Integrated surveys: how to benefit?

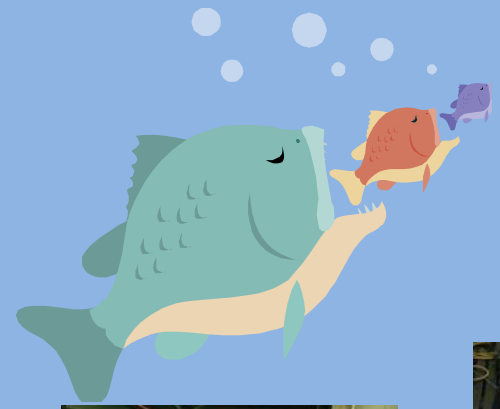
Ingeborg de Boois (ICES), April 2014

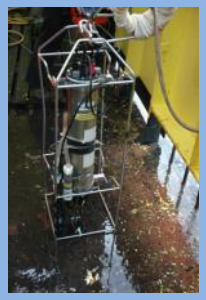
Integrated monitoring?

Integration=incorporating or combining into a whole

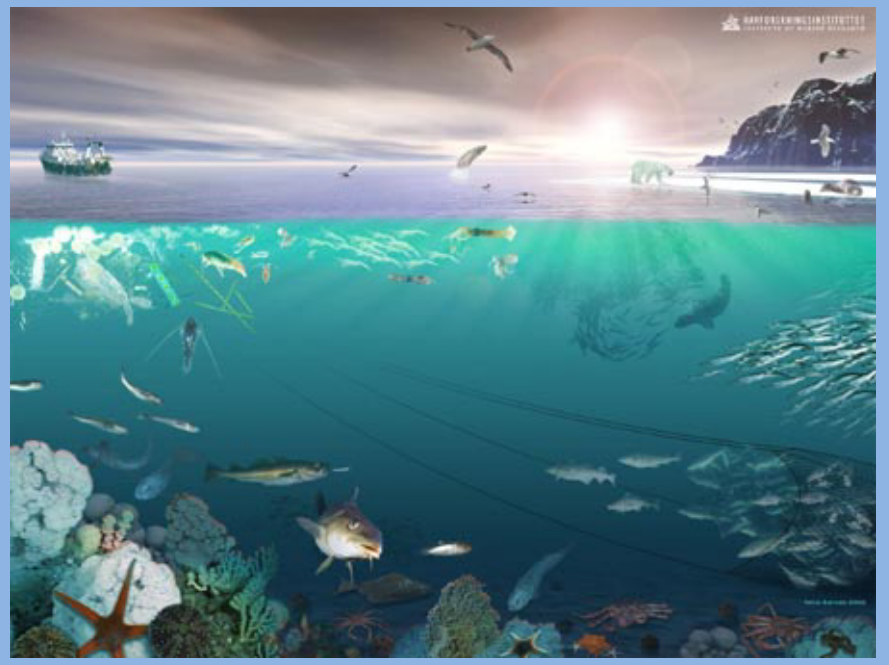
2 options:

Add to current monitoring



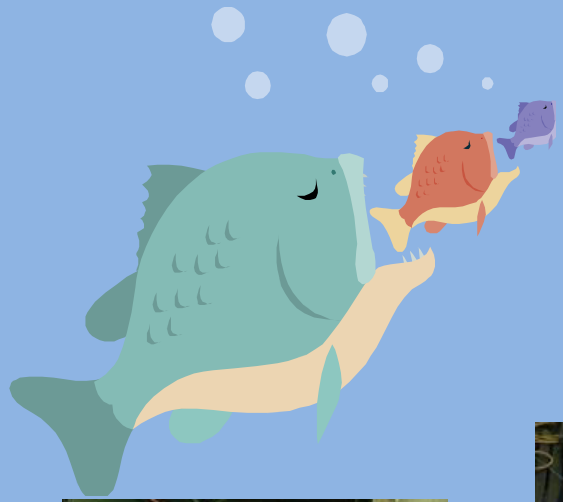
+  +  + …

Design ecosystem monitoring from scratch



http://www.mghs.sa.edu.au/internet/curriculum/science/Year10/ecosystemEarth.htm

Add to current monitoring



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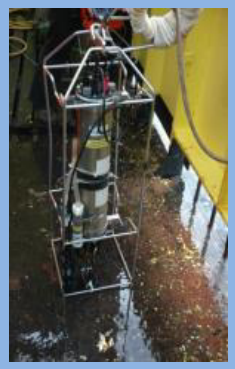
+ 

+ ...

Add to current monitoring programme

Task
Fish
Organism collection (e.g. for contaminants, fatty acids analys
Stomach sampling
Additional biological data (e.g. liver/gonad weight, otoliths,
Disease/parasite registration
Genetic information
Lipid content
Sonar observations pelagic fish
Tagging
Bioactive materials in marine species
Echosounder observations pelagic fish
Physical and chemical oceanography (e.g. CTD, chlorophyll, o
Continuous underway oceanographic measurements [from t
Station oceanographic measurements
Continuous underway oceanographic measurements [autonc
Water movement
Station nutrient samples
Biological oceanography
Station microbiological samples
Station phytoplankton samples
Continuous phytoplankton samples
Station zooplankton samples [towed]
Station zooplankton samples [dipped]
Continuous zooplankton samples
Invertebrates
Infauna
Epifauna [towed]
Epifauna [video]
Pelagic
Megafauna
ESAS sampling (birds, sea mammals)

