CONGRATULATIONS REFUGE EXPLORER!

You are officially requested to be part of an expedition to Long Island, a unit of Willapa National Wildlife Refuge, on _____, for the purpose of scientific observations and discovery.

An expedition is a journey or excursion made for some specific purpose or exploration. The staff of Willapa National Wildlife Refuge has requested that you make this expedition to help us help wildlife. For this purpose, please carefully craft your inferences that you will test on your Long Island Expedition. Work hard on your inferences and experiment ideas. You will be reporting your observations to the Refuge Staff at the end of your journey. This is an important challenge as your discovery will help local plants and animals.

LONG ISLAND EXPEDITION CHECKLIST

- ☐ *List of Three Inferences for Each Student Group*
- ☐ *Locations Selected for Test/Experiment*
- ☐ *Test/Experiment Design*
- ☐ *Pencil*
- ☐ *Observation Notebooks*
- ☐ *Wildlife Pocket Guide*
- ☐ *Lunch*
- ☐ *Water*
- ☐ *Snacks*
- ☐ *Waterproof & Sturdy Boots or Shoes*
- ☐ *Layered Clothing*
- ☐ *Rain Jacket*

Signed, this day:

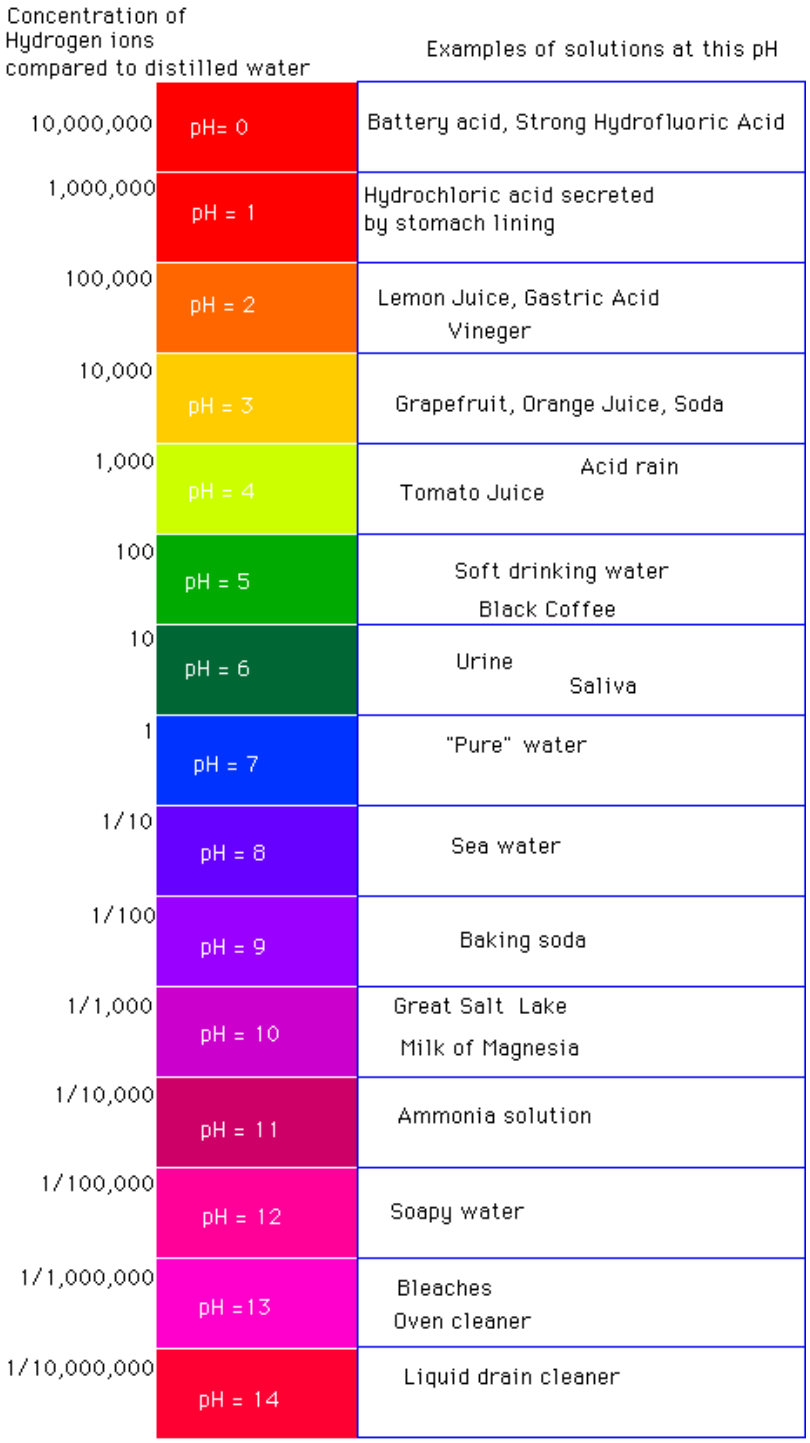
Jackie Ferrier

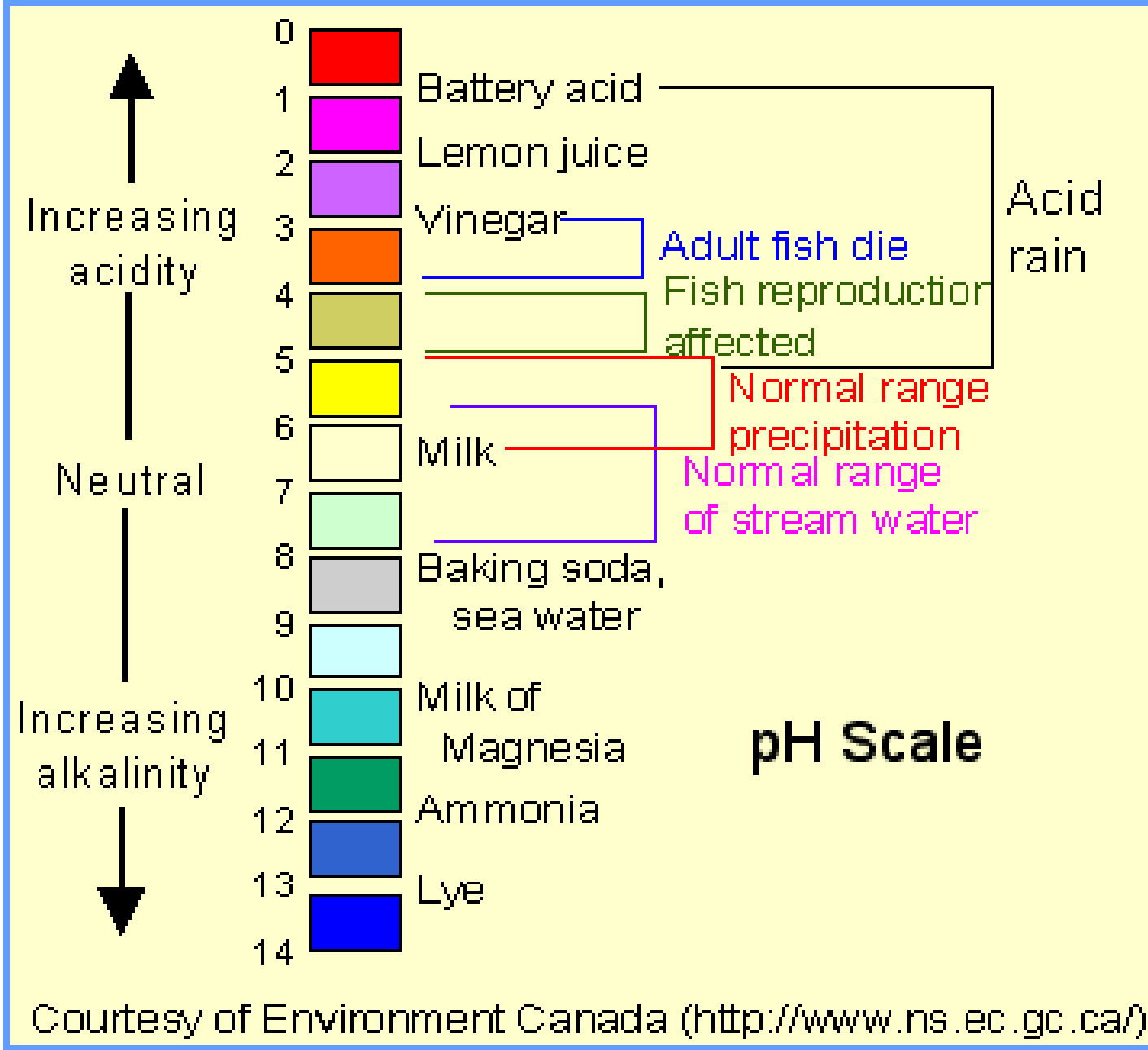
Project Leader, Willapa National Wildlife Refuge Complex

The salinity of seawater is usually 35 parts per thousand (also written as o/oo) in most marine areas. This salinity measurement is a total of all the salts that are dissolved in the water. Although 35 parts per thousand is not very concentrated (the same as 3.5 parts per hundred, o/o, or percent) the water in the oceans tastes very salty. The interesting thing about this dissolved salt is that it is always made up of the same types of salts and they are always in the same proportion to each other (even if the salinity is different than average). The majority of the salt is the same as table salt (sodium chloride) but there are other salts as well. The table below shows these proportions:

