUA CULTURE/KING PRAWN
SHARK DIVE
SPAWNING AREA
SNORKELING & SCUBA
LLMA LAGOON
HOTEL

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Hazard Identification

- Numerous **reefs** exist in Beqa passage – could lead to groundings
- **Insufficient AtoN** in Beqa passage - could lead to groundings
- Tropical **storms** may lead to grounding scenarios
- **Discharges** of oil, ballast water, sewage, and trash from vessels in area can lead to pollution
- **Antifouling** discharging from tourist vessels in the area may have a toxic effect on numerous species
- Entagled and **drifting fishing gear**

Scenarios

- A grounding of a large vessel in the Beqa passage due to lack of navigational aids, with major oil spill
- A grounding results in a **minor** oil spill which reaches Turtle nesting area(s)
- A grounding results in a **major** oil spill which reaches Turtle nesting area(s)
- A grounding of a large vessel on famous reefs
- A grounding and discharge on reefs with shark provisioning
- a vessel experiences mechanical/instrumental failure and drifts to the entrance or in close proximity of the Pearl marina

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Scenario probability and consequences

Zone 1 - Beqa passage north of the Lagoon

Id	Possible Scenario(s)	Description of Consequences (Short term and long term)	Existing Risk Control Measures	Probability Score	Consequence Score	Present Risk Score	Further Risk Control Options	New Probability Score	New Consequence Score	New Risk Score	Remarks
1.1	A grounding of a large vessel in the Beqa passage due to lack of navigational aids, with major oil spill	Damage to coral reef. Oil pollution in most of the lagoon. Loss of substantial quantities of different marine species. Traditional fishing ritual impossible for years. Most of the population must relocate due to lack of food. Major impact on tourism operators, thus on local economy.		2	5	10	Ensure that all oil tankers and large vessesl with significant bunker keep out of the Beqa passage. Either through national or international legislation and effective enforcement 24/7.	1	5	5	
1.2	A grounding results in a minor oil spill which reaches Turtle nesting area(s)	Loss of this years Turtle offsprings, but no severe long term impact	Oil tankers are not allowed to use the Beqa channel by local legislation. This is enforced during office hours.	2	4	8	Same as above	1	4	4	
1.3	A grounding results in a major oil spill which reaches Turtle nesting area(s)	Total loss of the turtle population, it may take decades for it to recover	Oil tankers are not allowed to use the Beqa channel by local legislation. This is enforced during office hours.	2	5	10	Same as above	1	5	5	
1.4	A grounding of a large vessel on famous reefs	Damage to coral reef. Long term impact on tourism activities and on local economy.		2	5	10	Same as above	1	5	5	
1.5	A grounding and discharge on reefs with shark provisioning	Damage to coral reef. Long term to ireversable impact on tourism operators and on local economy.		2	5	10	Same as above	1	5	5	
1.6	a vessel experiences mechanical/instrumental fail	Obstruction to the water way, inability for businesses, locals, and wildlife to navigate in or out of the river.		2	5	10	Have adequate regulation on maintenance and enforecement of seaworthiness	1	5	5	
1.7	A grounding results in a minor oil spill which reaches sea-bird nesting area(s)	Loss of this years sea-bird offsprings, but no severe long term impact, in addition to damage of the underlying reef		3	4	12	Ensure that all oil tankers and large vessesl with significant bunker keep out of the	1	4	4	
1.8	A grounding results in a minor oil spill which reaches sea-bird nesting area(s)	Total loss of the sea-bird population, it may take decades for it to recover, in addition to damage of the underlying reef		3	5	15	Same as above	1	5	5	
1.9	A collision between vessels crossing the passage and migrating, calfing whales	Injury or death to the whales		2	5	10	Alert sea-goers on whale migrating season and occurrence in the area	1	5	5	
1.10	A collision between vessels crossing the passage and turtles	Severe injury or death to the turtles		4	2	8	Alert sea-goers on turtle ocurence, and especially on migrating season and nesting	3	2	6	
1.11	Entagled and drifting fishing gear	Damage to the reef and deaf of entagled creatures		4	5	20	Ban commercial fishing in the passage	1	5	5	
							* A training program for indigenous communities be established to improve the				

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Scenario probability and consequences