Add to current monitoring programme

	MSFD descriptor related to										
Task	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Fish											
Organism collection (e.g. for contaminants, fatty acids analys	x	x	x	x				x	x		
Stomach sampling	x		x	x							
Additional biological data (e.g. liver/gonad weight, otoliths, s	x	x	x	x				x			
Disease/parasite registration	x							x	x		
Genetic information	x		x								
Lipid content				x							
Sonar observations pelagic fish			x								
Tagging			x								
Bioactive materials in marine species											
Echosounder observations pelagic fish	x	x	x								
Physical and chemical oceanography (e.g. CTD, chlorophyll, oxygen, nutrients, turbidity, etc.)											
Continuous underway oceanographic measurements [from the ship]							x				
Station oceanographic measurements							x				
Continuous underway oceanographic measurements [autonomous devices]							x				
Water movement							x				
Station nutrient samples					x						
Biological oceanography											
Station microbiological samples	x	x	x					x			
Station phytoplankton samples	x	x	x		x			x			
Continuous phytoplankton samples	x	x	x		x			x			
Station zooplankton samples [towed]	x	x	x					x			
Station zooplankton samples [dipped]	x	x	x					x			
Continuous zooplankton samples	x	x	x					x			
Invertebrates											
Infauna	x	x		x		x					
Epifauna [towed]	x	x		x		x					
Epifauna [video]	x	x		x		x					
Pelagic	x	x		x							
Megafauna											
ESAS sampling (birds, sea mammals)	x	x		x							

Add to current monitoring programme

	MSFD descriptor related to											
Task	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**Fisheries survey for data collection**
Fish												
Organism collection (e.g. for contaminants, fatty acids analys	x	x	x	x				x	x			trawl, acoustic and ichthyoplankon
Stomach sampling	x		x	x								trawl, acoustic and ichthyoplankon
Additional biological data (e.g. liver/gonad weight, otoliths, s	x	x	x	x				x				trawl, acoustic and ichthyoplankon
Disease/parasite registration	x							x	x			trawl, acoustic and ichthyoplankon
Genetic information	x		x									trawl, acoustic and ichthyoplankon
Lipid content				x								trawl, acoustic and ichthyoplankon
Sonar observations pelagic fish			x									all
Tagging			x									trawl, acoustic and ichthyoplankon
Bioactive materials in marine species												trawl, acoustic and ichthyoplankon
Echosounder observations pelagic fish	x	x	x									all
Physical and chemical oceanography (e.g. CTD, chlorophyll, oxygen, nutrients, turbidity, etc.)												
Continuous underway oceanographic measurements [from the ship]							x					all
Station oceanographic measurements							x					all
Continuous underway oceanographic measurements [autonomous devices]							x					all
Water movement							x					all
Station nutrient samples					x							all
Biological oceanography												
Station microbiological samples	x	x	x					x				all
Station phytoplankton samples	x	x	x		x			x				all
Continuous phytoplankton samples	x	x	x		x			x				all
Station zooplankton samples [towed]	x	x	x					x				all
Station zooplankton samples [dipped]	x	x	x					x				all
Continuous zooplankton samples	x	x	x					x				all
Invertebrates												
Infauna	x	x		x		x						all
Epifauna [towed]	x	x		x		x						all
Epifauna [video]	x	x		x		x						all
Pelagic	x	x		x								all
Megafauna												
ESAS sampling (birds, sea mammals)	x	x		x								all

Add to current monitoring programme

Task	MSFD descriptor related to 1	2	3	4	5	6	7	8	9	10	11	Fisheries survey for data collection	Preparation Additional equipment
Fish													
Organism collection (e.g. for contaminants, fatty acids analys	x	x	x	x				x	x			trawl, acoustic and ichthyoplankon	no
Stomach sampling	x		x	x								trawl, acoustic and ichthyoplankon	no
Additional biological data (e.g. liver/gonad weight, otoliths, s	x	x	x	x				x				trawl, acoustic and ichthyoplankon	no
Disease/parasite registration	x							x	x			trawl, acoustic and ichthyoplankon	no
Genetic information	x		x									trawl, acoustic and ichthyoplankon	no
Lipid content				x								trawl, acoustic and ichthyoplankon	Fat meter; Calibation s
Sonar observations pelagic fish			x									all	scientific sonar
Tagging			x									trawl, acoustic and ichthyoplankon	Tags and fish handling
Bioactive materials in marine species												trawl, acoustic and ichthyoplankon	no
Echosounder observations pelagic fish	x	x	x									all	no
Physical and chemical oceanography (e.g. CTD, chlorophyll, oxygen, nutrients, turbidity, etc.)													
Continuous underway oceanographic measurements [from the ship]							x					all	dependent on variable
Station oceanographic measurements							x					all	dependent on variable
Continuous underway oceanographic measurements [autonomous devices]							x					all	dependent on variable
Water movement							x					all	ADCP
Station nutrient samples					x							all	Water sampler
Biological oceanography													
Station microbiological samples	x	x	x					x				all	Water sampler
Station phytoplankton samples	x	x	x		x			x				all	Water sampler
Continuous phytoplankton samples	x	x	x		x			x				all	CPR
Station zooplankton samples [towed]	x	x	x					x				all	Towed samplers
Station zooplankton samples [dipped]	x	x	x					x				all	Dipped samplers
Continuous zooplankton samples	x	x	x					x				all	Echosounder at proper
Invertebrates													
Infauna	x	x		x		x						all	Grab/corer, sieve
Epifauna [towed]	x	x		x		x						all	Beam trawl/dredge/sle
Epifauna [video]	x	x		x		x						all	Video
Pelagic	x	x		x								all	Trawl net
Megafauna													
ESAS sampling (birds, sea mammals)	x	x		x								all	no