Chemical Ion Contributing to Seawater Salinity	**Concentration in o/oo (parts per thousand) in average seawater**	**Proportion of Total Salinity (no matter what the salinity)**
Chloride	19.345	55.03
Sodium	10.752	30.59
Sulfate	2.701	7.68
Magnesium	1.295	3.68
Calcium	0.416	1.18
Potassium	0.390	1.11
Bicarbonate	0.145	0.41
Bromide	0.066	0.19
Borate	0.027	0.08
Strontium	0.013	0.04
Fluoride	0.001	0.003
Other	less than 0.001	less than 0.001

The measurements listed in the table above from Castro and Huber's, **Marine Biology** textbook.


Concentration of Hydrogen ions compared to distilled water
Examples of solutions at this pH
10,000,000
pH= 0
Battery acid, Strong Hydrofluoric Acid
1,000,000
pH = 1
Hydrochloric acid secreted by stomach lining
100,000
pH = 2
Lemon Juice, Gastric Acid
Vineger
10,000
pH = 3
Grapefruit, Orange Juice, Soda
1,000
pH = 4
Acid rain
Tomato Juice
100
pH = 5
Soft drinking water
Black Coffee
10
pH = 6
Urine
Saliva
1
pH = 7
"Pure" water
1/10
pH = 8
Sea water
1/100
pH = 9
Baking soda
1/1,000
pH = 10
Great Salt Lake
Milk of Magnesia
1/10,000
pH = 11
Ammonia solution
1/100,000
pH = 12
Soapy water
1/1,000,000
pH =13
Bleaches
Oven cleaner
1/10,000,000
pH = 14
Liquid drain cleaner


Increasing acidity
Neutral
Increasing alkalinity
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
Battery acid
Lemon juice
Vinegar
Milk
Baking soda, sea water
Milk of Magnesia
Ammonia
Lye
Adult fish die
Fish reproduction affected
Normal range precipitation
Normal range of stream water
Acid rain
pH Scale
Courtesy of Environment Canada (http://www.ns.ec.gc.ca/)