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1.1	A grounding of a large vessel in the Beqa passage due to lack of navigational aids, with major oil spill	Damage to coral reef. Oil pollution in most of the lagoon. Loss of substantial quantities of different marine species. Traditional fishing ritual impossible for years. Most of the population must relocate due to lack of food. Major impact on tourism operators, thus on local economy.	

g Risk Control Measures	Probability Score	Consequence Score	PresentRisk Score	Further Risk Control Options	New Probability Score	New Consequence Score	New Risk Score
	2	5	10	Ensure that all oil tankers and large vessesl with significant bunker keep out of the Beqa passage. Either through national or international legislation and effective enforcement 24/7.	1	5	5

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Comparing Risk Values of different Scenarios

Risk Value Matrix

		PROBABILITY OR LIKELIHOOD				
		Very Rare (1)	Rare (2)	Occasional (3)	Frequent (4)	Very frequent (5)
CONSEQUENCE OR IMPACT	Catastrophic (5)	5	10	15	20	25
	Major (4)	4	8	12	16	20
	Severe (3)	3	6	9	12	15
	Minor (2)	2	4	6	8	10
	Insignificant (1)	1	2	3	4	5

Scales are not carved in stone!

Is the time scale suitable?

> 1040 weeks

1040 weeks

156 weeks

24 weeks

1 week

Probability

Classification	Score	Probability
Very rare	**1**	Very rare or unlikely, will occur only in exceptional circumstances and not more than once every 20 years
Rare	**2**	Rare, may occur every 3-20 years
Occasioal	**3**	Occasional, may occur every 6 months to 3 years
Frequent	**4**	Frequent, may occur once weekly to every 6 months
Very frequent	**5**	Very frequent, may occur at least once every week

Scales are not carved in stone!

Consequence / Impact

Description	Score	Service disruption criteria	Human Impact Criteria	Financial Criteria	Environmental Criteria
Superficial	1	No service disruption apart from some delays or nuisance	No injury to humans, perhaps significant nuisance	Loss, including third party losses, less than US$1.000	Insignificant damage to the environment
Minor	2	Some non-permanent loss of services such as closure of a port or waterway for up to 4 hours	Minor injury to one or more individuals, may require hospitalization	Loss, including third party losses, US$1.000 – 50.000	Some, but reversible damage in a small area
Severe	3	Sustained disruption to services such as closure of a port or waterway for 4-24 hours	Injuries to several individuals requiring hospitalization	Loss, including third party losses of $50.000-5.000.000	Severe, but reversible damage in a limitted area
Major	4	Sustained disruption to services such as closure of a major port or waterway for 1-30 days or permanent or irreversible loss of services	Severe injuries to many individuals or loss of life.	Loss, including third party losses of $5.000.000-50.000.000	Irreversible damage in a limited area
Catastrophic	5	Sustained disruption to services such as closure of a major port or waterway for months or years	Severe injuries to numerous individuals and/or loss of several lives.	Loss, including third party losses of over $50.000.000	Irreversible damage in a large area.

Impact on:

Default:

- Service/Operations
- Humans
- Finances
- Environment

Additional:

- Marine Species
- Heritage
- Tourism
- Culture

Scales are not carved in stone!

Additional criteria

Marine Species Criteria	Heritage Criteria	Tourism Criteria	Cultural Criteria
Insignificalt loss of the population or minor disturbance of one or more species in a small area	Minuscule destruction or loss of elements of a heritage site	Minuscule influence on volume of tourism in a small area	Minuscule influence on one or more features of a culture
Some reduction (<10%) of population or noticable disturbance of one or more species in a small area	Some destruction or loss (<10%) of elements of a heritage site	Some influence (<10%) on volume of tourism in a small area	Difficulty in maintaining one or more cultural features
Noticable reduction (>10%) in population and/or severe disturbance of one or more species in a limitted area	Noticable (>10%) destruction or loss of elements of a heritage site	Noticable (>10%) reduction of volume of tourism in a limitted area	Loss of one cultural feature
Over 50% reduction of population or extensive disturbance of one or more species in a limitted area	Destruction or loss of over 50% of the elements of a heritage site	Over 50% reduction of volume of tourism in a limitted area	Loss of several cultural features resulting in a threat to one or more cultural practices existence
Loss of the whole population of one or more species in a large area	Total loss of a heritage site or over 50% loss of elements of more than one heritage site	Total loss of tourism in a limitted area or over 80% reduction in volume in a large area	Loss of several significant cultural features resulting in the termination of one or more cultural practices

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