Add to current monitoring programme

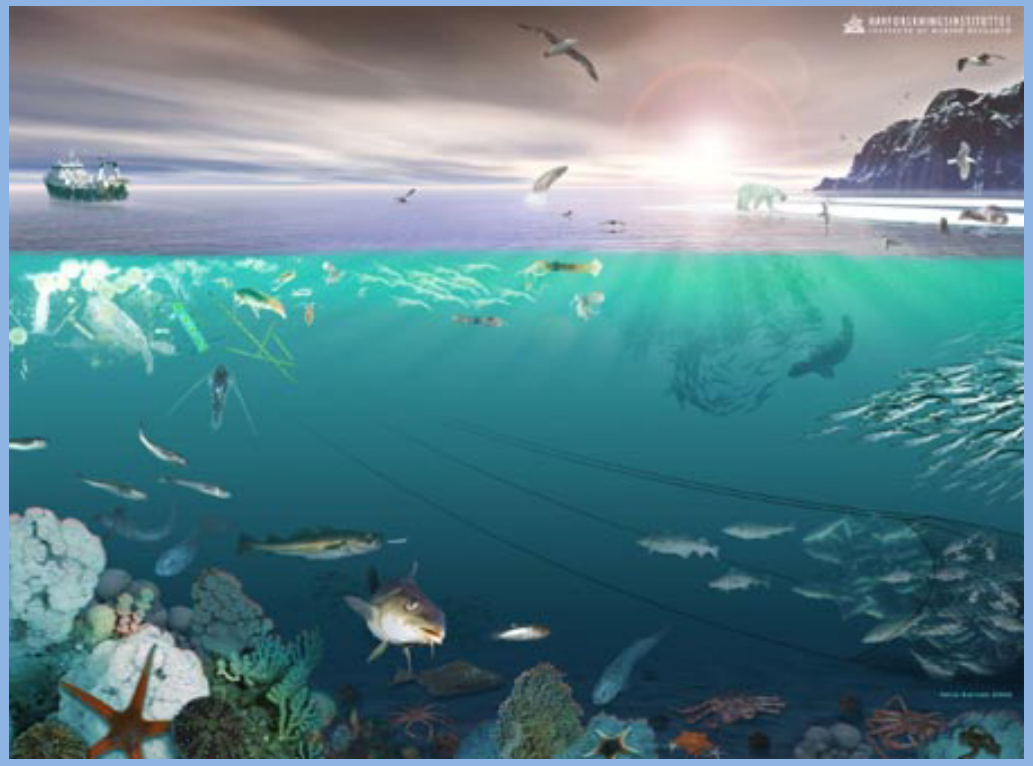
	MSFD descriptor related to											Preparation		During survey		
Task	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**Fisheries survey for data collection**	**Additional equipment**	**Additional skills**	**Extra personnel**	**Extra shiptime**	**Facilities**
Fish																	
Organism collection (e.g. for contaminants, fatty acids analys	x	x	x	x				x	x			trawl, acoustic and ichthyoplankon	no	no	no	no	sample storag
Stomach sampling	x		x	x								trawl, acoustic and ichthyoplankon	no	no	yes	no	preservation f
Additional biological data (e.g. liver/gonad weight, otoliths	x	x	x	x				x				trawl, acoustic and ichthyoplankon	no	no	dependent on t	no	no
Disease/para																	
Genetic info																	
Lipid conten																	
Sonar observ																	rage
Tagging																	dling f
Bioactive ma																	ation f
Echosounde																	rage
Physical and chemical oceanography (e.g. CTD, chlorophyll, oxygen, nutrients, turbidity, etc.)																	
Continuous																	ent on
Station ocea																	ent on
Continuous																	
Water move																	
Station nutr																	
Biological oc																	
Station micr																	ities, p
Station phytoplankton samples	x	x	x		x			x				all	Water sampler	skills for operatio	no	yes (deploy/rec	preservation f
Continuous phytoplankton samples	x	x	x		x			x				all	CPR	skills for operatio	yes	yes (deploy/rec	preservation f
Station zoop																	ation f
Station zoop																	ation f
Continuous																	rage
Invertebrates																	
Infauna	x	x		x		x						all	Grab/corer, sieve	sorting	yes	yes	preservation f
Epifauna [towed]	x	x		x		x						all	Beam trawl/dredge/sle	identification	dependent on t	yes, except for l	no
Epifauna [video]	x	x		x		x						all	Video	skills for operatio	no	yes	no
Pelagic	x	x		x								all	Trawl net	identification	dependent on t	yes, except for	no
Megafauna																	
ESAS sampling (birds, sea mammals)	x	x		x								all	no	identification, kn	yes (expert)	no	observation pl

1. many tasks can be added to a monitoring programme; additional resources might be required

2. selection of specific tasks is necessary, as we cannot carry out all tasks at the same time

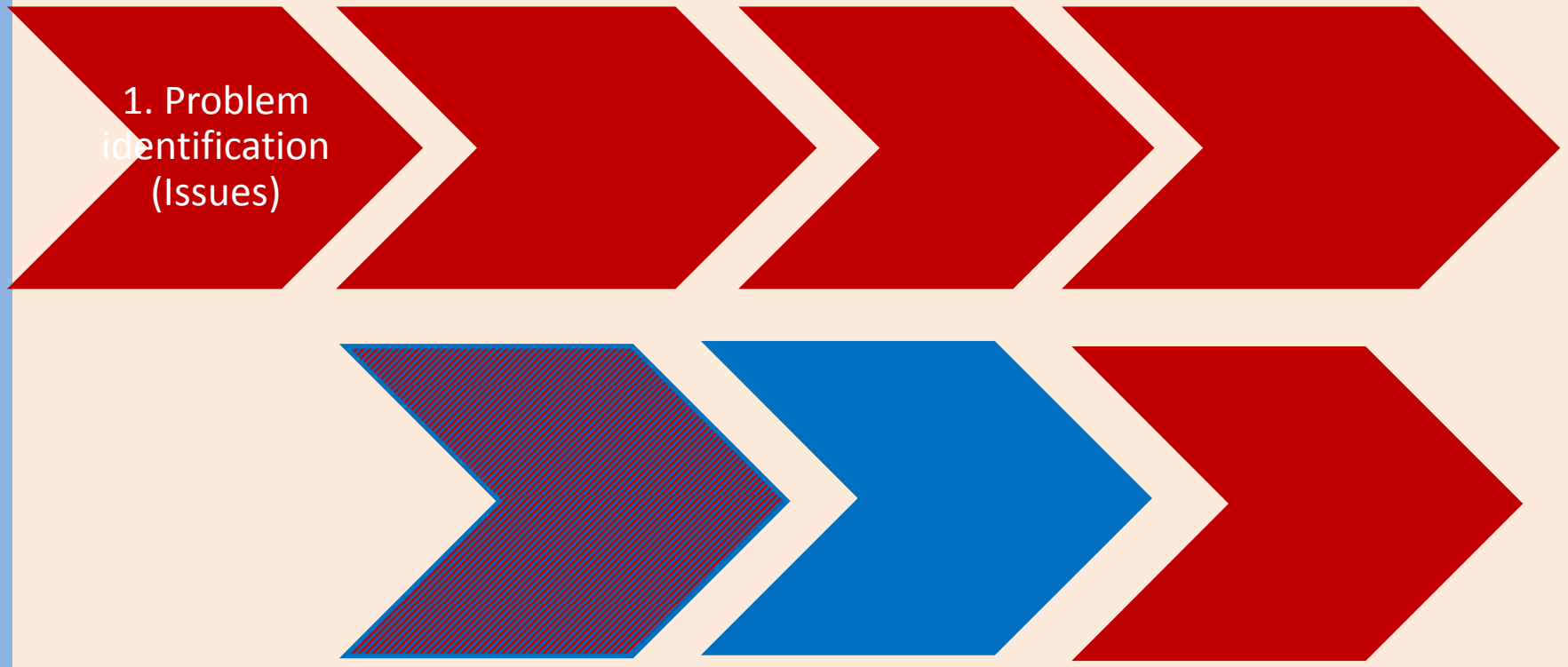
3. main objective of the survey is leading

Design ecosystem monitoring from scratch

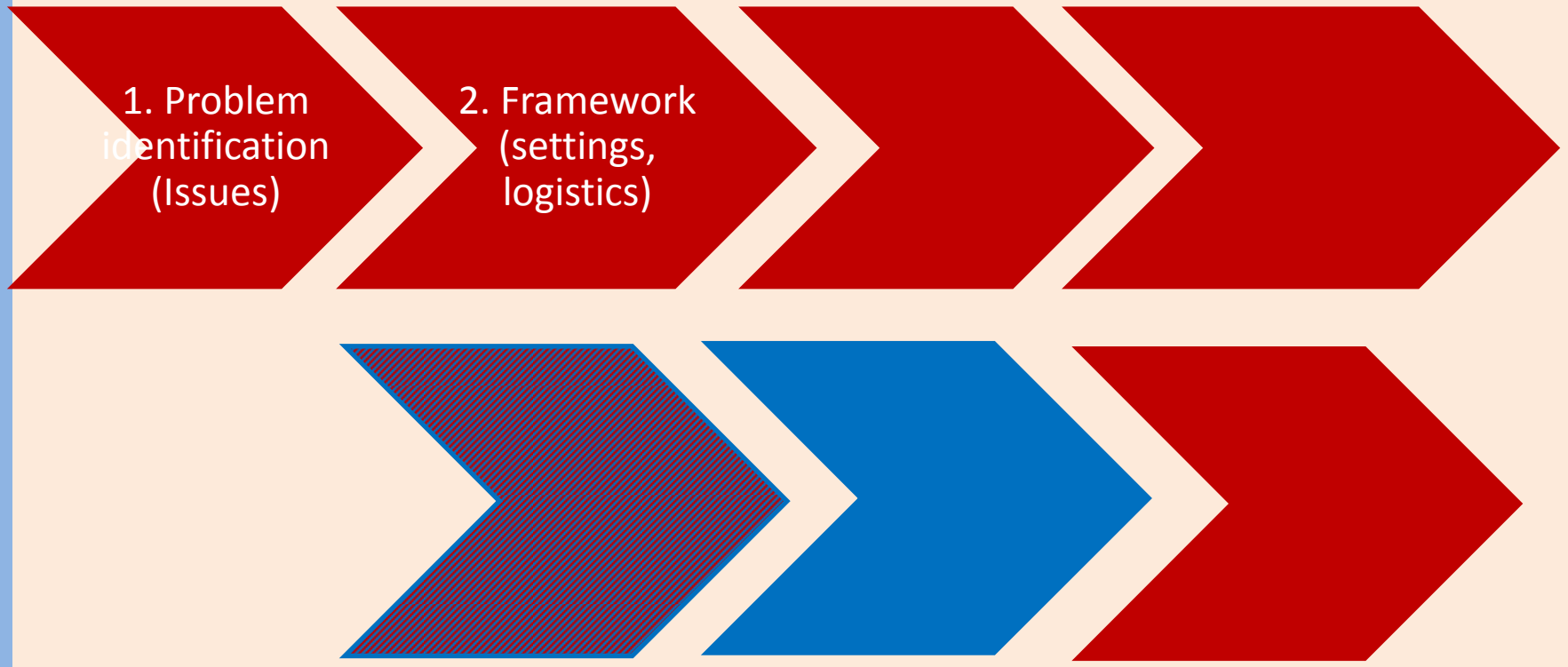


http://www.mghs.sa.edu.au/internet/curriculum/science/Year10/ecosystemEarth.htm

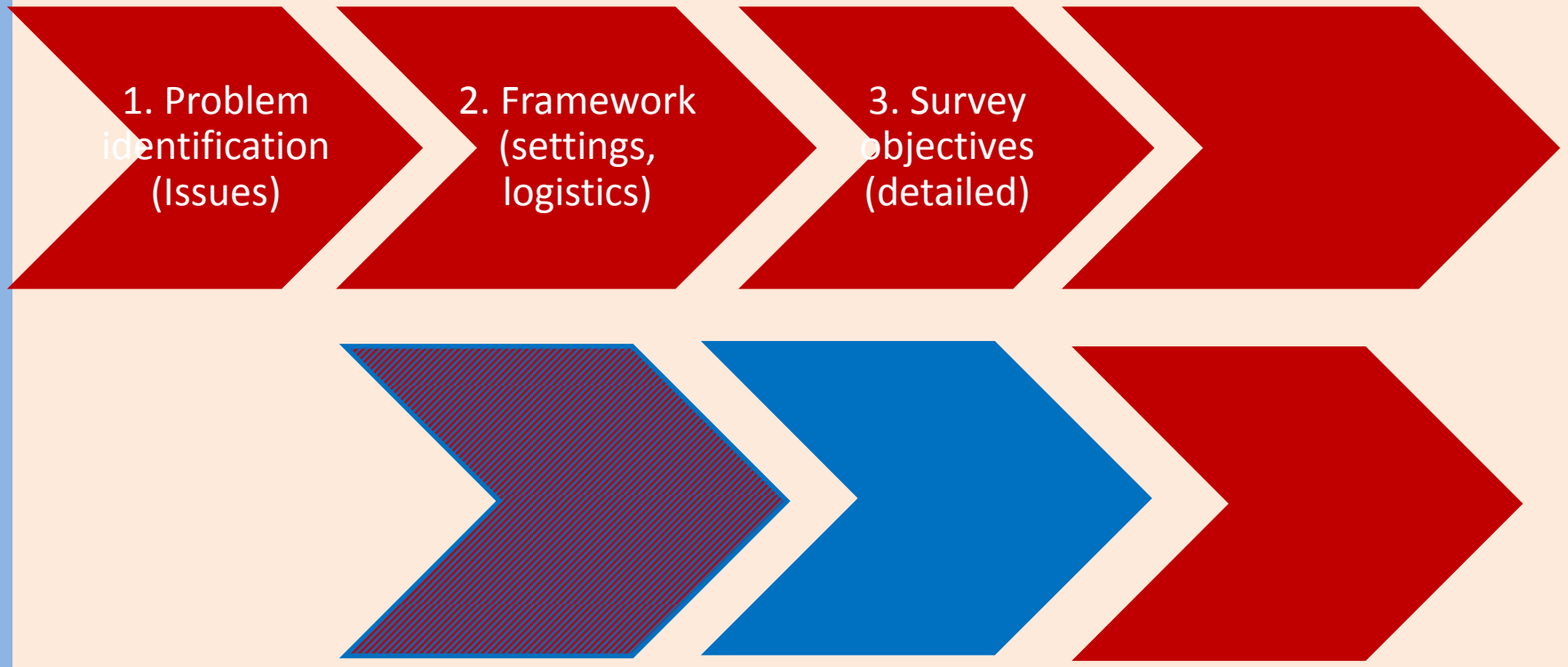
Design ecosystem survey from scratch (1)



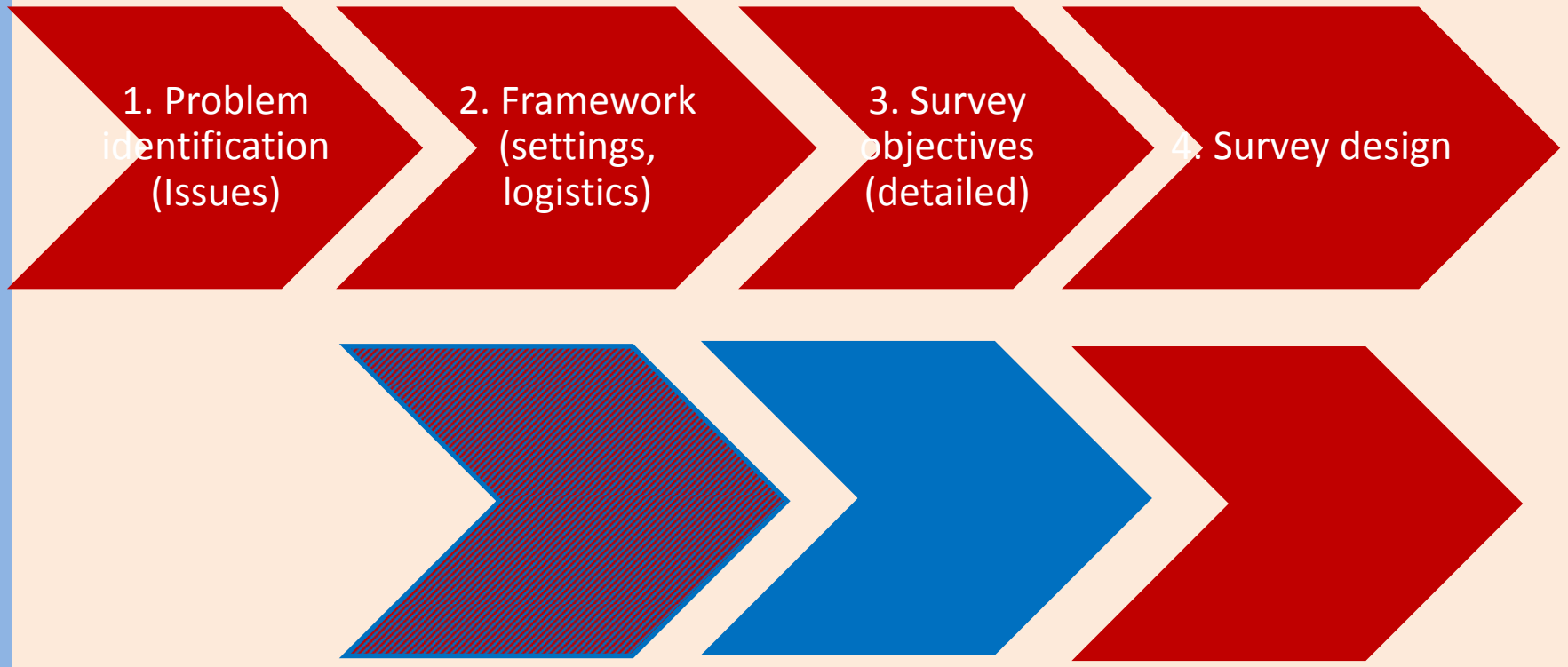
Design ecosystem survey from scratch (2)



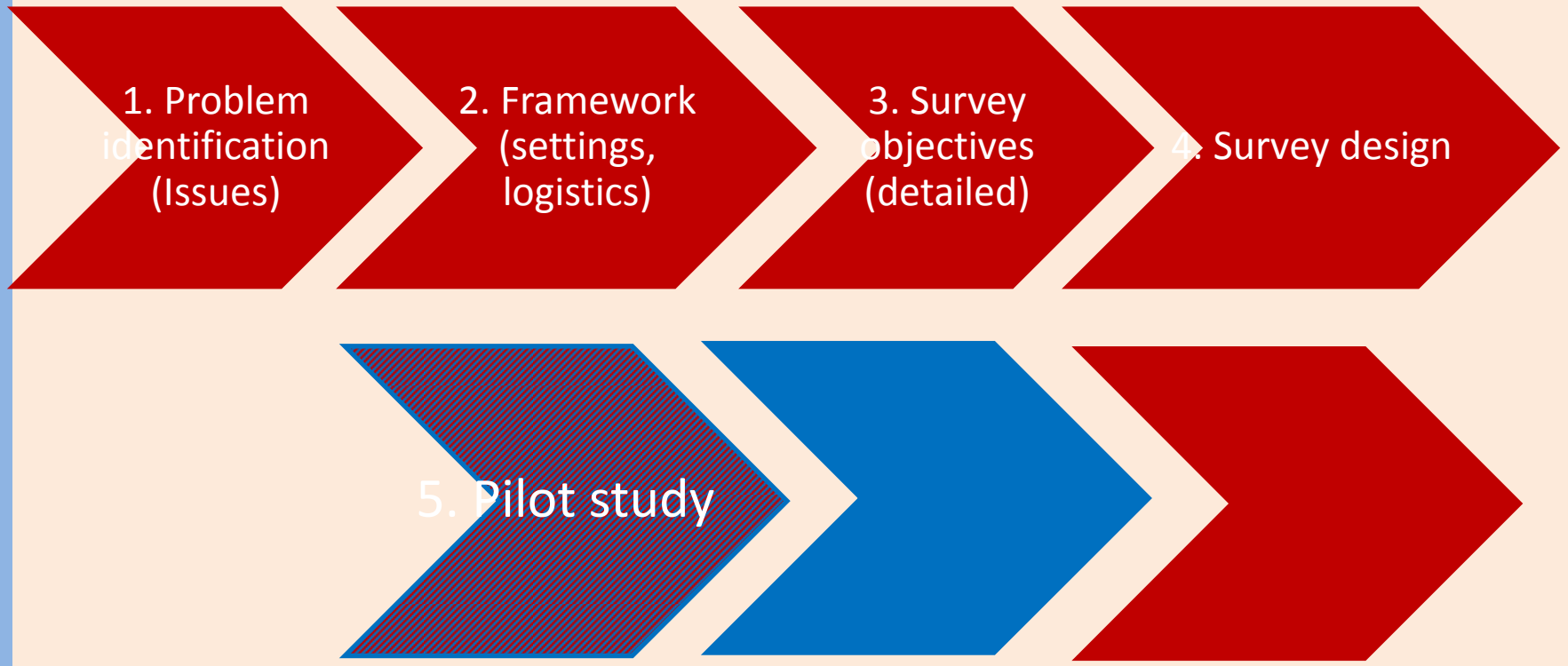
Design ecosystem survey from scratch (3)



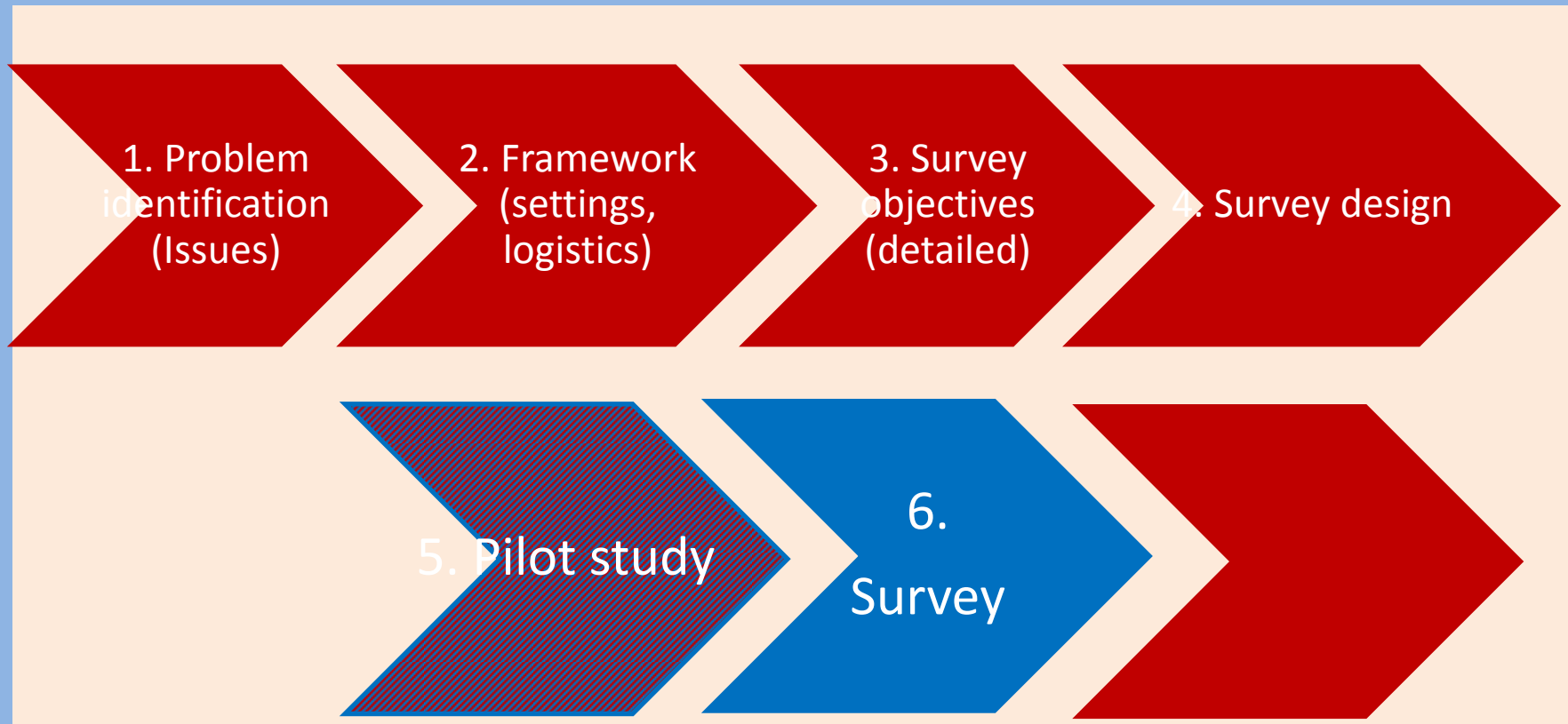
Design ecosystem survey from scratch (4)



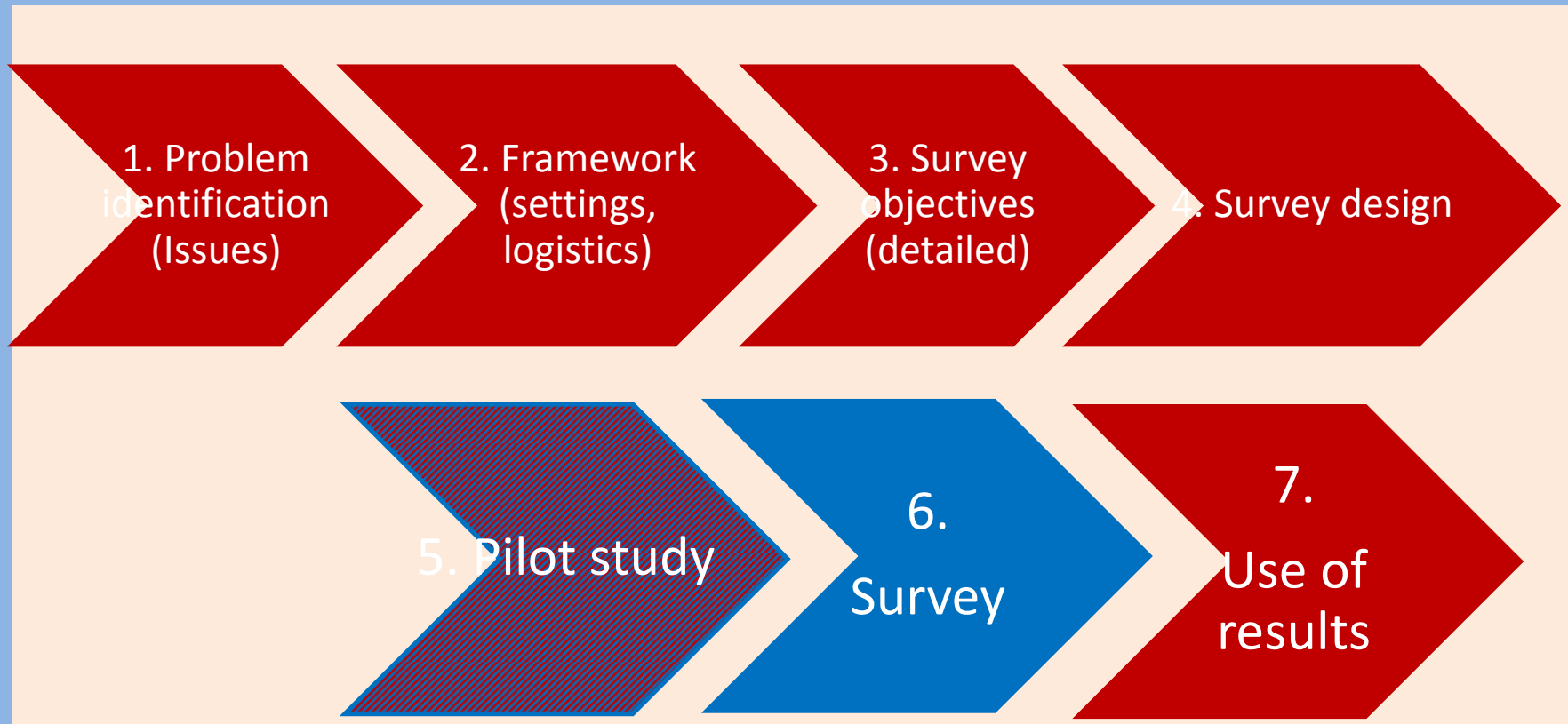
Design ecosystem survey from scratch (5)



Design ecosystem survey from scratch (6)



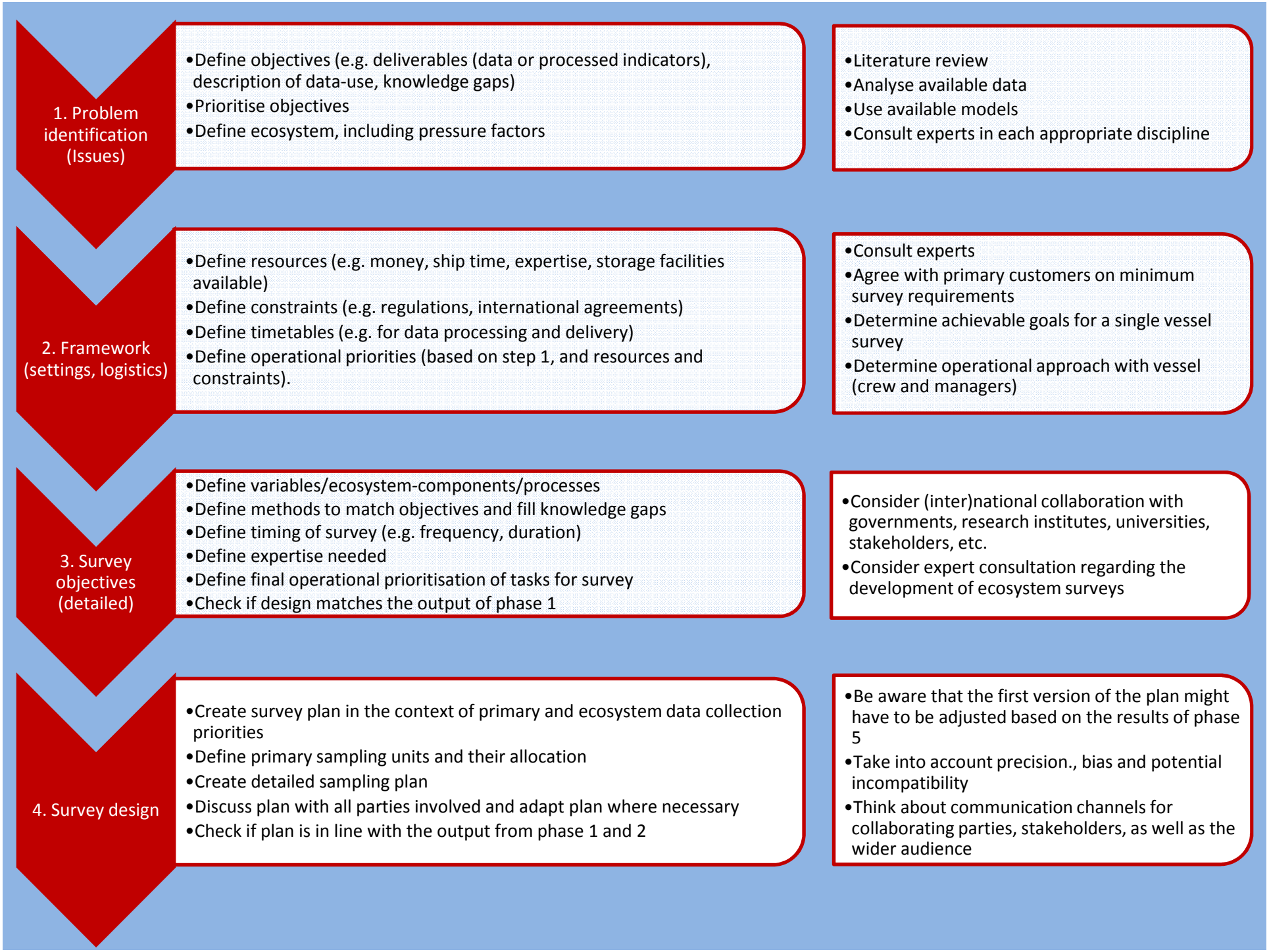
Design ecosystem survey from scratch (7)



Design ecosystem survey from scratch

Preparation is (almost) everything

Full diagram at http://www.ices.dk/community/Documents/Expert%20Groups/WGISUR/flow%20diagram_ecosystem%20survey_updated.pdf


1. Problem identification (Issues)
•Define objectives (e.g. deliverables (data or processed indicators), description of data-use, knowledge gaps)
•Prioritise objectives
•Define ecosystem, including pressure factors
•Literature review
•Analyse available data
•Use available models
•Consult experts in each appropriate discipline
2. Framework (settings, logistics)
•Define resources (e.g. money, ship time, expertise, storage facilities available)
•Define constraints (e.g. regulations, international agreements)
•Define timetables (e.g. for data processing and delivery)
•Define operational priorities (based on step 1, and resources and constraints).
•Consult experts
•Agree with primary customers on minimum survey requirements
•Determine achievable goals for a single vessel survey
•Determine operational approach with vessel (crew and managers)
3. Survey objectives (detailed)
•Define variables/ecosystem-components/processes
•Define methods to match objectives and fill knowledge gaps
•Define timing of survey (e.g. frequency, duration)
•Define expertise needed
•Define final operational prioritisation of tasks for survey
•Check if design matches the output of phase 1
•Consider (inter)national collaboration with governments, research institutes, universities, stakeholders, etc.
•Consider expert consultation regarding the development of ecosystem surveys
4. Survey design
•Create survey plan in the context of primary and ecosystem data collection priorities
•Define primary sampling units and their allocation
•Create detailed sampling plan
•Discuss plan with all parties involved and adapt plan where necessary
•Check if plan is in line with the output from phase 1 and 2
•Be aware that the first version of the plan might have to be adjusted based on the results of phase 5
•Take into account precision., bias and potential incompatibility
•Think about communication channels for collaborating parties, stakeholders, as well as the wider audience

5. Pilot study

- Test sampling plan at sea (exploratory survey)
- Test collected information: e.g. analyse samples, test data infrastructure, analyse data, run models. Take into account different primary units for different sampling strategies

- Keep in mind this phase might result in an iterative process as:
- The result of the test at sea might change the sampling plan. Additional testing of the new sampling plan might be required
- The result of the analysis of the information collected might change the sampling plan. Additional testing of the new sampling plan is required

6. Survey

- Carry out the survey following the plan

- Communication about the survey, the progress and first results is highly recommended.
- Information exchange between collaborating ships is required
- Coordination of the sampling is required, also to be adaptive to e.g. weather circumstances, technical problems

7. Use of results

- Quality check data
- Analyse samples
- Use data (take into account the different primary units)
- Information exchange with collaborating parties
- If data/samples are not immediately used: store sustainably
- Evaluation and review (internal/external)
- Disseminate information collected (including survey report)

- The results of the analysis might lead to a change in survey design. If major changes occur, go back to phase 3 or 4 and consider if a test is required

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2 options:

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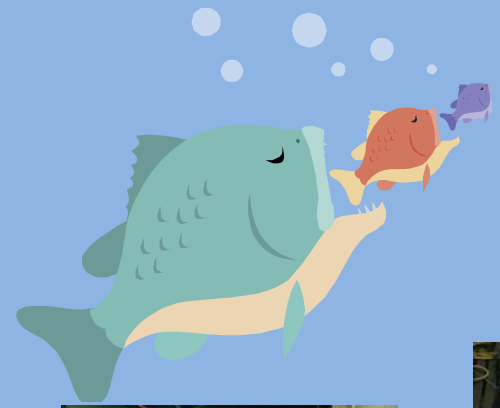
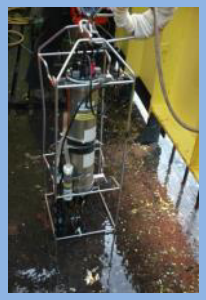


+  +  + …

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What to choose?

Things to keep in mind:

- Time-series
- Temporal coverage
- Spatial coverage
- Sampling methodology
- Logistics
- Future
- .....

Opportunities

- Collect as much information from the data collection you already carry out
- Combine different activities that are now carried out separately
- Combine international effort